Ski Doo Service Repair Manual

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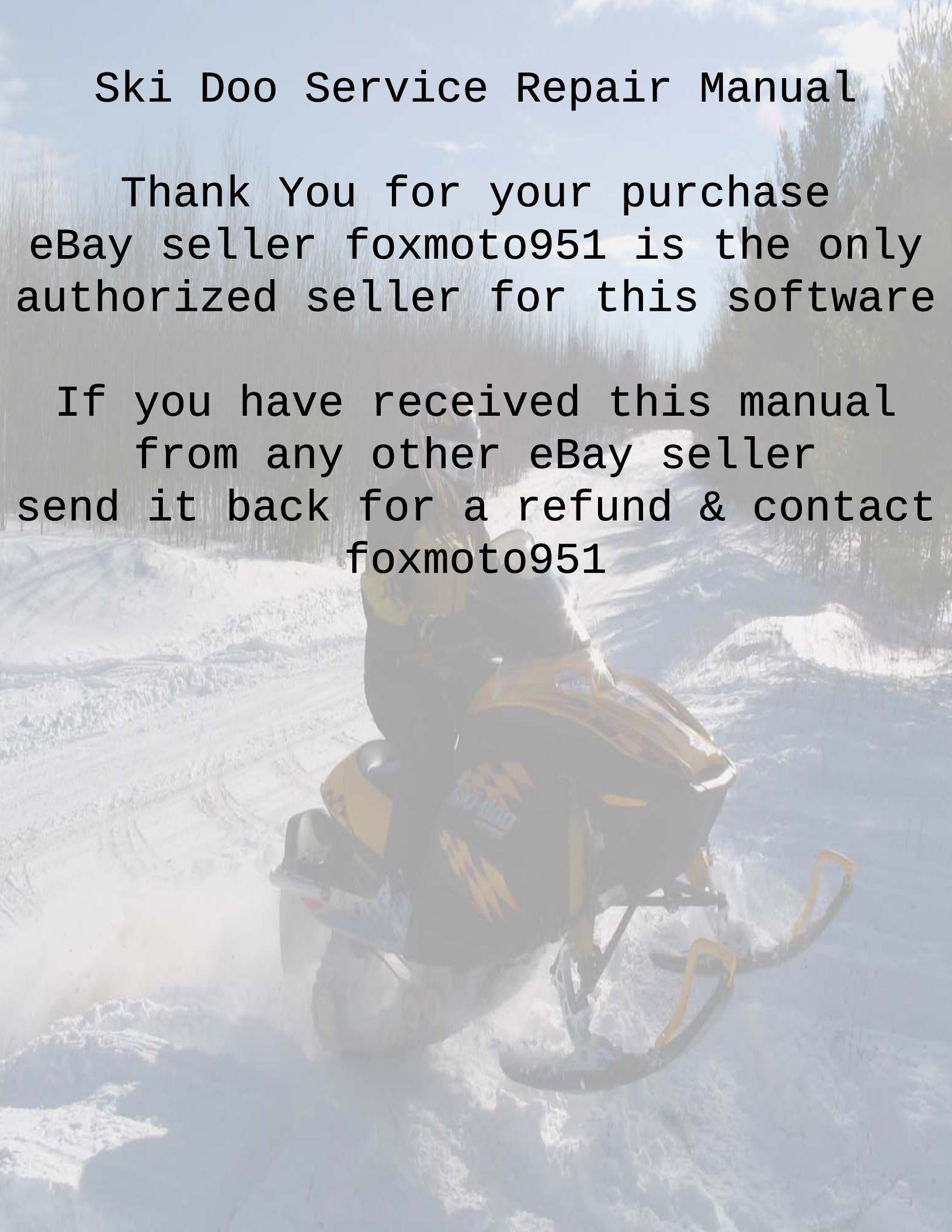

ski-doo®

2005

Shop Manual

Tundra™/ Skandic™ Series / Expedition

2005
Shop Manual

TUNDRA
SKANDIC LT/LT E/WT/SWT/WT LC/SUV 550/SUV 600
EXPEDITION TUV 600 HO SDI/TUV V-1000

BOMBARDIER RECREATIONAL PRODUCTS INC.

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SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2005 Ski-Doo® snowmobiles. See model list in introduction.

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.

Torque wrench tightening specifications must be strictly 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.

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. 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 snowmobiles:

MODEL	ENGINE	COLOR	MARKET	MODEL NUMBER
TUNDRA	280F (R)	YELLOW	CANADA USA	FK5A
TUNDRA	280F (R)	BLACK	CANADA USA	FK5B
SKANDIC LT	440F (R)	YELLOW	CANADA	FH5B
SKANDIC LT	440F (R)	YELLOW	USA	FH5A
SKANDIC LT (E)	440F (R)	YELLOW	CANADA	FH5D
SKANDIC LT (E)	440F (R)	YELLOW	USA	FH5C
SKANDIC WT	550F (R)	YELLOW	CANADA	FG5B
SKANDIC WT	550F (R)	YELLOW	USA	FG5A
SKANDIC SWT	550F (R)	YELLOW	CANADA	FE5B
SKANDIC SWT	550F (R)	YELLOW	USA	FE5A
SKANDIC WT LC	600 (R)	YELLOW	CANADA	FF5B
SKANDIC WT LC	600 (R)	YELLOW	USA	FF5A
SKANDIC SUV	550F (R)	YELLOW	CANADA	FD5B
SKANDIC SUV	550F (R)	YELLOW	USA	FD5A
SKANDIC SUV	600 (R)	YELLOW	CANADA	FC5B
SKANDIC SUV	600 (R)	YELLOW	USA	FC5A
SKANDIC SUV	600 (R)	BLACK	CANADA	FC5D
SKANDIC SUV	600 (R)	BLACK	USA	FC5C
SKANDIC SUV	550F (R)	BLACK	CANADA	FD5C
SKANDIC SUV	550F (R)	BLACK	USA	FD5D
EXPEDITION TUV	600 HO SDI (R)	BLACK	CANADA USA	FB5B
EXPEDITION TUV	600 HO SDI (R)	SEASHORE METALLIC	CANADA USA	FB5A
EXPEDITION TUV	V-1000 (R)	BLACK	CANADA USA	FA5B
EXPEDITION TUV	V-1000 (R)	SEASHORE METALLIC	CANADA USA	FA5A

(E) = Electric start
(R) = Reverse

Tundra

TYPICAL — TUNDRA

Skandic LT
Skandic LT E
Skandic WT
Skandic SWT
Skandic WT LC
Skandic SUV 550
Skandic SUV 600

TYPICAL — SKANDIC SERIES

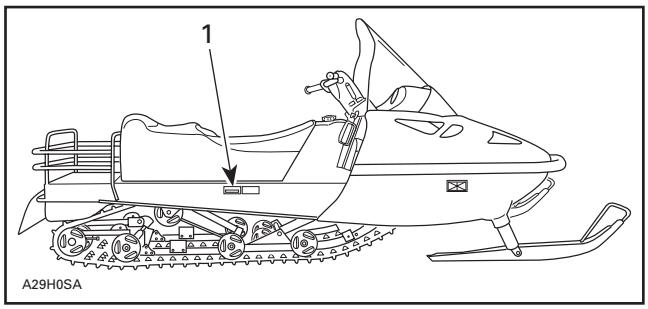
Expedition TUV 600 HO SDI
Expedition TUV V-1000

TYPICAL — EXPEDITION SERIES

VEHICLE DESCRIPTION DECAL

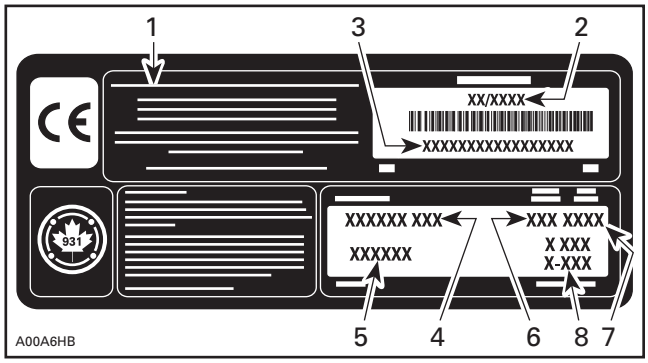
Location

Vehicle description decal is located on right hand side of tunnel.



TYPICAL
1. Vehicle description decal

Description



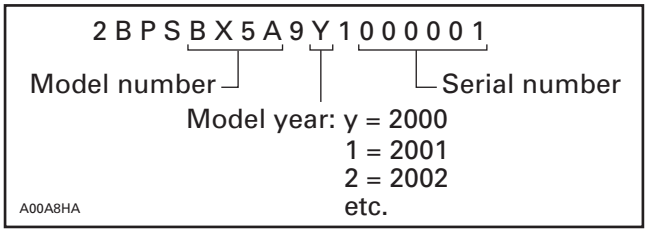
VEHICLE DESCRIPTION DECAL
1. *Manufacturer name and address*
2. *Manufacturing date*
3. *Vehicle identification number (VIN)*
4. *Model name*
5. *Option package*
6. *Engine type*
7. *Model year*
8. *Color codes*

VEHICLE IDENTIFICATION NUMBER (VIN)

Location

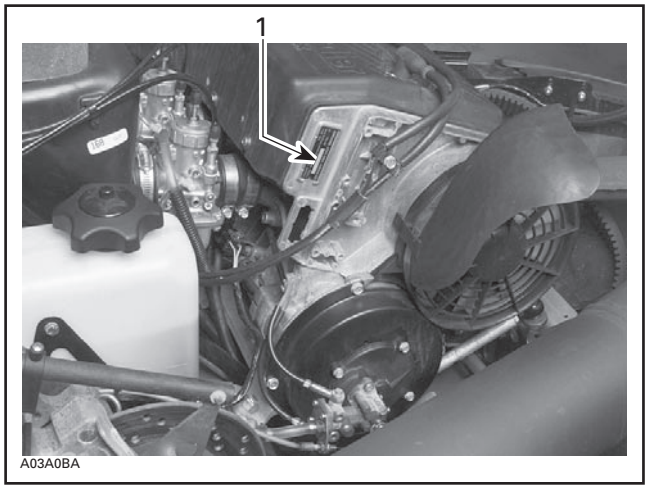
VIN is scribed on vehicle description decal. See above. It is also embossed on tunnel near vehicle description decal.

Description

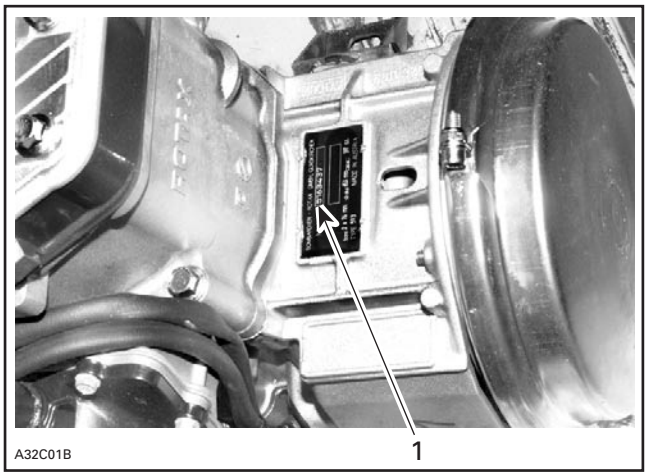


ENGINE SERIAL NUMBER

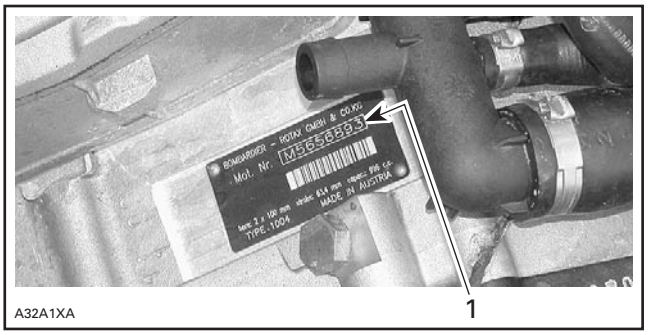
Location



TYPICAL — 2–STROKE FAN-COOLED ENGINES
1. *Engine serial number*



TYPICAL — 2–STROKE LIQUID-COOLED ENGINES
1. *Engine serial number*



4-TEC ENGINE — RH OF ENGINE
1. *Engine serial number*

LIST OF ABBREVIATIONS USED IN THIS MANUAL

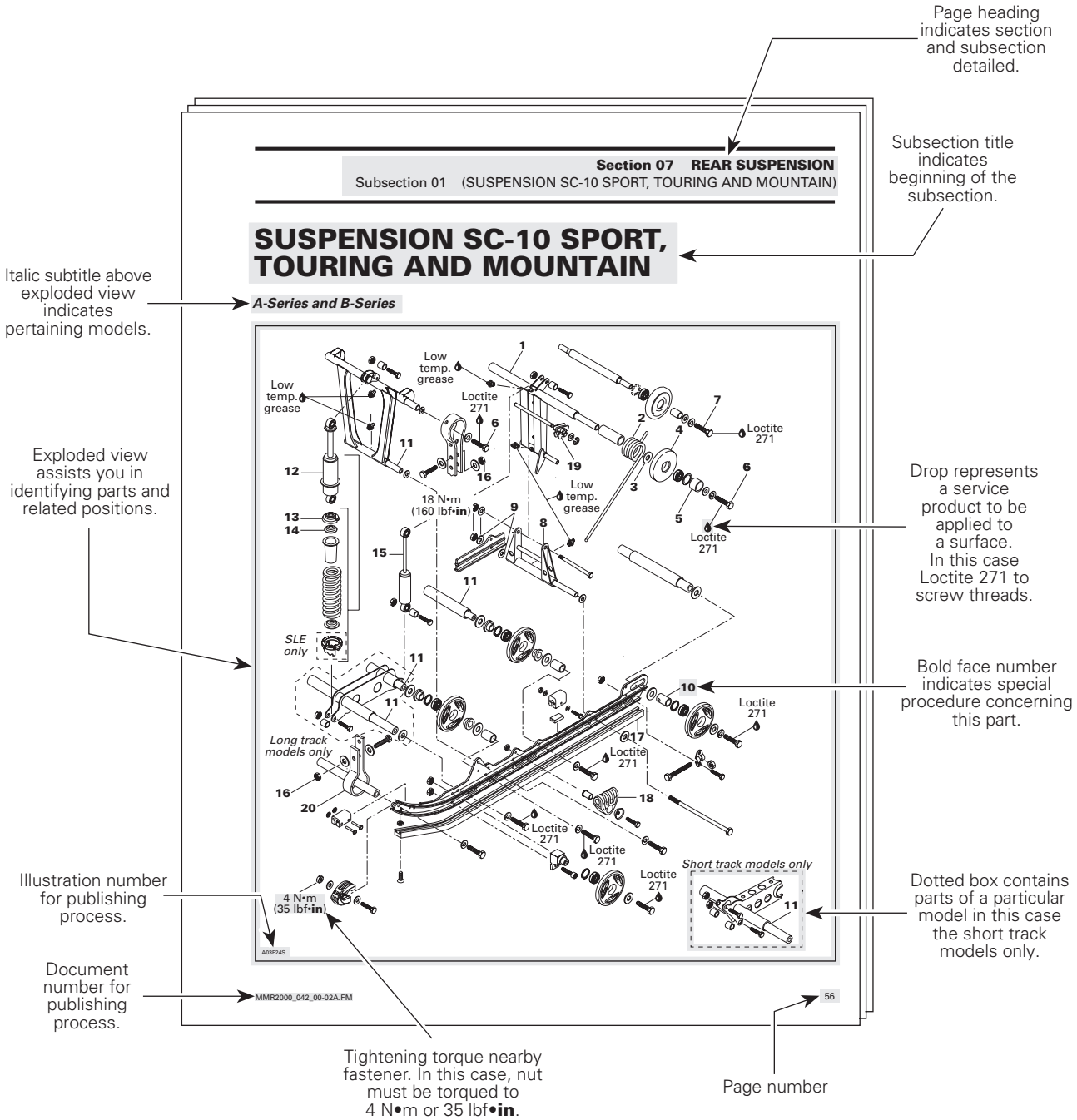
ABREVIATION	MEANING
A	ampere
amp	ampere
A•h	ampere-hour
AC	alternate current
ACM	acceleration and control modulator
ARM	advance ride management
BDC	bottom dead center
BTDC	before top dead center
°C	degree Celsius
cc	cubic centimeter
CDI	capacitor discharge ignition
CTR	center
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
DC	direct current
DPM	digital performance management
DSA	direct shock action
°F	degree Fahrenheit
FC	fan cooled
fl. oz	fluid ounce
ft	foot
GRD	ground
H.A.C.	high altitude compensator
hal.	halogen
HI	high
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)
LH	left hand

ABREVIATION	MEANING
LO	low
LT	long track
m	meter
m.	mile
MAG	magneto
Max.	maximum
Min.	minimum
mL	milliliter
mm	millimeter
MPEM	multipurpose electronic module
MPH	mile per hour
N	newton
N.A.	not applicable
no.	number
00.0	continuity
0.L	overload (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
RAVE	rotax adjustable variable exhaust
RPM	revolution per minute
RMS	root mean square
RRIM	reinforced reaction injection molding
Sp. Gr.	specific gravity
ST	semi-trapezoidal
TDC	top dead center
TRA	total range adjustable
U.S. oz	ounce (United States)
V	volt
Vac	volt (alternative current)

ARRANGEMENT OF THIS MANUAL

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

TYPICAL PAGE



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

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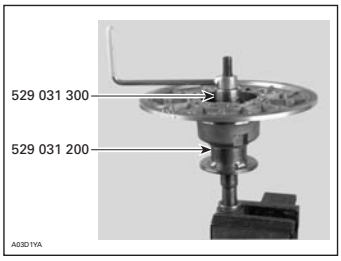
TYPICAL PAGE

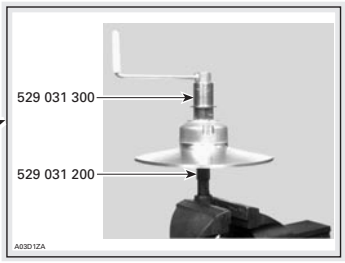
Turn puller handle and sliding half at once to extract the bushing.



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.

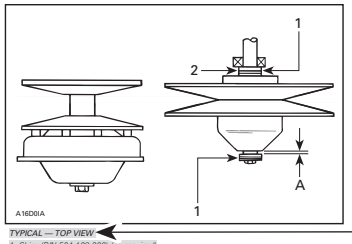
A-Series and B-Series Only

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.

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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.

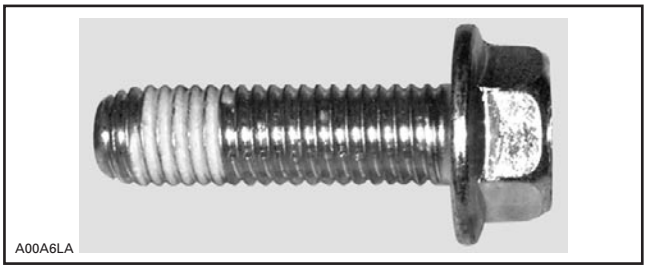
As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

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 screwtap 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.

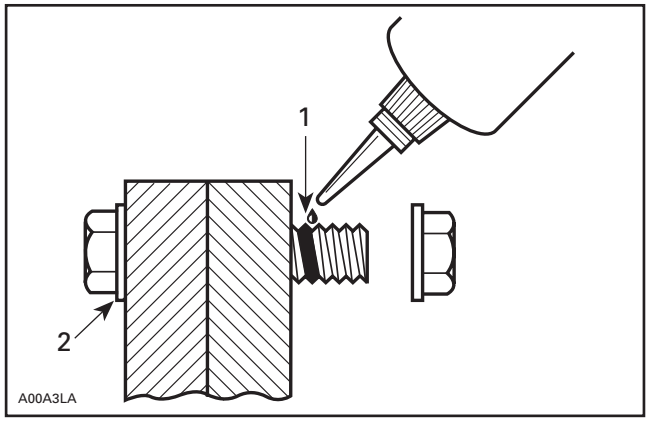
LOCTITE APPLICATION PROCEDURE

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

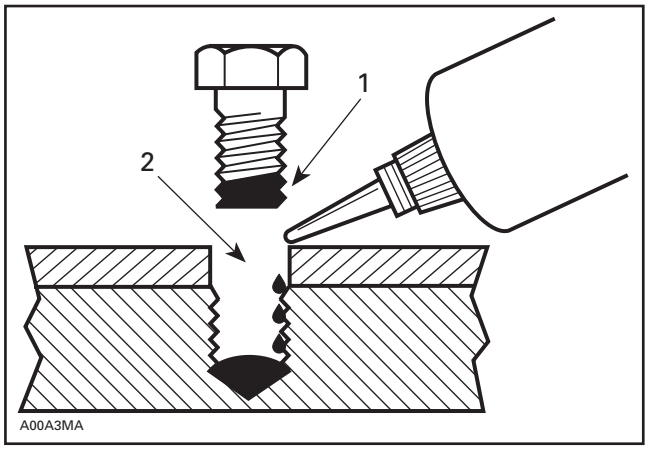
Uncovered Holes (bolts and nuts)



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.

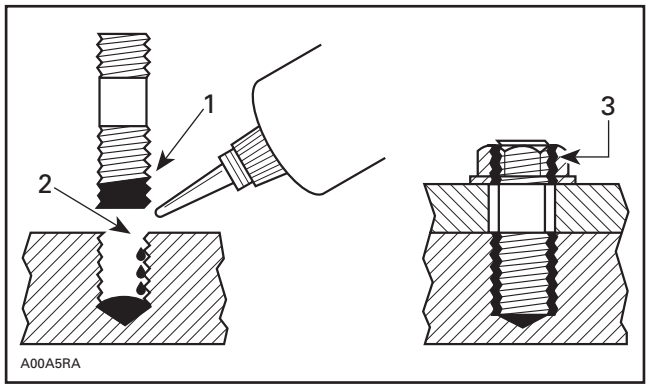
Blind Holes



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

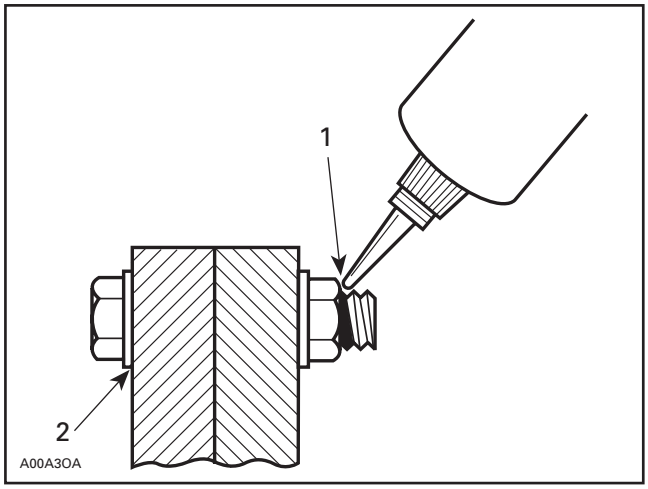


1. On threads
2. On threads and in the hole
3. Onto nut threads

– 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

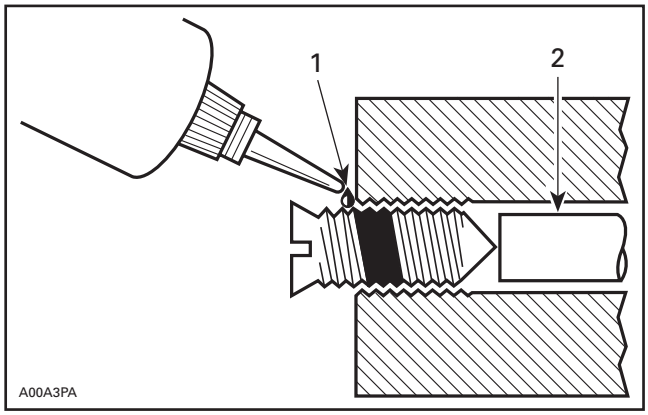


1. Apply here
2. Do not apply

– 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



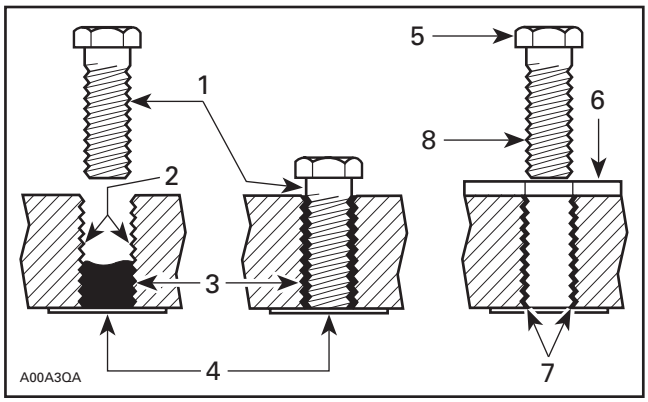
1. Apply here
2. Plunger

– 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 (P/N 413 708 600) 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.

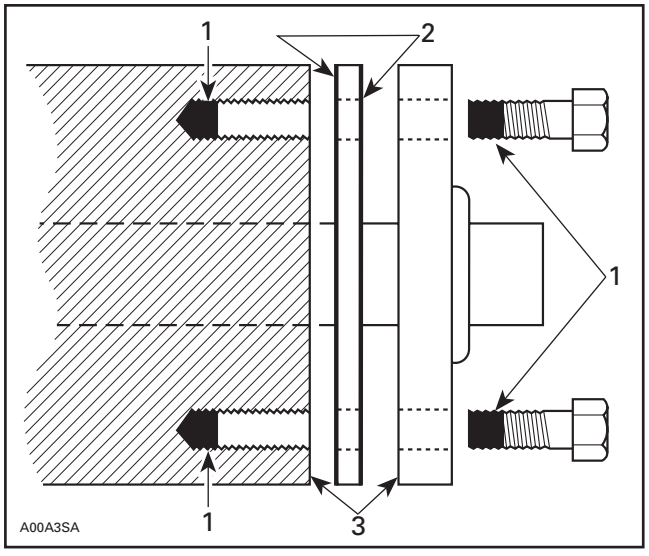
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

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 10) 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 (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.

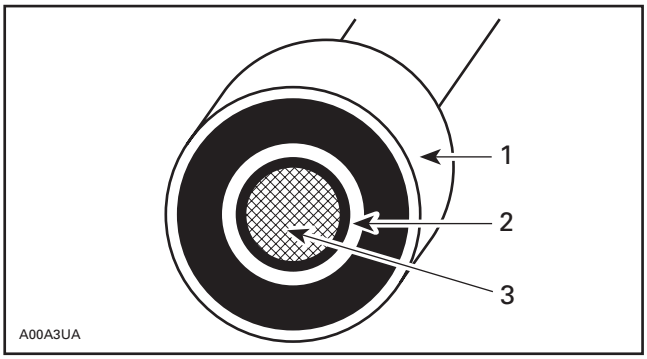
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

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.

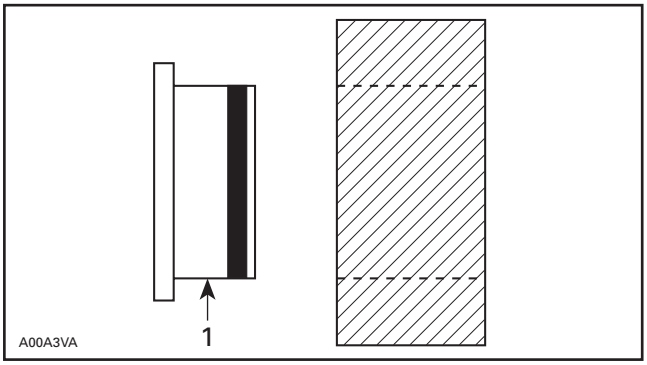
– DO NOT use antiseize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

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

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

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

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

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

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

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

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.

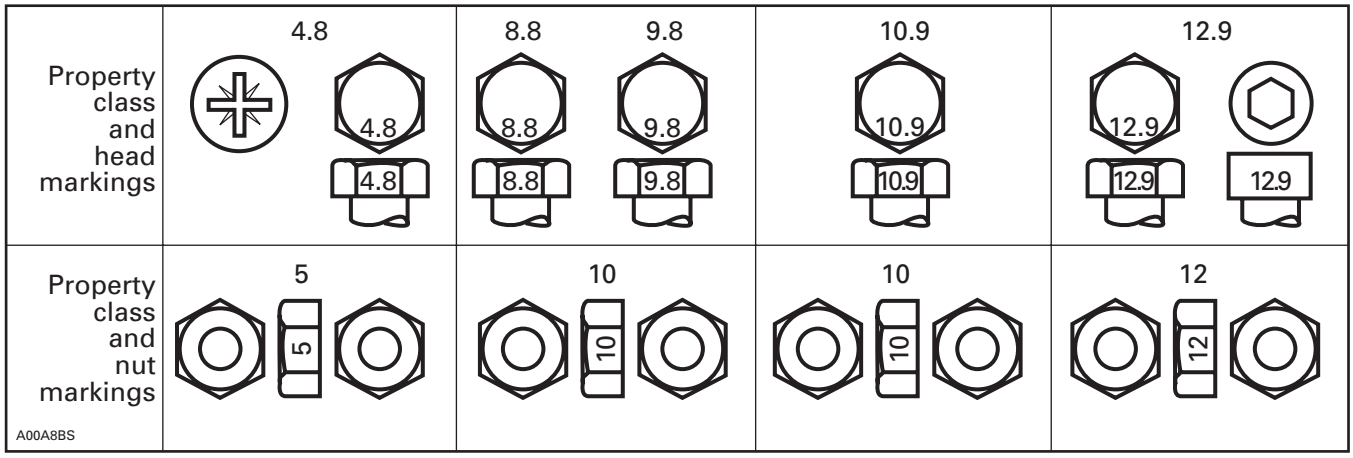
⚠ WARNING

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.



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.

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MAINTENANCE CHART

A: ADJUST
I: INSPECT (clean, inspect, repair, adjust, lubricate)
L: LUBRICATE
R: REPLACE
C: CLEAN

PART/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)
ENGINE								
Rewind starter and rope						I,L,C	I	03-09
Engine nuts and screws	I			I		I		Section 03 or 04, see the appropriate subsection
Exhaust system	I		I			I		Section 03 or 04, see the appropriate subsection
Engine lubrication						L		01-02
Cooling system	I			I			I	03-08 or 04-03
Coolant	I					R		03-08 or 04-03
Condition of seals [4]						I	I	03-01, 03-02, 03-03 or 04-02 to 04–07
RAVE valves [4]				C				03-03
LUBRICATION								
Oil and filter replacement (4-TEC)					R			04-04
Injection oil filter			I			R		03-06
Oil injection pump	A			A			A	03-06
FUEL								
Fuel stabilizer						R		01-02
Fuel filter							R	01-03
Fuel lines and connections	I					I	I	03-10, 06-03 or 05-03
Carburetor	A			A			A,C	03-10
Throttle cable	I			I		I	I	03-10
Air filter			C				C	01-03
Fuel injection system (visual inspection)				I				05-03 or 06-03
Throttle body bores and throttle plates [4]							C	05-03 or 06-03
DRIVE								
Drive belt	I	I					I	07-01
Drive and driven pulley	I		I	C		I	C	07-02 and 07-03
Tightening torque of drive pulley screw	I			I			I	07-02
Driven pulley preload	I			I		I		07-03
BRAKE								
Brake fluid	I	I				R	I	07-05
Brake	I	I	A			I,A	I	07-05

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TRANSMISSION								
Drive chain tension	A		A			A		07-06
Chaincase and gearbox oil	R		I	R(3)		R	I	07-06
Drive axle end bearing (2)	L		L			L		09-04
Countershaft	L		L			L		09-04
STEERING/FRONT SUSPENSION								
Steering and front suspension mechanism lubrication (2)	A,I,L		A,I	L		A,I,L		10-01 and 10-02
Wear and condition of skis and runners	I	I				I		10-02
SUSPENSION								
Suspension adjustments	A	AS REQUIRED						09-01, 09-02 or 09-03
Suspension (2)	I		I,L			I,L		
Suspension stopper strap				I		I		09-01, 09-02 or 09-03
Track	I		I			I		09-05
Track tension and alignment	A	AS REQUIRED						09-05
ELECTRICAL								
EMS fault codes (4)	I				I			05-03 or 06-03
Spark plugs (1) (4)	I		I				R	08-02
Battery (if so equipped)	I		I			I	I	08-04
Headlamp beam aiming				A			A	11-01
Wiring harnesses, cables and lines (4)	I		I			I		11-01
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
VEHICLE								
Rags in air intake and exhaust system						R	C	01-02 and 01-03
Engine compartment	C		C			C		01-02
Vehicle cleaning and protection	C		C			C		01-02

(1) Before installing new spark plugs at pre-season 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.

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

(3) Change oil every 3200 km (2000 mi).

(4) Emission-related

STORAGE

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	5
BOMBARDIER LUBE	293 600 016	3, 5
BOMBARDIER premixed coolant	293 600 038	5
BOMBARDIER Scratch Remover Kit	861 774 800	3
fuel stabilizer (250 mL)	413 408 600	4
Heavy duty cleaner (4 L)	293 110 002	3
Heavy duty cleaner (spray can 400 g)	293 110 001	3
storage oil (Canada)	413 711 600	4
storage oil (United States)	413 711 900	4
Vinyl & Plastic Cleaner (6 x 1 L)	413 711 200	3

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.

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 damaging further 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) and 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.

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

ENGINE COMPARTMENT

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

BATTERY

Remove battery, clean its tray and its exterior surface. Charge battery as explained in BATTERY section.

FUEL STABILIZER

With the new fuel additives, it is critical to use the fuel stabilizer (250 mL) (P/N 413 408 600) 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 so that stabilizer lubricate all fuel system components. 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).

On so equipped models, after engine starting, use primer several times so that stabilizer flows inside it.

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.

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. To protect appropriately the engine use storage oil (Canada) (P/N 413 711 600) or storage oil (United States) (P/N 413 711 900).

Proceed as follows:

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

⚠ WARNING

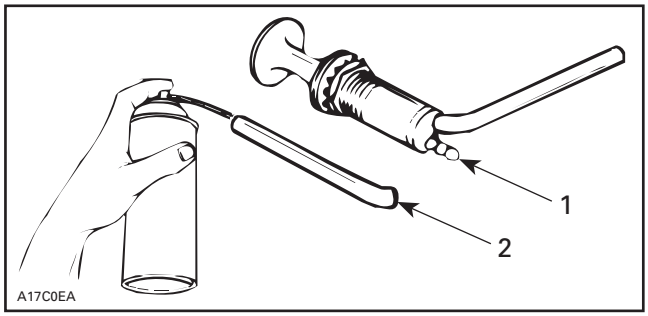
Ensure the track is free of all particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

Stop the engine.

Models with a Primer

To prevent fuel from draining, primer button should be pushed all the way in.

Disconnect the outlet primer hose from the primer valve (straight coupling).



1. Straight coupling
2. To intake manifold

Insert storage oil nozzle into primer outlet hose.

Models with a Choke

Remove air silencers to spray storage oil into each carburetor bore.

All Models

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 into each cylinder.

Crank slowly 2 or 3 revolutions to lubricate cylinders.

Reinstall the spark plugs and the outlet primer hose or air silencers.

⚠ WARNING

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

COOLING SYSTEM

4-Stroke Models

Antifreeze should be replaced for the storage period to prevent antifreeze deterioration.

Make sure to perform an antifreeze density test.

Cooling system must be filled with BOMBARDIER premixed coolant (P/N 293 600 038) or with distilled water antifreeze solution (50% distilled water, 50% antifreeze).

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

Refer to COOLING SYSTEM section.

ENGINE OIL CHANGE AND FILTER

4-Stroke Models

Change engine oil and filter. Refer to LUBRICATION in ENGINE section.

COUNTERSHAFT LUBRICATION

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.

PULLEY PROTECTION

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

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.

RAGS IN AIR INTAKE AND EXHAUST SYSTEM

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

PRESEASON PREPARATION

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

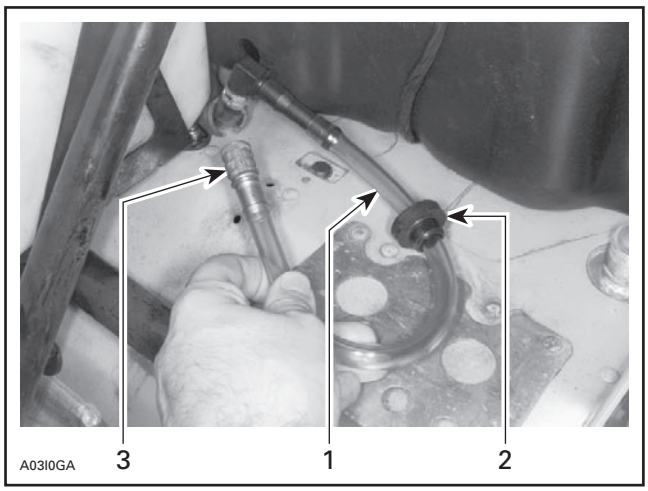
Unless otherwise specified, engine should be turned off for preparation procedure.

FUEL FILTER REPLACEMENT

All Models except V-1000 and 593 SDI Engine Equipped Models

Drain fuel tank.

Remove fuel line grommet from fuel tank and pull out inlet fuel line from tank.



TYPICAL
1. *Inlet fuel line*
2. *Position of grommet when installing*
3. *Fuel filter*

Replace fuel filter. To facilitate the fuel line installation, slide grommet on fuel line about 50 mm (2 in) away from elbow then install grommet on fuel tank and push elbow through grommet.

V-1000 and 593 SDI Engine Equipped Models Only

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

The fuel filter is located beside the steering column, next to coolant tank.

Using B.U.D.S. release the fuel pressure. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

Remove console to gain access to top of fuel pump module.

Disconnect both ends of fuel filter line.

Unfasten clip retaining fuel filter line to fuse box support.

Unscrew the fuel filter support nut then remove the filter.

Reverse removal procedure for installation.

THROTTLE BODY CLEANING (ON SO EQUIPPED MODELS)

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.

CARBURETOR CLEANING (ON SO EQUIPPED MODELS)

Disassemble carburetor(s) in order to clean all internal parts. Do not hesitate to replace any jets having gum or varnish on their surfaces.

AIR FILTER CLEANING

Check that inside of air silencer is clean and dry then properly reinstall the filter.

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

RAGS IN AIR INTAKE AND EXHAUST SYSTEM

Remove rags that were installed during STORAGE preparation.

ENGINE LUBRICATION

All Models except 4-TEC

Add 500 mL (17 U.S. oz) of recommended injection oil to the first full filled fuel tank.

CLEANING OF DRIVE AND DRIVEN PULLEYS

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

CLEANING OF BRAKE DISK

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

DRIVE BELT CONDITION

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.

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).

ENGINE (2-STROKE)

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **ENGINE BACKFIRES.**

1. **Check spark plugs.**
   - *Carbon accumulation caused by defective spark plug(s). Clean carbon accumulation from piston and cylinder head and install dry properly gapped spark plug(s).*
2. **Check ignition timing.**
   - *Timing is too advanced. Set timing according to specifications (refer to TECHNICAL DATA).*
3. **Check for erratic sparks.**
   - *Poor electrical connections. Repair.*
   - *Faulty stator. Replace defective parts.*
4. **Check carburetor.**
   - *Fuel passages obstructed. Clean carburetor and install new filter(s).*
   - *Fuel level too low. Adjust float level according to specifications.*
5. **Check cooling system.**

   Fan-Cooled Engines
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN COOLING SYSTEM).*
   - *Dirty cooling fins or blocked air ducts. Clean.*

   Liquid-Cooled Engines
   - *Low antifreeze level. Adjust antifreeze level. Proceed with a leakage test (refer to LIQUID COOLING SYSTEM) and repair as required.*
   - *Defective tank cap. Replace cap.*
   - *Defective thermostat. Replace thermostat.*
   - *Air in system. Bleed system.*

Symptom: **ENGINE SUDDENLY TURNS OFF AT HIGH RPM AND/OR WITH LIGHT LOAD.**

1. **Check that all ground wires are well connected.**

Symptom: **ENGINE SUDDENLY TURNS OFF.**

1. **Perform engine leak test. Check possible piston seizure.**
   - *Damaged gasket and/or seal. Replace defective parts.*
2. **"Four-corner" seizure of piston(s).**
   - *High acceleration when engine is cold. Piston expands faster than cylinder. Replace piston(s). Ask driver to refer to the warm-up procedure in the Operator's Guide.*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

3. Piston(s) seizure on exhaust side (color on piston dome is correct).

- *Kinked fuel tank vent tube. Relocate fuel tank vent tube.*
- *Leaks at fuel line connections or damaged fuel lines. Replace defective lines.*
- *Fuel does not flow through carburetor(s) (foreign particles in needle area and/or varnish formation in carburetor(s)). Clean carburetor(s) and install new filter(s).*
- *Spark plug heat range is too warm. Install spark plugs with appropriate heat range (refer to TECHNICAL DATA).*
- *Improper ignition timing. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Restriction in exhaust system. Replace.*
- *Compression ratio is too high. Install genuine parts.*
- *Too low fuel octane number. Use proper fuel octane number.*
- *Carburetor calibration is too lean. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Improper reed valve adjustment or damage. Adjust according to specifications (refer to appropriate ENGINES TYPES) and/or install BRP's recommended reed valve.*
- *Poor quality oil. Use XP-S injection oil.*
- *Leaks at air intake silencer. Replace air intake silencer grommets.*

4. Melted and/or perforated piston dome; melted section at ring end gap.

- *When piston reaches TDC, mixture is ignited by heated areas in combustion chamber. This is due to an incomplete combustion of a poor quality oil. Clean residue accumulation in combustion chamber and replace piston(s). Use XP-S injection oil.*
- *Spark plug heat range is too high. Install recommended dry properly gapped spark plugs (refer to TECHNICAL DATA).*
- *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Inadequate fuel quality. Use appropriate fuel.*
- *Carburetion is too lean. Adjust according to specifications (refer to TECHNICAL DATA).*

5. Seized piston all around the circumference (dry surface).

- *Lack of oil, damaged oil line or defective injection pump. Replace defective part(s).*

6. Grooves on intake side of piston only.

- *Oil film eliminated by water (snow infiltration in engine). This can also be caused by running engine on choke for too long. Excessive fuel will remove the oil film on the piston and make marks. Replace piston(s) and check if intake system leaks.*

7. Piston color is dark due to seizure on intake and exhaust sides.

- *Broken or loose fan belt. Replace fan belt and/or adjust its tension (refer to TECHNICAL DATA).*
- *Cooling system leaks and lowers coolant level. Proceed with a leakage test (refer to LIQUID COOLING SYSTEM) and repair as required. Add coolant in cooling system until appropriate level is reached.*
- *Accumulation of foreign particles in needle valve and/or main jet area. Clean carburetor(s).*

8. Cracked or broken piston(s).

- *Cracked or broken piston(s) due to excessive piston/cylinder clearance or engine overreving. Replace piston(s). Check piston/cylinder clearance (refer to TECHNICAL DATA). Adjust drive pulley according to specifications (refer to TECHNICAL DATA) and/or clean pulley sheaves if they are contaminated with greasy particles.*

9. DPM manifold air vent is obstructed.

- *Carburetion is too lean. Ensure proper air vent.*

Symptom: **PISTON RING AND CYLINDER SURFACES ARE SCRATCHED.**

1. **Check oil quality.**
   - *Poor quality oil. Use XP-S injection oil.*
2. **Check injection pump and its hoses.**
   - *Inadequate injection pump adjustment and/or defective hoses. Adjust pump according to specifications (refer to ENGINE) and/or replace hoses.*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. **Check spark plug condition and gap.**
   - *fouled spark plugs or wrong spark plug gap. Replace or readjust gap.*
2. **Check if there is water in fuel.**
   - *There is water in fuel. Drain fuel system, then fill with appropriate fuel.*
3. **Check proper operation of RAVE valves. (Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER).)**
   - *Repair.*
4. **Check items listed in ENGINE RUNS OUT OF FUEL (refer to FUEL AND OIL SYSTEMS subsection).**
5. **Check carburetor adjustments and cleanliness.**
   - *Inadequate carburetor adjustments or dirt accumulation. Adjust according to specifications (refer to TECHNICAL DATA) or clean.*
6. **Check drive belt.**
   - *Worn belt. Replace belt if width is 3 mm (1/8 in) less than nominal dimension (refer to TECHNICAL DATA).*
7. **Check track adjustment.**
   - *Too much tension and/or improper alignment. Align track and adjust its tension to specifications (refer to TECHNICAL DATA).*
8. **Check drive pulley.**
   - *Improper calibration screw adjustments (TRA pulley) and/or worn bushing(s). Adjust according to specifications (refer to TECHNICAL DATA) and/or replace bushing(s).*
9. **Check driven pulley.**
   - *Worn bushing and/or spring tension. Replace spring and/or adjust its tension according to specifications (refer to TECHNICAL DATA).*
10. **Check exhaust system.**
    - *Restriction or exhaust system leakage. Replace or reseal with Ultra Copper.*
11. **Check ignition timing.**
    - *Decrease in power due to delayed ignition. Adjust according to specifications (refer to TECHNICAL DATA).*
12. **Check engine compression.**
    - *Worn piston(s) and ring(s). Replace (refer to TECHNICAL DATA for specifications).*
13. **Check engine cooling system.**
    - *Improper fan belt tension. Adjust fan belt (refer to TECHNICAL DATA).*
    - *Coolant level is low, cap fails to pressurize system or air circulates through lines. Adjust level, replace cap or bleed cooling system.*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.** (cont'd)

14. Check reed valve.

- Improper tightness and/or opening. Replace or adjust. Refer to proper engine subsection.

Symptom: **ENGINE DETONATION AT MAXIMUM RPM.**

1. Check which type of fuel is used.

- Octane number is too low and/or alcohol level is too high. Use recommended fuel type.

2. Check spark plug type.

- Improper spark plug heat range. Install recommended spark plugs (refer to TECHNICAL DATA).

3. Check exhaust system.

- Too much restriction. Replace.

4. Check ignition timing.

- Timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).

5. Check proper operation of RAVE valves. (Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER).)

- Repair.

6. Check if engine is overheating. (Refer to HIGH ENGINE OPERATING TEMPERATURE).

7. Check carburetion.

- Fouled and/or improper carburetor components. Clean or replace according to specifications (refer to TECHNICAL DATA).

8. Check compression ratio and combustion chamber volume.

- Compression ratio is too high. Install genuine parts.

Symptom: **ENGINE TURNS OVER BUT FAILS TO START (MANUAL START).**

1. Check switches.

- Ignition switch, emergency cut-out switch or tether switch is OFF. Place all switches in the RUN or ON position. If it still does not work, connect DESS switch BK/GN and BK/WH wires together (harness side).

2. Check fuel valve.

- Fuel valve is OFF or not fully open. Fully open fuel valve.

3. Check fuel level.

- Mixture too lean to start cold engine. Check fuel tank level and use choke or primer.

4. Check spark plug.

- Defective spark plug (no spark) or wrong spark plug gap. Replace spark plugs or readjust gap.

5. Check amount of fuel on spark plug.

- Flooded engine (spark plug wet when removed). Do not overprime or overchoke. Remove wet spark plugs, turn ignition switch to OFF and crank engine several times. Install clean dry properly gapped spark plugs. Start engine following usual starting procedure.

6. Check fuel lines.

- No fuel to the engine (spark plugs dry when removed). Check fuel tank level; turn fuel valve on if applicable; check fuel filter, replace if clogged ; check condition of fuel and impulse lines and their connections.

Symptom: **ENGINE TURNS OVER BUT FAILS TO START (MANUAL START).** (cont'd)

7. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s) (ex.: piston(s), ring(s), etc.).*

Symptom: **IRREGULAR ENGINE IDLE (NORMAL USE AFTER ENGINE WARM UP).**

1. **Check choke.**
   - *Choke plunger may be partially opened. Readjust.*
2. **Check carburetor adapter.**
   - *Air enters through a crack. Replace.*
3. **Check air screw position.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL DATA).*
4. **Check dimension of pilot jet.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check reed valve.**
   - *Improper tightness and/or opening. Replace or adjust. Refer to proper engine subsection.*
6. **Perform engine leak test.**
   - *Leaking gaskets allow air to enter in engine. Replace defective parts.*
7. **DPM manifold air vent is obstructed.**
   - *Carburetion is too lean. Ensure proper air vent.*
8. **Check ignition system trigger coil air gap.**
   - *Air gap is too large. Adjust according to specifications (refer to TECHNNICAL DATA).*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (FAN COOLED ENGINES).**

1. **Check cooling system.**
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN COOLING SYSTEM).*
   - *Dirty cooling fins or blocked air ducts. Clean.*
2. **Check carburetion.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL DATA) or replace inadequate component(s).*
3. **Check cylinder O-rings.**
   - *Worn O-rings. Replace.*
4. **Check ignition timing.**
   - *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check if there are leaks at air intake silencer and/or engine crankcase.**
   - *Leak(s). Repair or replace.*
6. **Check condition and heat range of spark plugs.**
   - *Melted spark plug tip or inadequate heat range. Replace.*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (LIQUID COOLED ENGINES).**

1. **Check temperature gauge sensor.**
   - *False reading. Check terminal connections. If problem persists, replace sensor.*
2. **Check if heat exchangers are clean.**
   - *Dirty heat exchangers. Clean heat exchangers.*
3. **Check coolant level and check if there is air infiltration in the system or if there are leaks in gasket areas.**
   - *Low coolant level or air in system. Add coolant until recommended level is reached, bleed system and/or tighten clamps.*
4. **Check if coolant flows through system properly.**
   - *Foreign particles and/or broken coolant pump impeller. Clean cooling system and/or replace coolant pump impeller.*
5. **Check thermostat.**
   - *Thermostat reacts slowly or not at all. Replace.*
6. **Check antifreeze concentration.**
   - *Antifreeze concentration is too high. Adjust concentration according to BRP recommendations.*
7. **Check tank cap.**
   - *Cap does not hold pressure. Replace.*
8. **Check carburetion.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL DATA) or replace inadequate component(s).*
9. **Check cylinder head gaskets.**
   - *Worn gaskets. Replace.*
10. **Check ignition timing.**
    - *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
11. **Check if there are leaks at air intake silencer and/or engine crankcase.**
    - *Leak(s). Repair or replace.*
12. **Check condition and heat range of spark plugs.**
    - *Melted spark plug tip or inadequate heat range. Replace.*

Symptom: **ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM SLOWER).**

1. **Check RAVE valve pistons.**
   - *Valve piston(s) is (are) not screwed to the bottom. Screw valve piston(s) to bottom.*
2. **Check that valve moves freely.**
   - *Valve stuck in closed position. Clean.*
3. **Check RAVE valve stems.**
   - *Bent RAVE valve stem(s). Replace.*
4. **Check RAVE valves.**
   - *Jammed valve(s). Clean.*

Symptom: **ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM SLOWER).** (cont'd)

5. **Check tension of RAVE springs.**
   - *Inadequate spring tension. Replace.*
6. **Check RAVE pressure holes.**
   - *Clogged holes. Clean.*
7. **Check clamps or sleeves.**
   - *Damaged clamp(s) or sleeve(s). Replace.*
8. **Check exhaust tightness.**
   - *Exhaust system is leaking leading to a too low back pressure. Replaces parts and reseal.*

Symptom: **ENGINE EQUIPPED WITH RAVE. ENGINE HESITATES AT LOW OR MID-SPEED AND REACHES MAXIMUM PERFORMANCE ONLY AFTER A WHILE.**

1. **Check RAVE valve spring(s).**
   - *Spring tension is too low or spring(s) is (are) broken. Replace.*
2. **Check RAVE valve cover red adjustment screws.**
   - *Adjustment screw(s) is (are) too loose. Adjust according to ASSEMBLY PROCEDURE in appropriate engine subsections.*
3. **Check RAVE valve movement (RAVE movement indicator (P/N 861 725 800).**
   - *Valve(s) is (are) stuck in open position. Clean.*

Symptom: **REWIND STARTER ROPE DOES NOT REWIND.**

1. **Check rewind spring.**
   - *Broken spring. Replace spring.*

Symptom: **REWIND STARTER PAWL DOES NOT ENGAGE.**

1. **Check stopper spring.**
   - *Broken stopper spring. Replace.*
2. **Check pawl and pawl lock.**
   - *Pawl and pawl lock have stuck together because of heat. Replace.*
3. **Check pawl and rope sheave.**
   - *Pawl and rope sheave have stuck together because of heat. Replace.*

Symptom: **ENGINE PINGING.**

1. **Check for proper fuel octane number according to engine type.**
   - *Too low fuel octane number. Use appropriate fuel octane number (refer to Operator's Guide).*
2. **Check fuel lines.**
   - *Bent fuel lines (preventing fuel from flowing through). Relocate or replace fuel lines.*
3. **Check if carburetor(s) is (are) clean.**
   - *Dirt prevents fuel from flowing through. Clean.*
4. **Check ignition timing.**
   - *Timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*

Symptom: **ENGINE PINGING.** (cont'd)

5. Check compression ratio.

- *Compression ratio is too high. Replace inadequate part(s) to obtain manufacturer's recommended compression ratio or use a higher grade fuel.*

Symptom: **ENGINE GENERATES A LOT OF VIBRATIONS.**

1. Check engine supports and stopper.

- *Loose and/or broken supports or interference between support(s) and chassis. Retighten to specification (refer to TECHNICAL DATA) or replace.*

2. Check drive pulley (refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY).

3. Check carburetors synchronization.

- *Throttle slide height is not the same on each carburetor and/or throttle slides opening is unsynchronized. Adjust throttle slide heights and throttle cable.*

4. Check crankshaft and bearings.

- *Loose crankshaft bearings or uneven crankshaft. Replace parts.*

ENGINE (4-TEC)

COOLING SYSTEM

Symptom: **HIGH ENGINE OPERATING TEMPERATURE.**

1. **Check coolant level.**
   - *Coolant level lower than recommended. Check for leakage.*
   - *Coolant leaking from control bore means a damaged water pump rotary seal. Replace rotary seal (refer to COOLING SYSTEM and CRANKCASE).*
   - *Cylinder head and/or cylinder base. Gasket(s) is(are) causing coolant leakage. Replace.*
   - *Gasket on water pump housing leaks. Retighten screws and/or replace gasket.*
   - *Hoses are brittle and/or hard. Replace.*
   - *Hose clamps are loose. Retighten clamps.*
2. **Check temperature sensor for electrical/mechanical failure.**
   - *Temperature sensor defective. Replace.*
3. **Check thermostat (located in the thermostat housing on the alternator side cover).**
   - *Thermostat defective (does not open when engine gets hot). Replace water pump housing (refer to COOLING SYSTEM).*
4. **Check condition of impeller located on the water pump shaft.**
   - *Impeller fins broken and/or impeller threads are damaged. Replace.*

ALTERNATOR

Symptom: **NOT CHARGING AT ALL OR CHARGING VOLTAGE INADEQUATE.**

1. **Check the alternator and measure the charging voltage.**
   - *Defective alternator. Replace the alternator (refer to alternator).*
2. **Inspect the alternator; check if it is turning along during starting.**
   - *Generator gear damaged. Replace the generator gear (refer to CRANKSHAFT/DRIVE GEARS).*
3. **Check wiring harness for cracks or other damages.**
   - *Harness shows electrical failure and/or other damages. Replace wire harness.*
4. **Check the alternator charging light on the dashboard for proper functioning.**
   - *Alternator charging light defective. Replace the alternator charging light.*

LUBRICATION

Symptom: **LOW OR NO OIL PRESSURE.**

1. **Check oil level and search for leakage on crankcase and/or sealing parts.**
   - *Oil drain plug on engine bottom is loosed and/or gasket ring is missing. Retighten the plug and/or place gasket ring.*
   - *Control bore if oil leaks (beside thermostat housing). Oil leaking from control bore means a damaged oil seal on water pump shaft. Replace oil seal (refer to COOLING SYSTEM).*
   - *Crankcase is leaking due to damage. Rebuild engine with new crankcase and gasket parts. Use recommended oil (refer to TECHNICAL DATA).*
   - *Crankcase is leaking due to loose screws. Retighten screws with recommended torque.*
   - *Sealing rings, O-rings and/or gaskets are brittle and/or hard or damaged. Replace damaged parts.*
   - *Piston rings worn out (blue coloured engine exhaust emission). Replace piston rings (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Piston rings are broken (low compression). Replace piston rings (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Valve stem seal damaged and/or sealing lip is hard and/or brittle. Replace all valve stem seals.*
2. **Check oil pressure switch function.**
   - *Oil pressure switch damaged. Replace oil pressure switch.*
3. **Check oil orifice(s) on the oil pump suction side.**
   - *Oil orifice(s) is(are) clogged. Clean from contamination. Replace oil and oil filter if necessary (refer to MAINTENANCE or LUBRICATION SYSTEM).*
4. **Check oil pump function.**
   - *Oil pump rotor is out of wear limit. Replace oil pump shaft (refer to LUBRICATION SYSTEM).*
   - *Oil pump seized due to oil leakage and/or air inclusion. Replace oil pump (refer to LUBRICATION SYSTEM).*
   - *Gears driving oil pump are broken or otherwise damaged. Replace gears.*
   - *Incorrect oil being used. Use recommend oil (refer to TECHNICAL DATA).*
5. **Check oil pressure regulator valve (spring) function.**
   - *Valve spring damaged (valve always open). Replace spring.*
   - *Valve piston is stuck in oil pump housing. Repair valve piston.*
6. **Check plain bearings in crankcase for heavy wear.**
   - *Plain bearings out of specification (increased clearance). Replace plain bearings.*

Symptom: **OIL CONTAMINATION (WHITE APPEARANCE).**

1. **Check control bore (beside thermostat housing) if water and oil leaks.**
   - *Leakage of oil/water mixture from bore means damaged water pump seal ring and rotary seal. Replace sealing ring, rotary seal and change oil, oil filter and/or coolant (refer to LUBRICATION SYSTEM, COOLING SYSTEM and CRANKCASE).*
2. **Check cylinder head and/or cylinder base gasket.**
   - *Gasket damaged or leaking. Retighten cylinder head with recommended torque and/or replace gasket.*
3. **Check tightening torque of cylinder head screws.**
   - *Screws not properly tightened. Retighten screws to recommended torque and replace oil.*

Symptom: **OIL CONTAMINATION (WHITE APPEARANCE).** (cont'd)

4. **Check oil for particles (may indicate possible engine internal damages).**
   - *Oil contamination due to metal or plastic particles. Replace possibly damaged part(s) including oil and oil filter. Use recommended oil (refer to TECHNICAL DATA).*

CYLINDER AND CYLINDER HEAD

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from cylinder head area.**
   - *Faulty chain tensioner. Replace spring and/or mechanism.*
   - *Chain guide worn out. Replace chain guide.*
   - *Stretched chain and/or worn out sprockets. Replace chain and sprockets.*
   - *Sprocket screws got loose. Retighten screws with recommended torque.*
   - *Hydraulic element inside rocker arm(s) is(are) worn out (valve adjustment). Replace rocker arm(s).*
   - *Rocker arm screws not tightened. Replace screws and perform the torque procedure (refer to CYLINDER AND CYLINDER HEAD).*

Symptom: **OIL CONTAMINATION ON CYLINDER AND/OR CYLINDER HEAD.**

1. **Check screws for torque.**
   - *Loose screws. Retighten screws with recommended torque.*
   - *Gaskets are brittle, hard, worn out or otherwise damaged. Replace damaged gaskets, O-rings or the V-ring on breather.*
   - *Contact area between spark plug and stick coils fouled by oil. Clean spark plug area and replace spark plug tube.*

CRANKSHAFT

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from crankshaft area.**
   - *Crankshaft bushings are damaged. Replace the crankshaft bushings. (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Connecting rod bushings are damaged. Replace the connecting rod bushings. (refer to CRANKSHAFT/DRIVE GEARS).*
2. **Check if drive gears are loosen.**
   - *Crankshaft nut retaining drive gear is loose. Retighten retaining nut with recommended torque.*

ELECTRIC STARTER

Symptom: **STARTER DOES NOT TURN.**

1. **Check the battery voltage.**
   - *Battery discharged. Charge the battery.*
2. **Check wiring harness for cracks or other damages.**
   - *Harness shows electrical failure and/or other damages. Replace wire harness.*

Symptom: **STARTER DOES NOT TURN.** (cont'd)

3. **Check 30 A and 5 A fuses.**
   - *Burnt fuse. Check wiring condition and replace fuse.*
4. **Check continuity of starter switch contact points.**
   - *Poor contact of starter switch contact points. Repair or replace switch.*
5. **Check continuity between starter switch and ECM.**
   - *Open circuit. Repair.*
6. **Check continuity between ECM and solenoid switch.**
   - *Open circuit. Repair.*

Symptom: **STARTER TURNS, BUT ENGINE DOES NOT CRANK.**

1. **Check the starter gear.**
   - *Starter gear and/or intermediate gear is worn or damaged. Replace starter gear and/or intermediate gear (refer to CRANKSHAFT/DRIVE GEARS).*
2. **Check the sprag clutch.**
   - *Sprag clutch is worn or otherwise damaged. Replace sprag clutch (refer to CRANKSHAFT/DRIVE GEARS).*

Symptom: **STARTER TURNS SLOWLY**

1. **Check battery capacity.**
   - *Shorted battery cell(s). Replace.*
2. **Check battery charge.**
   - *Low battery. Recharge battery and check recharge system and wires.*
3. **Check wire connection.**
   - *Inadequate connection (too much resistance). Clean and reconnect.*
4. **Check brushes.**
   - *Poor contact of brushes. Replace starter.*
5. **Check commutator.**
   - *Burnt commutator. Replace starter.*
6. **Check engine.**
   - *Engine seized. Overhaul the engine.*
7. **Check field coil resistance.**
   - *Shorted field coil. Replace starter.*
8. **Check armature resistance.**
   - *Shorted armature. Replace starter.*
9. **Check tension of brush springs.**
   - *Weak brush spring tension. Replace starter.*
10. **Check if bushings are worn.**
    - *Worn bushings. Replace starter.*

ENGINE GENERAL

Symptom: ENGINE BACKFIRES.

1. **Check spark plug.**
   - *Carbon accumulation caused by defective spark plug. Clean carbon accumulation and replace spark plug.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
3. **Check leakage on intake manifold.**
   - *Air leak on intake system. Retighten screws and/or replace intake manifold gasket.*
4. **Check exhaust air leaking.**
   - *Exhaust gasket is leaking. Retighten screws and/or replace exhaust gasket.*
5. **Check intake valve(s) for leaking.**
   - *Intake valve(s) is(are) leaking. Repair or replace valve(s).*
6. **Check if fuel supply is sufficient at high RPM.**
   - *Fuel line is contaminated and/or bent (engine gets lean). Clean and/or replace defective part(s).*

Symptom: ENGINE SUDDENLY TURNS OFF.

1. **Check spark plug condition and/or gap.**
   - *Fouled spark plug or wrong spark plug gap. Readjust gap and clean spark plug or replaceplace pistons. Ask driver to refer to warm-up procedure in Operator's Guide.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
3. **Check if fuel supply is sufficient at high RPM.**
   - *Fuel line is contaminated and/or bent. Clean and/or replace defective part(s).*
4. **Perform engine leak test. Refer to ENGINE LEAK TEST procedure. Check for possible piston seizure.**
   - *Damaged head gasket and/or seal and/or leaking inlet/exhaust valve(s). Replace and/or repair defective parts.*
5. **Piston seizure.**
   - *Spark plug heat range is too hot. Install spark plug with appropriate heat range (refer to TECHNICAL DATA).*
   - *Compression ratio is too high. Install genuine parts.*
   - *Poor oil quality. Use BRP's XP-S recommended oil.*
   - *Leaks at air intake manifold (engine gets too lean). Retighten screws or replace air intake manifold gasket.*
   - *Snow/water intrusion through intake system into combustion chamber. Clean intake system and replace defective part(s).*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

6. Melted and/or perforated piston dome; melted section at ring end gap.

- *Spark plug heat range is too hot. Install recommended spark plug (refer to TECHNICAL DATA).*
- *Coolant less than recommended level (engine gets too hot). Repair cooling circuit and/or refill with recommended liquid.*
- *Poor quality and/or wrong fuel. Clean from contamination and use appropriate fuel (refer to TECHNICAL DATA).*

7. Piston color is dark due to seizure on intake and exhaust sides.

- *Cooling system leaks and lowers coolant level. Tighten clamps or replace defective parts. Add antifreeze in cooling system until appropriate level is reached. Replace damaged parts.*
- *Oil nozzle is clogged or bent. Clean or replace oil nozzle (refer to LUBRICATION SYSTEM).*

8. Cracked or broken piston.

- *Cracked or broken piston due to excessive piston/cylinder clearance or engine overreving. Replace piston. Check piston/cylinder clearance (refer to CRANKSHAFT/DRIVE GEARS).*

9. Check piston rings and cylinder surface for grooves.

- *Poor oil quality. Use recommended oil.*
- *Contamination through engine intake. Replace defective part(s) and use new air filter.*

10. Check valve springs exhaust/intake.

- *Broken valve spring damages the cylinder head, valve(s), rocker arm(s)/piston/ piston rings and connecting rod. Replace defective part(s).*

11. Check crankshaft, rocker arms movement.

- *Oil pump failure due to leack of oil. Repair and replace defective parts and use recommended oil.*
- *Oil contamination due to clogged oil filter/oil sieve. Replace oil and oil filter at the same time,replace defective part(s) (refer to MAINTENANCE CHART and LUBRICATION SYSTEM).*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. Check spark plug condition and/or gap.

- *Fouled spark plug or wrong spark plug gap. Readjust gap or replace.*

2. Check spark plug type.

- *Improper spark plug heat range. Install recommended spark plug (refer to TECHNICAL DATA).*

3. Check fault codes in B.U.D.S system.

- *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*

4. Check for water in fuel (wrong fuel).

- *There is water in fuel or wrong fuel. Drain fuel system, search for leakage and refill it with appropriate fuel.*

5. Check engine compression.

- *Worn piston(s) and/or piston ring(s). Replace (refer to CYLINDER AND HEAD).*

6. Check fuel pressure.

- *Low fuel pressure. Perform fuel pressure test (refer to COMPONENT INSPECTION AND ADJUSTMENT).*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.** (cont'd)

7. **Perform engine leak test. Refer to ENGINE LEAK TEST procedure. Check for possible piston seizure.**
   - *Damaged head gasket and/or seal and/or leaking intake/exhaust valve(s). Replace and/or repair defective parts.*

Symptom: **ENGINE CRANKS BUT FAILS TO START.**

1. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
2. **Check if stick coil fits on spark plug (refer to spark plug).**
3. **Check spark plug.**
   - *Define spark plug (no spark) or wrong spark plug gap. Readjust gap and clean spark plug or replace.*
4. **Check for fuel on spark plug.**
   - *Flooded engine (spark plug wet when removed). Activate engine drowned mode and crank engine with rags over the spark plug holes (refer to OVERVIEW in EMS system).*
5. **Check battery voltage.**
   - *Battery is discharged and starter works not properly. Charge battery.*
6. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s) (ex.: piston, ring(s), etc.).*
7. **In cold weathers, check engine decompressor (located on camshaft sprocket/timing gear).**
   - *Centrifugal weight spring is not engaged and/or damaged. Readjust spring or replace centrifugal weight if damaged.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG (REFER TO ENGINE MANAGEMENT SYSTEM).**

1. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
2. **Verify spark plug condition.**
   - *Defective, improperly set, worn out, fouled. Identify source of problem and correct. Replace spark plug.*
3. **Check stick coil (refer to COMPONENT INSPECTION AND ADJUSTMENT).**
   - *Defective part. Replace stick coil.*
4. **Check crankshaft position sensor (refer to COMPONENT INSPECTION AND ADJUSTMENT).**
   - *Defective crankshaft position sensor. Corroded connector terminals. Replace crankshaft position sensor. Clean terminals and apply silicone dielectric grease.*
5. **Check condition of wiring harness and connectors.**
   - *Cables and/or connectors are damaged and/or corroded. Replace connectors or complete wiring harness (refer to COMPONENT INSPECTION AND ADJUSTMENT). Clean terminals and apply silicone dielectric grease.*

FUEL AND OIL SYSTEMS (2-STROKE ENGINES)

The following chart is provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For the SDI fuel and oil systems troubleshooting, also refer to appropriate ENGINE subsection.

Symptom: **HIGH FUEL CONSUMPTION OR RICH MIXTURE.**

1. **Check fuel tank.**
   - *Perforated fuel tank. Replace fuel tank.*
2. **Check fittings on fuel pump, fuel tank and carburetor(s).**
   - *Leaking fittings. Replace defective part.*
3. **Check choke adjustment.**
   - *Fuel flows through choke circuit while engine runs. Readjust choke.*
4. **Check float height in carburetor(s).**
   - *Fuel level is too high in float bowl(s). Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check needle valve of carburetor(s).**
   - *Foreign particles prevent needle valve(s) from closing and/or worn seating area. Clean or replace needle valve(s), then clean seating area.*

Symptom: **FUEL LEAKS IN ENGINE BASE WHEN ENGINE IS STOPPED.**

1. **Check items 3, 4 and 5 of HIGH FUEL CONSUMPTION.**
2. **Check fuel pump diaphragm.**
   - *Cracked diaphragm. Replace.*

Symptom: **ENGINE LACKS POWER OR STALLS AT HIGH RPM.**

1. **Check fuel tank vent hose.**
   - *Kinked or clogged vent hose. Relocate or replace.*
2. **Check fuel filter.**
   - *Clogged filter. Replace.*
3. **Check fuel lines.**
   - *Kinked or clogged lines. Relocate or replace.*
4. **Check fuel pump flow.**
   - *Leaking impulse hose. Replace.*
   - *Dried diaphragm. Replace.*
5. **Check if carburetor(s) is (are) clean.**
   - *Varnish. Clean.*

Symptom: **HIGH INJECTION OIL CONSUMPTION.**

1. **Check oil injection pump adjustment.**
   - *Oil injection pump adjusted too rich. Adjust.*
2. **Check injection pump identification.**
   - *Wrong pump installed. Replace with the appropriate pump. Refer to OIL INJECTION SYSTEM.*
3. **Check injection oil lines and their fitting.**
   - *Leaking lines. Replace defective part(s).*
4. **Check injection pump cover gasket.**
   - *Worn gasket. Replace.*
5. **Check pump check valve(s).**
   - *Check valve(s) stuck open. Replace.*
6. **Check pump.**
   - *Leaking pump. Replace.*
7. **Check oil pump cable.**
   - *Cable stuck in open position. Replace cable.*
8. **On liquid-cooled models, test pump shaft gear reservoir for leaks.**
   - *Leaking seals. Replace seals.*

Symptom: **ENGINE LACKS FUEL (OR LEAN MIXTURE).**

1. **Check fuel filter ball located in fuel tank. Ball must move freely.**
   - *Corrosion due to oxidation at installation. Replace fuel filter.*
2. **Check if lines are perforated or kinked or if they leak at fittings.**
   - *Lines are too big for their fittings or are improperly routed. Replace or properly relocate lines.*
3. **Check fuel pump outlet flow.**
   - *Dirt clogging fuel pump lines or torn membrane. Clean or replace fuel pump.*
4. **Check needle valve of carburetor(s).**
   - *Dirt (varnish, foreign particle) clogging fuel line inlets. Clean.*
5. **Check main jet.**
   - *Dirt (varnish, foreign particle) accumulation at main jet. Clean.*
6. **Check float height in carburetor bowl(s).**
   - *Running out of fuel at high speed because float height is too low. Adjust float height according to specifications.*

Symptom: **DPM SEEMS TO BE DEFECTIVE.**

1. **Check electrical connections.**
   - *Corroded terminals. Clean or replace.*
2. **Fuel mixture is too rich or too poor.**
   - *Possible damage to DPM. If DPM does not operate properly, unplug compensation solenoid connector while engine is running. The carburetion is now identical to that of carburetors without a DPM, provided that all pipe fittings are tight and that solenoid is in good condition, (it must not be half-open). If problem is resolved with this procedure, DPM is faulty.*

Symptom: **DPM SEEMS TO BE DEFECTIVE.** (cont'd)

3. Check for DPM manifold leaking.

- DPM manifold is leaking. Repair or replace.

TRANSMISSION AND BRAKE SYSTEMS

The following charts are provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

TRANSMISSION

Symptom: **THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY FROM A STANDING START.**

1. **Check drive belt condition.**
   - *Belt is too narrow (drive belt engagement is higher in drive pulley). Replace belt if width is less than specified in DRIVE BELT.*
2. **Check distance between pulleys and/or drive belt deflection.**
   - *Distance is too small between pulleys or deflection is too high (drive belt engagement is higher in drive pulley). Adjust distance between pulleys and/or drive belt deflection according to specifications (refer to TECHNICAL DATA).*
3. **Check driven pulley sliding half play.**
   - *Jammed sliding half. Replace.*
4. **Check spring tension of driven pulley sliding half.**
   - *Sliding half rotation is accelerated when spring tension is too weak. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY and VIBRATIONS ORIGINATING FROM DRIVEN PULLEY and check items listed.**
6. **Check drive pulley spring tension.**
   - *Spring tension is too weak. Replace.*

Symptom: **ENGINE MAXIMUM RPM IS TOO HIGH AND TOP SPEED IS NOT REACHED.**

1. **Check items 1, 2 and 3 of THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY WHEN IT IS STOPPED.**
2. **Check driven pulley spring tension.**
   - *Spring tension is too stiff. Adjust according to specifications (refer to TECHNICAL DATA).*
3. **Check position of the calibration screws (TRA drive pulley).**
   - *Selected numbers are too high. Adjust according to specifications (refer to TECHNICAL DATA).*
4. **Refer to VIBRATIONS ORIGINATING FROM DRIVEN PULLEY and check items listed.**
5. **Check the driven pulley.**
   - *Driven pulley does not open completely. Clean, readjust or replace driven pulley.*
6. **Check if levers of drive pulley move freely.**
   - *Stuck levers. Replace lever bushings.*

Symptom: **LOOSENESS IS FELT IN DRIVE SYSTEM WHEN ACCELERATING/DECELERATING.**

1. **Check drive chain tension.**
   - *Drive chain is too loose. Adjust.*
2. **Check radial play of driven pulley.**
   - *Worn key, keyway or splines. Replace.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVE PULLEY.**

1. **Check drive belt.**
   - *Belt width is uneven at many places. Replace.*
2. **Check tightening torque of drive pulley screw.**
   - *Moving governor cup. Retighten screw.*
3. **Spring cover screws.**
   - *Spring cover moves and restrains sliding half movement. Retighten screws.*
4. **Check spring cover (TRA TYPE) and/or sliding half bushings.**
   - *Excessive gap between bushings and fixed half shaft, thus restraining sliding half movements. Replace bushing(s).*
5. **Check governor cup splines.**
   - *Excessive radial play. Replace governor cup.*
6. **Check lever assembly.**
   - *Lever assembly is damaged (worn bushing, bent lever, etc.). Replace damaged part.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVEN PULLEY.**

1. **Check sliding half side play.**
   - *Sliding half bushing worn out. Replace sliding half bushing.*
2. **Check sliding half and fixed half straightness.**
   - *Sliding half/fixed half warped. Replace.*
3. **Check cam slider shoes.**
   - *One or two slider shoes out of three are broken. Replace.*

Symptom: **PULLEYS DO NOT DOWN SHIFT PROPERLY.**

1. **Check driven pulley spring tension.**
   - *Spring tension is too low. Adjust according to specifications (refer to TECHNICAL DATA).*
2. **Refer to VIBRATIONS COMING FROM DRIVEN PULLEY and check items listed.**
3. **Check drive pulley bushings (cleanliness, wear, etc.).**
   - *Bushings stick to fixed half pulley shaft. Clean or replace.*

Symptom: **IN REVERSE ENGINE FAILS AND DRIVEN PULLEY OPENS TOO FAST (DRIVE BELT IS LOW IN DRIVEN PULLEY).**

1. **Check pulley distance and alignment.**
   - *Improper adjustment. Adjust according to specifications (refer to PULLEY DISTANCE AND ALIGNMENT) and make sure that torque rod is resting against engine. Check engine mounts.*
2. **Check for reverse sliding shoes.**
   - *Sliding shoes are worn or missing. Replace sliding shoes.*
3. **Check spring.**
   - *Spring is weak or insufficient tension. Replace spring.*

Symptom: **UNEVEN BELT WEAR ON ONE SIDE ONLY.**

1. **Check tightening torque of engine mount bolts.**
   - *Loose engine mount. Tighten engine mount nuts/bolts equally.*
2. **Check pulley alignment.**
   - *Pulley misalignment. Align pulleys.*
3. **Check drive belt contact area on pulleys.**
   - *Rough or scratched pulley surfaces. Repair or replace pulley half.*
4. **Check driven pulley sliding half play.**
   - *Driven pulley bushing worn. Replace bushing.*

Symptom: **BELT GLAZED EXCESSIVELY OR HAVING BAKED APPEARANCE.**

1. **Check if drive pulley bushings are worn.**
   - *Slipping due to insufficient pressure on belt sides. Replace bushing.*
2. **Check condition of drive pulley fixed half shaft.**
   - *Slipping due to rusted drive or driven pulley shafts. Clean shaft with fine steel wool.*
3. **Check if pulley halves are clean.**
   - *Slipping due to oily pulley surfaces. Clean pulley halves.*
4. **Check pulley calibration.**
   - *Slipping due to improper pulley calibration. Calibrate according to specifications.*

Symptom: **BELT WORN EXCESSIVELY IN TOP WIDTH.**

1. **Check drive pulley.**
   - *Excessive slippage due to jammed of drive pulley. Inspect drive pulley.*
2. **Check drive belt identification number.**
   - *Improper belt angle. (wrong type of belt). Replace belt with an appropriate drive belt.*
3. **Check drive belt width.**
   - *Considerable use. Replace belt if width is less than specified in DRIVE BELT.*

Symptom: **BELT TOO NARROW ON ONE SECTION.**

1. **Check for frozen track.**
   - *Frozen track. Free track from ice.*
2. **Check parking brake.**
   - *Parking brake is engaged. Release parking brake.*
3. **Check track tension/alignment.**
   - *Track too tight. Adjust track tension and alignment.*
4. **Check drive pulley.**
   - *Drive pulley does not operate properly. Repair or replace drive pulley.*
5. **Check idle speed.**
   - *Engine idle speed is too high. Adjust according to specifications.*
6. **Check drive belt length.**
   - *Incorrect belt length. Replace with an appropriate drive belt (refer to TECHNICAL DATA).*
7. **Check distance between pulleys.**
   - *Incorrect pulley distance. Readjust according to specifications.*
8. **Check belt height.**
   - *Belt height is incorrect. Adjust according to specifications.*

Symptom: **BELT SIDES WORN CONCAVE.**

1. **Check pulley half surfaces.**
   - *Rough or scratched pulley half surfaces. Repair or replace.*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace belt with an appropriate drive belt (refer to TECHNICAL DATA).*

Symptom: **BELT DISINTEGRATION.**

1. **Check drive belt identification number.**
   - *Excessive belt speed. Wrong type of belt. Replace belt with proper type of belt. (refer to TECHNICAL DATA).*
2. **Check if pulley halves are clean.**
   - *Oil on pulley surfaces. Clean pulley surfaces with fine emery cloth and wipe clean using Parts Cleaner (P/N 413 711 809) and a cloth.*

Symptom: **BELTCORD POPPED OUT.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to TECHNICAL DATA).*

Symptom: **FATIGUE CRACKS BETWEEN COGS.**

1. **Check drive belt condition.**
   - *Belt considerably worn, worn out. Replace.*
   - *Distortion of natural belt shape due to improper storage. Store properly.*

Symptom: **TOOTH CHUNK OUT.**

1. **Check drive belt rotational direction.**
   - *Improper belt installation. Replace.*
2. **Check if drive belt rubs against components.**
   - *Belt rubs against fixed components. Relocate components.*
3. **Check drive pulley.**
   - *Violent engagement of drive pulley. Check drive pulley engagement speed, drive pulley bushings and components.*

Symptom: **BELT "FLIP-OVER" AT HIGH SPEED.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to TECHNICAL DATA).*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace with an appropriate drive belt.*

BRAKE SYSTEM

MECHANICAL BRAKE

Symptom: **BRAKE DOES NOT ADJUST AUTOMATICALLY.**

1. **Check ratchet wheel spring.**
   - *Broken ratchet wheel spring tab. Replace.*
2. **Check mobile pad stud.**
   - *Stud rotates in pad. Replace.*

Symptom: **BRAKE HANDLE DOES NOT RETURN COMPLETELY.**

1. **Check brake return spring.**
   - *Broken return spring. Replace.*
2. **Check if brake cable moves freely in its housing.**
   - *Brake cable movement is limited due to oxidation or dirt accumulation. Replace.*
3. **Check distance between brake lever and caliper.**
   - *Distance is too wide. Adjust according to specifications (refer to TRANSMISSION).*

HYDRAULIC BRAKE

Symptom: **SPONGY BRAKE CONDITION.**

1. **Contaminated brake fluid.**
   - *Replace brake fluid and bleed system. If the problem persists, replace master cylinder.*
2. **Check for damaged hose, master cylinder and caliper.**
   - *Replace part(s) and check for proper mounting.*

Symptom: **BRAKE FLUID LEAKING.**

1. **Check for loosen hose connectors.**
   - *Replace copper washers and retighten.*

MECHANICAL AND HYDRAULIC BRAKES

Symptom: **BRAKE SYSTEM IS NOISY.**

1. **Check brake pad thickness.**
   - *Pads are worn up to wear warner. Replace.*
2. **Check key/keyway or splines.**
   - *Key/keyway or splines are worn out. Replace parts.*

ELECTRICAL SYSTEM

The following chart is provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **STARTER DOES NOT TURN.**

1. **Check fuse.**
   - *Burnt fuse. Check wiring condition and replace fuse.*
2. **Check continuity of starter switch contact points.**
   - *Poor contact of starter switch contact points. Repair or replace switch.*
3. **Check continuity between starter switch and solenoid on fan-cooled models or between starter switch and MPEM on liquid-cooled models.**
   - *Open circuit. Repair.*
4. **On liquid-cooled models check continuity between MPEM and solenoid switch.**
   - *Open circuit. Repair.*

Symptom: **STARTER TURNS BUT DOES NOT CRANK THE ENGINE.**

1. **Check engine.**
   - *Engine seized. Rebuild engine.*
2. **Check wire connection.**
   - *Inadequate connection (too much resistance). Clean and reconnect.*
3. **Check battery charge.**
   - *Weak battery. Recharge battery and verify recharge system and wires.*
4. **Check battery capacity.**
   - *Shorted battery cell(s). Replace.*
5. **Check starter relay contact disc.**
   - *Burnt or poor contact of starter relay contact disc. Replace starter relay.*
6. **Check continuity of starter relay pull-in winding.**
   - *Open circuit of starter relay pull-in winding. Replace starter relay.*
7. **Check continuity of starter relay hold-in winding.**
   - *Open circuit of starter relay hold-in winding. Replace starter relay.*
8. **Check brushes.**
   - *Poor contact of brushes or worn. Replace brushes.*
9. **Check commutator.**
   - *Burnt commutator. Turn commutator on a lathe. Respect outer diameter wear limit. Refer to ELECTRIC STARTER.*
10. **Check height of commutator mica.**
    - *Commutator mica too high. Undercut mica.*
11. **Check field coil resistance.**
    - *Shorted field coil. Repair or replace yoke.*
12. **Check armature resistance.**
    - *Shorted armature. Repair or replace armature.*

Symptom: **STARTER TURNS BUT DOES NOT CRANK THE ENGINE.** (cont'd)

13. Check tension of brush springs.
- *Weak brush spring tension. Replace springs.*

14. Check yoke assembly magnets.
- *Weak magnets. Replace yoke assembly.*

15. Check if bushings are worn.
- *Worn bushings. Replace bushings.*

Symptom: **STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.**

1. Check clutch pinion gear and small return spring.
- *Worn clutch pinion gear or damaged small return spring. Replace damaged part(s).*

2. Check clutch.
- *Defective clutch. Replace clutch.*

3. Check brackets.
- *Worn or broken brackets. Replace brackets.*

4. Check movement of clutch on splines.
- *Poor movement of clutch on splines. Clean and correct.*

5. Check clutch bushing.
- *Worn clutch bushing. Replace clutch.*

6. Check starter bushings.
- *Worn starter bushing(s). Replace bushing(s).*

7. Check ring gear.
- *Worn ring gear. Replace ring gear.*

8. Check for proper starter rotation direction.
- *Starter turns in wrong direction, incorrectly installed brushes, wrong polarity or wrong starter. Replace starter or reconnect properly.*

Symptom: **ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.**

1. Check clutch.
- *Jammed clutch pinion gear. Replace or clean.*

2. Check movement of clutch on splines.
- *Clutch is stuck on splines. Clean.*

3. Check starter brackets.
- *Broken bracket(s). Replace bracket(s).*

4. Check ignition switch (fan-cooled models).
- *Ignition switch does not return to its ON position or is short-circuited. Adjust retaining screw or replace switch.*

5. Check starter relay.
- *Shorted starter relay winding(s). Replace starter relay.*

Symptom: **ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.** (cont'd)

6. **Check starter relay contacts.**
   - *Melted starter relay contacts. Replace starter relay.*
7. **Check starter switch.**
   - *Starter switch returns poorly. Replace ignition switch.*

Symptom: **NOISE OCCURENCE WHEN STARTING ENGINE.**

1. **Check if ring gear is well-mounted to drive pulley fixed half.**
   - *Loose and/or broken bolts. Retighten bolts using threadslocker or replace ring gear and drive pulley fixed half.*

Symptom: **REGULATOR BLACK WIRE IS MELTED (HARNESS SIDE).**

1. **Check that big ground wire at battery is well connected to chassis.**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*

Symptom: **OPTIONAL ELECTRIC STARTER DOES NOT WORK WHEN TURNING IGNITION SWITCH.**

1. **Check connection of BLACK wire (starter relay ground) in 3-wire housing coming from magneto (white housing).**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*

Symptom: **ELECTRIC STARTER SOMETIMES DOES NOT WORK WHEN ACTIVATED.**

1. **Check battery cables and starter wires.**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*
2. **Check fuse(s).**
   - *Oxidized or burnt fuse(s). Clean or replace.*
3. **Check wiring harness connections.**
   - *Oxidized connections. Clean or replace defective terminals.*
4. **Check ignition switch.**
   - *Defective contacts in ignition switch. Replace.*
5. **Check starter relay.**
   - *Shorted starter relay wiring harness or eroded contact washer. Replace.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG. (AT ENGINE CRANKING.)**

1. **Verify spark plug condition.**
   - *Defective, improperly set, worn-out, fouled. Identify source of problem and correct. Replace spark plugs.*
2. **Verify spark plug cap resistance with an ohmmeter.**
   - *Defective part. Replace cap.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG. (AT ENGINE CRANKING.)** (cont'd)

3. **Verify if problem originated from electrical system wiring harness and/or accessories and/or ignition cut-out switches by unplugging the 3-wire connectors between the magneto/generator and the vehicle wiring harness. Check condition of connectors.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Defective switch(es). Corroded connector terminals. Replace or repair damaged wires. Reroute where necessary. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*
4. **Verify trigger coil resistance with an ohmmeter and connector condition.**
   - *Defective coil. Corroded connector terminals. Replace defective coil. Clean terminals and apply silicone dielectric grease.*
5. **Verify condition of ignition coil.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace ignition coil.*
6. **Verify condition of ignition generator coils.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace coils.*
7. **Verify MPEM.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace MPEM, retest and verify ignition timing.*

Symptom: **CDI/MPEM MODULE DOES NOT WORK.**

1. **Check that high tension coil wires do not touch any metal parts.**
   - *Short circuit. Isolate and reroute wires.*

Symptom: **ENGINE STALLS (AT LOW SPEED).**

1. **Verify items 4, 5 and 6 above.**

Symptom: **IRREGULAR ENGINE SPEED (AT HIGH SPEED).**

1. **Verify items 4, 5 and 6 above.**

Symptom: **IRREGULAR ENGINE SPEED (AT LOW SPEED).**

1. **Verify items 4 and 5 above and trigger coil/flywheel protrusion air gap.**
   - *Air gap too large. Readjust air gap.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG. (RIDING ON WET SNOW.)**

1. **Verify if spark plug wires and/or spark plug cap seals are sealing out moisture.**
   - *Defective wires and/or seals. Replace defective part.*
2. **Verify if ignition system wiring harness connectors are in good condition and/or are sealing out moisture.**
   - *Loose connectors, corroded terminals or defective parts. Clean terminals and apply silicone dielectric grease. Replace defective parts.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG (NORMAL USE).**

1. **Verify misfiring by observing flash of stroboscopic timing light; unplug connectors between magneto/generator and vehicle wiring harness to isolate problem. Check condition of connectors.**
   - *Defective spark plug(s) and/or cable(s)/cap(s). Defective electrical system wiring harness and/or accessories and/ignition cut-out switches. Condition of connector terminals. Replace defective parts and/or repair damaged wires. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG. (RIDING IN DEEP AND THICK SNOW.)**

1. **Perform all verifications outlined under ENGINE DOES NOT START — NO SPARK AT SPARK PLUG.**
2. **Verify spark plugs. Proceed with spark plug analysis in order to identify source of problem.**
   - *Defective and/or worn spark plug(s) and/or cable(s) and/or cap(s). Replace defective part(s). Proceed with ignition system testing procedures. Perform engine analysis.*

Symptom: **FOULED (BLACK) SPARK PLUG TIP.**

1. **Check carburetor(s).**
   - *Carburetion is too rich. Adjust according to specifications (refer to TECHNICAL DATA).*
2. **Check injection oil consumption.**
   - *Injection pump flow is too high. Adjust according to specifications or replace.*
3. **Check oil quality.**
   - *Poor quality oil. Use Bombardier injection oil.*
4. **Check engine compression.**
   - *Leaking piston ring(s). Replace.*

Symptom: **SPARK PLUG TIP(S) IS (ARE) LIGHT GREY.**

1. **Refer to ENGINE SLOWS DOWN OR STOPS AT HIGH RPM and check items listed.**
2. **Check spark plug heat range.**
   - *Spark plug heat range is too high. Replace by Bombardier's recommended spark plug (refer to TECHNICAL DATA).*
3. **Check if air intake silencer leaks.**
   - *Air surplus coming from opening(s) located between halves. Seal.*
4. **Check carburetor adapter collars.**
   - *Loose collar(s). Tighten.*
5. **Check carburetor adapter(s).**
   - *Cracked or deformed adapter(s). Replace.*
6. **Check if primary compression leaks.**
   - *Primary compression leaks. Perform leak down test and repair as necessary.*

Symptom: **RER (ROTAX ELECTRONIC REVERSE) DOES NOT WORK.**

1. **Check idle speed.**
   - *Wrong idle speed. Adjust according to specification (refer to TECHNICAL DATA).*
2. **Check spark plug.**
   - *Faulty spark plug. Replace.*
3. **Check drive belt deflection.**
   - *Wrong deflection. Adjust according to specification (refer to TECHNICAL DATA).*
4. **Check carburetor synchronization and air screw adjustment.**
   - *Wrong adjustment. Adjust according to specification (refer to TECHNICAL DATA) and read carburetor subsection.*
5. **Check electrical connections.**
   - *Bad electrical connections or damaged wires. Clean or replace.*
6. **Check MPEM.**
   - *Faulty MPEM. Replace.*

Symptom: **RER (ROTAX ELECTRONIC REVERSE) DOES NOT WORK (AT HIGH ALTITUDE).**

1. **Check high altitude cap continuity.**
   - *Broken jumper inside high altitude cap. Replace high altitude cap.*

Symptom: **HEADLAMP NOT LIGHTING (WHITE BULB).**

1. **Check bulb.**
   - *Gas leak. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING (BROKEN ELEMENT).**

1. **Check for loose headlamp housing and bulb socket.**
   - *Vibration problem. Tighten headlamp mounting screws. Lock bulb in socket. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING. (MELTED FILAMENT (ENDS OF ELEMENT HOLDER) AND BLACK BULB.)**

1. **Check voltage at headlamp at different speeds. It must not be above 15 Vac. (If quartz halogen bulb is involved, ensure that proper voltage regulator is installed).**
   - *Excessive voltage in lighting circuit. Replace voltage regulator and ensure proper grounding. Retest.*

Symptom: **HEADLAMP DIMING.**

1. **Check voltage at headlamp at different speeds. It must not be below 11 Vac.**
   - *Insufficient voltage in lighting circuit. Replace voltage regulator and retest.*
2. **Visually inspect wiring harness for damaged and/or melted wires and/or bad wire terminal crimping and/or connections.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Repair/replace damaged wires and/or terminals. Reroute harness where necessary.*
3. **On manual start models: Verify regulator ground.**
   - *Rusted or loose retaining screws. Clean, apply lithium grease (LMZ1) and firmly tighten screws.*

Symptom: **HEADLAMP DIMING.** (cont'd)

4. **Verify if there is an interconnection between AC and DC current (fan-cooled models).**
   - *Faulty installation of optional equipment. Find optional equipment connected directly to DC ground (BK wire or chassis) or to any DC hot wire (RD, RD/BU). Disconnect and reconnect to AC current (YL and YL/BK wires).*
5. **Verify if optional electric accessories are overloading the magneto/generator.**
   - *Excessive electrical load to magneto/generator. Reduce the electrical load by removing excess accessories. Reconnect as recommended by manufacturer.*
6. **Hot Grips brand: Verify if they were connected in parallel by mistake.**
   - *Excessive electrical load to magneto/generator. Reconnect as recommended by manufacturer.*
7. **Bombardier heating grips: Verify if the return wires of the elements were grounded to the chassis by mistake.**
   - *Faulty installation of optional equipment. Reconnect as recommended by manufacturer.*
8. **Verify if heating grips installation overloads the magneto/generator capacity.**
   - *Excessive electrical load to magneto/generator. Reduce the electrical load by removing accessories.*

Symptom: **FALSE FUEL AND/OR TEMPERATURE GAUGE READINGS.**

1. **Verify if gauge was connected on DC current by mistake (in case of optional installation).**
   - *Faulty installation of optional equipment. Find optional wires connected directly to DC ground (BK wire to chassis) or to any DC hot wire (RD, RD/BU). Disconnect and reconnect to AC current (YL and YL/BK wires).*
2. **Verify sender unit for resistance variation when moving float arm.**
   - *Defective or damage part. Replace sender unit.*
3. **Verify sender unit for free movement and/or correct arm position.**
   - *Defective or damaged part. Correct or replace sender unit.*
4. **Verify sender unit/gauge wiring harness condition.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Replace or repair damaged wires. Reroute where necessary.*

Symptom: **WITH ENGINE IDLING NO ELECTRICAL ACCESSORIES WORK.**

1. **Check idle speed.**
   - *Too low idle speed. Readjust to specifications.*
2. **Verify regulator.**
   - *Faulty regulator. Replace.*

Symptom: **BRAKE LIGHT REMAINS ON.**

1. **Check if bulb is properly installed.**
   - *Bulb is not installed correctly (contact elements are reversed). Install bulb correctly.*
2. **Check brake switch.**
   - *Switch contact remains closed. On mechanical brake if brake switch is in good condition, adjust brake cable or brake switch. On hydraulic brake, replace brake switch.*
3. **Check wiring harness.**
   - *Shorted wiring harness. Replace or repair wiring harness.*

Symptom: **REAR LIGHT BULB FLASHES.**

1. **Check bulb tightness in housing.**
   - *Looseness at bulb contact elements. Install bulb correctly.*
2. **Check if rear light is properly connected.**
   - *Connector housing is partially connected. Install connector housing properly.*
3. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires*

Symptom: **TACHOMETER DOES NOT WORK.**

1. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires.*

Symptom: **HIGH BEAM PILOT LAMP LIGHTS UP WHEN LOW BEAM IS SELECTED.**

1. **Check proper connections.**
   - *YELLOW wire connected to pilot lamp. Mixed-up connections with heating element pilot lamps. Reconnect a yellow/black wire to pilot lamp. yellow wires are connected to heating element pilot lamps.*

SUSPENSION AND TRACK

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **SUSPENSION IS TOO LOW.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Installed springs are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*

Symptom: **REAR SUSPENSION BOTTOMS OUT.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Springs installed are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
4. **Check the rear shock motion ratio position.**
   - *It is adjusted in soft position. Adjust rear shock motion ratio to firm position.*

Symptom: **REAR SUSPENSION IS TOO STIFF.**

1. **Check rear spring preload.**
   - *Too much preload. Adjust to a softer position.*
2. **Check springs.**
   - *Springs installed are too stiff. Install optional softer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
3. **Check the rear shock motion ratio position.**
   - *It is adjusted in firm position. Adjust rear shock motion ratio to soft position.*
4. **Check track tension.**
   - *Track is too tight. Adjust.*
5. **Check if axles are properly lubricated.**
   - *Improper lubrication and/or contaminated grease (sticky oil sludge). Clean and/or lubricate.*

Symptom: **WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.**

1. **Check ski runner condition.**
   - *Worn ski runners. Replace.*
2. **Check ski spring preload.**
   - *Insufficient ski pressure on the ground. Increase spring preload.*

Symptom: **WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.** (cont'd)

3. **Check if front arm stopper strap is too long.**
   - *Insufficient ski pressure on the ground. Shorten stopper strap.*
4. **Check front arm spring preload.**
   - *Insufficient ski pressure on the ground. Loosen spring tension.*

Symptom: **HANDLEBAR IS DIFFICULT TO TURN.**

1. **Check if the handle bar turns freely when skis are off the ground.**
   - *Ball joints corrosion restrains movement. Lubricate or replace the ball joint.*
   - *Component need proper lubrication. Lubricate. Refer to MAINTENANCE.*
   - *Bent parts. Replace parts.*
2. **Check ski spring preload.**
   - *Too much preload. Reduce ski spring preload.*
3. **Check position of stopper strap.**
   - *Too much weight when stopper strap is short. Lengthen front arm stopper strap.*
4. **Check position of front arm spring adjustment cam(s).**
   - *When spring tension is weak, more weight is transferred to the skis. Increase spring preload.*

Symptom: **THE SNOWMOBILE ZIGZAGS.**

1. **Check ski runner condition.**
   - *Worn or bent ski runners. Replace ski runners.*
2. **Check ski alignment.**
   - *Improper ski alignment. Align skis in order to obtain proper toe-out (opening) (to adjust, refer to STEERING SYSTEM).*
3. **Check if bushings are too loose in steering system.**
   - *Bushings are too loose. Replace.*
4. **Check ski pressure.**
   - *Too much pressure on skis. Reduce ski spring preload and/or increase center spring preload.*

Symptom: **SLIDER SHOES WEAR OUT PREMATURELY/OR TRACK CLEATS BECOME BLUE.**

1. **Check track tension.**
   - *Pressure is too great on slider shoes. Adjust according to specifications (refer to TECHNICAL DATA). Replace defective parts.*
2. **Check idler wheel condition.**
   - *Stuck bearing, flat spot on wheel or damaged wheel. Replace defective parts.*
3. **Check snow conditions or lack of snow.**
   - *Lack of lubrication of slider shoes Ask driver to ride in appropriate snow conditions (see Operator's Guide).*
4. **Check slider shoes and/or suspension retaining screws.**
   - *Twisted slider shoes or loose retaining screws. Replace defective parts and/or tighten loose screws.*

Symptom: **DERAILING TRACK.**

1. **Check track tension.**
   - *Track is too loose. Adjust.*
2. **Check if track and slider shoes are properly aligned.**
   - *Improper alignment. Adjust.*

Symptom: **NOISE OR VIBRATION COMING FROM THE TRACK.**

1. **Check slide suspension retaining bolts.**
   - *Missing bolt(s) (some components interfere with track rotation). Replace missing bolt(s).*
2. **Check condition of idler wheel(s).**
   - *Idler wheel rubber is damaged. Replace.*
3. **Check guide cleats.**
   - *Top portion of guide cleat(s) is bent. Replace.*
4. **Check sprockets.**
   - *One or several teeth of drive shaft sprockets are broken. Replace sprocket(s).*
5. **Check track tension.**
   - *Track is too loose. Adjust to recommended tension.*
6. **Check track rods and/or internal traction teeth.**
   - *One or several track rods and/or teeth are broken. Replace track.*

277 ENGINE TYPE

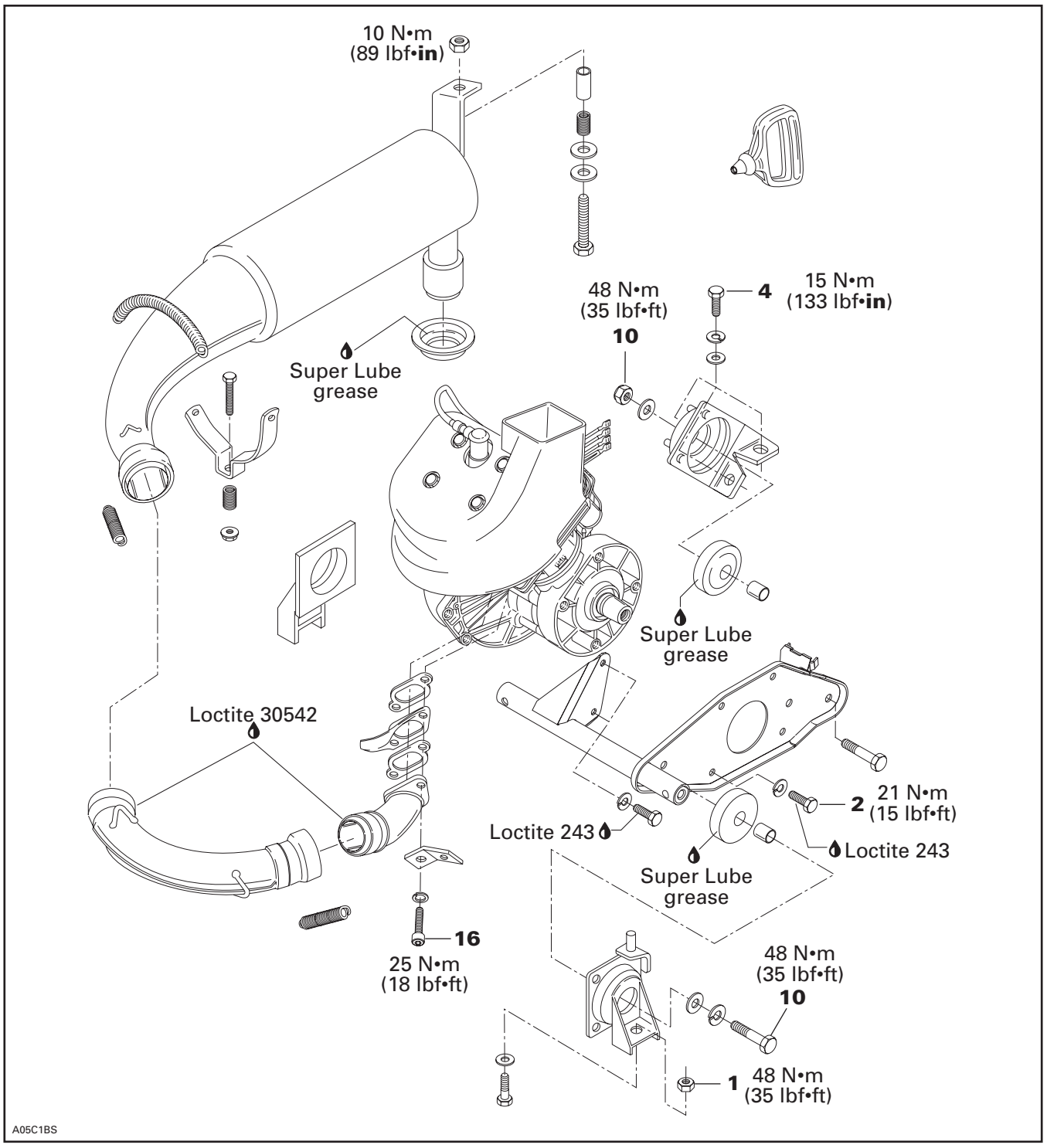
SERVICE TOOLS

Description	Part Number	Page
18 mm sleeve kit	529 035 541	51
locating sleeve	529 023 800	51
piston circlip installer	529 035 561	54
piston pin puller	529 035 503	51
plate	529 024 900	58
puller	420 876 298	58
pusher	420 277 875	59
pusher	420 876 660	59
rubber pad	529 023 400	51

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	58
Loctite 243	293 800 060	49
Loctite 30542	293 800 090	49

ENGINE REMOVAL AND INSTALLATION



REMOVAL FROM VEHICLE

Remove or disconnect the following then lift engine from vehicle:

– guard
– drive belt
– muffler
– carburetor
– oil injection pump cable
– oil injection inlet line
– impulse line
– electrical connectors
– hood retaining cable
– engine mount nuts.

ENGINE SUPPORT AND MUFFLER DISASSEMBLY AND ASSEMBLY

Torque the manifold screws **no. 16** to 25 N•m (18 lbf•ft).

Torque the support screws **no. 4** to 15 N•m (133 lbf•**in**) and nuts **no. 1** to 48 N•m (35 lbf•ft).

Torque the engine support screws and nut **no. 10** to 48 N•m (35 lbf•ft).

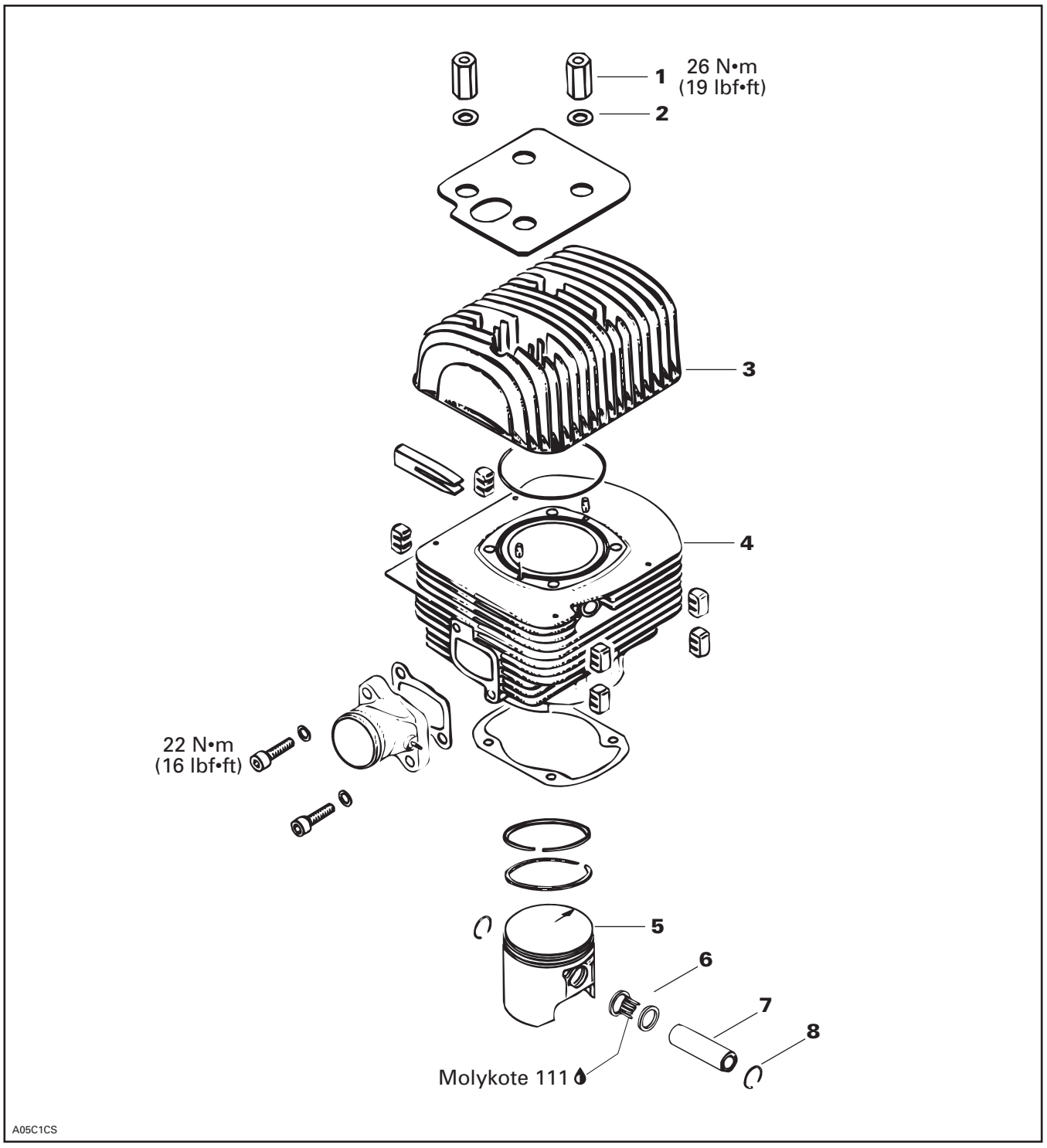
Apply Loctite 243 (P/N 293 800 060) on threads of screw **no. 2**. Torque screws **no. 2** retaining the engine support to engine crankcase to 21 N•m (15 lbf•ft).

INSTALLATION ON VEHICLE

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

– Check tightness of engine mount nuts, and drive pulley screw.
– After throttle cable installation, check maximum throttle slide opening.
– Check pulley alignment and drive belt tension.
– Seal exhaust ball joints with Loctite 30542 (P/N 293 800 090).

TOP END



TROUBLESHOOTING

Before completely disassembling the engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

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

TOP END REMOVAL (WITHOUT REMOVING ENGINE FROM CHASSIS)

Remove the following then lift cylinder head **no. 3** and cylinder **no. 4**:

- belt guard
- carburetor
- exhaust system
- spark plug
- oil injection inlet
- fan cowl and hood cable
- cylinder head nuts **no. 1** and washers **no. 2**.

CLEANING

Discard all gaskets.

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

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" (over an arrow on the piston dome) must be visible after cleaning.

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

DISASSEMBLY

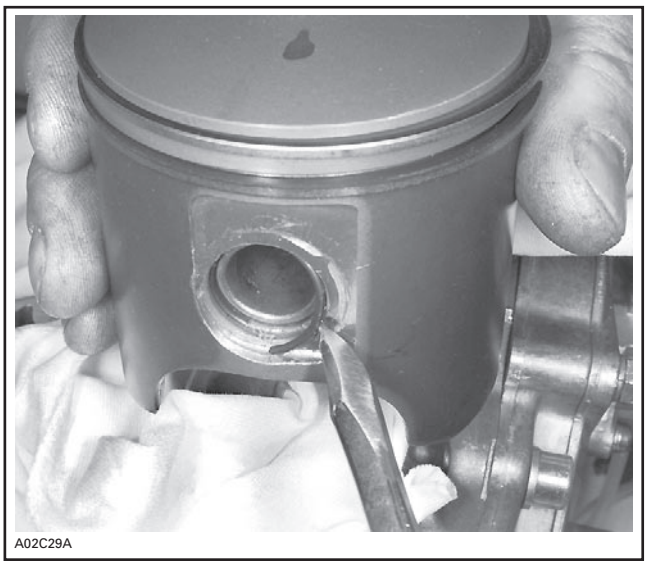
5, Piston

On this engine, piston pin needle bearing **no. 6** is mounted without a cage.

Use piston pin puller (P/N 529 035 503) along with 18 mm sleeve kit (P/N 529 035 541) and locating sleeve (P/N 529 023 800).

NOTE: The locating sleeve is the same that contains new cageless bearing.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips **no. 8** from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston **no. 5**.

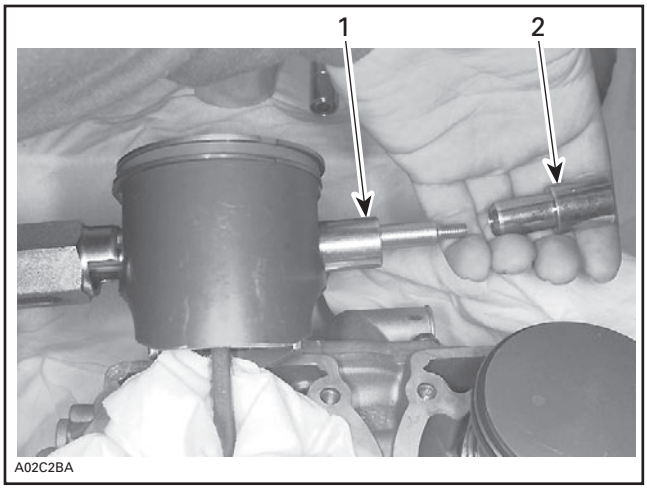


TYPICAL

Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.

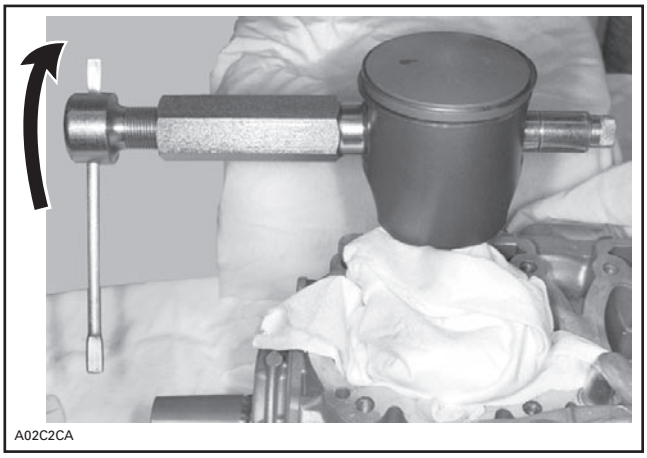
TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

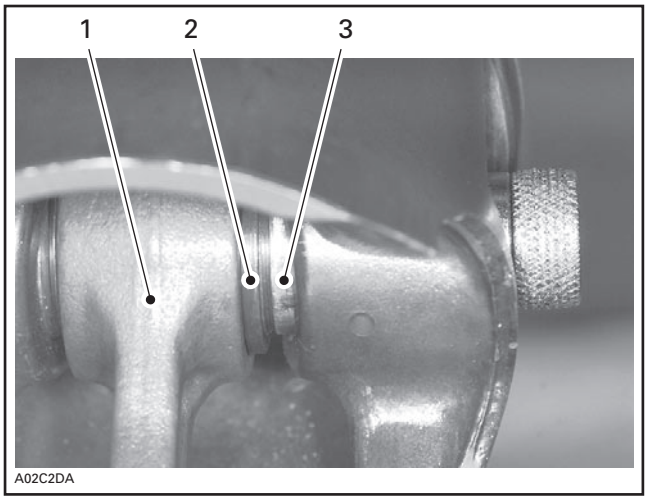


TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Pull out piston pin no. 7 by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

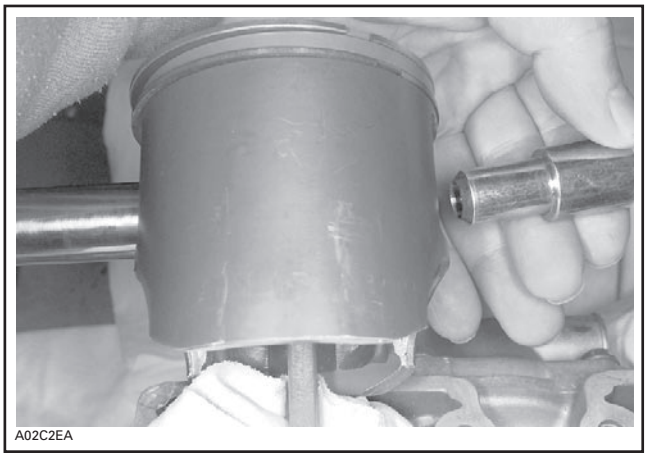


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

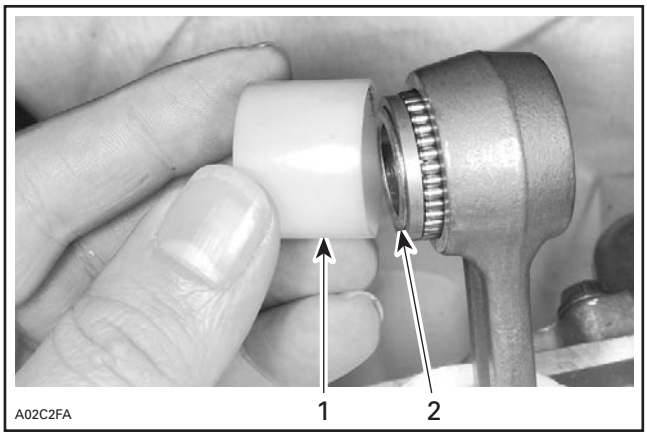
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

NOTE: 0.25 and 0.5 mm oversize pistons and rings are available if necessary.

Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

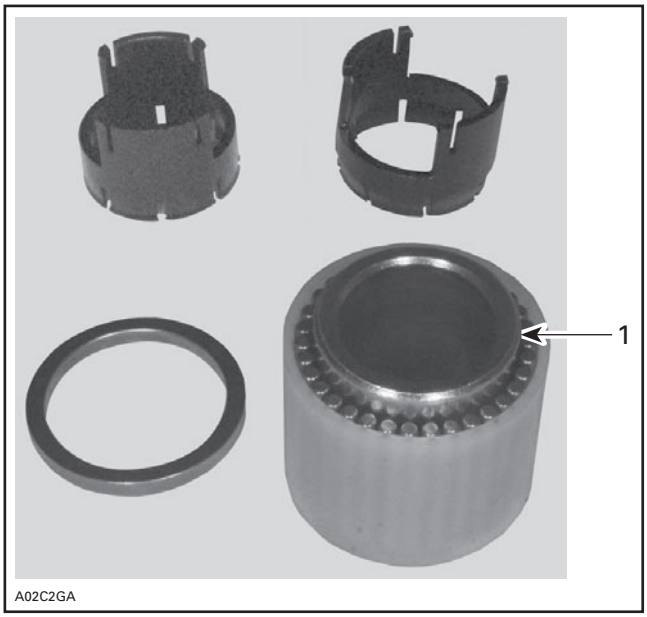
INSPECTION

Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

When reinstalling original needle bearings, make sure that 31 needles are inserted between sleeve and locating sleeve.

When installing a new cageless bearing, replace half plastic cages by sleeve.



TYPICAL
1. Sleeve

Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

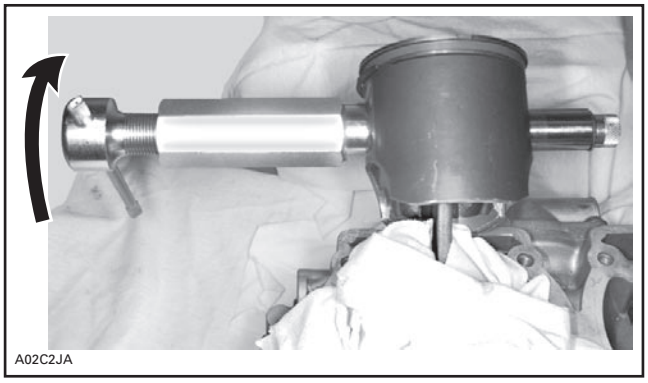
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Mount piston over connecting rod with the letters "AUS" (over an arrow on the piston dome) facing in the direction of exhaust port.

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

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

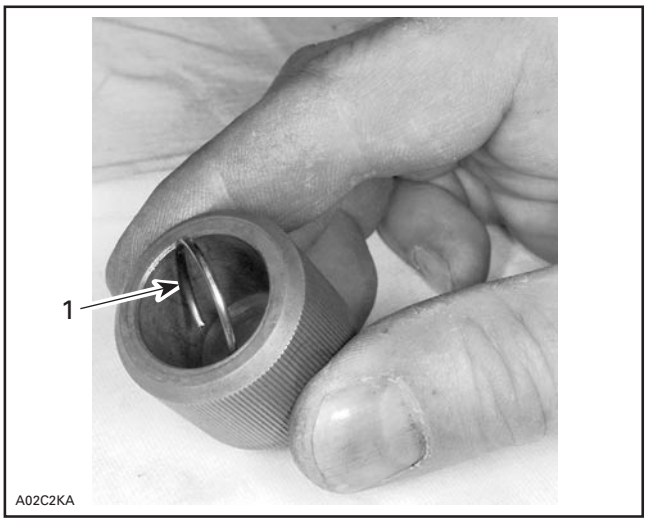


TYPICAL

Remove piston pin puller and sleeve kit.

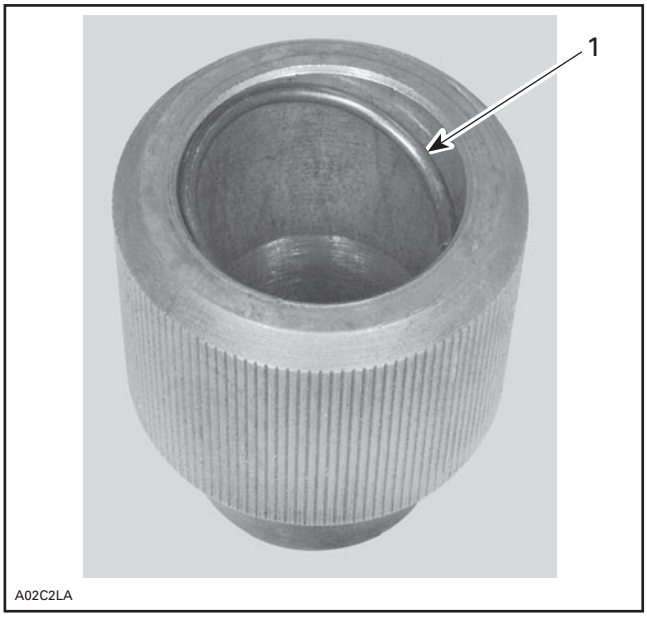
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



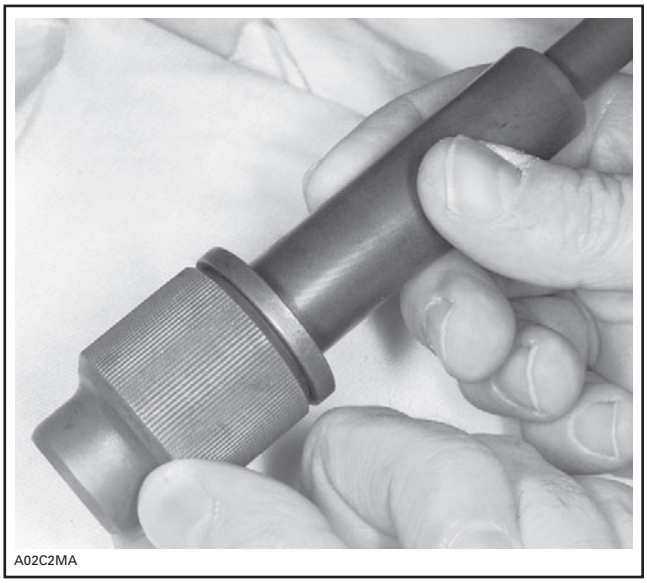
1. Circlip

Square it up using a finger.

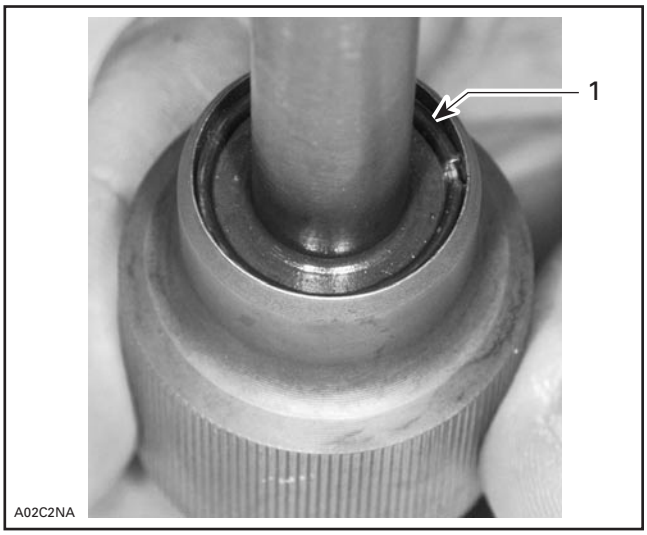


1. Circlip

Continue to square it up using round end of circlip installer.

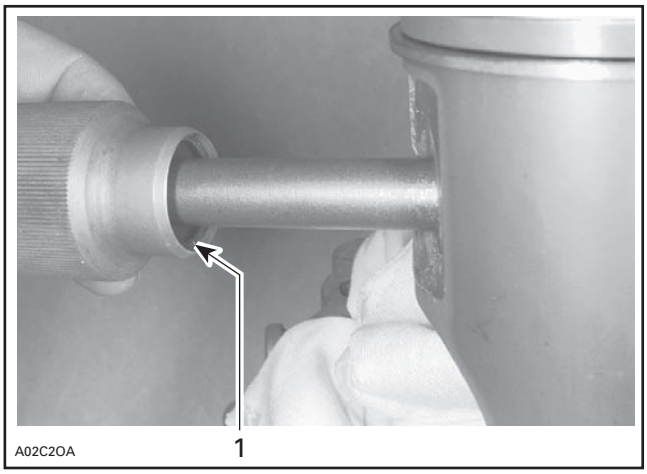


Using square end of tool, push circlip in until it rests in groove.



1. Circlip in groove

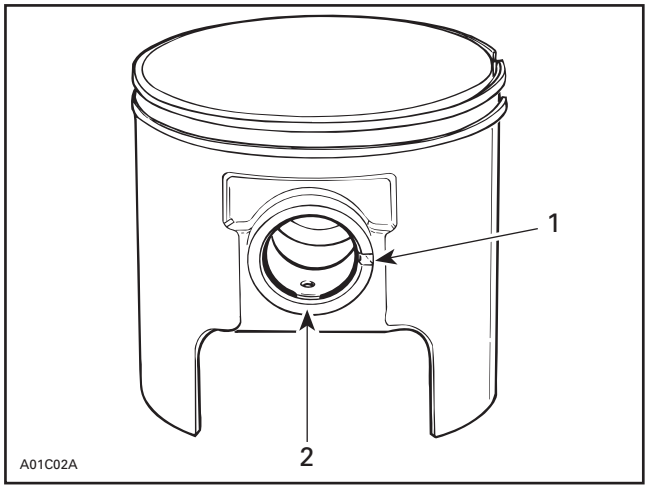
Mount tool in piston making sure that circlip break is facing down.



TYPICAL
1. Circlip break facing down

Hold tool firmly against piston then strike on round end of tool. Circlip will move from tool groove to piston groove.

TYPICAL



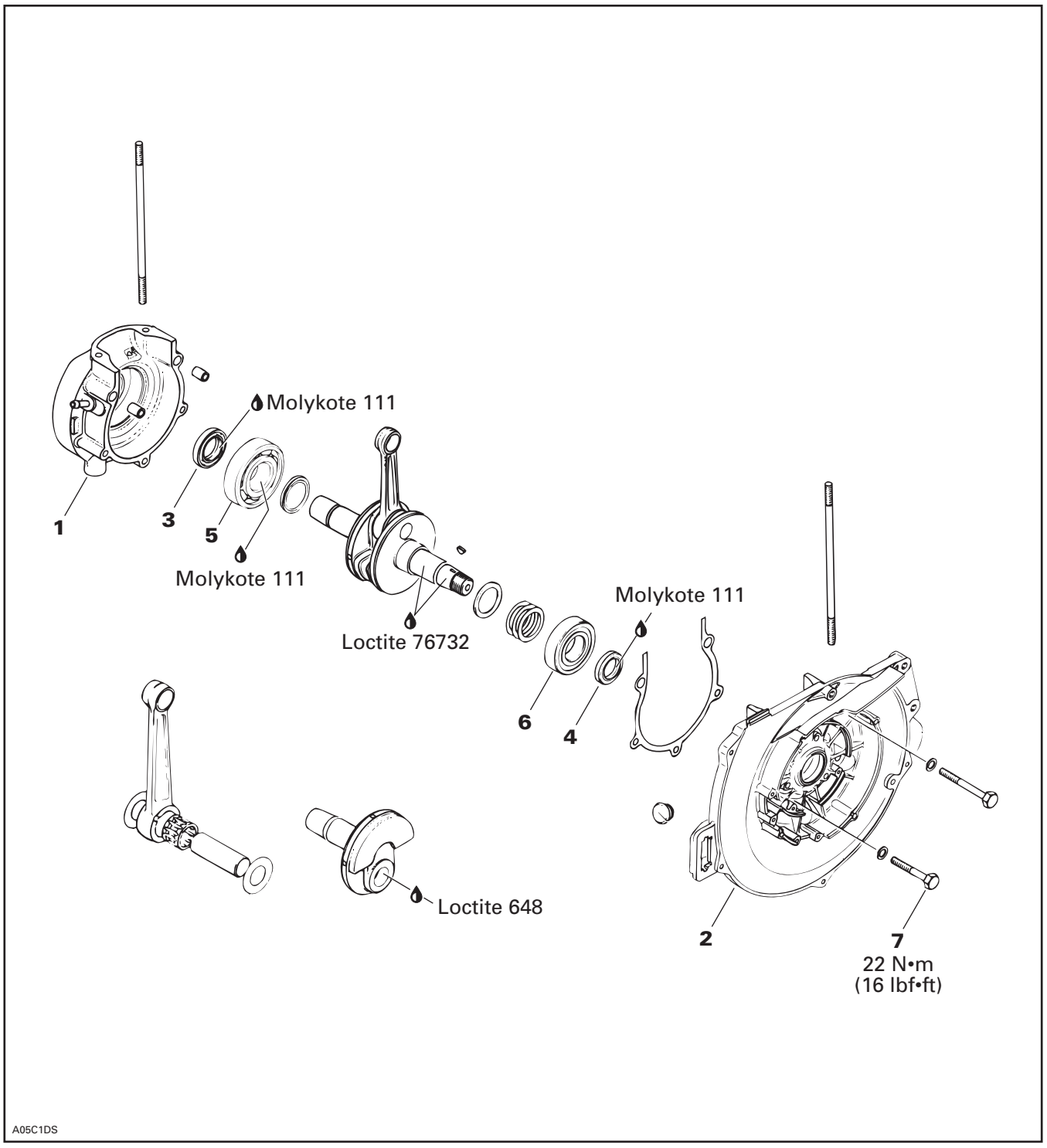
1. Piston notch
2. Circlip break

CAUTION: Circlips must not move freely in the groove after installation. If so, replace them.

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

Position cylinder head on cylinder with fins in line with crankshaft center line. Cross torque retaining nuts to 26 N•m (19 lbf•ft).

BOTTOM END


Molykote 111
1
3
5
Molykote 111
Loctite 76732
Molykote 111
6
4
Loctite 648
2
7
22 N•m
(16 lbf•ft)
A05C1DS

NOTE: Engine must be removed from chassis to perform the following procedures.

CLEANING

Discard all oil seals and gaskets.

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

DISASSEMBLY

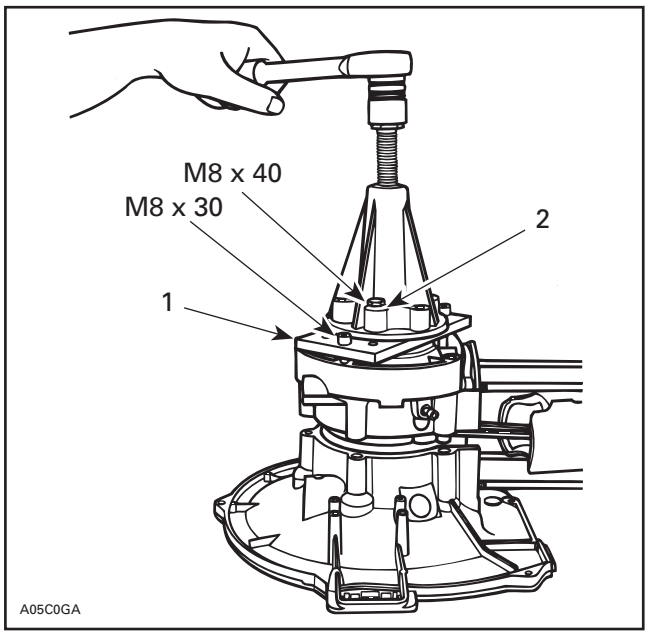
General

To remove drive pulley, refer to DRIVE PULLEY.

To remove magneto, refer to MAGNETO.

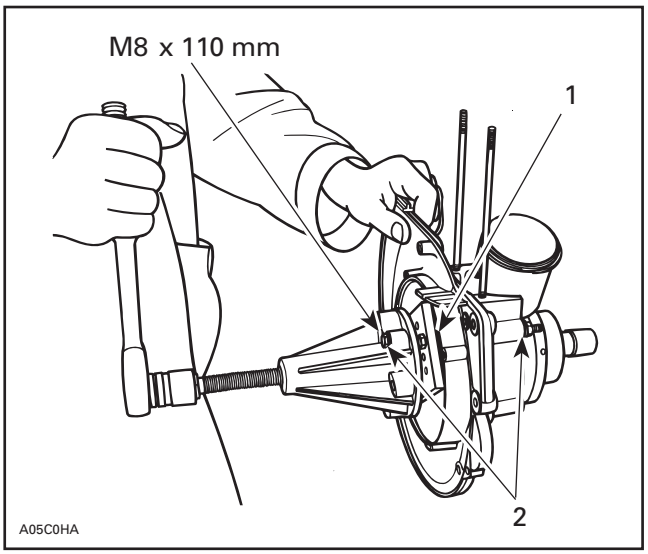
2,6, Crankcase Half

Heat to 110 - 120°C (230 - 248°F) all around bearing seat on PTO side. Install puller (P/N 420 876 298) to plate (P/N 529 024 900) with flat washer under screw heads and extract PTO side crankcase half **no. 1**.



1. Plate
2. Flat washer

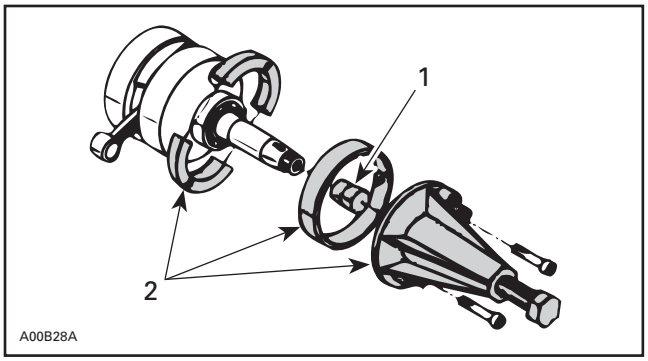
Heat to 110 - 120°C (230 - 248°F) all around bearing seat on MAG side. Install puller with plate, long bolts M8 x 110 mm and flat washers. Extract MAG side crankcase half **no. 2**.



1. Plate
2. Flat washers

To remove seals **no. 3 and 4**, push from outside the crankcase towards the inside.

To remove bearings **no. 5 and 6** from crankshaft use a protective cap and special puller as illustrated.



1. Protective cap
2. Special puller

INSPECTION

Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

ASSEMBLY

Install connecting rod with its lubrication slot on big end facing exhaust side.

Smear anti-seize lubricant (P/N 293 800 070) on part of crankshaft where bearing fits.

Prior to installation, place bearings into an oil container and heat the oil to 75°C (167°F) for 5 to 10 min. This will expand bearings and ease installation.

Install bearings with groove outward.

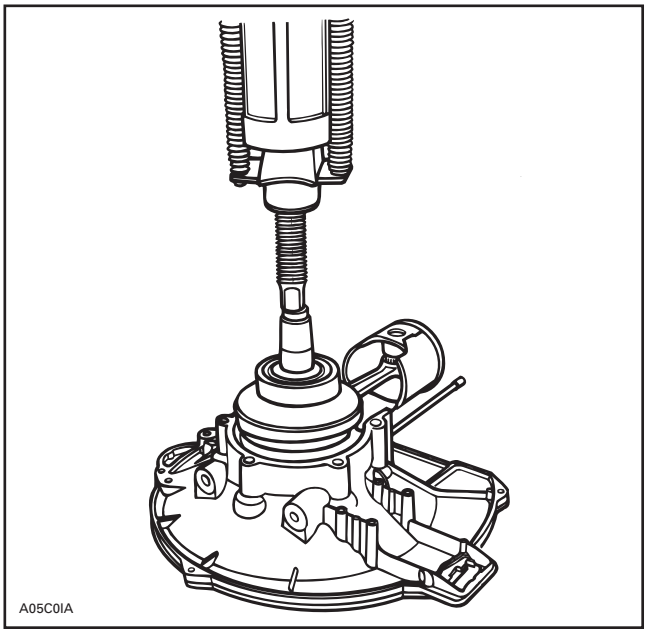
NOTE: Crankshaft end play requires adjustment only when crankshaft and/or crankcase is replaced. Prior to magneto side bearing installation, determine crankshaft end play and install required shim(s) on crankshaft extension. For the crankshaft end play adjustment procedure, refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

Prior to crankcase adjoining, install a protector sleeve on each crankshaft extension to prevent oil seal damage. Apply a light coat of lithium grease on seal lip. Spray some new injection oil on all moving parts of the crankshaft.

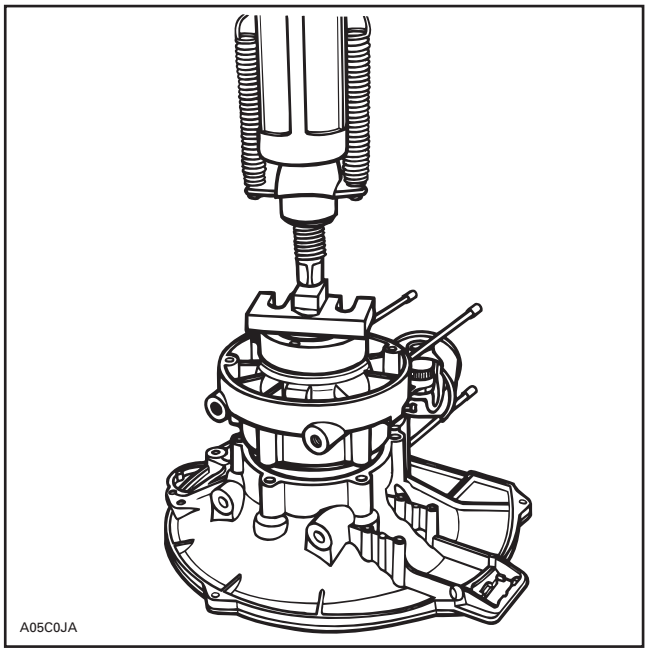
Install crankshaft seals with pusher (P/N 420 277 875) for MAG side seal no. 4 and pusher (P/N 420 876 660) for PTO side seal no. 3.

CAUTION: To ensure appropriate crankshaft bearing lubrication, seal outer surface must be pressed against seal crankcase shoulder.

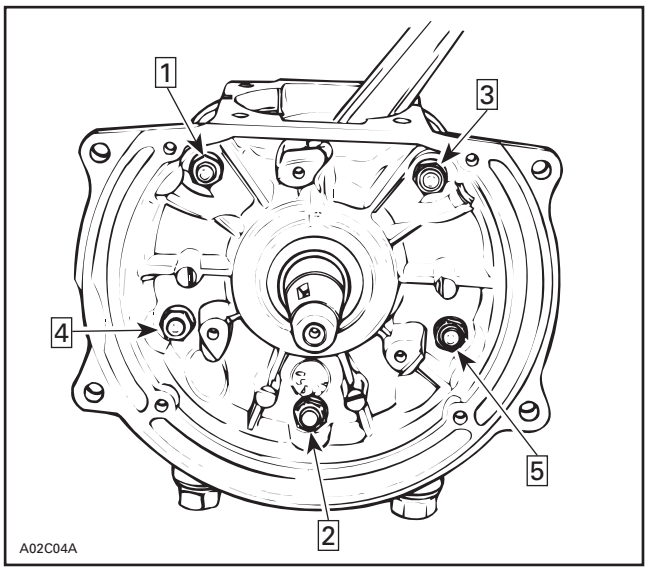
Using a press, install crankshaft into MAG side crankcase half.



Press down PTO side crankcase half onto crankshaft using appropriate spacer(s).



Torque the screws no. 7 to 22 N•m (16 lbf•ft) following illustrated sequence.



443 AND 552 ENGINES

SERVICE TOOLS

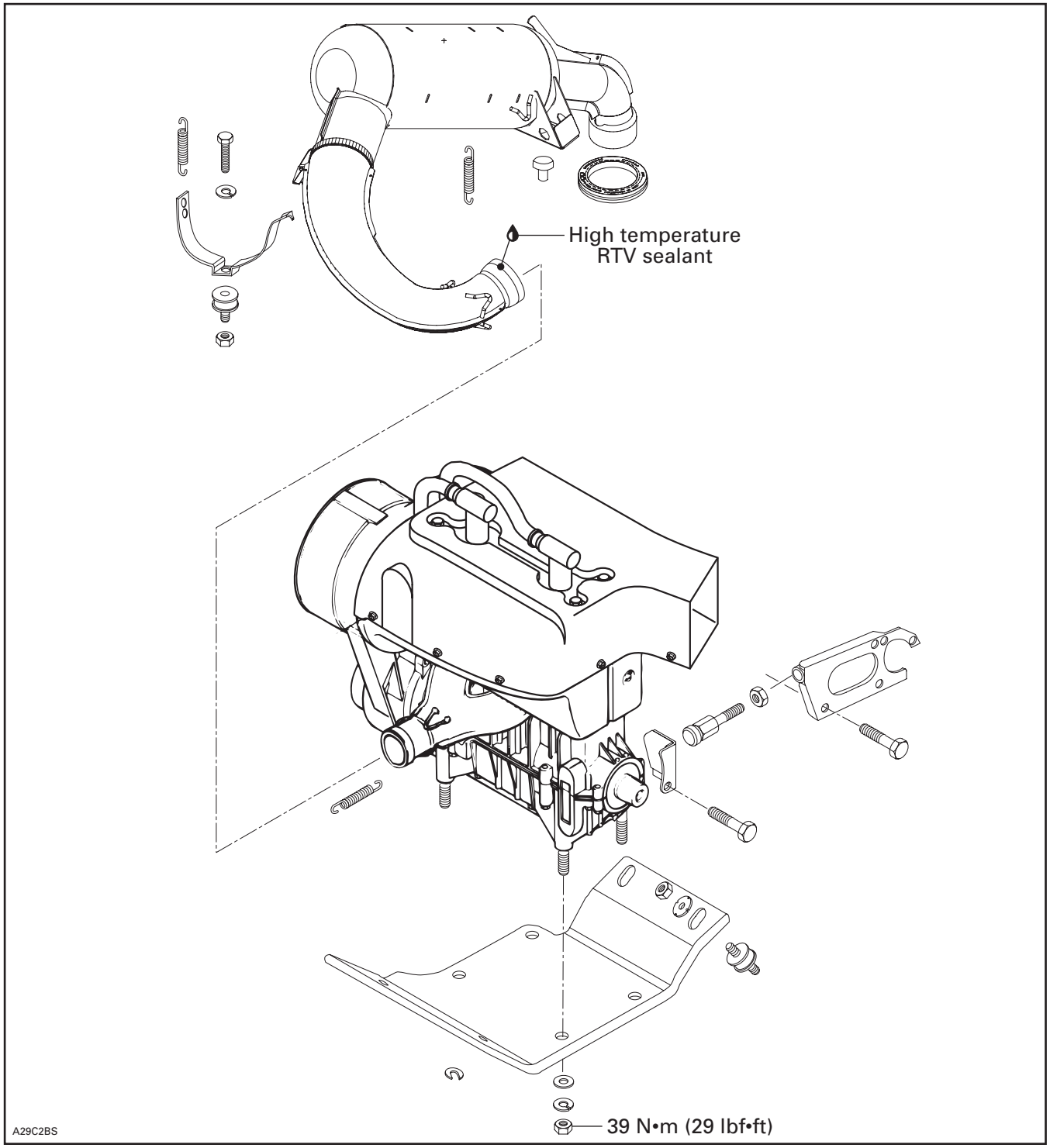
Description	Part Number	Page
bearing heater	529 035 969	70, 79
circlip installer	529 035 686	72
distance gauge	420 876 822	79
distance gauge	529 035 965	80
feeler gauge	420 876 620	79
piston circlip installer	529 035 561	71
piston pin puller	529 035 503	67
protective cap	420 876 552	77
protective cap	420 876 557	78
rubber pad	529 023 400	67
screws	420 840 681	77
support plate	529 035 976	80
temperature indicator stick	529 035 970	79

SERVICE PRODUCTS

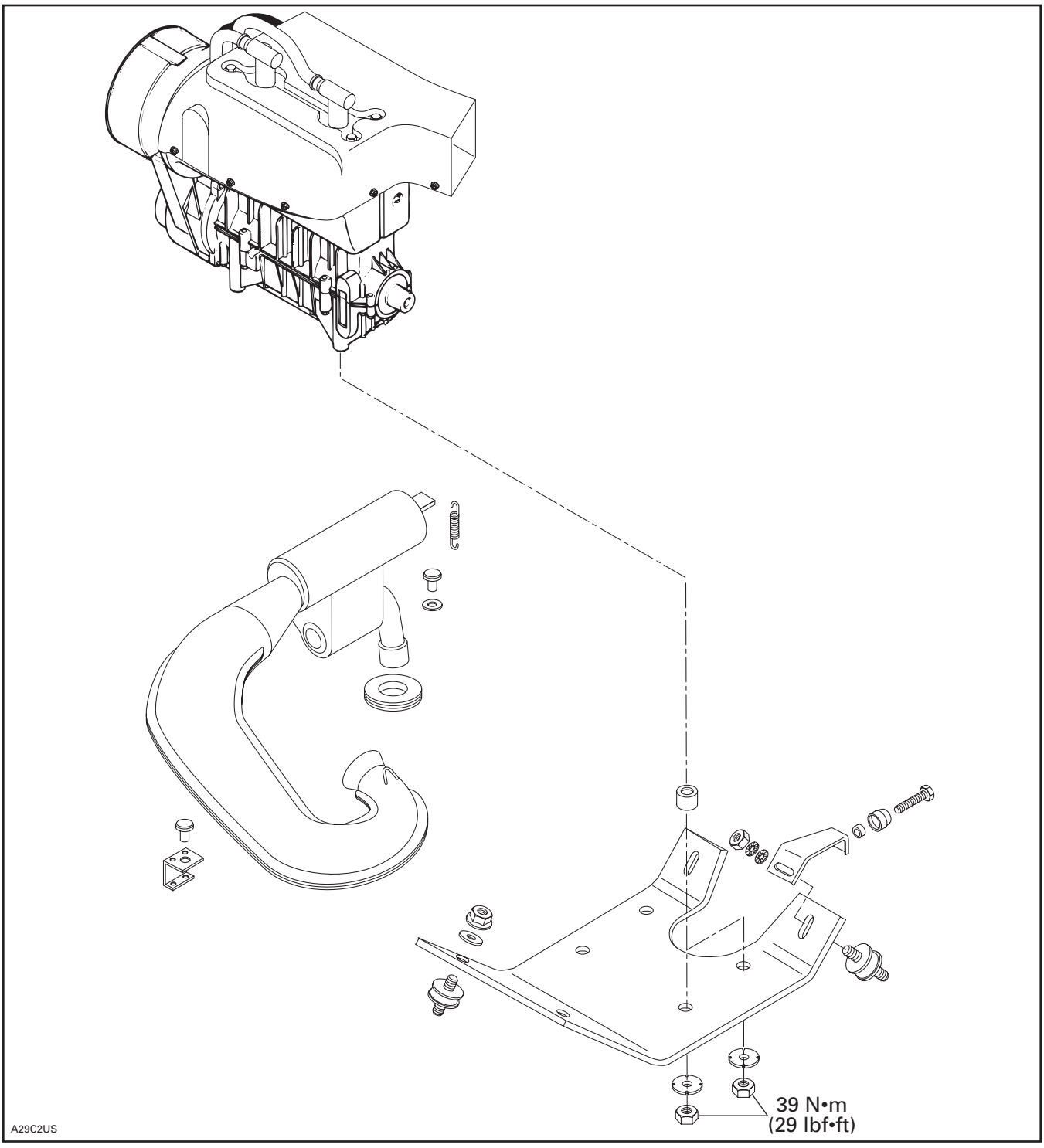
Description	Part Number	Page
anti-seize lubricant	413 701 000	78
Isoflex grease	293 550 021	81
Loctite 518	293 800 038	73
Loctite 5910	293 800 081	82
Loctite Chisel	413 708 500	67, 73, 77
pulley flange cleaner	413 711 809	78
RTV sealant	293 800 090	64
synthetic grease	413 711 500	77

ENGINE REMOVAL AND INSTALLATION

443 Engine



552 Engine



ENGINE REMOVAL AND INSTALLATION

Disconnect or remove the following:

⚠ WARNING

Before disconnecting any electrical wire in starter system always first disconnect the BLACK negative battery cable (on electric starting models).

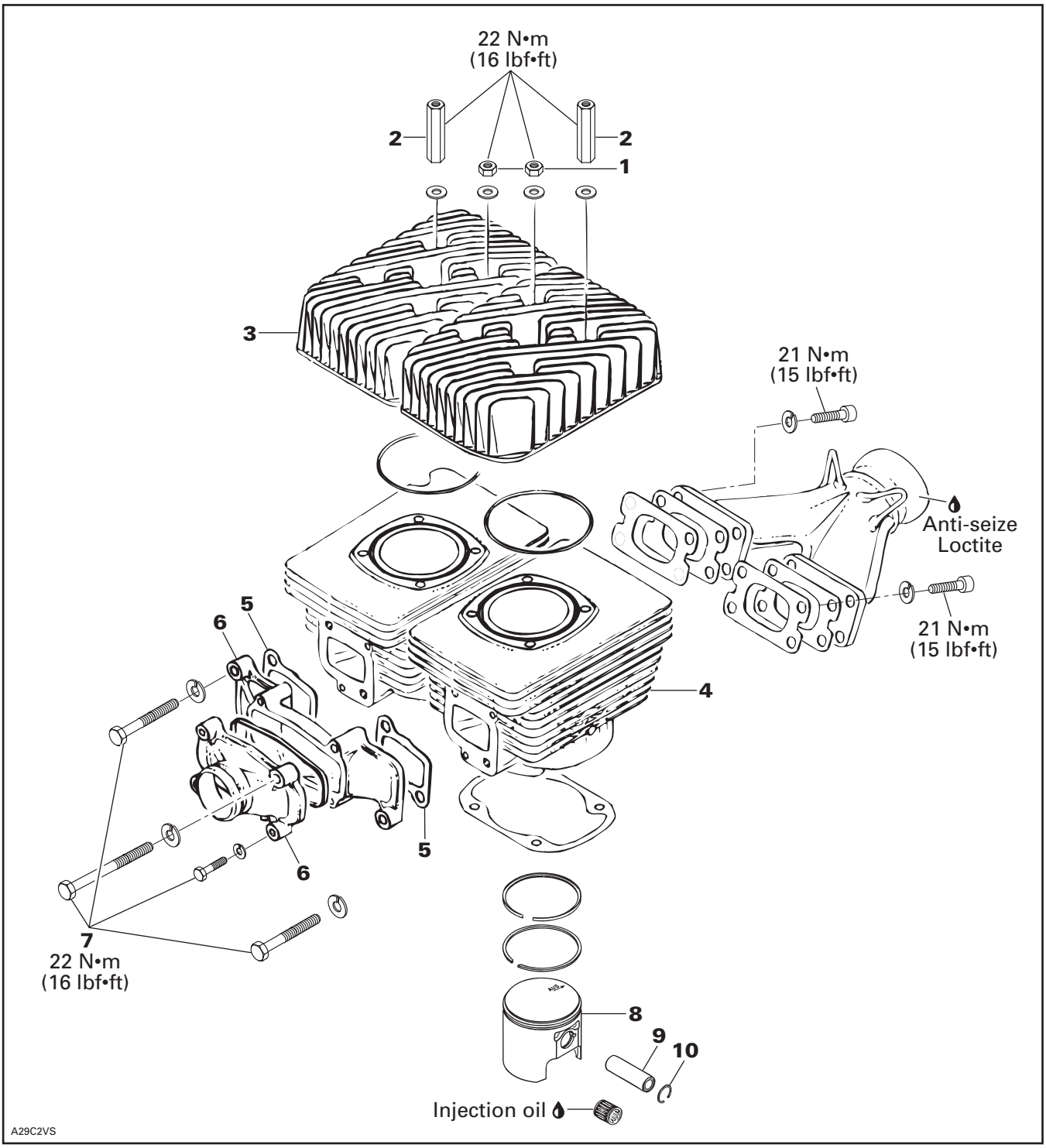
- negative cable from battery (on electric starting models)
- guard
- drive belt
- drive pulley using appropriate puller, refer to DRIVE PULLEY
- air silencer and carburetors
- impulse line from engine crankcase
- electrical connector housings
- exhaust pipe
- oil pump inlet line and plug it
- oil pump cable
- rewind cable: tie a knot near rewind housing and remove starting grip.

Tighten fasteners to recommended torque in appropriate exploded view.

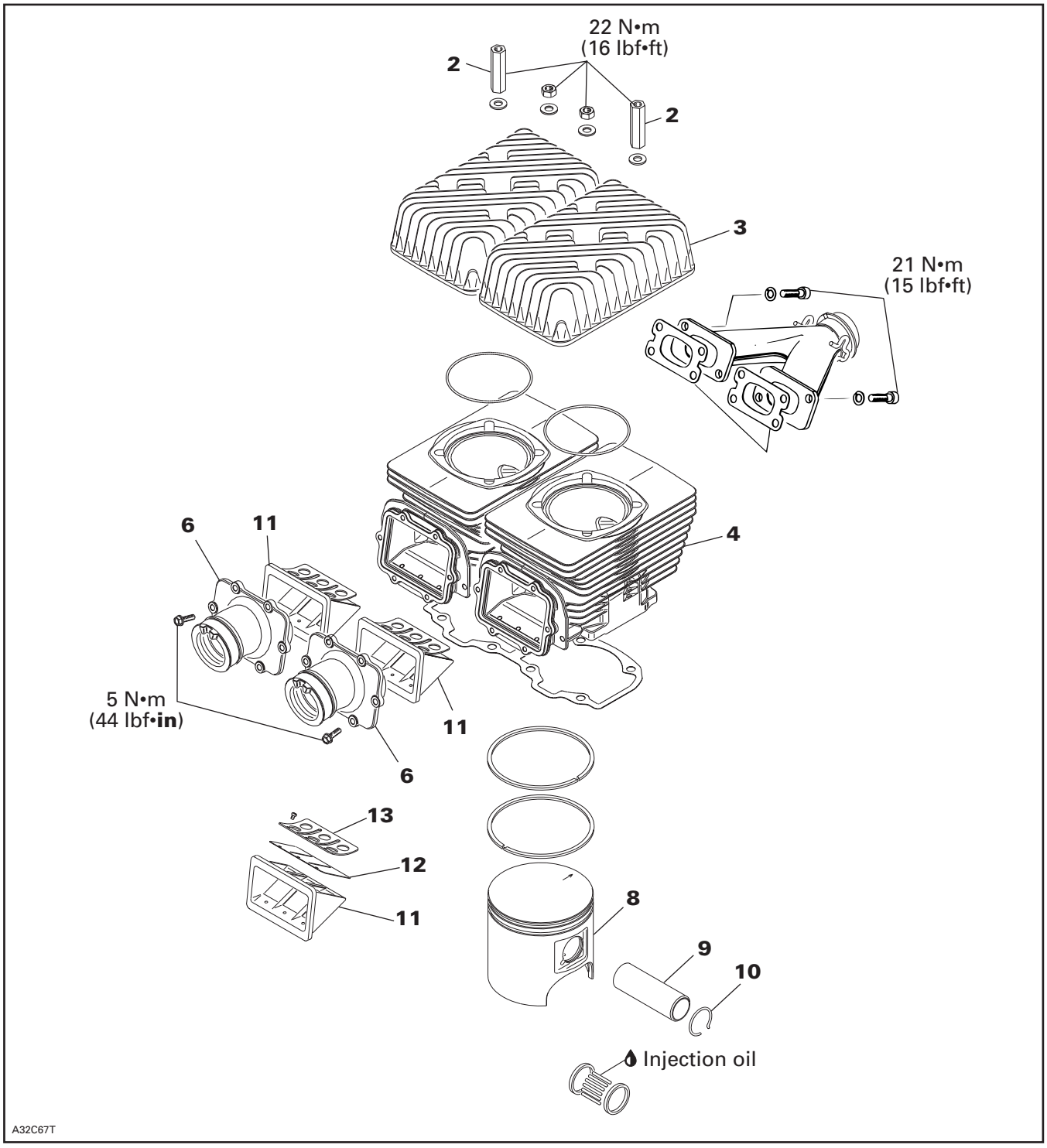
Apply high temperature RTV sealant (P/N 293 800 090) on metal-to-metal exhaust joints.

TOP END

443 Engine



552 Engine


22 N•m
(16 lbf•ft)
2
2
3
21 N•m
(15 lbf•ft)
4
6
11
5 N•m
(44 lbf•in)
11
6
13
12
11
8
9
10
Injection oil
A32C67T

GENERAL

CAUTION: While performing any engine related procedure, always make sure that the working area is clean and free from dust or particles to reduce the risk of damaging the engine.

TROUBLESHOOTING

Before completely disassemble engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

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

CLEANING

Discard all gaskets. 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 exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" and arrow on the piston dome must be visible after cleaning. Clean the piston ring grooves with a groove cleaner tool, or with a piece of broken ring.

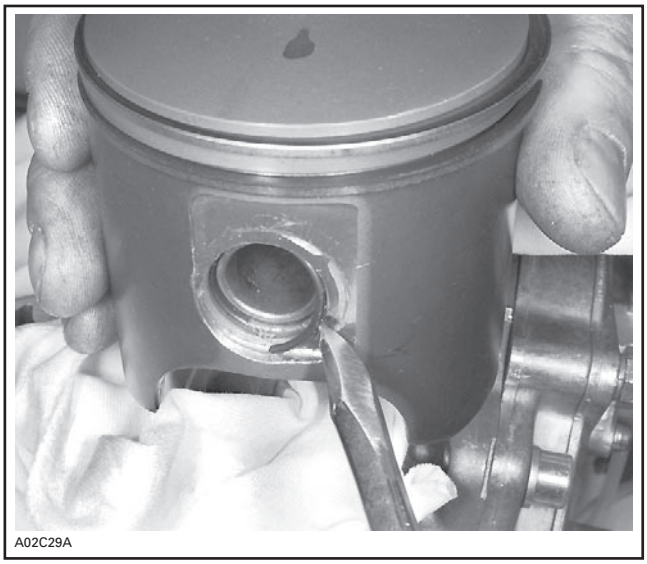
DISASSEMBLY

Remove top fan cowl, intake sockets and lower fan cowl.

Remove cylinder heads.

Remove cylinders.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips no. 10 from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston no. 8.


A02C29A

TYPICAL

443 and 552 Engines

On these engines, piston pin needle bearing is mounted without a cage.

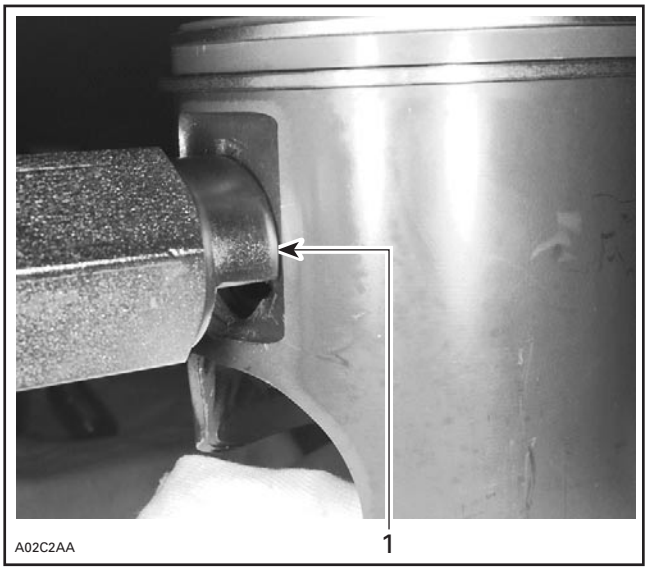
NOTE: The PTO cylinder or fan housing have to be removed to give access to MAG piston pin with the puller.

Use piston pin puller along with sleeve kit and locating sleeve as per following table.

ENGINE	PULLER P/N	SLEEVE KIT P/N	LOCATING SLEEVE P/N
443	529 035 503	529 035 541 (18 mm)	529 023 800
552	529 035 503	529 035 542 (20 mm)	529 023 800

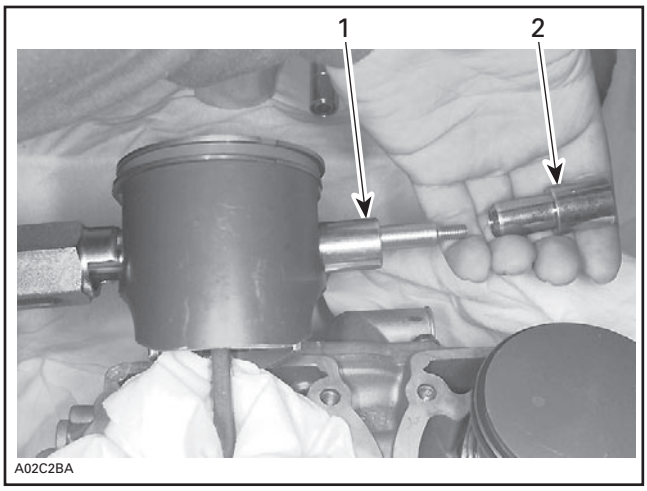
NOTE: The locating sleeve is the same that contains new cageless bearing.

Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



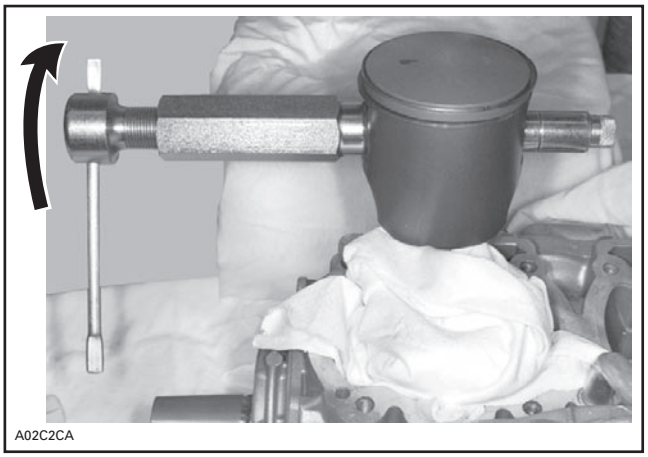
TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

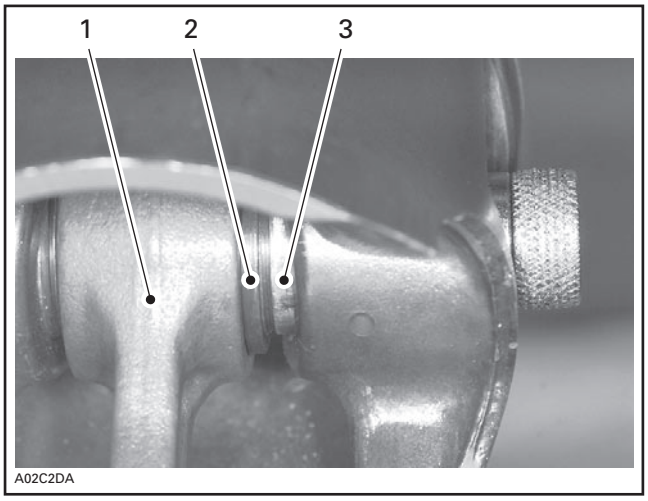


TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Pull out piston pin **no. 10** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

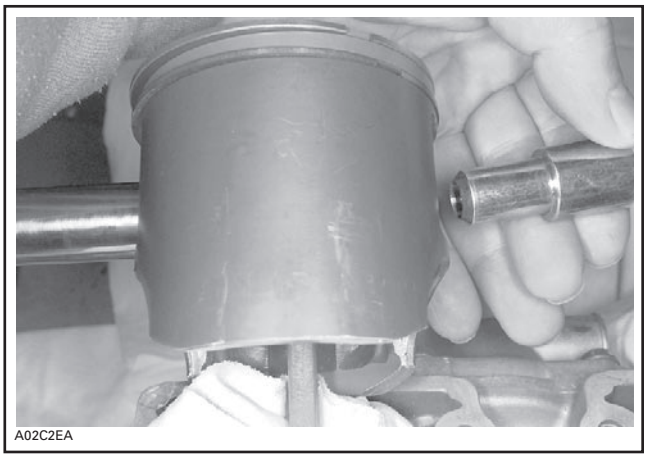


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

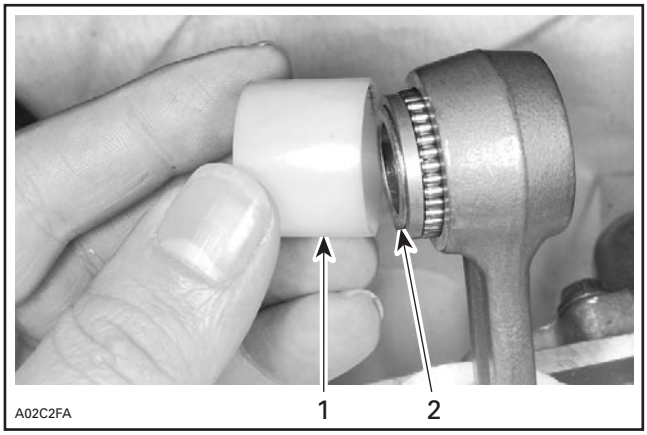
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

NOTE: 0.25 and 0.5 mm oversized piston and rings are available if necessary.

Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

INSPECTION

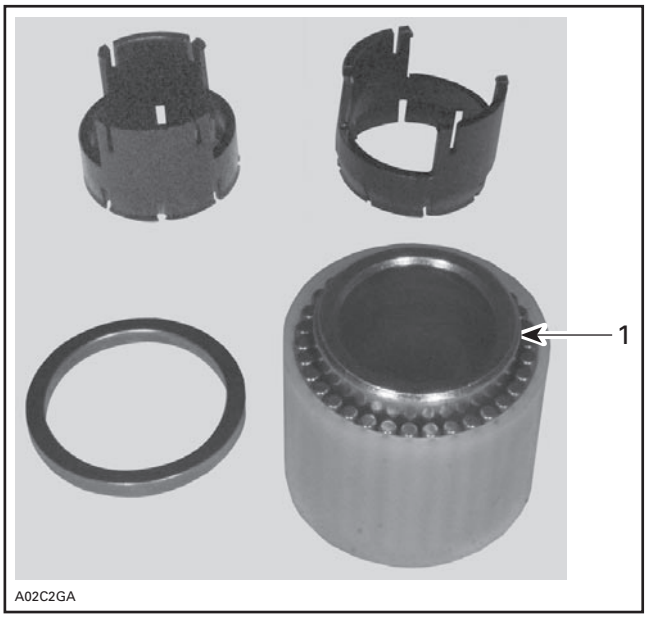
Refer to ENGINE DIMENSION MEASUREMENT.

ASSEMBLY

443 and 552 Engines

When reinstalling original needle bearings, make sure that 31 needles (in case of 443 engine) or 34 (in case of 552 engine) are inserted between sleeve and locating sleeve.

When installing a new cageless bearing, replace half plastic cages by sleeve.



TYPICAL
1. Sleeve

Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

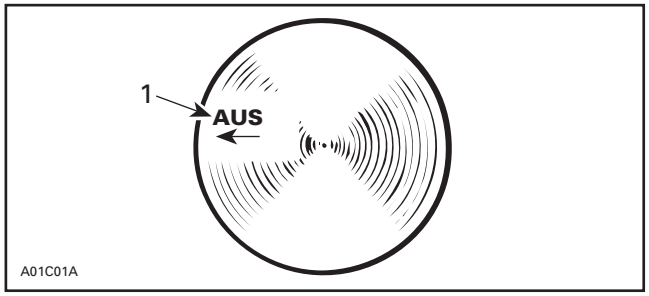
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Heat piston using bearing heater (P/N 529 035 969).


A32CBHA

CAUTION: Piston temperature must not exceed 46°C (115°F). NEVER USE DIRECT FLAME to heat the piston and never freeze the pin. Inappropriate heating procedure(s) may damage the piston.

Mount piston over connecting rod with the letters "AUS" (over an arrow on the piston dome) facing in the direction of exhaust port.



A01C01A

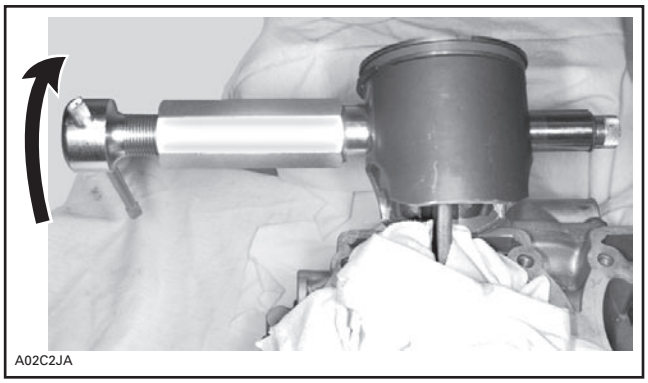
1. Exhaust

Install shouldered sleeve.


A02C2IA

TYPICAL — SHOULDERED SLEEVE INSTALLATION

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


A02C2JA

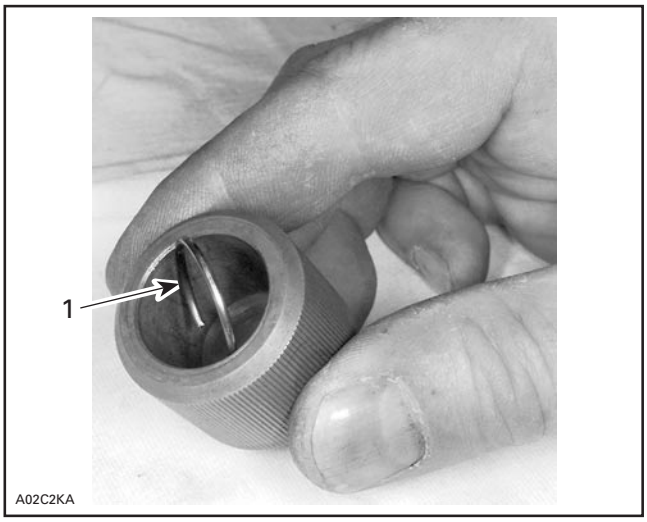
TYPICAL

Remove piston pin puller and sleeve kit.

443 Engine

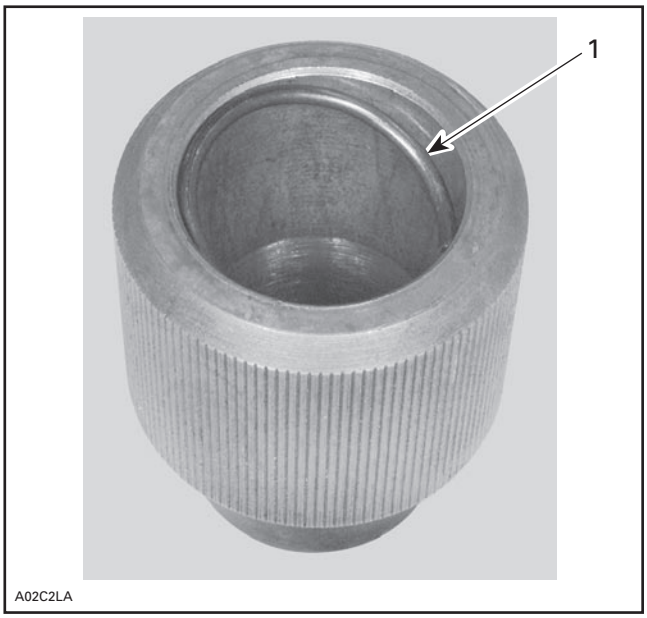
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



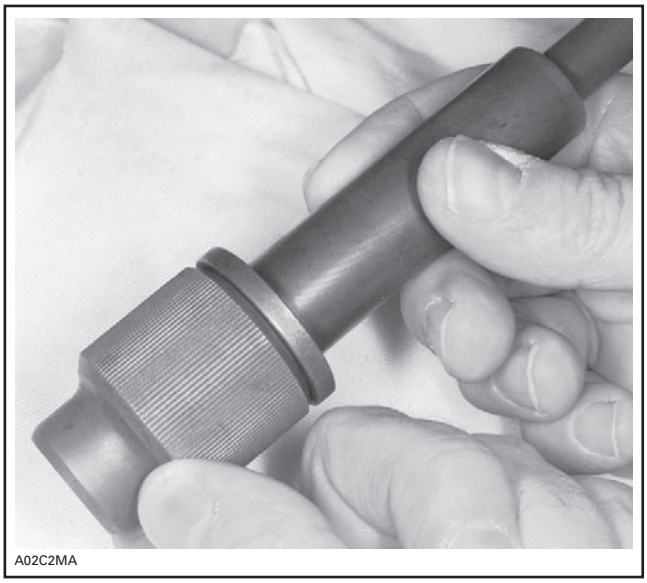
1. Circlip

Square it up using a finger.

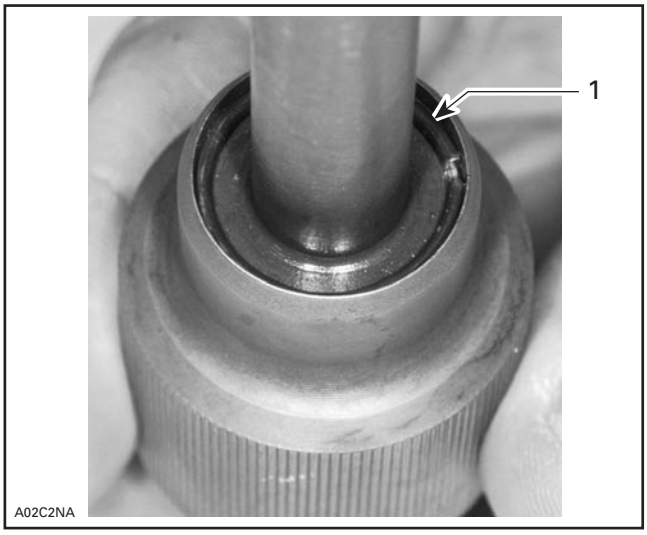


1. Circlip

Continue to square it up using round end of circlip installer.

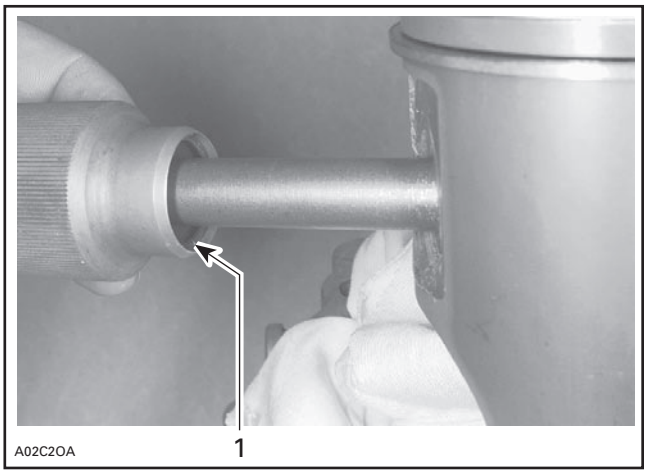


Using square end of tool, push circlip in until it rests in groove.



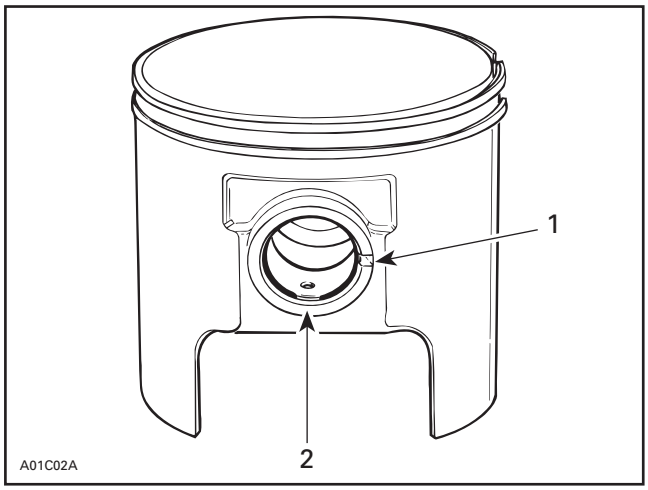
1. Circlip in groove

Mount tool in piston making sure that circlip break is facing down.



TYPICAL
1. Circlip break facing down

Hold tool firmly against piston then strike on round end of tool with a plastic hammer. Circlip will move from tool groove to piston groove.



1. Piston notch
2. Circlip break at 6 o'clock

CAUTION: Circlips must not move freely in the groove after installation. If so, replace them.

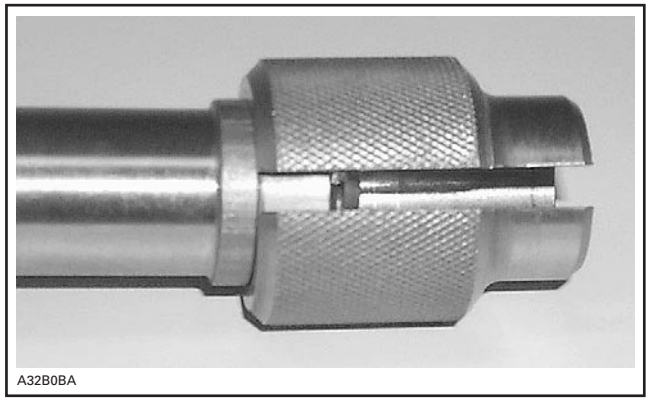
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

552 Engine

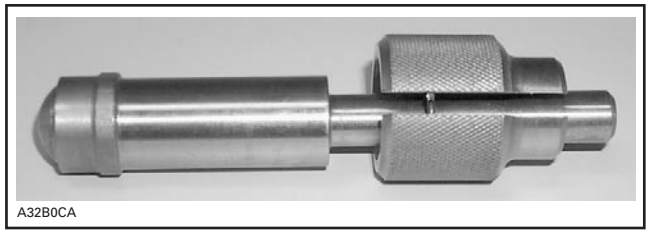
Use circlip installer (P/N 529 035 686) to install new mono-hook circlips no. 10.

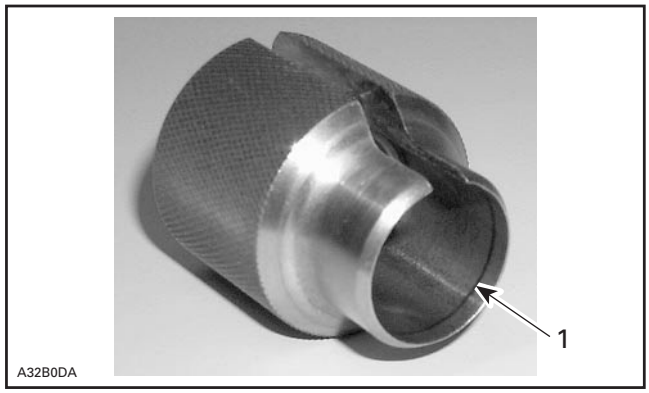
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

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



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

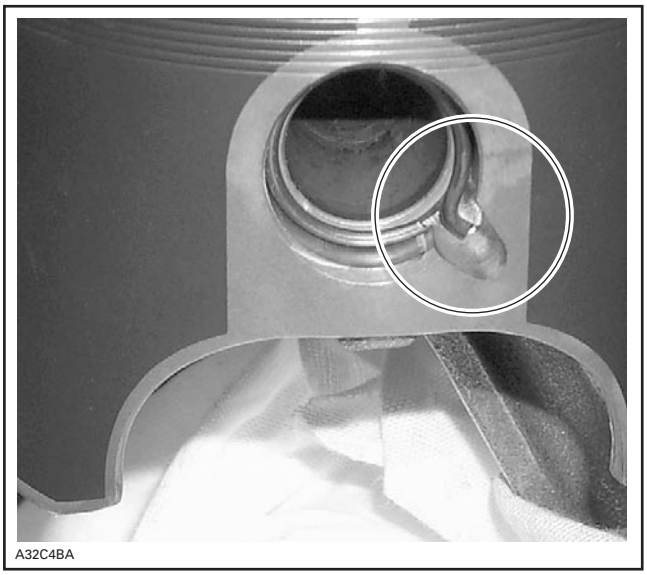




1. Groove

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care 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 as on a second attempt circlip will lose its normal retaining capabilities.

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

Clean cylinders and crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

Coat crankcase mating surface with Loctite 518 (P/N 293 800 038). Choose the right gasket thickness according to combustion chamber volume. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT. Install it on crankcase. Coat gasket with Loctite 518.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

All Engines

Before inserting piston in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Install proper ring compressor on piston assembly.

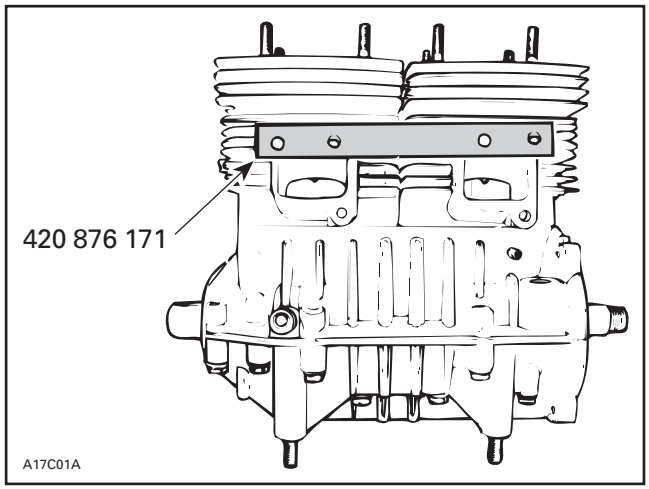
ENGINE	RING COMPRESSOR P/N
443	420 876 090
552	420 876 972

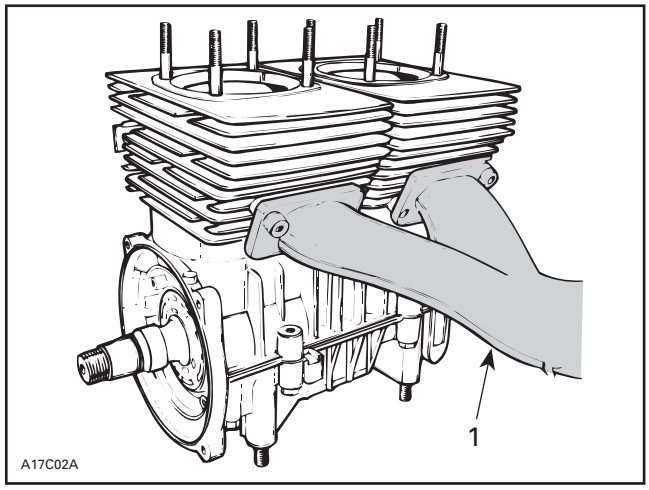
NOTE: The ring compressor will not fit on over size pistons.

Check flatness of intake sockets **no. 6**. Refer to ENGINE DIMENSION MEASUREMENT and look for CHECKING SURFACE FLATNESS.

At cylinder **no. 4** and/or cylinder head **no. 3** installation, use aligning tool or exhaust manifold itself to ensure sealing of intake manifold and exhaust before tightening cylinder head nuts.

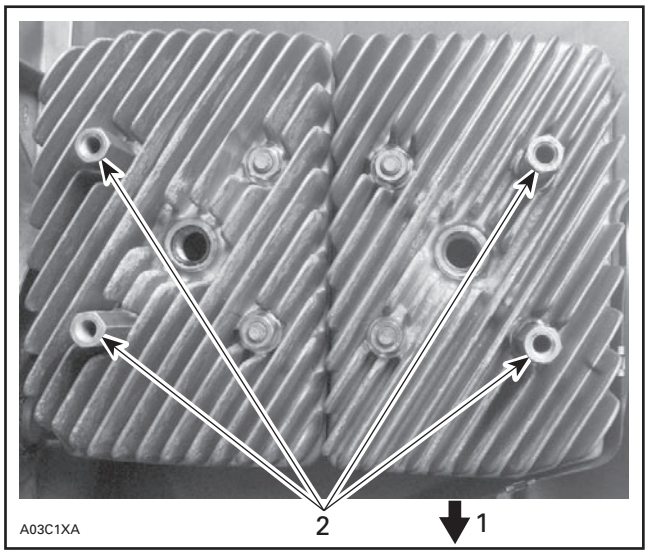
ENGINE	ALIGNING TOOL P/N
443 and 552	420 876 171





1. Or use exhaust manifold to align cylinders

Position distance nuts **no. 2** as shown below.



1. Exhaust
2. Distance nuts

Cross torque cylinder head nuts **no. 1** and **no. 2** to 22 N•m (16 lbf•ft); torque each cylinder head individually.

Install armature plate, fan housing and then air deflector.

Install a gasket on each side of the air deflector.

Torque intake socket bolts to 22 N•m (16 lbf•ft).

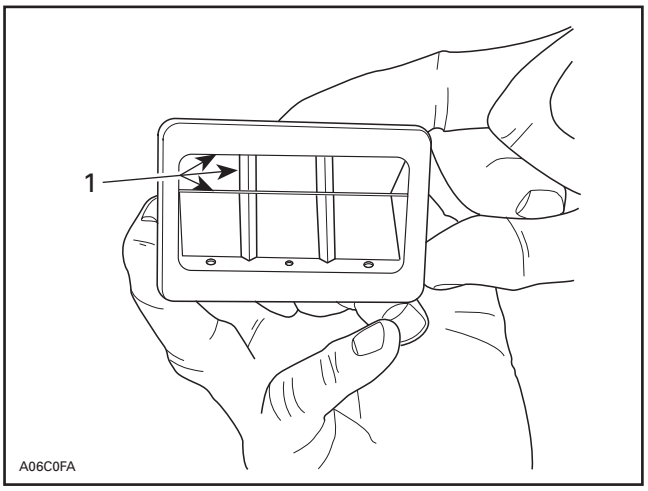
552 Engine

12, Reed Valve

Blades have a curved shape. Install with their curve facing reed block.

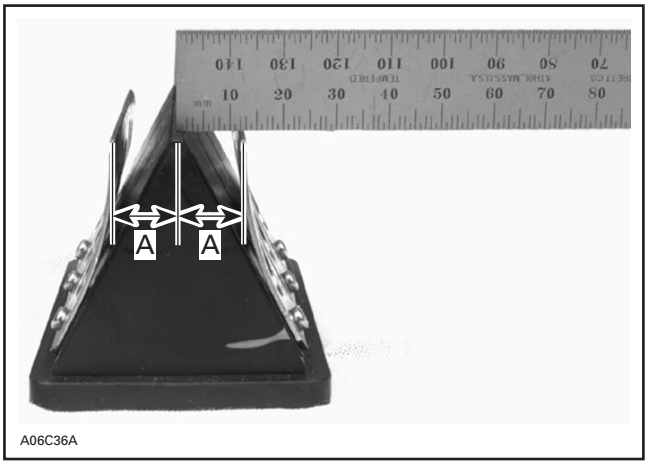
With blade stopper **no. 13** removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.



1. No play

Check distance from blade stopper inner edge and distance from center of reed valve block.



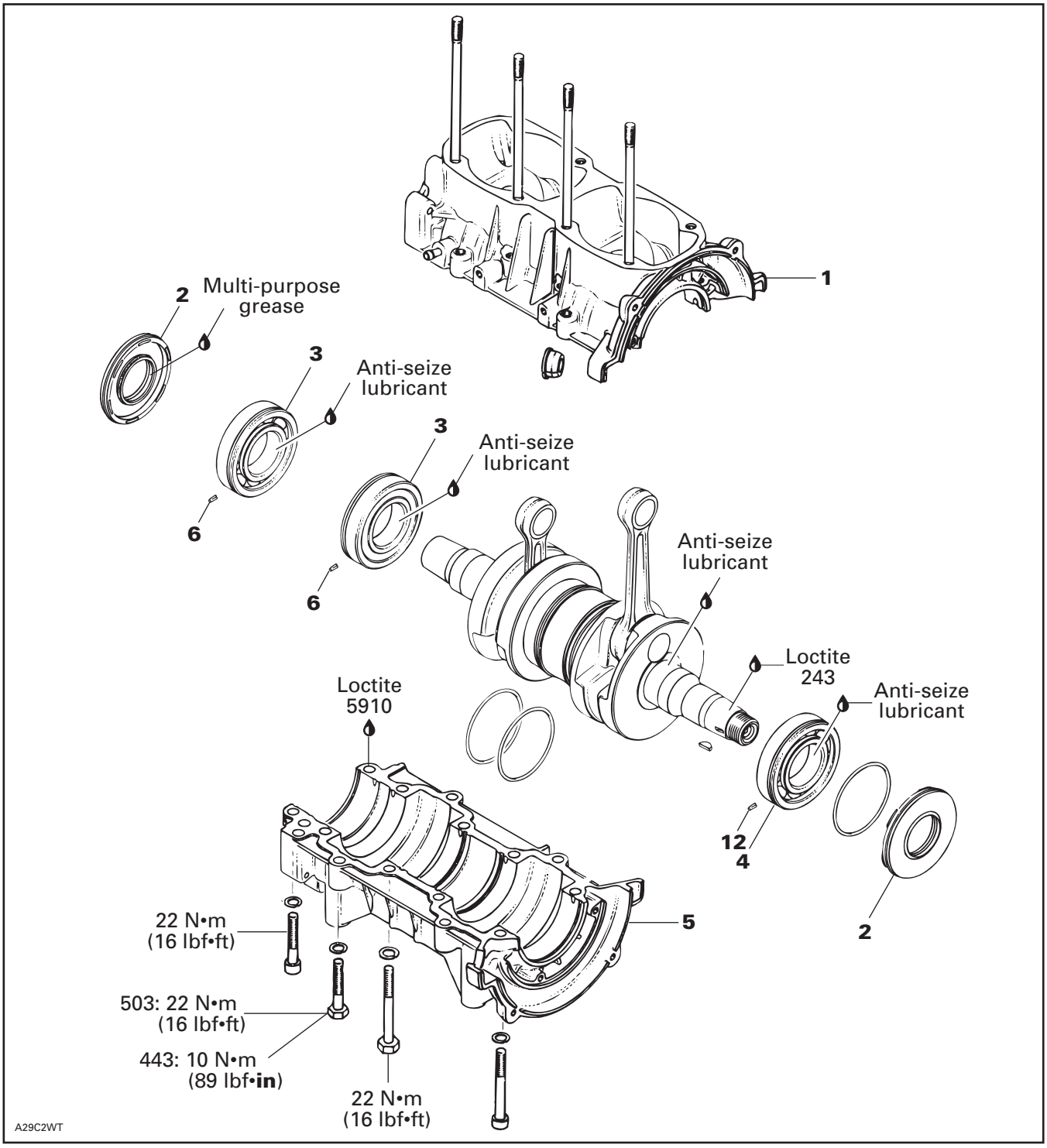
TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

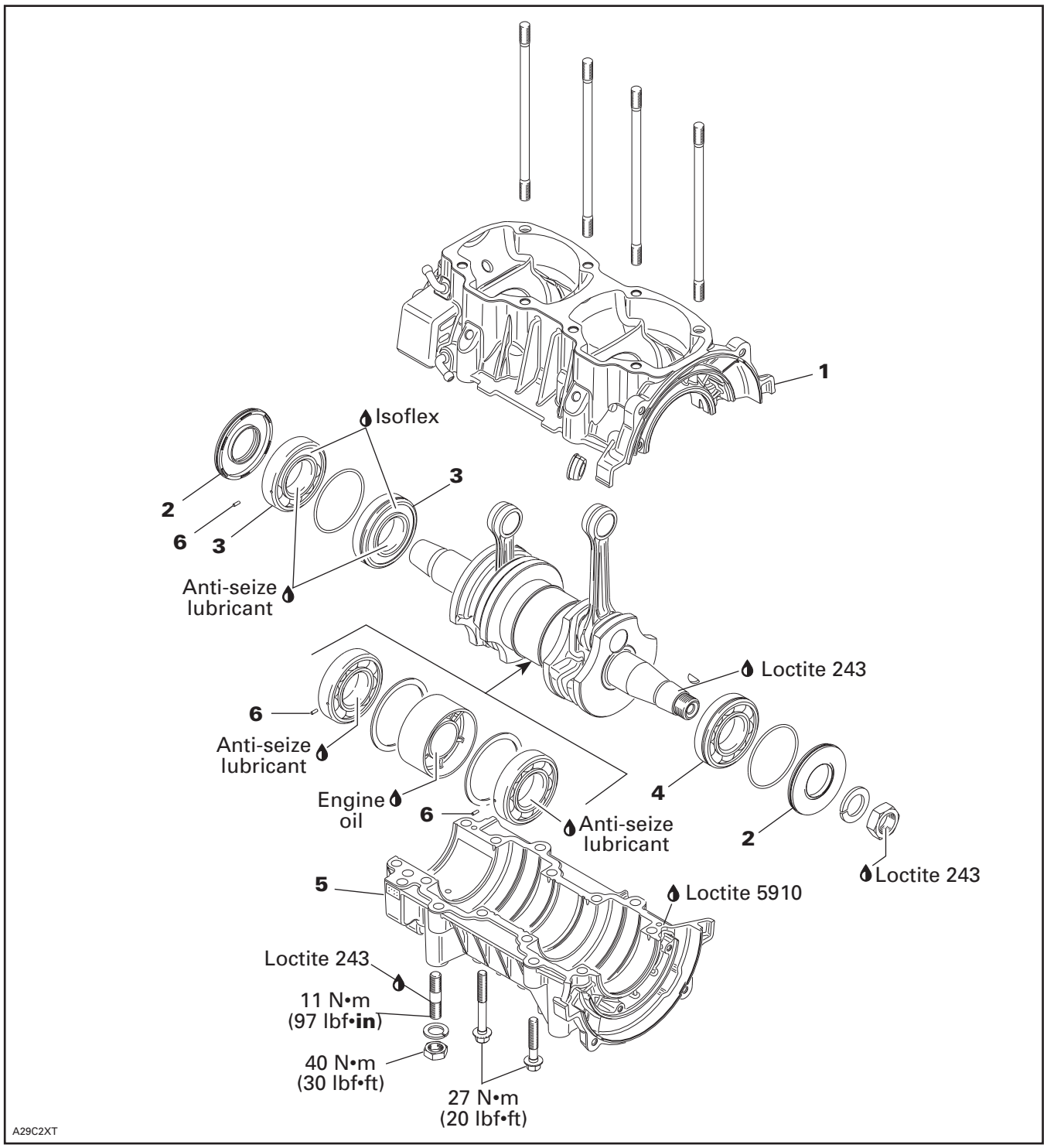
Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

443 Engine



552 Engine


1
Isoflex
2
3
6
3
Anti-seize lubricant
Loctite 243
6
Anti-seize lubricant
4
Engine oil
6
Anti-seize lubricant
2
Loctite 243
5
Loctite 5910
Loctite 243
11 N•m (97 lbf•in)
40 N•m (30 lbf•ft)
27 N•m (20 lbf•ft)
A29C2XT

NOTE: Engine must be removed from chassis to perform the following procedures.

Remove engine from chassis.

Remove fan guard, rewind starter, starting pulley, trigger coil wire from 4-connector housing, magneto flywheel then fan housing.

Remove stator plate.

CLEANING

Discard all seals, gaskets and O-rings.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

Remove all trace of Loctite from crankshaft taper.

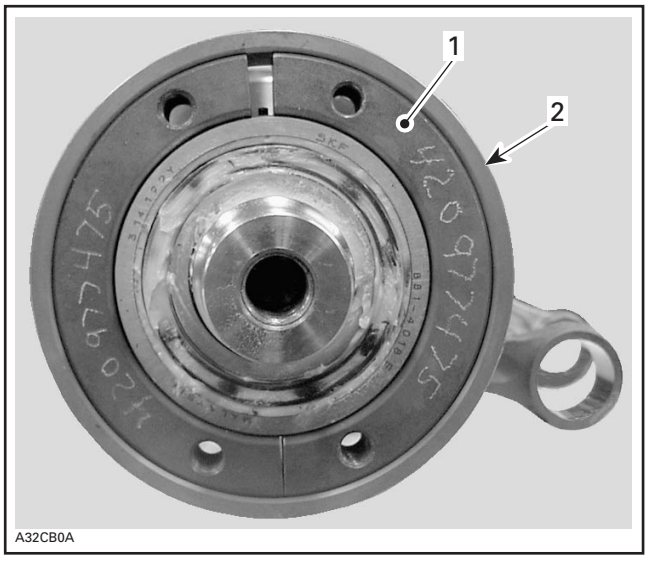
Remove old sealant from crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

DISASSEMBLY

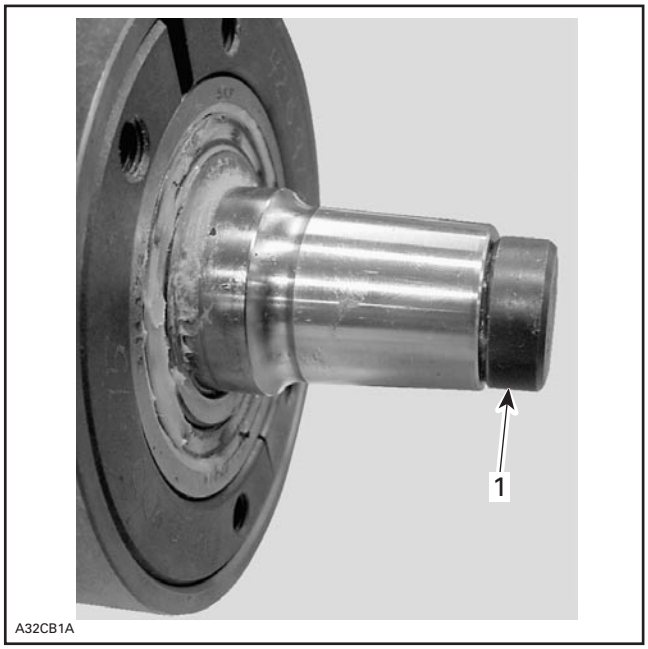
To remove PTO side bearing **no. 3** from crankshaft, install half rings on the bearing.

NOTE: Remove the bearing O-ring prior to installation of half ring.



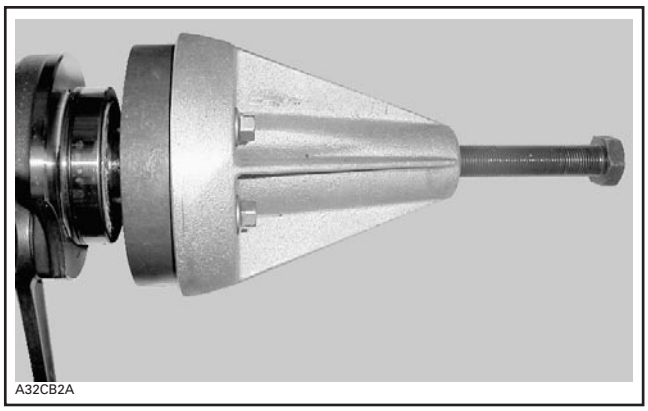
1. Half ring
2. Puller ring

Apply synthetic grease (P/N 413 711 500) on the crankshaft end and install protective cap (P/N 420 876 552).



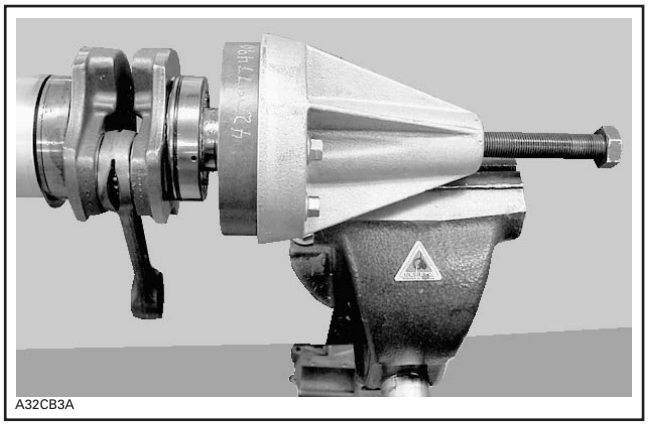
1. Protective cap

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



PULLER INSTALLED ON THE HALF RINGS

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


A32CB3A

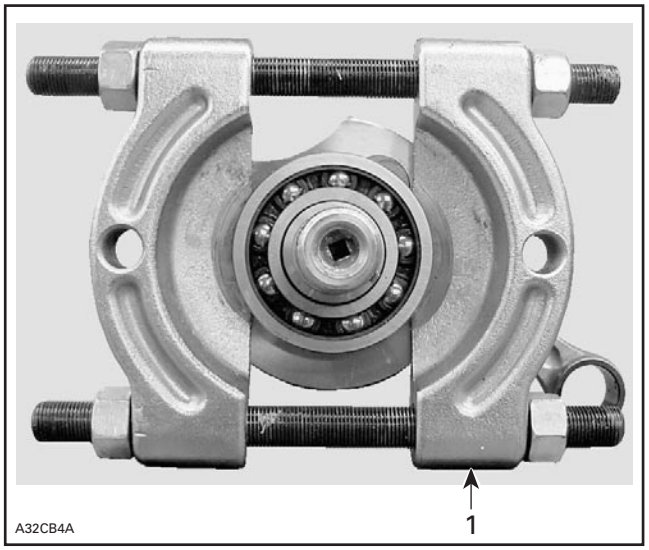
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool to tighten the puller bolt.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing, use bearing separator (Snap-On tool (P/N CJ951)) or (SPX/OTC tool (P/N 1124)) to facilitate the removal.



A32CB4A

1. Bearing separator

Procedure for MAG side bearings **no. 4** is same as of PTO side with the exception of protective cap (P/N 420 876 557).

INSPECTION

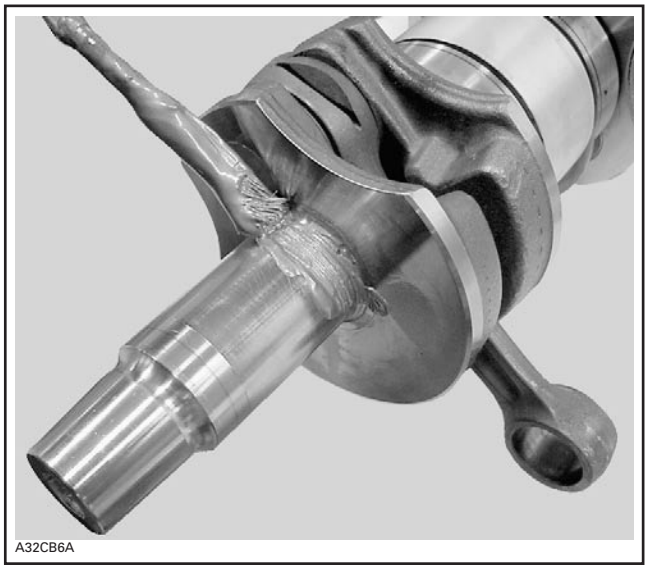
Refer to ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

Clean crankshaft end with sand paper no. 180 and remove all residue using pulley flange cleaner (P/N 413 711 809).


A32CB5A

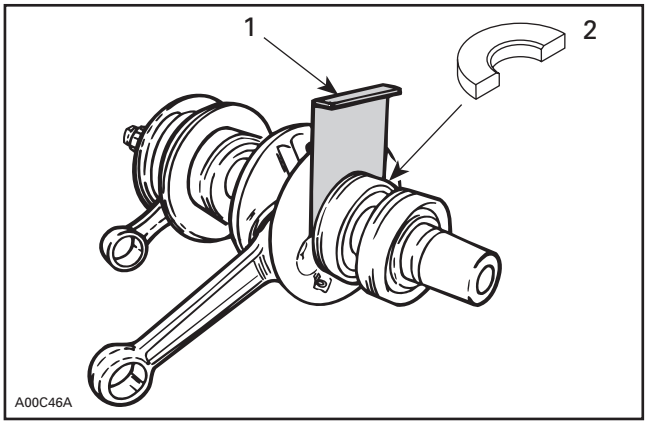
Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CB6A

443 Engine

To check proper clearance between bearing **no. 3** and crankshaft counterbalance, use feeler gauge (P/N 420 876 620).

Mount second bearing with distance gauge (P/N 420 876 822) for 443 for proper positioning.



1. Feeler gauge
2. Distance gauge

Prior to installation, heat the bearing as per the procedure given further in this subsection.

This will expand bearings and ease installation. Install bearings with groove as per exploded view.

552 Engine

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 and the heating surface.

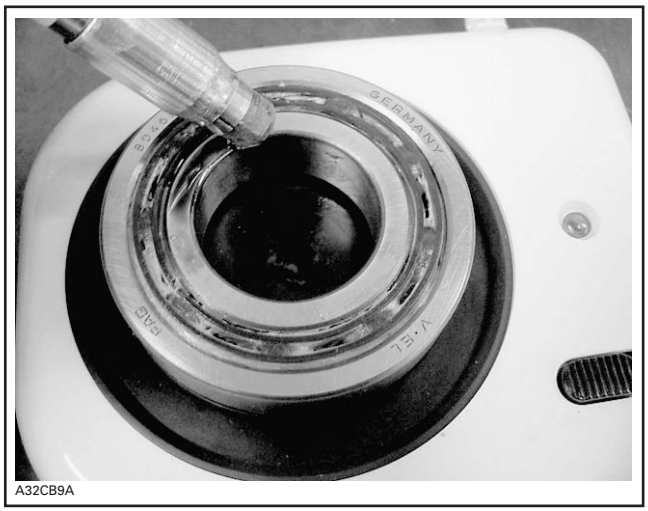
CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

Turn bearing(s) several times during heating process for heating it/them properly.

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

1. Bearings

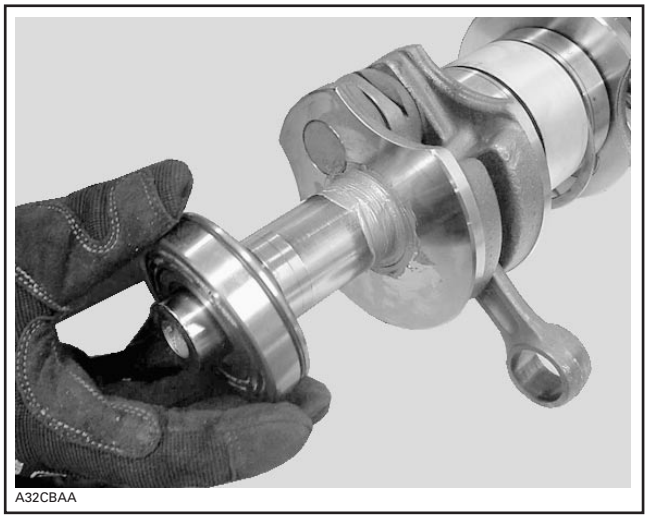
Touch the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reaches the proper temperature.

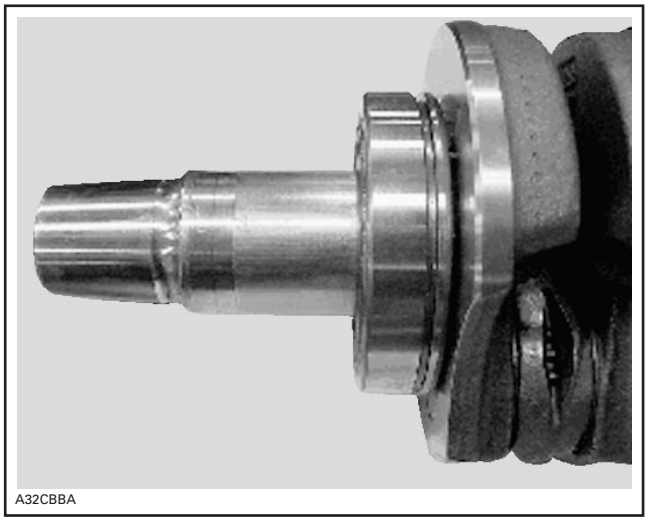


⚠ WARNING

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

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

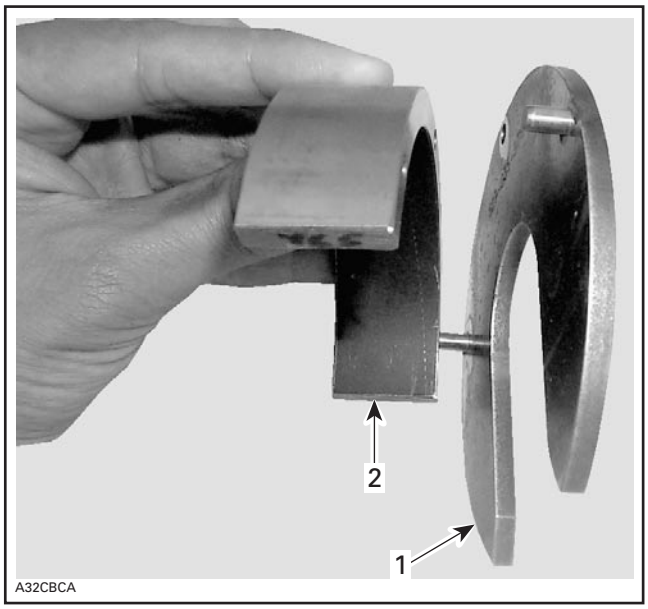

A32CBAA


A32CBBA

BEARING TO END POSITION

Install the O-ring.

Make a bearing locator tool using support plate (P/N 529 035 976) and distance gauge (P/N 529 035 965).



A32CBCA

1. Support plate
2. Distance gauge

Install bearing locator tool.


A32CBDA

Slide in the heated outer PTO bearing onto the crankshaft.


A32CBEA

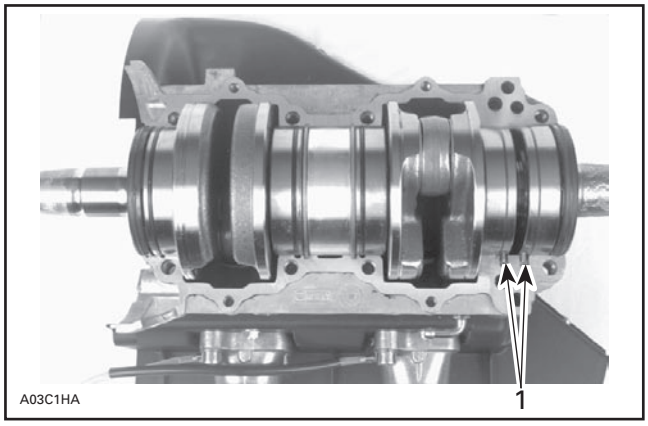
Install the MAG side heated bearing.


A32CBFA

All Engines

Bearings are pressed on crankshaft until they rest against radius. These radius maintain the gap needed for bearings lubrication.

When installing crankshaft, position drive pins **no. 6** as illustrated.



TYPICAL
1. Drive pins

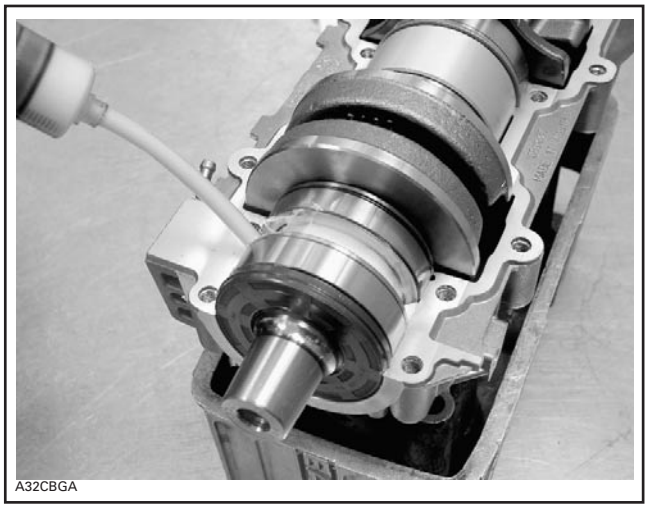
552 Engine

CAUTION: Use only the recommended Isoflex grease (P/N 293 550 021). Make sure not to push Isoflex grease between outside bearing race and half crankcase.

NOTE: The 50 g tube corresponds to 50 cc of grease.

Put 27 to 32 mL of grease in a syringe.

With the syringe, fill the PTO side ball bearings with 27 to 32 mL of Isoflex grease as shown below.

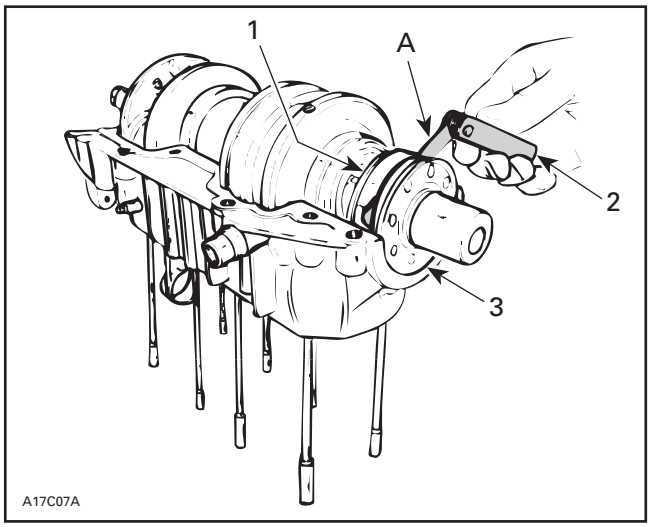

A32CBGA

All Engines

At seal **no. 2** assembly, apply a light coat of lithium grease on seal lip.

For bearing lubrication purpose, a gap of 1.0 mm (.040 in) must be maintained between seals and bearings.

When installing plain oil seals (seal without locating ring or without spacing legs), ensure to maintain 1.0 mm (.040 in) gap.



1. Bearing
2. Feeler gauge
3. Plain oil seal
A. 1 mm (.040 in)

Crankcase halves no. 1 and no. 5 are factory matched and therefore, are not interchangeable as single halves.

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.

Before screwing both parts of crankcase, seal it with a Loctite 5910 (P/N 293 800 081).

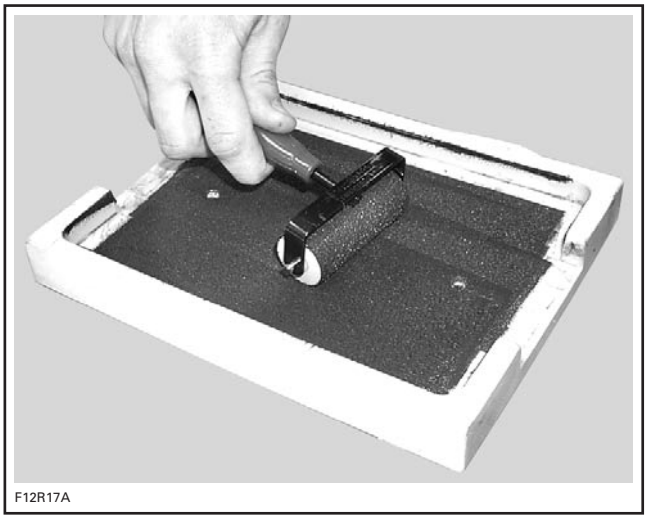
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (unlike the Dreibond sealing compound, using a finger will not affect the adhesion).

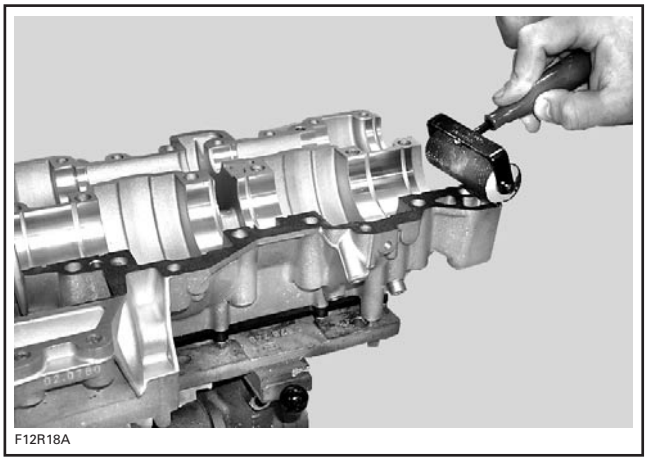
Use the silicone-based Loctite 5910 (P/N 293 800 081) on mating surfaces.

NOTE: The sealant curing time is similar to the Loctite 518 without using the Primer N.

CAUTION: Do not use Loctite 515 or 518 to seal crankcase. Do not use Loctite Primer N with the Loctite 5910. 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, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.





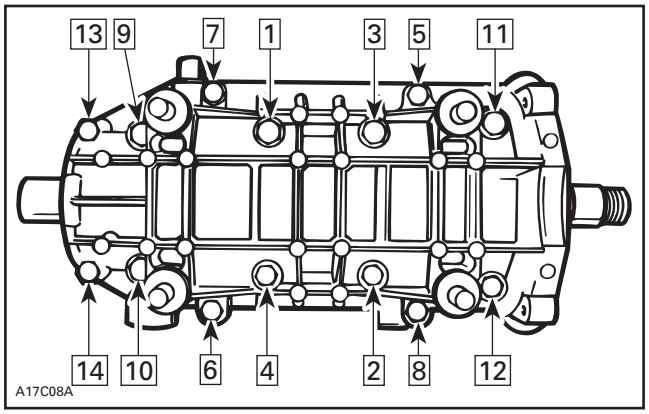
Do not apply in excess as it will spread out inside crankcase.

CAUTION: If sealant spreads out inside air compressor area, it could plug the compressor lubrication nipple and serious compressor damage may occur.

NOTE: Do not use Loctite Primer N with this sealant. The sealant curing time is similar to the Loctite 518 without using the Primer N, which is 4 to 24 hours.

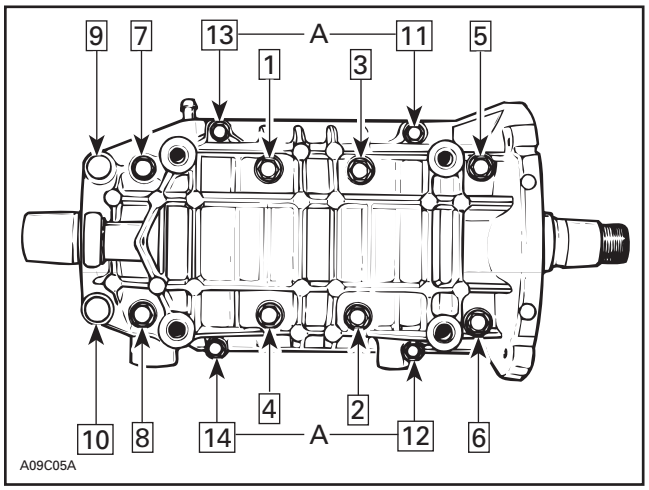
Screw all crankcase bolts in place in the following sequence and to the appropriate torque through a two steps torquing: first, screw bolts up to 60% of the final torque (13 N•m (115 lbf•**in**) for M8 bolts), then, tighten to the required torque (i.e. 22 N•m (16 lbf•ft)).

552 Engine



TIGHTENING SEQUENCE FOR 552 ENGINE TYPE

443 Engine



TIGHTENING SEQUENCE FOR 443 ENGINE TYPE
*A. 10 N•m (89 lbf•**in**). All the other screws are torqued to 22 N•m (16 lbf•ft)*

All Engines

To install magneto, refer to MAGNETO SYSTEM.

BREAK-IN

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

593 AND 593 HO SDI ENGINES

SERVICE TOOLS

Description	Part Number	Page
20 mm sleeve kit	529 035 542	93
bearing heater	529 035 969	96, 104
bearing puller	529 036 004	102
circlip installer	529 035 686	97
crankshaft protector	420 876 552	102
crankshaft protector	420 876 557	102–103
half rings	420 977 479	102
piston pin puller	529 035 503	93
puller ring	420 977 494	102
rubber pad	529 023 400	92
screws	420 840 681	102
support plate	529 035 976	105
temperature indicator stick	529 035 970	104
vacuum/pressure pump	529 021 800	90

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	103
BOMBARDIER LUBE	293 600 016	102
Dreibond sealing compound	420 297 906	95
grease	413 711 500	102
Isoflex grease	293 550 021	105–106
Loctite 518	293 800 038	98
Loctite 5910	293 800 081	107
Loctite Chisel	413 708 500	98, 102
Petamo grease	420 899 271	103
pulley flange cleaner	413 711 809	103
Ultra Copper	413 710 300	86

Skandic WT LC/SUV 600/Expedition TUV 600 HO SDI

REMOVAL FROM VEHICLE

Open hood.

Expedition TUV 600 HO SDI

Using B.U.D.S. software, remove the pressure in the fuel system. Refer to ENGINE MANAGEMENT.

All Models

Remove tuned pipe and muffler.

Drain engine coolant.

Remove or unplug the following then lift off engine from engine compartment.

NOTE: Use of a hoist is recommended.

– guard
– air silencer
– drive belt
– rewind starter handle
– drive pulley (not necessary if engine is not disassembled)
– hood
– carburetors/throttle body (as applicable)
– impulse hose and electrical connectors
– oil injection inlet line at oil injection pump, install hose pincher
– oil pump cable
– coolant hoses between cylinder head and radiator
– coolant by-pass hose
– coolant hose at front of coolant reservoir
– engine support screws
– engine stopper (left rear of engine).

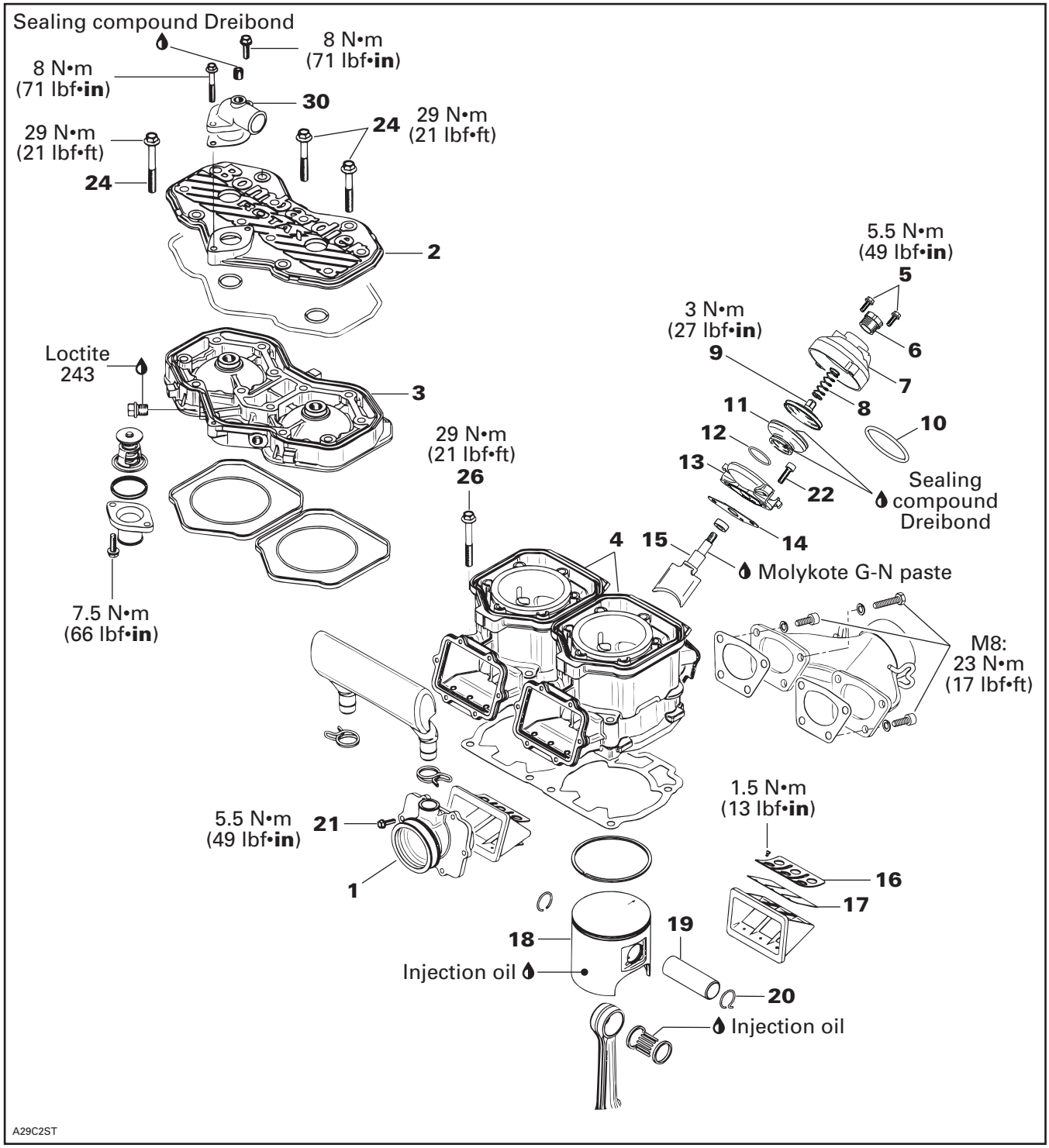
INSTALLATION ON VEHICLE

To install engine on vehicle, reverse removal procedure. However, pay attention, to all appropriate component/system reinstallation procedures described throughout this Shop Manual and to the following:

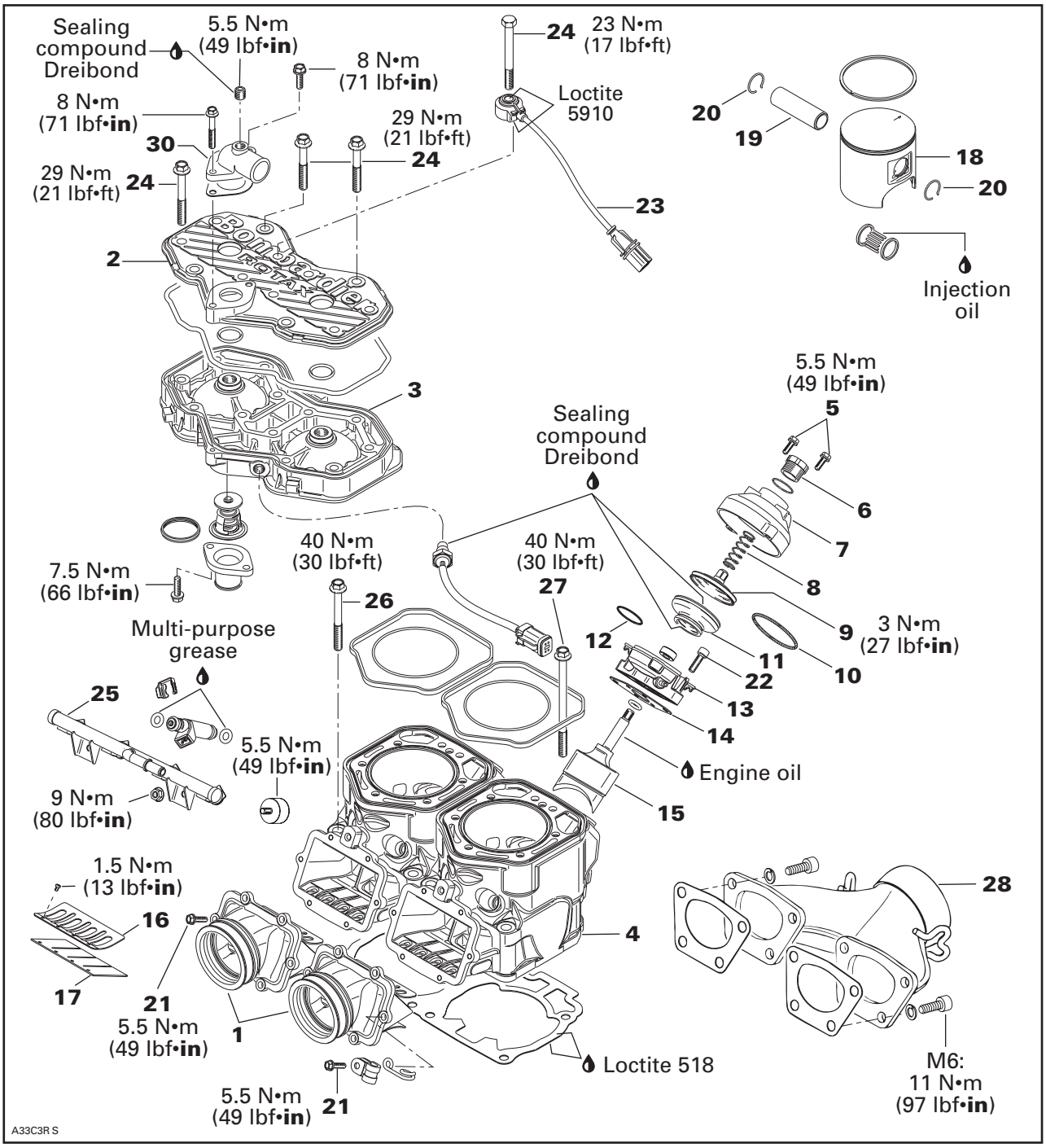
– After throttle cable installation, check carburetor/throttle body maximum throttle opening and oil injection pump adjustment.
– Check pulley alignment and drive belt tension.
– Seal exhaust ball joints with Ultra Copper (P/N 413 710 300).

TOP END

593 Engine



593 HO SDI Engine



GENERAL

CAUTION: While performing any engine related procedure, always make sure that the working area is clean and free from dust or particles to reduce the risk of damaging the engine.

TROUBLESHOOTING

Before completely disassembling the engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

COMPONENT REMOVAL

Most engine components can be removed with engine in vehicle such as:

– cylinder head
– piston(s)
– cylinder(s)
– rewind starter
– oil pump
– water pump
– magneto flywheel
– RAVE valve(s)
– reed valve(s).

CLEANING

Discard all gaskets and O-rings.

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

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" (over an arrow on the piston dome) must be visible after cleaning.

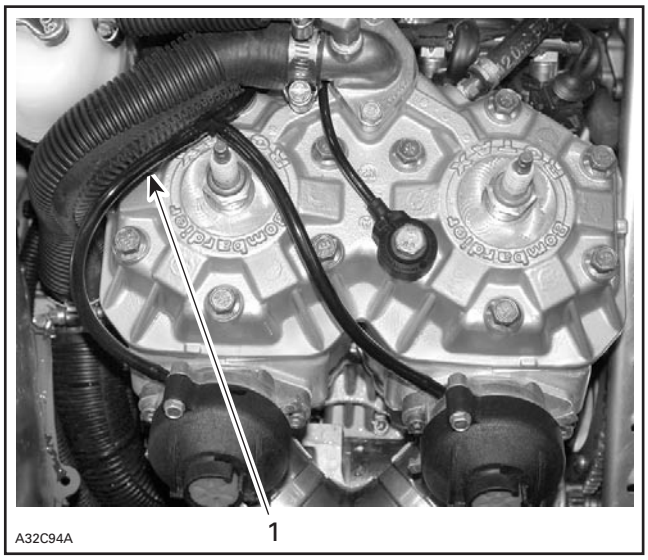
Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

RAVE VALVE BASIC OPERATION

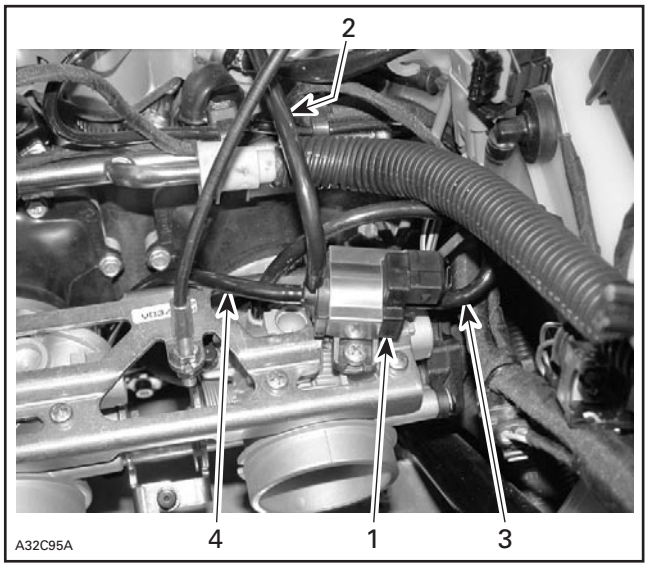
593 HO SDI Engine

The RAVE valves change the height of the exhaust port. The RAVE valve solenoid, which is controlled by the ECM, allows positive crankcase pressure to inflate the bellows and open the RAVE valves.

To open the RAVE valves, the ECM activates a solenoid which directs the pressure to the valves.



1. Pressure from solenoid



1. Solenoid
2. Pressure to RAVE valves
3. Vent to throttle body
4. Pressure with check valve from crankcase

To close the RAVE valves, the ECM deactivates the solenoid. In the closed position, the RAVE valves are vented through the intake manifold.

Maintenance

All Engines

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used.

BRP suggests annual cleaning of the valve. If a customer uses lower quality oil, than recommended, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

On **SDI models**, check if solenoid heating element is still functional once a year, the element should be warm after one minute of riding (measure should be between 0.0 to 0.4 ohms). At the same time, using a vacuum/pressure pump (P/N 529 021 800), check if crankcase check valve is still functional.

NOTE: Make sure hoses are not kinked or damaged.

Boring Precaution

All Engines

In its stock configuration, the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

DISASSEMBLY

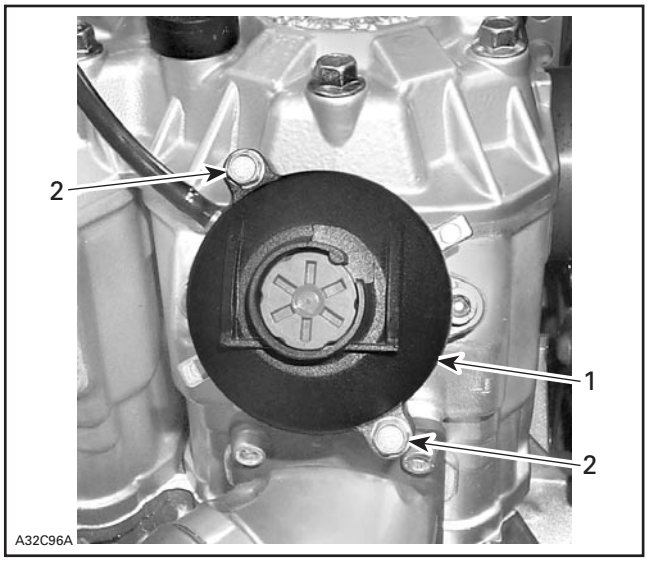
RAVE System

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

Remove RAVE valve cover **no. 7** by removing screws **no. 5**.

⚠ WARNING

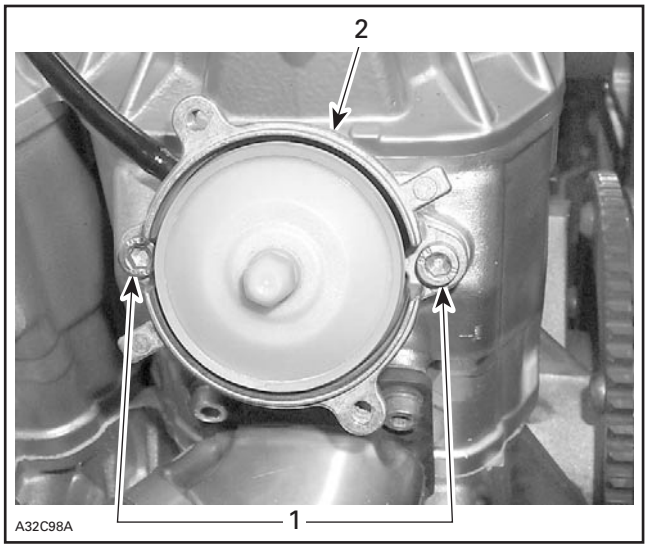
Firmly hold cover to valve base. The compression spring inside the valve is applying pressure against the cover.



TYPICAL
1. RAVE valve cover
2. Screws

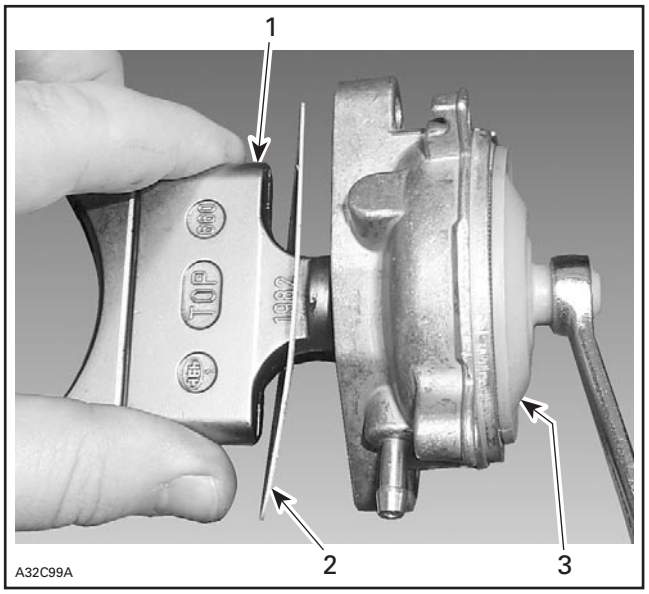
Remove the compression spring **no. 8**.

Unscrew the Allen socket screws **no. 22** then remove the RAVE valve base **no. 13**.



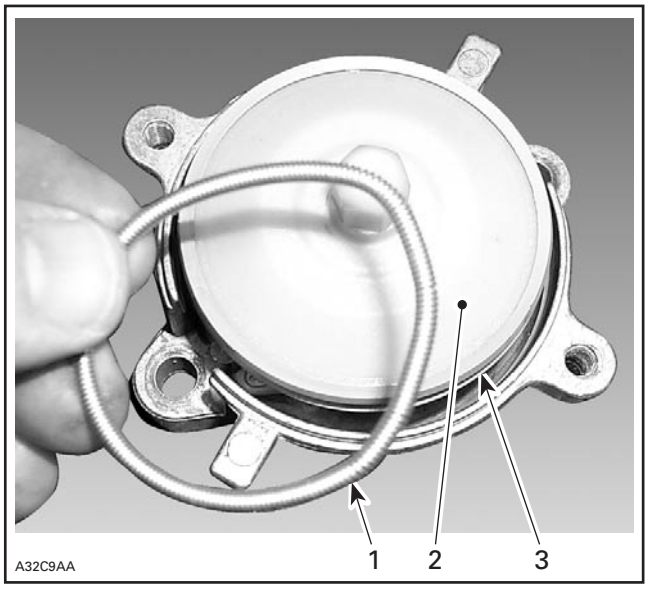
TYPICAL
1. *Allen socket screws*
2. *RAVE valve base*

Unscrew and remove the guillotine **no. 15** from the valve piston **no. 9** than remove the gasket **no. 14**.



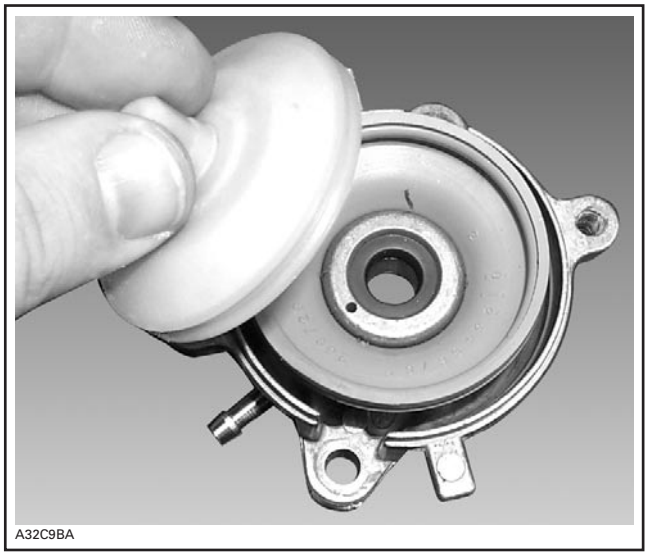
1. *Guillotine*
2. *Gasket*
3. *Valve piston*

Remove spring **no. 10** retaining bellows **no. 11** to valve piston.

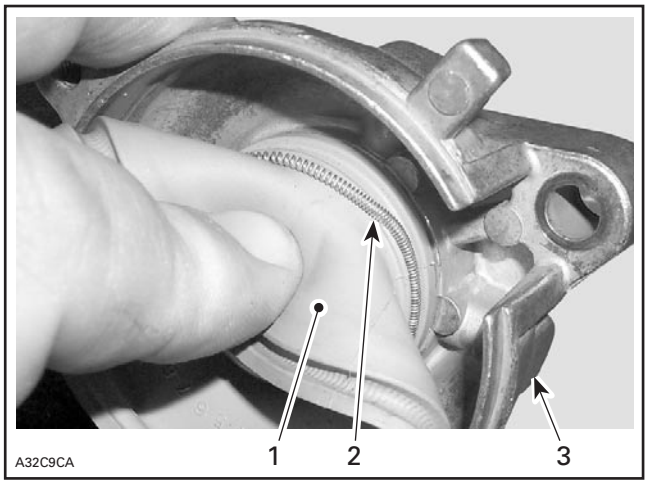


1. *Spring*
2. *Valve piston*
3. *Bellows*

Remove the valve piston.

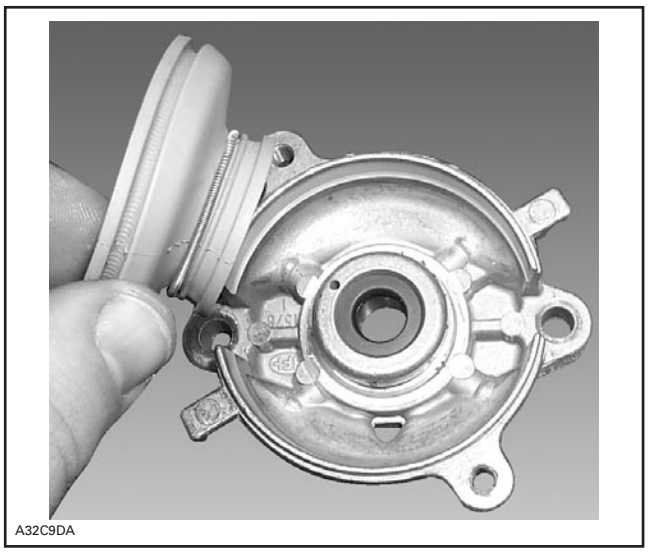


Remove the small spring **no. 12** retaining bellows to valve base.



1. Bellows
2. Small spring
3. Valve base

Remove bellows from valve base.



REED Valve

If applicable, remove intake resonator on top of reed valves **no. 1**.

Unscrew reed valve screws **no. 21** then remove reed valve(s).

Cylinder Head Cover

Unplug spark plug cables.

593 HO SDI Engine

Disconnect the knock sensor **no. 23**.

All Engines

Unplug coolant hose from upper thermostat housing **no. 30**.

Unscrew all cylinder head cover screws **no. 24**.

Cylinder Head

Remove the cylinder head cover **no. 2**.

Disconnect the temperature sensor connector.

Remove the cylinder head **no. 3**.

Cylinder

593 HO SDI Engine

Release the fuel pressure of the system. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

Unplug fuel injector connectors then remove the fuel rail **no. 25**. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

All Engines

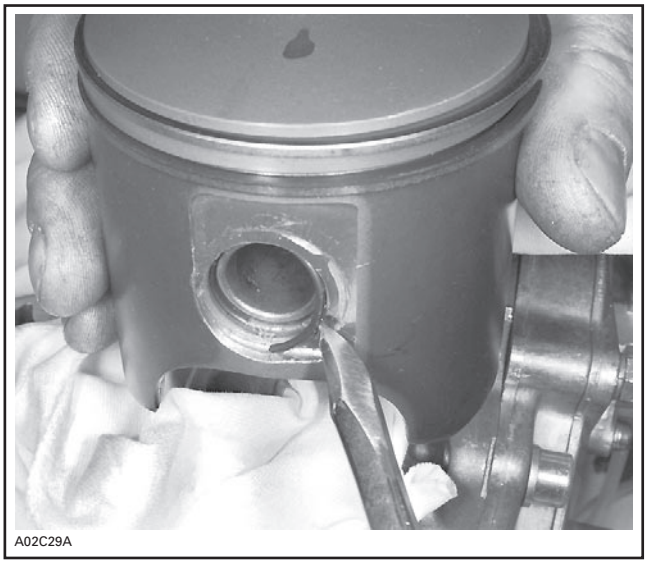
Remove cylinder head **no. 3**.

Remove manifold and RAVE valves.

Unscrew cylinder screws **no. 26** and **no. 27** then remove the cylinder(s) **no. 4**.

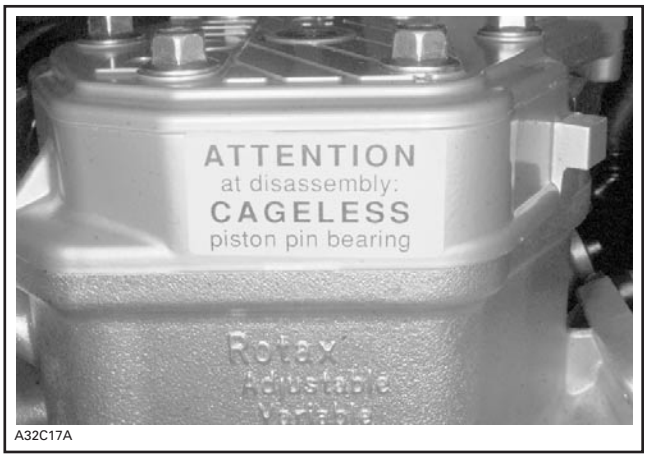
Piston

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase. Then with a pointed tool inserted in piston notch, remove both circlips **no. 20** from piston **no. 18**.



TYPICAL

This engine is equipped with cageless piston pin bearings.

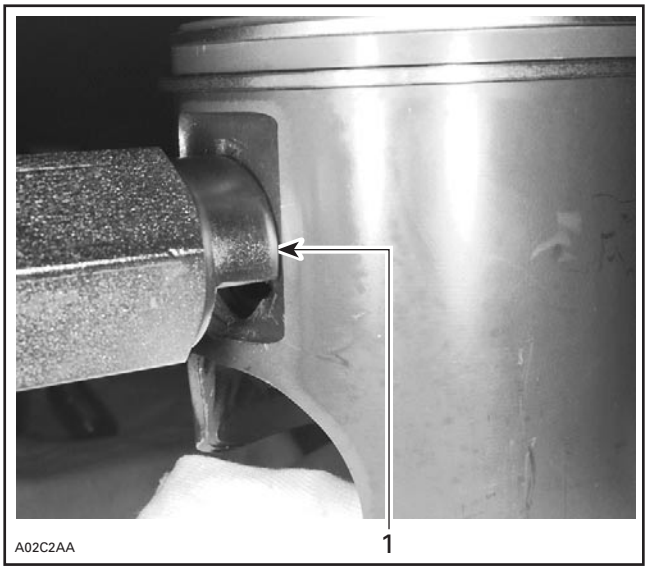


A32C17A

Use piston pin puller (P/N 529 035 503) along with 20 mm sleeve kit (P/N 529 035 542) and locating sleeve.

NOTE: The locating sleeve is the same that contains new cageless bearing.

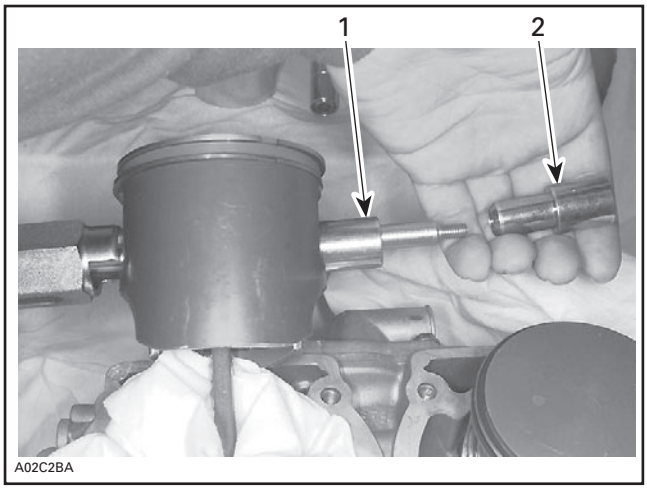
Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



A02C2AA

TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

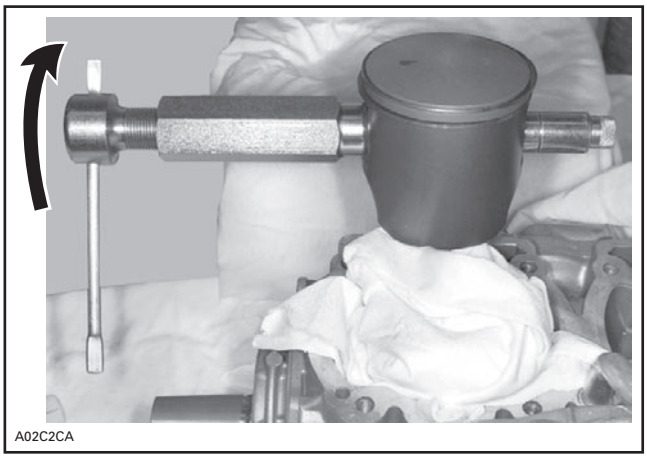


A02C2BA

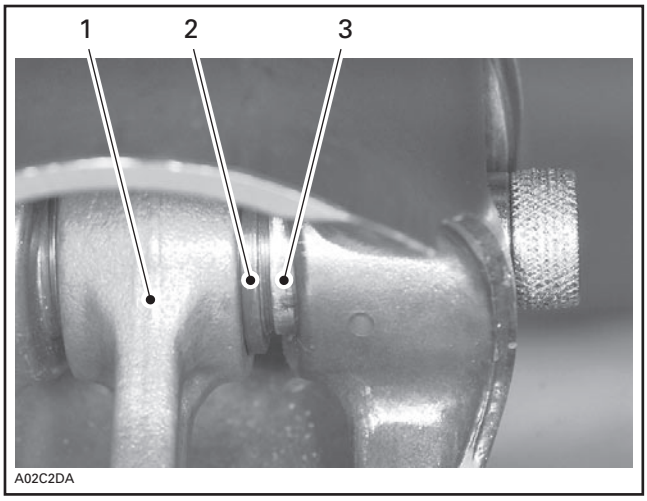
TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Screw (LH threads) extracting nut.

Pull out piston pin **no. 19** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

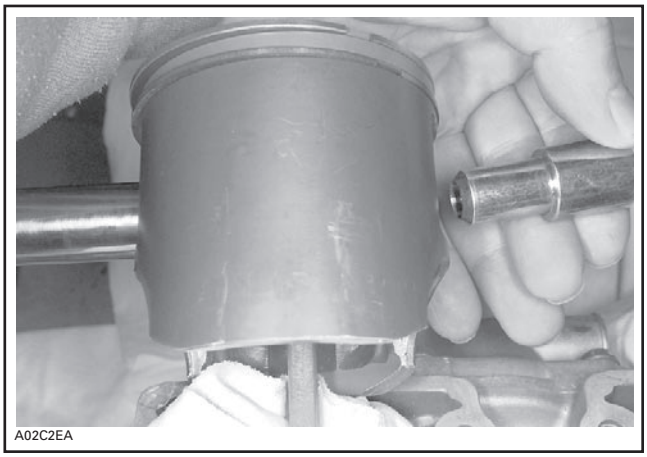

A02C2CA

TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

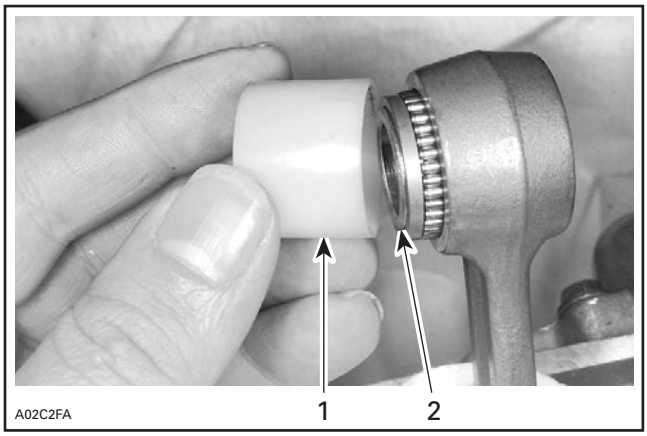
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

Exhaust Manifold

593 HO SDI Engine

Upon removal of the exhaust manifold **no. 28**, you must heat M6 bolt heads for 30 seconds before loosening.

NOTE: Heat one bolt at a time.

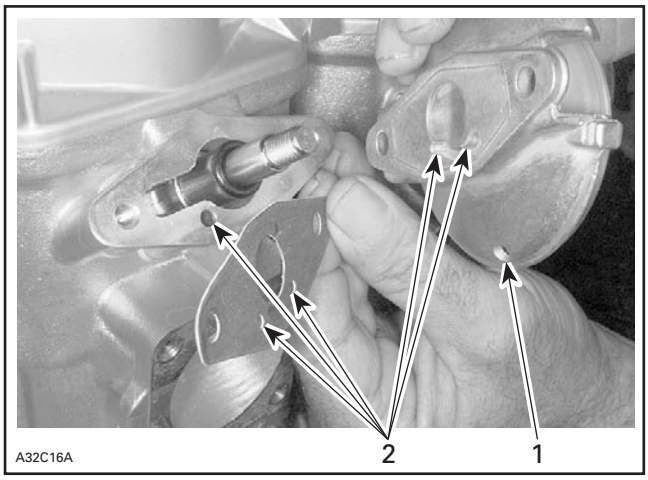
INSPECTION

Cylinder Head Cover, Cylinder Head and Cylinder

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

RAVE System

Check valve rod housing and cylinder for clogged passages.



1. Draining hole
2. Passages

NOTE: Oil dripping from draining hole indicates a loosen spring or damaged bellows.

Bellows

Check for cracked, dried or perforated bellows **no. 11**.

Spring

Check if the compression springs **no. 87** are in specifications.

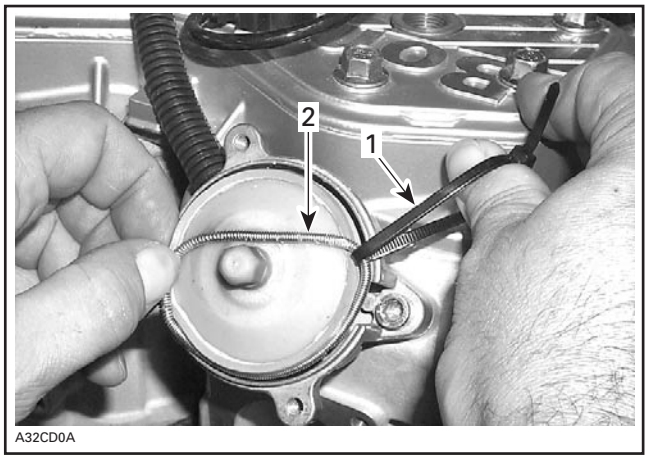
ENGINE	SPRING P/N	COLOR	WIRE DIA. mm (in)	FREE LENGTH mm (in)
593	420 239 948	GREY	1.0 (.039)	38.0 (1.50)
593 HO SDI	420 239 942	BLACK	0.8 (.031)	42.5 (1.67)

ASSEMBLY

RAVE System

Apply Dreibond sealing compound (P/N 420 297 906) in the groove of valve base and in the piston valve groove, then install bellows.

NOTE: To ease the installation of the spring **no. 12** retaining bellows **no. 13** to valve piston, refer to the following photo.



TYPICAL
1. Locking tie
2. Spring

Install RAVE valve with its mention "TOP" as illustrated in the following photo.

RAVE VALVE PARTIALLY INSERTED

Tighten red cap **no. 6** screw to bottom.

Cylinder and Piston

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

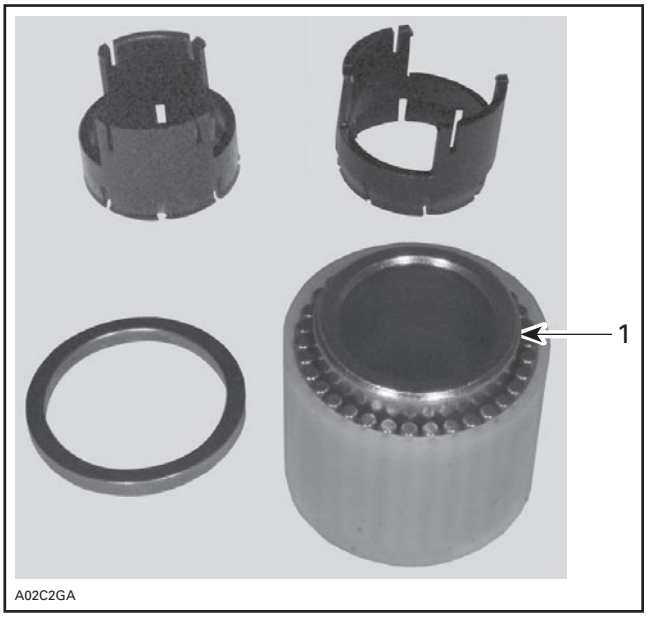
Before inserting piston **no. 18** in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Cylinder Head Cover, Cylinder Head and Cylinder

Check flatness of part sealing surfaces. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT and look for CHECKING SURFACE FLATNESS.

When installing a new cageless bearing, replace half plastic cages with sleeve.

NOTE: 593 engine cageless bearings have 28 needles.



TYPICAL
1. Sleeve

Lubricate needle bearings with injection oil. Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

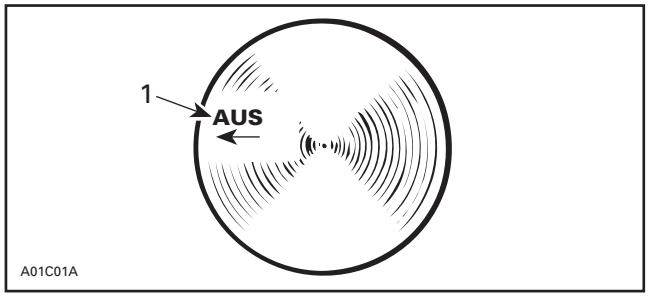
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Heat piston using bearing heater (P/N 529 035 969).

TYPICAL

CAUTION: Piston temperature must not exceed 46°C (115°F). NEVER USE DIRECT FLAME to heat the piston and never freeze the pin. Inappropriate heating procedure/s may damage the piston.

At assembly, place the pistons over the connecting rods with the letters "AUS" (above the arrow on the piston dome) facing in direction of the exhaust port.



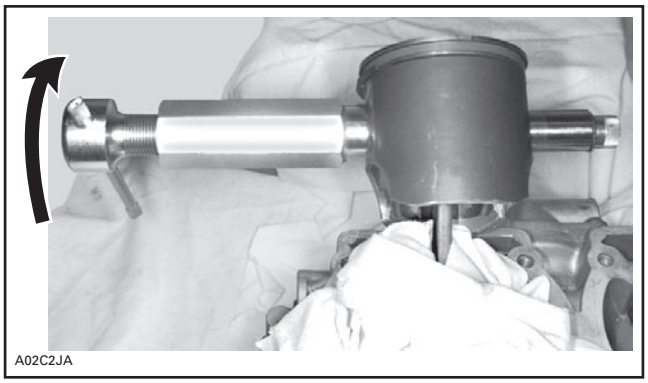
1. Exhaust

Install shouldered sleeve.


A02C2IA

TYPICAL — SHOULDERED SLEEVE INSTALLATION

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


A02C2JA

TYPICAL

CAUTION: Always install new circlips.

To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use appropriate piston circlip installer.

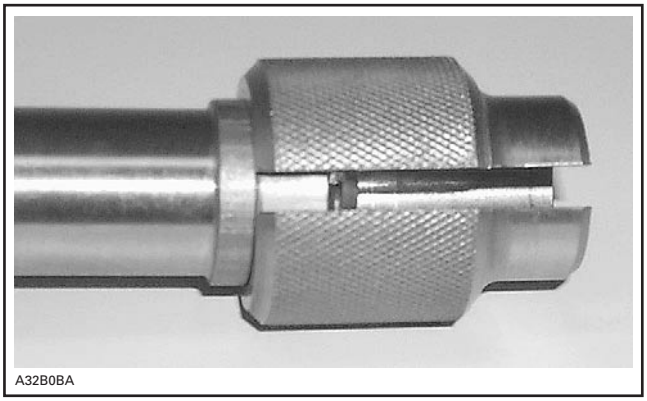
ENGINE	PISTON CIRCLIP INSTALLER (P/N)
593, 593 HO SDI	529 035 686

Use circlip installer (P/N 529 035 686) to install new mono-hook circlips **no. 20**.

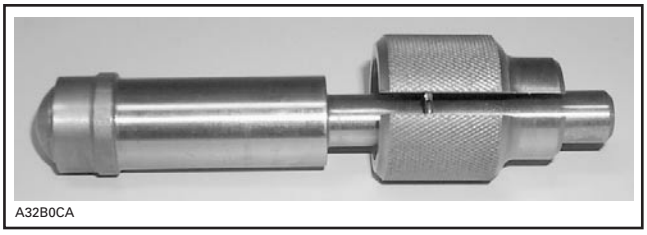
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

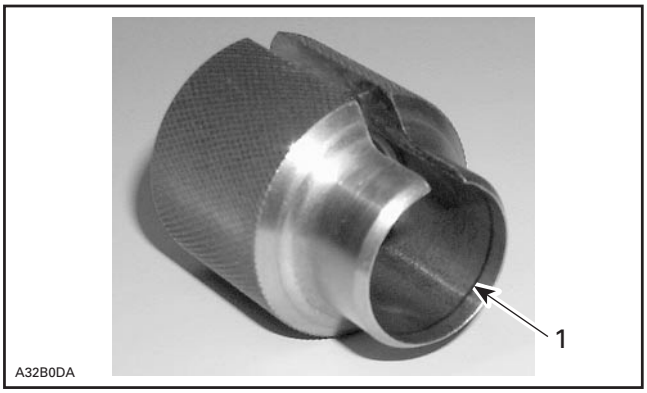

A32B0AA

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


A32B0BA

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


A32B0CA

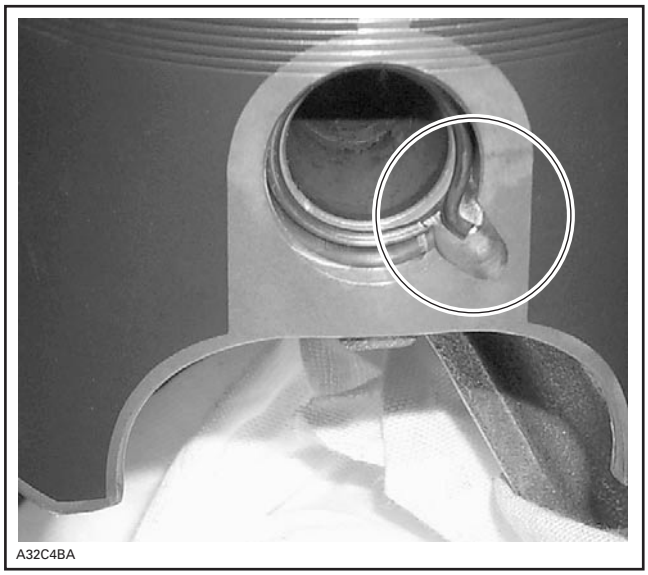


A32B0DA

1. Groove

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care 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 as on a second attempt circlip will lose its normal retaining capabilities.

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

Clean cylinders **no. 4** and crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

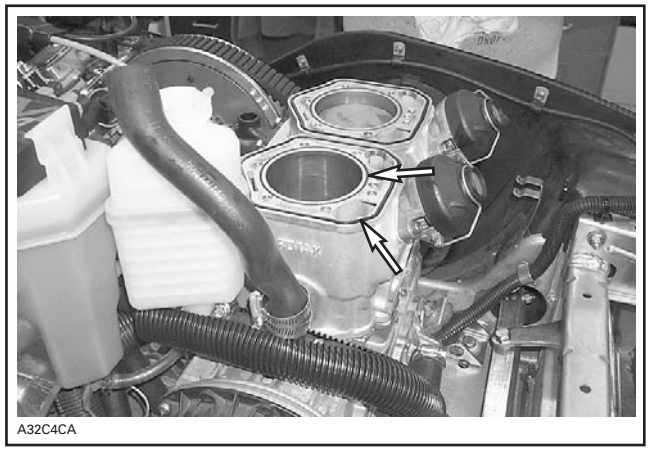
Coat crankcase mating surface with Loctite 518 (P/N 293 800 038). Choose the right gasket thickness according to combustion chamber volume. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT. Install it on crankcase. Coat gasket with Loctite 518.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

Before inserting piston **no. 18** in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Install cylinders. Do not tighten.

Install new rubber ring and round O-rings on each cylinder.



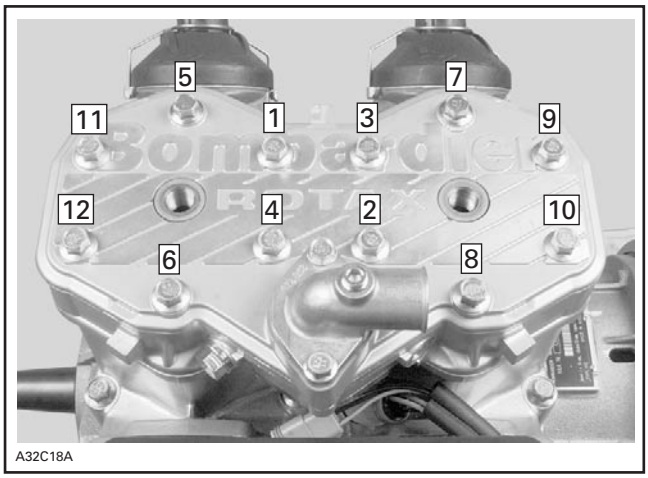
TYPICAL

NOTE: Carefully clean screws before reinstallation, specifically under screw head.

Install exhaust manifold with gaskets. Do not tighten yet.

At assembly, torque cylinder head screws using the following table and as per the following illustrated sequence.

ENGINE	
593	593 HO SDI
29 N•m (21 lbf•ft)	29 N•m (21 lbf•ft)
	Cylinder head screw with knock sensor: 23 N•m (17 lbf•ft)

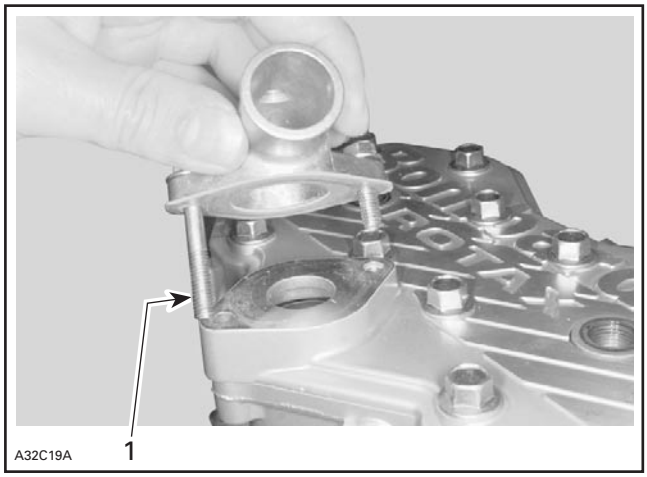


TYPICAL

Tighten exhaust manifold bolts in a criss-cross sequence as per the following table.

ENGINE	
593	593 HO SDI
23 N•m (17 lbf•ft)	11 N•m (97 lbf•**in**)

Install outlet socket and tighten screws to 8 N•m (71 lbf•**in**). Note position of longer screw.



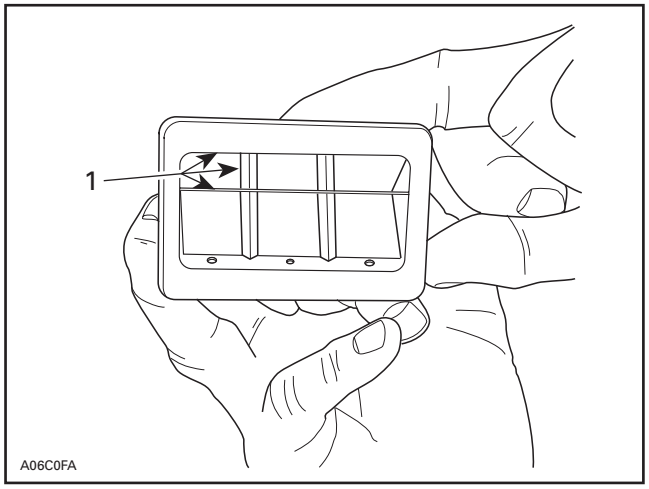
1. Longer screw

Reed Valve

Blades have a curved shape. Install with their curve facing reed block.

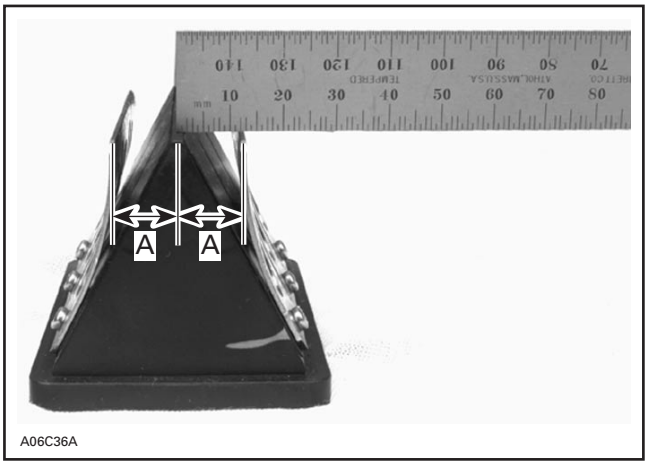
With blade stopper **no. 16** removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.



1. No play

Check distance from blade stopper inner edge and distance from center of reed valve block.



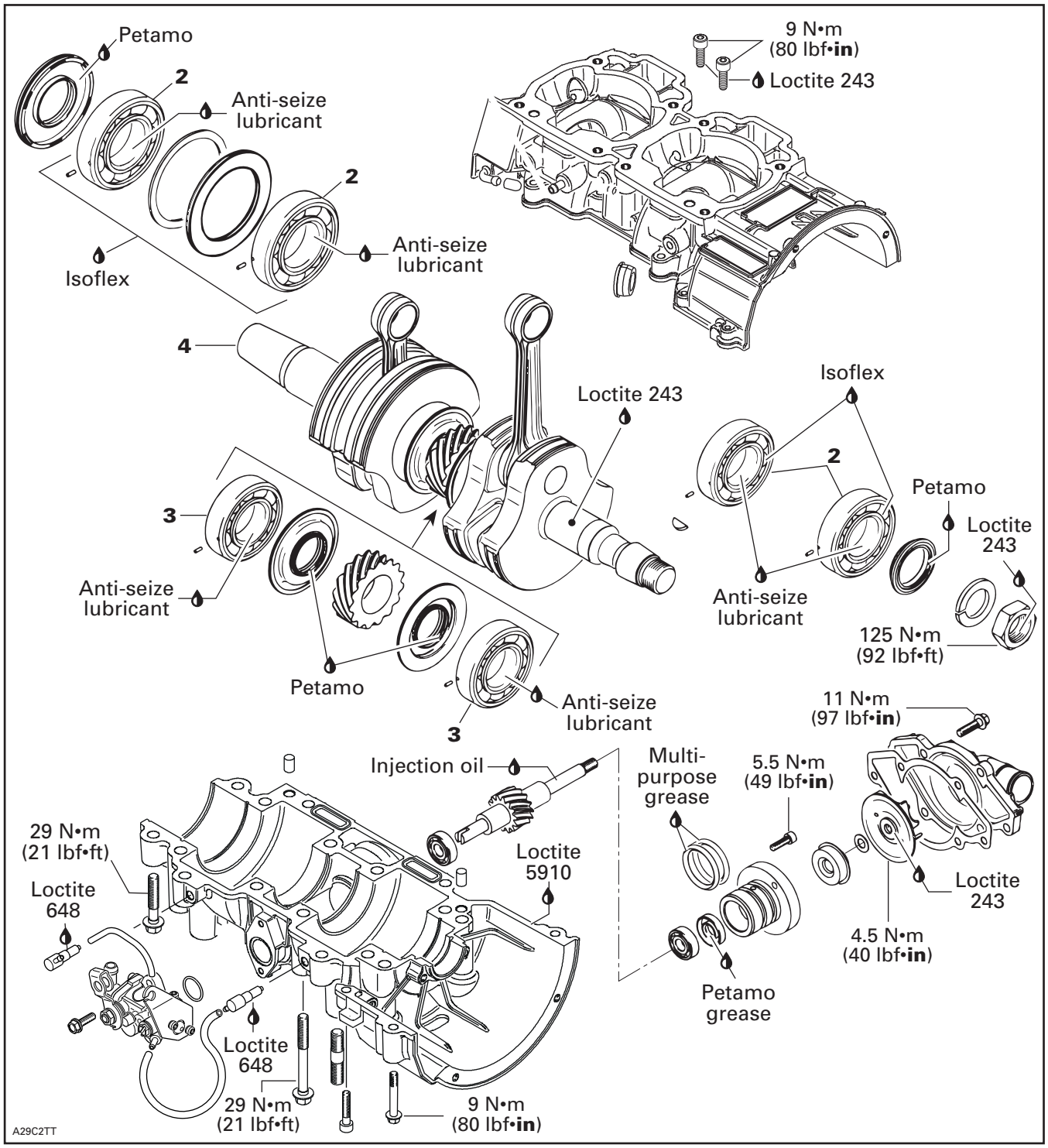
TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

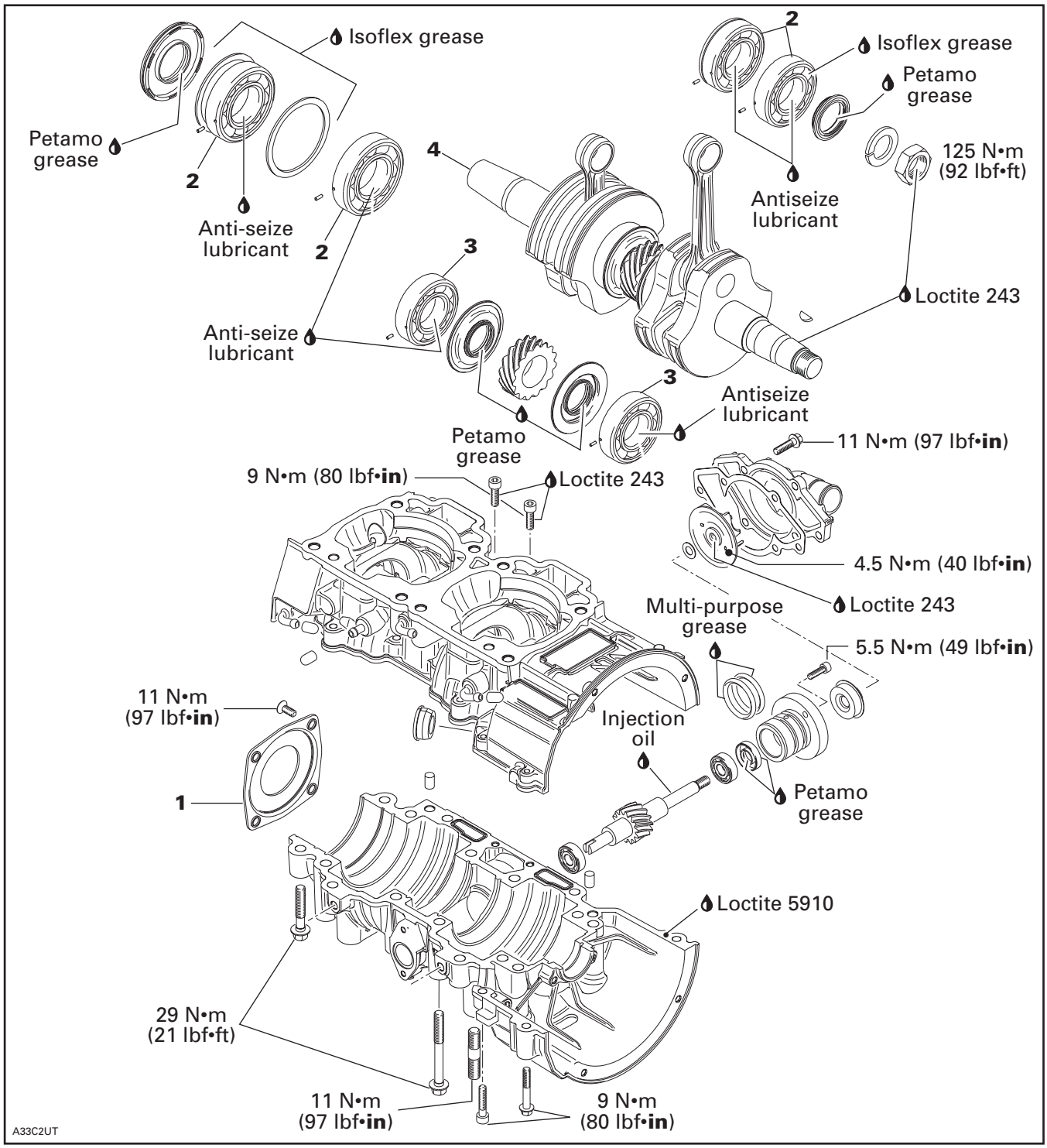
Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

593 Engine



593 HO SDI Engine



NOTE: Engine must be removed from chassis to perform the following procedures.

CLEANING

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

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

Remove old paste gasket from crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

DISASSEMBLY

General

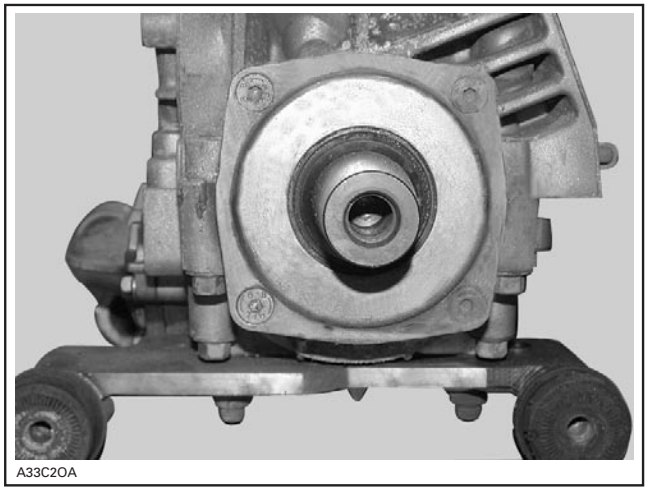
To remove drive pulley, refer to DRIVE PULLEY.

Remove rewind starter.

To remove magneto, refer to MAGNETO SYSTEM.

593 HO SDI Engine

Remove oil seal cover no. 1.

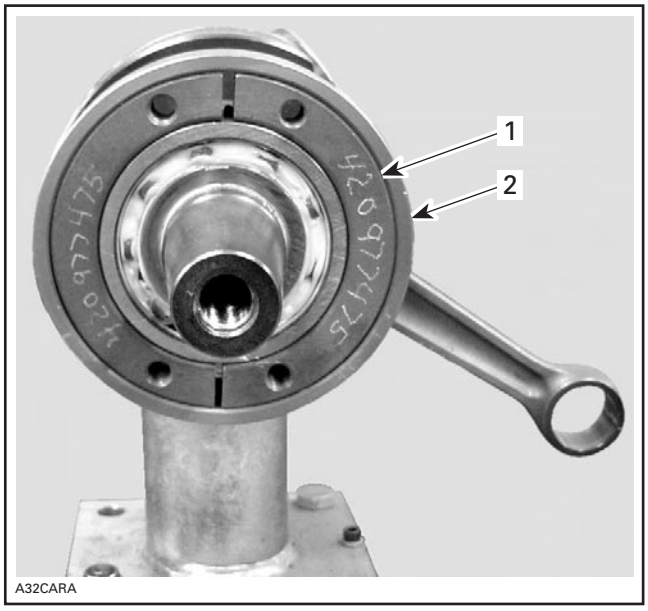

A33C2OA

TYPICAL

Crankshaft Bearing

To remove PTO side bearings no. 2 and no. 3 from crankshaft no. 4, install the following tools on the bearing.

– half rings (P/N 420 977 479)
– puller ring (P/N 420 977 494).



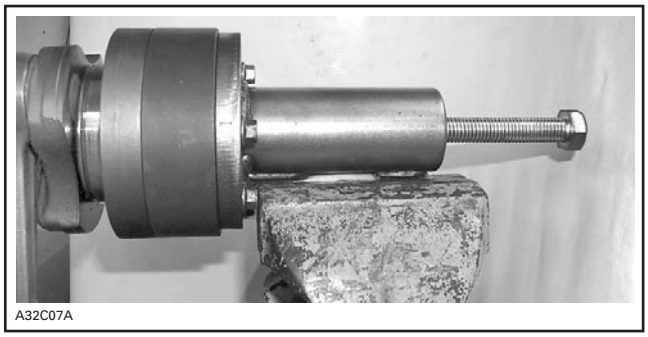
A32CARA

1. Half ring
2. Puller ring

NOTE: Apply grease (P/N 413 711 500) 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.


A32C07A

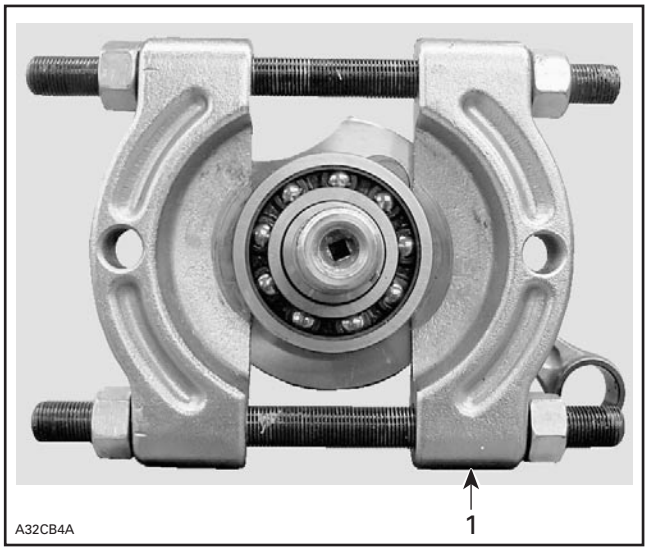
BEARING PULLER SECURED IN THE VISE

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.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner PTO side bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use bearing separator (Snap-On tool (P/N CJ951) or (P/N SPX/OTC) tool (P/N 1124) to facilitate the removal.



1. Bearing separator

Procedure for MAG side bearings **no. 2** and **no. 3** is same as of PTO side with the exception of crankshaft protector (P/N 420 876 557).

INSPECTION

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

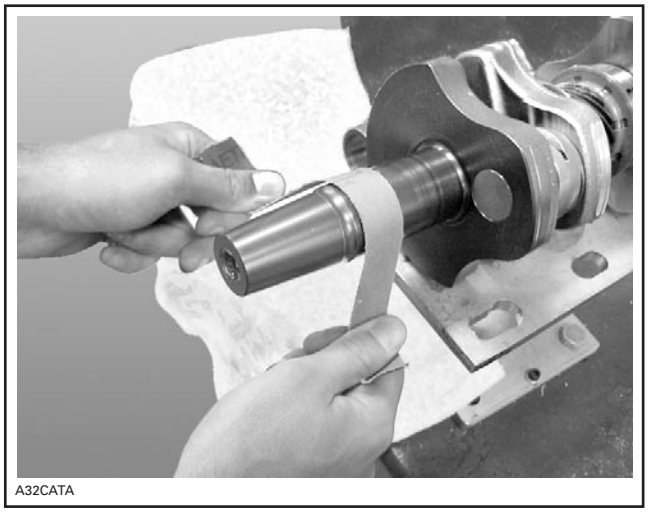
Coat lip of all seals with Petamo grease (P/N 420 899 271).

Crankshaft Bearing

CAUTION: Never reinstall a bearing that has been removed.

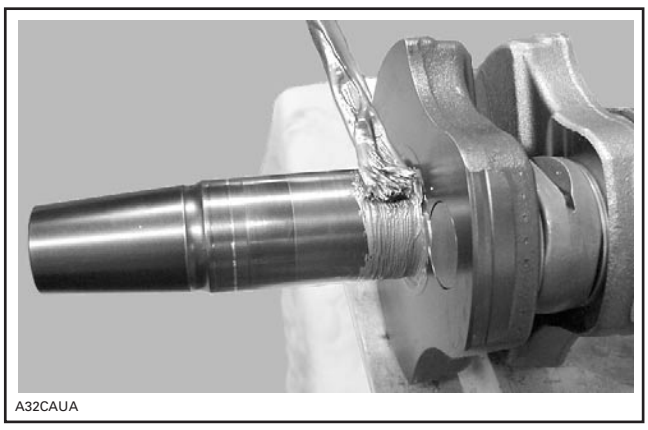
Inspect crankshaft ends for damage.

Clean crankshaft end with sand paper no.180 and remove all residue using pulley flange cleaner (P/N 413 711 809).



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.



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 and the heating surface.


A32CB7A

CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

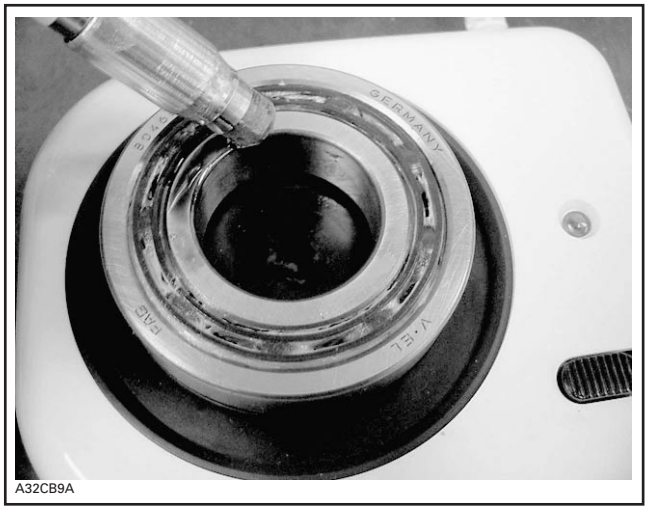
Turn bearing(s) several times during heating process for heating it/them properly.

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

A32CB8A

1. Bearings

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


A32CB9A

⚠ WARNING

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

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

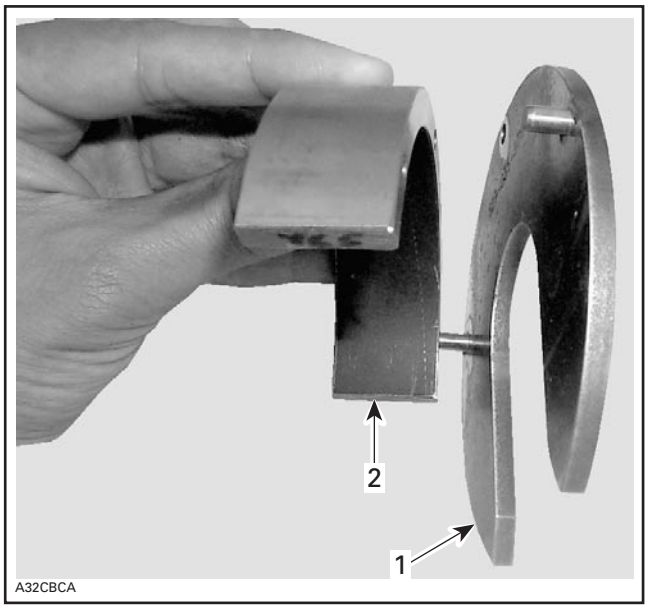

A32CAVA

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 drive pins and/or retaining discs.**

Install retaining discs.

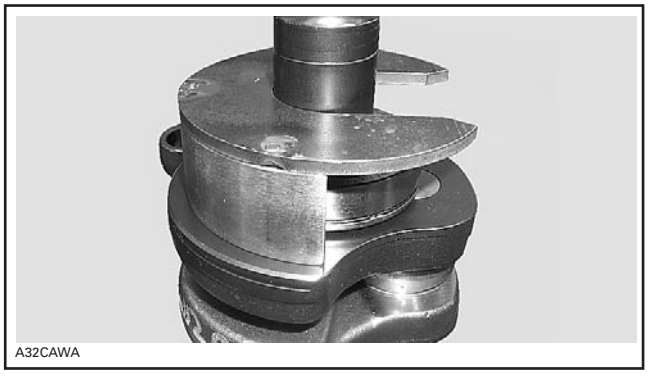
Install support plate (P/N 529 035 976) with appropriate distance gauge; refer to following table.

DISTANCE GAUGE P/N	ENGINE APPLICATION
529 035 966	593
529 035 968	593 HO SDI



1. Support plate
2. Distance gauge

Install bearing locator tool.



Slide in the heated outer PTO bearing onto the crankshaft until it contacts the distance gauge.

Slide-in the first MAG bearing **with the integrated seal facing crankshaft**. Push bearing to the bottom with pusher, using a rubber hammer.

Slide-in the second bearing until it contacts the first one.

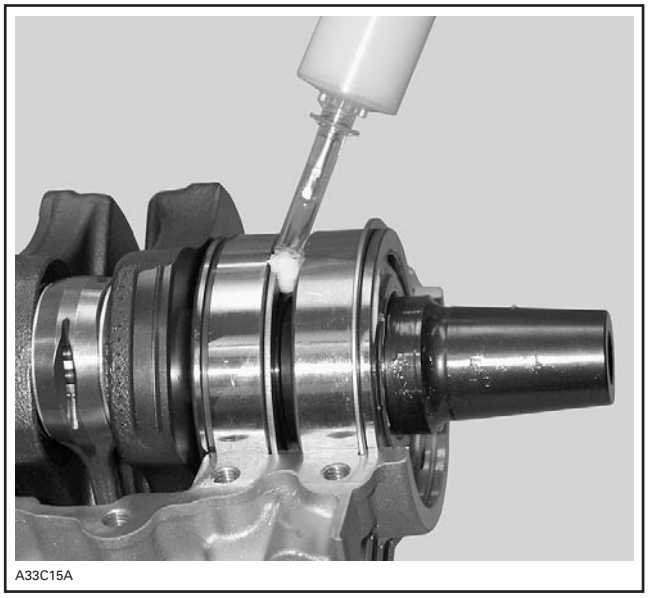
CAUTION: Use only the recommended Isoflex grease (P/N 293 550 021). Make sure not to push Isoflex grease between outside bearing race and half crankcase.

NOTE: The 50 g tube corresponds to 50 cc of grease.

Put 50 to 55 mL of Isoflex grease (P/N 293 550 021) in a syringe.

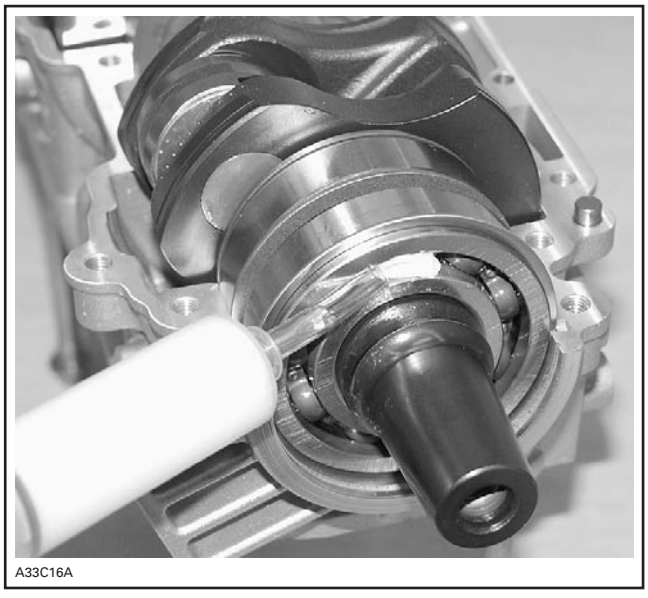
CAUTION: Do not exceed the recommended amount of grease.

Fill inner side of PTO side bearing with Isoflex grease (P/N 293 550 021) (about 10 mL).

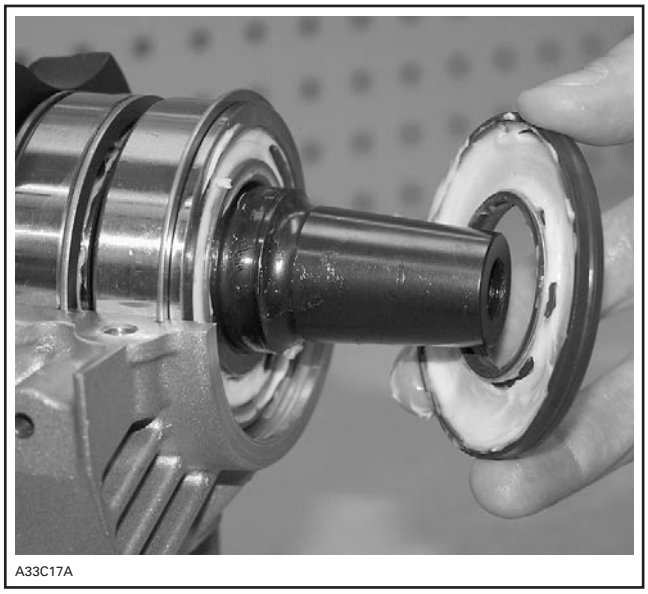

A33C15A

PTO SIDE BEARING FILLED WITH ISOFLEX GREASE

With the syringe, fill the outer ball bearing and inner side of outer seal with 40 to 45 mL of Isoflex grease (P/N 293 550 021).


A33C16A

BALLS COATED WITH A SEAM OF GREASE

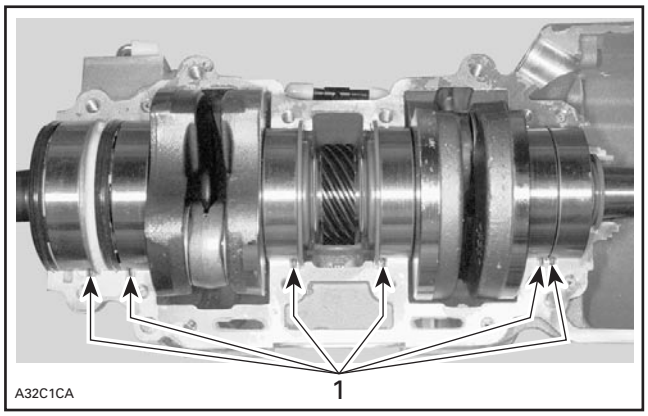

A33C17A

TYPICAL — FILL WITH GREASE AND SET IN PLACE

Apply 6 mL of Isoflex grease (P/N 293 550 021) to MAG side outer bearing.

NOTE: If replaced with new bearing, do not apply grease as new bearings come with grease already applied.

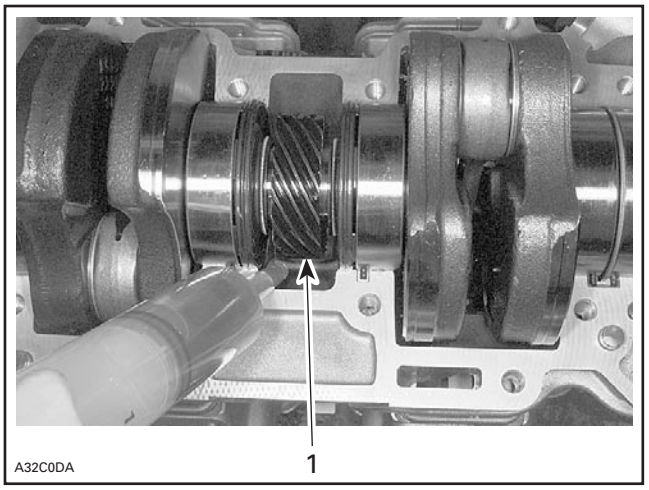
At crankshaft installation, position drive pins as illustrated.



A32C1CA

1. Position pins

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



1. Oil bath

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.

Before screwing both parts of crankcase, seal it with a Loctite 5910 (P/N 293 800 081).

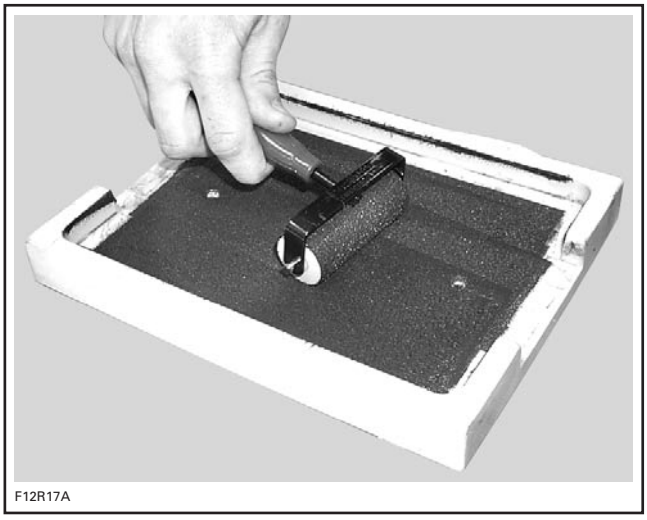
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (unlike the Dreibond sealing compound, using a finger will not affect the adhesion).

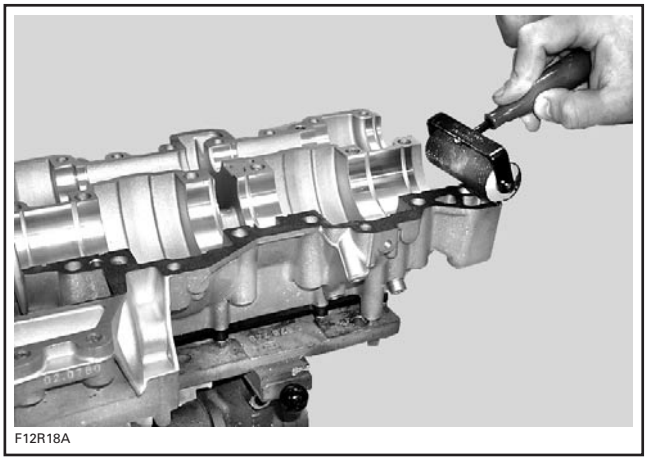
Use the silicone-based Loctite 5910 (P/N 293 800 081) on mating surfaces.

NOTE: The sealant curing time is similar to the Loctite 518 without using the Primer N.

CAUTION: Do not use Loctite 515 or 518 to seal crankcase. Do not use Loctite Primer N with the Loctite 5910. 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, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.



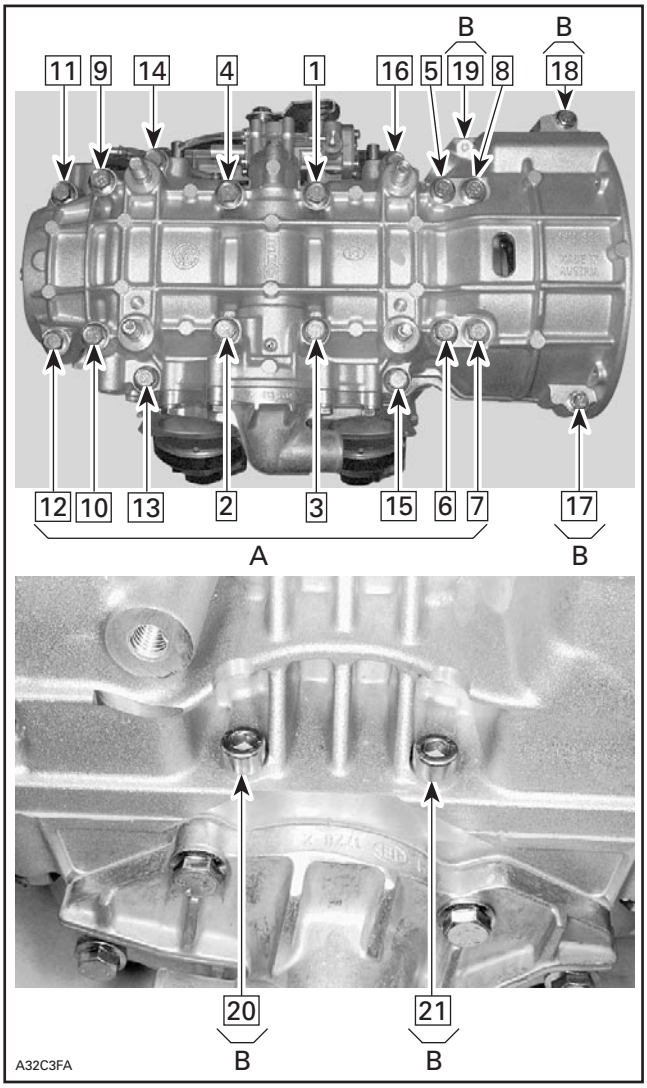


Do not apply in excess as it will spread out inside crankcase.

CAUTION: If sealant spreads out inside air compressor area, it could plug the compressor lubrication nipple and serious compressor damage may occur.

NOTE: Do not use Loctite Primer N with this sealant. The sealant curing time is similar to the Loctite 518 without using the Primer N, which is 4 to 24 hours.

Screw all crankcase bolts in place in the following sequence and to the appropriate torque through a two steps torquing: first, screw bolts up to 60% of the final torque (18 N•m (13.5 lbf•ft) for most of the bolts), then, tighten to the required torque (i.e. 29 N•m (21 lbf•ft)).



1. Torque bolts 1 through 16 to 29 N•m (21 lbf•ft)
*2. Torque bolts 17 through 21 to 9 N•m (80 lbf•**in**)*

593 HO SDI Engine

Install oil seal cover.

BREAK-IN

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

LEAK TEST AND ENGINE DIMENSION MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	414 352 900	121
dial indicator	414 104 700	118, 121
hose pincher	295 000 076	109
vacuum/pressure pump	529 021 800	110–111

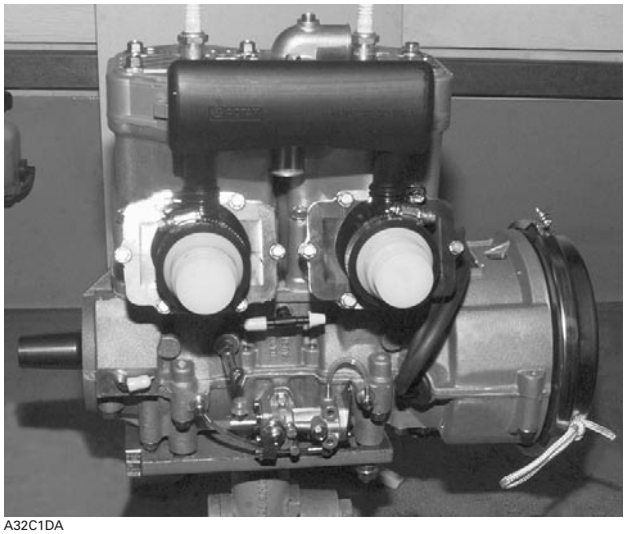
LEAK TEST

The following gives verification procedures for liquid cooled engines though it also applies to fan cooled engines. For FC engines, do not consider information pertaining to coolant system and pump shaft oil gear reservoir.

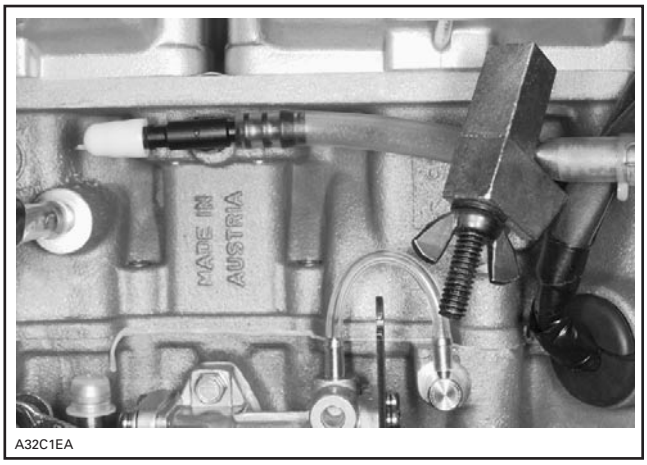
On FC twin-cylinder engines, each cylinder cannot be verified individually due to leakage from one cylinder to the other through labyrinth sleeve in center of crankshaft.

PREPARATION

– Remove tuned pipe.
– Install plug over exhaust manifold.
– Remove carburetors/throttle body assembly (as applicable).
– Insert plugs in intake rubber boots. Tighten with clamps already there.


A32C1DA

– Using a hose pincher (P/N 295 000 076), block impulse hose.
– Using hose pincher (P/N 295 000 076), block pump shaft oil hose and lubrication nipple on PTO side.

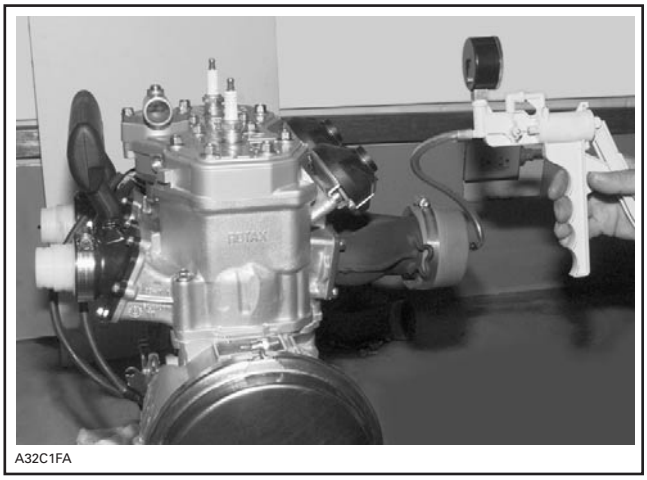


A32C1EA

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

NOTE: If necessary, lubricate vacuum/pressure pump (P/N 529 021 800) piston with mild soap.

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


A32C1FA

– Activate pump and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.
– Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, check tester kit by spraying a soapy solution on pump cylinder, all plugs and fittings.
  • If tester kit is leaking, bubbles will indicate where leak comes from.
  • If tester kit is not leaking, check engine as per following procedure.

PROCEDURE

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

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

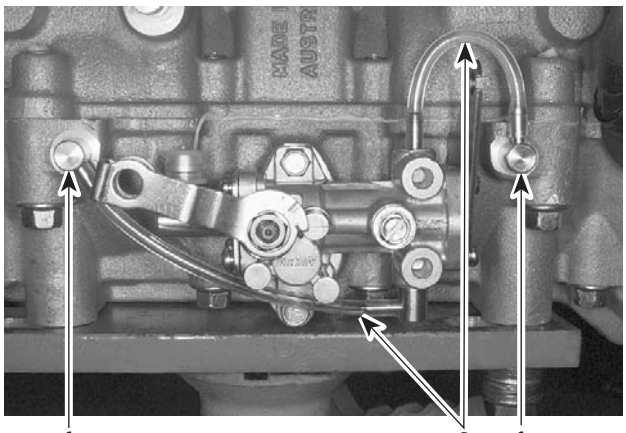
TEST PRESSURE: 34 KPA (5 PSI) FOR 3 MINUTES

– 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.

Engine

Check the following:

– All jointed surfaces and screw/stud threads of engine:
  • spark plug base, insulator
  • cylinder head
  • RAVE valve bellows, piston and housing
  • cylinder
  • crankcase halves (joint)
  • oil injection pump mounting flange (O-ring, seal)
  • coolant pump housing
  • bleed screws/plugs
  • crankcase grease reservoir fitting.
– Small injection oil lines coming from pump.



A32C1GA

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.

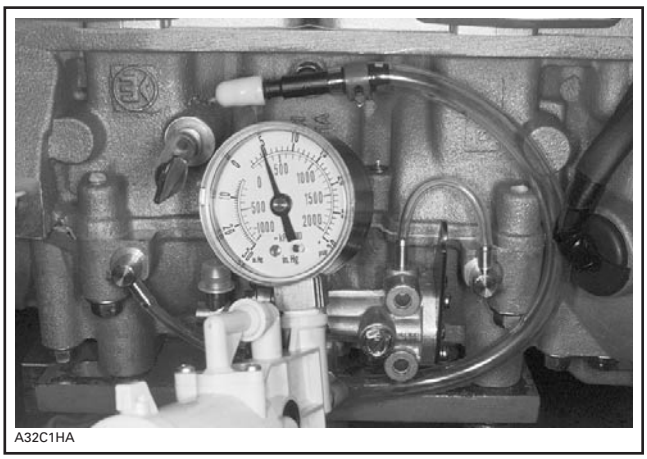
– Remove cooling system cap.

Check for air bubbles in antifreeze. It indicates defective cylinder head O-ring or cylinder base gasket.

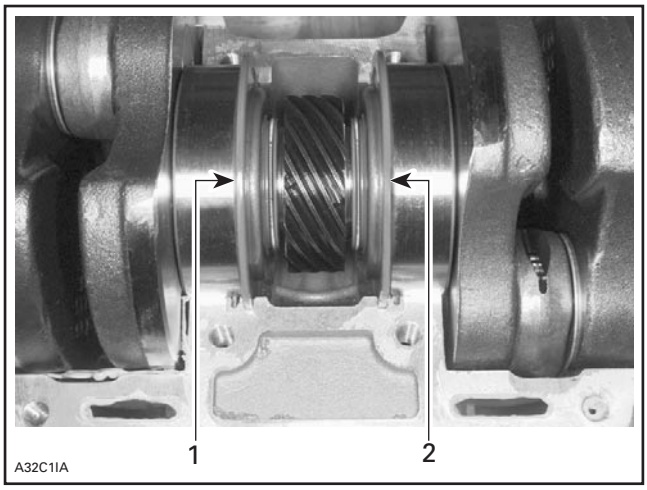
– Remove drive pulley then check crankshaft outer seal.
– Remove rewind starter and magneto system then check crankshaft outer seal.
– Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install vacuum/pressure pump (P/N 529 021 800) on adapter and pressurize as before.


A32C1HA

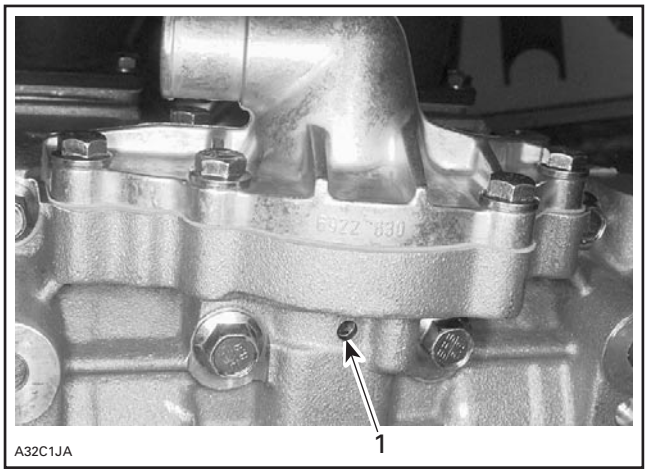
If pressure drops, it indicates a defective crankshaft inner seal.



A32C1IA

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

– Check weep hole below coolant pump housing with soapy water.

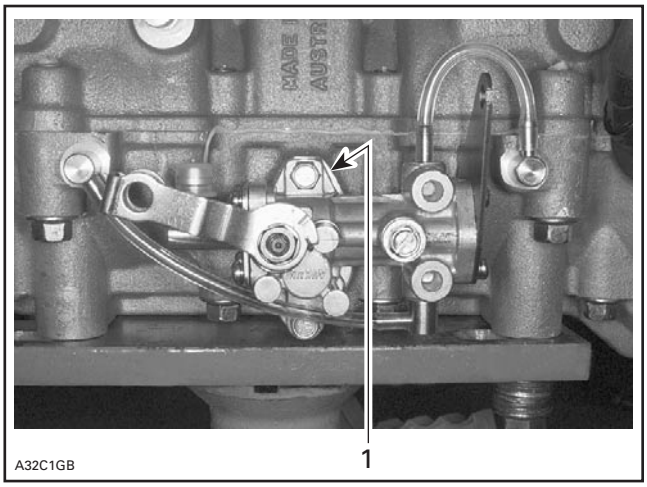


A32C1JA

1. *Weep hole*

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

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



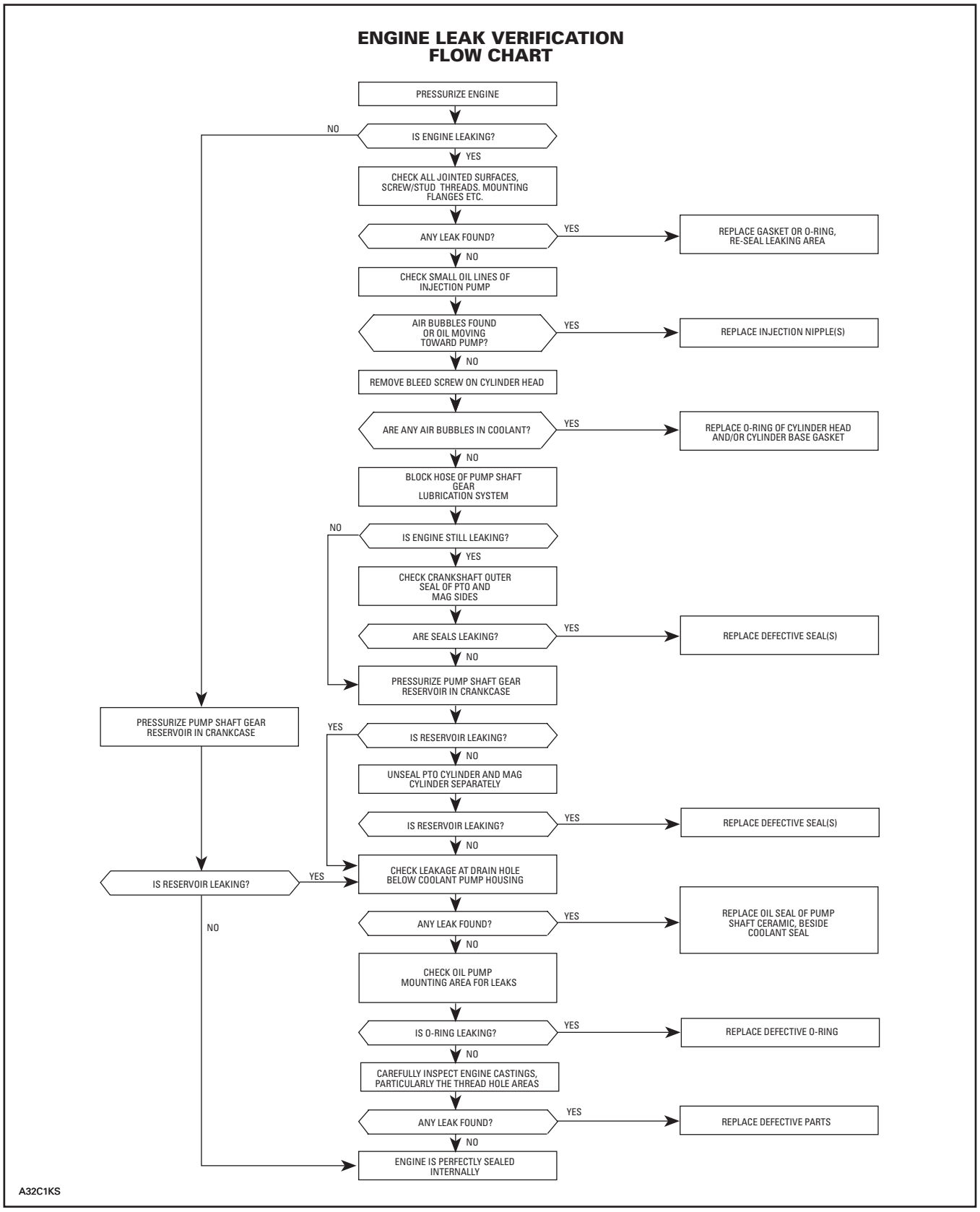
1. Check mounting area

– 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



ENGINE DIMENSION MEASUREMENT

This section covers all engine types.

CYLINDER HEAD WARPAGE

ENGINE TYPE	MAXIMUM
All	0.05 mm (.002 in) per 50 mm (2 in) of surface
	0.5 mm (.020 in) for total length of cylinder head

Check gasketed surface of the cylinder head with a straightedge and a feeler gauge.

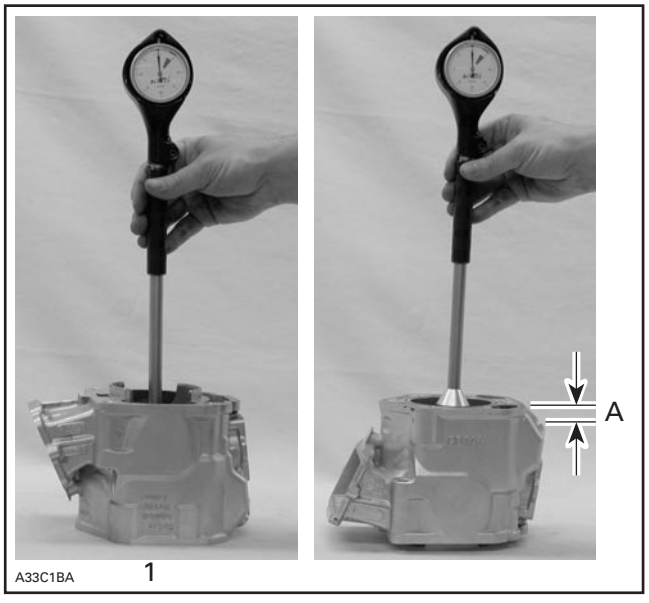
CYLINDER TAPER

ENGINE TYPE	MAXIMUM
All	0.10 mm (.004 in)

Compare cylinder diameter 16 mm (5/8 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.



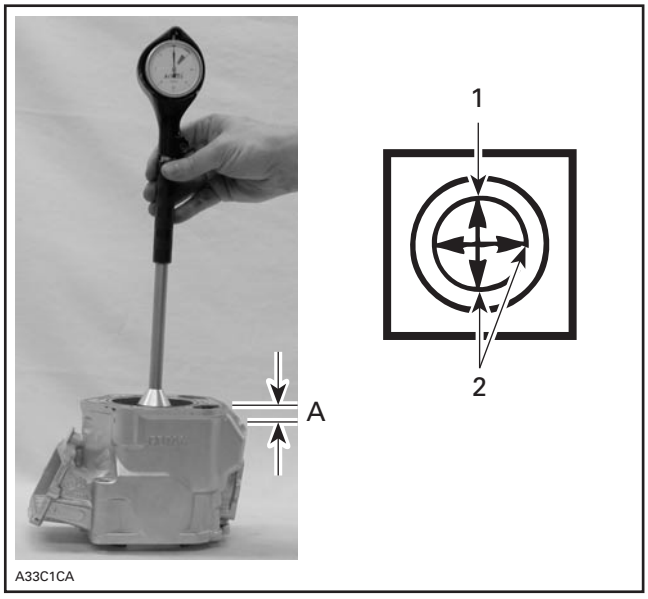
1. Below the intake port
A. 16 mm (5/8 in) from top

CYLINDER OUT OF ROUND

ENGINE TYPE	MAXIMUM
All	0.08 mm (.003 in)

Measuring 16 mm (5/8 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 can not be rebored.

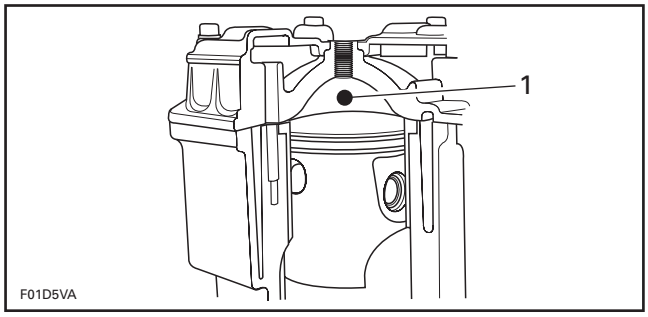
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. 16 mm (5/8 in)

COMBUSTION CHAMBER VOLUME MEASUREMENT

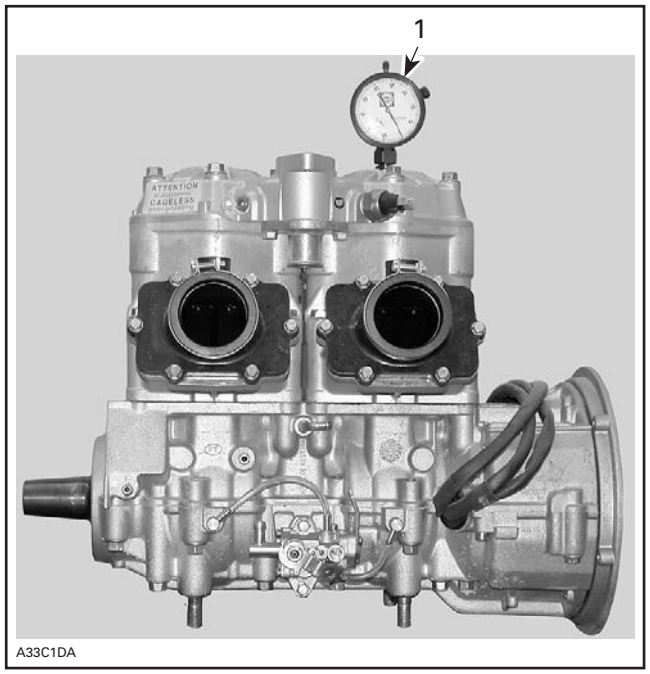
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



1. Combustion chamber

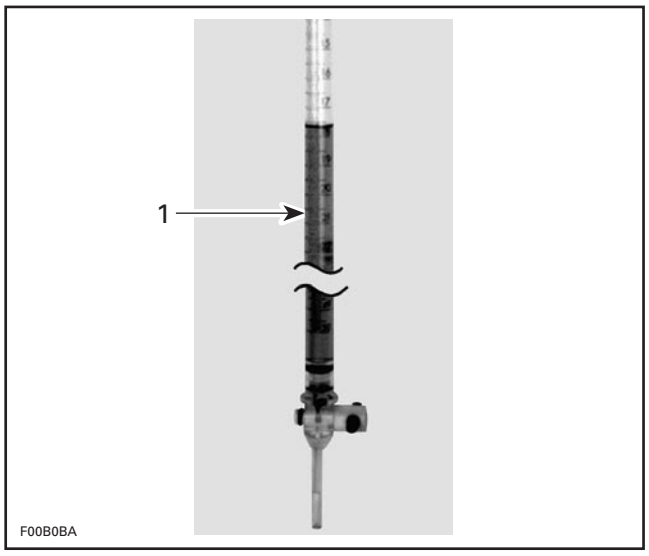
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposit and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using a TDC gauge.



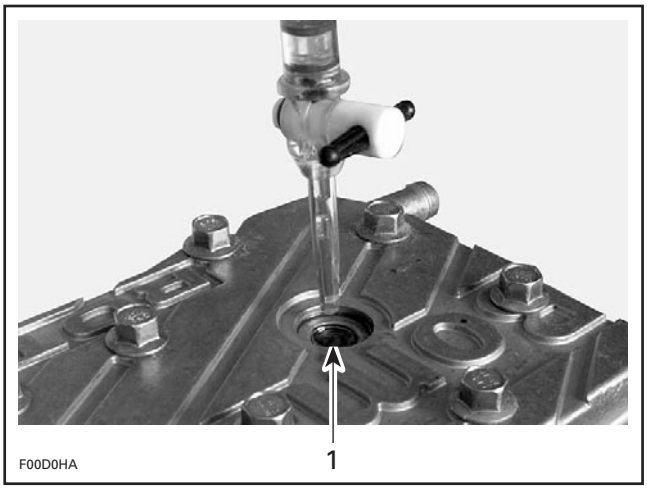
1. Bring piston to TDC

– 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 of the 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.

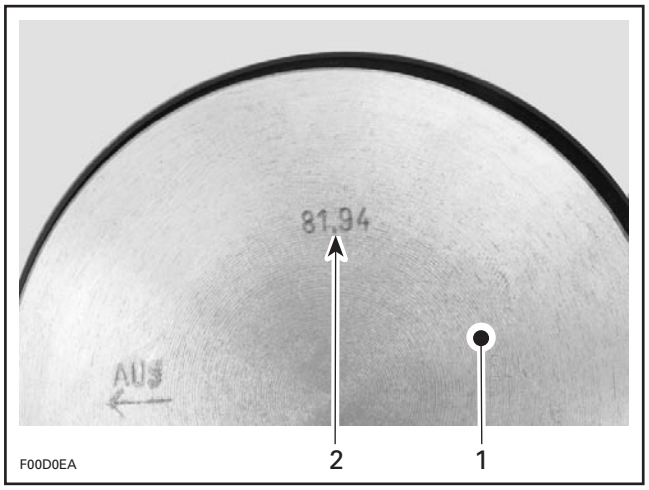
– Repeat the procedure for the other cylinder.

ENGINE TYPE	COMBUSTION CHAMBER VOLUME (cc) (up to top thread of spark plug hole)
443	24.0 ± 1.0
552	34.43 ± 1.2
593	28.97 ± 1.2
593 HO SDI	26.4 ±1.2

Install a thicker or thinner cylinder/crankcase gasket (refer to Parts Catalogs) in order to obtain the specified combustion chamber volume.

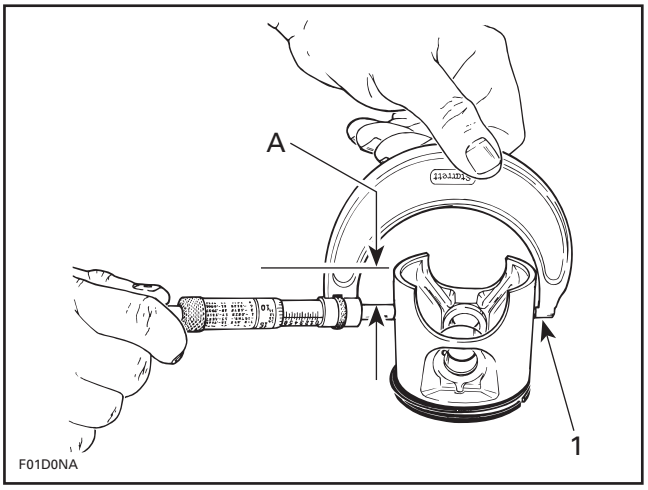
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

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



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

ENGINE TYPE	MAXIMUM PISTON SKIRT WEAR mm (in)
All	0.15 (.006)

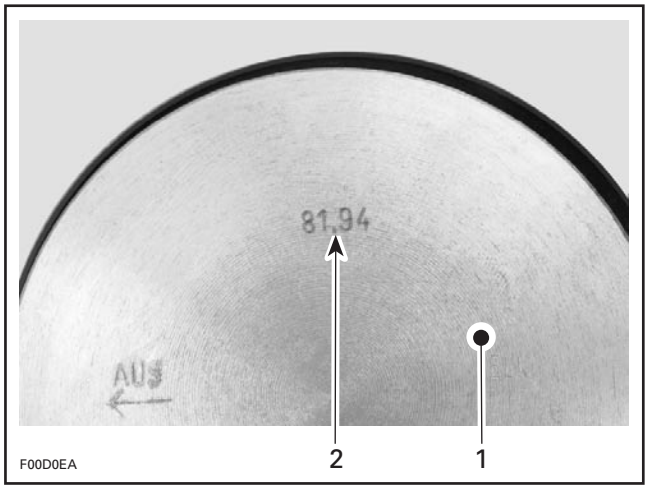
The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

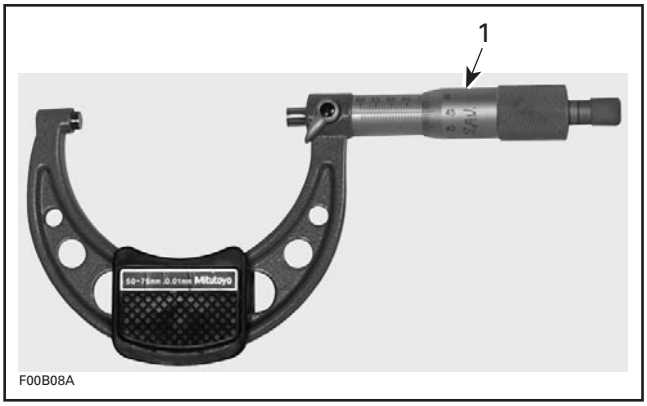
IMPORTANT: Make sure used piston is not worn more than specified. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



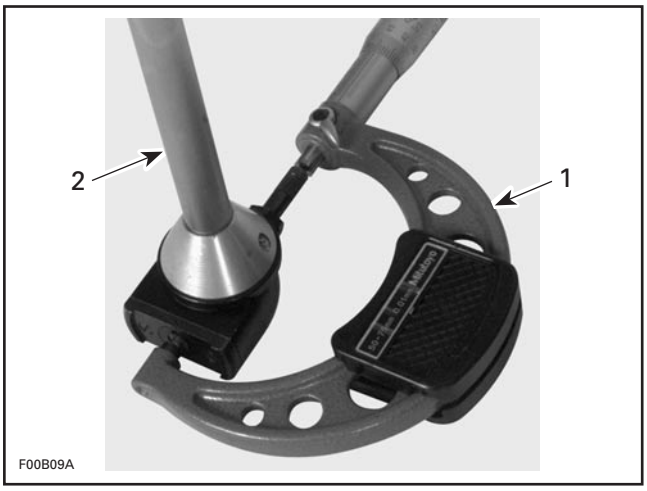
1. Piston dome
2. Piston measurement

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

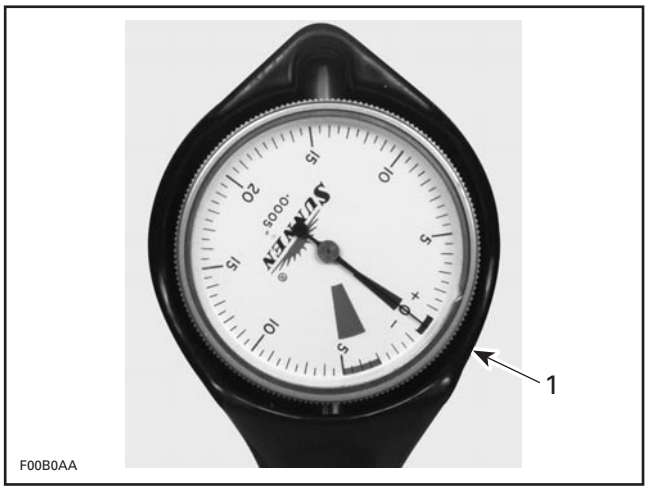


1. Micrometer set to the piston dimension

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



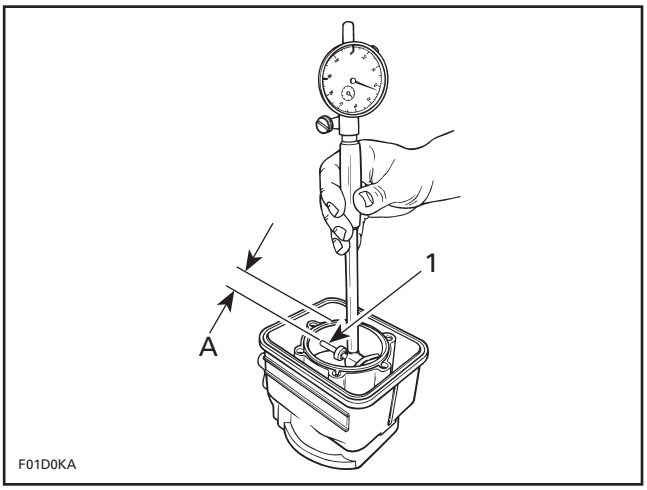
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0 (zero)

IMPORTANT: Always remove cylinders from crankcase before measuring.

Position the dial bore gauge at 16 mm (5/8 in) below cylinder top edge.



1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

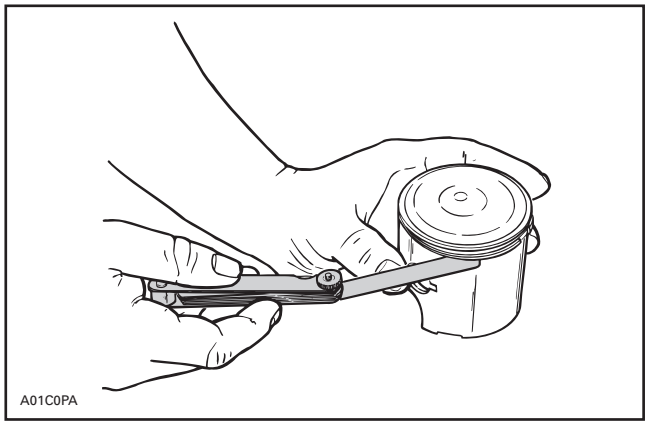
Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder or rebore. Refer to TECHNICAL DATA.

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.

IMPORTANT: The total piston/cylinder clearance (actual cylinder diameter minus actual piston skirt diameter) should be within 0.30 mm (.012 in).

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between upper compression ring and groove. Replace piston if clearance exceeds specified tolerance. Refer to TECHNICAL DATA.

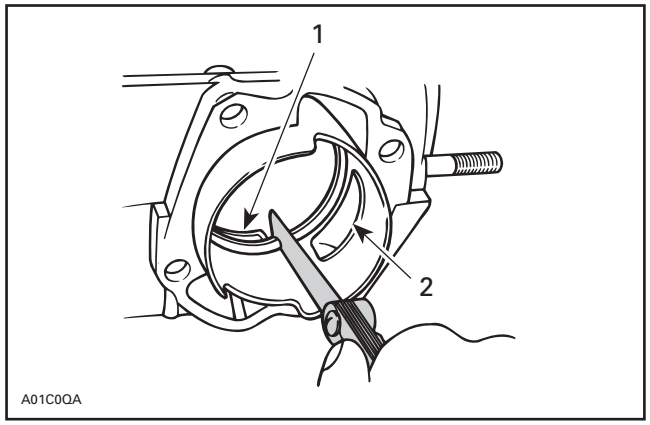


RING END GAP

Position ring halfway between transfer port 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. Refer to TECHNICAL DATA.



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

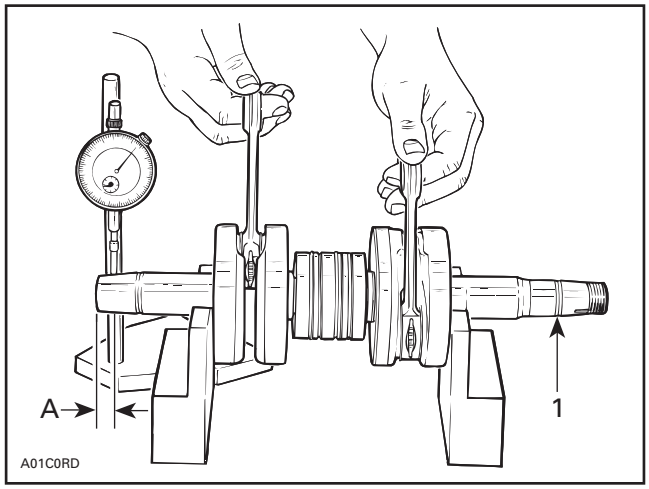
Crankshaft deflection is measured with a dial indicator (P/N 414 104 700).

Measuring (in crankcase)

First, check deflection with crankshaft in engine. 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)

Crankshaft Deflection on PTO Side

ENGINE TYPE	MAXIMUM ON PTO SIDE mm (in)
All	0.06 (.0024)

Crankshaft Deflection on MAG Side

ENGINE TYPE	MAXIMUM ON MAG SIDE mm (in)
277, 443 and 552	0.03 (.0012)
593/593 HO SDI	0.05 (.0020)

Crankshaft Deflection in Center of Crankshaft

ENGINE TYPE	MAXIMUM IN CENTER OF CRANKSHAFT mm (in)
All	0.08 (.0031)

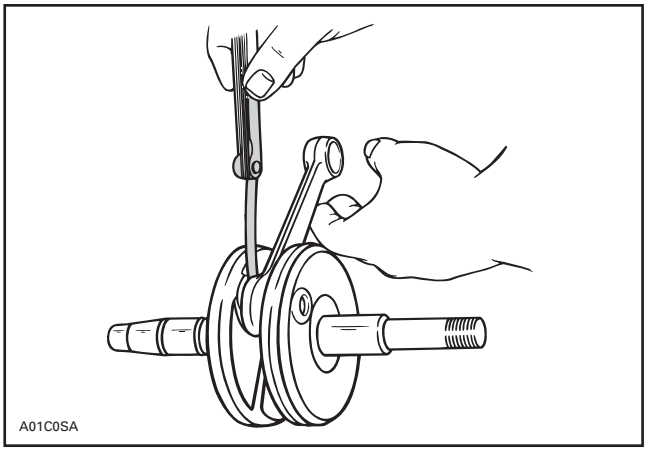
NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

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

CONNECTING ROD BIG END AXIAL PLAY

ENGINE TYPE	NEW PARTS (min. - max.)	WEAR LIMIT
277, 443 and 552	0.20 - 0.53 mm (.008 - .021 in)	1.0 mm (.039 in)
593	0.39 - 0.74 mm (.015 - .029 in)	1.20 mm (.047 in)
593 HO SDI	0.31 - 0.67 mm (.012 - .026 in)	1.20 mm (.047 in)

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



TYPICAL

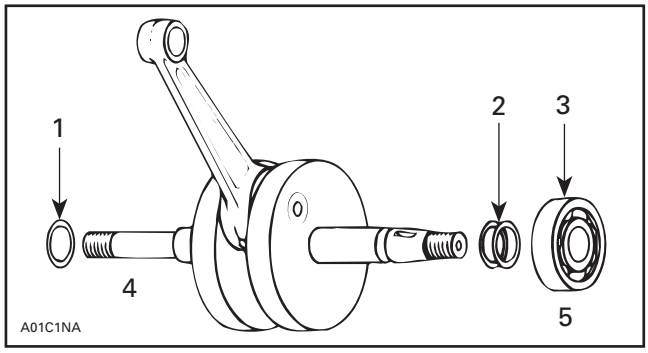
CRANKSHAFT END-PLAY

277 Engine Type

ENGINE TYPE	MINIMUM	MAXIMUM
277	0.10 mm (.004 in)	.030 mm (.012 in)

Adjustment

Crankshaft end-play is adjusted with shims located between crankshaft and magneto side bearing.



1. Distance ring
2. Shim location
3. Bearing
4. PTO
5. MAG

CAUTION: Always install end-play adjustment shims on the magneto side between bearing and crankshaft counterweight.

The following is required for the adjustment procedure:

– adjustment shims (refer to Parts Catalog)

THICKNESSES AVAILABLE
0.10 mm (.004 in)
0.20 mm (.008 in)
0.30 mm (.012 in)
0.50 mm (.020 in)

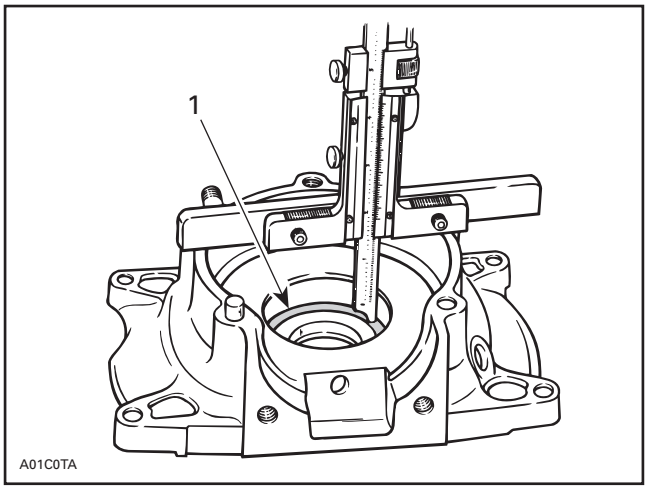
– micrometer

– caliper.

Total shim thickness needed for the end-play adjustment is determined with the following procedure:

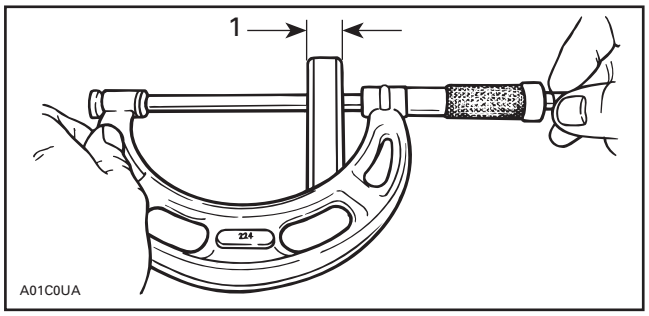
- Measure crankcase halves as illustrated (M_1 and M_2).

A standard compressed crankcase gasket will have a 0.30 mm (.012 in) thickness (M_3). **Add these measurements to obtain dimension A.**



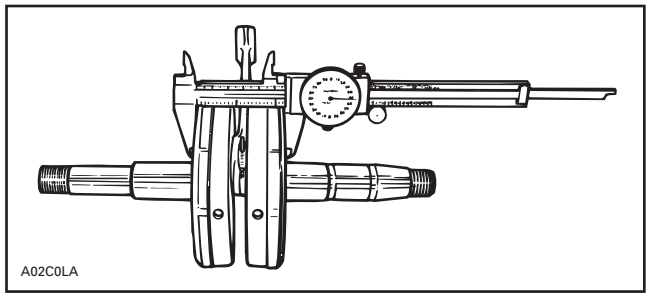
MEASURING M_1 AND M_2
1. Bearing seat

- Measure the thickness of each bearing (M_4 and M_5).



MEASURING M_4 AND M_5
1. Bearing thickness

- Measure distance between bearing shoulders on crankshaft (M_6).



MEASURING M_6

- Measure the distance ring (M_7) and adjustment shims thickness (M_8). **Add these measurements to obtain dimension B.**
- **From dimension A, subtract dimension B.**

The result is the actual crankshaft end-play that must be within specification.

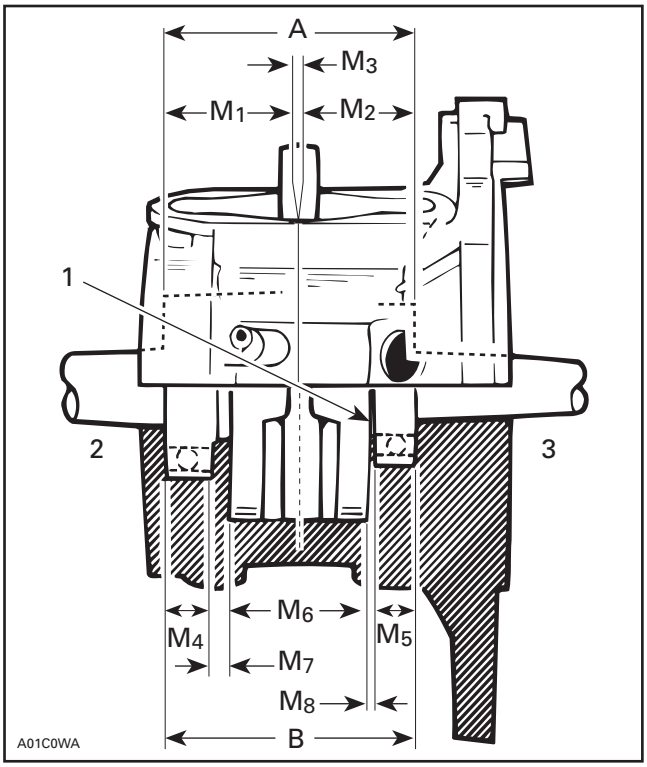
If the result is over specification, add adjustment shim(s) to reach this specification.

If the result is under specification, remove adjustment shim(s) to reach this specification.

To Summarize

A	=	$M_1 + M_2 + M_3$
B	=	$M_4 + M_5 + M_6 + M_7 + M_8$
A - B	=	Actual end-play that must be within specification.

M_8 is the dimension that must be adjusted to obtain the specified crankshaft end-play.



1. End-play is adjusted with shims
2. PTO
3. MAG

443, 552 and 593 Engine Types

End-play is not adjustable but it should be between 0.10 - 0.30 mm (.004 - .012 in).

CHECKING SURFACE FLATNESS

Intake manifold, intake manifold cover can be checked for perfectly mating surfaces.

Lay part on a surface plate (marble, mirror or thick glass plate).

Holding down one end of part, try pushing down the other end.

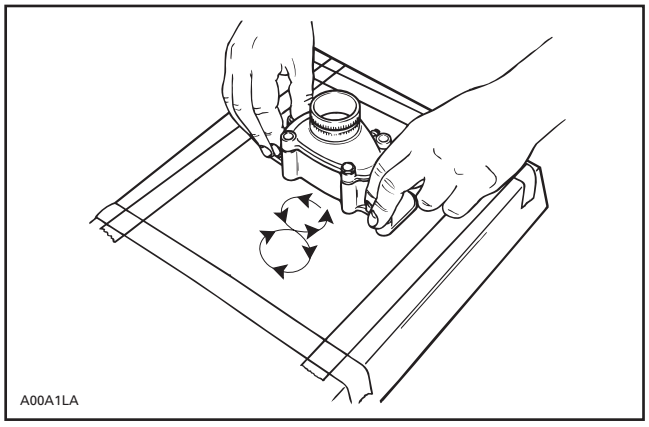
If any play is felt, part must be rectified.

RECTIFYING SURFACES

Stick a fine sand paper sheet on the surface plate then lightly oil the sand paper.

Rub part mating surface on sand paper using 8-figure movements.

Sand until mating surface is perfectly straight.



CHECKING CRANKSHAFT ALIGNMENT

Install a degree wheel (P/N 414 352 900) on crankshaft end.

Remove both spark plugs.

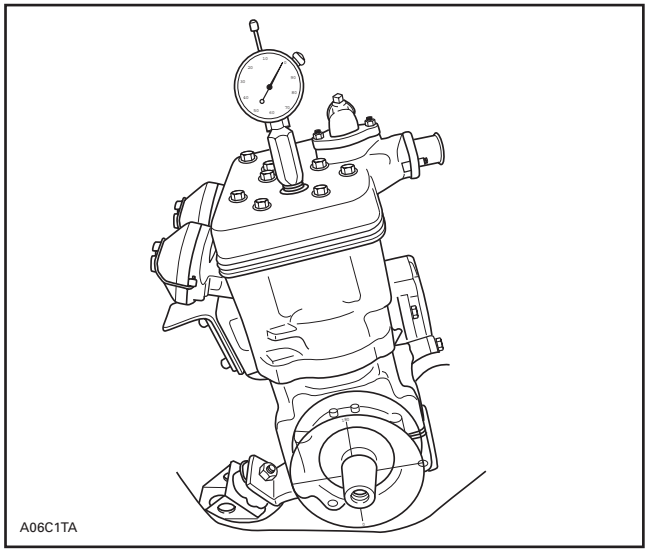
Install a dial indicator (P/N 414 104 700) in spark plug hole on MAG side.

Bring MAG piston at top dead center.

Rotate degree wheel (P/N 414 352 900) (not crankshaft) so that 360° mark aligns with center of crankcase. Scribe a mark on crankcase.

Remove dial indicator (P/N 414 104 700) and install it on PTO side cylinder.

Bring PTO piston to top dead center. degree wheel (P/N 414 352 900) must rotate with crankshaft.



TYPICAL

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

MAGNETO SYSTEM

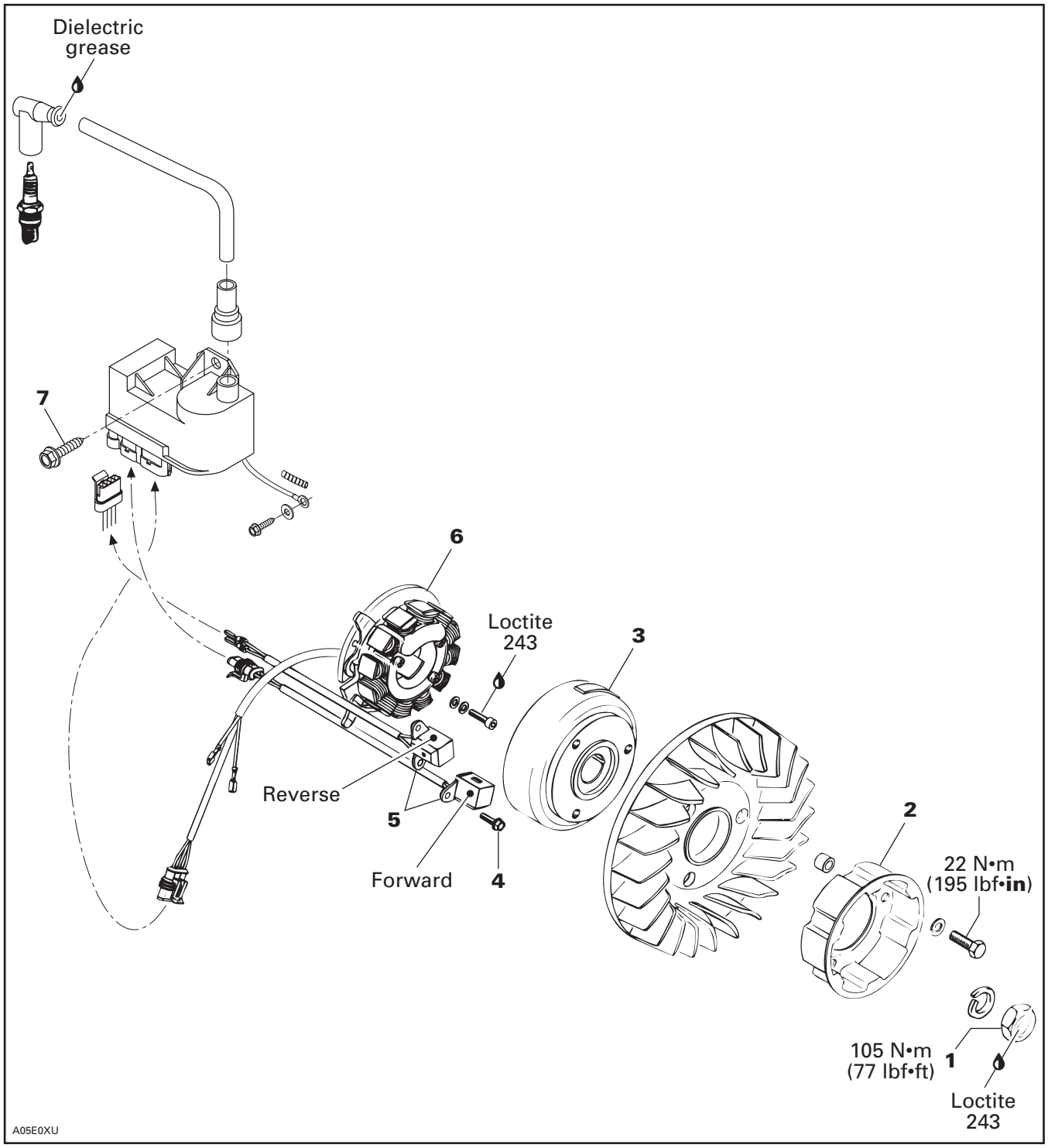
SERVICE TOOLS

Description	Part Number	Page
clutch holder	529 027 600	128
crankshaft protector	420 876 557	129
magneto puller	529 035 547	129
magneto puller ring	420 876 080	128

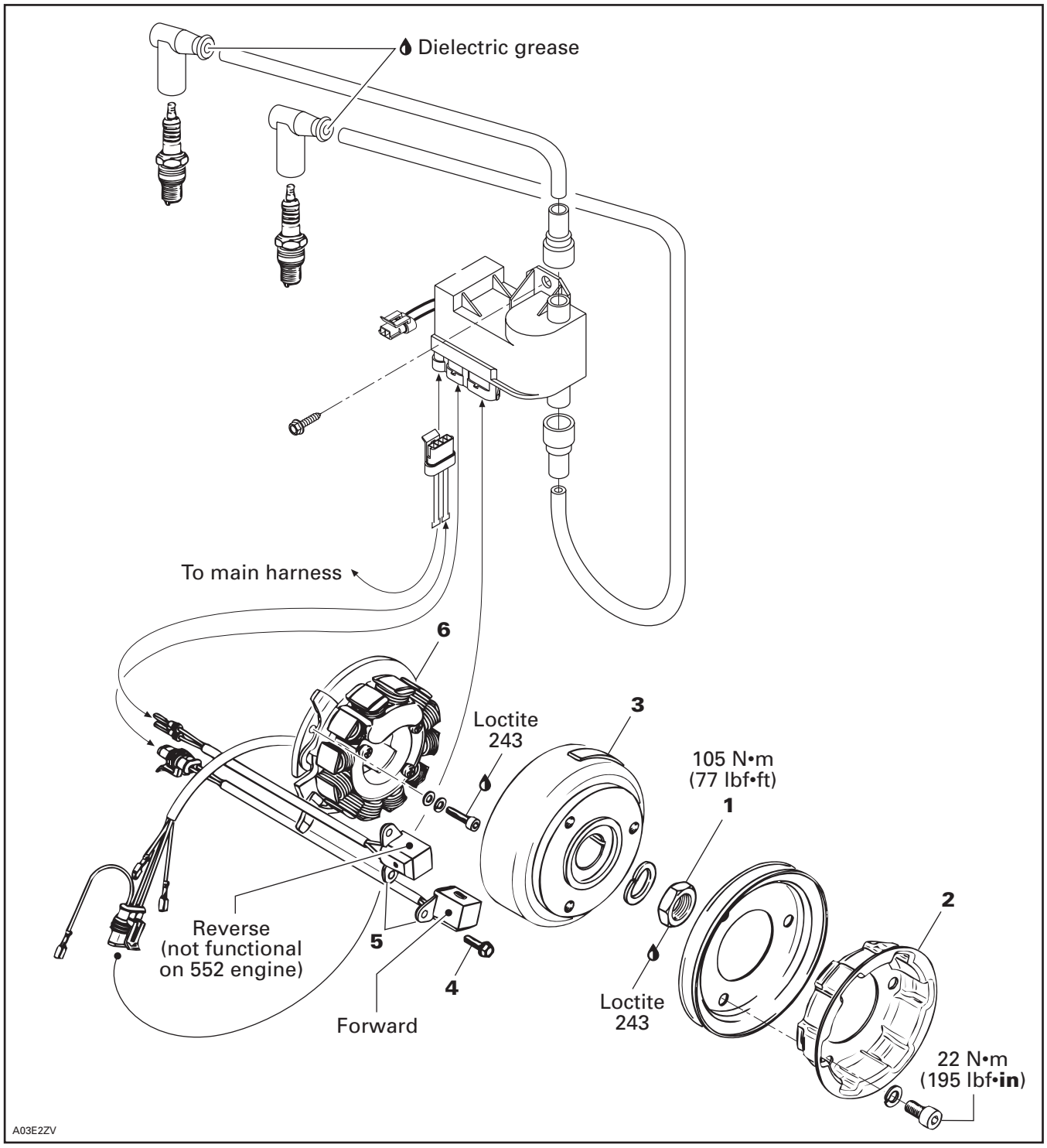
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	129–130
silicone dielectric grease	293 550 004	130

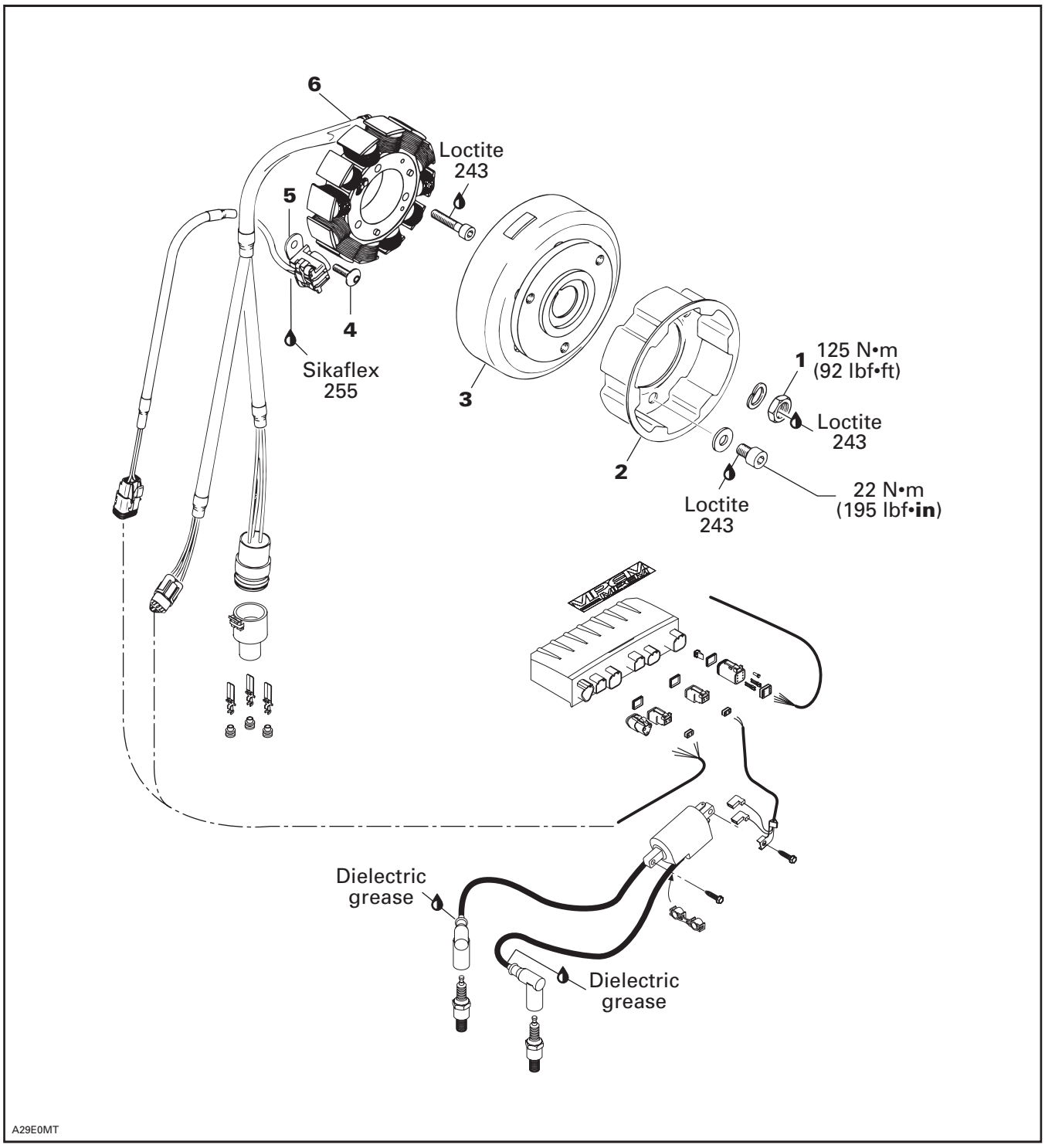
277 Engine


Dielectric grease
7
6
Loctite 243
3
Reverse
5
Forward
4
2
22 N•m (195 lbf•in)
105 N•m (77 lbf•ft)
1
Loctite 243
A05E0XU

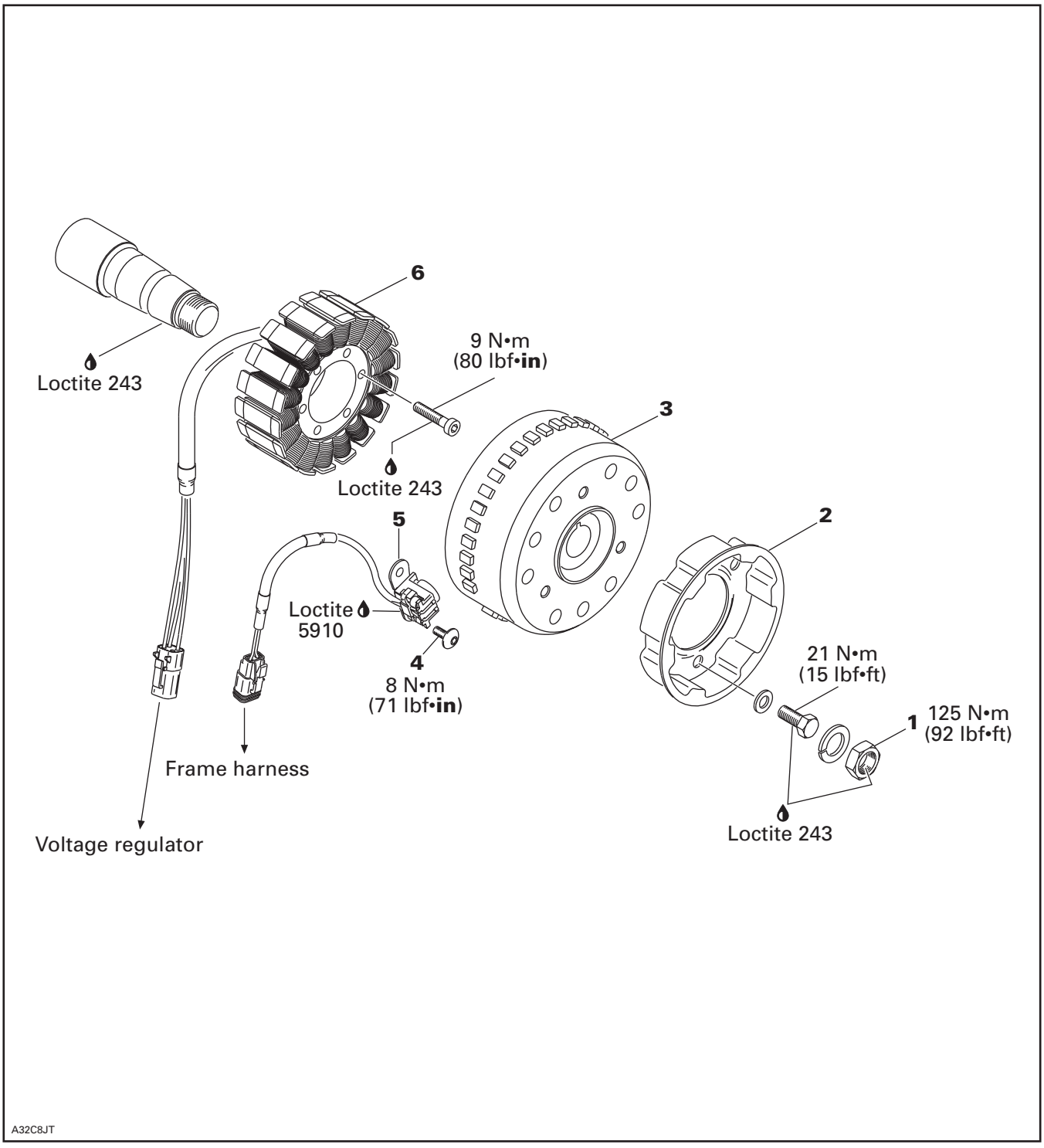
443 and 552 Engines



593 Engine


6
Loctite
243
5
4
Sikaflex
255
3
2
1
125 N•m
(92 lbf•ft)
Loctite
243
Loctite
243
22 N•m
(195 lbf•in)
Dielectric
grease
Dielectric
grease
A29E0MT

593 SDI Engine



GENERAL

NOTE: The following procedures can be done without removing the engine from chassis. To facilitate magneto removal, hold drive pulley with clutch holder (P/N 529 027 600).

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.

CLEANING

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

CAUTION: Clean stator and magneto using only a clean cloth.

DISASSEMBLY

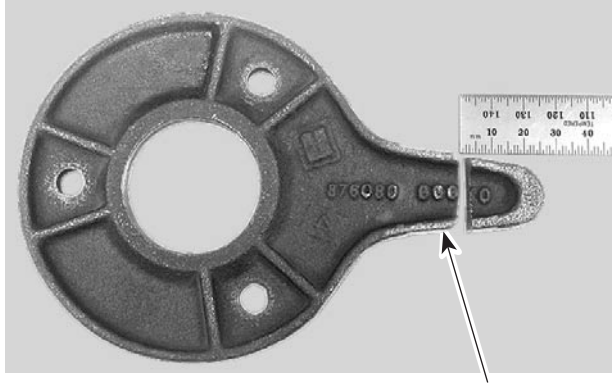
Magneto Flywheel

To gain access to magneto flywheel no. 3 assembly, remove the following parts as needed on different engines:

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

To remove magneto flywheel nut no. 1:

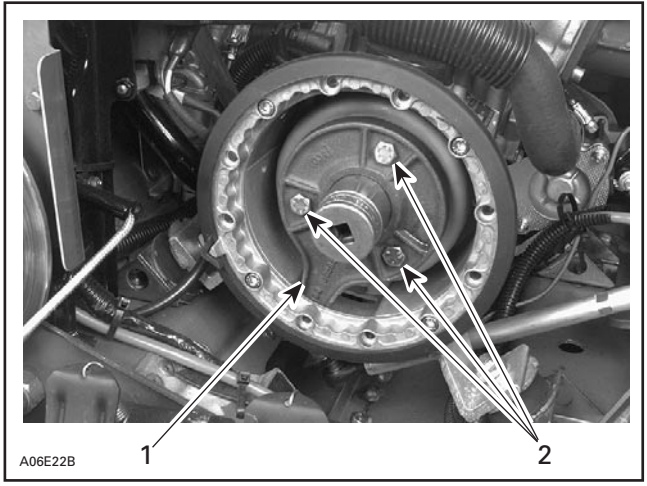
– Use magneto puller ring (P/N 420 876 080). Former puller has to be modified as shown.



1. Cut by 25 mm (1 in)

– Install magneto puller ring (P/N 420 876 080) with its tab in magneto housing opening.

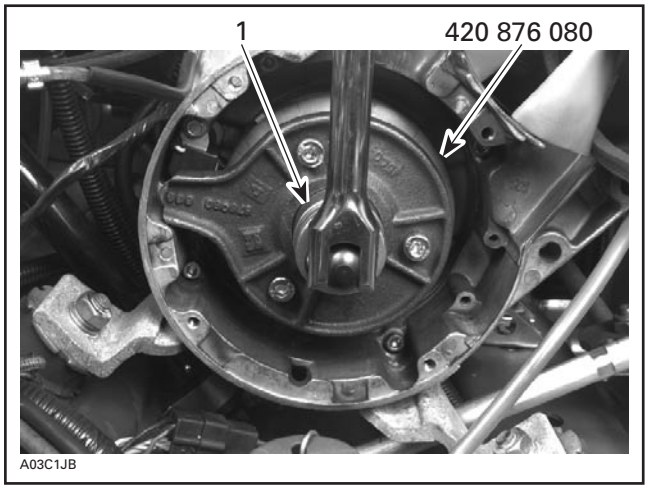
CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto.



TYPICAL
1. Tab in magneto housing opening
2. M8 x 20 mm screws

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

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



TYPICAL
1. 30 mm socket

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

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

Stator

NOTE: Always check stator **no. 6** before changing it, refer to TESTING PROCEDURE.

Remove:

– magneto flywheel **no. 3**
– all Allen socket screws retaining stator to magneto housing
– grommet from crankcase where trigger coil and stator wires exit magneto housing.

Unplug the trigger coil connectors and pull the wires through the grommet location.

NOTE: To pass the stator connector into the grommet location it is necessary to pass the trigger coil connector first.

Unplug the stator connector and remove the stator.

Trigger Coil

Magneto and stator **no. 6** must be removed before trigger coil removal.

To replace trigger coil **no. 5**:

– Disconnect trigger coil connector housing.
– Remove grommet from crankcase where trigger coil wire exits magneto housing.
– Remove retaining screws **no. 4**.
– Remove trigger coil and carefully pull wires.
– Install new trigger coil and other parts removed.

ASSEMBLY

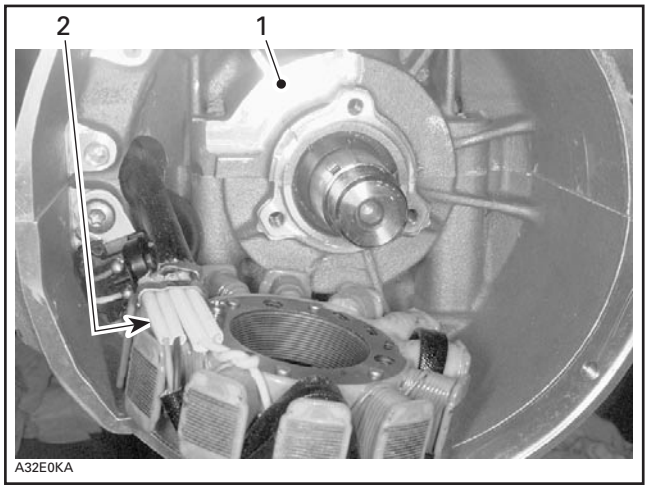
Trigger Coil

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicon at trigger coil location then apply new silicon. Screw trigger coil then stick the trigger coil wires in the silicon.

Stator

Make sure to position stator **no. 6** in a way that its wire protectors are over recess of crankcase.



1. Crankcase recess
2. Wire protectors

Apply Loctite 243 (P/N 293 800 060) on threads of stator screws then torque them to 9 N•m (80 lbf•**in**).

Reinstall all other removed parts.

Magneto Flywheel

Clean crankshaft extension (taper) and apply Loctite 243 (blue) on taper, then position Woodruff key, magneto flywheel **no. 3** and lock washer on crankshaft.

Clean nut threads and apply Loctite 243 (P/N 293 800 060) then tighten nut to 105 N•m (77 lbf•ft) for fan-cooled engines and to 125 N•m (92 lbf•ft) for liquid-cooled engines.

At reassembly coat all electric connections except Deutsch housings (waterproof gray 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 (P/N 293 550 004) on any Deutsch (gray) housing otherwise housing seal will be damaged.

Ignition Timing

Check as described in IGNITION TIMING.

OIL INJECTION SYSTEM

SERVICE TOOLS

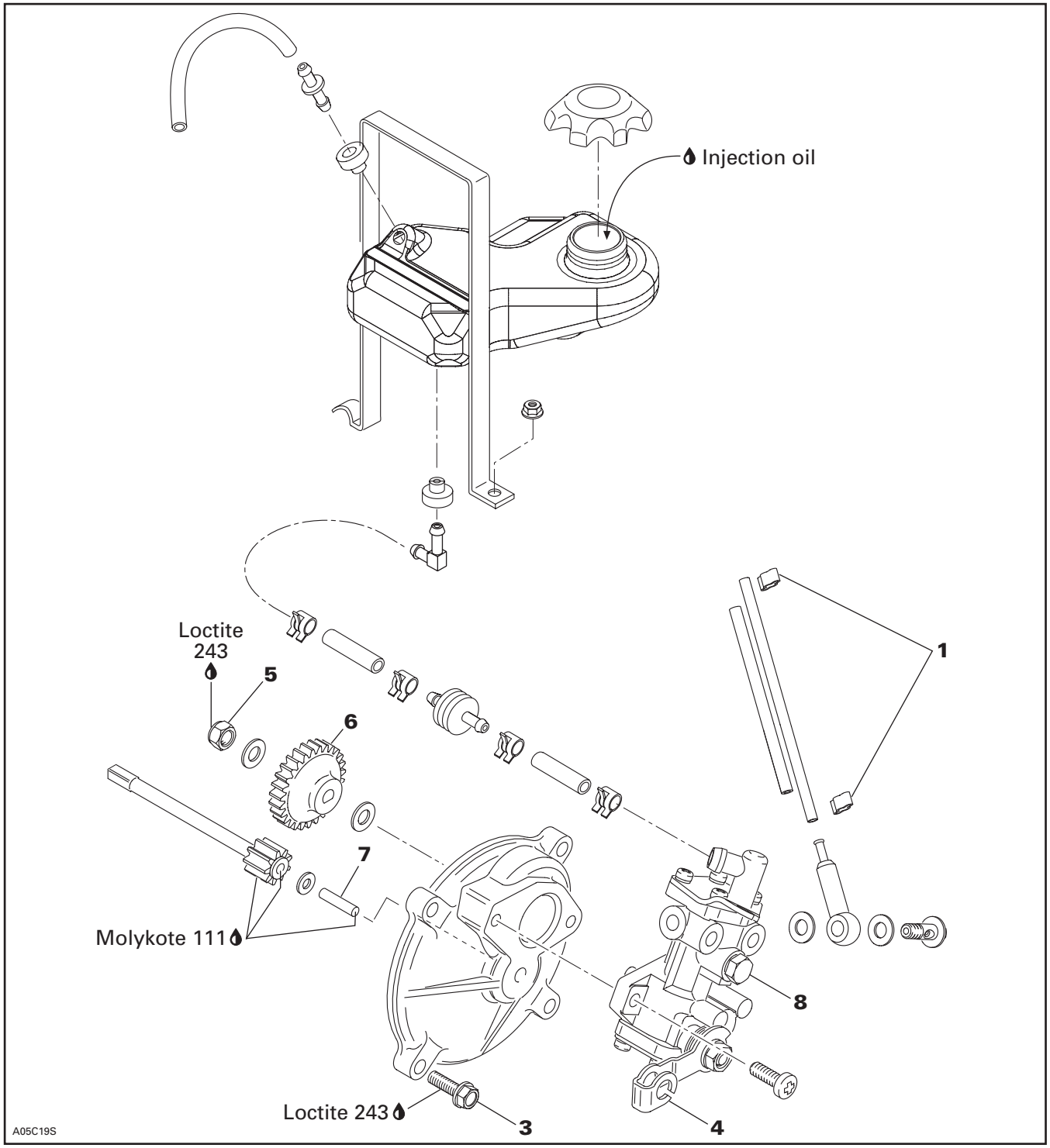
Description	Part Number	Page
gear holder	420 876 695	137
hose pinchers	295 000 076	136
leak testing kit	529 033 100	136

SERVICE PRODUCTS

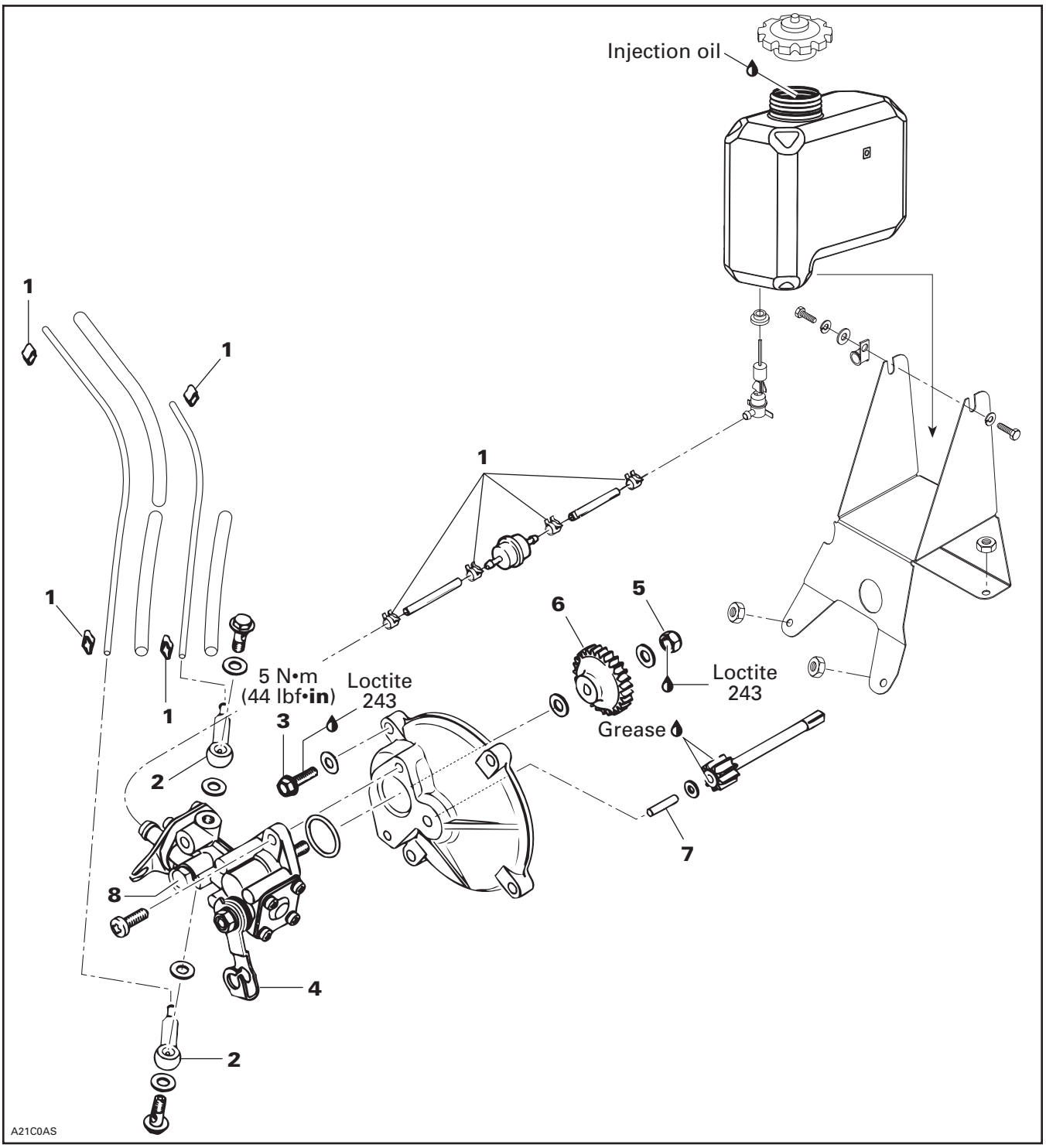
Description	Part Number	Page
Loctite 648 (green)	413 711 400	138
Molykote 111	413 707 000	137
pulley flange cleaner	413 711 809	138

OIL INJECTION PUMP

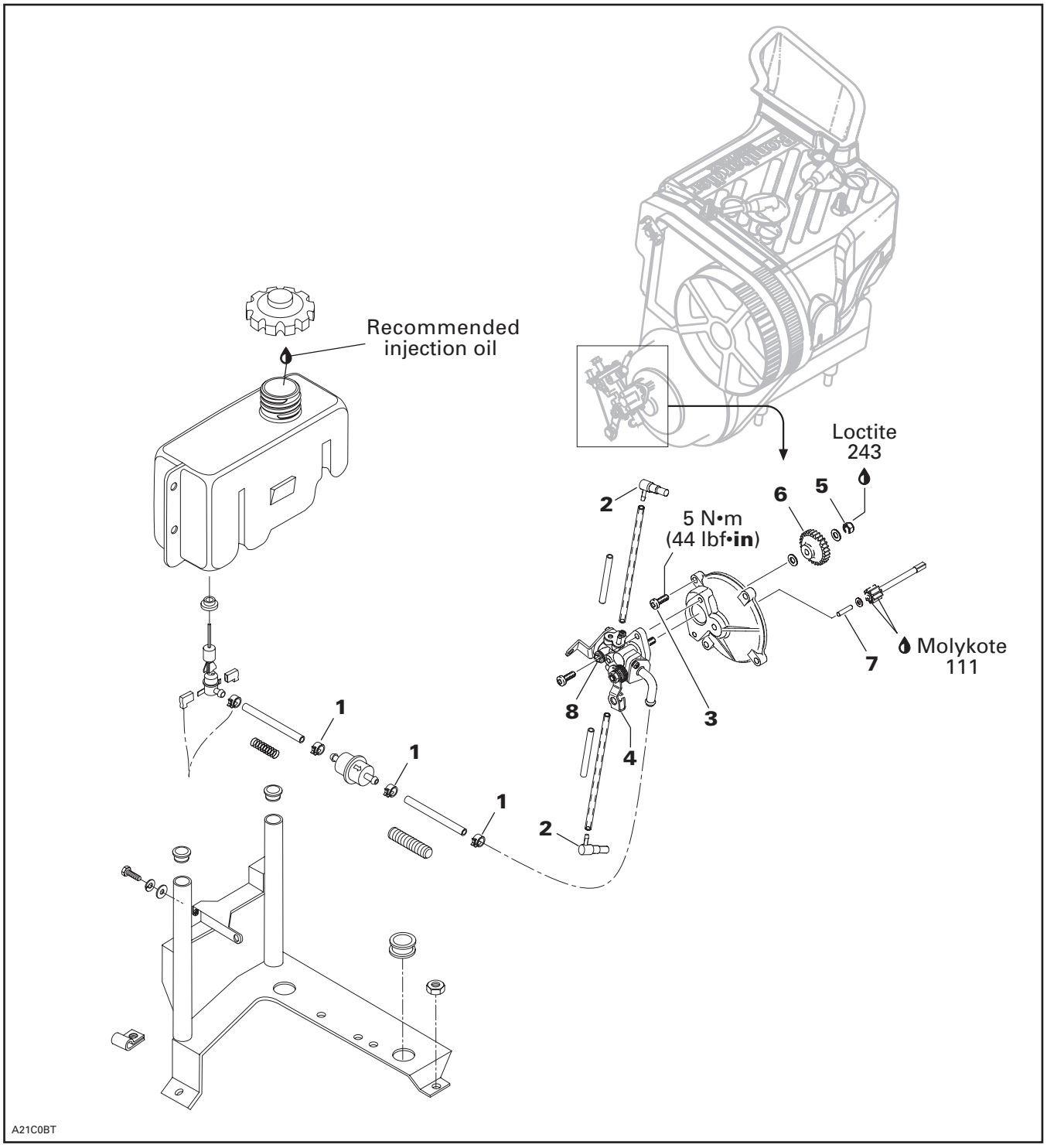
277 Engine



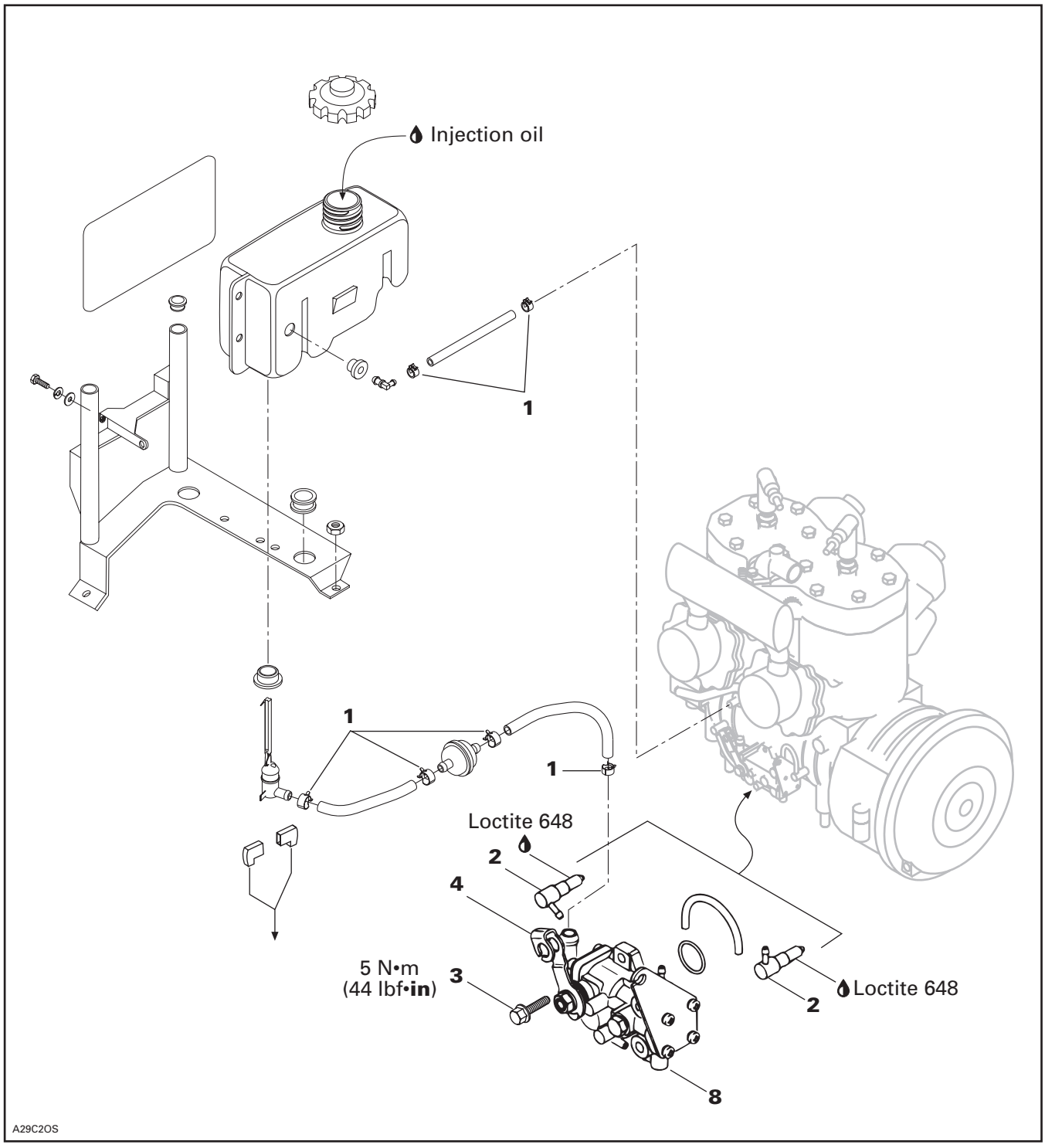
443 Engine


Injection oil
1
1
1
1
1
5 N•m
(44 lbf•in)
Loctite
243
3
2
6
5
Loctite
243
Grease
7
8
4
2
A21C0AS

552 Engine


Recommended injection oil
Loctite 243
5 N•m (44 lbf•in)
Molykote 111
1
2
3
4
5
6
7
8
A21C0BT

593 and 593 HO SDI Engines



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.

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

OIL TYPE

ENGINE	OIL TYPE
593 HO SDI(1)	XP-S™ synthetic 2-stroke oil or XP-S™ 2-stroke synthetic blend
All others 2-stroke engines	XP-S™ synthetic 2-stroke oil or XP-S™ 2-stroke synthetic blend or XP-S™ mineral injection oil (2) (3)

(1) **CAUTION: XP-S™ synthetic 2-stroke oil and XP-S™ 2-stroke synthetic blend 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 and XP-S™ 2-stroke synthetic blend. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

(2) If XP-S™ mineral injection oil is not available, API TC high-quality low ash two-stroke injection oil may be used.

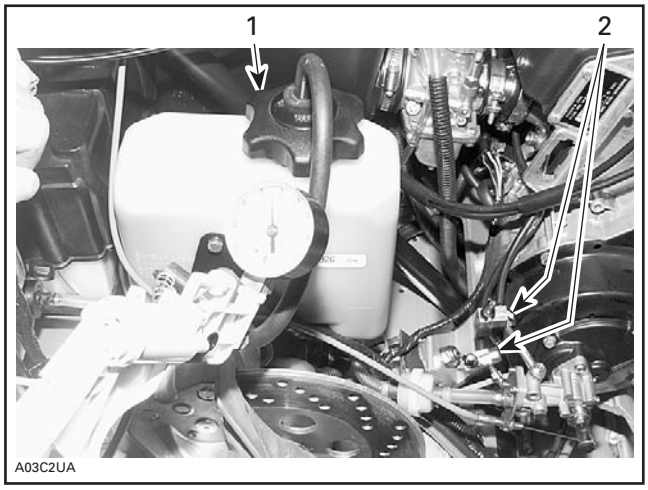
(3) XP-S™ synthetic 2-stroke, XP-S™ 2-stroke synthetic blend and XP-S™ mineral injection oil are compatible, they can be mixed together.

OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil reservoir to the banjo fitting(s).

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

Install hose pinchers (P/N 295 000 076) on outlet hoses.



TYPICAL
1. Special cap on reservoir
2. Hose pinchers on outlet hoses

Connect leak testing kit pump to special cap.

Pressurize oil system to 21 kPa (3 PSI). Pressure must not drop during 3 minutes.

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

OIL PUMP IDENTIFICATION

4, Pump Lever

Different engines need different pumps. See identification on lever no. 4.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
277	132K
443	E8
552	03
593	L7
593 HO SDI	02

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

CLEANING

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

DISASSEMBLY

NOTE: Some oil pump components are not available as single parts.

8, Injection Oil Pump

NOTE: Before removing the injection oil pump no. 8, check its operation. Refer to the end of this section.

443 and 552 Engines

Remove:
– air box
– carburetor
– pump mounting flange screws no. 3

Unplug all hoses connected to oil pump no. 8.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

593, 593 HO SDI Engines

Remove:
– air box
– carburetor or throttle body
– screw no. 3.

Unplug all hoses connected to oil pump no. 8.

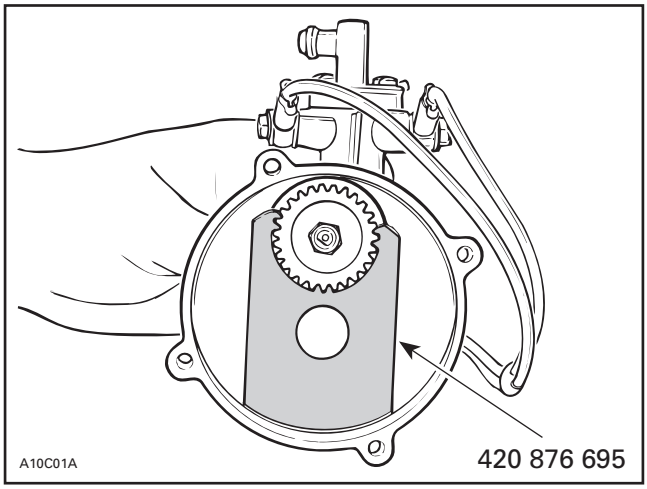
NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

5,6, Gear Retaining Nut and Oil Pump Gear

277, 443 and 552 Engines

To remove gear retaining nut, first extract the needle roller with pliers then lock gear in place using gear holder (P/N 420 876 695).



ASSEMBLY

1, Spring Clip

Always check for spring clips tightness.

6, Oil Pump Gear

At gear assembly, apply a light coat of Molykote 111 (P/N 413 707 000) on gear teeth.

8, Injection Oil Pump

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

Torque the screws no. 3 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.

7, Needle Roller (fan cooled engine only)

The needle roller must be engaged as deep as possible in the pump mounting flange.

3, Screw

Torque to 5 N•m (44 lbf•**in**).

Cable plastic elbow must be fastened and fully inserted.

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

Secure barrel with plastic washer and circlip.

Install cable lock washer on lever side.

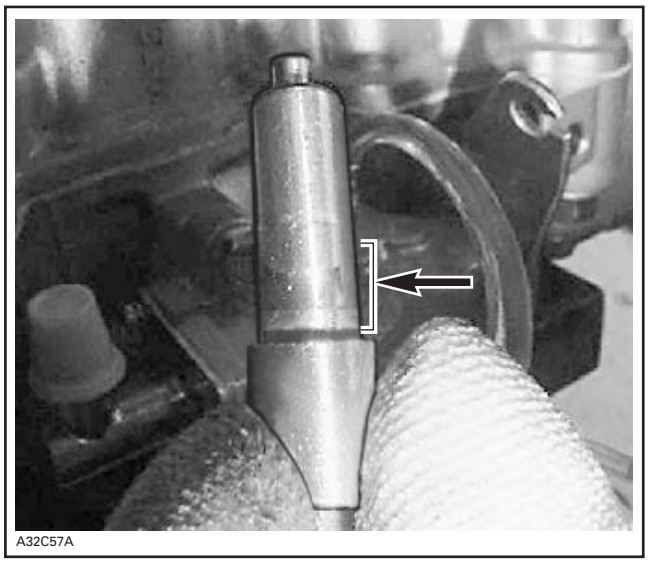
Verify cable and oil pump lever operation.

2, Check Valve

593 and 593 HO SDI Engines

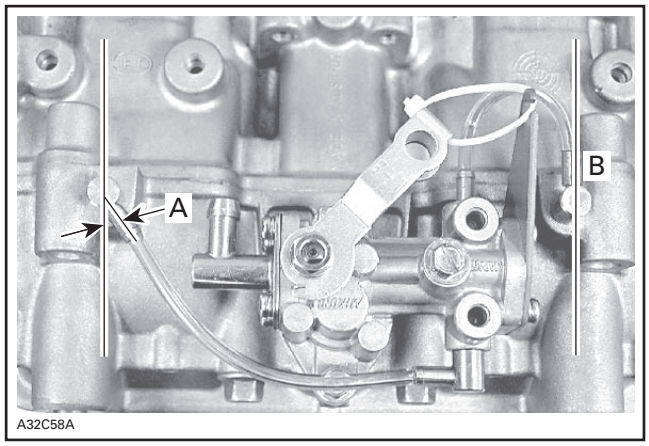
Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the check valve (machined section). Take care that Loctite is ONLY in this area.

NOTE: Prior to coating it 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).

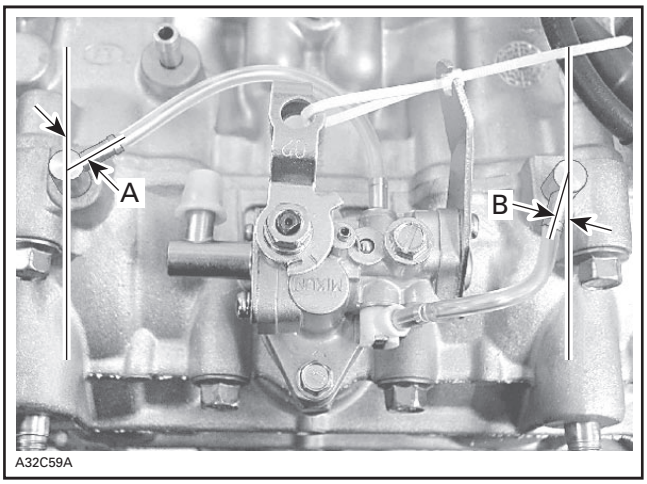


APPLY LOCTITE ON THIS AREA ONLY

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



POSITION FOR 593 ENGINE
A. PTO side: 30° ± 10° from cylinder axis to the bottom
B. MAG side: 0° from cylinder axis to the top



TYPICAL — POSITION FOR 593 HO SDI ENGINE
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.

ADJUSTMENT

Prior to adjusting the pump, make sure all carburetor adjustments are completed and engine is stopped.

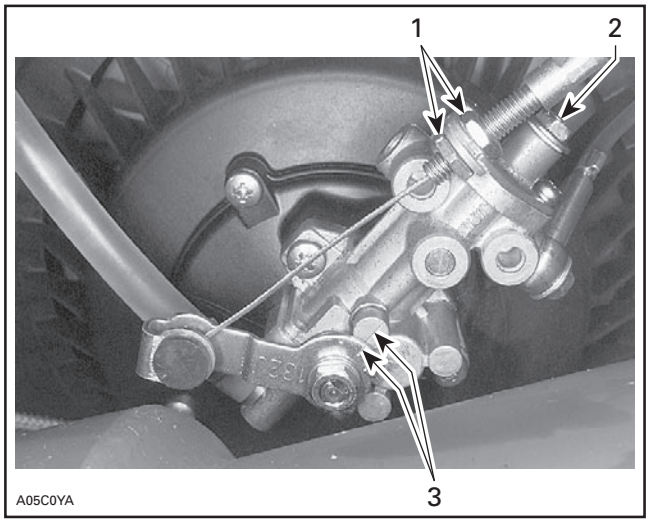
277, 443 and 552 Engines

Eliminate the throttle cable free-play by pressing the throttle lever until a light resistance is felt, then hold in place.

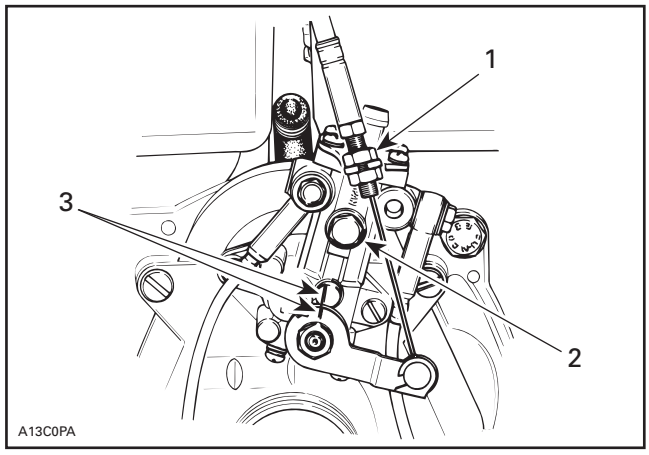
The mark on the pump casting and on the lever must align. Width of lever mark is the tolerance.

Loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.



TYPICAL — TUNDRA R
1. *Adjuster nuts*
2. *Bleeder screw*
3. *Marks*



TYPICAL — SKANDIC LT/WT/SWT/SUV 550
1. *Adjuster nut*
2. *Bleeder screw*
3. *Marks*

CAUTION: Proper oil injection pump adjustment is very important. Any delay in the opening of the pump can result in serious engine damage.

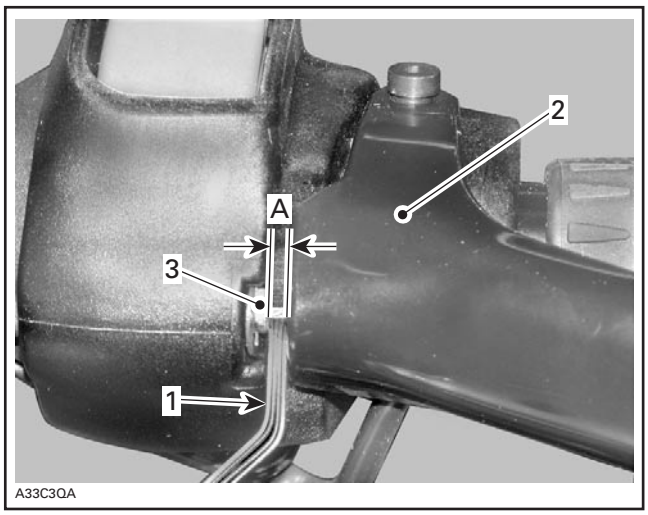
593 and 593 HO SDI Engines

Before proceeding with the oil pump cable adjustment, verify throttle cable adjustment and adjust if needed. Refer to FUEL SYSTEM or COMPONENT INSPECTION AND ADJUSTMENT, noting that the throttle cable free play should be adjusted just prior to the oil pump cable.

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

NOTE: Throttle cable visible distance "A" is measured between the throttle lever and the cable housing end, using a feeler gauge.

Measure the visible distance "A" using the appropriate feeler gauge and note measurement.



TYPICAL
1. *Feeler gauge*
2. *Throttle lever*
3. *Cable housing end*

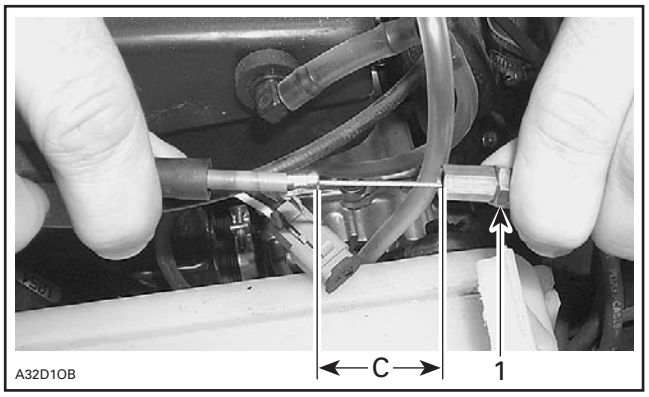
A. Measurement "A"

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

OIL PUMP ADJUSTMENT	
Engine Type	Specification "B"
593	16.5 mm (0.650 in)
593 HO SDI	18 mm (0.709 in)

The correct specification for measurement "C" is the sum of "A" plus the specification "B" found in the chart.

Stretch oil pump adjustment cable with a 32 N (7.2 lbf) force and measure the length of its visible distance "C".



TYPICAL
1. Lock nut
C. Oil pump adjustment (sum of "A" plus the specification "B")

If the visible distance 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.

EXAMPLE: — The 593 HO SDI has a throttle lever measurement "A" of 1.5 mm (0.059 in); by adding the appropriate specification "B" found in the chart (18 mm (0.709 in), you would determine that the correct measurement "C" at the cable would be 19.5 mm (0.768 in) as per equation A + B = C.

BLEEDING OIL LINES

Bleed main oil line (between tank and pump) by loosening the bleeder screw **no. 8** until air has escaped from the line. Add injection oil as required.

Reinstall all parts.

Bleed the small oil lines 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

Ensure not to operate carburetor throttle mechanism. Secure the rear of the vehicle on a stand.

CHECKING OPERATION

Oil Pump

On Vehicle

NOTE: Main oil line must be full of oil. See bleeding procedure above.

Lift rear of vehicle and support with a mechanical stand. Disconnect small oil lines from pump. Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever in fully open position. Oil columns must advance into small oil lines.

If not, remove pump assembly and check the pump gear and drive shaft (if applicable) for defects, replace as necessary. Test pump as describes below.

NOTE: Through normal use, oil level must not drop in small oil lines. If oil drops, verify check valve operation in injection nozzle. Replace as necessary.

Test Bench

Connect a hose filled with injection oil to supply 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.

2, Check Valve

For engine 593, check valve is part (built-in) of injection nozzle.

For engines 277, 443 and 552, check valve is part (built-in) of banjo fitting.

To verify this check valve, proceed the same as for checking pump operation on vehicle. First unplug oil line from injection nozzle. After restarting the engine, check that a clear section in small oil line is present. Reconnect oil line.

Run engine at idle. Oil column must advance. If the check valve is faulty, oil column will go back and forth. Replace if so.

AXIAL FAN COOLING SYSTEM

SERVICE TOOLS

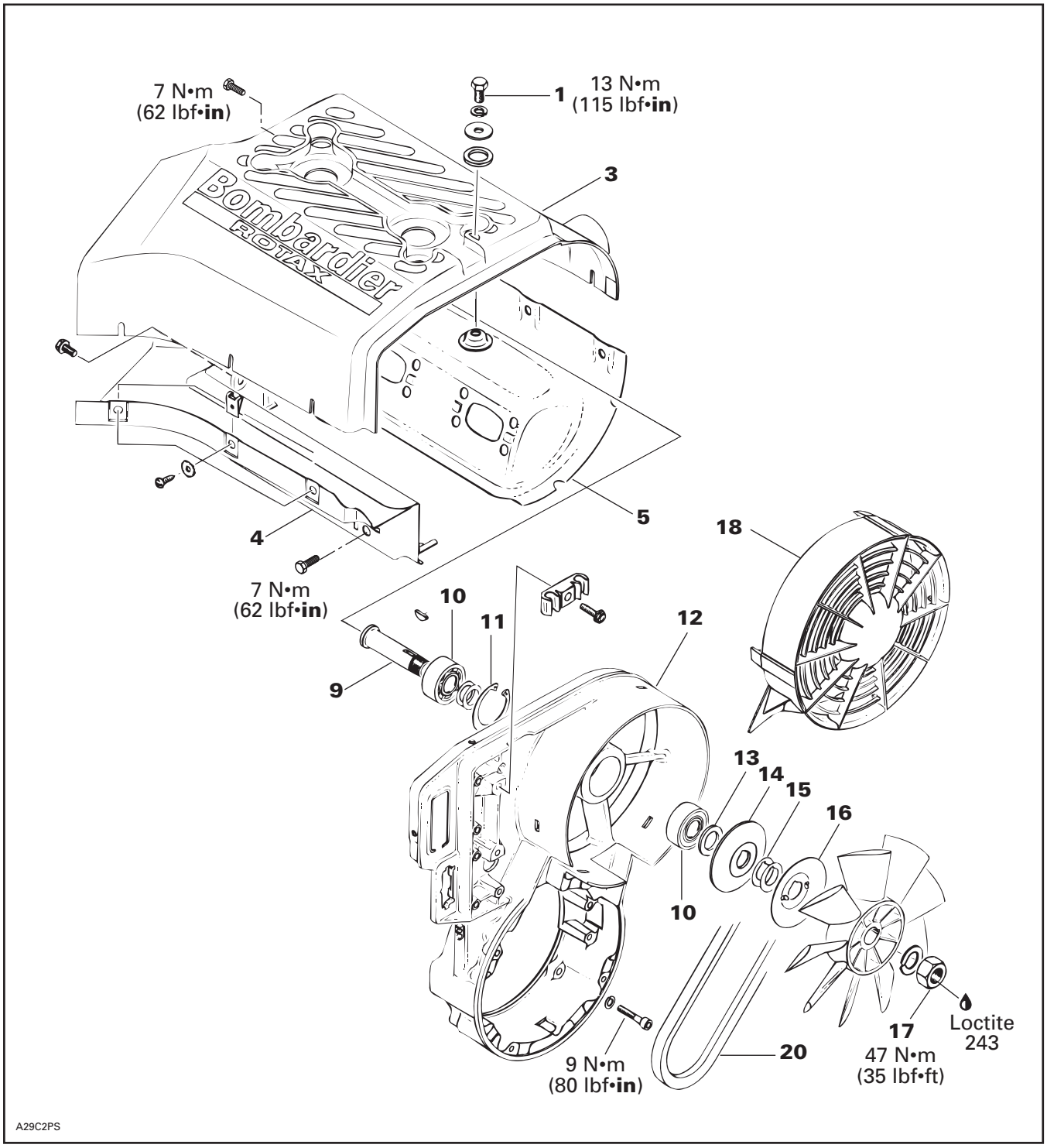
Description	Part Number	Page
holder wrench	420 876 357	144, 146

SERVICE PRODUCTS

Description	Part Number	Page
holder wrench for the 443 engine	420 876 357	143
holder wrench for the 5'52 engine	529 036 006	143
Loctite 243 (blue)	293 800 060	144, 146

443 and 552 Engines

NOTE: For 277 engine radial fan cooling system, refer to CDI SYSTEM.



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

REMOVAL

NOTE: To facilitate further disassembly, fan nut may be removed before removing fan housing.

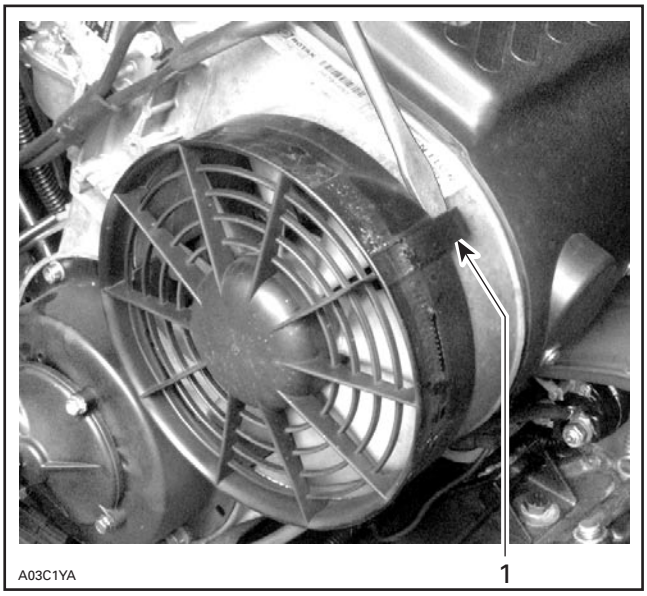
Remove rewind starter, starting pulley, trigger coil wire from 4-connector housing then fan housing ass'y.

CLEANING

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

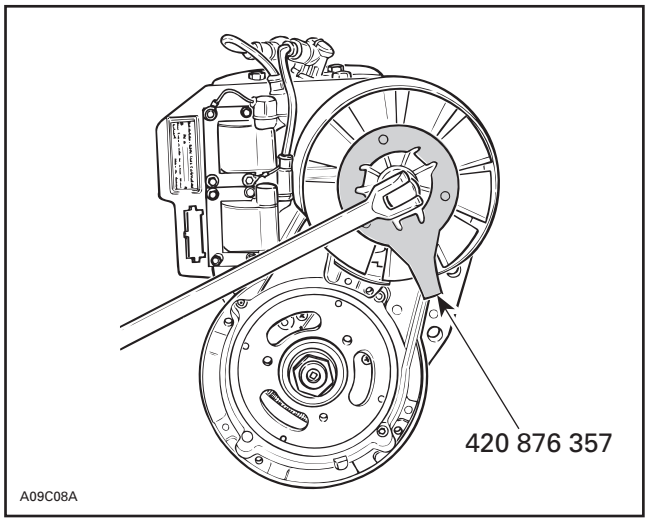
DISASSEMBLY AND ASSEMBLY

Using a flat screwdriver, lift fan protector tabs as shown in the following photo, then remove fan protector.



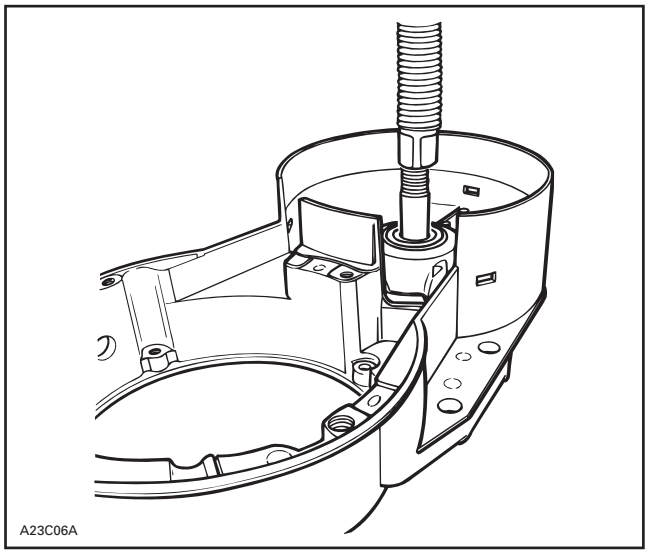
1. Lift tab and remove fan protector

To remove or install fan pulley retaining nut **no. 17**, lock fan pulley with holder wrench for the 443 engine (P/N 420 876 357) and holder wrench for the 552 engine (P/N 529 036 006). At assembly, torque nut to 48 N•m (35 lbf•ft).

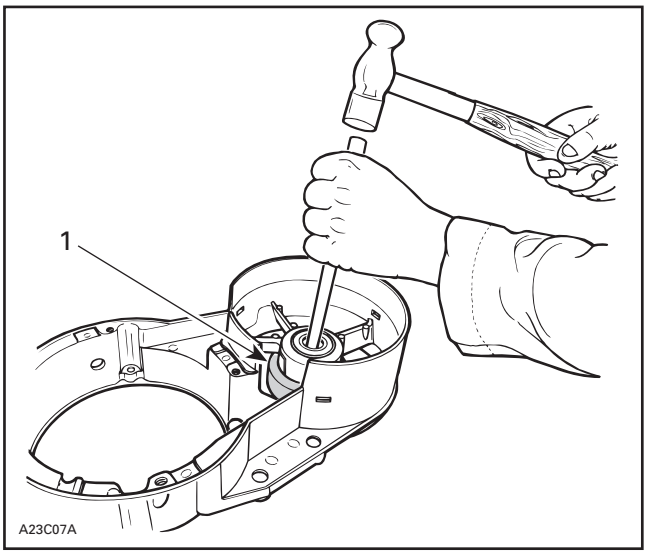


TYPICAL

Using a press, drive the fan shaft **no. 9** out.



Support fan housing **no. 12** with a ring. With a punch, working all around bearing **no. 10** inner race, drive bearing out of fan housing. Keep shims for installation.



1. Ring supporting fan housing

Remove circlip **no. 11** then remaining bearing.

To install, press one bearing in place then install circlip and shims. Press the other bearing from opposite side until it is flush with housing. Press fan shaft from engine side of fan housing. Check for free rolling action.

INSTALLATION

At assembly, apply a light coat of Loctite 243 (blue) (P/N 293 800 060) on screw **no. 1** threads.

A gasket must be placed on both sides (inner and outer) of intake and exhaust holes of cylinder cowl **no. 4 and 5**.

Reinstall fan protector **no. 18** properly.

⚠ WARNING

Always reinstall fan protector after servicing.

FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT

Remove muffler, rewind starter and on so equipped models connecting flange. Following procedure described above.

443 Engine

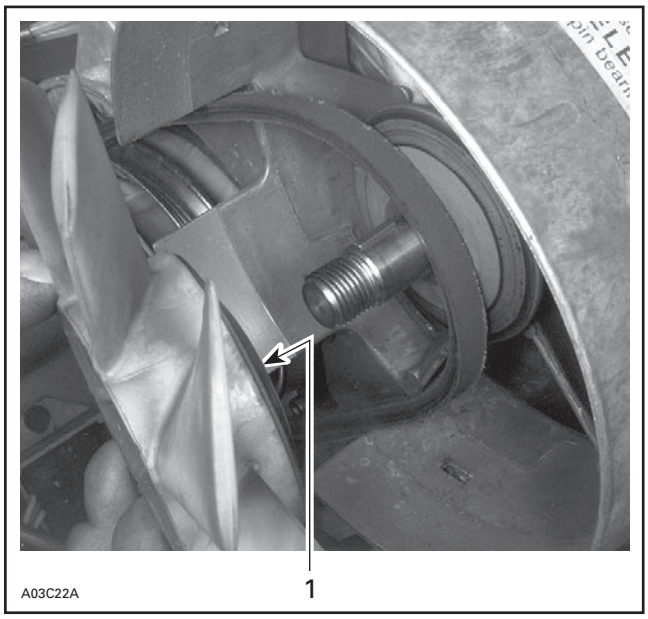
Using holder wrench (P/N 420 876 357), remove fan nut.

552 Engine

Using holder wrench (P/N 529 036 006), remove fan nut.

All Engines

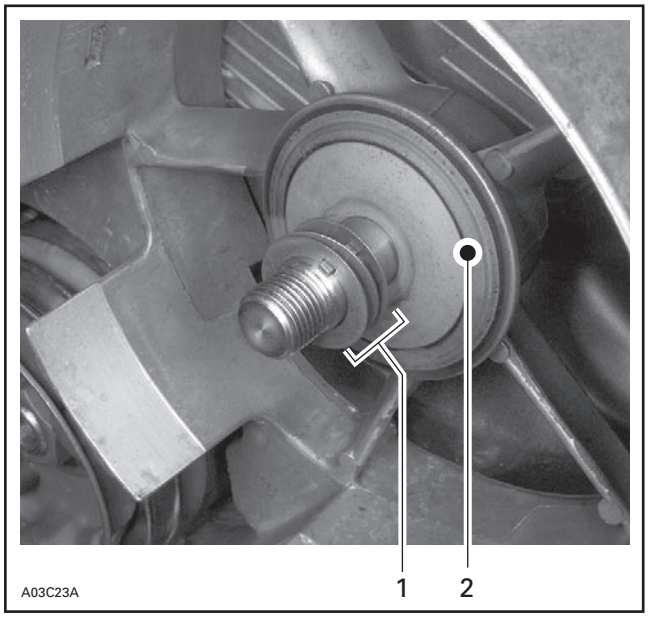
Remove fan with pulley half.



1. Remove fan with pulley half

Remove fan belt.

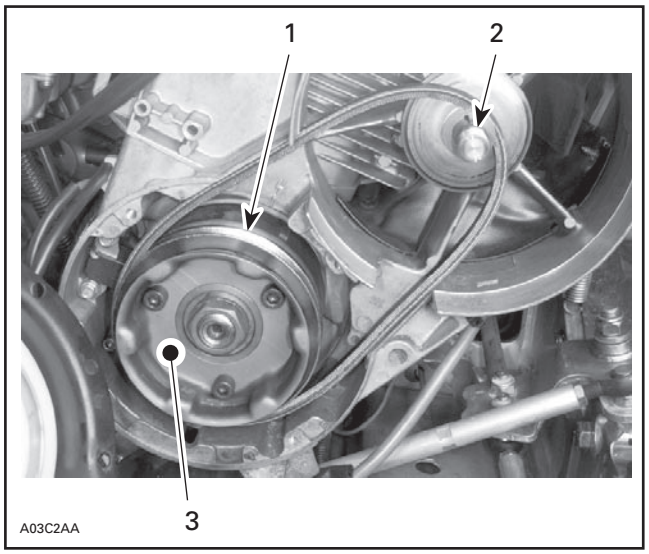
Leave shims and second half pulley in place. Refer to the following photo.



1. Keep shims
2. Leave second half pulley in place

Reassembly

Install fan belt on bottom pulley first then position onto fan shaft, as shown in the next photo.



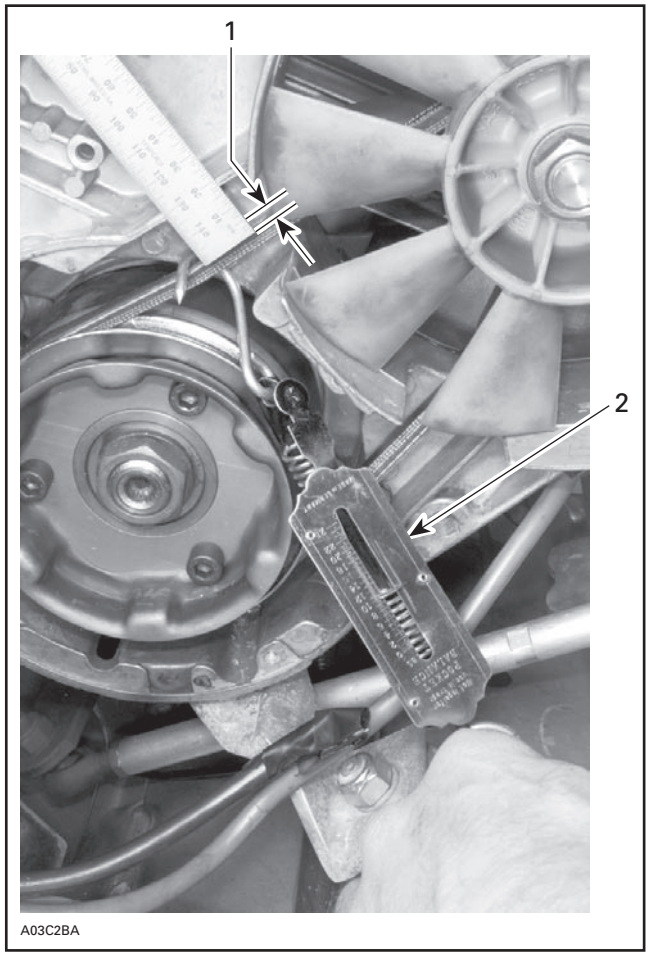
FAN BELT PROPERLY INSTALLED ON BOTTOM PULLEY AND FAN SHAFT
1. *Bottom pulley*
2. *Fan shaft*
3. *Starting pulley*

Reinstall fan assembly on fan shaft. Temporarily tighten fan nut.

CAUTION: When reinstalling fan assembly, ensure that key is properly positioned into fan shaft keyway.

Fan Belt Deflection Adjustment

Check fan belt deflection using a ruler and a fish scale positioned midway between pulleys as per following photo.

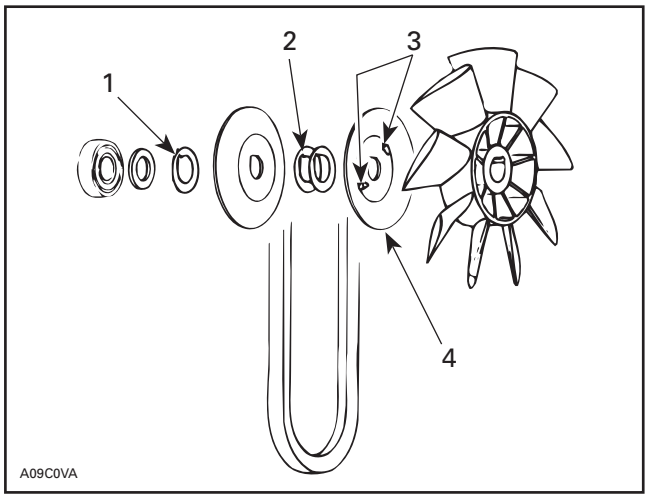


TYPICAL
1. *Measure deflection here*
2. *Fish scale*

Belt deflection must be according to the following specifications:

ENGINE TYPE	BELT DEFLECTION	FORCE APPLIED
443 and 552	9.5 mm (3/8 in)	5 kg (11 lb)

To adjust deflection tension, add or remove shim(s) **no. 15** between pulley halves **no. 14 and 16**. Install excess shim(s) between distance sleeve **no. 13** and pulley half **no. 14** (housing side).



1. Unused shim(s) here
2. Adjust here
3. Positioning noses
4. Some engines only

Select pulley halves so that the one with 2 positioning noses will be on fan side. Ensure to insert these noses into fan notches.

Once fan belt is properly adjusted, torque fan nut to 48 N•m (35 lbf•ft) using holder wrench (P/N 420 876 357), as shown in the following photo.

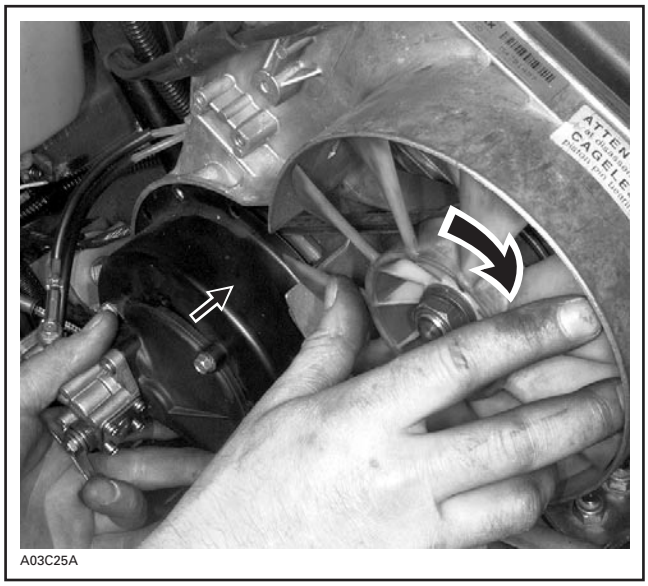
NOTE: Apply Loctite 243 (blue) (P/N 293 800 060) on fan nut threads.

TORQUE FAN NUT USING HOLDER WRENCH

Finalizing Reassembly

Reinstall rewind starter.

CAUTION: When installing rewind starter, ensure that oil pump shaft is properly positioned. Do not force shaft insertion. Turn fan until oil pump shaft slides in place, as shown in the following photo.



TURN FAN TO SLIDE OIL PUMP SHAFT IN PLACE

Secure rewind starter with original screws.

Reinstall fan protector no. 18 properly.

⚠ WARNING

Always reinstall fan protector after servicing.

Reinstall muffler.

LIQUID COOLING SYSTEM

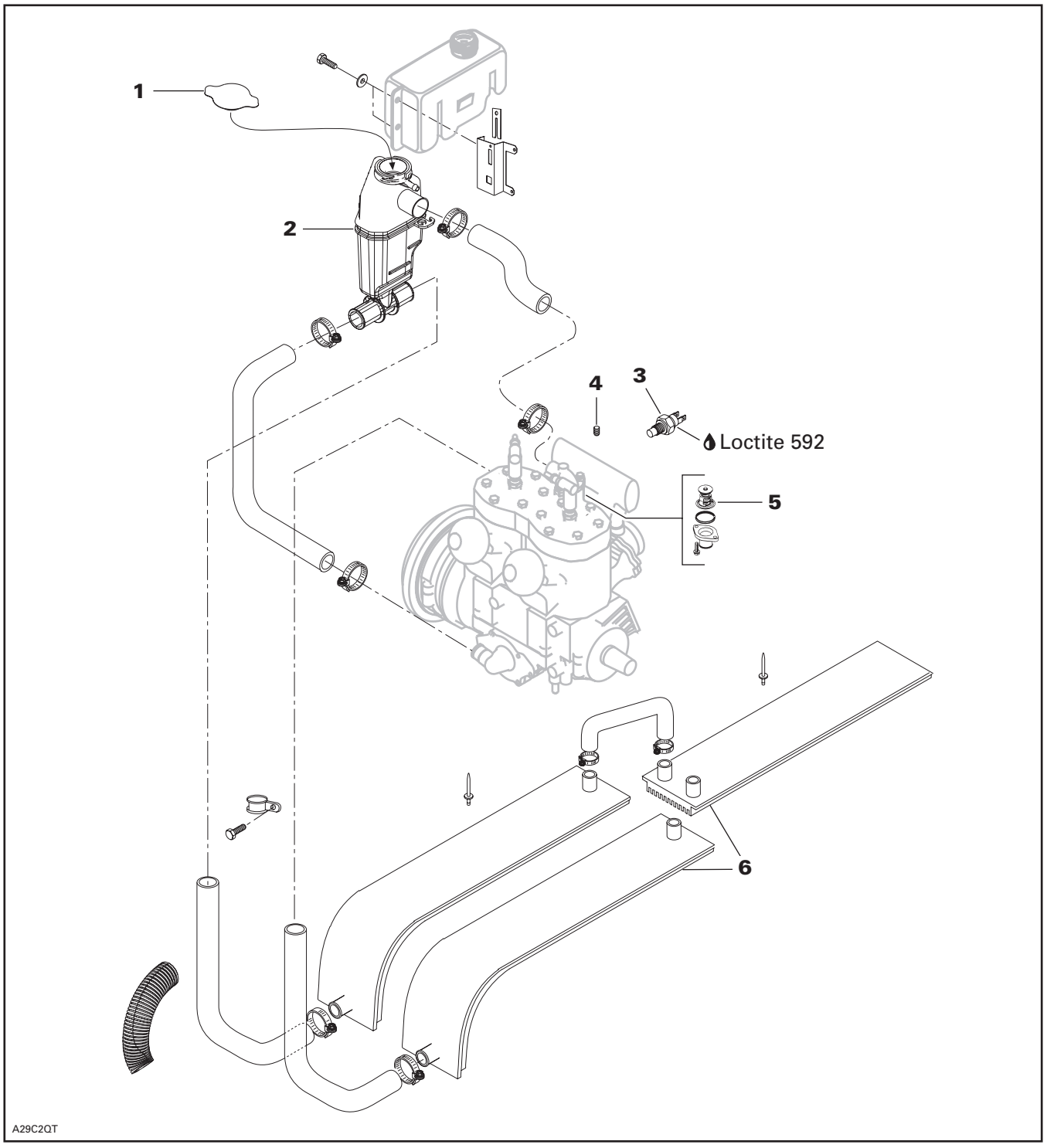
SERVICE TOOLS

Description	Part Number	Page
engine leak tester kit	861 749 100	149
hose pincher	295 000 076	149
siphon tool	529 035 880	149
special radiator cap	529 021 400	149
Supertanium™ bit	529 031 800	149

SERVICE PRODUCTS

Description	Part Number	Page
50/50 PREMIXED COOLANT - 37°C (- 35°F)	293 600 038	151
Loctite 592	293 800 018	149

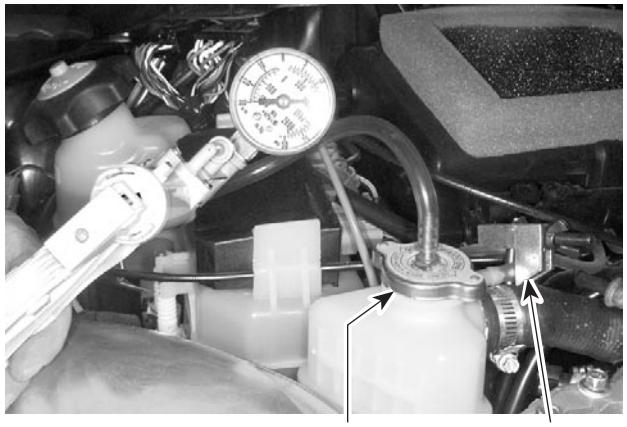
593 Engine



COOLING SYSTEM LEAK TEST

Install special radiator cap (P/N 529 021 400) included in 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 reservoir to 100 kPa (15 PSI).

Check all hoses and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.



INSPECTION

Check general condition of hoses and clamp tightness.

DRAINING THE SYSTEM

⚠ WARNING

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

To drain the cooling system, siphon the coolant mixture from the coolant tank **no. 2** using the siphon tool (P/N 529 035 880). Disconnect hose at water pump to drain coolant from engine.

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

DISASSEMBLY AND ASSEMBLY

Coolant Pump

Refer to BOTTOM END section.

3,4 Sender and Plug or Elbow

Apply Loctite 592 (P/N 293 800 018) thread sealant on sender **no. 3** and plug or elbow **no. 4** to avoid leaks.

1, Pressure Cap

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

2, Coolant Tank

For removal, drain cooling system before removing coolant tank **no. 2**.

Remove all hoses from coolant tank.

Slide down the 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.

NOTE: It may be necessary to move oil tank for an easier installation of coolant tank.

6, Radiators

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

Check if radiator fins are damaged. Replace broken radiator if necessary.

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

For disassembly, drain cooling system.

Remove rear suspension (refer to REAR SUSPENSION).

Using Supertanium™ bit (P/N 529 031 800), drill all rivets retaining radiator to the frame or grind the rivets with a grinding disk.

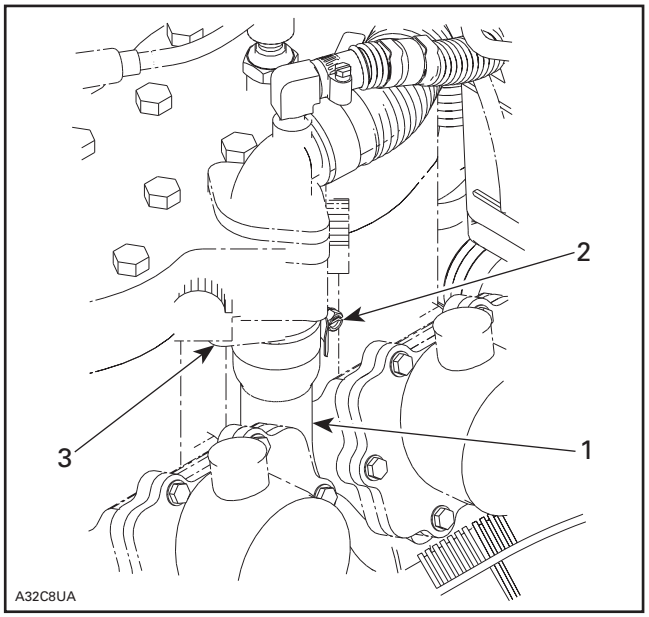
Pull the radiator a little and remove the Oetiker clamps.

For installation, reverse the removal procedure.

5, Thermostat

For disassembly, drain the cooling system (see above).

Unscrew clamp retaining hose to the water outlet socket.



1. Hose
2. Clamp
3. Water outlet socket

Remove:

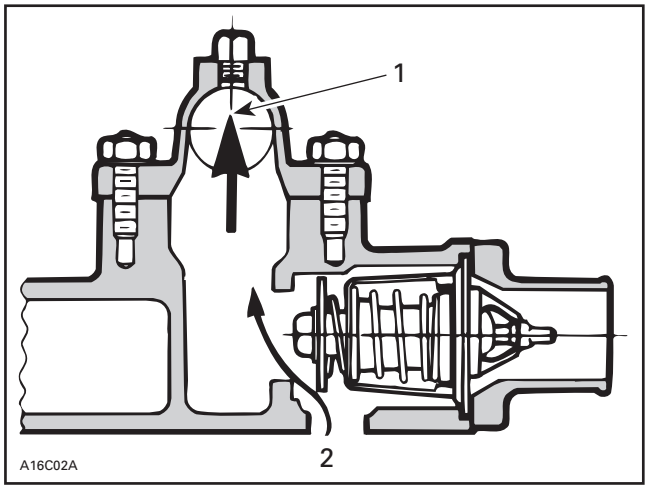
– water outlet
– socket screws
– gasket thermostat.

To check thermostat, put in water and heat water. Thermostat should start to open when water temperature reaches the following degree. It will be almost fully open at 50°C (122°F).

ENGINE	TEMPERATURE
593	42°C (108°F)

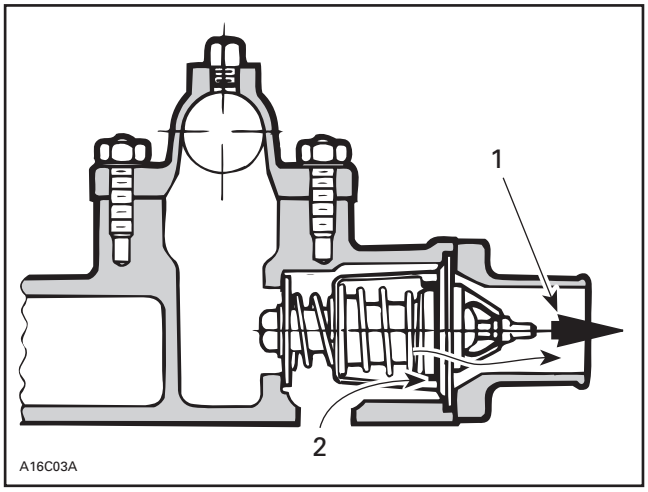
Thermostat is a double action type.

– Its function is to give faster warm up of the engine by controlling a circuit; water pump — engine — coolant tank. This is done by bypassing the radiator circuit.



TYPICAL — CLOSED THERMOSTAT, COLD ENGINE
1. To reservoir
2. From cylinders

– When the liquid is warmed enough, the thermostat opens progressively the circuit, water pump — engine — radiators — coolant tank to keep the liquid at the desired temperature. (See the diagram of the exploded view).



TYPICAL — OPEN THERMOSTAT, WARM ENGINE
1. To radiators
2. From cylinders

These 2 functions have the advantage of preventing a massive entry of cold water into the engine.

COOLING SYSTEM REFILLING PROCEDURE

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the Bombardier 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 50/50 PREMIXED COOLANT - 37°C (- 35°F) (P/N 293 600 038).

Do not reinstall pressure cap.

Lift front of vehicle until the tunnel is horizontal. With engine cold, refill coolant tank no. 2 up to cold level line. Wait a few minutes then refill to line. Start engine. Refill up to line while engine is idling until all air bubbles have escaped from system (about 4 to 5 minutes). Install pressure cap.

To make sure coolant flows through radiators, touch them by hand. They must feel warm.

Put back front of vehicle on the ground.

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

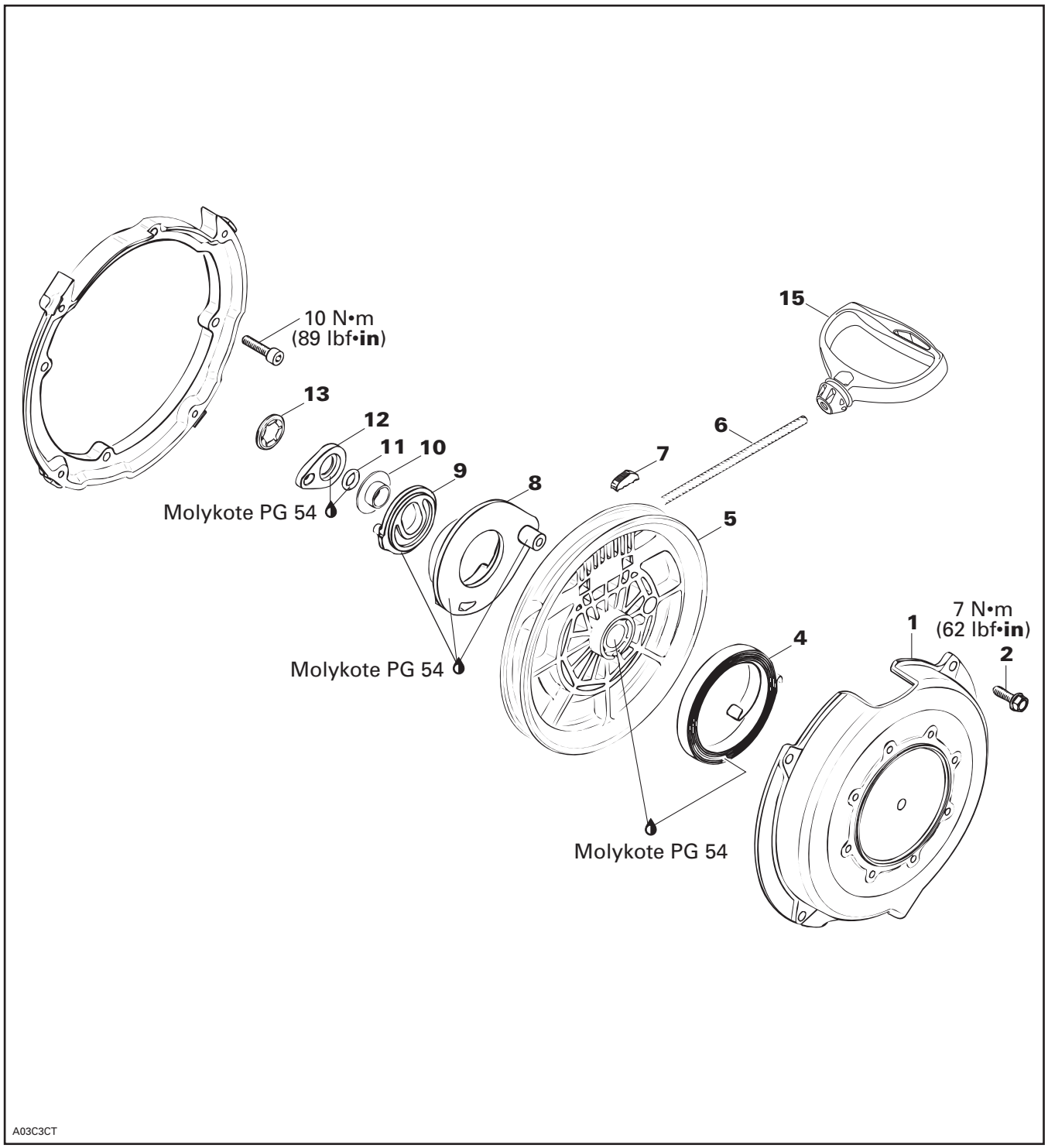
Check coolant concentration (freezing point) with proper tester.

REWIND STARTER

SERVICE PRODUCTS

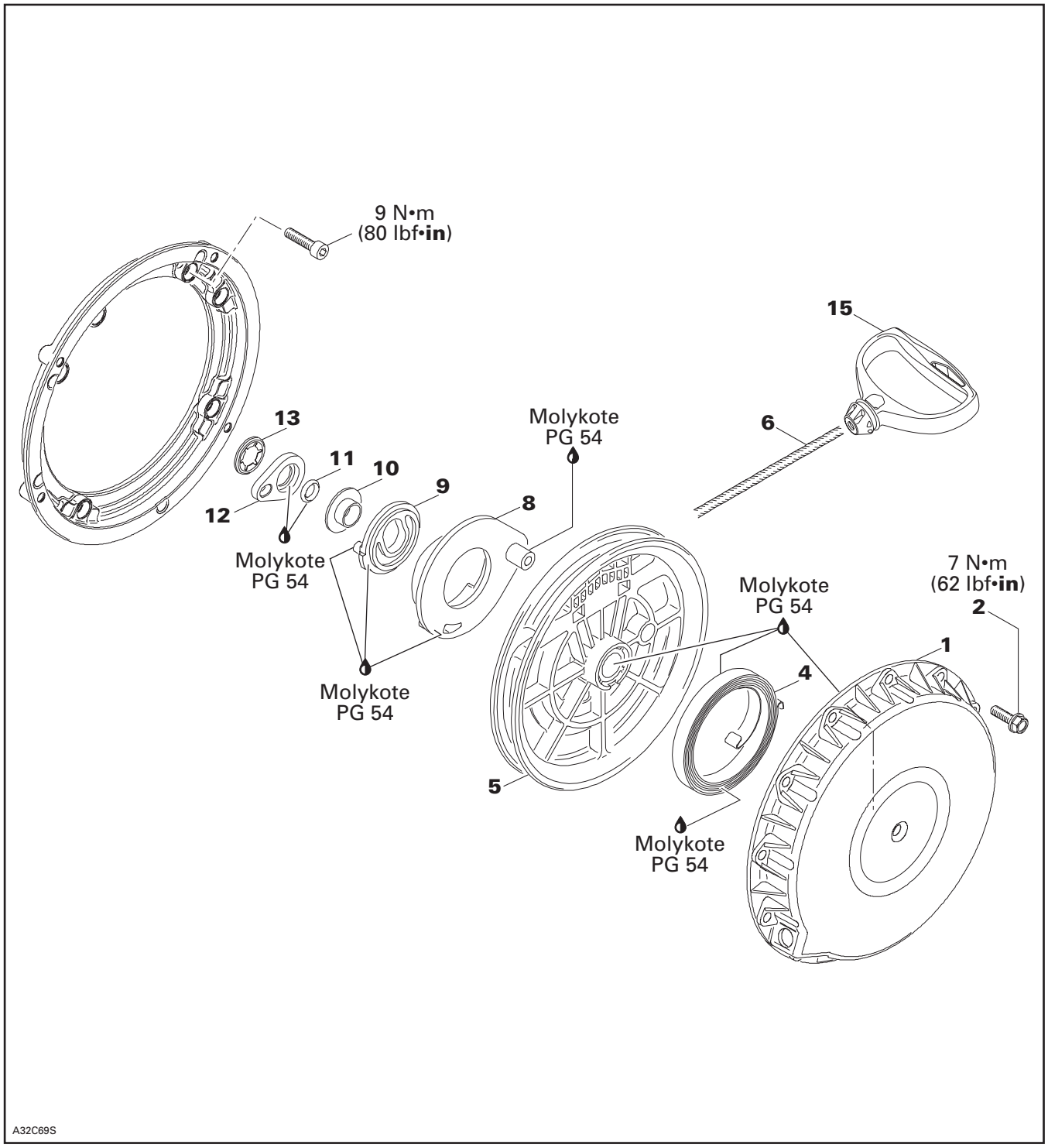
Description	Part Number	Page
Molykote PG 54	420 899 763	157, 159

Rewind Starter on Fan Cooled Models



TYPICAL

Rewind Starter on Liquid Cooled Models



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. 6** 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. 11** every time rewind starter is disassemble.

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

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

REMOVAL

Using a small screwdriver, extract rope knot from starter grip **no. 15**. 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.

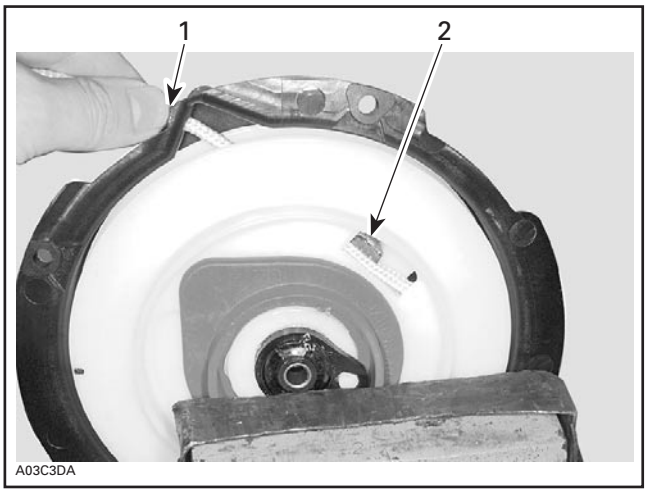
Fan Cooled Models Only

Remove pump from rewind starter cover.

ROPE REPLACEMENT

Fan Cooled Models Only

Completely pull out rope. Hold rewind starter in a vise.



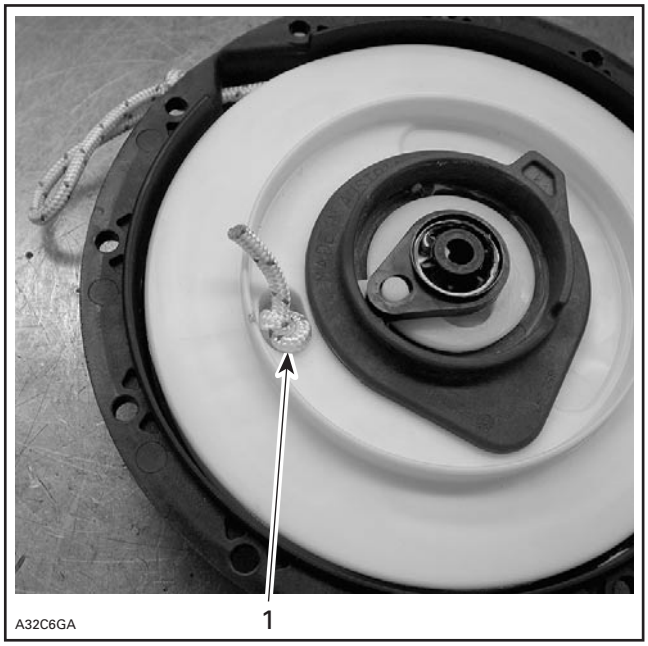
1. Rope exit hole
2. Key to be removed

With a long thin pin punch inserted through rope exit hole, push key **no. 7**. Remove key and rope. Install a new rope and lock it using key **no. 7**.

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

Liquid Cooled Models Only

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

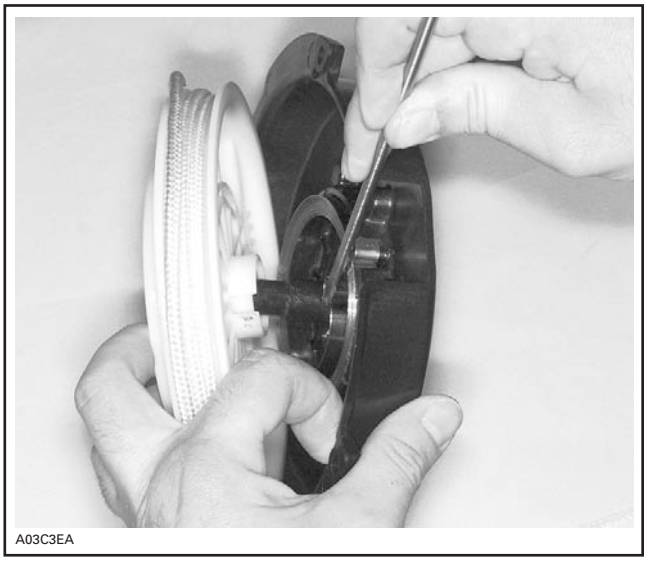
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

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

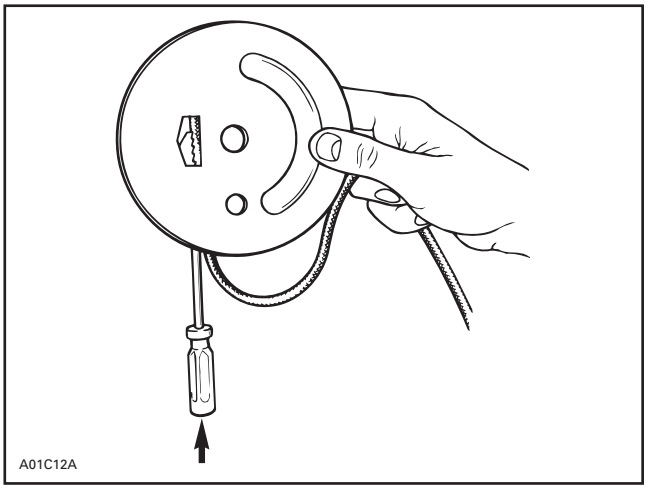
Cut push nut **no. 13** and discard. Remove locking element **no. 12**, O-ring **no. 11**, step collar **no. 10**, pawl lock **no. 9** and pawl **no. 8**.

Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.


A03C3EA

Fan Cooled Models Only

Disengage key **no. 7** and pull out rope **no. 6**.


A01C12A

GENTLY TAP ON KEY

Liquid Cooled Models Only

Take out the knot and then rope **no. 6**.

ASSEMBLY

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counterclockwise into guide.

⚠ WARNING

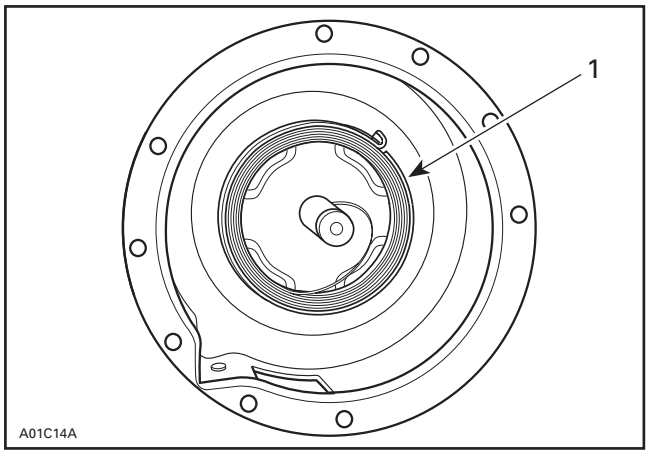
Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

A03C3FA

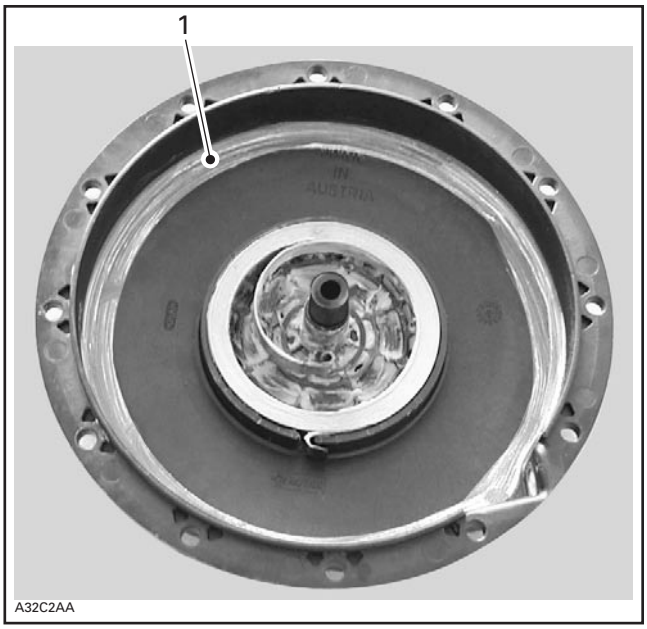
1. Outer end into guide notch

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).



TYPICAL
1. Molykote PG 54 inside spring guide

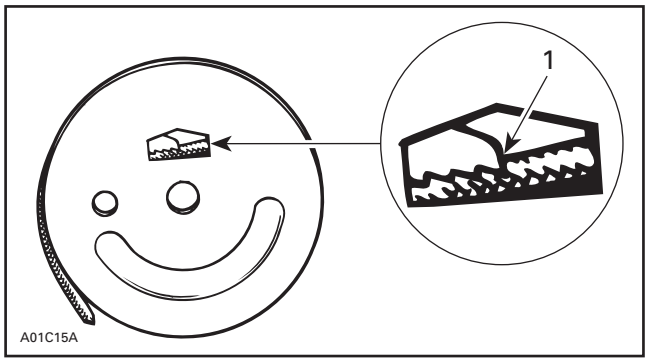


1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

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

Fan Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 orifice and lock it with the key no. 7 as illustrated.

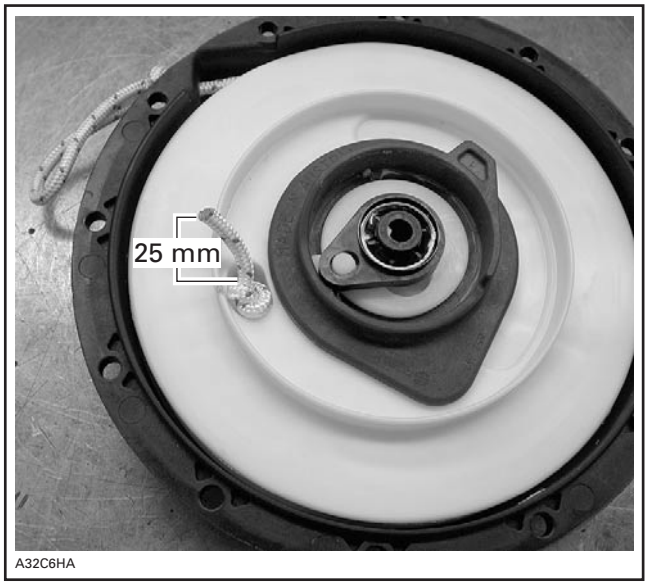


1. Push to lock

Lubricate housing post with silicone compound grease. Install sheave.

Liquid Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 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


A32C6IA

FREE PORTION INSERTED INTO SHEAVE

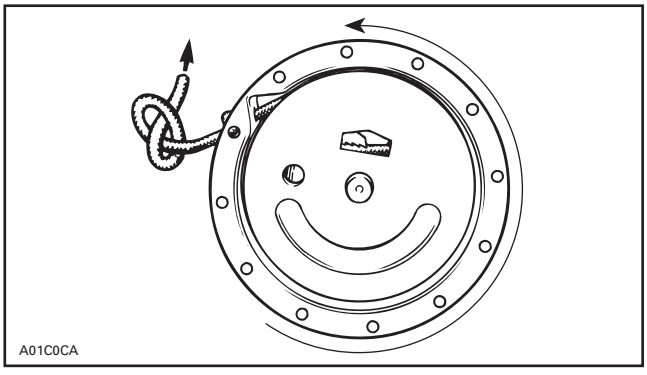
Lubricate housing post with silicone compound grease. Install sheave.

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.

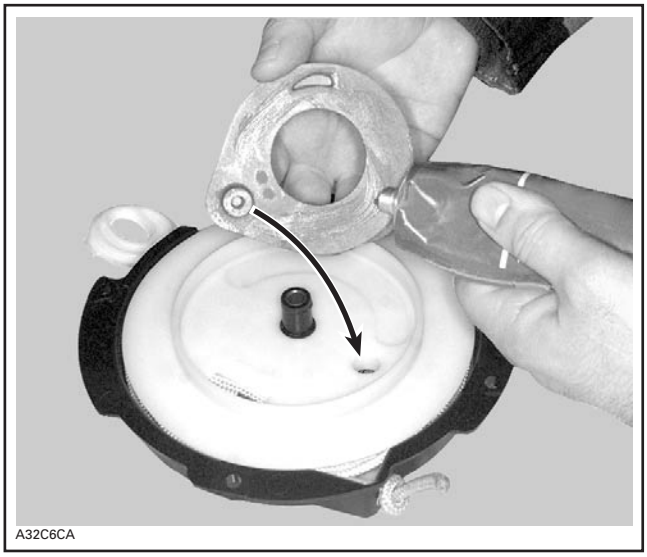
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

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

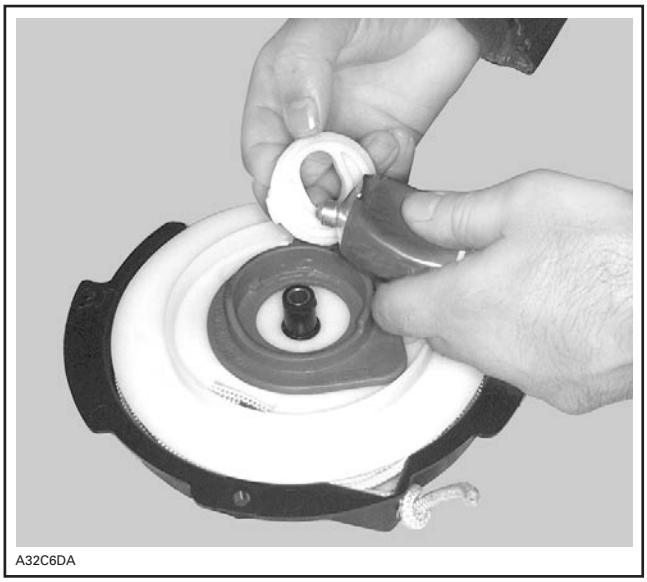

A01C0CA

TYPICAL

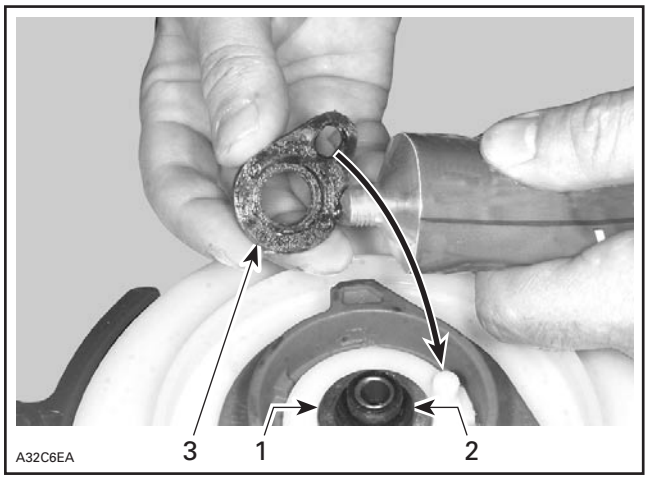
Lubricate pawl **no. 8** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.


A32C6CA

Lubricate pawl lock **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl.


A32C6DA

Install step collar **no. 10** with its sleeve first. Lubricate a new O-ring **no. 11** and locking element **no. 9** 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. 13.

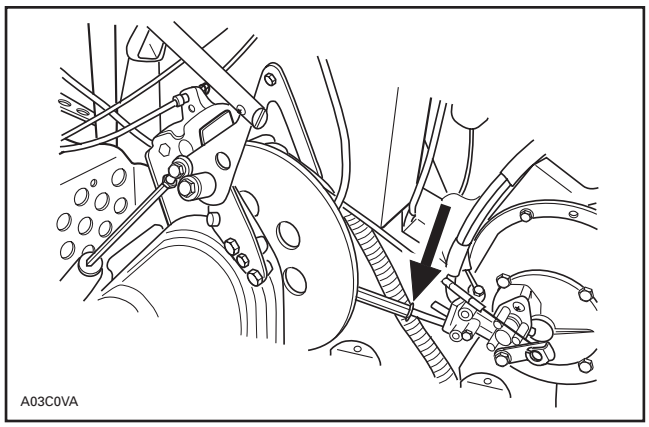
INSTALLATION

Fan Cooled Models Only

Reinstall oil pump on rewind starter assembly.

All Models

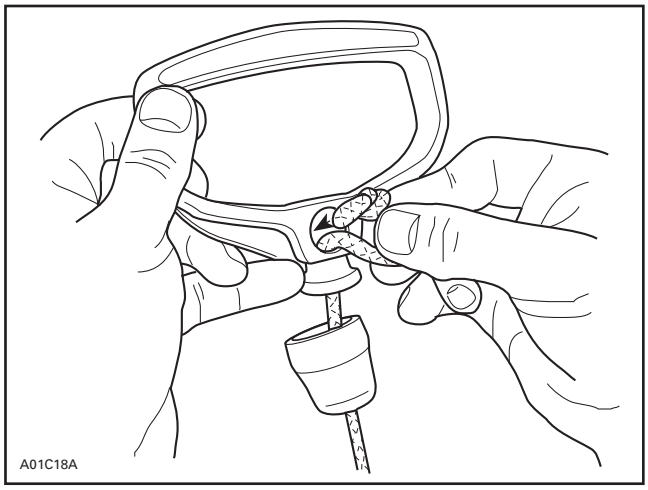
Thread starter rope no. 6 through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

Prior to installing starter grip no. 15 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

FUEL SYSTEM

SERVICE TOOLS

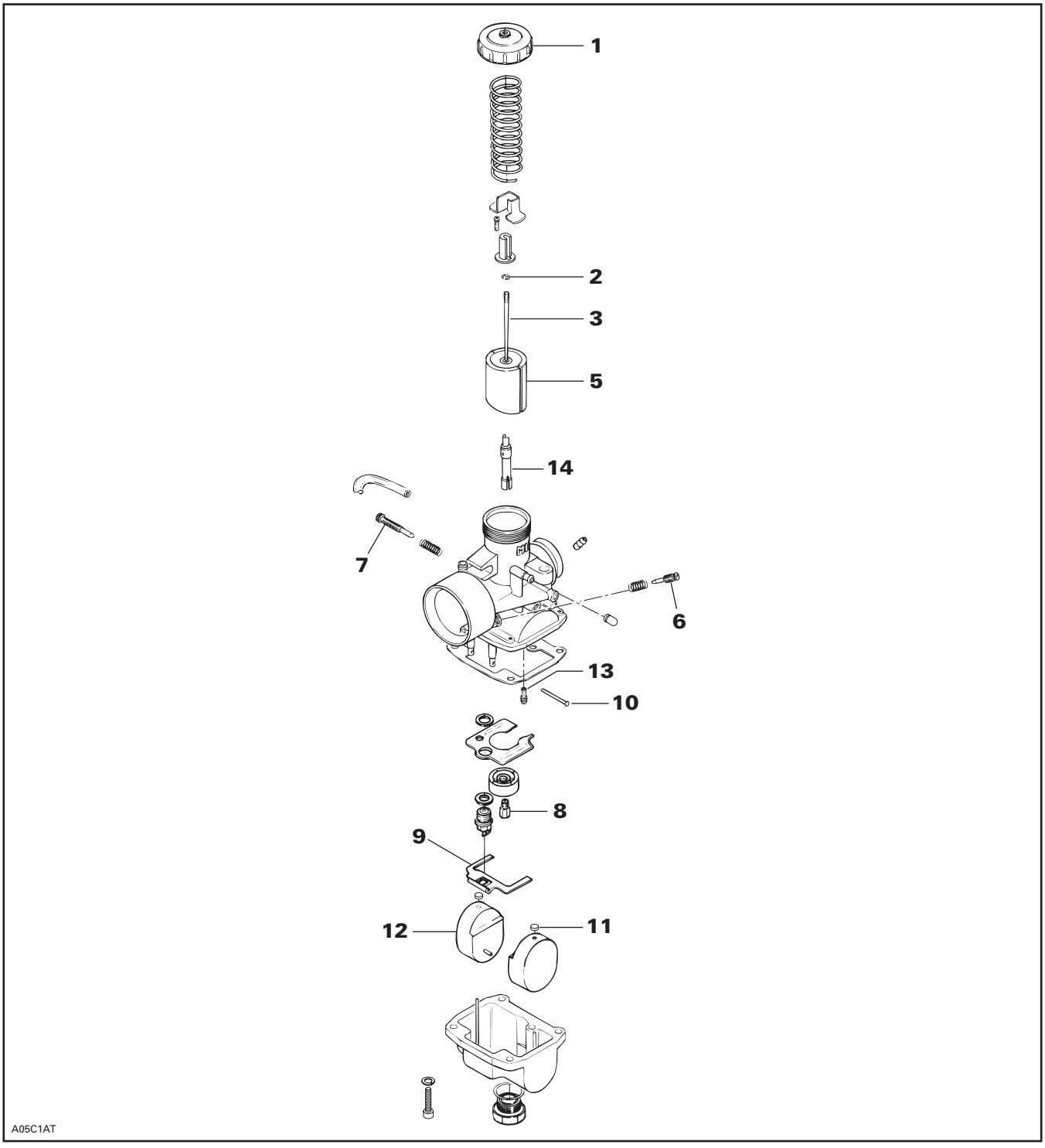
Description	Part Number	Page
carburetor tool kit	404 112 000	165
choke plunger tool	529 032 100	171
float level gauge	529 035 520	167
hose pincher	295 000 076	172–173
vacuum/pressure pump kit	529 021 800	172

SERVICE PRODUCTS

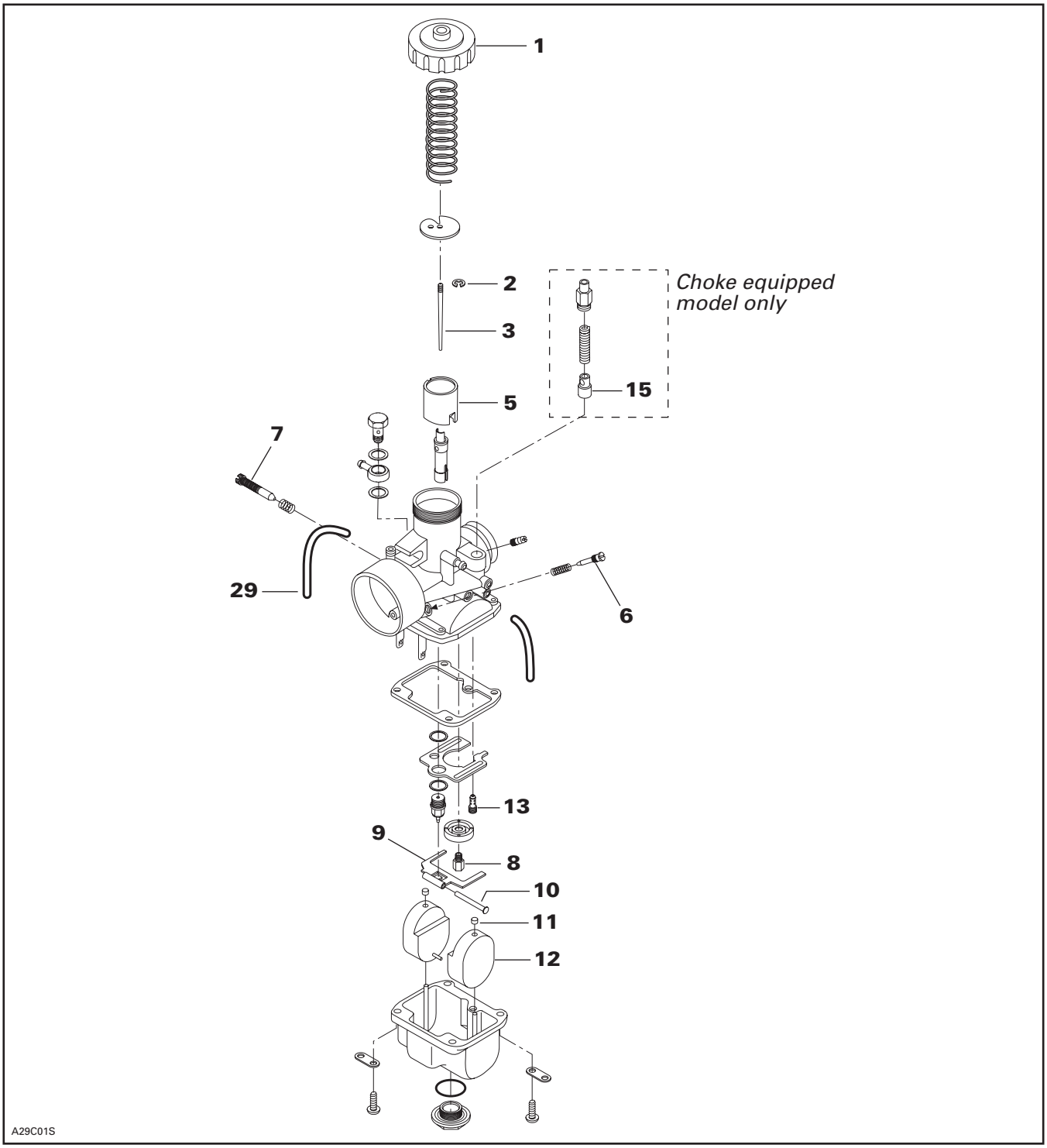
Description	Part Number	Page
silicone grease	293 550 004	169

CARBURETOR

Tundra

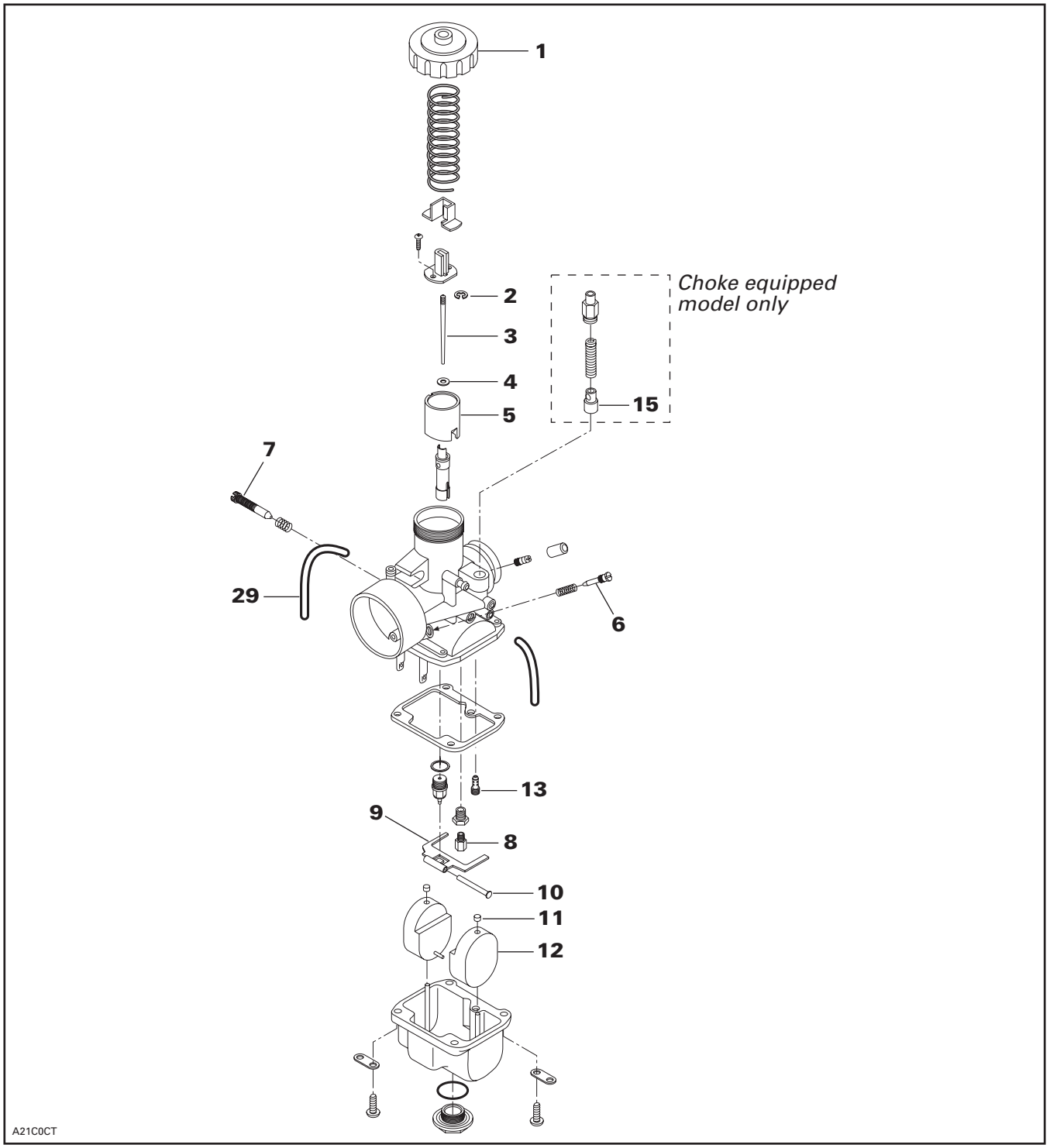


Skandic LT/LT E



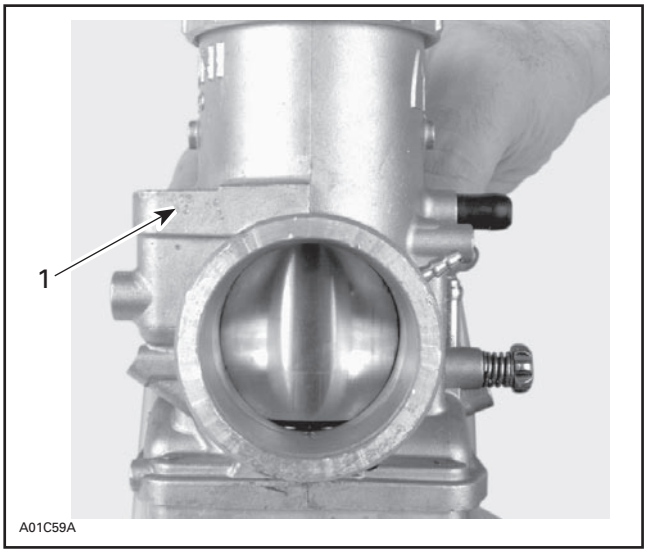
TYPICAL

Skandic WT/SUV/SWT



IDENTIFICATION

All carburetors are identified on their body.



1. Identification: 34-482

REMOVAL

Tundra and Skandic LT/WT/SWT

Remove air silencer.

All Models

Disconnect fuel inlet line.

Disconnect primer line from carburetor on some models.

Disconnect choke cable on some models.

Unscrew carburetor cover **no. 1** then pull out throttle slide **no. 5** from carburetor.

⚠ WARNING

Exercise care when handling throttle slide. Scratches incurred may cause throttle slide to stick open in operation.

Disconnect throttle cable from throttle slide.

Untighten rubber flange clamps then remove carburetor from engine.

CLEANING AND INSPECTION

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and jets should be cleaned in a carburetor cleaner following manufacturer's instructions. Replace any jets having gum or varnish on their surfaces.

⚠ WARNING

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

Check inlet needle tip condition. If worn, the inlet needle and seat must be replaced as a matched set.

NOTE: Install needle valve for snowmobile carburetor only. It is designed to operate with a fuel pump system.

Check throttle slide **no. 5** for wear. Replace as necessary.

Check idle speed screw **no. 7** for straightness. Replace as necessary.

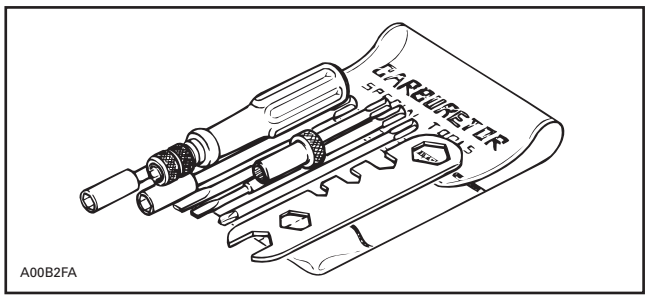
Check for fuel soaked into float **no. 12**; replace as necessary.

Check float **no. 12** for cracks or other damages affecting free movement ; replace as necessary.

Inspect throttle cable and housing for any damages. Replace as necessary.

DISASSEMBLY AND ASSEMBLY

NOTE: To ease the carburetor disassembly and assembly procedures it is recommended to use carburetor tool kit (P/N 404 112 000).

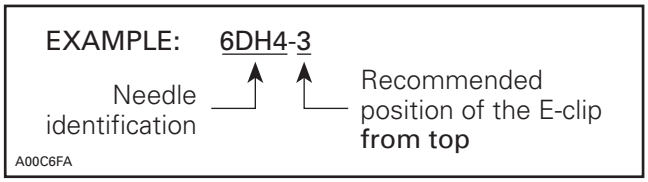


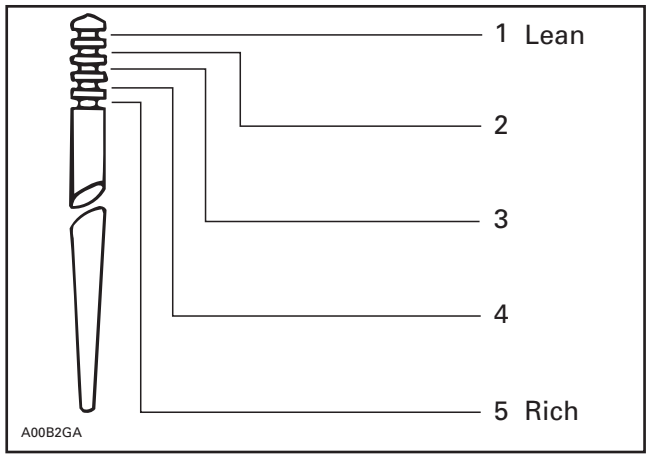
E-Clip and Needle

Remove screws from needle retaining plate to remove the needle **no. 3**.

The position of the needle in the throttle slide is adjustable by means of an E-clip **no. 2** inserted into 1 of 5 grooves located on the upper part of the needle. Position 1 (at top) is the leanest, 5 (at bottom) the richest.

NOTE: The last digit of the needle identification number gives the recommended position of the E-clip from the top of the needle.





CLIP POSITIONS

Main Jet

The main jet **no. 8** installed in the carburetor has been selected for a temperature of - 20°C (0°F) at sea level. Different jetting can be installed to suit temperature and/or altitude changes. A service bulletin will give information about calibration according to altitude and temperature.

CARBURETOR ADJUSTMENTS

NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude and temperature.

Adjustments should be performed following this sequence:

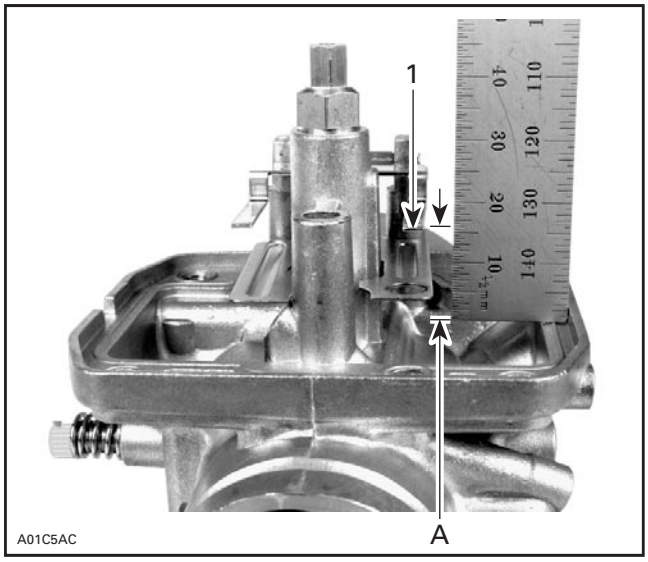
– float arm
– air screw **no. 6** adjustment
– throttle slide **no. 5** height (preliminary idle speed adjustment)
– throttle cable adjustment
– carburetor synchronization (dual carburetor models)
– final idle speed adjustment (engine running)
– oil pump and carburetor synchronization.

Float Arm

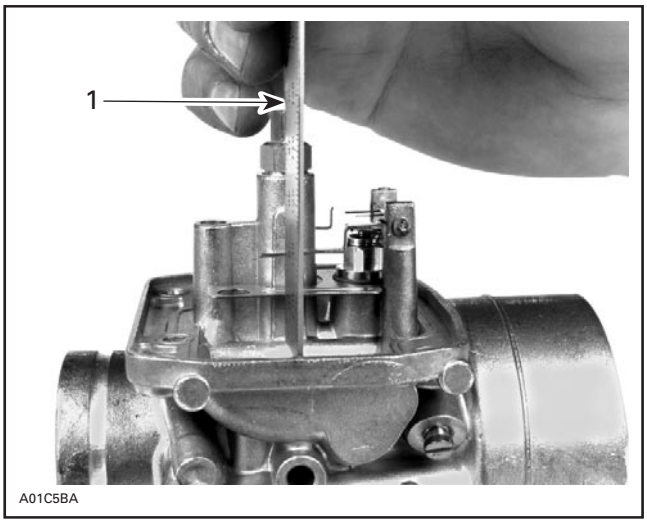
CAUTION: Spark plugs will foul if float is adjusted too low. Engine may be damaged if float is adjusted too high.

Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

– Make sure that float arm **no. 9** is symmetrical — not distorted.
– Remove float bowl and gasket from carburetor.
– With carburetor chamber upside-down on a level surface, measure height A between bowl seat and top edge of float arm. Keep ruler perfectly vertical and in line with main jet hole.

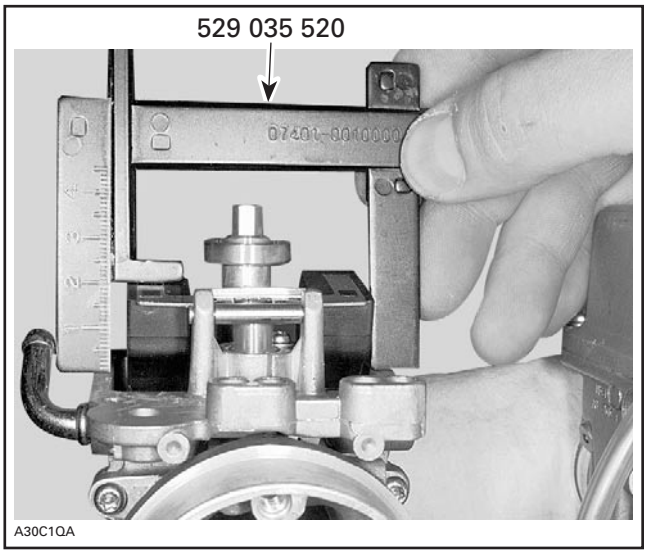


TYPICAL
1. Measure from top of float arm
A. Float height (including float arm thickness)



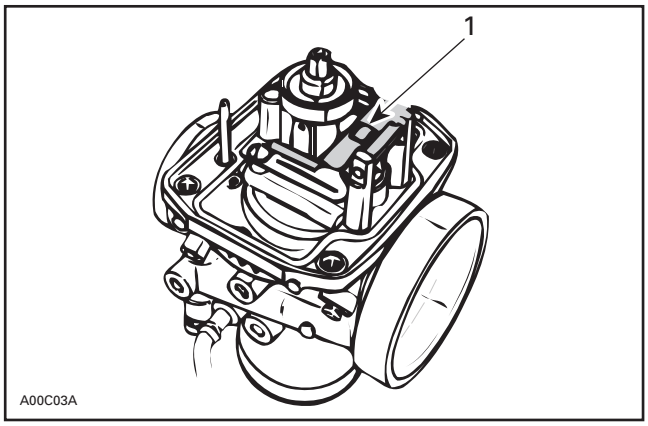
1. Ruler vertical and in line with main jet

Float level height can be checked using float level gauge (P/N 529 035 520). Keep tool in line with main jet as explained above.



MODELS	FLOAT HEIGHT ± 1 mm (± .040 in)
Tundra Skandic 440 LT Skandic 550F WT/SWT/SUV	23.9 (.941)
Skandic 600 WT LC/SUV	18.1 (.713)

– Bend the contact tab of float arm until the specified height is reached.



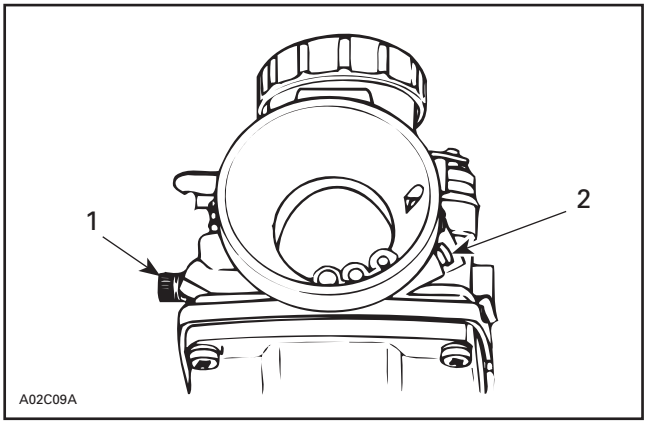
1. Contact tab

Air Screw Adjustment

Completely close the air screw **no. 6** (until a slight seating resistance is felt) then back off as specified.

Turning screw in clockwise enriches mixture and conversely, turning it out counterclockwise leans mixture.

Refer to TECHNICAL DATA for the specifications.



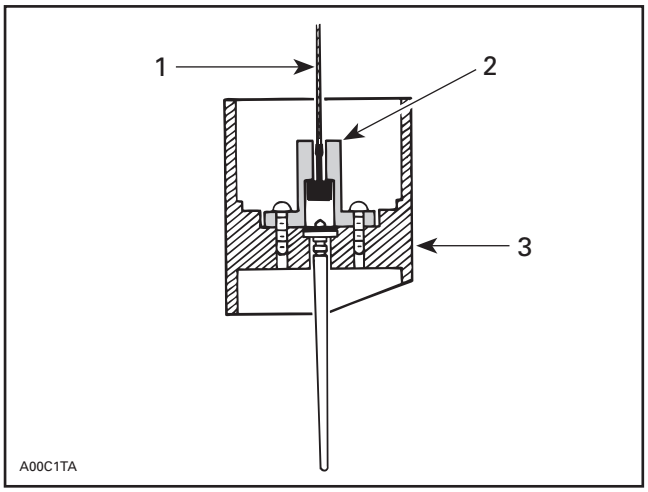
1. Idle speed screw
2. Air screw

Throttle Slide Height

Preliminary Idle Speed Adjustment

Hook throttle cable into the needle retainer plate.

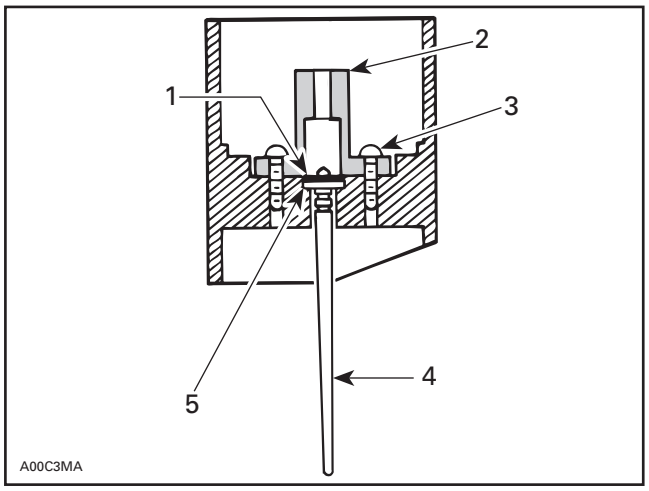
NOTE: Do not obstruct hole in throttle slide when installing needle retaining plate. This is important to let air escape through and thus allow a quick response.



CENTER POST TYPE
1. *Throttle cable*
2. *Needle retaining plate*
3. *Throttle slide*

Make sure the nylon packing no. 4 is installed on all applicable throttle slides.

CAUTION: Serious engine damage can occur if this notice is disregarded.



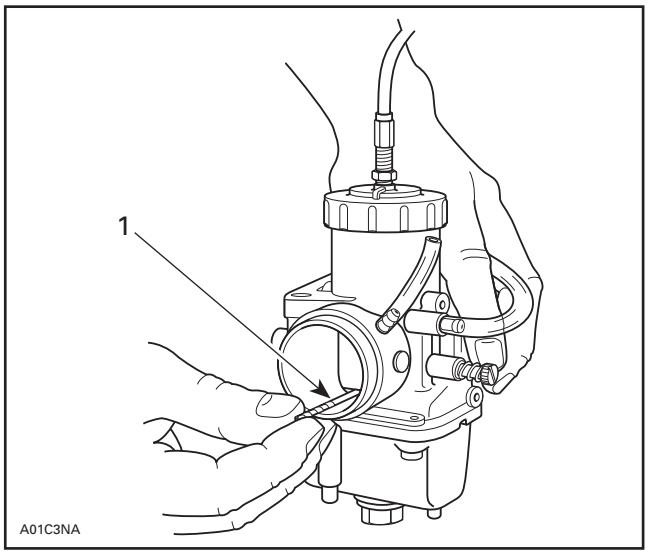
CENTER POST TYPE
1. *E-clip*
2. *Needle retaining plate*
3. *Screw*
4. *Needle*
5. *Nylon packing*

Using a drill bit as a gauge, adjust throttle slide height (see following table) by turning idle speed screw no. 7. Throttle slide height is measured on outlet side of carburetor (engine side).

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly. Throttle cable adjustment will be done during adjustment of throttle-slide-to-cover free play.

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

MODELS	THROTTLE SLIDE HEIGHT ± 0.1 mm (± .004 in)
Tundra Skandic WT/ SWT/WT LC/ SUV 550/ SUV 600	1.5 (. 059)
Skandic LT	1.3 (.051)



TYPICAL
1. *Drill bit used as gauge for throttle slide height*

INSTALLATION

CAUTION: Never allow throttle slide(s) to snap shut.

Prior to installing carburetor, adjust air screw and preliminary idle speed as described above.

To install carburetor on engine, inverse removal procedure.

However, pay attention to the following:

On applicable models, make sure to align tab of carburetor and air intake silencer (if applicable) with notch of adaptor(s). On applicable models, install adaptor with up mark facing up.

CAUTION: The rubber flange must be checked for cracks and/or damage. At assembly, the flange must be perfectly matched with the air intake manifold or severe engine damage will occur.

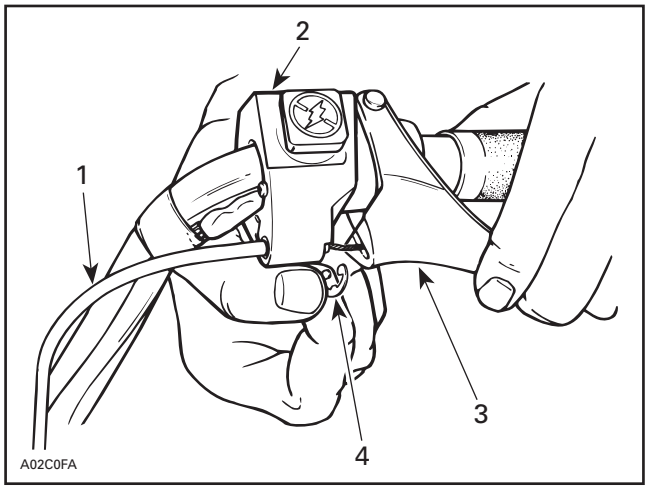
Install clamps in a way that their tightening bolts are staggered — not aligned.

Throttle Cable Circlip at Handlebar

Put silicone grease (P/N 293 550 004) around cable barrel. Locate circlip as per illustration.

⚠ WARNING

If this procedure is disregarded, throttle lever might be half-open at normally closed position and the engine will speed up when starting.



TYPICAL
1. *Throttle cable housing*
2. *Throttle lever housing*
3. *Throttle lever*
4. *Circlip*

Throttle Cable Routing

CAUTION: Check that throttle cable is routed away from sharp edges, hot or vibrating parts. When turning handlebar while engine is running, idle speed must not vary.

Throttle Cable Adjustment

⚠ WARNING

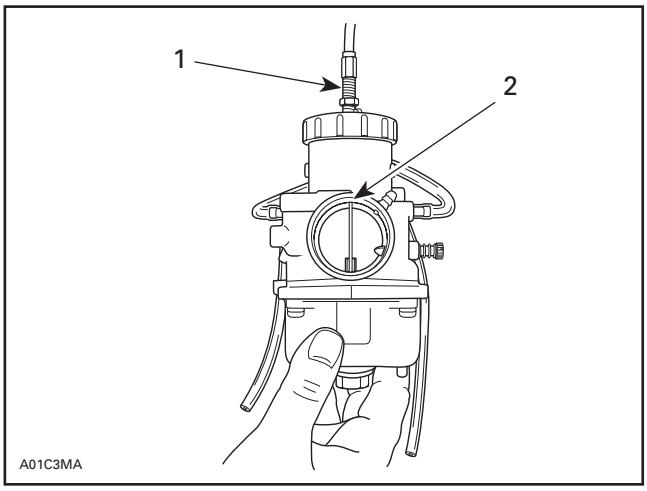
Ensure the engine is turned OFF, prior to performing the throttle cable adjustment.

Carburetors must be installed on engine and throttle cable properly routed.

For maximum performance, correct cable adjustment is critical.

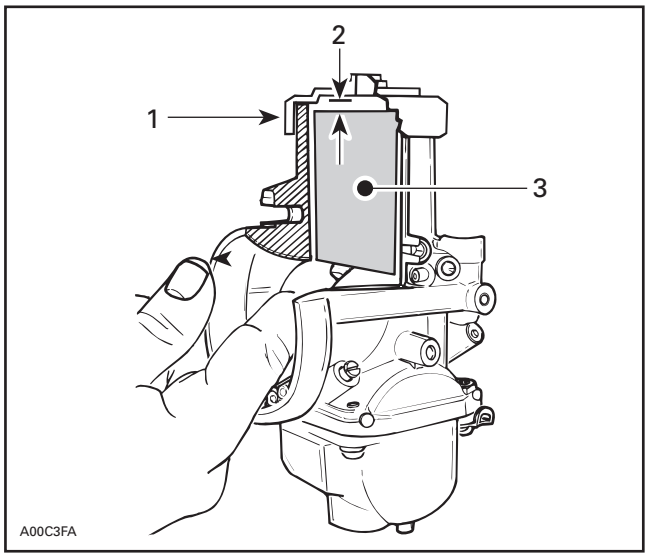
At full opening, throttle slide must be flush or 1.0 mm (.040 in) lower than the top of carburetor outlet bore (engine side). Use a mirror to look through inlet bore.

First loosen adjuster nut then turn throttle cable adjuster accordingly.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. *Throttle cable adjuster*
2. *Throttle slide flush or 1.0 mm (.040 in) lower than carburetor outlet bore (engine side)*

With the throttle lever fully depressed, check that there is a free play between the carburetor cover and top of throttle slide.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. *Cover*
2. *Free play*
3. *Throttle slide*

⚠ WARNING

This gap is very important. If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

After throttle cable adjustment, synchronized carburetors (refer to CARBURETOR SYNCHRONIZATION) and adjusted oil pump cable (refer to OIL INJECTION PUMP).

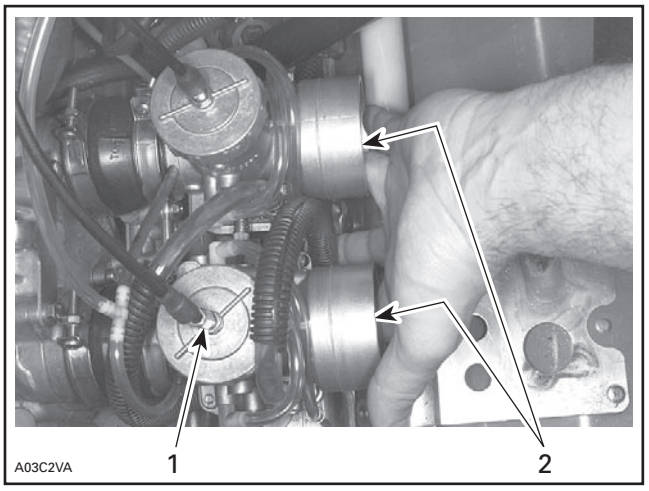
Carburetor Synchronization

Dual Carburetor Models Only

When depressing throttle lever, both carburetor slides must start to open at the same time.

Unlock cable adjustment lock nut on one carburetor.

Screw or unscrew cable adjuster until both carburetor slides start to open at same time. Cable play will be identical on both carburetors. Retighten jam nut.



TYPICAL
1. *Screw or unscrew adjuster*
2. *Check that both slides start to open at the same time*

Check throttle slide position at wide open throttle. Throttle slide must be flush or 1 mm (.040 in) lower than carburetor outlet bore. At that same position, check that throttle slide does not contact carburetor cover. Turn cable adjuster and recheck synchronization.

CAUTION: If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

CAUTION: On dual carburetor models, make sure both carburetors start to operate simultaneously. Do not interchange carburetors as the jetting may be different on each side. A red dot is printed on one carburetor and on the engine. Match the carburetor and the engine dots when applicable.

CAUTION: The oil injection pump adjustment must be checked each time carburetor is adjusted. Refer to OIL INJECTION SYSTEM.

IDLE SPEED FINAL ADJUSTMENT

Idle Speed Screw

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked each time carburetor is adjusted. Refer to OIL INJECTION SYSTEM.

Start engine and allow it to warm then adjust idle speed **no. 7** to specifications by turning idle speed screw clockwise to increase engine speed or counterclockwise to decrease it.

NOTE: On twin-carburetor models, turn adjustment screw the same amount to keep carburetors synchronized.

NOTE: Refer to TECHNICAL DATA for the specifications.

CAUTION: Do not attempt to set the idle speed by using the air screw. Severe engine damage can occur.

CHOKE

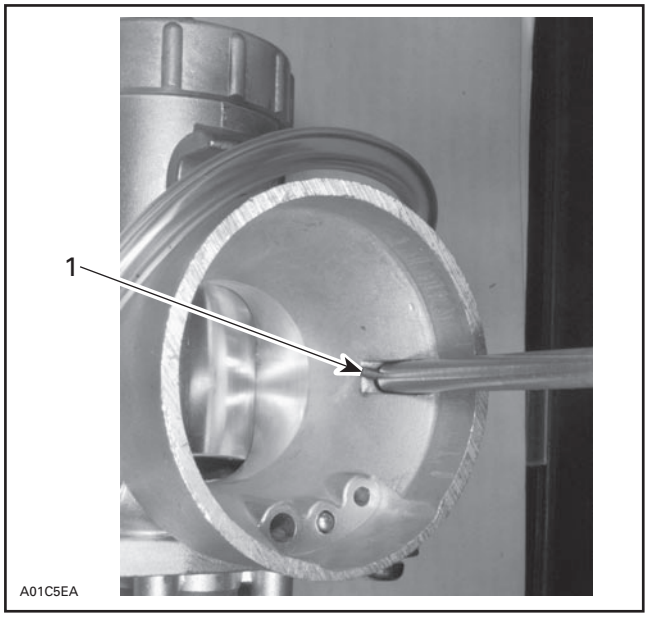
Skandic LT/WT/SWT/WT LC

Choke Plunger Adjustment

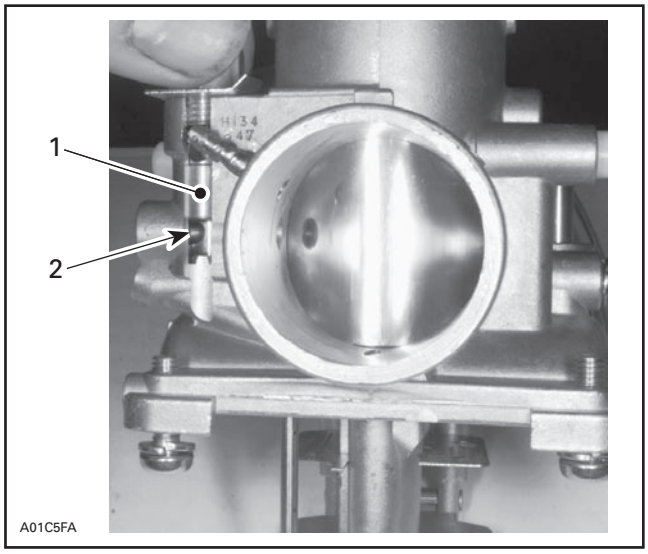
Set choke lever to fully open position.

CHOKE LEVER — FULLY OPEN POSITION

Insert choke plunger tool (P/N 529 032 100) into choke air inlet of each carburetor. Tool stopper may not lean against recess wall. Though it must be within 1 mm (.040 in) of recess wall.



AIR SILENCER SIDE SHOWN
1. Tool stopper within 1 mm (.040 in) of recess wall

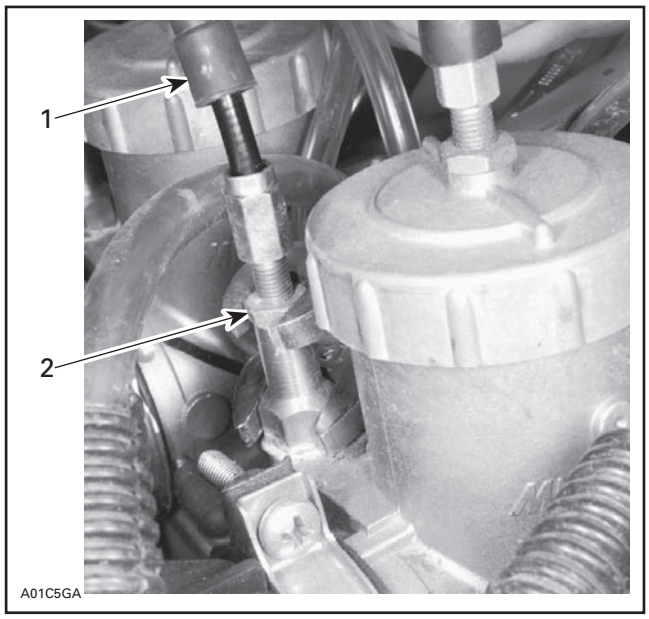


CUT-AWAY (ENGINE SIDE SHOWN)
1. Choke plunger
2. Tool properly seated under choke plunger

If tool tip does not sit under choke plunger **no. 15**, adjust as follows:

Make sure choke lever is at fully open position.

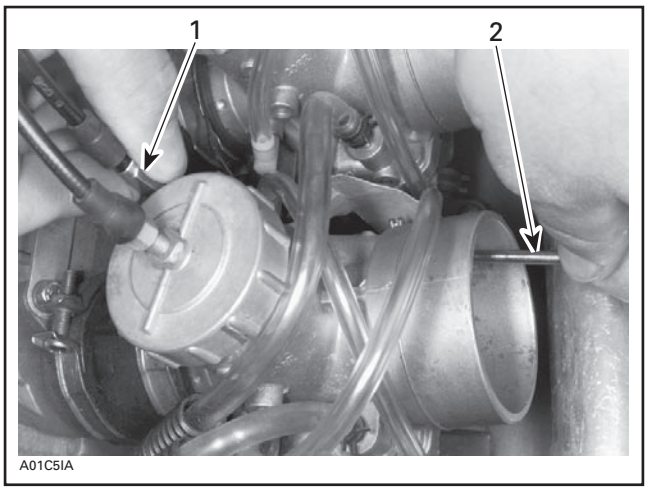
Lift up protector cap and loosen choke cable lock nut, as shown in the next photo.



1. Lift up protector cap
2. Loosen lock nut

Turn choke cable adjustment nut by hand until tool properly sits under choke plunger.

NOTE: A light pressure is be needed to position tool under plunger.



1. Choke cable adjustment nut
2. Choke plunger tool

Tighten choke cable lock nut and reinstall protector cap.

Set choke lever to close and open positions and ensure that tool properly seats under plunger only when lever is set to fully open position.

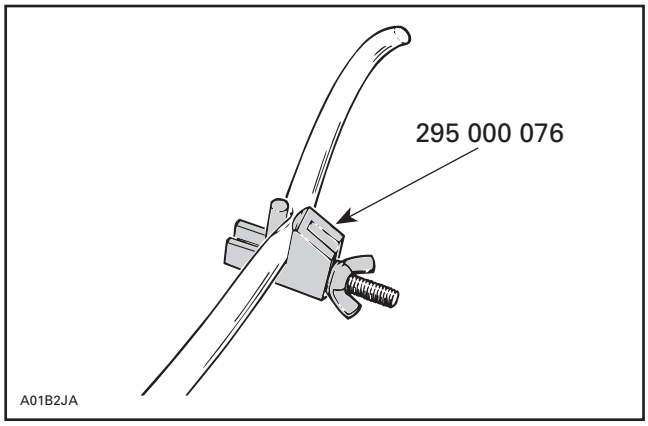
Set choke lever to close position and, by pulling and pushing choke lever, make sure there is no tension on cable (free play).

CHOKE LEVER — CLOSED POSITION

FUEL PUMP

REMOVAL

Install a hose pincher (P/N 295 000 076) on fuel supply line close to pump inlet.



Disconnect fuel outlet line(s).

Disconnect impulse line.

Remove screws securing fuel pump.

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 release under vacuum.

NOTE: On model fitted with 2 outlets, plug 1 outlet with finger while checking outlet valve.

To check impulse diaphragm and gasket on high-supply fuel pump equipped with twin outlets, proceed as follows:

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover. Either apply pressure or vacuum using the vacuum/pressure pump kit (P/N 529 021 800). The diaphragm/gasket must not leak.

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 a 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.

High-supply pump with twin outlets: Thoroughly clean filter on top cover. Replace pump if too dirty.

INSTALLATION

To install, inverse removal procedure.

⚠ WARNING

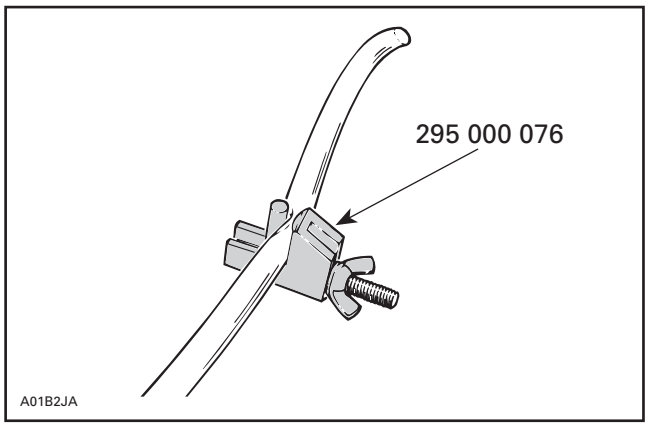
Pressure test to ensure there is no leak in fuel system.

FUEL TANK

Fuel Tank Lines

⚠ WARNING

When draining a fuel tank or whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or equivalent device. Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.



Impulse/Fuel Lines Spring Clips

Always reposition spring clips after any repair to prevent possible leaks.

LEAK TEST

VERIFICATION

Before performing the cylinder leak test, verify the following:

– clamp(s) tightness
– radiator and hoses
– oily contamination on leak indicator hole means a damaged oil seal on water pump shaft
– coolant out of leak indicator hole means a damaged rotary seal on water pump shaft (refer to COOLING SYSTEM)
– coolant escaping from water pump housing means damaged gasket(s) and/or loosened screws (refer to COOLING SYSTEM).

NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

LEAK TEST PROCEDURE

NOTE: The following instructions are valid for both cylinders.

PREPARATION AND TEST

NOTE: The following procedures should be done with a cold engine.

PREPARATION

Disconnect battery.

⚠ WARNING

Always respect this order for disassembly; disconnect BLACK (-) cable first. Electrolyte or fuel vapors can be present in engine compartment and a spark may ignite them and possibly cause personal injuries.

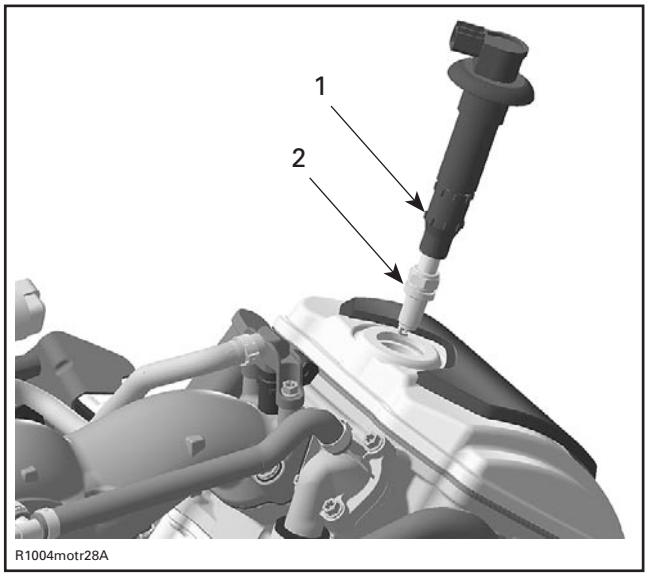
Remove:

– radiator cap.

Unplug and remove ignition coil.

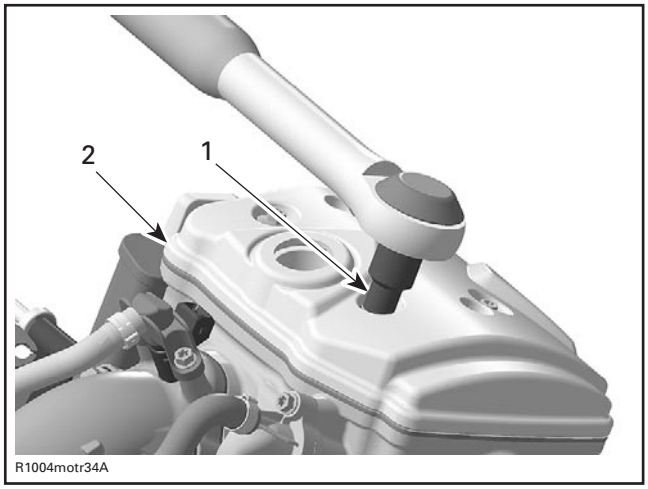
Remove spark plug from cylinder head.

NOTE: Ignition coil can help removing spark plug.



1. Ignition coil
2. Spark plug

Remove valve cover.

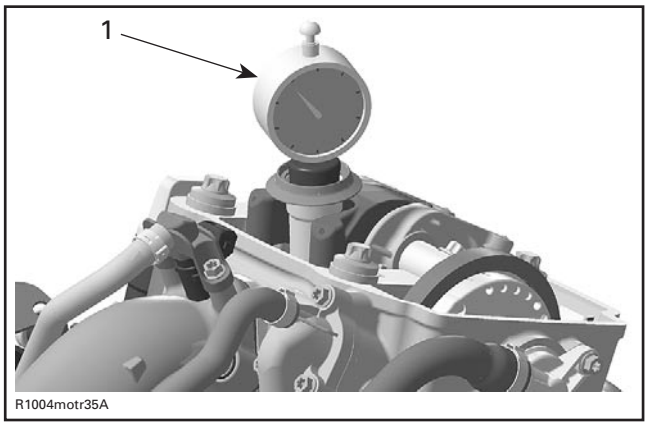


1. Ratchet wrench
2. Valve cover

Preparation

Using a dial gauge set the crankshaft and the piston to precisely ignition TDC. If a dial gauge is not available, use a screwdriver or another similarly suitable tool.

NOTE: The engine must be set to precisely ignition TDC; if this is not ensured the engine will continue to rotate when pressure builds up.



1. Dial gauge

Connect to adequate air supply.

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Install gauge adapter into previously cleaned spark plug hole.

Supply combustion chamber with air pressure.

Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 7%	Excellent condition
8% to 15%	Fair condition; proceed with tune-up or adjustment
16% to 30%	Poor condition; engine will run but performance might be down in some cases.
30% and higher	Very poor condition, diagnose and repair engine.

Diagnose

Listen for air leaks.

- air escaping on intake port/carburetor means leaking intake valve(s)
- air escaping on exhaust port means leaking exhaust valve(s)
- air bubbles out of radiator means leaking cylinder head gasket
- air/oil escaping from crankcase means damaged gasket and/or loosened screws (refer to CRANKCASE)
- air/coolant escaping from cylinder/head means damaged gasket(s) and/or loosened screws (refer to CYLINDER AND HEAD)
- air escaping into crankcase area means excessively worn cylinder and/or broken piston rings.

NOTE: For all the checkpoints mentioned above see the appropriate engine section to diagnose and repair the engine.

INSTALLATION

NOTE: Within the course of the assembly, always replace the valve cover gasket.

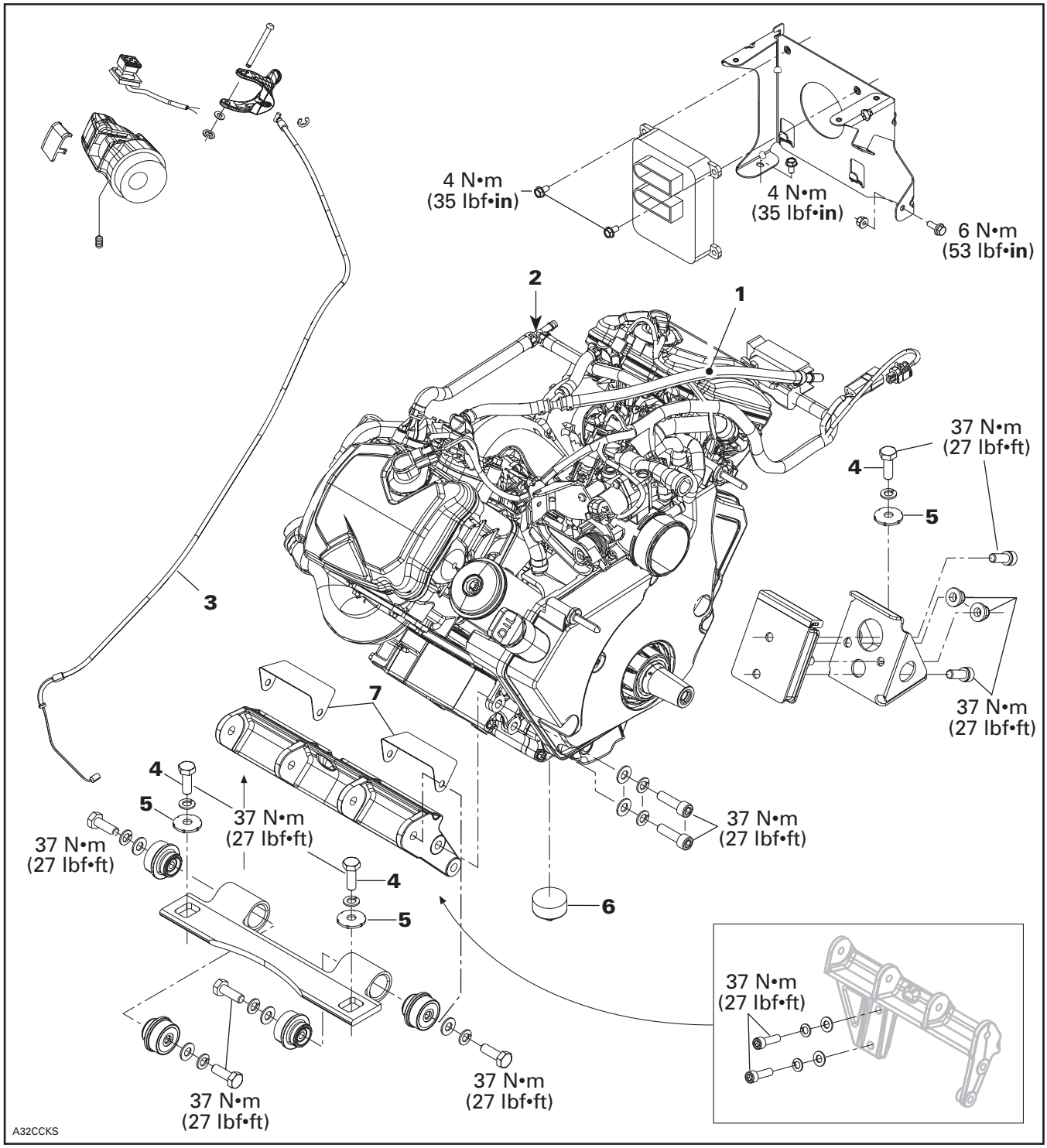
Torque valve cover screws to 9 N•m (80 lbf•**in**).

Torque spark plugs to 17 N•m (150 lbf•**in**).

Slightly oil the bottom outer part of the stick coil. This will simplify installation.

For installation, reverse the preparation procedure.

REMOVAL AND INSTALLATION



ENGINE REMOVAL

Use B.U.D.S. to release fuel pressure. Refer to B.U.D.S. instructions.

Disconnect battery.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

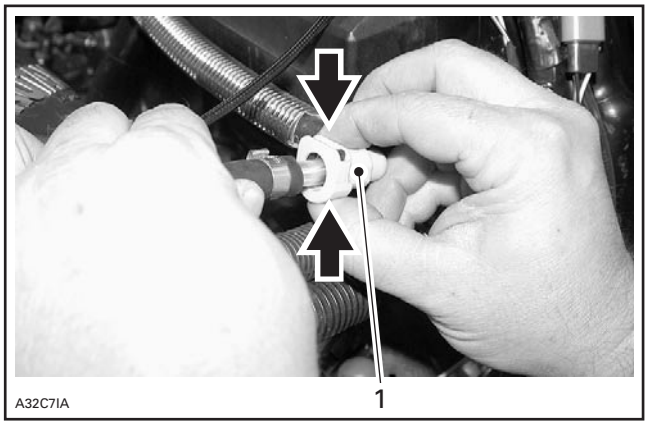
⚠ WARNING

Never charge or boost battery while installed. Battery contains sulfuric acid which is corrosive and poisonous. In case of contact with skin, flush with water and call a physician immediately.

⚠ WARNING

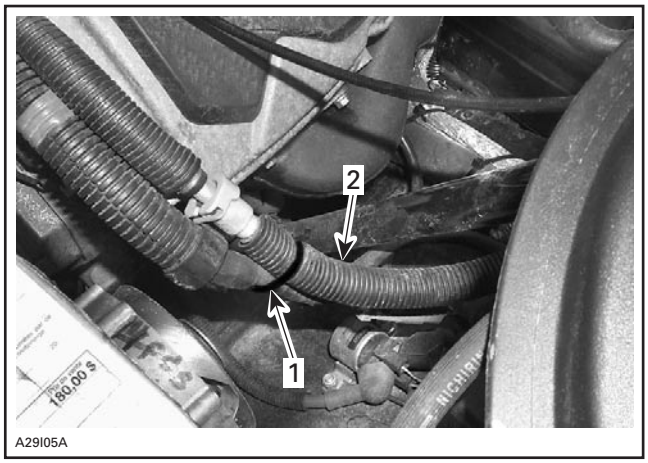
Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Unplug fuel supply line no. 1 by squeezing spring lock of plastic female coupling.



1. Plastic female coupling

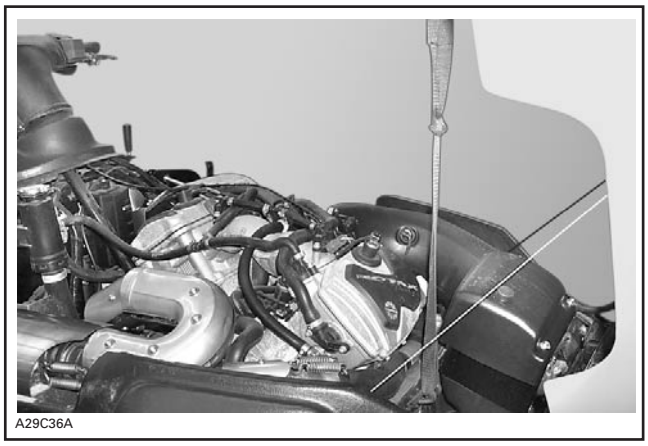
Cut locking tie retaining fuel supply line to engine harness.



1. Locking tie
2. Fuel supply line

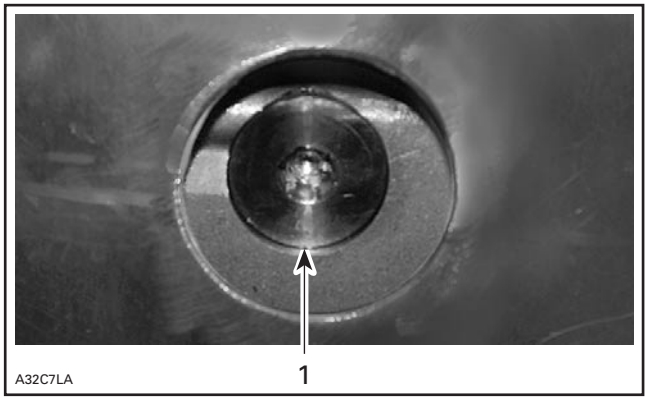
Lift front of vehicle by the front cross member.

CAUTION: Never lift front of 4-TEC models by the front bumper.



NOTE: At this point, drain engine oil only if engine needs repair.

Working underneath bottom pan, remove oil drain plug then lift oil filter cover.



1. Oil drain plug

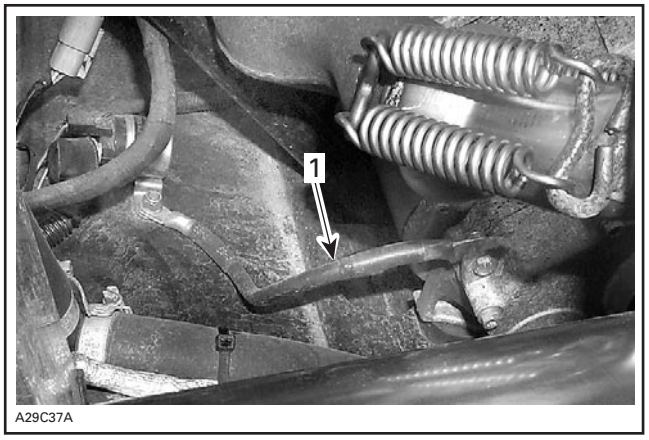
Drain the engine oil.

Put back vehicle on the ground.

Remove muffler and pipes.

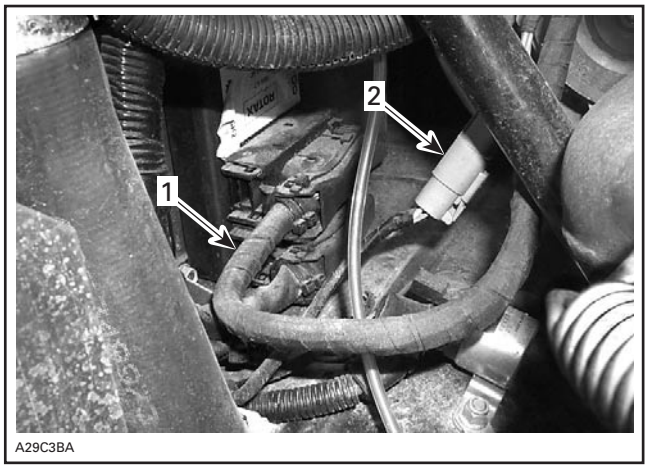
Remove coolant reservoir cap. Siphon as much coolant as possible.

Disconnect the following:
- bottom hose from thermostat housing
- side hose from thermostat housing
- air bleed hose from T-fitting **no. 2**
- alternator
- ground cable from engine.



1. Ground cable

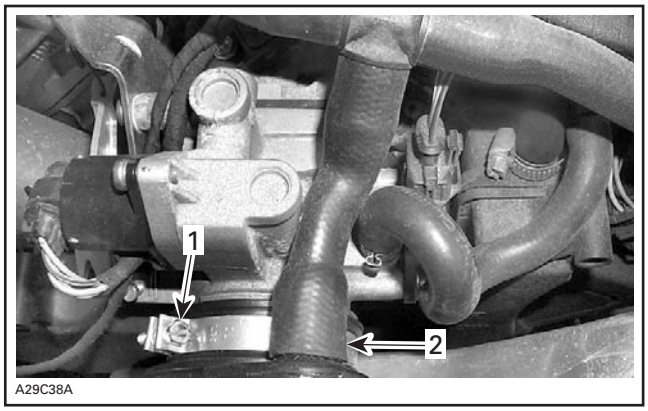
Disconnect engine harness connectors (top one) from ECM (engine control module) and main harness.



1. ECM
2. Main harness

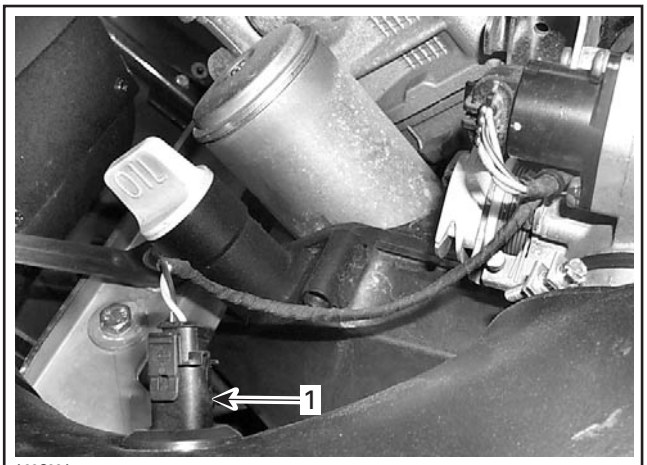
Loosen collar screw on air silencer grommet.

Disconnect blow-by hose from air silencer.



1. Collar screw
2. Blow-by hose

Disconnect air temperature sensor at rear of air silencer.



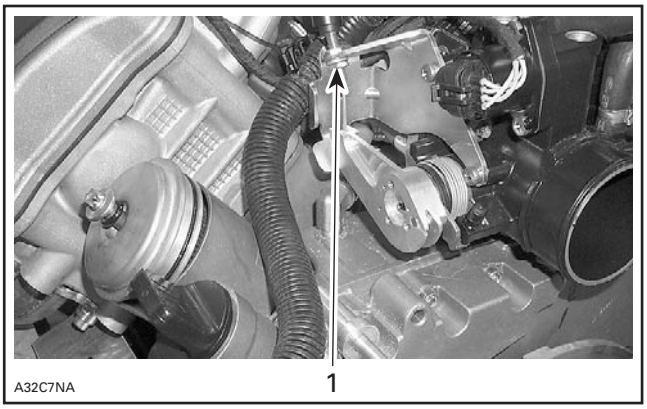
1. Air temperature sensor

Remove air silencer.

Remove guard, drive belt, drive pulley.

Disconnect the starter RED (+) cable from starter.

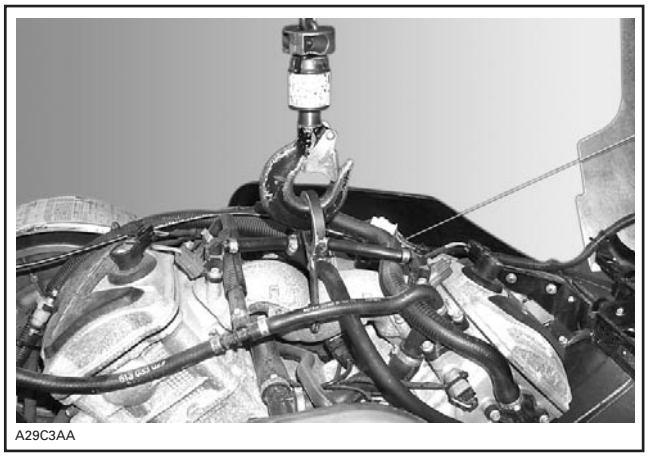
Disconnect throttle cable **no. 3** from throttle body.



1. Throttle cable attachment

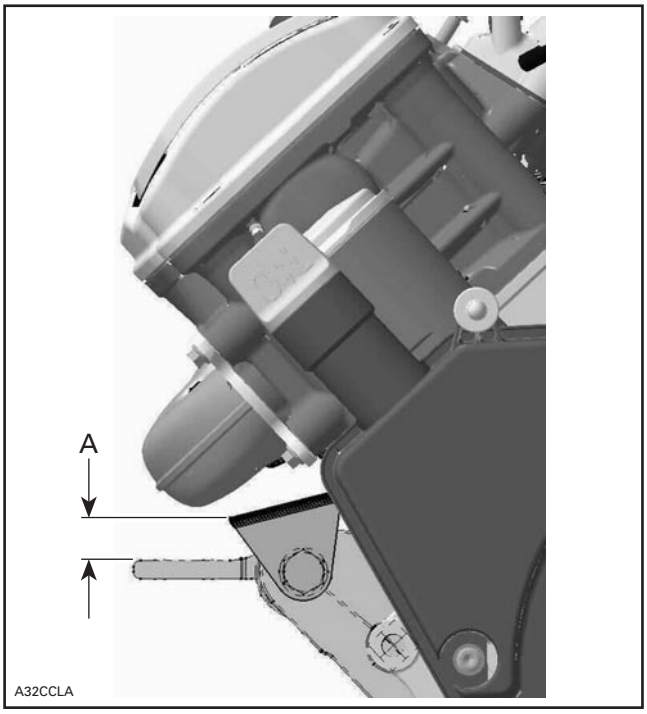
Remove screws **no. 4** of engine supports.

Hook up engine by lifting eye located on intake manifold. Using appropriate lifting device, remove engine from vehicle.



ENGINE INSTALLATION

Before engine installation, make sure that the front deflectors **no. 7** are positioned as per following illustration.



A. 10 ± 1.5 mm (1/2 ± 1/16 in)

Before engine installation make sure a good condition stopper **no. 6** is in place.

To install engine on vehicle, reverse removal procedure. However, pay attention, to all appropriate component/system reinstallation procedures described throughout this *Shop Manual* and to the following:

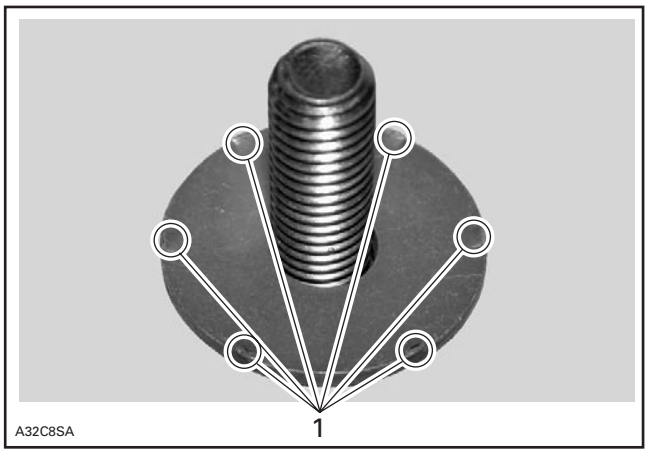
Check pulley alignment and drive belt height.

Install doughnut shaped exhaust gasket with both notches aligned with Y-manifold protrusions.

NOTE: No sealant required on doughnut shaped exhaust gasket.

Torque screws **no. 4** of engine supports to 37 N•m (27 lbf•ft).

NOTE: Install washers **no. 5** with the teeth toward the support.



1. Teeth

Do not forget to connect air temperature sensor to air silencer otherwise a fault code will appear.

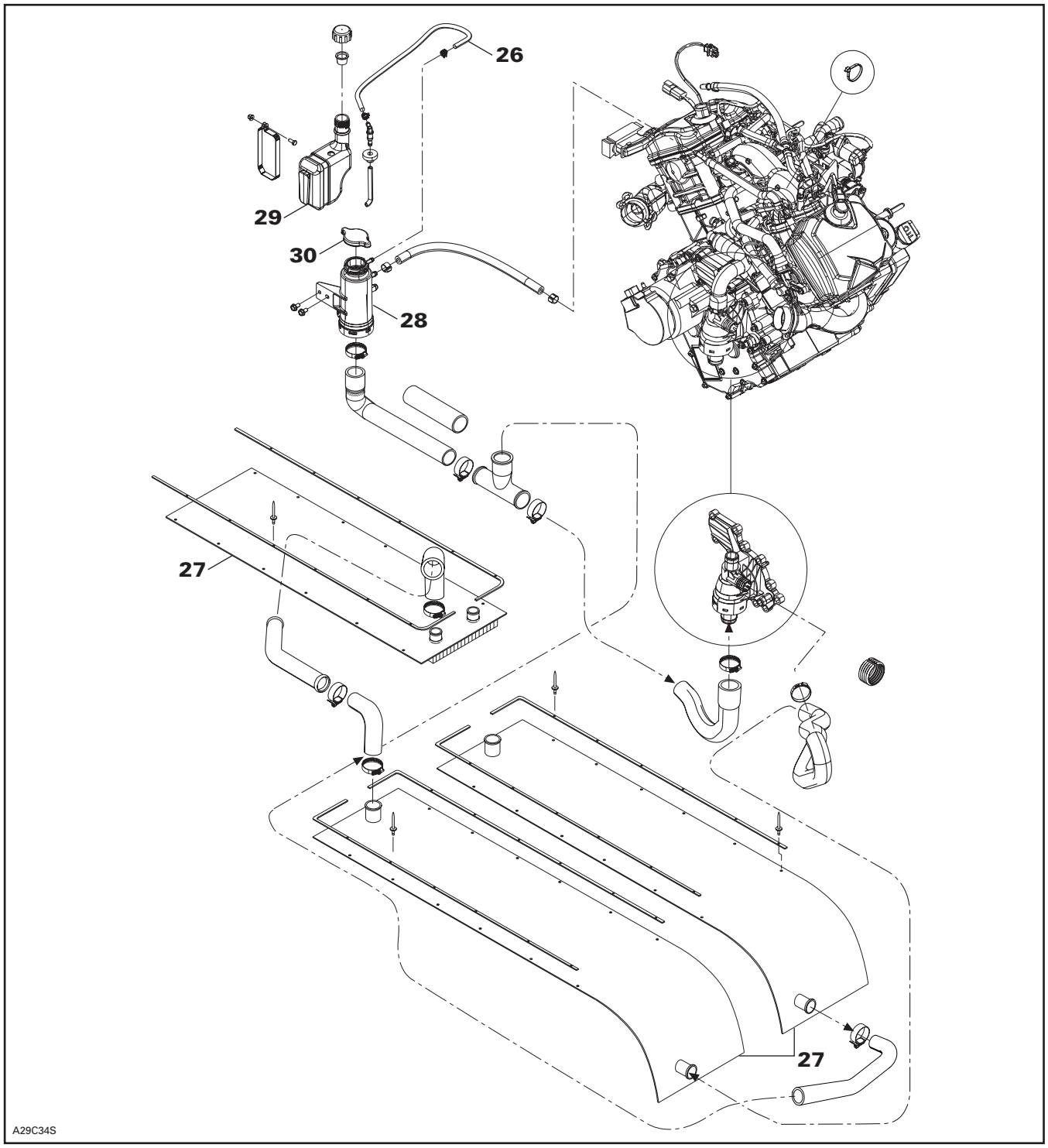
COOLING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
engine leak tester kit	861 749 100	186
hand pump	529 021 800	186
hose pincher	295 000 076	186
oil seal pusher	529 035 757	192
seal installer	529 035 766	192
special radiator cap	529 021 400	186

SERVICE PRODUCTS

Description	Part Number	Page
50/50 PREMIXED COOLANT - 37°C (- 35°F)	293 600 038	186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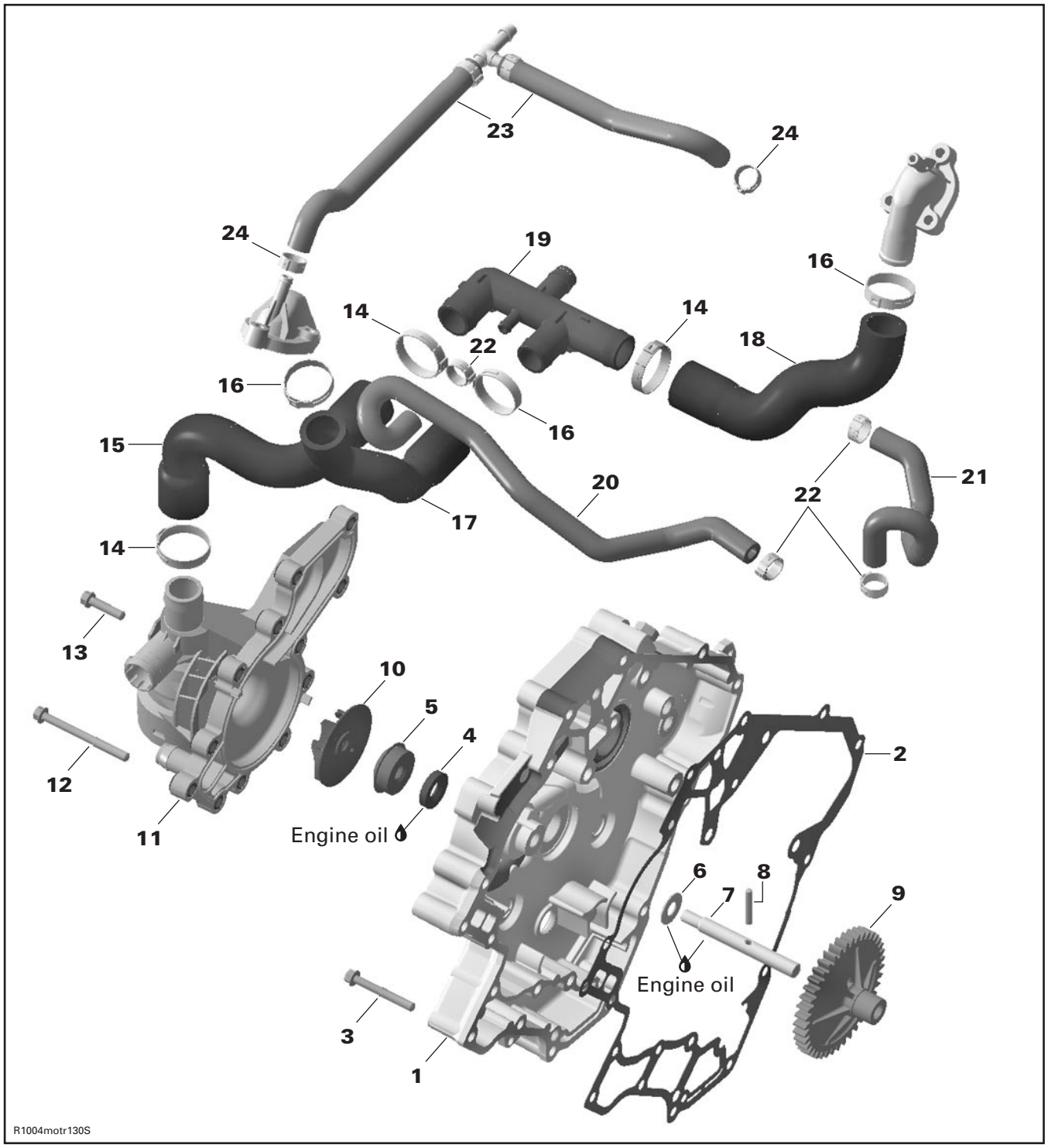
A29C34S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17
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5
4
12
11
Engine oil
2
6
8
7
9
Engine oil
3
1
R1004motr130S

COOLING SYSTEM LEAK TEST

⚠ WARNING

To prevent burning yourself, do not work on cooling system when the engine is hot.

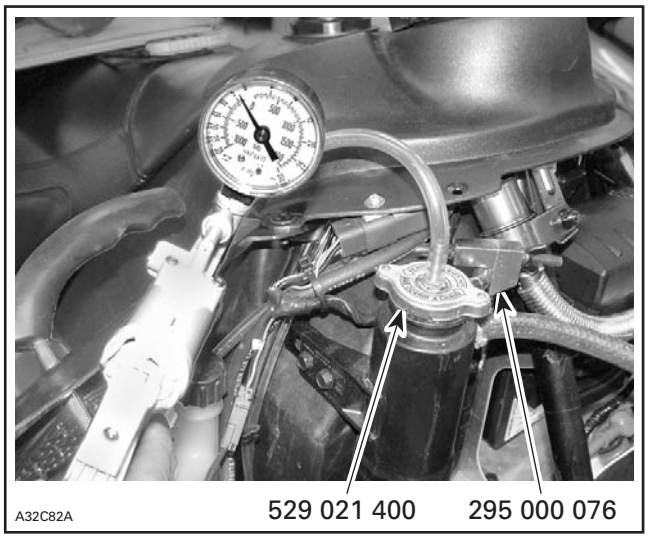
Remove pressure cap **no. 30**.

Install special radiator cap (P/N 529 021 400) included in engine leak tester kit (P/N 861 749 100) on coolant tank **no. 28**.

Install hose pincher (P/N 295 000 076) on overflow hose **no. 26**.

Using the hand pump (P/N 529 021 800) pressurize all system through coolant tank to 120 kPa (17 PSI).

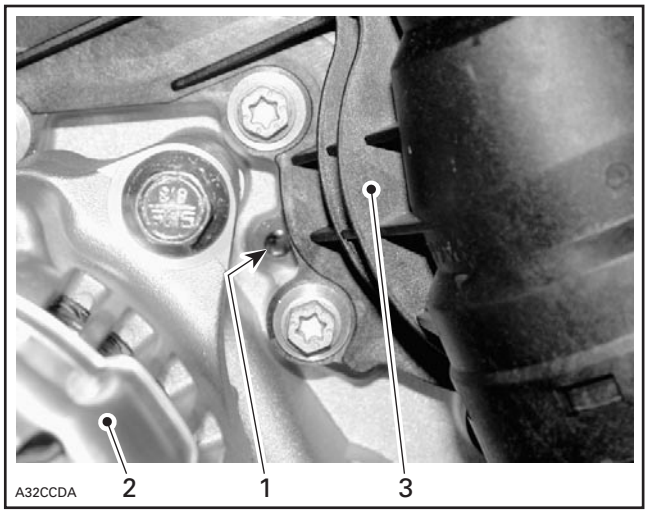
Check all hoses, radiators **no. 27** and cylinder/base for coolant leaks.



INSPECTION

Check general condition of hoses and clamp tightness.

Check leak indicator hole to see if there is oil or coolant.



1. Leak indicator hole
2. Alternator
3. Water pump

NOTE: Flowing coolant indicates a damaged rotary seal **no. 5**. Oil out of the leak indicator hole indicates a defective oil seal **no. 4**.

COOLANT REPLACEMENT

Recommended Coolant

IMPORTANT: USE THE 50/50 PREMIXED COOLANT - 37°C (- 35°F) (P/N 293 600 038).

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the recommended coolant.

System Capacity

Refer to TECHNICAL DATA.

Draining the System

⚠ WARNING

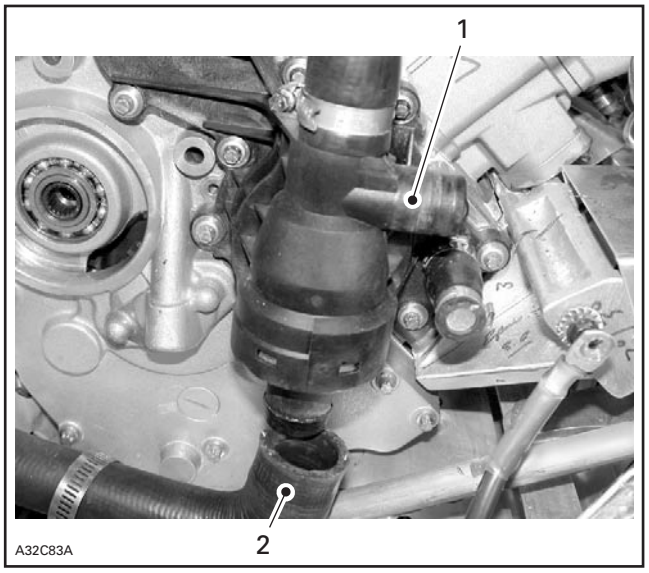
To prevent burning yourself do not work on cooling system when the engine is hot.

Remove pressure cap **no. 30**.

Siphon as much coolant through coolant tank **no. 28**.

Empty the overflow coolant tank **no. 29**.

Disconnect side hose and bottom hose from thermostat housing.

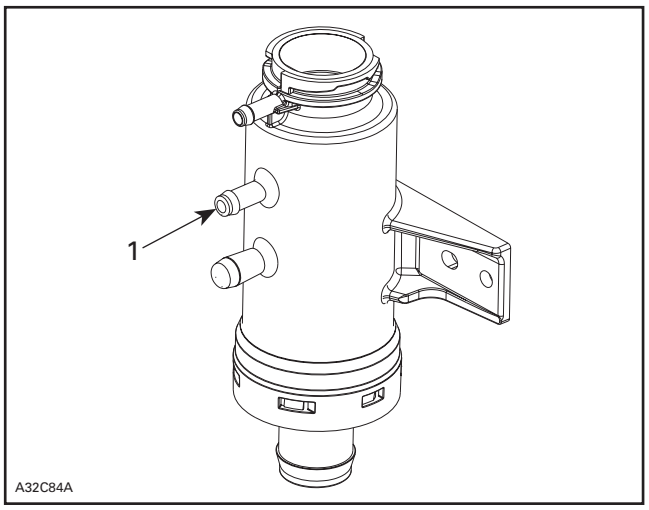


1. Side hose location
2. Bottom hose

Let coolant drain.

Refilling the System

With vehicle on a flat surface, engine cold, slowly half fill coolant tank **no. 28**. Coolant level must not reach bleed hose nipple to allow air to escape from the system.



1. Bleed hose nipple

Coolant level will be stable once coolant tank is half filled.

Do not install the pressure cap **no. 30**.

Start engine. Check level in coolant tank. Refill with coolant to keep coolant tank half filled.

CAUTION: Never allow coolant tank to be empty during the filling procedure.

Let engine idling for about 10 minutes or until radiators are warm — which means that the thermostat is open.

Keep engine idling for an additional 5 minutes maximum or until coolant temperature reaches 100°C (212°F). Always keep coolant tank half filled but the bleed hose free.

CAUTION: Never allow coolant to exceed 100°C (212°F). Put a thermometer in coolant tank to monitor the temperature.

Stop engine. Fill up both coolant tank **no. 28** and overflow coolant tank **no. 29**. Install their respective caps.

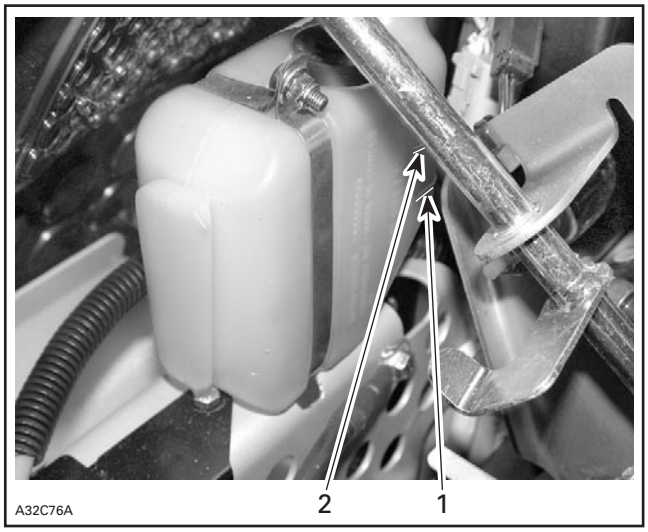
Let vehicle cool down for at least 30 minutes.

Check coolant level in overflow coolant tank **no. 29**. Some coolant should have been sucked through the overflow hose up to the coolant tank. If not repeat refilling procedure.

If some coolant have been siphoned from the overflow coolant tank **no. 29**, remove pressure cap **no. 30** and fill up the coolant tank **no. 28**. Reinstall pressure cap **no. 30**.

Fill overflow coolant tank **no. 29** to maximum level line.

Recheck coolant level after vehicle has completely cooled down. Coolant tank **no. 28** must be full and the level in overflow coolant tank **no. 29** must be between the minimum and maximum marks.



1. Minimum
2. Maximum

After the first few kilometers (miles) of running recheck level.

COOLANT HOSES

Any damaged/leaky or brittle coolant hose or component must be replaced. When replacing a hose, also replace the clamps.

At installation, do not twist or bend the hoses.

WATER PUMP HOUSING/THERMOSTAT

The thermostat is a dual action type.

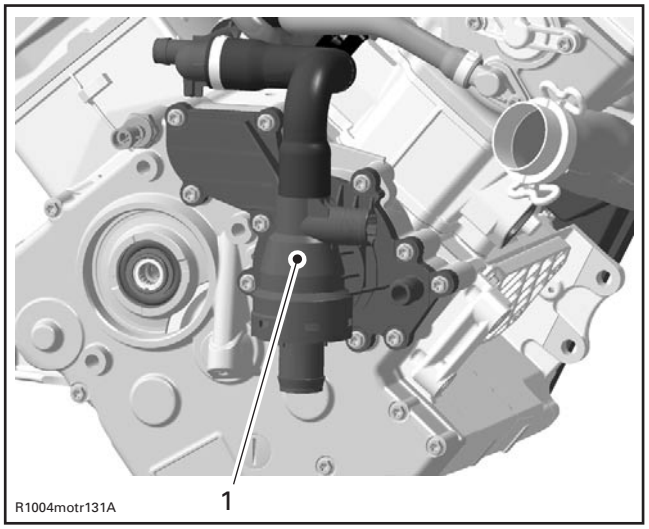
Removal

NOTE: The thermostat is located on the ignition cover. Thermostat and water pump housing form one unit and can only be replaced as one complete component.

Drain cooling system (refer to DRAINING THE SYSTEM above).

Remove:

– water pump housing screws **no. 12** and **no. 13** and pull water pump housing **no. 11**.



1. Water pump housing with screws and thermostat inside

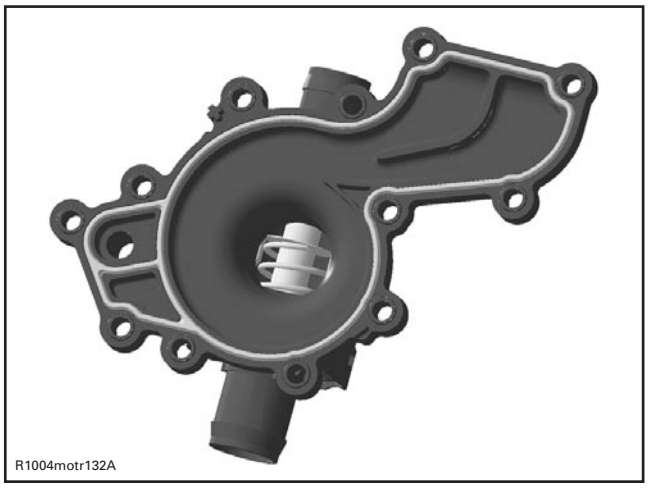
Test

To check thermostat, put in water and heat water. Thermostat should open when water temperature reaches 80°C (176°F).

Inspection

Check the water pump housing for cracks or other damage.

Replace water pump housing if damaged.



WATER PUMP HOUSING WITH GASKET

Installation

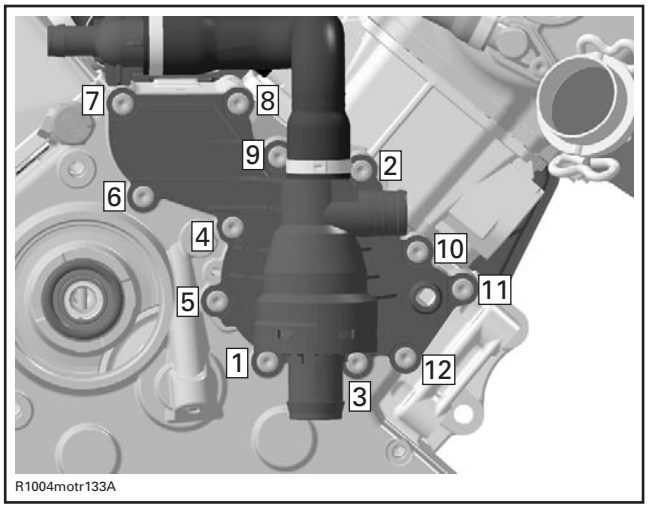
The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the gasket of the water pump housing.

Torque water pump housing screws to 9 N•m (80 lbf•**in**).

CAUTION: To prevent leakage, make sure the gasket is exactly in the groove when the water pump housing is reinstalled.

Tightening sequence for screws on water pump housing is as per following illustration.



R1004motr133A

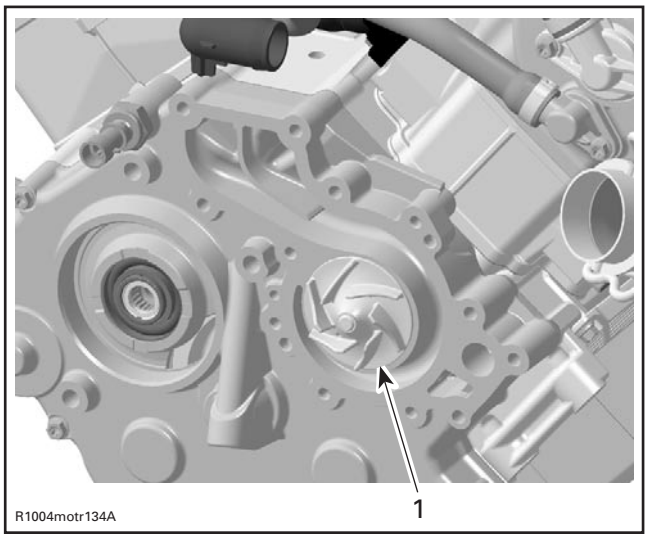
WATER PUMP IMPELLER

Removal

Remove:

– water pump housing **no. 11**
– impeller **no. 10**.

Using pliers, carefully turn the impeller anti-clockwise to remove it from the water pump shaft without any damage. The thread of the water pump shaft is right-hand.



R1004motr134A

1. Impeller

Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

CAUTION: Be careful not to damage impeller wings during installation. Tighten impeller to 7 N•m (62 lbf•**in**).

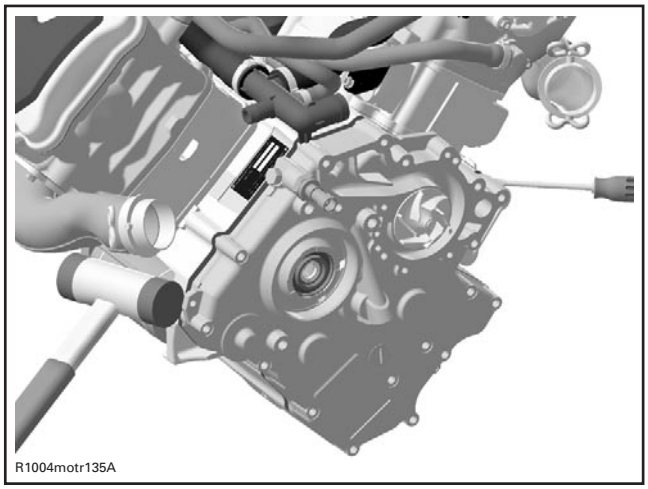
IGNITION COVER

Removal

Remove:

– drain lubrication system (refer to OIL CHANGE)
– alternator (refer to ALTERNATOR)
– water pump housing **no. 11**
– impeller **no. 10**
– screws **no. 3** and pull ignition cover **no. 1**.

Carefully remove the ignition cover using a screwdriver and a plastic hammer.


R1004motr135A

Ball Bearing Removal Procedure

NOTE: Heat ignition cover up to 100°C (212°F) before removing ball bearings.

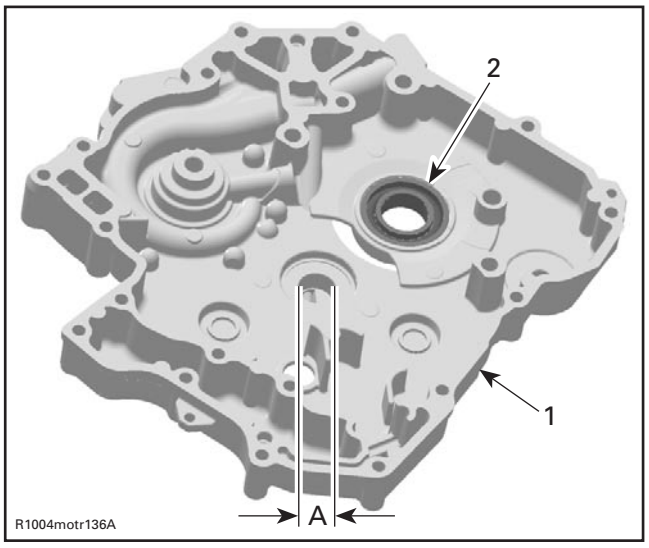
⚠ WARNING

Clean oil, outside and inside ignition cover before heating it.

NOTE: Using a suitable arbor, eject the ball bearing with slight hammer blows towards the inside. The ignition cover has to be supported from below in order to prevent damage of the sealing surface.

Inspection

Check oil supply hole/support bearing for scorings or other damages. There are no plain bearings in the ignition cover.



1. Ignition cover
2. Ball bearing
A. Oil supply hole/support bearing diameter

NOTE: Measure oil supply hole/support bearing diameter. Compare to crankshaft journal diameter on alternator (refer to CRANKSHAFT). Replace the ignition cover if the measurement is out of specification.

DIAMETER OF OIL SUPPLY HOLE/ SUPPORT BEARING	
SERVICE LIMIT	20.040 mm (0.7889 in)

NOTE: Check ball bearing for excessive play and smooth operation. Replace if necessary.

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

Ball Bearing Installation Procedure

NOTE: Heat ignition cover up to 100°C (212°F) before installing ball bearing.

⚠ WARNING

Clean oil, outside and inside housing before heating it.

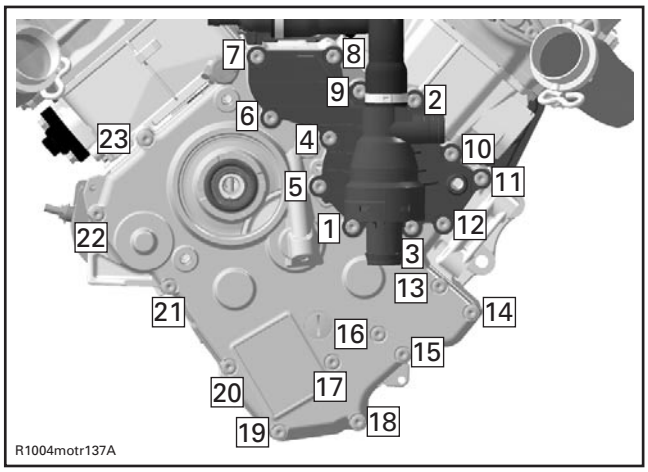
Place new ball bearing in freezer for 10 minutes before installation.

NOTE: Do not use any striking tool to insert the ball bearing. The bearing must be mounted manually with moderate (thumb) pressure into the ignition cover.

Replace gasket **no. 2**.

Torque ignition cover screws to 9 N•m (80 lbf•**in**).

Tighten screws in the following sequence.

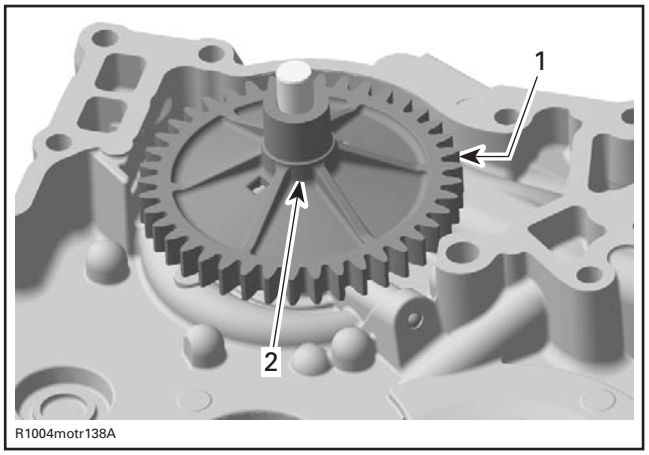


WATER PUMP SHAFT

Removal

Remove:

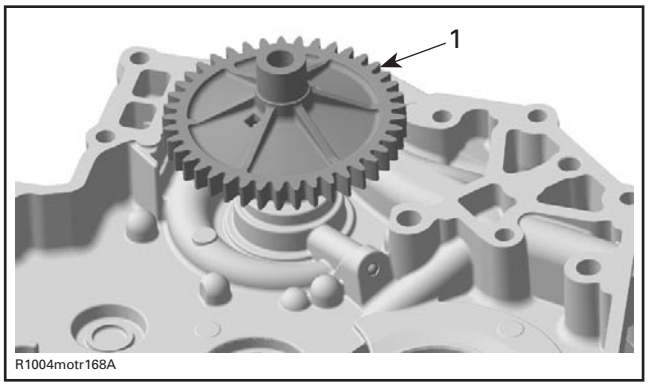
– water pump housing **no. 11**
– impeller **no. 10**
– ignition cover



1. Water pump gear
2. Thrust washer behind water pump gear

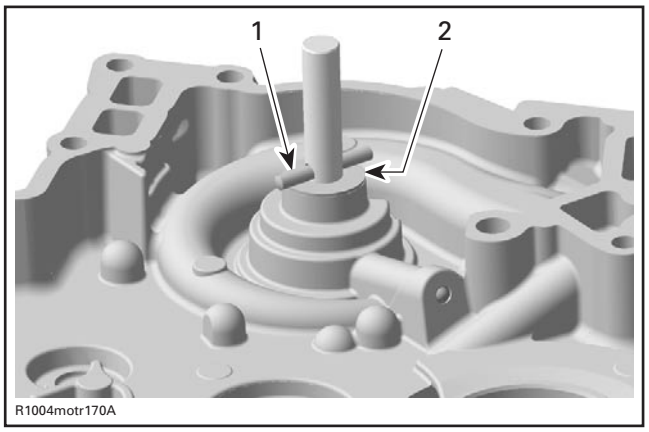
– water pump gear **no. 9**

NOTE: The water pump gear is held by a needle pin on the water pump shaft.



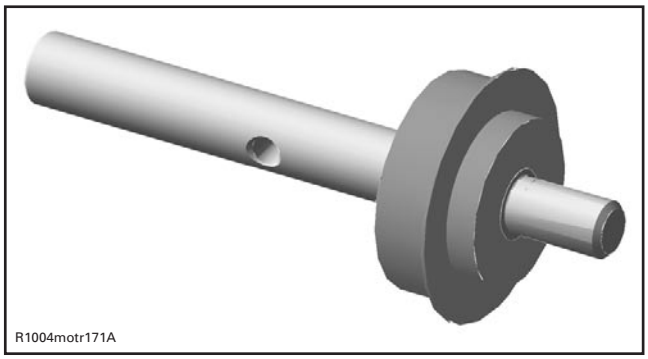
1. Water pump gear

– needle pin **no. 8** and thrust washer **no. 6**.

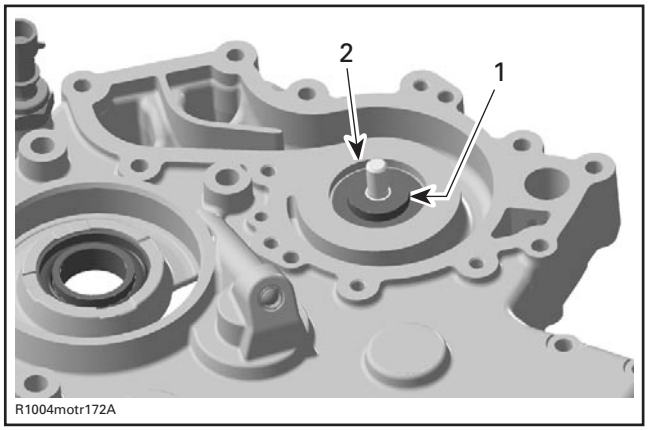


1. Needle pin
2. Thrust washer

CAUTION: When removing water pump shaft, always replace rotary seal with water pump shaft no. **7** and oil seal no. **4** (behind rotary seal).



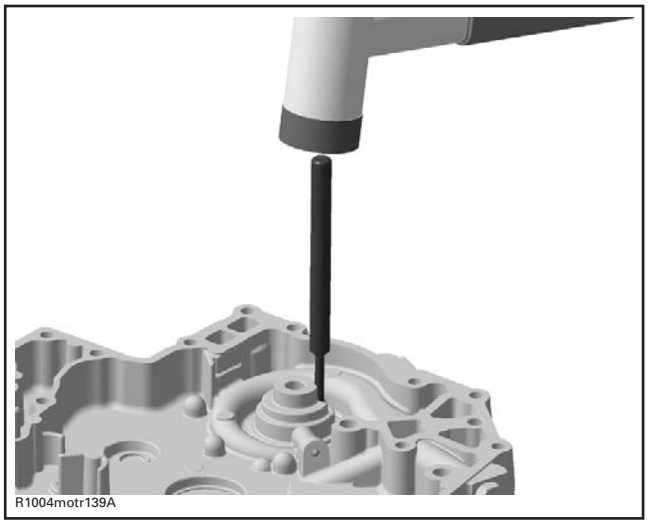
WATER PUMP SHAFT WITH ROTARY SEAL



1. Oil seal behind the rotary seal
2. Rotary seal bore

Extract the water pump shaft with rotary seal **no. 5** together with oil seal **no. 4** from inside ignition cover with a pusher.

CAUTION: Be careful not to damage the surface of the rotary seal bore in ignition cover.


R1004motr139A

Inspection

Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.

Water pump shaft with rotary seal must rotate freely. Otherwise, replace it.

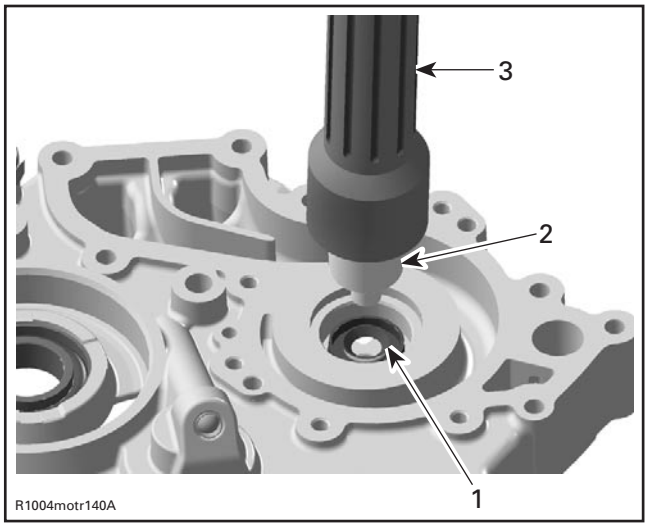
NOTE: When removing water pump shaft, always replace together retaining ring, oil seal, water pump shaft with rotary seal with new parts.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Never use oil in the press fit area of the oil seal and rotary seal.

Push water pump shaft oil seal in place by using the oil seal pusher (P/N 529 035 757).

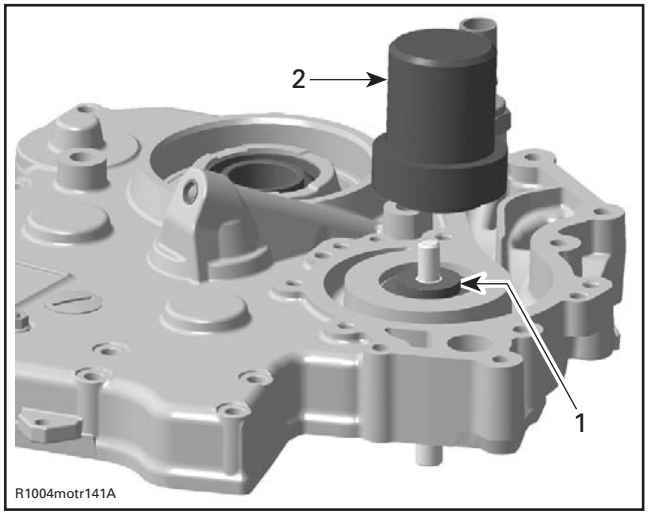


R1004motr140A

1. Oil seal for the water pump shaft
2. Oil seal pusher (P/N 529 035 757)
3. Handle for insertion jig (P/N 420 877 255)

Install the water pump shaft assembly using the water pump ceramic seal installer (P/N 529 035 766).

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



R1004motr141A

1. Water pump shaft with rotary seal
2. Water pump ceramic seal installer (P/N 529 035 766)

Mount thrust washer no. 6 and needle pin no. 8.

NOTE: The water pump shaft must be slightly preloaded by the spring of the rotary seal.

Use multi-purpose grease in water pump shaft bore.

PRESSURE CAP

Check if cap pressurizes the system. If not, install a new 110 kPa (16 PSI) cap (do not exceed this pressure).

RADIATORS

Refer to CHASSIS for radiators no. 27 removal and installation.

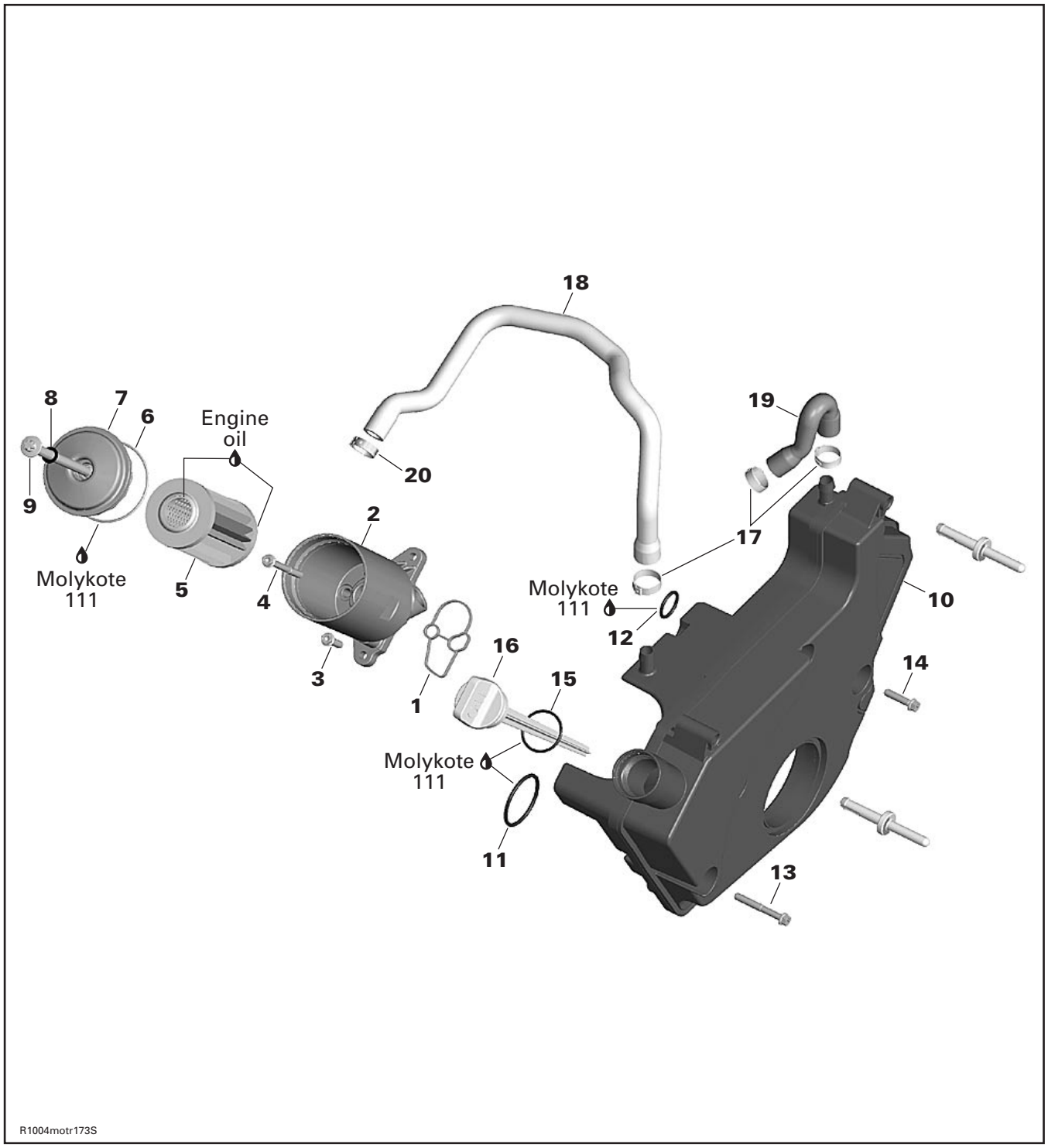
LUBRICATION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
dial indicator	414 104 700	203
fuel line remover	529 035 714	198
oil pressure adapter	529 035 652	198
oil pressure gauge	529 035 709	198
oil seal pusher	529 035 911	204

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	199
Molykote 111	413 707 000	200, 207
XP-S 0W40 synthetic 4-stroke oil (12 x 1L)	293 600 054	198


18
8
7
6
Engine
oil
19
20
9
2
17
Molykote
111
5
4
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111
10
12
3
16
14
1
15
Molykote
111
11
13
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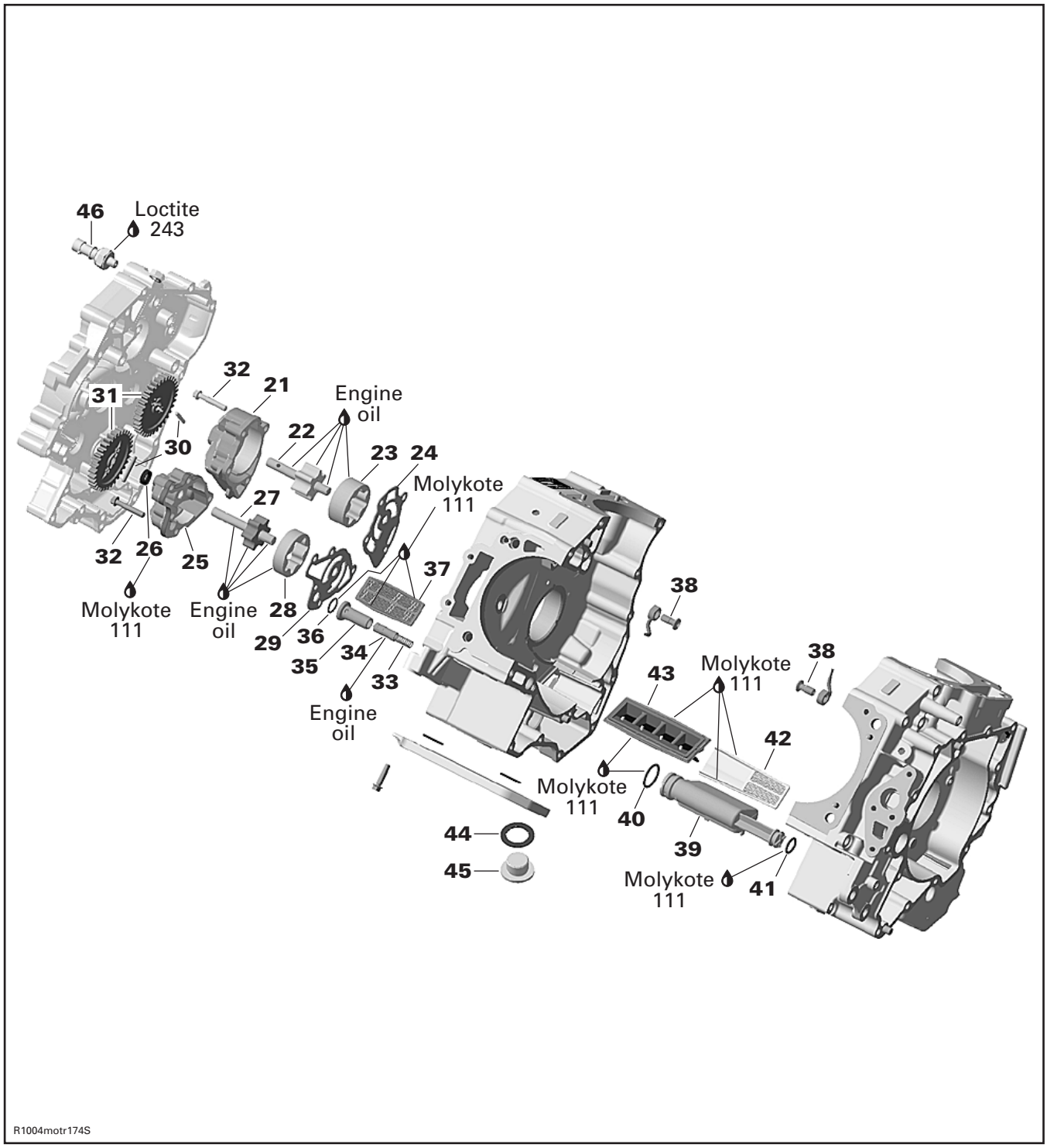

46
Loctite 243
31
32
21
Engine oil
22
23
24
Molykote 111
30
27
32
26
25
37
38
Molykote 111
Engine oil
28
29
36
35
34
33
Engine oil
38
Molykote 111
43
42
Molykote 111
40
39
44
45
Molykote 111
41
R1004motr174S

GENERAL

Prior to changing the oil, ensure vehicle is on a level surface.

Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

⚠ WARNING

The engine oil can be very hot. Wait until engine oil is warm.

At installation, use torque values and service products from the exploded view. Clean threads before using Loctite products when installing screws.

Dispose oil and filter as per your local environmental regulations.

OIL LEVEL CHECK

Snowmobile must be on a level surface.

Warm up the engine to 80°C (176°F).

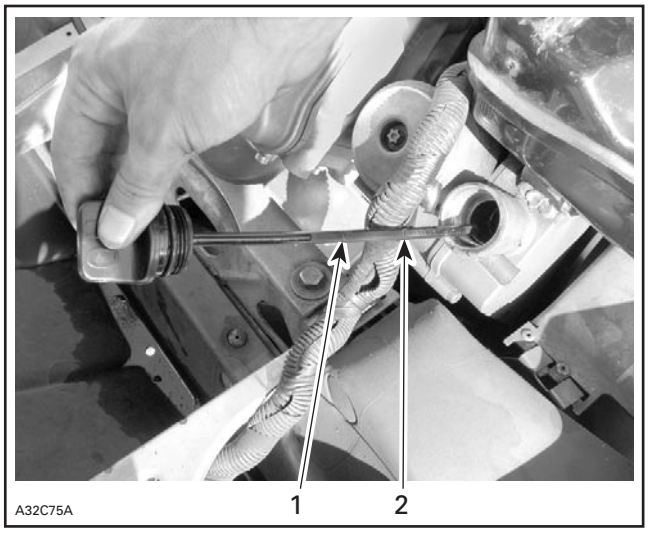
Leave engine running at idle for at least 30 seconds.

Stop engine and wipe the dipstick.

Dipstick must be completely screwed in before checking oil level.

Oil level must be between minimum and maximum marks on dipstick.

There is a capacity of 500 mL (17 U.S. oz) between the two marks.



1. Maximum
2. Minimum

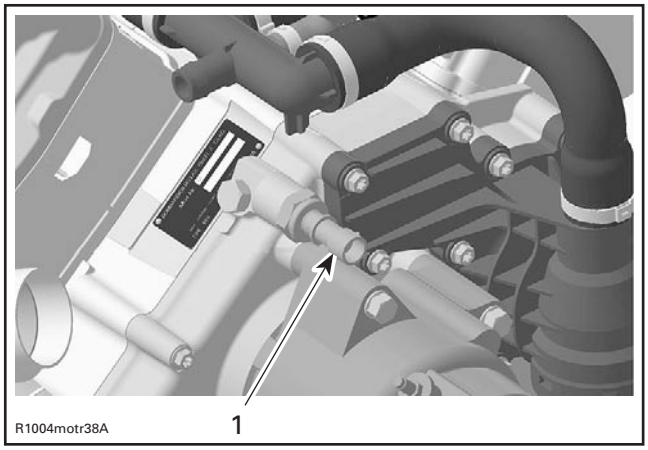
Add XP-S 0W40 synthetic 4-stroke oil (12 x 1L) (P/N 293 600 054)through dipstick hole as required.

Reinstall dipstick.

ENGINE OIL PRESSURE TEST

NOTE: The engine oil pressure test should be done with a **warm engine** 80°C (176°F) and the **recommended oil**.

Remove the oil pressure switch **no. 46** in the area of the cylinder head (intake side), mounted on the ignition cover and install the oil pressure gauge (P/N 529 035 709) and oil pressure adapter (P/N 529 035 652). Use fuel line remover (P/N 529 035 714) to unplug oil pressure adapter from oil pressure gauge.



1. Oil pressure switch

NOTE: Oil pressure switch works between 20 kPa (2.9 PSI) and 40 kPa (5.8 PSI).

The engine oil pressure should be within the following values.

OIL PRESSURE	1300 RPM	7250 RPM
MINIMAL	150 kPa (22 PSI)	400 kPa (58 PSI)
NOMINAL	200 kPa (29 PSI)	450 kPa (65 PSI)
MAXIMAL	250 kPa (36 PSI)	550 KPa (80 PSI)

If the engine oil pressure is out of specifications, check the points described in troubleshooting section.

To install oil pressure switch, reverse the removal procedure.

NOTE: Fit oil pressure switch with Loctite 243 (P/N 293 800 060).

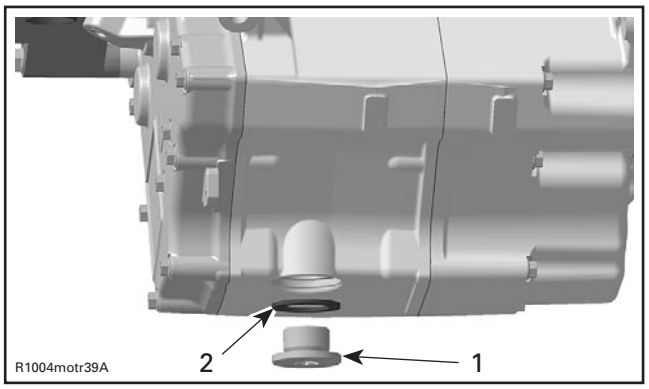
OIL CHANGE

Removal

Place a drain pan under the engine drain plug area.

Clean the drain plug area.

Unscrew drain plug **no. 45** then remove dipstick **no. 16**.



1. Drain plug
2. Gasket ring

– Unscrew retaining screw **no. 9** to drain the oil filter housing.
– Wait a while to allow oil to flow out of oil filter.

Inspection

Oil condition gives information about the engine condition. See TROUBLESHOOTING section.

Installation

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

NOTE: At installation, remember to replace the gasket ring **no. 44** of the drain plug.

Torque drain plug to 55 N•m (40 lbf•ft).

System Capacity

Refer to TECHNICAL DATA.

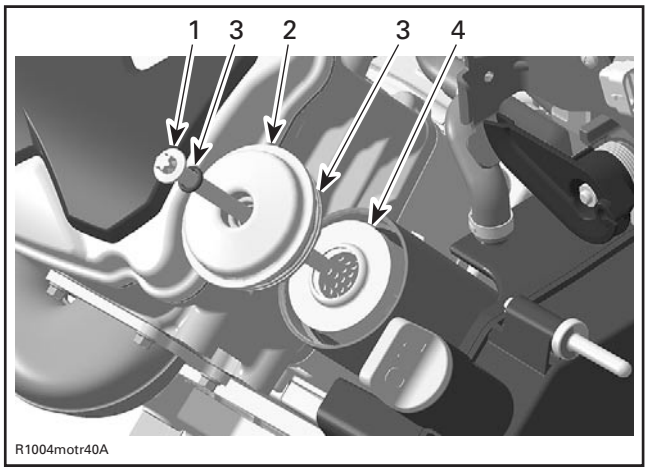
NOTE: After filling, warm up the engine to 80°C (176°F) and check the oil level with the dipstick. Refer to OIL LEVEL CHECK above.

OIL FILTER

Removal

Remove:

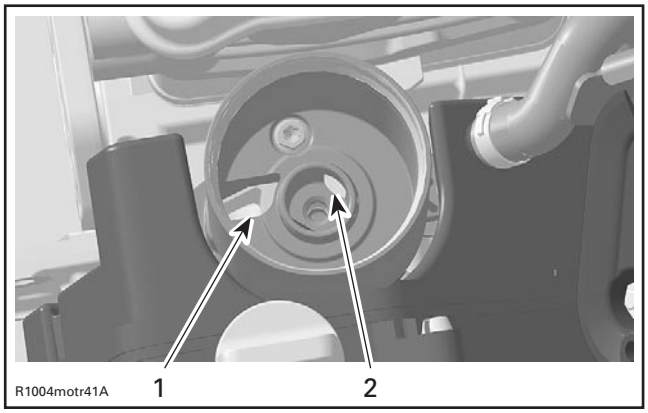
– engine oil (refer to OIL CHANGE)
– oil filter screw **no. 9**
– oil filter cover **no. 7**
– oil filter **no. 5**.



1. Oil filter screw
2. Oil filter cover
3. Gaskets
4. Oil filter

Inspection

Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



1. Inlet bore from the oil pump to the oil filter
2. Outlet bore to the engine oil providing system

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: Slightly oil the two gaskets at the top and bottom sides of the oil filter before assembly. This will ease assembly and prevent displacement of the gasket during installation.

At assembly, remember to replace the two O-rings **no. 6** and **no. 8** of the oil filter screw.

Slightly grease the O-ring **no. 6** of the oil filter cover before assembly using Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

Torque oil filter screw to 9 N•m (80 lbf•**in**).

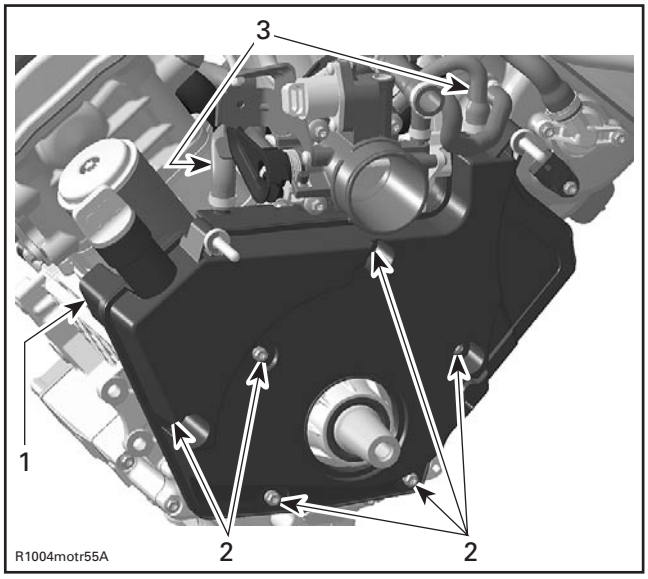
OIL TANK

Removal

First drain the lubrication system (refer to OIL CHANGE).

Remove:

– hose clamps **no. 17** and pull hoses
– oil tank screws **no. 13** and **no. 14** and pull oil tank **no. 10**.



1. Oil tank
2. Six screws
3. Hoses

CAUTION: Make sure that the O-rings no. 11 and no. 12 do not get stuck in the crankcase.

Inspection

Inspect the oil tank for cracks/fractures or other damage/leakage.

NOTE: If necessary, replace the oil tank.

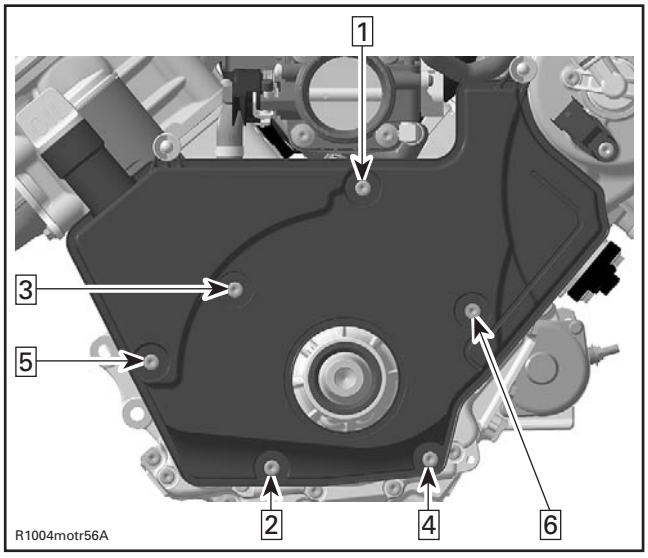
Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: At assembly, replace both O-rings **no. 11** and **no. 12**.

Before assembly, slightly grease the O-rings. This will ease assembly and prevent displacement of the gasket during installation.

Torque oil tank screws to 9 N•m (80 lbf•**in**) as per following sequence.



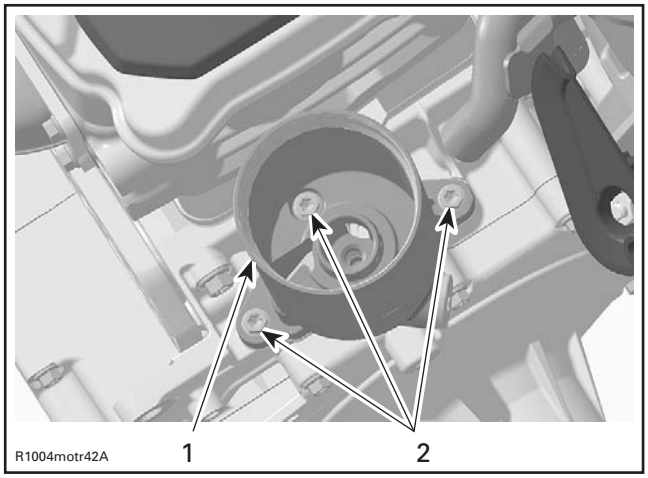
OIL FILTER HOUSING

Removal

First drain the lubrication system (refer to OIL CHANGE).

Remove:

– oil tank (refer to OIL TANK)
– oil filter (refer to OIL FILTER)
– oil filter housing screws **no. 3** and **no. 4** and pull oil filter housing **no. 2**.



1. Oil filter housing
2. Three screws

Inspection

Check the oil filter housing for cracks or other damage.

Replace oil filter housing if damaged.

Installation

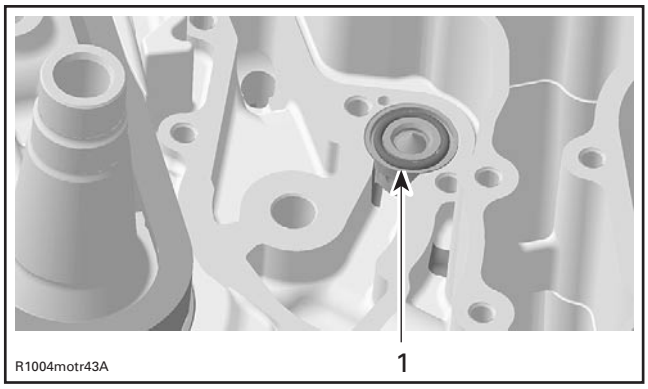
The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: Always replace gasket **no. 1**.

Torque oil filter housing screws to 9 N•m (80 lbf•**in**).

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the engine alternator side (behind ignition cover/pressure oil pump cover).



1. Engine oil pressure regulator

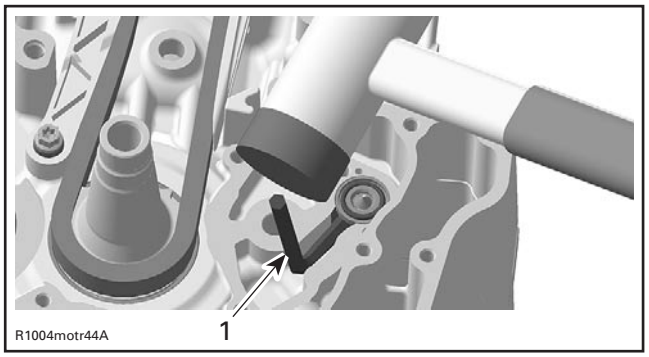
NOTE: The oil pressure regulator system works between 240 kPa (35 PSI) and 430 kPa (62 PSI).

Removal

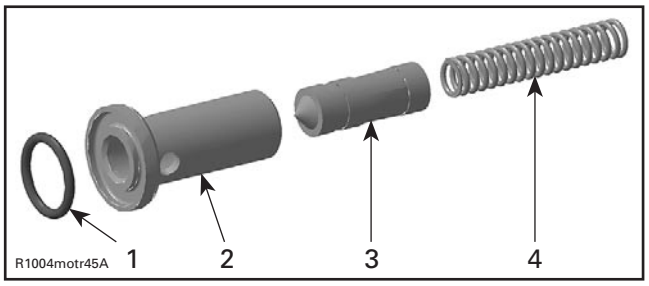
Remove:

– water pump housing (refer to COOLING SYSTEM)
– ignition cover (refer to COOLING SYSTEM)
– oil pump cover **no. 25** (refer to PRESSURE OIL PUMP)
– O-ring **no. 36**, valve seat **no. 35**, pressure regulating piston **no. 34** and spring **no. 33**.

Put a suitable Allen wrench or another 90° angle tool under the engine oil pressure regulator. By slight hammer blows against the Allen wrench carefully drive out the oil pressure regulator.



1. Allen wrench



1. O-ring
2. Valve seat
3. Pressure regulator piston
4. Spring

Inspection

Inspect pressure regulator piston and valve seat for scoring or other damages.

Check spring for free length.

SPRING FREE LENGTH	
NEW NOMINAL	46 mm (1.811 in)
SERVICE LIMIT	45 mm (1.771 in)

NOTE: Replace worn or damaged components. Pressure regulator piston and valve seat may only be replaced together.

Clean bore and threads in the oil pump housing from metal shavings and other contaminations.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Oil the pressure regulator piston before installation.

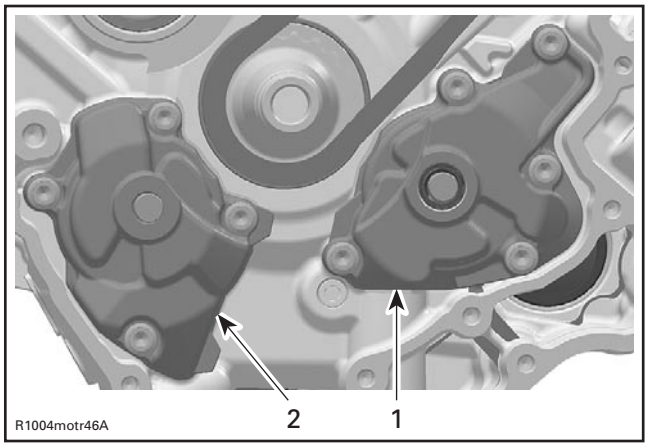
Fit the engine oil pressure regulator by pushing it carefully with an aluminum or brass rod. The engine oil pressure regulator must be flush with the crankcase. Following installation check the pressure regulator piston for easy movement.

NOTE: At installation always replace the O-ring **no. 36**, and fit it with grease.

OIL PUMPS

The oil pumps are located on the engine alternator side (behind ignition cover).

The engine is equipped with two oil pumps, a pressure oil pump and a suction oil pump.



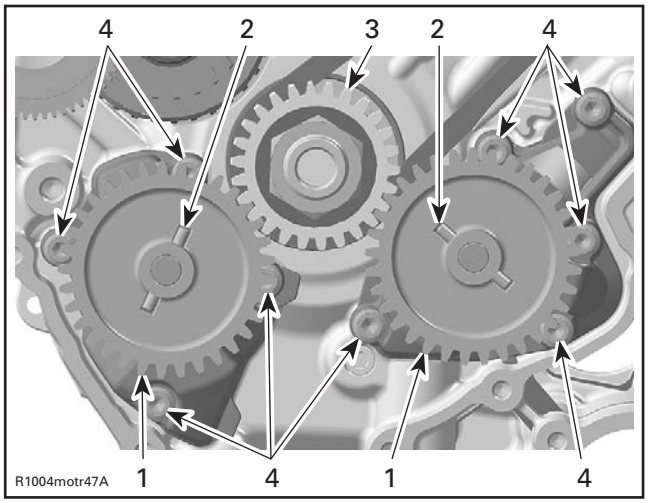
1. Pressure oil pump
2. Suction oil pump

PRESSURE OIL PUMP

Removal

Remove:

– water pump housing (refer to COOLING SYSTEM)
– ignition cover (refer to COOLING SYSTEM)
– oil pump gear **no. 31**
– needle pin **no. 30**
– drive gear of crankshaft (refer to CRANKSHAFT)
– oil pump cover screws **no. 32** and pull oil pump cover **no. 25**
– oil pump shaft with inner rotor **no. 27** and outer rotor **no. 28**
– intermediate plate **no. 29**.

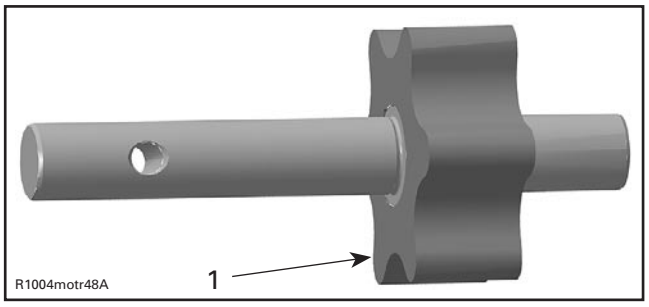


1. *Oil pump gear*
2. *Needle pin*
3. *Drive gear of crankshaft*
4. *Oil pump cover screws*

Inspection

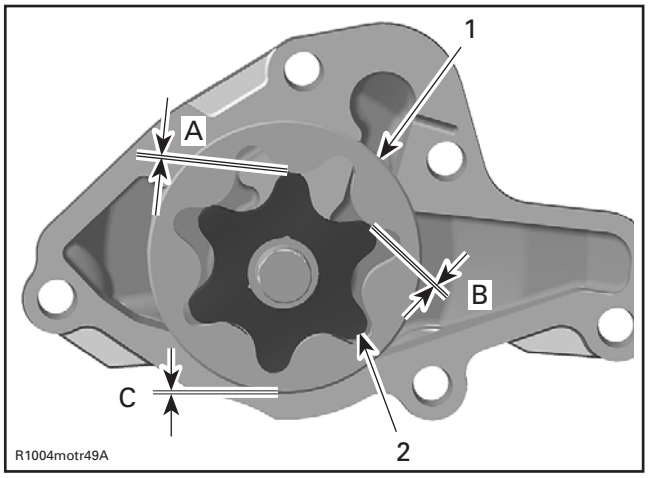
Inspect oil pump shaft assembly and the oil pump cover for marks or other damages.

Check inner rotor for corrosion pin-holes or other damages. If so, replace oil pump shaft assembly. Also check the oil pump cover. If damaged, replace the complete oil pump assembly.



1. *Pittings on the teeth*

Using a feeler gauge, measure the clearance between inner and outer rotors.



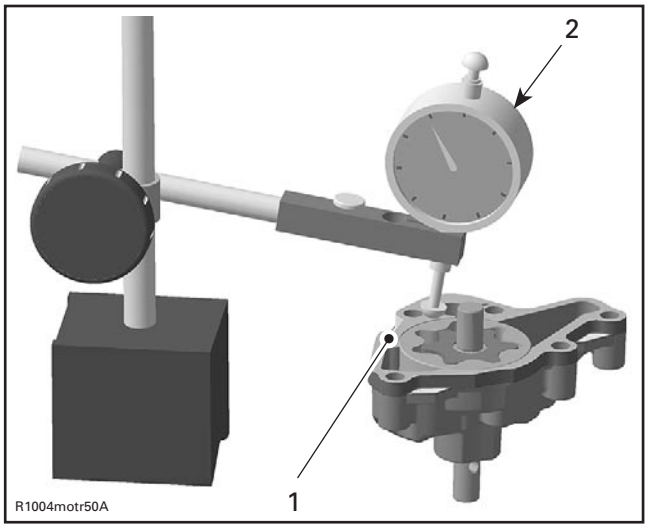
1. *Outer rotor*
2. *Inner rotor*

OUTER AND INNER ROTORS CLEARANCE MM (IN)	
SERVICE LIMIT	
A	0.25 mm (.009 in)
B	
C	

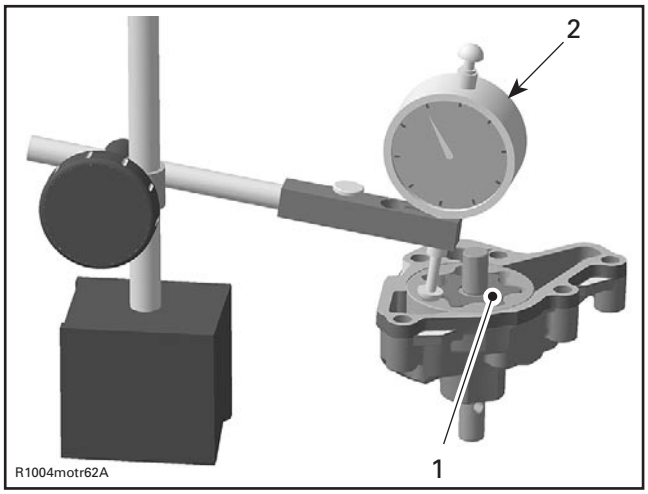
If clearance between inner and outer rotors exceeds the tolerance, replace oil pump shaft assembly. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump assembly.

Using a dial indicator (P/N 414 104 700), measure side wear as shown.



1. Oil pump cover surface
2. Dial indicator



1. Oil pump outer rotor surface
2. Dial indicator

Difference between oil pump cover and outer rotor should not exceed 0.1 mm (.004 in). If so, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

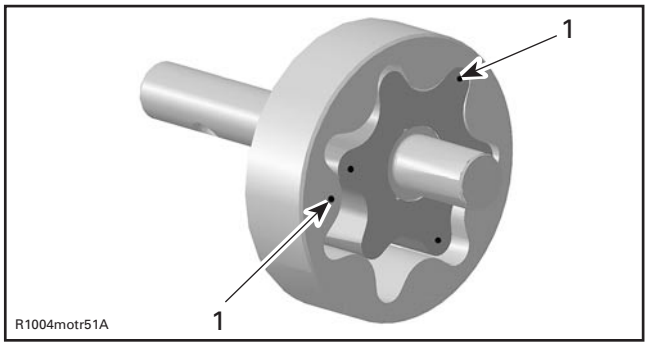
Check the inside of oil pump cover for scoring or other damages. If so, change the complete oil pump assembly.

Installation

For installation, reverse the removal procedure.

Pay attention to the following details.

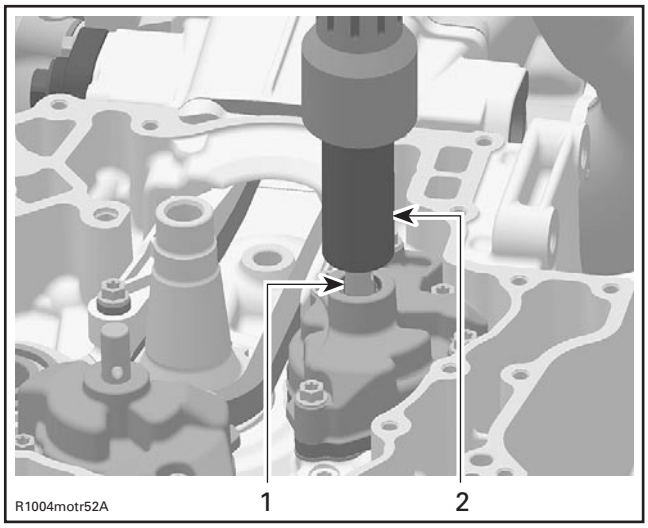
CAUTION: The outer rotor no. 28 and the oil pump shaft with inner rotor no. 27 are marked on the upper side. When installing, make sure that the position of the outer rotor is not reversed.



1. Marking

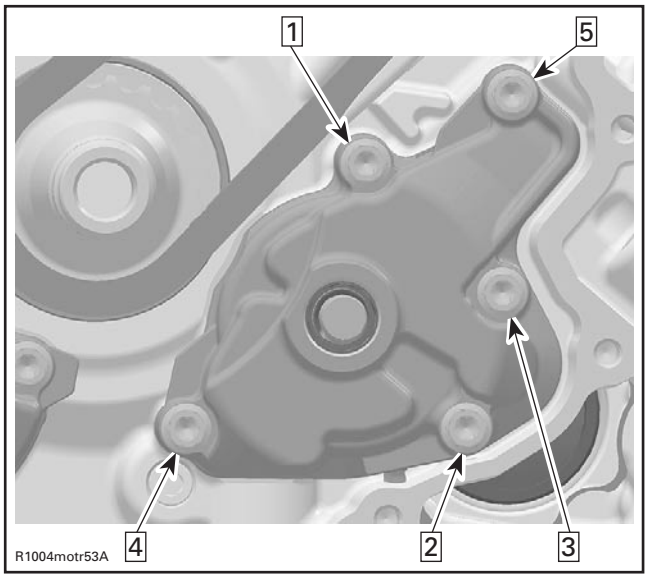
NOTE: At installation always replace the oil seal **no. 26** fitted in the oil pump cover.

Push oil seal in place by using the oil seal pusher (P/N 529 035 911).



1. Oil seal
2. Oil seal pusher (P/N 529 035 911)

Torque oil pump housing screws to 9 N•m (80 lbf•**in**) as per following sequence.



Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

SUCTION OIL PUMP

Removal

For information about disassembly of the suction oil pump please refer to PRESSURE OIL PUMP. Disassembly is the same for both pumps.

Inspection

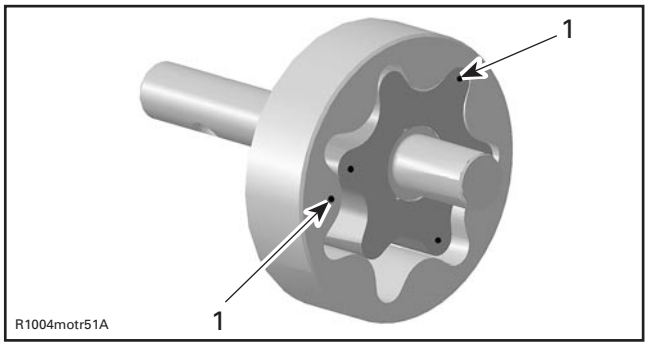
For information about inspection of the suction oil pump please refer to PRESSURE OIL PUMP. Inspection is the same for both pumps.

Installation

For installation, reverse the removal procedure.

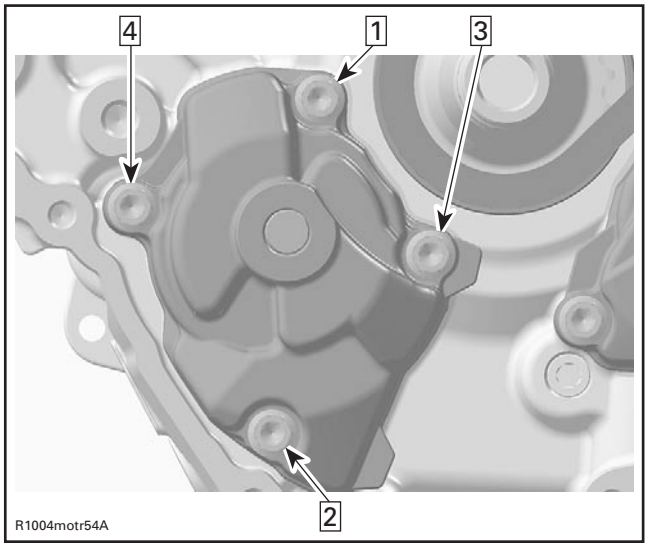
Pay attention to the following details.

CAUTION: The outer rotor no. 23 and the oil pump shaft with inner rotor no. 22 are marked on the upper side. When installing, make sure that the position of the outer rotor is not reversed.



1. Marking

Torque oil pump housing screws to 9 N•m (80 lbf•**in**) as per following sequence.

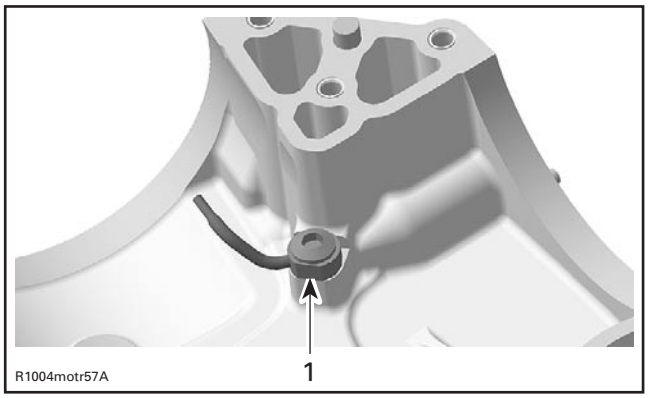


Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

OIL NOZZLE

The oil nozzles **no. 38** are located within the crankcase. Each piston is equipped with a separate oil nozzle.



1. Oil nozzle

NOTE: If the engine has to be disassembled within the scope of repair work, take this opportunity to clean the oil nozzles.

Cleaning and Inspection

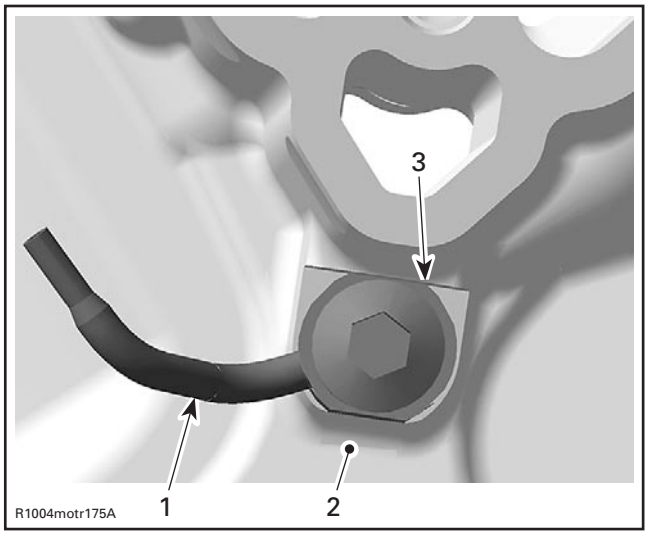
Clean oil nozzle with a part cleaner then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

Installation

CAUTION: At assembly, make sure the contact surfaces of the oil nozzle are well fitted onto the crankcase. If this is not ensured, the spray direction will change, causing potential damage to the engine.



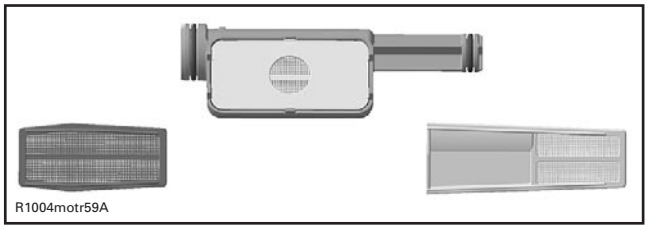
1. Oil nozzle
2. Crankcase
3. Contact surface

NOTE: If the oil nozzles are damaged or bent during installation work in the crankcase, they must be replaced immediately.

Torque oil nozzle screws to 19 N•m (168 lbf•**in**).

OIL SIEVES

The engine is equipped with 3 oil sieves **no. 37**, **no. 39** and **no. 42** for filtering dirt and abraded particles from the oil circuit. The sieves are fitted into the crankcase.



3 OIL SIEVES

NOTE: Cleaning of the oil sieves is only possible if the engine is disassembled. So, if the engine has to be disassembled within the scope of repair work, clean the sieves at the same time.

Cleaning and Inspection

Clean oil sieves with a part cleaner then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

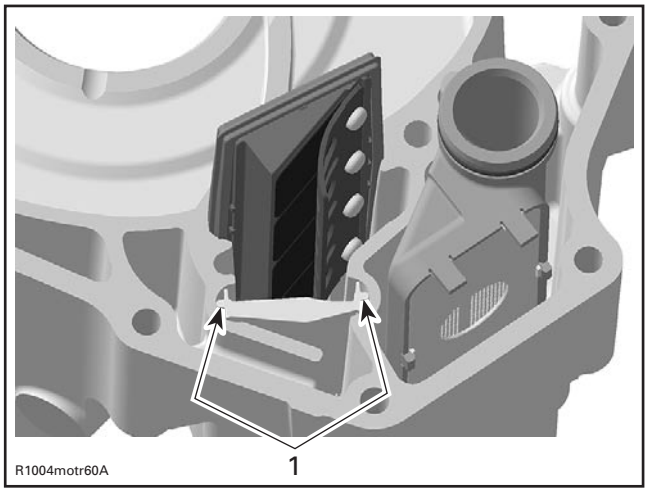
Check sieves for cracks or other damage.

NOTE: Replace sieves if damaged.

Installation

NOTE: During assembly always replace both O-rings no. 40 and no. 41.

CAUTION: Take particular care with oil sieve no. 42 to ensure that it is re-installed in exactly the same position.

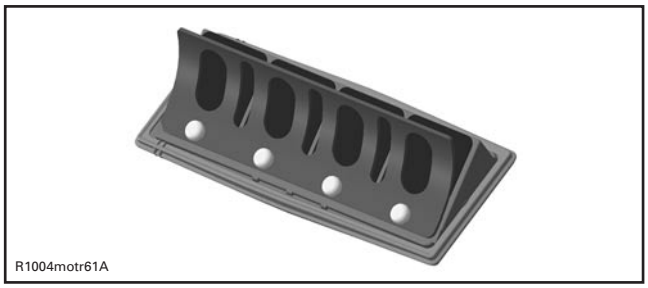


1. Correct installation position of oil sieve

NOTE: Before assembly, slightly oil the O-rings and the sieves at the outside using Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

REED VALVE

The engine is equipped with a reed valve no. 43 which prevents accumulation of larger oil quantities in the crankcase. The reed valve is fitted into the crankcase.



REED VALVE

NOTE: If the engine has to be disassembled within the scope of repair work, take this opportunity to clean the reed valve, using a rag.

Inspection

Check reed valve for cracks or other damage.

NOTE: Replace reed valve if damaged.

Installation

At installation, replace the rubber gasket of the reed valve.

NOTE: Slightly grease the rubber gasket with Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

CYLINDER AND CYLINDER HEAD

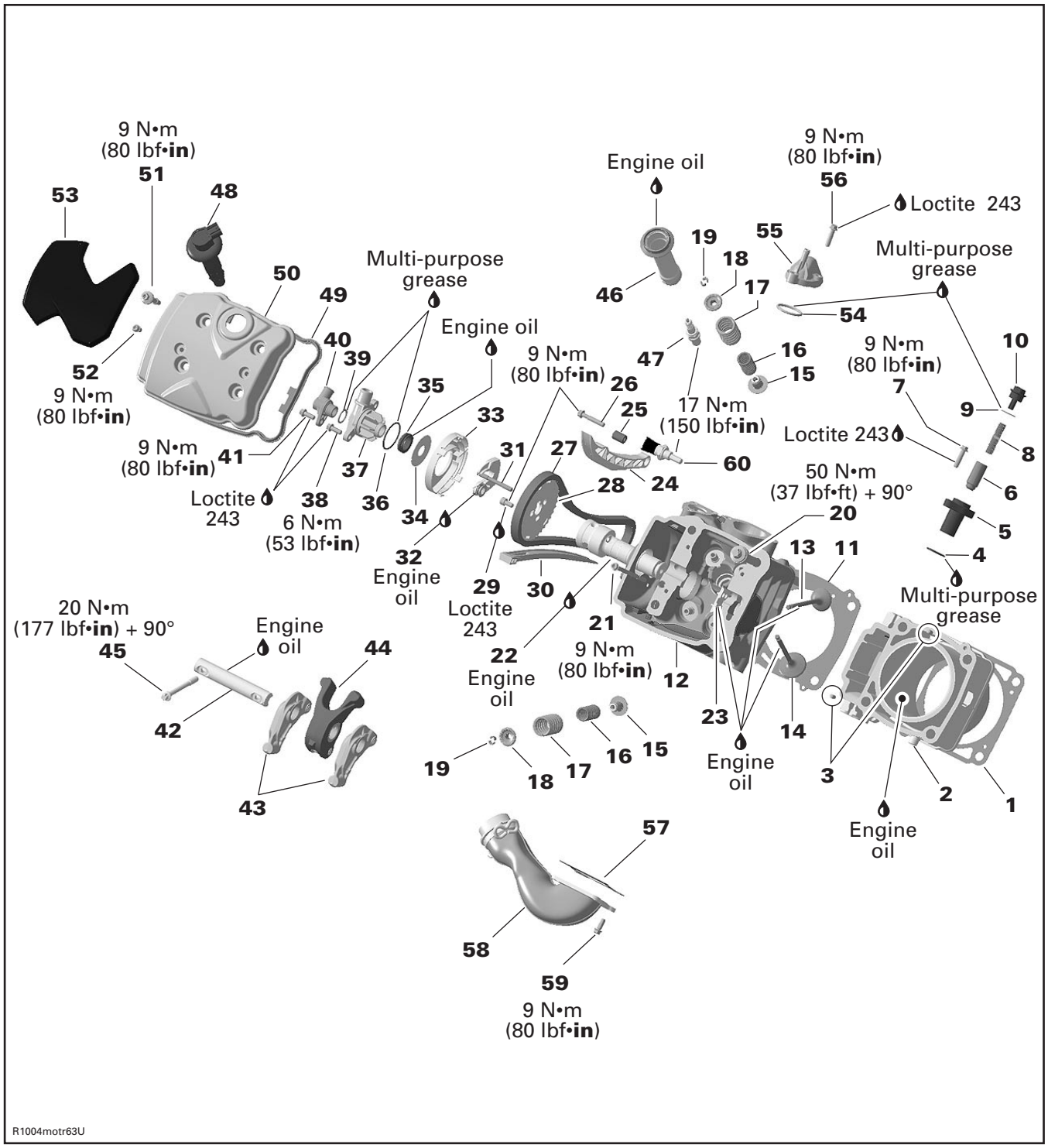
SERVICE TOOLS

Description	Part Number	Page
camshaft locking tool	529 035 839	220
crankshaft locking tool	529 035 900	213–214, 219–220, 222, 227–228
valve spring compressor clamp	529 035 764	223
valve spring compressor cup	529 035 724	223
valve stem seal installer	529 035 687	227

SERVICE PRODUCTS

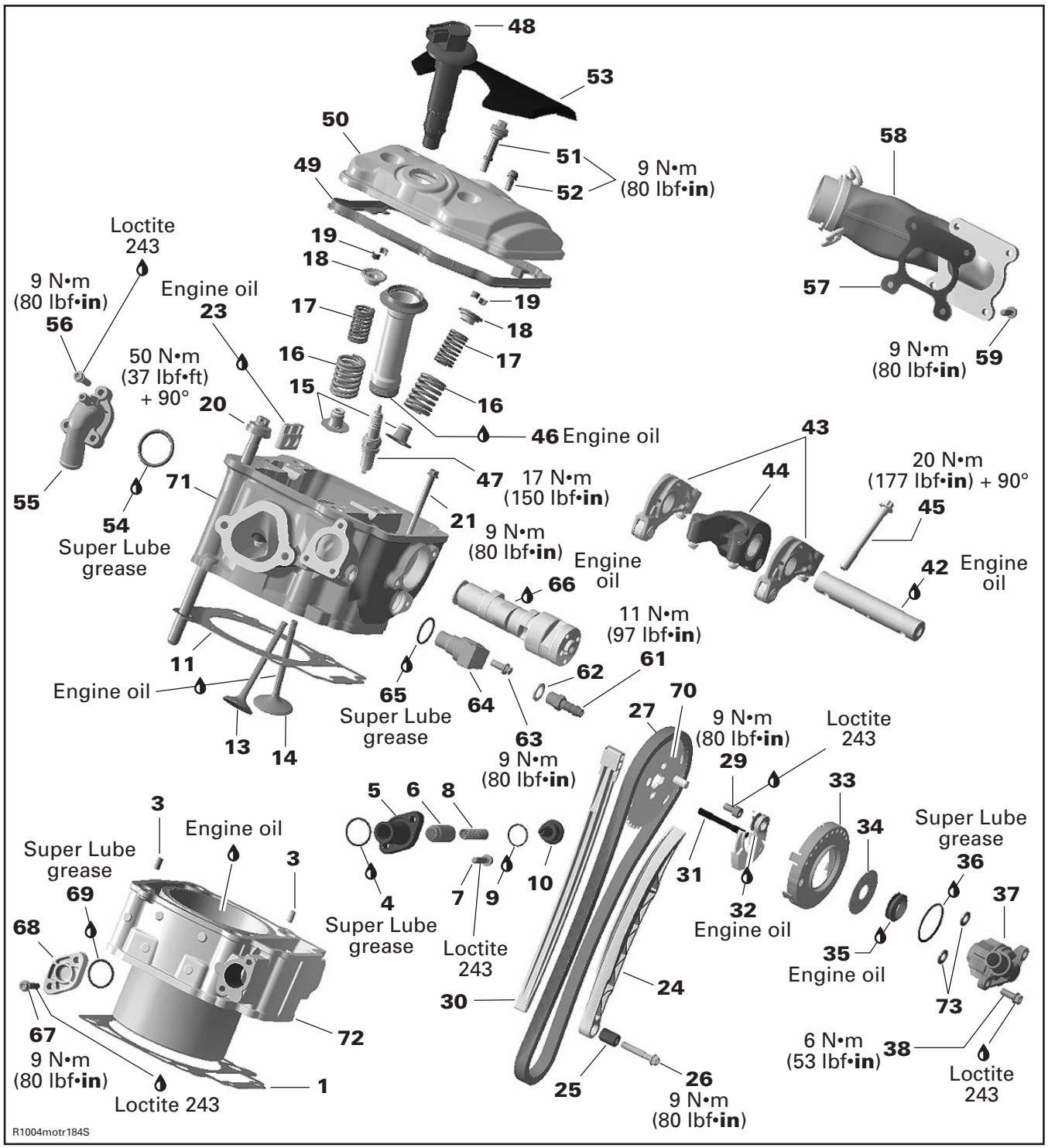
Description	Part Number	Page
Loctite 243	293 800 060	217, 220

CYLINDER/CYLINDER HEAD 1 (FRONT-SIDE)



R1004motr63U

CYLINDER/CYLINDER HEAD 2 (REAR-SIDE)



GENERAL

NOTE: Components which are identical for both cylinders/cylinder heads are identified in the two exploded views by the same number. Components which are different or which are, for instance, present on one of the cylinders/cylinder heads but not on the other, have different numbers. The information given below always relates to both cylinders/cylinder heads as a general rule.

Special reference is made in the text to work instructions which are not the same for cylinder 1 and cylinder 2.

NOTE: For cylinder head, cylinder and piston removal, it is not necessary to remove engine from vehicle.

NOTE: When diagnosing an engine problem, always perform a cylinder leak test. This will help pin-point the problem. Refer to the instructions included with your leak tester and LEAK TEST section for procedures.

Always place the vehicle on a level surface.

NOTE: For a better understanding, the following illustrations are taken with engine out of vehicle. However, it is not necessary to remove engine from vehicle to perform the following instructions.

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

Even though many parts do not need to be removed to reach other parts, it is recommended to remove these parts anyway in order to check them.

For installation, use the torque values and service products from exploded views. Clean threads before using Loctite product when installing screws.

When disassembling parts that are duplicated in the engine, (e.g.: valves), it is strongly recommended to note their position (PTO, alternator side) and to keep them as a "group". If you find a defective component, it will be much easier to find the cause of the failure among its group of parts (e.g.: you found a worn valve guide. A bent spring could be the cause. It will be easy to know which one among the springs is defective if you grouped them at disassembly). Besides, since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their "group".

SPARK PLUG

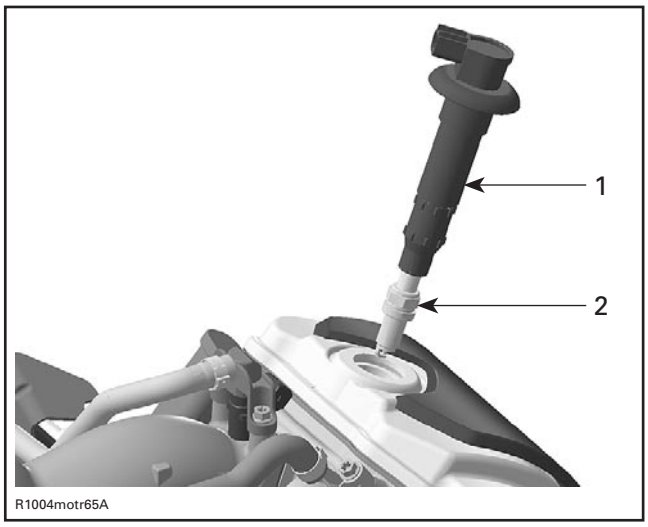
Removal

Unplug the stick coil connector.

Remove the stick coil **no. 48**.

Clean spark plug and stick coil area before disassembly.

Unscrew spark plug **no. 47** then use the stick coil to take spark plug out of spark plug hole.



1. Stick coil
2. Spark plug

Inspection

Check spark plug and stick coil condition (refer to COMPONENT INSPECTION AND ADJUSTMENT).

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Check spark plug gap (refer to TECHNICAL DATA).

Slightly oil the bottom outer part of the stick coil. This will ease installation.

Place spark plug into stick coil, screw spark plug then remove the stick coil. Torque spark plug to 17 N•m (150 lbf•**in**). Reinstall the stick coil.

TEMPERATURE SENSOR

Temperature sensor **no. 60** is located in the cylinder head 1 (front-side).

Inspection

Check the temperature sensor for damage or leakage. For electrical inspection refer to COMPONENT INSPECTION AND ADJUSTMENT.

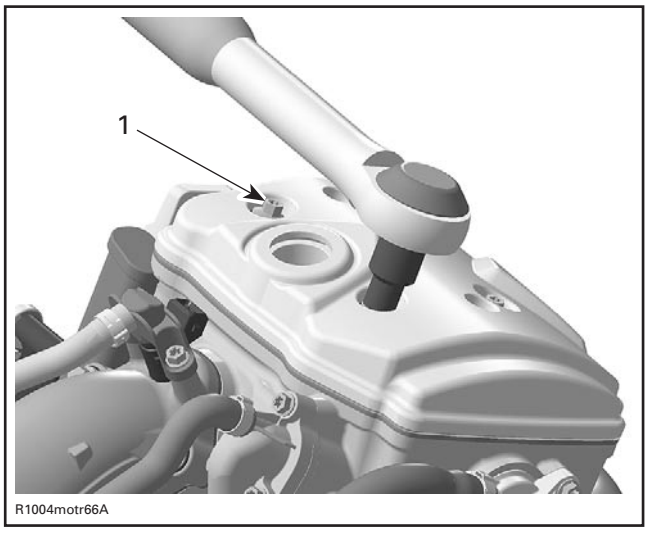
Torque temperature sensor to 17 N•m (150 lbf•**in**).

VALVE COVER

Removal

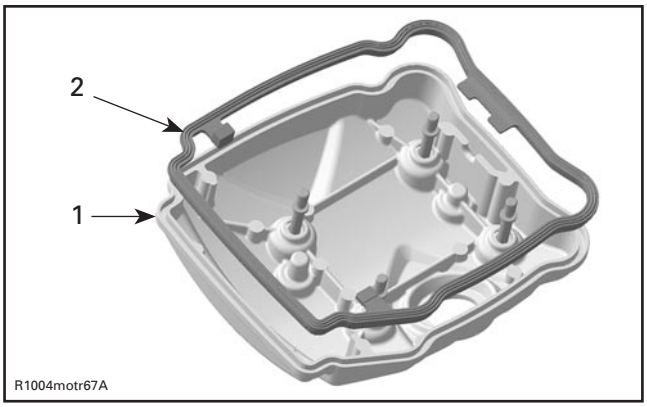
Remove:

– valve cover shield **no. 53**
– valve cover screws **no. 51**



1. Valve cover screws

– valve cover **no. 50** and profile sealing ring **no. 49**.



1. Valve cover
2. Profile sealing ring

Inspection

Check the profile sealing ring on the valve cover and the rubber bushing on the valve cover screws if they are brittle, cracked or hard. If so, replace the profile sealing ring or the valve cover screw accordingly.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the profile sealing ring **no. 49**.

NOTE: Install the valve cover screws in a criss-cross sequence.

Torque valve cover screws to 9 N•m (80 lbf•**in**).

ROCKER ARM

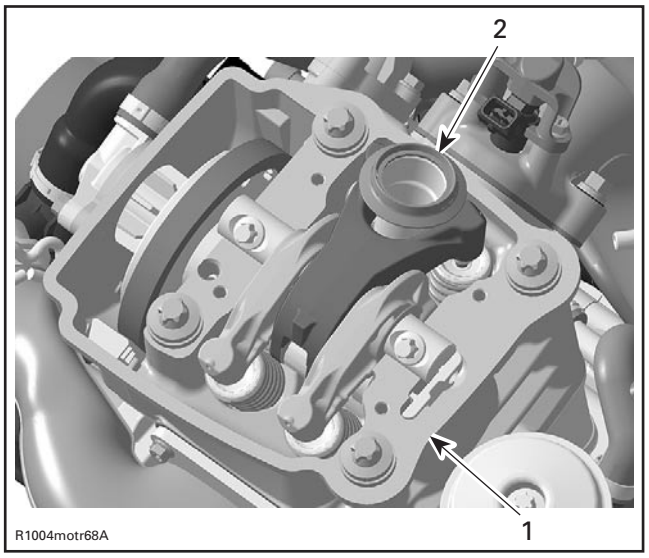
When disassembling the rocker arms, the specified sequence must be followed. Start with cylinder 1, continue with cylinder 2.

Removal Cylinder 1 (front-side)

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

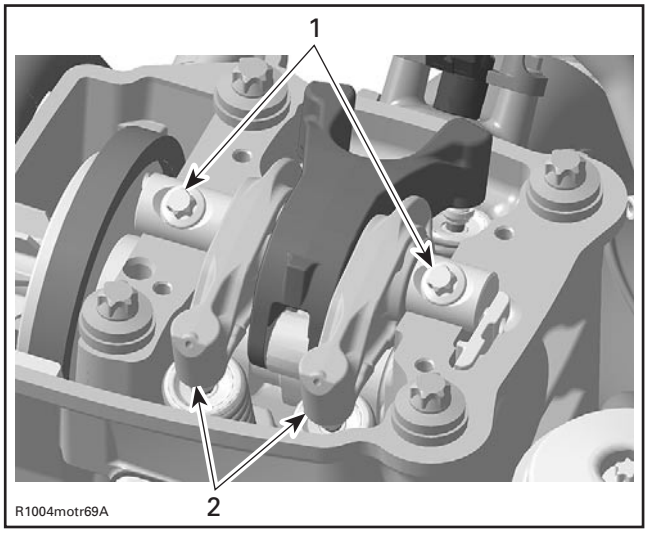
Remove:

– spark plug (refer to SPARK PLUG)
– valve cover (refer to VALVE COVER)
– spark plug tube **no. 46**



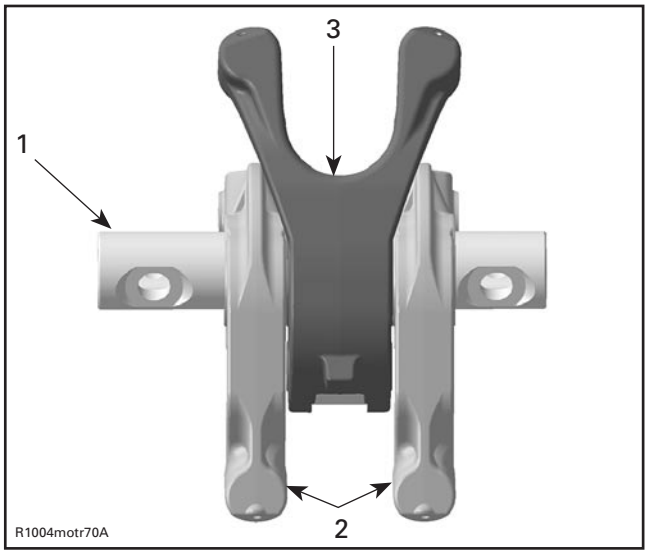
1. Cylinder head
2. Spark plug tube

– rocker arm shaft screws **no. 45** (discard screws)

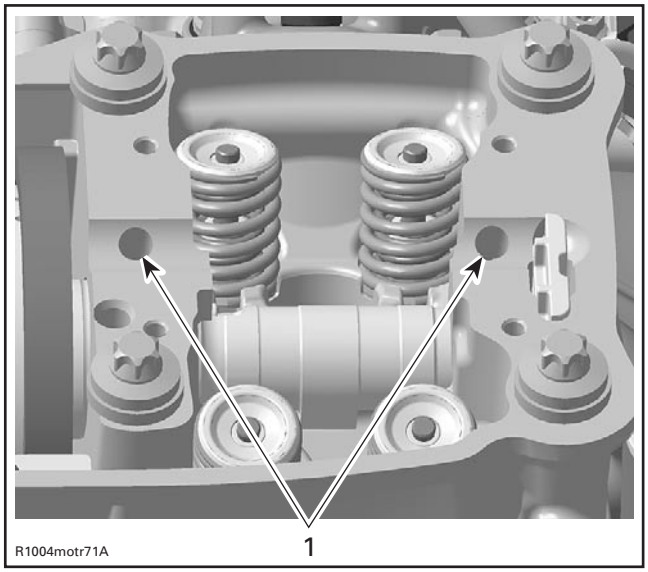


1. Rocker arm shaft screws
2. Rocker arms

– rocker arm shaft **no. 42** with rocker arm assembly (exhaust side **no. 43** and intake side **no. 44**)



1. Rocker arm shaft
2. Rocker arms (exhaust side)
3. Rocker arm (intake side)



1. Oil supply from the camshaft to the rocker arm shaft, then to the rocker arms and finally to the valve adjustment

Removal Cylinder 2 (rear-side)

Remove:

– spark plug (refer to SPARK PLUG)
– valve cover (refer to VALVE COVER)
– spark plug tube **no. 46**

Remove the crankshaft locking tool (P/N 529 035 900).

Crank the engine further until the second cylinder is positioned at ignition TDC.

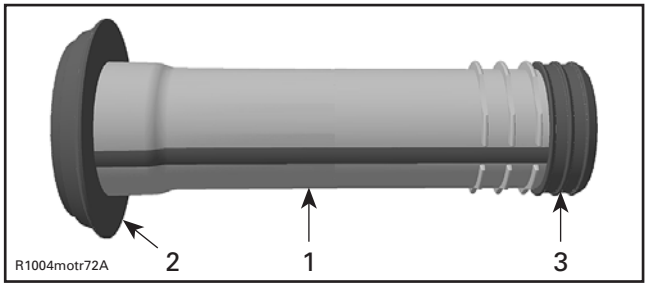
– rocker arm shaft screws **no. 45** (discard screws)

– rocker arm shaft **no. 42** with rocker arm assembly (exhaust side **no. 43** and intake side **no. 44**).

Inspection

Spark Plug Tube

Check seals on spark plug tube. If seals are brittle, cracked or hard, replace spark plug tube.

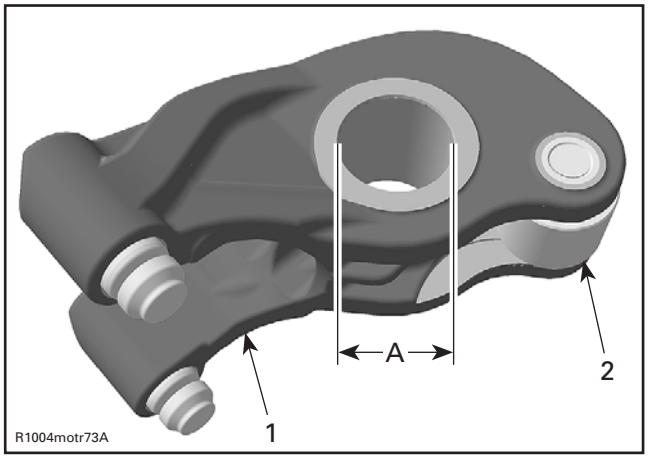


1. *Spark plug tube*
2. *Seal to the valve cover*
3. *Seal to the cylinder head*

Rocker Arm

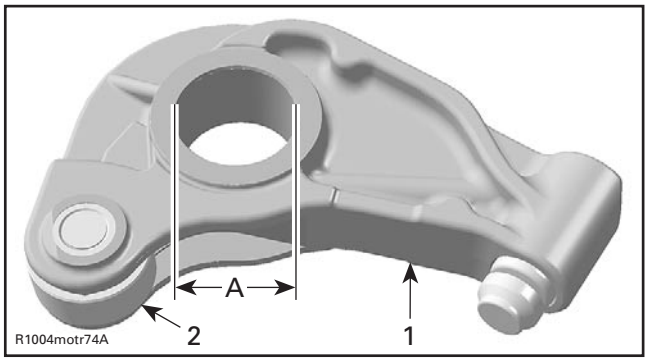
Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.



1. *Rocker arm (intake side)*
2. *Roller*

A. Bore for rocker arm shaft



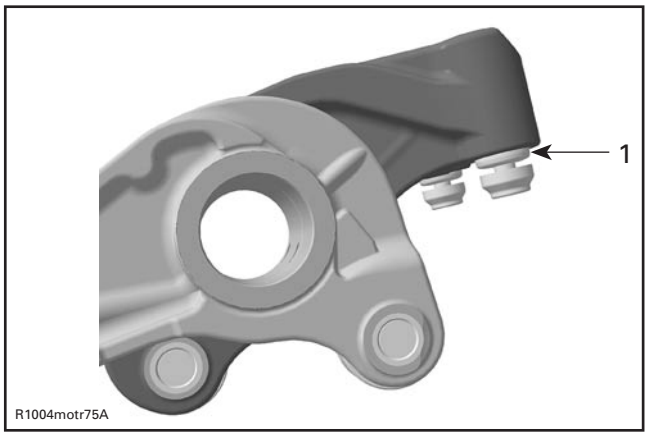
1. *Rocker arm (exhaust side)*
2. *Roller*

A. Bore for rocker arm shaft

Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.

ROCKER ARM BORE DIAMETER	
MINIMUM (NEW)	20.007 mm (.7877 in)
MAXIMUM (NEW)	20.020 mm (.7881 in)
SERVICE LIMIT	20.035 mm (.7887 in)

Press the hydraulic lifter with your thumb. If the hydraulic lifter groove disappears inside rocker arm casting, replace rocker arm assembly. Lifter must turn freely in rocker arm bore. Otherwise, replace.



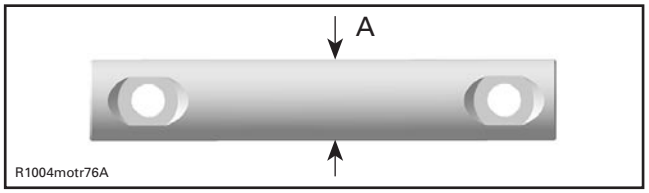
1. *Hydraulic lifter groove*

Rocker Arm Shaft

Check for scored friction surfaces, if so, replace parts.

Measure rocker arm shaft diameter.

ROCKER ARM SHAFT DIAMETER	
MINIMUM (NEW)	19.980 mm (.7866 in)
MAXIMUM (NEW)	19.993 mm (.7871 in)
SERVICE LIMIT	19.965 mm (.7860 in)



A. Measure rocker arm shaft diameter here

Replace any part that shows excessive wear.

Installation

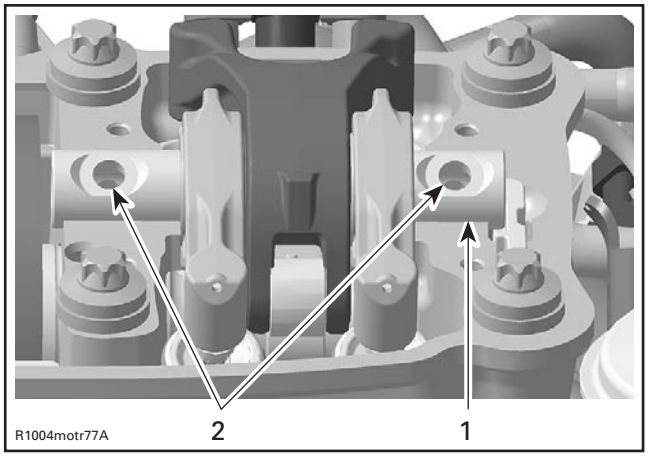
For installation, reverse the removal procedure. Pay attention to the following details.

CAUTION: Make sure to observe the correct matching of rocker arm shaft and rocker arm. When installing the components, make sure they are fitted exactly in their original position on their respective cylinder head. Any inversion of the components may cause damage to the engine.

NOTE: At assembly, position the cylinder to ignition TDC. This will ensure stress-free installation of the rocker arm shaft.

Apply engine oil on rocker arm shaft.

Position the rocker arm shaft with the notches on top.

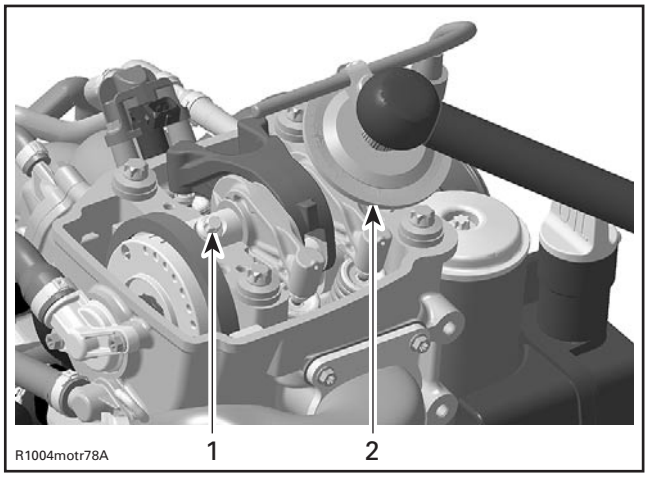


1. Rocker arm shaft
2. Rocker arm shaft notches

Install **NEW** rocker arm shaft screws **no. 45**. Torque as per following procedure:

CAUTION: For this assembly, stretch screws are used. As the screws have been stretched from the previous installation, it is very important to **use new screws at assembly**. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

– Torque rocker arm shaft screws to 10 N•m (88 lbf•**in**).
– Torque rocker arm shaft screws to 20 N•m (177 lbf•**in**).
– Finish tightening screws turning an additional **90° rotation** with a torque angle gauge.



1. Rocker arm shaft screw
2. Torque angle gauge

CHAIN TENSIONER

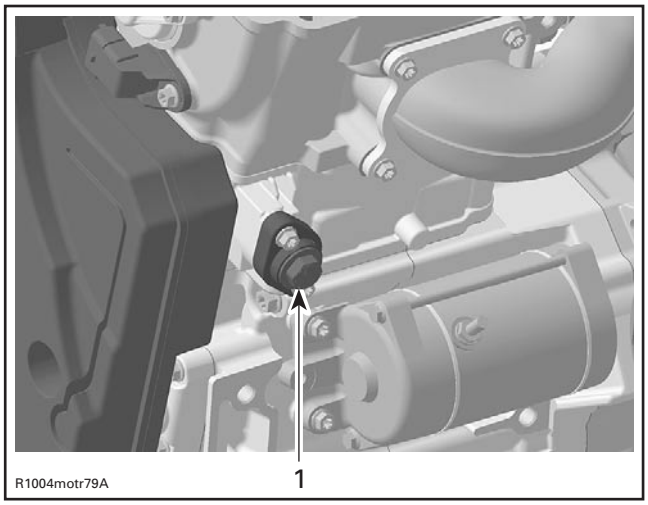
Removal

⚠ WARNING

Chain tensioner is spring loaded. Take that into account when removing chain tensioner plug.

Remove:

– air silencer, guard and driven pulley to gain access to cylinder 2 chain tensioner
– chain tensioner plug **no. 10**

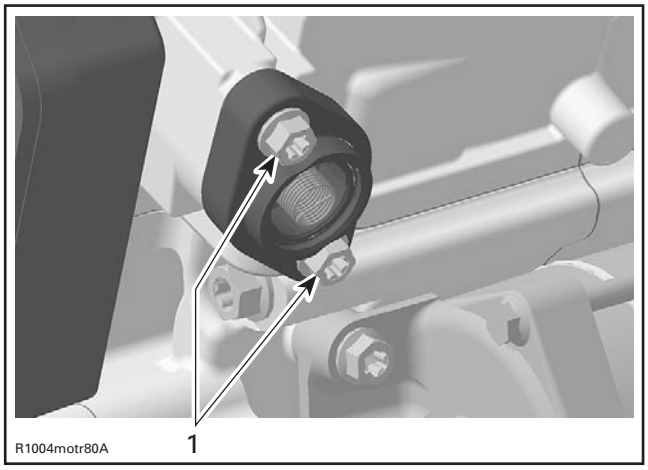


1. Chain tensioner plug

⚠ WARNING

Never perform this operation immediately after the engine has been run because the exhaust system can be very hot. Wait until exhaust system is warm or cold.

– spring **no. 8**
– screws **no. 7**

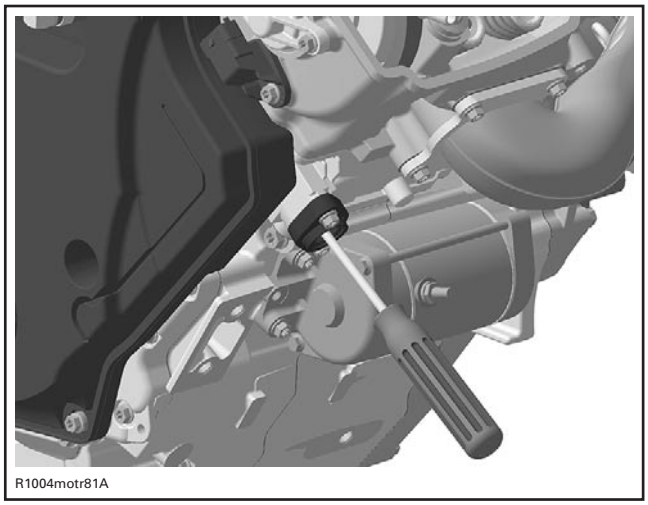


1. Chain tensioner screws

– chain tensioner housing **no. 5**.

Inspection

Using a flat screwdriver, unscrew chain tensioner plunger **no. 6**. Check chain tensioner plunger for free movement in the threads of chain tensioner housing.



Check chain tension guides **no. 24** for wear. Replace as necessary.

Check spring condition. Replace if broken or worn.

Installation

NOTE: At installation, replace the O-rings **no. 4** and **no. 9**. Slightly grease the O-rings before assembly using super lube grease.

For installation, reverse the removal procedure. Pay attention to the following details.

Torque chain tensioner housing screws to 9 N•m (80 lbf•**in**). Apply Loctite 243 (P/N 293 800 060) on threads.

NOTE: Slightly screw the plunger until it touches the chain tension guide. Use only two fingers to hold the screwdriver, in order to recognize the gentle contact with the chain tension guide.

CAUTION: Improper adjustment of the chain tension will lead to severe engine damage.

Install a spring end in plunger groove and the other in the plug screw groove.

Screw in plug screw **no. 10** by hand. There must be no distortion of the spring during installation.

Torque plug screw to 5 N•m (44 lbf•**in**).

BREATHER

Removal

Remove:

– exhaust pipe and muffler

– air silencer then move vehicle harness away from engine
– remove breather hose then unscrew breather screws **no. 38**
– pull out the breather **no. 37** and gasket rings **no. 70**.

NOTE: Pull out the breather with utmost care. Thrust washer **no. 34** may get caught on the breather and drop into the crankcase.

Inspection

Inspect the breather for cracks/fractures or other damage/leakage.

If necessary, replace the breather.

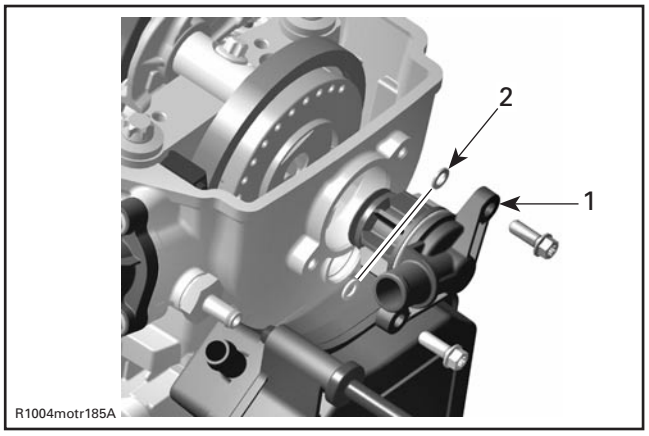
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the O-ring **no. 36**, and fit it with grease.

Take care during installation that the flat surface of thrust washer precisely fits in the cover **no. 33.**

NOTE: Make sure to reinstall the two gasket rings **no. 70** between breather and cylinder head surface.



1. Breather
2. Gasket rings

Torque breather screws to 6 N•m (53 lbf•**in**).

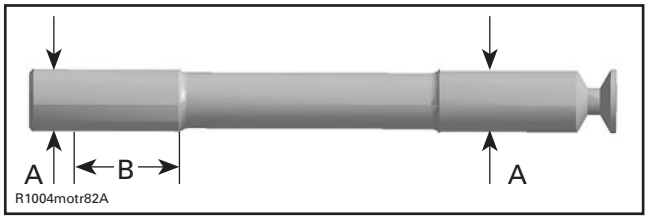
DECOMPRESSOR

Removal

Remove:
– breather (refer to BREATHER)
– valve cover (refer to VALVE COVER)
– thrust washer **no. 34**
– cover **no. 33**
– centrifugal weight **no. 32**
– decompressor shaft **no. 31**.

Inspection

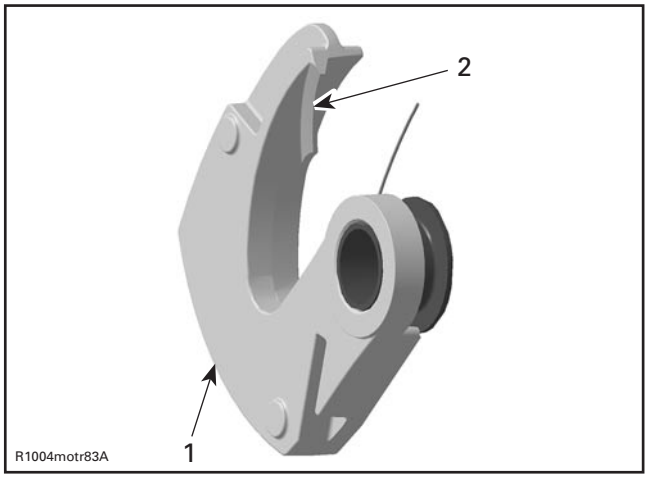
Check decompressor shaft for service limit, replace if it out of specifications.



DECOMPRESSOR SHAFT
A. Measure here
B. Measurement area

DECOMPRESSOR SHAFT MEASUREMENT A	
MINIMUM (NEW)	5.978 mm (.235 in)
MAXIMUM (NEW)	5.990 mm (.236 in)
SERVICE LIMIT	5.850 mm (.230 in)

Check torsion spring and edge of the centrifugal weight for visible wear. If so, replace them together.

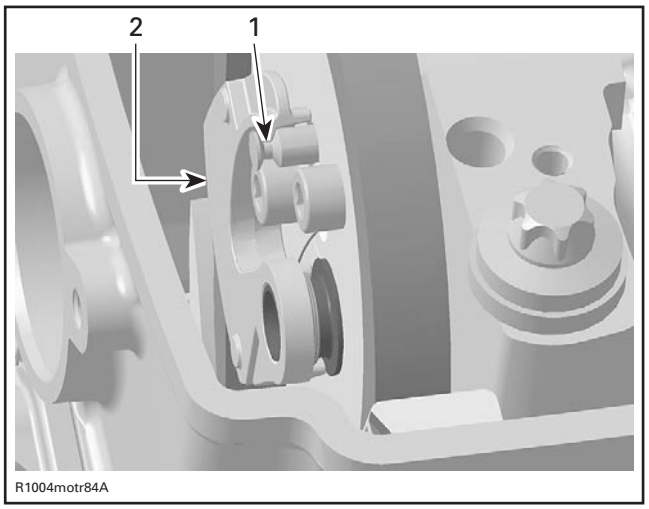


1. Centrifugal weight with torsion spring
2. Edge of centrifugal weight

Installation

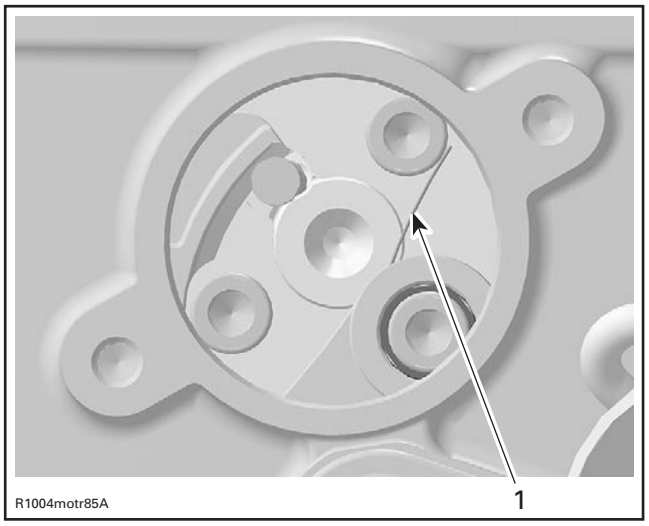
The installation is essentially the reverse of the removal procedure but, pay attention to the following details.

NOTE: Engage the edge of centrifugal weight into the decompressor shaft groove then put the parts in place.



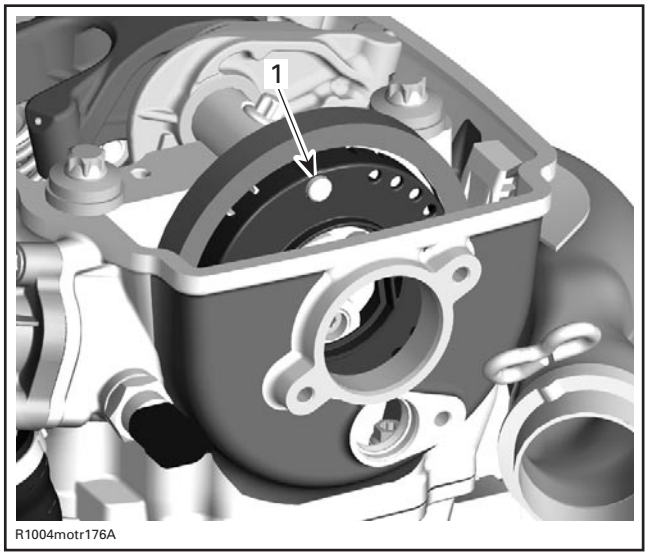
1. *Decompressor shaft groove*
2. *Centrifugal weight*

Place the torsion spring end under socket screw head.



1. *Position of torsion spring end*

Install the cover **no. 33**. Position the cover on the timing gear so that the holes fits to the pin of timing gear.



1. *Hole in cover fits to pin of timing gear*

CAUTION: Before and after cover installation, make sure the centrifugal system works properly.

CAMSHAFT TIMING GEAR

The engine is equipped with two camshaft timing gears **no. 28** and **no. 70**. The timing gear provides the signals for the camshaft position sensor and is located in the cylinder head of the cylinder 2.

NOTE: Although it is not necessary to position crankshaft to TDC for disassembly, it is a good practice to do it, as a troubleshooting step, to know before disassembly if valve timing was appropriate.

Removal

The procedure for disassembly of the two camshaft timing gears **no. 28** and **no. 70**, is the same.

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT AND DRIVE GEARS.

Remove:

- valve cover (refer to VALVE COVER)
- breather (refer to BREATHER)
- chain tensioner (refer to CHAIN TENSIONER)
- decompressor (refer to DECOMPRESSOR)
- chain guide **no. 30**
- screws **no. 29**
- camshaft timing gear **no. 70**.

NOTE: Secure camshaft chain **no. 27** with a retaining wire.

Inspection

Check camshaft timing gear for wear or deterioration.

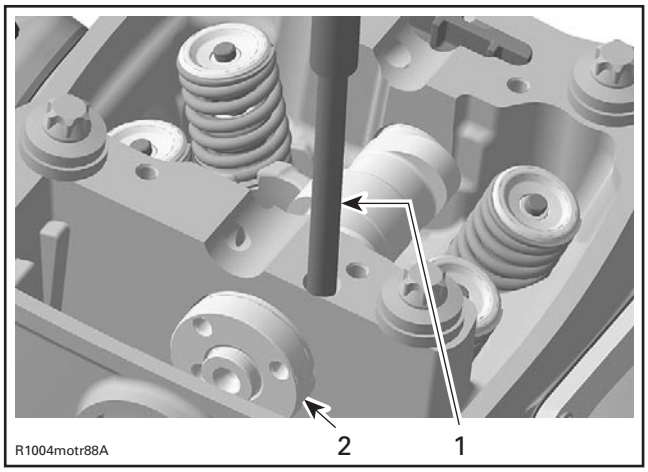
If gear is worn or damaged, replace it as a set (camshaft timing gear and timing chain).

For crankshaft timing gear, refer to CRANKSHAFT AND DRIVE GEARS.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Using the camshaft locking tool (P/N 529 035 839), lock camshaft on TDC position.



1. Camshaft locking tool
2. Camshaft on TDC position

Install the camshaft timing gear with the writing visible.

IMPORTANT: Make sure that tensioner is in place and properly preloaded before tightening sprocket screws.

Fit the screws with Loctite 243 (P/N 293 800 060).

Torque screws to 9 N•m (80 lbf•**in**).

CAUTION: Crankshaft and camshaft must be locked on ignition TDC position of cylinder 1 (front-side) to place camshaft timing gear and timing chain in the proper position.

TIMING CHAIN

Refer to CRANKSHAFT/DRIVE GEARS.

CYLINDER HEAD

Removal

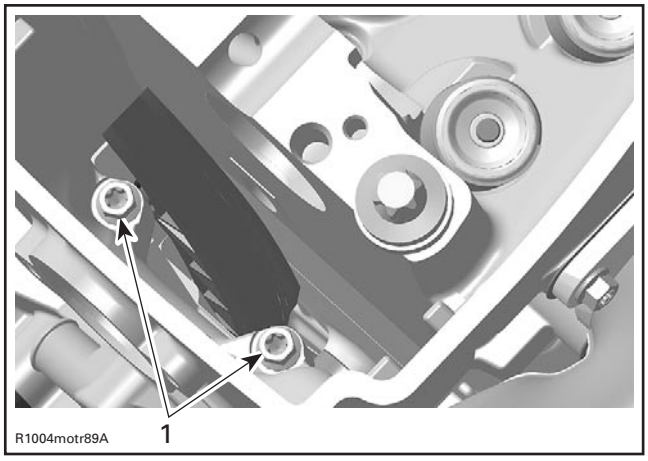
The removal procedure is the same for both cylinder heads **no. 12** and **no. 71**.

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

Drain coolant (refer to COOLING SYSTEM).

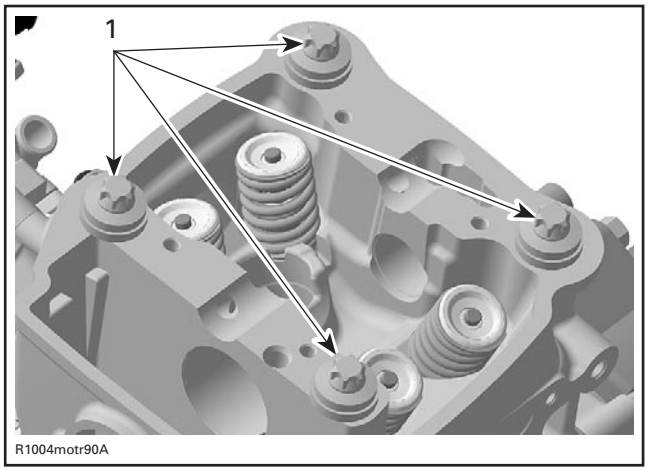
Disconnect temperature sensor and/or camshaft position sensor.

Remove:
- RH side cover
- seat support
- exhaust pipe and upper engine support (refer to REMOVAL AND INSTALLATION)
- engine outlet hose
- air intake manifold (refer to COMPONENT INSPECTION AND ADJUSTMENT)
- chain tensioner (refer to CHAIN TENSIONER)
- valve cover (refer to VALVE COVER)
- valve cover and profile sealing ring (see VALVE COVER above)
- breather (refer to BREATHER)
- decompressor (refer to DECOMPRESSOR)
- camshaft timing gear (refer to CAMSHAFT TIMING GEAR)
- cylinder head screws M6 **no. 21**



1. Cylinder head screws M6

- cylinder head screws M11 **no. 20** retaining cylinder head and cylinder to cylinder base.



1. Cylinder head screws M11

Pull up cylinder head **no. 71**.

Remove gasket **no. 11**.

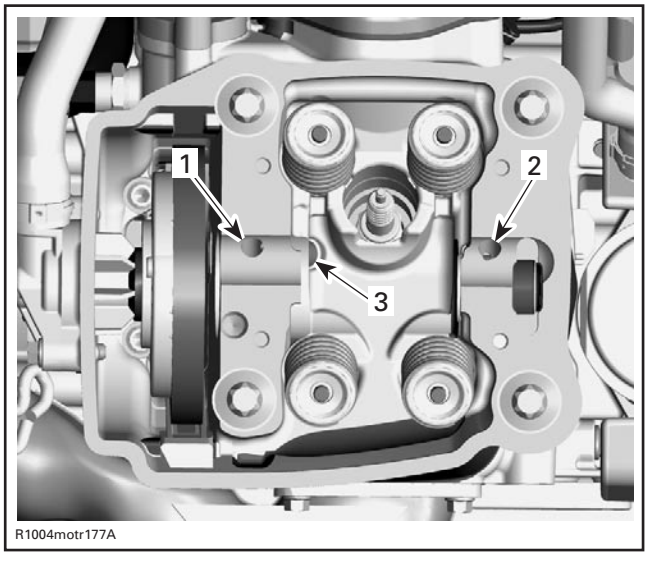
Inspection

Check for cracks between valve seats, if so, replace cylinder head.

Check gasket for cracks or other damages.

Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.

Check oil supply hole in cylinder head for contamination.



1. Oil supply to camshaft bearing journal- big end
2. Oil supply to camshaft bearing journal- small end
3. Oil back flow through chain compartment to engine bottom

Installation

NOTE: The cylinder heads are not identical in design. Do not invert the cylinder heads at assembly.

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace gasket **no. 11**.

Ensure dowel pins are in place.

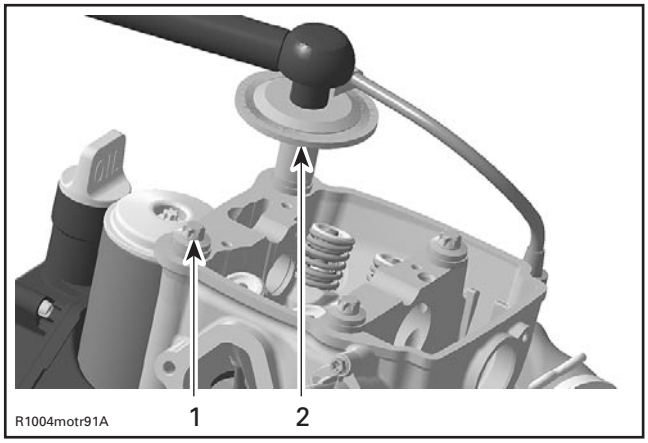
Install cylinder head screws M6 and M11.

Torque screws as per following procedure.

CAUTION: This assembly uses stretch screws. As the screws have been stretched from the previous installation, it is very important to measure each screw at assembly. If screws are out of specification, replace by a new ones. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

CYLINDER HEAD SCREW M11	
SERVICE LIMIT	216.5 mm (8.524 in)

– Torque cylinder head screws M11 in criss-cross sequence to 25 N•m (18 lbf•ft).
– Torque cylinder head screws M11 in criss-cross sequence to 50 N•m (37 lbf•ft).
– Finish tightening screws turning an additional 90° rotation with a torque angle gauge then, torque cylinder head screws M6 to 9 N•m (80 lbf•**in**).

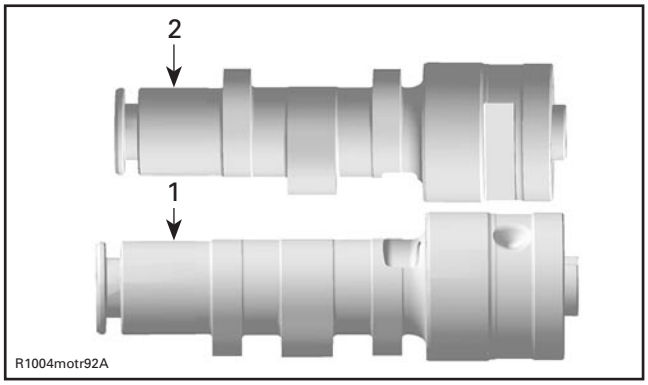


1. Cylinder screws M11
2. Angle torque wrench

Remove crankshaft locking tool (P/N 529 035 900) then install plug with sealing ring.

CAMSHAFT

NOTE: The engine is equipped with two different camshafts **no. 22** and **no. 66**.



1. Camshaft of cylinder 1
2. Camshaft of cylinder 2

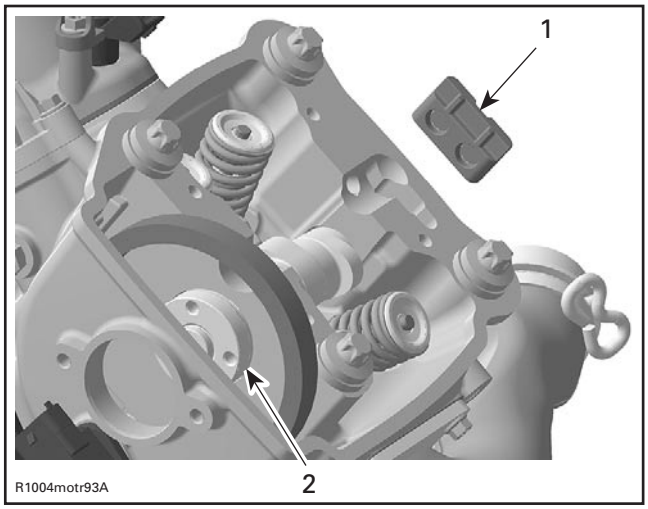
Removal

The removal procedure is the same for both camshafts.

Each camshaft is different in design. Thus, it is important not to mix up any parts of the camshaft assembly with that of the other cylinder. Keep parts as a "group".

Remove:

– valve cover (refer to VALVE COVER)
– chain tensioner (refer to CHAIN TENSIONER)
– breather (refer to BREATHER)
– decompressor (refer to DECOMPRESSOR)
– rocker arms (refer to ROCKER ARMS)
– camshaft timing gear (refer to CAMSHAFT TIMING GEAR)
– camshaft lock **no. 23**
– camshaft **no. 22** and/or **no. 66**.



1. Camshaft lock
2. Camshaft

Cleaning

Remove carbon deposits from combustion chamber, exhaust port and piston top.

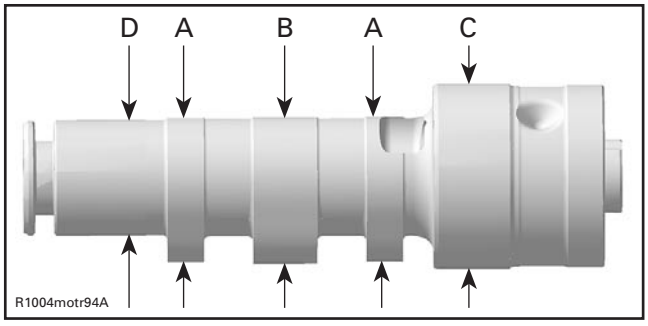
Inspection

Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.

Measure camshaft bearing journal diameter and lobe height using a micrometer.

Measure clearance between both ends of camshaft and cylinder head.

NOTE: The data in the following tables are valid for both camshafts.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft bearing journal (big end)
D. Camshaft bearing journal (small end)

CAMSHAFT LOBE - EXHAUST VALVE	
MINIMUM (NEW)	31.435 mm (1.237 in)
MAXIMUM (NEW)	31.635 mm (1.245 in)
SERVICE LIMIT	31.400 mm (1.236 in)
CAMSHAFT LOBE - INTAKE VALVE	
MINIMUM (NEW)	31.654 mm (1.246 in)
MAXIMUM (NEW)	31.854 mm (1.254 in)
SERVICE LIMIT	31.600 mm (1.244 in)
CAMSHAFT BEARING JOURNAL - BIG END	
MINIMUM (NEW)	39.927 mm (1.5719 in)
MAXIMUM (NEW)	39.935 mm (1.5722 in)
SERVICE LIMIT	39.920 mm (1.5716 in)
CAMSHAFT BEARING JOURNAL - SMALL END	
MINIMUM (NEW)	24.967 mm (.9829 in)
MAXIMUM (NEW)	24.980 mm (.9835 in)
SERVICE LIMIT	24.960 mm (.9827 in)
CAMSHAFT BORE - BIG END MEASURED IN DIAMETER	
MINIMUM (NEW)	39.984 mm (1.5742 in)
MAXIMUM (NEW)	40.000 mm (1.5748 in)
SERVICE LIMIT	40.020 mm (1.5756 in)
CAMSHAFT BORE - SMALL END MEASURED IN DIAMETER	
MINIMUM (NEW)	24.987 mm (.9837 in)
MAXIMUM (NEW)	25.000 mm (.9842 in)
SERVICE LIMIT	25.020 mm (.9850 in)

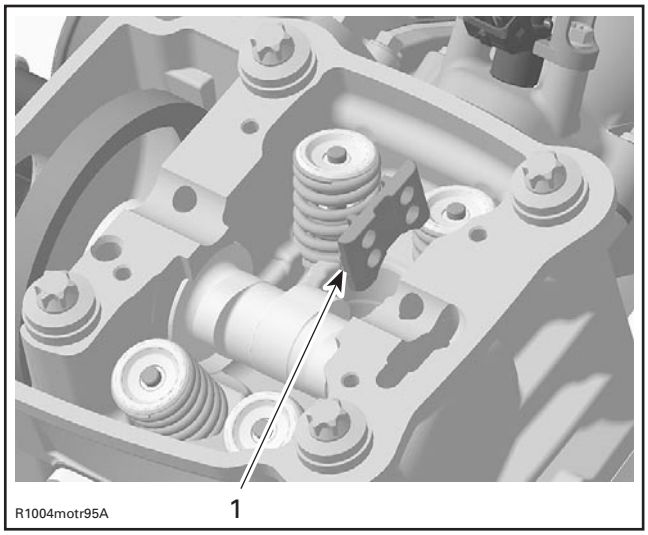
Replace parts that are not within specifications.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

CAUTION: The camshafts are not identical in design. Do not invert the camshafts during assembly. Any mix-up of the components will lead to engine damage.

Install camshaft then place the camshaft lock in the slot.



1. Camshaft lock

For other parts, refer to proper installation procedure.

VALVE SPRINGS

NOTE: The engine is equipped with two different valve springs **no. 16** (inner) and **no. 17** (outer) for every valve.

Removal

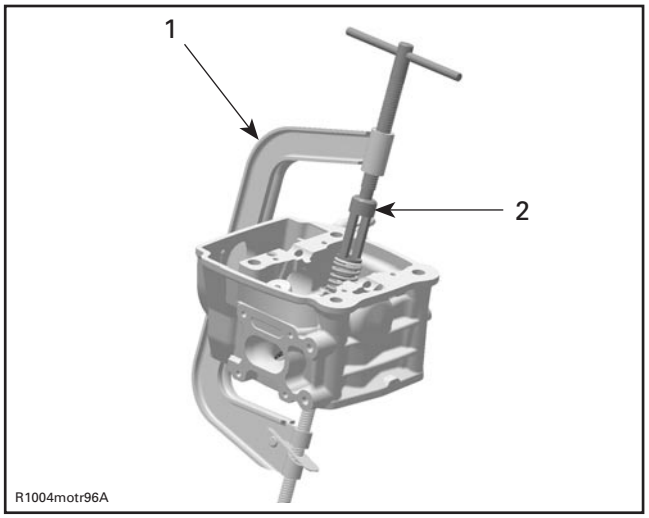
Remove:

– rocker arms (refer to ROCKER ARMS)
– cylinder head (refer to CYLINDER HEAD).

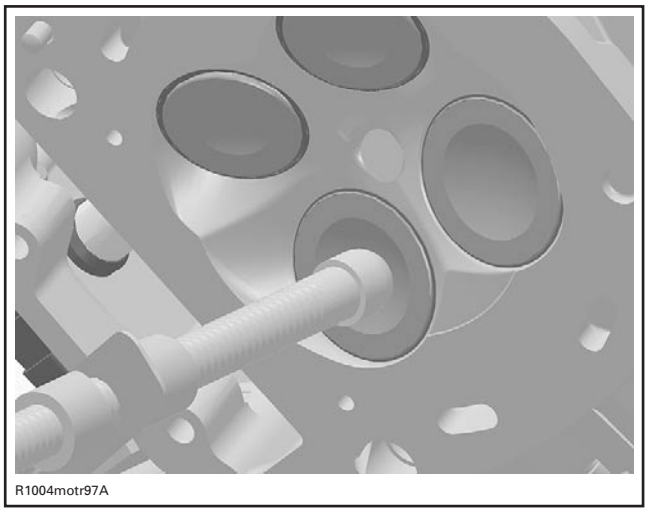
Compress valve springs **no. 16** and **no. 17**, use valve spring compressor clamp (P/N 529 035 764) and valve spring compressor cup (P/N 529 035 724).

⚠ WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could be expelled under pressure from preloaded spring.



1. Valve spring compressor clamp (P/N 529 035 764)
2. Valve spring compressor cup (P/N 529 035 724)



LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters **no. 19**.

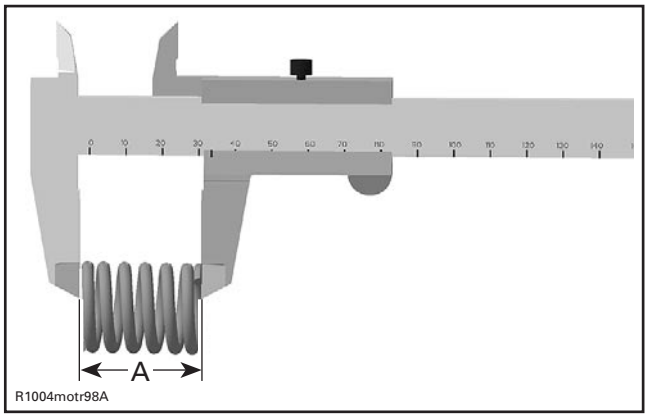
Withdraw valve spring compressor, valve spring retainer **no. 18** and valve springs.

Inspection

Check valve springs for rust, corrosion or other visible damages. If so, replace valve springs.

Check valve springs for free length and straightness.

Replace valve springs if not within specifications.



A. Valve spring length

VALVE SPRING FREE LENGTH	
OUTER VALVE SPRING	
NOMINAL (NEW)	45.45 mm (1.789 in)
SERVICE LIMIT	43 mm (1.693 in)
INNER VALVE SPRING	
NOMINAL (NEW)	41.02 mm (1.615 in)
SERVICE LIMIT	38.80 mm (1.528 in)

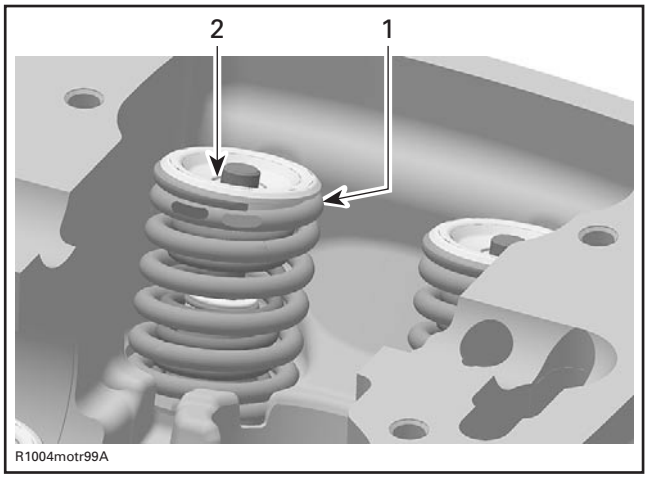
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Colored area of the valve spring must be placed on top.

If the color cannot be identified any more, orientation is possible, based on the shape of the spring. The spacing of the coils is smaller at one end. At installation, this end must be directed towards the cylinder head.

NOTE: Valve cotters must be properly engaged in valve stem grooves.



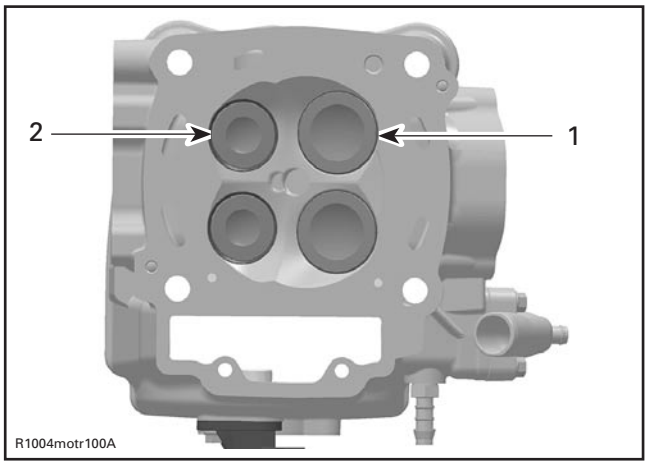
1. Position of the valve spring
2. Valve cotters

VALVE

Removal

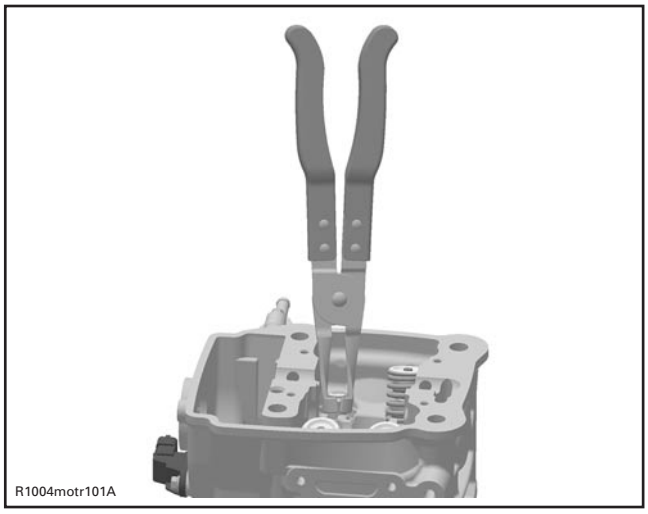
Remove valve springs.

Push valve stem then pull valves **no. 13** and **no. 14** out of valve guide.



1. Intake valve 38 mm
2. Exhaust valve 31 mm

Remove valve stem seal **no. 15** with special pliers such as Snap-ON YA 8230.



Inspection

Valve Stem Seal

NOTE: Inspection of valve stem seals is not needed because new seals should always be installed whenever cylinder head is removed.

Valve

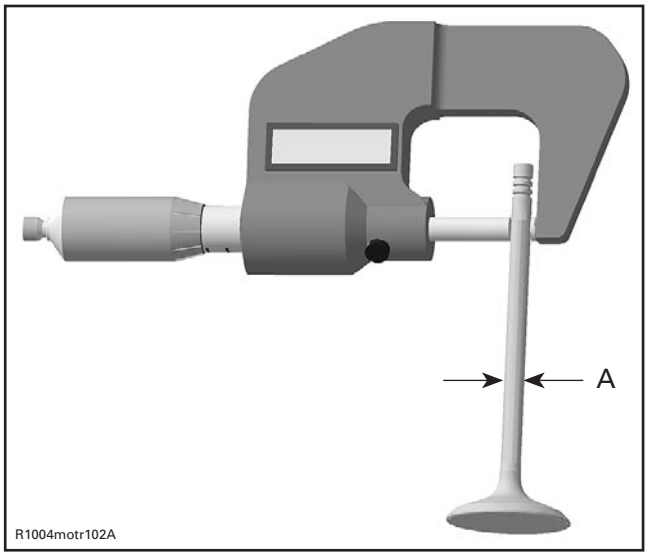
Inspect valve surface, check for abnormal stem wear and bending. If so, replace by a new one.

Valve Stem and Valve Guide Clearance

Measure valve stem and valve guide in three places, using a micrometer and a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Change valve if valve stem is out of specification or has other damages such as wear or traces of friction.



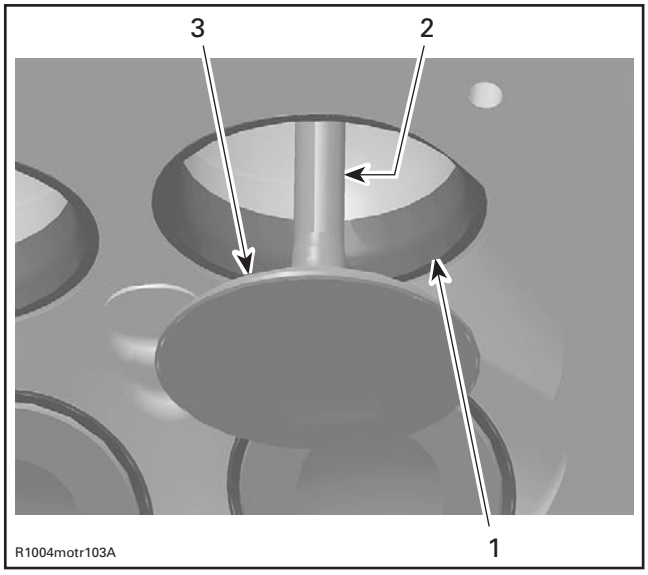
A. Valve stem diameter

VALVE STEM DIAMETER	
MINIMUM (NEW)	
Exhaust	5.946 mm (.2341 in)
Intake	5.961 mm (.2347 in)
MAXIMUM (NEW)	
Exhaust	5.960 mm (.2346 in)
Intake	5.975 mm (.2352 in)
SERVICE LIMIT	
Exhaust	5.93 mm (.233 in)
Intake	

Replace cylinder head if valve guide is out of specification or has other damages such as wear or traces of friction.

VALVE GUIDE DIAMETER	
SERVICE LIMIT	
Exhaust	6.060 mm (.2386 in)
Intake	

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool.

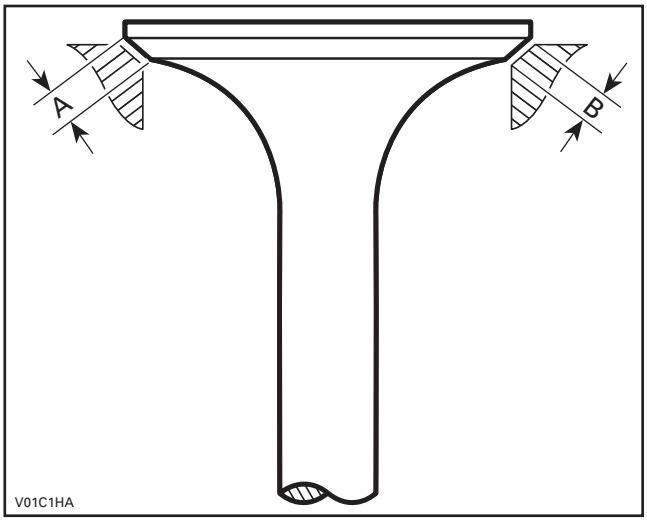
Measure valve face contact width.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width, using a caliper.

VALVE SEAT CONTACT WIDTH	
NEW	
Exhaust	1.25 to 1.55 mm (.049 to .061 in)
Intake	1.10 to 1.30 mm (.043 to .051 in)
SERVICE LIMIT	
Exhaust	1.8 mm (.071 in)
Intake	1.6 mm (.063 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.

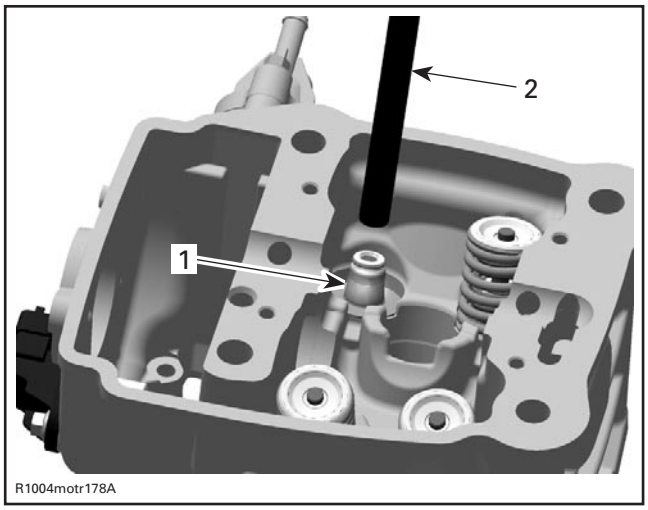


A. Valve face contact width
B. Valve seat contact width

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

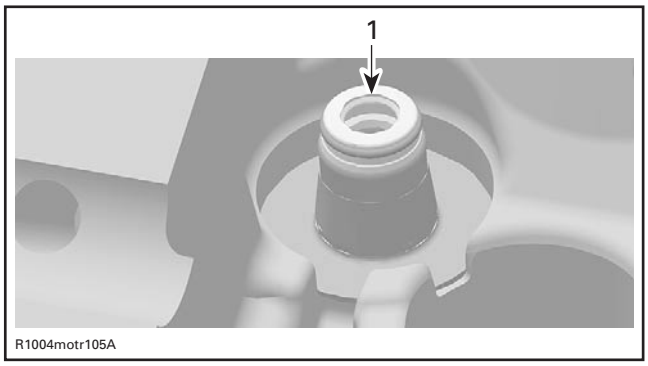
NOTE: At installation, replace the valve stem seal **no. 15**, use valve stem seal installer (P/N 529 035 687).



1. Valve stem seal
2. Valve stem seal installer (P/N 529 035 687)

Apply engine oil on valve stem and install it.

CAUTION: Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

CAUTION: An improperly locked valve spring will cause engine damage.

CYLINDER

NOTE: The engine is equipped with two different cylinders **no. 2** and **no. 72**.

Removal

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

Remove:

– cylinder heads (refer to CYLINDER HEAD).

Pull cylinder **no. 2** and **no. 72**.

Discard cylinder gaskets **no. 1**.

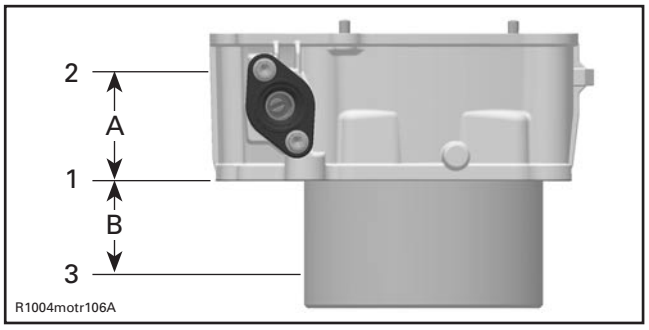
Inspection

Cylinder

Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore at 3 recommended positions. See the following illustration.



1. First measuring diameter in line with cylinder bottom
2. Second measuring diameter
3. Third measuring diameter

A. 60 mm (2.362 in)
B. 50 mm (1.968 in)

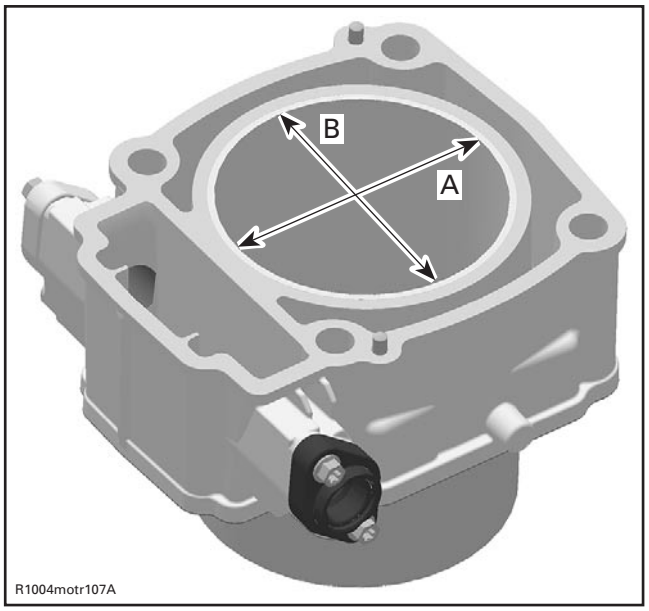
CYLINDER TAPER	
MAXIMUM (NEW)	0.038 mm (.001 in)
SERVICE LIMIT	0.090 mm (.004 in)

Difference between measurements should not exceed the service limit mentioned above.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take another measurement 90° from first one and compare.

NOTE: Take the same measuring points like described in CYLINDER TAPER above.



A. Parallel to piston axis
B. Perpendicular to piston axis

CYLINDER OUT OF ROUND	
MAXIMUM (NEW)	0.01 mm (.0002 in)
SERVICE LIMIT	0.02 mm (.0008 in)

CAUTION: Always replace gasket no. 1 before installing the cylinder.

Installation

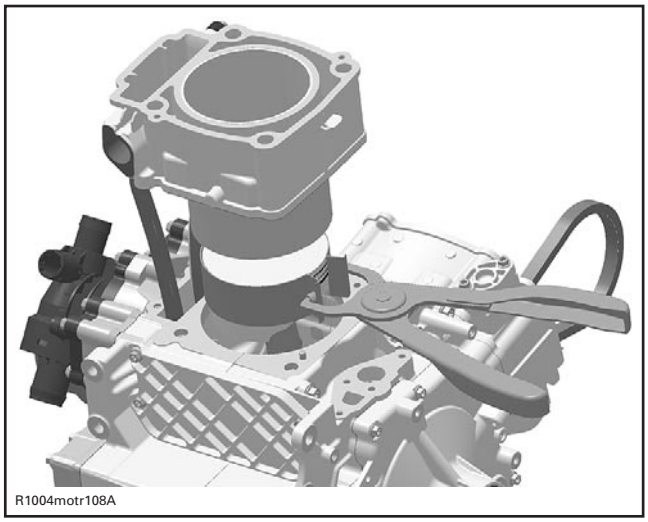
For installation, reverse the removal procedure. Pay attention to the following details.

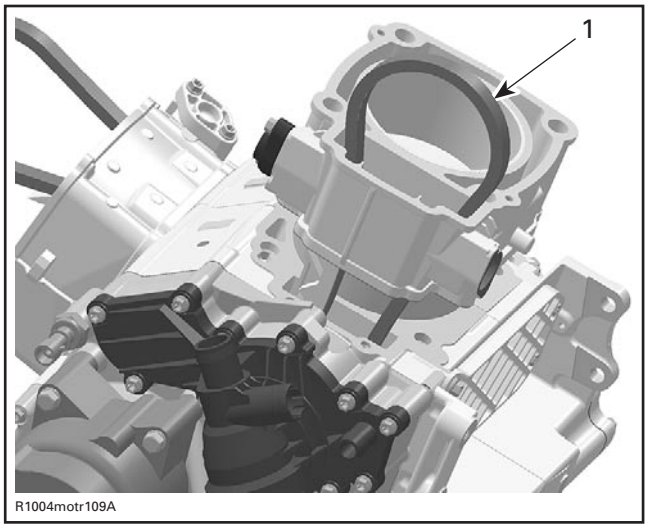
NOTE: The cylinders are not identical in design. Do not invert the cylinders during assembly.

First mount cylinder 1. Then remove the crankshaft locking tool (P/N 529 035 900). Crank the engine further and position piston 2 at TDC. Mount cylinder 2. The cylinder cannot be pushed fully over the piston unless the piston is located at TDC.

Apply engine oil in the bottom area of the cylinder bore and also on the band of the piston ring compressor tool.

Using a piston ring compressor plier, such Snap-On RC-980, slide piston into cylinder.





1. Timing chain

NOTE: Put timing chain through the chain pit then put the cylinder in place.

Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

Refer to CRANKSHAFT/DRIVE GEARS.

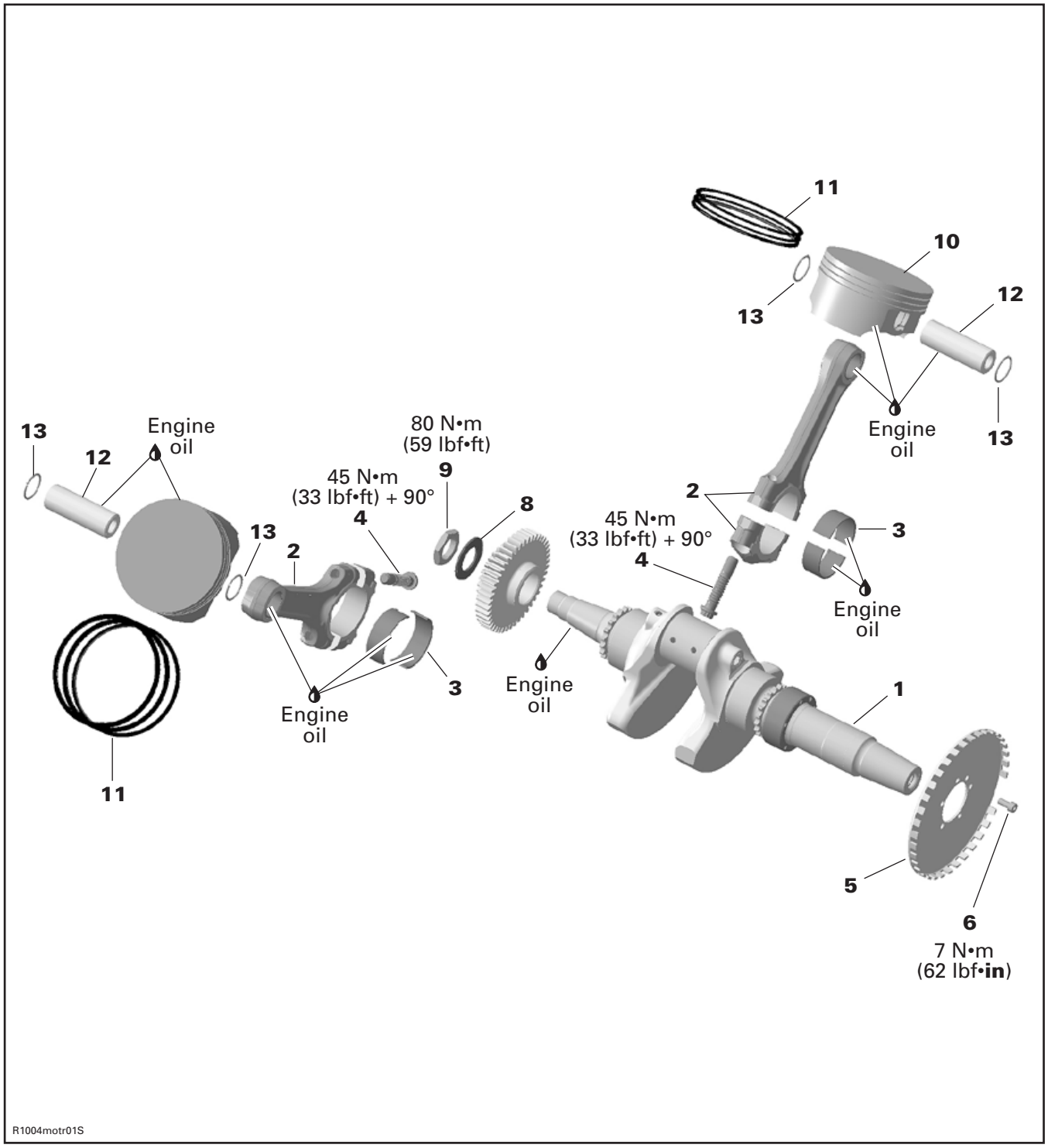
CRANKSHAFT/DRIVE GEARS

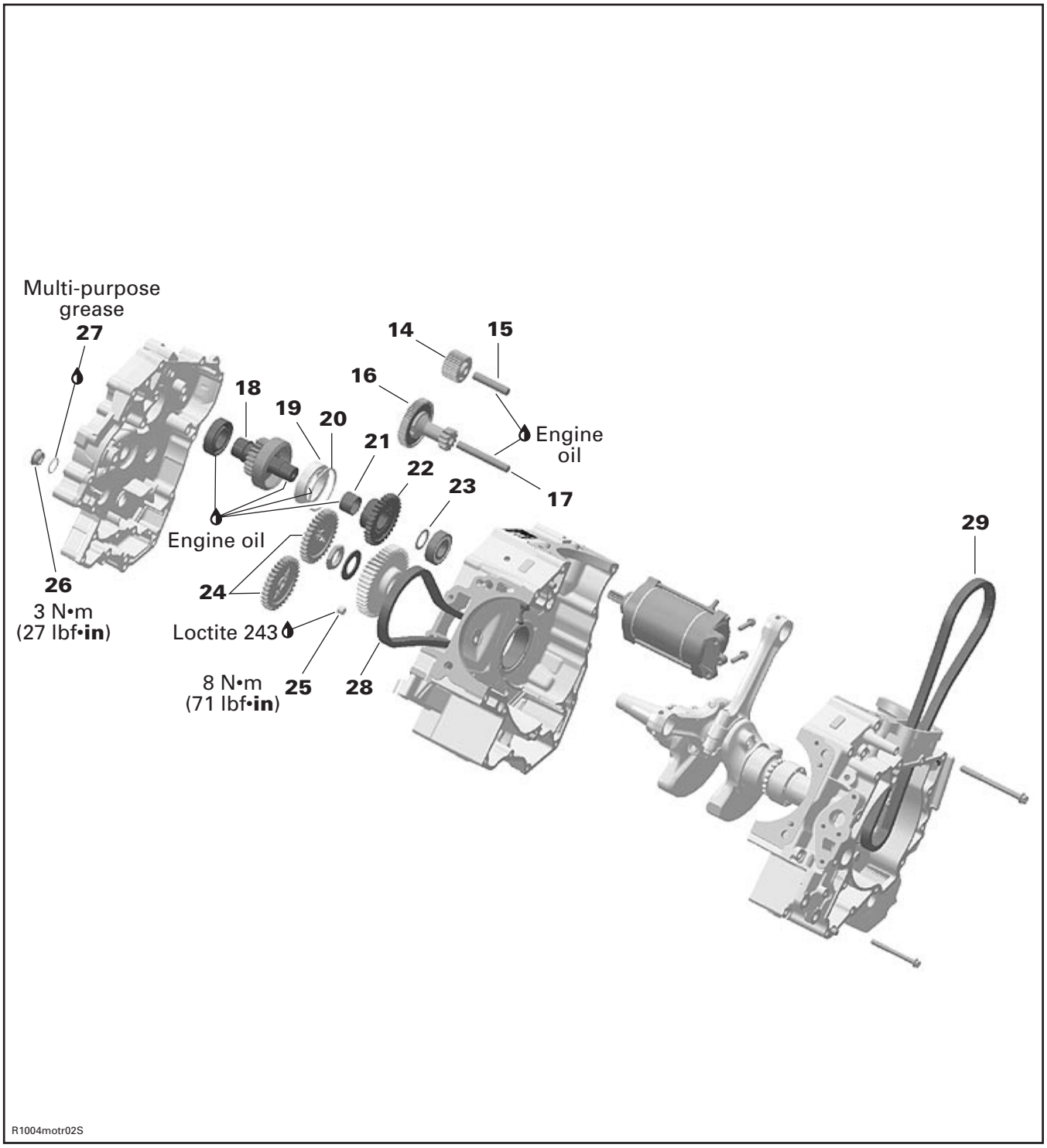
SERVICE TOOLS

Description	Part Number	Page
crankshaft locking tool	529 035 900	235, 241
piston circlip installer	529 035 765	244
protection mushroom	420 876 552	235

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	241
Molykote 111	413 707 000	241


11
10
13
12
13
Engine oil
13
12
Engine oil
80 N•m (59 lbf•ft)
45 N•m (33 lbf•ft) + 90°
9
8
4
2
45 N•m (33 lbf•ft) + 90°
3
4
13
2
Engine oil
Engine oil
3
Engine oil
1
11
5
6
7 N•m (62 lbf•in)
R1004motr01S


Multi-purpose grease
27
26
3 N•m (27 lbf•in)
18
19
20
21
22
23
24
Engine oil
Loctite 243
8 N•m (71 lbf•in)
25
28
14
15
16
Engine oil
17
29
R1004motr02S

TIMING CHAIN

The engine is equipped with two timing chains **no. 28** and **no. 29**. One of the timing chains is located on the engine alternator side behind the ignition cover. The second is located on the PTO side behind the PTO cover.

Removal of Alternator Side Timing Chain

Remove:

– ignition cover (refer to COOLING SYSTEM)
– chain tensioner and chain guide (refer to CYLINDER AND CYLINDER HEAD)
– camshaft sprocket (refer to CYLINDER AND CYLINDER HEAD)
– oil pump gears **no. 24** (refer to LUBRICATION SYSTEM)
– crankshaft drive gear **no. 7** (refer to DRIVE GEARS).

Carefully pull the timing chain sideward and down from the crankcase.

Removal of PTO Side Timing Chain

Remove:

– engine from vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank (refer to LUBRICATION SYSTEM)
– chain tensioner and chain guide (refer to CYLINDER AND CYLINDER HEAD)
– camshaft timing gear (refer to CYLINDER AND CYLINDER HEAD)
– PTO cover (refer to CRANKCASE)
– trigger wheel **no. 6** (refer to TRIGGER WHEEL).

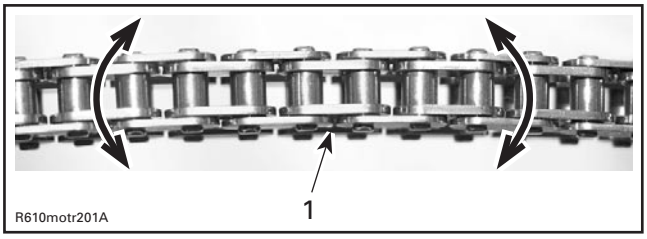
Carefully pull the timing chain sideward and down from the crankcase.

Inspection

Inspection is the same for both timing chains **no. 28** and **no. 29**. Pay attention to the following details.

NOTE: Check timing chain on camshaft sprocket/timing gear for excessive radial play.

Check chain condition for wear and rollers condition.



1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft sprocket/timing gear and timing chain).

Installation

Installation is the same for both timing chains **no. 28** and **no. 29**.

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

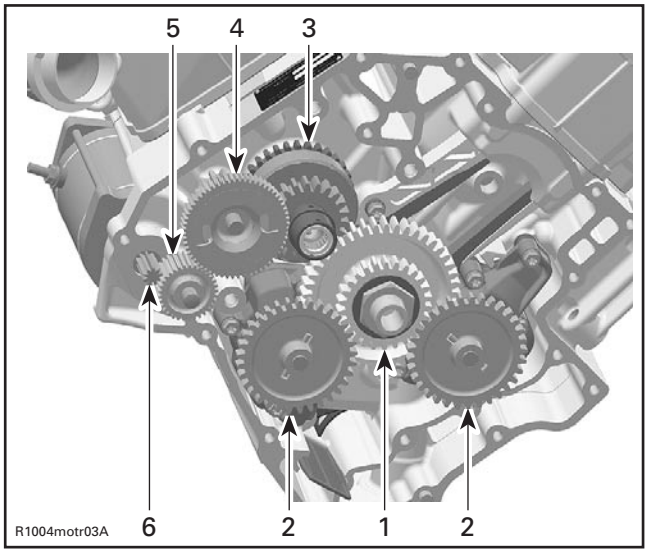
NOTE: Ensure to perform proper valve timing. Lock crankshaft and camshaft at TDC (refer to CYLINDER AND CYLINDER HEAD).

Install chain then, adjust chain tension (refer to CYLINDER AND CYLINDER HEAD).

CAUTION: Improper valve timing will damage engine components.

DRIVE GEARS

The drive gears are located on the engine alternator side behind the ignition cover.



1. *Crankshaft drive gear*
2. *Oil pump gears*
3. *Generator gear*
4. *Double gear*
5. *Intermediate gear*
6. *Starter gear*

Removal

Lock crankshaft with crankshaft locking tool (P/N 529 035 900) (refer to CRANKSHAFT LOCKING TOOL).

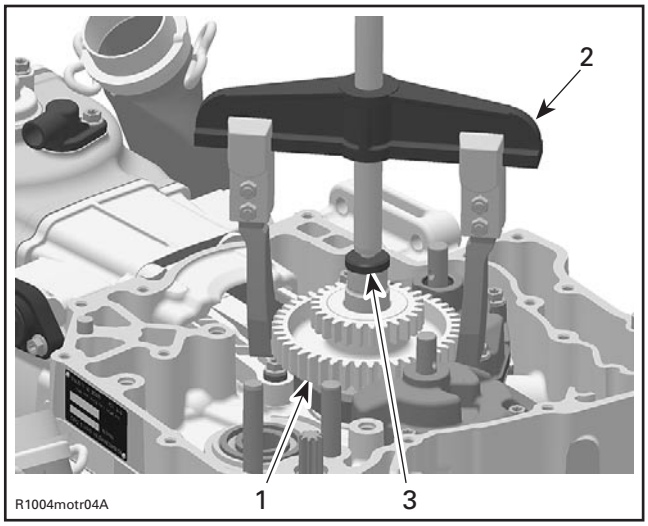
Remove:

– ignition cover (refer to COOLING SYSTEM)
– oil pump gears **no. 24** (refer to LUBRICATION SYSTEM)
– crankshaft nut **no. 9**
– crankshaft drive gear **no. 7**.

Remove crankshaft drive gear with gear puller (aftermarket tool). Also use the protection mushroom (P/N 420 876 552) to avoid damage of the crankshaft.

⚠ WARNING

The gear puller and the crankshaft drive gear are highly tensioned. When the crankshaft drive gear is loosened, the puller may forcefully swing up.



1. *Crankshaft drive gear*
2. *Gear puller*
3. *Protection mushroom (P/N 420 876 552)*

– generator gear **no. 18** and thrust washer **no. 23**
– double gear **no. 16**
– intermediate gear **no. 14**.

Inspection

Double Gear/Intermediate Gear/Crankshaft Drive Gear

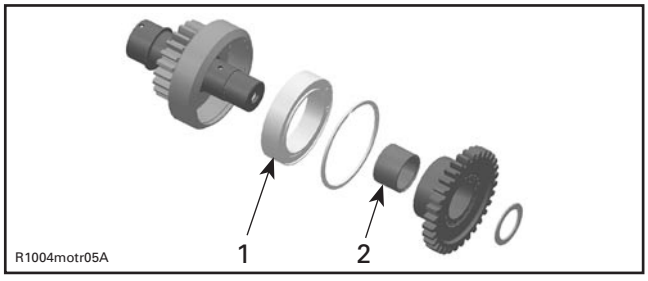
NOTE: Inspect the gears for wear and damage.

Oil Pump Gears

Refer to LUBRICATION SYSTEM.

Generator Gear

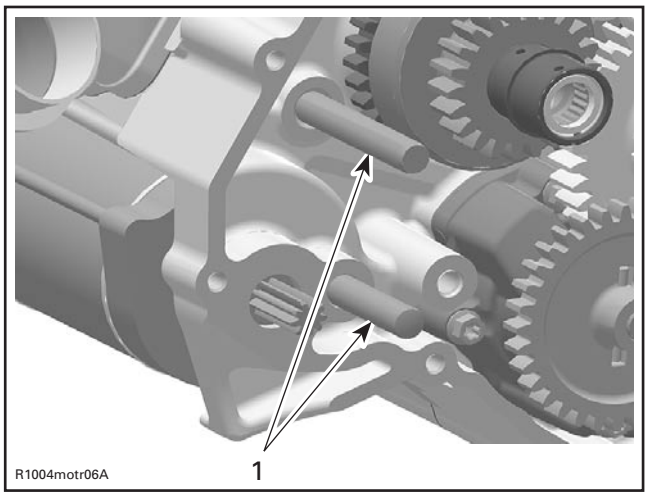
Completely disassemble the generator gear.



1. *Sprag clutch*
2. *Needle bearing*

NOTE: Inspect all components, especially the needle bearing, for wear and damage. Perform a function test of the sprag clutch.

Location Pins



1. Location pins

NOTE: Inspect all pins for wear and damage. The pins are firmly pressed into the crankcase but may work loose during the course of time. If the pins can be rotated, there is no need for repair work.

Installation

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

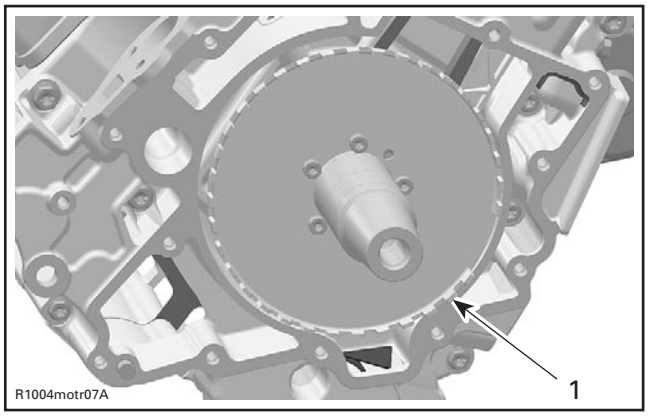
NOTE: Adequately oil all components prior to installation. The oil pump gears and the crankshaft drive gear do not need to be oiled.

The generator gear and the double gear must be installed at the same time on their respective location pin.

Torque crankshaft nut **no. 9** to 80 N•m (59 lbf•ft).

TRIGGER WHEEL

The trigger wheel is located on the engine PTO side behind the PTO cover.



1. Trigger wheel

Removal

Remove:

– oil tank (refer to LUBRICATION SYSTEM)
– PTO cover (refer to CRANKCASE)
– trigger wheel screws **no. 6** and pull trigger wheel **no. 5**.

Inspection

NOTE: Refer to COMPONENT INSPECTION AND ADJUSTMENT in ENGINE MANAGEMENT section.

Installation

For installation, reverse the removal procedure.

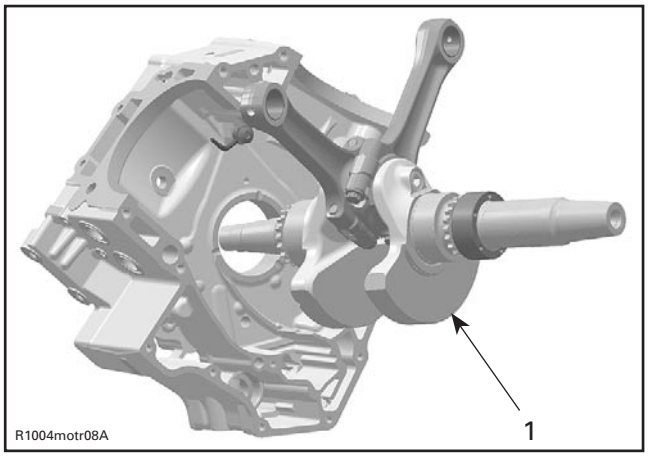
Torque trigger wheel screws to 7 N•m (62 lbf•**in**).

CRANKSHAFT

Removal

Remove:

– drive gears (refer to DRIVE GEARS above)
– crankcase (refer to CRANKCASE)
– crankshaft **no. 1**



1. Crankshaft

– connecting rods **no. 2**.

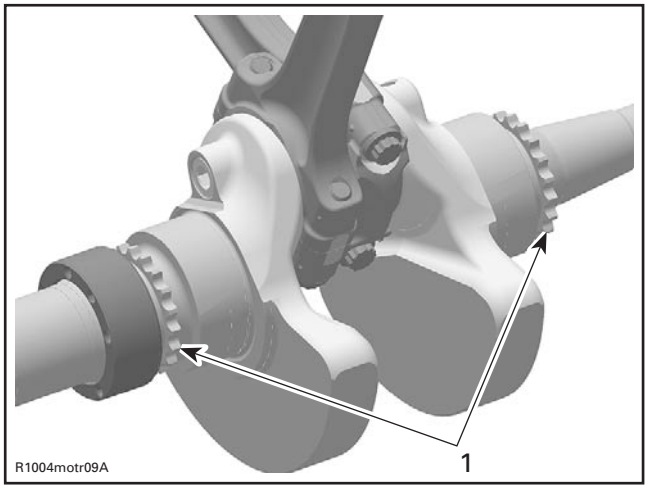
NOTE: Mark the connecting rods prior to dismantling. The connecting rods must be reinstalled in exactly the same position and running direction.

Inspection

NOTE: Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.

NOTE: Replace crankshaft if the gears are worn or otherwise damaged.

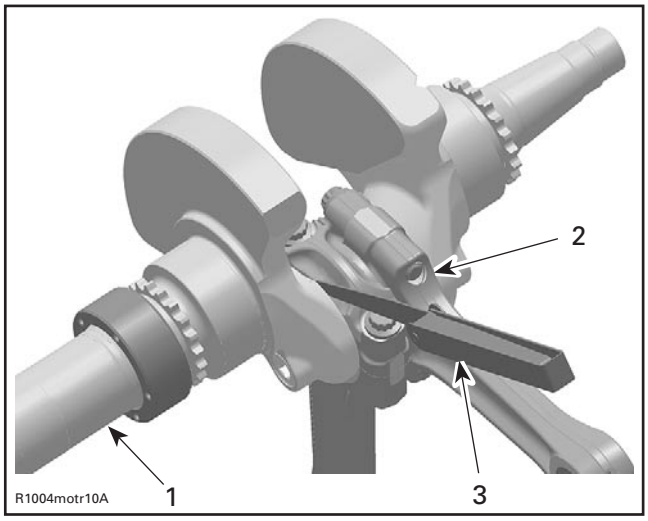
CAUTION: Components with less than the service limit always have to be replaced. If this is not observed, severe damage may be caused to the engine.



1. Crankshaft timing gear

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rods and crankshaft counterweight. If the distance exceeds specified tolerance, replace the crankshaft.

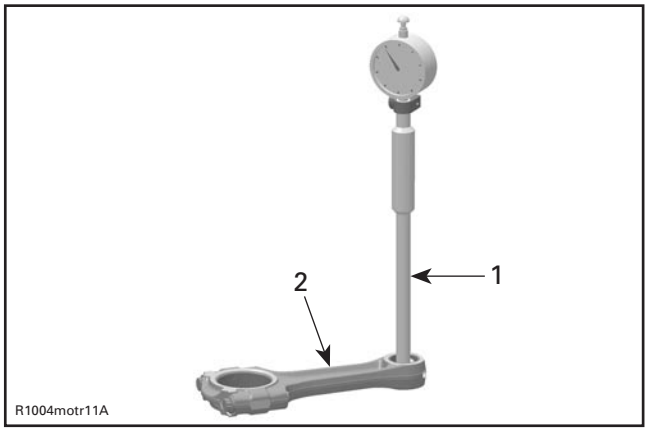


1. Crankshaft
2. Connecting rods
3. Feeler gauge

CONNECTING ROD BIG END	
NEW MINIMUM	0.150 mm (.006 in)
NEW MAXIMUM	0.450 mm (.017 in)
SERVICE LIMIT	0.5 mm (.020 in)

Connecting Rod/Piston Pin Clearance

Measure piston pin. Compare to inside diameter of connecting rod **no. 2**.



1. Bore gauge
2. Connecting rod

A. Piston pin diameter in the area of the bushing

CONNECTING ROD SMALL END DIAMETER	
NEW MINIMUM	23.01 mm (.9059 in)
NEW MAXIMUM	23.02 mm (.9063 in)
SERVICE LIMIT	23.07 mm (.908 in)

PISTON PIN DIAMETER	
NEW MINIMUM	22.996 mm (.9053 in)
NEW MAXIMUM	23.000 mm (.9055 in)
SERVICE LIMIT	22.990 mm (.904 in)

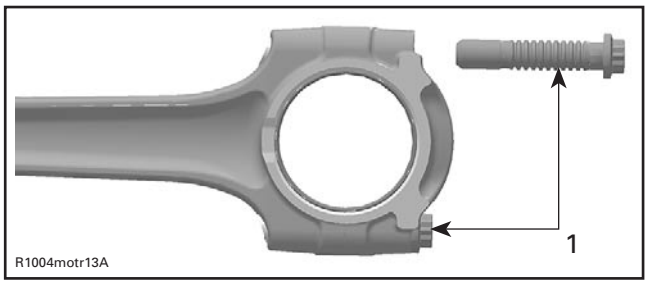
PISTON PIN BORE CLEARANCE	
SERVICE LIMIT	0.080 mm (.0035 in)

NOTE: If the connecting rod small end diameter is out of specification, replace connecting rod.

Connecting Rod Big End Radial Play

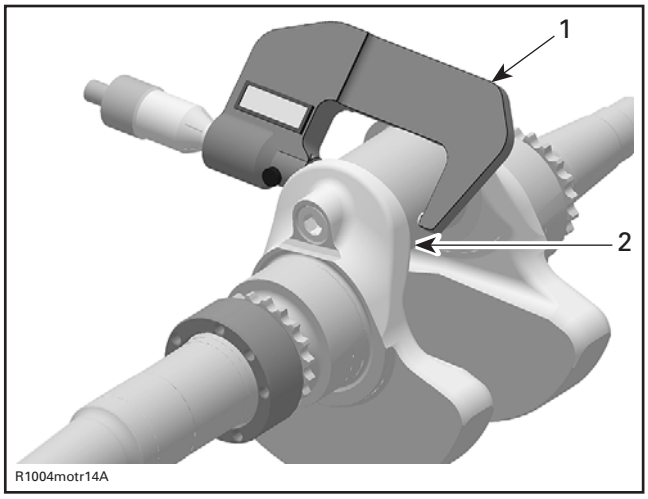
Remove connecting rod **no. 2** from crankshaft **no. 1**.

CAUTION: Always replace connecting rod screws no. 4 if removing the connecting rod. It is recommended to replace bushings no. 3, in case of installing the connecting rod.



1. Connecting rod screw

Measure crankpin. Compare to inside diameter of connecting rod big end.

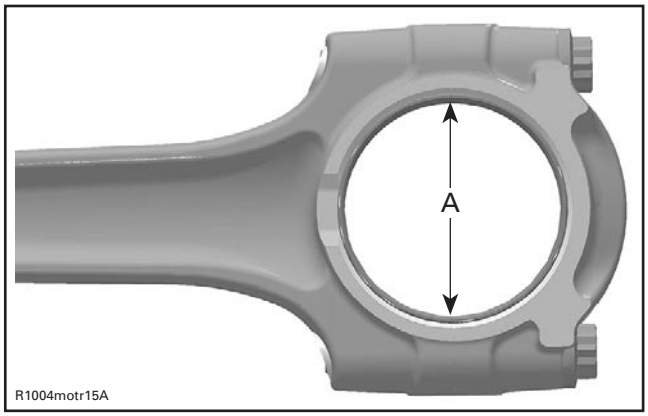


1. Micrometer
2. Crankpin area for bushings

To measure the connecting rod big end diameter, use the OLD screws **no. 4**.

Install the OLD bushings **no. 3** as they were mounted initially.

Do the torque procedure as described further.



A. Connecting rod big end bushing

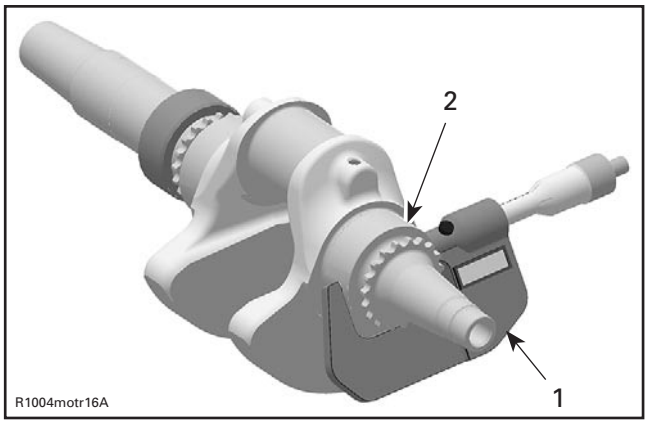
CRANKSHAFT PIN DIAMETER	
NEW MINIMUM	45.017 mm (1.7723 in)
NEW MAXIMUM	45.033 mm (1.7729 in)
SERVICE LIMIT	45.000 mm (1.772 in)

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	45.090 mm (1.775 in)

CONNECTING ROD BIG END CLEARANCE	
SERVICE LIMIT	0.09 mm (.0035 in)

Crankshaft Radial Play Alternator Side

Measure crankshaft on alternator side. Compare to inside diameter of alternator bushing (refer to CRANKCASE).



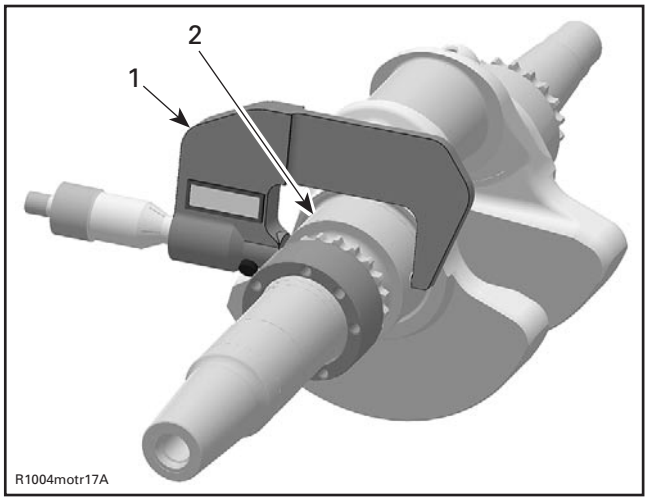
1. Micrometer
2. Crankshaft area for alternator bushing

CRANKSHAFT ALTERNATOR SIDE DIAMETER	
NEW MINIMUM	54.961 mm (2.1638 in)
NEW MAXIMUM	54.980 mm (2.1645 in)
SERVICE LIMIT	54.940 mm (2.1629 in)

CRANKSHAFT ALTERNATOR SIDE RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (PTO side)

Measure crankshaft on PTO side. Compare to inside diameter of PTO bushing (refer to CRANKCASE).



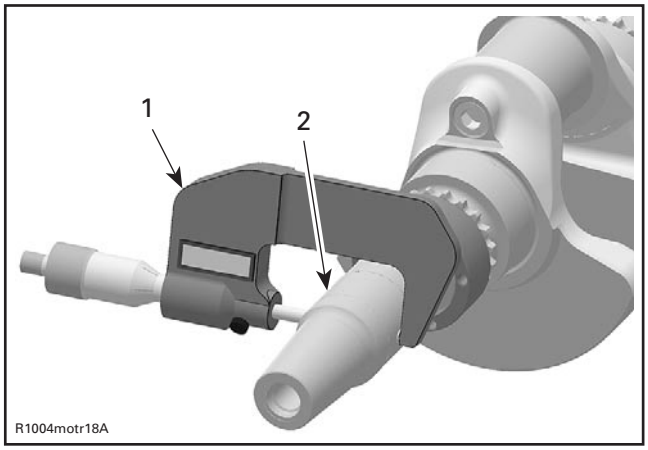
1. Micrometer
2. Crankshaft area for PTO bushing

CRANKSHAFT JOURNAL PTO DIAMETER	
NEW MINIMUM	54.961 mm (2.1638 in)
NEW MAXIMUM	54.980 mm (2.1645 in)
SERVICE LIMIT	54.940 mm (2.1629 in)

CRANKSHAFT ALTERNATOR SIDE RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (PTO side support bearing)

Measure crankshaft on PTO side journal for support bearing. Compare to inside diameter of PTO support bearing (refer to PTO COVER in CRANKCASE section).



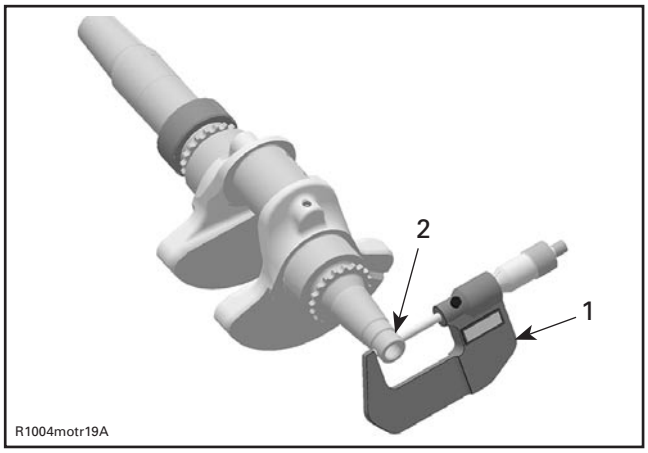
1. Micrometer
2. Crankshaft area (PTO support bearing)

CRANKSHAFT JOURNAL DIAMETER (PTO SUPPORT BEARING)	
NEW MINIMUM	37.984 mm (1.4954 in)
NEW MAXIMUM	38.000 mm (1.4960 in)
SERVICE LIMIT	37.960 mm (1.4945 in)

CRANKSHAFT PTO SUPPORT BEARING RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (alternator side — oil supply hole)

Measure crankshaft on alternator side journal for oil supply hole. Compare to inside diameter of oil supply hole in ignition cover (refer to IGNITION COVER in COOLING SYSTEM).



1. Micrometer
2. Crankshaft area (journal for oil supply hole)

CRANKSHAFT JOURNAL DIAMETER (OIL SUPPLY HOLE)	
NEW MINIMUM	19.987 mm (0.7869 in)
NEW MAXIMUM	20.00 mm (0.7874 in)
SERVICE LIMIT	0.08 mm (.0031 in)

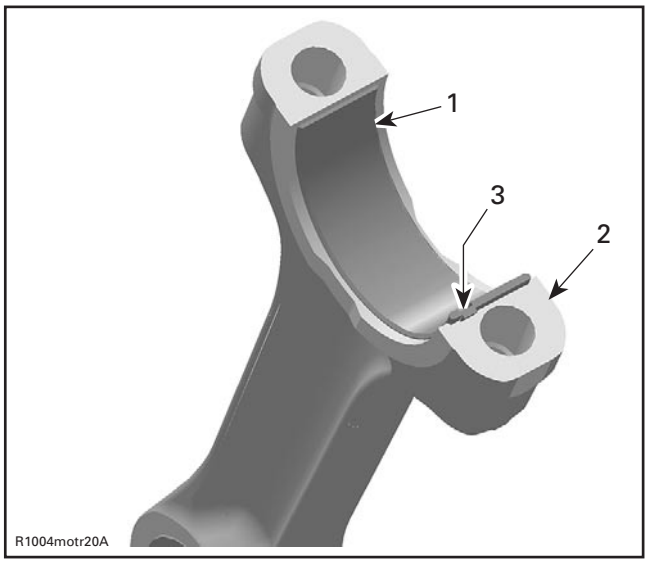
CRANKSHAFT PTO SUPPORT BEARING RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Installation

For installation, reverse the removal procedure. Pay attention to following details.

NOTE: Use NEW bushings **no. 3**, when connecting rod big end diameter is out of specification.

Put bushings correctly in place and clean the split surface on both sides (cracked area) carefully.



1. Half bushing of connecting rod big end
2. Split surface of the connecting rod
3. Nose of bushing in line with connecting rod groove

NOTE: Oil the plain bearing of the connecting rod before installation.

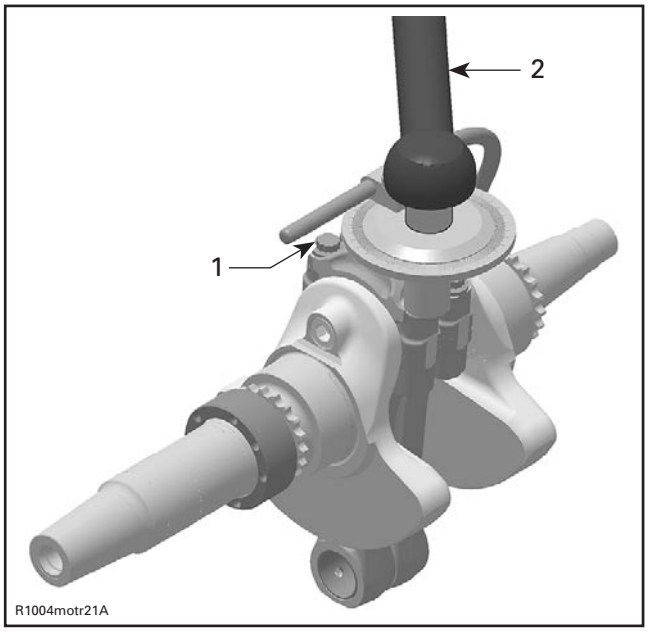
Torque NEW connecting rod screws **no. 4** as per following procedure:

– Torque connecting rod screws to 20 N•m (177 lbf•**in**). Do not apply any thread locker product.
– Torque connecting rod screws to 45 N•m (33 lbf•ft).
– Finish tightening the screws with an additional 90° turn using an angle torque wrench.

CAUTION: Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. The bushing tapered end must be against the counterweight. Besides, as the "crankpin" screw has been stretched from the previous installation, it is very important to use a new screw at assembly.

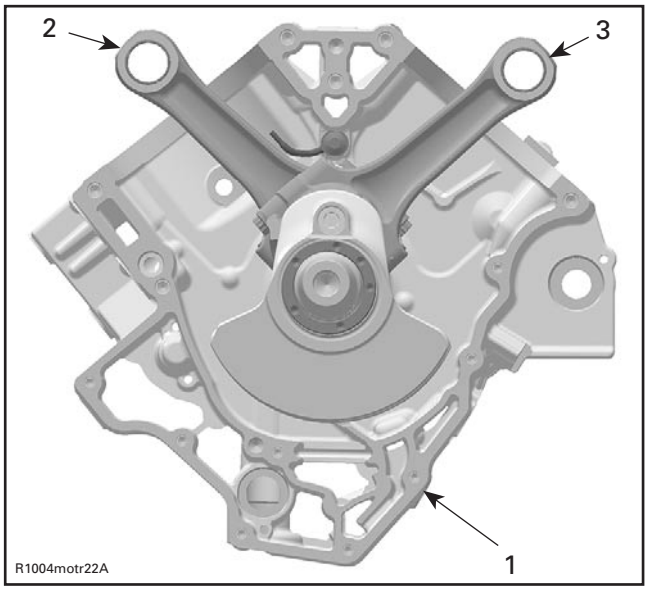
Take care during installation that the connecting rods are not installed with a twist. The running direction of the big end bearings and of the piston pins must not change.

Do not mix up the connecting rods of cylinders 1 and 2 during installation.



1. Connecting rod screws
2. Angle torque wrench

CAUTION: Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod alternator side has to face to cylinder 1.

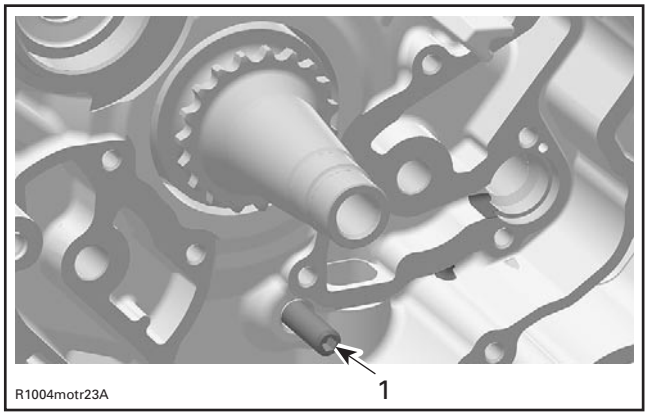


1. Crankcase alternator side
2. Connecting rod cylinder 1
3. Connecting rod cylinder 2

CAUTION: Install crankshaft locking tool (P/N 529 035 900) (refer to CRANKSHAFT LOCKING TOOL) right away to put crankshaft in TDC position before installing the camshaft and rockers (refer to CYLINDER AND CYLINDER HEAD).

CRANKSHAFT LOCKING TOOL

The engine must be locked for removal and installation work on crankshaft and camshaft. The opening for the crankshaft locking tool is located in the ignition cover and in crankcase alternator side.



1. Crankshaft locking tool (P/N 529 035 900)

Removal

Remove:

– plug screw **no. 26**
– plug screw **no. 25**.

CAUTION: Pull out the plug screw with utmost care to prevent it from being dropped into the crankcase during dismantling.

Installation

Fit the plug screw **no. 25** with Loctite 243 (P/N 293 800 060).

Torque plug screw **no. 25** to 8 N•m (71 lbf•**in**).

Replace O-ring **no. 27** during installation and grease it with Molykote 111 (P/N 413 707 000).

Torque plug screw **no. 26** to 3 N•m (26 lbf•**in**).

PISTON

Removal

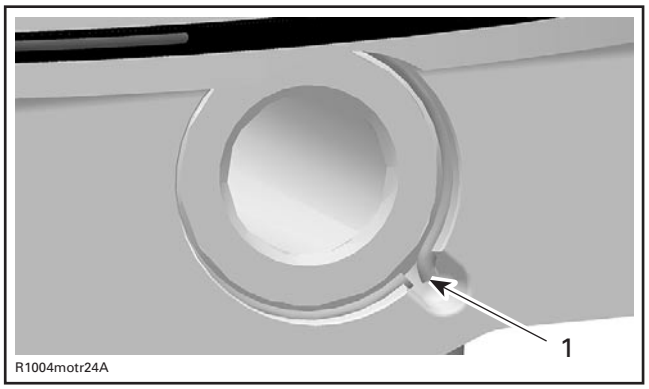
Remove:

– cylinder head (refer to CYLINDER AND CYLINDER HEAD)

– cylinder (refer to CYLINDER AND CYLINDER HEAD).

Place a rag under piston.

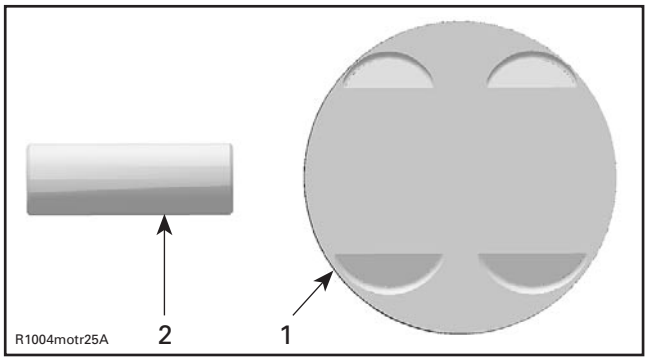
Remove one piston circlip **no. 13** and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin **no. 12** out of piston.



1. Piston
2. Piston pin

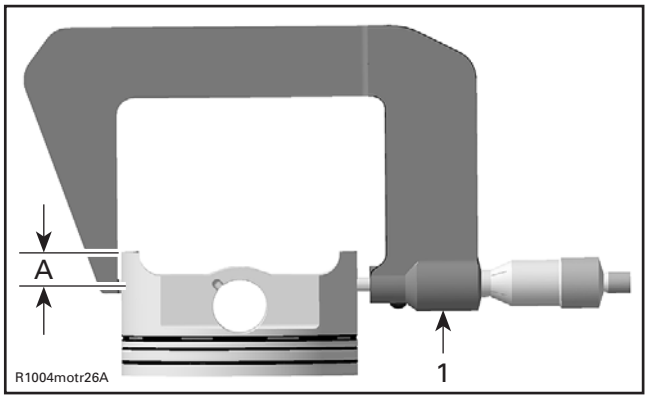
Detach piston **no. 10** from connecting rod.

Inspection

Piston

NOTE: Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 18 mm (.709 in) perpendicularly (90°) to piston pin.



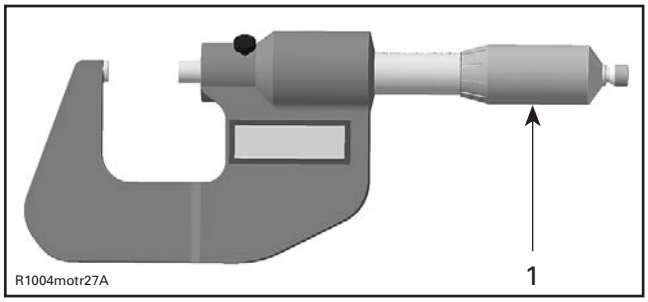
1. Measuring perpendicularly (90°) to piston pin
A. 18 mm (.709 in)

The measurement should be as in the following table. If not, replace piston.

PISTON MEASUREMENT	
NEW NOMINAL	99.951 to 99.969 mm (3.935 to 3.936 in)
SERVICE LIMIT	99.80 mm (3.929 in)

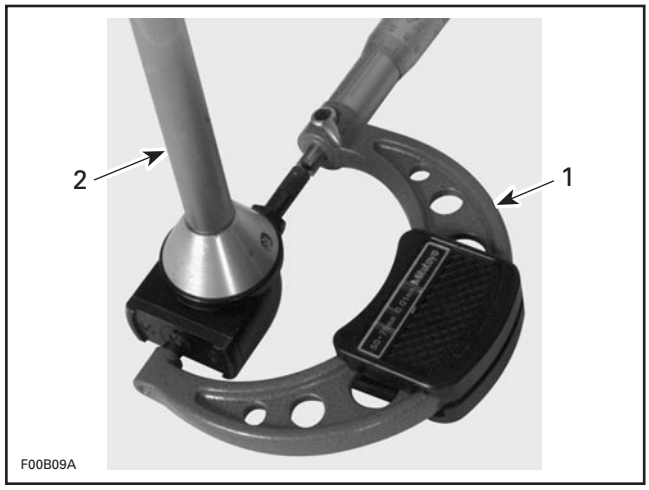
Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

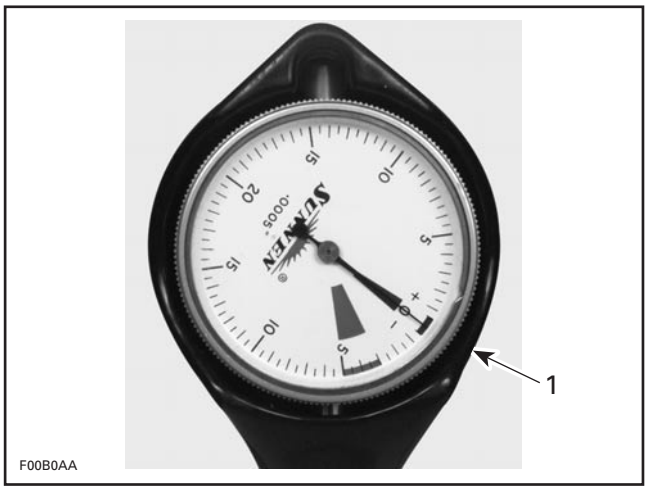


1. Micrometer set to the piston dimension

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



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



TYPICAL
1. Indicator set to 0 (zero)

Position the dial bore gauge 50 mm (2 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE	
NEW NOMINAL	0.024 to 0.056 mm (.001 to .002 in)
SERVICE LIMIT	0.090 mm (.004 in)

NOTE: Make sure used piston is not worn. See PISTON MEASUREMENT above.

If clearance exceeds specified tolerance, replace cylinder.

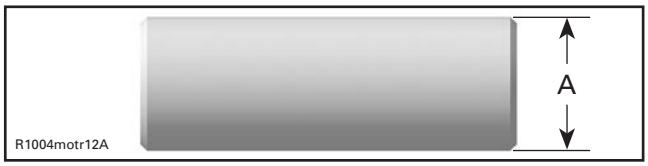
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Piston Pin

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement position.



A. Piston pin diameter

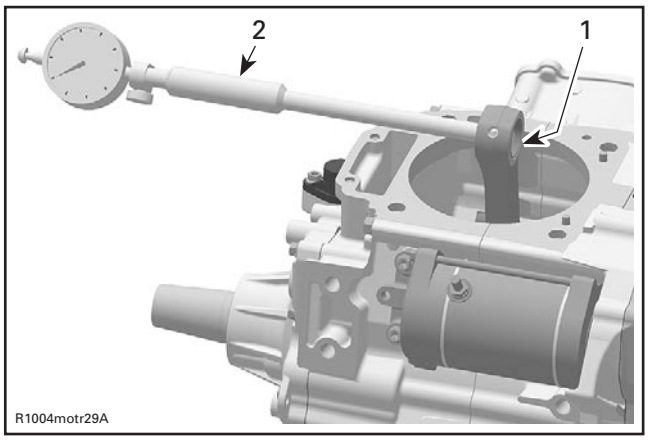
PISTON PIN	
NEW MINIMUM	22.996 mm (.9053 in)
NEW MAXIMUM	23.000 mm (.9055 in)
SERVICE LIMIT	22.990 mm (.9051 in)

NOTE: Replace piston pin if diameter is out of specifications.

Piston Pin/Connecting Rod Bushing Clearance

Measure inside diameter of connecting rod.

CONNECTING ROD SMALL END DIAMETER	
NEW MINIMUM	23.01 mm (.9059 in)
NEW MAXIMUM	23.02 mm (.9063 in)
SERVICE LIMIT	23.07 mm (.908 in)



1. Bushing of the connecting rod
2. Bore gauge

NOTE: Replace connecting rod if diameter of connecting rod small end is out of specifications.

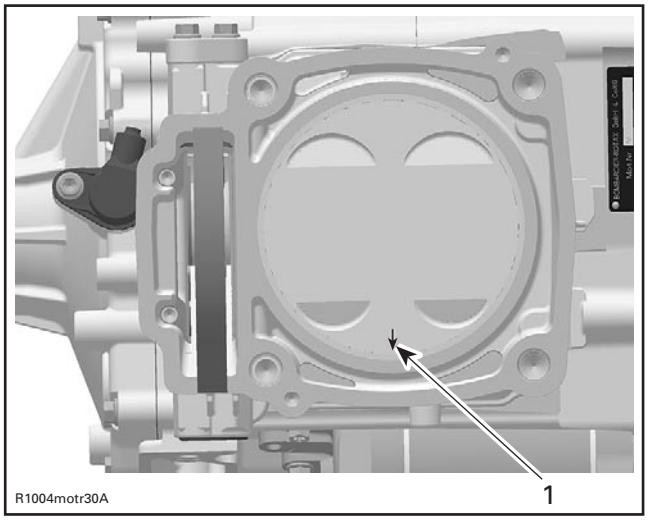
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Apply engine oil on the piston pin.

Insert piston pin into piston and connecting rod.

CAUTION: Take care that piston will be installed with the punched arrow on piston top to the exhaust side.

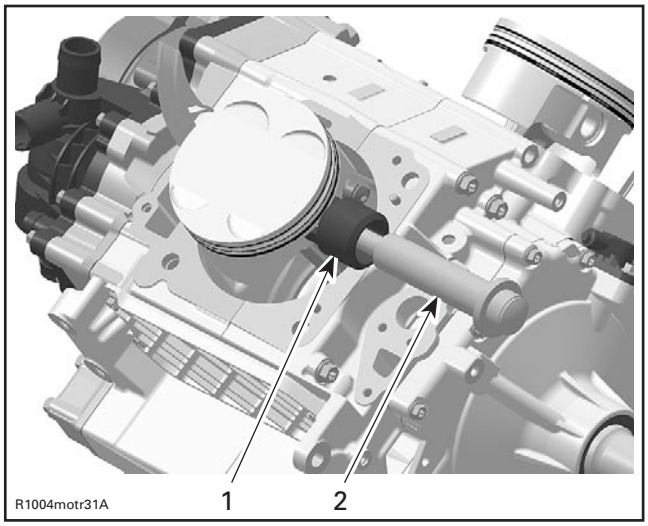


1. Arrow should indicate to the exhaust side

Use the piston circlip installer (P/N 529 035 765) to assemble the piston circlip.

CAUTION: Secure piston pin with new piston circlips.

NOTE: Take care that the hook of the piston circlip is positioned properly.



1. Sleeve with piston circlip inside
2. Assembly jig from piston clip installer

PISTON RINGS

Removal

Remove:

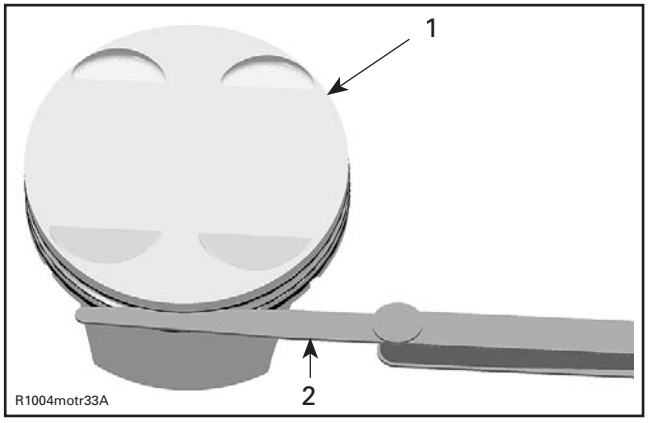
– cylinder head (refer to CYLINDER AND CYLINDER HEAD)
– cylinder (refer to CYLINDER AND CYLINDER HEAD)
– piston pin **no. 12** (refer to PISTON above)
– piston **no. 10**.

Inspection

Ring/Piston Groove Clearance

NOTE: Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE MM (IN)	
NEW MINIMUM	
UPPER COMPRESSION RING (rectangular)	0.025 mm (.001 in)
LOWER COMPRESSION RING (taper-face)	0.015 mm (.0006 in)
OIL SCRAPER RING	0.020 mm (.0008 in)
NEW MAXIMUM	
UPPER COMPRESSION RING (rectangular)	0.070 mm (.0028 in)
LOWER COMPRESSION RING (taper-face)	0.060 mm (.0024 in)
OIL SCRAPER RING	0.055 mm (.0021 in)
SERVICE LIMIT	
ALL	0.15 mm (.006 in)



1. Piston
2. Feeler gauge

Ring End Gap

RING END GAP	
NEW MINIMUM	
UPPER COMPRESSION RING (rectangular)	0.30 mm (.012 in)
LOWER COMPRESSION RING (taper-face)	0.35 mm (.014 in)
OIL SCRAPER RING	0.35 mm (.014 in)
NEW MAXIMUM	
UPPER COMPRESSION RING (rectangular)	0.50 mm (.020 in)
LOWER COMPRESSION RING (taper-face)	0.55 mm (.022 in)
OIL SCRAPER RING	0.50 mm (.020 in)
SERVICE LIMIT	
ALL	1.5 mm (.059 in)

Measure position for ring end gap in the area of 8 to 16 mm (.315 to .630 in) from top of cylinder.

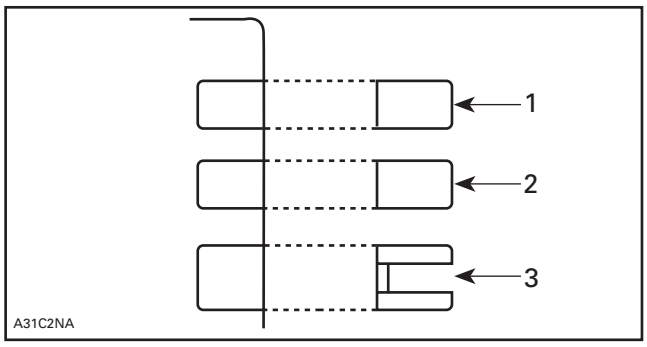
NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds above described specified tolerance.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Install the oil scraper ring first with "O" facing up, then the lower compression (taper-face) ring with the word "TOP" facing up, then the upper compression (rectangular) ring with the word "TOP" facing up.



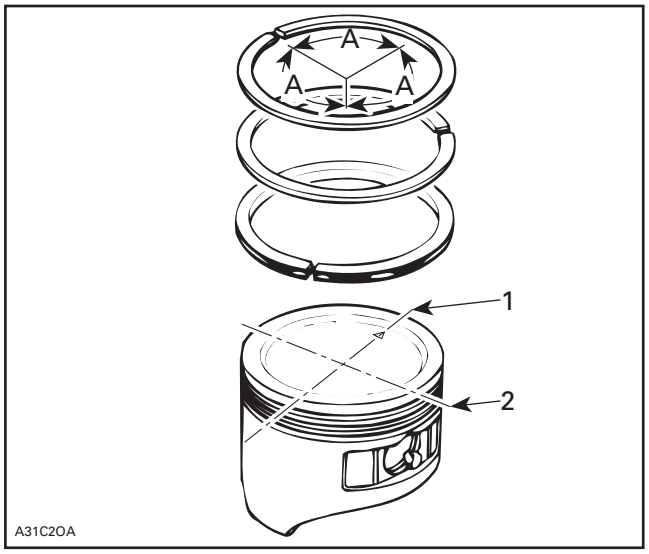
1. Rectangular ring
2. Taper-face ring
3. Oil scraper ring

CAUTION: Ensure that top and second rings are not interchanged.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. DO NOT align ring gap with piston thrust side axis
2. DO NOT align ring gap with piston pin bore axis
A. 120°

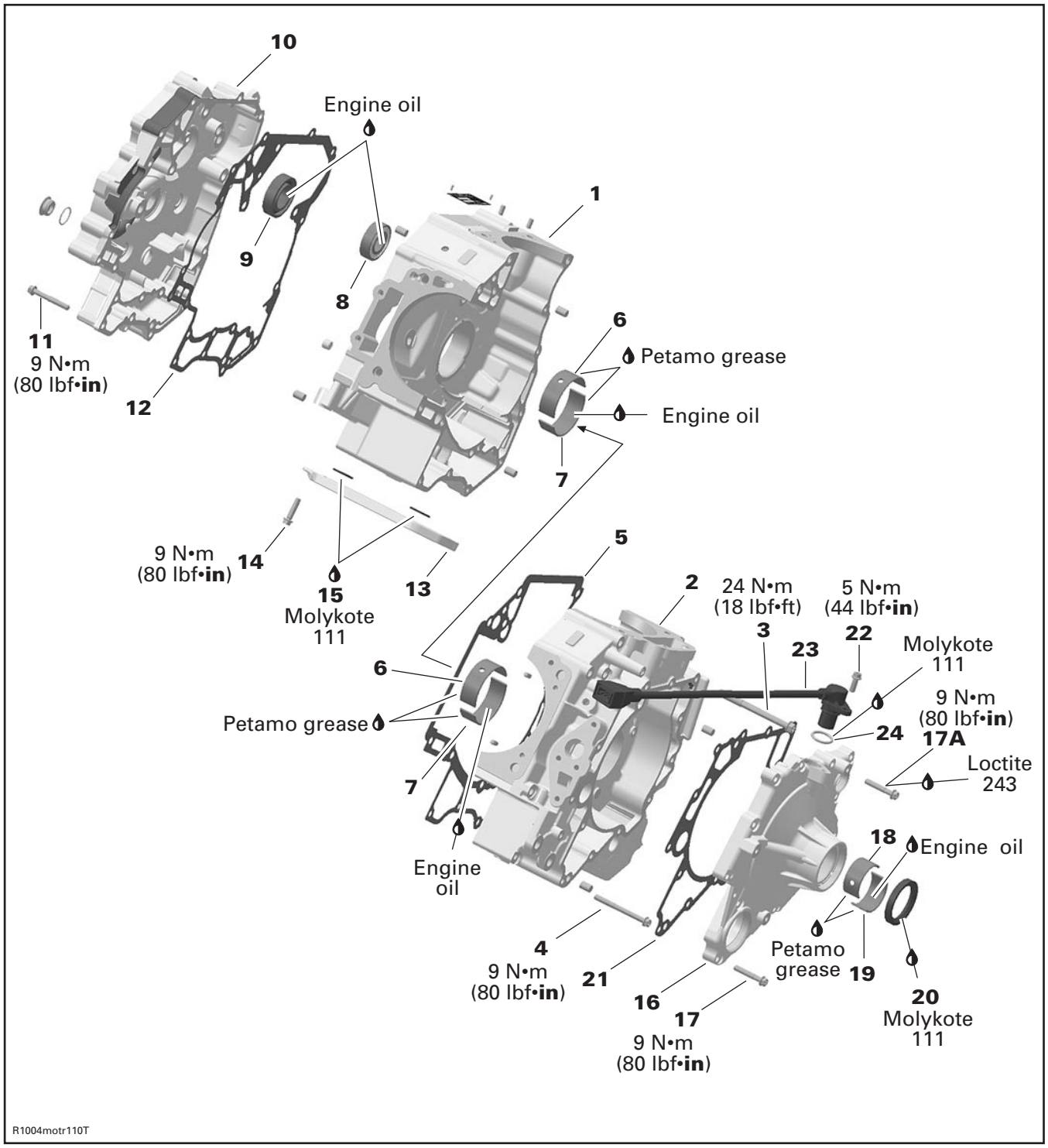
CRANKCASE

SERVICE TOOLS

Description	Part Number	Page
bearing installer/remover	529 035 913	253
bearing installer/remover	529 035 914	250
PTO cover oil seal installer	529 035 910	250
support sleeve	529 035 944	253–254

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	251
Molykote 111	413 707 000	255
Petamo grease	420 899 271	250, 253


10
Engine oil
1
9
8
6
Petamo grease
11
9 N•m
(80 lbf•in)
12
Engine oil
7
9 N•m
(80 lbf•in)
14
15
Molykote
111
13
5
2
24 N•m
(18 lbf•ft)
5 N•m
(44 lbf•in)
3
23
22
Molykote
111
6
9 N•m
(80 lbf•in)
Petamo grease
24
17A
Loctite
243
7
18
Engine oil
Engine
oil
4
9 N•m
(80 lbf•in)
21
Petamo
grease
19
16
17
9 N•m
(80 lbf•in)
20
Molykote
111
R1004motr110T

GENERAL

To remove crankcase, the engine removal is necessary.

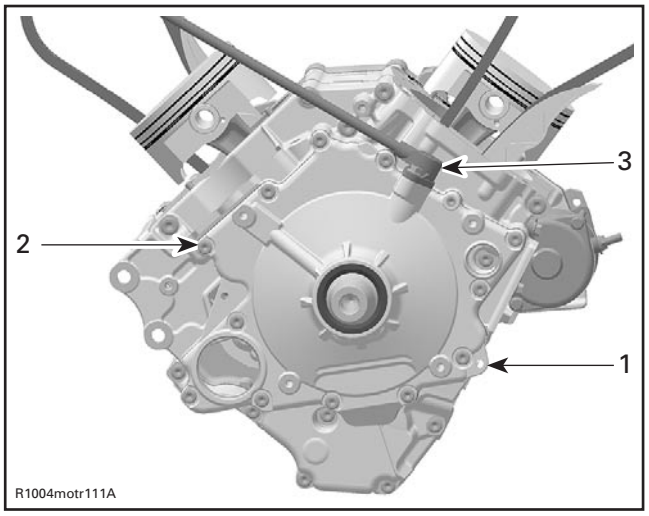
For installation, use the torque values and Loctite products indicated in the exploded view. Clean threads before using Loctite when installing screws.

PTO COVER

Removal

Remove:

– engine from the vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank (refer to LUBRICATION SYSTEM)
– disconnect crankshaft position sensor **no. 23**
– PTO cover screws **no. 17** and **no. 17A** and pull PTO cover **no. 16**.



1. PTO cover
2. PTO cover screws
3. Crankshaft position sensor

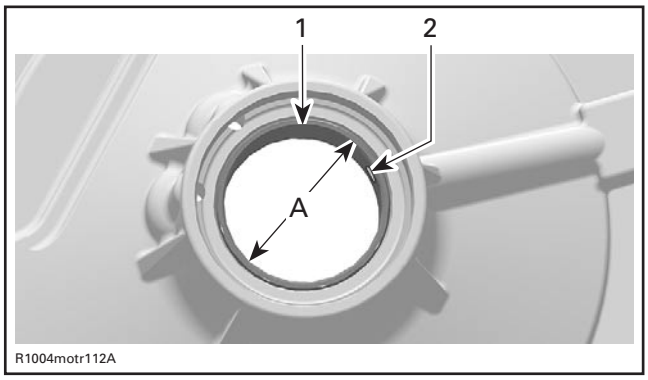
Inspection

Check the PTO cover for cracks or other damage.

Replace PTO cover if damaged.

Check plain bearings **no. 18** and **no. 19** for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to crankshaft journal diameter (PTO support bearing). Refer to CRANKSHAFT/DRIVE GEARS. Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter to be measured in area of oil bore

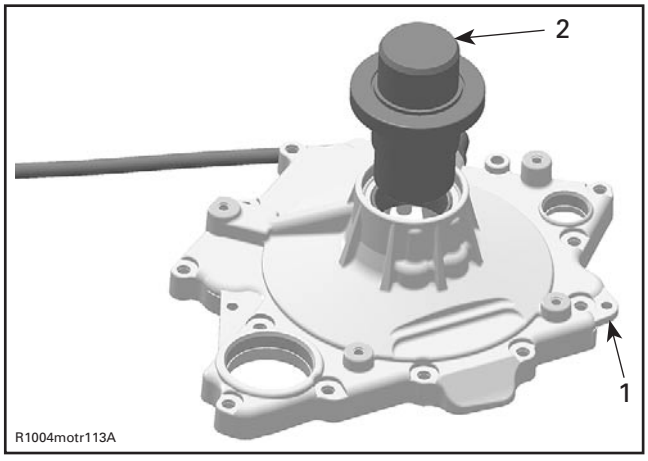
PLAIN BEARING INSIDE DIAMETER (PTO SIDE SUPPORT BEARING)	
Service limit	38.040 mm (1.4976 in)

Bearing Removal Procedure

Carefully remove the oil seal **no. 20** with a screwdriver, without inflicting damage to the PTO cover.

TOOLS P/N TO REMOVE PTO SIDE PLAIN BEARING	
PTO side plain bearing remover	529 035 914

NOTE: Carefully push-out the plain bearings **no. 18** and **no. 19** from the outside towards the inside. The PTO cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



1. PTO cover
2. Plain bearing remover (P/N 529 035 914)

Bearing Installation Procedure

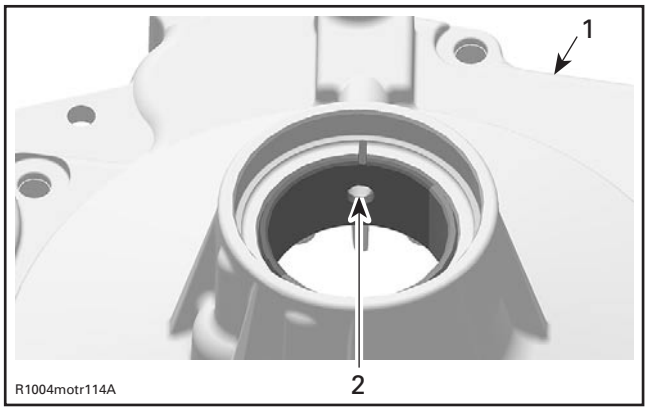
NOTE: Unless otherwise instructed, never use hammer to install plain bearings. Use press machine only.

Install plain bearings with the proper plain bearing installer/remover (P/N 529 035 914).

Fit the plain bearings with Petamo grease (P/N 420 899 271).

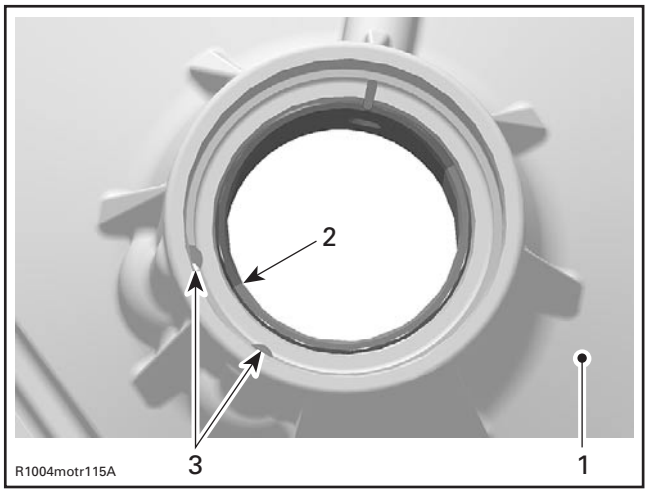
NOTE: Carefully press-in the plain bearings **no. 18** and **no. 19** in the same direction as during disassembly, from the outside towards the inside. Support PTO cover with suitable support with straight surface, in order to prevent damage of the sealing surface.

CAUTION: Mark position of oil bore in plain bearing on crankcase half. Align mark on plain bearing installer/remover with mark on crankcase half. Wrong oil bore position will stop oil supply to plain bearing and will damage the engine.



1. PTO cover
2. Oil bore

CAUTION: The partition of the plain bearings must be positioned between the oil return holes (refer to no. 3 in next illustration) in the PTO cover.

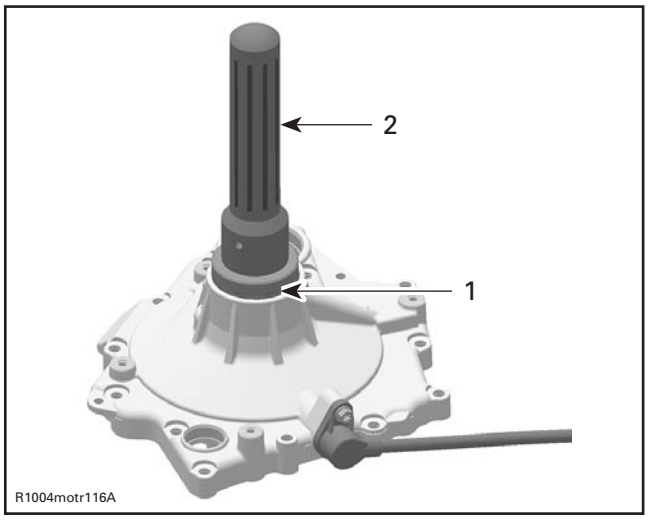


1. PTO cover
2. Partition
3. Oil return holes

Oil Seal Installation Procedure

NOTE: At installation, replace PTO cover oil seal **no. 20**.

Push PTO cover oil seal in place by using the PTO cover oil seal installer (P/N 529 035 910).



1. Oil seal for the PTO cover
2. Oil seal pusher (P/N 529 035 910)

Installation

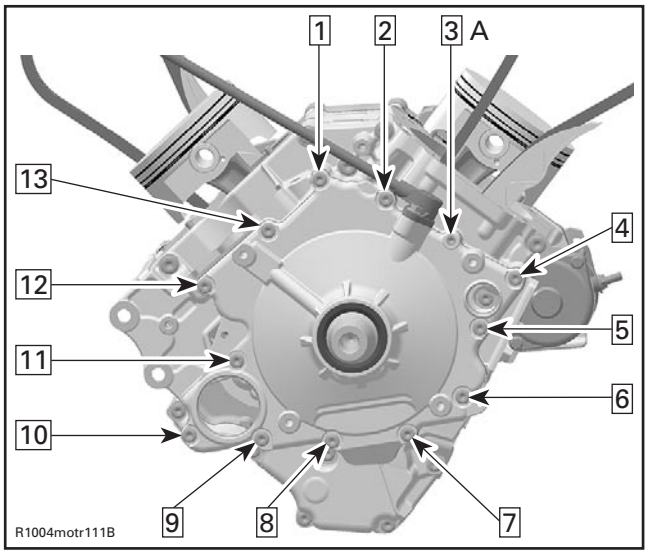
For installation, reverse the removal procedure.

Pay attention to the following details.

NOTE: At installation, replace gasket **no. 21**.

Torque PTO cover screws to 9 N•m (80 lbf•**in**).

Tightening sequence for screws on PTO cover is as per following illustration. Fit the screw **no. 17A** with Loctite 243 (P/N 293 800 060).



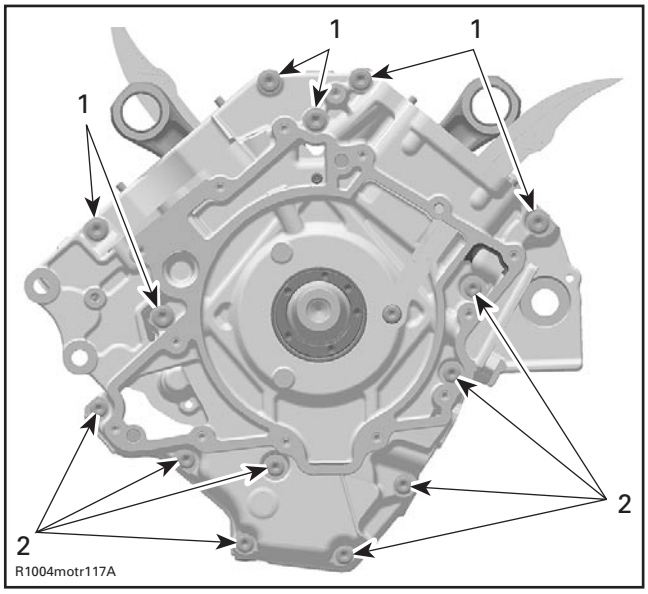
A. Screw 17A with Loctite 243

CRANKCASE

Disassembly

Remove:

– engine from vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank and oil filter housing (refer to LUBRICATION SYSTEM)
– PTO cover (refer to PTO COVER above)
– trigger wheel (refer to CRANKSHAFT/DRIVE GEARS)
– electric starter (refer to ELECTRIC STARTER)
– alternator side cover (refer to COOLING SYSTEM)
– drive gears (refer to CRANKSHAFT/DRIVE GEARS)
– cylinder head and cylinder (refer to CYLINDER AND CYLINDER HEAD)
– timing chains (refer to CRANKSHAFT/DRIVE GEARS)
– cover **no. 13**
– screws **no. 3** and **no. 4** retaining crankcase halves.

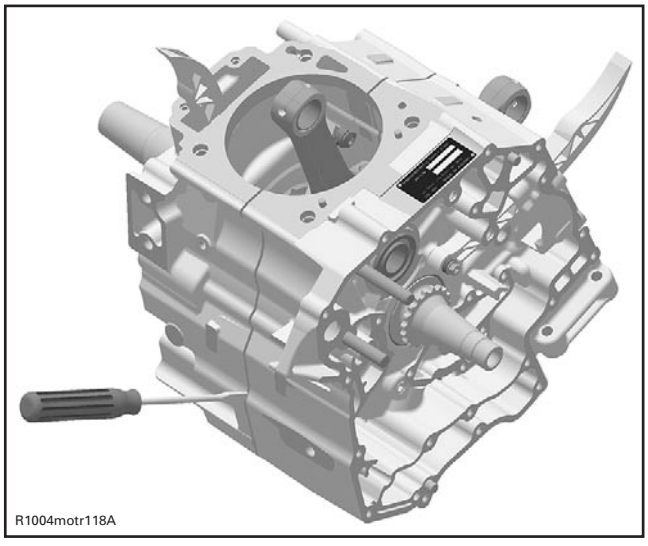


1. Six screws M8 x 90
2. Eight screws M6 x 65

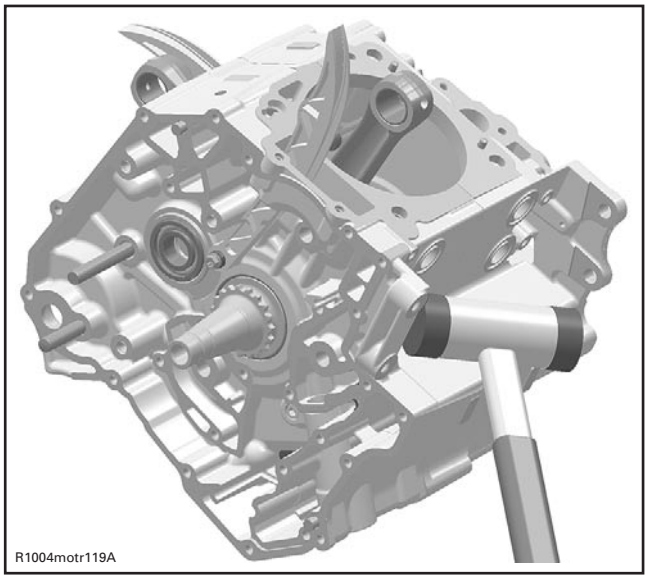
Place the crankcase on a wood stand, PTO side upwards.

Carefully separate crankcase halves by using a screwdriver and a plastic hammer.

NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.



POSITION FOR SCREWDRIVER



POSITION FOR PLASTIC HAMMER

Inspection

NOTE: Remove all remaining parts from the crankcase halves; they could get damaged during the repair work.

Clean crankcase halves from contaminations and blow the oil supply lines with compressed air.

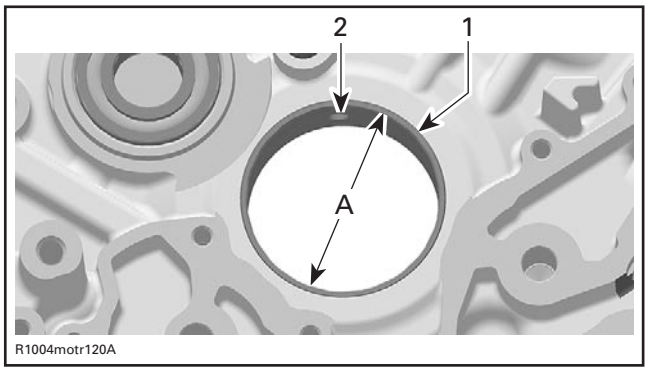
⚠ WARNING

Use safety goggles to avoid eye injuries.

Check bearing **no. 8**, for excessive play and smooth operation. Replace if necessary.

Check plain bearings **no. 6** and **no. 7** for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to PTO/alternator side journal diameters (refer to CRANKSHAFT/DRIVE GEARS). Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter to be measured in area of oil bore

PLAIN BEARING INSIDE DIAMETER (ALTERNATOR SIDE)	
Service limit	55.020 mm (2.1661 in)
PLAIN BEARING INSIDE DIAMETER (PTO side)	
Service limit	55.020 mm (2.1661 in)

Bearing Removal Procedure

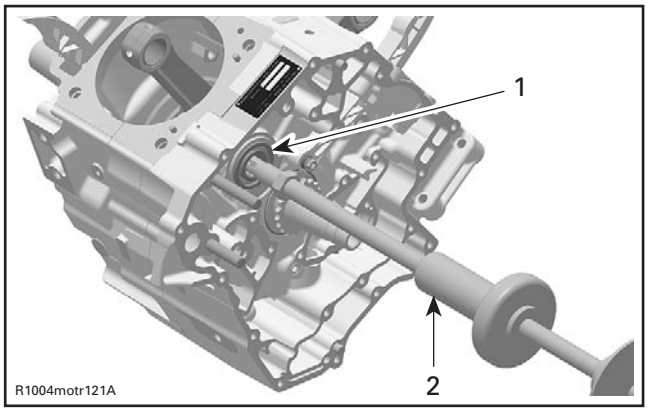
Always heat crankcase half up to 100°C (212°F) before removing ball bearings.

⚠ WARNING

Clean oil, outside and inside of crankcase half before heating it.

CAUTION: Always support crankcase halves properly when ball bearings or plain bearings are removed. Damages to crankcase halves may occur if this procedure is not performed correctly.

The generator gear ball bearing **no. 8** in alternator side crankcase half is removed with a suitable bearing puller (not sold by BRP).



1. Ball bearing
2. Bearing puller

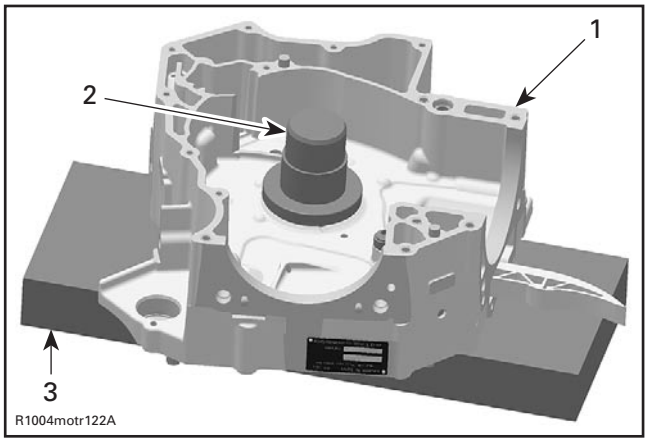
Remove plain bearings **no. 6**, **no. 7**, **no. 18** and **no. 19** with the proper plain bearing installer/remover (P/N 529 035 913).

NOTE: Carefully push the plain bearings out, from the crankcase half inside towards the outside.

NOTE: Place the proper support sleeve (P/N 529 035 944) under PTO crankcase half before removing plain bearings. There is no support sleeve for alternator side crankcase half. To brace the crankcase half, use a suitable wooden block or other support.

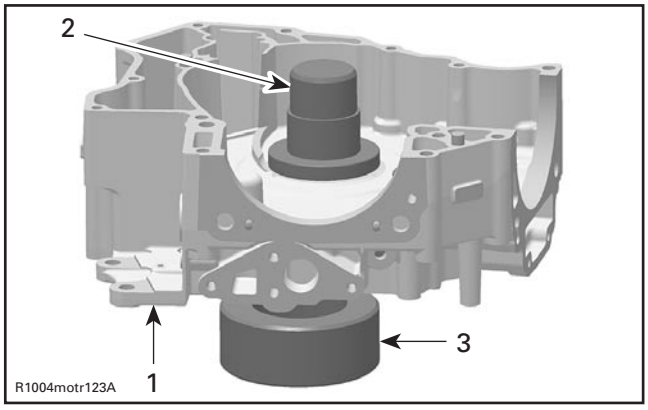
CAUTION: Suitable support sleeve must have straight surface.

During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.



PUSH PLAIN BEARINGS OUTSIDE
1. Crankcase half alternator side
2. Plain bearing remover
3. Wooden block

PLAIN BEARING REMOVER	
Alternator side	529 035 913
PTO side	
SUPPORT SLEEVE	
PTO side	529 035 944



PUSH PLAIN BEARINGS OUTSIDE
1. Crankcase half PTO side
2. Plain bearing remover
3. Support sleeve (P/N 529 035 944)

Bearing Installation Procedure

Unless otherwise instructed, never use hammer to install ball bearings or plain bearings. Use press machine only.

Always heat crankcase half up to 100°C (212°F) before installing ball bearing.

⚠ WARNING

Clean oil, outside and inside of crankcase half before heating it.

NOTE: Place new ball bearing in freezer for 10 minutes before installation.

NOTE: No striking tools are to be used to insert the ball bearing. With moderate (thumb) pressure the bearing has to be mounted manually into the alternator side cover.

Install plain bearings **no. 6**, **no. 7**, **no. 18** and **no. 19** with the proper plain bearing installer/remover (P/N 529 035 913).

Fit the plain bearings with Petamo grease (P/N 420 899 271).

NOTE: Carefully press-in the plain bearings in the same direction as during disassembly, from the case inside towards the outside.

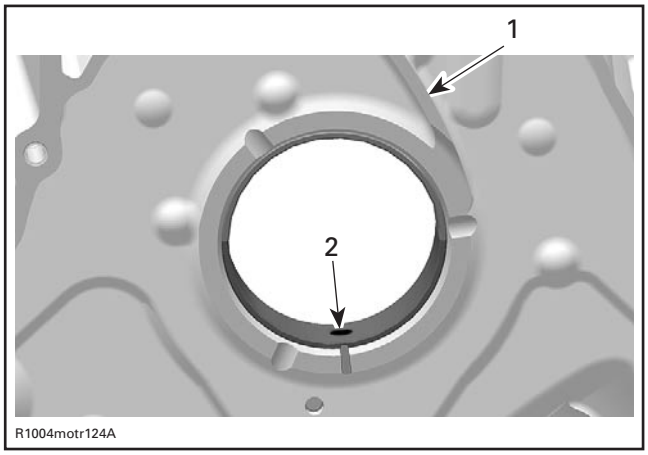
NOTE: Place the proper support sleeve (P/N 529 035 944) under PTO crankcase half before installing the plain bearings. There is no support sleeve for alternator side crankcase half. For bracing of the crankcase half use a suitable wooden block or other support (refer to BEARING REMOVAL PROCEDURE above).

CAUTION: Suitable support sleeve must have straight surface.

During reassembly, make sure not to damage the sealing surfaces of the crankcase halves.

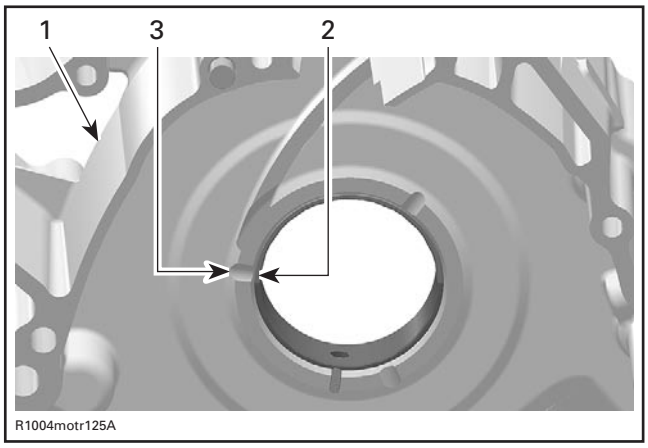
PLAIN BEARING INSTALLER/REMOVER	
Alternator side	529 035 913
PTO side	
SUPPORT SLEEVE	
PTO side	529 035 944

CAUTION: Mark position of oil bore in plain bearing on crankcase half. Align mark on plain bearing installer/remover with mark on crankcase half. Wrong oil bore position will stop oil supply to plain bearing and will damage the engine.



1. Crankcase
2. Oil bore

CAUTION: The partition of the plain bearings must be positioned near the groove (refer to no. 3 in next illustration) of the crankcase.



1. Crankcase
2. Partition
3. Groove

NOTE: Use an O-ring (∅ 55 x 1 to 1.5 mm (.04 to .06 in) thickness) to hold plain bearings in place during installation. The O-ring will disappear in the groove of the plain bearing installer/remover.

Assembly

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.

NOTE: Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

NOTE: At installation, replace gasket **no. 5**.

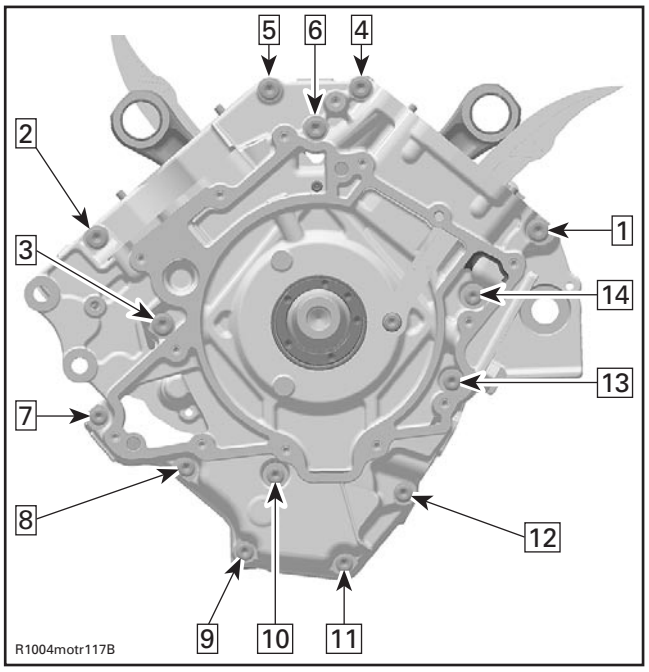
NOTE: Oil the plain bearings before mounting the crankshaft.

Reinstall all other parts (refer to LUBRICATION SYSTEM).

Torque screws **no. 4** M6 x 65 to 9 N•m (80 lbf•**in**).

Torque screws **no. 3** M8 x 90 to 24 N•m (18 lbf•ft).

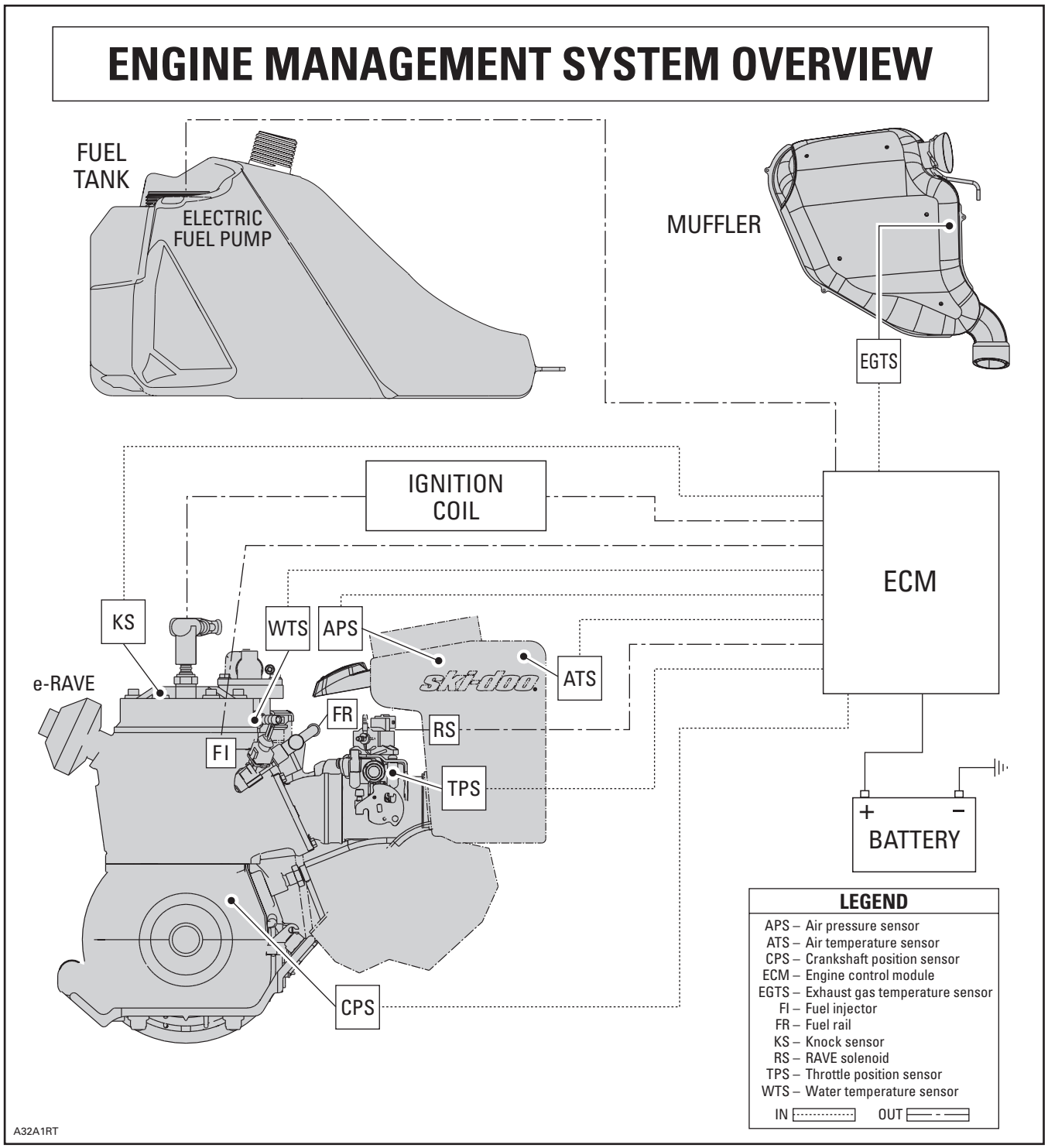
Tightening sequence for screws on crankcase is as per following illustration.



NOTE: At installation, replace gasket rings no. 15.

Slightly grease the gasket rings no. 15 before assembly using Molykote 111 (P/N 413 707 000). Torque cover screws no. 14 to 9 N•m (80 lbf•**in**).

OVERVIEW

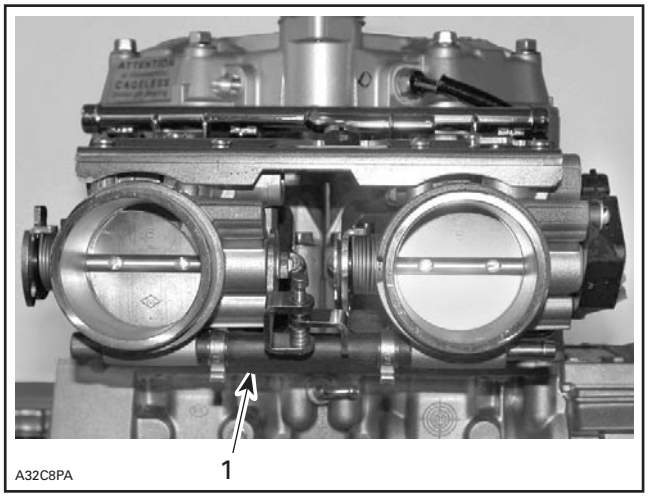

ENGINE MANAGEMENT SYSTEM OVERVIEW
FUEL TANK
ELECTRIC FUEL PUMP
MUFFLER
EGTS
IGNITION COIL
ECM
KS
WTS
APS
ATS
e-RAVE
FR
RS
FI
TPS
CPS
+
–
BATTERY
LEGEND
APS – Air pressure sensor
ATS – Air temperature sensor
CPS – Crankshaft position sensor
ECM – Engine control module
EGTS – Exhaust gas temperature sensor
FI – Fuel injector
FR – Fuel rail
KS – Knock sensor
RS – RAVE solenoid
TPS – Throttle position sensor
WTS – Water temperature sensor
IN
OUT
A32A1RT

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 cleanest 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.

AIR INDUCTION

Through air filters mounted on dash, 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

GENERAL

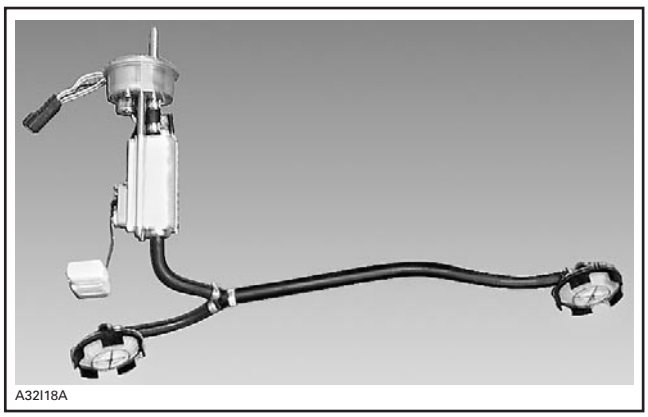
When the piston reaches the correct position, the ECM opens the fuel injectors and fuel is discharged into the transfer ports of cylinders. This air/fuel mixture is then ignited by the spark plug.

COMPONENT DESCRIPTION

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 level sensor.



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 approximately 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 with a fuel pressure of approximately 400 kPa (58 PSI).

Fuel Injectors

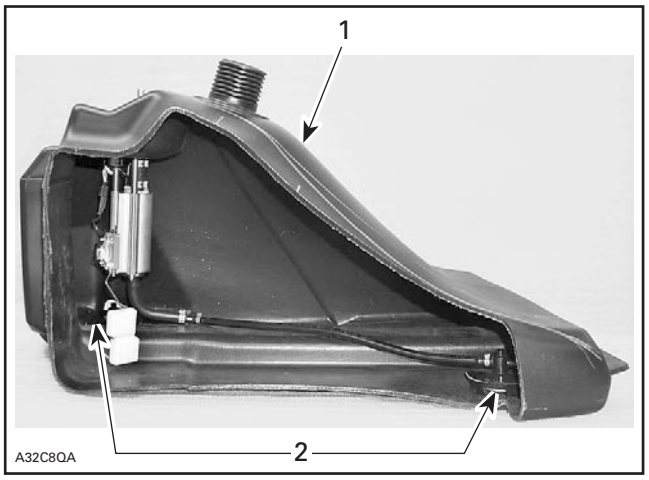
Fuel injectors (two per cylinder) are used to inject fuel into the transfer port of cylinder.

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.

Fuel Pickups

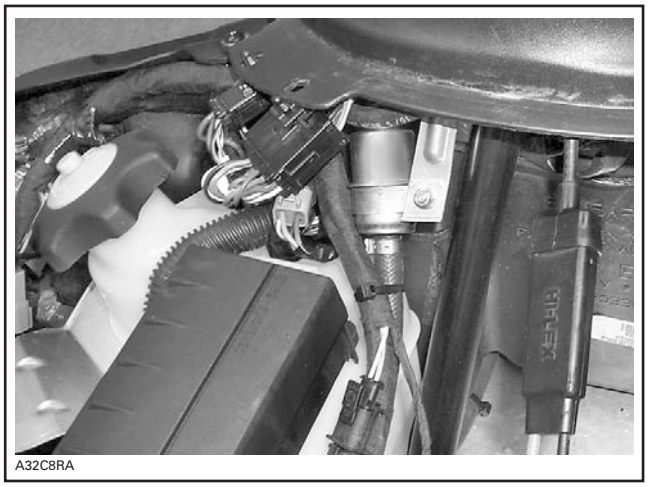
The two fuel pickups come with 70 micron filter. One is located at the front right side of the fuel tank and the other at the rear left side.



1. Fuel tank
2. Fuel pickups

In-Line Fuel Filter

The in-line 10 micron fuel filter is fastened under the steering console. It comes as a complete assembly.



ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an ECM which controls the ignition system, the vehicle electrical system, the fuel injection system and the electronically controlled RAVE.

TYPICAL — ECM

The ECM is directly powered by the battery. It is responsible for the following engine management/electrical functions:

– interpreting information
– distributing information
– start/stop function
– DESS (Digitally Encoded Security System)
– ignition control
– injection control

NOTE: The ECM applies the proper maps (injection and ignition) for optimum engine operation in all conditions.

– engine RPM limiter
– RER (Rotax Electronic Reverse)
– etc.

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

EMS — GENERAL FUNCTIONS

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.

Antidrive Feature

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

Digitally Encoded Security System (DESS)

The following components are specially designed for this system: ECM, tether cord cap and 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 the HELP menu to program a tether cord cap.

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the vehicle 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 waking up the ECM 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. Engine starting can take place.
– 1 short beep indicates a wrong tether cord cap is being used or that something is defective. Engine starting is not allowed.

The memory of the ECM features two self-diagnostic modes for the DESS operation. Refer to DIAGNOSTIC PROCEDURES section for more information.

The memory of the ECM is permanent. If the battery is disconnected, no information is lost.

Note that the DESS anti-drive circuitry is already activated on all new ECMs.

Gauges Current Supply

The purpose of this function is to allow reading of gauges without the engine running. It will give access to most functions of the information center gauge without starting the engine.

Gauges are supplied with current for 30 seconds when connecting the tether cord cap on its post and pressing the START/RER switch.

NOTE: Each time the tether cord cap is connected to the post, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

Engine Starting

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

If the tether cord cap is left on the DESS post for more than 30 seconds after stopping the engine, the ECM will shut down. The current supply to gauges will be stopped as explained in the ANTIDRIVE FEATURE section.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The buzzer will also be activated intermittently.

High Coolant Temperature Warning Device

When the coolant temperature is getting to high, the ECM sends out signals to the buzzer, the high temperature LED and to the check engine LED.

High Muffler Temperature Warning Device

When the muffler temperature is getting to high, the ECM will extend the injection period temporarily, until the temperature of the muffler will decrease.

If the temperature still increases, the high temperature LED will be illuminated and further the ECM will limit the engine speed to maximum 5250 RPM.

Power Distribution

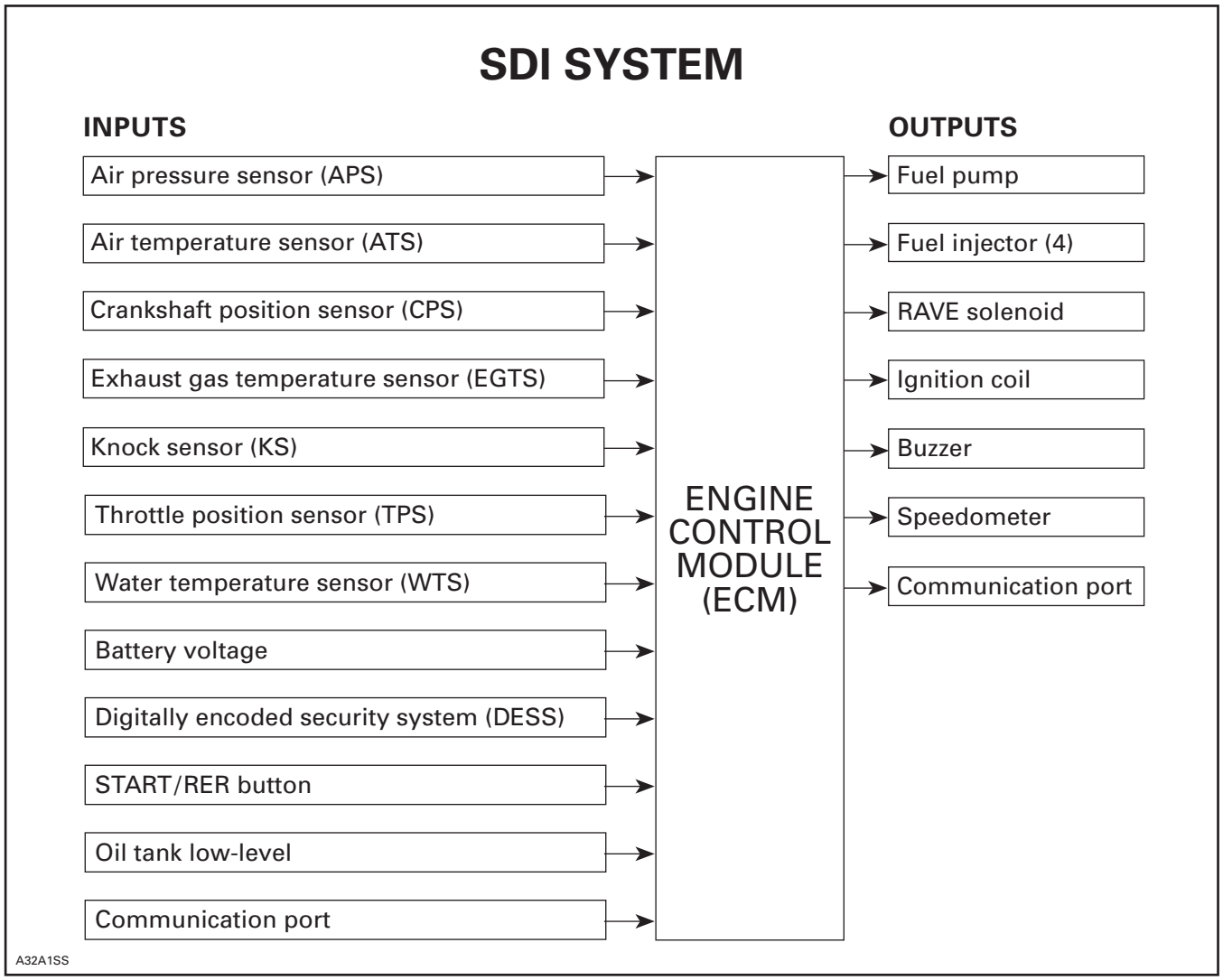
The ECM distributes power from battery to all accessories. Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: The sensors and injectors are continuously powered with the supply from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

The system uses 3 relays: a main relay, a second for the headlights and a third for the accessories.

If a problem occurs with the magneto system, the ECM will turn off the accessories relay to distribute the remaining voltage to the main systems.

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



This engine management system controls the fuel injection, the ignition timing and the electronically controlled RAVE.

As shown in the ENGINE MANAGEMENT SYSTEM FUNCTIONS illustration, the ECM is the central point of the fuel injection system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

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

ELECTRONIC FUEL INJECTION

The ECM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

IGNITION TIMING

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.

ELECTRONICALLY CONTROLLED RAVE

The electronically controlled RAVE (e-RAVE) offers two performance enhancements to conventional RAVE system.

– The opening of the valve is now activated electronically. A solenoid holds the valve closed. The ECM monitors altitude, engine temperature, throttle position and RPM, and operates the solenoid in optimal conditions.
– The valve is now opened by crankcase pressure, as opposed to exhaust pressure. The greater and more constant pressure from the crankcase opens the valve more crisply.

NOTE: An electric heating element has been added to the RAVE solenoid to ensure proper function in very cold weather.

KNOCK SENSOR

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

ENGINE MODES OF OPERATION

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start up, idle, warm up, normal operation, engine speed limiter, flooded engine and limp home (see below).

FLOODED ENGINE (DROWNED MODE)

If the engine does not start and it is fuel-flooded, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Press the START/RER button. The mode is now on.

The engine should be cranked for 20 seconds.

NOTE: No spark occurs on drowned mode.

Release START/RER button and throttle lever. Try to start the engine normally.

If the engine does not start, it may be necessary to remove the spark plugs and crank the engine with rags over spark plug holes. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

MONITORING SYSTEM

The ECM monitors the electronic components of the fuel injection system and some components of the electrical system.

When a fault occurs, it sends visual messages through the referring LED and/or audible signals through a buzzer to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES section for the referring LED and the buzzer coded signals chart.

LIMP HOME MODES

Besides the signals as seen above, the ECM may automatically set default parameters to the engine management to ensure the adequate operation of the vehicle if a component of the fuel injection system is not operating properly.

NOTE: Sensor failures will not lead to a limp home mode, warning will follow by the check engine LED and the buzzer.

When minor fault occurs, the fault and message/buzzer will disappear automatically, when the condition disappears.

Depending on the severity of the malfunction, the vehicle speed may be reduced and not allowed to reach its usual top speed.

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 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.

If a fault occurs and involves a limp home mode operation, the engine management system will reduce engine RPM gradually to the proper level.

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.

The B.U.D.S. software must be used for this system (always use the latest software version).

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.

Unregulated AC current is rectified and regulated between 13.4 and 15 volts for the vehicle electrical system.

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

Refer to MAGNETO SYSTEM.

IGNITION SYSTEM

The following type of ignition system is used:

– Digital Inductive System.

DOUBLE IGNITION COIL

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 receive input from 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 or MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

Double ignition coil is located underneath air silencer.

TRIGGER COIL

Trigger coil is used for:

1) Forward engine rotation.
2) Reverse engine rotation.
3) As a crankshaft position sensor (CPS). This information is sent to the ECM.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
GRAY diagnostic key	529 035 896	267
supply cable	529 035 869	267
VCK (Vehicle Communication Kit)	529 035 981	266

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.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION 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.
3 short beeps per second.	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.
Battery pilot lamp lights up.	No charging.	Check battery and charging system.

Many other codes use the engine pilot lamp and the buzzer to indicate a problem. A complete list of codes is available in B.U.D.S.

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.

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

The **SDI models** require B.U.D.S. version G2.1 or P2.1 or above.

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

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

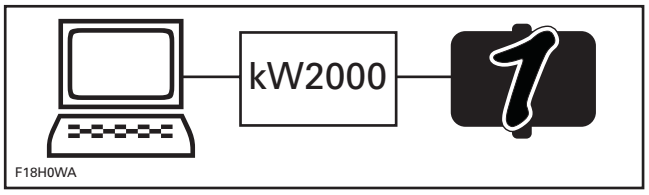
⚠ WARNING

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.

IMPORTANT: When using the software B.U.D.S., with the **SDI engine**, ensure that the protocol "kW2000" is properly selected in **"MPI"** (multi protocol interface) under "CHOOSE PROTOCOL".

When B.U.D.S. is connected to the vehicle, the status bar shows the protocol (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.



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.

ECM Supply

To power-up the ECM, push the START button shortly while the engine cut-out switch is depressed and the tether cord cap installed on DESS post. If your intention is to program the vehicle key, use GRAY diagnostic key (P/N 529 035 896) on DESS post.

The supply cable (P/N 529 035 869) may also be used. Just the fact to connect it between MPI and vehicle will power-up the ECM.

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.

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 15 seconds after tether cord cap removal).

2-TEC SYSTEM 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.

Supplemental Information

– Electrical noise is picked up by the ECM. Ensure that all connections are in good condition, also grounds (battery, ECM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine — particularly in the ignition system. Installing non-resistive spark plugs may lead to generate fault code.
– Electrical noise might also lead engine to occasional cutout without generating a fault code.
– If everything is in good condition, try a new ECM.

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 D41.

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 ADAPTION 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 failures can be effected 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**.
EMS 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.

COMPONENT INSPECTION AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	271
fuel pressure gauge	529 035 868	278
supply cable	529 035 869	271
VCK (Vehicle Communication Kit)	529 035 981	269, 279
wrench	529 035 603	279
wrench	529 035 899	279, 281

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	292
dielectric grease	293 550 004	282
Loctite 5910	293 800 081	289, 292
pulley flange cleaner	413 711 809	275

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

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. 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 work in a well ventilated area. Always disconnect battery prior to working on the fuel system. After performing a pressure test, release the pressure.

– Always disconnect battery properly prior to working on the fuel system. Refer to BATTERY section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Perform the fuel pressure test as explained in this section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. A pressure test must be done before connecting the tether cord cap. 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).

To check fuel rail for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

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:

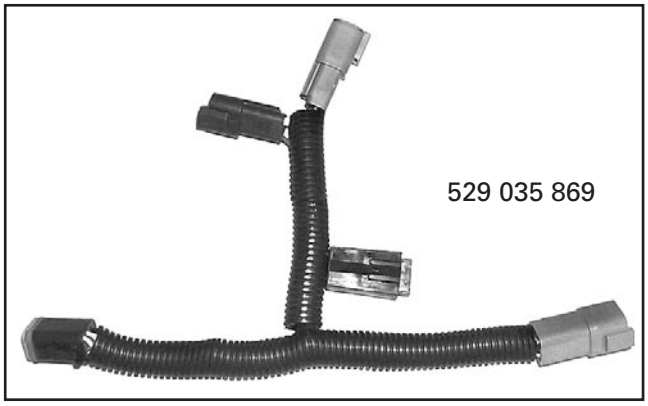
– battery
– fuses
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

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) may be suddenly supplied by the battery when the tether cord cap is installed and the start button is depressed or if engine is rotated (manually or with the rewind starter). Even a small movement of the crankshaft or the usage of the supply cable (P/N 529 035 869) will automatically activate the actuators. Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.


529 035 869

To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868) should be used.


529 035 868

Pay particular attention to ensure that pins 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 a ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them with a silicon-based dielectric grease or equivalent.

NOTE: Do not apply dielectric grease or other lubricant on the ECM connectors.

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 subsection.

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. 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	EGTS	CTS FOR	
				GAUGE	ECM
- 40	- 40		169.7		72412
- 35	- 31				52637
- 30	- 22	28000			38681
- 25	- 13				28718
- 20	- 4	14500	185.1	733.8	21529
- 15	5			587.7	16288
- 10	14			474	12431
- 5	23			384.8	9565
0	32	5500	200.5	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		219.6	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		238.5	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
85	185			21.95	282.8
90	194			19.45	244.8
95	203			17.28	212.8
100	212	180	275.9	15.4	185.6
105	221				162.4
110	230				142.7
115	239				125.9

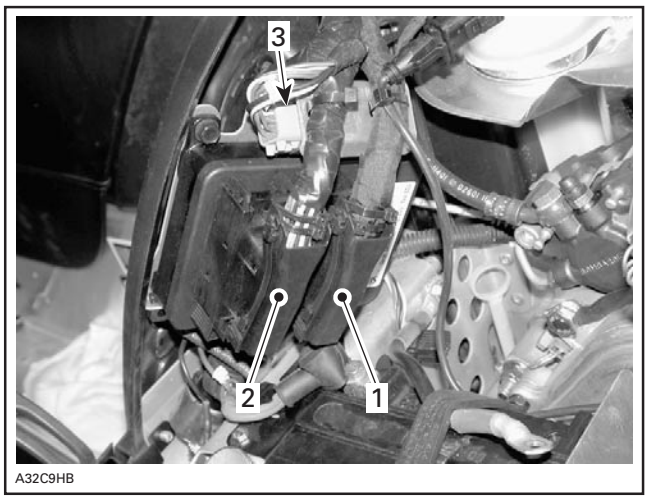
TEMPERATURE SENSOR TABLE					
TEMPERATURE		RESISTANCE (OHMS)			
°C	°F	ATS	EGTS	CTS FOR	
				GAUGE	ECM
120	248				111.5
125	257				99.02
130	266	90			88.26
135	275				78.93
140	284				70.81
145	293				63.71
150	302		312.7		57.49
200	392		349.0		
250	482		384.6		
300	572		419.7		
350	662		454.2		
400	752		488.1		
450	842		521.4		
500	932		554.1		
600	1112		617.8		
700	1292		679.2		
800	1472		738.2		
900	1652		794.9		
1000	1832		849.2		

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.

ENGINE CONNECTOR PIN-OUTS

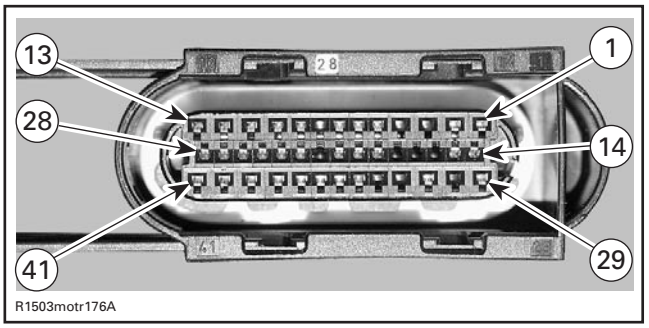
Connector Position



1. *ECM connectorA*
2. *ECM connector B*
3. *Engine connector*

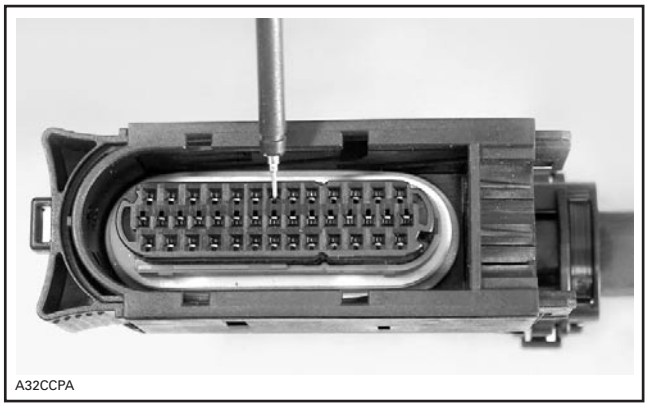
ECM Connector

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



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

CAUTION: Probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this could lead to improper function of the engine management system.

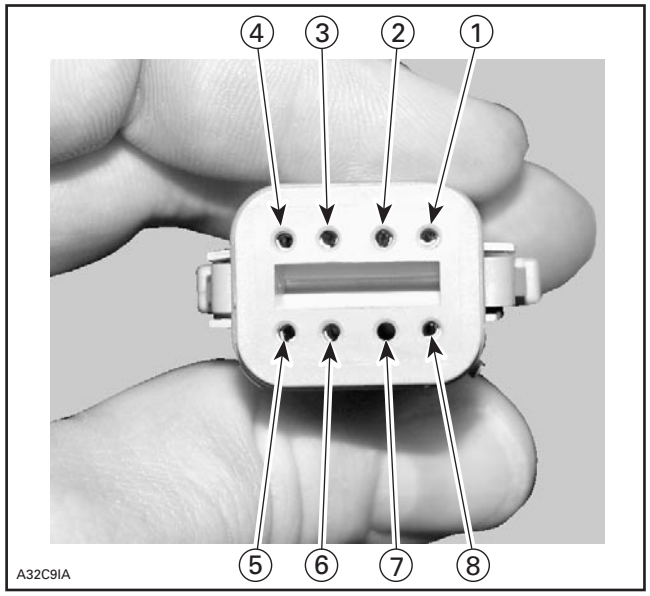


PROBE ONLY ON THE PIN NOZZLE OF FEMALE CONNECTOR

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine Connector

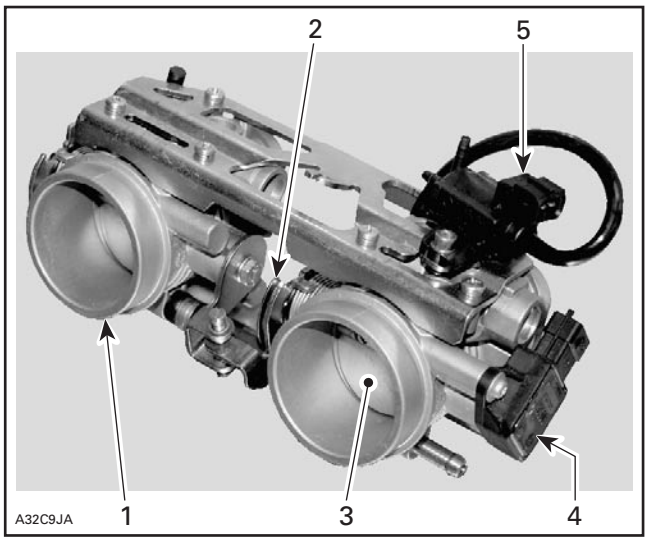
Use this illustration to locate the pin numbers on the engine connector of the wiring harness when performing tests.



ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

AIR INDUCTION SYSTEM

THROTTLE BODY



1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS
5. E-RAVE solenoid

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever. Take this opportunity to lubricate the throttle cable.

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 linkage between the two throttles has moved.
– 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

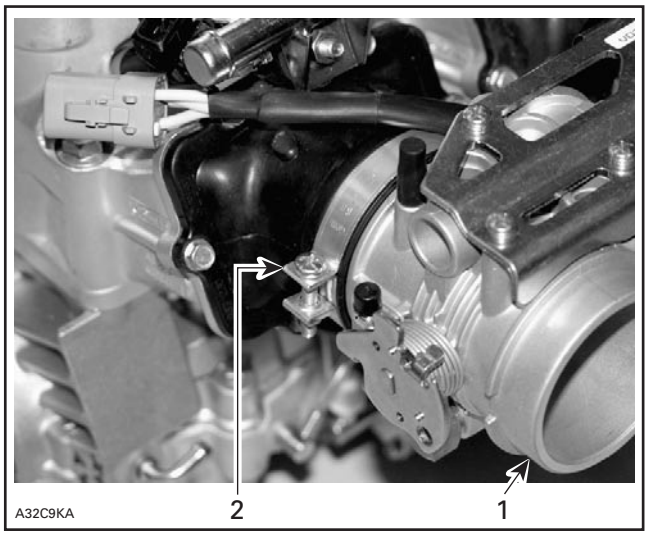
Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect connectors from ATS (Air Temperature Sensor) and APS (Air Pressure Sensor).
– Disconnect air intake silencer from throttle body. Move boot away.
– Drain cooling system.
– Remove clamps and hoses for throttle body heating from nipples.
– Disconnect connectors and hoses from E-RAVE solenoid and 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.

Refill and bleed the cooling system, refer to LIQUID COOLING SYSTEM.

For TPS and E-RAVE solenoid replacement procedures, refer to the respective paragraph in ELECTRONIC MANAGEMENT below.

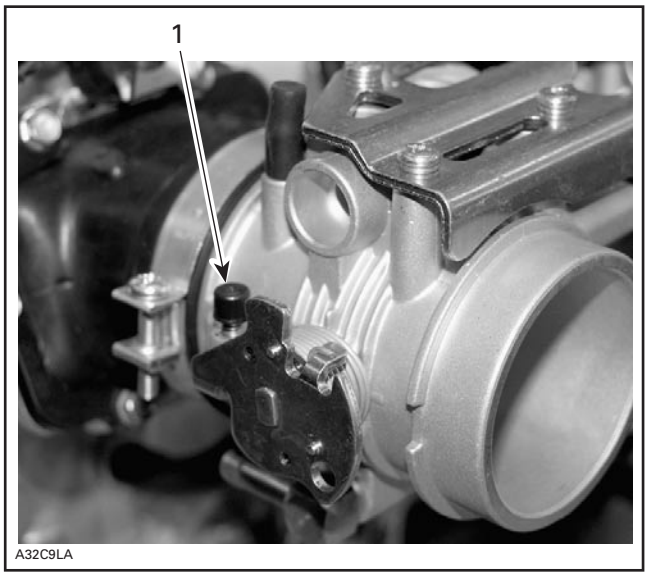
Adjustment

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.

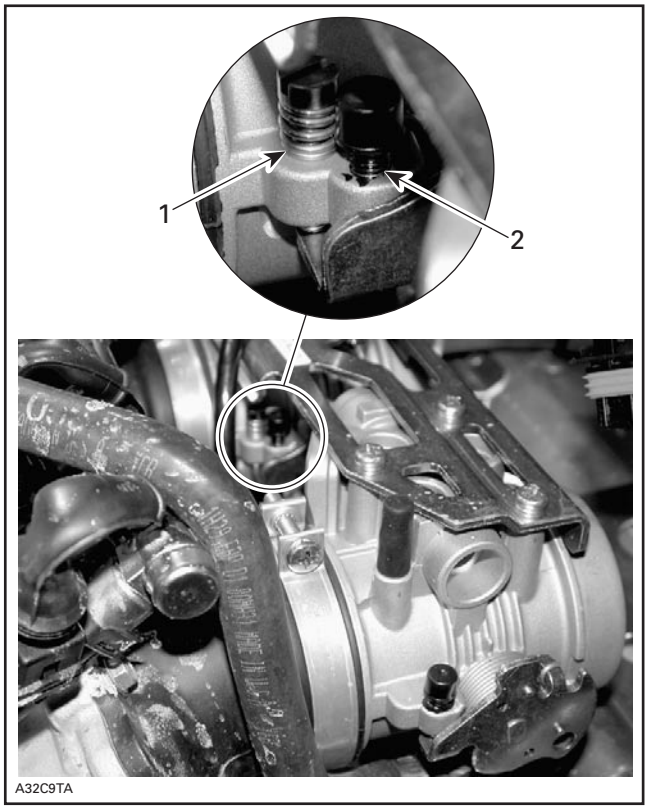


THROTTLE BODY
1. Zero position stopper screw

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.



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 ELECTRONIC MANAGEMENT below.

Throttle Cable Adjustment

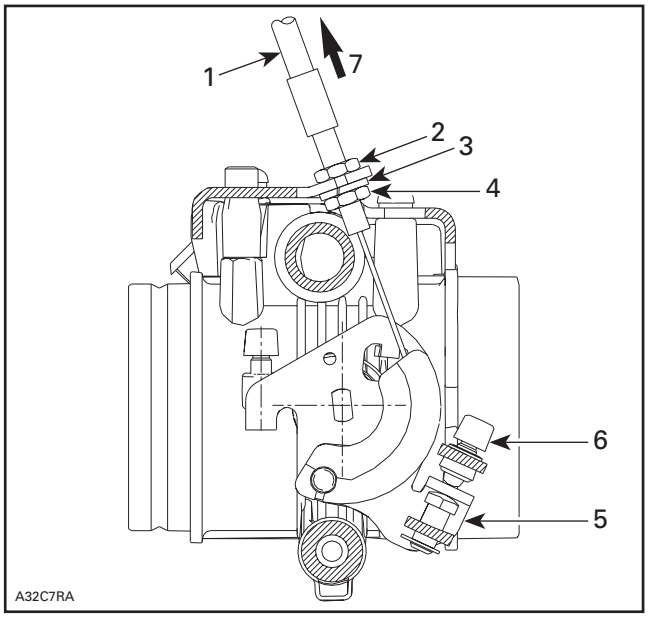
If closed throttle reset is required, then do it before throttle cable adjustment.

Mechanically adjust the throttle cable.

Handlebar and throttle cable must be at their normal position.

Adjust top nut to have a small 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

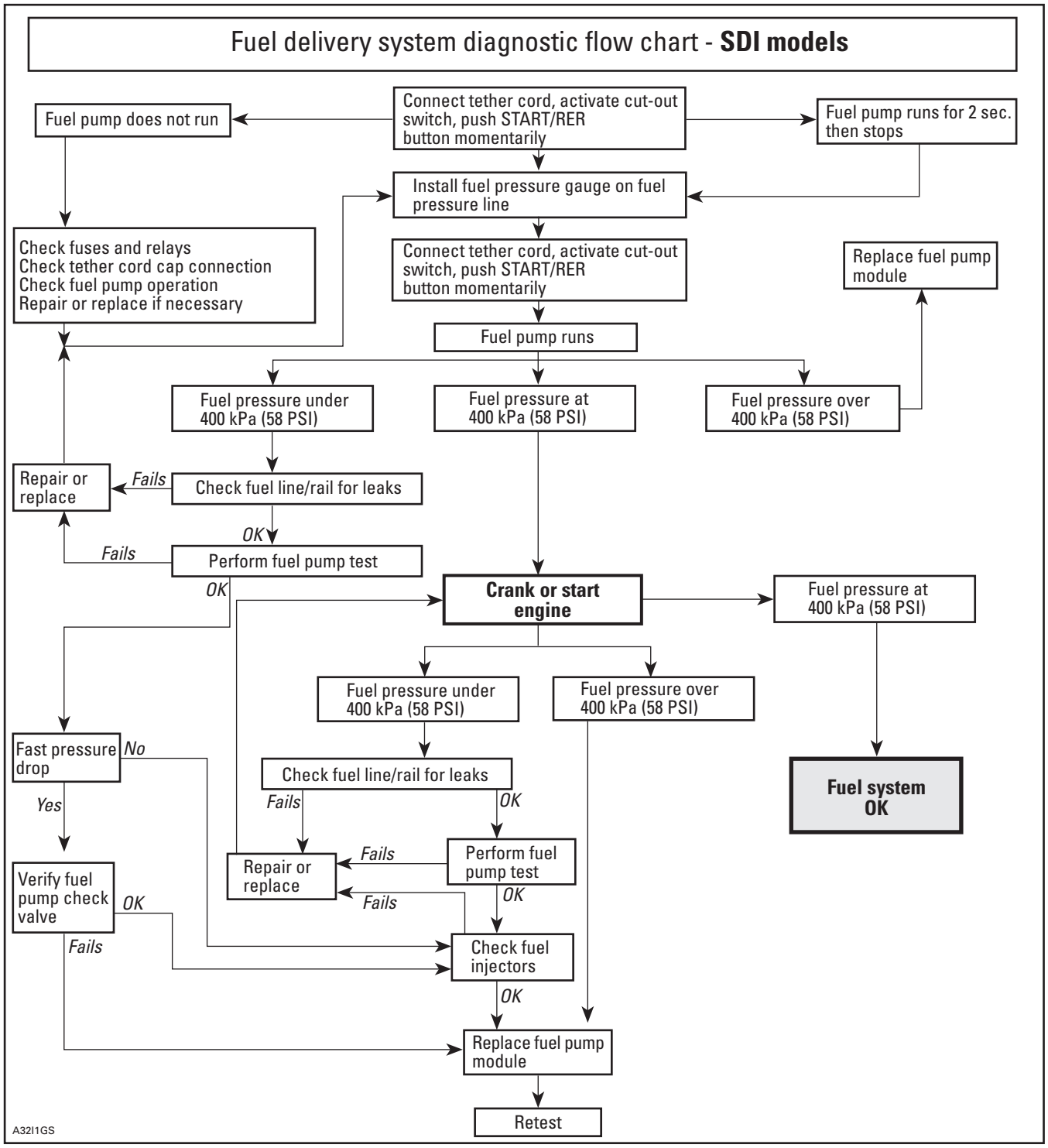
Activate the throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension on the cable.

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) in ELECTRONIC MANAGEMENT below.

FUEL DELIVERY



FUEL PUMP

Fuel Pressure Test

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

Release the fuel pressure in the system using B.U.D.S. Refer to 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.

Install fuel pressure gauge (P/N 529 035 591) between disconnected hose (inline 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 pump check valve. 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.

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, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+ on PINK wire and – on PINK/BLACK wire) to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe PINK wire 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 infuse, relay, harness or in fuel pump connector. Repair or replace appropriate part (fuel pump may be blown).

Check continuity between PINK/BLACK wire 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 Pump Module Replacement

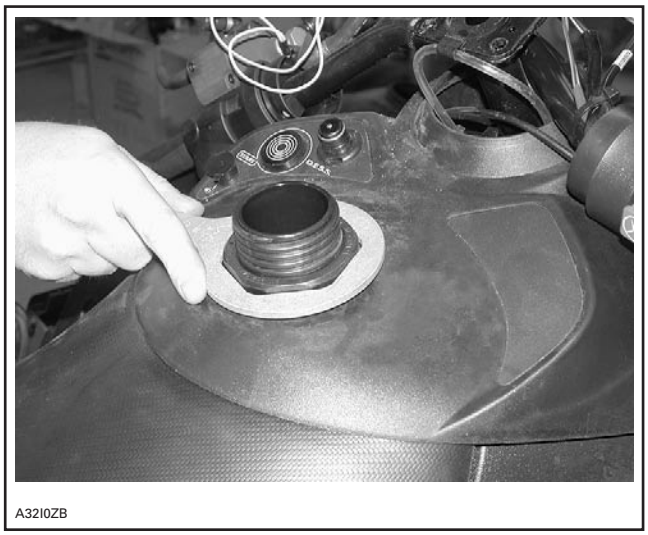
Removal

Open hood. Connect VCK (Vehicle Communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Drain fuel tank as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).

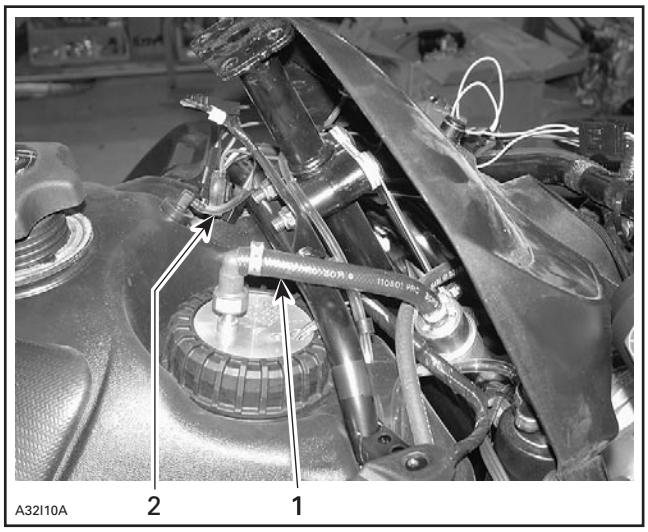


TYPICAL

Unbolt console, then move it forward.

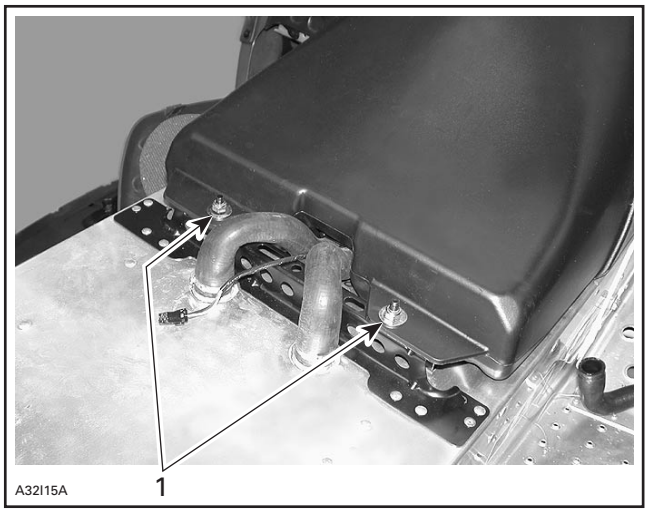
Disconnect fuel supply hose from fuel pump module.

Disconnect vent tube from vent elbow.



1. *Fuel supply hose*
2. *Vent tube*

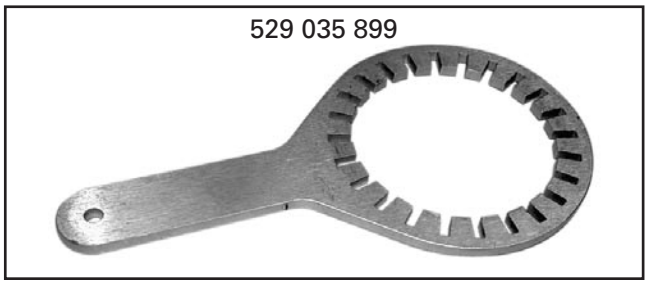
Remove seat. Unbolt fuel tank.



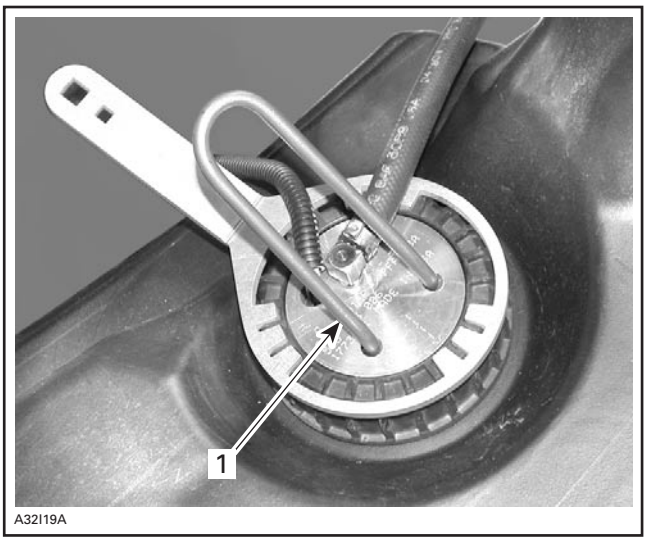
1. *Fuel tank retaining screws*

Move fuel tank rearward, then unplug the fuel pump module electric connector.

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




A32I11A



A32I19A

1. Bent rod

Pull fuel pump module out of fuel tank to expose sensor body.

Remove fuel pump module. Guide fuel pickups when pulling out fuel pickup hoses.

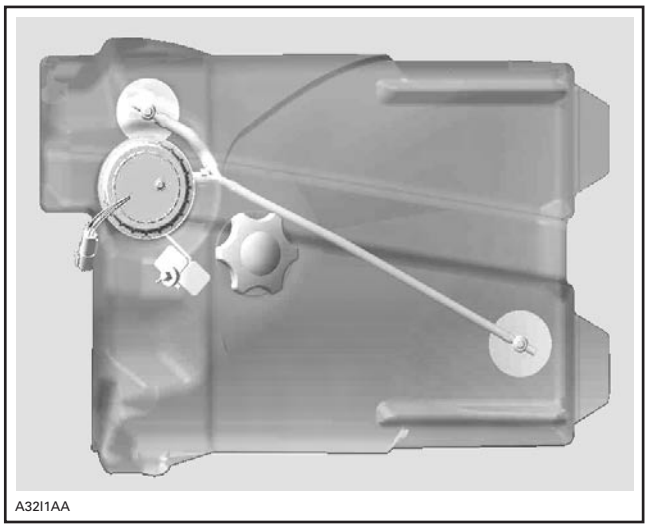

A32I13A

Installation

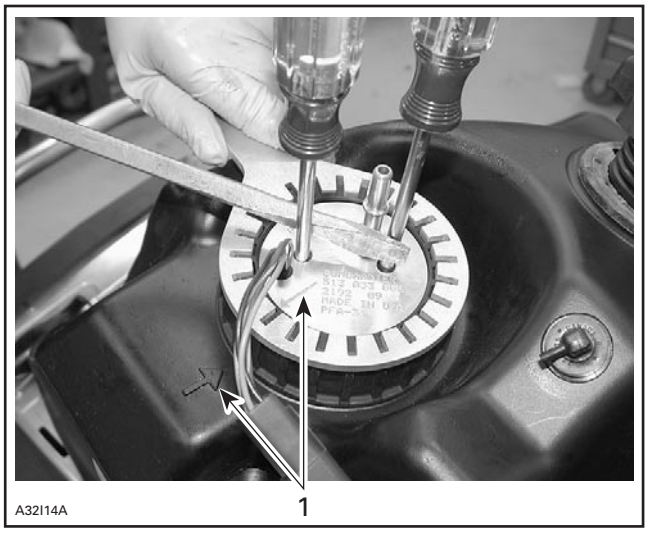
For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Make sure that rear pickup hose is positioned as following illustration.

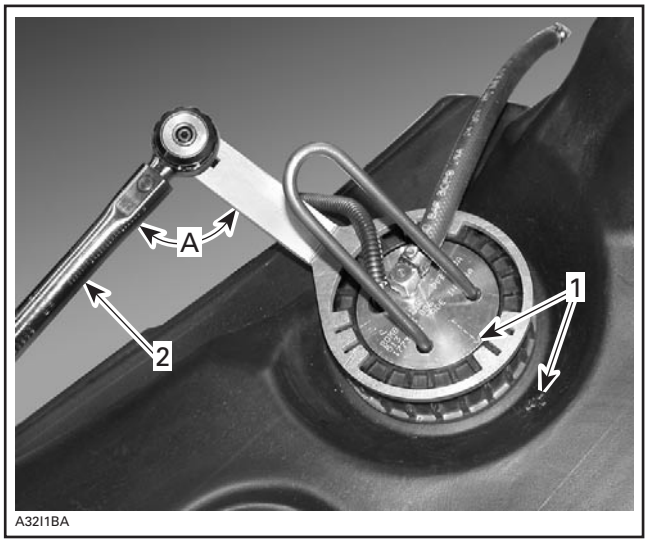

A32I1AA

Align the arrow on fuel pump module with the one on fuel tank. Keep arrows aligned during fuel pump module nut tightening.



1. Arrows

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



1. Arrows
2. Torque wrench
A. 90°

Bleed the fuel system as following procedure.

Fuel Bleeding Procedure

The rear fuel pickup hose has to be bled.

Pour 12 L (3.17 U.S. gal.) of recommended fuel in the fuel tank.

Apply parking brake. Start the engine. Let it run at idle speed.

Lift the front of vehicle at a 45° angle.

Put the vehicle back on the ground.

Do the above procedure three times.

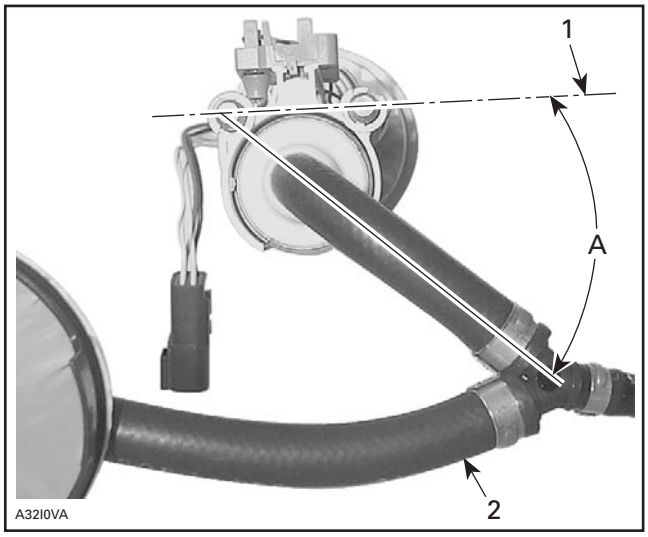
Stop the engine. The rear fuel pickup hose is now bled.

Fuel Hose Kit

Remove fuel pump module as explained above.

Unfasten blue hose clamp retaining old fuel hose ass'y to pump inlet nipple. Remove old fuel hose ass'y.

Install fuel hose ass'y to pump at an angle of 46 ± 3° from retaining rods axis.



1. Retaining rods axis
2. Fuel hose ass'y
A. 30° ± 3

Install a new blue hose clamp on fuel hose ass'y.

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

Pump Ass'y Kit

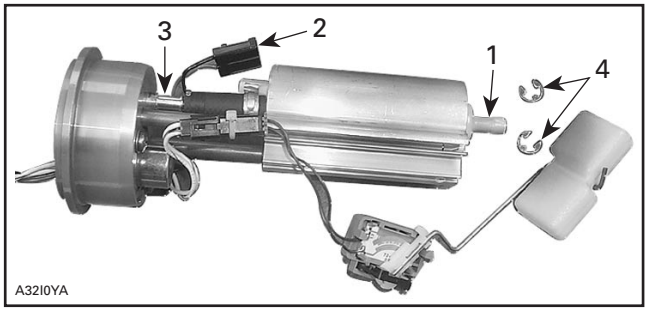
Remove fuel pump module as explained above.

Disconnect fuel hose from pump inlet nipple.

Disconnect pump electric connector.

Disconnect pump outlet hose from pump module flange nipple.

Remove E-clips. Slide pump ass'y out of retaining rods.



TYPICAL
1. *Pump inlet nipple*
2. *Pump electric connector*
3. *Pump module flange nipple*
4. *E-clips*

Reverse removal procedure for installation.

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

Regulator Kit

Remove fuel pump module as explained above.

Remove 2 screws retaining regulator to pump module flange.

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

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

Reverse removal procedure for installation.

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

FUEL RAILS

Pressure at fuel rails is supplied and controlled by the fuel pump module. Refer to FUEL PUMP for pressure test.

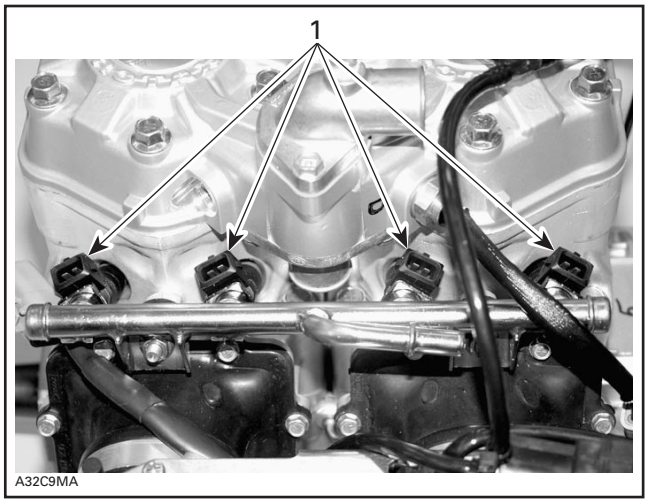
Fuel Rail Replacement

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 injectors

Disconnect wiring harness from the four fuel injectors.

Cut tie raps and remove the wiring harness from the fuel rail.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

If necessary remove fuel injectors as described below.

Installation

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

Replace O-rings with new ones.

A thin film of injection oil should be applied to O-rings of fuel injectors to ease installation in cylinder.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Make sure that injector clips are well in place.

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

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

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

FUEL INJECTORS

Leakage Test

To perform a leakage test, the injectors and fuel rail have to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.

NOTE: Do not detach injectors from the fuel rail.

Reconnect the fuel line and the wiring harness.

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).

The leakage test is validated when performing the FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART elsewhere in this section.

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 pin 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»)	INJECTOR NUMBER
A-15	1/1 (MAG external)
A-33	2/1 (PTO external)
A-14	1/2 (MAG internal)
A-30	2/2 (PTO internal)

– 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

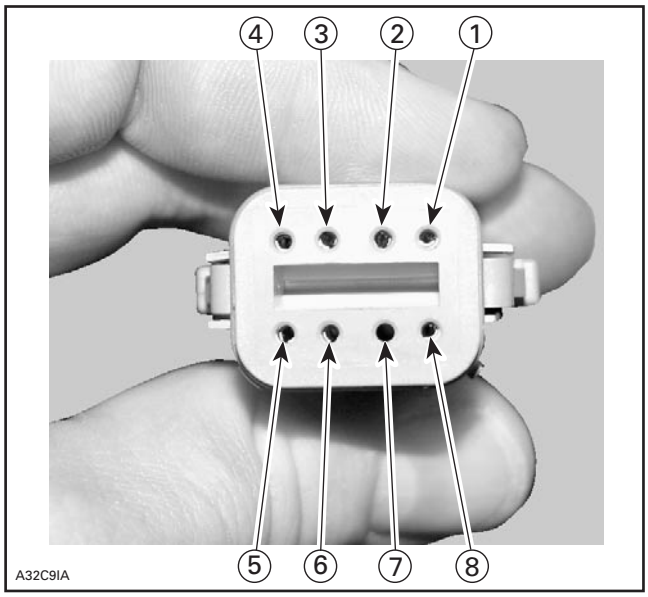
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

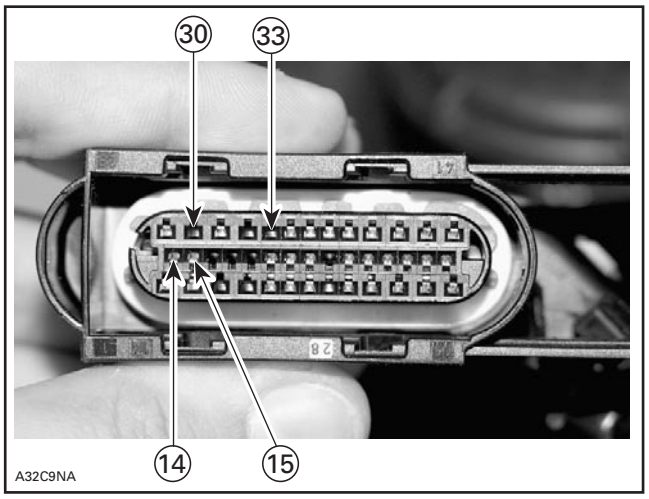
If resistance value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector A from the ECM as well as the engine connector.

Using a multimeter, check resistance value between terminals as shown in the table below.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Cylinder 1 fuel injector 1	4 (Engine Connector) and A-15 (ECM connector)
Cylinder 1 fuel injector 2	3 (Engine Connector) and A-14 (ECM connector)
Cylinderr 2 fuel injector 1	4 (Engine Connector) and A-33 (ECM connector)
Cylinder 2 fuel injector 2	3 (Engine Connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

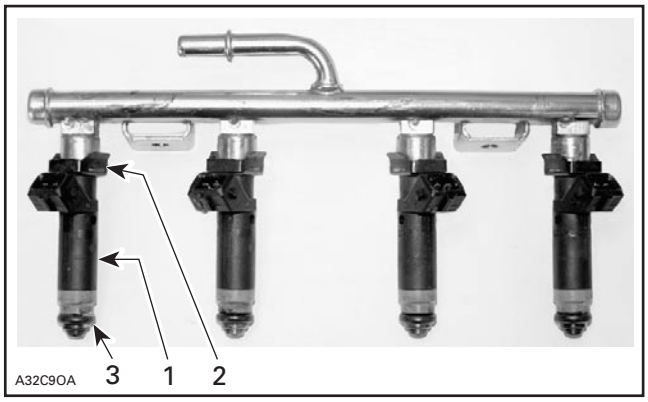
If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Before removing the injectors, the fuel rail has to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.



FUEL RAIL ASS'Y
1. *Fuel injector*
2. *Injector clip*
3. *O-ring*

Then remove the injector clip. Now the 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.

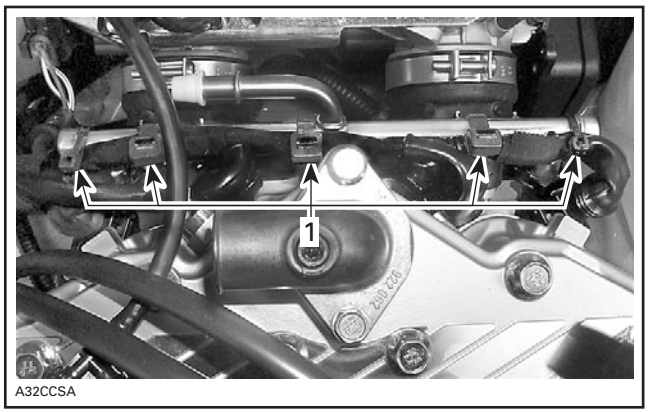
Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Replace O-rings with new ones.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Attach injector wires with locking ties as shown in following photo.



1. Locking ties

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

ELECTRONIC MANAGEMENT

ECM REPLACEMENT

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.

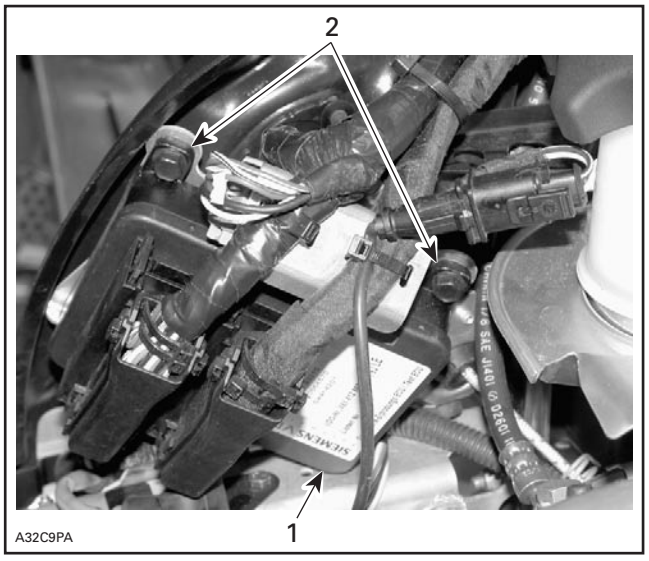
ECM Replacement

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.

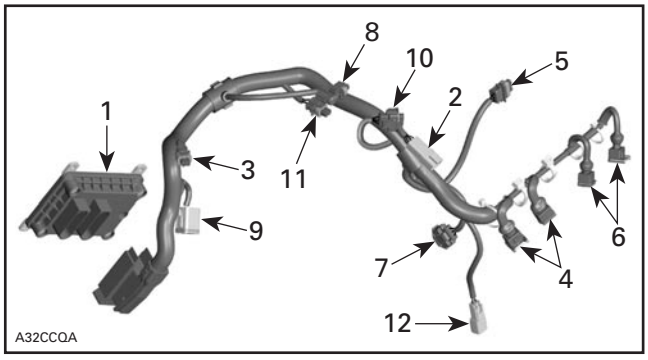
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

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 5000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. ECM
2. CTS connector
3. EGTS connector
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 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 connector to the vehicle wiring harness.

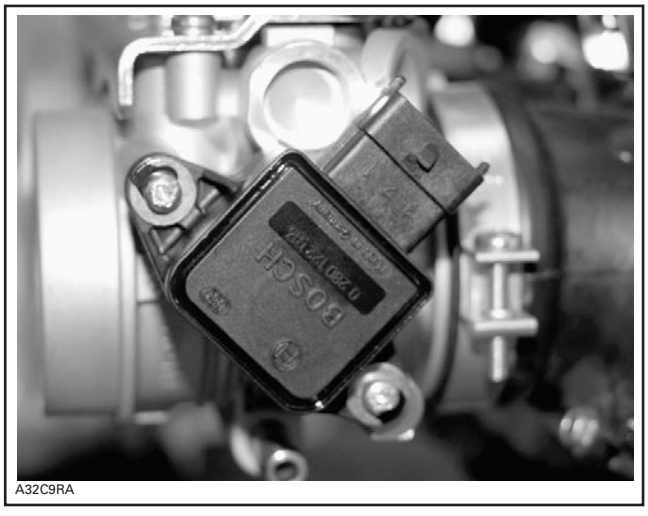
Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

Install all remaining parts, which have been removed.

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.



THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY in AIR INDUCTION SYSTEM above.

The ECM may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

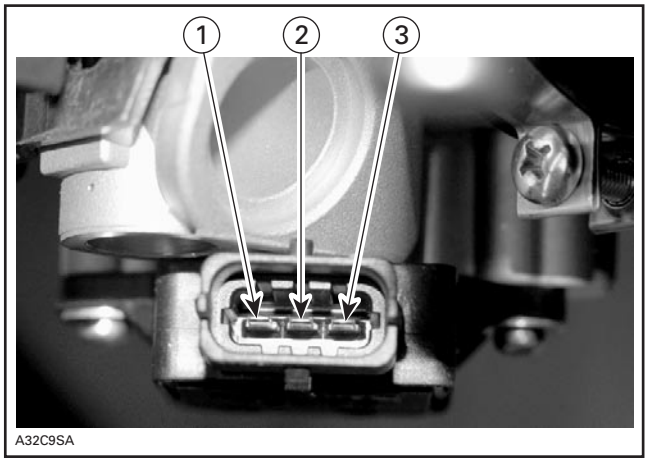
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

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 desired 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 pin-out and its pin numbers, 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 pin 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on wiring harness TPS connector and pin 24 on wiring harness ECM connector.

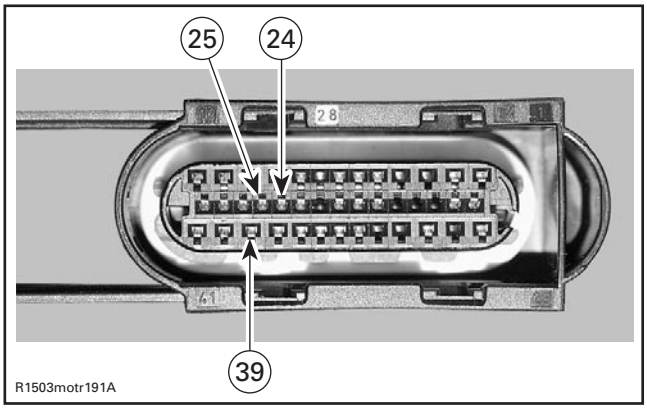
If tests are good, replace the TPS.

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 between terminal A-25 and A-39.

The resistance should be 1600 - 2400 Ω in any throttle position.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **idle** position.

The resistance should be approximately 1000 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **wide open** position.

The resistance should be 2500 Ω.

Check the resistance between terminal A-24 and A-25 with throttle plate in **idle** position.

The resistance should be 2500 Ω.

Now check the resistance with the throttle plate in **wide open** position.

The resistance should be approximately 1000 Ω.

NOTE: When measuring between pins A-24 and A-39, resistance **value increases** while depressing throttle lever. When measuring between pins A-24 and A-25, resistance **value decreases** while depressing throttle lever. 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 ECM REPLACEMENT procedures elsewhere in this section.

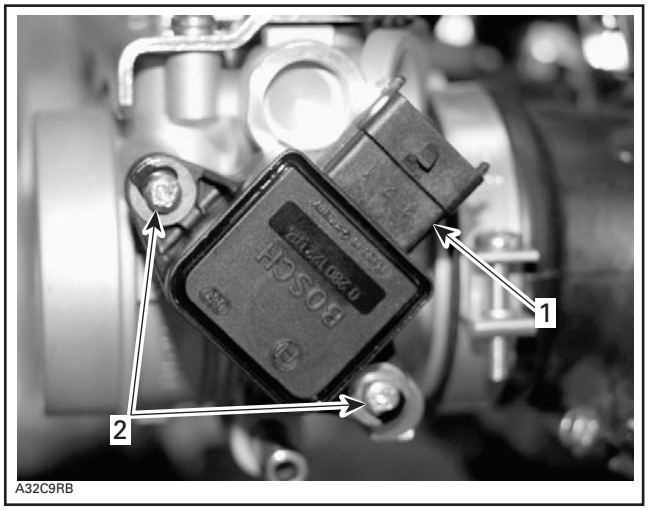
If resistance values are incorrect, repair connector or replace the wiring harness between ECM connector and the TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on 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

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.

Push the **Reset** button in the **Setting** section of B.U.D.S.

The following message will be displayed:

Make sure the idle screw is not in contact with the throttle stopper. Click OK to continue.

Follow instructions and click OK.

Another message will appear to ask you to perform a ECU tracking shut down to save the changes into the ECU permanent memory.

Remove the tether cord cap from the DESS post and wait until the message disappears before reinserting the tether cord cap.

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.

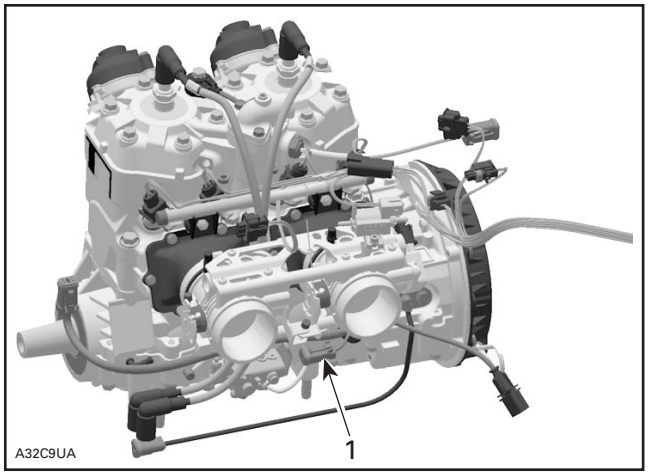
ENGINE TYPE	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
593 SDI	3.9° ±0.1	4.9° ±0.1

If throttle cable has been loosen during the procedure, adjust a throttle cable.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is the trigger coil 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.

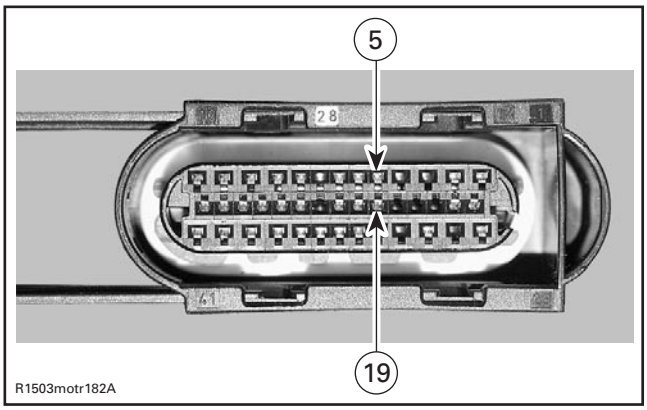
Resistance Test

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.

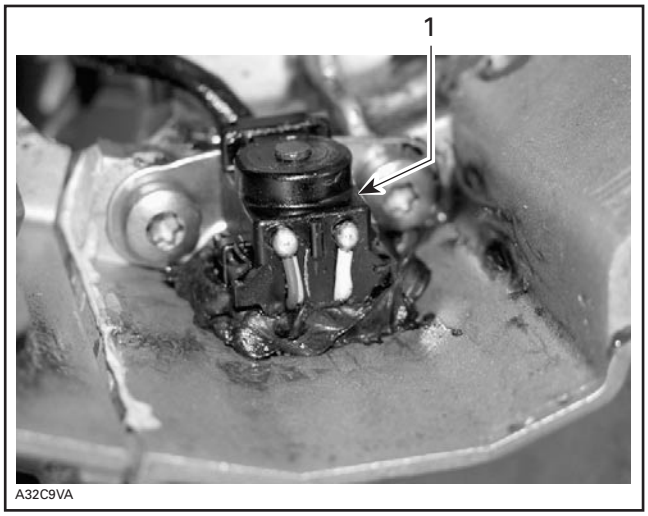
If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

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

Remove CPS.



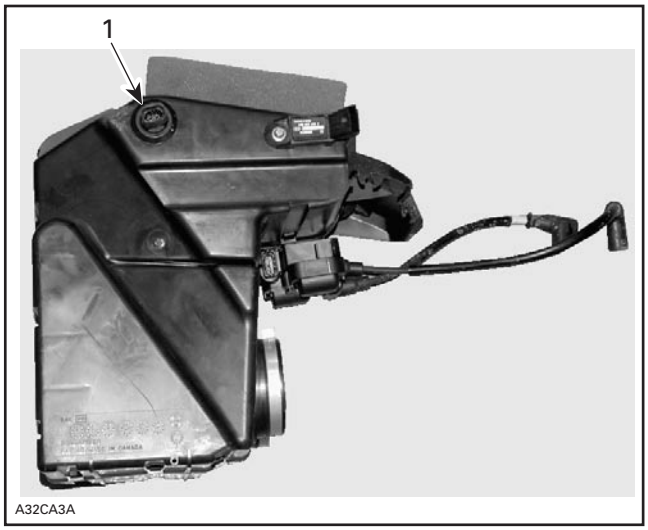
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

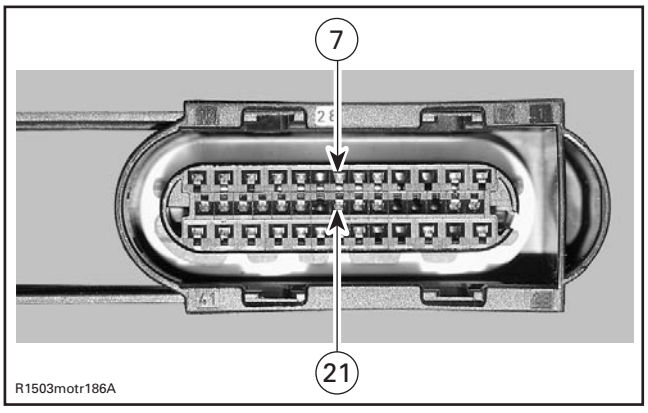
Resistance Test

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 ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

Disconnect the connector of the ATS.

Pull the ATS out of the air intake silencer.

Follow this procedure to install the ATS.

First, install the ATS rubber ring.

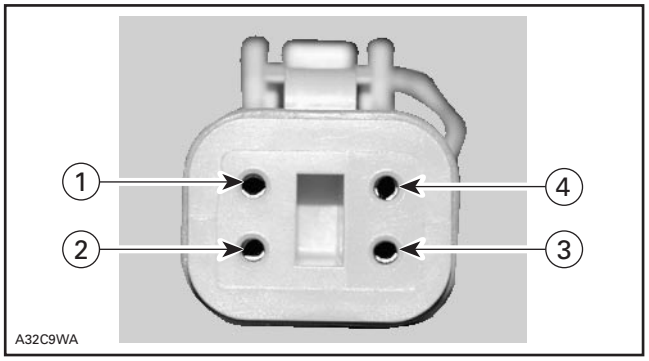
NOTE: If the rubber ring is installed on ATS sensor, remove it before ATS installing.

Spray soapy water on ring. Install ring on air intake silencer then push the sensor in place. Reconnect it.

COOLANT TEMPERATURE SENSOR (CTS)

Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.



The resistance between pin 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.

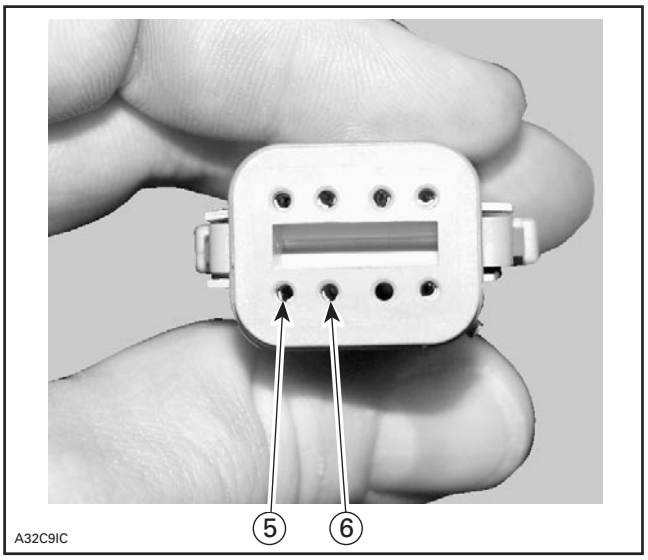
If out of specification, replace the sensor.

The resistance between pin 3 and 4 is used for ECM.

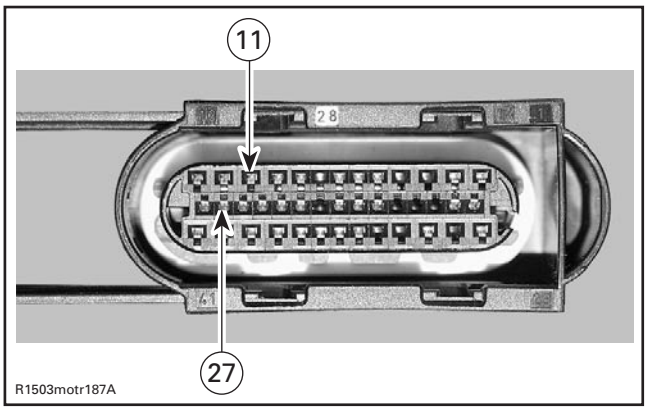
Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If 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 connector.



ENGINE CONNECTOR



ECM CONNECTOR A

Using a multimeter, recheck resistance value between terminals 5 and 6 on engine 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 ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

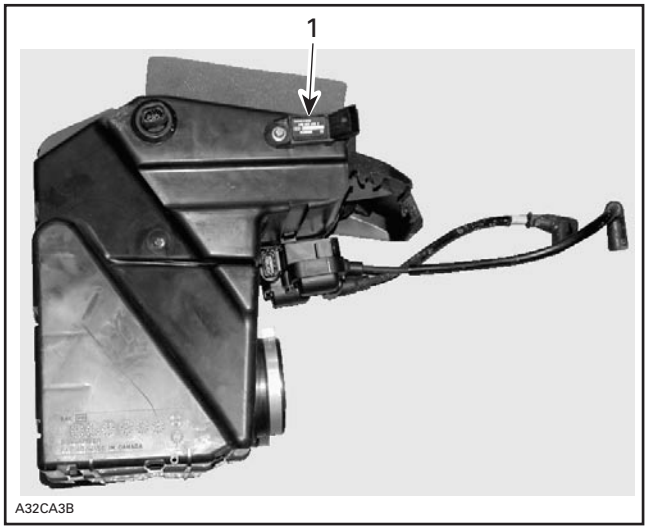
Drain cooling system.

Disconnect CTS connector and remove CTS. Install 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)



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 pin 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on APS connector and pin 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	PIN 1
A-4	PIN 2
A-18	PIN 3

If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

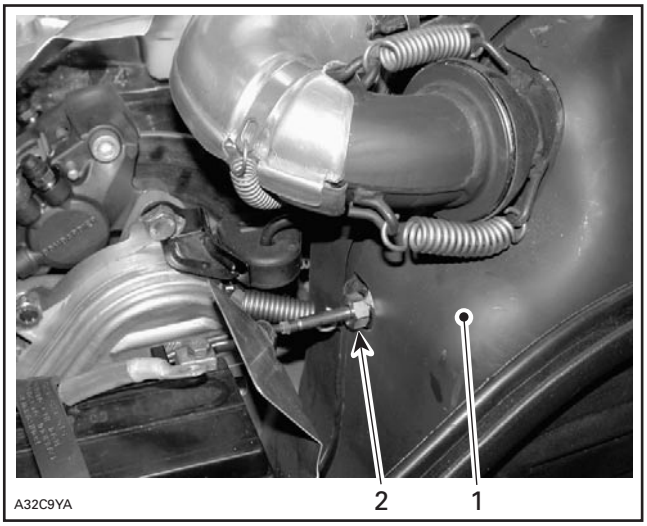
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The ATS is retained with a screw.

Install the new APS.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



1. Muffler
2. Exhaust gas temperature sensor (EGTS)

Resistance Test

Disconnect the plug connector from the EGTS and check sensor resistance.

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 EGTS and disconnect the connector A on the ECM.

Using a multimeter, recheck resistance value between terminals 10 and 26.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

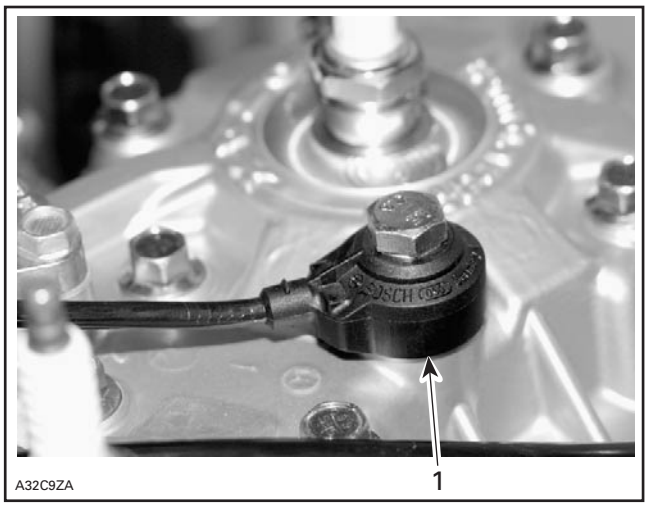
Disconnect EGTS connector and remove EGTS.

Apply anti-seize lubricant (P/N 293 800 070) over EGTS threads to prevent possible seizure.

Torque the new EGTS to 45 N•m (33 lbf•ft).

Replug connector.

KNOCK SENSOR (KS)



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.

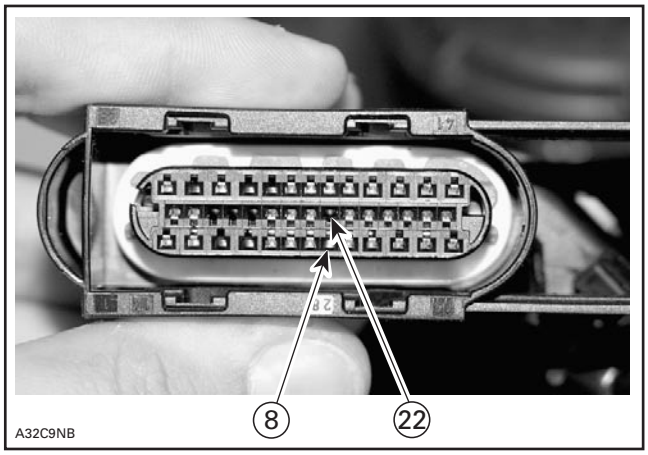
Otherwise, do the following.

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 from the ECM and check continuity of circuit as per following table.



CIRCUIT NUMBER (ECM CONNECTOR A)	KS CONNECTOR
A-22	PIN 1
A-8	PIN 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.

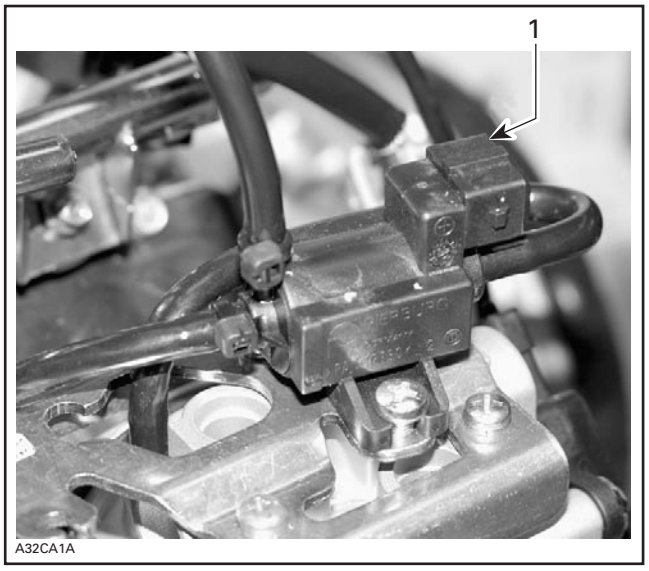
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

Torque screw to 24 N•m (18 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE SOLENOID



1. E-RAVE solenoid

Resistance Test

Disconnect the solenoid connector.

Check resistance value between both terminals of the solenoid.

The resistance value should be approximately 30 Ω.

Voltage Test

Install the tether cord cap and push the START/RER button momentarily to activate ECM.

Battery voltage should be present on WHITE/GREEN wire. If test fail, fuse or relay may be faulty.

Continuity Test

WHITE/BROWN wire must show continuity between solenoid connector and pin 15 on ECM connector.

If test fail, repair connector or replace wiring harness between ECM connector and solenoid.

Replacement

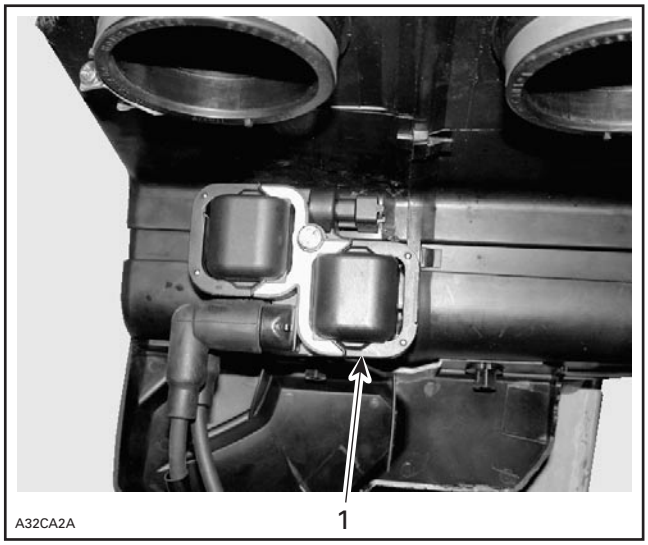
Remove the air intake silencer. Unplug the solenoid connector and all hoses.

NOTE: Mark hose locations for installation.

Remove solenoid screws then the solenoid.

For installation, reverse the removal procedure.

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.

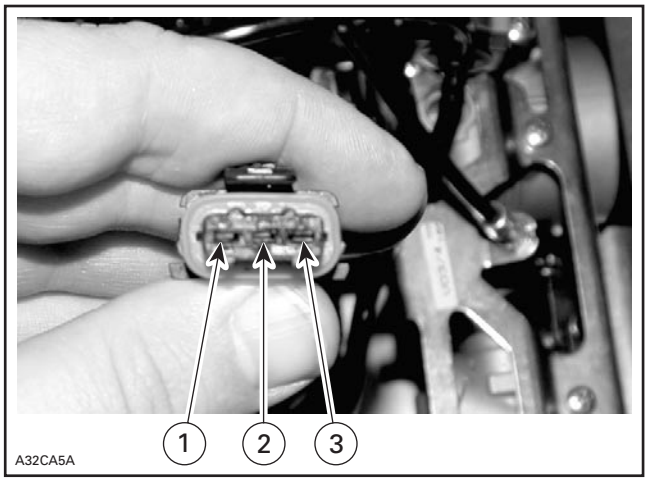
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

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.



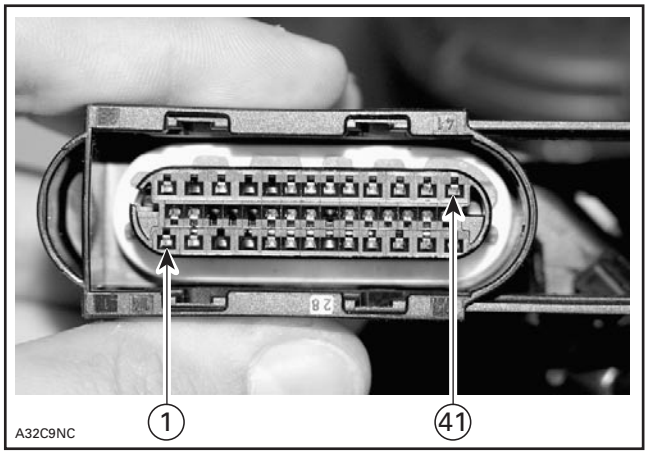
Install **tether cord cap** on the DESS post and push the START/RER button momentarily to activate the ECM.

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, pin 3 and pin 1 respectively.



ECM CONNECTOR

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

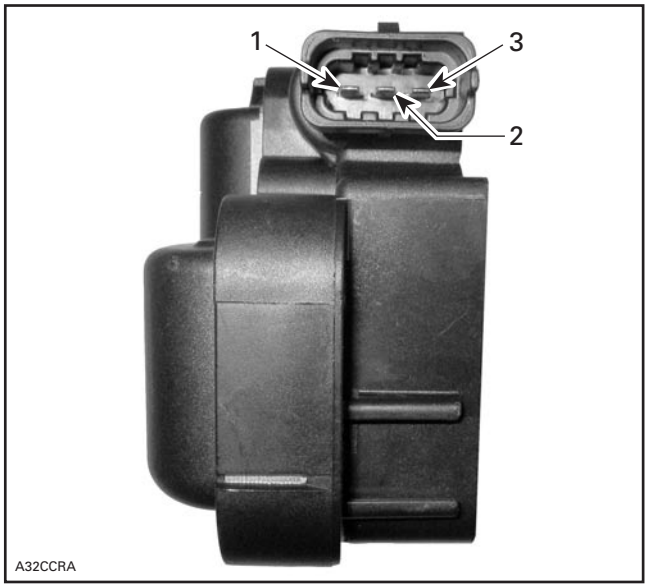
If wiring harness is good, test resistance of primary winding of ignition coil.

Resistance Test

Remove spark plug cables from ignition coil.

Using a multimeter, check the resistance of primary winding.

NOTE: The secondary winding can not be measured with an ohmmeter. Try a new double ignition coil if necessary.



1. *Terminal 1a*
2. *Terminal 15*
3. *Terminal 1b*

For primary winding, check the resistance between terminal 15 and terminal 1a (cylinder 1) of the ignition coil and between terminal 15 and terminal 1b (cylinder 2) respectively.

The resistance should be between 0.40 and 1.15 Ω at 20°C (68°F).

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

If the windings test good, check corresponding fuse, relay and wiring. If 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.

IGNITION TIMING

Refer to IGNITION TIMING section.

ENGINE START/RER BUTTON VERIFICATION

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the START/RER button and look at the START/RER button LED. It should turn on, indicating the starting system is working on the input side of the starting system (START/RER button, ECM and wiring). If so, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Otherwise, check the input side as follows.

Disconnect the connector of the steering harness.

Measure the resistance of the GREEN/RED and LIGHT BROWN wires for 0Ω. Depress start button and the reading should change from 0Ω to infinitely high.

Release the start button and measure the resistor between LIGHT BROWN and BLACK wires. It should be 50Ω.

Test continuity of circuit B-19. If it is good, try a new ECM. Otherwise, repair harness/connectors.

DESS SWITCH 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 switch wires.

Tether Cord Cap Removed

Connect test probes to switch GREY/GREEN and WHITE/BLACK 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 GREY/GREEN wire and the other test probe to the switch ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

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

SPARK PLUGS

Disassembly

Disconnect the spark plug cable from the spark plug.

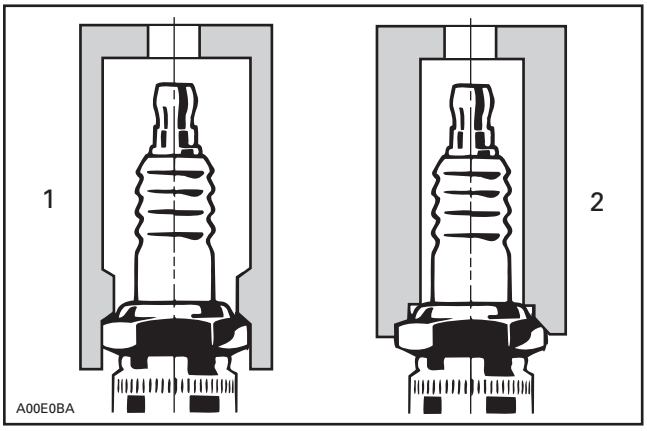
First unscrew the spark plug one turn.

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

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1) Using a wire feeler gauge, set electrode gap according to the following chart.
2) Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
3) Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise an additional 1/4 turn with a proper socket.



1. Proper socket
2. Improper socket

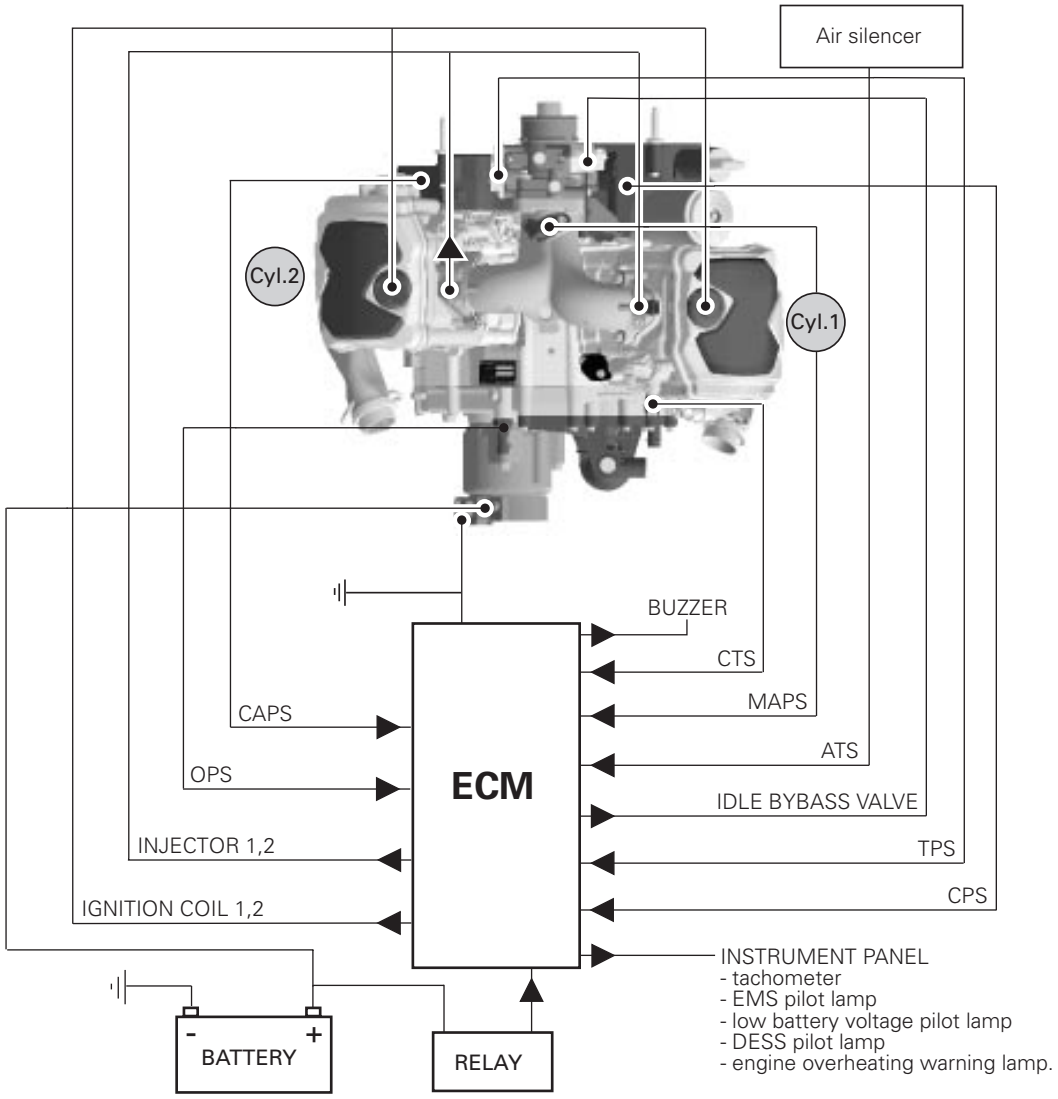
ENGINE	SPARK PLUG	TORQUE	GAP mm (in)
593 SDI	NGK BR 9 ECS	Hand tighten + 1/4 turn with a socket	0.8 (.031)

CRANKING SYSTEM

See above for start/stop switch and the DESS post testing.

OVERVIEW

ENGINE MANAGEMENT SYSTEM - OVERVIEW
ROTAX 4-TEC 1004



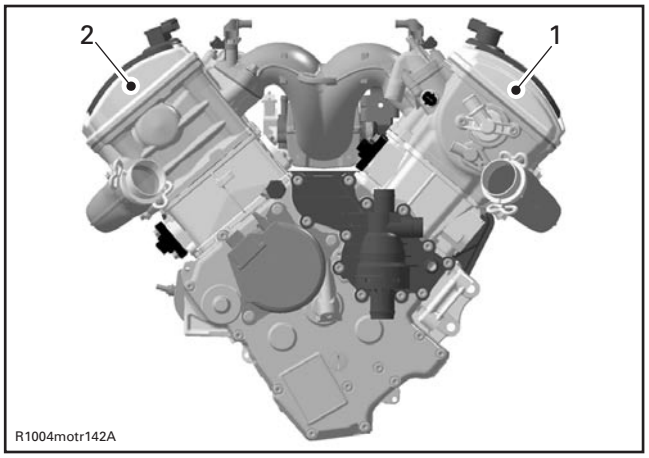
CPS	Crankshaft Position Sensor
TPS	Throttle Position Sensor
ATS	Air Temperature Sensor
CTS	Coolant Temperature Sensor
OPS	Oil Pression Switch
CAPS	Camshaft Position Sensor
MAPS	Manifold Air Pression Sensor
EMS	Engine Management System
ECM	Engine Control Module

A32I0LS

OPERATING PRINCIPLE OF ENGINE MANAGEMENT

A highly advanced engine management system (EMS) has been used to ensure a high power output with cleaner combustion. The EMS calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the intake port of each cylinder.

NOTE: On the 1004, the cylinders are referenced as 1 (front) and 2 (rear) instead of PTO and MAG.

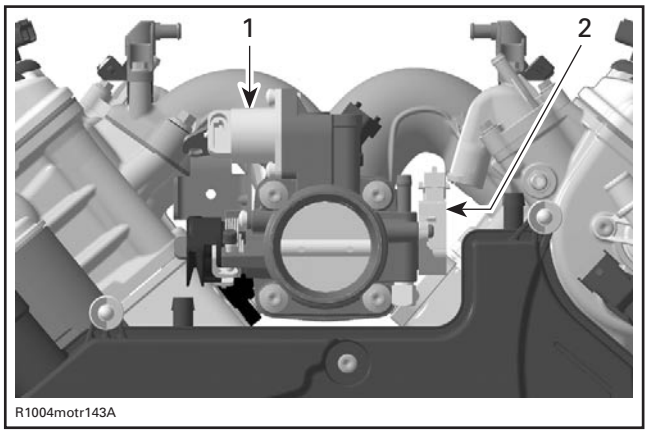


1. Cylinder 1
2. Cylinder 2

NOTE: "EMS" stands for engine management system. "EMS" includes an ECM (engine control module), sensors and injectors.

AIR INDUCTION

Through air filters, air goes into the air silencer. ECM measures at this point air temperature. Air pressure is measured directly in the intake manifold. Then, air for combustion is drawn through one 52 mm throttle body. The air flow is controlled by a throttle plate and an idle bypass valve respectively. The air continues through the intake manifold and goes into the cylinder head.



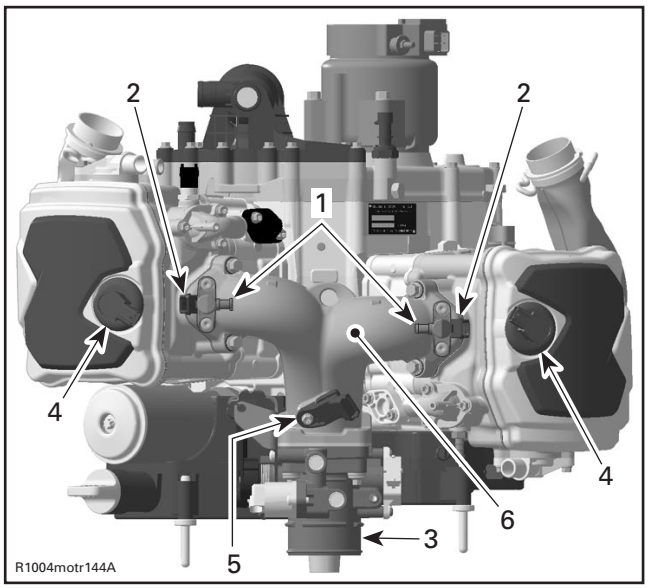
52 MM THROTTLE BODY
1. Idle bypass valve
2. Throttle position sensor (TPS)

FUEL DELIVERY SYSTEM

BASIC OPERATION

When the intake valve reaches the correct position, the ECM (engine control module) opens the fuel injector and fuel is discharged into the intake port at the air intake manifold by the high fuel pressure inside the fuel rail. The air/fuel mixture enters then the combustion chamber through the open intake valve. This mixture is then ignited by the spark plug.

INTAKE MANIFOLD



INTAKE MANIFOLD
1. *Fuel rail*
2. *Injector*
3. *Throttle body*
4. *Ignition coil*
5. *Manifold air pressure sensor (MAPS)*
6. *Intake manifold*

The intake manifold is mounted on the top of the engine on both cylinder heads. It provides support for the fuel injectors, the fuel rails, MAPS (manifold air pressure sensor) and the throttle body. The air intake manifold is a resonator between the throttle body and the air intake at the cylinder heads.

Fuel Rail

Two fuel rails, one for each injector, are mounted on the intake manifold. The fuel rails ensure all the time, that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rails are fed by the fuel pump with a fuel pressure of approximately 400 kPa (58 PSI).

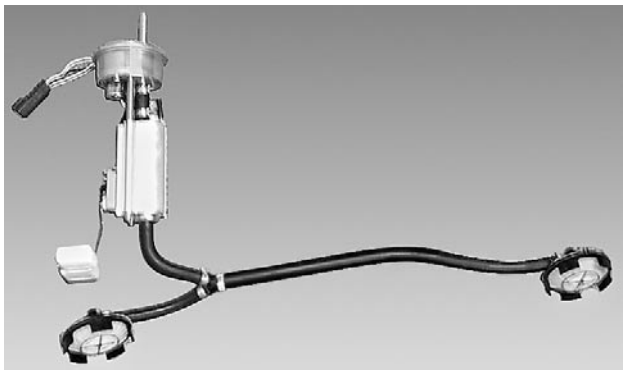
Fuel Injector

Two fuel injectors (one per cylinder) are used to inject fuel into the intake port of the cylinder head.

Throttle Body

It is a 52 mm heated throttle body mounted on intake manifold. Fitted on the throttle body, there is the TPS and the idle bypass valve which allows the ECM to control the RPM while the throttle plate is closed.

FUEL PUMP MODULE



The fuel pump module is located inside the fuel tank. The module includes fuel pump, fuel pressure regulator and fuel level sensor.

Fuel Pump

It provides fuel pressure and flow rate to the system.

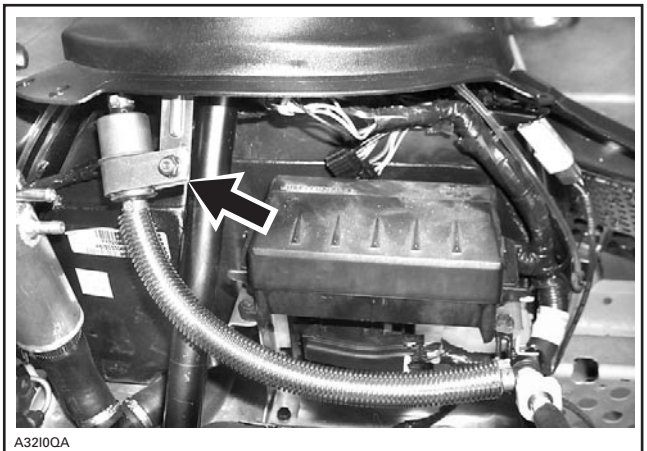
Fuel Pressure Regulator

A fuel pressure regulator controls the pressure in the system and allows excess fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at approximately 400 kPa (58 PSI).

Fuel Pickups

Two fuel pickups come with 70 micron filter. One is located at the front right side of the fuel tank and the other at the rear left side.

In-Line Fuel Filter

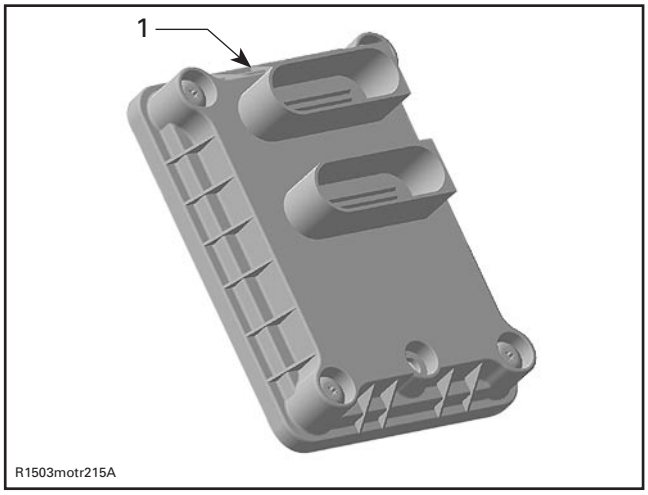


The in-line fuel filter is fastened under the steering console. It comes as a complete assembly.

ELECTRONIC MANAGEMENT

EMS (ENGINE MANAGEMENT SYSTEM)

The engine management system is controlled by the ECM.

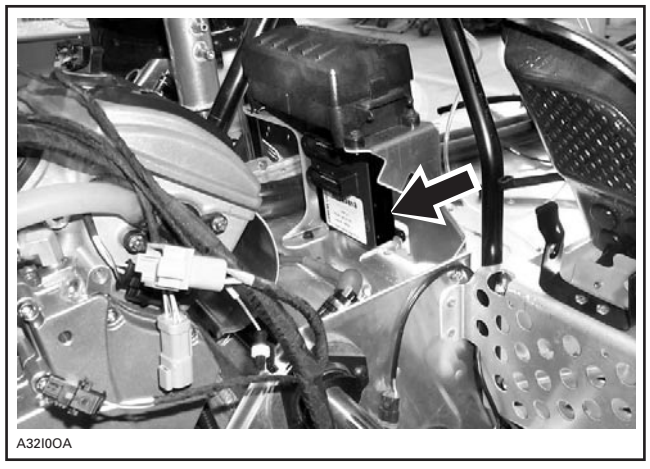


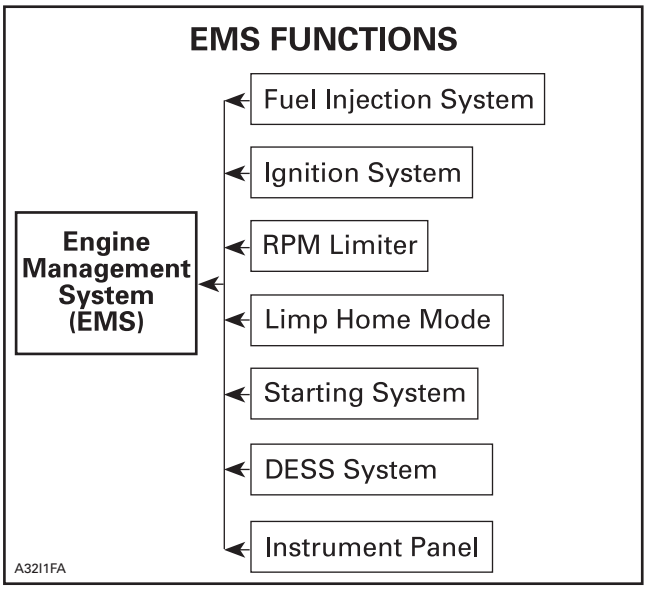
TYPICAL
1. ECM

ECM

The ECM is located between the engine and the fuel tank, under the fuse box.

It controls all engine management functions, by processing the information given by various sensors.





The ECM (engine control module) is directly powered by the battery. It is responsible for the following engine management/electrical functions:

- analysis of information
- distribution of information
- start/stop function
- timer
- DESS (Digitally Encoded Security System)
- ignition timing control
- injection control
- proper mapping (injection and ignition) for optimum engine operation in all conditions.
- engine RPM limiter
- etc.

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

EMS — GENERAL FUNCTIONS

Anti-Drive Feature

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

Digitally Encoded Security System (DESS)

The ECM is designed to work with the DESS.

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 B.U.D.S. 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 vehicle ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicles equipped with the DESS. It only needs to be programmed for that vehicle.

The memory of the ECM features a self-diagnostic mode for the DESS operation. Refer to DIAGNOSTIC PROCEDURES section for more information.

The memory of the ECM is permanent. If the battery is disconnected, no information is lost.

Note that the DESS anti-drive circuitry is already activated on all new ECM.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

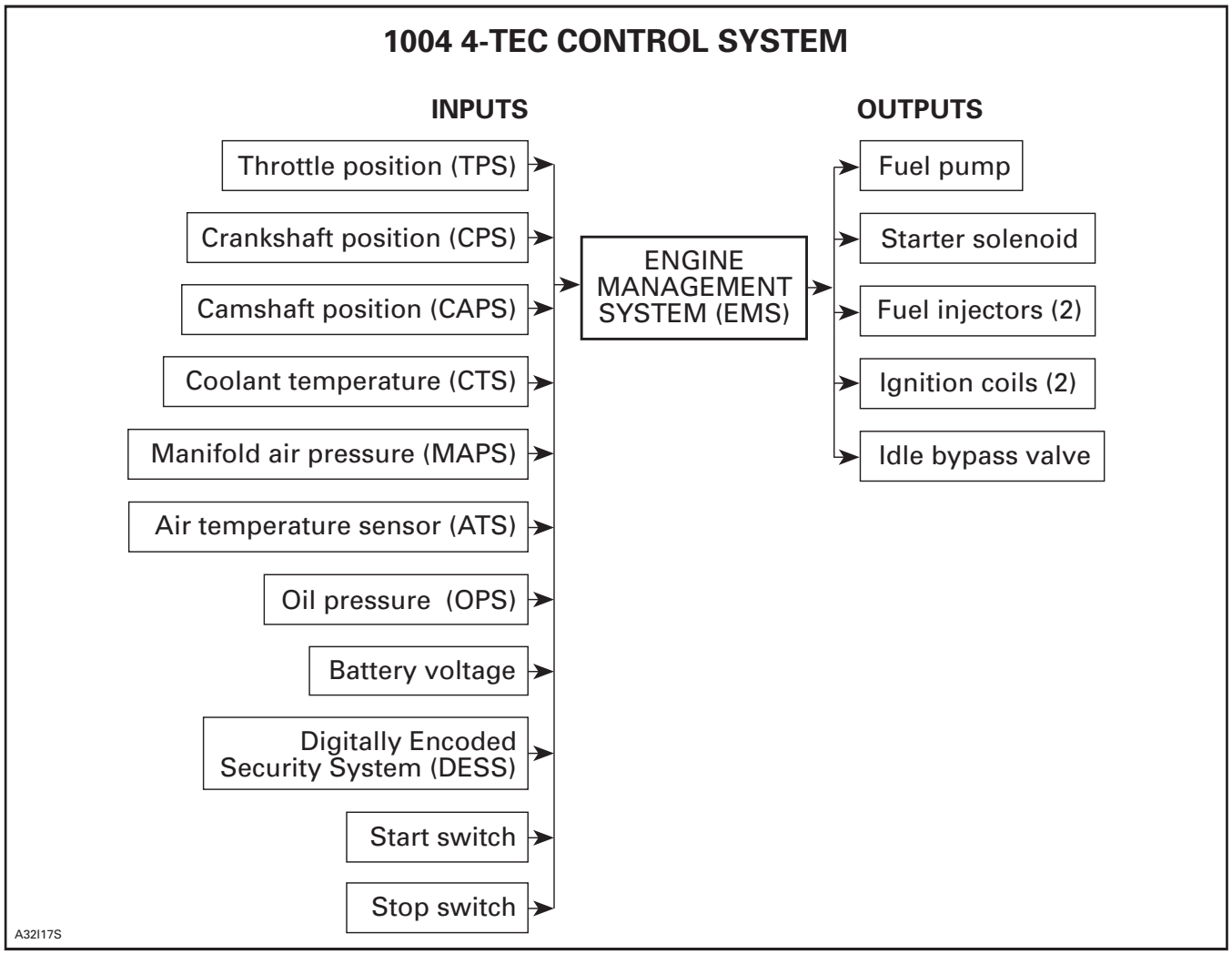
Low Oil Pressure Warning Device

When the oil pressure falls under a certain level, the ECM sends out signals to the buzzer, the low oil pressure warning lamp and to the EMS pilot lamp.

High Coolant Temperature Warning Device

When the coolant temperature is getting to high, the ECM sends out signals to the buzzer, the engine overheating warning lamp and to the EMS pilot lamp.

EMS — ENGINE MANAGEMENT FUNCTIONS



This engine management system controls both the fuel injection and the ignition timing.

As shown in the 1004 4-TEC CONTROL SYSTEM illustration, the ECM is the central point of the fuel injection system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

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

Electronic Fuel Injection

The ECM reads the signals from different sensors which indicate engine operating conditions at millisecond intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS, the ATS, the MAPS and the TPS are the primary sensors used to control the injection and ignition timing. Other sensors (like temperature sensors, etc.) are used for secondary input.

Ignition System

The ignition system is fully managed by the ECM which controls the ignition system parameters, such as spark timing, duration and firing order to achieve the proper engine requirements.

Ignition Coils

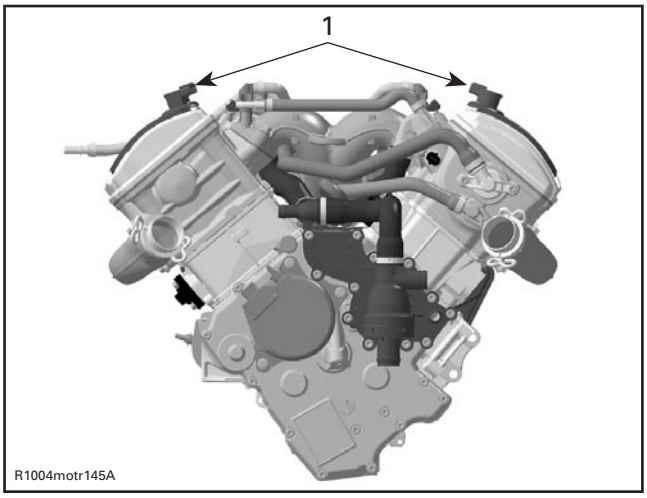
Two separate ignition coils induce voltage to a high level in the secondary windings to produce a spark at the spark plug.

The ignition coils receive input from the ECM. Each coil provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

NOTE: Ignition coil wires are not interchangeable due to different lengths of the wiring harness.

Both ignition coils are located on the cylinder heads directly on the spark plugs.



1. Ignition coils

Ignition Timing

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.There is no mechanical adjustment to perform.

Engine Modes of Operation

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start-up, idle, warm up, part load, full load, engine speed limiter, drowned engine and limp home (see below).

Flooded Engine (drowned mode)

If engine is fuel-flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows to activate it.

With tether cord cap on its post while engine is stopped, press and HOLD throttle lever at WOT position.

Press the start button. The mode is now on.

Releasing throttle lever will bring back the normal mode.

If engine does not start, it may be necessary to remove spark plugs and crank engine with rags over spark plug holes. Refer to COMPONENT INSPECTION AND ADJUSTMENT subsection.

⚠ 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.

Limp Home Mode

Besides the signals as seen above, the ECM may automatically set default parameters to the engine management to ensure the adequate operation of the vehicle if a component of the fuel injection system is not operating properly.

Sensor failures will not lead to a limp home mode, warning will follow through the EMS pilot lamp and the buzzer.

When minor fault occurs, the fault and message/buzzer disappear automatically when the condition no longer exists.

Releasing throttle and letting the engine returning at idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on its 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.

Shutdown Mode

ECM will shut down all outputs 5 seconds after the tether cord cap is removed.

If the tether cord cap is still on DESS post but the engine is turned off using engine cut-out switch, the ECM will shut down all outputs after 15 seconds.

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.

The ECM and the VCK are able to communicate through a connector on the vehicle. Refer to the DIAGNOSTIC PROCEDURES section. B.U.D.S. Version G2.10 or P2.10 and up must be used for this system.

Monitoring System

The ECM monitors the electronic components of the fuel injection system and also the electrical system. When a fault occurs, it sends visual messages through the referring LED and/or audible signals through a buzzer to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES section for the LED and the buzzer coded signals chart.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

GENERAL

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

- Check the chart in the 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.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.
- Refer to COMPONENT INSPECTION AND ADJUSTMENT section for procedures.

Terminology

Some documents or softwares use technical terms that may be different from the one used in this manual. The following table will help to find the equivalence.

TERMS USED IN THIS MANUAL	TERMS USED IN OTHER DOCUMENTS OR SOFTWARES
Camshaft	Cam
Crankshaft	Crank
ECM	– ECU – Module
Idle bypass valve	– DLA (Digital Linear Actuator) – Idle actuator – Idle valve – Idle control air valve
MAPS (Manifold Air Pressure Sensor)	APS (Air Pressure Sensor) or (Atmospheric Pressure Sensor)
DESS tether cord	– DESS key – key

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 pulley engagement.	Normal condition.
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.	Reinstall tether cord cap correctly over post.
	Defective tether cord cap.	Use another programmed tether cord cap.
	Dirt or snow in tether cord cap.	Clean tether cord cap.
	Defective DESS post.	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 electronic module.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
3 short beeps per second. Oil pilot lamp also lights up.	Low oil pressure on 4-TEC models.	Stop engine immediately and check oil level and top it. Check lubrication system.
3 short beeps per second. Battery pilot lamps lights up.	Low battery voltage. No charging.	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.

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 4-TEC models.

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

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

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

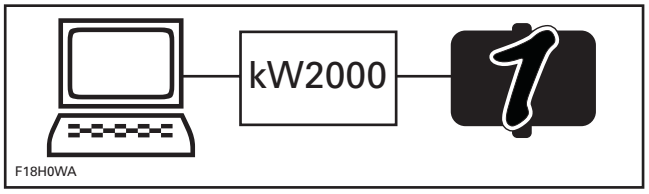
⚠ WARNING

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.

IMPORTANT: When using the software B.U.D.S., with the 4-TEC engine, ensure that the protocol "kW2000" is properly selected in **"MPI"** (multi-protocol interface) under **"Choose protocol"**.

When B.U.D.S. is connected to the vehicle, the status bar shows the protocol (kW2000) and the number 1 to the right. To communicate with the ECM (Engine Control Module), number 1 must be displayed.

Number 1 means that one module is connected.



ONE MODULE IS CONNECTED

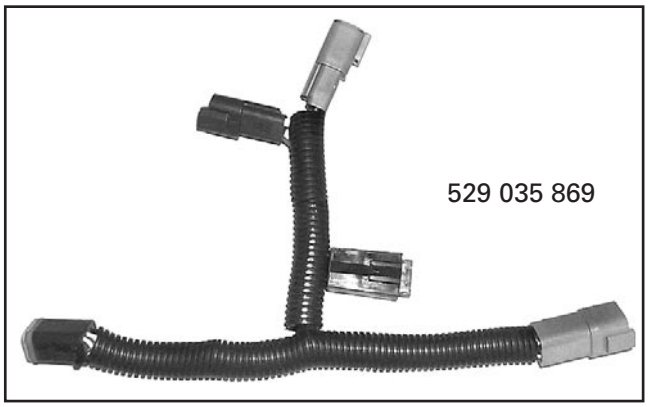
If an "X" is shown, this means that no communication between the MPI and the ECM is possible. Possible causes are:

– ECM is not powered-up
– wrong protocol is used
– bad connection between MPI and module.

ECM Supply

To power-up the ECM, push the START button shortly while the engine cut-out switch is OFF and the tether cord cap installed on DESS post. If your intent is to program the vehicle key, use gray key (P/N 529 035 896) on DESS post.

The supply cable (P/N 529 035 869) may also be used. Connecting it between MPI and vehicle will power-up the ECM.



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.

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 (approximately 15 seconds after tether cord cap removal).

4-TEC SYSTEM FAULT CODES

General

The faults saved in the ECM (Engine Control Module) are kept even if 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) and 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.

Supplemental Information

– Electrical noise is picked up by the ECM. Ensure that all connections are in good condition, also grounds (battery, ECM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine — particularly in the ignition system. Installing non-resistive spark plugs may lead to generate fault code.
– Electrical noise might also lead engine to occasional cutout without generating a fault code when engine is restarted.
– If everything is in good condition, try a new ECM.

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 "DA" on the ECM and the circuit 41.

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 ADAPTION FAILURE.

4-TEC TPS FAULT TABLES

TPS "OUT OF RANGE" Fault

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

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

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Fix.
Check if sensor is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Inspect sensor for damage or corrosion	Replace and reset **Closed Throttle and Idle Actuator**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle and Idle Actuator**.
Test sensor operation (wear test)	Replace and reset **Closed Throttle and Idle Actuator**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "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 and Idle Actuator**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
ECM has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
Throttle cable too tight	Fix and reset **Closed Throttle and Idle Actuator**.
Sensor is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Throttle bracket is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Adjustment screw worn or loose	Change throttle body.
Idle bypass valve replaced but not reset	Reset **Closed Throttle and Idle Actuator** using B.U.D.S.

COMPONENT INSPECTION AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	313
fuel pump wrench	529 035 899	321–322
pressure gauge	529 035 591	319
supply cable	529 035 869	338
tachometer	529 014 500	315
VCK (vehicle communication Kit)	529 035 981	311, 320
wrench	529 035 603	320

SERVICE PRODUCTS

Description	Part Number	Page
silicone lubricant	293 600 041	338

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

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 on 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.

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. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing pressure test equipment or disconnecting fuel line connections. Use the VCK (Vehicle Communication Kit) 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 work in a well ventilated area. Always disconnect battery prior to working on the fuel system. After performing a pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

– Always disconnect battery properly prior to working on the fuel system. Refer to BATTERY section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Perform the pressure test as explained in this section and pressurize the fuel tank and fuel lines as explained in FUEL SYSTEM section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the pressure test if any component has been removed. A pressure test must be done before connecting the tether cord cap. The fuel pump is started each time the tether cord cap is installed and it builds pressure very quickly.

To check fuel rails for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

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
– fuses
– 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 (idle bypass valve, injectors, fuel pump, ignition coils and starter solenoid) are permanently supplied by the battery when the VCK (Vehicle Communication Kit) is connected to the diagnostic connector of the engine wiring harness and the tether cord cap is installed. Always disconnect 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.

529 035 868

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

⚠ WARNING

Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure connectors are properly crimped on wires and fastened in housing, and that they are free of corrosion. Check if wiring harness shows any signs of scoring. Ensure proper electrical connection. 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 pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them prior to assembling with a silicon-based dielectric grease.

NOTE: Do not apply an other lubricant on the ECM connectors.

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 subsection.

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

TEMPERATURE SENSOR TABLE			
TEMPERATURE		**RESISTANCE (ohms)**	
°C	°F	ATS	CTS
- 40	- 40	—	45000
- 30	- 22	28000	28000
- 20	- 4	14500	15000
0	32	5500	5750
20	68	2500	2600
40	104	1200	1200
60	140	600	600
80	176	320	320
100	212	180	180
130	266	90	90

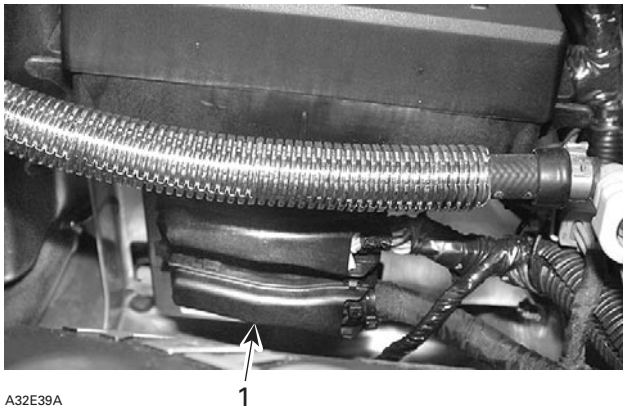
CONVERSION CHART FOR TEMPERATURE SENSORS

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

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

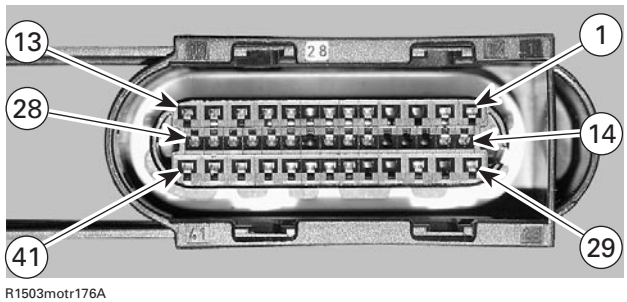
ENGINE CONNECTOR PIN-OUTS

Connector Position



1. ECM connector A

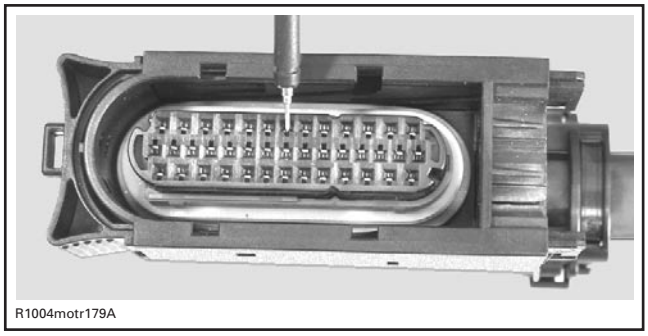
Use this diagram to locate the pin numbers on the ECM connector A of the wiring harness when performing tests.



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

ECM Connector

CAUTION: 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 may lead to improper function of the engine management system.

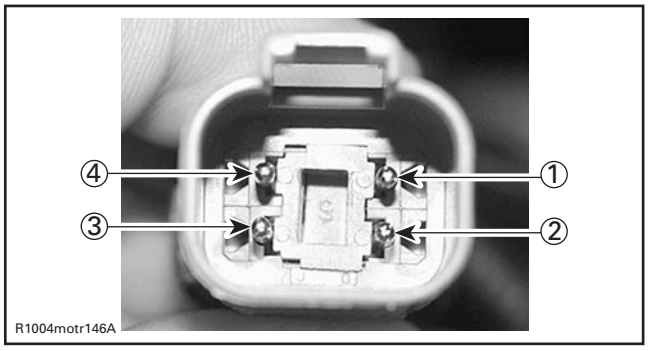


PROBE ONLY ON THE PIN NOZZLE OF FEMALE CONNECTOR

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine Connector

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

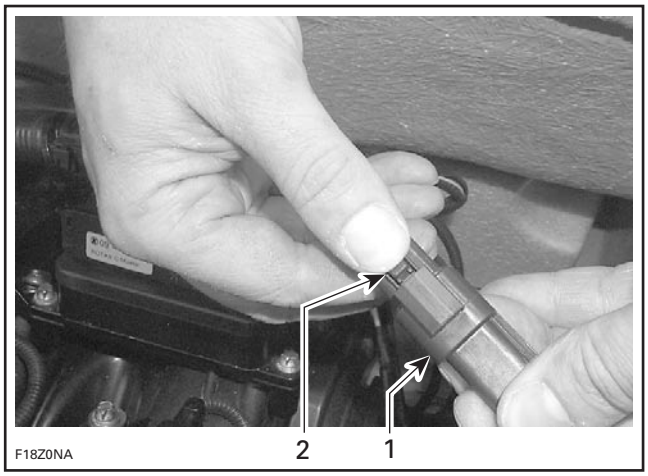


ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

CONNECTORS ON ENGINE

Removal

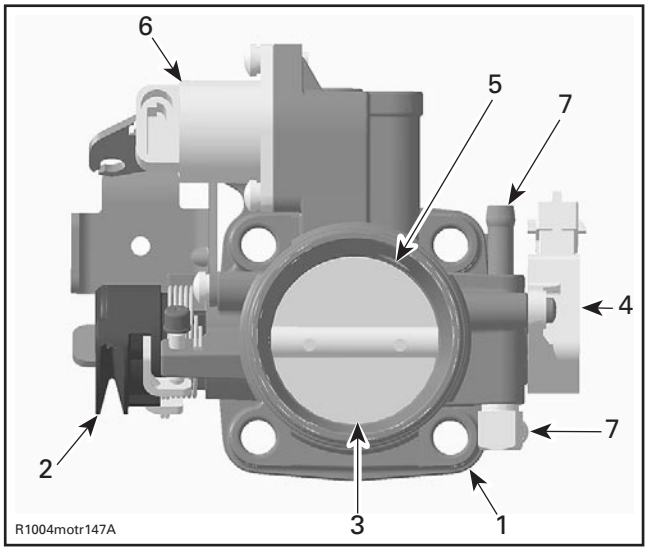
To disengage both connectors, press the release button and disconnect them.



TYPICAL
1. *Connector*
2. *Press release button*

AIR INDUCTION SYSTEM

THROTTLE BODY



1. *Throttle body*
2. *Throttle cable attachment*
3. *Throttle plate*
4. *TPS*
5. *Idle bypass channel*
6. *Idle bypass valve*
7. *Nipples for throttle body heating*

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 idle stop or modifying it in any way will not increase performance or change the idle speed but may cause poor startability and erratic idling.

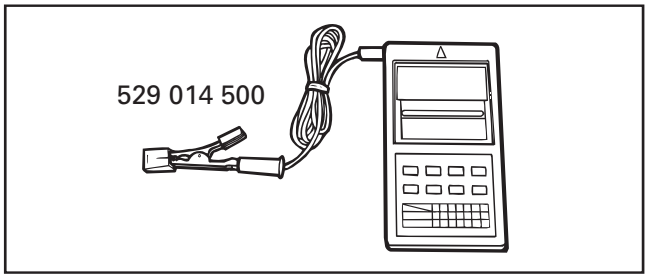
Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is off.

- Throttle cable adjustment too tight. Not returning fully to idle stop.
- Throttle body idle set screw is loose or worn.
- TPS is loose.
- Idle bypass valve is loose.
- Corroded or damaged wiring or connectors.
- Throttle body has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.
- ECM has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.

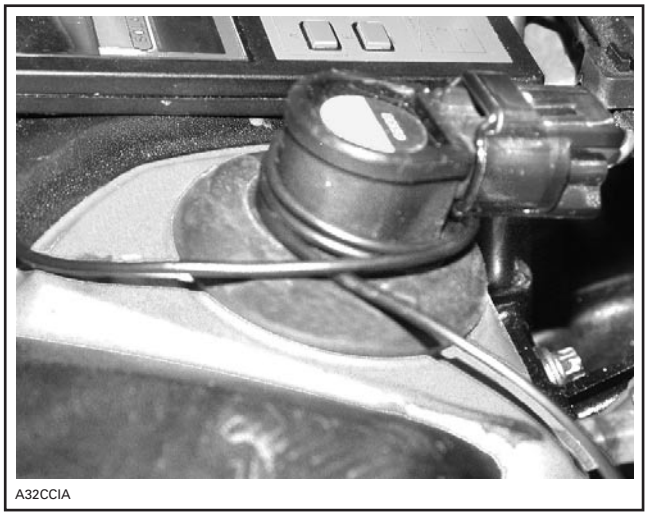
Electrical Inspection

Refer to THROTTLE POSITION SENSOR (TPS) and IDLE BYPASS VALVE in ELECTRONIC MANAGEMENT below.

To verify the engine RPM with the tachometer (P/N 529 014 500), use the following procedure.



The inductive tachometer works on these ignition coils (stick coils) as well as on regular high tension coil. Simply wrap the tachometer's wire a few turns around the protruding part of ignition coil.



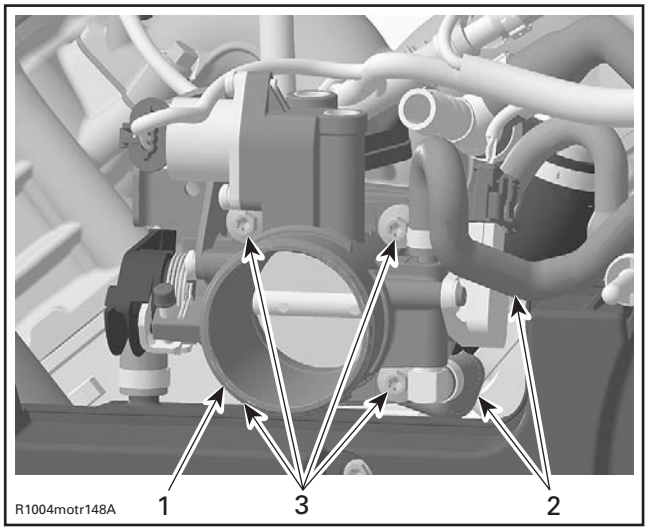
TYPICAL

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect air intake silencer from throttle body.
– Drain cooling system.
– Remove clamps and hoses for throttle body heating from nipples.
– Remove retaining screws of throttle body.



1. *Throttle body*
2. *Hoses*
3. *Screws*

– Slightly pull throttle body out.
– Disconnect connectors from idle bypass valve, and TPS.
– Disconnect throttle cable.

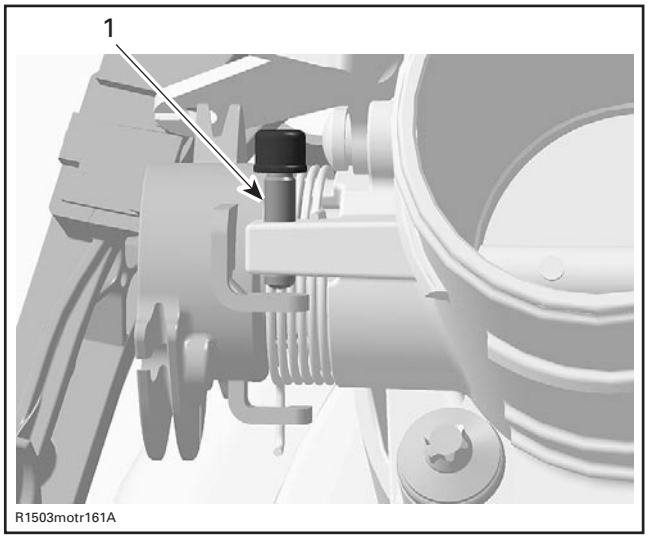
Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention for the following details.

Refill and bleed the cooling system, refer to COOLING SYSTEM subsection.

For TPS and idle bypass valve replacement procedures, refer to the respective paragraph in ELECTRONIC MANAGEMENT below.

Adjustment



THROTTLE BODY
1. *Idle stop screw*

CAUTION: It is not allowed to perform any change on the idle stop screw.

The adjustment of the idle stop screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the idle speed through the throttle body tamper proof screw. If so, it would impair the idle speed stability. Besides, no adjustment could be performed by the dealer nor the factory to correct the idle speed. The throttle body would need to be replaced.

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

The only thing that has to be performed when the throttle body has been replaced is the **Closed Throttle and Idle Actuator** reset. Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Throttle Cable Adjustment

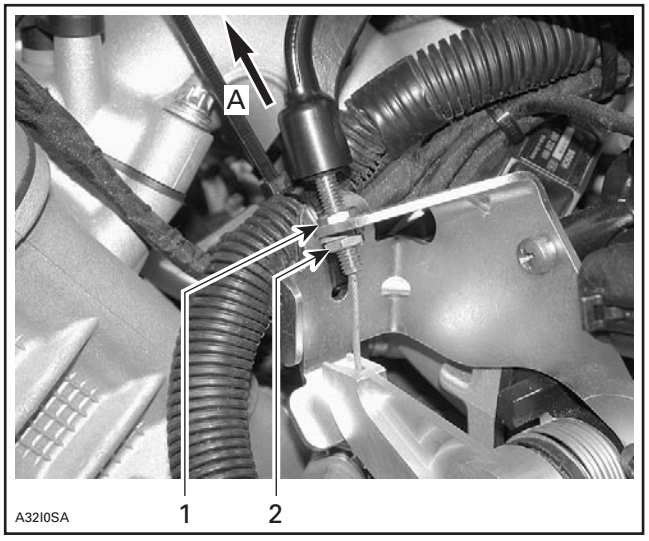
Mechanically adjust the throttle cable.

Handlebar and throttle cable must be at their normal position.

Apply full throttle.

Pull on throttle cable housing with a force of 50 N (11 lbf). Tighten top nut to 1 N•m (9 lbf•**in**).

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



WIDE OPEN THROTTLE POSITION
1. *Top nut torqued to 1 N•m (9 lbf•**in**)*
2. *Bottom nut torqued to 4.5 N•m (40 lbf•**in**)*

A. 50 N (11 lbf)

Activate throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension in the cable.

CAUTION: If there is no free-play at idle position, it may cause poor idling and startability. Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

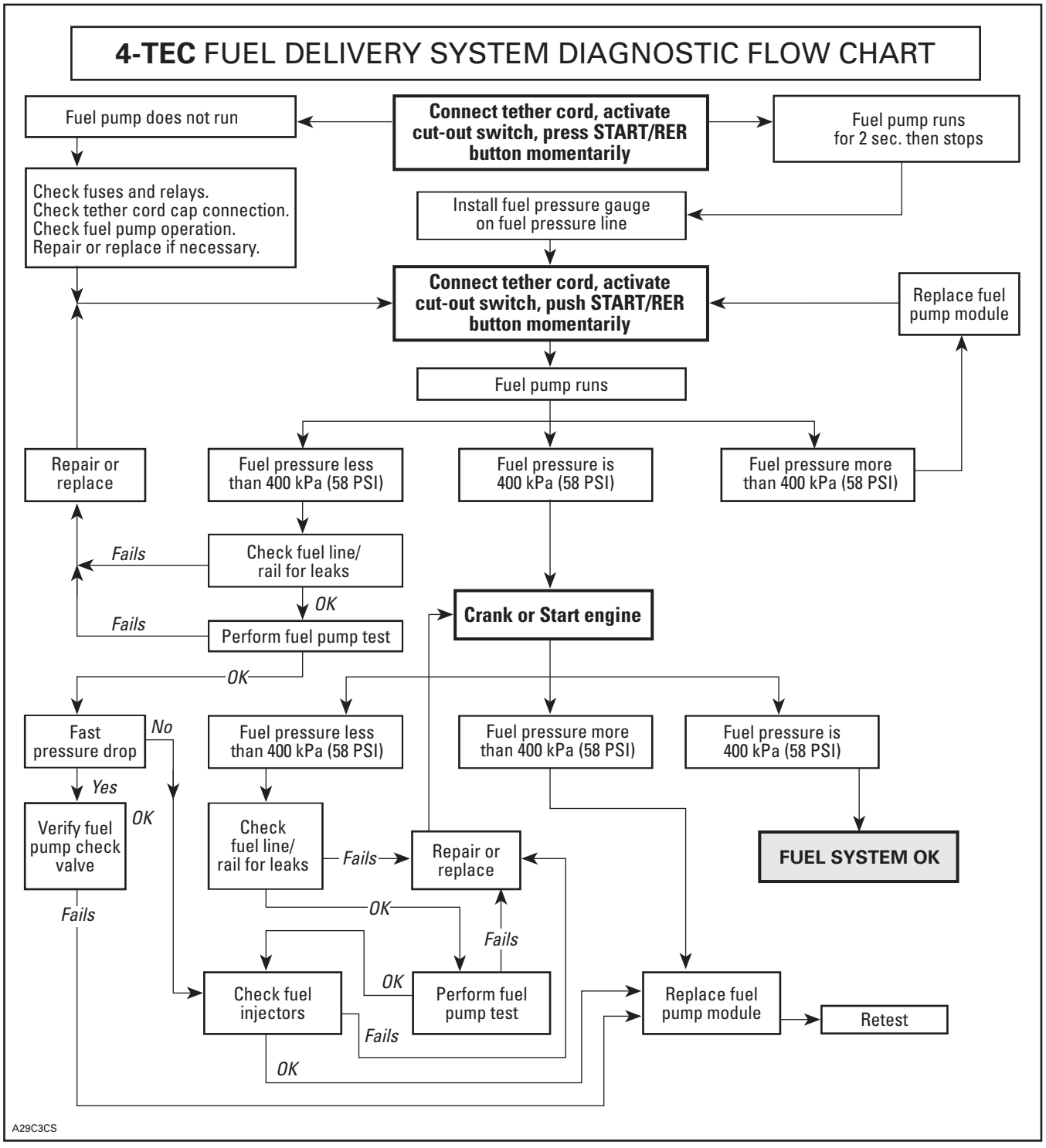
⚠ WARNING

Make sure idle speed stopper contacts throttle cam when throttle lever is fully released at handlebar.

Closed Throttle and Idle Actuator Reset

Perform the **Closed Throttle and Idle Actuator** reset as described in THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

FUEL DELIVERY



FUEL PUMP

Fuel Pressure Test

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

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

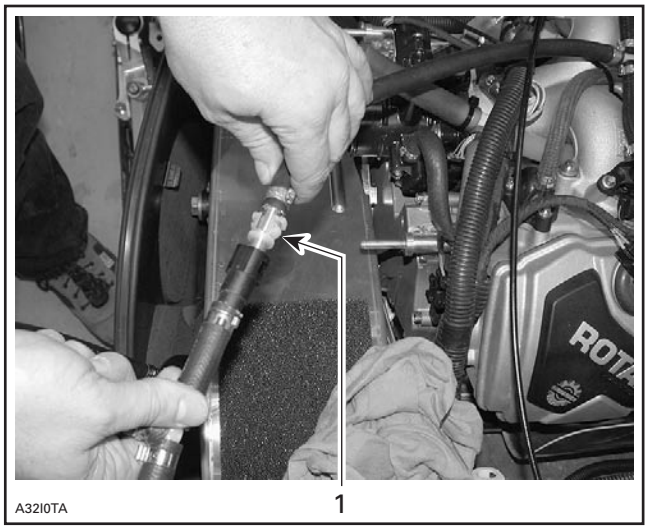
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose.

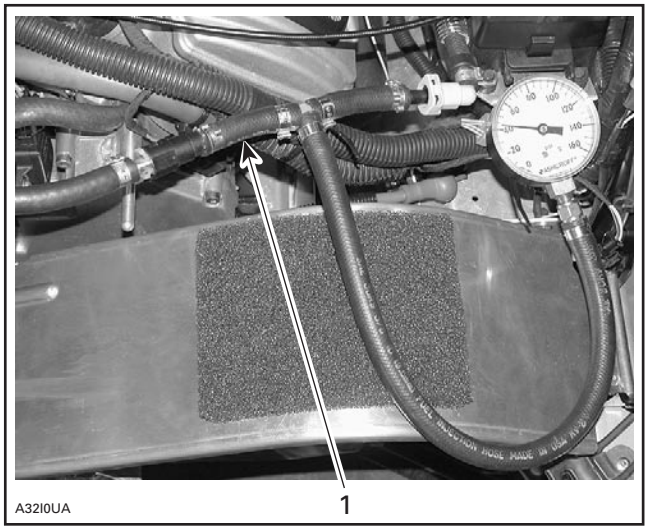
Remove plastic clip (P/N 275 500 429) from male fitting of pressure gauge (P/N 529 035 591).

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



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).



1. In-line installation of fuel pressure gauge

Install the tether cord cap. Activate the cut-out switch so the engine will not crank. Depress start button and observe fuel pressure. Release pressure using B.U.D.S. so that the gauge is «reset» to zero (0). Remove the tether cord cap and install it again. Repeat the test.

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. Reconnect inlet 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.

Electrical Test

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

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+ on PINK wire and – on PINK/BLACK wire) to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe terminalsof fuel pump connector on vehicle harness side. When depressing start button, you should read battery voltage for approximately 2 seconds (then voltage will drop to approximately 11 V). If battery voltage is read, the problem can be in harness or in fuel pump connector. Repair or replace appropriate part.

Fuel Pump Module Replacement

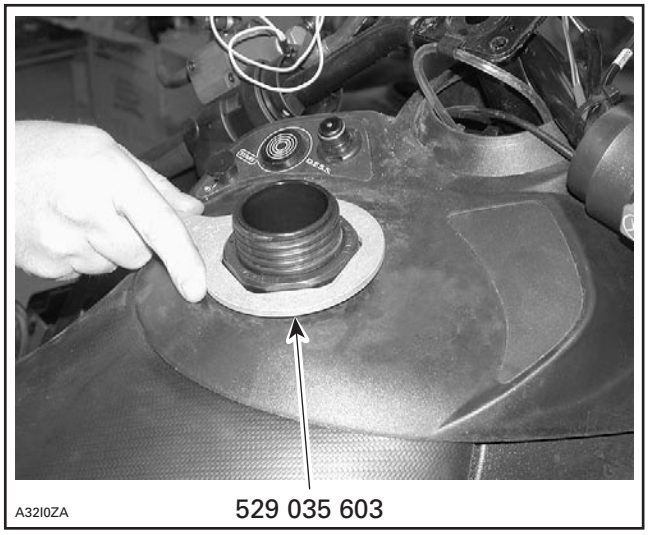
Removal

Open hood. Connect VCK (vehicle communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Drain fuel tank as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).

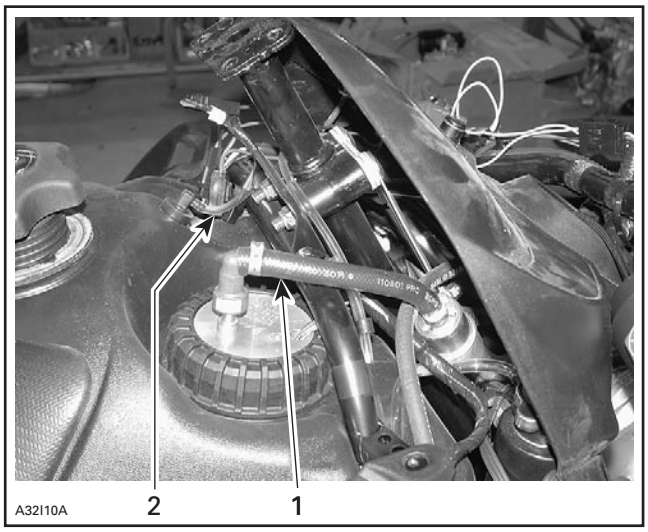


TYPICAL

Unbolt console, then move it forward.

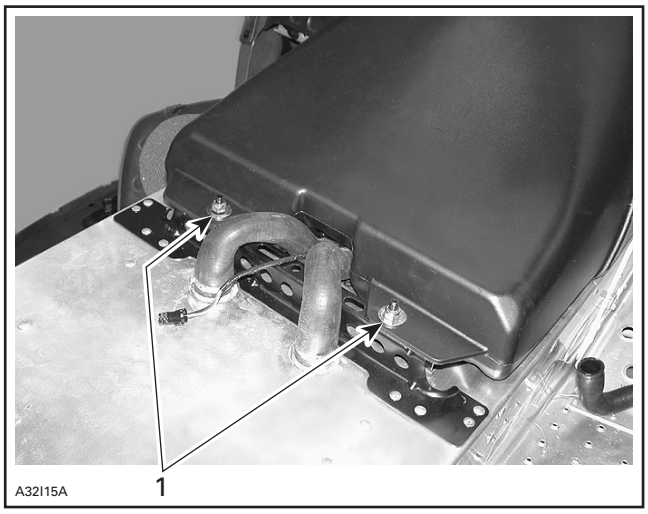
Disconnect fuel supply hose from fuel pump module.

Disconnect vent tube from vent elbow.



TYPICAL
1. Fuel supply hose
2. Vent tube

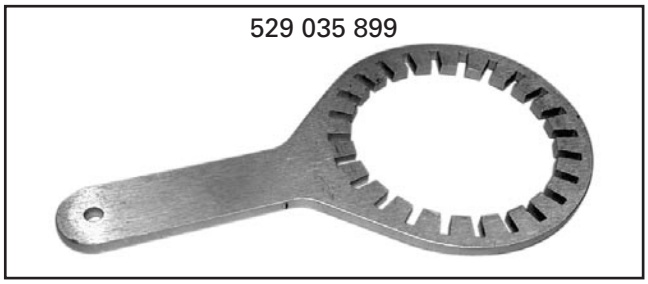
Remove seat. Unbolt fuel tank.



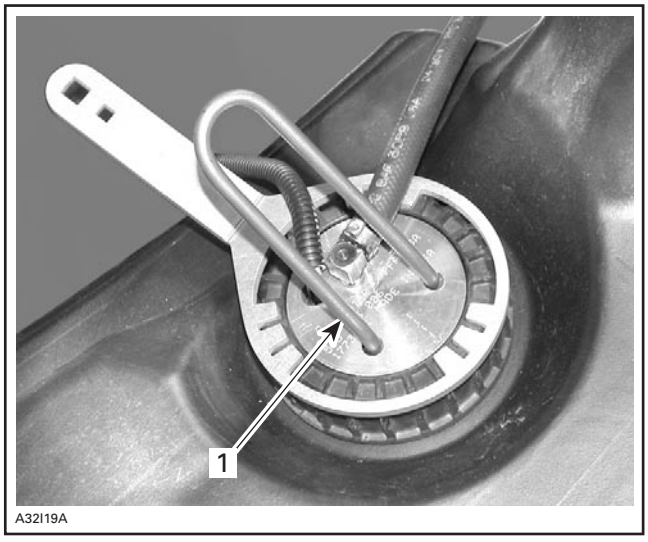
TYPICAL
1. Fuel tank retaining screws

Move fuel tank rearward, then unplug the fuel pump module electric connector.

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



TYPICAL



TYPICAL
1. Bent rod

Pull fuel pump module out of fuel tank to expose sensor body.

Remove fuel pump module. Guide fuel pickups when pulling out fuel pickup hoses.


A32I13A

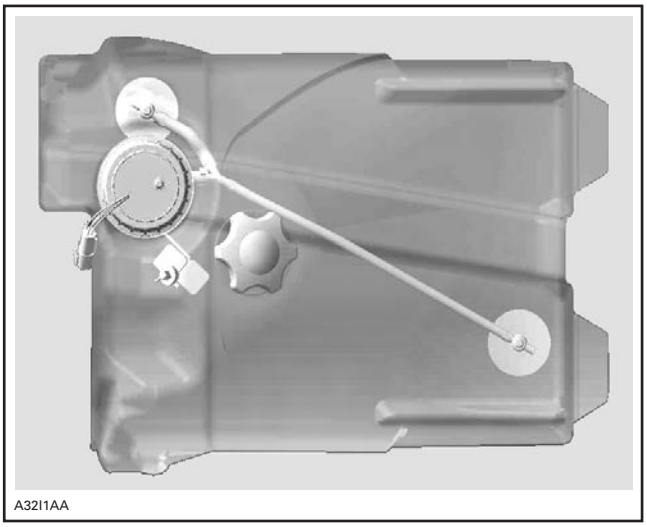
TYPICAL

Installation

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

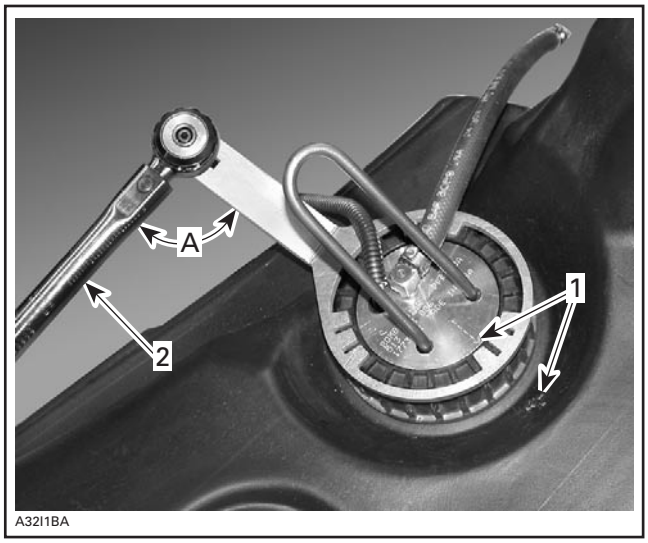
Install a new gasket.

Make sure that rear pickup hose is positioned as following illustration.


A32I1AA

Align the arrow on fuel pump module with the one on fuel tank. Keep arrows aligned during fuel pump module nut tightening.

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



A32I1BA

1. Arrows aligned
2. Torque wrench
A. 90°

Bleed the fuel system as per following procedure.

Fuel Bleeding Procedure

The rear fuel pickup hose has to be bled.

Pour 12 L (3.17 U.S. gal.) of recommended fuel in the fuel tank.

Apply parking brake. Start the engine. Let it run at idle speed.

Lift the front of vehicle at a 45° angle.

Put the vehicle back on the ground.

Repeat the operation twice.

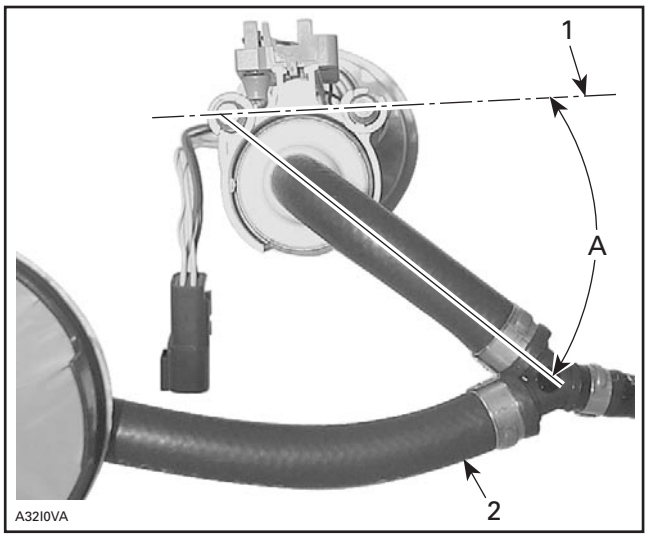
Stop the engine. The rear fuel pickup hose is now bled.

Fuel Hose Kit

Remove fuel pump module as explained above.

Unfasten blue hose clamp retaining old fuel hose ass'y to pump inlet nipple. Remove old fuel hose ass'y.

Install fuel hose ass'y to pump at an angle of 30 ± 3° from retaining rods axis.



1. Retaining rods axis
2. Fuel hose ass'y
A. 30 ± 3°

Install a new blue hose clamp on fuel hose ass'y.

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

Pump Ass'y Kit

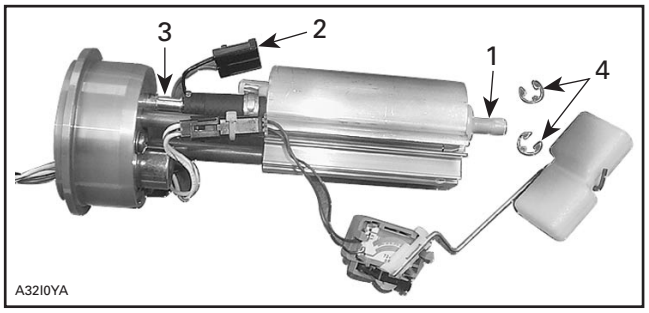
Remove fuel pump module as explained above.

Disconnect fuel hose from pump inlet nipple.

Disconnect pump electric connector.

Disconnect pump outlet hose from pump module flange nipple.

Remove circlips. Slide pump ass'y out of retaining rods.



TYPICAL

1. Pump inlet nipple
2. Pump electric connector
3. Pump module flange nipple
4. Circlips

Reverse removal procedure for installation.

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

Regulator Kit

Remove fuel pump module as explained above.

Remove 2 screws retaining regulator to pump module flange.

Remove regulator from pump module flange.

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

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

Reverse removal procedure for installation.

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

FUEL RAILS

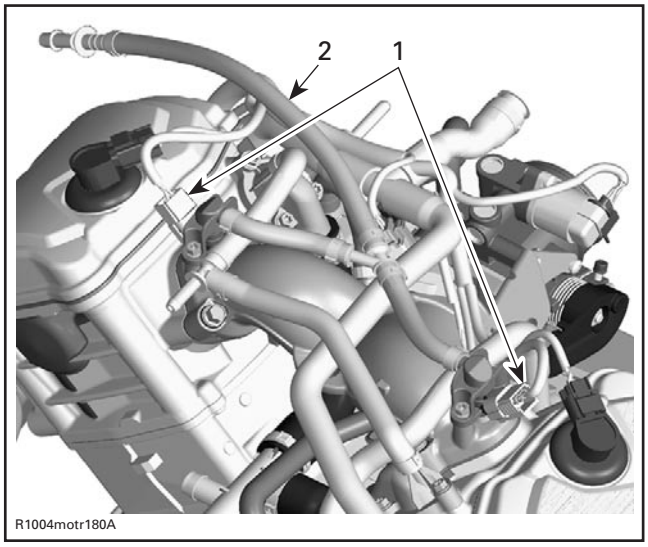
Pressure at fuel rails is supplied and controlled by the fuel pump module. Refer to FUEL PUMP for pressure test.

Fuel Rail Replacement

Removal

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

Wrap a rag around the hose end to prevent rail draining.



1. Fuel injector connectors
2. Fuel hose

Remove clamps and fuel hose from the fuel rails.

Disconnect wiring harness from the two fuel injectors.

Unscrew rail retaining screws.

Gently pull rail up by hand.

Pull rail out with fuel injector.

If necessary remove fuel injector as described below.

Installation

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

A thin film of injection oil should be applied to O-rings of fuel injectors to ease installation in intake manifold.

Tightening torque of the rail retaining screws is 10 N•m (89 lbf•**in**).

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

FUEL INJECTORS

Leakage Test

To perform a leakage test, the injectors and fuel rails have to be removed from the engine.

NOTE: Do not detach injectors and fuel rails from the intake manifold. Remove complete intake manifold with installed fuel rails and injectors to perform this test.

Reconnect the fuel line and the wiring harness.

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and push start button, without cranking the engine, 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).

The leakage test is validated when performing the FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART elsewhere in this section.

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.

Using B.U.D.S., activate injector while probing pin corresponding to the power (VIOLET/BLUE for injector 1 and VIOLET/GREEN for injector 2) and battery ground.

– If 12 V is read, check continuity of circuit as per following table. If it is good, try a new ECM.

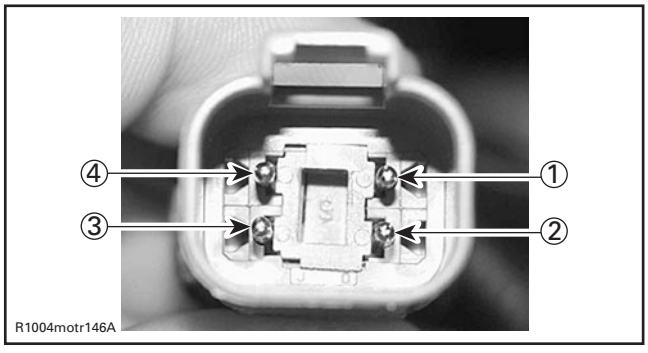
CIRCUIT NUMBER (ECM connector "A")	INJECTOR NUMBER
A-15	1
A-33	2

– If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

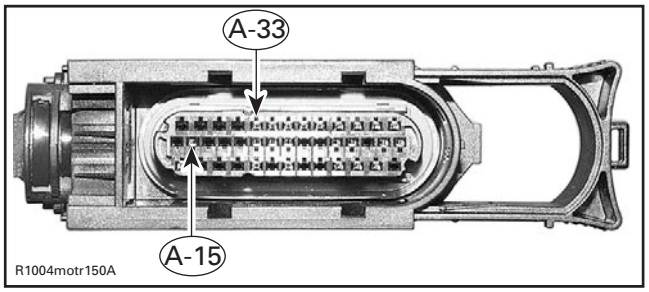
Resistance Test

Reconnect the injector and disconnect the connector A from the ECM.

Using a multimeter, check resistance value between terminals as follows.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector cylinder 1	1 (engine connector) and A-15 (ECM connector)
Fuel injector cylinder 2	2 (engine connector) and A-33 (ECM connector)

The resistance should be between 13.8 and 15.2 Ω.

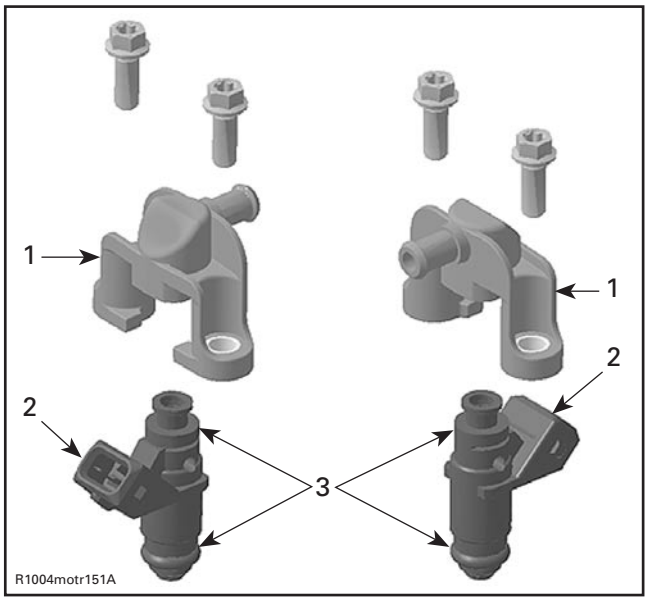
If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM plug connector and fuel injector.

Fuel Injector Replacement

Removal

Before removing the injector, the fuel rail has to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.



FUEL RAIL ASS'Y
1. *Fuel rail*
2. *Fuel injector*
3. *O-ring*

The 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.

Install new O-rings, if you reinstall a used injector then insert the fuel injector in place with your hand. Do not use any tool.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail.

Tightening torque of the rail retaining screws is 10 N•m (89 lbf•**in**).

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

ELECTRONIC MANAGEMENT

ECM REPLACEMENT

General

Prior to replacing a possibly faulty ECM, ensure that all the recommendations in the general introduction of this section have been carried out.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle and Idle Actuator** 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 in its help system.

NOTE: If the old ECM still works, its information must be read by B.U.D.S. before being removed from the vehicle in order to transfer vehicle information and history to the new ECM.

ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.

Unscrew all retaining screws and remove the ECM from vehicle.

Install the new ECM to the vehicle.

Reconnect connectors to ECM, and then battery cables.

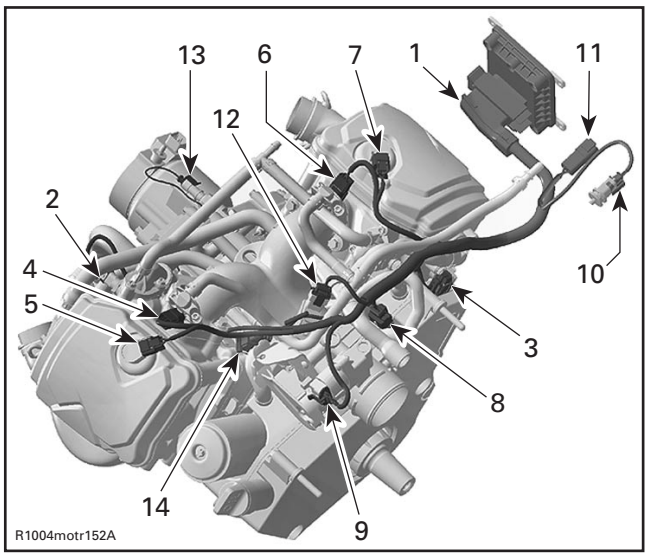
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

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 5000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. ECM connector A
2. CTS connector
3. CAPS connector
4. Fuel injector connector (cylinder 1)
5. Ignition coil connector (cylinder 1)
6. Fuel injector connector (cylinder 2)
7. Ignition coil connector (cylinder 2)
8. TPS connector
9. Idle bypass valve connector
10. ATS connector
11. Engine connector
12. MAPS connector
13. OPS connector
14. CPS connector

Resistance Test

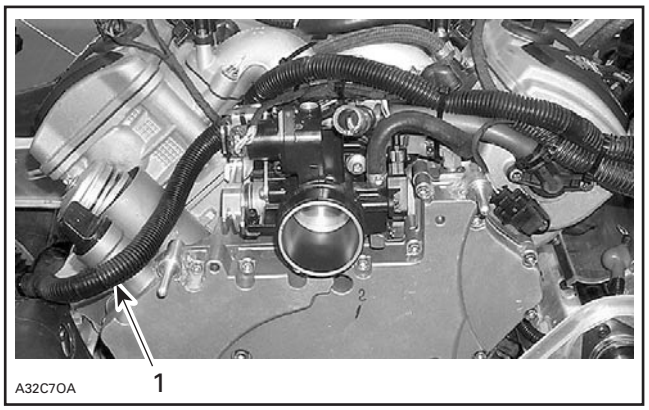
Check continuity of the circuits according to the wiring diagram in the WIRING DIAGRAMS section of this manual.

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

Cut the locking ties retaining vehicle harness to engine. Move the vehicle harness away from engine.

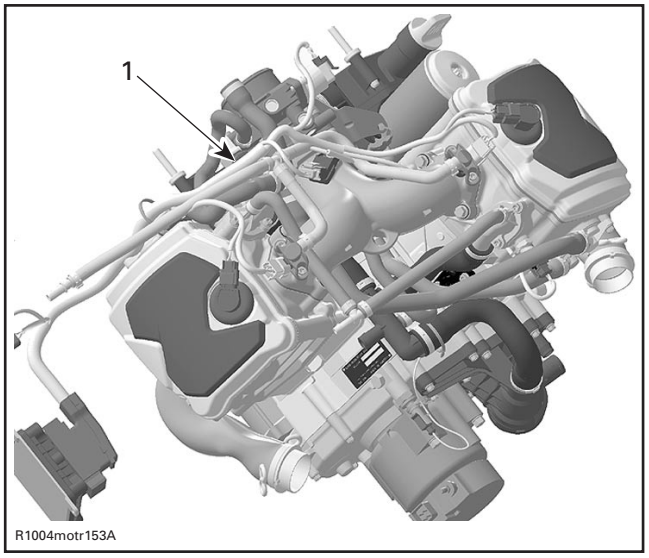


1. Vehicle harness

Disconnect the wiring harness from all sensors/ actuators.

Disconnect the connector A from the ECM.

Cut all locking ties which are holding the wiring harness in position.



1. Wiring harness

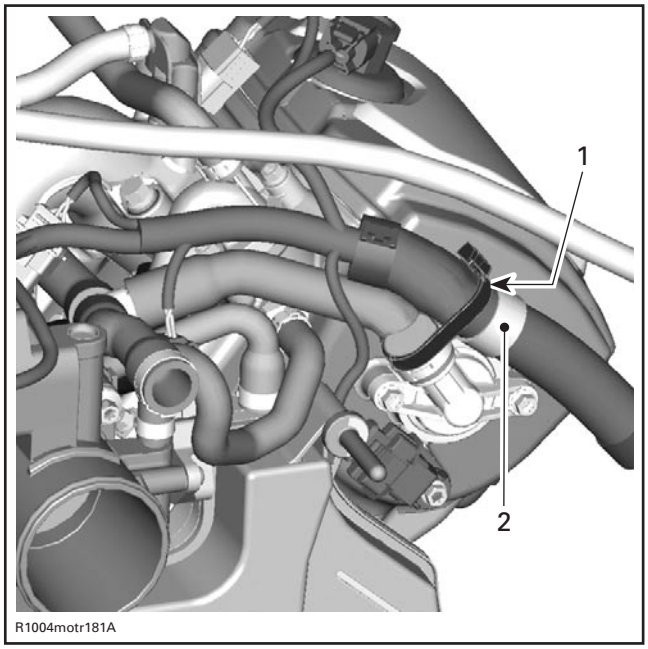
Remove complete wiring harness.

Installation

First connect the connector A to the ECM and the engine connector to the vehicle wiring harness.

Now attach the engine wiring harness with a locking tie to the breather hose.

NOTE: Wiring harness is marked with a green tape, where locking tie has to be installed.



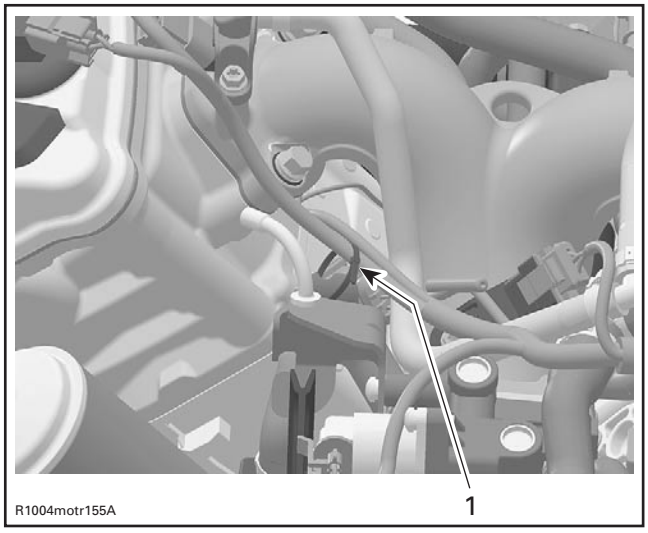
1. Position of locking tie
2. Green mark (tape) on wiring harness

Then connect CAPS. Ensure the cable is above the breather hose, then fasten it with a locking tie.

Connect injector and ignition coil of cylinder 2 to the wiring harness. Ensure that cables are underneath the fuel line.

Also connect the TPS, MAPS (grey connector) and the idle bypass valve to the wiring harness.

Then connect injector and ignition coil of cylinder 1 to the wiring harness. Attach the cable with locking tie on the throttle cable bracket.

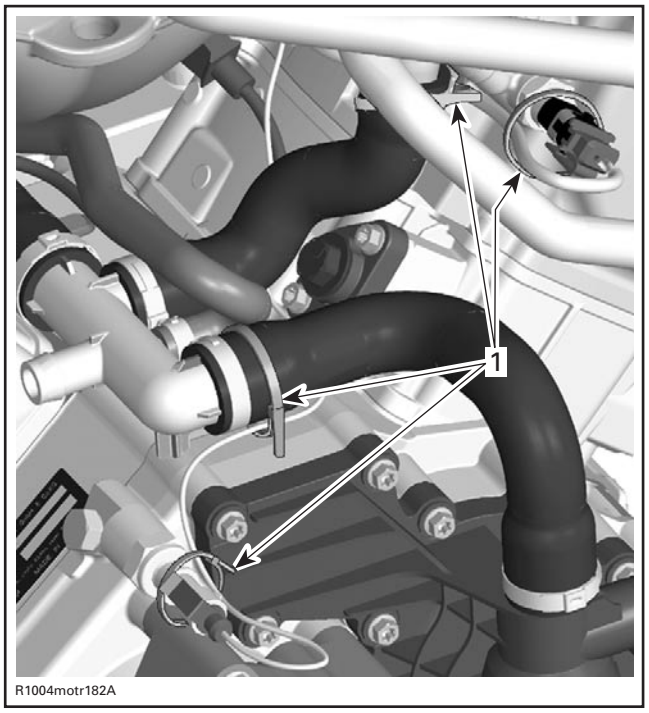


1. Locking tie

Connect the CPS, CTS and OPS to the wiring harness.

NOTE: Routing of the harness for CAPS, CTS and OPS has to be between the intake manifold and cylinder 1, underneath the water hoses.

Use locking ties to attach the cables for the CTS on the water hose and on the sensor itself then for the OPS on the T-fitting and on the sensor itself.



1. Locking ties

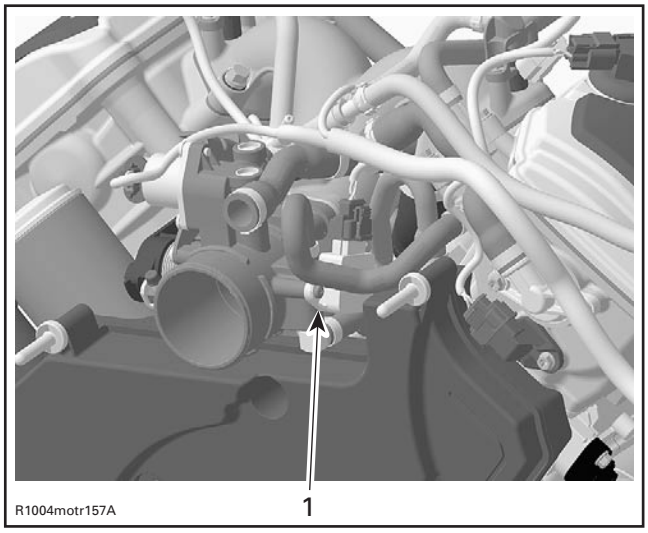
Install all remaining parts, which have been removed.

Do not forget to connect ATS connector to the ATS on the air intake silencer.

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.



1. Throttle position sensor (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY in AIR INDUCTION SYSTEM above.

The EMS may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

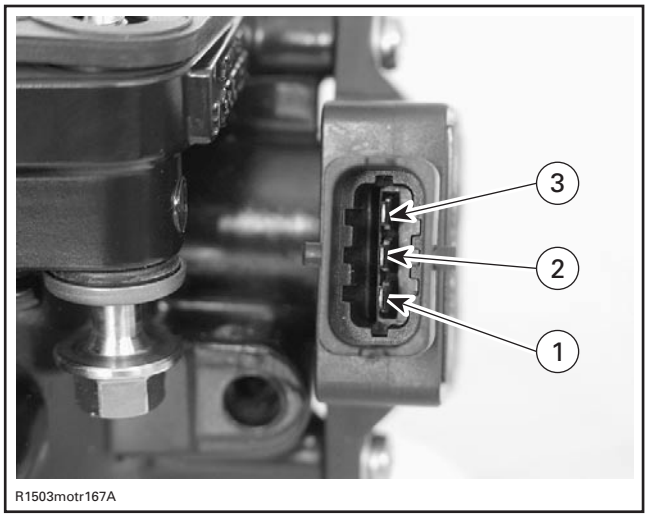
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

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 that the TPS needs to be replaced.

Voltage Test

Check the voltage output from ECM to the desired throttle position sensor.



TPS

Disconnect plug connector from throttle position sensor. To unlock connector, press the release tab. To see the connector pin-out, temporarily remove the connector shield joining the harness, to expose the pin numbers. Connect a voltmeter between pin 1 and 3 and also between pin 1 and 2 in the wiring harness.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM.

Check the voltage readings as follows.

CONNECTION	VOLTAGE
Pin 1 with engine ground	0 V
Pin 2 with engine ground	5 V
Pin 3 with engine ground	4.75 - 5 V

NOTE: Make sure the engine is properly grounded.

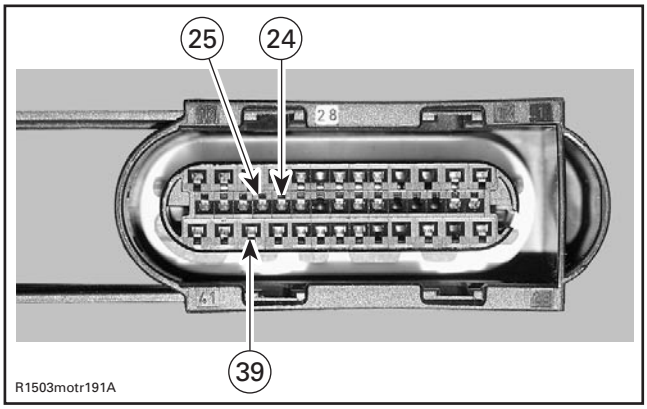
If voltage test is good, replace the TPS.

If voltage test is not good, check the resistance of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector A from the ECM.



Using a multimeter, check resistance value between terminal A-25 and A-39.

The resistance should be 1600 - 2400 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **idle** position.

The resistance should be approximately 2500 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **wide open** position.

The resistance should be 1000 - 1100 Ω.

Check the resistance between terminal A-24 and A-25 with throttle plate in **idle** position.

The resistance should be 1000 - 1100 Ω.

Now check the resistance with the throttle plate in **wide open** position.

The resistance should be 2600 - 2700 Ω.

NOTE: When measuring between pins A-24 and A-39, resistance **value decreases** while depressing throttle lever. when measuring between pins A-24 and A-25, resistance **value increases** while depressing throttle lever. The resistance value should change smoothly and proportionally to throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

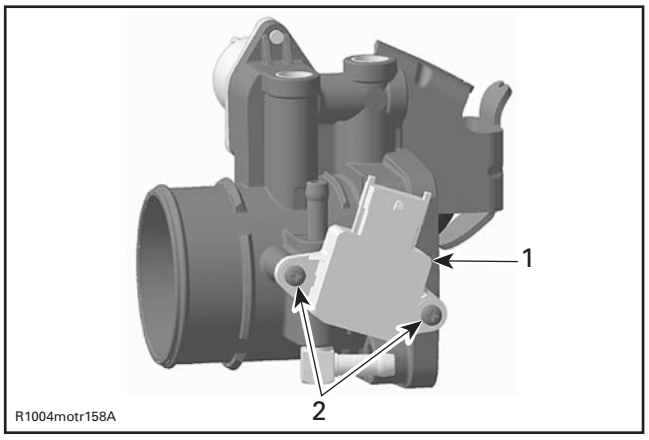
If resistance values are incorrect, repair connector or replace the wiring harness between ECM connector and the TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. Throttle position sensor (TPS)
2. Screws

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the CLOSED THROTTLE AND IDLE ACTUATOR RESET. See below.

Closed Throttle and Idle Actuator Reset

NOTE: This operation performs a reset of the values in the ECM.

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

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body is replaced or ECM is replaced.

CAUTION: An improperly set TPS or idle bypass valve may lead to poor engine performance.

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

Ensure the throttle body plate stop lever rest against its stopper. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. If stopper does not rest against its stop lever, perform throttle cable adjustment. Refer to THROTTLE BODY in AIR INDUCTION SYSTEM above.

Click on the **Reset** button in the **Setting** section of B.U.D.S.

NOTE: No message will be displayed if operation is successful. If operation is wrong, an error message will be displayed.

NOTE: There is no idle speed adjustment to perform. The ECM takes care of that. If TPS is not within the allowed range while resetting the **Closed Throttle and Idle Actuator**, the ECM will generate a fault code and will not accept the setting.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

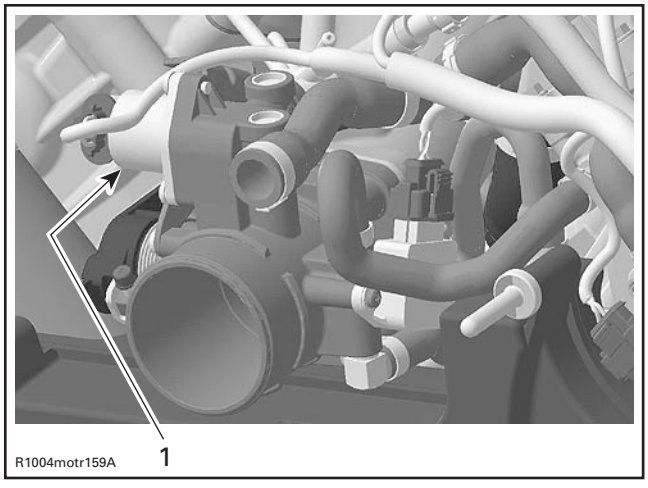
IDLE BYPASS VALVE

An idle bypass valve with good resistance measurement can still be faulty. It is also possible that a mechanical failure occurs which is not detectable without measuring the air flow. Replacing the idle bypass valve may be necessary as a test.

Resistance Test

Disconnect idle bypass valve from the wiring harness.

Using a multimeter, check the resistance in both windings.



1. Idle bypass valve

Check the resistance between pin 1 and pin 4 and also between pin 3 and pin 2 of the idle bypass valve.

The resistance in each winding should be approximately 50 Ω at 23°C (73°F).

If the resistance of one or both windings is not good, replace the idle bypass valve.

If resistance test of valve windings is good, check continuity of circuits A-35, A-36, A-37, A-38.

Visual Inspection

NOTE: Make sure the tether cord cap is removed during the following procedure.

Remove idle bypass valve from throttle body.

Check the piston and bypass channel for dirt/deposits which can cause a sticking piston.

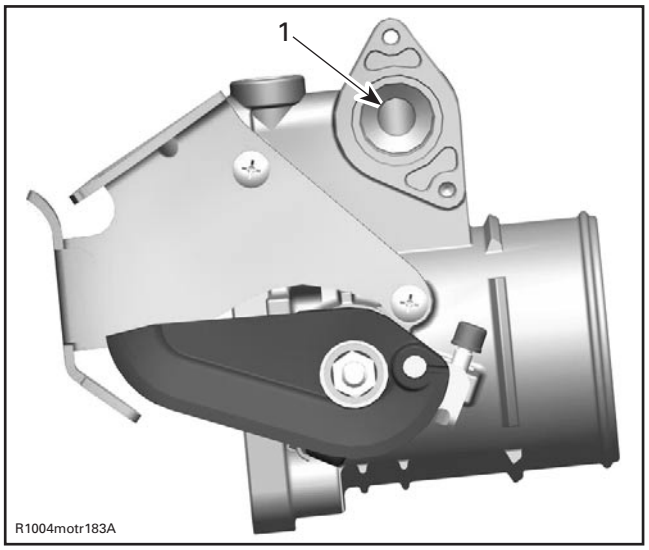
CAUTION: Always keep the tether cord cap disconnected, while the idle bypass valve is removed.

CAUTION: Do not try to operate the piston of the idle bypass valve when it is dismounted. Also do not move the piston by hand. The drive screw is very sensitive and may be destroyed.

Using a part cleaner, clean idle bypass in throttle body from contamination then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

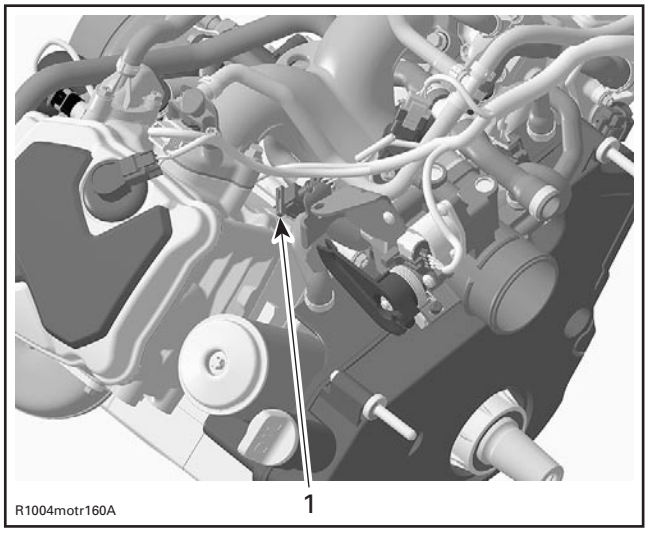


1. Clean bore from contamination

Clean all remaining parts and install the idle bypass valve on the throttle body.

Proceed with the CLOSED THROTTLE AND IDLE ACTUATOR RESET. See above.

CRANKSHAFT POSITION SENSOR (CPS)



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals 1 and 2 coming from CPS while cranking engine. Voltage should be within 1-2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

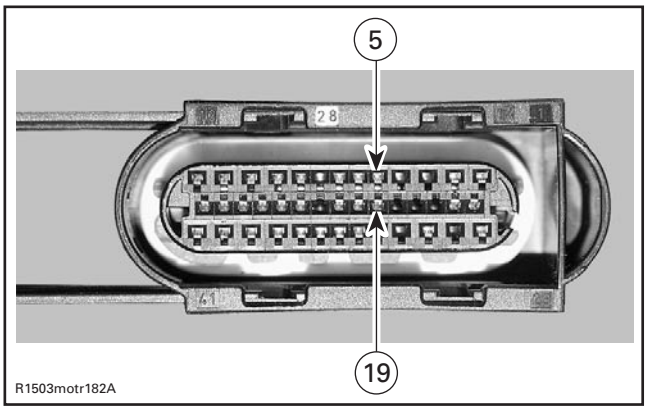
Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 0.7 kΩ and 1.1 kΩ.

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.

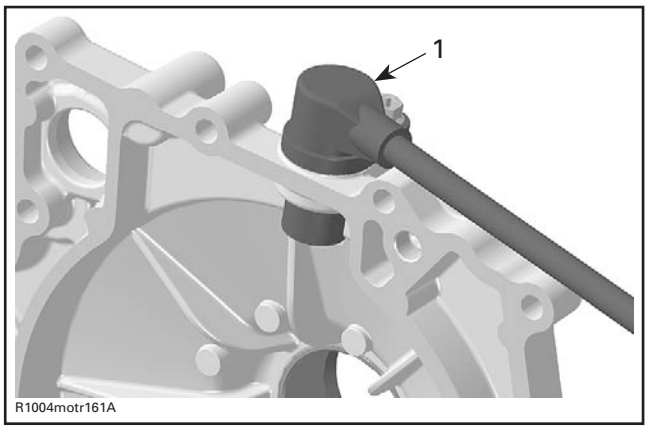
If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

Disconnect CPS connector and remove the PTO cover. Refer to CRANKCASE subsection in ENGINE section.

Remove CPS.



1. CPS inside PTO cover

Install new CPS.

Tightening torque of the CPS retaining screws is 6 N•m (53 lbf•**in**).

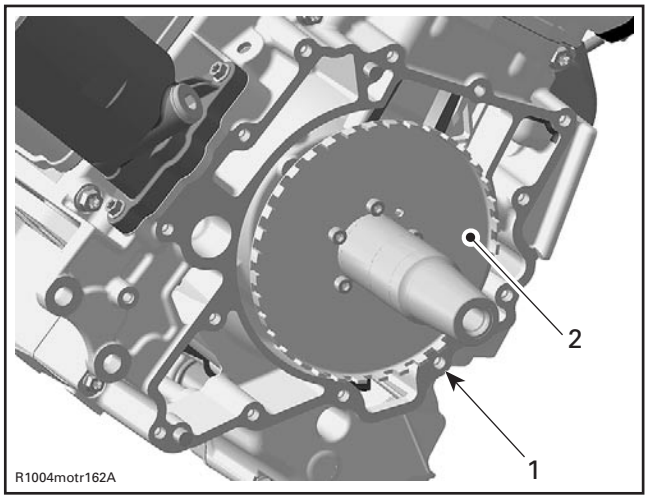
Reinstall remaining removed parts.

Trigger Wheel Inspection

Remove PTO cover. Refer to CRANKCASE subsection in ENGINE section.

Remove trigger wheel.

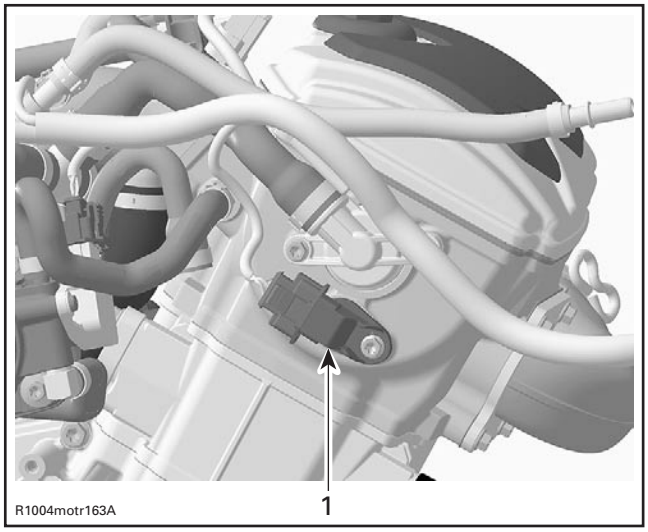
Perform visual inspection of the trigger wheel for bent teeth and also check the mating surface for straightness. If necessary, straighten the teeth or replace the trigger wheel.



1. Trigger wheel
2. Mating surface

Properly reinstall trigger wheel and cover.

CAMSHAFT POSITION SENSOR (CAPS)



1. CAPS

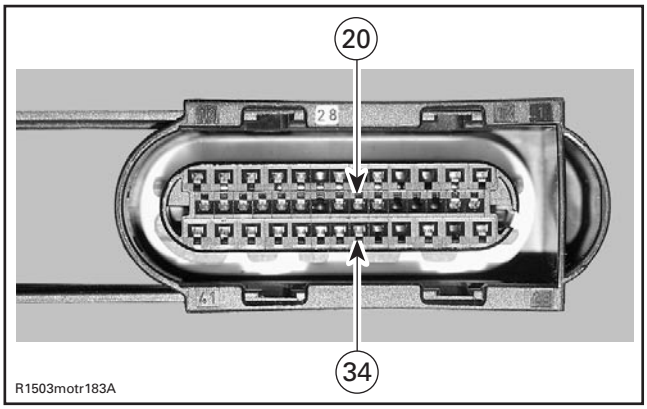
Voltage Test (harness)

Disconnect the connector from the CAPS.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM.

Probe pin 3 of CAPS connector (wiring harness side) and battery ground.

– If 12 V is read, check continuity of circuits A-20 and A-34. If test is good, perform the CAPS voltage test as explained below. If CAPS tests good, try a new ECM.

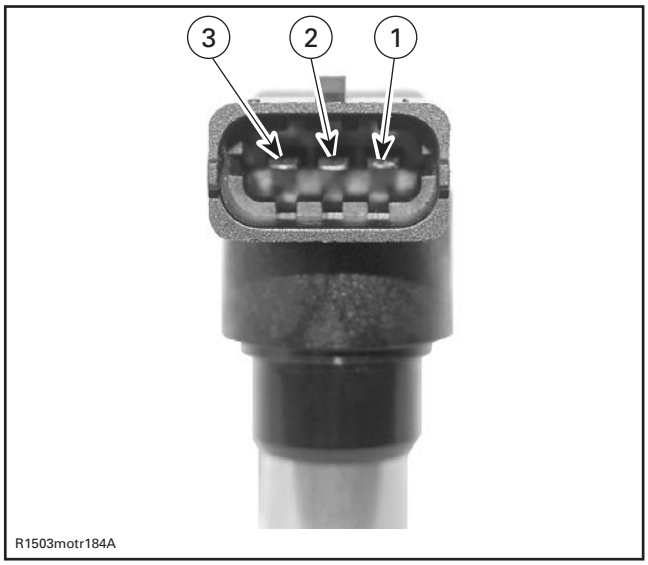


ECM CONNECTOR

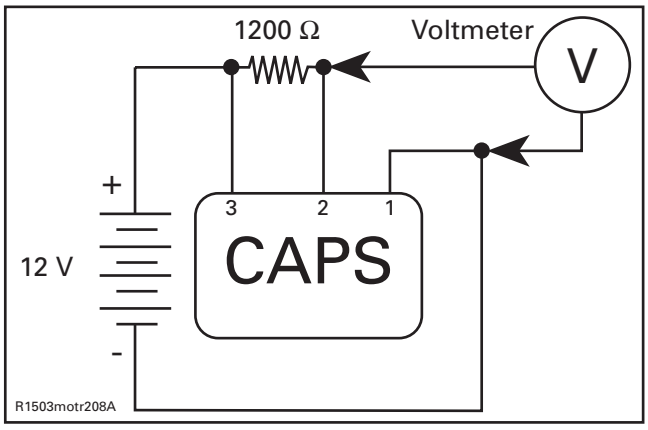
– If 12 V is not read, check continuity of circuit between pin 3 of CAPS connector and the corresponding fuse. Otherwise, repair wiring harness.

Remove the CAPS from the cylinder head.

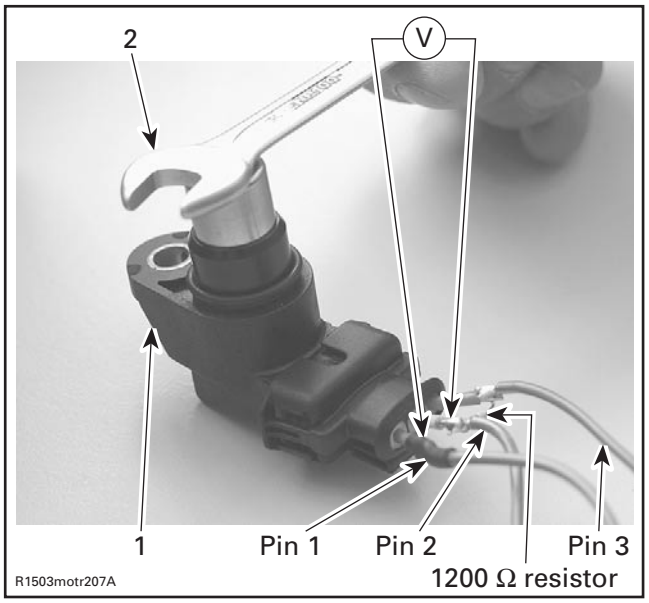
Set up the following electric circuit to perform the voltage test.



CAPS PIN-OUT



Touch the CAPS with a conductor (ex.: screwdriver) and look if the voltage at the multimeter switches from 12 V to less than 1 V.



1. CAPS
2. Conductor

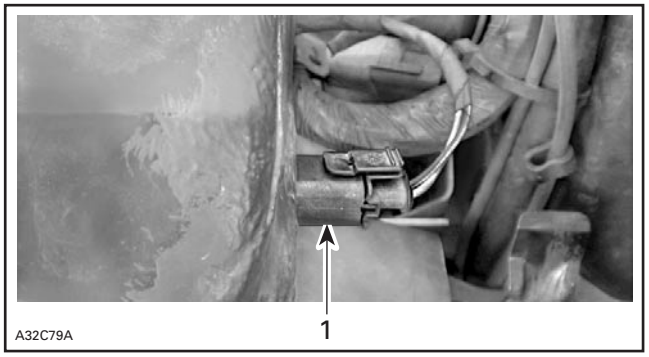
If the voltage is not good, replace the CAPS.

Replacement

Unscrew the retaining screw and replace the CAPS. Ensure to reinstall O-ring.

Apply Loctite 243 (blue) on thread and torque to 6 N•m (53 lbf•**in**).

AIR TEMPERATURE SENSOR (ATS)



AIR SILENCER
1. Air temperature sensor (ATS)

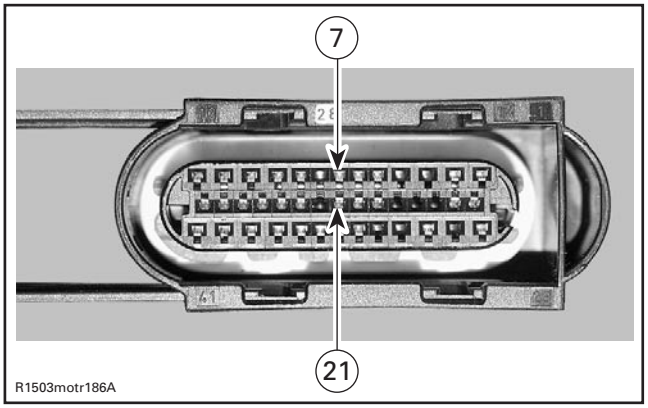
Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω at 20°C (68°F).

Otherwise, replace the ATS.

If resistance tests good, **reconnect** the ATS and disconnect the connector A from the ECM.



Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

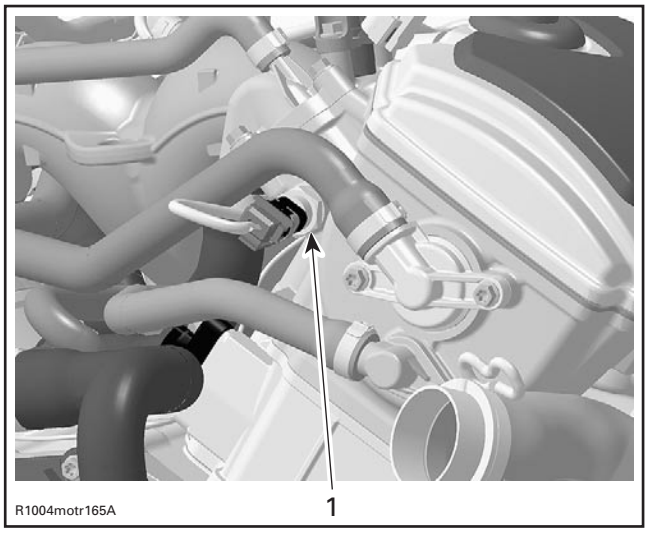
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Disconnect the connector of the ATS.

Pull ATS out and install the new one.

COOLANT TEMPERATURE SENSOR (CTS)



1. Coolant temperature sensor (CTS)

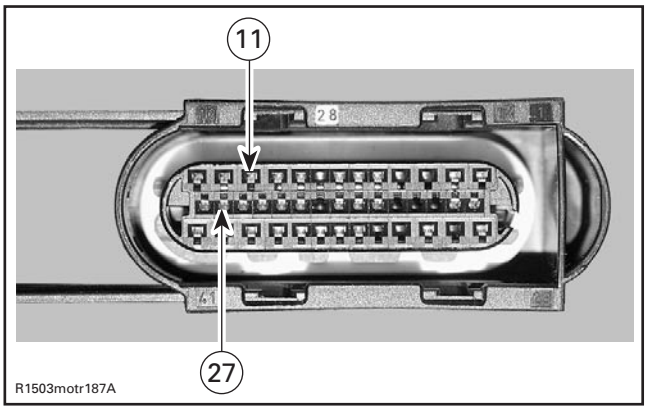
Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω at 20°C (68°F).

Otherwise, replace the CTS.

If resistance tests good,**reconnect** the CTS and disconnect the ECM connector A from the ECM.



Using a multimeter, recheck resistance value between terminals 11 and 27.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Replacement

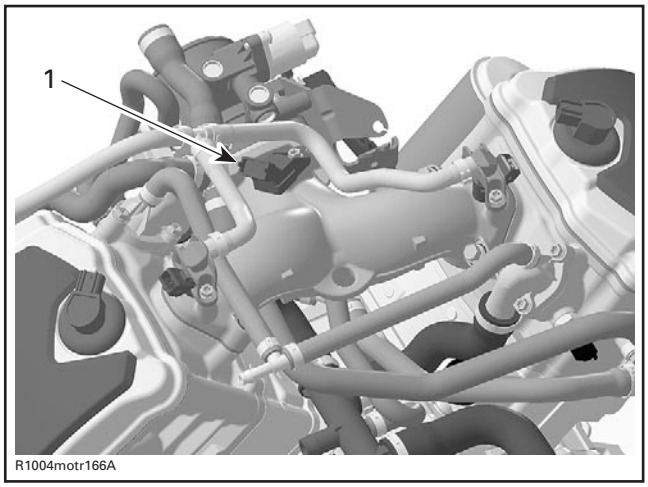
Disconnect CTS connector and remove CTS.

Install the new CTS and torque to 18 N•m (159 lbf•**in**).

Reinstall remaining removed parts.

Refill and bleed the cooling system, refer to COOLING SYSTEM subsection.

MANIFOLD AIR PRESSURE SENSOR (MAPS)



1. Manifold air pressure sensor (MAPS)

NOTE: This sensor is a dual function device. When engine is started and it runs at idle speed, the sensor takes the atmospheric pressure and stores it in the ECM. Thereafter, it takes the manifold air pressure at operating RPMs.

Ensure sensor is correctly installed on intake manifold. Otherwise, the MAPS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the manifold air pressure sensor (MAPS).

Disconnect plug connector from MAPS and connect a voltmeter between pin 1 and 2.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM. The measure should be 5 Vdc on the voltmeter.

If voltage test is good, replace the MAPS.

If voltage test is not good, check the continuity of the MAPS circuit.

Resistance Test

Disconnect the connector A from the ECM.

Using a multimeter, check continuity of circuits 12, 28 and 40.

If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

Verification Test

Using VCK, energize the MAPS from the MONITORING section and read out the proper pressure value while engine is stopped.

Perform the same test with a new MAPS and compare both readings.

Values have to be within ± 3.4 kPa (0.5 PSI).

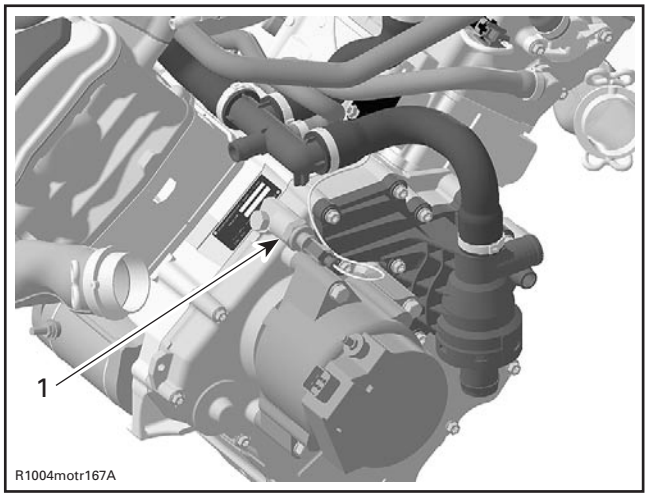
If old MAPS's value is out of this range, replace it.

Replacement

Disconnect MAPS connector and remove the MAPS.

Install the new MAPS paying attention to index its tab into the adaptor notch. Apply Loctite 243 (blue) on screw then torque to 6 N•m (53 lbf•**in**).

OIL PRESSURE SWITCH (OPS)



1. OPS

Oil Pressure Test

To check the function of the oil pressure switch, an oil pressure test has to be performed. Refer to OIL PRESSURE TEST in LUBRICATION SYSTEM section.

If the engine oil pressure is out of specifications, check the points described in troubleshooting section.

If the engine oil pressure is good, check the resistance of the OPS while engine is off and while engine is running.

Resistance Test

Disconnect the plug connector from the OPS and use a multimeter to check the resistance between OPS pin and engine ground while engine is stopped (without oil pressure) and while engine is running (with oil pressure).

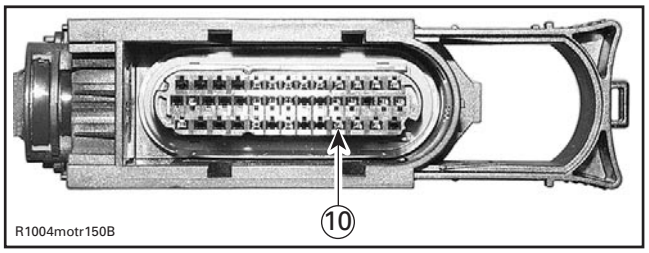
When engine is stopped the resistance is close to 0_{Ω} (normally close switch).

When engine is running and the oil pressure reaches 20 - 40 kPa (2.9 - 5.8 PSI), the resistance of the OPS is infinitely high.

If resistance values are incorrect, replace OPS.

If the values are correct, check the continuity of the wiring harness.

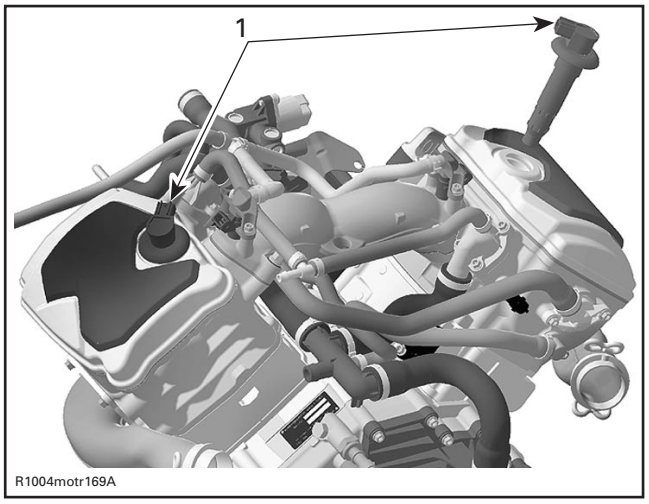
Disconnect the connector A from the ECM and check continuity of circuit 10.



If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

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

IGNITION COILS



1. Ignition coil

NOTE: The ECM energizes the primary side of each ignition coil individually. A trouble code will appear if the ECM can not energize the ignition coils.

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.

⚠ WARNING

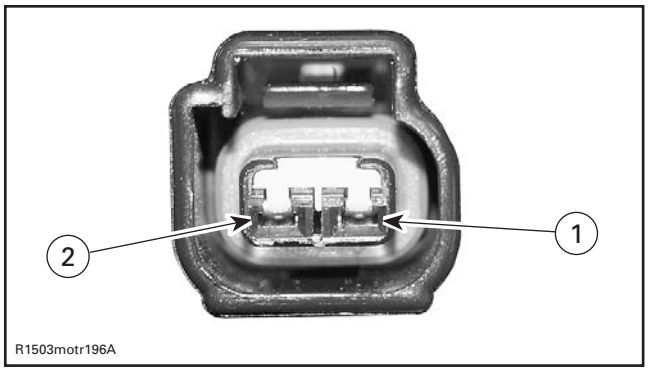
Never make a spark test with spark plug removed. Flammable vapors may be present in the engine compartment and ignited which could cause an explosion.

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.



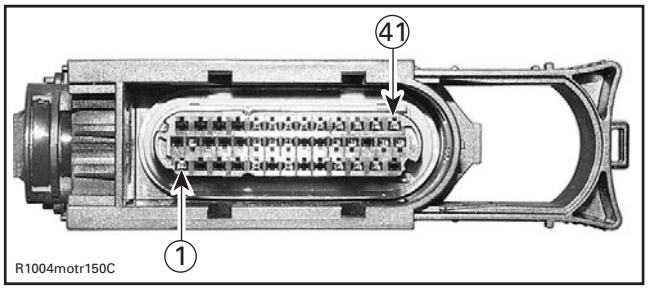
Install tether cord cap and connect the VCK (Vehicle Communication Kit) to activate the system.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

The voltage should be 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).



ECM CONNECTOR

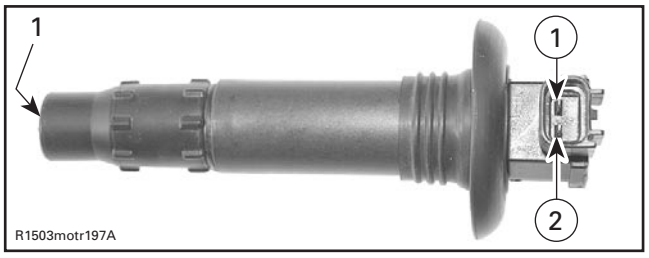
If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

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

Resistance Test

CAUTION: Do not remove the ignition coil before disconnecting the connector, or the wires may be damaged. To avoid damage, do not pry up ignition coil with a screwdriver.

Remove ignition coil from spark plug.



1. Spark plug terminal

Using a multimeter, check the resistance in both primary and secondary windings.

For primary winding check the resistance between pin 1 and pin 2 of the ignition coil.

The resistance should be between 0.85 and 1.15 Ω at 20°C (68°F).

For secondary winding check the resistance between pin 1 and spark plug terminal.

The resistance should be between 9.2 and 13.8 kΩ at 20°C (68°F).

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

If the windings test good, check corresponding fuse, relay and wiring. If good, try a new engine ECM.

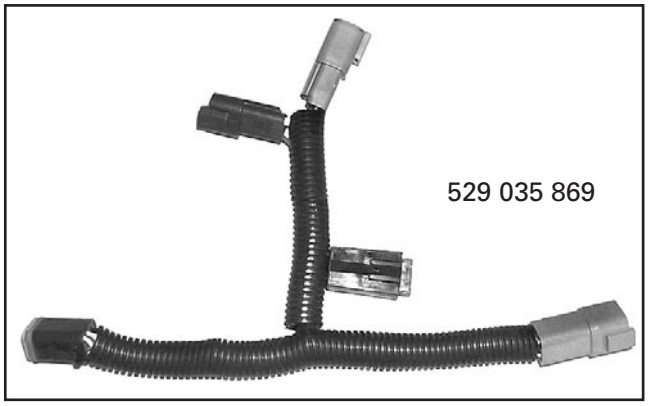
NOTE: Prior to inserting the ignition coil to its location, apply some silicone lubricant (P/N 293 600 041) around the seal area that touches the spark plug hole. After installation, ensure the seal seats properly with engine top surface.

⚠ 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. The genuine wiring harness is designed to prevent mixing up the cables since they are different in length.

ENGINE START SWITCH VERIFICATION

If the ECM fails to wake-up or engine fails to start while depressing start button check battery voltage and fuses F1 and F8. Connect supply cable (P/N 529 035 869) to wake-up the ECM.



NOTE: Make sure the engine cut-out switch is not in operation.

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the start button and look at the start button LED. It should turn on, indicating the starting system is working on the input side of the starting system (start button, ECM and wiring). If so, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Refer to STARTING SYSTEM for testing procedures). Otherwise, check the input side as follows.

Test corresponding fuse, relay and wiring.

Disconnect the connector of the steering harness.

Measure the resistance of the BLUE/RED and LIGHT BROWN wires for 0 Ω. Depress start button and the reading should change from 0 Ω to infinitely high.

Release the start button and measure the resistor between LIGHT BROWN and BLACK wires. It should be 50 Ω.

Test continuity of circuit B-17. If it is good, try a new ECM. Otherwise, repair harness/connectors.

Test continuity of circuit B-19. If it is good, try a new ECM. Otherwise, repair harness/connectors.

DESS SWITCH VERIFICATION

If 2 short beeps are not heard when engine is started, 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 DESS post GREY/GREEN and WHITE/BLACK wires. Measure resistance, there should be NO continuity (open circuit).

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

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

Tether Cord Cap on DESS Post

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

SPARK PLUGS

Disassembly

⚠ WARNING

Never remove ignition coil from the spark plug without disconnecting it from the wiring harness. Flammable vapors may be present in the engine compartment and ignited by a spark which could cause an explosion.

Disconnect the wiring harness from the ignition coil.

Remove the ignition coil.

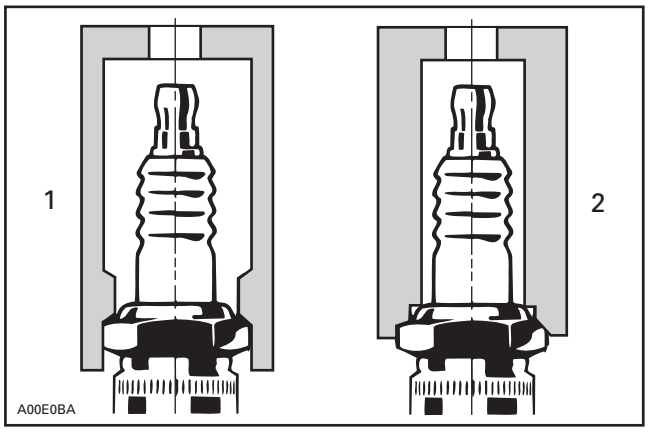
First unscrew the spark plug one turn.

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

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

– Using a wire feeler gauge, set electrode gap according to the following chart.
– Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
– Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise an additional 1/4 turn with a proper socket.



TYPICAL
1. Proper socket
2. Improper socket

ENGINE	SPARK PLUG	TORQUE	GAP ± 0.05 mm (± .002 in)
1004 4-TEC	NGK DCPR8-E	Hand tighten + 1/4 turn with a socket	0.75 (.030)

CRANKING SYSTEM

See above for start switch and the DESS post testing.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	344
drive belt tension adjuster	529 008 700	343

SERVICE PRODUCTS

Description	Part Number	Page
Pulley flange cleaner	413 711 809	341

APPLICATION CHART

MODEL	PART NUMBER	MINIMUM WIDTH (wear limit)
Tundra	414 827 600	30.0 mm (1.181 in)
Skandic LT/LT E/WT/SWT/SUV 550	414 633 800	32.0 mm (1.260 in)
Skandic WT LC/SUV 600	414 300 155	34.7 mm (1.366 in)
Expedition TUV 600 HO SDI	605 348 425	34.7 mm (1.366 in)
Expedition TUV V-1000	605 348 425	34.7 mm (1.366 in)

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.

CLEANING

Before drive belt installation, clean drive and driven pulley sheaves with Pulley flange cleaner (P/N 413 711 809).

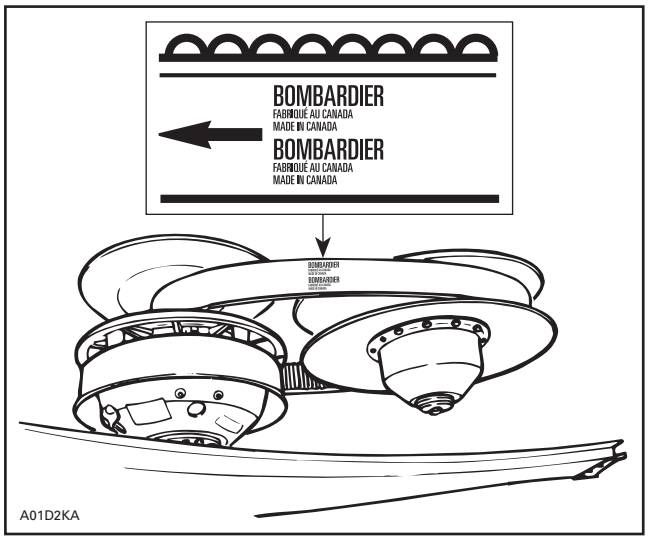
INSPECTION

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.

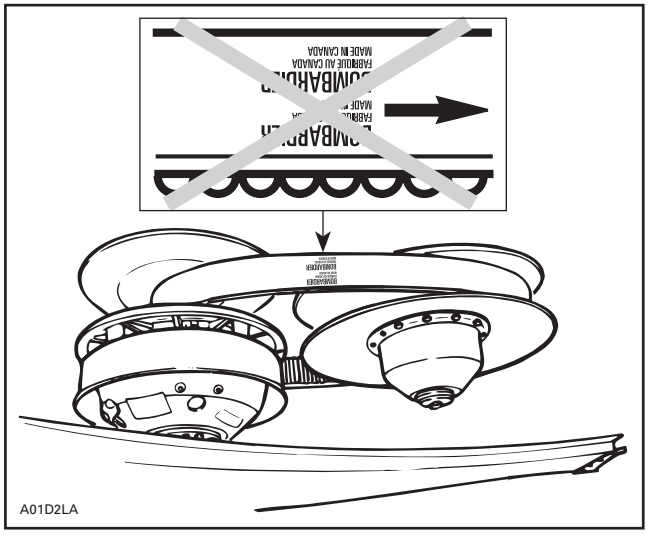
Check the drive belt width. Replace the drive belt if width is less than the minimum width recommended (see table above).

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

NOTE: The drive belt height measurement and adjustment must be performed each time a new drive belt is installed.

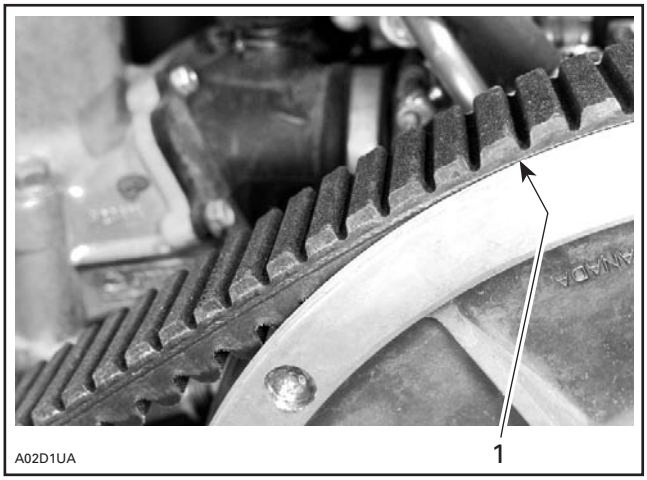
Measurement

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

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

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

MODEL	BELT HEIGHT mm (in)
All models	Top edge of drive belt cord should be flush with driven pulley edge



1. Flush

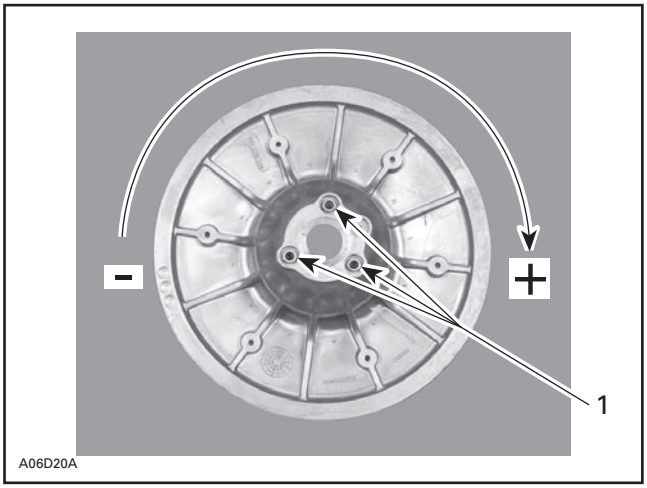
Models Equipped with Formula VSA Type Driven Pulley

Adjust drive belt height using Allen screws, as shown.

To lower belt in driven pulley: turn Allen screws clockwise.

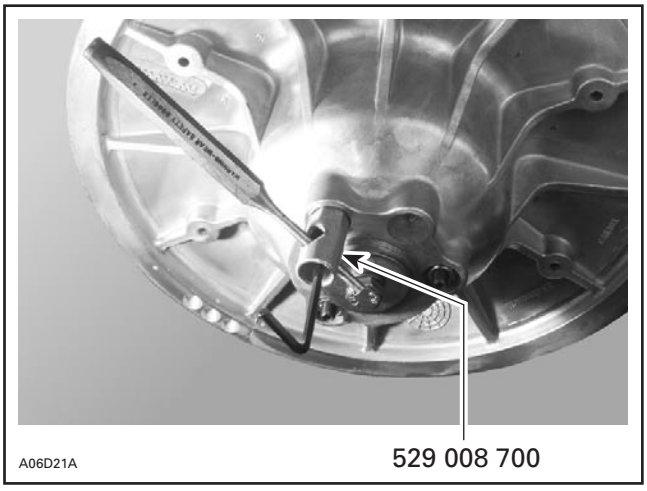
To raise belt in driven pulley: turn Allen screws counterclockwise.

NOTE: Turn Allen screws 1/4 turn at a time, then rotate driven pulley to allow drive belt to settle in pulley. Check height, repeat as required.



TYPICAL
1. Allen screws with jam nuts

Allen screws must be restrained while tightening jam nut to prevent throwing adjustment out. Use drive belt tension adjuster (P/N 529 008 700).



TYPICAL

All Models

Vary pulley distance — within tolerances — to obtain proper drive belt height.

DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY)

IMPORTANT: The drive belt deflection will be automatically set after performing the pulley distance and belt height adjustments. The following procedure will confirm proper pulley distance and belt height adjustment.

NOTE: To obtain an accurate drive belt deflection measurement, it is suggested to allow a break-in period of 50 km (30 mi).

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

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.

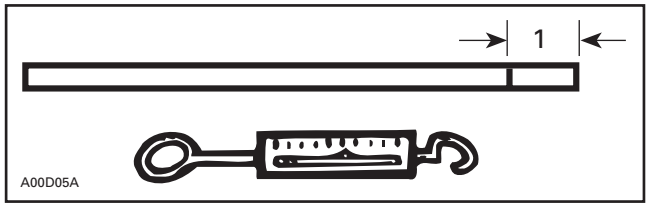
MODEL	DEFLECTION† mm (in)	FORCE kg (lb)
Tundra	32 ± 5 (1.260 ± .197)	6.8 (15)
All models (except Tundra)	32 ± 5 (1.260 ± .197)	11.5 (25)

† FOR REFERENCE ONLY

To Check Tension

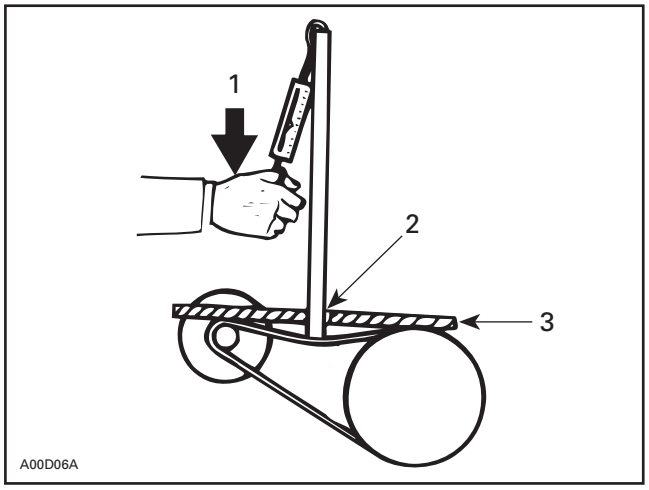
Position a reference rule on drive belt.

Wooden Stick and Spring Scale Method



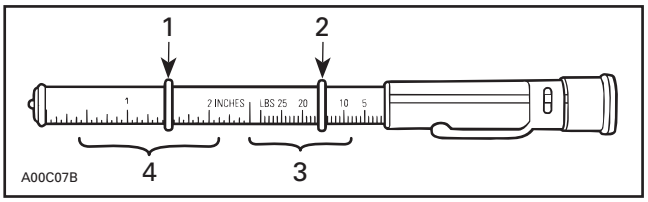
1. Mark specified deflection

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



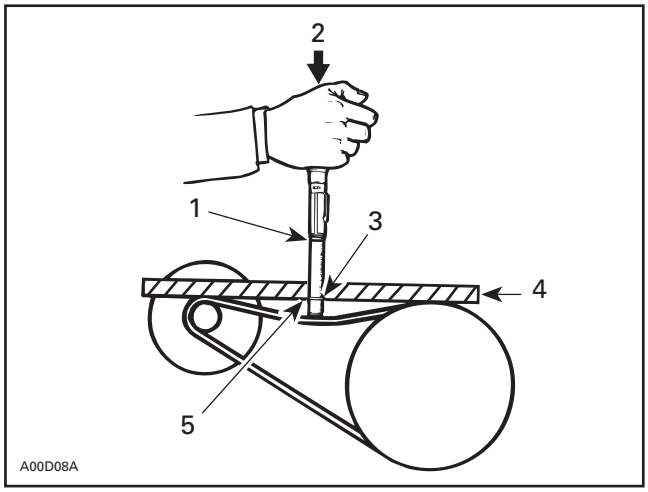
1. Force
2. Read deflection here
3. Reference rule

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 tester to specified deflection.
2) Slide upper O-ring of tester until reaching mark 0 (zero).
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 applied
3. Lower O-ring — deflection
4. Reference rule
5. Deflection

DRIVE PULLEY

SERVICE TOOLS

Description	Part Number	Page
COMET drive pulley puller	529 025 000	351, 354
drive pulley retainer	529 035 674	357
driven pulley opening tool	529 017 200	351
fork	529 005 500	359, 364
governor cup extractor	529 035 894	358
holder	529 006 400	351
holder	529 027 600	347
large bushing extractor tool	529 035 931	360–361
pulley spring compressor	529 035 524	359–361, 364
short dial indicator	295 000 143	365
spider tool	529 025 200	352
spider wrench	529 025 400	353
spring cover tool	529 027 300	348
tapered tool	529 035 826	352
TRA drive pulley puller	529 022 400	347–348, 357
TRA IV drive pulley support tool	529 035 942	365
vise mount tool	529 031 200	360

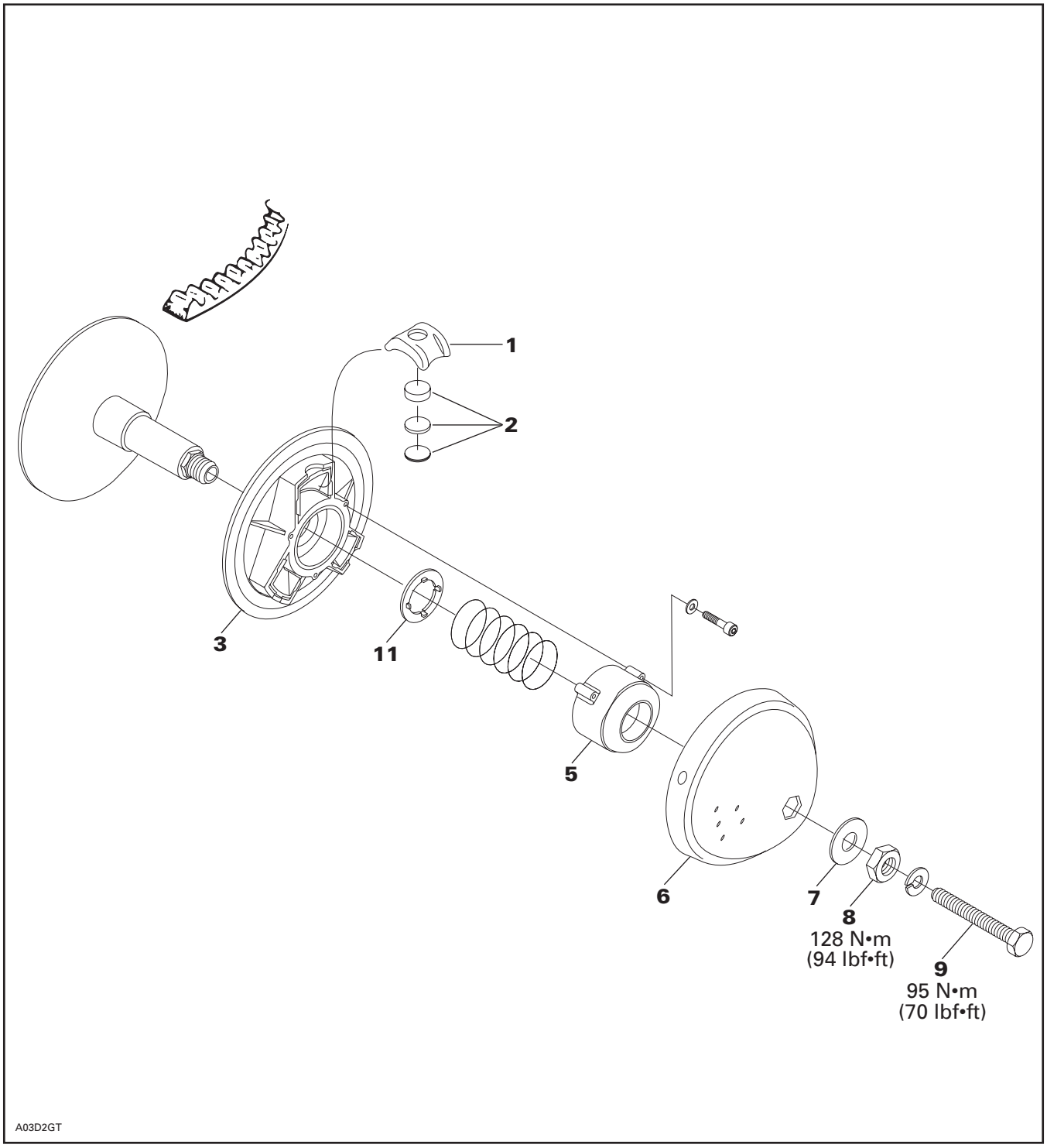
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271	293 800 005	353–354, 362
Primer N	293 800 041	353
pulley flange cleaner	413 711 809	359, 361

BOMBARDIER LITE

NOTE: This is a lubrication free drive pulley.

Tundra/Skandic WT 550/SWT/SUV 550



GENERAL

Some drive pulley components (return spring, calibration disk) 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.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

REMOVAL

NOTE: If disassembling drive pulley, first straighten tab washer no. 7 then untighten nut no. 8.

⚠ WARNING

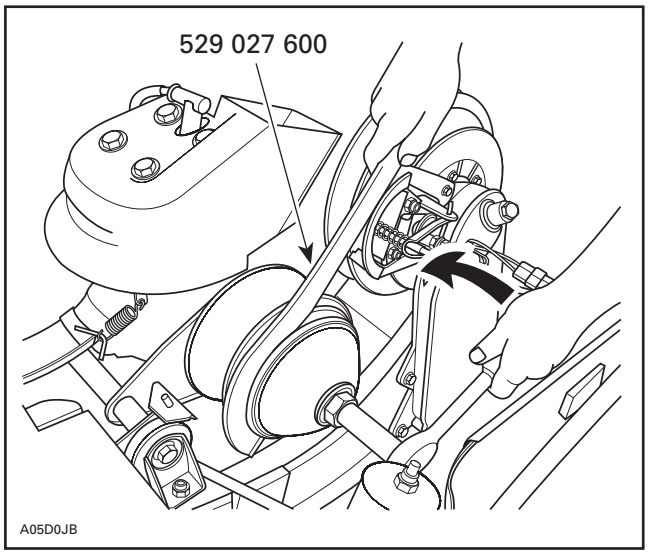
Never use an impact wrench to remove or install the drive pulley.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

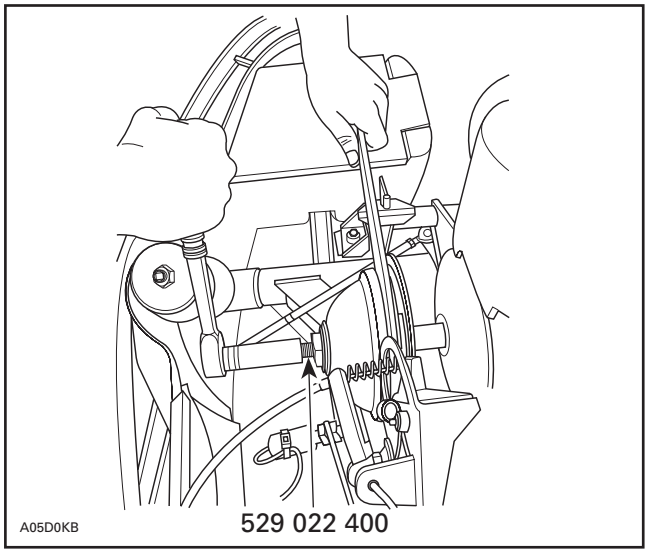
Use holder (P/N 529 027 600).

Remove retaining screw no. 9.



TYPICAL

Insert TRA drive pulley puller (P/N 529 022 400) then remove drive pulley.

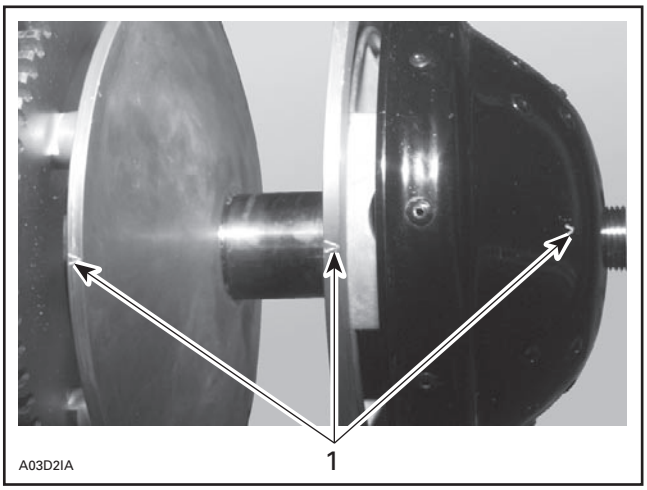


TYPICAL

DISASSEMBLY

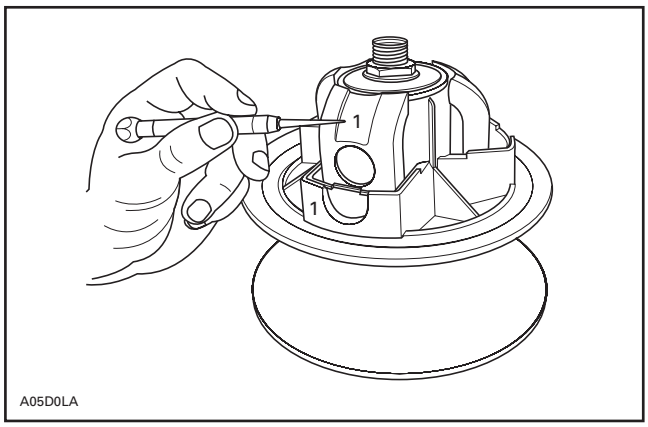
Unscrew nut. Remove tab washer.

Check for alignment marks for proper indexing at reassembly.



1. Alignment marks

Identify blocks **no. 1** and their respective positive positions for reassembly.

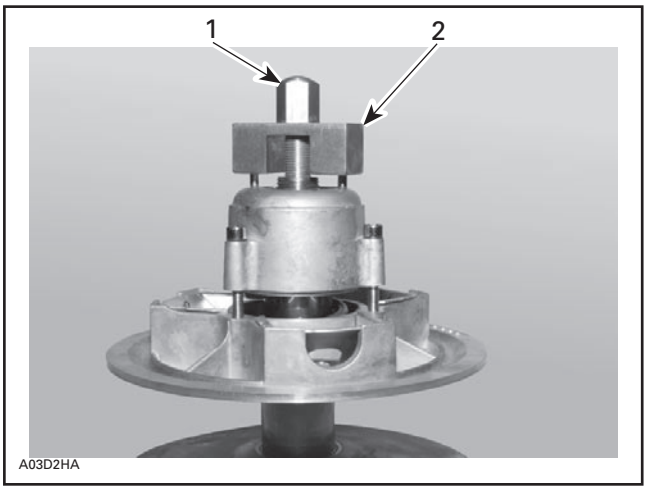


1. Identify

2, Cap, Washer and Disk

These are calibration parts. Refer to TECHNICAL DATA.

Install spring cover tool (P/N 529 027 300) with TRA drive pulley puller (P/N 529 022 400) on spring cover.



1. Puller tool
2. Spring cover tool

Screw puller (hand tight) to hold spring cover and remove screws holding spring cover.

Slowly unscrew puller to release spring pressure.

Remove spring cover **no. 5**, spring and spring seat **no. 11**.

CLEANING

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding half bushing with clean dry cloth.

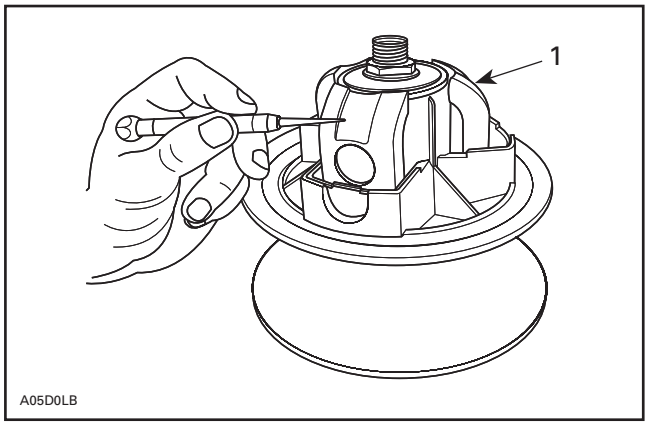
INSPECTION

Check sliding half for excessive lateral play and fixed half shaft for scratches. Replace as required.

ASSEMBLY

Install spring seat **no. 11** then the spring and its cover **no. 5**.

Make sure to install blocks in their original position and with their curved end toward governor cup. See following illustration.



1. Curved end

Tighten nut **no. 8** to 128 N•m (94 lbf•ft).

INSTALLATION

Torque screw to 80 to 100 N•m (59 to 74 lbf•ft).

Install drive belt and belt guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Make sure the track is free of particles that 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.

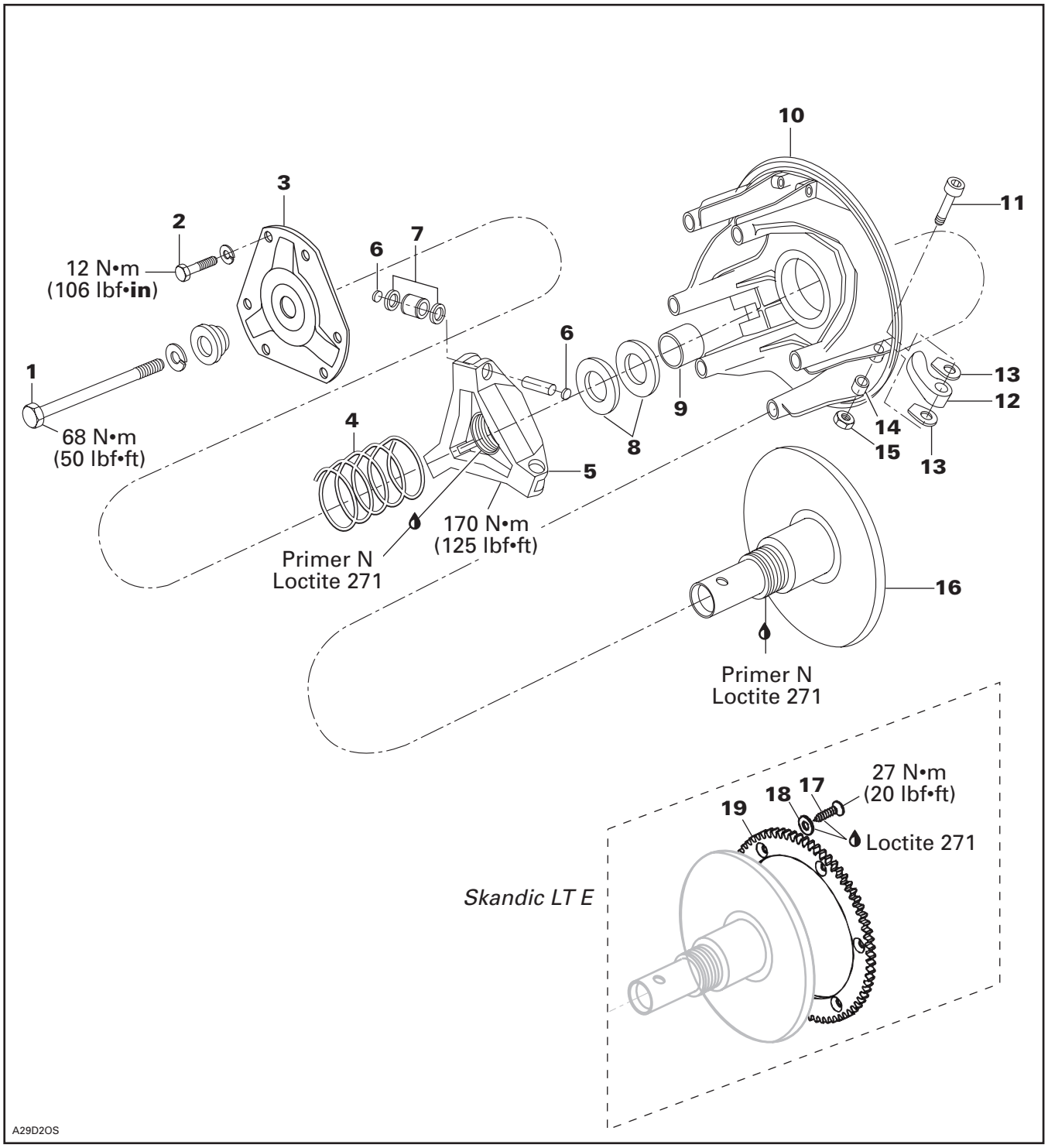
Re-torque screw to 90 to 100 N•m (66 to 74 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

COMET® 102C

Skandic LT/LT E



GENERAL

Some drive pulley components 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 experience mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

MAINTENANCE

Cam Arm Pivot Nut

At first 10-hour (500 km) cam arm pivot nuts **no. 15** have to be retighten.

To do so, loosen one turn all cover screws **no. 2**.

Retighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.

Retighten cover screws 2 to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

Cam Arm Bushing

Cam arm bushings **no. 14** have to be replaced every 3000 km (2000 mi).

With drive pulley still installed on crankshaft, remove one cam arm **no. 12** at a time. Install parts included in Cam Arm Kit. Proceed with remaining cam arms.

Loosen one turn all cover screws **no. 2**.

Retighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.

Retighten cover screws 2 to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

REMOVAL

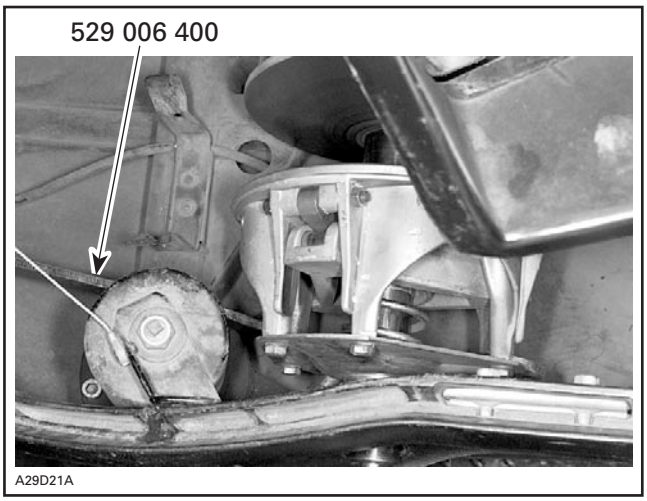
⚠ WARNING

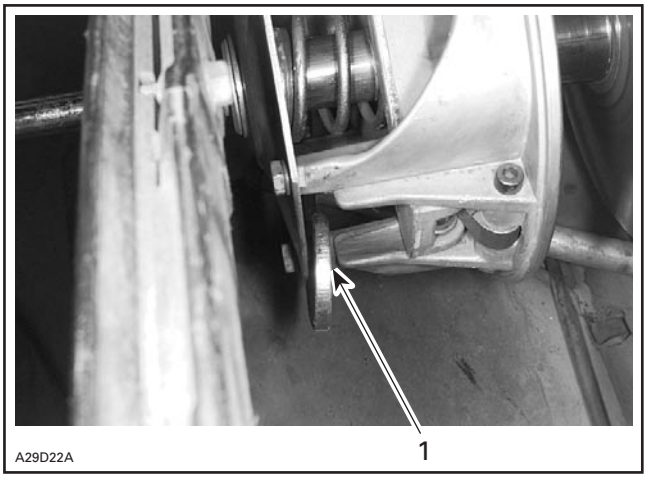
Never use an impact wrench to remove or install the drive pulley.

Unfasten center and rear bottom pan attachments on left hand side. Remove belt guard.

Open driven pulley using driven pulley opening tool (P/N 529 017 200). Remove drive belt.

Use holder (P/N 529 006 400). Make sure holder hook is positioned on top of tower.



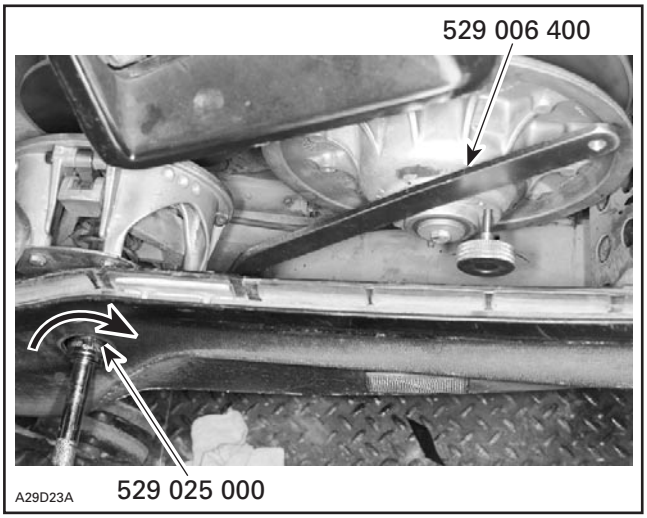


1. Holder hook on top of tower

Remove retaining screw **no. 1**.

Install holder (P/N 529 006 400) in a way to limit pulley clockwise rotation.

Insert COMET drive pulley puller (P/N 529 025 000) then turn puller clockwise to free drive pulley from crankshaft taper.



Remove driven pulley to make room for drive pulley removal.

Remove drive pulley.

DISASSEMBLY

Skandic LT E Only

Remove retaining screws **no. 17** and washers **no. 18** from ring gear **no. 19**.

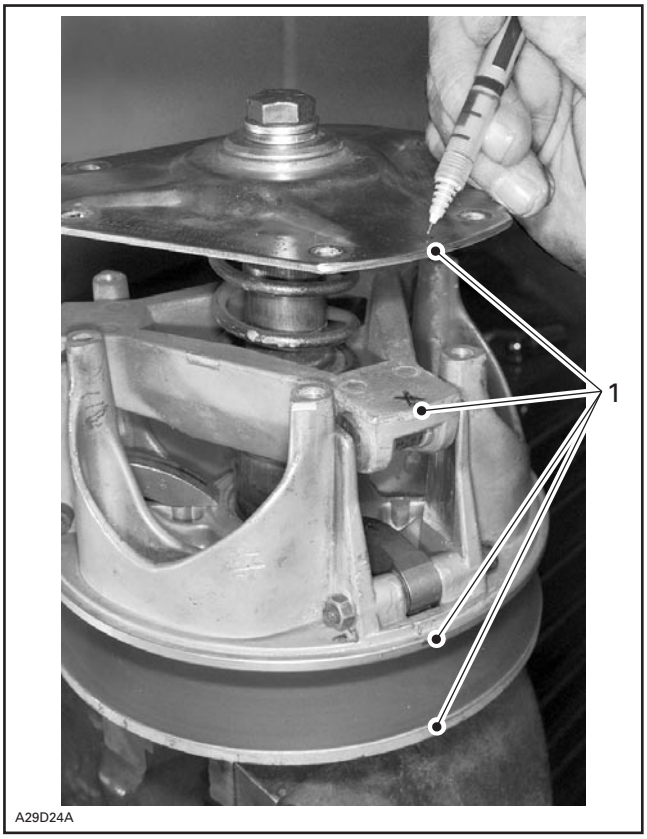
CAUTION: Retaining screws must be heated before disassembly. Heating temperature must not exceed 150°C (300°F).

Skandic LT and Skandic LT E

Mount tapered tool (P/N 529 035 826) in a vise.

Install drive pulley over retainer then, fasten retaining screw **no. 1** and torque to 68 N•m (50 lbf•ft). Now drive pulley is locked on retainer.

Scribe pen marks on fixed half **no. 16**, sliding half **no. 10**, spider **no. 5** and cover **no. 3** for proper indexing at reassembly.



1. Scribe marks

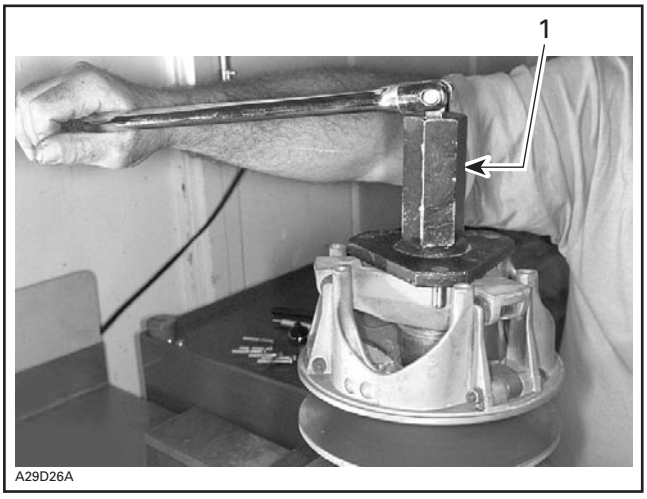
Remove cover screws **no. 2**.

Hold cover **no. 3** by hand then, unscrew retaining screw **no. 1**.

Remove cover **no. 3**.

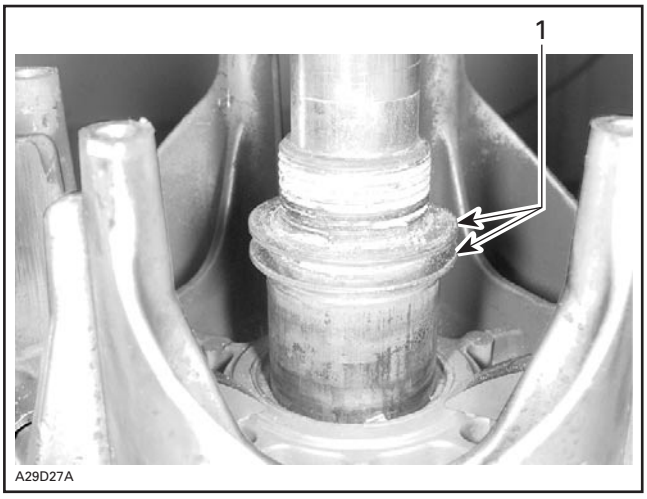
Heat spider **no. 5** to melt threadlocker.

Install spider tool (P/N 529 025 200) then, unscrew spider **no. 5**.



1. Spider wrench

Note shim **no. 8** quantity.



1. Shims

Remove cam arms **no. 12**.

CLEANING

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding half bushing **no. 9** and cover bushing with clean dry cloth.

Thoroughly clean spider threads and fixed half post threads.

INSPECTION

Check sliding half for excessive lateral play and fixed half post for scratches. Replace as required.

Check cover bushing interior. Replace cover if bushing is completely bronze instead of the original teflon coating.

Check spider thrust buttons **no. 6** for proper sliding action. Replace as required.

Check rollers **no. 7** for free action. Replace as required.

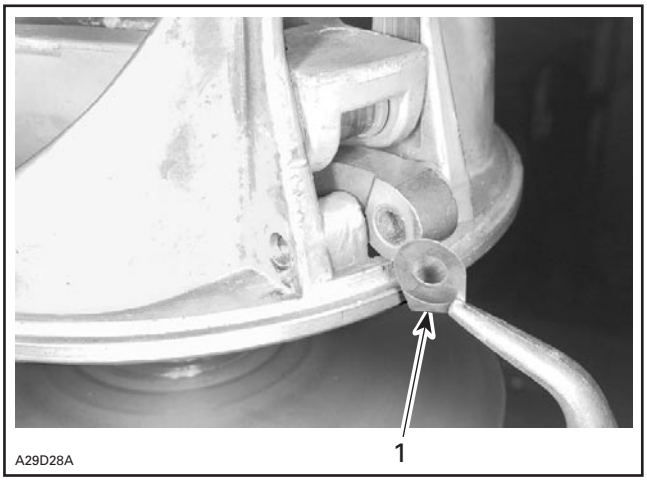
ASSEMBLY

Install shims **no. 8** on fixed half post.

Apply Primer N (P/N 293 800 041) to both post and spider threads, allow to dry for 10 minutes. Apply Loctite 271 (P/N 293 800 005) to threads.

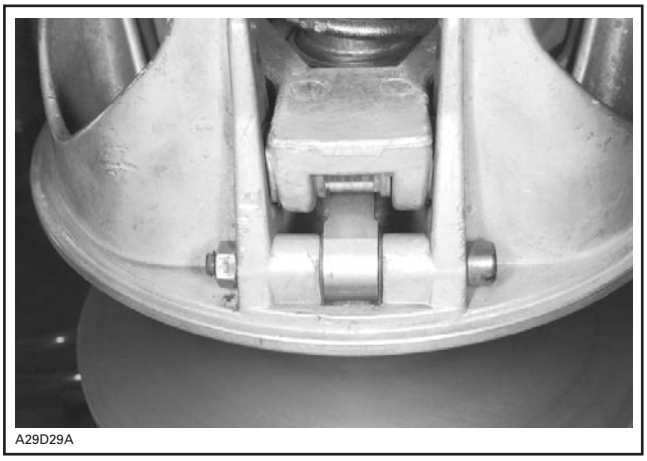
Using spider wrench (P/N 529 025 400) from tool kit, torque spider to 5 to 170 N•m (125 lbf•ft).

With square end facing sliding half, install a washer **no. 13** on each side of cam arm **no. 12**.



1. Square end facing sliding half

Tighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.


A29D29A

Install spring **no. 4**, cover **no. 3**.

Tighten cover screws **no. 2** to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

Use COMET drive pulley puller (P/N 529 025 000) to unlock drive pulley from retainer.

A29D2AA

Skandic LT E Only

Secure ring gear **no. 19** on inner fixed half using self-tapping screws **no. 17** and thick M8 flat washers **no. 18**. Apply Loctite 271 (P/N 293 800 005) on screw threads and between screw heads and thick flat washers.

NOTE: It is of the utmost importance to use thick flat washers **no. 18** with self-tapping screws **no. 17** in order not to pierce inner fixed half with the screws.

CAUTION: Loctite 271 (P/N 293 800 005) must be applied to safely assemble ring gear.

Torque screws in a criss-cross sequence to 27 N•m (20 lbf•ft).

INSTALLATION

Install drive pulley on crankshaft.

Install a new lock washer.

Torque retaining screw to 68 N•m (50 lbf•ft).

Reinstall driven pulley, drive belt and belt guard. Refasten bottom pan center and rear attachments on left hand side.

Raise 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.

Recheck the torque of 68 N•m (50 lbf•ft).

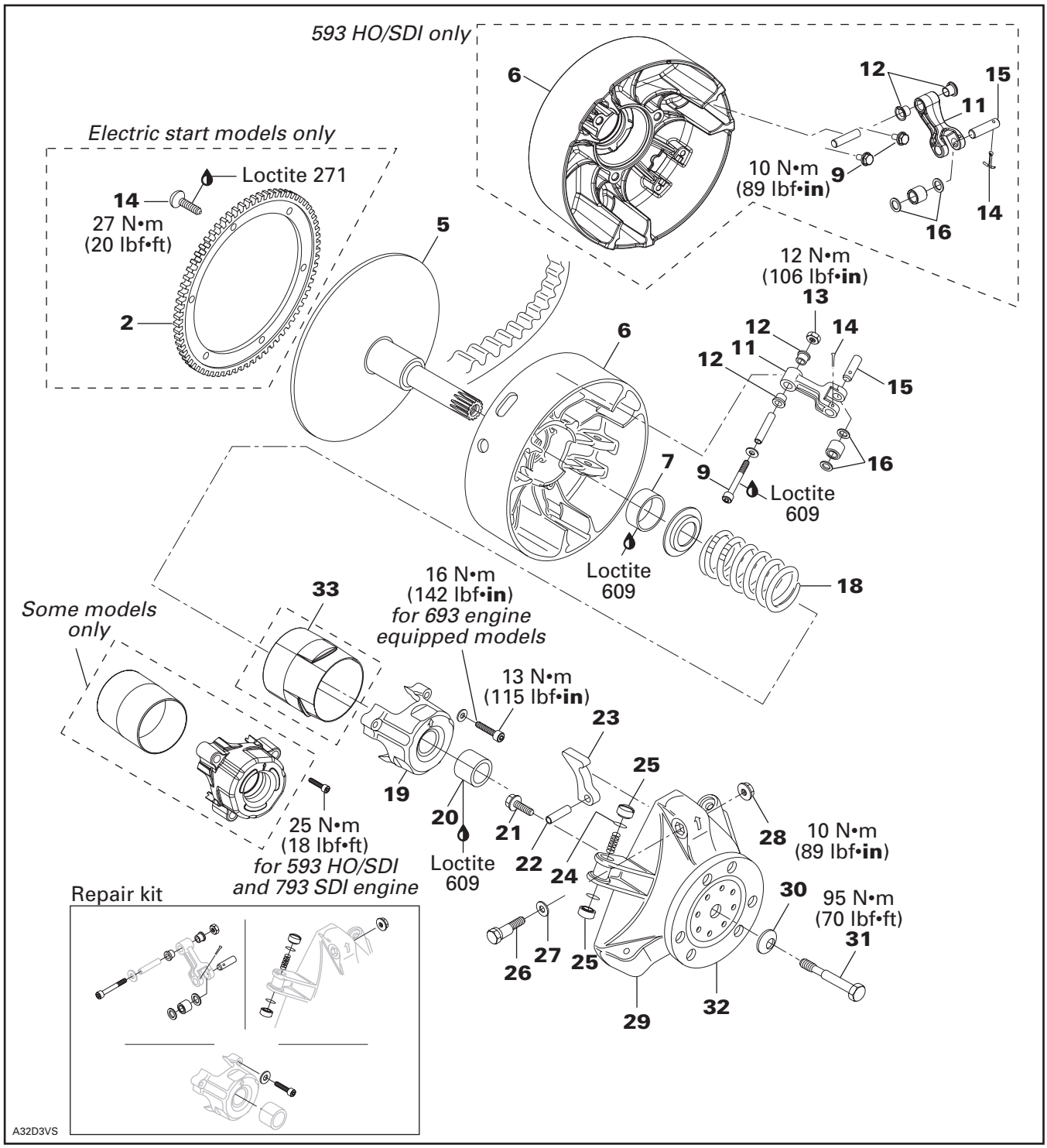
⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

TRA III

All Liquid Cooled Models except 4-TEC Models

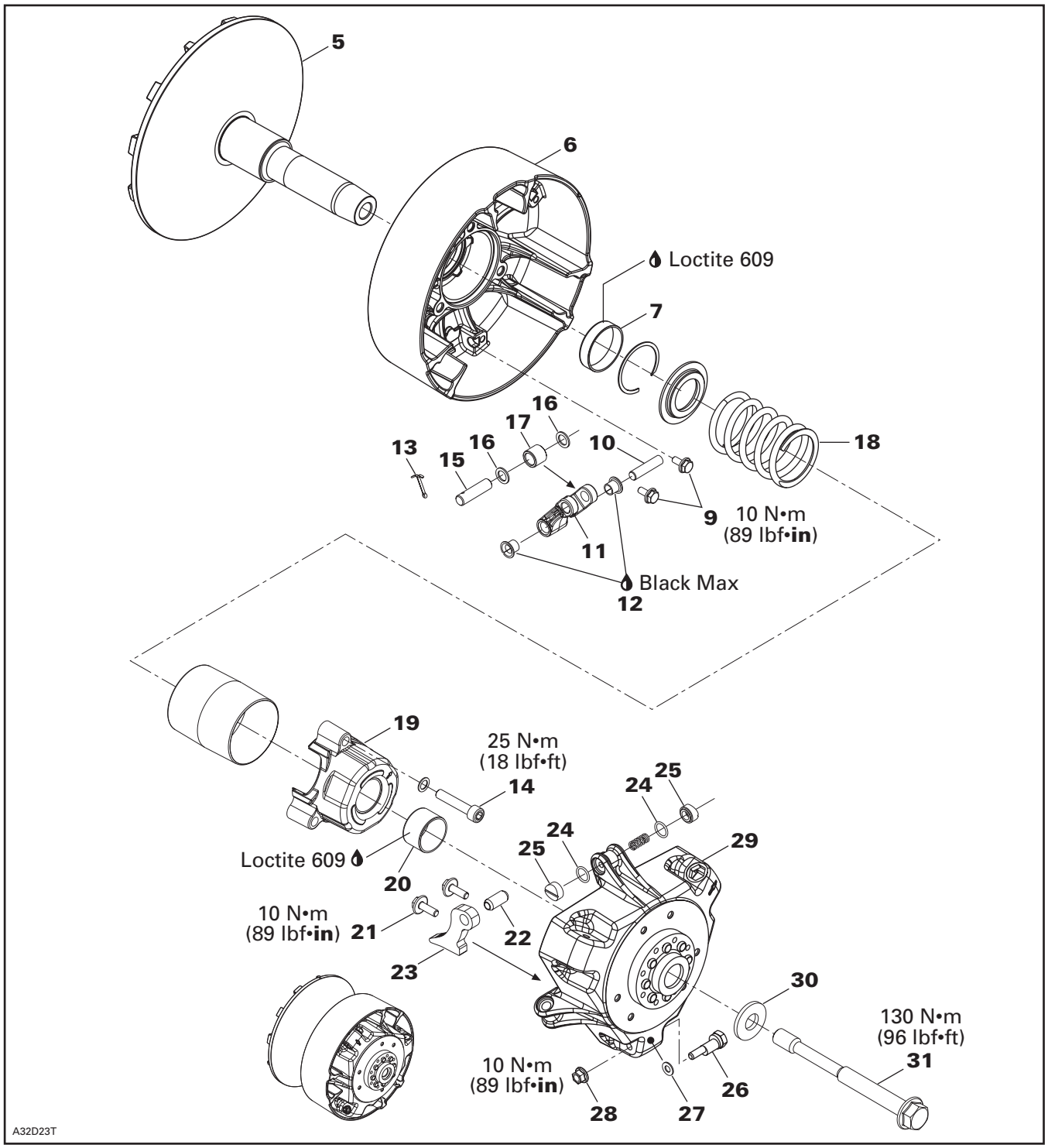
NOTE: These are lubrication free drive pulleys. Always refer to appropriate parts catalog for replacement part. Most parts of TRA III are not interchangeable with those of the TRA.



TRA IV

4-TEC Models

NOTE: This is a lubrication free drive pulleys. Always refer to appropriate parts catalog for replacement part. Most parts of TRA IV are not interchangeable with those of the TRA/TRA III.



GENERAL

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.

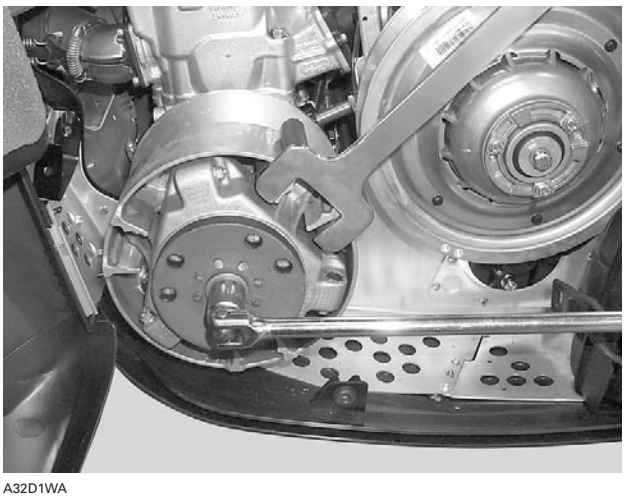
⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Sub-component installation and assembly tolerances require strict adherence to procedures detailed.

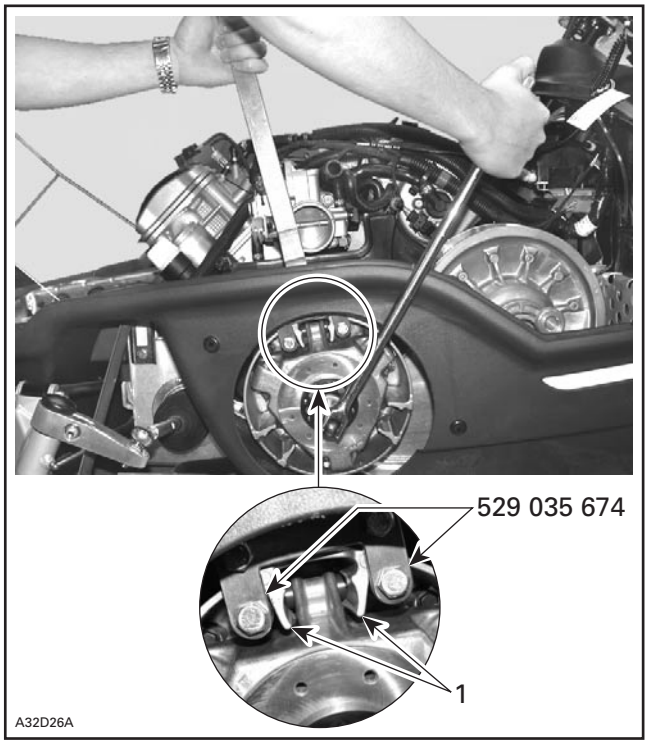
REMOVAL

30,31, Conical Spring Washer and Screw

Secure drive pulley retainer (P/N 529 035 674) over a sliding half tower.



TRA III — INSERT THE TOOL IN SLIDING FLANGE TOWER



1. TRA IV — Sliding half tower

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Remove retaining screw.

To remove drive pulley ass'y and/or fixed half from engine, use TRA drive pulley puller (P/N 529 022 400).

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.

To Remove Drive Pulley Ass'y:

Retain drive pulley with drive pulley retainer (P/N 529 035 674).

Install puller in pulley shaft then tighten.

DISASSEMBLY

Models with TRA III

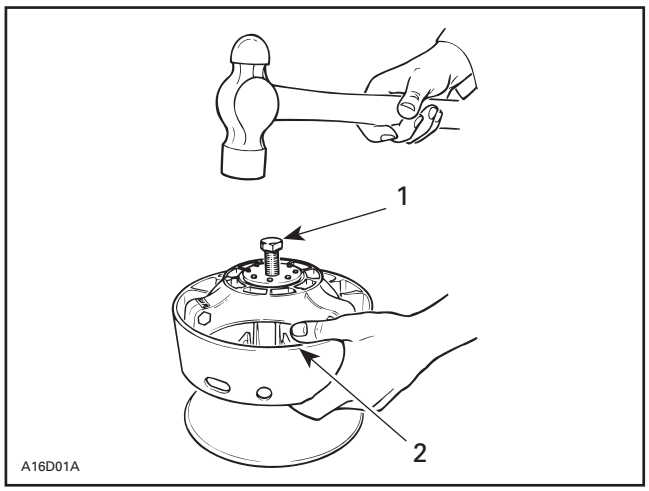
1,2, Screw and Ring Gear

CAUTION: Retaining screws must be heated before disassembly. Do not exceed 150°C (300°F).

5,6, Fixed and Sliding Halves

CAUTION: Do not tap on governor cup.

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.



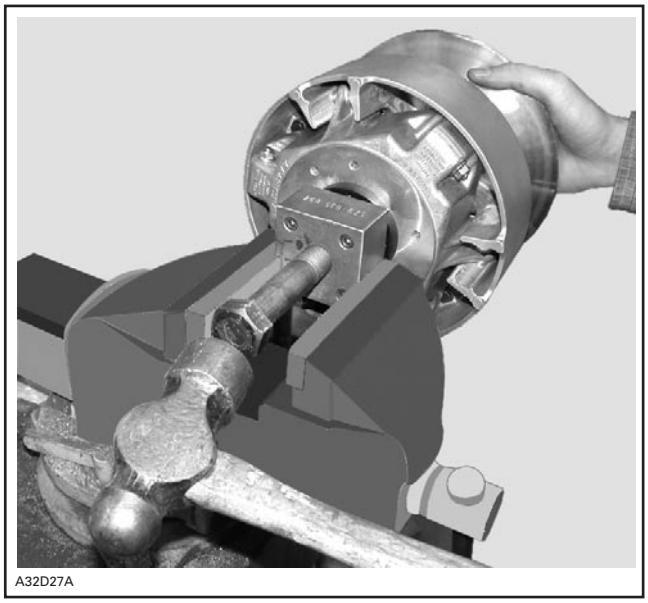
TYPICAL
1. *Puller*
2. *Holding sliding half*

Models with TRA IV

Install governor cup extractor (P/N 529 035 894) on governor cup. Tighten Allen screws in a criss-cross sequence.

Mount governor cup extractor in a vise.

Tighten extractor screw. Hold fixed half and slighty hammer on extractor screw head. Fixed half will come off.



All Models

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

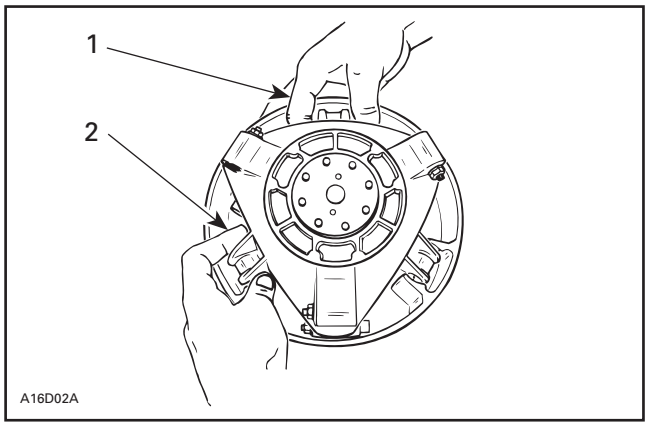
32, Cushion Drive

CAUTION: Do not disassemble cushion drive. Governor cup and cushion drive are factory balanced as an assembly.

25,29, Slider Shoe and Governor Cup

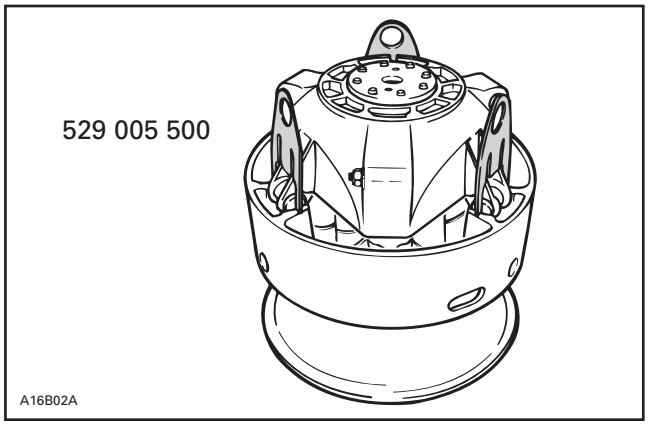
Carefully lift governor cup until slider shoes come at their highest position into guides.

Hold a slider shoe set then carefully lift its housing and remove slider shoes. Proceed the same way for other housings lifting one at a time.



1. *Hold slider shoes*
2. *Lift one housing at a time*

NOTE: To ease disassembly, fork (P/N 529 005 500) should be used to hold slider shoes prior to removing governor cup.



19, Spring Cover Ass'y

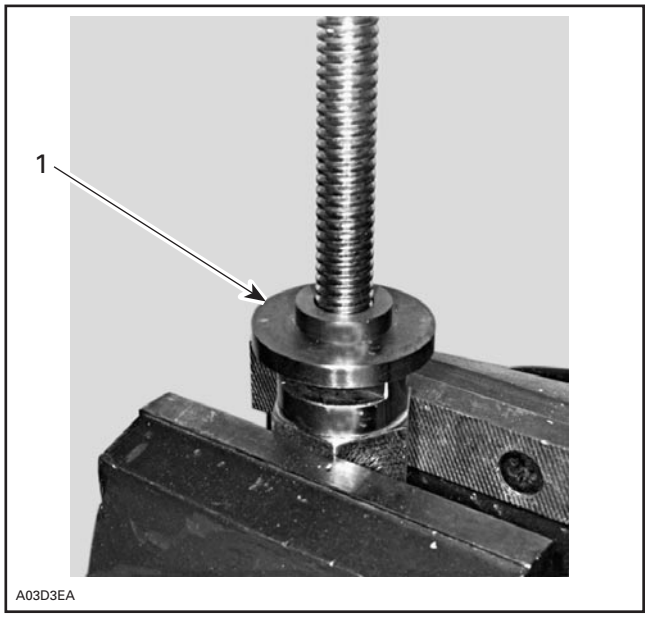
It is pushed by clutch spring pressure.

⚠ WARNING

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

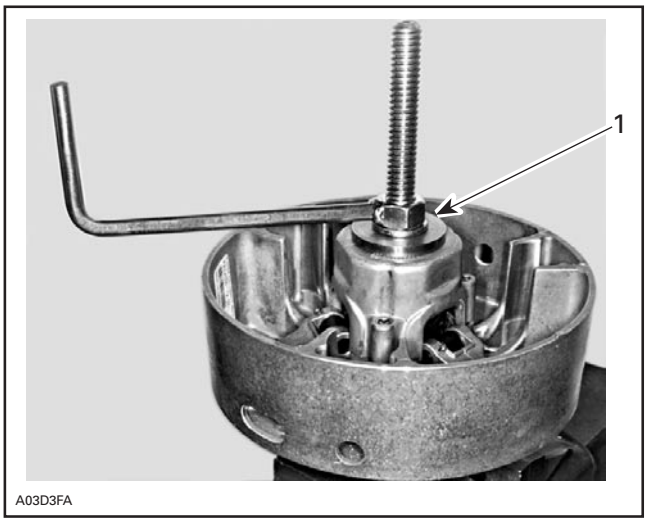
Use pulley spring compressor (P/N 529 035 524).

Install support guide.



1. Support guide

Install sliding half then a second support guide. These support guides will prevent bushing damages.



1. Support guide

Remove 3 Allen screws retaining spring cover then unscrew compressor.

CLEANING

5,6, Fixed and Sliding Halves

Clean pulley halves and shaft with fine steel wool and dry cloth.

5,29, Fixed Half/Crankshaft End and Governor Cup/Fixed Half Post

Parts must be at room temperature before cleaning.

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.

Before installation of drive pulley, clean also crankshaft threads and retaining screw threads.

⚠ WARNING

This procedure must be performed in a well-ventilated area.

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.

7,20, Bushing

Only use petrol base cleaner when cleaning bushings.

CAUTION: Do not use acetone to clean bushing.

INSPECTION

Drive pulley should be inspected annually.

16,17, Thrust Washer and Roller

Check roller for roundness of external diameter. Check thrust washer for thickness wear. Replace as required.

CAUTION: Ensure rollers are in good condition. Replace as required.

9,12, Fitting Bolt Ass'y and Flanged Bushing

Check for wear, replace as required.

24,25, O-Ring and Slider Shoe

Check if O-rings are cracked, cut or crushed. Replace as required.

Check slider shoes for wear. Replace if groove is not apparent on top.

5,29, Fixed Half and Governor Cup

Inspect splines and free play between both parts. Maximum free play is 0.5 mm (.020 in) measured at calibration screw radius. Replace if required.

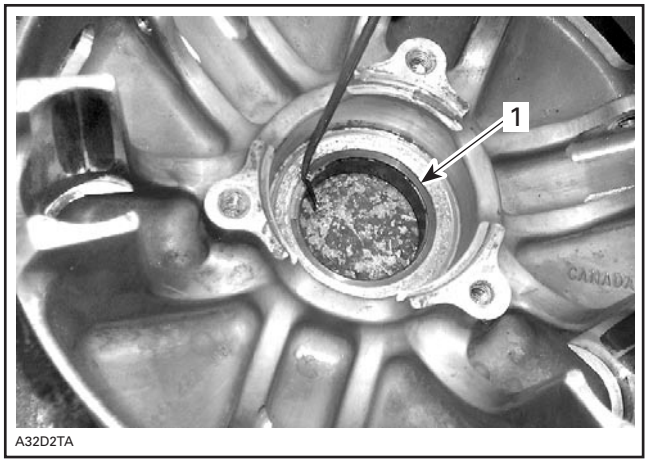
7,20, Sliding Half and Spring Cover Bushing

Visually inspect coating. Replace if worn.

Sliding Half Bushing Replacement

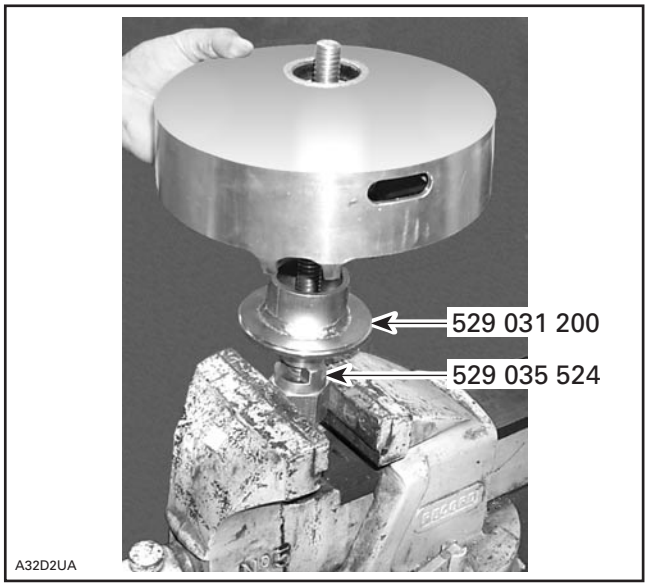
NOTE: In case of worn out bushing, it is advisable to replace whole sliding half ass'y as replacing just the bushing may reduce the drive pulley performance.

Remove circlip from the sliding half.



1. Circlip

Secure the pulley spring compressor (P/N 529 035 524) in a vise mount tool (P/N 529 031 200) and the sliding half ass'y on it.

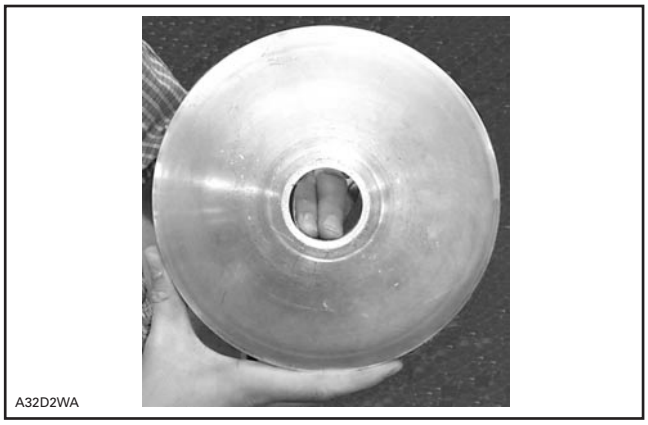


Use the large bushing extractor tool (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the large bushing extractor tool (P/N 529 035 931) as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.

A32D2VA

Use a soft sand paper to clean sliding half bushing mounting surface.


A32D2WA

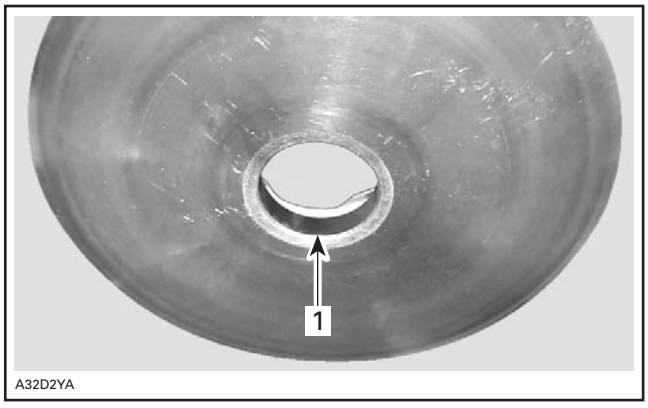
Clean sliding half bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

To install a new bushing, secure the pulley spring compressor (P/N 529 035 524) in a vise and mount the sliding half ass'y. Insert the bushing from inner side of sliding half ass'y.

Mount the large bushing extractor tool (P/N 529 035 931) with side marked "IN" to press in a new bushing.


A32D2XA

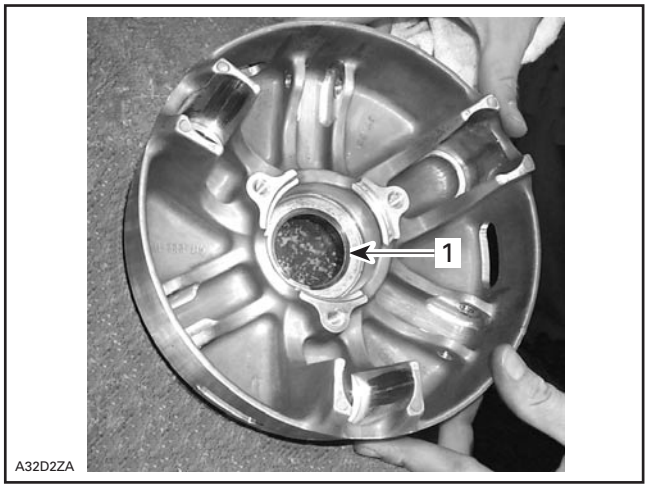
NOTE: Make sure that the bushing is well seated on the sliding half ass'y.



A32D2YA

1. Bushing

Install the circlip.



A32D2ZA

1. Circlip

Spring Cover Bushing Replacement

Under normal use there is no need to replace this bushing.

In case of replacement, it's recommended to replace spring cover ass'y.

ASSEMBLY

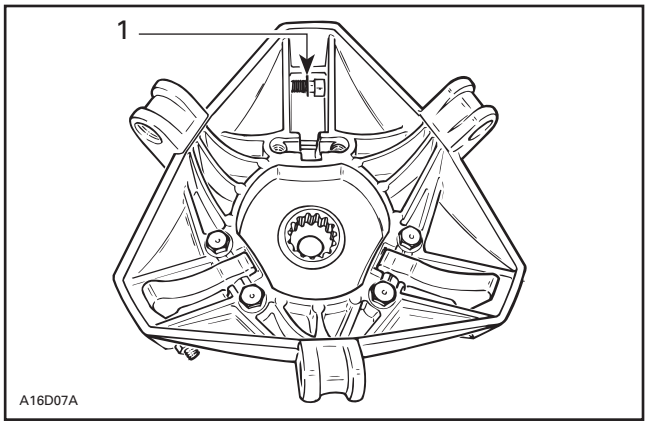
NOTE: This drive pulley is lubrication free. Do not lubricate any component.

1,2,3, Screw, Ring Gear and Loctite 271

Apply Loctite 271 (P/N 293 800 005) on threads and then torque to 27 N•m (20 lbf•ft).

26,27,28, Calibration Screw, Washer and Locking Nut

When installing calibration screw, make sure to install washer as shown.



TYPICAL
1. Washer

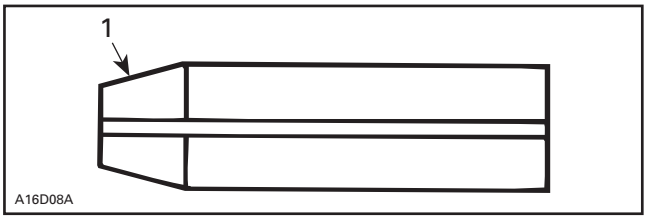
Torque locking nut to 10 N•m (89 lbf•**in**).

15, Pin

Always use the same type of pin as originally installed when servicing. Different types have different weights for calibration purpose. Refer to TECHNICAL DATA.

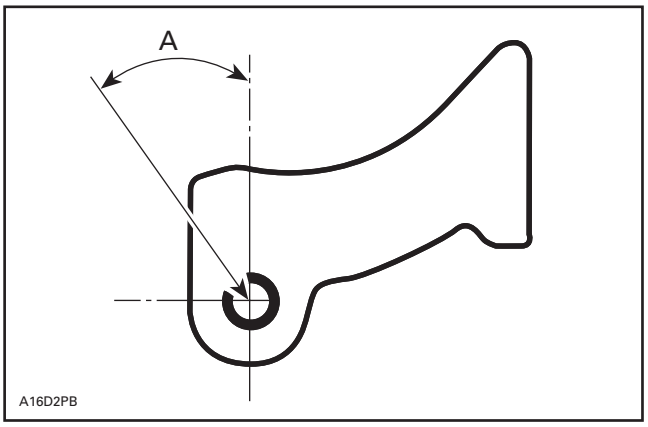
21,22,23, Screw, Dowel Tube and Ramp

Insert dowel tube from chamfered side. Make sure ramp is centered on dowel tube.

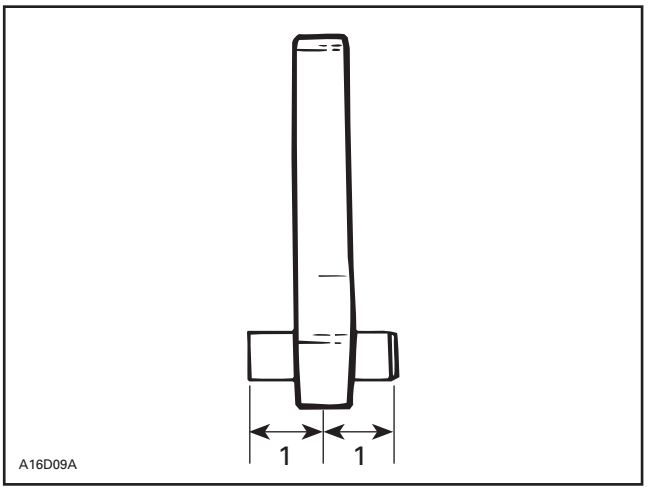


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA	30 ± 5°
With TRA III and IV	45 ± 3°



1. Equal distance

Torque screws to 10 N•m (89 lbf•**in**).

9,11,13,14, Screw, Lever Ass'y, Nut and Cotter Pin

TRA III and IV

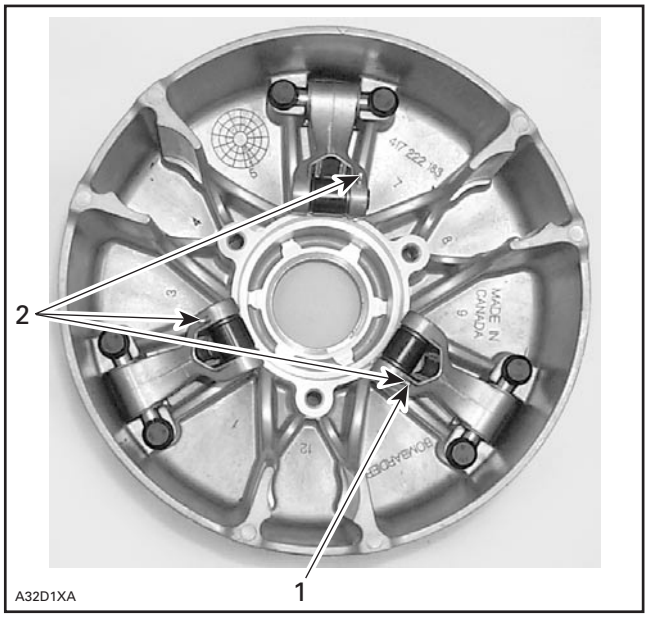
NOTE: While installing lever assemblies make sure that the curved sides of the levers are outwards as shown.

All Models

Always install lever assemblies so that cotter pins are on the shown side. Besides install cotter pin head on top when lever is sat at bottom of sliding half. Bend cotter pin ends to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley misbalancing will occur because of levers difference.



1. Head on top
2. All on the same side

CAUTION: Lever assemblies must be installed so that cotter pins are on the same side.

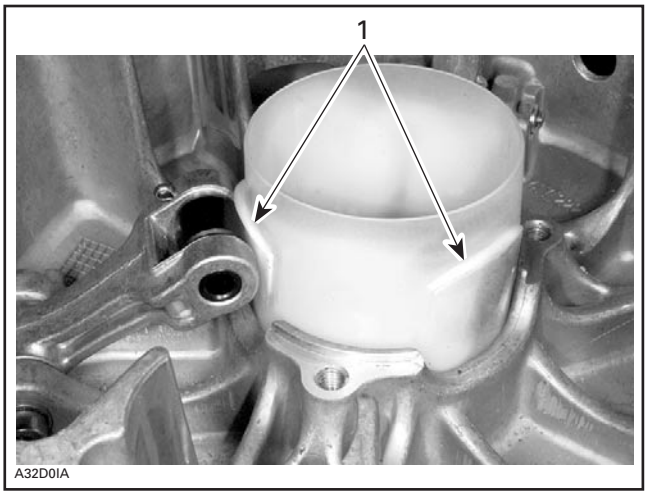
Torque nuts **no. 9** as per the exploded view.

CAUTION: Lever ass'y and rollers must move easily after installation.

33, Guard

Some Models Only

Install guard with its reinforcements in line with levers.



1. Reinforcements

5,6,18,19, Fixed Half, Sliding Half, Spring, Spring Cover and Screw

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

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

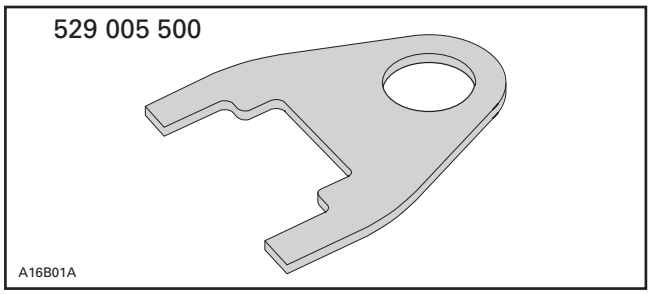
Lift sliding half against spring cover and align spring cover arrow with sliding half mark.

1. Align

Tighten screws to proper torque as mentioned in exploded view.

6,25,29, Sliding Half, Slider Shoe and Governor Cup

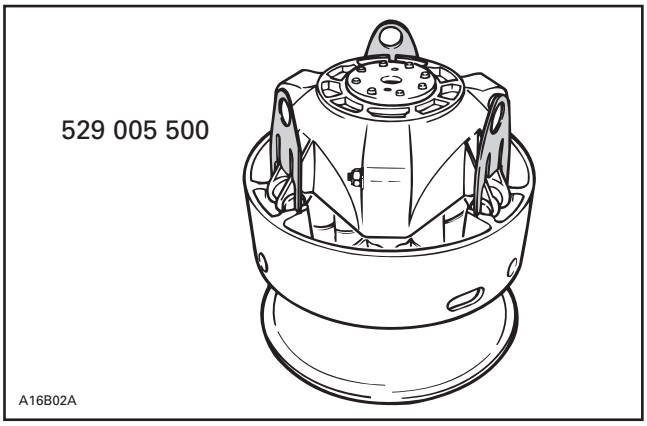
To install governor cup, use following tool:



Insert spring and slider shoes into governor cup so that groove in each slider shoe is vertical to properly slide in guides.

CAUTION: Make sure O-rings are installed on slider shoes and that grooves are positioned vertically.

Install fork (P/N 529 005 500) into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.

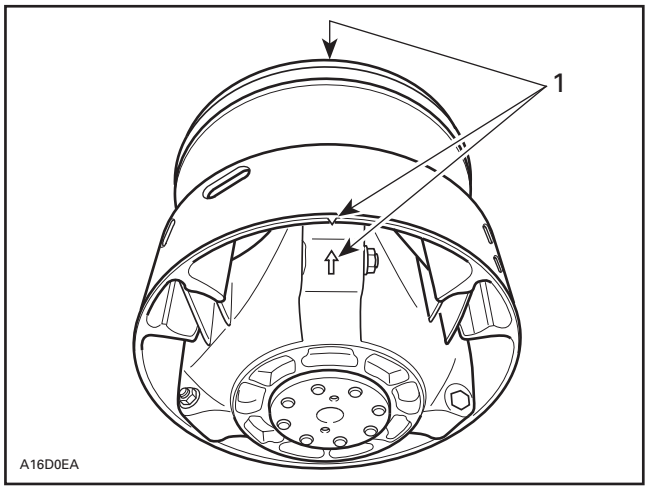


TYPICAL

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

TRA III

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



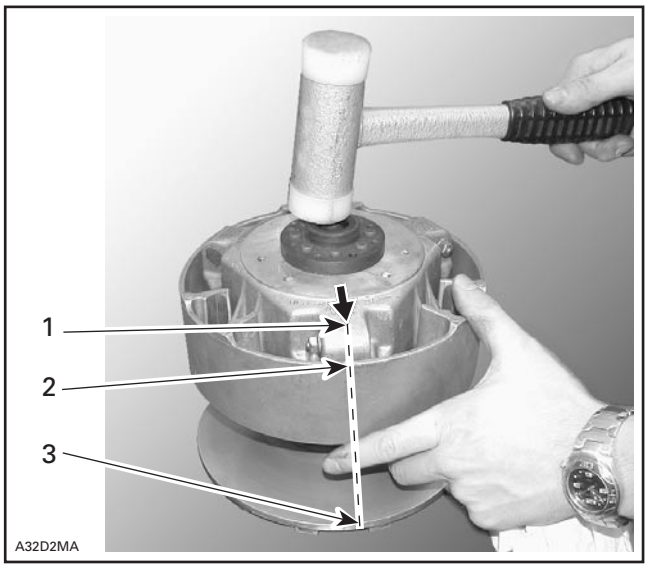
TYPICAL
1. Align

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

Remove forks and push governor cup so that its splines engage with fixed half shaft splines.

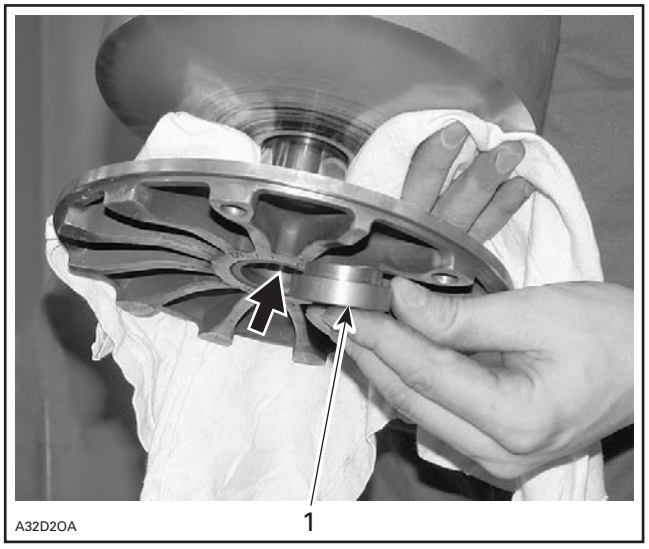
TRA IV

Using a plastic hammer, strike hub firmly 2 or 3 times to ensure proper seating of cones.



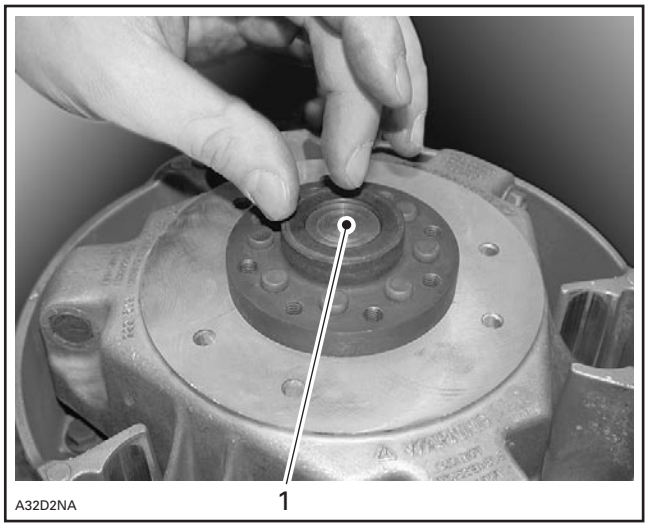
STRIKING HUB
1. *Alignment mark (arrow)*
2. *Sliding flange alignment mark*
3. *Fixed flange alignment mark (reported from underneath)*

Position TRA IV drive pulley support tool (P/N 529 035 942) in hole and align assembly on press, with press shaft.



POSITIONING TRA IV DRIVE PULLEY SUPPORT
1. *TRA IV drive pulley support*

Position dial support tool in hub and make sure it is well seated on fixed flange shaft.

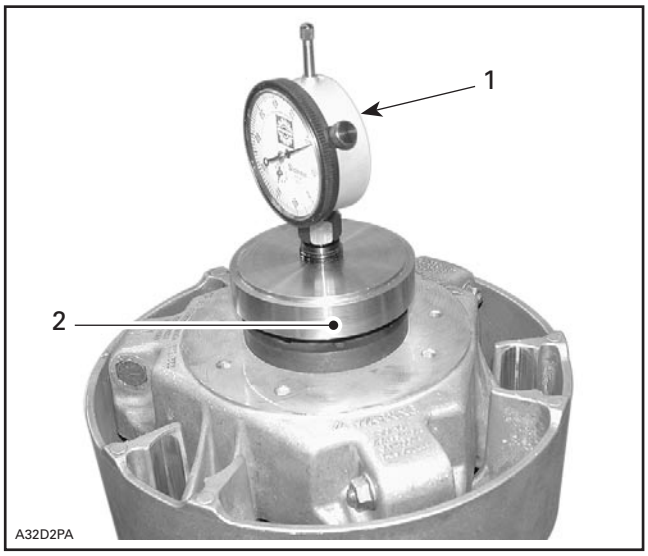


1. *Dial support in hub*

CAUTION: For following procedure, make sure to take off the wheel from the extremity of the dial indicator.

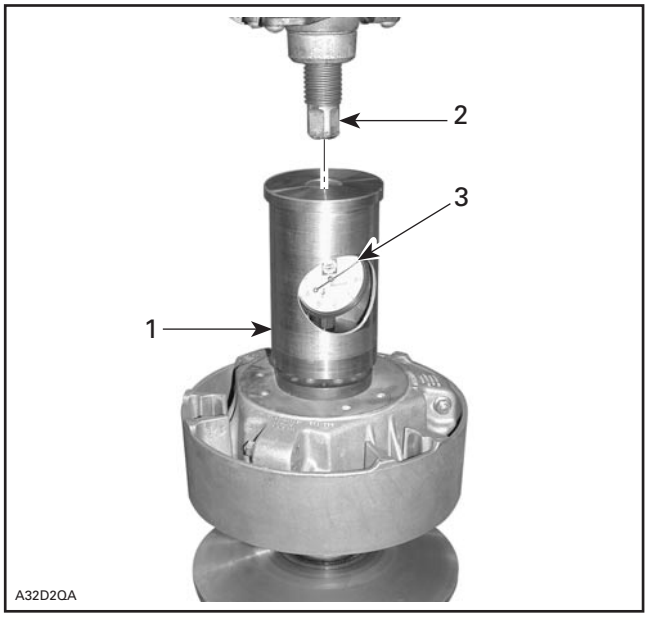
SHOWS WHEEL REMOVED

Completely screw short dial indicator (P/N 295 000 143) in housing support tool and install it on pulley assembly; set dial indicator to "0". Make sure the set-up is well mounted and the dial constantly reads "0".



1. Indicator
2. Housing support

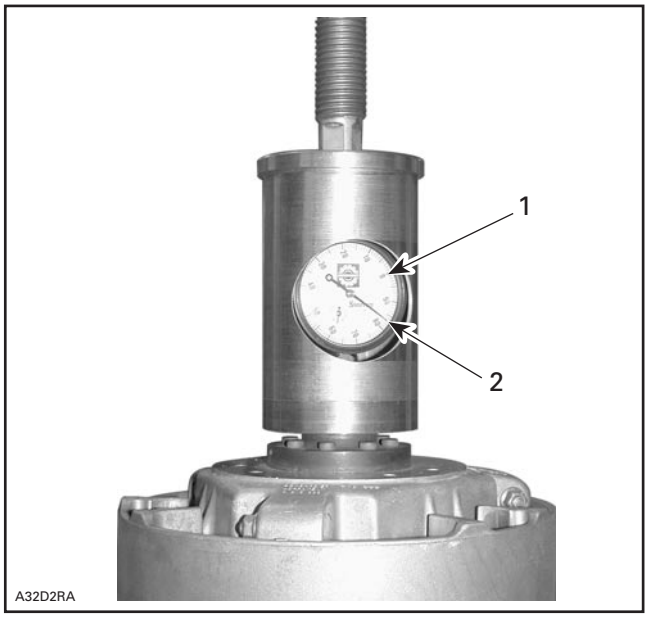
Cover indicator with dial housing tool.



1. Dial housing
2. Press shaft (aligned)
3. Needle at absolute "0"

Align press shaft just over and without touching the very middle of dial housing; do not apply pressure yet.

Ensure indicator needle is still set at absolute "0" and then start activating press until needle reads a displacement of .017 ± .0005 in.



1. Absolute "0"
2. .017 in displacement

CAUTION: Make sure to respect given specification to ensure adequate reassembly of drive pulley. Failure to do so could cause damage to drive pulley assembly.

CAUTION: Make sure splines of both parts are fully engaged.

INSTALLATION

⚠ WARNING

Do not apply anti-seize or any lubricant on crankshaft and drive pulley tapers.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in CLEANING above.

Drive Pulley Ass'y

The following installation procedure must be strictly adhered.

Install drive pulley on crankshaft extension.

Install a new conical spring washer with its concave side towards drive pulley then install screw.

⚠ WARNING

Never substitute conical spring washer and/or screw with jobber ones. Always use BRP genuine parts for this particular case.

Use holder. See removal procedure.

TRA III

Torque screw to 80 to 100 N•m (59 to 74 lbf•ft).

TRA IV

Torque screw to 125 to 135 N•m (92 to 100 lbf•ft).

All Models

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.

TRA III

Retorque screw to 90 to 100 N•m (66 to 74 lbf•ft).

TRA IV

Retorque screw to 125 to 135 N•m (92 to 100 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

DRIVE PULLEY ADJUSTMENT

TRA III

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.

TRA IV

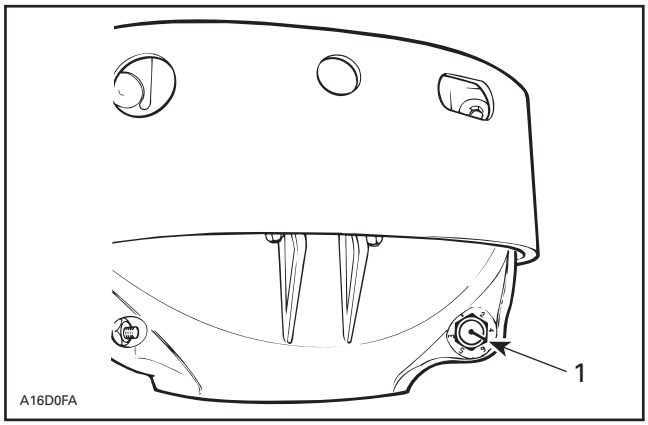
From factory TRA drive pulley adjustment screws are set to position 3. This position allows the best compromise between acceleration, top speed and fuel economy.

Position 1 or 2 would provide the best fuel economy. Top speed would be reduced.

Position 4 would give the best acceleration. Fuel economy would be reduced.

26,28,29, Calibration Screw, Locking Nut and Governor Cup

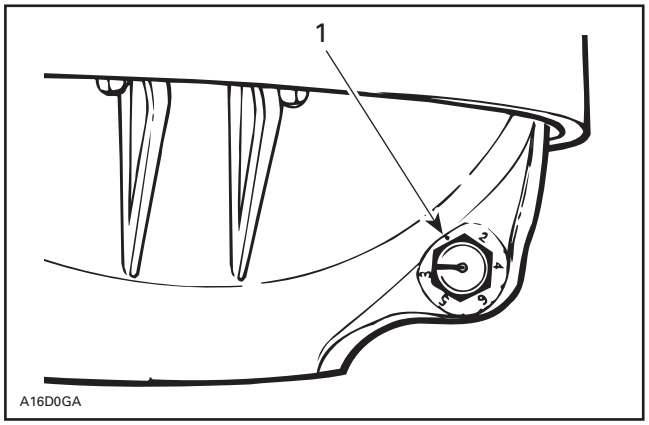
Calibration screw has a notch on top of its head.



1. Notch

Governor cup has 6 positions numbered 2 to 6. Note that in position 1 there is no stamped number (due to its location on casting).

See TECHNICAL DATA for original setting.



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:

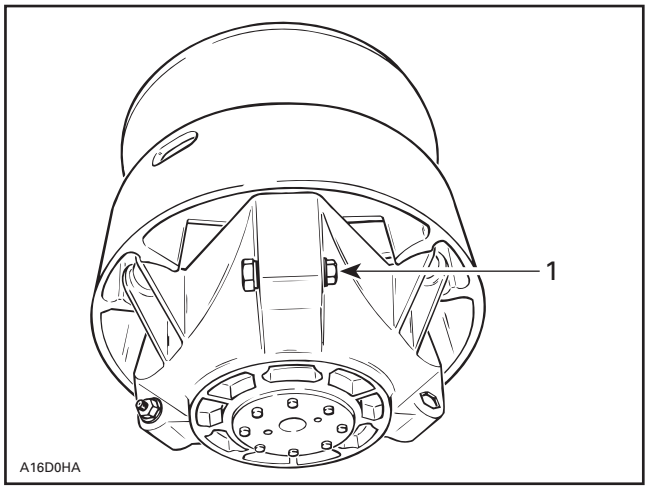
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

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

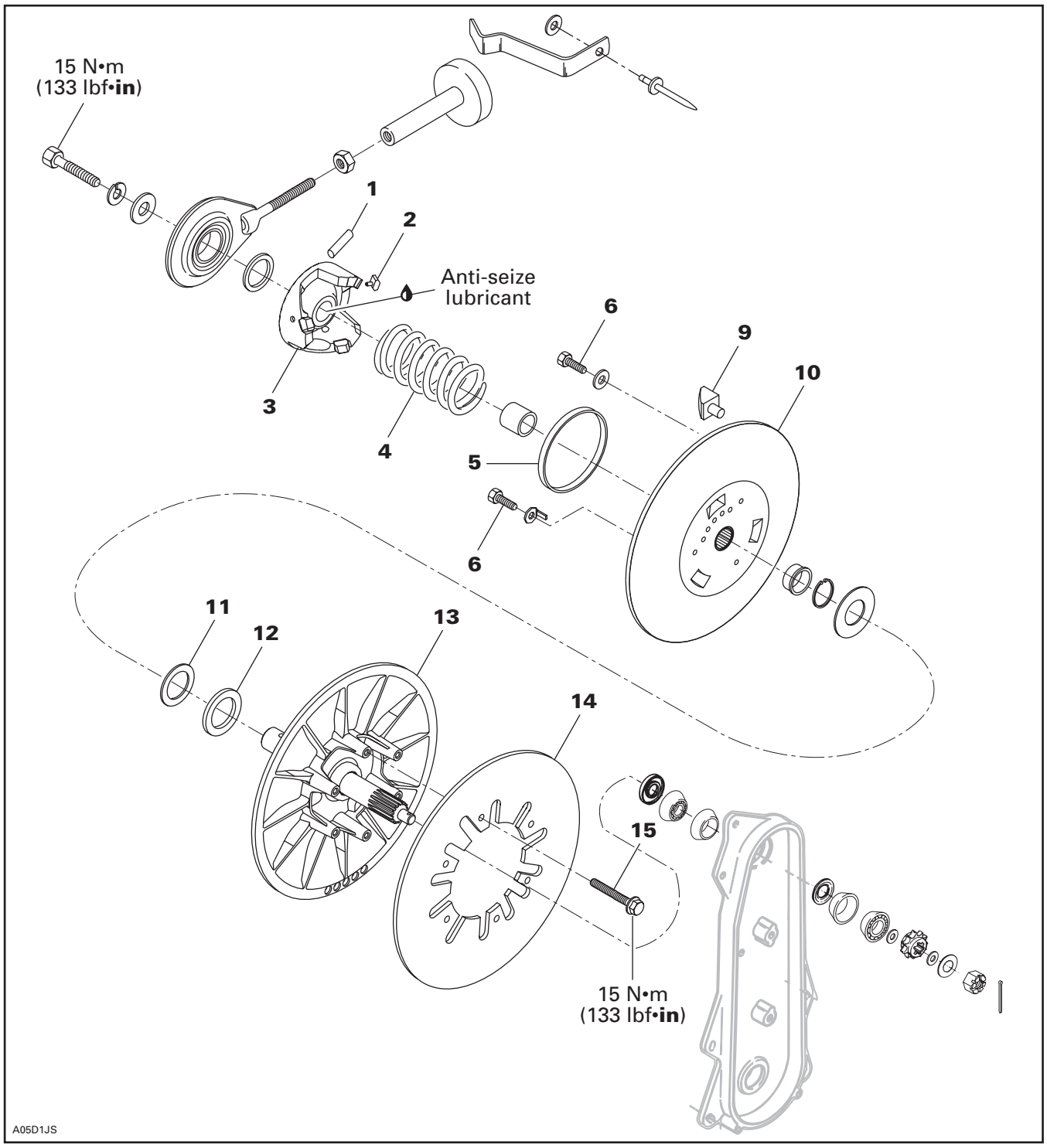
SERVICE TOOLS

Description	Part Number	Page
driven pulley spring compressor	529 035 300	371, 373
extractor	529 035 575	375
pulley spring compressor	529 035 524	375
pulley spring compressor	529 035 524	375–376, 379
spring scale hook	529 006 500	379
support plate	529 031 100	375

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	373, 376, 379
Loctite 609	413 703 100	375
pulley flange cleaner	413 711 809	379

Tundra


15 N•m
(133 lbf•in)
1
2
Anti-seize
lubricant
3
4
5
6
6
9
10
11
12
13
14
15
15 N•m
(133 lbf•in)
A05D1JS

NOTE: Driven pulley components (support, cam, shoes, etc.) can be serviced without removing the whole driven pulley from chaincase. Refer to the following procedures but neither remove brake caliper nor open chaincase for those cases.

REMOVAL

To remove driven pulley from chaincase, follow this procedure.

Remove guard and drive belt from vehicle.

Remove brake support from chaincase with brake ass'y.

Free countershaft support from support clamp.

Chaincase

Open chaincase and drain oil. Unlock and remove upper sprocket.

The following is required to have enough space to remove driven pulley from chaincase:

Loosen steering column upper retaining screws.

Disconnect carburetor boots from intake manifold and air intake silencer.

Disconnect impulse hose from engine.

Disconnect oil injection supply line at injection pump and plug line to prevent draining.

Remove screws retaining rear engine support to chassis.

Tip engine forward just enough to allow driven pulley removal from chaincase. Block in this position.

NOTE: In some cases, chaincase retaining screws might have to be loosened to allow pivoting of chaincase. In this case, note position of alignment shims. In addition, air intake silencer and oil injection reservoir might have to be slightly moved to get enough space to pull driven pulley.

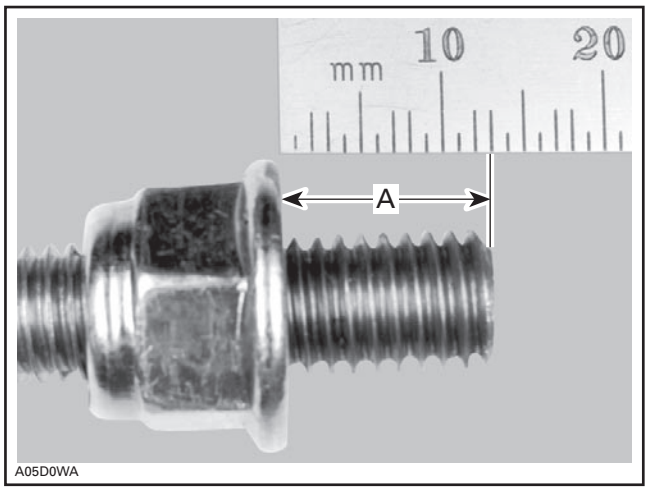
Remove bearing cone.

Knock driven pulley shaft with a plastic hammer and pull driven pulley out.

DISASSEMBLY

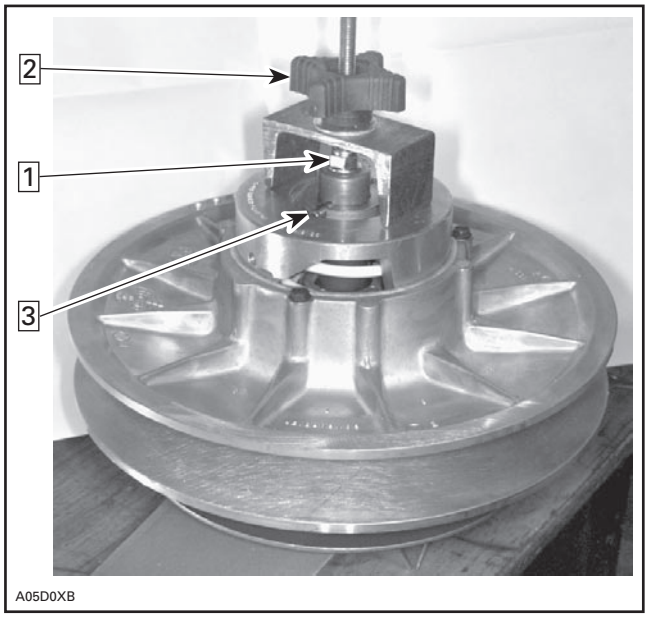
To disassemble driven pulley, driven pulley spring compressor (P/N 529 035 300)) must be used. See following procedure.

Position stop nut 13 mm (1/2 in) from threaded rod end, as shown in the next photo.



1. 13 mm (1/2 in)

Install driven pulley spring compressor (P/N 529 035 300). Fully tighten the 13 mm (1/2 in) exposed threads in driven pulley. Tighten stop nut. Tighten tool knob to compress spring then remove roll pin no. 2.

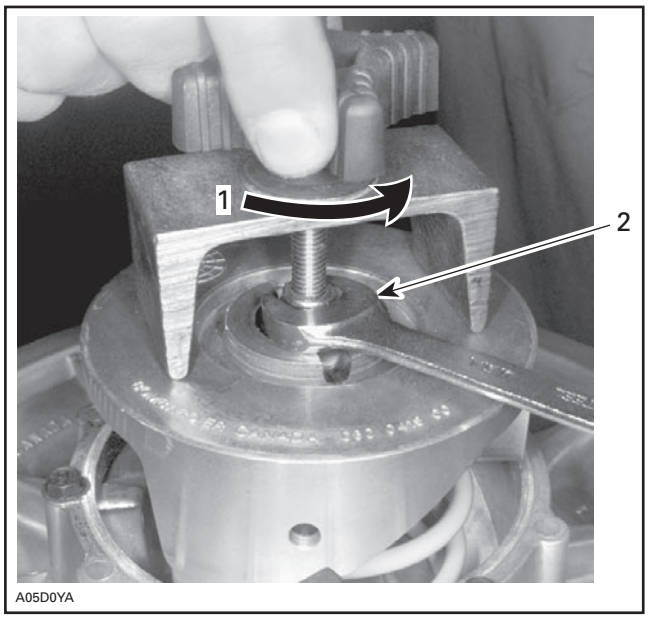


Step 1: Tighten stop nut
Step 2: Tighten knob to compress spring
Step 3: Remove roll pin

Once roll pin has been removed, loosen knob until spring pressure is completely released.

⚠ WARNING

To avoid injuries always hold stop nut with a key when loosening knob, as shown in the next photo.



1. When loosening knob
2. Hold stop nut with a key

Remove tool and cam **no. 3**. Remove spring **no. 4** and sliding half **no. 10**.

5, Large Bushing

Remove 3 screws **no. 6** with washers and pry bushing **no. 5** out.

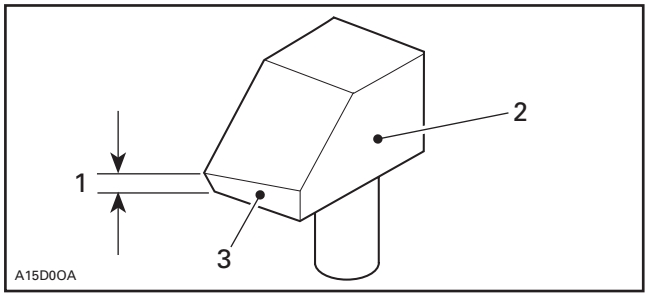
INSPECTION

2,9, Slider Shoe

Black slider shoe = forward

Red slider shoe = reverse

Check cam slider shoes for wear. Replace when inside edge thickness of cam slider shoe slope base is 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slop base

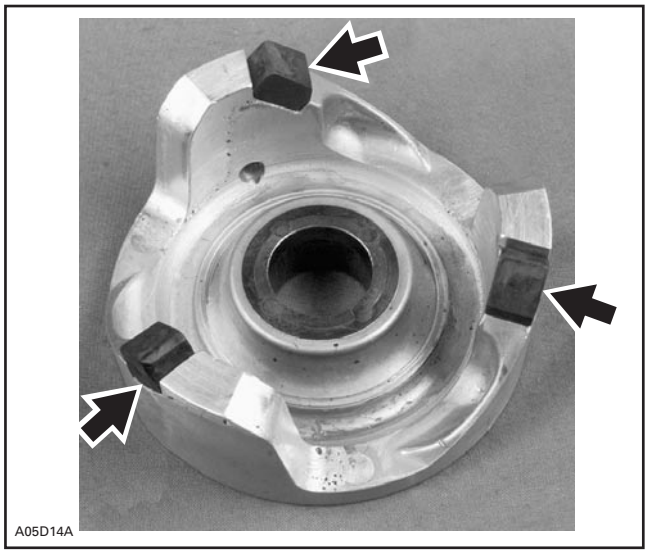
ASSEMBLY

Assemble driven pulley components by reversing the disassembly procedure except for the following.

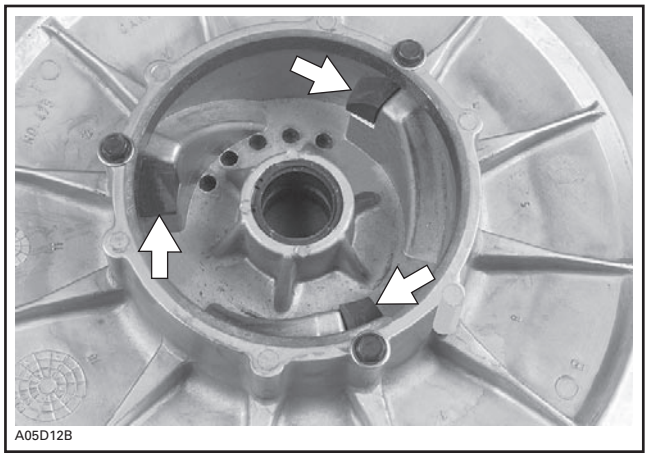
2,9, Slider Shoe

When replacing slider shoes, 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.



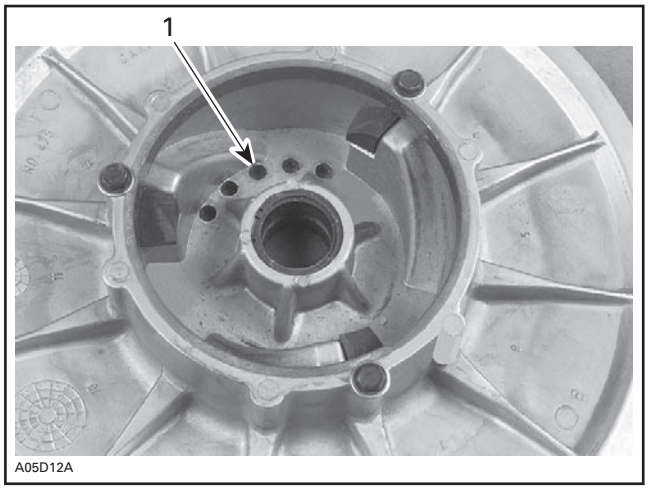
BLACK SLIDER SHOES ON CAM



RED SLIDER SHOES ON PULLEY HALF

2,4,5, Roller Pin, Outer Cam and Spring

Insert spring in adjusting hole **no. 3** into sliding half, as illustrated.



1. Adjusting hole

Insert other spring end in cam. Mount driven pulley spring compressor (P/N 529 035 300) as in DISASSEMBLY procedure.

Push cam all the way in then install roll pin coated with anti-seize lubricant (P/N 413 701 000).

13,14,15, Fixed Pulley Half, Brake Disc and Screw

Install brake disc on fixed pulley half and torque screws to 15 N•m (133 lbf•**in**).

INSTALLATION

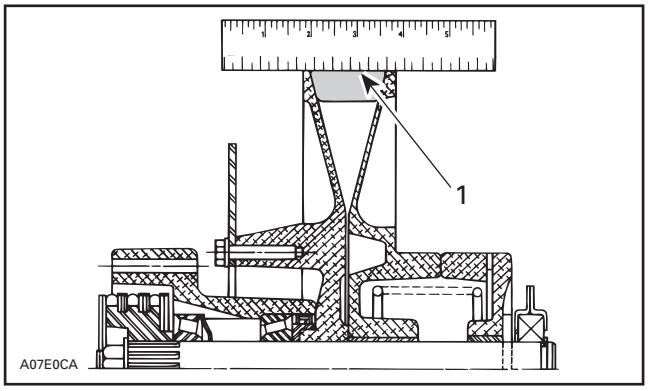
Follow INSTALLATION procedure for Tundra driven pulley at beginning of this subsection.

ADJUSTMENT

11,12, Shim

NOTE: The following adjustment must be performed with a new drive belt.

For best performance, particularly at starting, top of drive belt should be flush with top of driven pulley halves.



TYPICAL
1. Belt flush with the top of the pulley halves

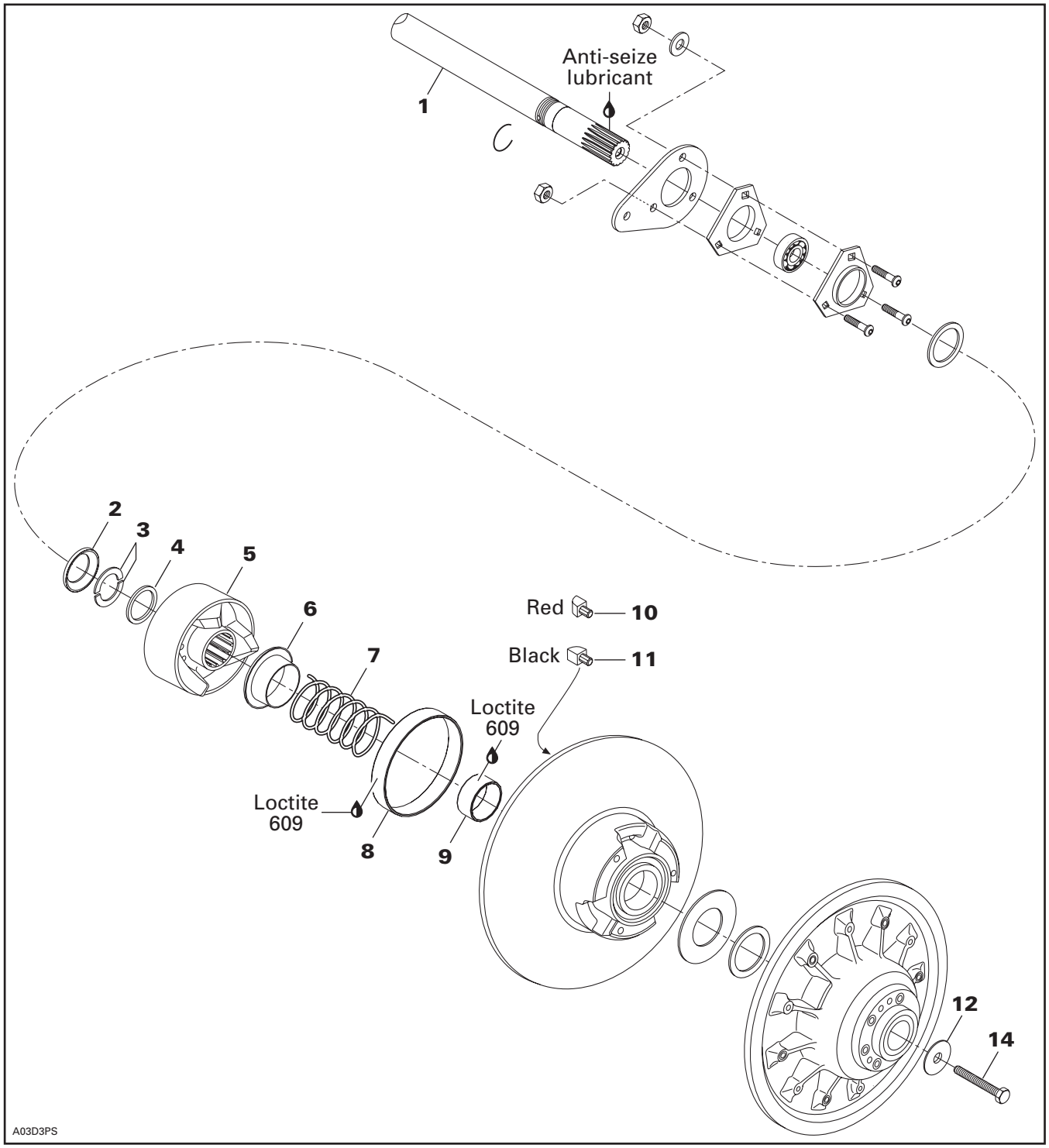
Shim(s) no. 11 and no. 12 provide belt height adjustment between pulley halves. Adding shims will lower the belt in driven pulley, while removing shims will raise the belt. Adjust properly.

Pulley Alignment and Drive Belt Deflection

Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

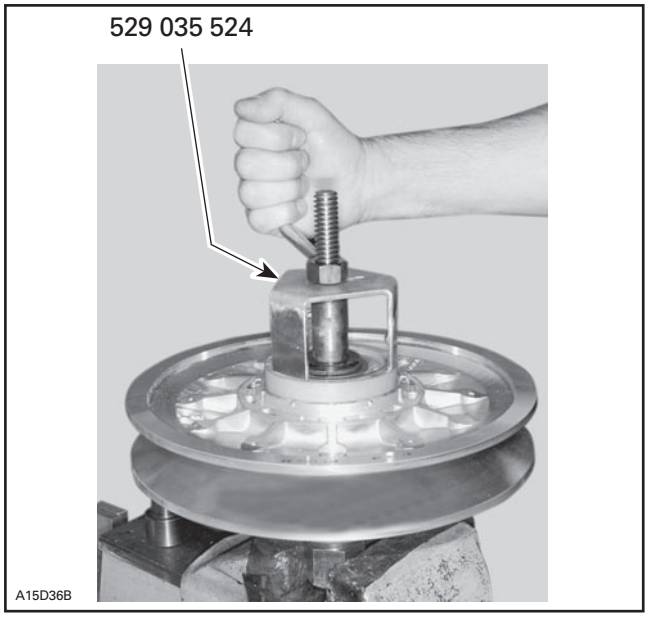
CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

Skandic LT/LT E



DISASSEMBLY

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



TYPICAL

Remove half keys **no. 3** and spacer **no. 4** to disassemble the outer cam and the 2 pulley halves.

⚠ WARNING

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

INSPECTION

Replace bushing(s) if worn more than specified.

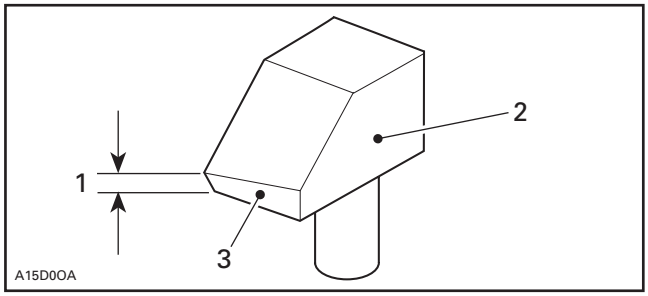
DRIVEN PULLEY BUSHING WEAR LIMIT mm (in)	
Small bushing	38.30 (1.508)
Large bushing	108.2 (4.260)

10,11, Slider Shoe

Black slider shoe = forward

Red slider shoe = reverse

Check cam slider shoes for wear. Replace when inside edge thickness of cam slider shoe slope base is 1 mm (.039 in) or less.



1. *Measure thickness of slope base here*
2. *Sliding pulley side*
3. *Slope base*

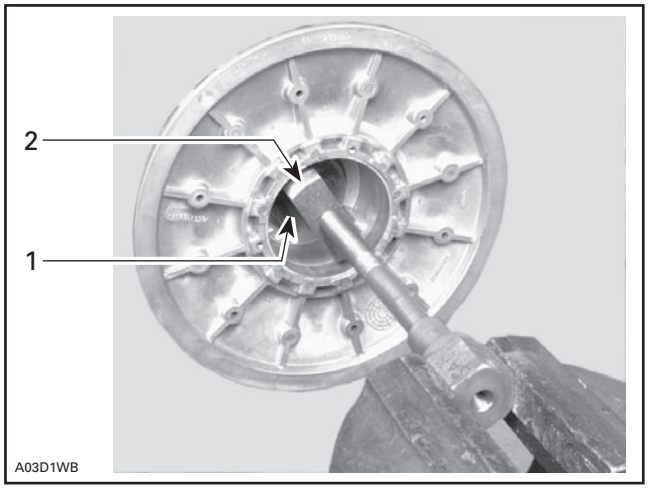
Bushing Replacement

Large Bushing

Remove Allen screws if applicable. Heat to break Loctite bond.

Install support plate (P/N 529 031 100) (included in tool) inside sliding half.

Place extractor (P/N 529 035 575) below bushing.



TYPICAL
1. *Support plate*
2. *Extractor*

Mount screw head of pulley spring compressor (P/N 529 035 524) in a vise.

Turn pulley half by hand to extract old bushing.

Before bushing installation, file sliding half bore to remove burrs from crimping areas.

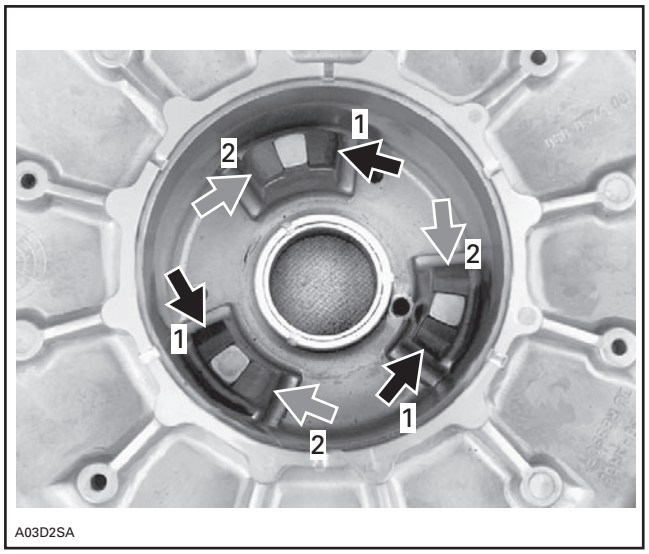
Coat bushing outside diameter with Loctite 609 (P/N 413 703 100). Place new bushing on sliding half and slightly tap to engage squarely the bushing in the sliding.

ASSEMBLY

10,11, Cam Slider Shoe

When replacing slider shoes, 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.



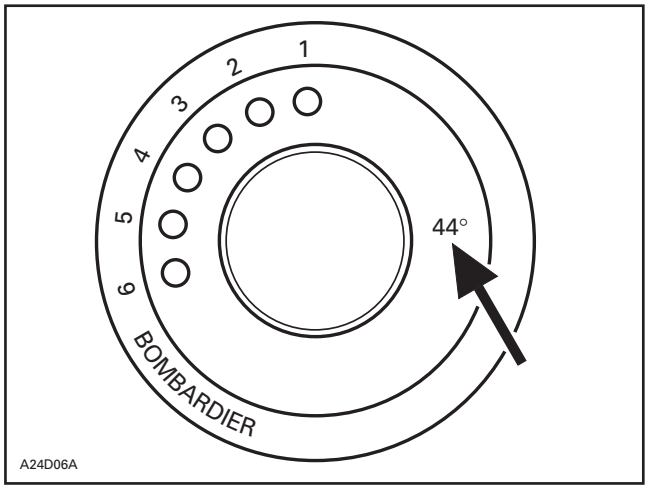
1. BLACK slider shoe
2. RED slider shoe

Assemble driven pulley components by reversing the disassembly procedure.

5,6,7, Cam, Guard and Spring

Make sure to install proper cam. Refer to TECHNICAL DATA.

Cam angle is identified on cam.

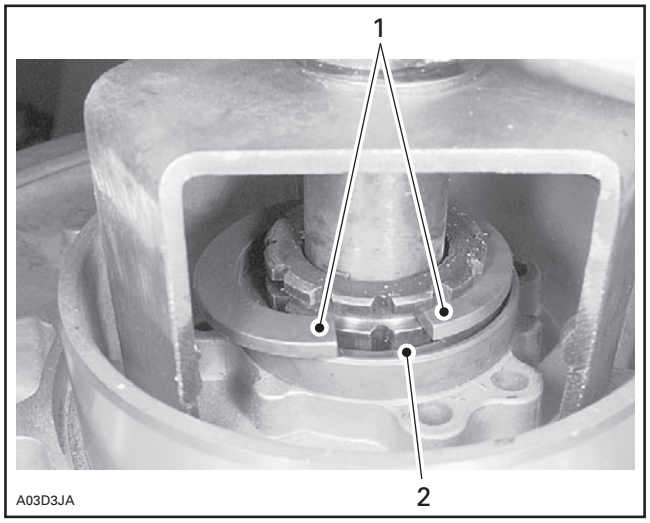


Position guard **no. 6** in cam **no. 5** then insert spring in adjusting hole **no. 3** (mid-hole) into outer cam.

Compress outer cam using pulley spring compressor (P/N 529 035 524).

Install spacer **no. 4** then secure outer cam with half keys **no. 3**, as shown in the next photo.

CAUTION: Ensure that half keys are properly inserted into shaft groove and that spacer recess is facing half keys.



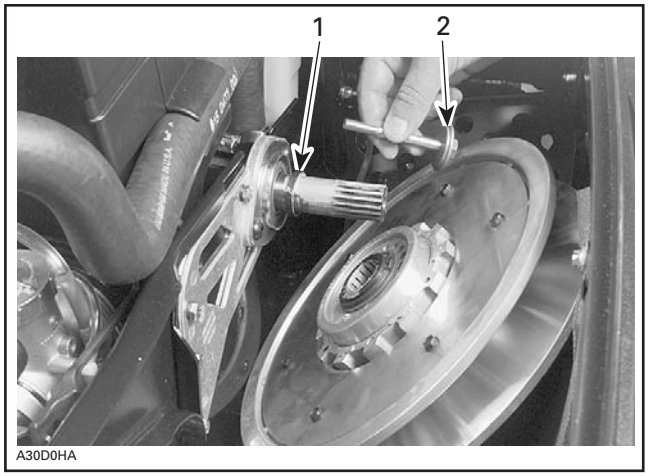
1. Half keys inserted into shaft groove
2. Spacer recess facing half keys

INSTALLATION

1, Countershaft

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

Make sure that spacer **no. 2** is on countershaft before installing driven pulley. Note also that washer shoulder is facing driven pulley.



TYPICAL
1. Spacer
2. Shoulder on this side

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.

14, Pulley Retaining Screw

Torque to 25 N•m (18 lbf•ft).

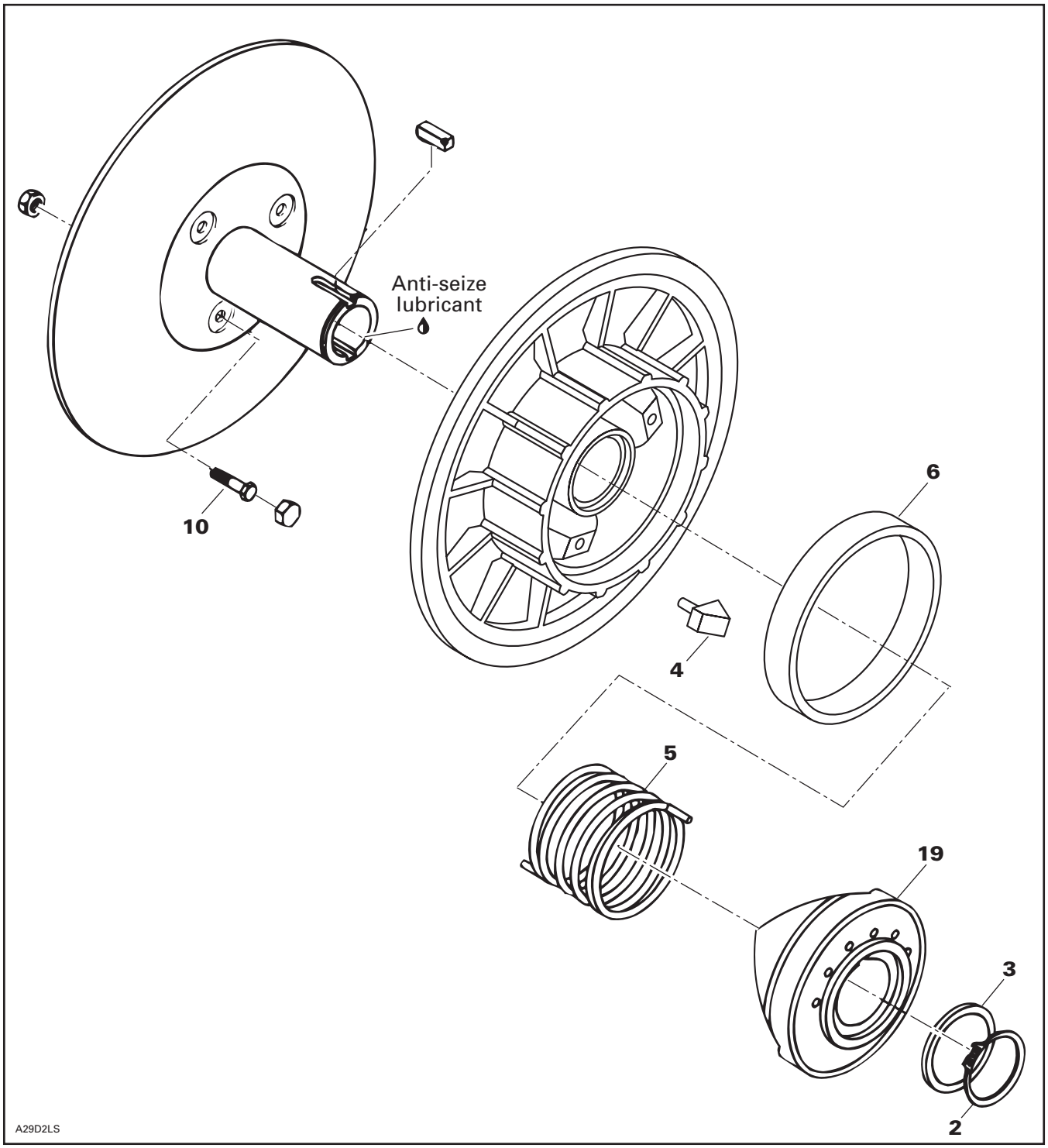
ADJUSTMENT

Pulley Alignment and Drive Belt Deflection

Refer to PULLEY DISTANCE AND 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.

Skandic WT/WT LC/SWT/SUV/Expedition TUV



REMOVAL

Remove guard and drive belt from vehicle.

Remove the screw, and washer then pull the driven pulley from the shaft.

DISASSEMBLY

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

Remove snap ring **no. 2** and washer **no. 3** to disassemble the outer cam and the 2 pulley halves.

⚠ WARNING

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

CLEANING

6, Bushing

During break-in period (about 10 hours of use), teflon from bushing 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).

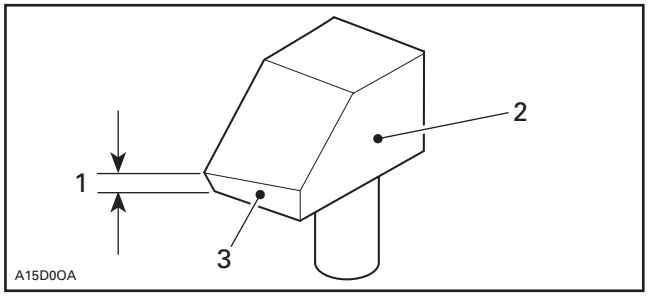
INSPECTION

6, Bushing

Check for cracks, scratch and for free movement when assembled to fixed half.

4, Slider Shoe

Check cam slider shoes for wear. Replace when inside edge 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

ASSEMBLY

4, Cam Slider Shoe

When replacing slider shoes, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

19, Cam

Coat cam interior with anti-seize lubricant.

INSTALLATION

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

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height in driven pulley. Turn screws **no. 10** equally accordingly.

5, Spring

General

It is usual to experience spring setting during breaking period of a new spring. The factory spring preload is slightly higher (about 1 kg (2 lb)) to compensate for spring setting. Specifications in TECHNICAL DATA are applicable after break-in period (about 10 hours of use).

Spring Torsional Pre-Load

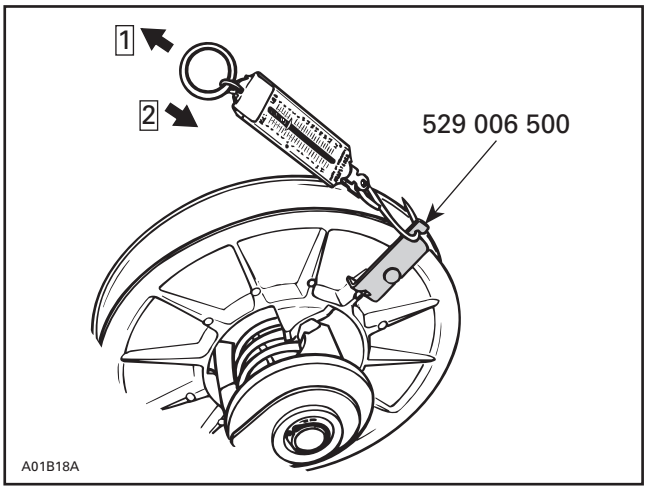
To check spring preload adjustment, use spring scale hook (P/N 529 006 500) and a spring scale.

Remove drive belt.

Install the hook on the sliding half. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take 1st measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold fish scale at this position. Slowly release tension from fish scale and take 2nd measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

1ST MEASUREMENT (when opening)	+	2ND MEASUREMENT (when closing)	=	SPRING PRELOAD
2				
EXAMPLE: 3.8 KG (8.4 LB) (when opening)	+	3.4 KG (7.5 LB) (when closing)	=	3.6 KG (8 LB) ACTUAL SPRING PRELOAD
2				



TYPICAL
Step 1: 1st measurement
Step 2: 2nd measurement

To adjust spring preload, relocate spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Deflection

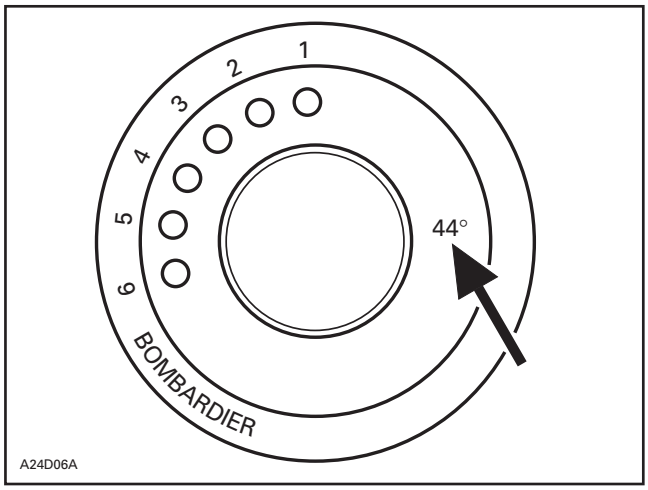
Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

19, Cam

Make sure to install proper cam. 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.

PULLEY DISTANCE AND ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
driven pulley opening tool	529 034 200	381
driven pulley opening tool	529 035 501	381

GENERAL

The pulley distance we will refer to in this section, is the space separating the drive and driven pulley outside diameters (Z measurement).

This basic distance is provided as an assembly guide and indicates the dimensions between which satisfactory belt deflection will be obtained.

Both pulley distance adjustment and pulley alignment must be carried 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.

Z = Distance between outside diameter of pulleys.

GENERAL PROCEDURE

Remove guard.

Tundra

Use driven pulley opening tool (P/N 529 034 200).

Skandic LT/LT E

Use driven pulley opening tool (P/N 529 035 501).

All Models

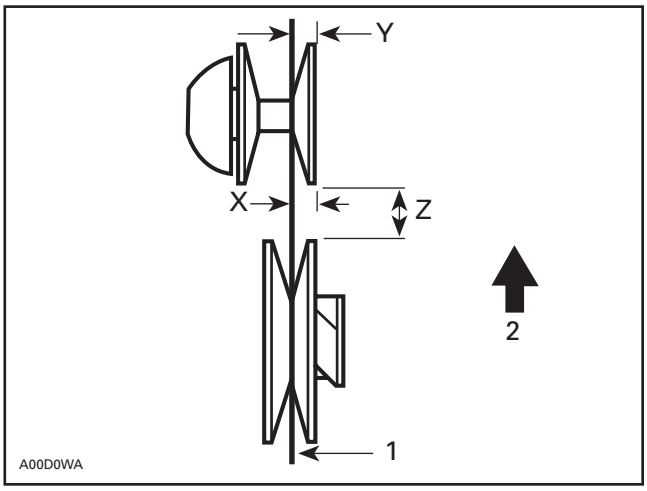
Remove drive belt.

Insert a straight bar 9.5 mm (.375 in) square, 48 cm (19 in) long or the proper alignment bar into the opened driven pulley.

Measuring Procedure

Using Straight Bar

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).



1. Straight bar
2. Front of vehicle

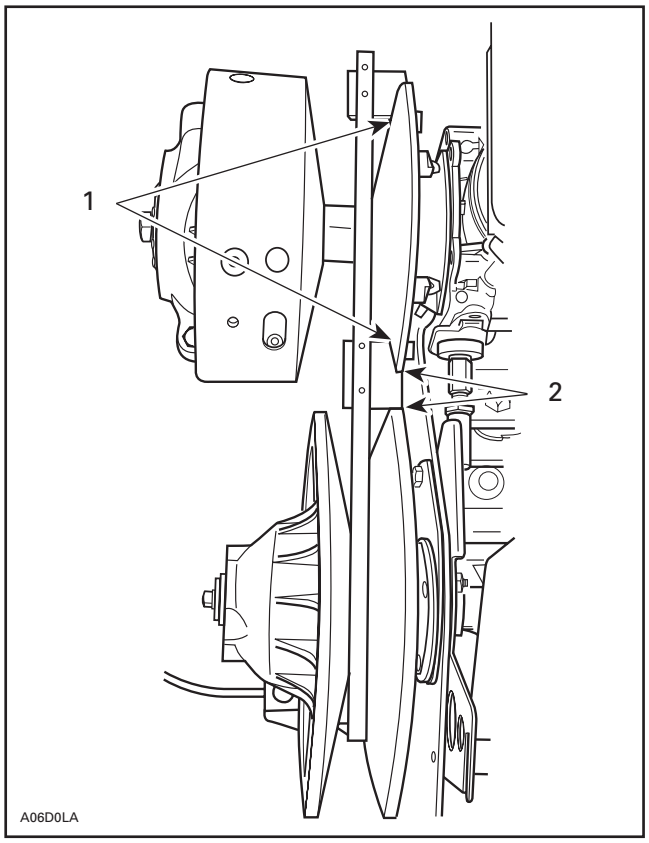
The distance Y must exceed distance X to compensate for the twist due to the engine torque.

Mean Value Procedure and Quick Alignment and Distance Check

Alignment bar tabs must fully contact fixed half of drive pulley.

Pulley distance is correct when tab contacts both pulley halves.

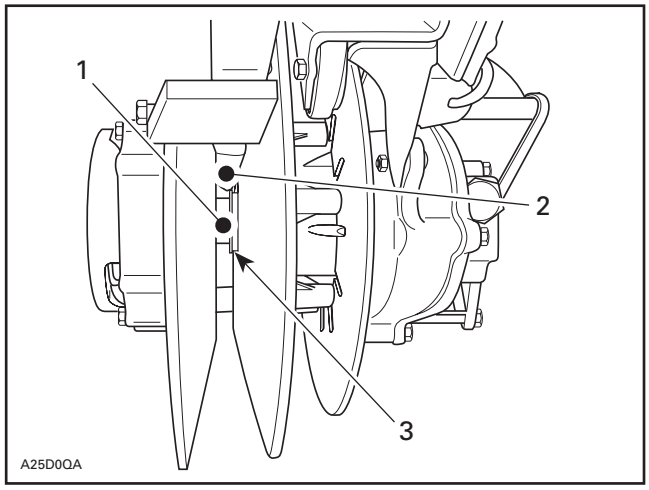
Refer to chart on next page for proper alignment bar.



TYPICAL
1. Contact (alignment)
2. Contact (distance)

Tundra

Bottom of alignment bar must not seat on shaft nor fixed half shoulder and shim(s).



TYPICAL
1. Shaft
2. Alignment bar
3. Fixed half shoulder and shim(s)

Drive Belt Height

NOTE: When pulley distance and alignment are adjusted to specifications, refer to DRIVE BELT to adjust drive belt height.

CAUTION: This section deals mainly with adjustment procedures. For complete assembly requirements, refer to the proper ENGINE or TRANSMISSION installation section.

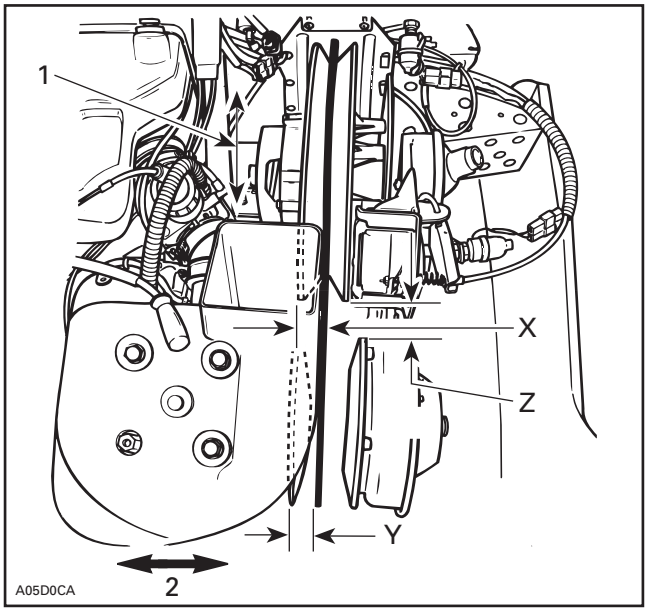
PULLEY ALIGNMENT AND DISTANCE SPECIFICATIONS CHART

MODELS	PULLEY DISTANCE	OFFSET		ALIGNMENT BAR ① P/N
	Z	X	Y-X	
Tundra	37.0 + 0 - 1.5 mm (1.457 + 0 - 0.3 in)	36.0 ± 1.0 mm (1.417 ± .040 in)	0 to 1.5 mm (0 to .060 in)	529 026 900
Skandic LT/LT E	39.0 + 0 - 1.0 mm (1.535 + 0 - .039 in)	37.0 ± 0.75 mm (1.457 ± .030 in)	0.75 to 1.5 mm (.030 to .060 in)	529 035 808
Skandic WT/SWT/SUV 550	41.8 + 0 - 1.0 mm (1.645 + 0 - .039 in)	35.0 ± 0.75 mm (1.380 ± .030 in)	0.75 to 2.25 mm (.030 to .086 in)	529 035 974
Skandic WT LC/SUV 600	35.5 + 0 - 1.0 mm (1.400 + 0 - .039 in)	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	529 035 545
Expedition TUV 600 HO SDI	61 + 0 - 1.0 mm	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	(Universal) 529 035 831
Expedition TUV V-1000	61 + 0 - 1.0 mm	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	

① Alignment bars have been made according to pulley alignment mean values. However, they do not take into account allowed tolerances for alignment specifications. They are used as GO/NOGO gauges for quick alignment and pulley distance check and as reference to reach alignment nominal values.

Pulley Distance Adjustment Method

Tundra

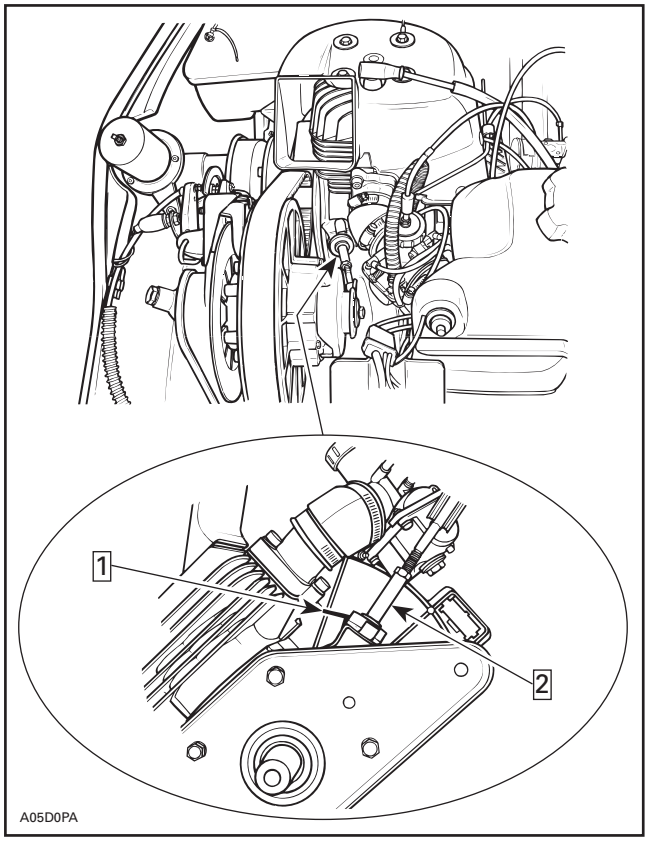


1. Driven pulley movement
2. Engine movement

CAUTION: The rear suspension must be mounted on the vehicle and track tension and alignment must be done to provide the right frame width.

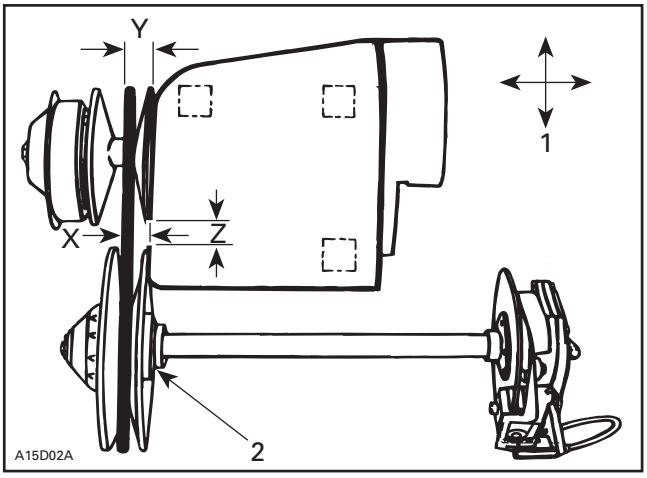
Loosen the 4 chaincase retaining bolts, unlock and raise pulley support.

Move chaincase to obtain specific adjustment and adjust driven pulley support length accordingly (light contact).



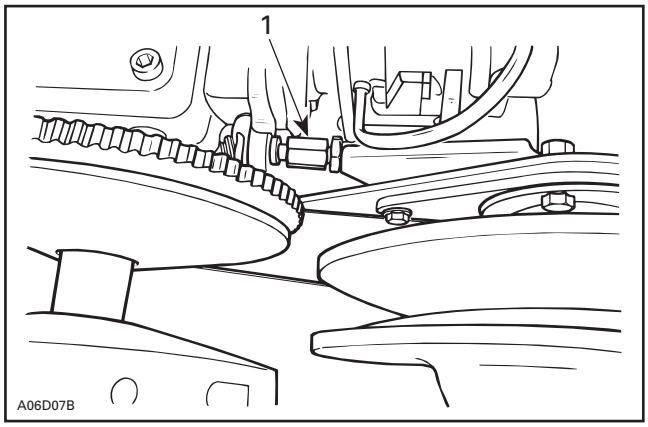
Step 1: Push and hold
Step 2: Raise support

Skandic LT/LT E



TYPICAL
1. Engine movement
2. Contact

NOTE: Prior to performing pulley adjustment, loosen torque rod nut to allow engine movement. Engine supports have tendency to stick to frame, work engine loose prior to aligning.



1. Loosen

Engine Movement

The engine support has slotted mounting holes. Move engine to obtain specified distance between pulleys.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws and move gearbox accordingly.

Retighten screws.

Pulley Alignment Method

Tundra

Engine Movement

Loosen the support retaining bolts.

Move the engine to obtain specified pulley alignment, torque engine support bolts to 55 N•m (41 lbf•ft) and remove engine support positioner.

Driven Pulley Movement

Shims can be mounted between chaincase and frame. Use shim (P/N 504 039 800), 0.53 mm (.021 in) thick.

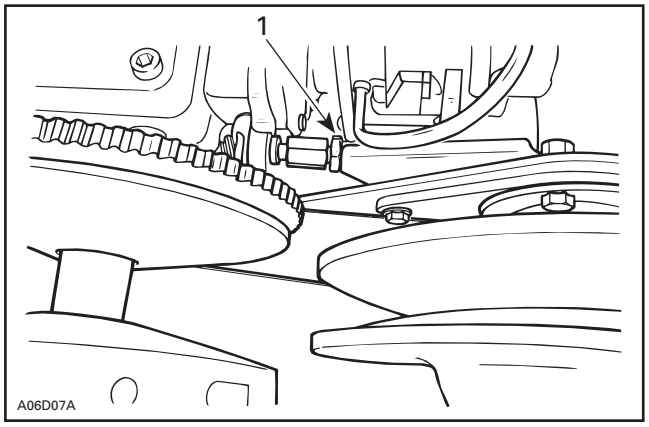
Skandic LT/LT E

When engine slotted mounting holes do not allow to set proper pulley offset X, adjust with shims (P/N 504 108 200) between pulley and countershaft bearing support (pulley pushed toward brake disc).

Engine Movement

Loosen the 4 bolts retaining engine support to the frame. Position engine to obtain the specified alignment.

NOTE: After alignment, adjust torque rod so it slightly contacts stopper plate. Do not over tighten, it will disalign pulleys.



1. Retighten

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws.

Install or remove shims accordingly.

Retighten screws.

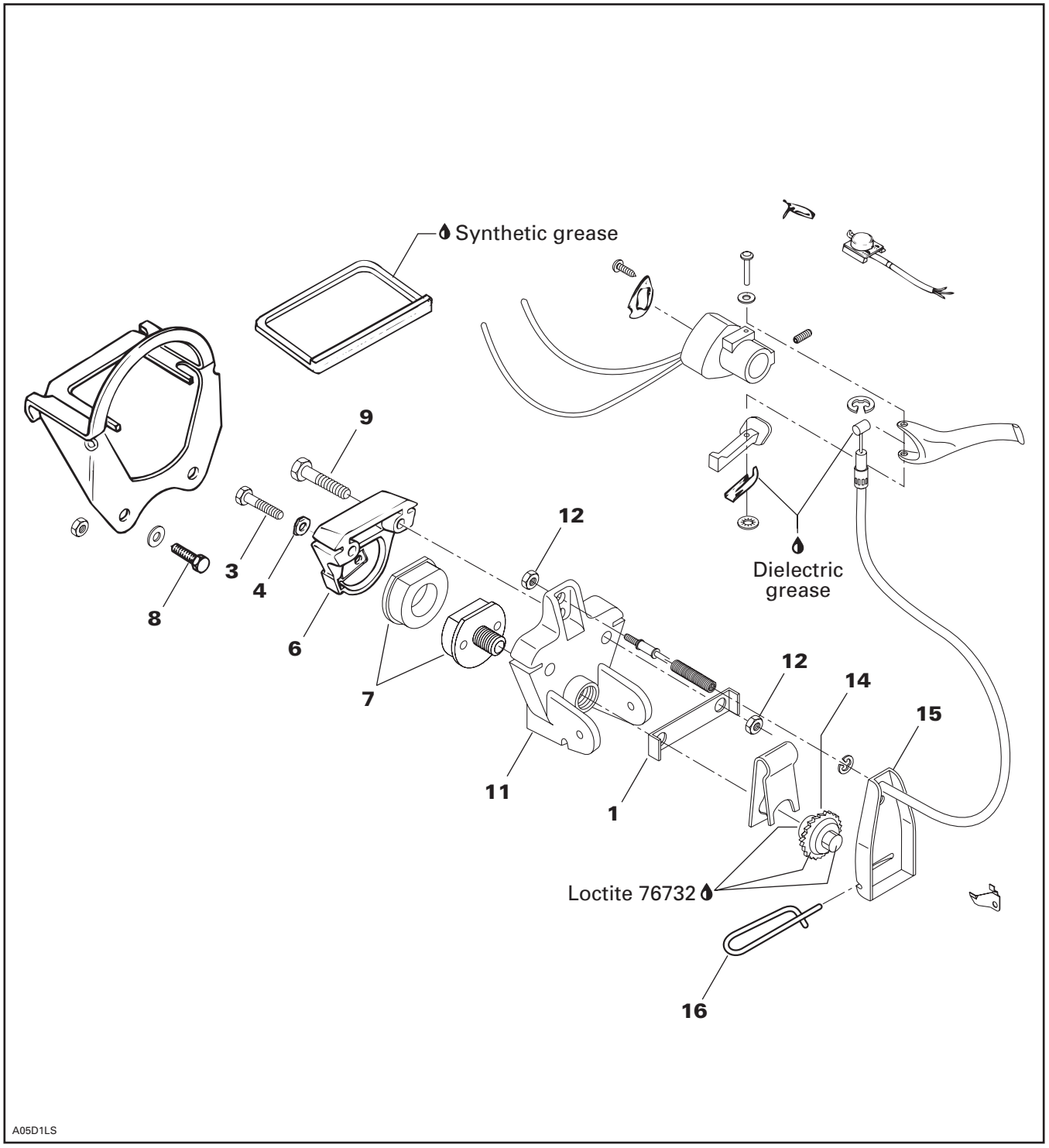
BRAKE

SERVICE PRODUCTS

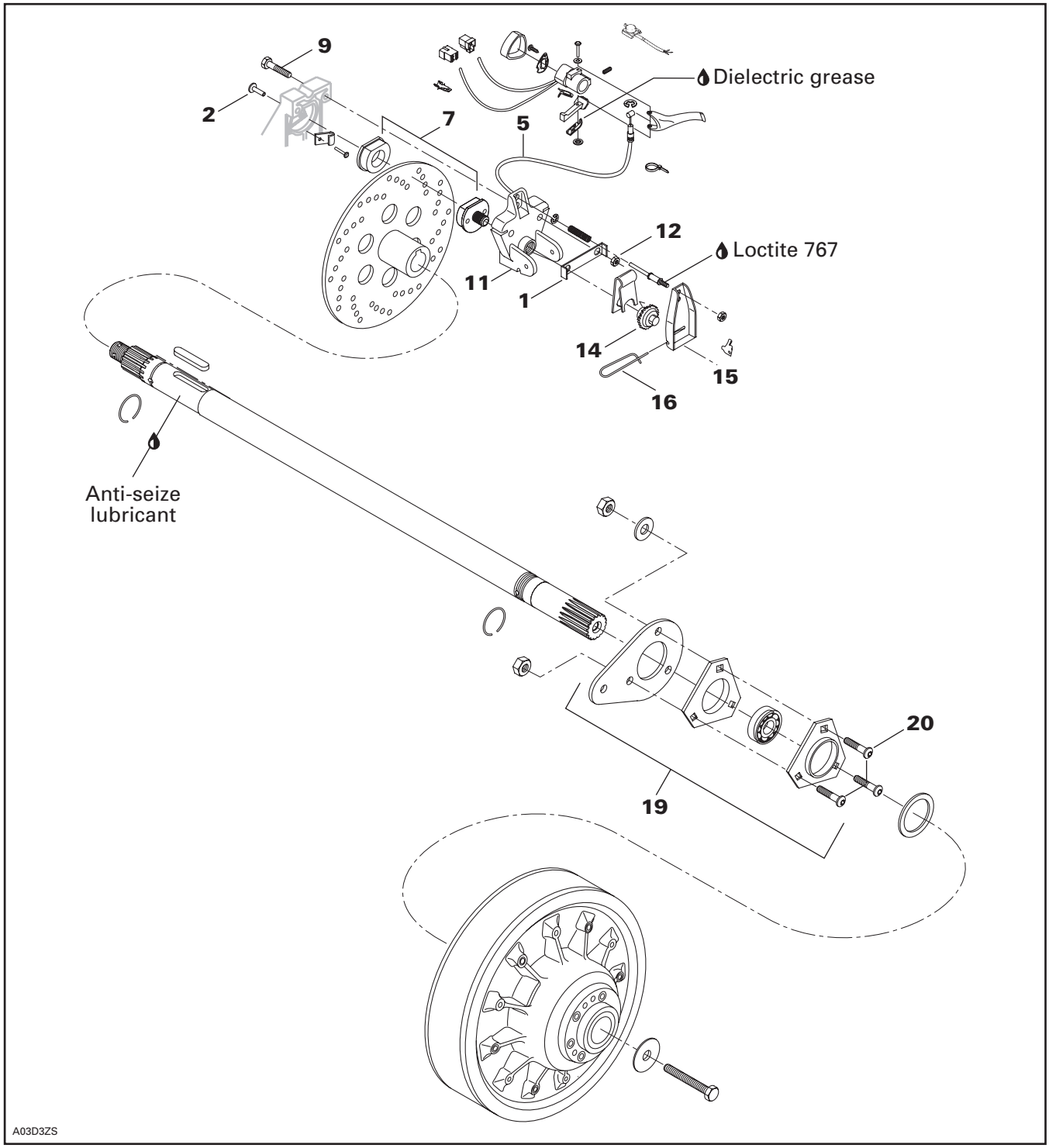
Description	Part Number	Page
anti-seize lubricant	413 701 000	393
brake fluid GTLMA (DOT 4)	293 600 062	391, 395
brake fluid SRF (DOT 4)	293 600 063	391, 395
synthetic grease	413 711 500	393

MECHANICAL BRAKE

Tundra

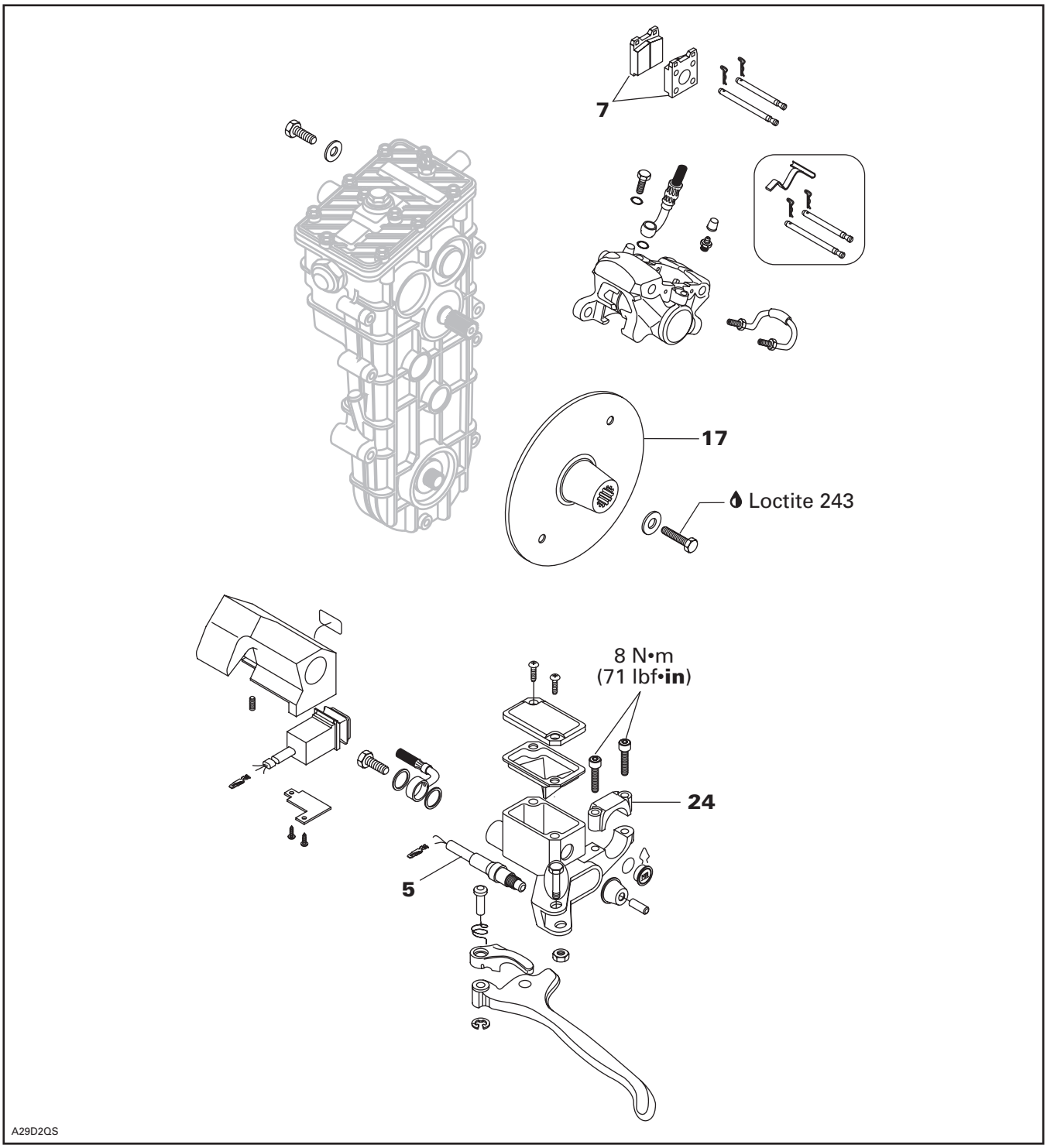


Skandic LT


9
2
7
5
Dielectric grease
12
Loctite 767
11
1
14
15
16
Anti-seize
lubricant
20
19
A03D3ZS

HYDRAULIC BRAKE

Skandic WT/SWT/WT LC/SUV/Expedition TUV



BRAKE FLUID TYPE

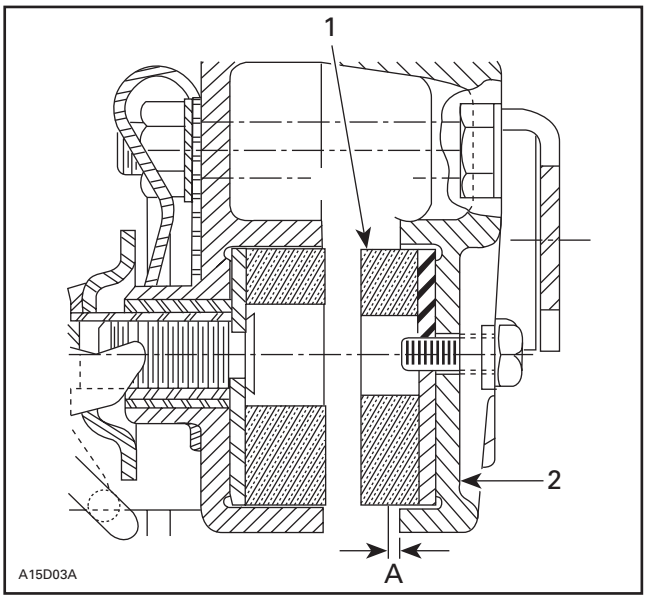
Use recommended brake fluid SRF (DOT 4) (P/N 293 600 063) or brake fluid GTLMA (DOT 4) (P/N 293 600 062).

BRAKE PADS REPLACEMENT

Models with Mechanical Brake

Brake pads must be replaced when fixed pad projects only 1 mm (1/32 in) from caliper.

CAUTION: Brake pads must always be replaced in pairs.



TYPICAL
1. *Fixed pad*
2. *Inner caliper*

A. 1 mm (1/32 in) minimum

Removal

Pull pin **no. 16** out of caliper and remove lever **no. 15**.

Fixed pad is riveted to chaincase on these models. Caliper must be split to remove moving pad. To remove fixed pad, drill out its rivet **no. 2** then pry disc in order to free fixed pad.

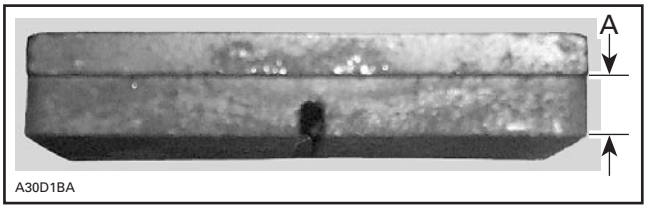
Installation

Reverse removal procedure.

All Models with Hydraulic Brake

Brake pads must be replaced when lining is 1 mm (1/32 in) thick or less.

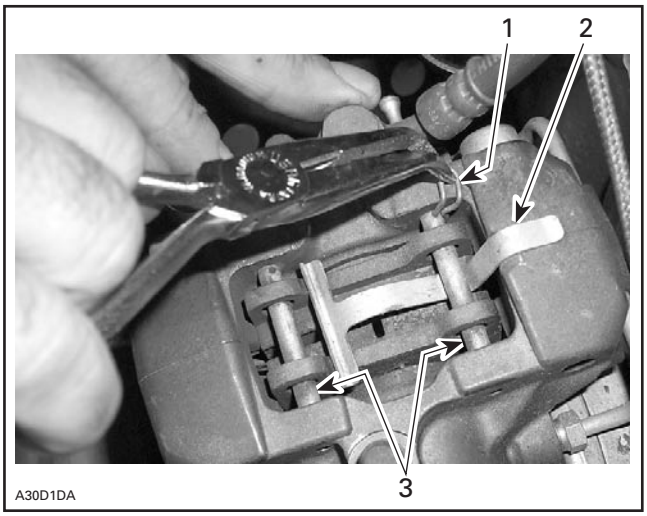
CAUTION: Brake pads must always be replaced in pairs.



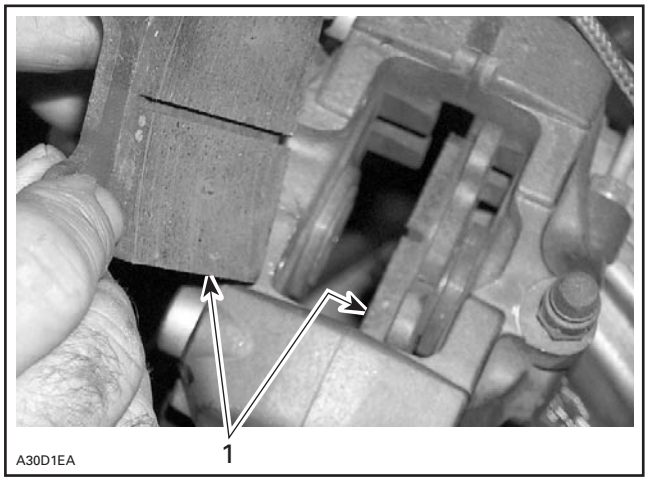
A. 1 mm (1/32 in) minimum

Removal

Brake pads removal procedure is as follows:
- Remove 2 retainers from the pins.
- Pull out 2 pins which releases the spring.
- Remove the brake pads.



TYPICAL
1. *Retainer*
2. *Spring*
3. *Pin*



TYPICAL
1. Brake pad

Installation

– Install new brake pads.
– Install spring and push 2 pins to lock the brake pads.
– Install 2 retainers in the pin holes.

⚠ WARNING

Avoid getting oil on brake pads.

Press the brake lever until both new pads are touching the brake disc.

REMOVAL

Brake Disc Removal

Tundra R

The split caliper type brake should be removed from chaincase as an assembly. Proceed as follows:

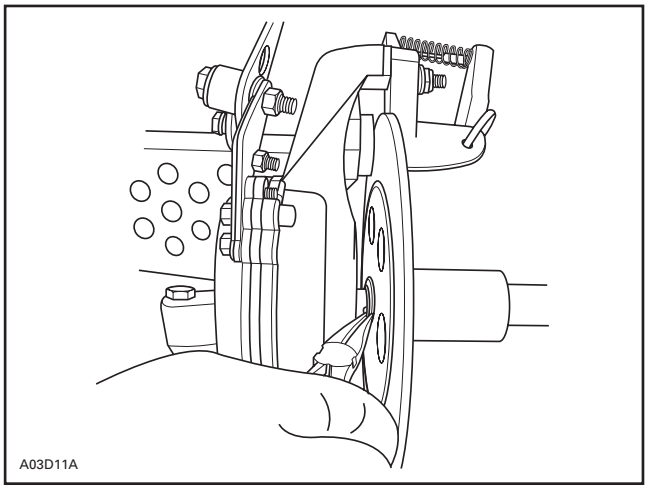
– Remove guard.
– Disconnect brake cable.
– Remove bolts **no. 8** securing brake support to chaincase.
– Slide brake caliper ass'y out of brake support.
– To remove brake disc, driven pulley has to be removed first. Refer to DRIVEN PULLEY.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

– Remove caliper by unscrewing M10 Allen screws.
– Unbolt disc.

Skandic LT

– Remove caliper.
– Remove guard, belt and driven pulley.
– Remove air silencer.
– Unbolt bearing support **no. 19** from chassis.
– Open chaincase and remove upper sprocket.
– Pull countershaft assembly toward driven pulley side to gain access to clip **no. 25**.
– Remove clip **no. 25** on countershaft.



– Pull countershaft toward driven pulley side to free from chaincase and disc.
– Remove disc.

DISASSEMBLY

7,15,16,23, Brake Pad, Brake Lever, Pin and Screw

All Models with Mechanical Brake

Pull pin **no. 16** out of caliper and remove lever **no. 15**.

Fixed pad is riveted to chaincase on these models. Caliper must be split to remove moving pad. To removed fixed pad, drill out its rivet **no. 2** then pry disc in order to free fixed pad.

All Models with Hydraulic Brake

Only brake pads are available as spare parts. If caliper or master cylinder are damaged, replace each of them as an assembly.

CLEANING

Clean all metal components in a general purpose solvent. Thoroughly dry all components before assembling.

CAUTION: Do not clean brake pads in solvent. Soiled brake pads must be replaced by new ones.

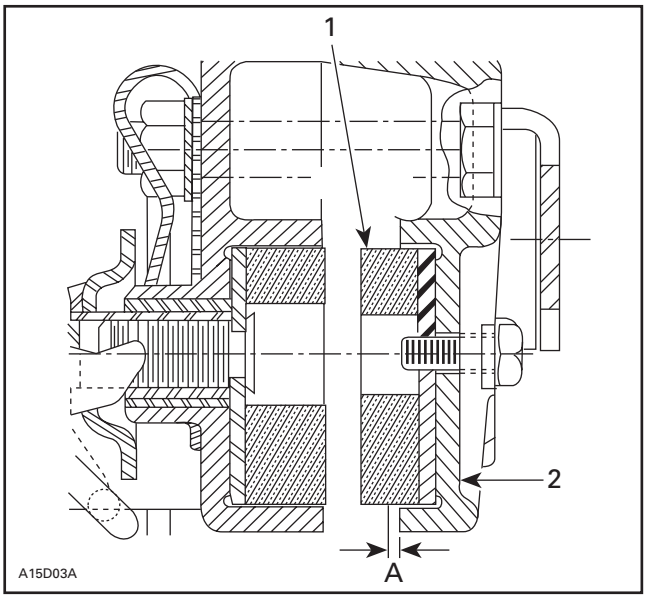
INSPECTION

7, Brake Pad

Models with Mechanical Brake

Brake pads must be replaced when fixed pad projects only 1 mm (1/32 in) from caliper.

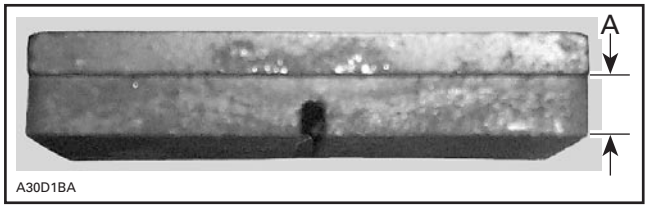
CAUTION: Brake pads must always be replaced in pairs.



TYPICAL
1. Fixed pad
2. Inner caliper
A. 1 mm (1/32 in) minimum

Models with Hydraulic Brake

Brake pads must be replaced when lining is 1 mm (1/32 in) thick.



A. 1 mm (1/32 in) minimum

CAUTION: Brake pads must always be replaced in pairs.

Brake Disc

All Models

Check for scoring, cracking or heat discoloration, replace as required.

CAUTION: Brake disc should never be machined.

ASSEMBLY

14, Ratchet Wheel

Apply synthetic grease (P/N 413 711 500) on threads and spring seat prior to installing. Fully tighten then back off one turn.

16, Pin

Install so that it can only be removed upward. Lock it in the caliper casting notch.

INSTALLATION

To install brake, reverse removal procedure paying attention to the following.

⚠ WARNING

Avoid getting oil on brake pads. Do not lubricate or apply antirust or antifreeze solution in brake cable.

17, Brake Disc

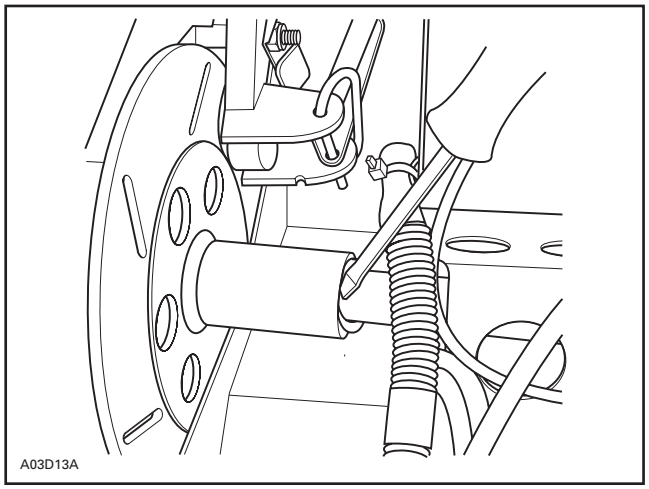
Skandic LT

The brake disc must be floating on countershaft for efficient operation of brake.

Apply anti-seize lubricant (P/N 413 701 000) on shaft and check that disc slides freely.

The disc hub exceeds the disc more from one side than from the other. Install disc with the longer exceeding portion toward driven pulley.

Push O-rings inside disc hub.

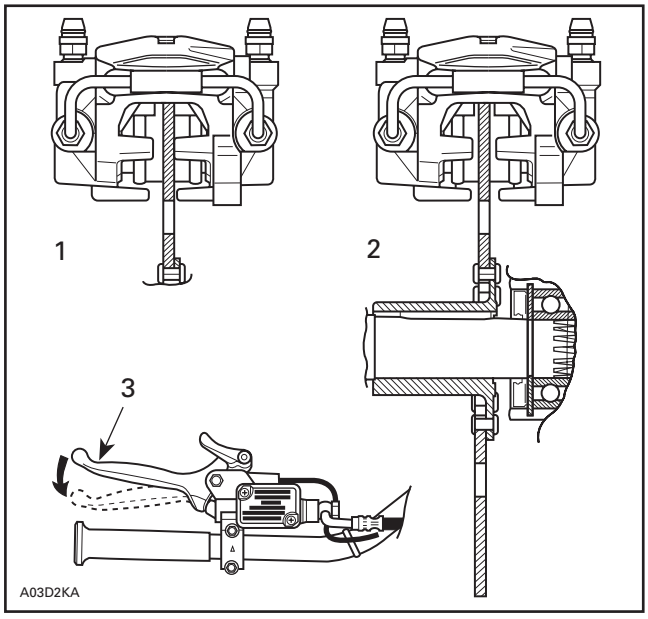


7, Brake Pad

Models with Hydraulic Brake

After brake pads installation, brake disc must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



1. Brake disc not centered
2. Brake disc centered
3. Apply brake before checking

Apply brake then recheck.

1,11,12, Locking Tab, Outer Caliper and Nut

Skandic LT

Install caliper retaining bolts.

Assemble outer caliper. Install locking tab then nuts. Torque nuts to 24 N•m (18 lbf•ft). Bend locking tab over a flat of each nut.

5,12, Brake Cable and Nut

Insert brake cable into upper hole in brake lever and caliper. Install nut and tighten until a few threads exceed.

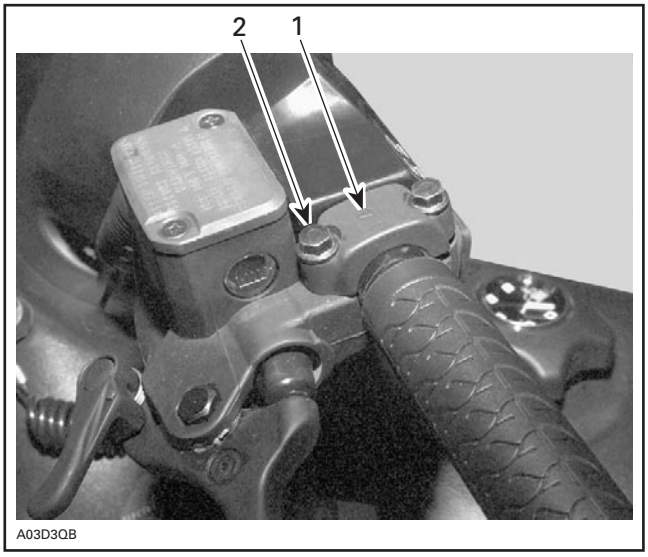
⚠ WARNING

At least 3 threads must exceed the elastic stop nut.

24, Upper Clamp

Models with Hydraulic Brake

Install upper clamp with its arrow pointing at front of vehicle. Tighten to 8 N•m (71 lbf•**in**) front screw before rear one.



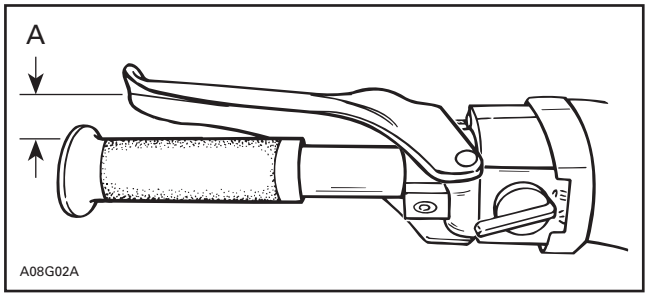
TYPICAL
1. Arrow on upper clamp pointing at front of vehicle
2. Tighten front screw first

ADJUSTMENT

Brake

Models with Mechanical Brake

Fully depress brake handle several times to obtain 13 mm (1/2 in) between brake handle and handlebar grip when brake is fully applied.



A. 13 mm (1/2 in)

Should this adjustment be unattainable, retighten nut no. 12 as needed.

Models with Hydraulic Brake

There is no adjustment on these models.

Change brake fluid once a year.

If brake handle feels spongy or if hydraulic system has been opened, the system must be bled, refer to BLEEDING PROCEDURE.

Brake Light

Skandic LT and Tundra Models Only

Brake light should light up before brake pads touch brake disc. To adjust, unscrew nut no. 12 until brake light goes on.

⚠ WARNING

At least one full thread must exceed the elastic stop nut.

Check brake adjustment as described above.

NOTE: If brake light adjustment is unattainable while respecting brake adjustment, ratchet wheel may be too far out. If so, tighten ratchet wheel.

Models with Hydraulic Brake

There is no adjustment on these models. Check that switch is securely installed.

BLEEDING

Change brake fluid once a year.

Bleed brake system as follows:

Keep sufficient brake fluid SRF (DOT 4) (P/N 293 600 063) or brake fluid GTLMA (DOT 4) (P/N 293 600 062) 4 brake fluid in reservoir at all times.

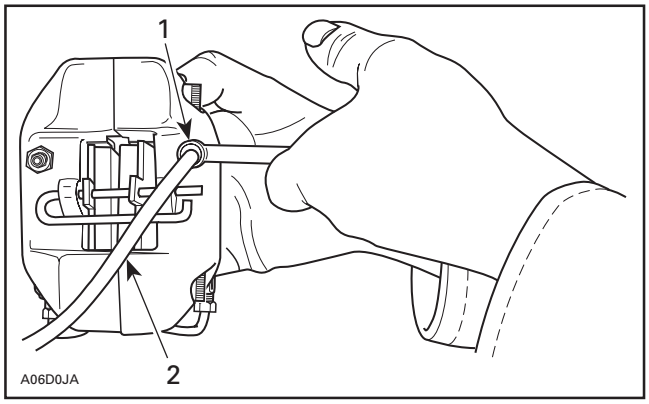
CAUTION: Use only SRF (DOT 4) (P/N 293 600 063) or GTLMA (DOT 4) (P/N 293 600 062) brake fluid.

Install a clear hose on left side bleeder. Route this hose to a container. Open bleeder.

Pump brake lever until no air escapes from hose.

Close bleeder.

Proceed the same way with the right side bleeder.



TYPICAL
1. Open bleeder
2. Clear hose to catch used brake fluid

⚠ WARNING

Avoid getting oil on brake pads. Do not lubricate or apply antirust or antifreeze solution in brake cable.

CHAINCASE

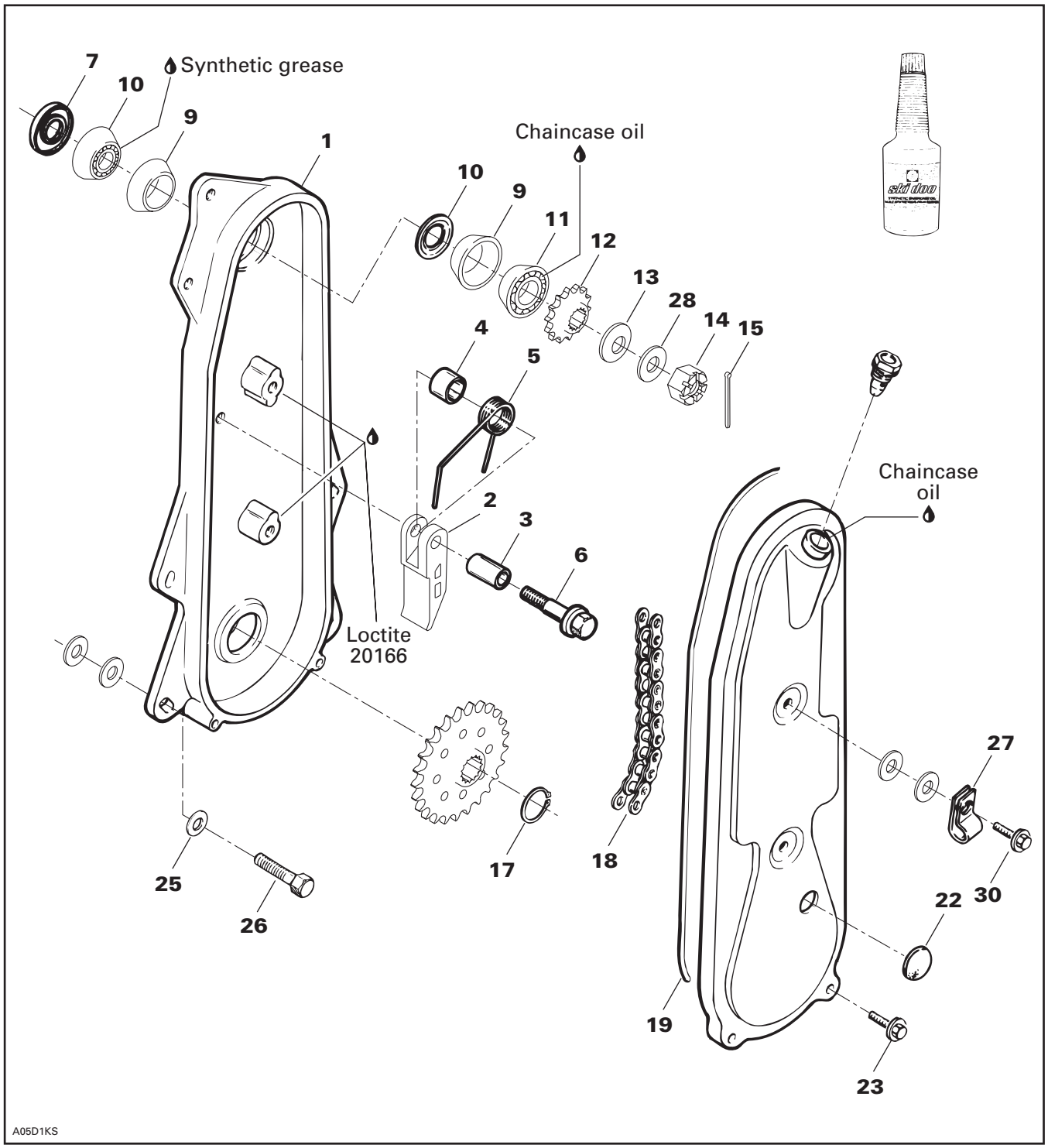
SERVICE TOOLS

Description	Part Number	Page
drive axle holder	529 007 200	399, 402
pusher	529 035 584	402

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 20166	293 800 066	400
Loctite 609	413 703 100	402
XP-S mineral chaincase oil	413 801 900	400
XP-S synthetic chaincase oil	413 803 300	403

Tundra

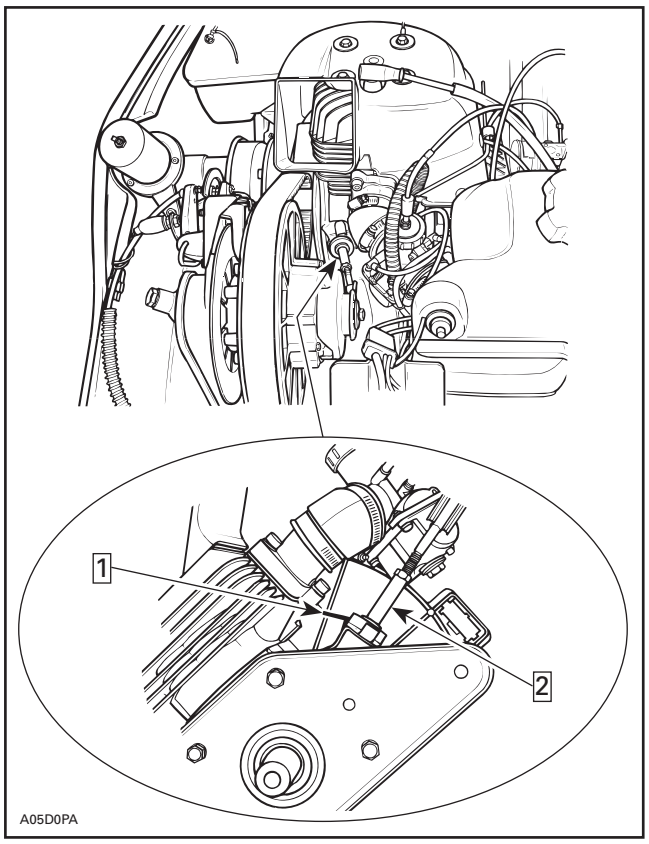

7
10
Synthetic grease
9
1
Chaincase oil
10
9
11
12
13
28
14
15
4
5
2
3
6
Loctite
20166
Chaincase
oil
27
17
18
25
26
22
30
19
23
A05D1KS

REMOVAL

Chaincase and driven pulley can be removed from the vehicle as an assembly.

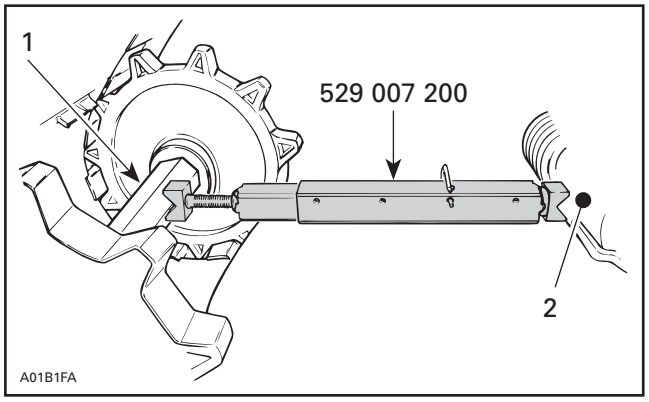
Remove guard and drive belt.

Unlock and raise driven pulley support.



Step 1: Push and hold
Step 2: Raise support

Release track tension. Install drive axle holder (P/N 529 007 200).



1. Drive axle
2. Suspension cross shaft

Remove chaincase cover **no. 20** and drain oil.

Remove right side drive axle bearing cover.

Remove circlip **no. 17**.

Move drive axle and track together to the right side as far as possible.

Unscrew the nut **no. 14** on the upper sprocket **no. 12**. Remove chain tensioner assembly **no. 2 to 6**, then simultaneously remove chain **no. 18** and both sprockets.

Remove the 4 cap screws **no. 26** securing chaincase to frame.

Chaincase and Driven Pulley Assembly

Using 2 large prybars inserted between chaincase and frame, pry complete assembly from vehicle.

DISASSEMBLY

Disassemble driven pulley from chaincase. Refer to DRIVEN PULLEY.

INSPECTION

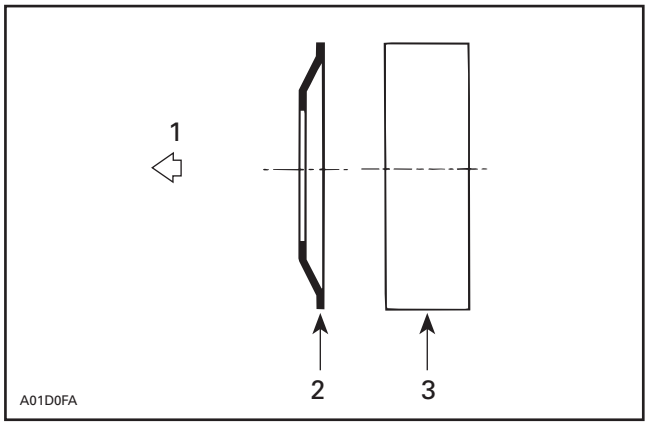
Visually inspect the chain for cracked, damaged or missing link rollers. Check for defective bearings, sprockets and worn chain tensioner components.

⚠ WARNING

If chain deflection is greater than 38 mm (1.5 in) (without chain tensioner), replace chain and check condition of sprockets.

ASSEMBLY

Position oil deflector ring **no. 10** then sit bearing in chaincase aperture. Install spacer then the other bearing.



1. Toward chaincase
2. Oil deflector
3. Bearing

1, Oil Seal

Using an appropriate pusher, press new oil seal **no. 7** into chaincase hub. Oil seal must sit flush with case hub edge.

INSTALLATION

Reverse removal procedure. Pay particular attention to the following:

Torque castellated nut 14 to 14 N•m (124 lbf•**in**), loosen then retorque to 0.5 - 2.5 N•m (5 - 22 lbf•**in**).

Apply Loctite 20166 (P/N 293 800 066) around both threaded holes of cover screws.

Grease new gasket **no. 19** with petroleum jelly, or other suitable product, and install it making sure it does not shift from its correct position. Tighten bolts evenly.

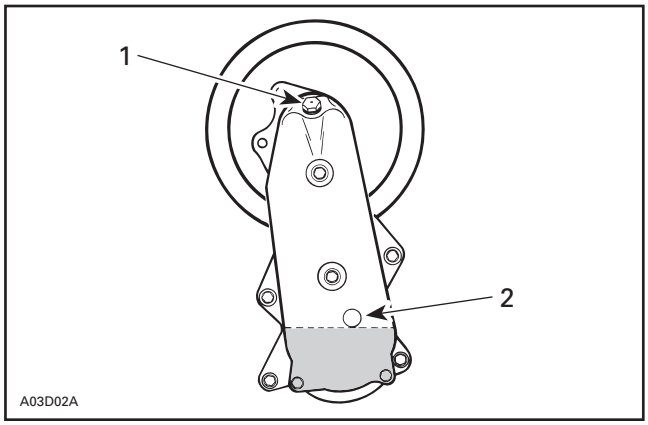
NOTE: Bottom pan has an emboss below chaincase housing to ease installation.

Chaincase Oil

Remove filler cap and pour 250 mL (8.5 fl. oz) of XP-S mineral chaincase oil (P/N 413 801 900) into chaincase.

NOTE: Chaincase oil capacity is 250 mL (8.5 fl. oz).

Check the oil level by removing the chaincase oil level plug.



1. Filler cap
2. Oil level plug

The oil should be leveled with the bottom of the oil level orifice.

Reinstall battery and connect cables on electric starting models.

CAUTION: Always connect positive RED cable first to prevent sparks.

ADJUSTMENT

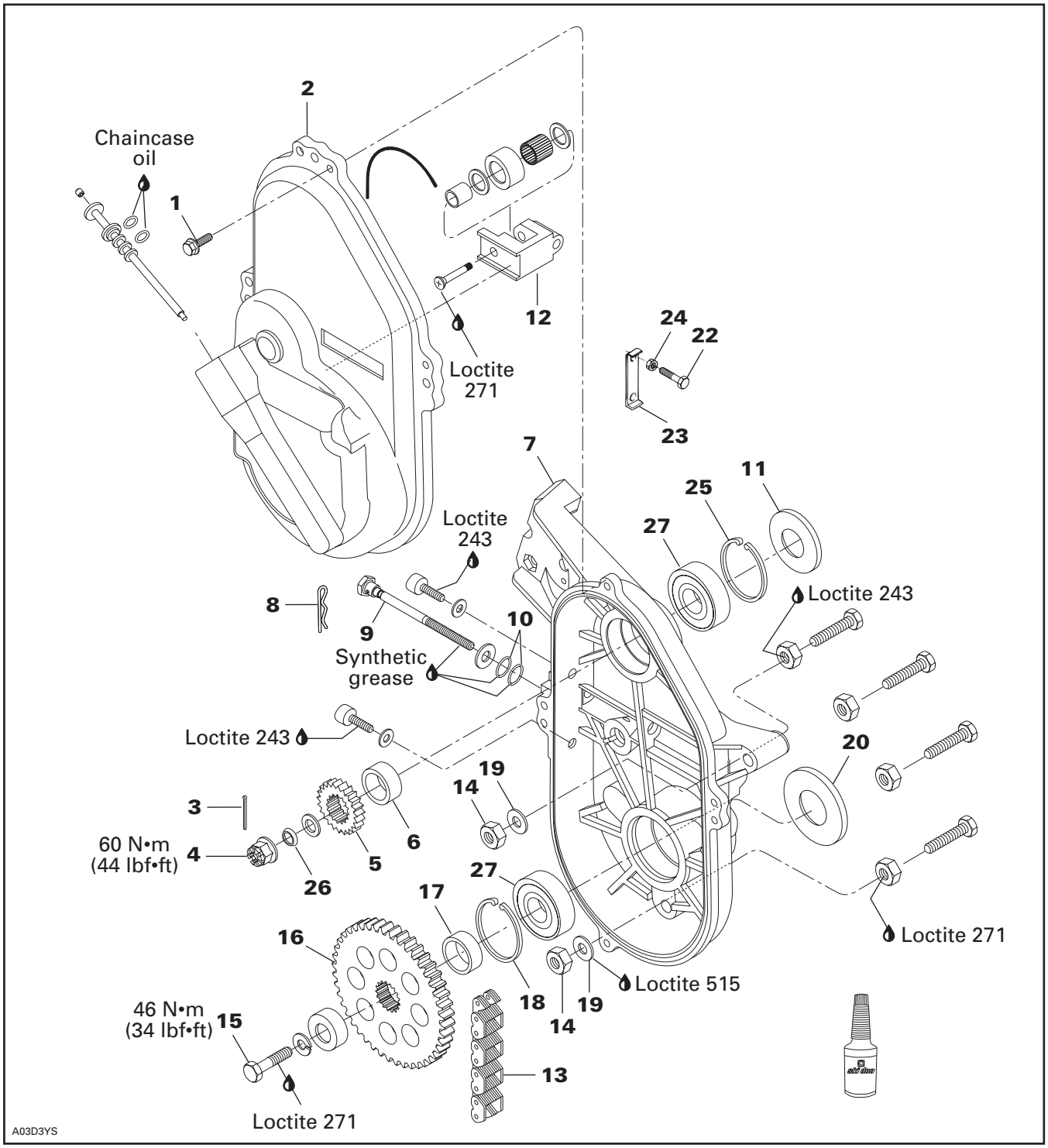
Pulley Alignment

Refer to PULLEY DISTANCE AND ALIGNMENT.

Track Tension and Alignment

Refer to TRACK.

Skandic LT


2
Chaincase oil
1
12
24
22
Loctite 271
23
7
11
25
27
Loctite 243
8
9
10
Synthetic grease
Loctite 243
Loctite 243
20
19
14
3
60 N•m (44 lbf•ft)
4
26
5
6
27
17
16
Loctite 515
18
19
14
46 N•m (34 lbf•ft)
15
13
Loctite 271
Loctite 271
A03D3YS

REMOVAL

To remove chaincase proceed as follows.

Remove tuned pipe and muffler.

⚠ WARNING

Never remove exhaust components when engine is hot.

Remove hair pin **no. 8**. Release drive chain tension by unscrewing tensioner adjustment screw.

Drain oil by removing chaincase cover **no. 2**.

Apply brakes.

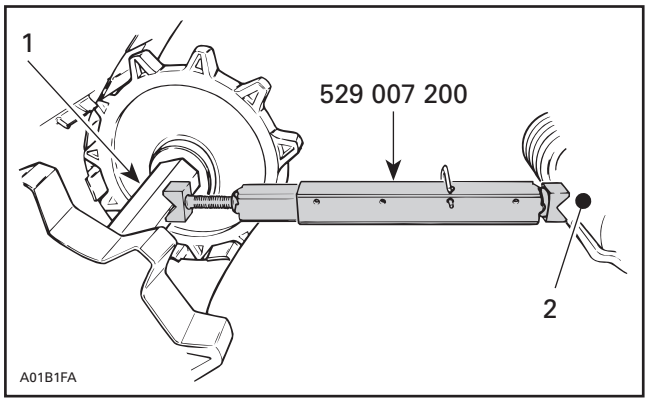
Remove cotter pin **no. 3**, nut **no. 4**, washer **no. 26** retaining upper sprocket **no. 5** and screw **no. 15** retaining lower sprocket **no. 16**. Pull sprockets and drive chain simultaneously. Remove shims **no. 6** and **no. 17**.

NOTE: Should countershaft removal be required, refer to BRAKE then look for BRAKE DISC.

Remove 5 nuts **no. 14**. Three nuts are behind the lower sprocket.

Unfold locking tab **no. 23**, then remove caliper retaining screws **no. 22**.

Release track tension, use drive axle holder (P/N 529 007 200).



TYPICAL
1. Drive axle
2. Suspension cross shaft

Pry out drive axle oil seal **no. 20** from chaincase.

Pull chaincase from drive axle and countershaft.

Using 2 prybars inserted between chaincase **no. 7** and frame, pry complete assembly from vehicle.

INSPECTION

Visually inspect the chain for cracked, damaged or missing links. Check for worn or defective bearings, sprockets and chain tensioner components.

⚠ WARNING

If chain deflection is greater than 38 mm (1.5 in) (without chain tensioner), replace chain and check condition of sprockets.

GEAR RATIO MODIFICATION

For particular applications, the number of teeth of the sprockets can be increased or decreased on lower and upper sprockets.

Refer to TECHNICAL DATA for gear ratios.

CAUTION: Gear ratio modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance.

NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude.

INSTALLATION

Reverse removal procedure and pay attention to the following. Replace oil seals, gaskets and O-rings.

Sealed side of bearing **no. 27** must face chaincase cover.

11, Oil Seal

Clean chaincase bore with cleaning solvent then apply Loctite 609 (P/N 413 703 100) to oil seal mounting surface (outside).

Using pusher (P/N 529 035 584), press the oil seal into chaincase hub. Oil seal must fit flush with the chaincase edge.

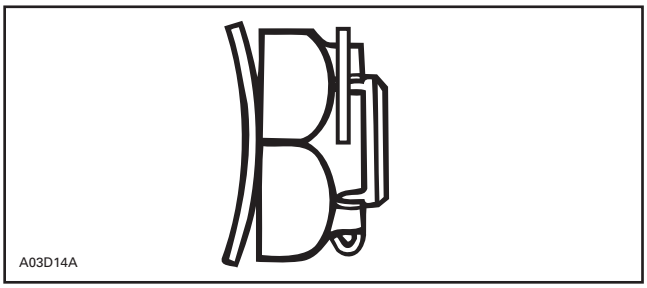
NOTE: Should installation procedure for countershaft be required, refer to BRAKE then look for BRAKE DISC AND COUNTERSHAFT BEARING ADJUSTMENT.

5,16, Sprockets

Position the sprockets with the writing facing the chaincase cover.

26, Conical Spring Washer

Install washer with its concave side towards sprocket.



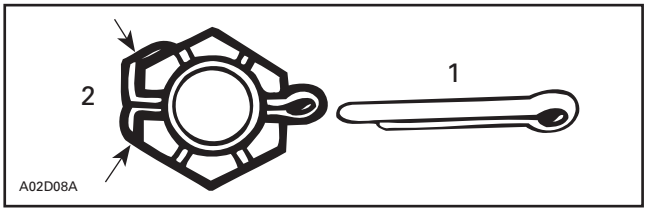
4, Upper Sprocket Castellated Nut

Torque to 60 N•m (44 lbf•ft).

Install new cotter pin in the position shown.

CAUTION: When removing a cotter pin always replace with a new one.

CAUTION: Cotter pin will rub on chaincase cover if installed otherwise.



1. New
2. Fold cotter pin over castellated nut flats only

18, Circlip

CAUTION: It is of the utmost importance to install the circlip otherwise damage to the chaincase components may occur.

DRIVE CHAIN ADJUSTMENT

NOTE: Brake disc key must be in good condition before checking chain free play.

10, O-Ring

Replace both O-rings **no. 10** on tensioner adjustment screw. Fully tighten tensioner adjustment screw by hand, then back off only far enough for hair pin to engage in locking hole.

This initial adjustment should provide 3 - 5 mm (1/8 - 13/64 in) free-play when measured at the outer circumference of the brake disc.

CAUTION: Free-play must not exceed 5 mm (13/64 in), readjust if necessary.

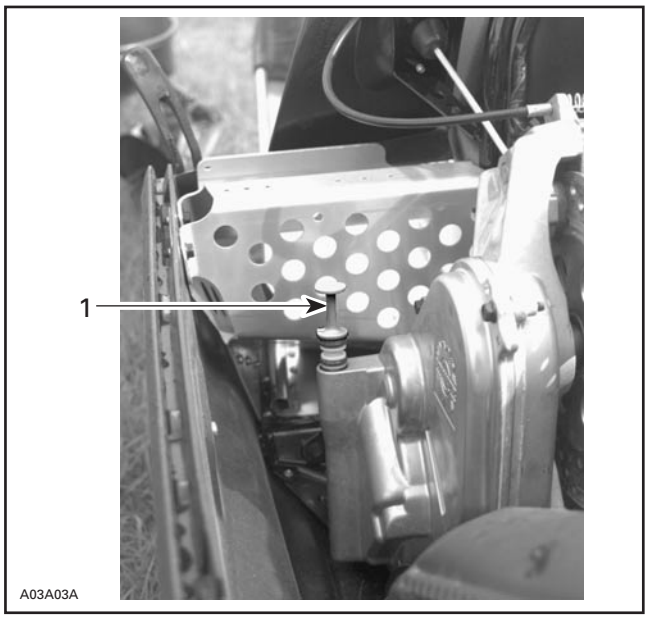
⚠ WARNING

If the specified free-play is not reached with the tensioner screw fully tightened, replace chain and check the condition of sprockets.

21, Chaincase Oil

Pour 250 mL (8.5 fl. oz) of XP-S synthetic chaincase oil (P/N 413 803 300) into chaincase.

Check oil level with the dipstick then add if required. Remove metal particles from magnet.



TYPICAL
1. Dipstick

NOTE: Chaincase must be in its proper position when checking oil level.

ADJUSTMENT

Pulley Alignment

Refer to PULLEY DISTANCE AND ALIGNMENT.

Track Tension and Alignment

Refer to TRACK.

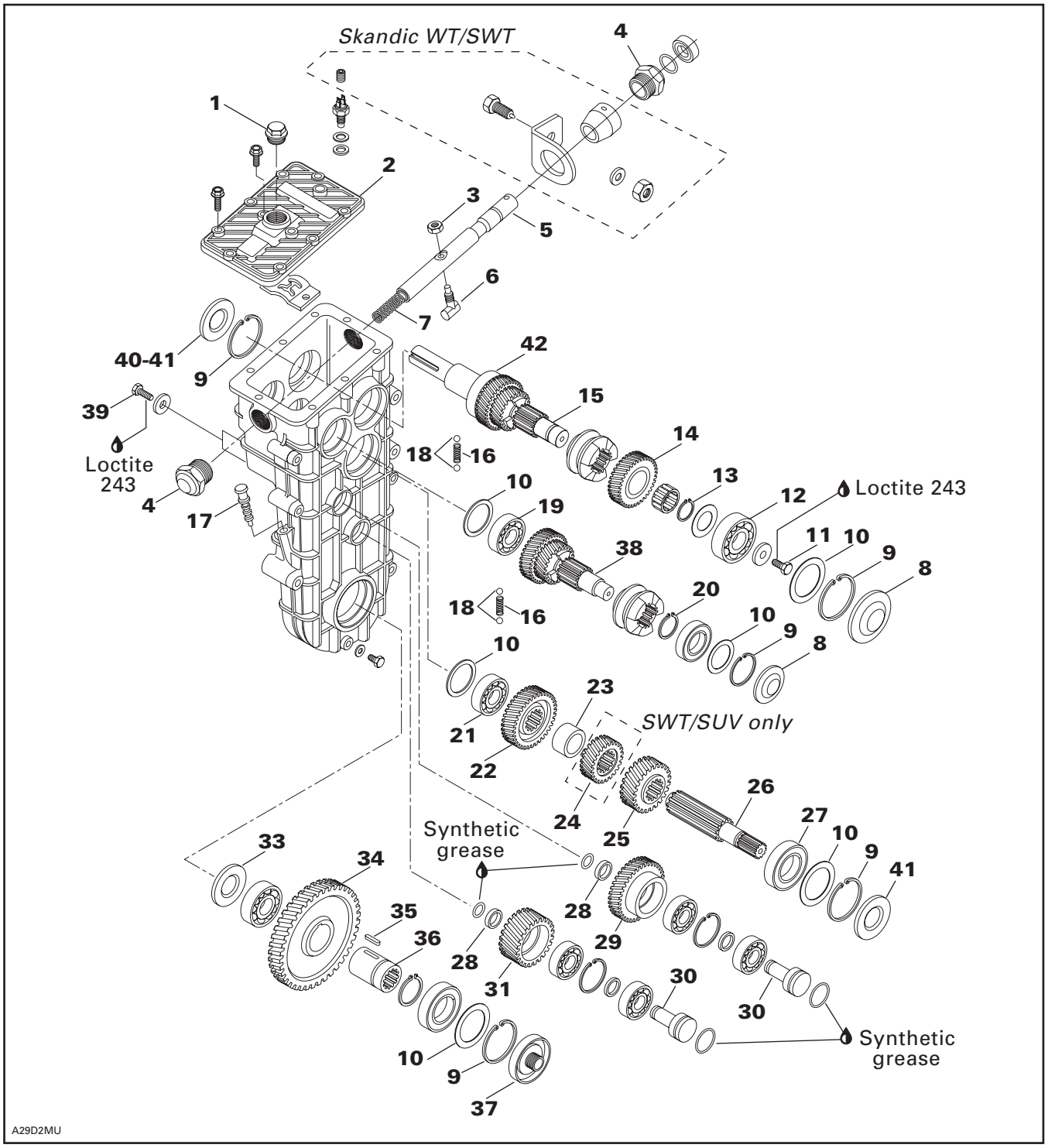
GEARBOX

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	415
XP-S synthetic chaincase oil	413 802 800	418

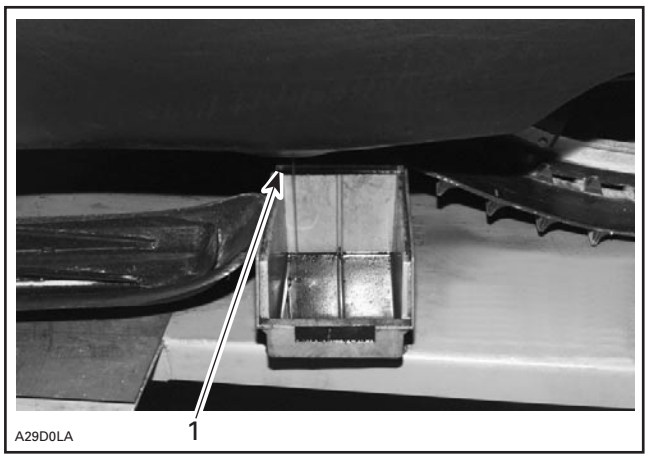
3-SPEED GEARBOX

Skandic WT/SWT/WT LC/SUV/Expedition TUV



REMOVAL

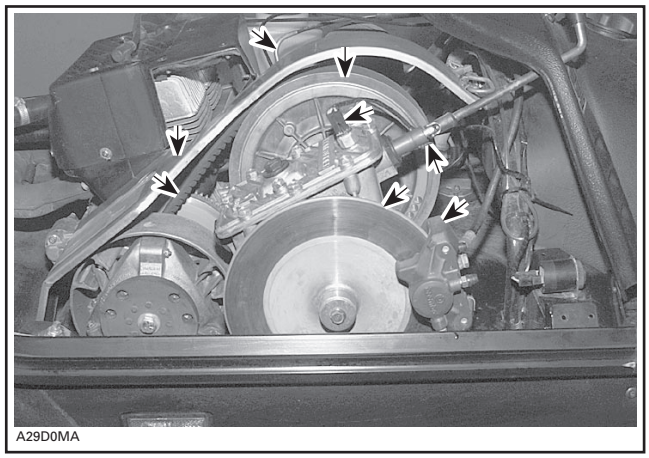
Drain gearbox oil.



1. Bottom pan drain hole nearby gearbox drain plug

Remove belt guard, drive belt. Remove air silencer and carburetor(s); then remove driven pulley.

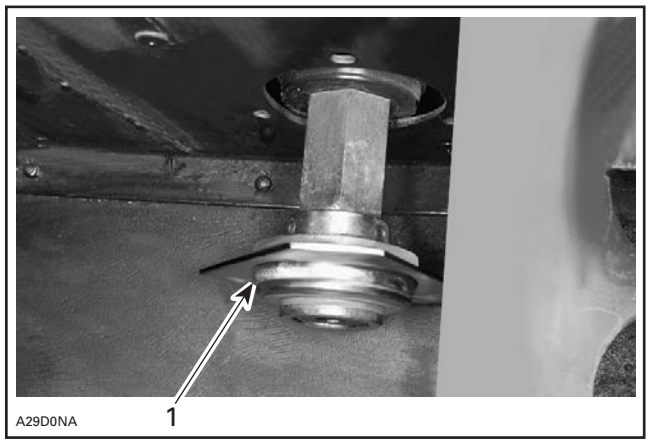
Remove brake caliper, brake disc. Unfasten shifting rod and unplug reverse switch.



Remove rear suspension.

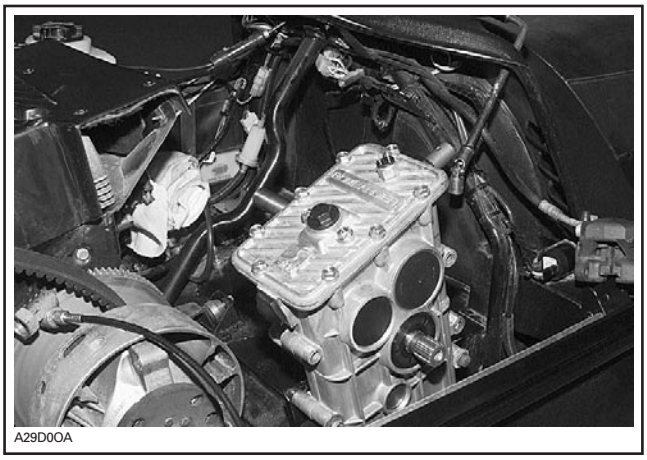
Remove angle drive and square pin from bottom of gearbox.

Remove muffler. Unbolt RH end bearing then pull drive axle toward right side.



1. RH end bearing

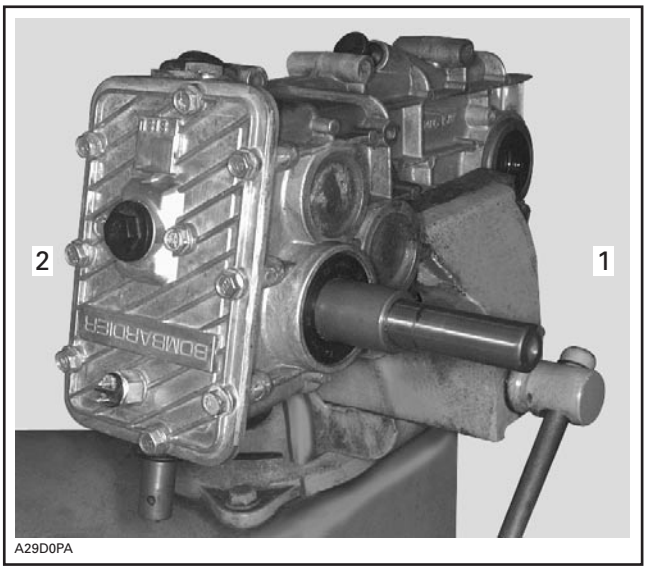
Unbolt gearbox from chassis.



DISASSEMBLY

General

For the following procedure, right hand side refers to driven pulley side and left hand side to brake disc side.



1. RH side driven pulley side
2. LH side brake disc side

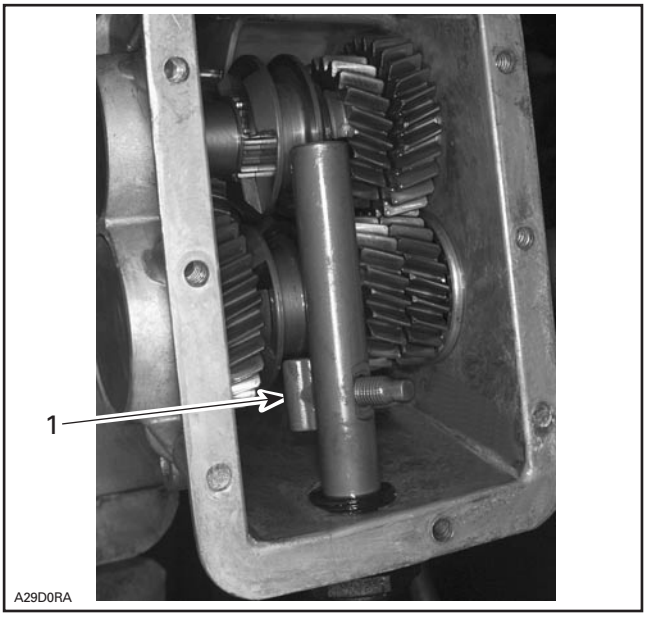
Shaft

Remove dipstick **no. 17**. Unfasten cover **no. 2** from gearbox housing.

Remove nut **no. 3** retaining pin **no. 6**.

1. Cover
2. Nut

Unfasten sleeve nuts **no. 4**, remove spring **no. 7** then, partially pull shaft **no. 5** and remove pin **no. 6**.



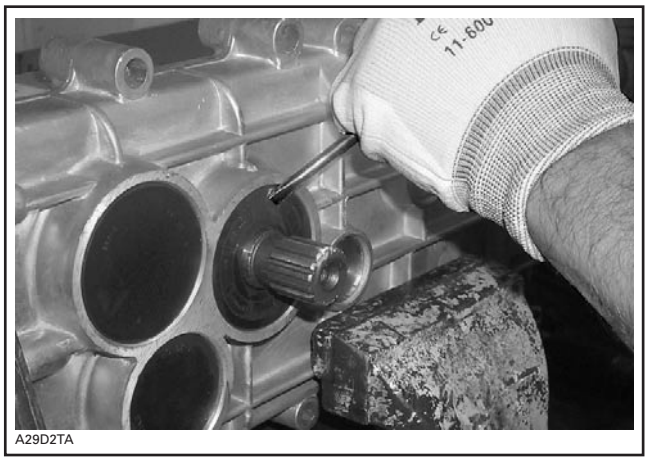
1. Pin

Completely remove shaft **no. 5**.

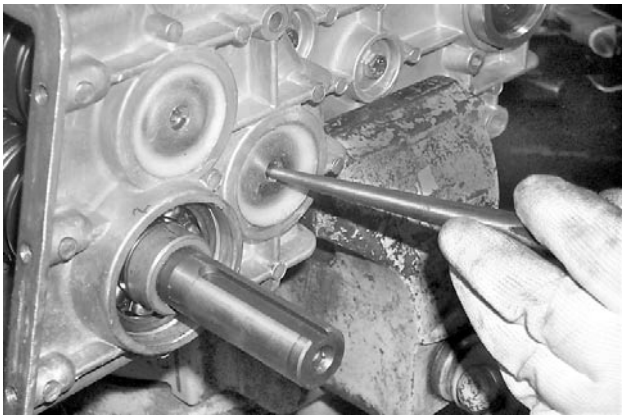
Plug

Remove LH side rubber plugs **no. 8** and oil seal **no. 41**.

Remove RH side oil seal **no. 41**.

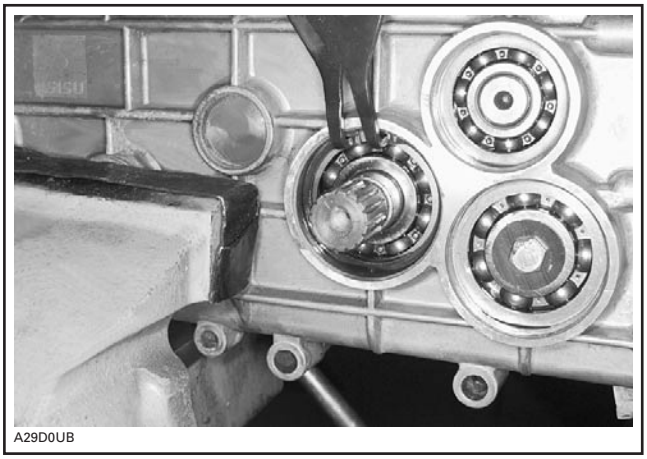


Drill a 10 mm (3/8 in) diameter hole through RH side plugs **no. 40**.

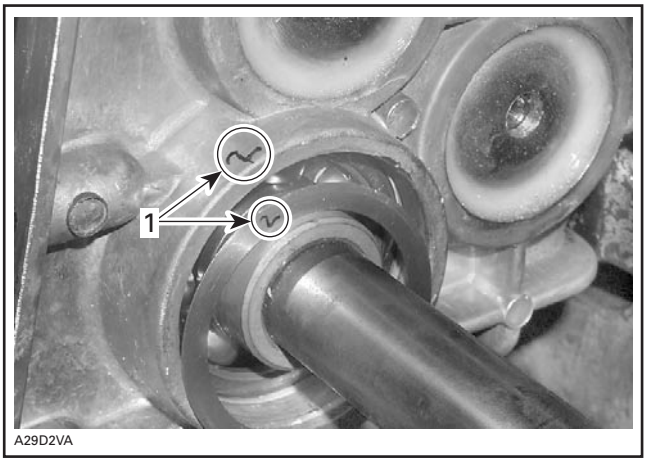

A29D2UA

Brake Shaft

Remove all circlips **no. 9**.


A29D0UB

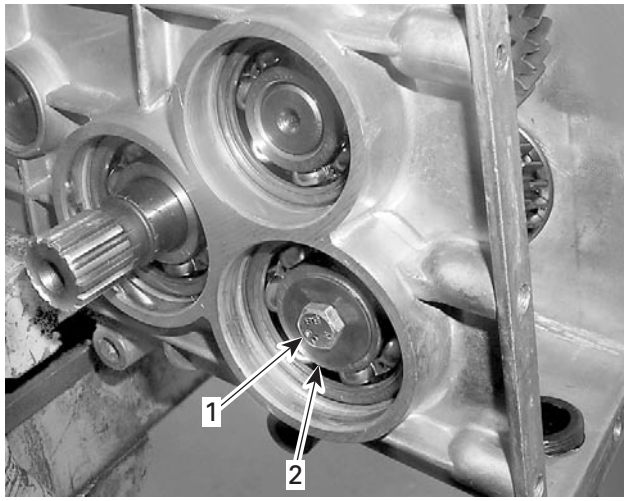
IMPORTANT: Note all shims **no. 10** quantity and location.



A29D2VA

1. Note shims location

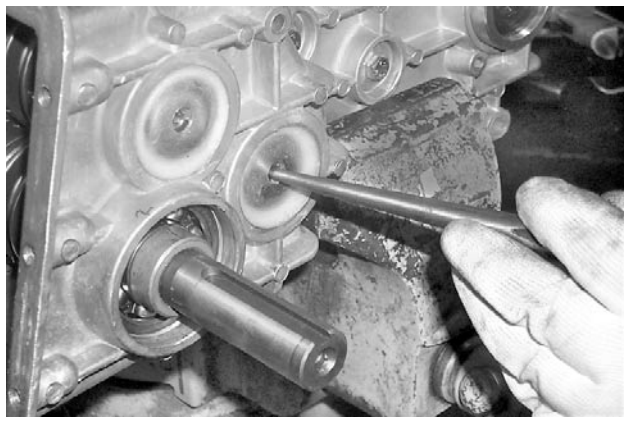
Remove driven shaft bolt **no. 11** and washer.

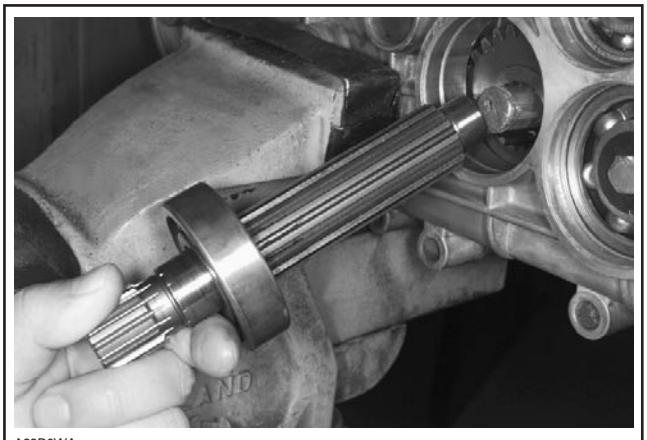


A29D2WA

1. Driven shaft bolt
2. Washer

Proceeding from right side, drive brake shaft **no. 26** out of gearbox housing.


A29D2UA


A29D0WA

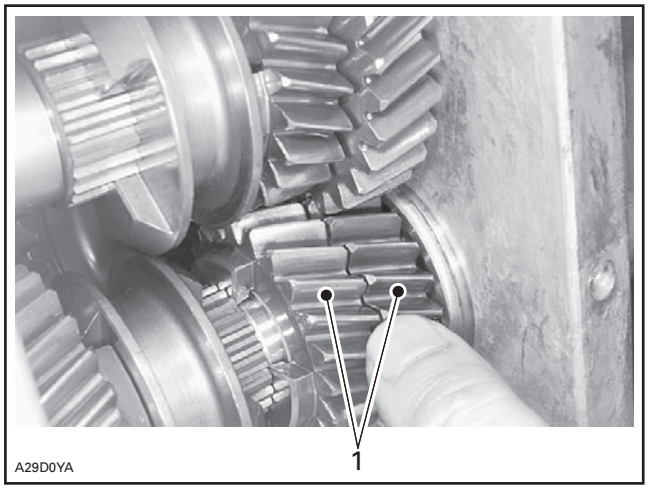
NOTE: Brake shaft gears and sleeve remain in gearbox housing.

Remove bearing **no. 27** from brake shaft **no. 26** using a press.


A29D0XA

Reverse Shaft

Make sure gears mesh.



A29D0YA

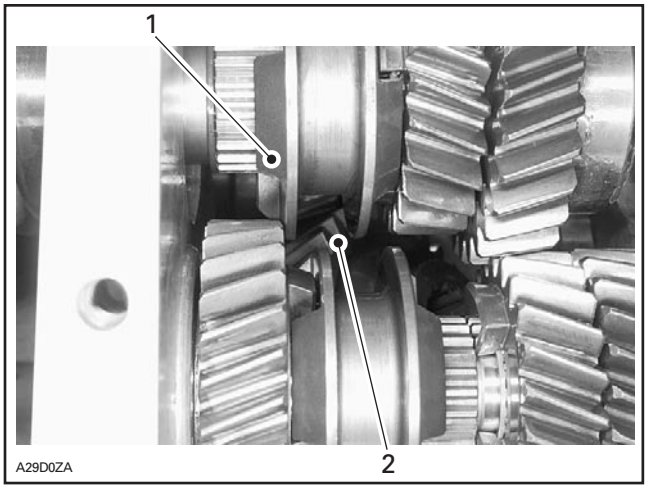
1. These gears must mesh as reverse shaft is driven out

Push sleeve dog against gear to lock it in place (reverse gear).

This will allow the driven pulley shaft to be pushed out enough for bearing removal and sliding sleeve dog will not touch the RH gear of driven pulley shaft **no. 15**.

Drive reverse shaft **no. 38** out until its LH side bearing is free.

CAUTION: Make sure loose gears do not interfere.



A29D0ZA

1. Sleeve dog not touching right gear
2. Brake shaft gears are still in gearbox

Use a puller to extract LH reverse shaft bearing.

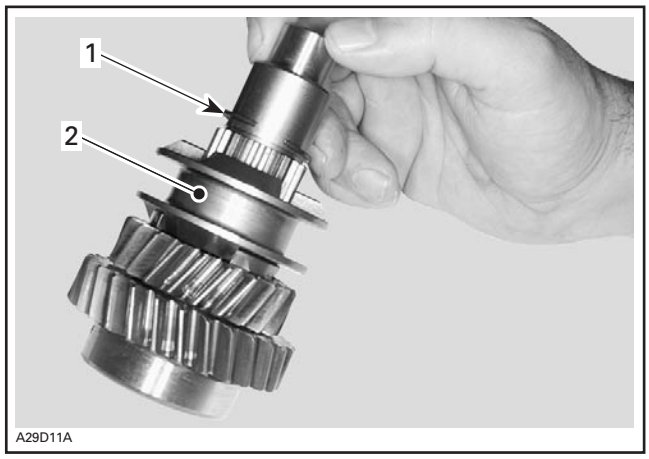

A29D2YA

Remove reverse shaft **no. 38** from gearbox.

Remove loose gears.

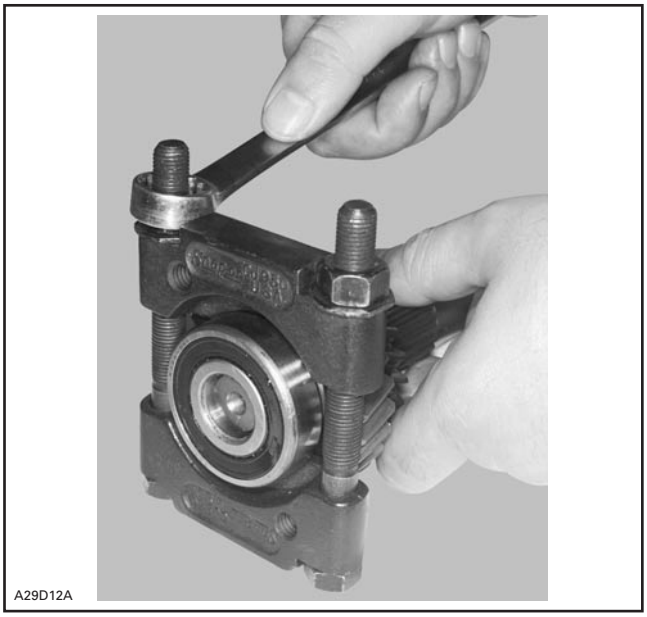
To remove sliding sleeve from reverse shaft, first remove circlip.

NOTE: Take care not to loose balls **no. 18** and spring **no. 16** when removing sliding sleeve.



1. Circlip
2. Sliding sleeve

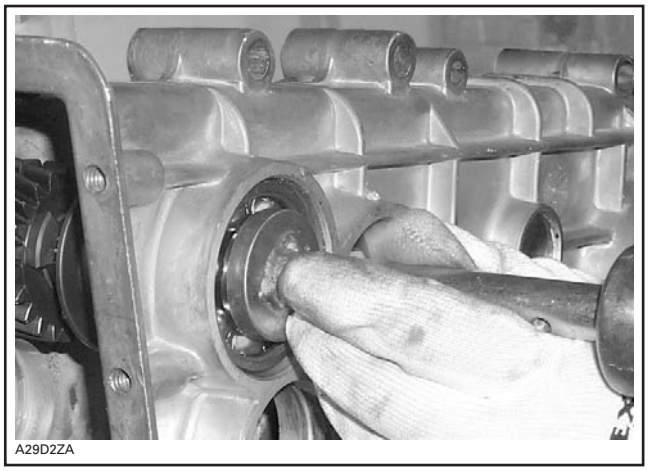
Use a puller to extract bearing **no. 19**.



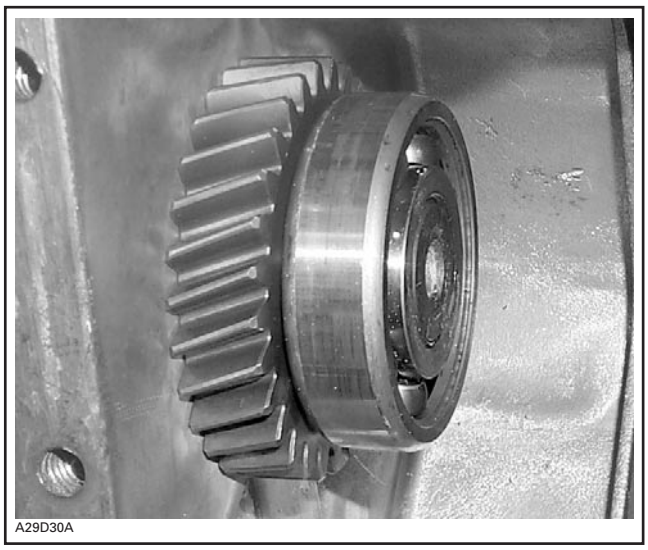
Remove brake shaft gears.

Pulley Shaft

Push driven pulley shaft **no. 15** out of gearbox until its LH gear **no. 14** is against gearbox inner wall.

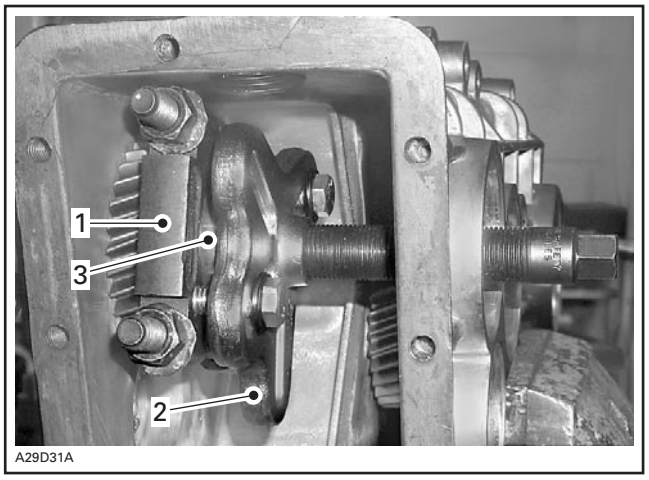


PUSH DRIVEN PULLEY SHAFT OUT



LH GEAR IS AGAINST GEARBOX INNER WALL

Use a puller and a puller retaining plate to extract bearing **no. 12**.

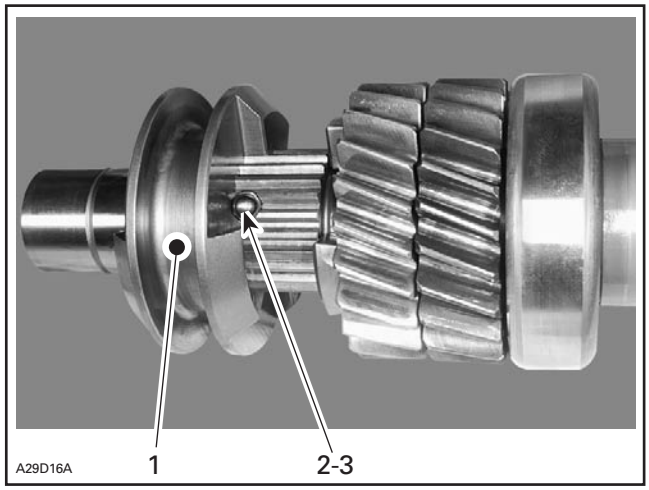


A29D31A

1. *Puller*
2. *Puller retaining plate*
3. *Bearing*

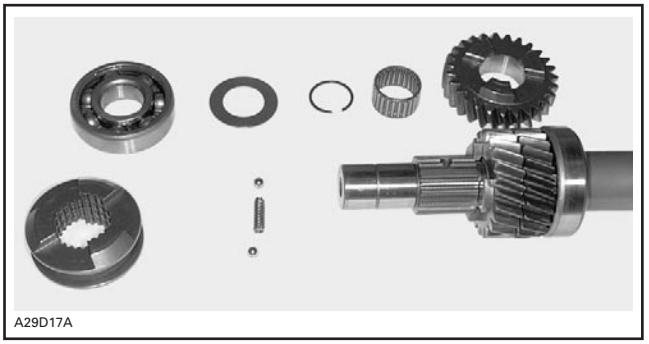
Remove circlip then, gear **no. 14**. Now driven pulley shaft can be pulled out from gearbox.

Remove sliding sleeve taking care not to lose balls **no. 18** and spring **no. 16**.



A29D16A

1. *Sliding sleeve*
2. *Spring*
3. *Balls*


A29D17A

DRIVEN PULLEY SHAFT COMPONENTS

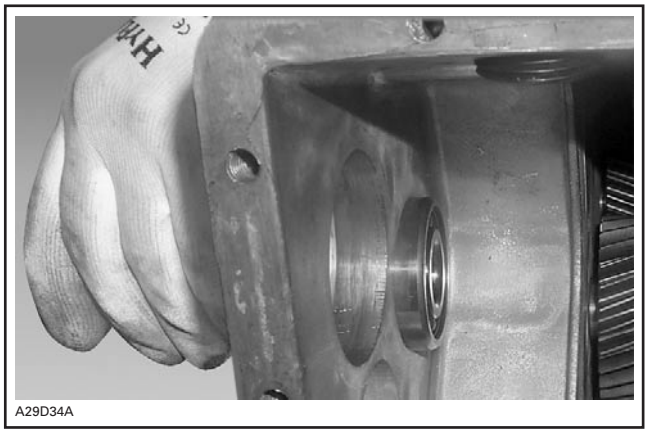
Remove sealant around caps **no. 40**.


A29D32A

Remove caps **no. 40**.


A29D33A

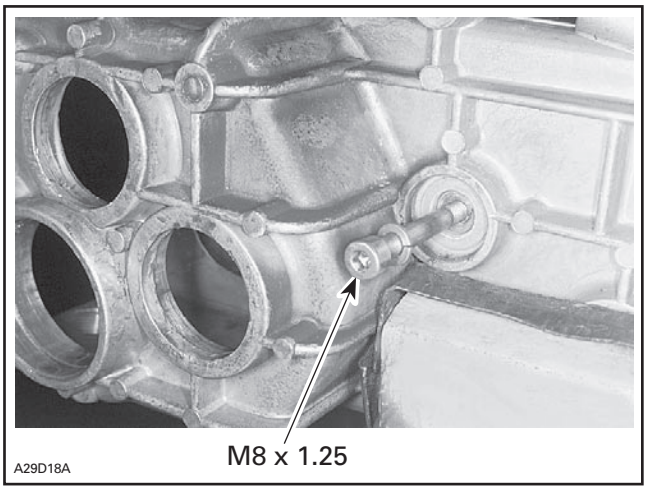
NOTE: Brake shaft bearing and shims will come out with cap **no. 40**.


A29D34A

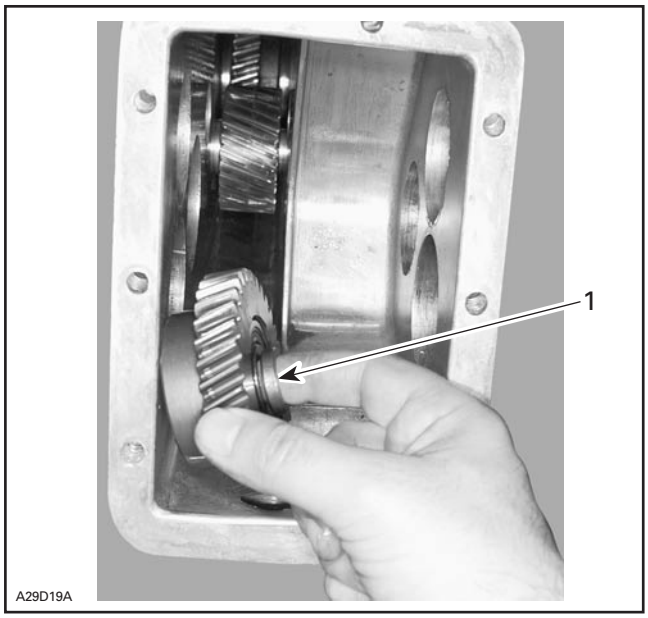
Intermediate Shaft

Remove screws **no. 39** from intermediate shafts **no. 30**.

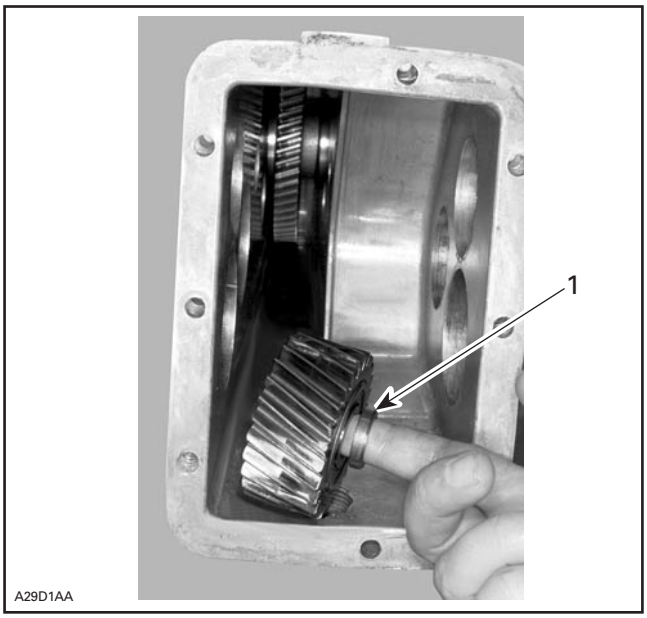
Fasten a long M8 x 1.25 screw in axle end then drive it out, beginning with top one.



Remove intermediate gears and spacers.



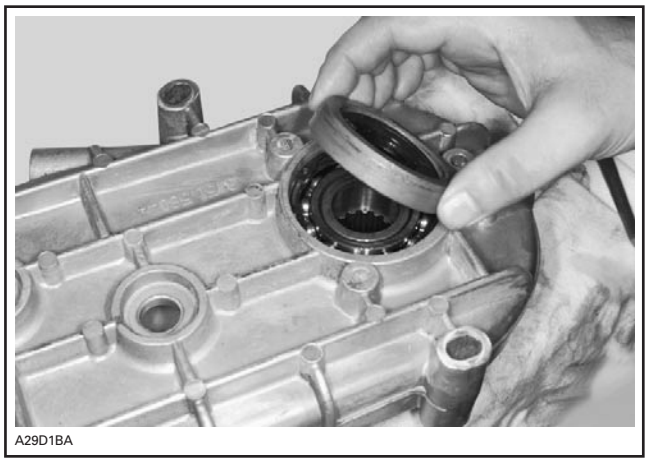
1. Spacer



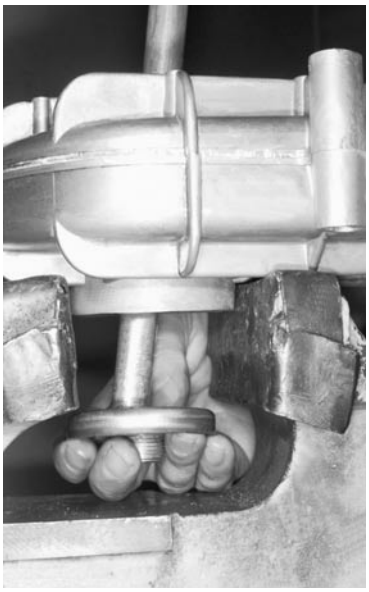
1. Spacer

Do not disassemble bearings of intermediate gears needlessly.

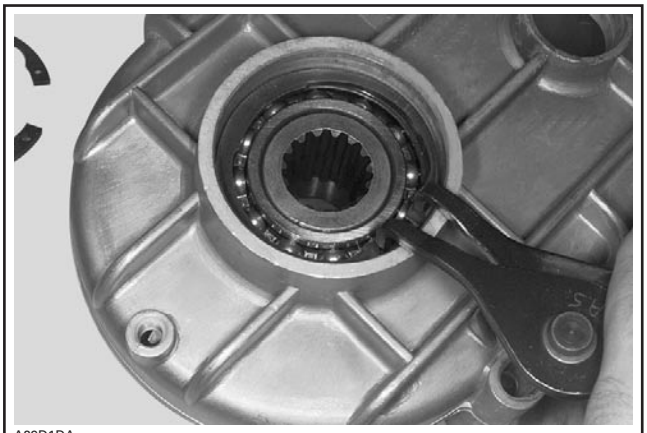
Pry out bottom seal **no. 33** from gearbox housing. Remove circlip **no. 9**.



Drive out plug **no. 37**.

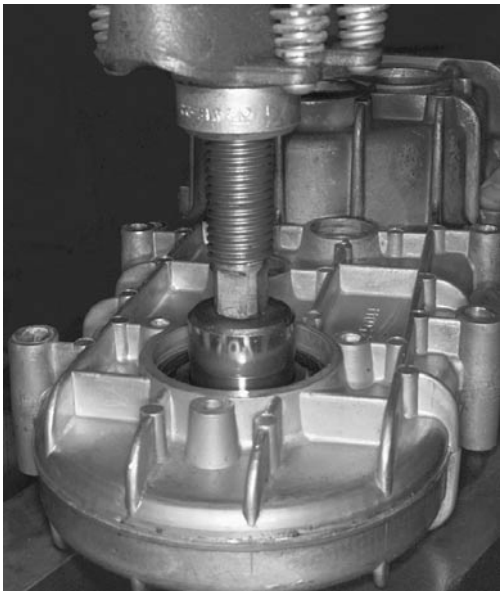

A29D1CA

Remove circlip **no. 9** from LH side.


A29D1DA

Using a press, drive out lower shaft **no. 36** from RH side.

CAUTION: Do not push against inner bearing race.


A29D1EA

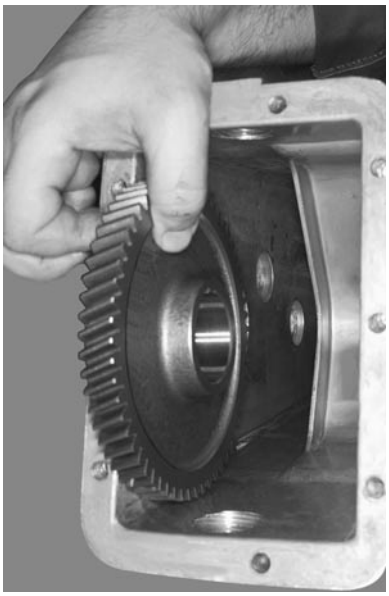
INSPECTION

Check bearing condition. There must be no discoloration, missing rollers or balls, broken cages, etc.

Check sprocket teeth.

ASSEMBLY

Install lower gear **no. 34** with its shoulder facing RH side.


A29D1FA

Install lower shaft **no. 36** with its hollow side (no splines) on RH side. Align key with lower gear **no. 34** keyway.


A29D1GA

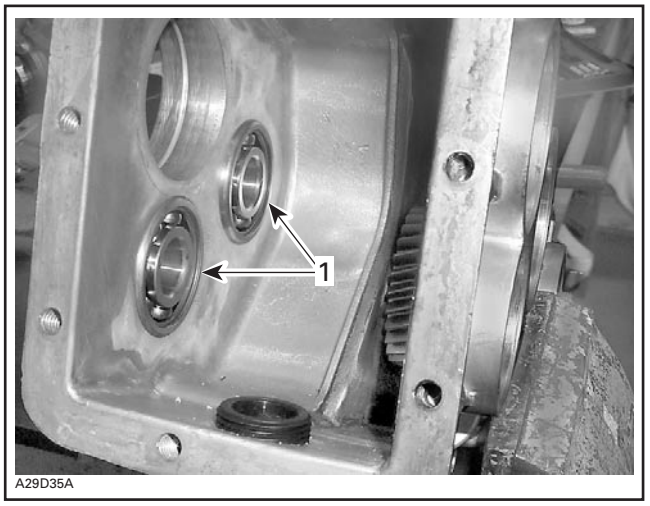
Apply synthetic grease (P/N 413 711 500) on intermediate shaft **no. 30** O-rings.

Install intermediate gears **no. 29** with their shoulder towards LH side. Position spacers **no. 28** as illustrated in removal procedure. Beveled side of spacers goes against gearbox wall.

Install new caps **no. 40**.

Install the appropriate premarked shims **no. 10**.

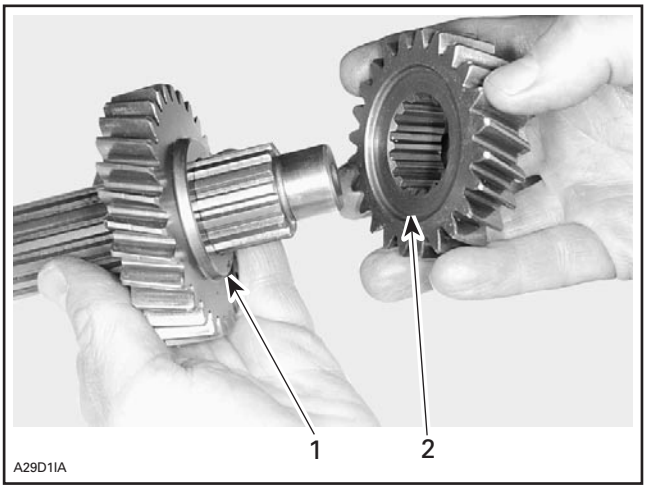
Using a pusher, install RH side bearing of brake and reverse shafts.



A29D35A

1. Bearings installed

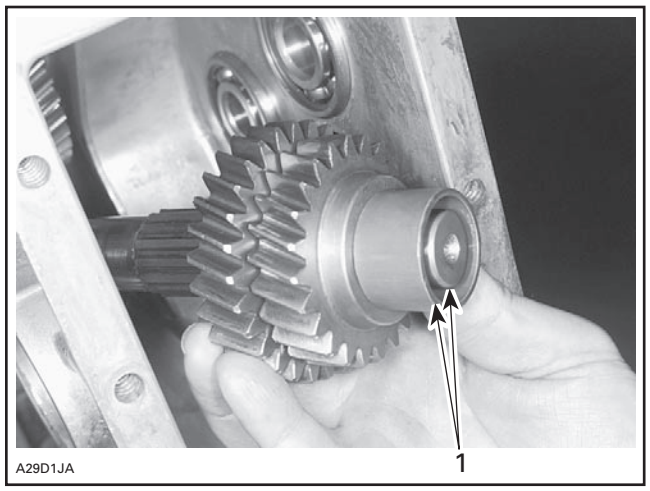
Partially assemble brake shaft gears **no. 24** and **no. 25** with shoulder facing recess.



A29D1IA

1. Shoulder
2. Recess

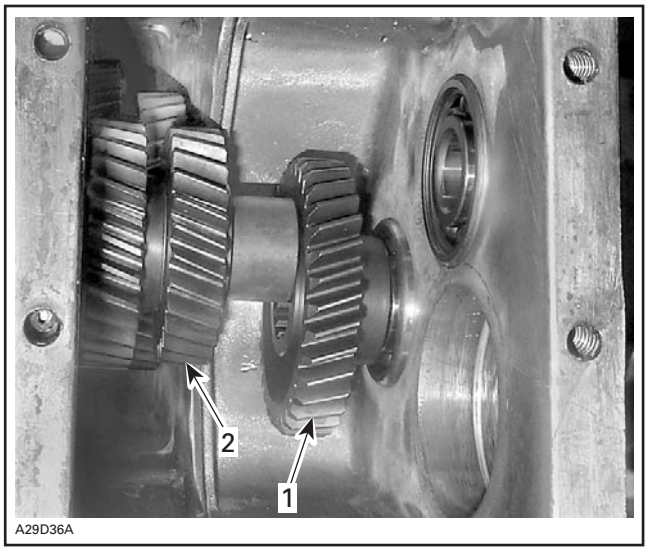
Install sleeve **no. 23** on brake shaft **no. 26** then, slide gears and sleeve until end of sleeve is flush with shaft end.



A29D1JA

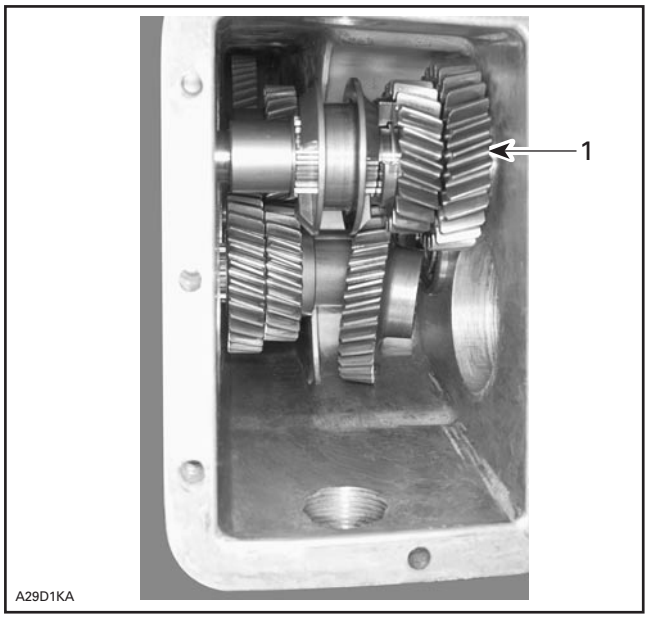
1. Flush

Install brake shaft **no. 26** into gearbox then, loosely install gear **no. 22** with its shoulder facing bearing **no. 21**. Do not push brake shaft into bearing **no. 21** at this time.



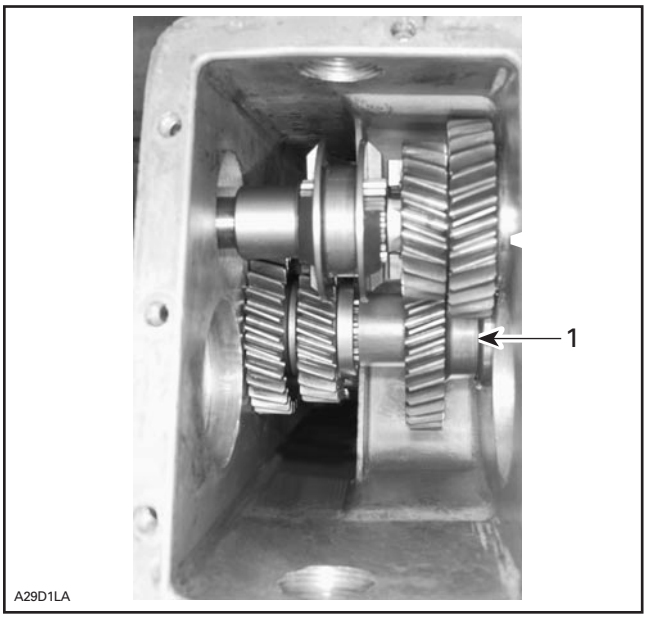
1. Gear loosely installed
2. Brake shaft assembly

Install reverse shaft ass'y **no. 38** into its RH side bearing **no. 19**.



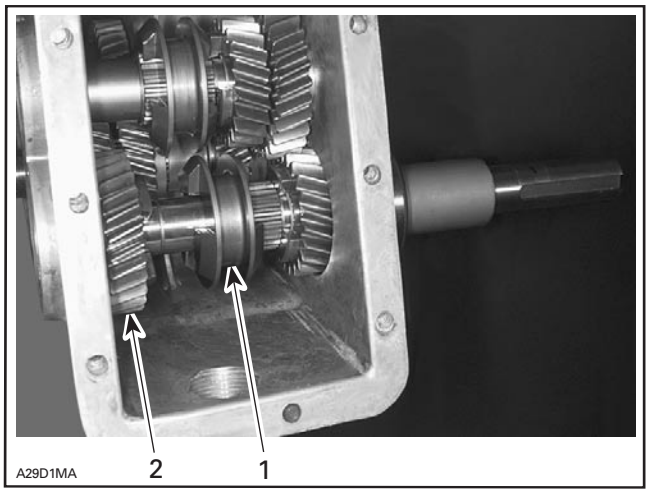
1. Reverse shaft installed in its RH bearing

Position gear **no. 22** against RH side bearing **no. 19** then, finalize brake shaft **no. 26** insertion.



1. Finalizing brake shaft insertion

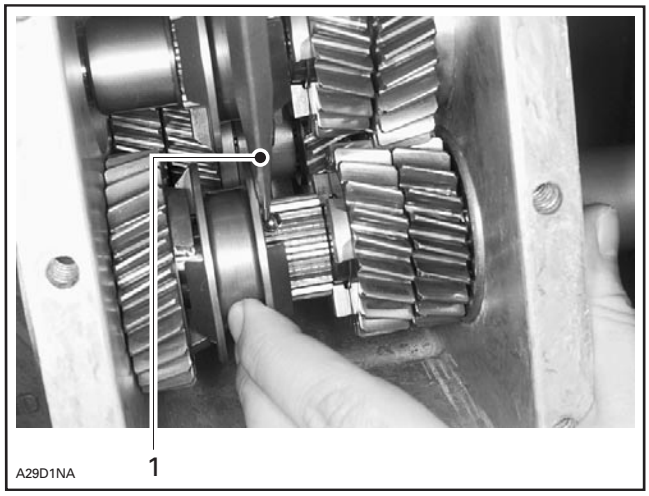
Install driven pulley shaft **no. 15** with the sliding sleeve loosely inserted. Gear **no. 14** must be at its place.



1. Sliding sleeve loosely inserted
2. Gear **no. 14** *in place*

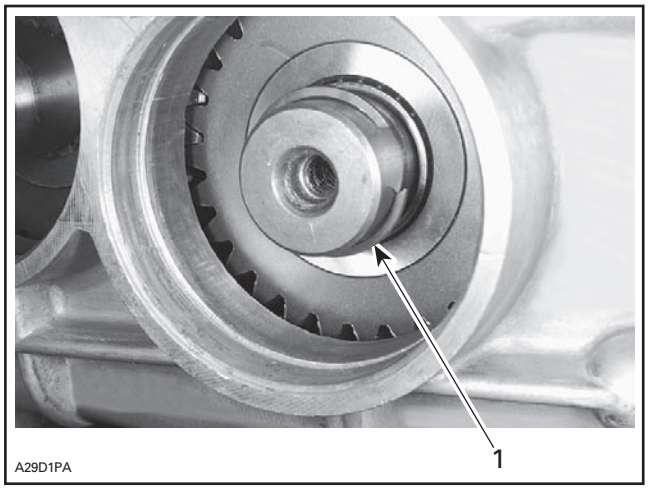
Install balls **no. 18** and spring **no. 16** into driven pulley shaft.

NOTE: If necessary, partly install bearing in gearbox to ease installation of balls and spring.



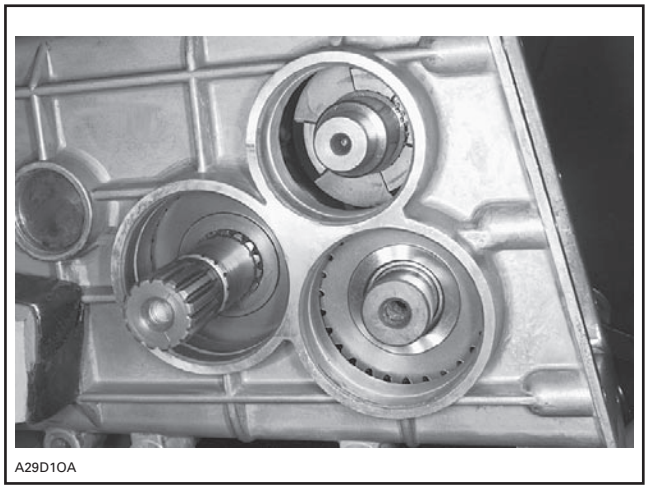
1. Push on ball with a screwdriver then move sliding sleeve to the right

Finalize driven pulley shaft insertion. Make sure that gears mesh during insertion. Install circlip **no. 20**.



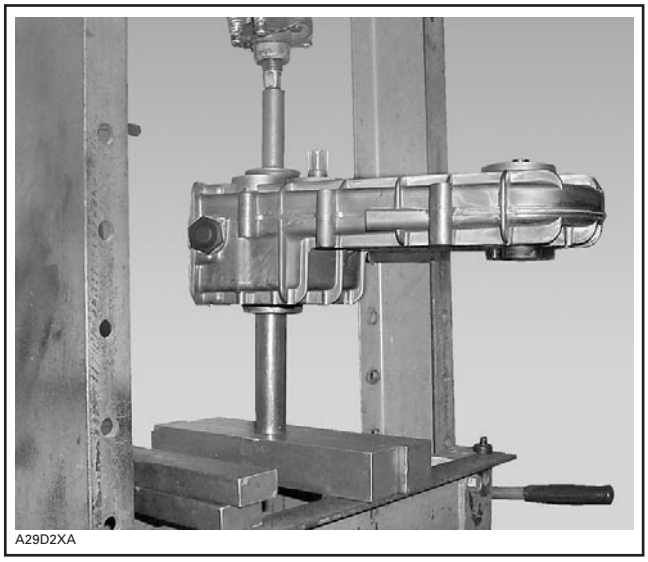
1. Circlip

Install LH side bearings **no. 42, 19 and 21**, shims **no. 10**, circlip **no. 9** then, plugs **no. 40** and oil seal **no. 41**.



READY TO INSTALL BEARINGS, SHIMS, CIRCLIPS AND PLUGS

CAUTION: Make sure that gearbox is well supported before inserting driven pulley shaft bearing, see photo.



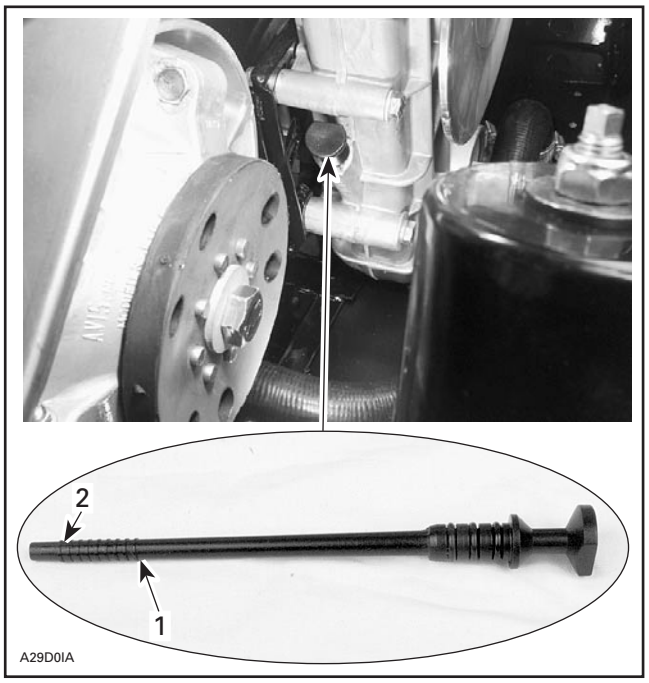
INSTALLATION

Reverse removal procedure. Check pulley alignment.

OIL LEVEL

To check, pull dipstick. Oil should reach level mark.

NOTE: After first outing, oil level will decrease as the upper oil cavity fills with oil. Recheck oil level and refill as required.



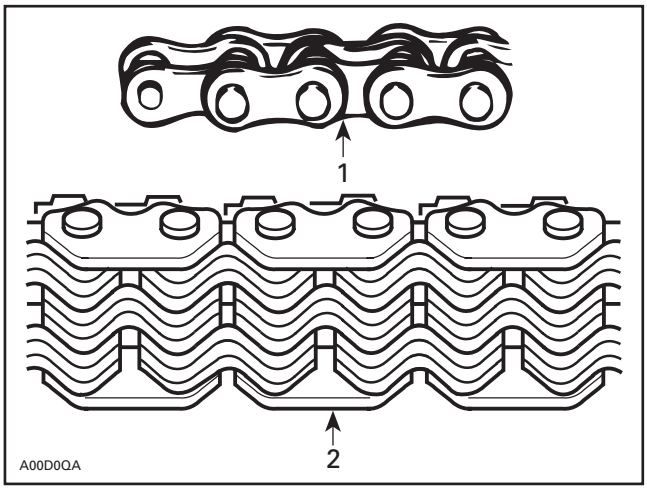
1. Full level mark
2. Lower level mark

To fill, remove filler plug from top of transmission. Refill as required using XP-S synthetic chaincase oil (P/N 413 802 800).

DRIVE CHAIN

GENERAL

Bombardier drive chains exist in 2 types, for proper use refer to TECHNICAL DATA.



1. 1/2 in single
2. 3/8 in silent chain

SILENT CHAIN

There are 2 types of silent chain. One is 11-plates wide and the other is 13-plates wide (stronger). Do not interchange sprockets. Fit chain on sprockets to make sure using right ones according to width. Refer to TECHNICAL DATA.

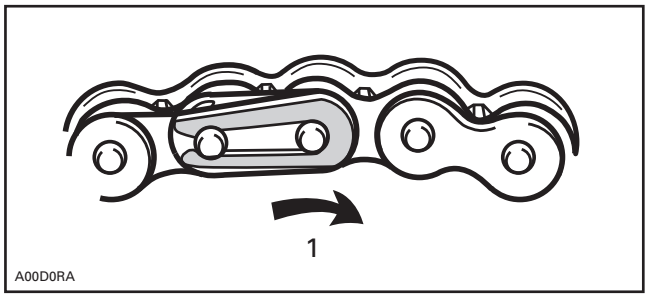
NOTE: No work (separation, lengthening) can be done on the silent chain type.

CHAIN ATTACHMENT

When joining chain ends, the open end of the circlip must be on opposite side of chain rotation. The circlip should also be facing the outer side of chaincase.

⚠ WARNING

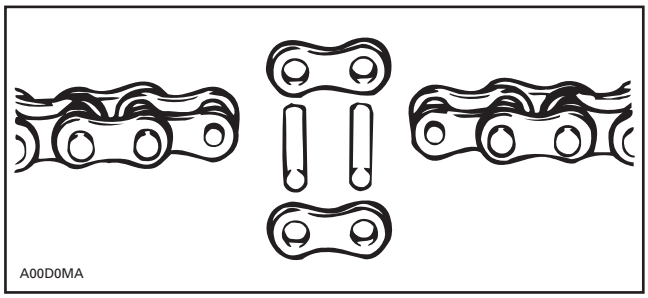
Always ensure that the connecting link circlip is in good condition and is properly secured.



TYPICAL
1. Rotation

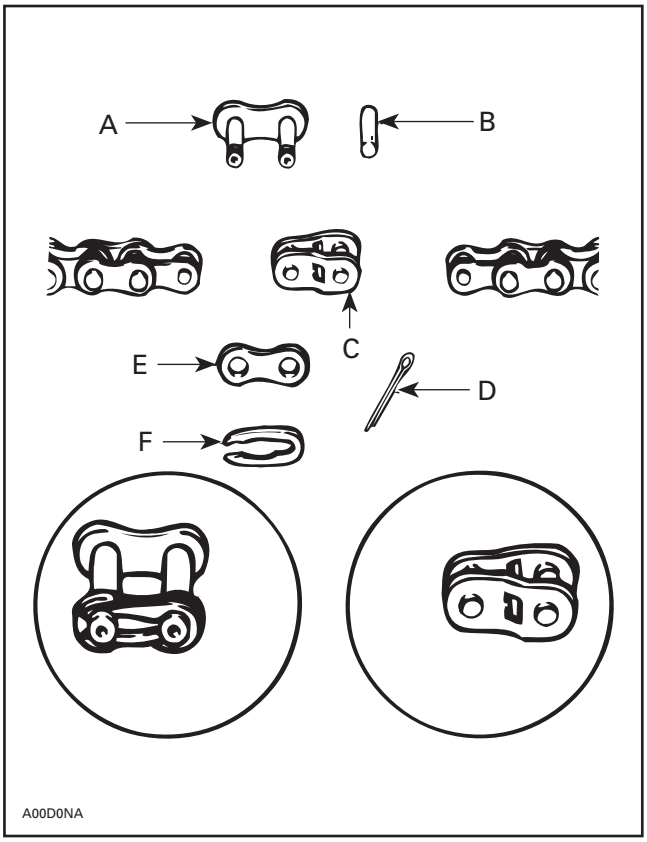
CHAIN SEPARATION

When separating an endless chain, always use a chain bearing pin extractor. Also, make sure to remove one complete link.

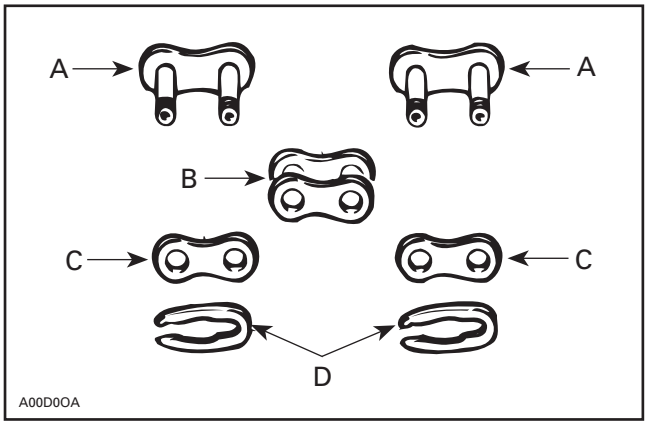


NOTE: Chain connecting link should only be used to lengthen or shorten a chain when changing the sprocket(s) for one(s) with a different number of teeth. A stretched chain must never be shortened because the chain pitch has changed (increased) and will not properly match the sprocket pitch, causing premature wear.

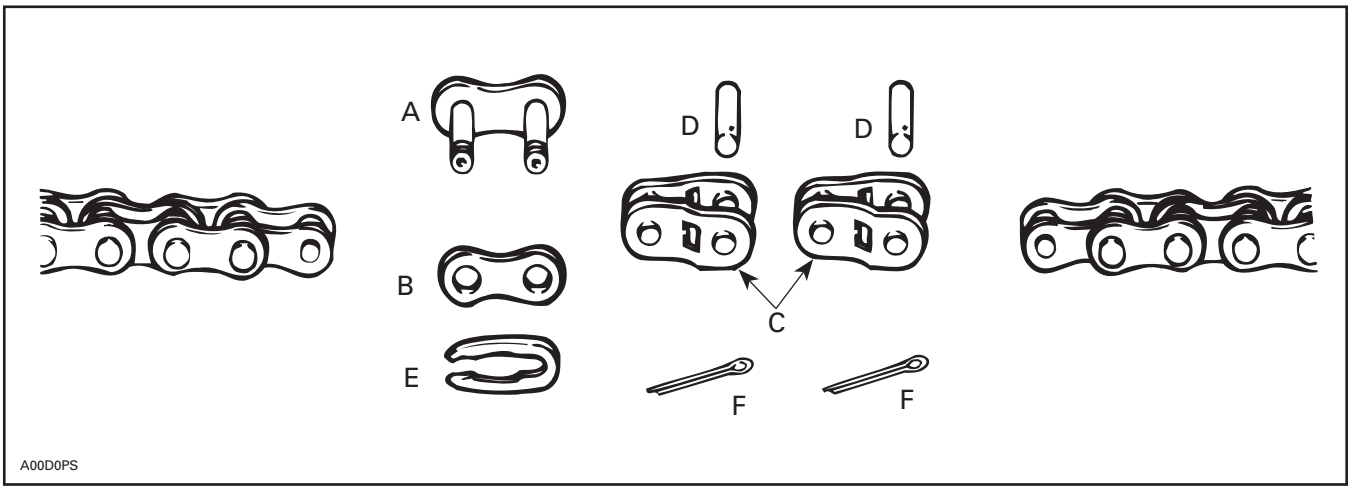
NOTE: Refer to TECHNICAL DATA, for chain length according to gear ratio of each specific vehicle.



LENGTHENING 1/2 LINK
A. Connecting link
B. Link pin
C. Cranked link
D. Cotter pin
E. Outer link
F. Circlip



LENGTHENING 1 LINK
A. Connecting link
B. Inner link
C. Outer link
D. Circlip



LENGTHENING 1-1/2 LINKS
A. Connecting link
B. Outer link
C. Cranked link
D. Link pin
E. Circlip
F. Cotter pin

IGNITION TIMING

SERVICE TOOLS

Description	Part Number	Page
9 volt adapter	529 035 675	428
digital induction type tachometer	529 014 500	422, 424, 427
MPEM programmer	529 035 878	428
supply cable	529 035 869	428
TDC gauge	414 104 700	421, 423, 426
Vehicle Communication Kit (VCK)	529 035 981	428, 431

277 Engine Type

This 277 engine type is equipped with a Rotax Electronic Reverse system (RER). It uses a single coil ignition system and 2 trigger coils. Refer to MAGNETO SYSTEM for more information.

This section is mainly divided in 2 parts, the first one using a Top Dead Center gauge to VERIFY THE MAGNETO FLYWHEEL TIMING MARK POSITION. The second one using a stroboscopic timing light to CHECK IGNITION TIMING.

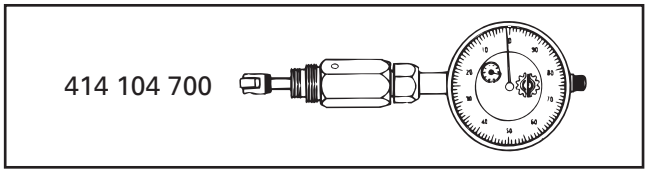
Flywheel timing mark position verification is required to:

– To detect a missing or broken magneto flywheel Woodruff key which change the timing, with eventual break down of the engine.
– To correctly locate and mark a timing mark on a new service magneto flywheel.
– To verify the correct location of the factory timing mark.
– To detect a wrong magneto flywheel corresponding to a different engine type.

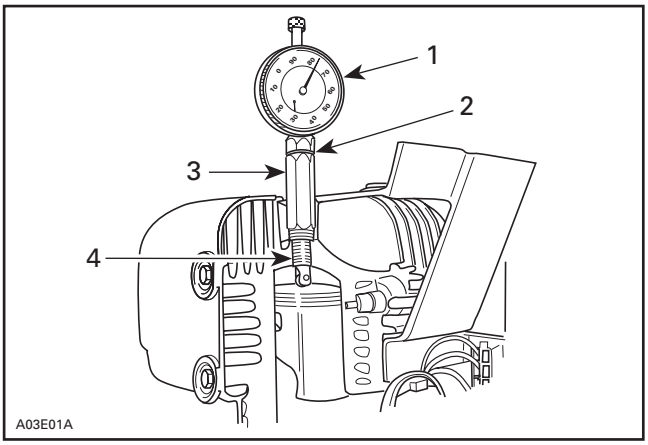
Always verify magneto flywheel timing mark position before checking ignition timing.

Verifying Magneto Flywheel Timing Mark Position

– Disconnect spark plug wire and remove spark plug.
– Install and adjust TDC gauge (P/N 414 104 700) on engine as follows:



- Rotate magneto flywheel clockwise until piston is just Before Top Dead Center.



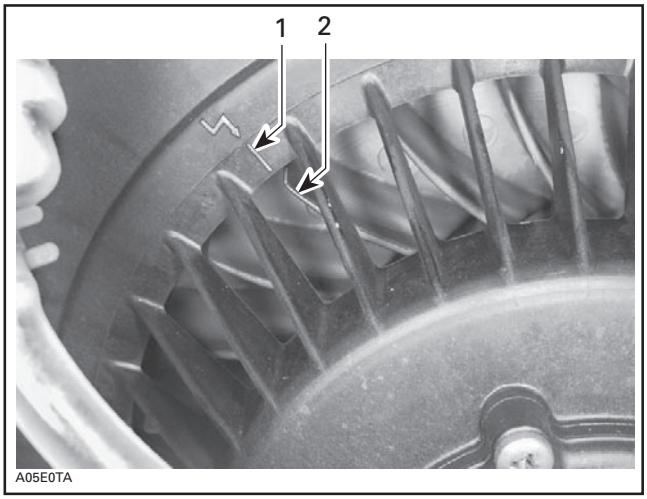
1. Outer ring
2. Adaptor lock nut
3. Roller lock nut
4. Adaptor

- Loosen adaptor lock nut then holding gauge with dial face toward magneto, screw adaptor in spark plug hole.
- Slide gauge far enough into adaptor to obtain a reading then finger tighten adaptor lock nut.
- Rotate magneto flywheel clockwise until piston is at Top Dead Center.
- Unlock outer ring of dial and turn it until "0" (zero) on dial aligns with pointer.

- Lock outer ring in position.

– From this point, rotate magneto flywheel back 1/4 turn then rotate it clockwise to reach the specified position. Refer to TECHNICAL DATA.

Check if red fin aligns with mark on fan cowl.



1. Fan cowl timing mark
2. Red fin

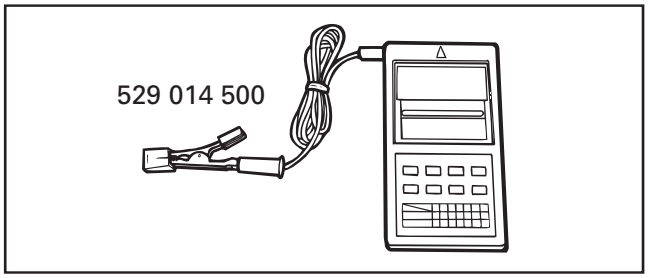
If marks do not align, there is something wrong with fan mounting. Check Woodruff key and fan.

CAUTION: Always check the timing with a stroboscopic timing light at 3500 RPM after the marks have been checked.

Checking Ignition Timing

NOTE: To perform this procedure we strongly recommend a stroboscopic timing light which is able to exceed 3500 RPM.

– Connect timing light pickup to the spark plug lead. Use a digital induction type tachometer (P/N 529 014 500).



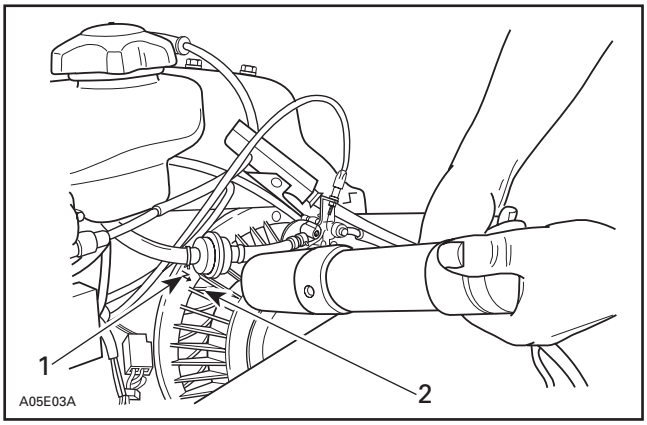
TACHOMETER

Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.

⚠ 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 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.

– Start the engine and point timing light straight in line with the fan cowl timing mark. Bring engine to 3500 RPM (3000 to 4000 RPM) for a brief instant.



TYPICAL — TUNDRA
1. Fan cowl timing mark
2. Red fin

– Check if the red fin aligns with the fan cowl timing mark. Tolerance is ± 1°.

If the red fin aligns with the fan cowl timing mark, timing is correct. If not the case, check for proper flywheel, trigger coil position or MPEM.

The RER ignition system is not adjustable. Only trigger coil air gap can be verified. Refer to MAGNETO SYSTEM.

443 and 552 Engine Types

If for any reason, ignition timing accuracy is suspected, it can be verified as follows.

NOTE: Ignition timing can not be adjusted (trigger coil is fixed). If ignition timing is not within specifications, a component is either defective or broken.

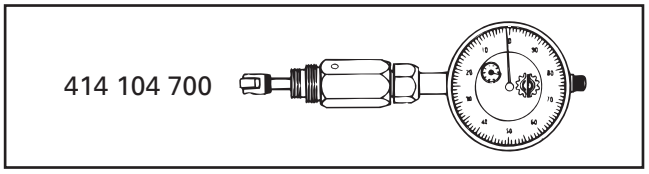
Verifying Magneto Flywheel Timing Mark Position

Prior to checking the timing, it may be necessary to verify the position of the timing mark on the magneto flywheel, for the following reasons:

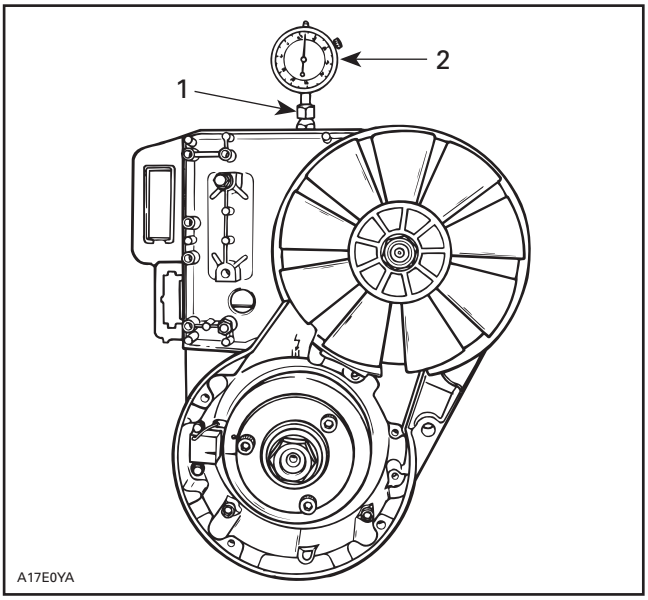
– To detect a missing or broken magneto flywheel Woodruff key which would allow a change of timing to occur, with eventual break down of the engine.
– To correctly locate and mark a timing mark on a new service magneto flywheel.
– To verify the correct location of the factory timing mark.
– To detect a wrong magneto flywheel corresponding to a different engine type.

To verify the position of the timing mark on the magneto flywheel, proceed as follows:

– Clean the area around the spark plugs, and remove them.
– Remove the rewind starter from the engine.
– Install the TDC gauge (P/N 414 104 700) in the spark plug hole (magneto side) and adjust as follows:



- Position the magneto flywheel at approximately TDC.



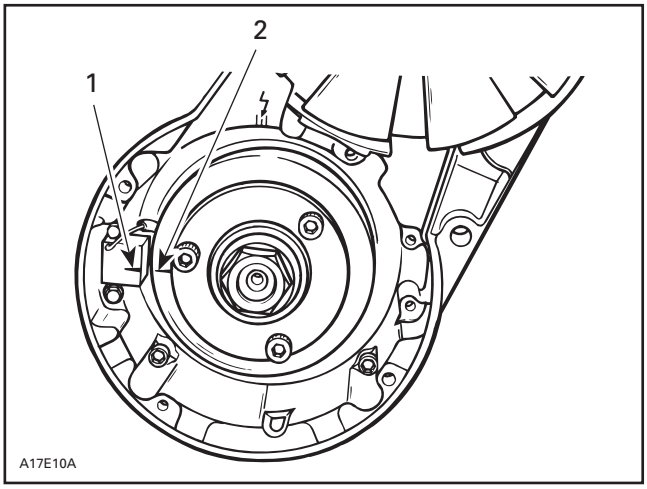
TYPICAL — INSTALLATION OF TDC GAUGE
1. Gauge on MAG side cylinder
2. Adaptor lock nut

- 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 magneto. 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 magneto flywheel back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston changes direction.
- Rotate the dial face so that "0" is in line with the needle when it stops moving.
- Again, slowly rotate the magneto flywheel 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.
- Verify the position of the timing mark on the magneto flywheel as follows:

NOTE: When checking timing, certain procedures require that the magneto flywheel be turned in a clockwise direction, viewed facing the magneto. If it is necessary to turn back (counterclockwise) for any reason, rotate the magneto flywheel at least one-quarter turn counterclockwise, and then rotate it clockwise. The last magneto flywheel movement when making a critical check must always be in a clockwise direction, to ensure that the slack in engine moving parts is taken-up.

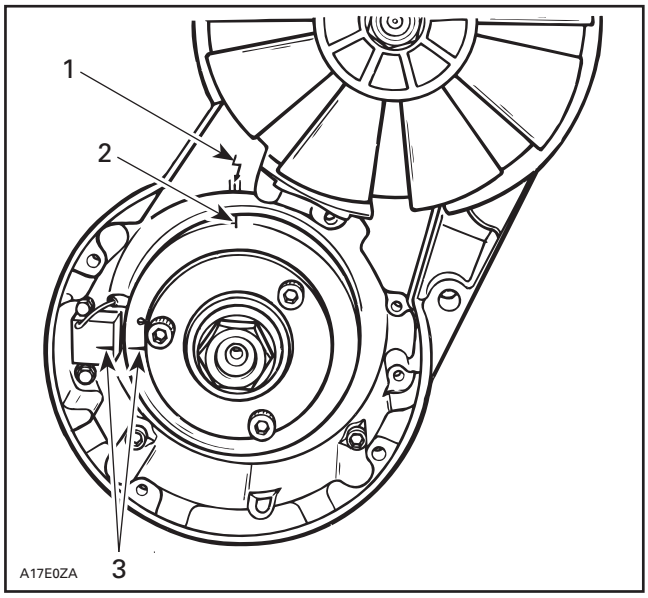
a. Rotate the magneto flywheel counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement. Refer to TECHNICAL DATA.
b. Verify that the magneto flywheel mark perfectly aligns with the mark on the trigger coil, refer to illustration.
c. If the marks do not align, check magneto flywheel and trigger coil part numbers and check Woodruff key condition. If all parts are the appropriate ones and if Woodruff key is in good condition, continue the procedure.



TYPICAL
1. *Trigger coil mark*
2. *Magneto flywheel mark*

NOTE: These marks cannot be used to check dynamic (with engine running) ignition timing with a timing light: a new mark must be scribed on magneto flywheel for this purpose.

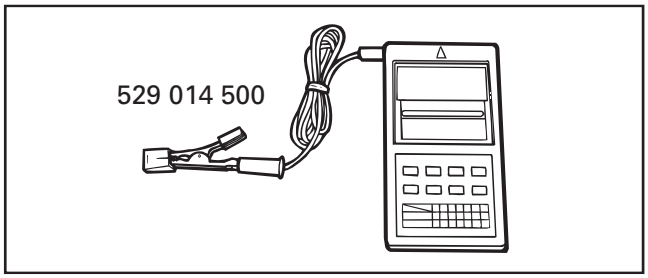
– Scribe a new mark on magneto flywheel as follows.
  - Remove the fan cover from the engine.
  - Maintain magneto flywheel so that previous marks remain aligned.
  - Scribe or punch a mark on magneto flywheel so that it perfectly aligns with the arrow on crankcase, refer to illustration. This new timing mark should be used for future timing checks (dynamic timing).
  - Reinstall rewind starter.
  - Check the timing with a timing light.



TYPICAL
1. *Crankcase arrow*
2. *Scribe a mark here*
3. *Maintain verified timing marks aligned (static timing)*

Checking Ignition Timing

Use a timing light and digital induction type tachometer (P/N 529 014 500).



TACHOMETER

To check the ignition timing, refer to illustration and proceed as follows:

⚠ WARNING

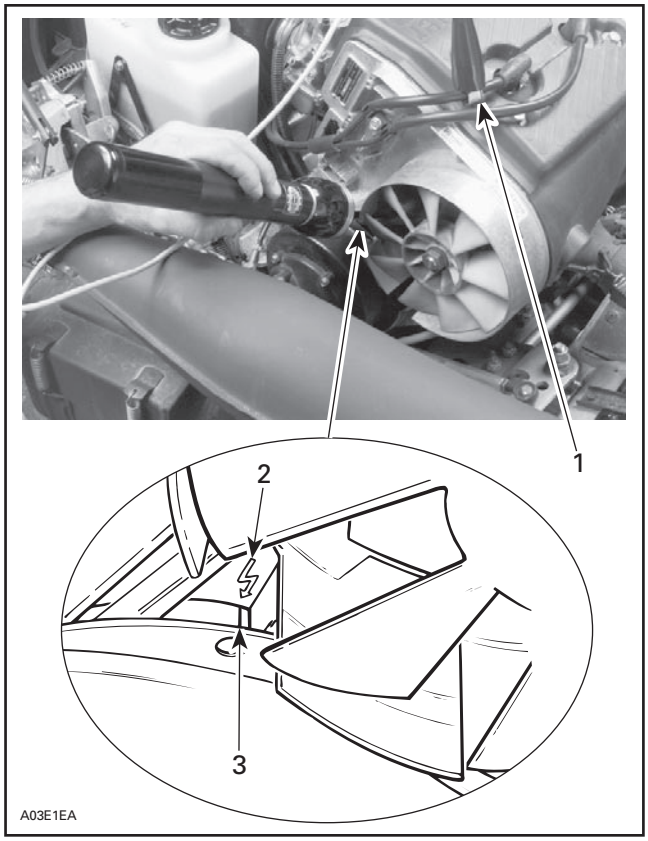
Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

– Connect the timing light pickup to a spark plug cable.

NOTE: To avoid an incorrect reading due to parallax, view the magneto flywheel and the crankcase timing marks in a straight line.

– Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.
– Start the engine and raise the engine speed to 3500 RPM while observing the timing marks, refer to illustration.

NOTE: Ignition timing may be verified when engine speed is anywhere within 3000 - 4000 RPM.



1. Timing light pickup on MAG side
2. Crankcase arrow
3. Magneto flywheel mark

– The magneto flywheel mark scribed previously and the crankcase arrow should be perfectly aligned. If the marks do not align, a faulty trigger coil (check proper grounding of coil), a faulty flywheel, a faulty Woodruff key, a misaligned (twisted) crankshaft or a faulty CDI module could be the cause: substitute one part at a time and recheck timing marks (check connectors condition prior to substituting any part).
– Install parts which were removed.

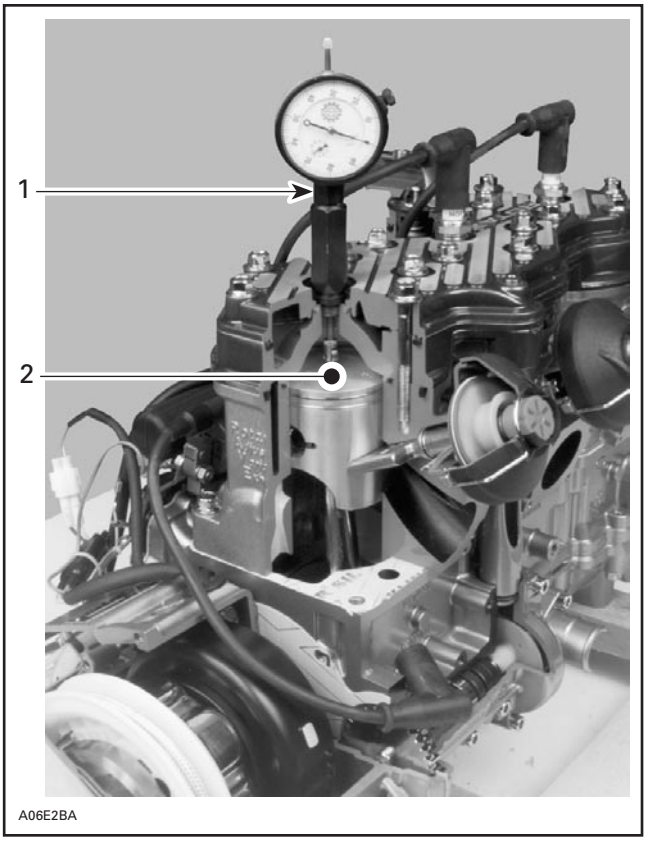
593 and 593 HO SDI Engine Types

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 trigger coil or the MPEM. 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 (P/N 414 104 700) in the spark plug hole, (magneto side) and adjust as follows:
  • Position the MAG piston at approximately TDC.

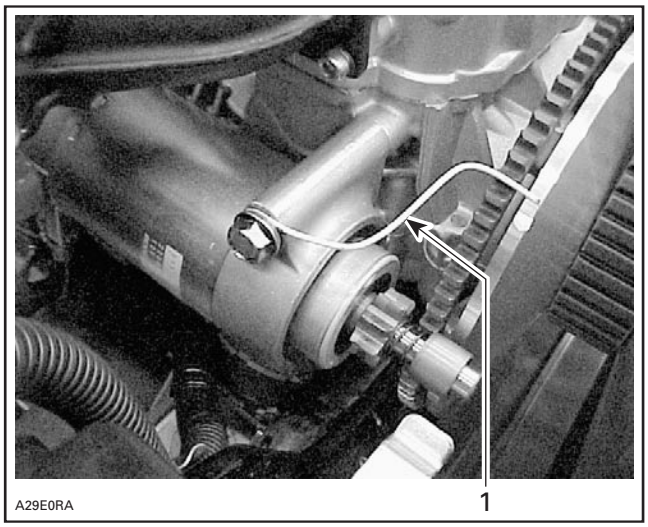


TYPICAL
1. TDC gauge on MAG side
2. MAG side piston at TDC

  • 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.

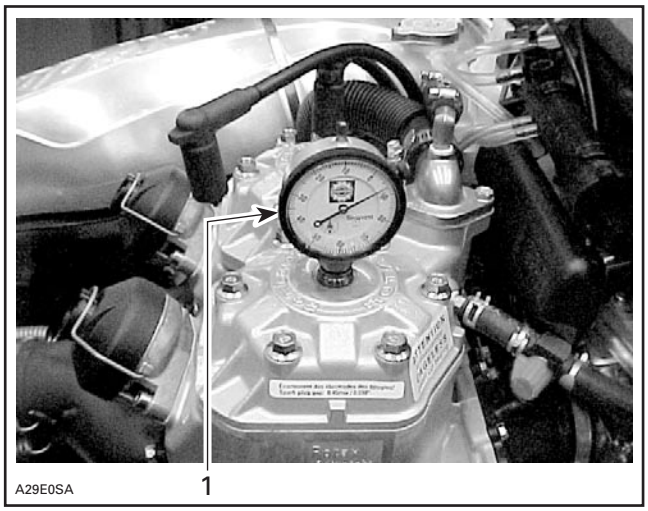
- "0" now indicates exact TDC.

– Rotate the drive pulley clockwise, one-quarter turn then carefully rotate it counterclockwise until the needle indicates the specified measurement, indicated in TECHNICAL DATA.
– Twist a wire as shown and use it as a pointer. Install the wire on upper starter bolt.

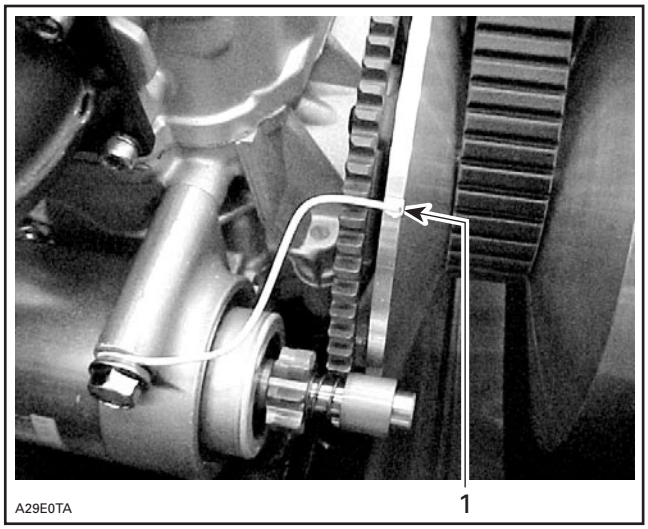


TYPICAL
1. Pointer

– With the TDC gauge indicating specified timing, scribe a mark on drive pulley fixed half in line with pointer end.



TYPICAL
1. TDC gauge indicating specified timing



TYPICAL
1. Timing mark in line with pointer end

Checking Ignition Timing

Use a timing light.

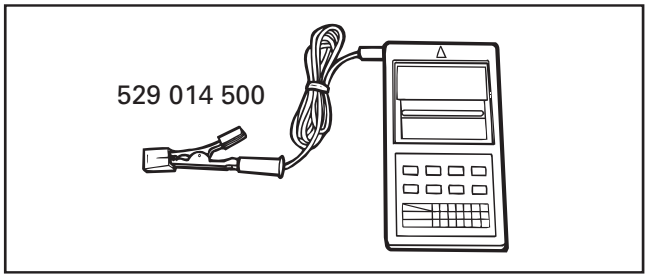
To check the ignition timing, refer to illustration and proceed as follows:

⚠ 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.

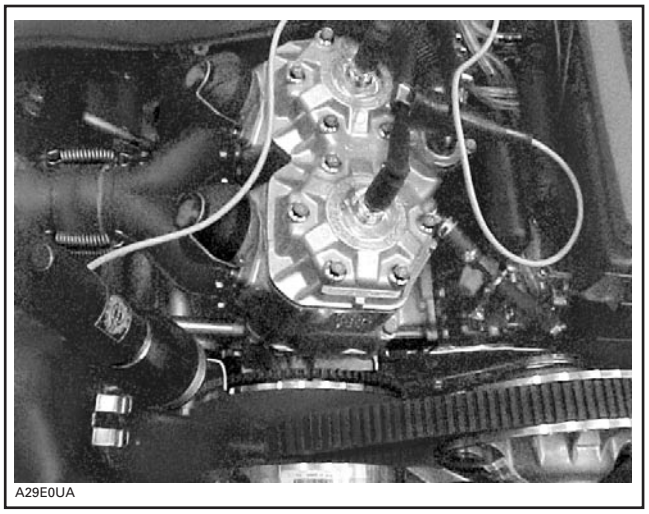
– Connect the timing light pickup to a spark plug cable.

Connect a digital induction type tachometer (P/N 529 014 500).

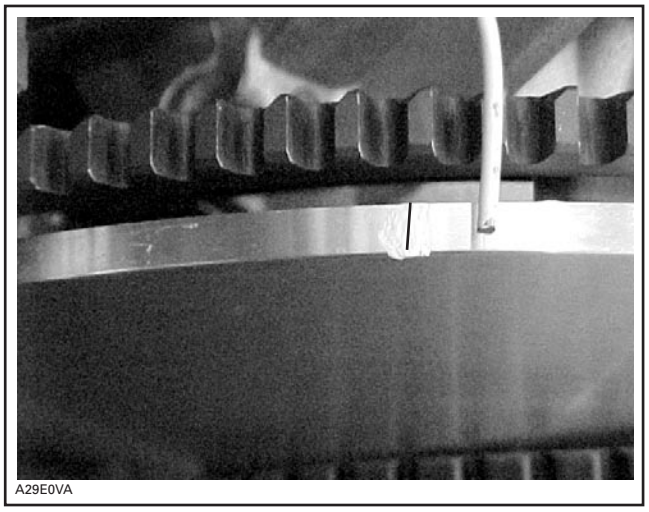


TACHOMETER

– Start the engine and point timing light on timing mark. Bring engine to 3500 RPM.


A29E0UA

The timing mark must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced. Tolerance is ± 1°.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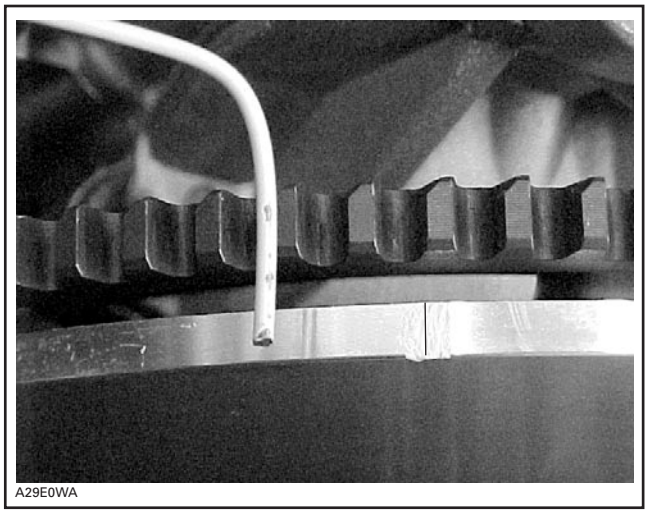
TIMING RETARDED BY ABOUT 2°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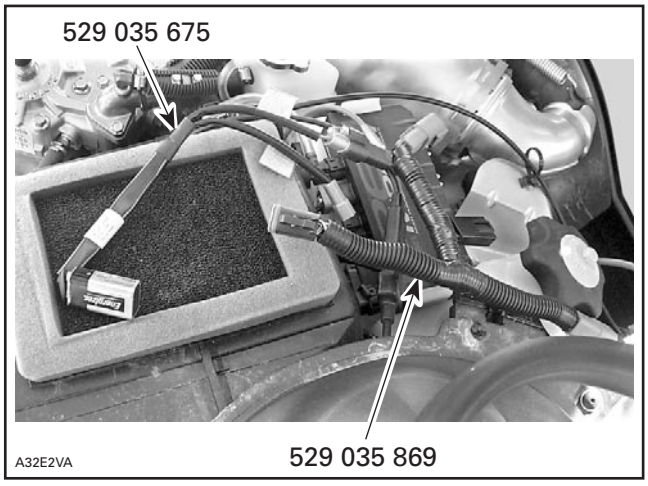
TIMING ADVANCED BY ABOUT 2°

Changing Ignition Timing

593 Engine

Timing can be changed using the MPEM programmer (P/N 529 035 878) or using the Vehicle Communication Kit (VCK) (P/N 529 035 981). See 593 HO SDI engine for more information on the VCK kit or follow the procedure below when using the MPEM programmer.

Connect the 9 volt adapter (P/N 529 035 675) to supply cable (P/N 529 035 869) and supply cable to diagnostic connector.

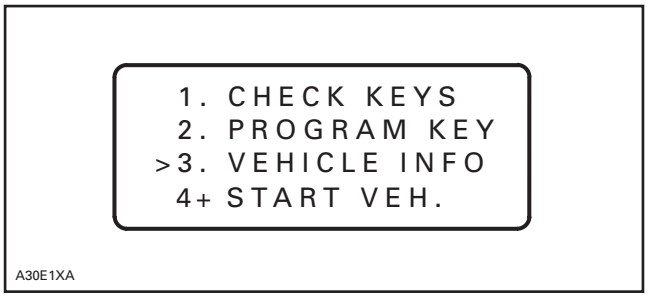


A32E2VA

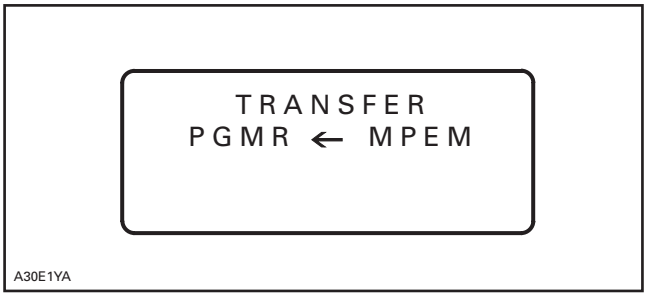
Connect MPEM programmer to DESS post.

Turn on programmer then enter password.

From main menu select no. 3 INFO VEHICLE.

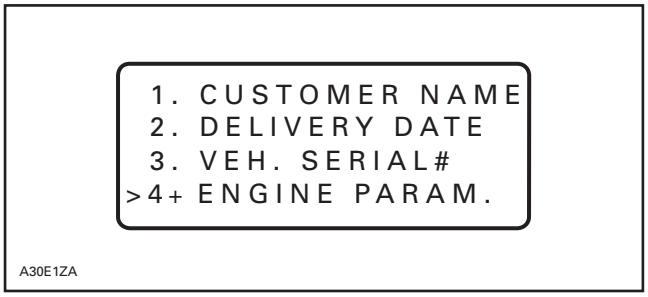


Vehicle information is transferred from MPEM to programmer.

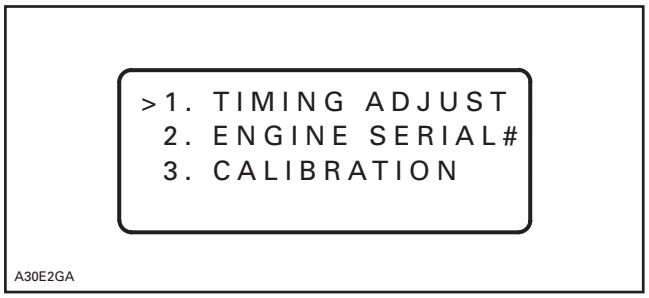


NOTE: In fact the programmer takes a copy of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4 ENGINE PARAMETER.

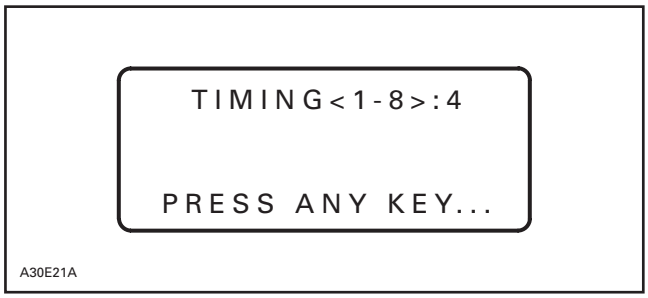


Select no. 1 TIMING ADJUSTMENT.



Press ENTER.

Now the display shows the engine timing correction factor that is programmed in the MPEM. In the following example timing correction factor is no. 4.

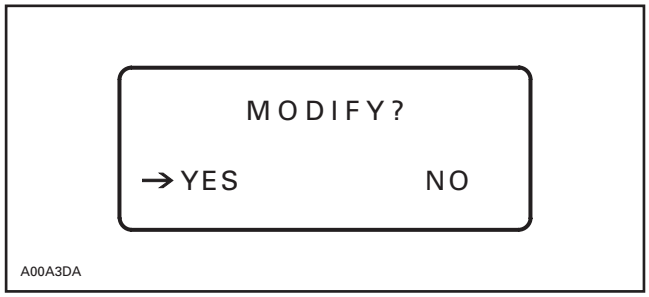


Press any key.

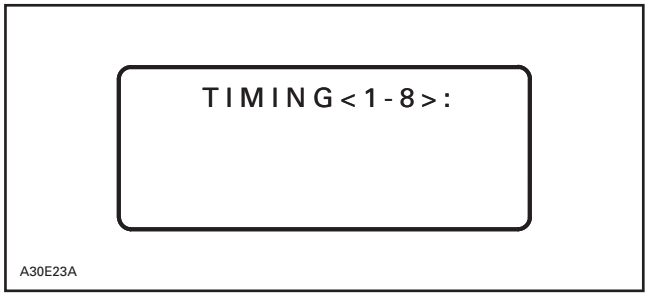
Select YES using the key

←

←



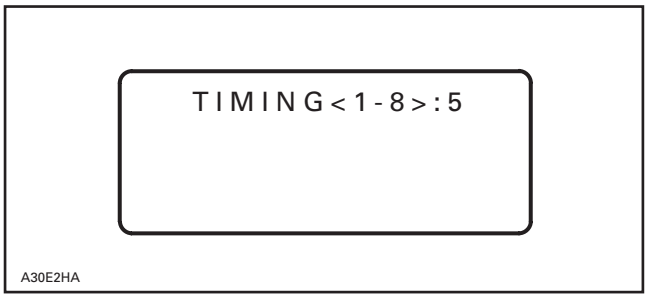
Press ENTER.



Select a timing correction factor corresponding to correction needed.

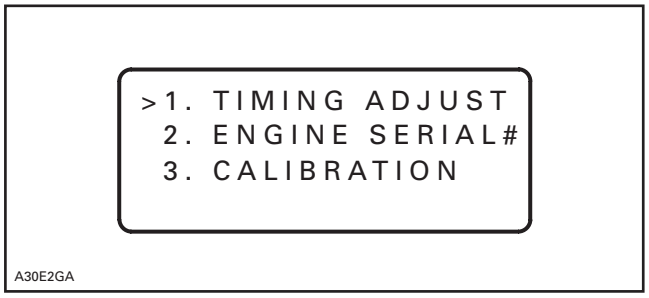
Example: Timing mark as verified with a timing light at 3500 RPM was too early by 2°. The correction factor programmed is no. 4.

Select correction factor no. 5. This will retard the timing by 2° because the difference between correction factor no. 4 and no. 5 is - 2° (passing from 1° to - 1°).

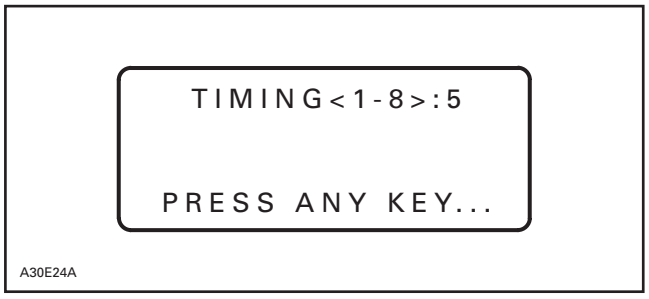


IGNITION CORRECTION FACTOR	
CORRECTION FACTOR PROGRAMMED IN MPEM	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0°
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Press ENTER.

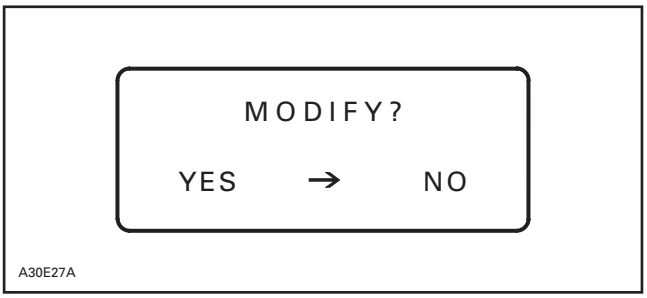


Press ENTER.

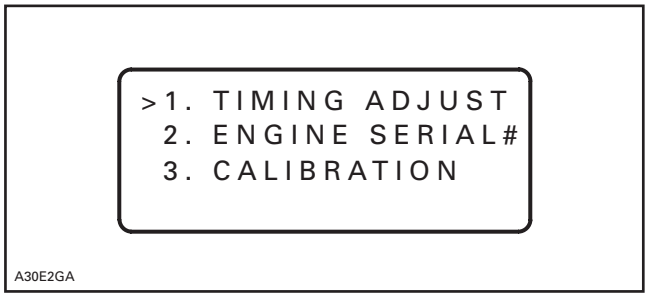


The display confirms that correction factor has been changed to no. 5.

Press any key.

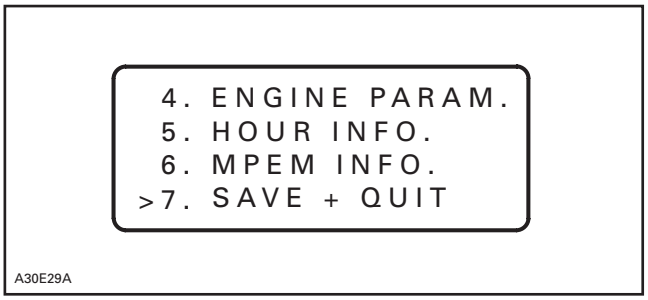


If the new correction factor selected above is the good one select NO and press ENTER. Otherwise select YES to choose an other correction factor.

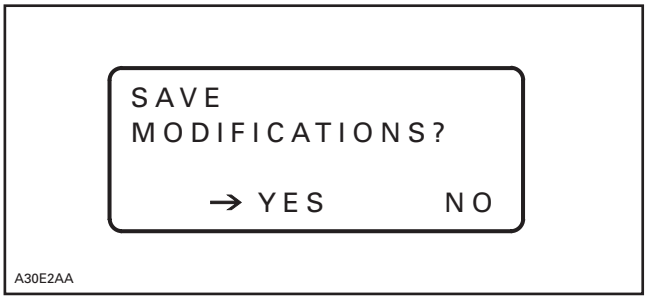


Press MENU.

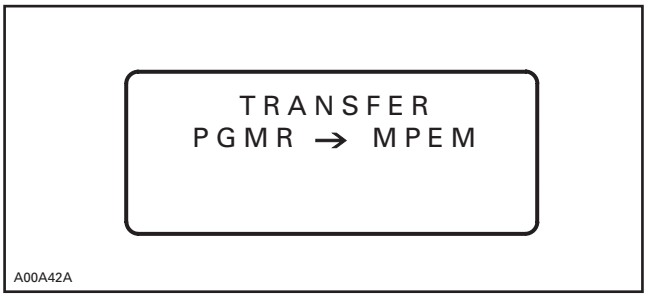
Scroll to no. 7 SAVE AND QUIT.



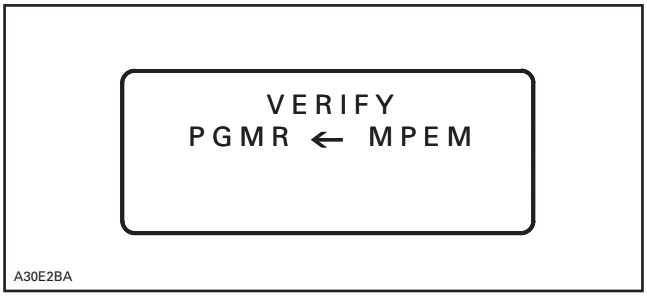
Press ENTER.



Press ENTER.

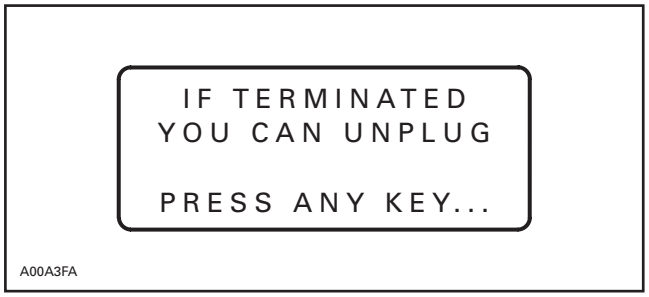


During a very short period of time the following message will appear.

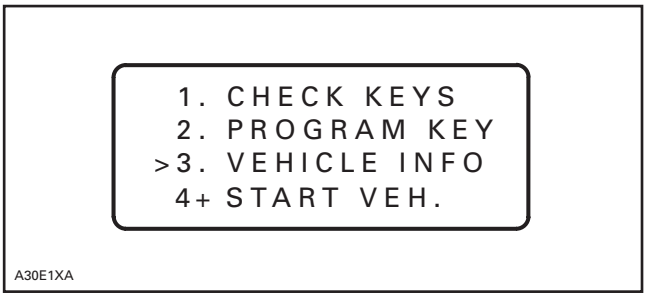


After the programmer has verified, following message will appear.

Press any key.



Press any key.

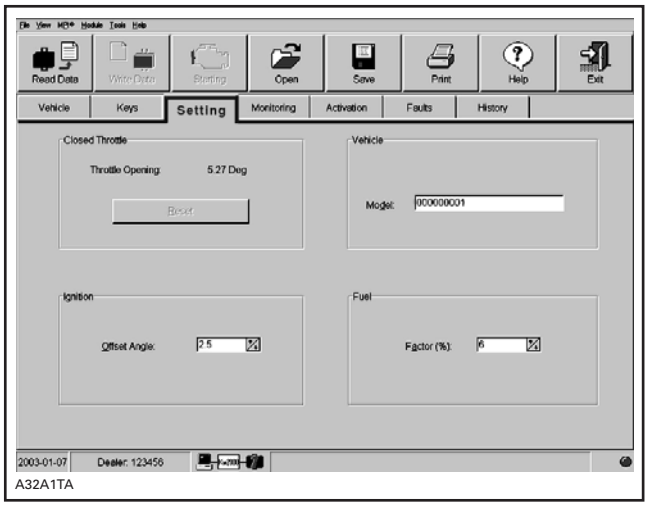


Unplug supply cable and 9-volt adaptor.

593 HO SDI Engine

To change the ignition timing on the 593 HO SDI, the Vehicle Communication Kit (VCK) (P/N 529 035 981) is mandatory. The MPEM programmer can not be used.

Look under the Setting tab of the BUDS software to change the ignition timing.



Detailed information about the BUDS software and its usage is available under the HELP tab.

SPARK PLUGS

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	436

NGK SPARK PLUG

All Models

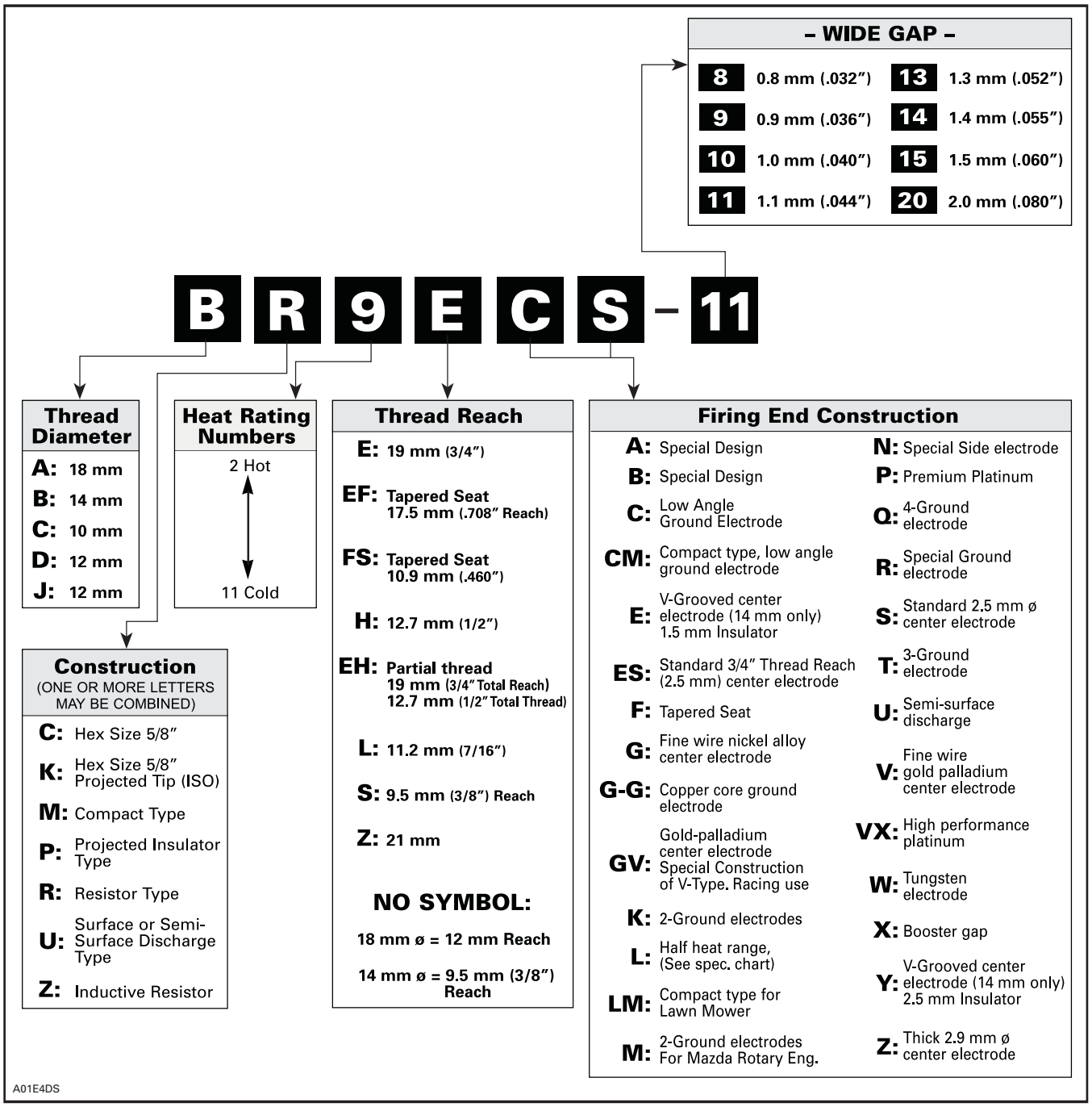
NGK SPARK PLUG NUMBERING SYSTEM

BRP uses NGK brand spark plugs on all its snowmobile models.

The heat range identification system is:

Low number	→	hot plug
High number	→	cold plug

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



DISASSEMBLY

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.

HEAT RANGE

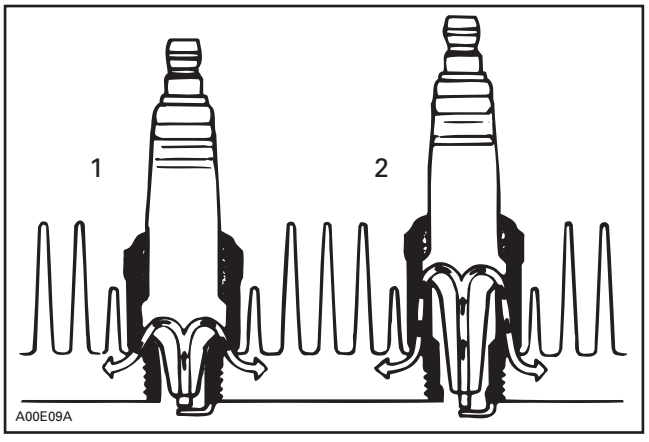
The proper operating temperature or heat range of the spark plugs is determined by the spark plug ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the hotter the spark plug operating temperature will be — and inversely, the shorter the heat path, the colder the operating temperature will be.

A cold type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

The hot type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during prolonged idle or low speed operation.



1. Cold
2. Hot

CAUTION: Severe engine damage might occur if a wrong heat range plug is used.

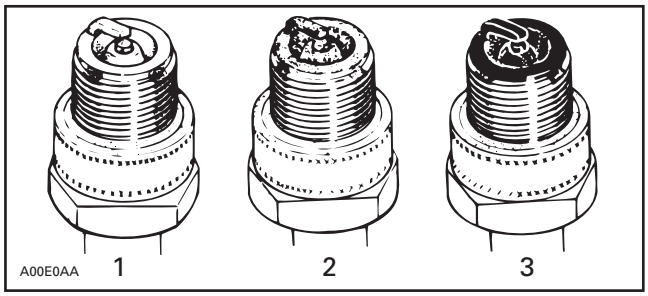
A too hot plug will result in overheating and pre-ignition, etc.

A too cold plug will result in fouling (shorting the spark plug) or may create carbon build up which can heat up red-hot and cause pre-ignition or detonation.

FOULING

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling, or running on a too rich mixture due to a faulty carburetor adjustment or incorrect fuel and/or fuel mixing. The plug face of a fouled spark plug has either a dry coating of soot or an oily, glossy coating given by an excess either of oil or of oil with soot. Such coatings form a conductive connection between the center electrode and ground.

SPARK PLUG ANALYSIS



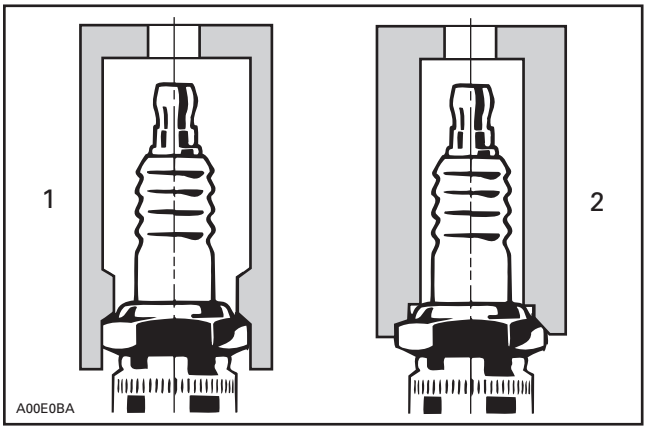
1. Overheated (light grey)
2. Normal (brownish)
3. Fouled (black)

The plug electrode and piston dome reveal the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug electrode and the piston dome.

SPARK PLUG INSTALLATION

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1) Using a wire feeler gauge, set electrode gap according to TECHNICAL DATA.
2) Apply anti-seize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
3) Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

SPARK PLUG TIGHTENING TORQUE

MODELS	SPARK PLUGS	TORQUE N•m (lbf•ft)
All models	NGK	27 (20)

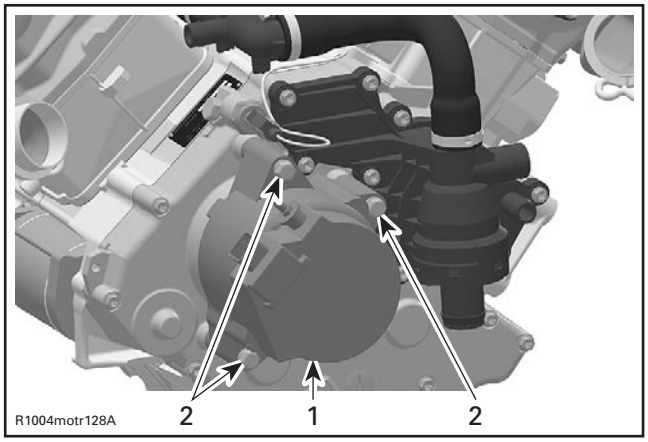
ALTERNATOR

The alternator is located on the ignition cover on the engine right hand side (alternator side).

REMOVAL

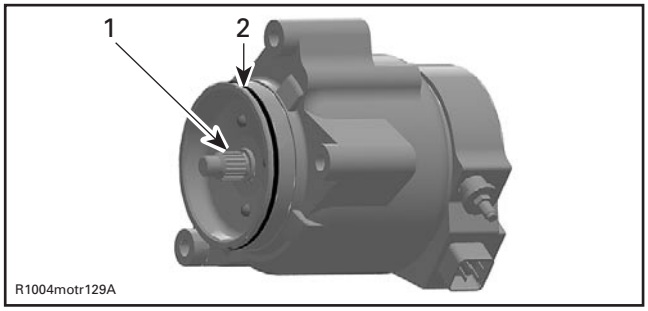
Remove:

– alternator cable
– alternator plug
– alternator screws and pull alternator.



1. Alternator
2. Three screws

INSPECTION



1. Drive gear splines
2. O-ring

NOTE: The alternator does not require any maintenance and must not be opened for repair work.

Inspect the housing, O-ring and the alternator drive gear splines for damage or wear. In case of damage, the alternator must be replaced. The alternator can only be replaced as a complete assembly.

INSTALLATION

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

NOTE: At assembly replace the O-ring of the alternator. Grease the drive gear splines and the O-ring before assembly using multi purpose grease. This will ease assembly and prevent displacement of the gasket during installation.

If it is not possible to move the alternator into the guide, this is due to the position of the drive gear. Pull the alternator out once more, slightly rotate the drive gear and try again.

Torque alternator screws to 23 N•m (17 lbf•ft).

BATTERY

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	447

SERVICE PRODUCTS

Description	Part Number	Page
protective heat shrink rubber tube	278 001 692	448
silicone dielectric grease	293 550 004	442, 447

GENERAL

All Models Except Skandic LT E

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.

MODEL	SUPPLIER P/N	BRP P/N
2-stroke	YTX20L-BS	410 301 203
4-stroke	YTX24HL-BS	410 922 962

REMOVAL

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Expedition TUV

NOTE: Battery is located under the seat.

Unhook battery cover strap from its support.

Open battery cover.

Remove battery.

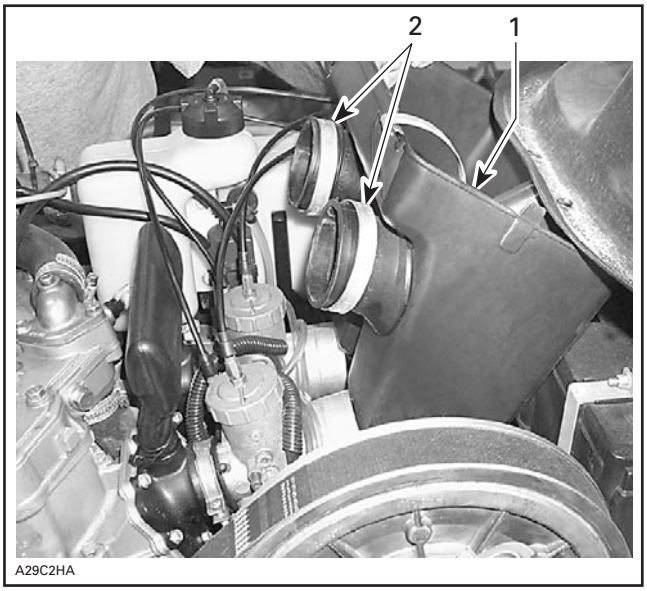
All Models Except Expedition TUV

Before removing battery, remove air silencer to get access to the battery.

Unlock the spring lock and remove intake cover and tube plate from the air silencer.

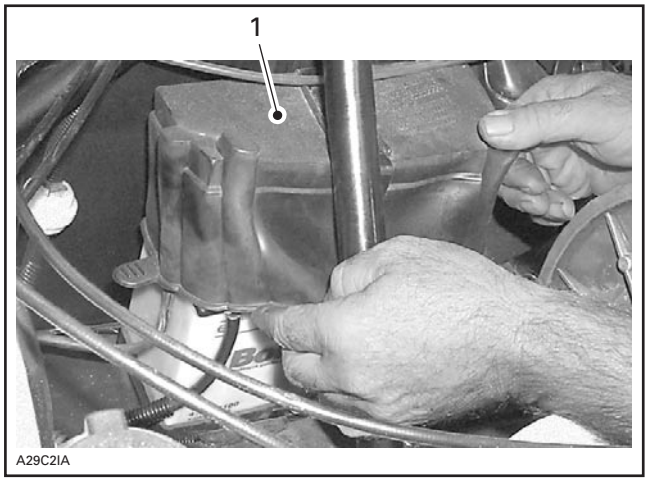
Remove pulley guard to get access to air intake adaptor collars clamps of air silencer.

Loose clamps and remove air silencer.



TYPICAL
1. *Air silencer (cover and tube plate removed)*
2. *Collars loosened*

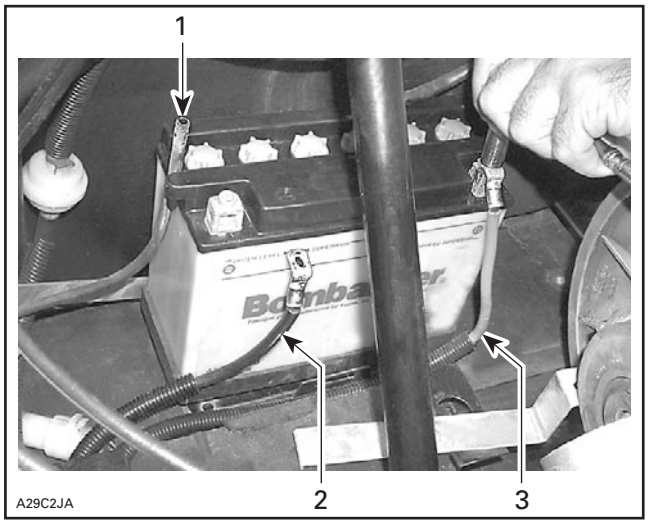
Unbolt battery cover steel strip and remove battery cover.



TYPICAL
1. Battery cover

Unplug vent tube (if applicable) from battery vent nipple.

Disconnect the black negative cable first followed by red cable and remove battery.



TYPICAL
1. Vent tube (if applicable)
2. Black negative cable
3. Red cable

Remove battery from vehicle.

NOTE: On some models, be careful not to lean the battery so that electrolyte flows out of vent tube.

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, vent tube, caps, 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.

Skandic LT E

CAUTION: Do not allow cleaning solution to enter battery interior since it will destroy the electrolyte.

INSPECTION

All Models

Visually inspect battery casing for cracks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

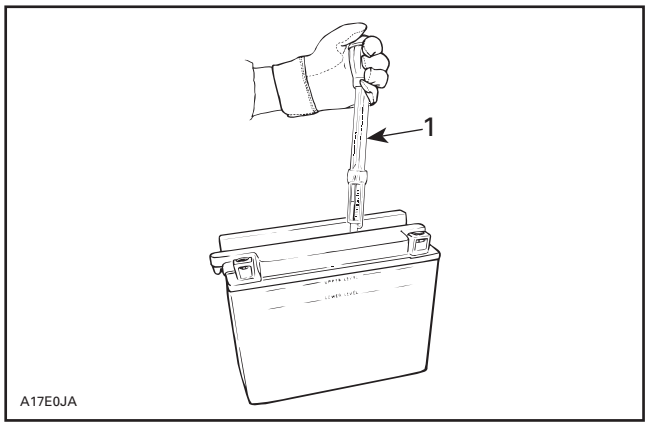
⚠ WARNING

Battery caps do not have vent holes. Make sure that vent tube is not obstructed.

BATTERY CHARGE TESTING

Skandic LT E

Hydrometer Test



1. Specific gravity 1.265

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte. Most hydrometers give a true reading at 25°C (77°F).

In order to obtain correct readings, adjust the initial reading by adding .001 to the hydrometer readings for each 2°C (3°F) above 25°C (77°F) and by subtracting .001 for every 2°C (3°F) below 25°C (77°F).

This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM		
°C	°F			
38	100	ADD	.008	TO THE READING
32	90		.003	
25	**77**	**correct reading**		
21	70	subtract	.002	from the reading
16	60		005	
10	50		009	
4	40		012	
- 1	30		016	
- 7	20		019	
- 12	10		022	
- 18	0		026	
- 23	- 10		029	
- 29	- 20		032	
- 34	- 30		036	
- 40	- 40		039	

EXAMPLE **no. 1** Temperature below 25°C (77°F): Hydrometer Reading: 1.250 Electrolyte temperature: - 7°C (20°F) Subtract .019 Sp. Gr. Corrected Sp. Gr. is 1.231

EXAMPLE **no. 2** Temperature above 25°C (77°F): Hydrometer Reading: 1.235 Electrolyte temperature: 38°C (100°F) Add .008 Sp. Gr. Corrected Sp. Gr. is 1.243

TEMPERATURE CORRECTED SPECIFIC GRAVITY	BATTERY CHARGE
1.265	Fully charged
1.215	3/4 charged
1.165	1/2 charged
1.125	1/4 charged
1.110	Discharged

CAUTION: Do not install a partially charged battery on a snowmobile since the casing might crack at freezing temperature. The following chart shows the freezing point of the electrolyte in relation to the temperature corrected specific gravity.

TEMPERATURE CORRECTED SPECIFIC GRAVITY	FREEZING POINT OF ELECTROLYTE	
1.265	- 59°C	(- 75°F)
1.225	- 37°C	(- 35°F)
1.200	- 27°C	(- 17°F)
1.150	- 15°C	(+ 5°F)
1.110	- 3°C	(+ 27°F)

Voltmeter Test

Skandic WT/SWT/SUV/Expedition TUV

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

Skandic LT E

Disconnect and remove battery from the vehicle.

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Do not overfill.

The battery must always be stored in fully charged condition. If required, charge until specific gravity of 1.265 is obtained.

CAUTION: Battery electrolyte temperature must not exceed 50°C (122°F). The casing should not feel hot.

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 and caps using a solution of baking soda and water. Do not allow cleaning solution to enter battery, otherwise it will destroy the electrolyte. Rinse battery with clear water and dry well using a clean cloth.

Store battery in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum.

During the storage period, recheck electrolyte level and specific gravity readings at least every 40 days. As necessary, keep the battery at its upper level line and near full charge as possible (trickle charge).

Skandic WT/SWT/SUV/Expedition TUV

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 a temperature below 15°C (60°F).

Charge the battery every two weeks if stored at a temperature above 15°C (60°F).

ACTIVATION OF NEW BATTERY

Skandic WT/SWT/SUV/Expedition TUV

Refer to the instructions provided with the battery.

Skandic LT E

⚠ WARNING

Never charge or boost battery while installed on vehicle.

CAUTION: Prior to charging the battery, always remove it from the vehicle to prevent electrolyte spillage.

A new battery is factory fresh dry charged. For storage purposes, it is fitted with a temporary sealing tube.

Do not remove the sealing tube or loosen battery caps unless activation is desired.

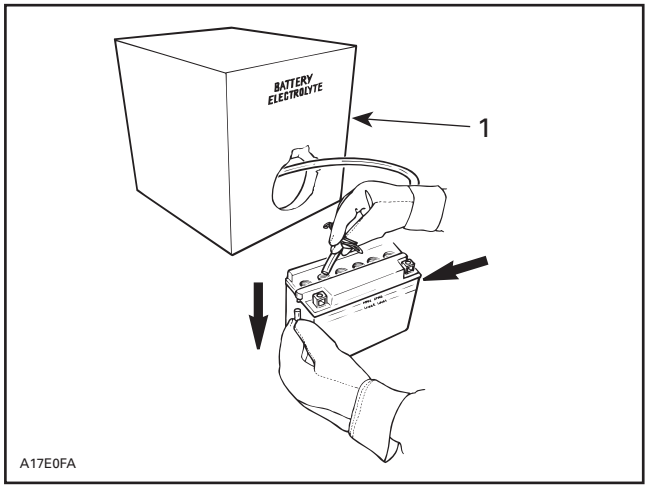
In case of accidental premature removal of caps or sealing tube, battery should be given a full charge.

Perform the following operations anytime a new battery is to be installed.

– Remove the sealing tube from the vent elbow. Install vent tube, included in the battery kit, to battery elbow.

⚠ WARNING

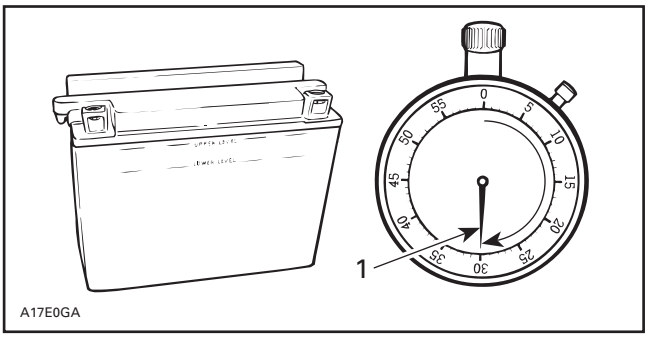
Failure to remove the sealing tube could result in an explosion.



1. Battery electrolyte

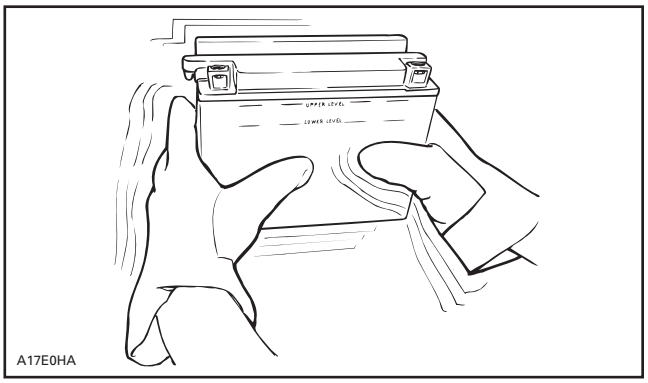
– Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity : 1.265 at 20°C (68°F)).

– Allow the battery to stand for 30 minutes MINIMUM (1 hour MAXIMUM) so that electrolyte soaks through battery cells.

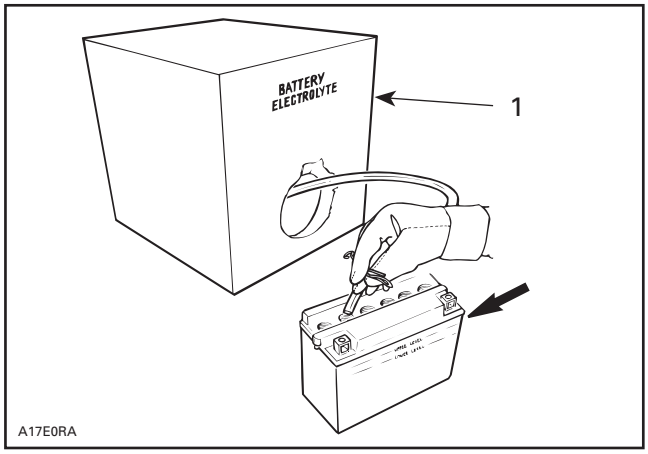


1. 30 minutes

– Allow gas bubbles to escape by lightly shaking battery by hand.

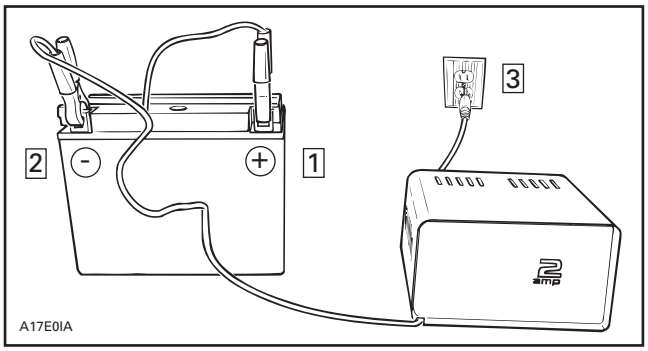


– Readjust the electrolyte level to the UPPER LEVEL line.



1. Battery electrolyte

– Connect a 2 A battery charger for 10 to 20 hours.

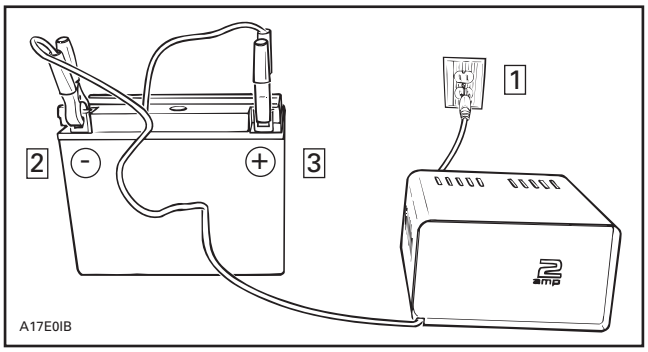


CAUTION: If charging rate raises higher than 2.4 A reduce it immediately. If cell temperature rises higher than 50°C (122°F) (if the casing feels hot) discontinue charging temporarily or reduce the charging rate.

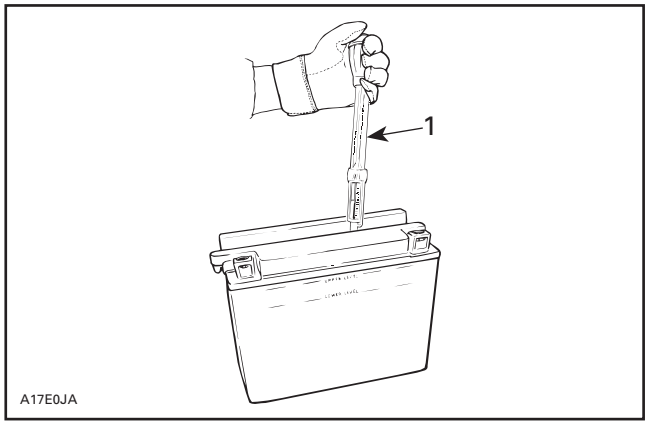
⚠ WARNING

Gases given off by a battery being charged are highly explosive. Always charge in a well ventilated area. Keep battery away from cigarettes or open flames. Always turn battery charger off prior to disconnecting cables. Otherwise a spark will occur and battery might explode.

– Disconnect battery charger.

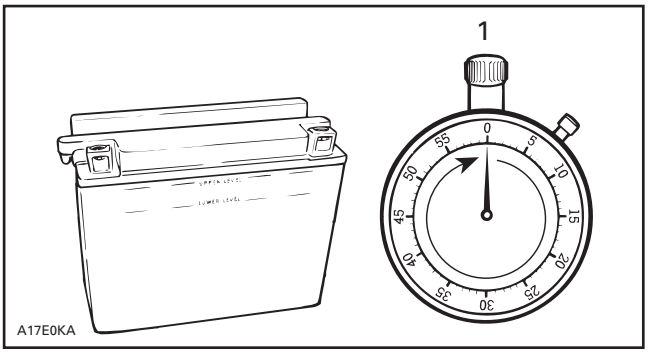


– Test battery state of charge. Use a hydrometer.



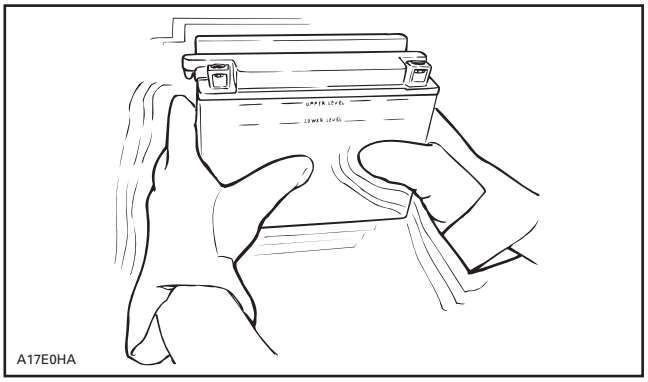
1. Specific gravity 1.265

– Let battery settle for 1 hour.

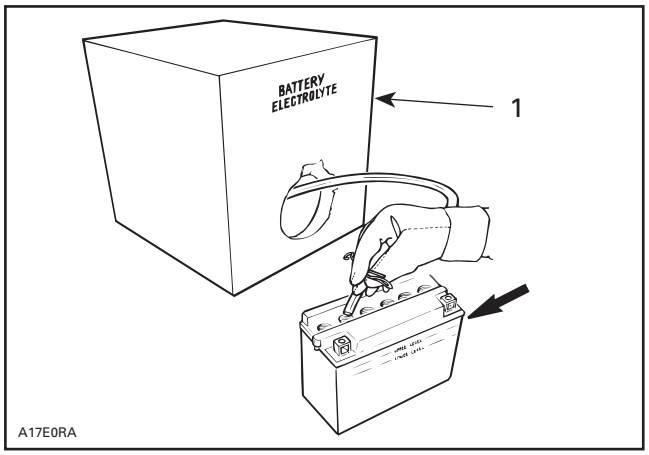


1. 60 minutes

– Allow gas bubbles to escape by lightly shake battery.

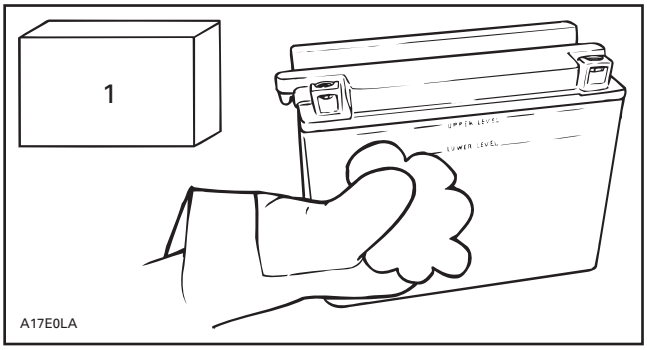


– Readjust electrolyte level.



1. Battery electrolyte

– Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.



1. Baking soda

CAUTION: Do not allow cleaning solution to enter battery interior since it will destroy the electrolyte.

NOTE: It is recommended to verify the battery charge once a month. If necessary, fully charge battery.

SERVICING

Electrolyte Level

Skandic LT E

Since a battery has been activated (see above), add distilled water to top up electrolyte.

BATTERY CHARGING

Tips for Charging a Used Battery

Skandic LT E

CAUTION: Prior to charging the battery, always remove it from the vehicle to prevent electrolyte spillage.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging begun.

Do not charge frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

⚠ WARNING

Do not place battery near open flame.

Time required to charge a battery will vary depending some factors such as:

– Battery temperature: Charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
– State of charge: Because the electrolyte is nearly pure water in a completely discharged battery, it cannot accept current as well as electrolyte. This is the reason the battery will not accept current when the charging cycle first begins. As the battery remains on the charger, the current from the charger causes the electrolytic acid content to rise which makes the electrolyte a better conductor and then, the battery will accept a higher charging rate.
– Type of charger: Battery chargers vary in the amount of voltage and current that they can supply. Therefore, time required for the battery to begin accepting measurable current will also vary.

Charging a Very Flat or Completely Discharged Battery

Skandic LT E

Unless this procedure is properly followed, a good battery may be needlessly replaced.

– Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in term of milliamperes, because electrolyte is nearly pure water as explained above. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
– Only for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction telling how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

– Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
– If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.
– If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in Activation of a new battery.
– It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

All Except Skandic LT E

⚠ 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.

NOTE: If battery cannot be recharged using the following charging chart, replace battery.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4 – 9 hours	2 A
YTX24HL-BS	5 – 10 hours	

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 minutes	10 A
YTX24HL-BS	1 hour	

INSTALLATION OF BATTERY

Skandic LT E

Ensure vent tube is properly installed on battery elbow.

Connect vent tube to vehicle fitting on front frame.

All Except Skandic LT E

Route RED positive cable behind retaining strip and connect it to positive battery terminal. Connect RED wire (coming from ignition switch).

Connect BLACK negative cable LAST.

⚠ WARNING

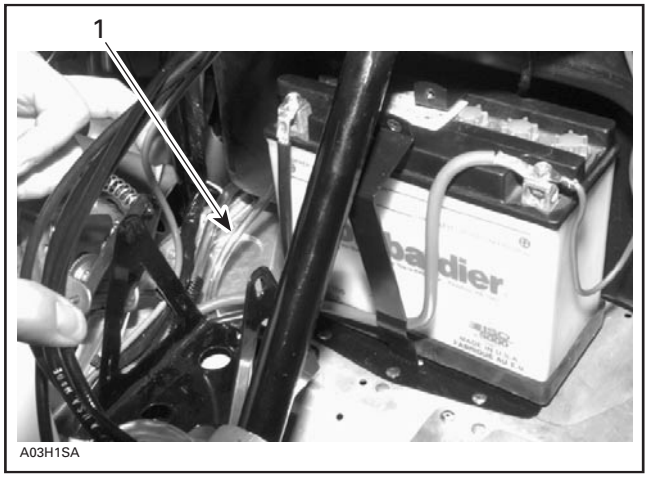
Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

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

All Models Except Expedition TUV



TYPICAL — BATTERY CONNECTION
1. Vent tube on fitting (if applicable)

Ensure that vent tube is not kinked or blocked then install battery cover over battery (if applicable).

Close and fasten retaining strips.

Reinstall air silencer and pulley guard.

Expedition TUV

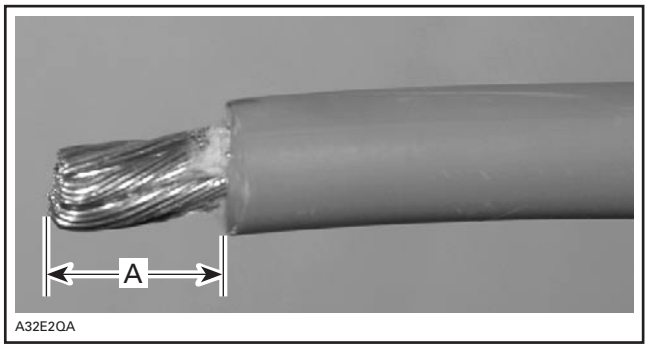
Properly position the battery on its rack.

Close battery cover.

Secure cover with rubber strap.

CABLE TERMINAL INSTALLATION

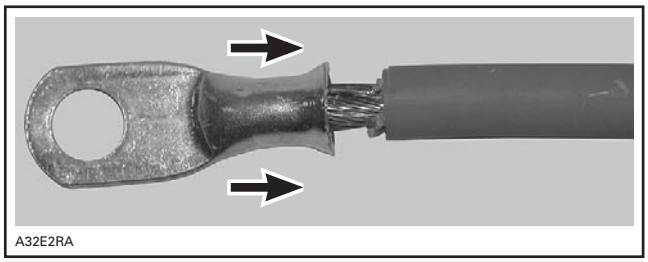
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

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

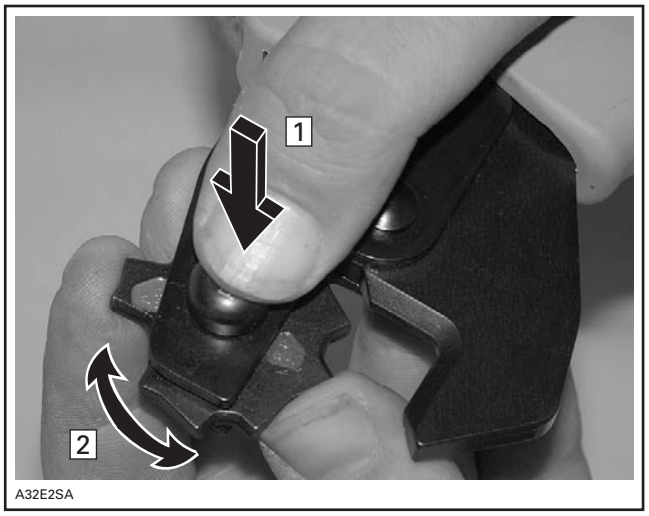
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.



INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.

NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.



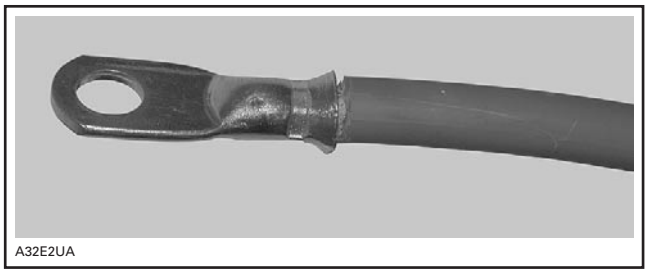
A32E2SA

POSITIONING THE CRIMP PLIERS
Step 1 : Press
Step 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 weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube (P/N 278 001 692) on the terminal. Heat the shrink rubber tube using a heat gun so that it grasps the wire and the terminal.

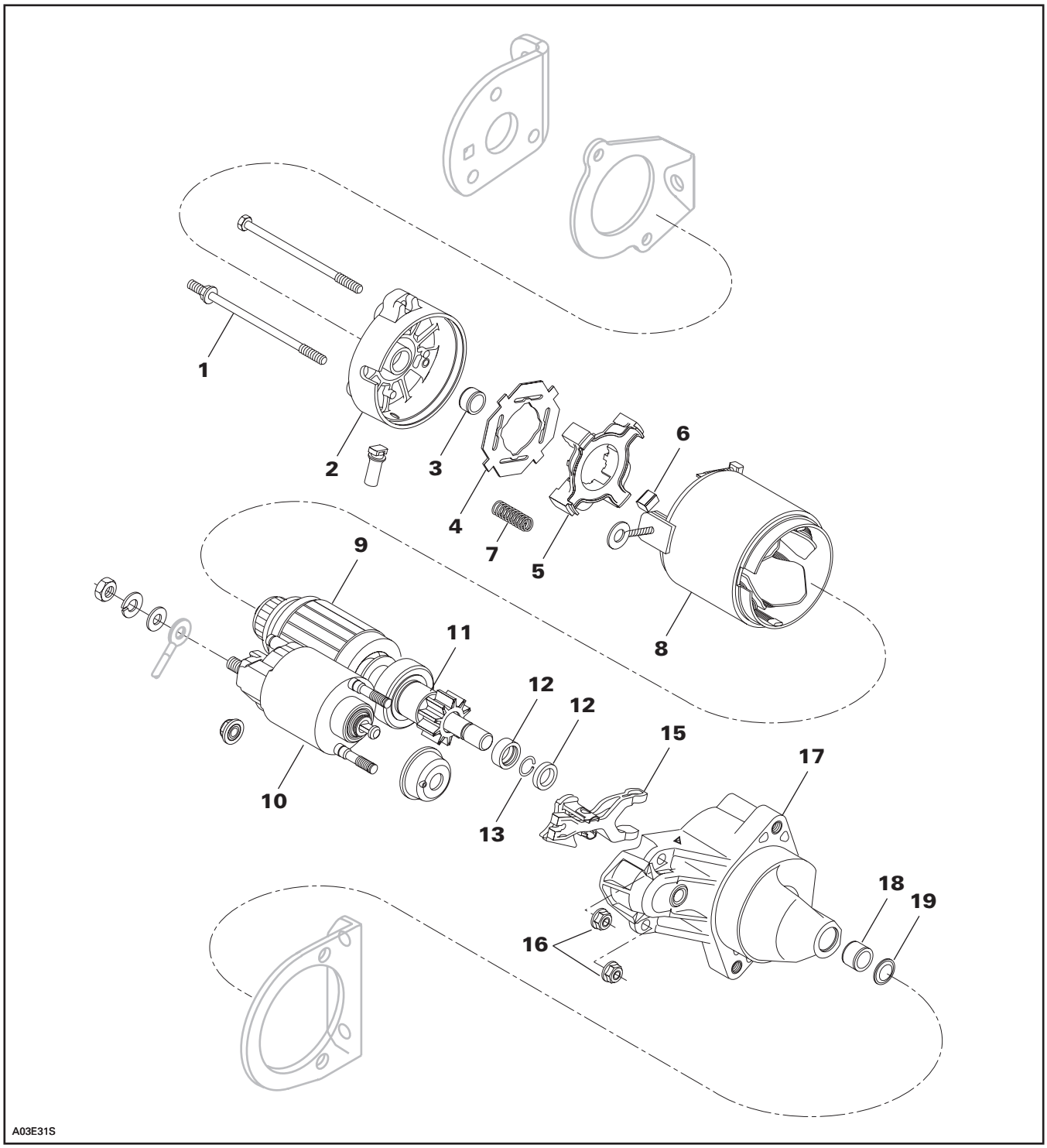
CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

ELECTRIC STARTER

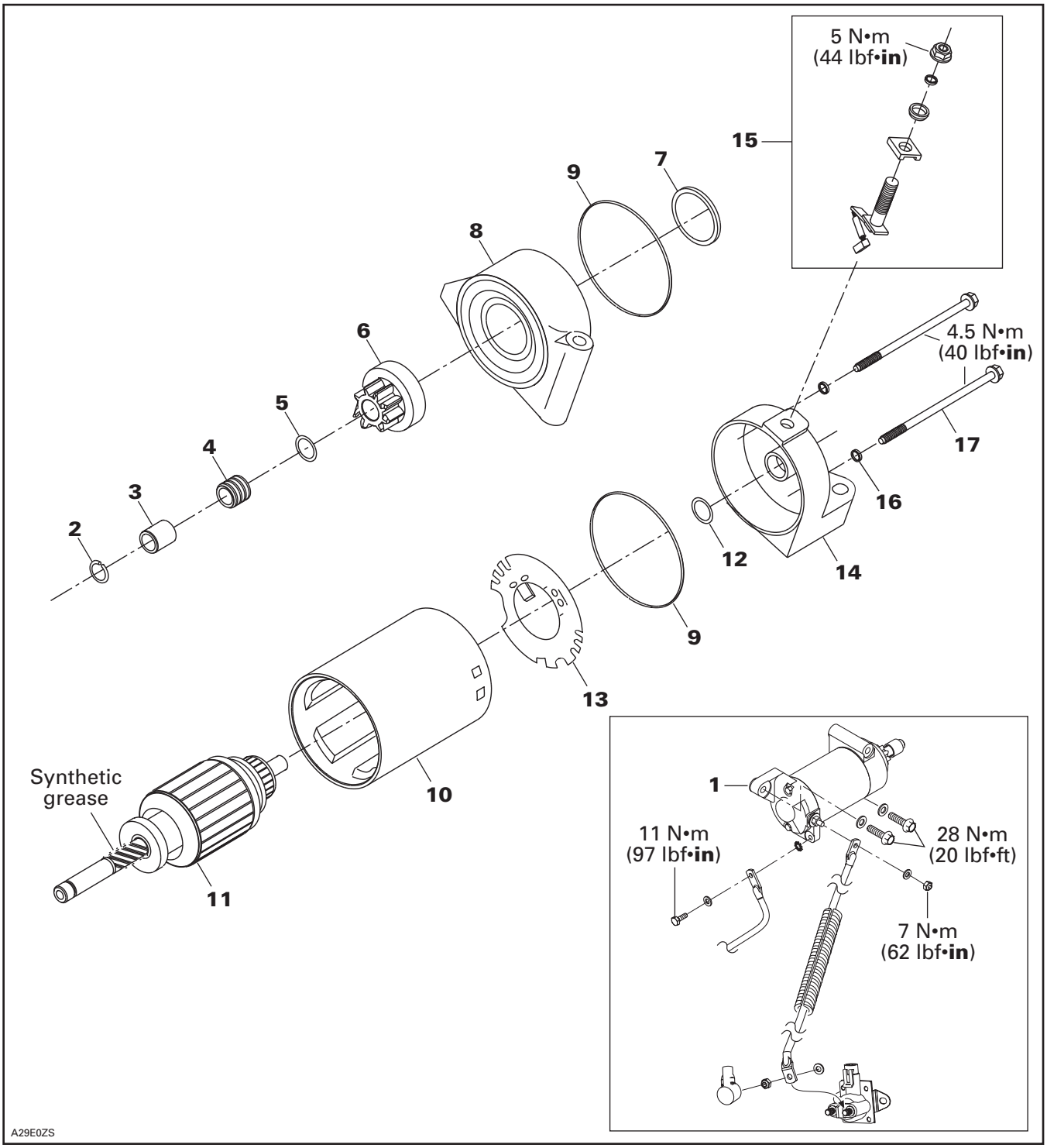
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271	293 800 005	460
Super Lube grease	293 550 030	461
synthetic grease	413 711 500	458–459

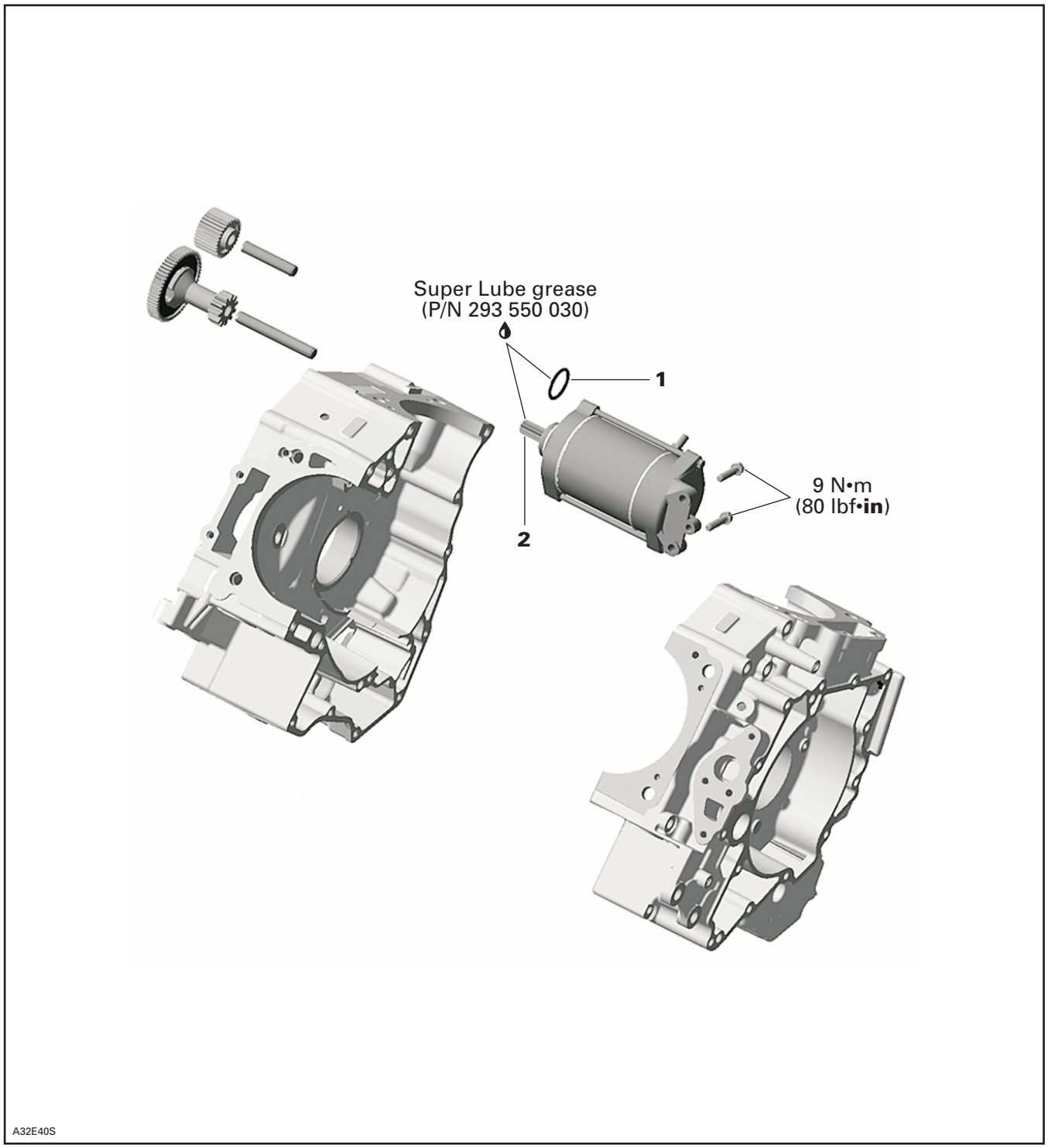
443 and 552 Engines



593 and 593 HO SDI Engines



V-1000 Engine



REMOVAL

443 and 552 Engines

– Disconnect BLACK ground cable from battery.
– Disconnect RED positive cable from battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Disconnect RED cable and RED/GREEN wire from starter relay.
– Unbolt starter from PTO side bracket.
– Unbolt MAG side bracket from engine.
– Remove starter from engine.

593 and 593 HO SDI Engines

– Disconnect BLACK ground cable from battery.
– Disconnect RED positive cable from battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Remove tuned pipe.
– Disconnect RED cable from starter.
– Disconnect ground cable from starter.
– Unbolt and remove starter from engine.

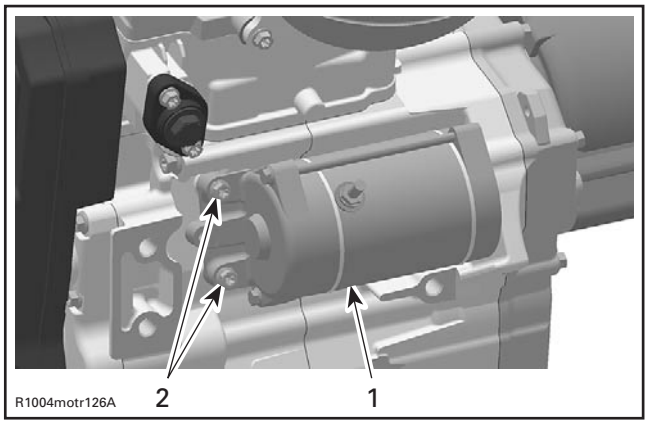
V-1000 Engine

Disconnect BLACK (-) cable from battery.

⚠ WARNING

Always disconnect BLACK (-) cable first and connect last.

The starter is located below the second cylinder in the crankcase.



1. Electric starter
2. Screws

Remove:
– starter cable
– starter screws.

Remove starter.

DISASSEMBLY

443 and 552 Engines

Disconnect bare wire linking starter and relay.

Remove nuts **no. 16** then relay **no. 10** by lifting and pulling to disengage from drive lever **no. 15**.

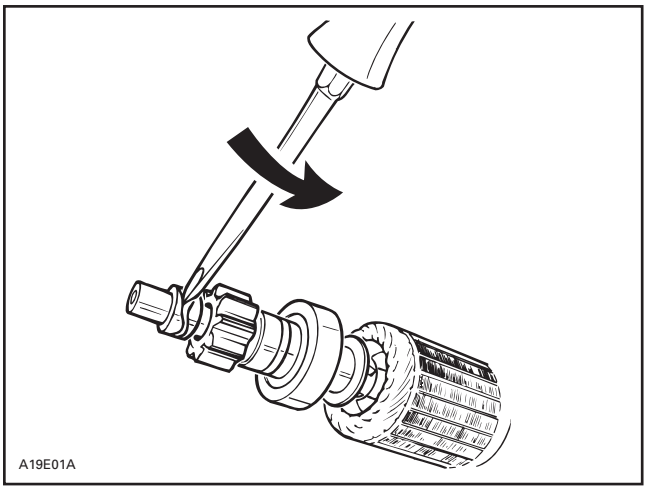
Unscrew starter screws (long) **no. 1** then pull yoke **no. 8** with end frame **no. 2** to separate from drive housing **no. 17**.

Pull armature **no. 9** with drive lever **no. 15**.

Remove insulator **no. 4** then brush springs **no. 7** being careful not to lose them since they will be projected out.

Pull brush holder **no. 5** from yoke **no. 8**.

Insert blade of a small screwdriver between stop collars.



Twist screwdriver to separate stop collars **no. 12** thus giving access to circlip **no. 13**.

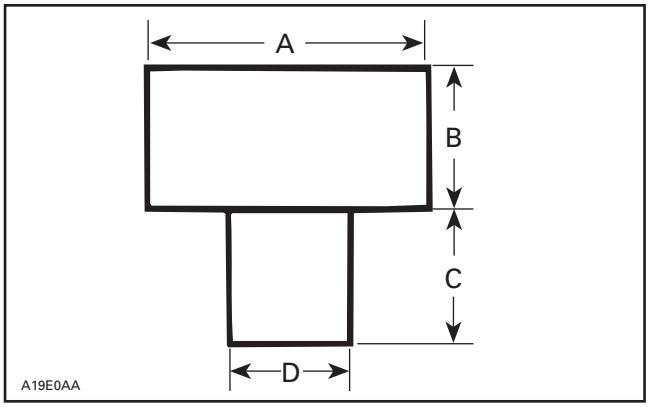
Remove outer collar, circlip then inner collar.

Remove overrunning clutch **no. 11**.

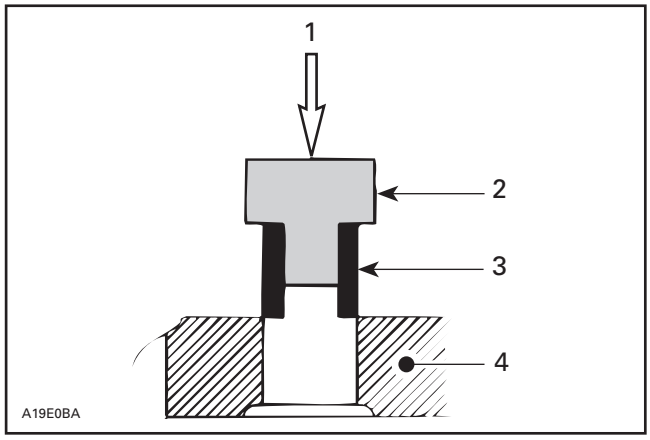
Check the wear on bushing **no. 18** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace the bushing. To replace, press out the old one toward bushing cover and press in a new one with a bushing pusher. The correct size of the bushing pusher to use is given on next illustration.

CAUTION: Support drive housing adequately to prevent damage when pressing bushing.

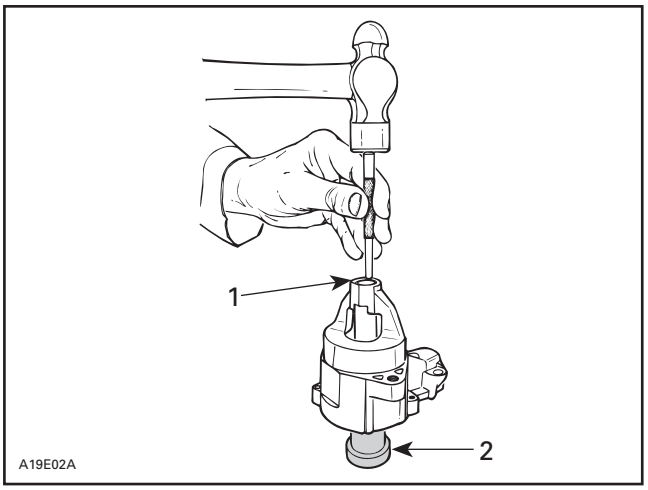


BUSHING PUSHER
A. 16 mm (5/8 in) diameter
B. 13 mm (1/2 in)
C. 11 mm (7/16 in)
D. 11.0 mm (.433 in)



1. Press-in
2. Bushing pusher
3. Bushing
4. Drive housing

Install bushing cover **no. 19** then, using a punch, stake bushing cover in place.



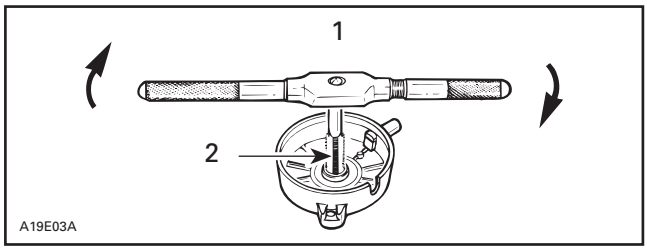
1. Stake bushing cover
2. Support

3, Bushing (end frame)

Check the wear on bushing **no. 3** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace bushing as follows:

Using a 12 mm tap, cut threads into bushing so that the tap contacts the end frame. Continue to rotate tap until the bushing comes free.



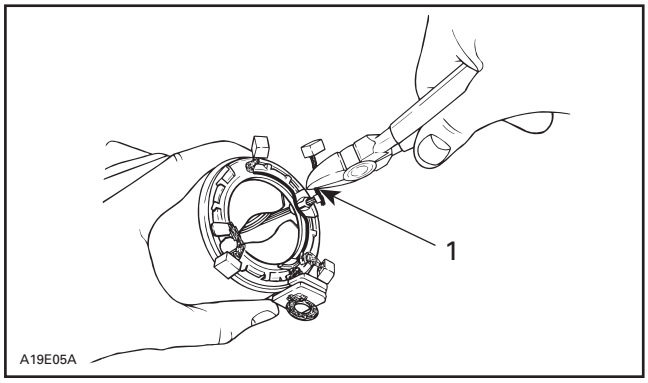
1. Turn until bushing goes out
2. 12 mm tap

To install new bushing, use the same bushing pusher as for drive housing bushing installation.

6, Brush

To replace brush **no. 6**, proceed as follows:

Cut brush wire close to connector at the welded portion.



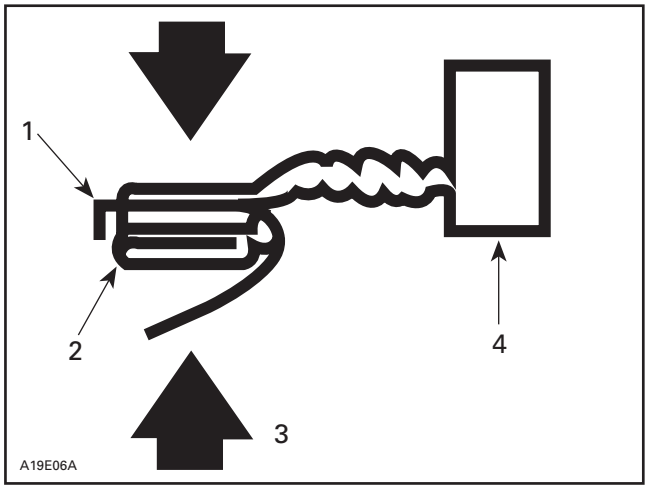
1. Cut close to connector

Remove burrs with a file on the remaining welded portion.

CAUTION: Be careful not to damage plastic portion of starter housing.

Place spare brush plate edge against housing connector edge (welded portion).

Crimp plate over housing connector with a pair of pliers.



1. Plate edge
2. Housing connector
3. Crimp
4. Spare brush

Solder the crimped portion.

CAUTION: Do not overheat and quickly perform soldering to prevent solder from flowing to the brush through the wire. Preferably use a heat sink.

593 and 593 HO SDI Engines

Before disassembling, trace index marks on starter housing **no. 10** and starter housing assembly **no. 8** to ease later assembly.

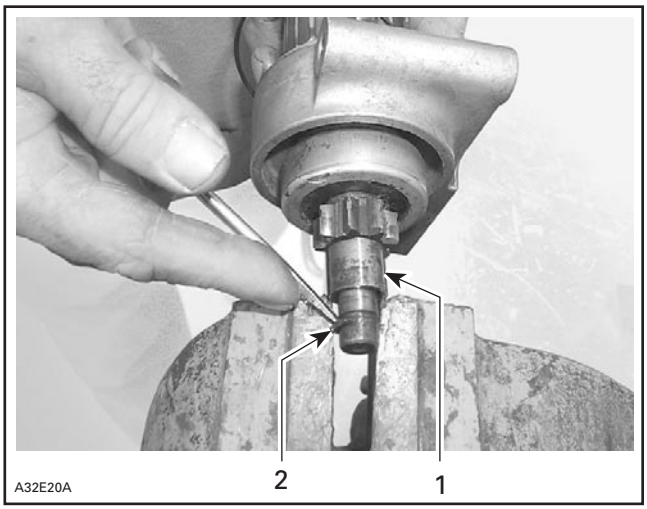
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

Brush holder **no. 13** can be removed from end frame housing **no. 14** by disconnecting the end frame attached brush from brush holder **no. 13**.

Check the radial play between the armature shaft and end frame bearing. Replace the end frame bearing or replace starter. If parts are in good condition then coat with synthetic grease (P/N 413 711 500) before reinstalling them.

Push back the collar **no. 3** using a screwdriver.

Remove snap ring **no. 2**. Remove collar **no. 3** and spring **no. 4**.



1. Collar
2. Snap ring

Turn starter clutch no. 6 clockwise to remove it from armature assembly no. 11.

Pull housing from armature.

V-1000 Engine

The starter is not serviceable. If defective, replace with a new one.

CLEANING AND INSPECTION

CLEANING

CAUTION: Armature starter yoke ass'y and drive unit assembly must not be immersed in cleaning solvent.

Clean brushes and holder with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holder clean using compressed air.

⚠ WARNING

Always wear safety goggles when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

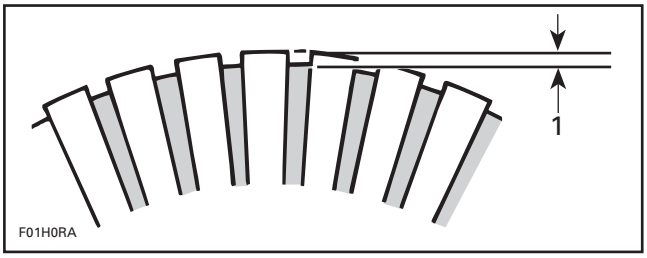
INSPECTION

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning the shorted windings in the armature.

Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, enough to remove grime only.

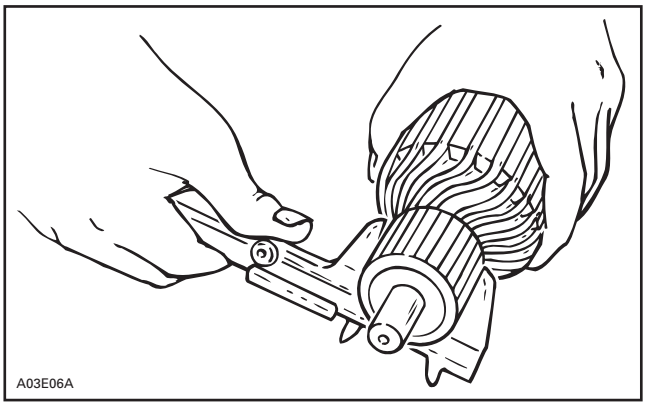
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



1. Commutator undercut 0.20 mm (.008 in)

Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

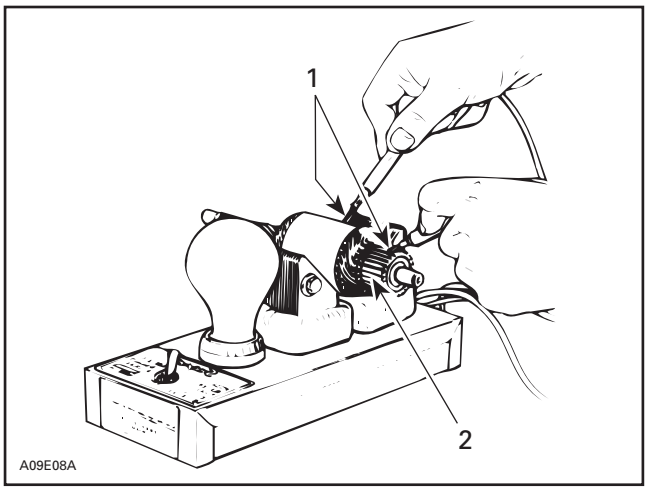
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
All	27 mm (1.063 in)

Test for Ground Circuit in the Armature

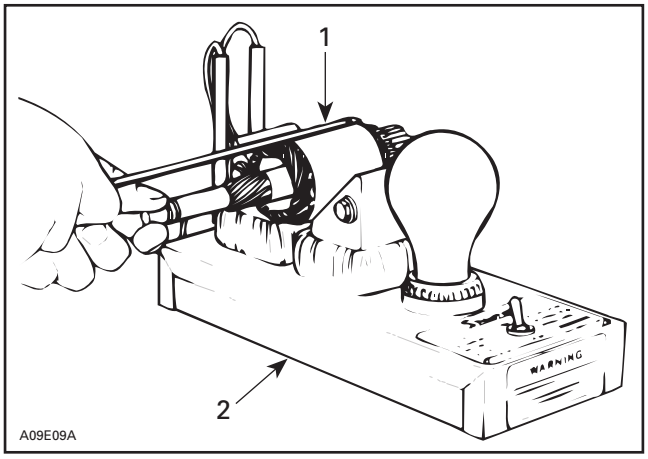
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has short circuit. Replace armature if so.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

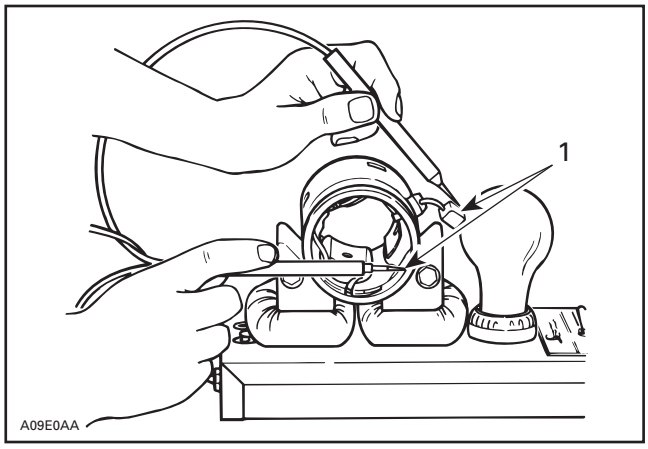
Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced or repaired; open circuits most often occur at the commutator riser where coils are soldered. (Burnt commutator bars are usually an indication of an open-circuit armature coil.)

Field Windings and Brushes

443 and 552 Engines

Test the Field Winding for Open Circuit

Use growler test probes. Place one test probe on the negative brush and the other test probe on the yoke. If growler lamp does not turn on, the field winding has an open-circuit. The yoke has to be repaired or replaced.



1. Test probes

Check the dynamic brake winding for open circuit by placing one test probe on the positive brush and the other probe on the negative brush.

If growler lamp does not turn on, the winding circuit is open-circuit and the starter housing has to be repaired or replaced.

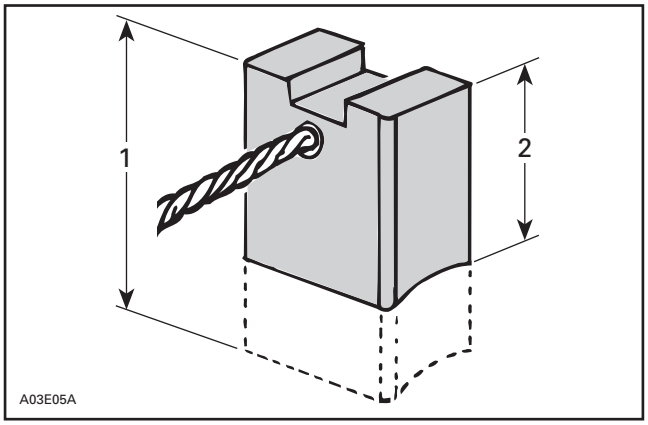
Brush Holder

Check the brush holder for insulation using growler test probes. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate. If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than the specified value, replace them.

MODEL	LENGTH	
	NEW	WEAR LIMIT
All	10 mm (.400 in)	6 mm (.236 in)

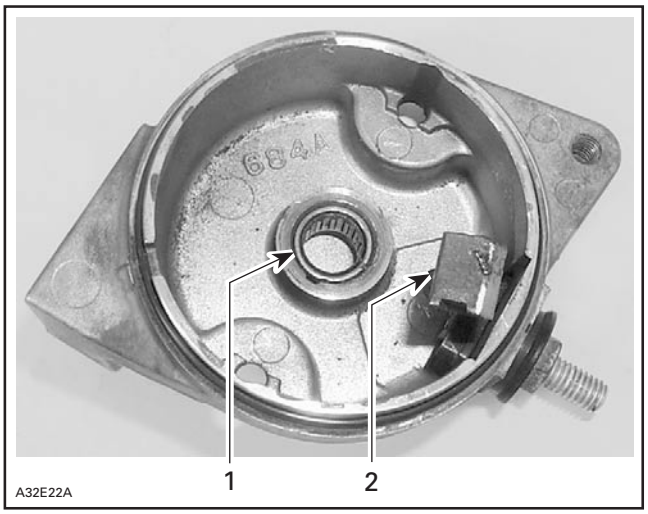


TYPICAL
1. New
2. Wear limit

End Housing

593 and 593 HO SDI Engines

Check the mica insulation of the positive brush and also the roller bearing condition. Replace, if required.



1. Roller bearing
2. Positive brush

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check the pinion teeth for wear and damage. If defective, replace.

Starter Relay

Inspect connections and clean as necessary. Relay condition can be checked with an ohmmeter. Install test probes on large connectors of relay when it is activated ((+) on RED/GREEN wire and (-) on relay body for the fan cooled models and (-) on the BLACK wire for liquid cooled models).

IMPORTANT: No current must be present on large cables when using ohmmeter, otherwise meter could be damaged.

ASSEMBLY

443 and 552 Engines

Prior to assembling, coat sliding surfaces and moving parts on armature shaft splines, overrunning clutch, relay plunger, drive lever and bushings with synthetic grease (P/N 413 711 500).

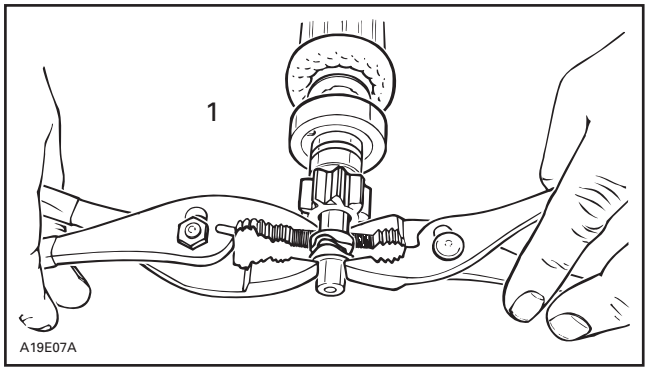
Proceed as follows for assembly.

Install overrunning clutch onto armature shaft. Insert inner collar onto shaft. Install a new circlip.

CAUTION: Always install a new circlip when servicing.

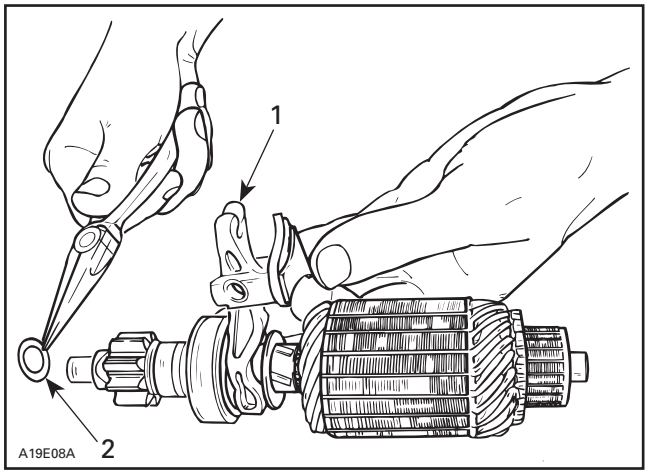
Insert outer collar being careful to match protrusions with notches of collars.

Using a pair of pliers on each side of stop collars, squeeze evenly until collars sit over circlip.



1. Squeeze evenly

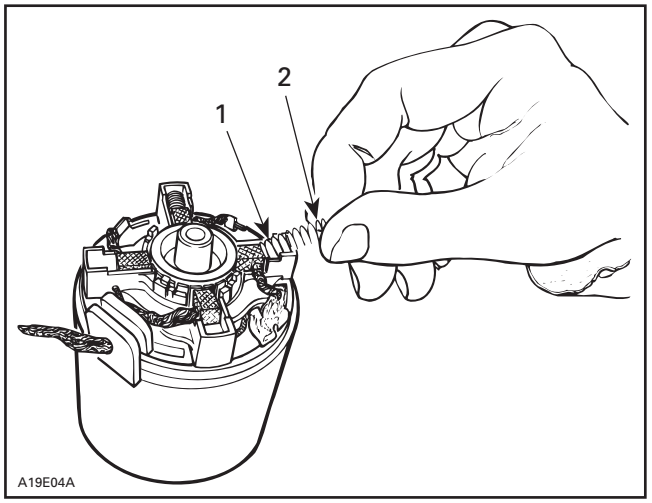
Install thrust washer against outer stop collar. Place drive lever onto overrunning clutch then insert into drive housing.



1. Install on overrunning clutch
2. Install thrust washer

Slide starter housing over armature.

Install brush holder then brushes in their housings. Insert springs as follows: place one end of spring against brush, compress, then push the other end of spring onto its housing. Repeat for remaining springs.



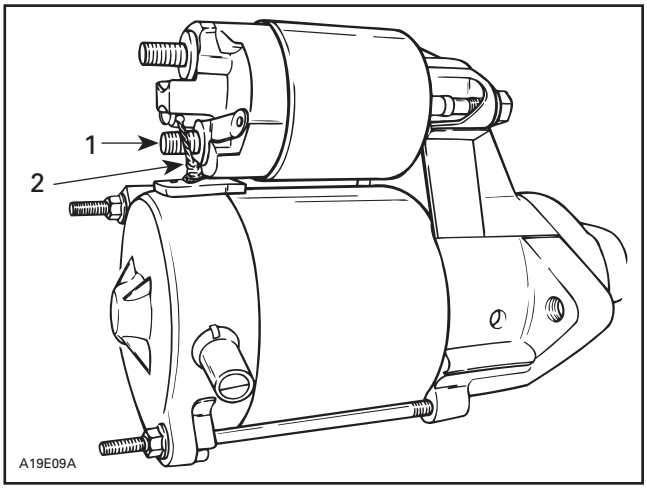
1. This end first
2. Push this end to complete

Secure insulator over brushes and springs. Properly install end frame and tighten screws.

Insert relay plunger inside of drive lever fork and secure to drive housing.

Connect starter bare wire to relay.

NOTE: Connect this wire on the shorter relay stud.



1. Shorter stud
2. Bare wire

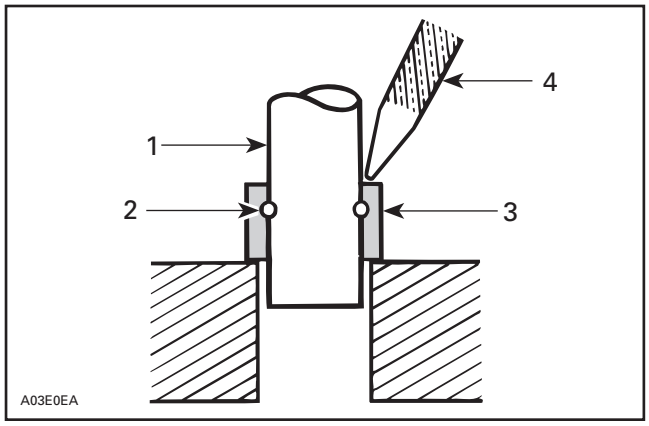
593 and 593 HO SDI Engines

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch, bushing and roller bearing with synthetic grease (P/N 413 711 500).

After placing collar **no. 3** on armature shaft **no. 11**, fit new snap ring **no. 2** on armature shaft, then make sure that it is properly secured.

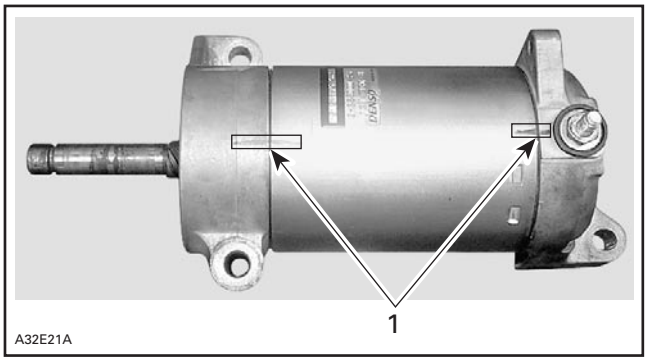
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it at two or three places.



1. *Armature shaft*
2. *Snap ring*
3. *Collar*
4. *Punch*

Starter Housing Assembly and Starter Housing

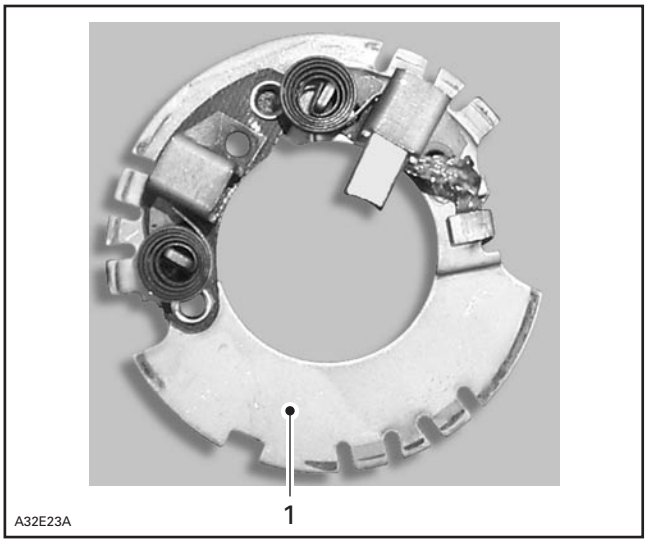
Align previously traced indexing marks.



TYPICAL
1. *Aligned indexing marks*

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder **no. 13** into housing **no. 14**.



1. *Brush holder*

To ease end frame installation, retain brush holder with a small screwdriver while installing armature assembly.

CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

INSTALLATION

443 and 552 Engines

Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.

CAUTION: Make sure that both starter brackets are well seated against engine crankcase and starter before torquing all retaining bolts.

Torque all M8 bolts to 24 ± 4 N•m (18 ± 3 lbf•ft).

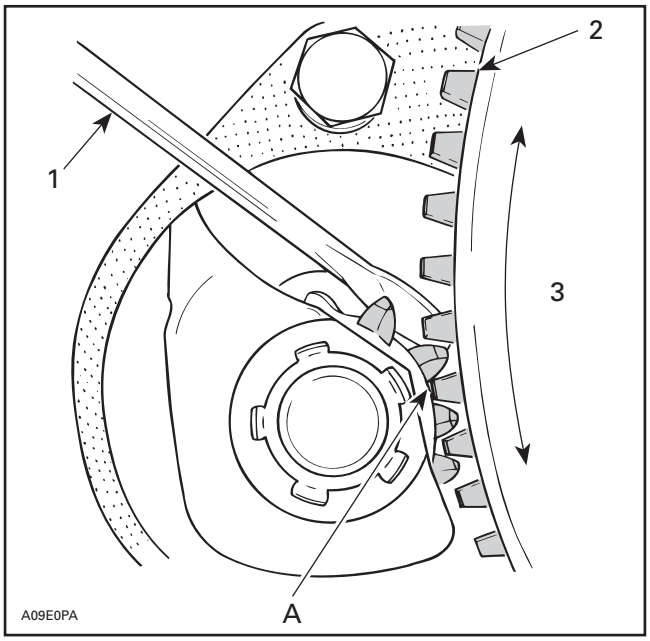
Torque all M5 bolts to 5 ± 0.5 N•m (44 ± 5 lbf•**in**).

CAUTION: Before checking engaging depth of starter pinon teeth, make sure that battery cables are disconnected.

Install starter.

NOTE: Check proper engaging depth of starter pinion teeth to ring gear teeth (see illustration). Install hardened washers (P/N 503 007 900) between engine and starter supports accordingly.

CAUTION: All starter bracket fasteners must be secured with Loctite 271 (P/N 293 800 005).



1. Screwdriver pulling starter pinion
2. Ring gear
3. No excessive backlash
A. 0.5 to 1.5 mm (.020 to .060 in)

Connect the RED battery cable and the RED wire to the large terminal of the relay. Connect RED/GREEN wire to small terminal of relay.

Connect BLACK cable to battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

593 and 593 HO SDI Engines

– Use new teflon washers on the 3 bolts retaining starter to engine.
– Torque the bolts to 28 ± 1 N•m (21 ± 1 lbf•ft).
– Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
– Connect the RED battery cable and the RED wire to the large terminal of the starter.
– Torque large terminal nut to 7 N•m (62 lbf•**in**).

⚠ WARNING

Always disconnect ground cable first and connect last.

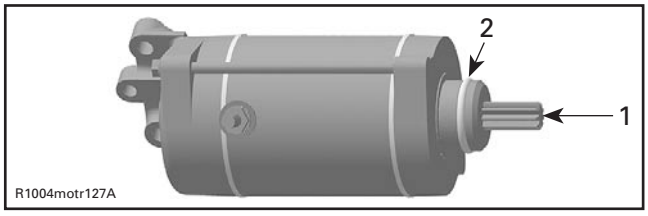
– Connect ground cable to the starter with star washer in between.
– Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

V-1000 Engine

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

NOTE: During assembly replace the O-ring **no. 1**of the starter. Grease the drive gear and the O-ring before assembly using Super Lube grease (P/N 293 550 030). This will simplify assembly and prevent displacement of the O-ring during installation.

If it is not possible to move the starter into the guide, this is due to the position of the drive gear**no. 2**. Pull the starter out once more, slightly rotate the drive gear and try again.

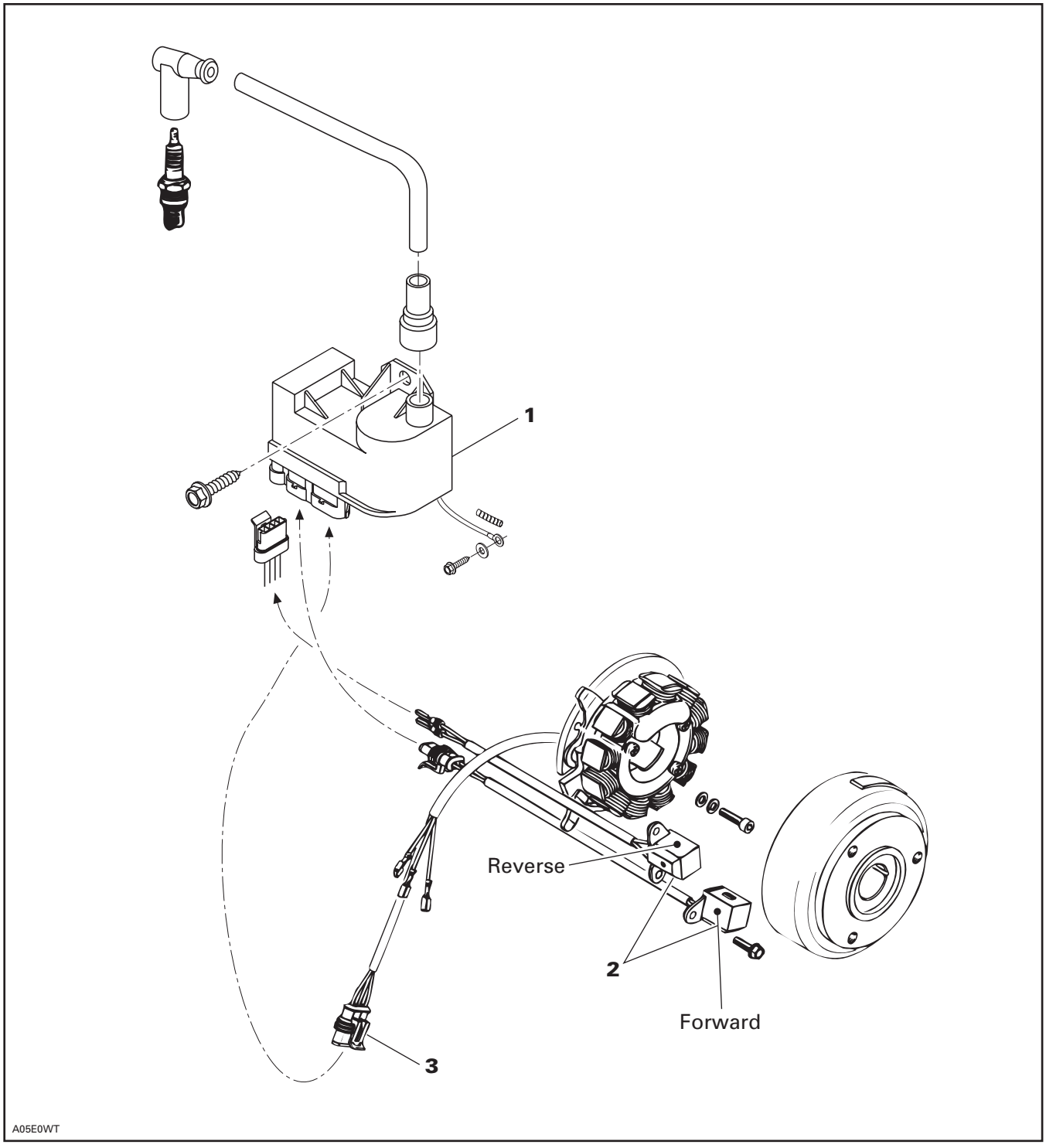


1. Drive gear
2. O-ring

Torque starter screws to 9 N•m (80 lbf•**in**).

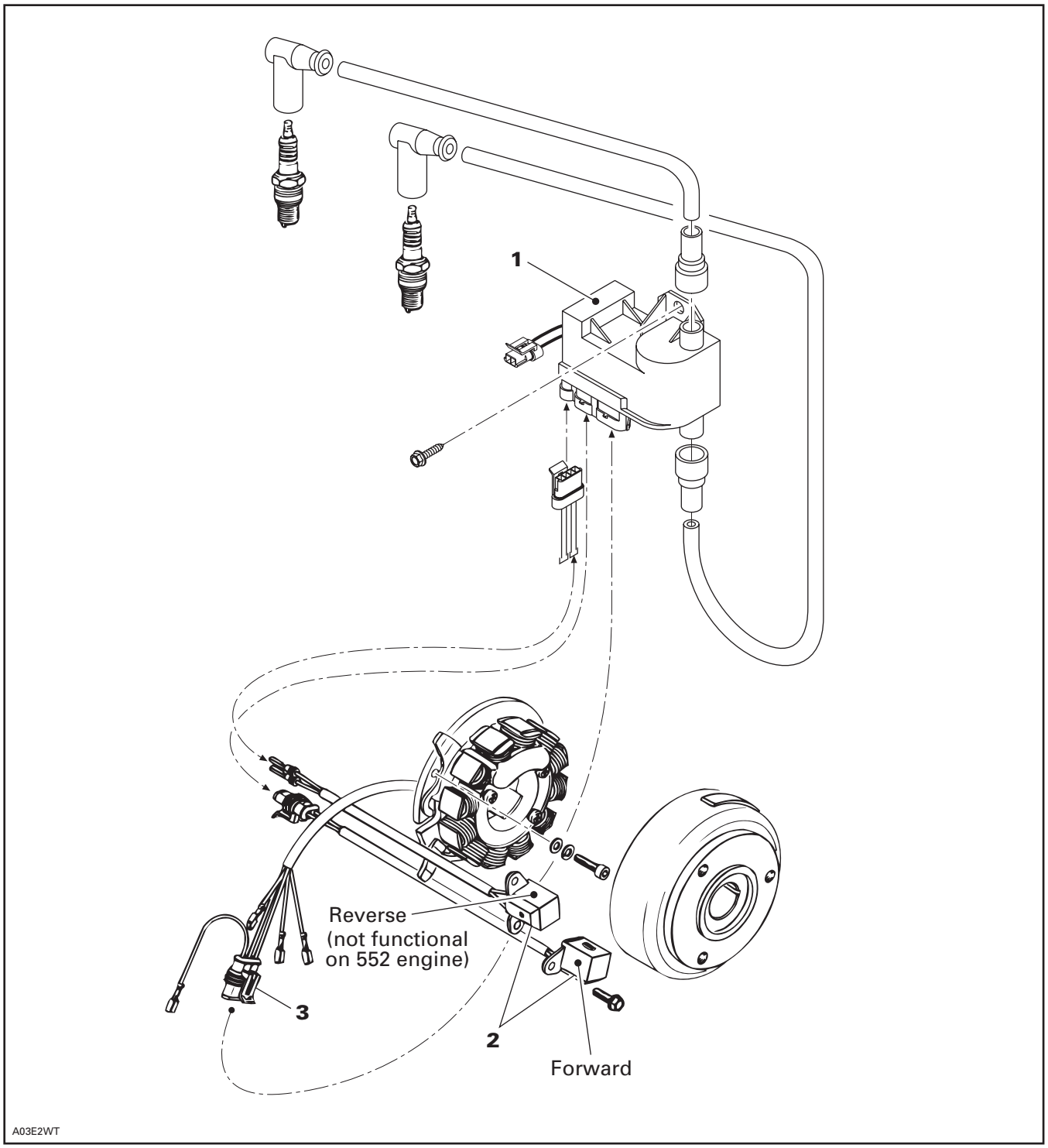
TESTING PROCEDURE

277 Engine



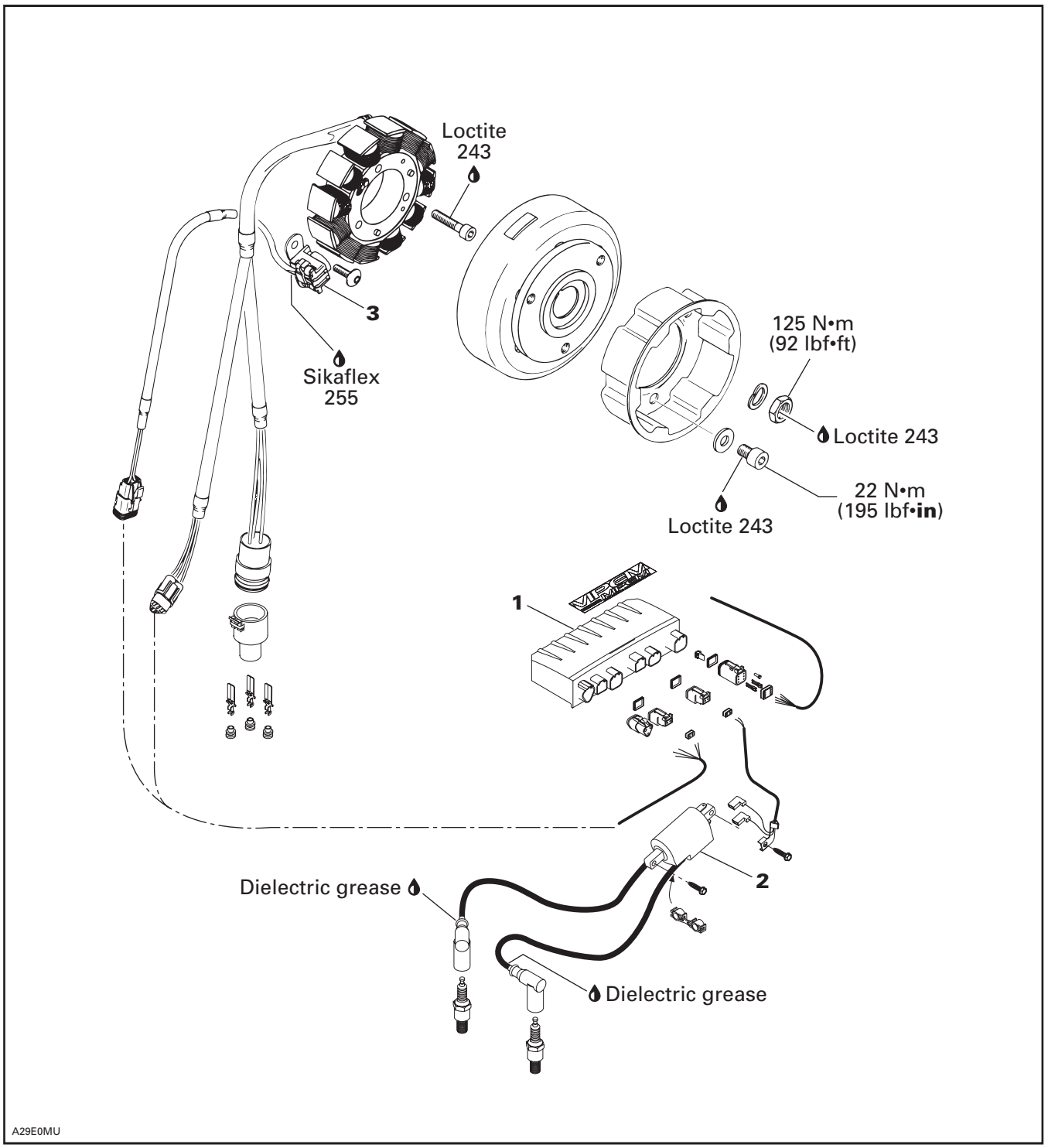
1. MPEM
2. Trigger coils
3. 4-DB housing (BLACK and RED wires)

443 and 552 Engines



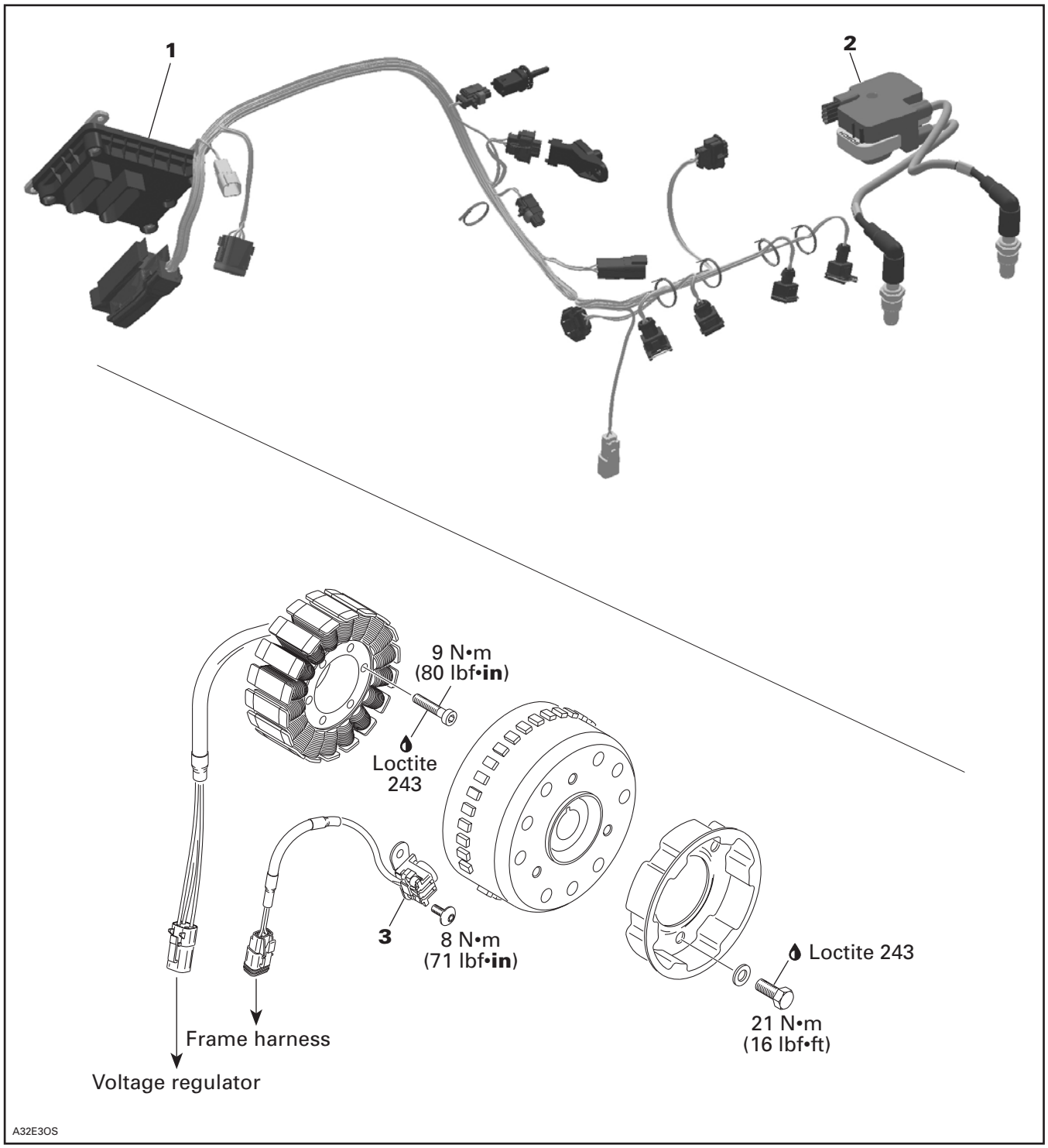
1. MPEM
2. Trigger coils
3. 3-connnector housing (BLACK and RED wires)

593 Engine



1. *MPEM*
2. *Ignition coil*
3. *Trigger coils*

593 HO SDI Engine



1. *ECM*
2. *Ignition coil*
3. *Trigger coil*

GENERAL

NOTE: The 4-TEC engines are equipped with an alternator, not with a magneto. Refer to ALTERNATOR subsection for the checking procedure.

277 and 443 Engines

The RER dual trigger coil CDI system has an ignition coil integrated to the MPEM.

MPEM is connected to a single ignition generator coil via a 3-connector housing (BLACK and RED wires).

MPEM is programmed to recognize a signal sent by the switch located on snowmobile console.

When switch is activated, MPEM cuts off ignition and engine rev drops at approximately:

ENGINE	RPM
277	700
443	450

MPEM fires a spark at a great advance creating a thrust which reverses engine rotation.

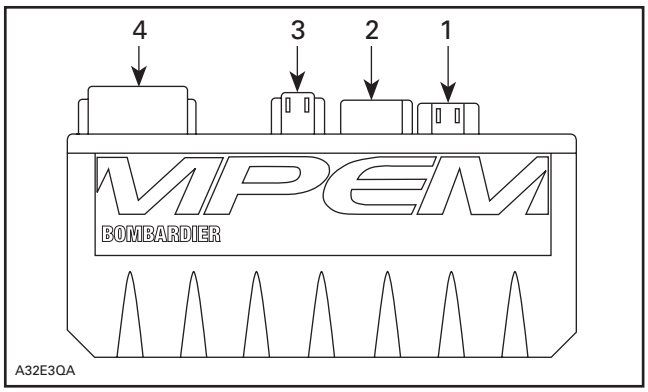
Second trigger coil located on crankcase takes over to produce spark in reverse rotation.

A safety device is incorporated to MPEM preventing it from reading any signal coming from reverse switch at following engine revs:

ENGINE	NO REVERSE SIGNAL	
	BELOW	ABOVE
277	800 RPM	3500 RPM
443	1000 RPM	3500 RPM

Multi-Purpose Electronic Module (MPEM) Connections

593 Engine



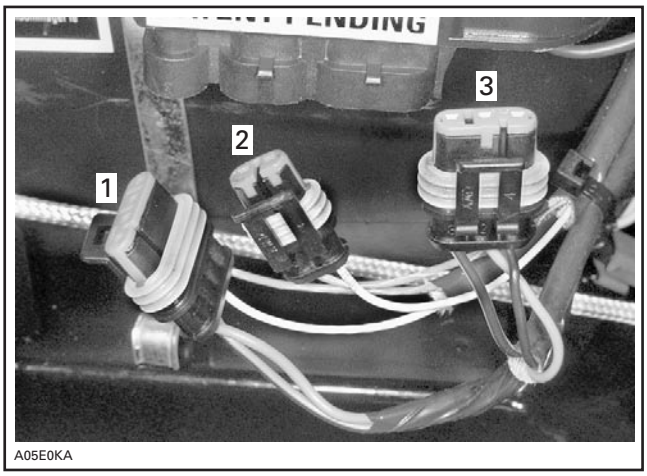
1. *Trigger coil*
2. *Cooling temperature sensor*
3. *High tension coil*
4. *DESS, ignition and engine stop switches, DESS pilot lamp*

593 HO SDI Engine

For more informations concerning the Engine Control Module (ECM) refer to OVERVIEW in ENGINE MANAGEMENT (2-TEC) section.

TYPICAL — ECM

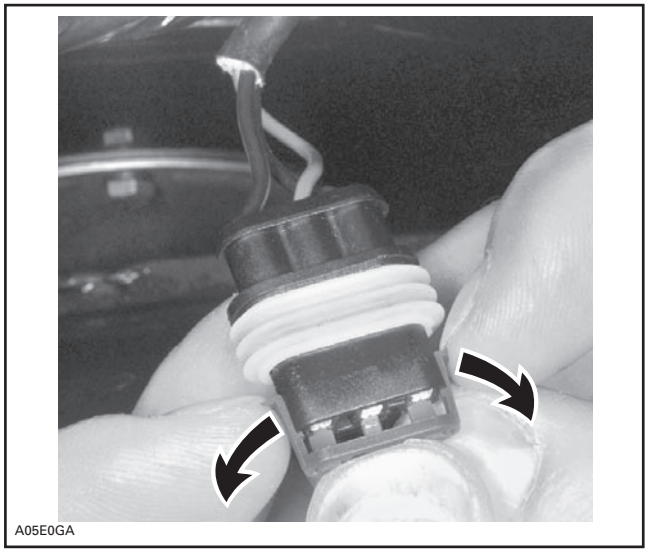
277, 443 and 552 Engines



MPEM
1. *Reverse switch, reverse indicator and trigger coil*
2. *Trigger coil*
3. *Generator output and cut-off switches*

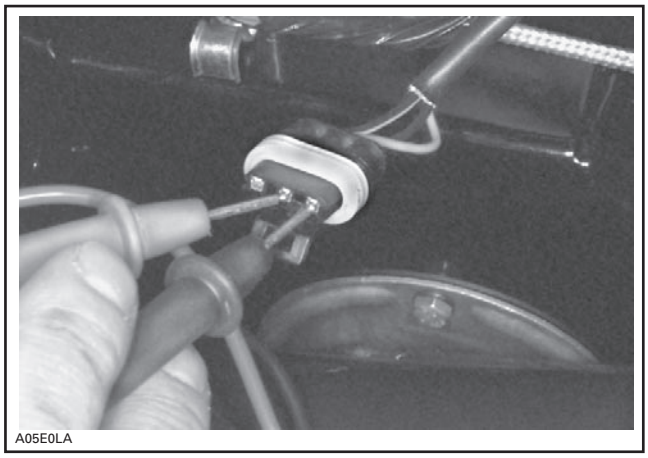
To ease electrical readings on MPEM connectors, connector cap must be removed.

Hold connector in hands then lift both tabs to remove connector cap.



LIFT TABS TO REMOVE CAP

Insert multimeter probes into connector.



TEST USING MULTIMETER PROBES

IGNITION SYSTEM TESTING SEQUENCE

All Models

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

1) Sparking/spark plug condition.
2) Electrical connectors.
3) Ignition switch, DESS switch or tether cut-out switch and engine cut-out switch.
4) Ignition generator coil.
5) Trigger coil.
6) MPEM voltage (liquid cooled engines only).
7) High voltage coil (liquid cooled engines only).
8) Buzzer testing.

LIGHTING SYSTEM TESTING SEQUENCE

1) Electrical connectors.
2) Magneto output (lighting generator coil).

Testing Conditions

Voltage measurements are always taken upon starting the vehicle. Readings taken when the engine is running will be higher than indicated range.

Part temperature must be approximately 21°C (70°F) (room temperature), otherwise readings could be distorted.

Analysis of Readings

Voltage Readings

When testing the different magneto components, it is important to take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

Doing 3 trials, the readings must each time be within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and it must be replaced.

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.

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.

Multiple Problems

As a matter of fact, more than 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.

1. SPARKING

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. If no spark is produced, replace the spark plug with a new one and do the test again.

2. ELECTRICAL CONNECTOR TESTING

Make sure that none of the connectors are disconnected.

3. IGNITION SWITCH, DESS SWITCH OR TETHER CORD CUT-OUT SWITCH AND ENGINE CUT-OUT SWITCH TESTING

Disconnect connector housing and check resistance as indicated in IGNITION table.

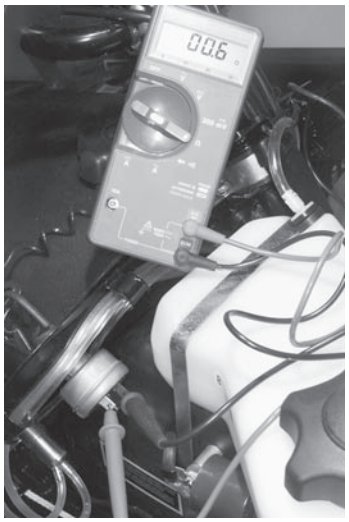

A03E1IA

If readings are acceptable, go on to next step.

If readings are inadequate, individually check each switch as follows.

Ignition Switch (key, if equipped)

Disconnect switch housing. Using a multimeter, check between **MAG** and **GRD** terminals if the circuit is open (0.L MΩ) in operating position and if the circuit is closed (0 Ω) in off position.


A05E07A

TYPICAL

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

If readings are acceptable, check other switches.

Liquid Cooled Models Only

Check using a multimeter by connecting probes to BLACK/GREEN and BLACK/WHITE wires. The multimeter should indicate a closed circuit (0 Ω) in operating position and a open circuit (0.L MΩ) in off position.

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

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Proceed as follows:

Engine Cut-Out Switch

All Models

Unplug switch block connected to main wiring harness. Check using a multimeter. Connect probes to terminals. The multimeter should indicate an open circuit (0.L MΩ) in operating position and a closed circuit (0 Ω) in off position.


A05E08A

TYPICAL

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

If readings are acceptable, check other switches.

Tether Cord Switch

Fan Cooled Engines

Unplug switch block connected to main wiring harness. Check using a multimeter by connecting probes to wires. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection. The multimeter should indicate an open circuit (0.L MΩ) in operating position and a closed circuit (0 Ω) in off position.


A05E09A

TYPICAL

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

If readings are acceptable, check other switches.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Proceed as follows:

NOTE: For this next step, no stop switch must be connected to the main wiring harness.

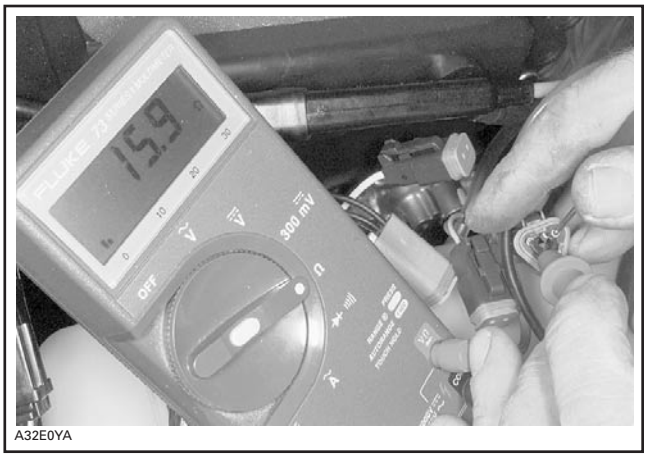
Disconnect all stop switches from the main wiring harness and check the continuity of each wire by connecting probes to the end of wires of the same color. Repeat with all other wires. It is important to mention that all wires of the same color within a given harness are connected together. These wires should therefore have a closed circuit. On the other hand, BLACK and BLACK/YELLOW wires must have an open circuit (0.L MΩ).

Repair or replace if necessary.

4. IGNITION GENERATOR COIL TESTING

Resistance Testing

– Disconnect housing between the magneto and the MPEM.
– Connect multimeter probes to appropriate wires and measure resistance. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.



A32E0YA

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

When manually starting the engine while the spark plug is installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output power.

– Disconnect housing between the MPEM and the magneto.
– Connect multimeter probes to RED and BLACK wires (female end), then bring selector to Vac and scale to 00.0.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

5. TRIGGER COIL TESTING

Resistance Testing

– Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.

A32E10A

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

– Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

6. MPEM VOLTAGE TESTING

Liquid Cooled Engines

– Disconnect the housing between module and high voltage coil.

– Connect multimeter probes to WHITE/BLUE and BLACK wires coming out from module. Place the selector switch to Vac and the scale to 00.0.


A32E0ZA

TYPICAL

– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

7. HIGH VOLTAGE COIL TESTING

Liquid Cooled Engines

Resistance Testing

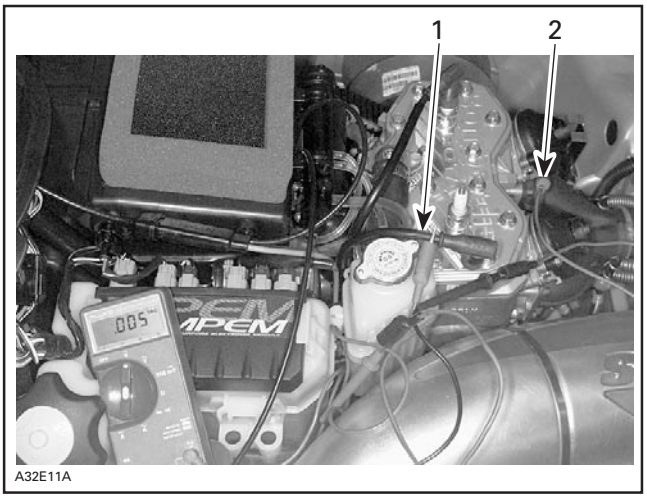
– Unplug housing between high tension coil and MPEM.
– Connect multimeter probes to WHITE/BLUE and BLACK wires and measure resistance.


A32E12A

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

– Disconnect spark plug cap from spark plug.
– Fasten alligator clip to spark plug cable, near the spark plug.
– Connect other multimeter wire to engine (ground), then place selector switch to Vac and scale to 0.00.



A32E11A

1. MAG side spark plug cable
2. Connected to ground

– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

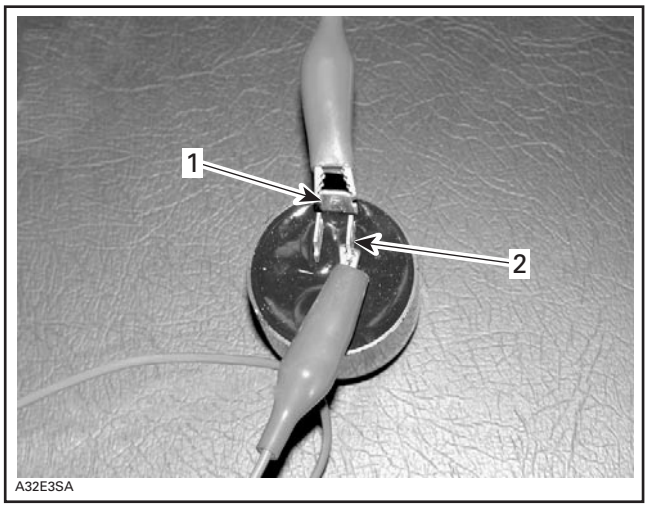
8. BUZZER TESTING

2-Stroke Engines

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

Connect battery negative post to buzzer negative tab.

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



TYPICAL — 12-VOLT BATTERY PLUGGED TO BUZZER
1. Buzzer positive tab
2. Buzzer negative tab

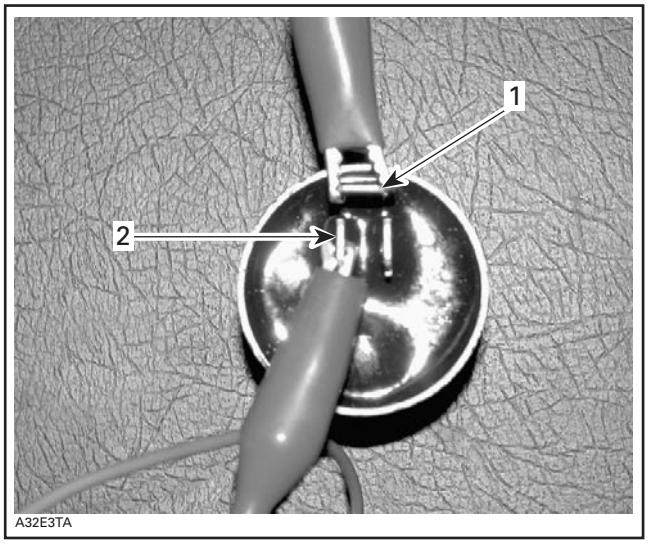
A continuous sound should be heard. if not, replace the buzzer with a new one.

4-Stroke Engines

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

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

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

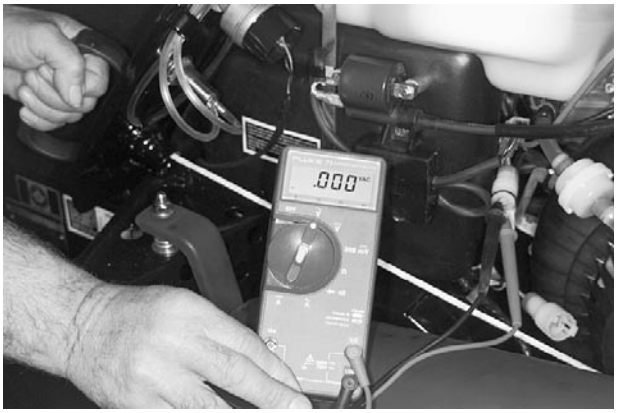


TYPICAL — 12-VOLT BATTERY PLUGGED TO BUZZER
1. Buzzer positive tab
2. Buzzer negative tab

An intermittent sound should be heard. If not, replace the buzzer with a new one.

LIGHTING GENERATOR COIL VOLTAGE TESTING

– Disconnect housing from engine (YELLOW wires).
– Connect multimeter probes to YELLOW wires, then place selector switch to Vac and scale to 0.00.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.



TYPICAL

– Compare readings with those appearing in the LIGHTING table.

CONCLUSION

If none of the above testing operations produced valid results, it is strongly recommended to keep on testing according to the list appearing in the RESISTANCE column of IGNITION or LIGHTING table.

When using the tables, make sure to follow these guidelines:

NOTE: Stop switches include the ignition switch, the tether cord switch and the engine cut-out switch.

It is important to take note that voltage measurements must be taken while starting the vehicle using the manual starter.

Voltages obtained upon starting are proportional to the force applied onto the manual starter. A low voltage is therefore normal under a low cranking force.

Perform testing in the prescribed order and replace any parts not performing according to specifications.

It is important to resume all tests when replacing a component.

If not specified, the probe connecting sequence is not important.

Set the multimeter as indicated.

IGNITION SYSTEM TESTING — 277 ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switch	Running insulation	BK BK/YL	4-MOC-M 4-MOA-M	0.L	00.0 MΩ	—	—	No stop switch must be operational.
	Continuity in STOP position	BK BK/YL	4-MOC-M 4-MOA-M	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be operational. Test them one after the other.
Ignition generator coil	Output	RD BK	4-DB-1-F 4-DB-2-F	4.5 - 6.5	00.0 Ω	7.0 - 15.0	00.0VAC	—
	Ground continuity	BK engine	4-DB-2-F engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
Trigger coil	Forward	WH/YL BU/YL	4-DC-2-F 4-DC-1-F	160 -180	00.0 Ω	.100 - .300	.000VAC	—
	Reverse	WH/YL BU/YL	4-DA-4-F 4-DA-3-F	160 -180	00.0 Ω	.100 - .300	.000VAC	—
MPEM and high voltage coil	Secondary winding resistance with caps	Spark plug cap engine	In spark plug cap and on the engine	4.90 K - 7.10 K	0.00 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance without caps	BK engine	Inside spark plug cable and on the engine	0.90 K - 1.10 K	0.00 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK engine	On spark plug cable housing and on the engine	—	—	.150 - .350	.000VAC	The measurement must be taken on the spark plug cable (without the spark plug).
Spark plug cap	Cap resistance	—	Spark plug side and cable side	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 277 ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Power	YL YL	4-MOB-F 4-MOA-F	00.0 - 00.6	00.0 Ω	3.0 - 7.0	00.0VAC	—
	Insulation	YL engine	4-MO (A,B)-F engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
	Ground continuity	BK engine	4-MOC-F engine	00.0 - 00.5	00.0 Ω	—	—	—

IGNITION SYSTEM TESTING — 443 AND 552 ENGINES							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switch	Running insulation	BK BK/YL	0.L	00.0 MΩ	—	—	All switches must be in run position.
	Continuity in STOP position	BK BK/YL	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be in stop position. Test them one after the other.
Ignition generator coil	Output	RD BK	4.5 - 6.5	00.0 Ω	7.0 - 15.0	00.0VAC	—
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
Front trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000VAC	—
Rear trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000VAC	—
MPEM and high voltage coil	Secondary winding resistance with caps	Spark plug cap Spark plug cap	8.90 K - 13.1 K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance without caps	BK BK	0.90 K - 1.10 K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK engine	—	—	.100 - .250	0.00VAC	The measurement must be taken on the spark plug cable (without the spark plug).
Spark plug cap	Cap resistance	—	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 443 AND 552 ENGINES							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Power	YL YL/BK	00.0 - 00.6	00.0 Ω	3.0 - 7.0	00.0VAC	—
	Insulation	YL engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts con nected to the magneto housing.
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	

IGNITION SYSTEM TESTING — 593 ENGINE							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switches	Running insulation	BK and BK/YL	0.L	00.0 MΩ	—	—	All switches must be in run position.
	Continuity in stop position	BK and BK/YL	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be in stop position. Test one at a time.
	Insulation in stop position	BK/GN and BK/WH	0.L	00.0 Ω	—	—	Tether cord cap must be off.
	Running continuity	BK/GN and BK/WH	00.0 - 00.5	00.0 Ω	—	—	Tether cord cap must be in place.
Ignition generator coil	Output	RD and BK/RD	11.6 - 21.6	00.0 Ω	15.0 - 30.0	00.0VAC	—
	Coil insulation	RD and BK	0.L	00.0 MΩ	—	—	—
	Ground continuity	BK and engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts con nected to the magneto housing.
Trigger coil	Resistance and output	WH/YL and BL/YL	190 - 300	00.0 Ω	.200 - .350	.000VAC	—
MPEM	Output voltage	WH/BL and BK	—	—	25.0 - 100.0	00.0VAC	All switches must be in run position.
High voltage coil	Primary winding resistance	WH/BL and BK	00.0 - 00.9	00.0 Ω	—	—	—
	Secondary winding resistance (spark plug cap included)	Spark plug cap and Spark plug cap	19.5 K - 26.5K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance (without spark plug cap)	BK and BK	9.6 K - 14.4K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK and engine	—	—	0.1 - 1.4	0.00VAC	The measurement must be taken on the spark plug wire (without the spark plug).
	Insulation	Spark plug cap and BK	0.L	00.0 MΩ	—	—	—
Spark plug cap	Cap resistance	—	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 593 ENGINE							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Output	YL and YL	00.1 - 00.4	00.0 Ω	0.5 - 2.0	00.0VAC	—
	Coil insulation	YL and engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
	Ground continuity	BK and engine	00.0 - 00.5	00.0 Ω	—	—	

IGNITION SYSTEM TESTING — 593 HO SDI ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volt)	
Engine stop switch	Running insulation	YL/BK and BK	B-21 ground	00.0 Ω or auto range	0.L	—	—	Engine cut-out switches must be in run position.
	Continuity in STOP position	YL/BK and BK	B-21 ground	00.0 Ω or auto range	00.0 - 00.5	—	—	Engine cut-out switches must be in stop position.
DESS switch	Insulation with DESS removed	WH/GR and WH/BK	B-38 B-26	00.0 Ω or auto range	0.L	—	—	DESS key removed.
	Continuity with DESS in run position	WH/GR and WH/BK	B-38 B-26	00.0 Ω or auto range	00.0 - 00.5	—	—	DESS key must be in place.
ECM	Ground connection	BK and negative battery terminal or body	B-1, B-2, B-9, B-32 and B-41	00.0 Ω or auto range	00.0 - 00.5	—	—	—
ECM power (with battery)	Power from battery	PK	B-11 ground	—	—	00.0 VDC	Same as battery voltage	Voltage always present.
	Power from regulator	GN/BL	B-36 and ground	—	—	00.0 VDC	1 to 2 volts	While cranking engine.
CPS	Resistance and output	BU/YL and WH/YL	A-5 A-19	00.0 Ω or auto range	190 - 290	00.0 VAC	2.0	While cranking engine.
High voltage coil	Primary winding resistance	—	Pin 1-2 Pin 2-3	00.0 Ω or auto range	0.3 to 0.6	—	—	Disconnect the ignition coil from the ECM
	Secondary winding resistance	—	—	—	—	—	—	No test possible.
Start switch	Start signal at ECM	OR/BK and LBN	11–DA-7–F 11–DA-3–F	—	—	00.0 VDC	Battery voltage	When start/RER switch is activated in all conditions.

LIGHTING SYSTEM TESTING — 593 HO SDI ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volt)	
Charging voltage	Refer to B.U.D.S.	—	—	—	—	—	—	—
Lighting generator coil	Output	YL and YL and GN	Pin 1, 2, 3	00.0 Ω or autorange	.145 to .185 3 times	00.0 VAC	3.5 to 5.5 3 times	Do the test between 1 and 2, 1 and 3 and 2 and 3 using manual starter.
	Coil insulation	YL, GN and engine	Pin 1, 2, 3 and engine	00.0 Ω or autorange	0.L	—	—	The term engine refers to the metal parts connected to the magneto housing.

INSPECTION OF AC CIRCUIT ISOLATION

All Electric Start Models

If AC circuit is not isolated from frame, headlamp beam will weaken.

INSPECTION

Disconnect regulator/rectifier.

On models with hydraulic brake, pull off the rubber boot from brake light microswitch assembly.

Connect one digital ohmmeter probe (needle ohmmeter will not offer enough precision) to frame and other probe to one of 2 YELLOW magneto wires.

Measured resistance must be infinite. If such is not the case, it means there is a connection between AC circuit and DC circuit.

Disconnect one accessory at the time to identify the faulty circuit.

INSPECTION OF HEATING ELEMENTS

All Skandic Models

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

Throttle Lever Heating Element

Current Measurement

HIGH INTENSITY	BROWN wire	0.23 A minimum
LOW INTENSITY	BROWN/YELLOW wire	0.13 A minimum

Handlebar Grip Heating Element

Resistance Measurement

LOW INTENSITY	YELLOW/BLACK wire ORANGE/VIOLET wire	17.7 to 20.7 ohms
HIGH INTENSITY	YELLOW/BLACK wire ORANGE wire	8.73 to 10.67 ohms

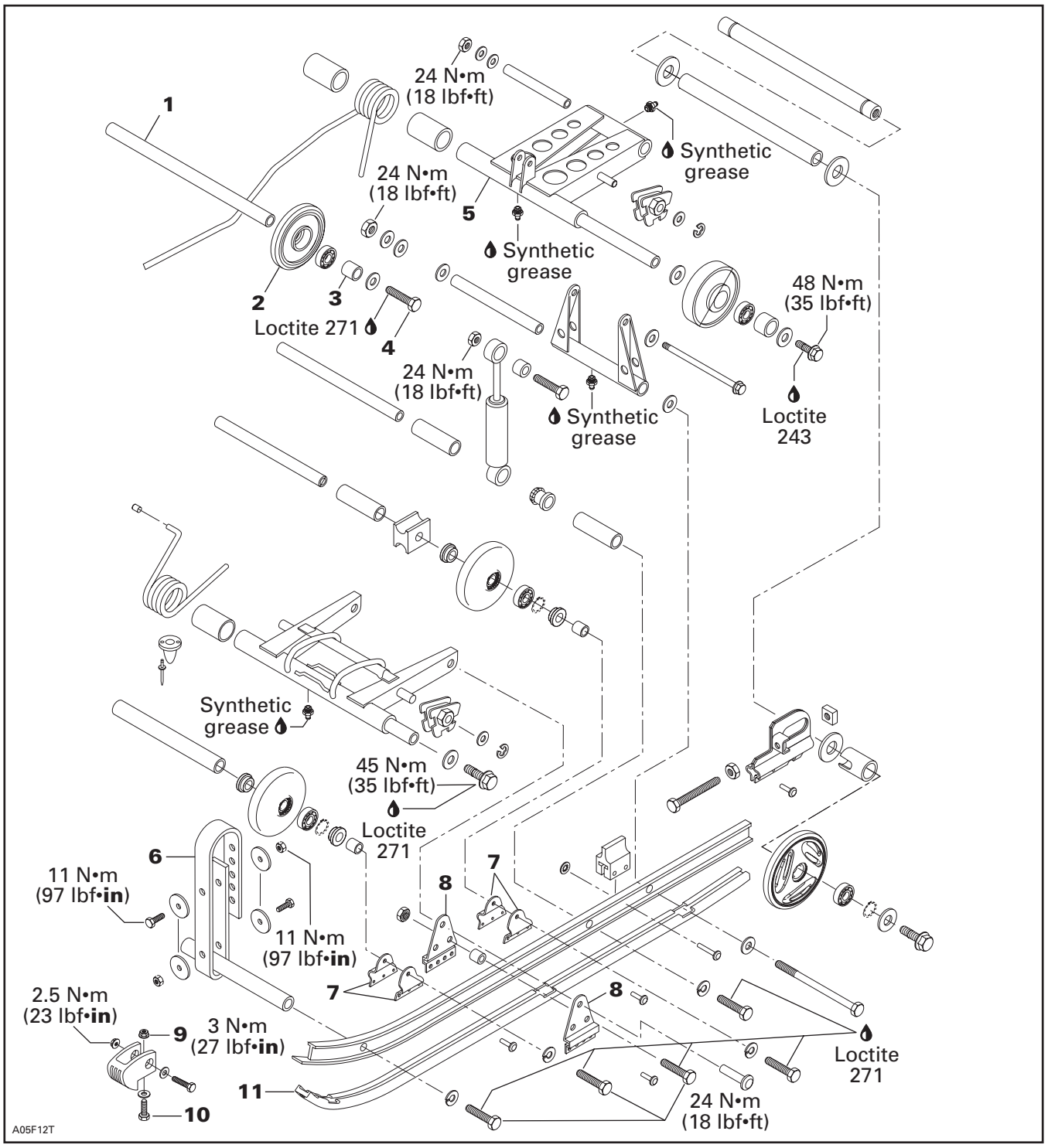
When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.

TORQUE REACTION SUSPENSION

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	293 550 033	487

Tundra


24 N•m
(18 lbf•ft)
1
Synthetic
grease
24 N•m
(18 lbf•ft)
5
Synthetic
grease
2
3
Loctite 271
4
48 N•m
(35 lbf•ft)
24 N•m
(18 lbf•ft)
Synthetic
grease
Loctite
243
Synthetic
grease
45 N•m
(35 lbf•ft)
Loctite
271
6
11 N•m
(97 lbf•in)
11 N•m
(97 lbf•in)
7
8
7
8
2.5 N•m
(23 lbf•in)
9
3 N•m
(27 lbf•in)
Loctite
271
11
10
24 N•m
(18 lbf•ft)
A05F12T

COMPONENT REMOVAL

Lift rear of vehicle and support it off the ground.

5, Rear Arm

Release track tension.

Release spring tension. Unfasten shock from rear arm. Remove 3 screws retaining rear arm.

SUSPENSION ASS'Y REMOVAL

Release track tension.

NOTE: To prevent cross shaft from turning when unscrewing screws assembled with threadlocker, proceed as follows:

– Loosen one screw then retighten.
– Remove the other screw.
– Remove the first one.

1,2,3,4, Cross Shaft, Idler Wheel, Spacer and Screw

Remove idler wheel ass'y.

Suspension Ass'y

Lift rear of vehicle and support it off the ground.

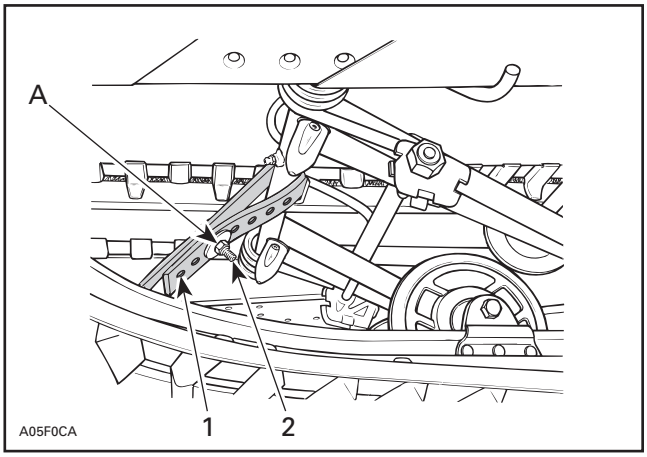
Unscrew 4 screws retaining front arm and rear arm to frame.

Remove suspension.

DISASSEMBLY AND ASSEMBLY

6, Stopper Strap

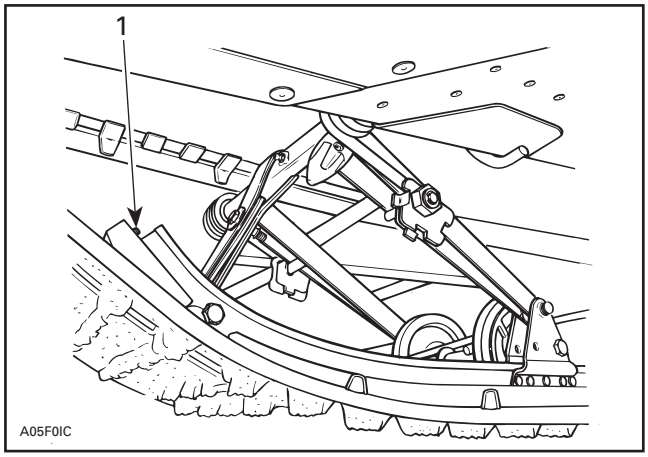
When assembling make sure it is attached through the 3rd hole from the end. Torque nut to 11 N•m (97 lbf•**in**).



1. 1st hole
2. 3rd hole
*A. 11 N•m (97 lbf•**in**)*

9,10,11, Nut, Slotted Screw and Slider Shoe

To replace a worn shoe, remove the front screw and stop nut, then slide the shoe rearward out of the runner.



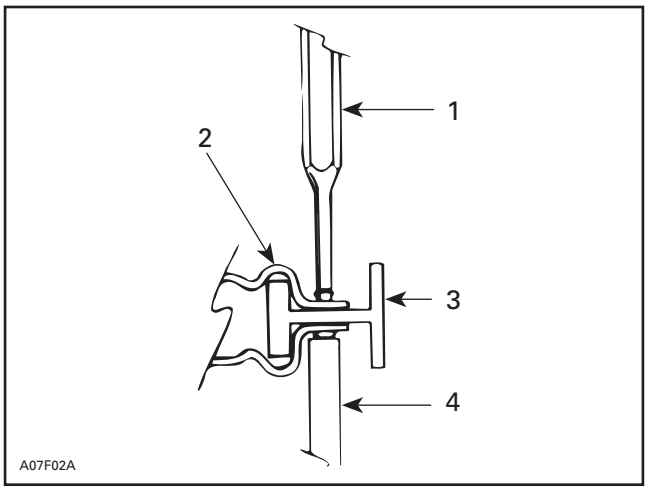
1. Front screw and nut

CAUTION: Slider shoes must always be replaced in pairs.

7,8, Support and Front Arm Support

To remove rivets securing the supports, cut rivet heads off using a cold chisel.

At assembly, position the rivet head toward the outside of the assembly. Support the rivet head against a metal block, as shown, and use a flat head punch to secure the rivet in place.



1. Flat head punch
2. Support
3. Runner
4. Metal block

NOTE: Rivets can be substituted with 3/16 in x 3/4 in long screws and flanged elastic stop nuts. Always position screw head outside the assembly.

INSPECTION

6, Stopper Strap

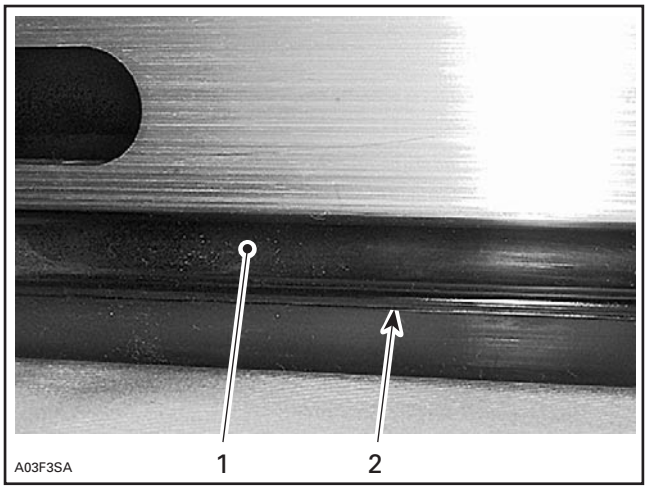
Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Shock Absorber

Refer to SUSPENSION AND SKI SYSTEM for shock inspection.

11, Slider Shoe

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.

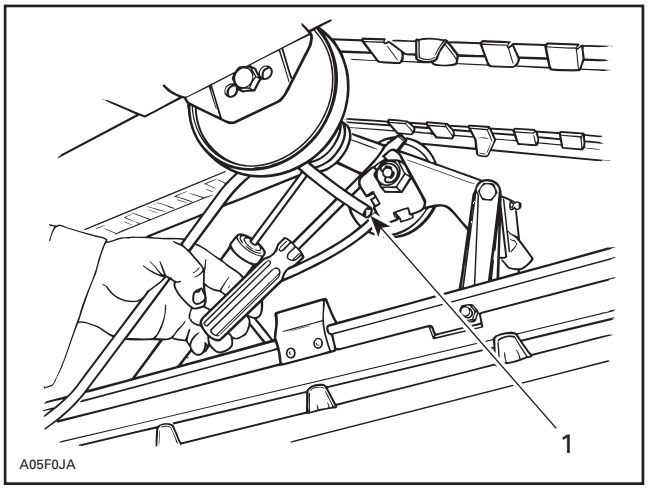
SUSPENSION ASS'Y INSTALLATION

Release rear spring tension then install assembled suspension into track with front portion first.

Insert rear portion of suspension into track.

Bolt suspension to tunnel.

Pry rear spring end onto cam.



1. Spring end

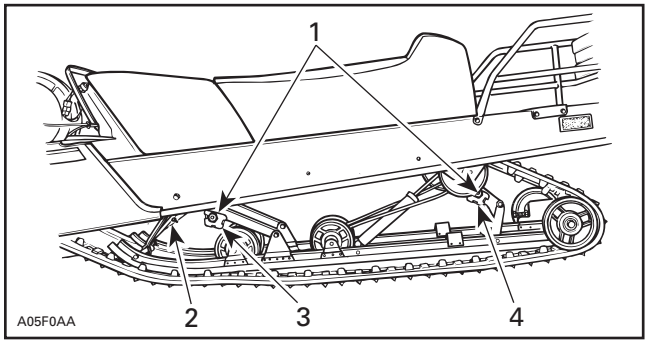
Adjust track tension/alignment. Refer to TRACK.

RIDE ADJUSTMENT

The front portion of rear suspension is adjustable for surface condition and steering effects.

The stopper strap is adjustable for vehicle weight transfer control.

The rear portion of rear suspension is adjustable for driver's weight.



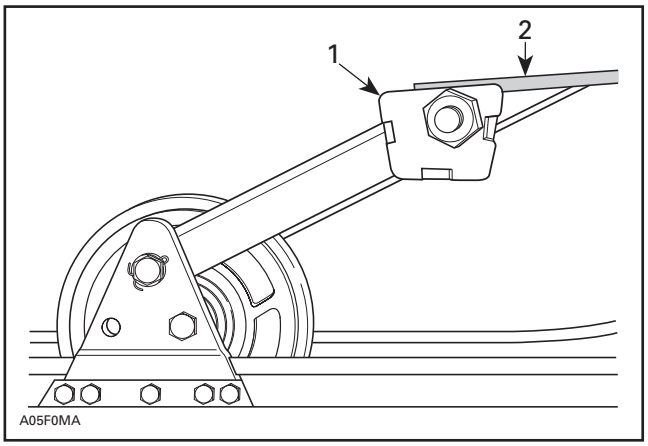
1. Driver's weight
2. Stopper strap for weight transfer
3. Steering effect/surface condition
4. Adjustment cams

Choice of suspension adjustments depends on carrying load, driver's weight, personal preference, riding speed and field condition.

Slight suspension bottoming occurring under the worst riding conditions indicates a good choice of spring preload.

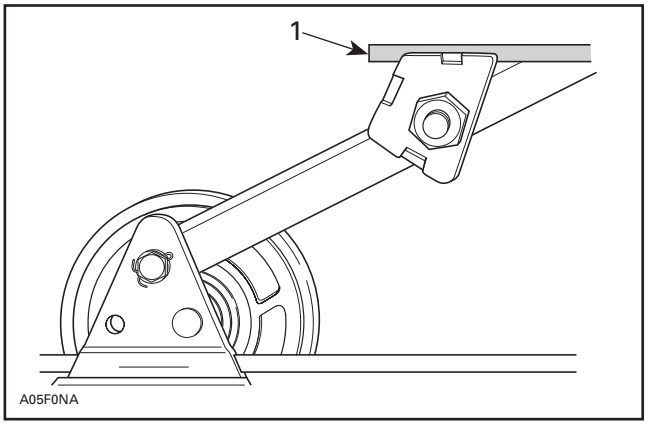
To adjust rear suspension with the adjustment cams, use special key supplied in vehicle tool box.

Turning adjustment cam moves edges of cam supporting spring rod. The softest adjustment is reached when the supporting edge of cam is the closest to hexagonal portion of cam.



SOFTEST ADJUSTMENT
1. Supporting edge closest to hexagonal
2. Spring

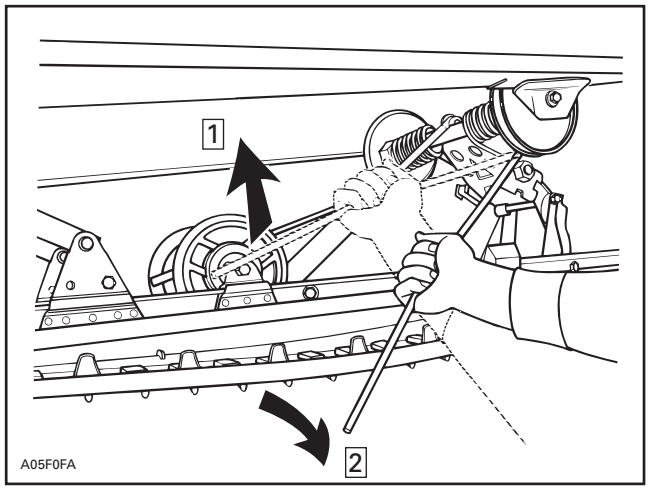
The stiffest adjustment is reached when the supporting edge of cam is the farthest to hexagonal portion of cam.



STIFFEST ADJUSTMENT
1. Supporting edge farthest to hexagonal

NOTE: To quickly change rear cam position without using any tool:

– Lay vehicle on its side.
– Unhook rear spring by hand from lower idler wheel.



– Turn adjustment cam by hand to the desired position.
– Reinstall spring on its support making sure that it sits in the groove of support.

Stopper Strap

The function of the stopper strap is to control the transfer of vehicle weight during acceleration and to control track lead angle.

The longer the belt, the more the weight will be transferred to the track to provide a better traction. The shorter the belt, the lesser the weight transferred to the track, thus maintaining a more positive steering.

The longer the belt, the greater will be the track lead angle. A shorter belt will reduce track lead angle which may help when negotiating a particular snow condition.

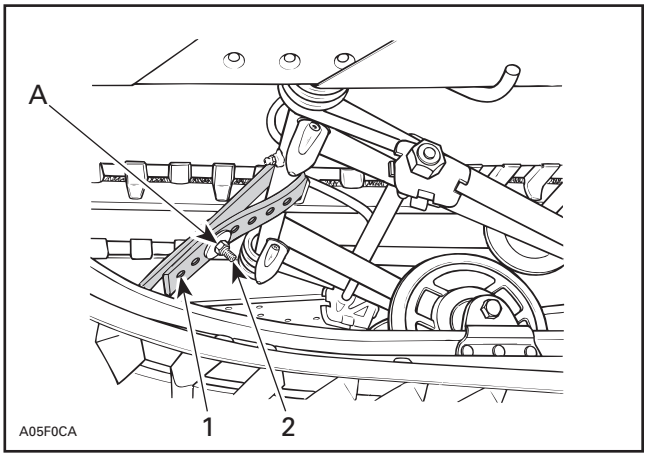
Adjusting holes on the stopper strap allow to adjust it according to driver's requirements, field and/or snow conditions.

CAUTION: Whenever stopper strap length is changed, track tension must be readjusted to prevent any possibility of operating vehicle with a too loose or too tight track tension.

For normal use, locate bolt through 3rd hole from strap end.

⚠ WARNING

Always torque the nut to 11 N•m (97 lbf•in). Replace strap if worn or torn.



1. 1st hole
2. 3rd hole
A. 11 N•m (97 lbf•in)

NOTE: When towing a load, it is suggested to adjust stopper strap to its shortest length, soften front springs of rear suspension and stiffen rear springs. These adjustment will improve steering ability.

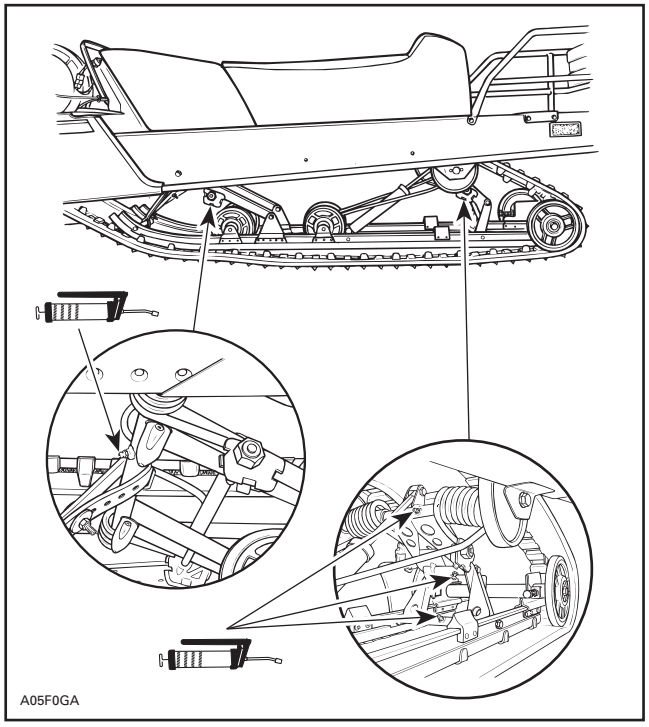
Deep Snow Operation

When operating the vehicle in deep snow, it may be necessary to change position of adjustment cams, stopper strap and/or driver's riding position, to change the angle at which the track rides on the snow. Operator's familiarly with the various adjustments as well as snow conditions will dictate the most efficient combination.

LUBRICATION

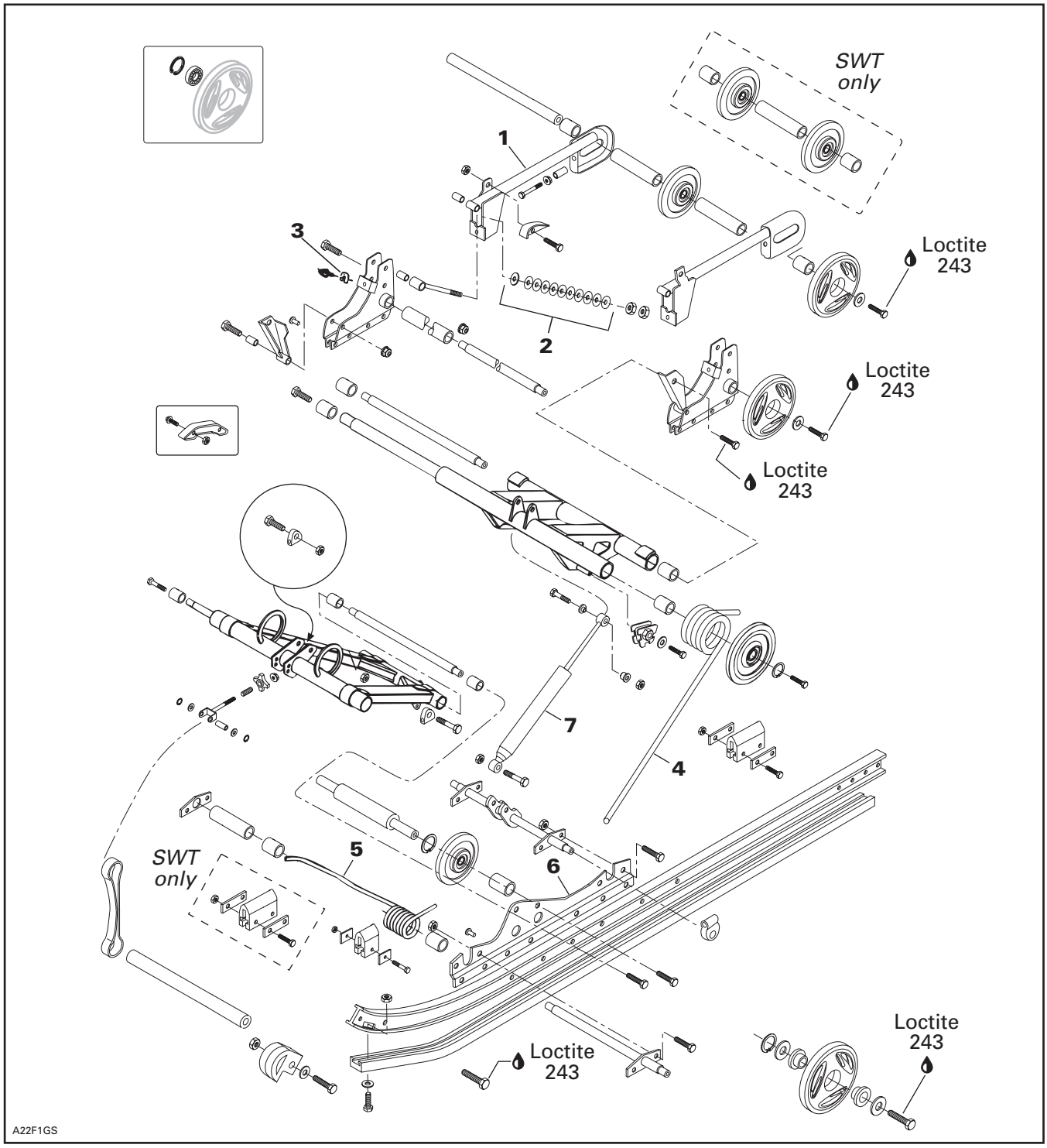
Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).

NOTE: There are 4 grease fittings.



ARTICULATING SLIDE SUSPENSION

Skandic LT/WT/SWT/WT LC



TYPICAL

REMOVAL

Release track tension.

Lift rear of vehicle and support it off the ground.

Unbolt front arm then rear arm.

Self-Locking Screws

CAUTION: These self-locking screws must always be replaced by new ones every time 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.

Remove suspension assembly.

A22F1EA

DISASSEMBLY AND ASSEMBLY

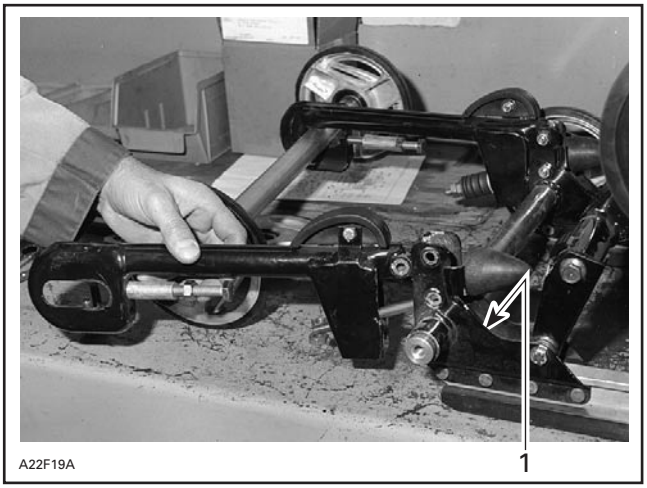
1, Extension

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to support.

Remove rear idler wheel on appropriate side.

Remove idler wheel from support.

Unbolt extension from its support.



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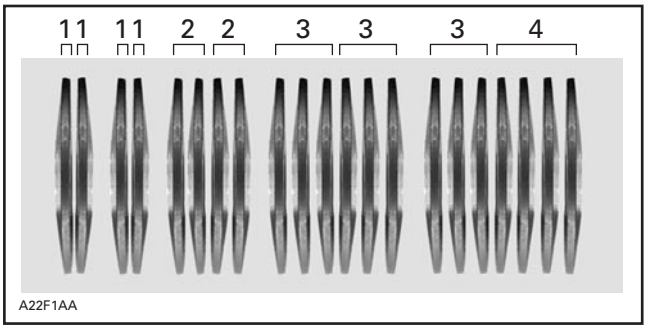
1. Support

2, Conical Washer

At installation, position conical washers as shown.



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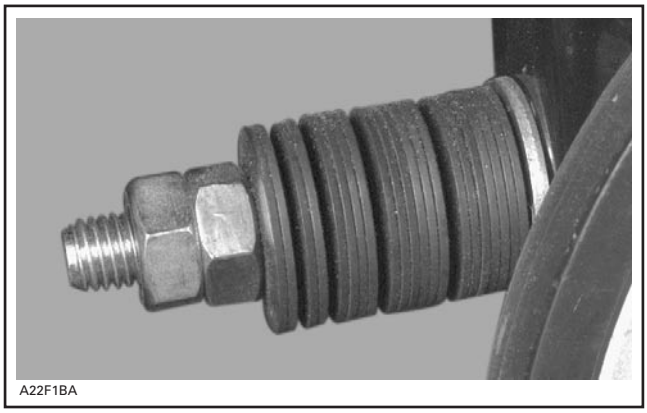
WASHER QUANTITY AND MOUNTING POSITION


A22F1BA

Tighten nut 3/4 turn after contacting washers for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

4, Rear Spring

Remove top idler wheels.

Unscrew one end of shock.

Remove spring.

5, Front Spring

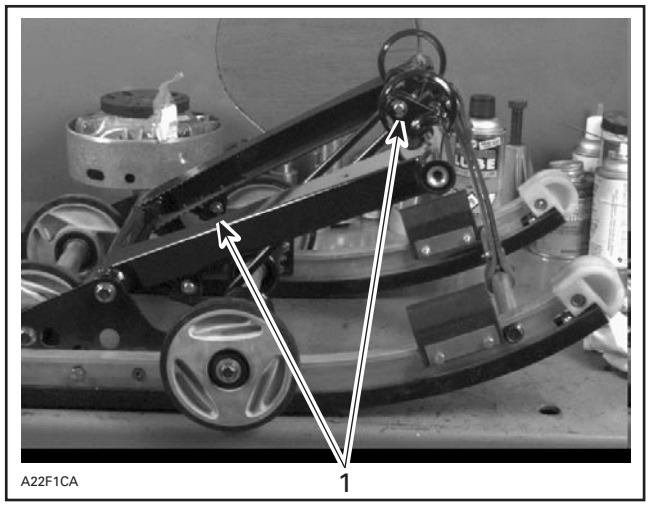
Remove circlips retaining spring support to top and bottom of front arm.

Holding spring end, remove lock pin of top spring support then bottom support lock pin.

Unbolt front idler wheel axle.

Remove idler wheel on side where axle retaining plate is not welded.

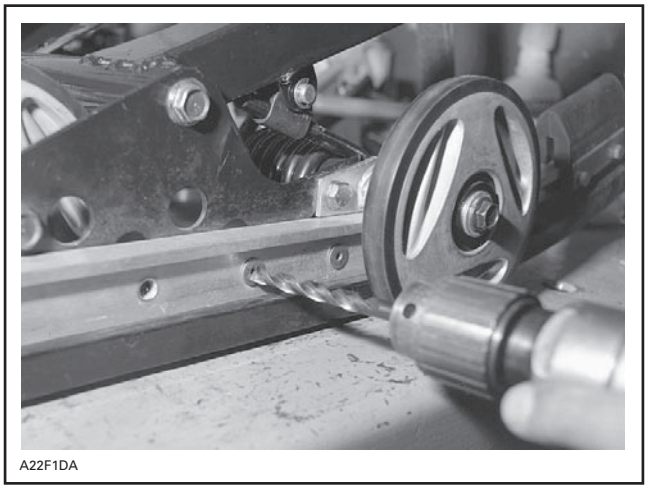
Remove springs.



1. Circlips

6, Support Plate

Drill rivets to remove support plate. Use a 8 mm (21/64 in) drill bit.



Rivets can be substituted by M8 x 20 bolts and nuts.

3, Horse-Shoe Washer

For deep snow riding, do not install washer.

For trail riding with passenger and/or weight, install 1 washer under each rubber stoppers.

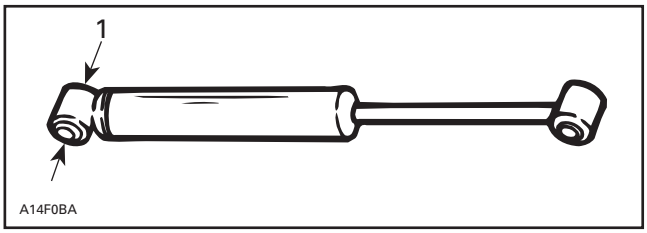
For trail riding with heavy load and/or pulling a load, use 2 washers under each rubber stoppers.

7, Shock

Install shock with its rod upward.

SHOCK ABSORBER SERVICING

Secure the shock body end in a vise.



TYPICAL
1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke then check that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a faulty shock:

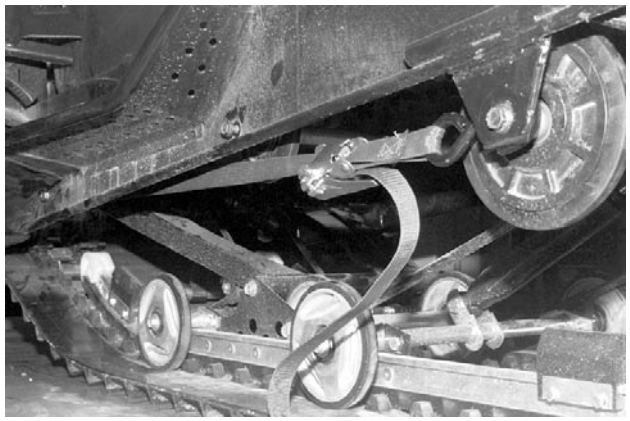
– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme ends of stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any fault is present.

INSTALLATION

Threaded holes must be cleaned before a self-locking screw is installed. Use a metal brush or a screwtap 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.

Use a tie-down between front arm and spring axle to ease installation of front arm screws.



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RIDE ADJUSTMENT

Refer to *Operator's Guide*.

SUV SUSPENSION

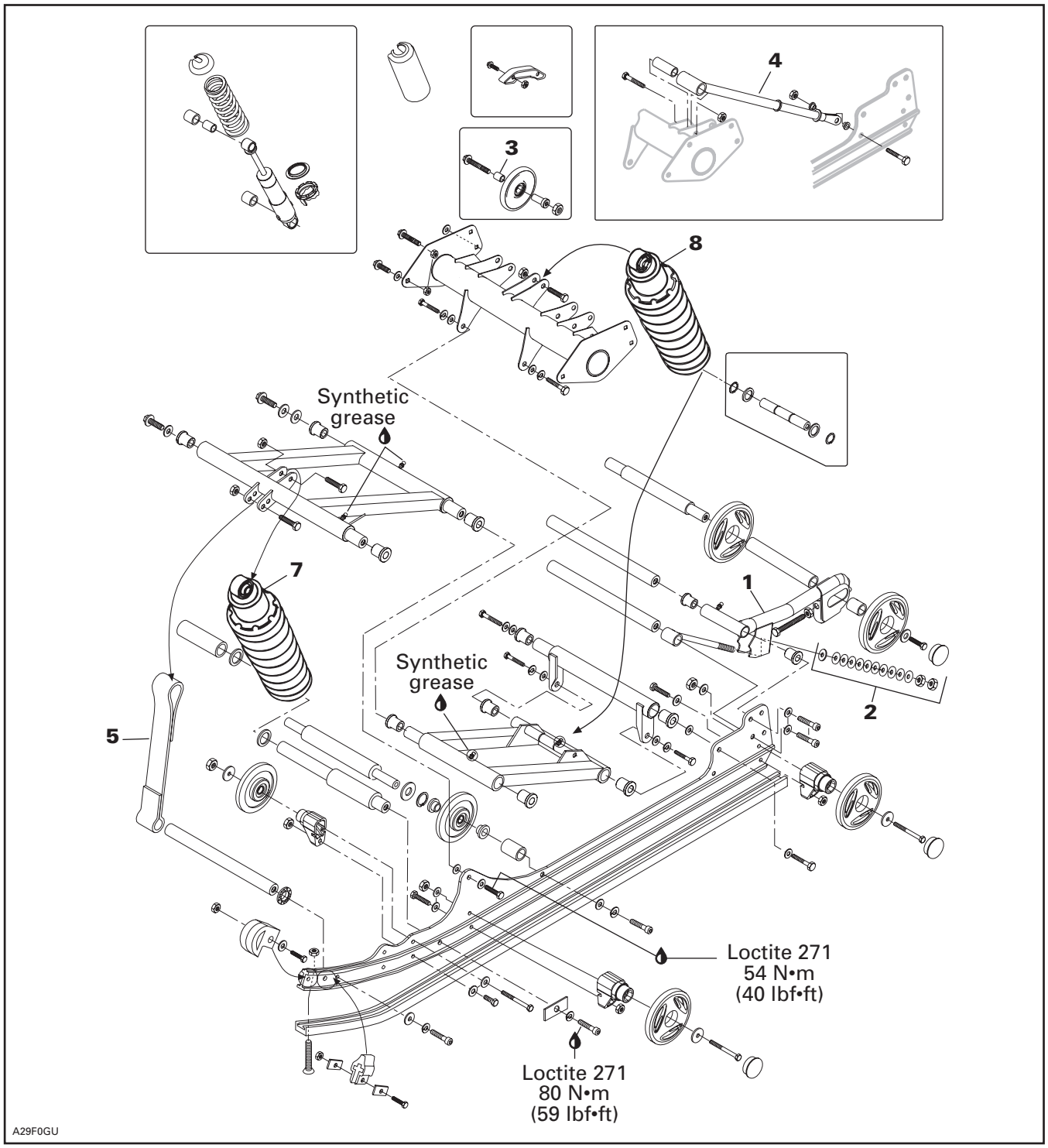
SERVICE TOOLS

Description	Part Number	Page
shock spring removal kit	529 035 504	496

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	498

Skandic SUV/Expedition TUV



TYPICAL

REMOVAL

Release track tension.

Lift rear of vehicle and support it off the ground.

Unbolt front arm then rear arm.

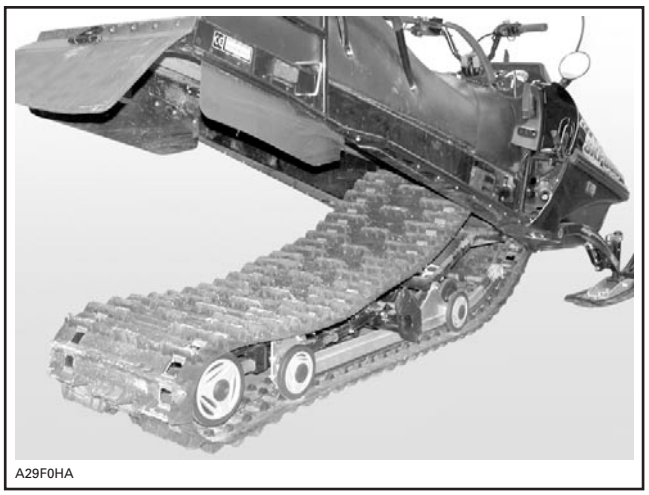
Self-Locking Screws

CAUTION: These self-locking screws must always be replaced by new ones every time 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.

Remove suspension assembly.



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DISASSEMBLY AND ASSEMBLY

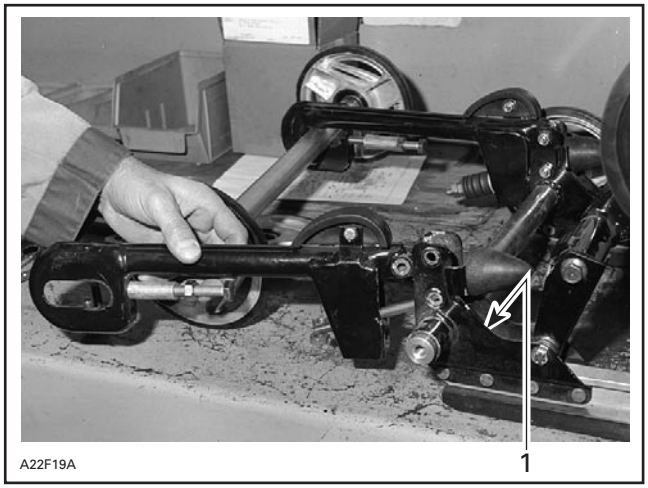
1, Extension

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to support.

Remove rear idler wheel on appropriate side.

Remove idler wheel from support.

Unbolt extension from its support.



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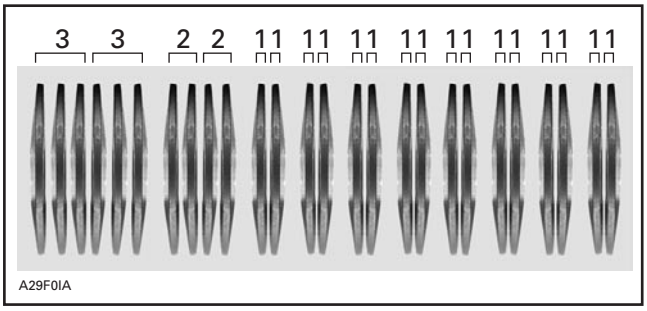
TYPICAL
1. Support

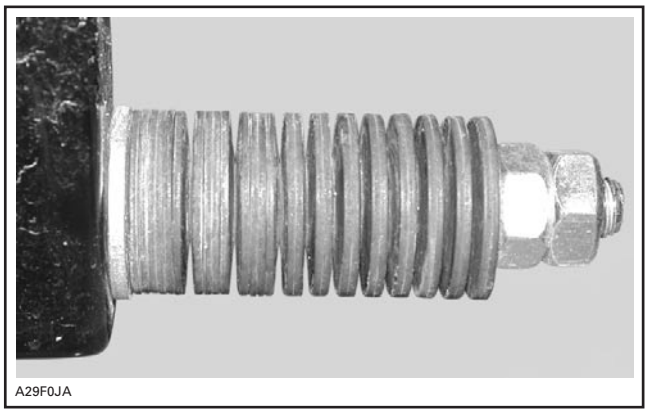
2, Conical Washer

At installation, position conical washers as shown.



A29F0IA

WASHER QUANTITY AND MOUNTING POSITION



A29F0JA

Tighten nut 3/4 turn after contacting washers for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

8, Rear Spring

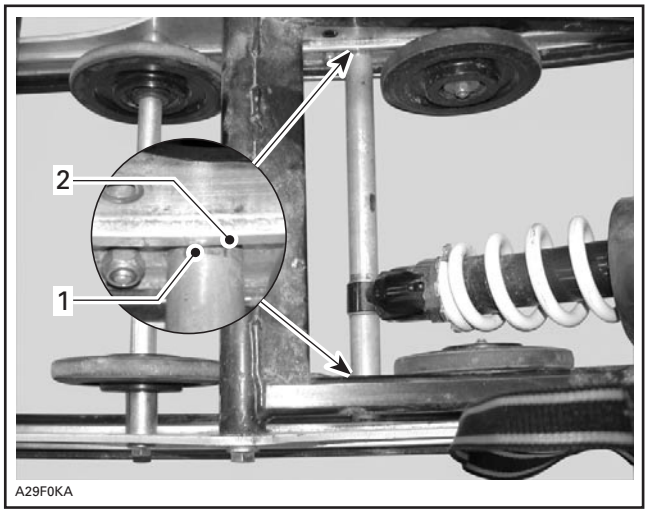
Unbolt top and bottom ends of shock.

7, Front Spring

Unbolt top end of shock.

Unbolt axle retaining bottom end of shock.

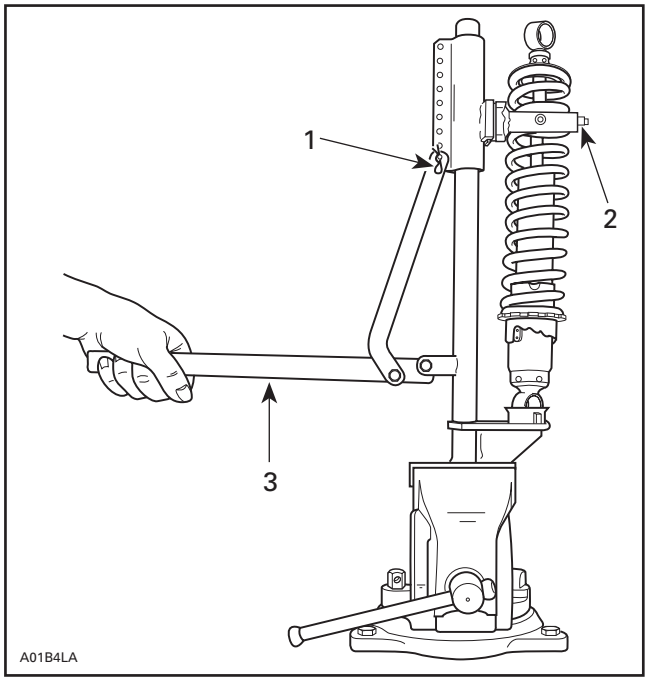
At assembly, make sure that notch on both axle sleeves match rail rib.



1. Notch
2. Rail rib

For shock spring disassembly use shock spring removal kit (P/N 529 035 504) in a vise. Mount shock in it and turn shock so that spring coils rests against spring compressor jaw.

Close and lock the bar. Place handle horizontally by changing the position of the clevis pin.

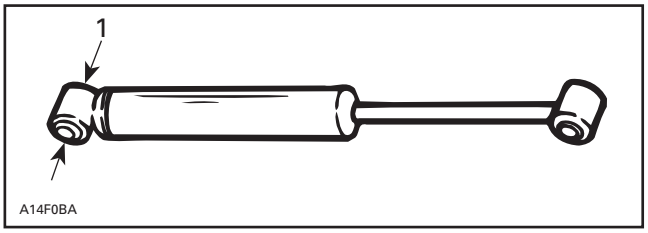


1. Clevis pin
2. Bar
3. Handle horizontal

Push down on the handle until it locks. Remove spring stopper then release handle.

SHOCK ABSORBER INSPECTION

Secure the shock body end in a vise.



TYPICAL
1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke then check that it moves smoothly and with uniform resistance.

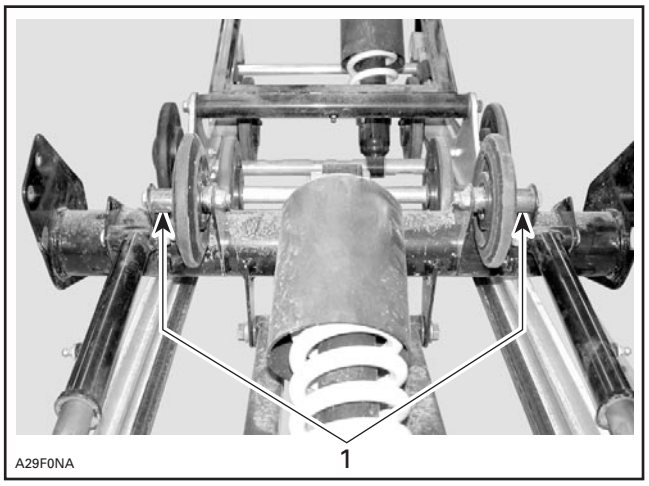
Pay attention to the following conditions that will denote a faulty shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme ends of stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any fault is present.

3, Spacer

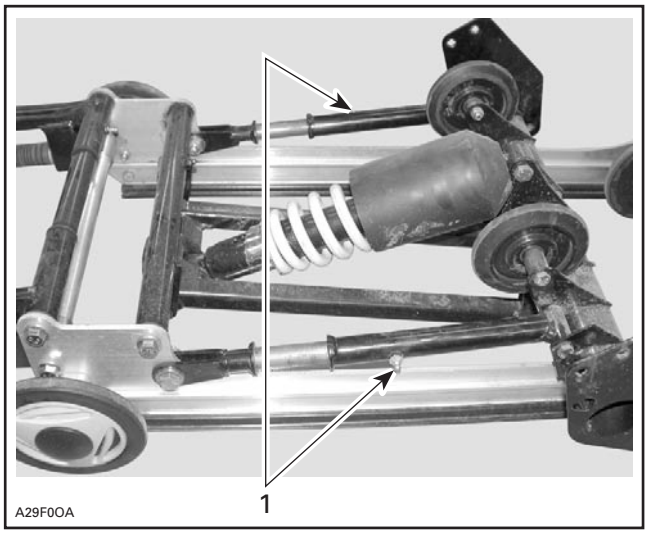
At assembly, install spacer on outer side of top idler wheel.



1. Spacers

4, Coupling Tube

At assembly, install coupling tube with its grease fitting facing outward.



1. Grease fitting facing outward

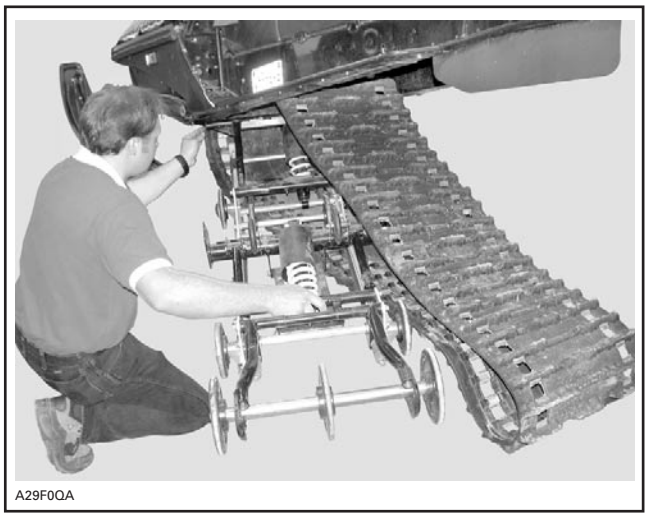
5, Stopper Strap

Fasten stopper strap to lower bracket hole.

INSTALLATION

Threaded holes must be cleaned before a self-locking screw is installed. Use a metal brush or a screwtap 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.

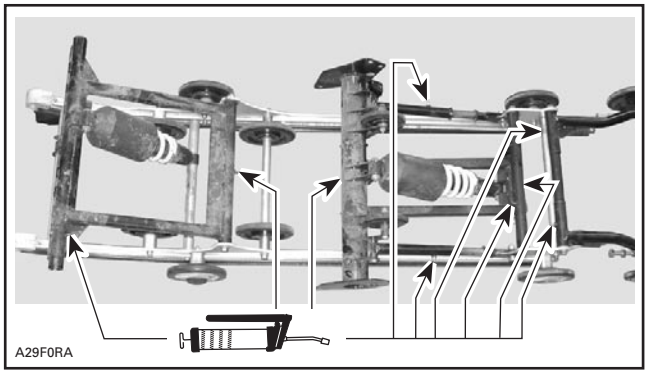
Install front portion of suspension first.



LUBRICATION

Lubricate front and rear arms at grease fittings using synthetic grease (P/N 413 711 500).

NOTE: There is 9 grease fittings.



RIDE ADJUSTMENT

Refer to *Operator's Guide*.

DRIVE AXLE

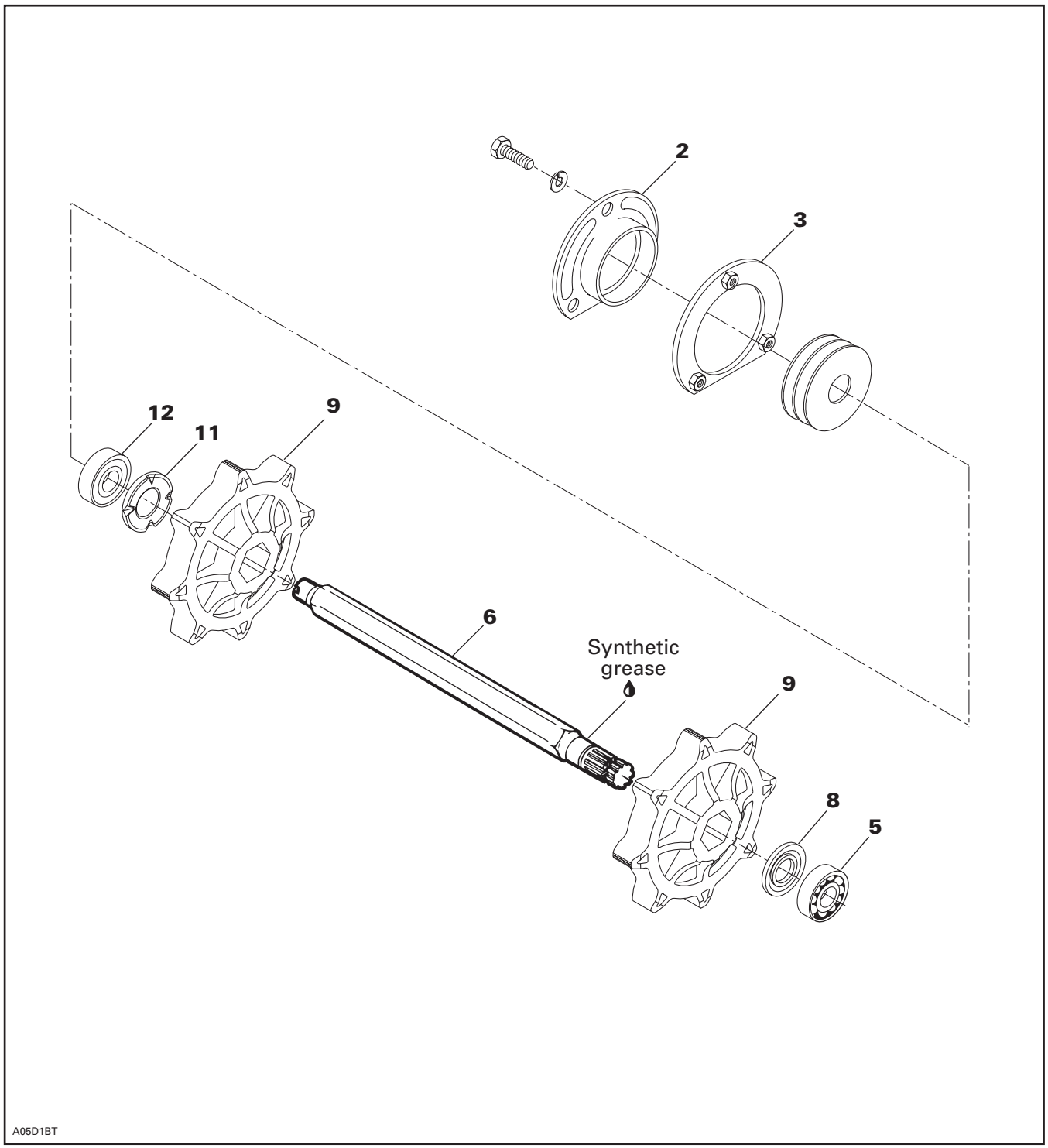
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	509

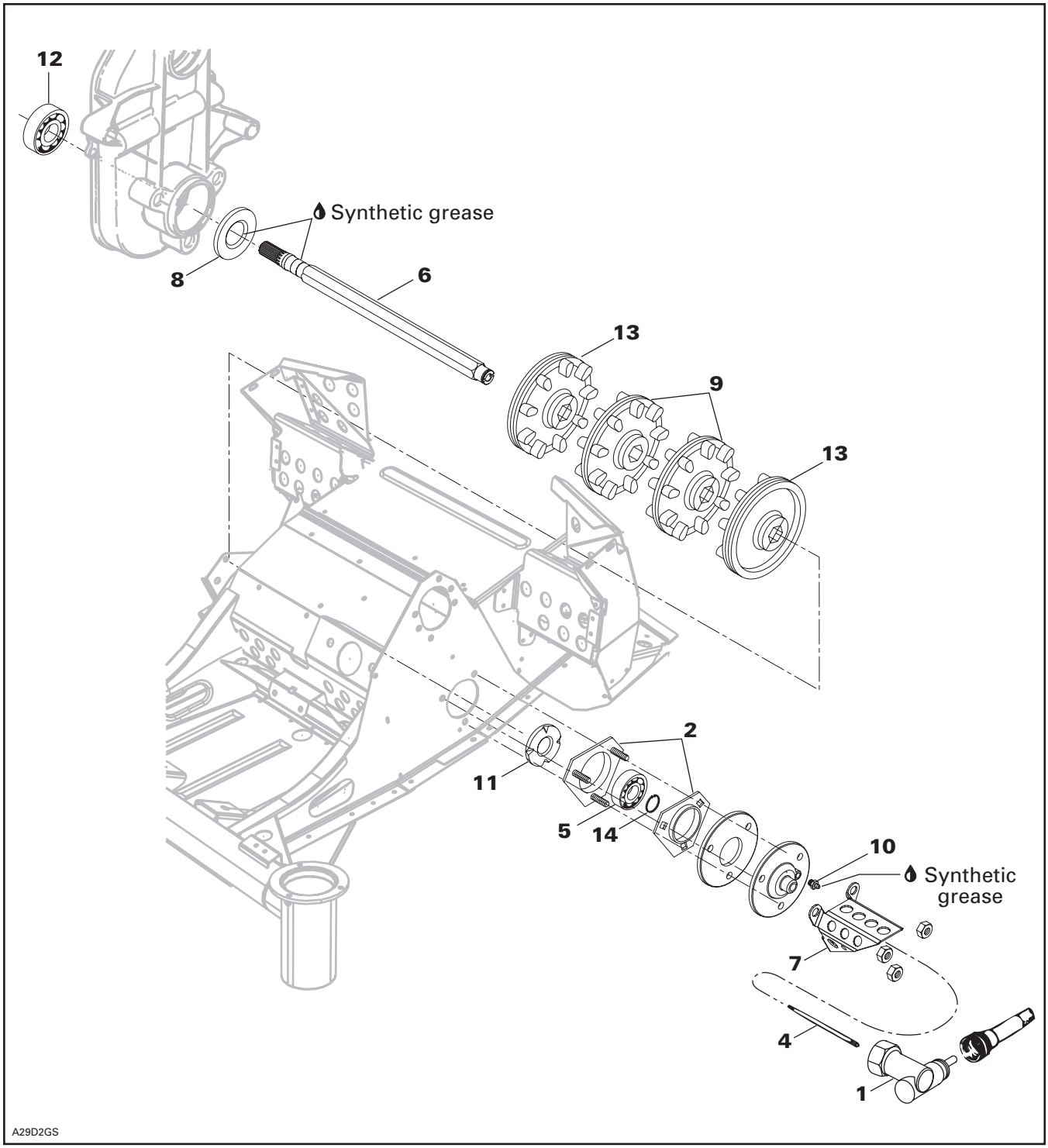
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	508

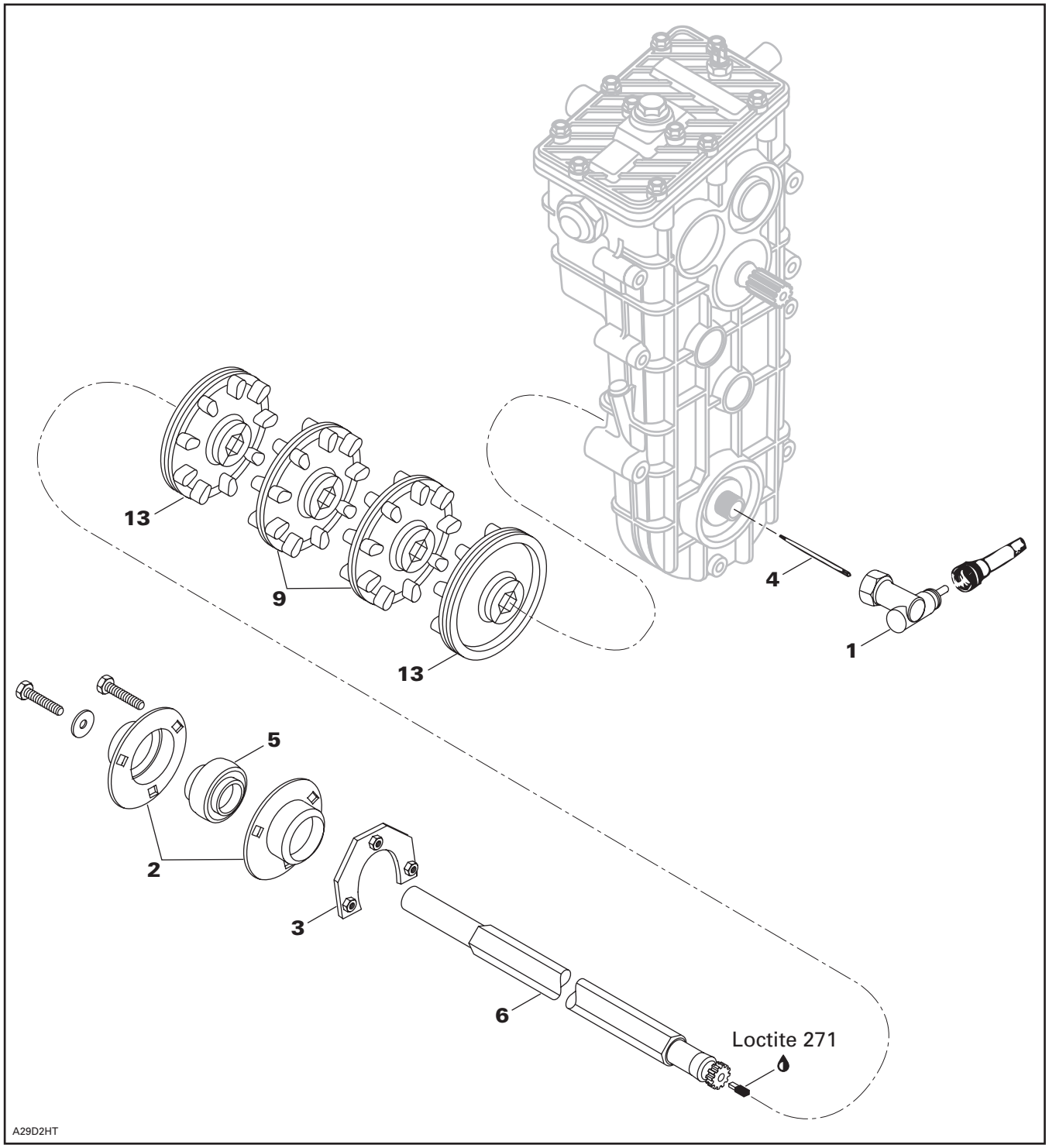
Tundra



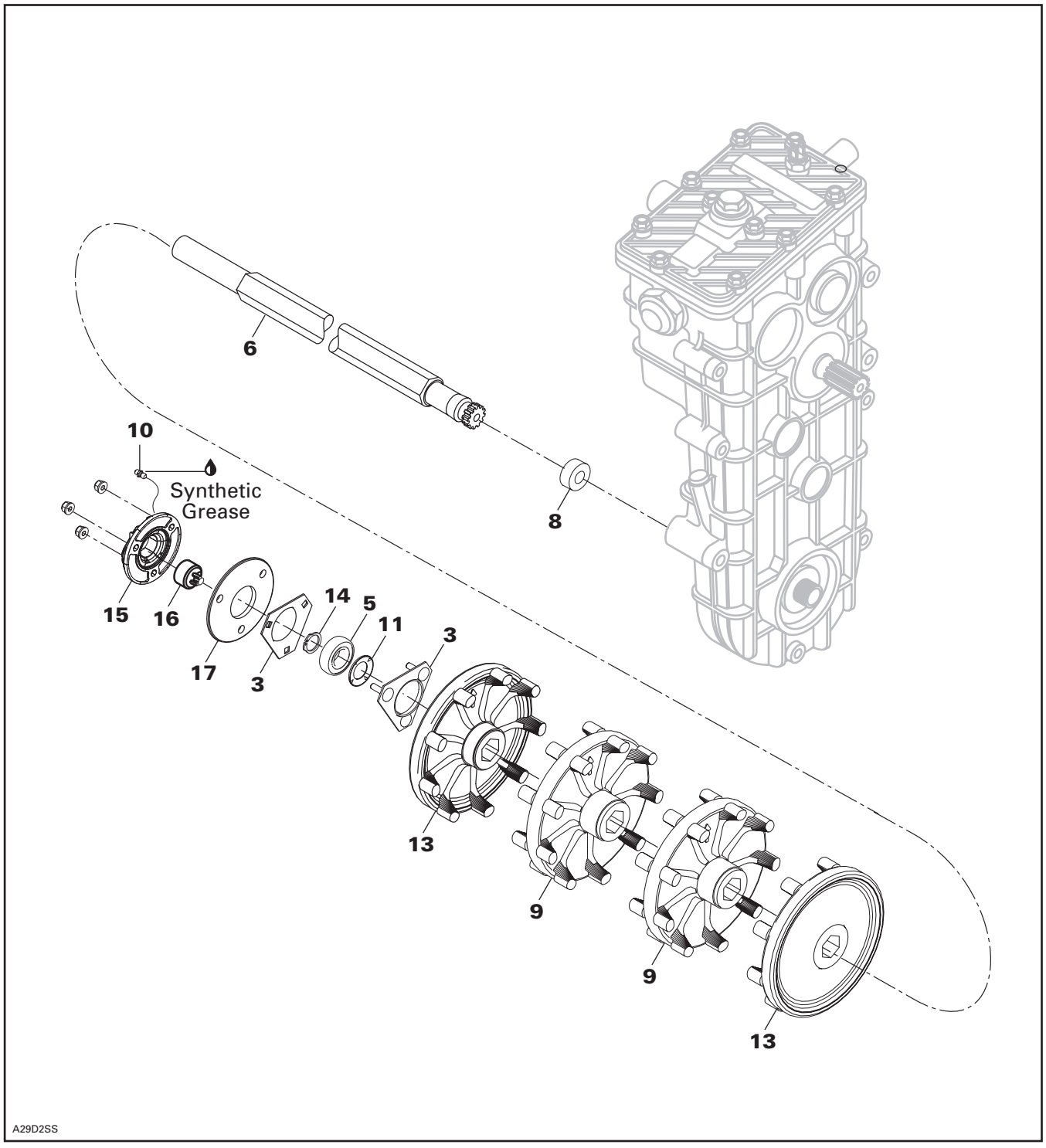
Skandic LT/LT E



Skandic WT/SWT/WT LC/SUV



Expedition TUV



REMOVAL

Tundra R and Skandic LT/LT E

Drain oil from chaincase. Release drive chain tension. Remove chaincase cover.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to SUSPENSION.

2,8, End Bearing Housing and Seal

Remove cable protector **no. 7**, and plastic bearing cover. Remove circlip **no. 14** from drive axle.

Remove chain and sprocket then circlip and bearing **no. 12** from drive axle.

Pry oil seals from chaincase and end bearing housing.

6,9,13, Drive Axle and Sprocket

Release drive axle sprocket from track and at the same time, pulling the drive axle towards the end bearing housing side.

Remove drive axle from vehicle.

Skandic WT/SWT/WT LC/SUV

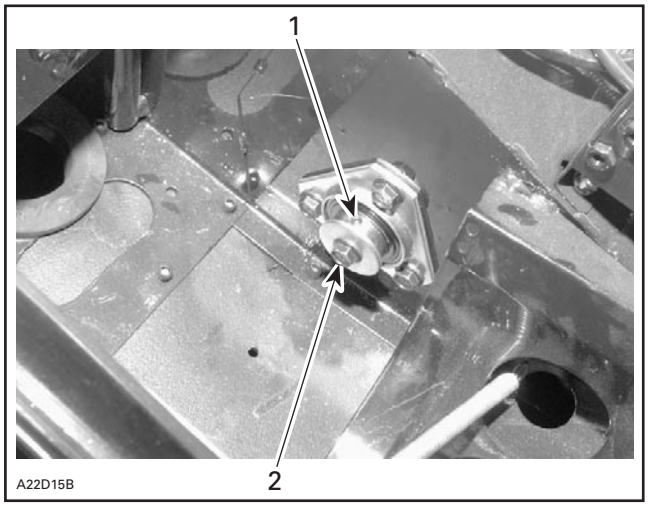
Drain gearbox.

Remove angle drive **no. 1** and square pin **no. 4**.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to ARTICULATING SLIDE SUSPENSION.

Remove muffler. Unfasten screw from drive axle end. Loosen Allen screw on bearing race.



1. Allen screw
2. Screw

Remove 3 screws retaining ball bearing housing then, remove inner plate **no. 3**.

Remove drive axle.

Expedition TUV

Drain gearbox.

Remove the following parts:
- speedometer flange **no. 15**
- magnetic adaptor **no. 16**
- washer **no. 17**
- bearing housing cover **no. 3**.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to ARTICULATING SLIDE SUSPENSION.

Release drive axle sprocket from track and at the same time, pulling the drive axle towards the end bearing housing side.

Remove drive axle.

DISASSEMBLY

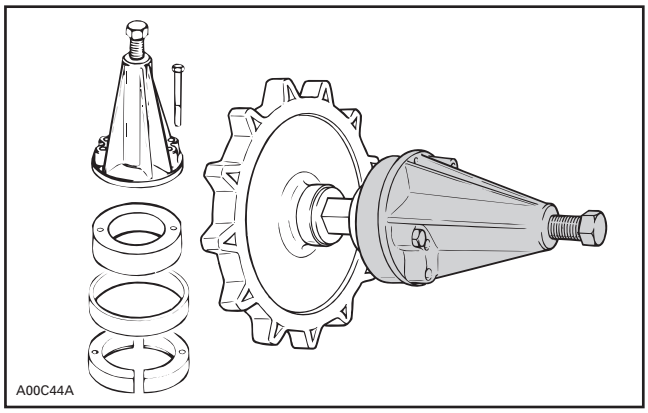
4, Speedometer Drive Insert

Remove speedometer drive insert.

5,12, Bearing

Tundra Only

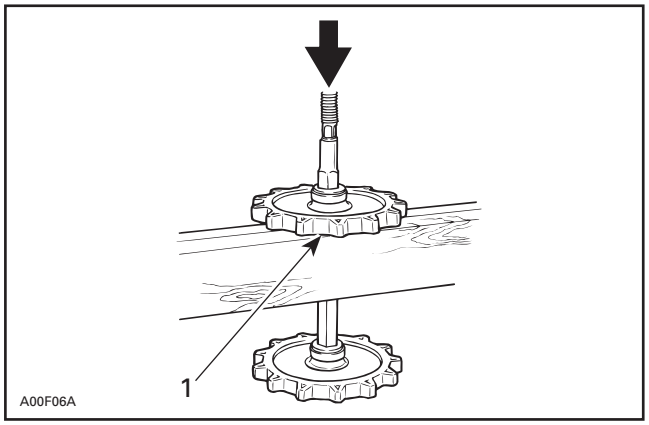
To remove bearings, use puller assembly, ring and half rings as illustrated.



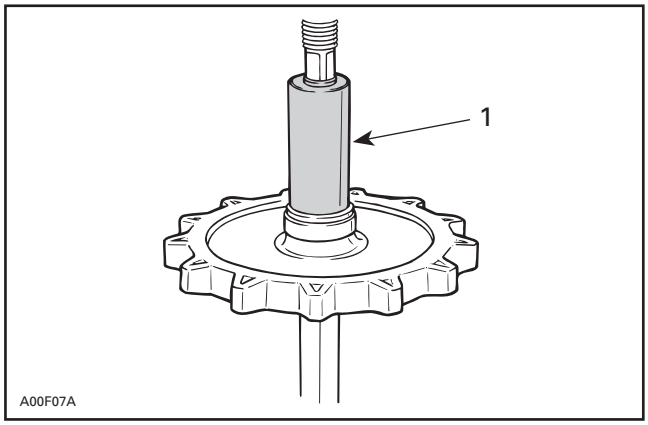
9,13, Sprocket and Half-Sprocket

All Models

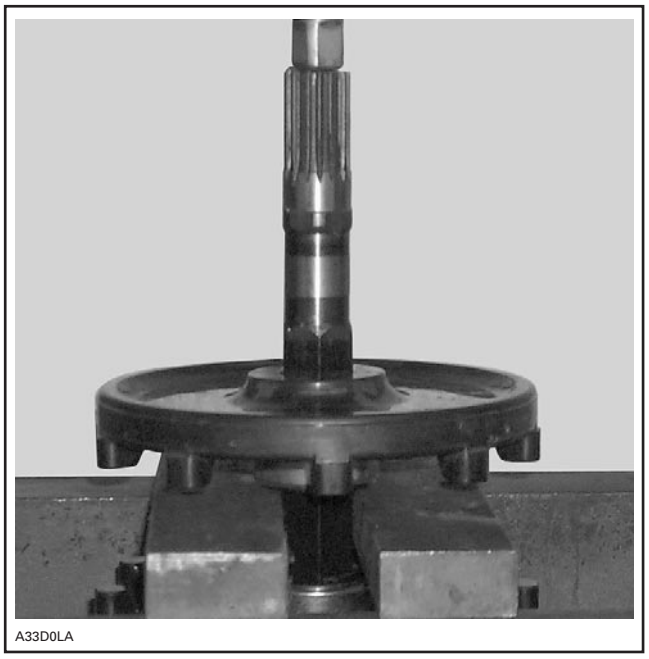
To remove press fit sprockets, use a press and a suitable support as illustrated.



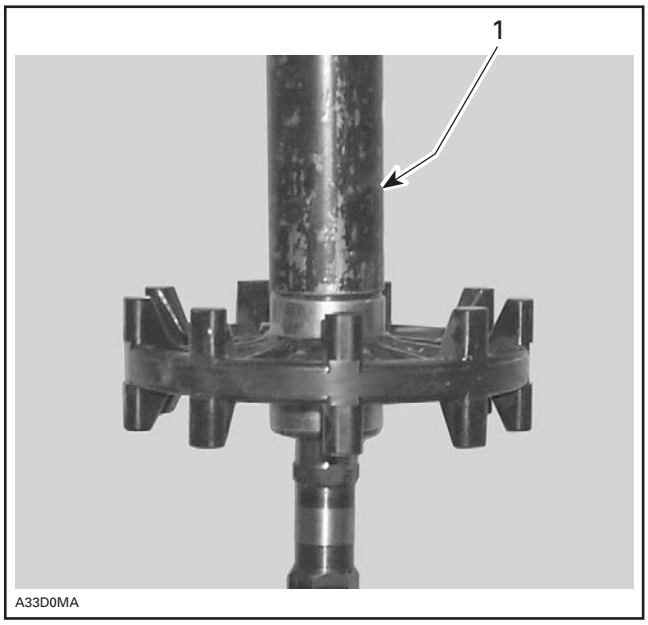
TYPICAL — TUNDRA
1. Support sprocket near hub



TYPICAL — TUNDRA
1. Pipe



TYPICAL — ALL MODELS EXCEPT TUNDRA



TYPICAL — ALL MODELS EXCEPT TUNDRA
1. Pipe

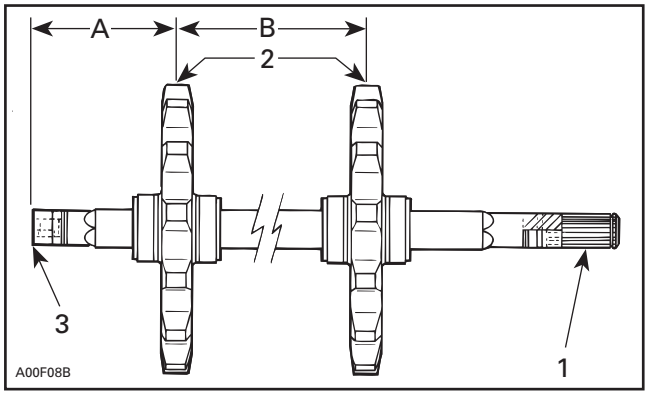
NOTE: Two different types of sprocket press fit can be found. Ensure to replace ring reinforced sprockets with the same type.

ASSEMBLY

6,9,13, Drive Axle and Sprocket

To assemble press fit sprockets, use a press and a suitable pipe as illustrated. Sprockets must be assembled according to the following dimensions.

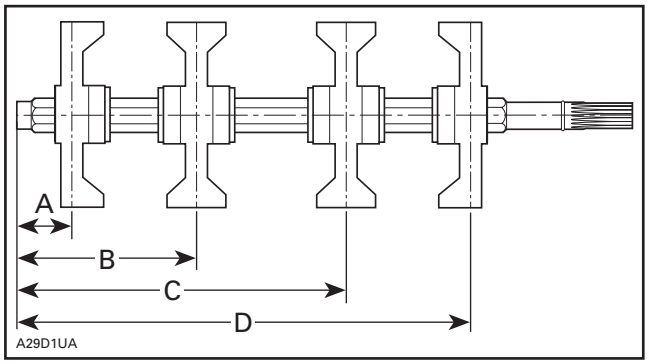
Tundra



TYPICAL
1. Chaincase side
2. Center line of sprocket
3. Drive axle end

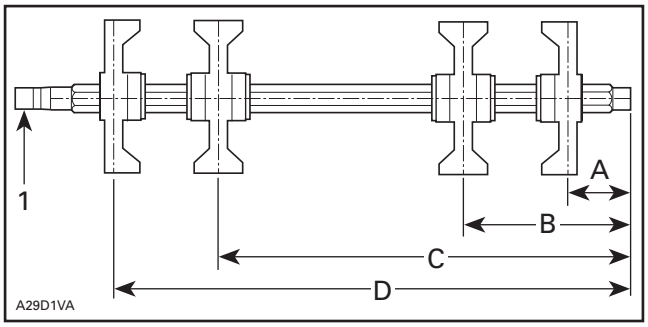
A. 83.0 mm (3-17/64 in)
B. 237 mm (9-21/64 in)

Skandic LT/LT E



A. 47.0 mm (1.850 in)
B. 148.0 mm (5.827 in)
C. 271.0 mm (10.669 in)
D. 372.0 mm (14.646 in)

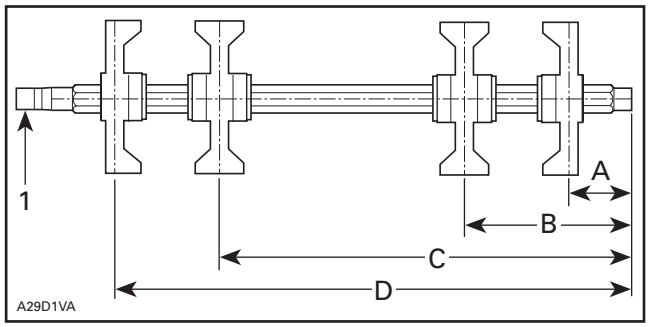
Skandic WT/WT LC/SUV



1. Gearbox side

A. 55.0 mm (2.165 in)
B. 157.0 mm (6.181 in)
C. 399.0 mm (15.709 in)
D. 501.0 mm (19.724 in)

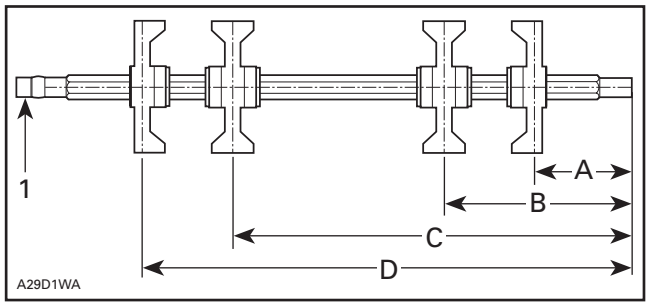
Expedition TUV



1. Gearbox side

A. 46.0 mm (1.811 in)
B. 148.0 mm (5.827 in)
C. 390.0 mm (15.354 in)
D. 492.0 mm (19.370 in)

Skandic SWT

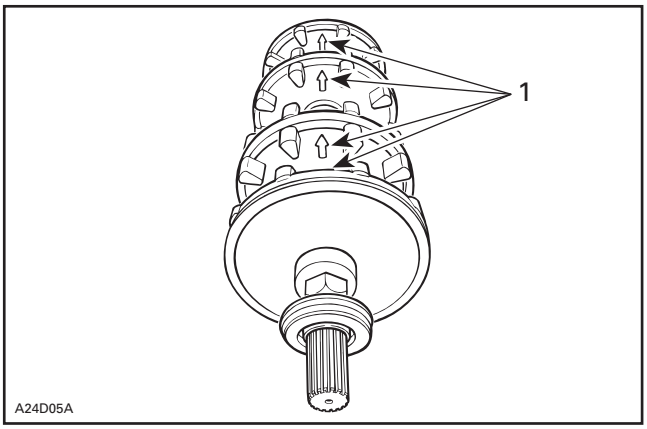


1. Gearbox side

A. 105.0 mm (4.016 in)
B. 207.0 mm (8.150 in)
C. 449.0 mm (17.677 in)
D. 551.0 mm (21.693 in)

All Models

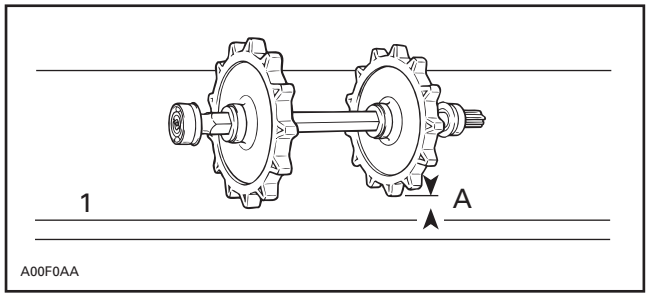
Ensure to align indexing marks of each sprocket when assembling.



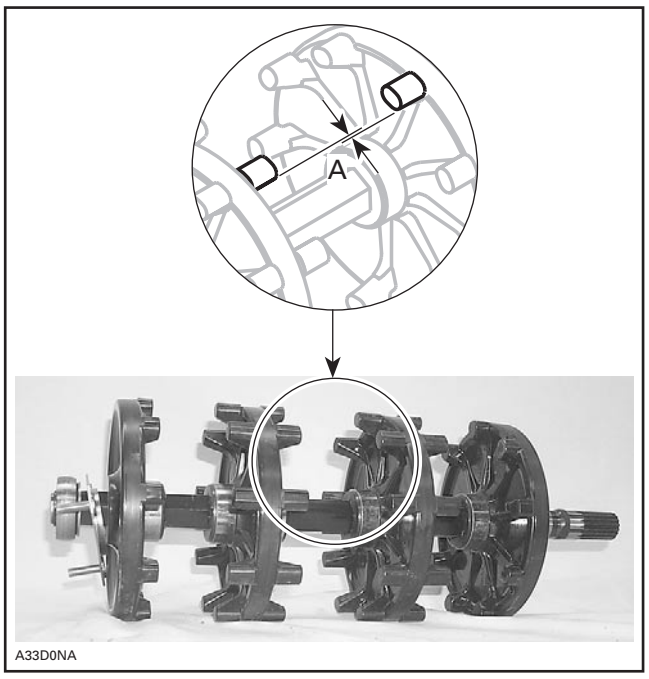
TYPICAL
1. Indexing marks aligned

The maximum de-synchronization for the sprockets is 1.5 mm (1/16 in).

To check this tolerance, place axle assembly on a plane surface and measure the gap between sprocket tooth and surface.



TYPICAL — TUNDRA
1. Plane surface
A. 1.5 mm (1/16 in) MAXIMUM

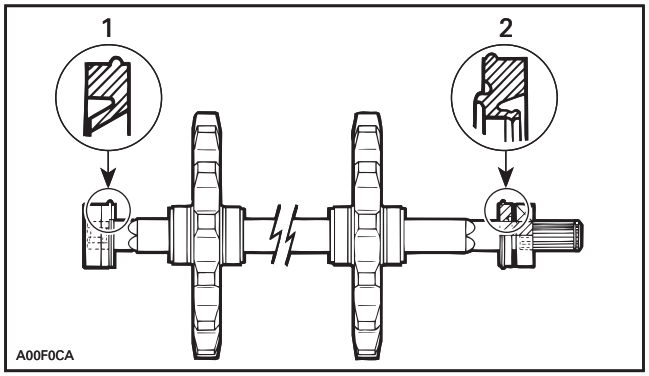


TYPICAL — ALL MODELS EXCEPT TUNDRA
A. 1.5 mm (1/16 in) MAXIMUM

CAUTION: The same sprocket must not be pressed twice on the axle. If synchronization is found to be defective, use a new sprocket.

6,8, Drive Axle and Seal

When assembling drive axle, always position a new seal on each end of drive axle (if applicable). Locate seal lip as illustrated.



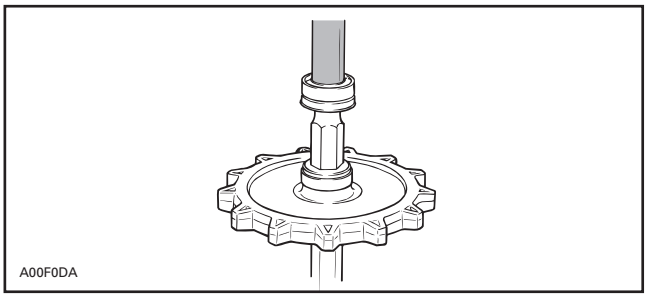
1. Grease seal type
2. Oil seal type

11, Bearing Protector

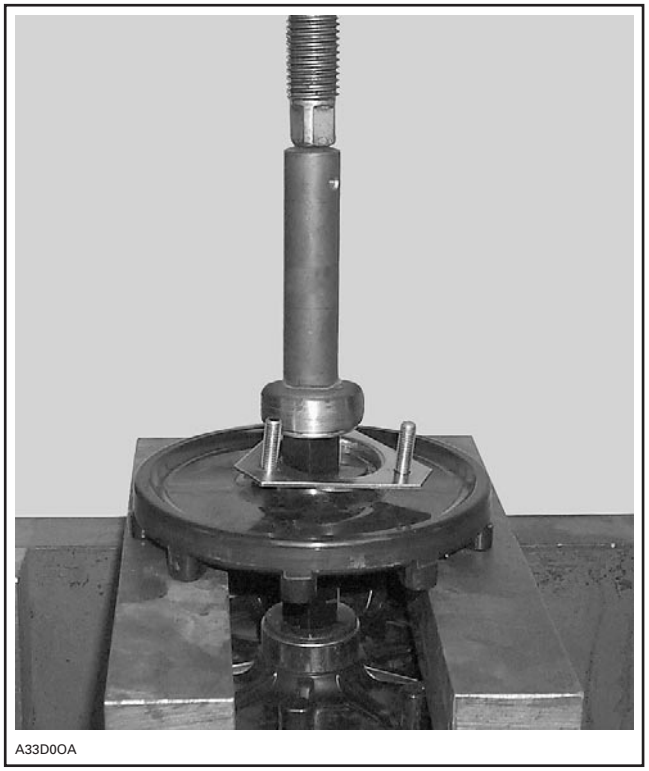
At assembly, flat side of bearing protector must be against bearing.

5,12, Bearing

Always push bearing by inner race.

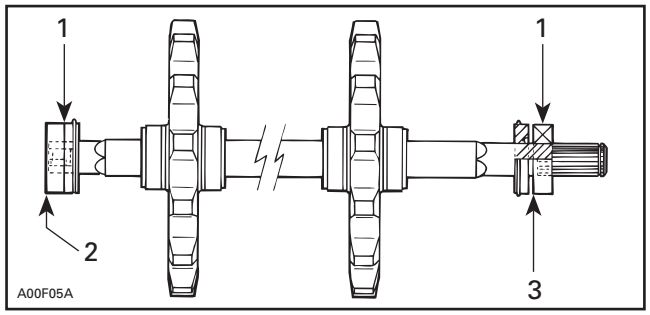


TYPICAL — TUNDRA


A33D0OA

TYPICAL — ALL MODELS EXCEPT TUNDRA

The bearing on the splined side of axle must be pushed until it is seated on shaft shoulder. The end bearing housing bearing must be flush with end of drive axle. Each bearing must have its shield facing the sprocket.

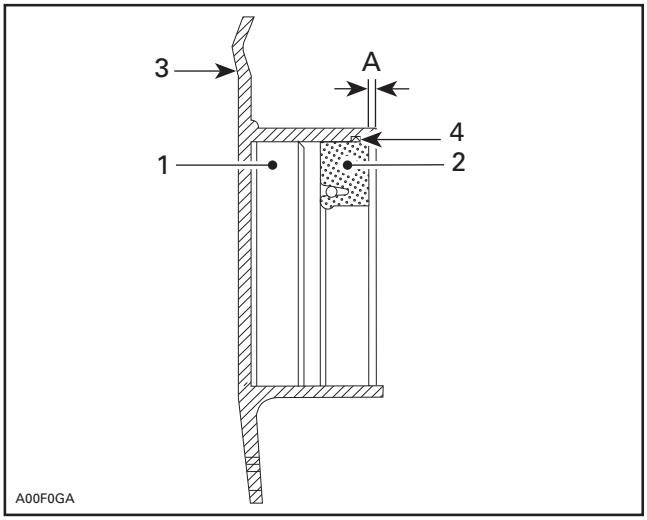


1. Bearing shield on this side
2. Flush with drive axle
3. Seated on shaft shoulder

INSTALLATION

Position drive axle assembly into location. Install end bearing housing. Install spacer (if applicable) between bearing and lower chaincase sprocket.

Install chaincase and position seals (if applicable), making sure that a gap of approximately 2 mm (1/16 in) exists between end of bearing housing and each seal.



SIDE VIEW
1. Bearing
2. Seal
3. Housing
4. Seal lip

A. 2 mm (.080 in) approximately

3, Retainer Ring

Make sure that welded nuts are toward inside of tunnel.

Lock drive axle sprocket with a circlip.

Reinstall the chaincase cover.

Refill with chaincase oil. Refer to TECHNICAL DATA.

Install the suspension. Refer to TRACK and adjust track tension and carry out track alignment procedure.

LUBRICATION

10, Grease Fitting

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033).

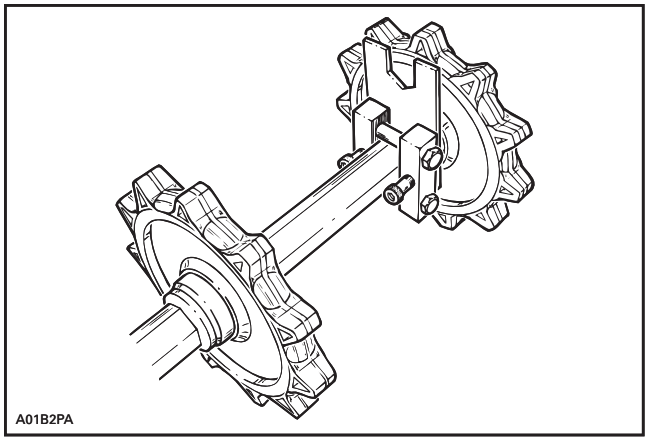
ADJUSTMENT

Sprocket/Track Alignment

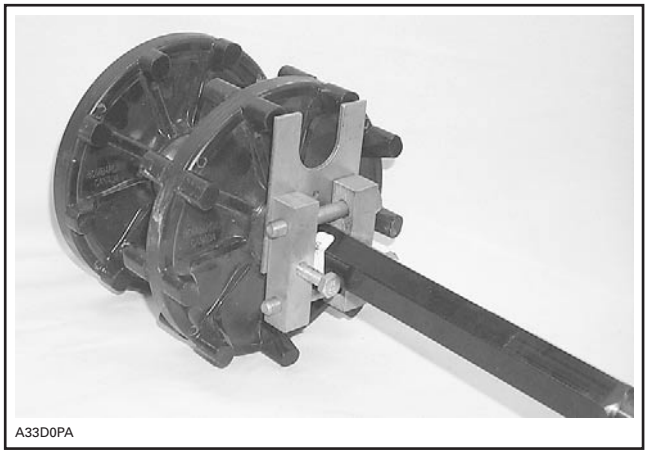
CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets might be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



TYPICAL — TUNDRA



TYPICAL — ALL MODELS EXCEPT TUNDRA

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	512
narrow track cleat installer	529 008 500	511
narrow track cleat installer	529 028 800	514
snowmobile mechanical stand	529 020 000	512
track cleat remover	529 028 700	511, 514

TRACK TYPE APPLICATION

Refer to TECHNICAL DATA section.

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 track cleat remover (P/N 529 028 700). Use narrow track cleat installer (P/N 529 008 500).

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

REMOVAL

Tundra

Remove the following items:
- chaincase cover, sprockets, chain
- muffler
- upper center idler ass'y
- suspension
- end bearing housing
- drive axle seal
- drive axle (outwards from end bearing housing)
- track.

Skandic LT/LT E

Remove the following parts:
- speedometer cable
- muffler
- chaincase cover
- suspension
- drive axle seal
- end bearing housing
- sprockets and chain
- drive axle (toward end bearing housing)
- track.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Remove the following parts:
- rear suspension
- muffler.

Drain gearbox.

Remove drive axle then track.

INSTALLATION

All Models

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.

Track Tension and Alignment

Track tension and alignment are inter-related. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Tension

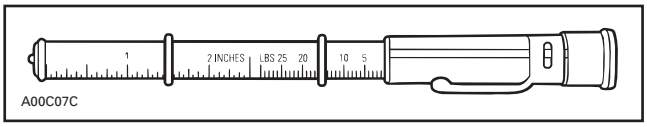
NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

Remove the tether cord cap.

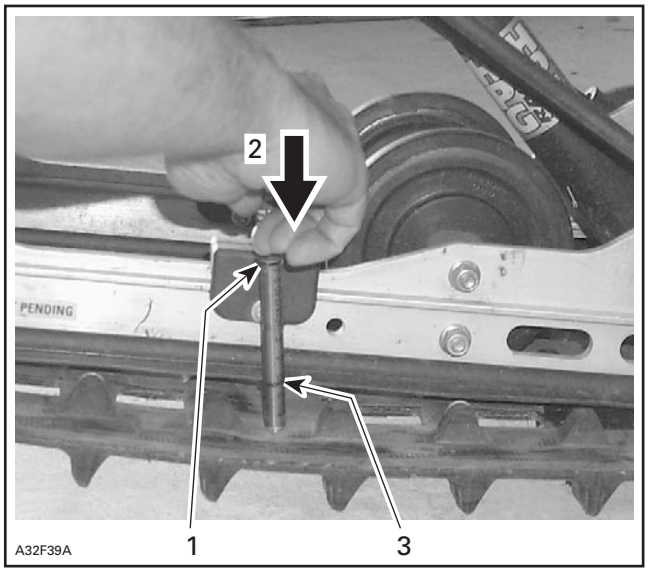
Lift rear of snowmobile and support it with a wide-base snowmobile mechanical stand (P/N 529 020 000).

Allow the suspension to extend normally 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 at the end of this guide. If the track tension is too loose, track will have a tendency to thump.

NOTE: A belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

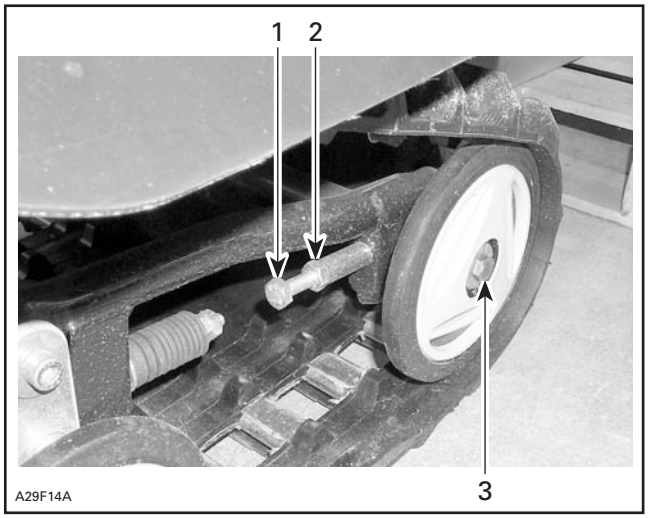


TYPICAL
1. *Top tool O-ring positioned at 7.3 kg (16 lb)*
2. *Push on top portion of tool until it contacts the top O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To adjust track tension:

– Remove the tether cord cap.
– Loosen the rear idler wheel retaining screws.
– Loosen the lock nuts (on so equipped models) then turn adjustment screws to adjust.



TYPICAL
1. *Adjustment screw*
2. *Loosen lock nut (on so equipped models)*
3. *Loosen screw*

– Retighten retaining screws and lock nuts (on so equipped models).
– Check track alignment as described below.

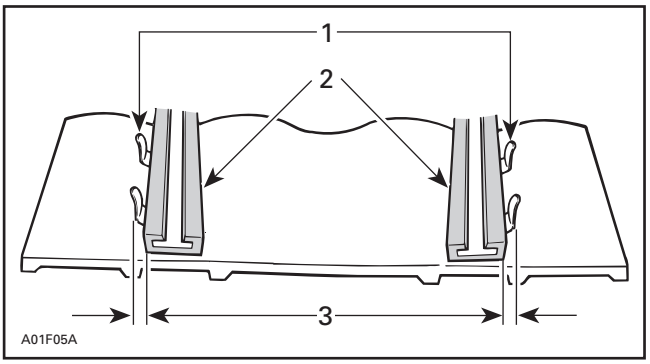
Alignment

⚠ 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 snowmobile. Never rotate track at high speed.

Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (15 to 20 seconds).

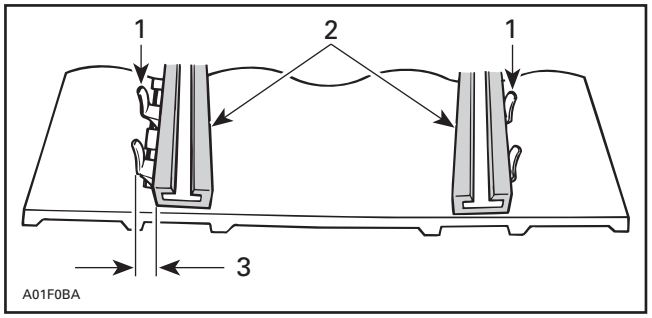
Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. *Guides*
2. *Slider shoes*
3. *Equal distance*

To adjust track alignment:

– Remove the tether cord cap.
– Loosen rear idler wheel retaining screws.
– Loosen the lock nuts (on so equipped models).
– Tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.

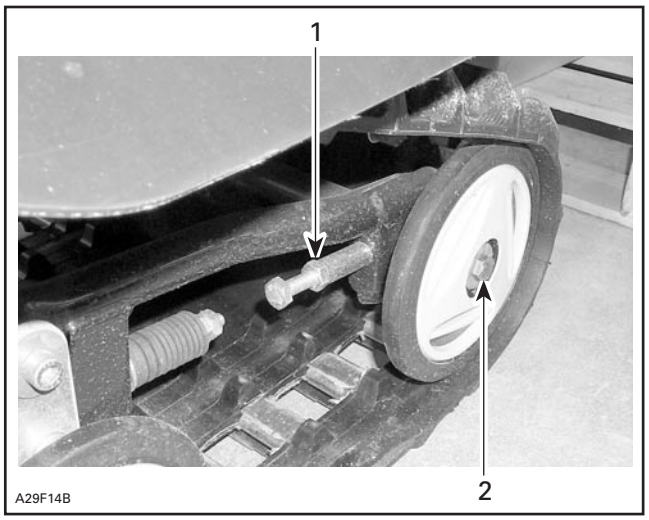


1. *Guides*
2. *Slider shoes*
3. *Tighten on this side*

Tighten lock nuts (some models only) and retaining screws.

⚠ WARNING

If lock nuts are not tightened properly, the adjusting screws could loosen causing the track to become extremely loose and, under some operating conditions, allow the idler wheels to climb over the track lugs forcing the track against the tunnel causing the track to "lock". Properly tighten wheel retaining screws, otherwise wheel may come off and cause track to "lock".



TYPICAL
1. *Retighten (so equipped models)*
2. *Retighten to 48 N•m (35 lbf•ft)*

Restart engine and rotate track slowly to recheck alignment.

Reposition snowmobile on ground.

Track Cleat

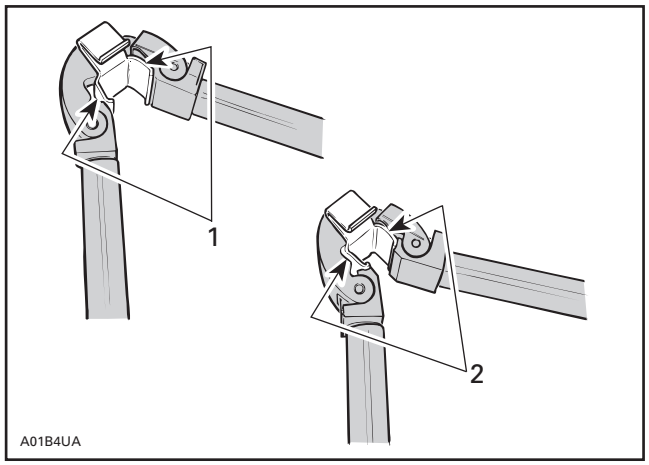
Removal

– Raise rear of vehicle off the ground and lift snow guard then rotate track to expose a cleat to be replaced.
– Using track cleat remover (P/N 529 028 700) for all models.

Installation

NOTE: Keep the same pitch between guide cleats.

– Place new cleat in position and using narrow track cleat installer (P/N 529 028 800) bend cleat then push tabs into rubber.



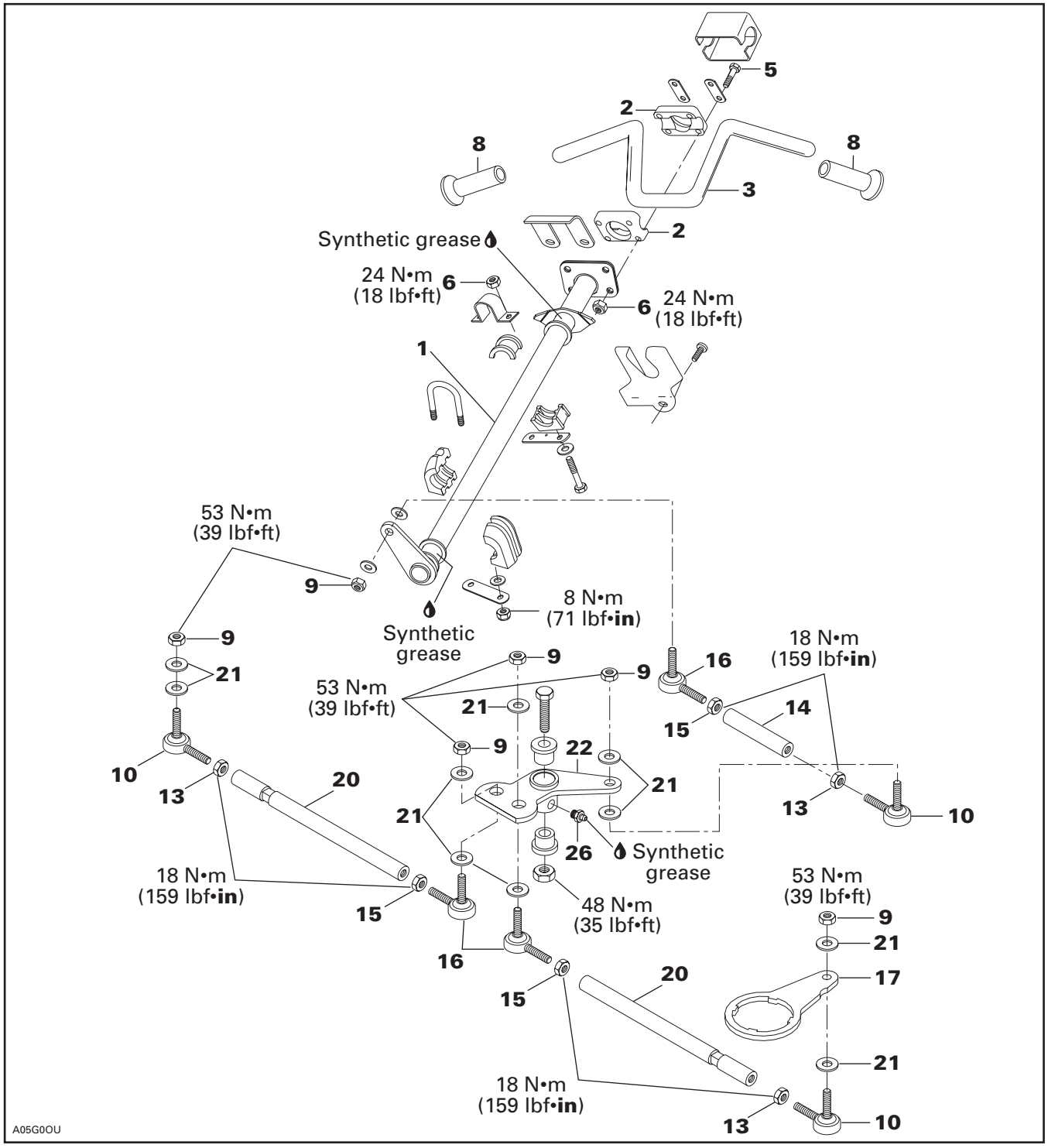
TYPICAL
1. *First step*
2. *Second step (to push tabs into rubber)*

STEERING SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier Lube	293 600 016	527–528
suspension synthetic grease	293 550 033	527
synthetic grease	413 711 500	528

Tundra


5
2
8
8
3
2
Synthetic grease
24 N•m
(18 lbf•ft)
6
6
24 N•m
(18 lbf•ft)
1
53 N•m
(39 lbf•ft)
9
8 N•m
(71 lbf•in)
Synthetic
grease
9
21
9
9
16
18 N•m
(159 lbf•in)
53 N•m
(39 lbf•ft)
21
14
15
9
22
10
13
20
21
21
13
10
26
Synthetic
grease
18 N•m
(159 lbf•in)
48 N•m
(35 lbf•ft)
53 N•m
(39 lbf•ft)
15
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18 N•m
(159 lbf•in)
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10
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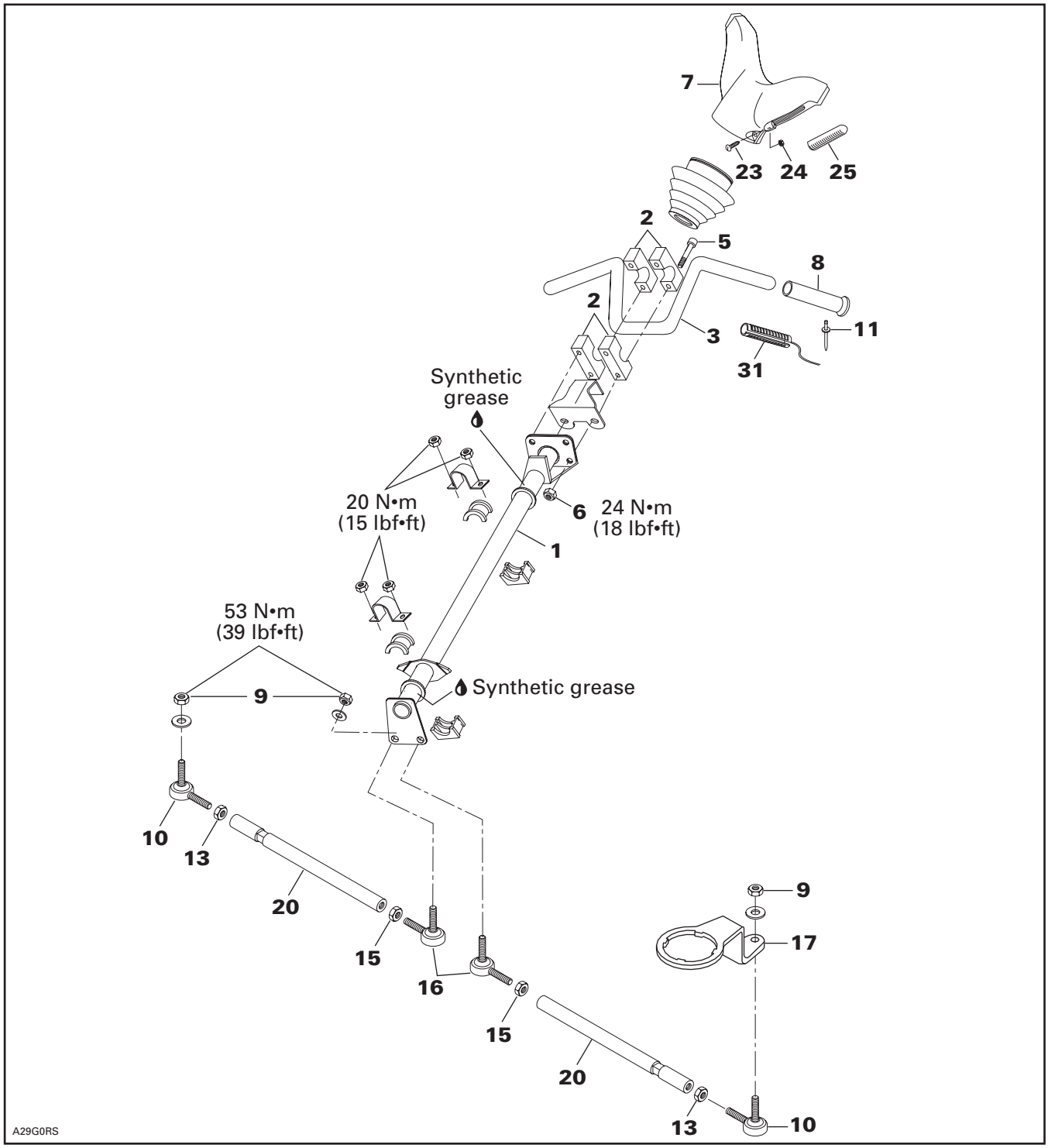
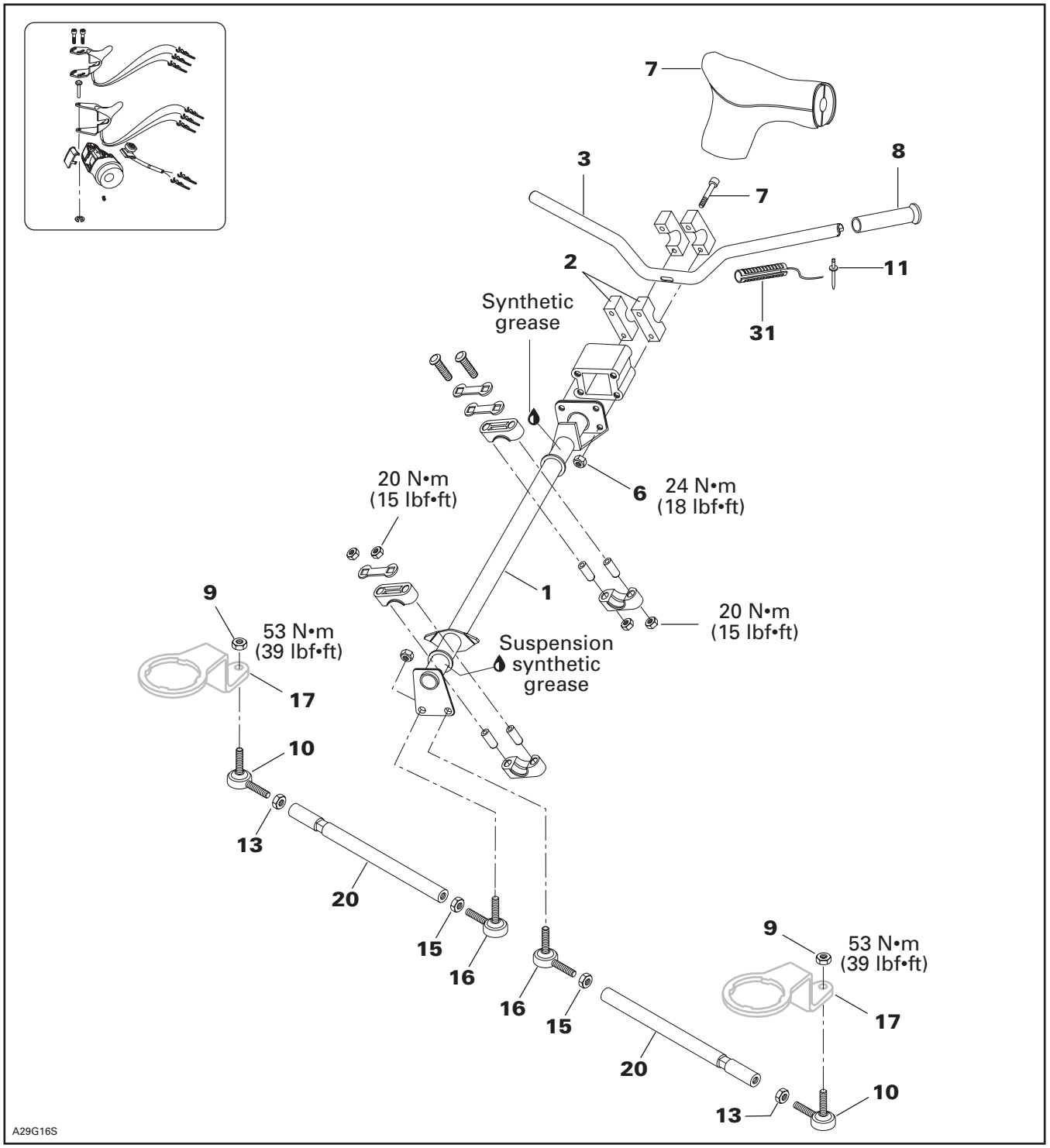
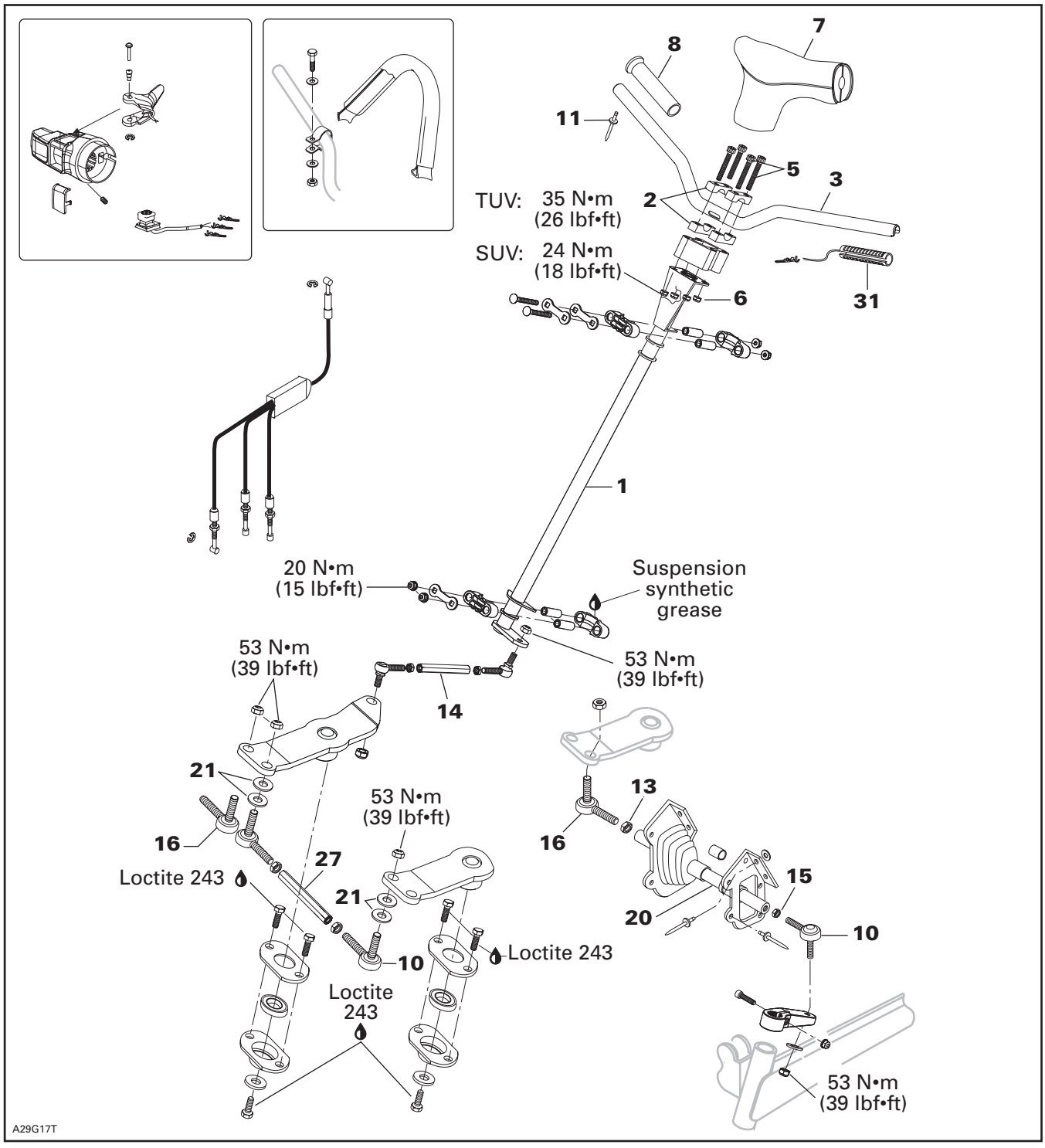
Skandic LT/LT E



Skandic WT/SWT/WT LC



Skandic SUV/Expedition TUV



INSPECTION

Check skis and ski runner for wear, replace as necessary. Refer to STEERING SYSTEM.

17, Steering Arm and Ski Leg

Make sure steering arm and ski leg splines interlock without excessive play.

⚠ WARNING

Any parts having worn splines have to be replaced with new ones.

Check steering system components for wear. Replace if necessary.

31, Heating Grip Element

To test heating elements, refer to TESTING PROCEDURE.

10,16, Ball Joint (left hand and right hand threads)

Inspect ball joint ends for wear or looseness, if excessive, replace them.

DISASSEMBLY AND ASSEMBLY

8, Grip

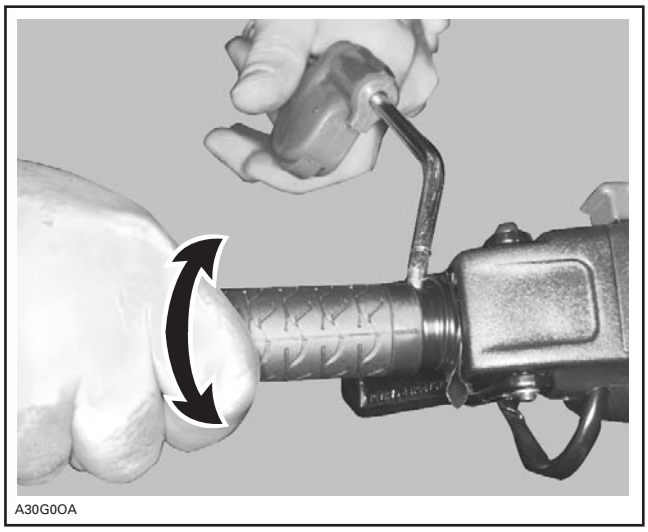
Grips must be carefully removed to prevent damaging the heating elements.

Remove rivet **no. 11** if applicable.

Heat grip with a heat gun.

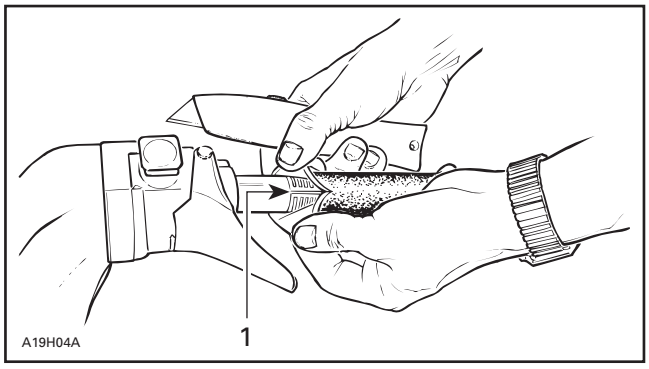
Apply tape to handlebar near the grip to protect paint.

Inject compressed air into the handlebar and twist grip while pulling it out.



The grips might not be removable as explained above; in this case, carefully proceed as follows to prevent damaging the heating elements.

Start cutting and immediately peel it open to locate the gap in the heating element, as shown.



TYPICAL
1. Gap in the heating element opposite the wires

Continue cutting along the gap and remove the grip.

If required, slowly peel heating element **no. 31** from handlebar and remove it.

To install, stick the heating element to the handlebar making sure the wires do not interfere with operation of the accelerator or brake handle.

⚠ WARNING

Never use lubricants (e.g. oil, grease, etc.) to install the handlebar grip. Only use a mix of soap and water. Mix 40 parts of water with one part of dish washing soap (recommended: Ultra Joy, Sunlight or Palmolive).

Heat the grip with a heater gun or a spot light to ease installation. Insert new grip with compressed air.


A30G0NA

Install rivet no. 11 if applicable.

1, Steering Column

Remove steering pad then handlebar ass'y.

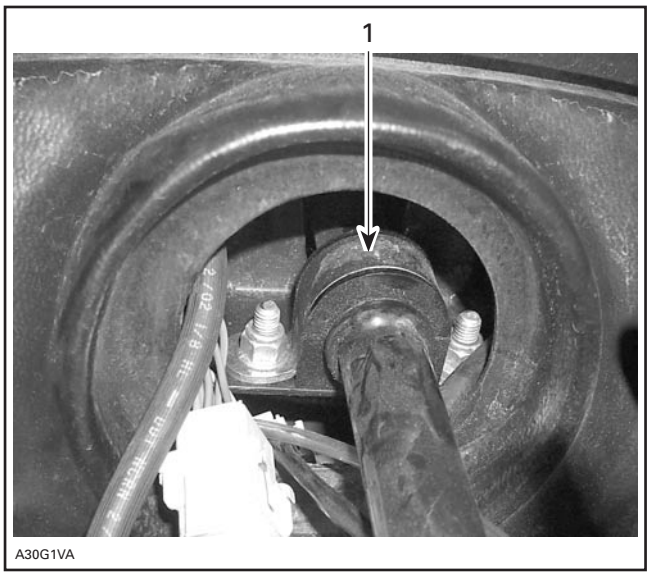
Detach tie rod(s) from the steering column.

Remove U-clamps or half bushings (as applicable) holding steering column.

NOTE: It may be necessary to remove part(s) to gain access to lower U-clamp or half bushing (as applicable).

Remove steering column.

NOTE: To remove steering column on Skandic models only, loosen rear engine fastening screws.



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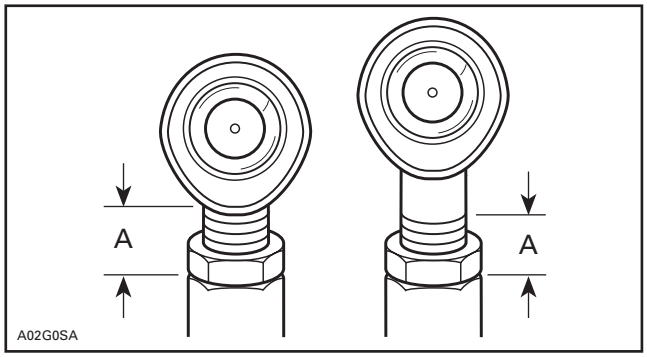
TYPICAL
1. U-clamp

10,16, Ball Joint (left hand and right hand threads)

Screw threaded end of the ball joint into the tie rod. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).

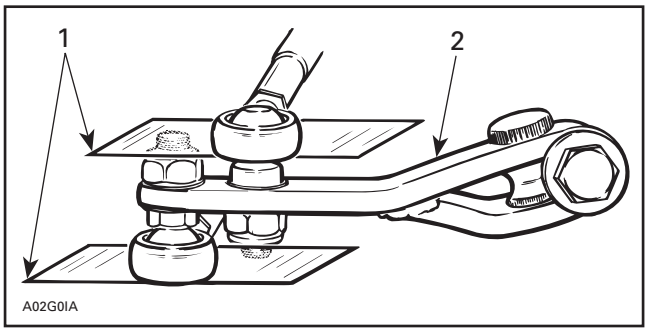


A02G0SA

TYPICAL
A. 20 mm (25/32 in) maximum

The ball joint 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

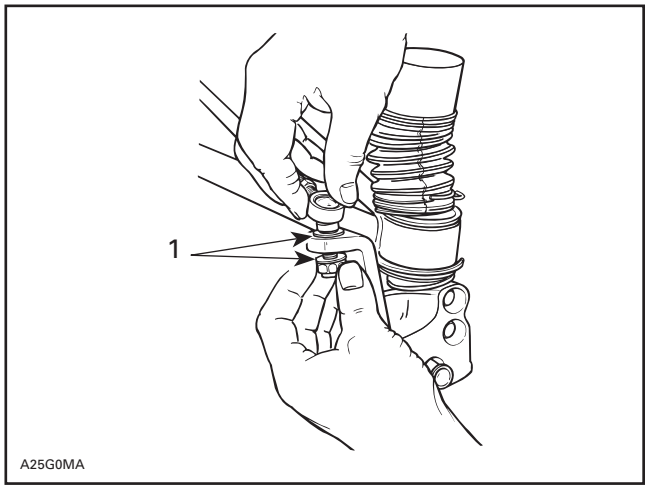
⚠ WARNING

The cut off section of the ball joint must run parallel with the steering arm. 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).

21, Hardened Washer on Ball Joint Stud

Tundra and Skandic SUV

Install a hardened washer on each side of the arm.

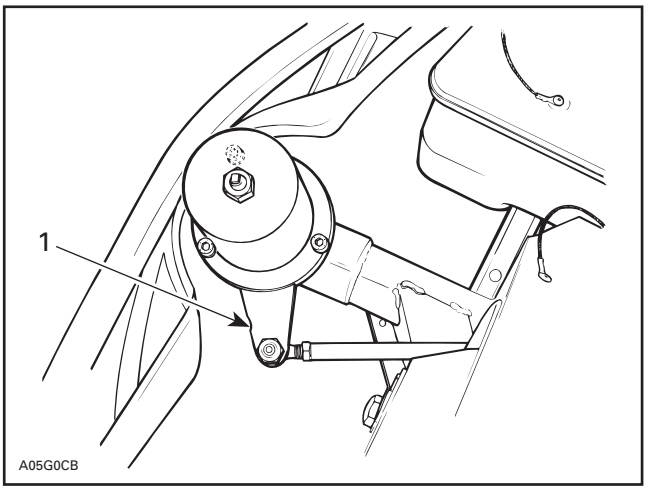


TYPICAL
1. Hardened washers

17, Steering Arm

Tundra

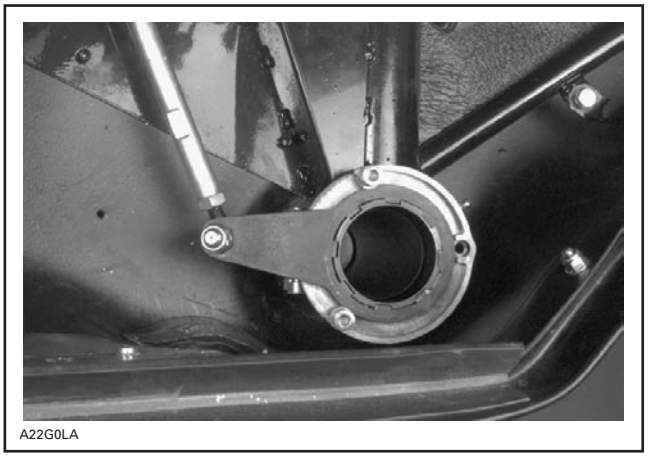
Steering arm notch must face outside of vehicle.



1. Notch facing outside

Skandic LT/LT E/WT/SWT/WT LC

Install steering arm at mid-travel position when handlebar and skis are facing straight ahead.



TYPICAL

Skandic SUV/Expedition TUV

Steering arm must be installed parallel to ski.

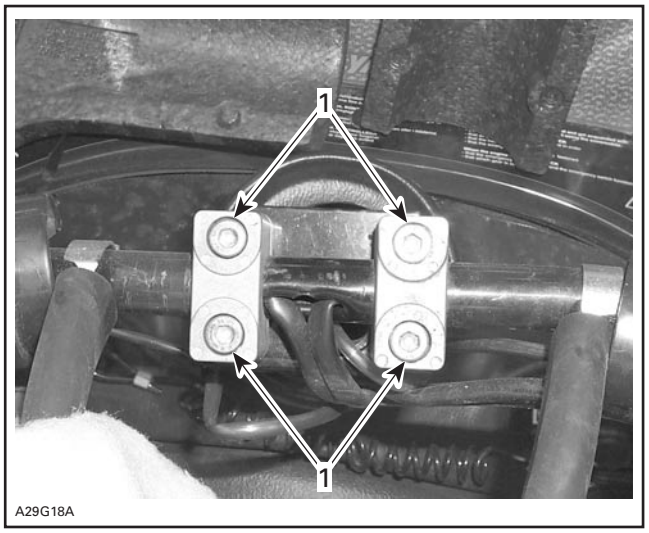
9,13,15, Ball Joint Nut and Jam Nut

Tighten ball joint nuts and jam nuts to specified torque (see exploded view).

HANDLEBAR POSITION ADJUSTMENT

All Models

Remove steering cover and paddings. Loosen 4 nuts on steering clamps **no. 2**.

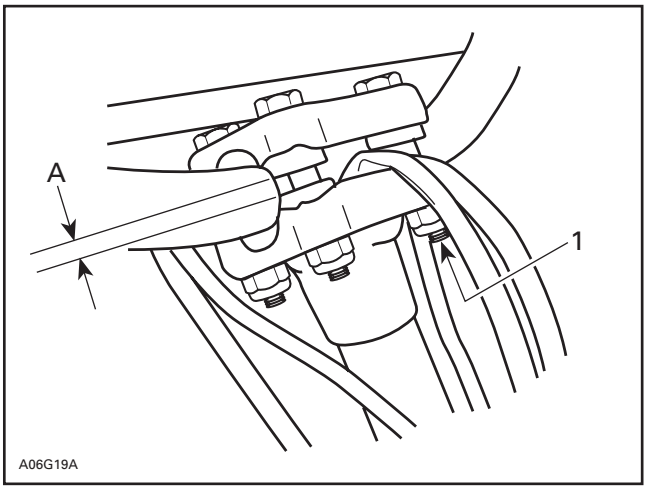


1. Nuts to be removed

Adjust the steering handlebar to the desired position.

Lock the handlebar in place by tightening the 4 nuts as specified in the illustrations.

CAUTION: Tighten the nuts equally in a criss-cross sequence and ensure there is an equal gap on each side of the clamps no. **2.**



TYPICAL
1. Torque to 24 N•m (18 lbf•ft)
A. Equal gap all around

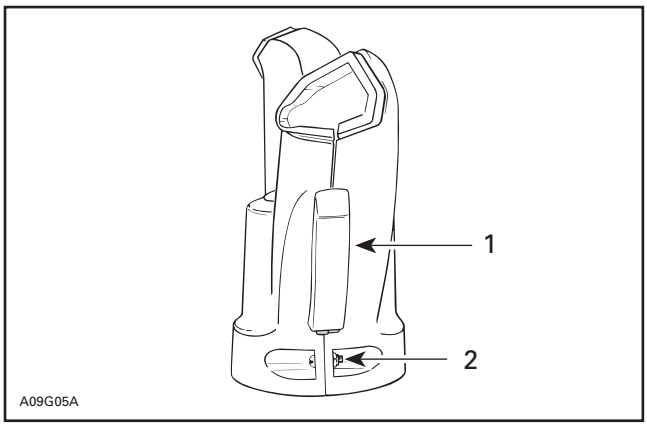
⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Properly fit the steering pad to the handlebar. Assemble using the 2 rubber attachments, nuts and bolts where applicable.

⚠ WARNING

Make sure that the steering pad and all controls are properly fixed to their normal location on the handlebar.



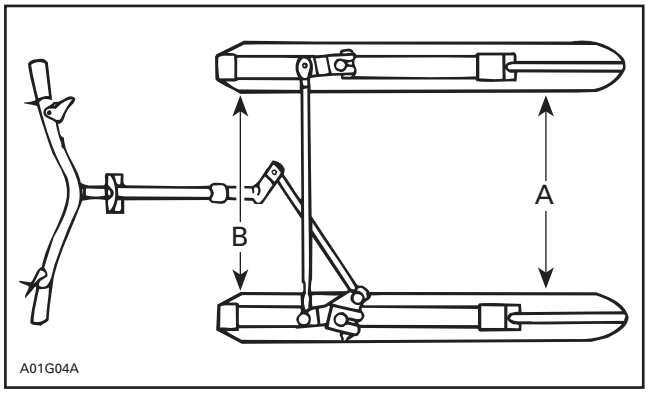
TYPICAL
1. Rubber attachment
2. Nut and bolt (where applicable)

STEERING ADJUSTMENT (SKIS)

Definitions

TOE-OUT:

A difference measured between the front edge of the skis A and rear edge B as viewed from the top. It is adjustable.



CAMBER:

A specific inward or outward tilt angle of ski leg compared to a vertical line when viewing the vehicle from front. This angle is not adjustable on any models.

Adjustments

Tundra

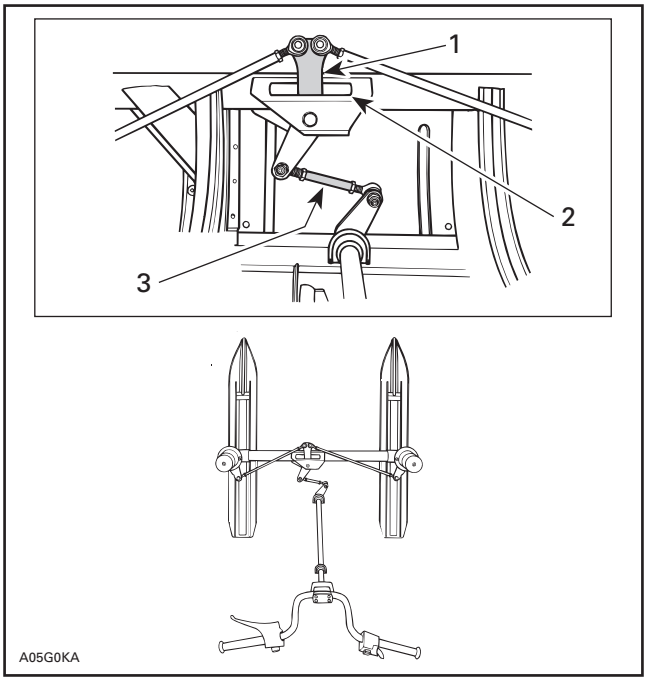
Adjustments should be performed following this sequence:

– Handlebar/pivot arm centering.
– Set toe-out adjustment.

HANDLEBAR/PIVOT ARM CENTERING

Turn handlebar until pivot arm is well centered in slot of its bracket.

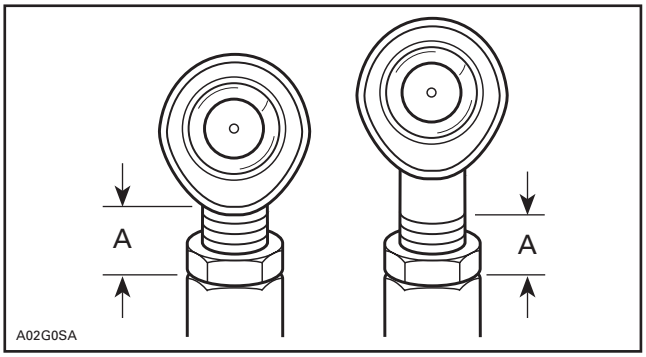
Check if handlebar is horizontal. To adjust, loosen lock nuts of short tie rod and turn it accordingly.



1. Pivot arm centered in slot
2. Slot
3. Turn to adjust

⚠ WARNING

Maximum ball joint external threaded length not engaged in the tie rod end must not exceed 20 mm (25/32 in). Torque lock nut to 18 N•m (159 lbf•in).



1. 20 mm (25/32 in) maximum

Restrain short tie rod while torquing nuts so that ball joint sockets run parallel with steering arm and pivot arm.

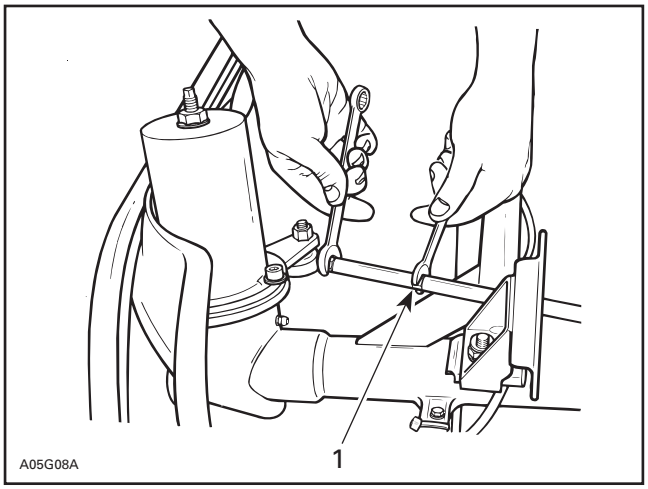
Ensure that pivot arm is still centered and check ski toe-out.

TOE-OUT ADJUSTMENT

Raise front of vehicle so that skis are off the ground.

Loosen lock nuts of long tie rods and turn each tie rod so that skis are in a straight ahead position. To adjust toe-out, slightly turn both tie rods exactly the same amount.

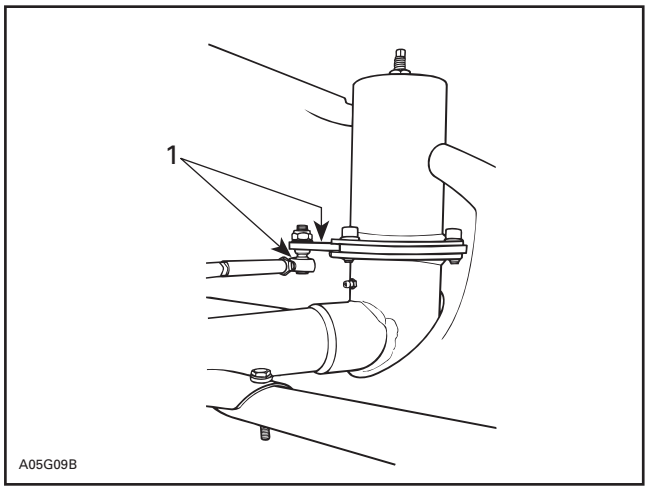
Make sure external threaded length not engaged is not too long and torque nuts as specified above.



LONG TIE ROD SHOWN
1. Restrain tie rod to tighten lock nuts

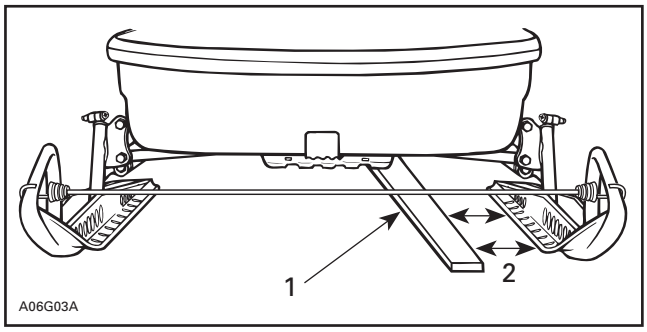
⚠ WARNING

Ball joint sockets must run parallel with steering arm and pivot arm. Tie rod must be restrained when tightening lock nuts.

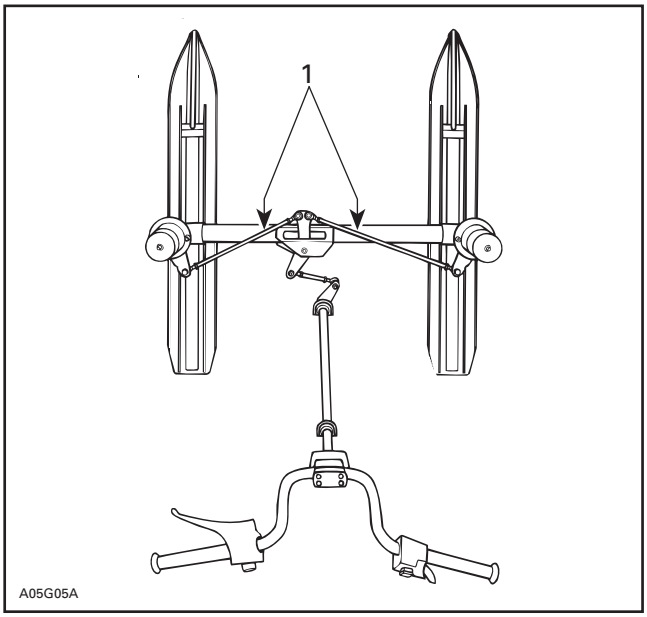


LONG TIE ROD SHOWN
1. Ball joint parallel with arm

NOTE: To make sure skis are in straight-ahead position, place a straight edge against pre-adjusted track and measure distance between front and rear of skis and straight edge. Measurements are taken 200 mm (8 in) at rear and front of ski pivot bolt. Distances should be equal. After ski toe-out adjustment, distance at front of ski must be 3.0 mm (1/8 in) more than at rear on both sides for a total toe-out of 6 mm (1/4 in).



TYPICAL
1. Straight edge
2. 3.0 mm (1/8 in) more at front than at rear



1. Turn to adjust

⚠ WARNING

Do not attempt to adjust skis straight-ahead position by turning ball joint on tie rod no. **14**.

Skandic SUV/Expedition TUV

Adjustments should be performed following this sequence:

– Handlebar/pivot arm positioning.
– Idler arm positioning.
– Set toe-out adjustment.

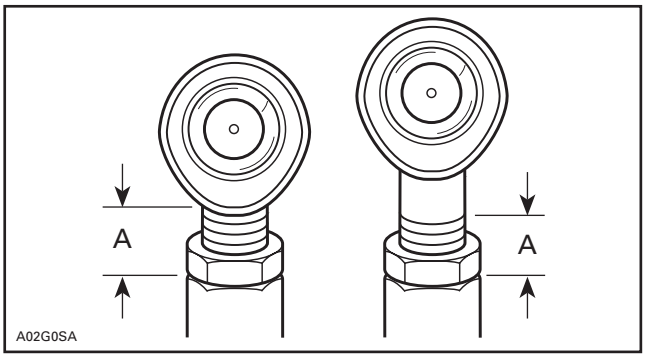
HANDLEBAR/PIVOT ARM POSITIONING

Turn handlebar until pivot arm is pointing straight forward.

Check if handlebar is horizontal. To adjust, loosen lock nuts of short tie rod and turn it accordingly.

⚠ WARNING

Maximum ball joint external threaded length not engaged in the tie rod end must not exceed 20 mm (25/32 in). Torque lock nut to 18 N•m (159 lbf•in).



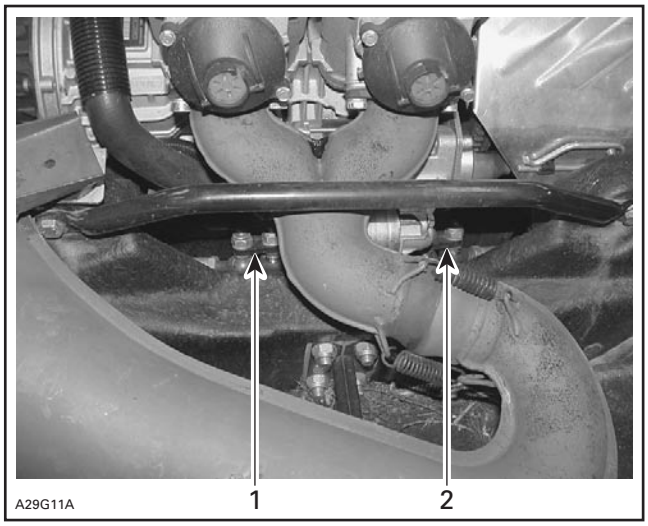
A. 20 mm (25/32 in) maximum

Restrain short tie rod while torquing nuts so that ball joint sockets run parallel with steering arm and pivot arm.

Ensure that pivot arm is still pointing straight forward and check ski toe-out.

IDLER ARM POSITIONING

With the pivot arm pointing straight forward, loosen lock nuts of idler arm tie rod and turn tie rod until idler arm is pointing straight forward too. With this adjustment properly done, turning radius will be the same on both sides.



TYPICAL
1. Pivot arm pointing straight forward
2. Idler arm pointing straight forward too

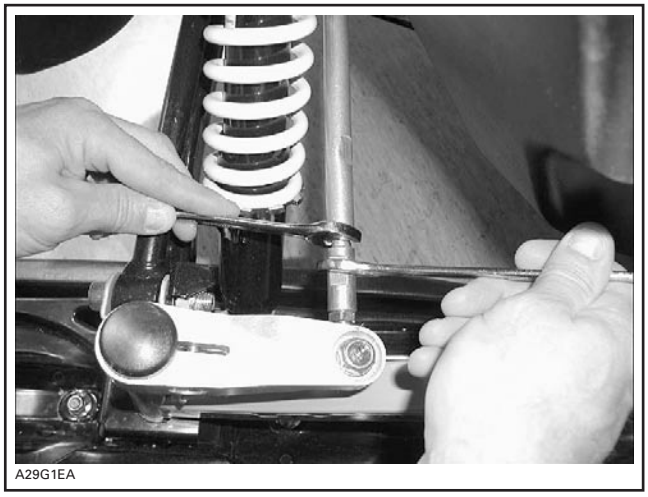
TOE-OUT ADJUSTMENT

With the handlebar in straight ahead position, turn left and right tie rods **no. 20** or tie rods adjuster to obtain specified toe-out.

Procedure:

– Loosen jam nuts **no. 13** and **no. 15** of both tie rods **no. 20**.

NOTE: On models with tie rod adjuster, only loosen adjuster jam nut.



MODELS WITH TIE ROD ADJUSTER

⚠ WARNING

Never lengthen tie rod making threaded portion of ball joint exceed 20 mm (25/32 in).

– Close front of skis manually to take all free-play from steering mechanism.

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Skis should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 2.5 mm (3/32 in) more than at rear on both sides for a total toe-out of 5 mm (3/16 in).

Skandic LT/LT E/WT/SWT/WT LC

Toe-out adjustment is performed by adjusting length of left and right tie rods **no. 20**. Handlebar centering is done at same time by turning tie rods accordingly.

Procedure:

– Loosen jam nuts **no. 13** and **no. 15** of both tie rods **no. 20**.
– Close front of skis manually to take all free-play from steering mechanism.

⚠ WARNING

Never lengthen tie rod making threaded portion of ball joint exceed 20 mm (25/32 in).

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Skis should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

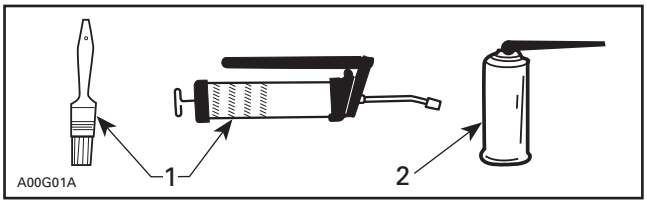
NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 2.5 mm (3/32 in) more than at rear on both sides for a total toe-out of 5 mm (3/16 in).

LUBRICATION

⚠ WARNING

Do not lubricate throttle and/or brake cable nor their housing.

The following symbols will be used to show what type of lubricant should be used at the suitable locations.



1. Synthetic grease (P/N 413 711 500)
2. Penetrating lubricant (P/N 293 600 016)

Tundra

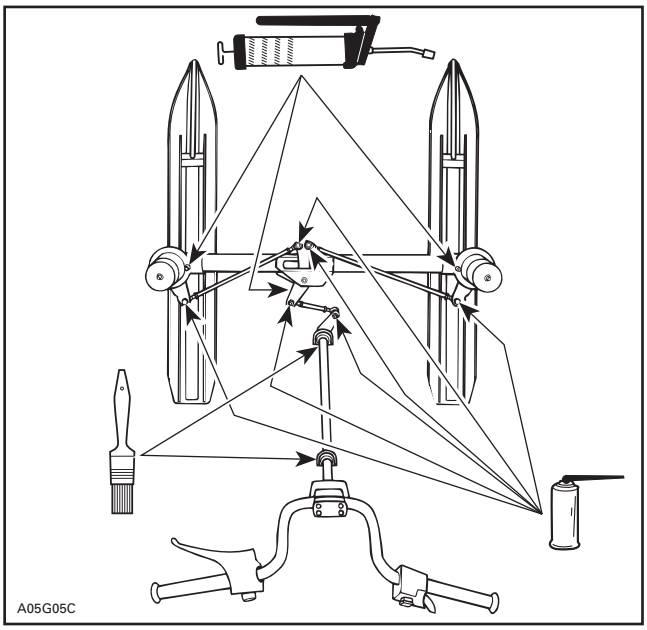
Lubricate front suspension posts and pivot arm at grease fittings. Pump five strokes of grease gun on each post. Use suspension synthetic grease (P/N 293 550 033).

NOTE: There are 3 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to ball joints.

NOTE: There are 6 lubrication points.

Apply suspension synthetic grease (P/N 293 550 033) to both steering column bushings.



TUNDRA

Skandic LT/LT E/WT/SWT/WT LC

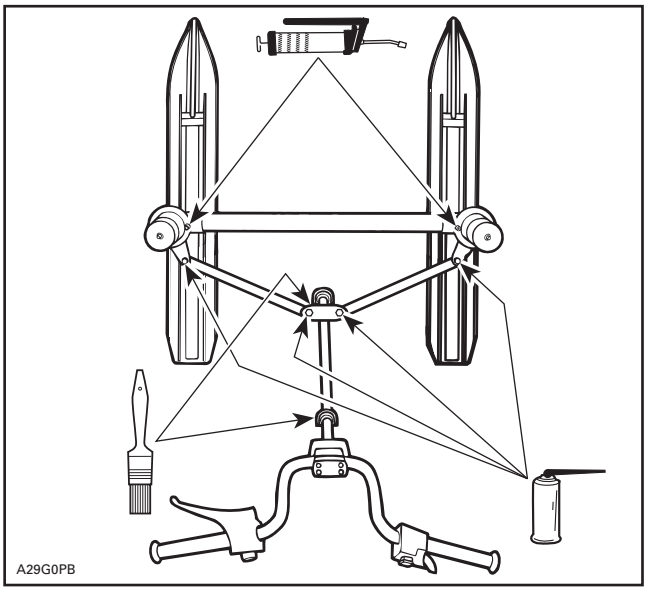
Lubricate front suspension posts. Pump five strokes of grease gun on each post. Use synthetic grease (P/N 413 711 500).

NOTE: There are 2 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to ball joints.

NOTE: There are 4 lubrication points.

Apply synthetic grease (P/N 413 711 500) to both steering column bushings.



SKANDIC LT/LT E/WT/SWT/WT LC

Skandic SUV

Lubricate ski legs. Pump five strokes of grease gun on each ski leg. Use synthetic grease (P/N 413 711 500).

NOTE: There are 2 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to all ball joints.

Apply synthetic grease (P/N 413 711 500) to both steering column bushings.

SUSPENSION AND SKI SYSTEM

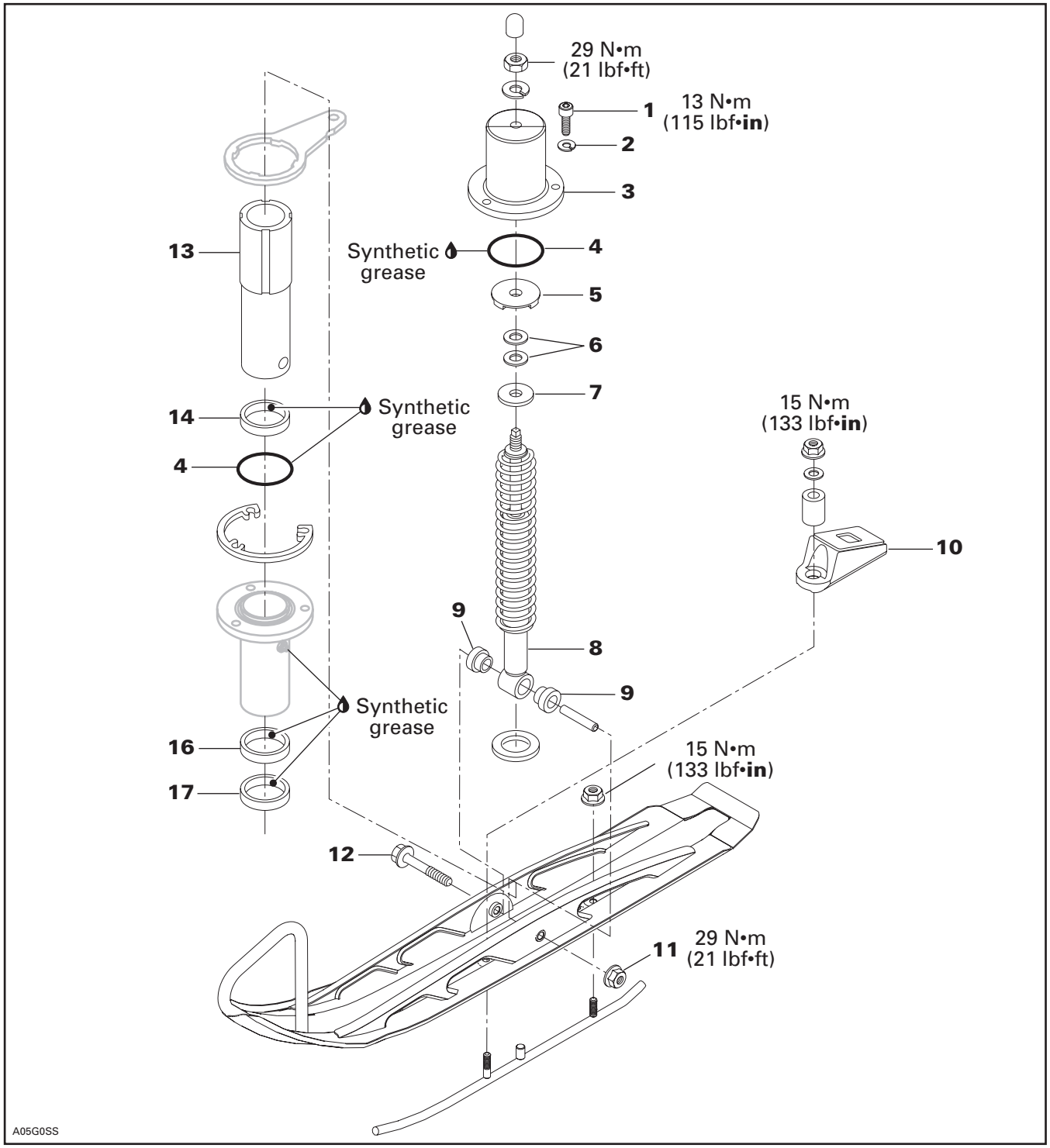
SERVICE TOOLS

Description	Part Number	Page
shock spring removal kit	529 035 504	539

SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	532, 537, 540

Tundra


29 N•m
(21 lbf•ft)
13 N•m
(115 lbf•in)
1
2
3
13
Synthetic grease
4
5
6
7
14
Synthetic grease
4
15 N•m
(133 lbf•in)
10
9
8
9
Synthetic grease
16
17
15 N•m
(133 lbf•in)
12
11
29 N•m
(21 lbf•ft)
A05G0SS

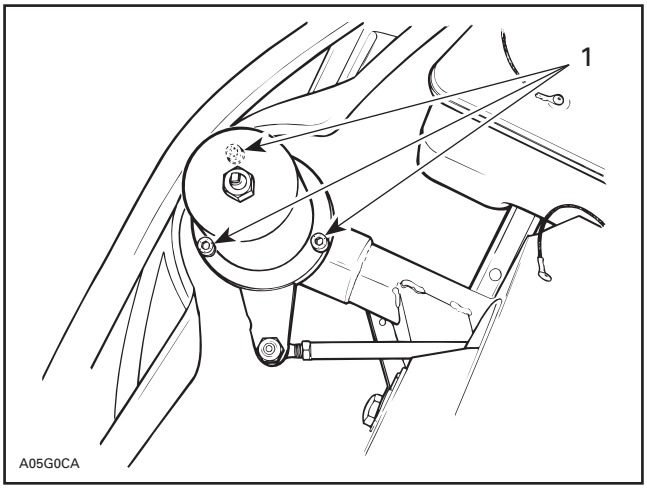
ON-VEHICLE COMPONENT REMOVAL

8, Shock

Lift front of vehicle and support off the ground.

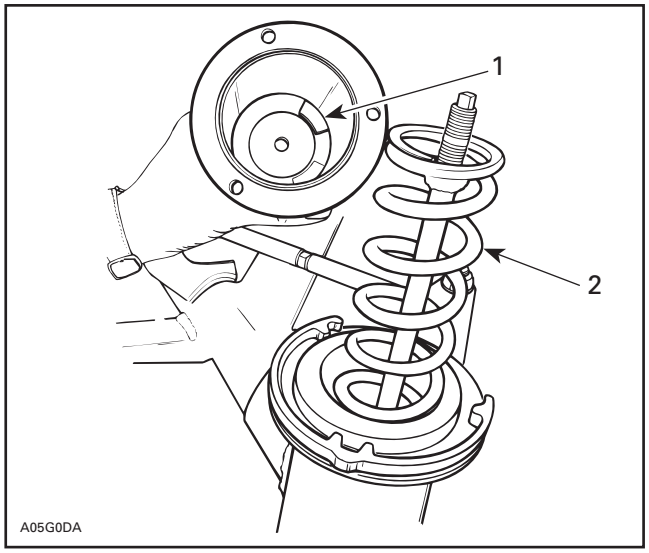
Remove ski.

Unscrew shock rod piston pin nut then remove washer. Unscrew 3 Allen screws retaining cover **no. 3**, then remove stopper **no. 5**, washers **no. 6**, washer **no. 7**.



1. Allen screws

NOTE: These washers and stopper can be wedged in cover.



1. Washers and stopper wedged in cover
2. Spring

Pull out spring then check shock as described below in INSPECTION.

DISASSEMBLY

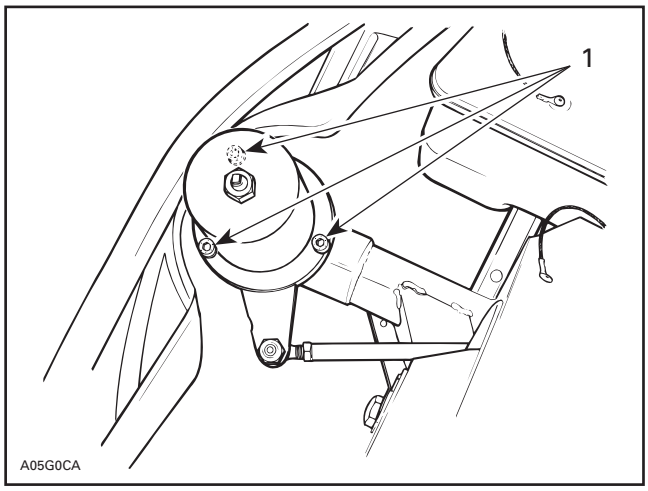
Lift front of vehicle and support off the ground.

1,2,3,5,6,7,9,11,12, Bolt, Lock Washer, Cover, Stopper, Bushing, Cushion and Nut

Remove ski bolt, nut, bushings and ski.

Unscrew shock rod nut then remove washer. Shock will fall off the ski leg.

Unscrew 3 Allen screws retaining cover, then remove stopper and washers.

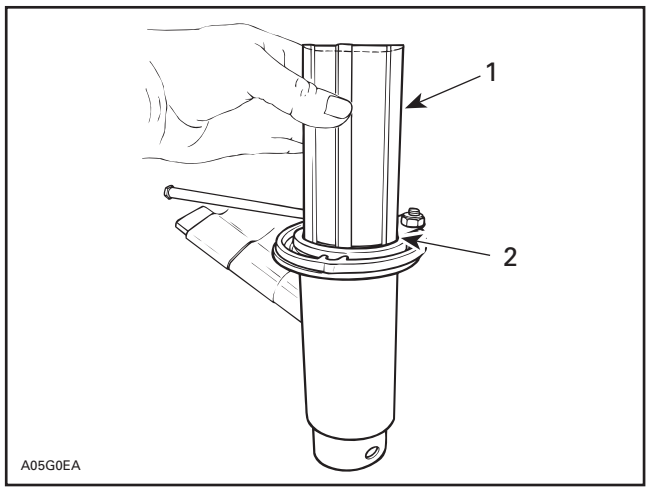


1. Allen screws

NOTE: These washers **no. 6** and **no. 7** and stopper **no. 5** can be wedged in cover.

4,13,14,16,17, O-Ring, Ski Leg, Upper Cushion, Lower Cushion and Seal

Pull up ski leg. Steering arm will not interfere.



1. Pull up ski leg
2. Steering arm in place

Remove seal and O-rings. Drive out upper and lower cushions if worn out.

INSPECTION

Suspension Free Operation

Remove cover and check for free movement of ski leg by lifting end of ski.

13, Ski Leg

Check straightness of ski leg. Check for scored or scratched surface. Replace as required. Check that splines on ski leg and steering arm interlock properly without excessive free play. Replace as necessary.

5, Stopper

Check condition of stopper. Replace it when deteriorated.

Grease Fitting

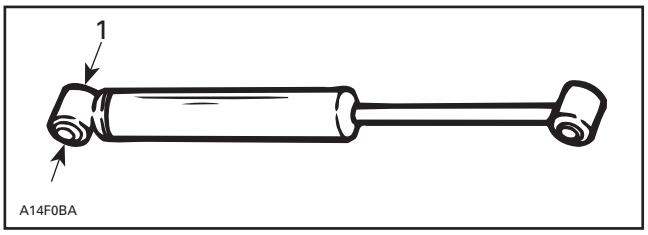
Ensure that grease fittings are not clogged.

10, Stopper

Check stopper for crack or deterioration. Replace as required.

8, Shock Absorber

Secure the shock body end in a vise with its rod upward.



1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke checking that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a defective shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme end of either stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

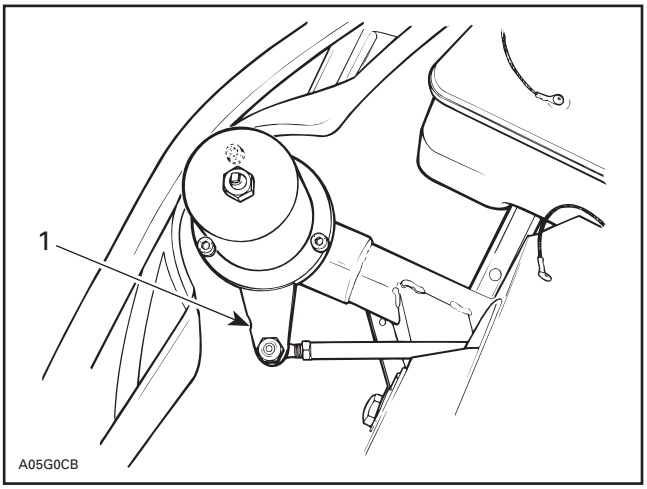
INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) as illustrated in exploded view above.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Steering arm notch must face outside of vehicle.

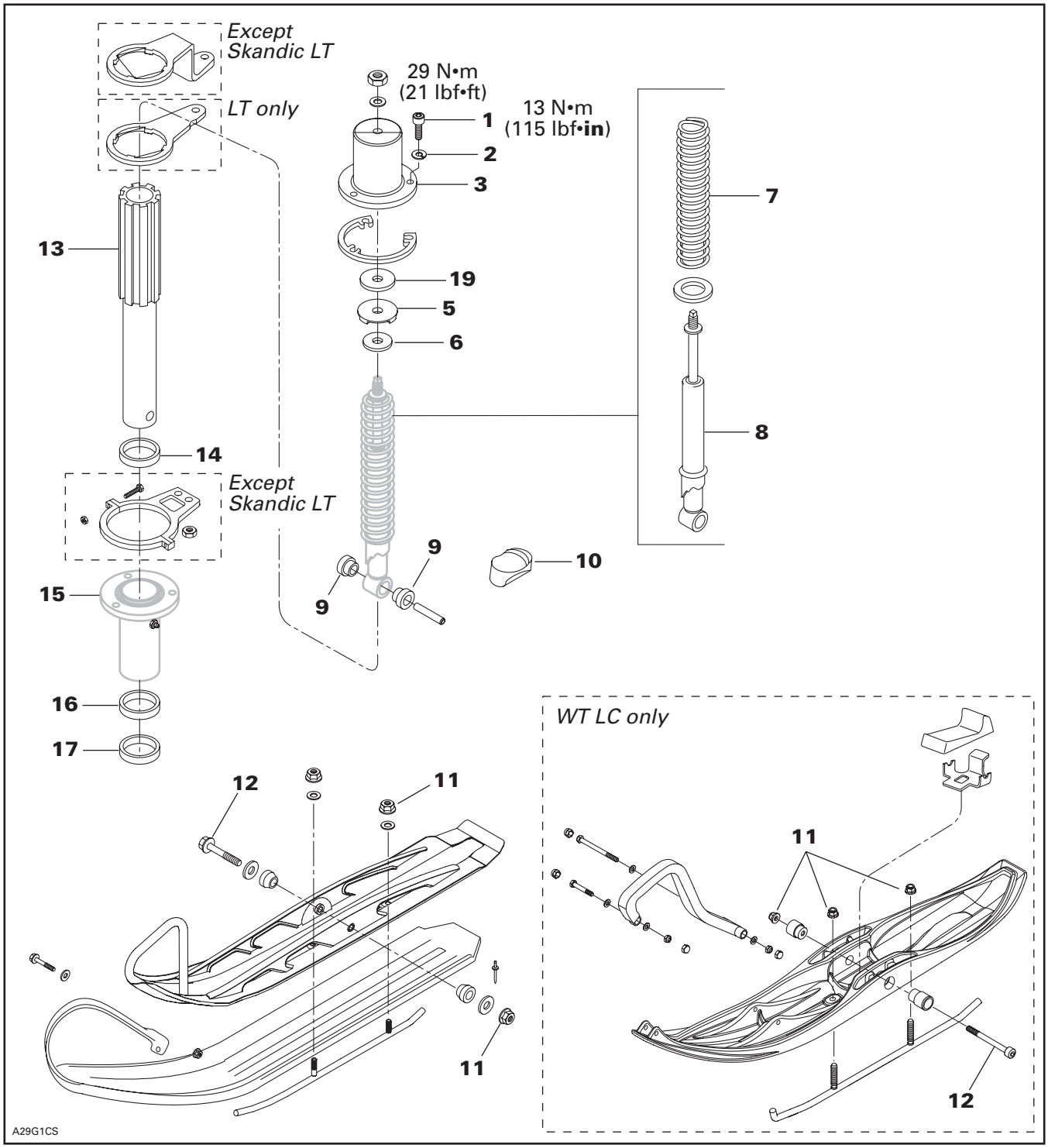


1. Recess facing outside

16,17, Seal

Install seal before reinstalling ski leg.

Skandic LT/LT E/WT/SWT/WT LC



TYPICAL

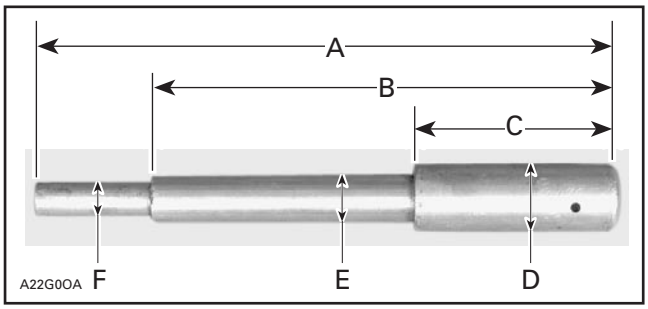
ON-VEHICLE COMPONENT VERIFICATION

8, Shock

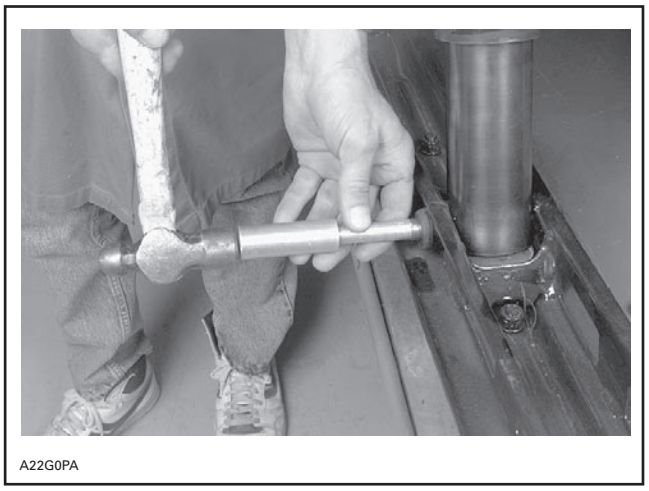
Lift front of vehicle and support off the ground.

Remove ski bolt and nut.

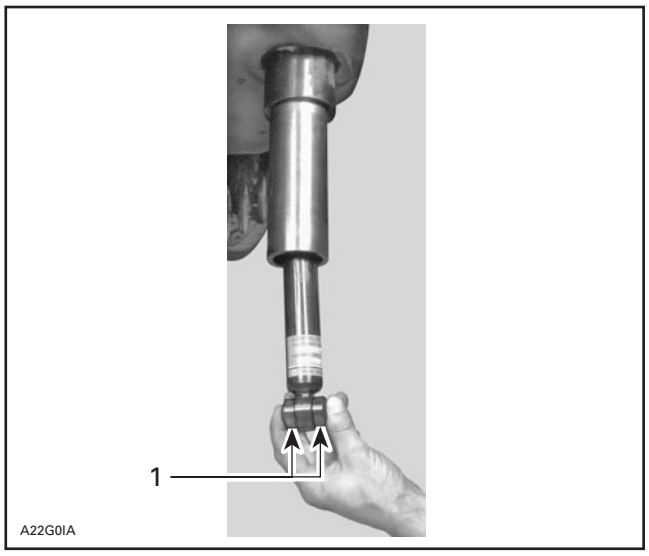
Remove steel bushing from ski using a pusher. See pusher dimensions below.



A. 220 mm (8.66 in)
B. 180 mm (7.09 in)
C. 70 mm (2.75 in)
D. 25 mm (1.0 in)
E. 15 mm (0.59 in)
F. 9 mm (0.35 in)



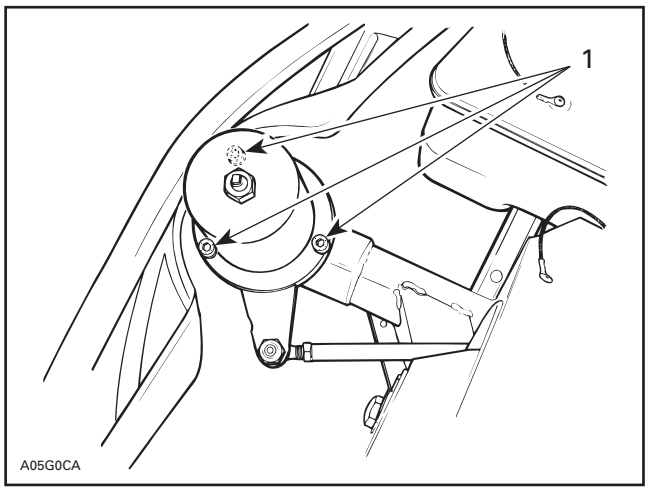
Unfasten rod nut then pull out shock from bottom. Check shock as described below in INSPECTION. At installation, make sure bushings are in place.



1. Bushings

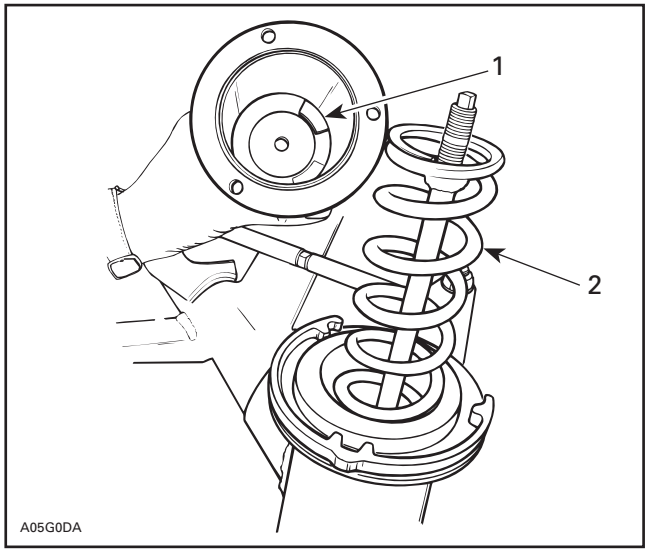
7, Spring

Unscrew shock rod nut then remove washer. Unscrew 3 Allen screws retaining cover **no. 3**, then remove stopper **no. 5**, washers **no. 6**, washer **no. 19**.



1. Allen screws

NOTE: These washers and stopper can be wedged in cover.



1. Washers and stopper wedged in cover
2. Spring

Pull out spring.

DISASSEMBLY

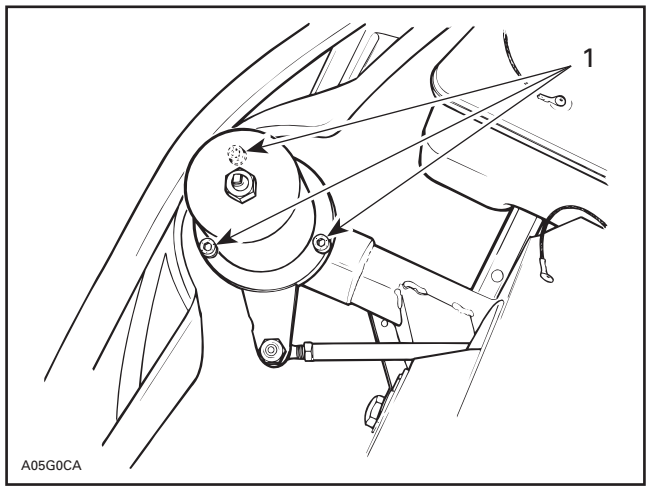
Lift front of vehicle and support off the ground.

1,2,3,5,6,9,11,12, Bolt, Lock Washer, Cover, Stopper, Bushing and Nut

Remove ski bolt, nut, bushings and ski.

Unscrew shock rod nut then remove washer. Shock will fall off the ski leg.

Unscrew 3 Allen screws retaining cover, then remove stopper and washers.

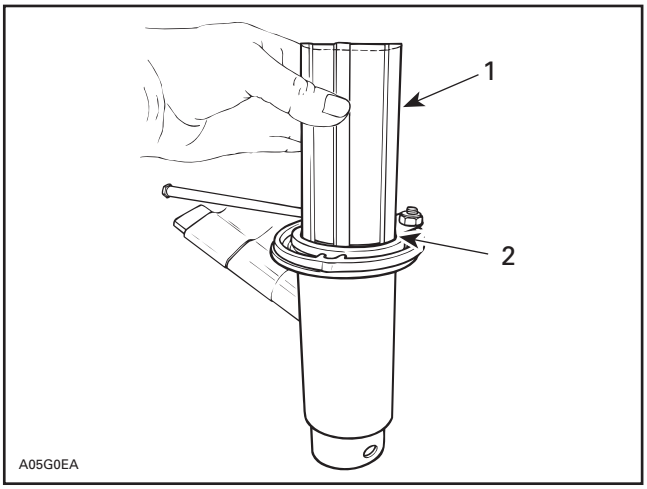


1. Allen screws

NOTE: These washers and stopper can be wedged in cap.

13,14,16,17, Ski Leg, Bushing and Seal

Pull up ski leg. Steering arm will not interfere.



1. Pull up ski leg
2. Steering arm in place

Remove seal. Drive out bushing if worn out.

INSPECTION

All Models

Suspension Free Operation

Remove cover and check for free movement of ski leg by lifting end of ski.

13, Ski Leg

Check straightness of ski leg. Check for scored or scratched surface. Replace as required.

Check that splines on ski leg and steering arm interlock properly with no excessive free play. Renew as necessary.

5, Stopper

Check condition of stopper. Replace it when deteriorated.

Grease Fitting

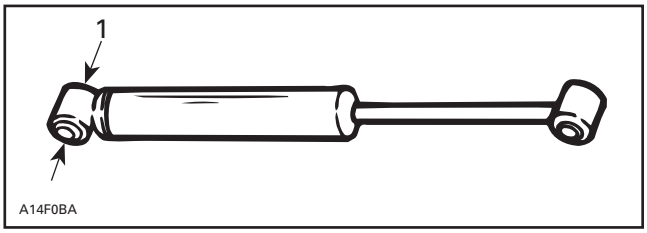
Ensure that grease fittings are not clogged.

10, Ski Stopper

Check stopper for crack or deterioration. Replace as required.

8, Shock Absorber

Secure the shock body end in a vise with its rod upward.



1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke checking that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a defective shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme end of either stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

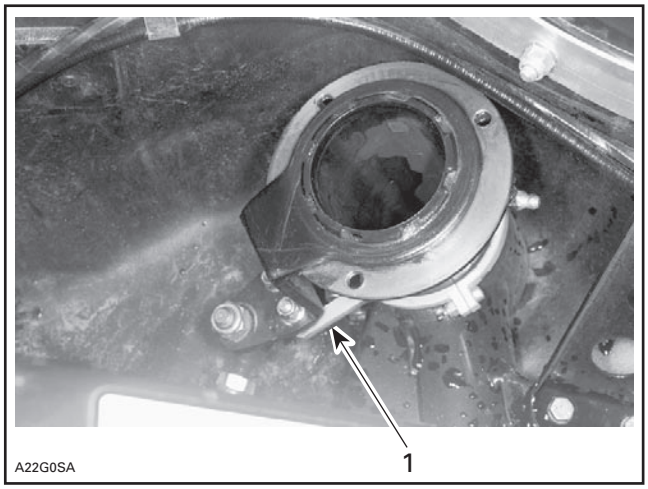
INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) as illustrated in exploded view above.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Reinstall steering arm reinforcement when removed.

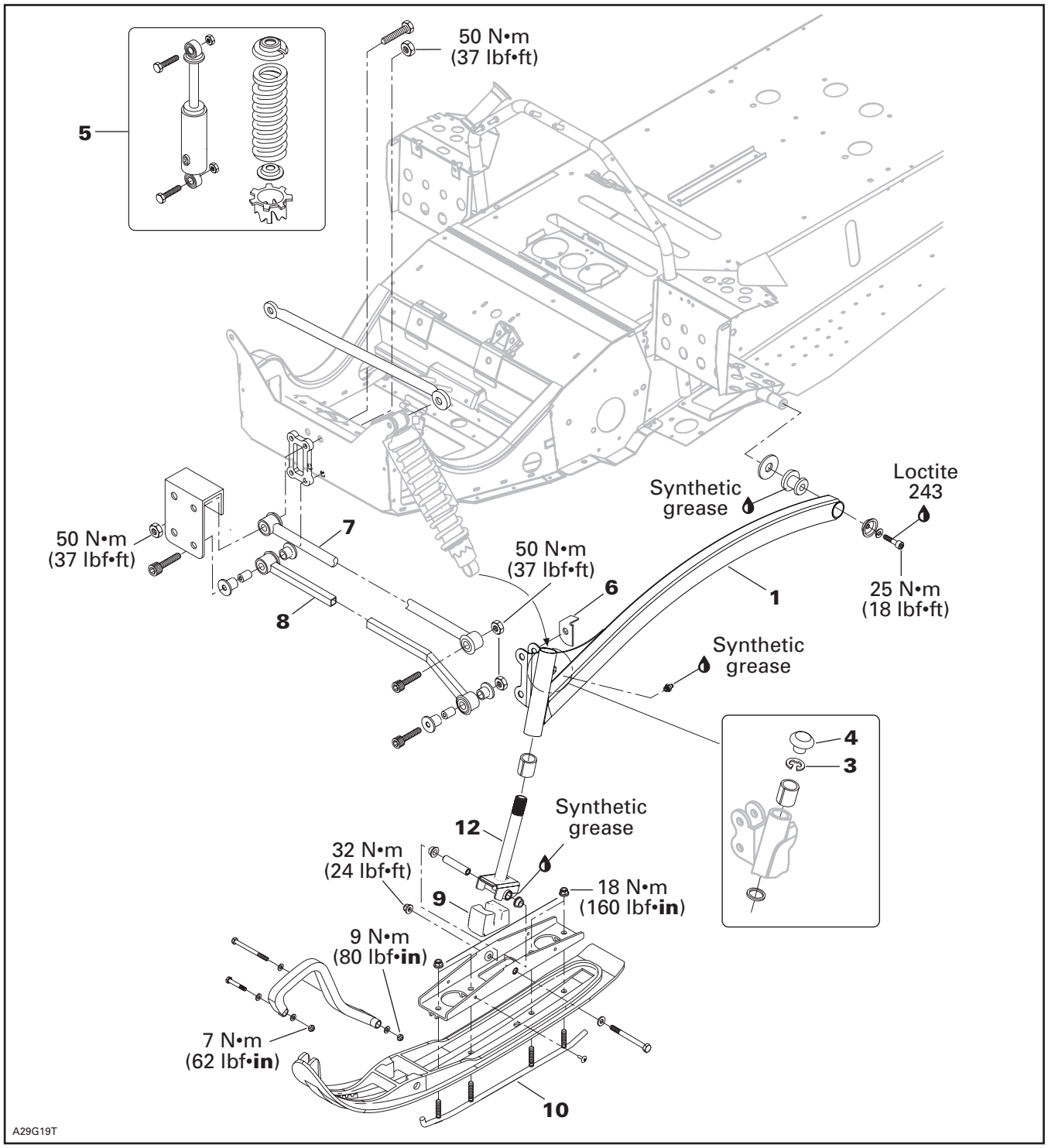


1. Reinforcement

16,17, Seal

Install seal before reinstalling ski leg.

Skandic SUV/Expedition TUV



TYPICAL

DISASSEMBLY

5, Shock

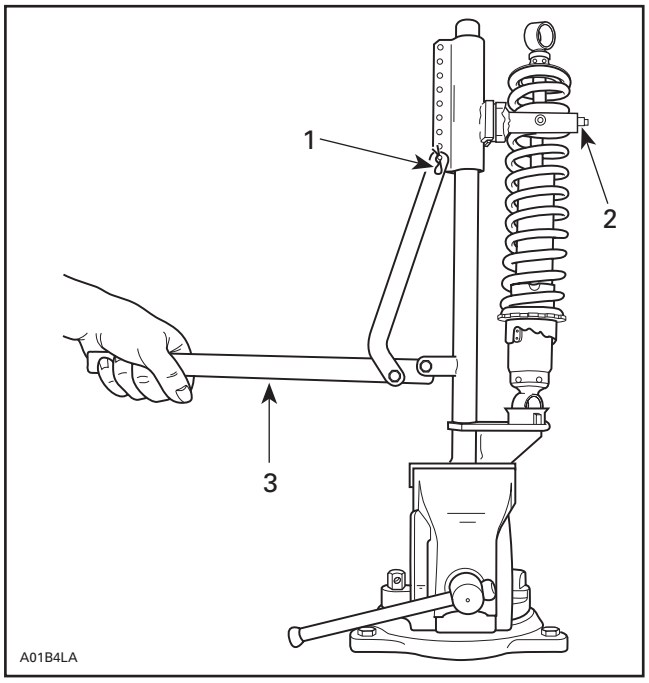
Lift front of vehicle and support it off the ground.

Reduce spring preload by turning adjusting ring accordingly.

Remove lower bolt then upper bolt of shock.

For shock spring disassembly use shock spring removal kit (P/N 529 035 504) in a vise. Mount shock in it and turn shock so that spring coils matched spring compressor.

Close and lock the bar. Adjust the handle at horizontal position by changing the position of the clevis pin.



1. Clevis pin
2. Bar
3. Handle horizontal

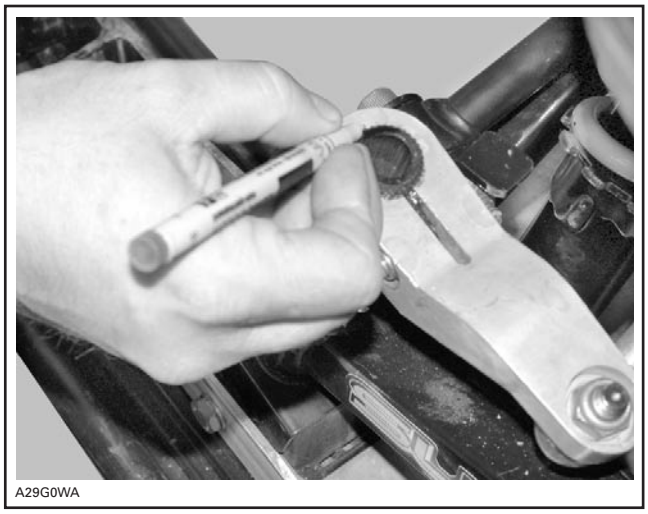
Push down on the handle until it locks. Remove spring stopper then release handle.

1, Swing Arm

Lift front of vehicle and support it off the ground.

Remove cap **no. 4**, circlip **no. 3**.

Scribe mark the steering arm and ski leg before disassembly.



Then loosen steering arm bolt and pull up steering arm. Ski leg may fall off from swing arm.

Unbolt lower end of shock from swing arm.

Unbolt upper and lower arms.

Unbolt rear of swing arm from frame.

Pull swing arm off the vehicle.

INSPECTION

Check all rubber cushions for crack and wear. Replace as required.

Check straightness of ski leg **no. 12** and make sure that splines are properly interlocking with steering arm. Replace as required.

Check for straightness of swing arm. Replace as required.

Check for clogged grease fittings. Clean or replace as required.

Check skis and runners **no. 10** for wear, replace as necessary.

Check condition of ski stopper **no. 9**. Replace it when deteriorated.

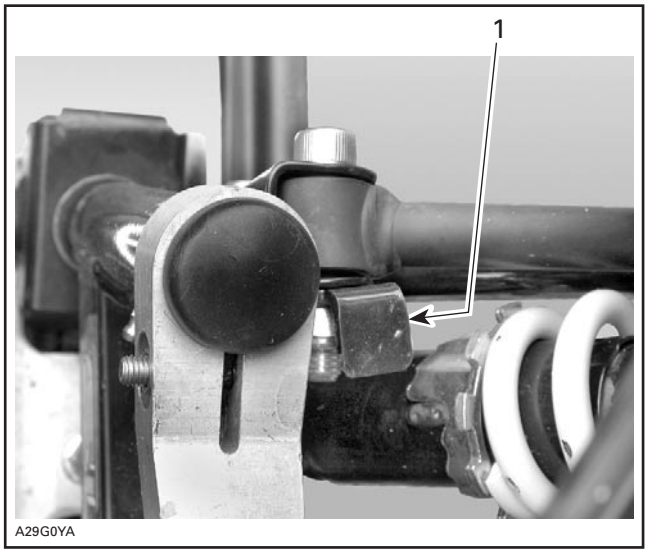
To check condition of shock, refer to SHOCK ABSORBER in INSPECTION CHAPTER.

INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) to ski leg components.

Install steering stopper **no. 6** as per following photo.



TYPICAL
1. Steering stopper

Longer bolts for shock and swing arm go on upper attachments.

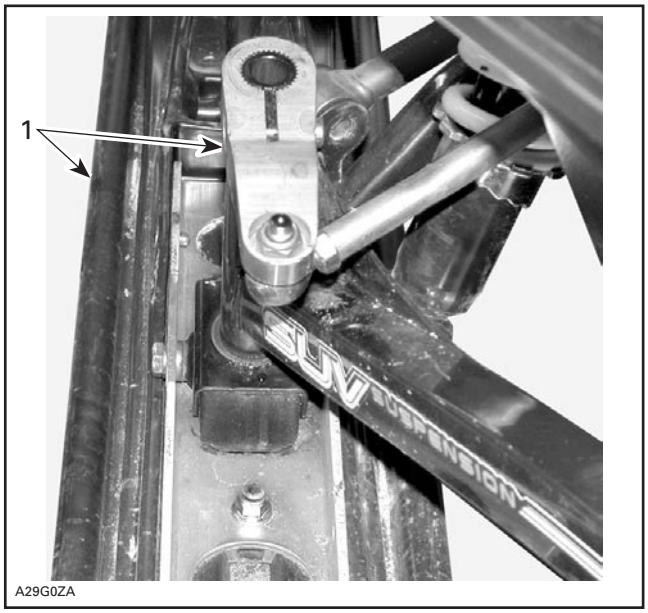
Tighten nuts and screws to proper torque as mentioned in exploded view.

7,8, Upper and Lower Arms

Position arms and tie rods horizontally before tightening nuts.

Bent portion of lower arm **no. 6** must face down.

Steering arm must be installed parallel to ski.



1. Parallel

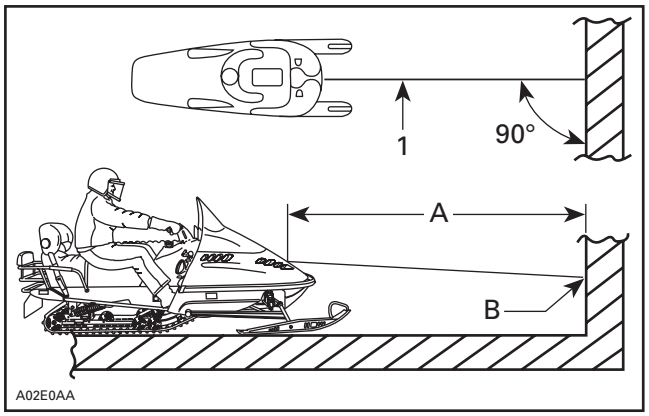
BODY

INSTALLATION AND ADJUSTMENT

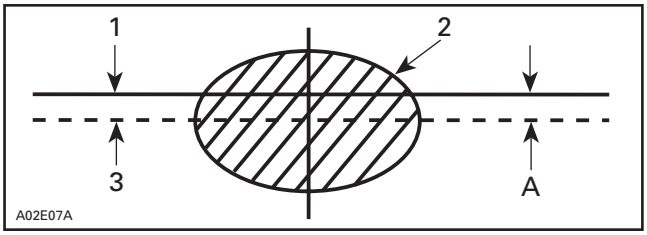
HEADLAMP BEAM AIMING

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.

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.



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)

Required Conditions

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.

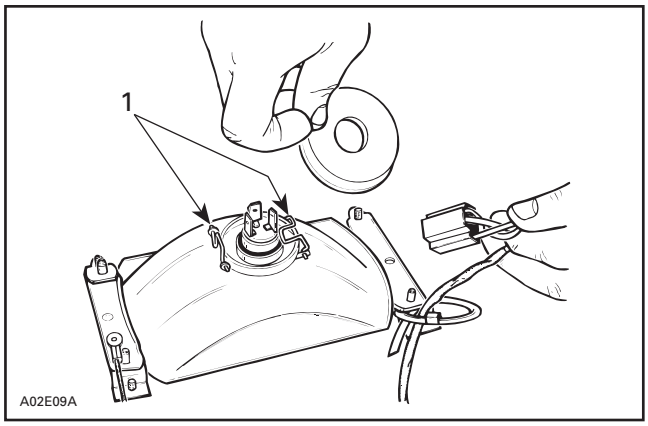
Select high beam.

BULB REPLACEMENT

Headlamp

Tundra

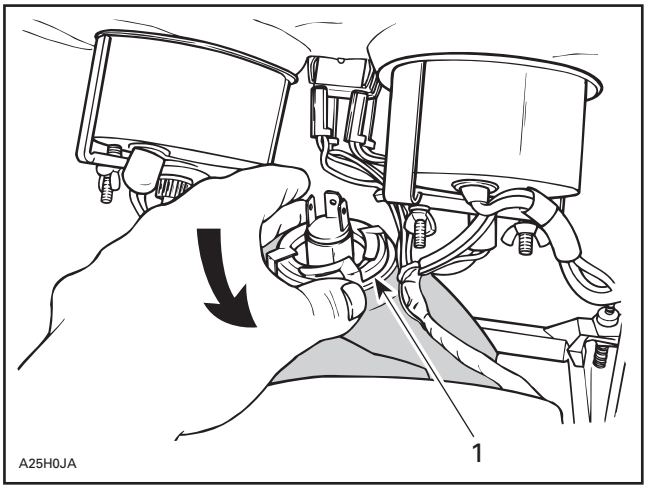
If headlamp is burnt, tilt hood. Unplug connector from headlamp. Remove protector cap and unfasten bulb retainer clips. Detach bulb and replace.



TYPICAL
1. Retainers clips

Skandic LT/LT E

If headlamp bulb is burnt, tilt cab and unplug the connector from the headlamp. Remove the rubber boot and unfasten the bulb retainer ring. Detach the bulb and replace it with a new one. Properly reinstall parts.

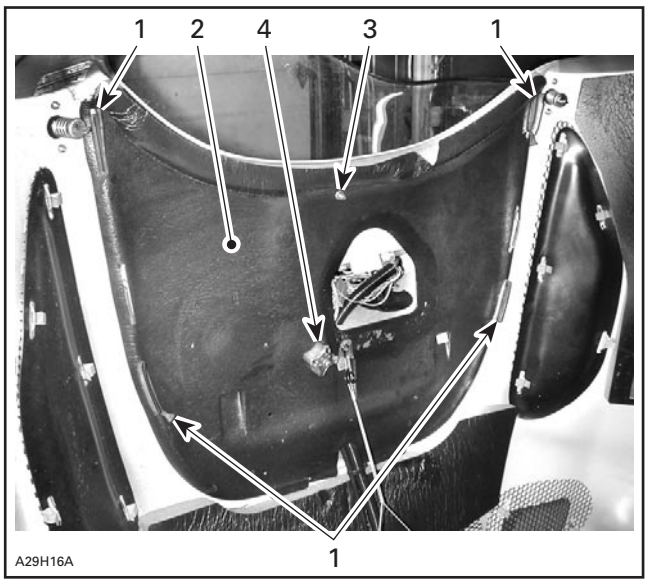


TYPICAL
1. Locking ring

Skandic LT/SWT/WT LC/SUV

If headlamp bulb is burnt, tilt hood.

Remove latches retaining plastic cover. Temporary reinstall the top two latches to retain windshield during bulb replacement.



SKANDIC LT/SWT/WT LC/SUV
1. *Latches*
2. *Plastic cover*
3. *Retaining nut and screw*
4. *Headlamp height adjustment knob*

Expedition TUV

To replace a burnt headlamp bulb, remove the following:

– windshield assembly
– air intake dashboard cover.

Replace bulb.

EXPEDITION TUV

All Models

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.

Taillight

If the taillight bulb is burnt, expose the bulb by removing red plastic lens. To remove, unscrew the 2 retaining screws. Verify all lights after replacement.

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals.

BELT GUARD

Disassembly and Assembly

NOTE: For additional information (ex.: exploded view) refer to the corresponding *Parts Catalog*.

⚠ WARNING

Engine should be running only with belt guard well-secured in place.

Inspection

All Models

Check belt guard mounting bosses, clips and retainers for wear.

WIRING HARNESS

⚠ WARNING

Ensure all terminals are properly crimped on the wires and that all connector housings are properly fastened. Keep wires away from any rotating, moving, heating and vibrating parts. Use proper fastening devices as required.

CABLES

⚠ WARNING

Before installation, ensure that all cables are in perfect condition. Properly install the cable ends and secure them in place. Pay attention to route them properly, away from any rotating, moving, heating, or vibrating parts.

TUBING

⚠ WARNING

Always ensure that the fuel, vent, primer, impulse, injection oil and rotary valve oil lines are properly fixed to their connectors, that they are not perforated or kinked and that they are properly routed away from any rotating, moving, heating or vibrating parts. Also check for leaks. Replace if required.

NOTE: Refer to proper *Parts Catalog* to find suitable clip part numbers.

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. Refer to following chart.

CAUTION: Consult chart and repair kit instructions carefully, some repair products are not compatible with certain plastics.

⚠ WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

		IRRE-PAIRABLE	RE-PAIRABLE
PART	MODEL	High density polyethylene	R.I.M. urethane
HOOD	Tundra		
	Skandic LT/ WT/SWT/ WT LC/ SUV/ Expedition TUV		
BOTTOM PAN	Tundra		
	Skandic LT/ WT/SWT/ WT LC/ SUV/ Expedition TUV		

REPAIR PROCEDURE FOR R.I.M. URETHANE

R.I.M. urethane is light colored (tan) on the inside with a smooth surface.

⚠ WARNING

Material should be repaired and repainted in a well-ventilated area only.

CAUTION: **Clean R.I.M. with isopropyl alcohol or Crest Hi-Solv product. Never use cleaners or products that contain chlorine.**

CAUTION: **R.I.M. should never be exposed to temperatures exceeding 93°C (200°F).**

NOTE: When working on a R.I.M. surface, never use a grinder or a high revolution tool such as an air or electric buffer. Use of such tools could overheat material and liberate agents in it thus causing a bad adhesion.

Small Scratches

– Sand and scuff area.
– Feather out edges.
– Paint with a matching acrylic auto touch-up paint.

Deep Scratches

– Sand and scuff area.
– Make a V groove using a knife or a rough round file.
– Clean surface with isopropyl alcohol or Crest Hi-Solv stock no. AH-S product.
– Cover with TP-E epoxy mixed in equal quantities.
– Heat the surface with a heater lamp placed at 38 cm (15 in) for a period of 15 minutes.
– Sand the surface using a smooth dry sand paper.
– Use the same product if a final finish is required.
– Clean surface with Crest Hi-Solv product.
– Apply a flexible primer such as Crest Prima Flex stock no. AP-F.
– Wait 10 minutes.
– Repaint (air dry during 72 hours (approximately)).

Large Crack

– Sand and scuff outside and inside area by exceeding it 31.7 mm (1-1/4 in) on each side and 12.7 mm (1/2 in) at each end.
– Make a V groove (appr. 90°) on both sides of hood using a knife or a rough round file.
– Enlarge the crack to 2.4 mm (3/32 in) – 3.2 mm (1/8 in) using a sharp knife.
– Clean outside and inside surface with isopropyl alcohol or Crest Hi-Solv product.
– Repair inside surface first.
– Cover inside area with Crest TP-E epoxy.
– Apply a 50 mm x 30 mm (2 in x 1-1/4 in) patch. If no room for the patch, use tape.
– Cover exterior surface with same product. Damaged area should be slightly higher.
– Heat surface with a heater lamp placed at 38 mm (15 in) for a period of 15 minutes.
– Sand outside surface using a smooth dry sand paper.
– Use same product if a final finish is required.
– Apply a flexible primer.
– Wait 10 minutes.
– Repaint (air dry during 72 hours approximately).

NOTE: R.I.M. materials are high static plastics, painting must be done in a dust free area such as a paint booth.

Crest products used in R.I.M. repair procedure are available from following locations:

CREST MAIN OFFICE AND MANUFACTURING PLANT	
CREST INDUSTRIES INC. 1337 King Road Trenton, Michigan, U.S.A. 48183	Phone: 734-479-4141 Toll free: 1 800 822-4100 Fax: 734-479-4040 E-Mail: info@crestauto.com www.crestauto.com

FRAME

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 would peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

Seat Cleaning

For all models, it is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

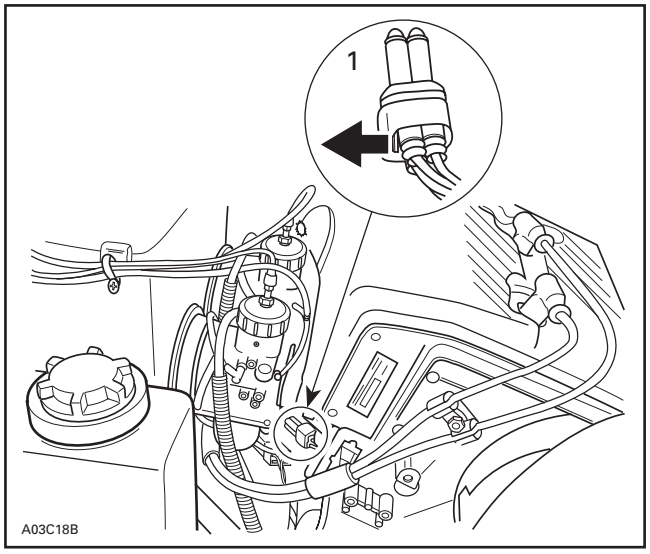
CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

FRAME WELDING

Steel Frame:

– electric welding
– amperage: 70-110 A
– voltage: 20-24 V
– electrode: E-7014 (3/32 in).

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug the multiple connector at the electronic box. On models equipped with a battery, also unplug the negative cable. This will protect the electronic box and battery against damage caused by flowing current when welding.



TYPICAL — FAN COOLED MODELS
1. Unplug before electrical welding

TYPICAL — LIQUID COOLED MODELS MPEM UNPLUGGED

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.

ENGINES

TUNDRA			
ENGINE TYPE			**277**
ENGINE			
Number of cylinder			1
Bore	Standard	mm (in)	72.00 (2.835)
Stroke		mm (in)	66.00 (2.598)
Displacement		cm^3 (in^3)	268.7 (16.40)
Compression ratio (corrected)			11.2
Maximum power engine speed (1)		± 100 RPM	6900
Piston ring type	1st		ST
	2nd		R
Ring end gap	New	mm (in)	ST ring 0.25 (.010) R ring 0.20 (.008)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.025 (.001)
	Wear limit	mm (in)	0.2 (.008)
Piston/cylinder wall clearance	New	mm (in)	0.080 (.0031)
	Wear limit	mm (in)	0.2 (.008)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.00241)
Connecting rod big end axial play	New	mm (in)	0.20 (.0079)
	Wear limit	mm (in)	1.2 (.0472)
ELECTRICAL			
Magneto generator output		W	240
Ignition type			CDI
Spark plug	Make and type		NGK BR9ES
	Gap	mm (in)	0.45 (.018)
Ignition timing BTDC (3)		mm (in)	3.61 (.142)
Trigger coil (4)		Ω	160 - 180
Generating coil (4)	Low speed	Ω	N.A.
	High speed	Ω	5.1 - 6.2
Lighting coil (4)		Ω	.17 - .21
High tension coil (4)	Primary	Ω	N.A.
	Secondary	kΩ	.9 - 1.1

TUNDRA			
ENGINE TYPE			**277**
FUEL SYSTEM			
Carburetor type	PTO/MAG		1 x VM 34-585
Main jet	PTO/MAG		200
Needle jet			159 O-8
Pilot jet			40
Needle identification — clip position	PTO/MAG		6DH4-3
Slide cut-away			2.5
Float adjustment		mm (in)	23.9 (.94) ± 1 (.040)
Air or pilot screw adjustment	± 1/16 turn		1
Idle speed	± 200 RPM		1650
Gas	Type		Regular unleaded gasoline
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection
COOLING SYSTEM			
Type			Radial Fan
Axial fan belt adjustment	Deflection	mm (in)	N.A.
	Force	kg (lbf)	N.A.
Coolant			N.A.
Thermostat opening temperature		°C (°F)	N.A.
Radiator cap opening pressure		kPa (PSI)	N.A.
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		N•m (lbf•ft)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•ft)	25 (18)
Magneto ring nut		N•m (lbf•ft)	95 (70)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	N.A.
	M8	N•m (lbf•ft)	22 (16)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	21 (15)
Cylinder head screws or nuts		N•m (lbf•ft)	27 (20)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	N.A.
Axial fan shaft nut		N•m (lbf•ft)	N.A.

SKANDIC				LT	WT/SWT/SUV	SUV/WT LC
ENGINE TYPE				443	552	593
ENGINE						
Number of cylinder				2	2	2
Bore	Standard		mm (in)	67.5 (2.6575)	76.00 (2.992)	76.00 (2.992)
Stroke			mm (in)	61.0 (2.402)	61.0 (2.402)	65.8 (2.591)
Displacement			cm^3 (in^3)	436.6 (26.64)	553.4 (33.78)	597.0 (36.43)
Compression ratio (corrected)				9.6	9.6	12.0
Maximum power engine speed (1)			± 100 RPM	6900	6900	7000
Piston ring type	1st			ST	ST	ST
	2nd			R	R	N.A.
Ring end gap	New		mm (in)	0.2 (.008)	0.4 (.0157)	0.4 (.0157)
	Wear limit		mm (in)	1.0 (.039)	1.0 (.0394)	1.0 (.0394)
Ring/piston groove clearance	New		mm (in)	0.04 (.0016)	0.037 (.0015)	0.04 (.0016)
	Wear limit		mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
Piston/cylinder wall clearance	New		mm (in)	0.070 (.0031)	0.147 (.0058)	0.12 (.0047)
	Wear limit		mm (in)	0.2 (.008)	0.2 (.0079)	0.2 (.0079)
Maximum crankshaft end play (2)	New		mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit		mm (in)	0.06 (.0024)	0.06 (.0024)	0.06 (.0024)
Connecting rod big end axial play	New		mm (in)	0.20 (.0079)	0.2 (.0079)	0.39 (.0154)
	Wear limit		mm (in)	1.2 (.0472)	1.2 (.0472)	1.2 (.0472)
ELECTRICAL						
Magneto generator output			W	240	340	290
Ignition type				CDI	CDI	CDI
Spark plug	Make and type			NGK BR9ES	NGK BR9ES	NGK BR9ECS (7)
	Gap		mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)
Ignition timing BTDC (3)			mm (in)	2.79 (.110)	2.77 (.109)	3.00 (.118)
Trigger coil (4)			Ω	160 - 180	160 - 180	190 - 300
Generating coil (4)	Low speed		Ω	N.A.	N.A.	17.5 - 42.5
	High speed		Ω	5.1 - 6.2	6.3 - 7.7	2.4 - 5.8
Lighting coil (4)			Ω	.17 - .21	.145 - .175	.10 - .40
High tension coil (4)	Primary		Ω	N.A.	N.A.	.3 - .7
	Secondary		kΩ	.9 - 1.1	.9 - 1.1	8 - 16

SKANDIC			LT	WT/SWT/SUV	SUV/WT LC
ENGINE TYPE			443	552	593
FUEL SYSTEM					
Carburetor type	PTO/MAG		1 x VM 32-306	2 x VM 34-614	2 x VM 38-449
Main jet	PTO/MAG		180	190	330
Needle jet			159 O-0	159 P-0	480 P-9
Pilot jet			50	40	40
Needle identification — clip position	PTO/MAG		6DGY12-3	6DH4-2	6DGL24-3
Slide cut-away			3	2.5	2.5
Float adjustment		mm (in)	23.9 (.941) ± 1 (.040)	23.9 (.941) ± 1 (.040)	18.1 (.710) ± 1 (.040)
Air or pilot screw adjustment	± 1/16 turn		1	1-1/2	2
Idle speed	± 200 RPM		1800	1650	1900
Gas	Type		Regular unleaded	Regular unleaded	Regular unleaded
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON	North America: 87 (R+M)/2 Elsewhere: 91 RON	North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection	Injection	Injection
COOLING SYSTEM					
Type			Axial Fan	Axial fan	Liquid
Axial fan belt adjustment	Deflection	mm (in)	9 - 10 (.35 - .39)	9 - 10 (.35 - .39)	N.A.
	Force	kg (lbf)	5 (11)	5 (11)	N.A.
Coolant			N.A.	N.A.	(8)
Thermostat opening temperature		°C (°F)	N.A.	N.A.	42 (108)
Radiator cap opening pressure		kPa (PSI)	N.A.	N.A.	100 (14.5)
TIGHTENING TORQUE (engine cold)					
Drive pulley retaining screw		N•m (lbf•ft)	(5)	(5)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•ft)	22 (16)	22 (16)	23 (17)
Magneto ring nut		N•m (lbf•ft)	105 (77)	105 (77)	125 (92)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	9 (6.5)	N.A.	9 (6.5)
	M8	N•m (lbf•ft)	22 (16)	27 (20)	29 (21)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	39 (29)	40 (30)	35 (26)
Cylinder head screws or nuts		N•m (lbf•ft)	22 (16)	22 (16)	29 (21)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	N.A.	N.A.	29 (21)
Axial fan shaft nut		N•m (lbf•ft)	48 (35)	48 (35)	N.A.

SKANDIC EXPEDITION TUV			600 HO SDI
ENGINE TYPE			593
ENGINE			
Number of cylinder			2
Bore	Standard	mm (in)	72 (2.835)
Stroke		mm (in)	73.00 (2.874)
Displacement		cm^3 (in^3)	594.40 (36.273)
Compression ratio (corrected)			12.25
Maximum power engine speed (1)		± 100 RPM	8000
Piston ring type	1st		ST
	2nd		N.A.
Ring end gap	New	mm (in)	0.40 - 0.55 (.016 - .022)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.05 - 0.10 (.0020 - .0039)
	Wear limit	mm (in)	0.2 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.105 ± 0.013 (.0041 ± .0009)
	Wear limit	mm (in)	0.18 (.0071)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.0024)
Connecting rod big end axial play	New	mm (in)	0.310 - 0.677 (.0122 - .0267)
	Wear limit	mm (in)	1.2 (.0472)
ELECTRICAL			
Magneto generator output		W	480
Ignition type			Inductive
Spark plug	Make and type		NGK BR9ECS
	Gap	mm (in)	0.75 - 0.85 (.030 -.033) (7)
Ignition timing BTDC (3)		mm (in)	5.390 (.2122)
Trigger coil (4)		Ω	190 -300
Generating coil (4)	Low speed	Ω	N.A.
	High speed	Ω	N.A.
Lighting coil (4)		Ω	.175 - .180
High tension coil (4)	Primary	Ω	N.A.
	Secondary	kΩ	N.A.

SKANDIC EXPEDITION TUV			600 HO SDI
ENGINE TYPE			**593**
FUEL SYSTEM			
Fuel injection type			SDI with Dell'Orto 46 mm throttle body (no IACV)
Fuel pressure		kPa (PSI)	400 (58)
Idle speed		RPM	1600 ± 200
Throttle Position Sensor (TPS) (4)		kΩ	1.6 - 2.4
Crankshaft Position Sensor (CPS) (4)		Ω	190 - 300
Air Pressure Sensor (APS) (4)		V	5
Air Temperature Sensor (ATS) (4)		kΩ	2.28 - 2.74
Coolant Temperature Sensor (CTS) (4)		kΩ	2.6 - 3.2
Fuel injector		Ω	13.8 - 15.2
Gas	Type		Regular unleaded
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection
COOLING SYSTEM			
Type			Liquid
Axial fan belt adjustment	Deflection	mm (in)	N.A.
	Force	kg (lbf)	N.A.
Coolant			N.A.
Thermostat opening temperature		°C(°F)	42 (108)
Radiator cap opening pressure		kPa (PSI)	90 (13)
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		N•m (lbf•ft)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•**in**)	11 (97)
Magneto ring nut		N•m (lbf•ft)	125 (92)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	9 (80)
	M8	N•m (lbf•ft)	29 (21)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	35 (26)
Cylinder head screws or nuts		N•m (lbf•ft)	29 (21)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	40 (29)
Axial fan shaft nut		N•m (lbf•ft)	N.A.

SKANDIC EXPEDITION TUV				V-1000
ENGINE TYPE				**1004**
ENGINE				
Engine type				BOMBARDIER-ROTAX 1004 4-TEC, 4-stroke, Over Head Camshaft (OHC), liquid cooled
Cylinder arrangement and quantity				V2
Valves per cylinder				4 valves with hydraulic lifters (no adjustment)
Bore		Standard	mm (in)	100 (3.937)
Stroke			mm (in)	63.4 (2.496)
Displacement			cm^3 (in^3)	995.90 (60.774)
Compression ratio				10.3
Decompressor type				Automatic
Maximum power engine speed (1)			RPM	7250 RPM
Lubrication				Dry sump with replaceable oil filter
Intake valve opening			BTDC	10°
Intake valve closing			ATDC	45°
Exhaust valve opening			BTDC	50°
Exhaust valve closing			ATDC	5°
Starting system				Electric start
Valve stem diameter	Intake	New	mm (in)	5.961 - 5.975 (.2347 - .2352)
		Wear limit	mm (in)	5.930 (.2330)
	Exhaust	New	mm (in)	5.946 - 5.960 (.2341 - .2346)
		Wear limit	mm (in)	5.930 (.2330)
Valve guide diameter		Wear limit	mm (in)	6.060 (.2386)
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)
		Wear limit	mm (in)	38.8 (1.499)
	Outer	New	mm (in)	45.45 (1.789)
		Wear limit	mm (in)	43 (1.693)
Valve seat contact width	Intake	New	mm (in)	1.1 - 1.3 (.043 - .051)
		Wear limit	mm (in)	1.6 (.063)
	Exhaust	New	mm (in)	1.25 - 1.55 (.049 - 061)
		Wear limit	mm (in)	1.8 (.071)
Rocker arm bore diameter		New	mm (in)	20.007 - 20.020 (.7876 - .7881)
		Wear limit	mm (in)	20.035 (.7887)
Rocker arm shaft diameter		New	mm (in)	19.980 - 19.993 (.7866 - 7871)
		Wear limit	mm (in)	19.965 (.7860)
Cylinder head screw length		Service limit	mm (in)	216.5 (8.524)

SKANDIC EXPEDITION TUV					V-1000
ENGINE TYPE					1004
ENGINE (cont'd)					
Piston ring type		1st			Rectangular
		2nd			Taper-face
		3rd			Oil scraper ring
Ring end gap	1st	New		mm (in)	0.30 - 0.50 (.012 - .020)
	2nd			mm (in)	0.35 - 0.55 (.014 - .022)
	3rd			mm (in)	0.15 - 0.3 (.006 - .012)
	All	Wear limit		mm (in)	1.5 (.059)
Ring/piston groove clearance	1st	New		mm (in)	0.025 - 0.07 (.001 - .0028)
	2nd			mm (in)	0.015 - 0.06 (.0006 - .0024)
	3rd			mm (in)	0.02 - 0.055 (.0008 - .0021)
	All	Wear limit		mm (in)	0.15 (.006)
Piston/cylinder wall clearance		New		mm (in)	0.024 - 0.056 (.001 - .0022)
		Wear limit		mm (in)	0.09 (.0035)
Cylinder taper (maximum)		New (maximum)		mm (in)	0.038 (.0015)
		Wear limit		mm (in)	0.09 (.0035)
Cylinder out of round		New (maximum)		mm (in)	0.01 (.0004)
		Wear limit		mm (in)	0.02 (.0008)
Camshaft bearing journal	PTO side	New		mm (in)	24.967 - 24.980 (.9830 - .9835)
		Wear limit		mm (in)	24.960 (.9827)
	Alternator side	New		mm (in)	39.927 - 39.935 (1.5719 - 1.5722)
		Wear limit		mm (in)	39.920 (1.5716)
Camshaft bore	PTO side	New		mm (in)	25.000 - 25.013 (.9842 - .9848)
		Wear limit		mm (in)	25.020 (.9850)
	Alternator side	New		mm (in)	40.000 - 40.016 (1.5748 - 1.5754)
		Wear limit		mm (in)	40.020 (1.5756)
Cam lobe	Intake	New		mm (in)	31.654 - 31.854 (1.2462 - 1.2541)
		Wear limit		mm (in)	31.600 (1.2441)
	Exhaust	New		mm (in)	31.435 - 31.635 (1.2376 - 1.2455)
		Wear limit		mm (in)	31.400 (1.2362)
Crankshaft axial clearance		New		mm (in)	0.100 - 0.45 (.0039 - .0177)
Crankshaft journal diameter		New		mm (in)	54.961 - 54.980 (2.1638 - 2.1646)
		Wear limit		mm (in)	54.940 (2.1630)
Crankshaft deflection		Wear limit		mm (in)	0.050 (.002)
Crankshaft radial clearance		Wear limit		mm (in)	0.080 (.0031)

SKANDIC EXPEDITION TUV			V-1000
ENGINE TYPE			**1004**
ENGINE (cont'd)			
Connecting rod big end diameter	Wear limit	mm (in)	45.090 (1.7752)
Connecting rod big end clearance	Wear limit	mm (in)	0.09 (.0035)
Connecting rod big end axial play	New	mm (in)	0.150 - 0.450 (.0059 - .0177)
	Wear limit	mm (in)	0.500 (.0197)
Connecting rod small end diameter	New	mm (in)	23.010 - 23.020 (.9059 - 9063)
	Wear limit	mm (in)	23.070 (.9080)
Piston pin diameter	New	mm (in)	22.996 - 23.000 (.9053 - .9055)
	Wear limit	mm (in)	22.990 (.9051)
Piston pin bore clearance	Wear limit	mm (in)	0.080 (.0031)
ELECTRICAL			
Alternator output		V, A	12, 40
Ignition system type			DI (Digital Induction)
Ignition timing			Not adjustable
Spark plug	Make and type		NGK DCPR8E
	Gap	mm (in)	0.75 (.030)
Ignition coil	Primary	Ω	.85 - 1.15
	Secondary	kΩ	9.2 - 13.8
Engine RPM limiter setting		RPM	8000
FUEL SYSTEM			
Fuel injection type			ROTAX EMS (Engine Management System) Multipoint Fuel Injection, Single throttle body (52 mm)
Fuel pressure		kPa (PSI)	400 (58)
Idle speed		RPM	1400 ± 100
Throttle Position Sensor (TPS) (4)		kΩ	1.6 - 2.4
Crankshaft Position Sensor (CPS) (4)		Ω	.7 - 1.1
Camshaft Position Sensor (CAPS)		V	12
Camshaft Position Sensor (CAPS) (4)		kΩ	1.2
Air Temperature Sensor (ATS) (4)		kΩ	2.28 - 2.74
Coolant Temperature Sensor (CTS) (4)		kΩ	2.28 - 2.74
Manifold Air Pressure Sensor (MAPS)		V	5
Idle bypass valve (4)		Ω	50
Oil Pressure Switch (OPS) (4)		Ω	0 (continuity), if oil pressure is lower than 20 kPa (2.9 PSI)
Fuel injector		Ω	13.8 - 15.2
Fuel	Type		Regular unleaded
	Octane		North America: 87 (R+M)/2 Elsewhere: 91 RON

SKANDIC EXPEDITION TUV			V-1000
ENGINE TYPE			**1004**
COOLING SYSTEM			
Type			Liquid cooled
Coolant			(8)
Thermostat		°C (°F)	80 (176)
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw			(6)
Cylinder head screws or nuts	M11	N•m (lbf•ft)	50 (37) + 90° rotation
	M6	N•m (lbf•**in**)	9 (80)
Rocker arm shaft screws		N•m (lbf•ft)	20 (15) + 90° rotation
Crankshaft nut		N•m (lbf•ft)	80 (59)
Connecting rod screws		N•m (lbf•ft)	45 (33) + 90° rotation
Crankcase screws	M6	N•m (lbf•**in**)	9 (80)
	M8	N•m (lbf•ft)	24 (18)
Oil drain plug		N•m (lbf•ft)	55 (41)
Alternator screws		N•m (lbf•ft)	23 (17)
Oil filter cover screw		N•m (lbf•**in**)	9 (80)
Manifold screws		N•m (lbf•ft)	22 (16)

VEHICLES

TUNDRA/SKANDIC LT					277	443
DRIVE						
Chain drive ratio					14/25	17/44
Chain	Pitch			in	1/2	3/8
	Type/links qty/plate qty				Single/62	Silent 70/13
Drive pulley	Type				Bombardier Lite (1)	Comet
	Calibration	Clutch engagement		±100 RPM	3000	3200
		Spring color			Red/Yellow	Silver/Black
		Spring length	± 1.5 mm (± .060 in)		87.9 (3.461)	78.99 (3.110)
		Weight	Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g		5 x 3.4 g	
		Block			417 114 300	218311C
		Cap			417 114 500	N.A.
		Pin			N.A.	417 003 900
		Ramp			N.A.	N.A.
		Screw position			N.A.	N.A.
Driven pulley	Type				Tundra Reverse	LPV27
	Spring preload		± 0.7 kg (± 1.5 lb)		0, pos. 3	0
	Cam angle			degree	37.8	40
Pulley distance	Z			mm (in)	37.0 +0, -0.75 (1.457 +0, -.030)	39 ± 0.75 (1.535 ± .030
Offset	X			mm (in)	36.0 ± 1.0 (1.417 ± .040)	37 ± 0.75 (1.457 ± .030)
	Y – X	MIN.-MAX.		mm (in)	1.51 (.060)	0.75 - 2.25 (.030 .090)
Drive belt part number (P/N)					414 827 600	414 633 800
Drive belt width		Wear limit		mm (in)	30.3 (1-3/16)	32.0 (1-1/4)
Drive belt adjustment		Deflection	± 5 mm (13/64 in)		32 (1-1/4)	32 (1-1/4)
		Force [2]		kg (lbf)	6.8 (15)	11.3 (25)
Track	Width			mm (in)	381 (15.0)	381 (15.0)
	Length			mm (in)	3540 (139)	3968 (156.2)
	Profile height			mm (in)	18.4 (.724)	25 (1)
	Adjustment	Deflection		mm (in)	35 - 40 (1-3/8 - 1-9/16)	40 - 50 (1-9/16 - 1-31/32)
		Force [3]		kg (lbf)	7.3 (16)	7.3 (16)
Suspension type		Track			Torque Reaction Slide	Skandic WT
		Ski			Telescopic Strut	Telescopic Strut

TUNDRA/SKANDIC LT			277	443
ELECTRICAL				
Battery		V (Ah)	N.A.	N.A.
Headlamp		W	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27
Tachometer and speedometer bulbs		W	N.A.	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.
Fuse	Starter solenoid	A	N.A.	N.A.
	Fuel level sensor	A	N.A.	N.A.
CAPACITIES				
Fuel tank		L (U.S. gal)	26 (6.9)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)	250 (8.5)
Cooling system (5)		L (U.S. oz)	N.A.	N.A.
Injection oil reservoir		L (U.S. oz)	1.9 (64)	2.5 (84.5)
VEHICLE INFORMATIONS				
Mass (dry)		kg (lb)	173 (380)	210 (462)
Length		mm (in)	2845 (112)	3020 (118.9)
Width		mm (in)	953 (37.5)	960 (37.8)
Height		mm (in)	1120 (44.1)	1295 (51)
Ski stance (carbide to carbide)		mm (in)	813 (32.0)	820 (32.3)
Toe-out		mm (in)	6 (1/4)	5 (3/16)
Camber		mm (in)	N.A.	N.A.
Ground contact area		cm^2 (in^2)	7570 (1173)	8811.3 (1365.8)
Ground contact pressure		kPa (PSI)	2.24 (.325)	2.46 (.357)
Frame material			Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density
Hood material			Polyethylene High Density	RRIM

SKANDIC					WT 552	SWT 552	WT LC 593
DRIVE							
Gear ratio				1st	1:2.82	1:3.80	1:2.82
				2nd	1:1.89	1:2.29	1:1.7
				R	1:3.44	1:4.63	1:3.44
Drive pulley	Type				Bombardier Lite (1)	Bombardier Lite (1)	TRA III
	Calibration	Clutch engagement		±100 RPM	2500	2500	2700
		Spring color			Yellow/Green	Yellow/Green	Yellow/Red
		Spring length	± 1.5 mm (± .060 in)		94.61 (3.725)	94.61 (3.725)	128 (5.039)
		Weight	Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g		417 120 400 4 x 417 114 400	417 120 400 4 x 417 114 400	N.A.
		Block			N.A.	N.A.	N.A.
		Cap	417 114 500 = 1.65 g		417 114 500	417 114 500	N.A.
		Pin			N.A.	N.A.	417 222 594
		Ramp			N.A.	N.A.	600 (4)
		Screw position			N.A.	N.A.	3
Driven pulley	Type				Cvtech	Cvtech	Cvtech VSA
	Spring preload			± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)
	Cam angle			degree	40/35	40/35	35/30
Pulley distance	Z			mm (in)	41.8 ± 0.75 (1.647 ± .030)	41.8 ± 0.75 (1.647 ± .030)	35.5 ± 0.75 (1.398 ± .030)
Offset	X			mm (in)	35 ± 0.75 (1.380 ± .030)	35 ± 0.75 (1.380 ± .030)	37 ± 0.75 (1.457 ± .030)
	Y – X	MIN.-MAX.		mm (in)	0.75 - 2.25 (.030 - .089)	0.75 - 2.25 (.030 - .089	0.75 - 2.25 (.030 - .089
Drive belt part number (P/N)					414 633 800	414 633 800	417 300 155
Drive belt width		Wear limit		mm (in)	32.0 (1-1/4)	32.0 (1-1/4)	34.3 (1-11/32)
Drive belt adjustment		Deflection		mm (in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
		Force (2)		kg (lbf)	11.3 (25)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	500 (19.7)	600 (23.6)	500 (19.7)
	Length			mm (in)	3968 (156.2)	3968 (156.2)	3968 (156.2)
	Profile height			mm (in)	31.8 (1.250)	23.5 (.925)	31.8 (1.250)
	Adjustment	Deflection		mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
		Force (3)		kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension type		Track			Skandic WT	Skandic WT	Skandic WT
		Ski			Telescopic Strut	Telescopic Strut	Telescopic Strut

SKANDIC			WT 552	SWT 552	WT LC 593
ELECTRICAL					
Battery		V (Ah)	12 (18)	12 (18)	12 (18)
Headlamp		W	H4 60/55	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27	8/27
Tachometer and speedometer bulbs		W	3	3	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.	N.A.
Fuse	Starter solenoid	A	20	20	15
	Fuel level sensor	A	N.A.	N.A.	N.A.
CAPACITIES					
Fuel tank		L (U.S. gal)	40 (10.6)	40 (10.6)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	400 (13.5)	400 (13.5)	400 (13.5)
Cooling system		L (U.S. oz)	N.A.	N.A.	4.5 (152)
Injection oil reservoir		L (U.S. oz)	2.5 (84.5)	2.5 (84.5)	2.5 (84.5)
VEHICLE INFORMATIONS					
Mass (dry)		kg (lb)	258 (568)	277 (610)	275 (605)
Length		mm (in)	3020 (118.9)	3150 (124.0)	3150 (124.0)
Width		mm (in)	1045 (41.1)	1100 (43.3)	1100 (43.3)
Height		mm (in)	1295 (50.98)	1330 (52.4)	1220 (48)
Ski stance (carbide to carbide)		mm (in)	900 (35.4)	900 (35.4)	900 (35.4)
Toe-out		mm (in)	5 (3/16)	5 (3/16)	5 (3/16)
Camber		mm (in)	N.A.	N.A.	N.A.
Ground contact area		cm^2 (in^2)	10793 (1672.9)	13986 (2167.8)	12335 (1912)
Ground contact pressure		kPa (PSI)	2.46 (.357)	2.04 (.296)	2.33 (.338)
Frame material			Steel	Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density	Polyethylene High Density
Hood material			RRIM	RRIM	RRIM

SKANDIC SUV					552	593
DRIVE						
Gear ratio				1st	1:2.82	1:2.82
				2nd	1:1.89	1:1.7
				R	1:3.44	1:3.44
Drive pulley	Type				Bombardier Lite (1)	TRA III
	Calibration	Clutch engagement		±100 RPM	2500	2700
		Spring color			Yellow/Green	Yellow/Red
		Spring length		± 1.5 mm (± .060 in)	94.61 (3.725)	128 (5.039)
		Weight		Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g	417 120 400 4 x 417 114 400	N.A.
		Block			N.A.	N.A.
		Cap	417 114 500 = 1.65 g		417 114 500	N.A.
		Pin			417 222 594	417 222 594
		Ramp			N.A.	600 (4)
		Screw position			N.A.	3
Driven pulley	Type				Cvtech	Cvtech
	Spring preload			± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)
	Cam angle			degree	40/35	35/30
Pulley distance	Z			mm (in)	41.8 ± 0.75 (1.647 ± .030)	35.5 ± 0.75 (1.398 ± .030)
Offset	X			mm (in)	35 ± 0.75 (1.380 ± .030)	37 ± 0.75 (1.457 ± .030)
	Y – X		MIN.-MAX.	mm (in)	0.75 - 2.25 (.030 - .089)	0.75 - 2.25 (.030 - .089)
Drive belt part number (P/N)					414 633 800	417 300 155
Drive belt width			Wear limit	mm (in)	32.0 (1-1/4)	32.0 (1-1/4)
Drive belt adjustment			Deflection	mm (in)	32 (1-1/4)	32 (1-1/4)
			Force (2)	kg (lbf)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	500 (19.7)	500 (19.7)
	Length			mm (in)	3968 (156.2)	3968 (156.2)
	Profile height			mm (in)	31.8 (1.25)	31.8 (1.25)
	Adjustment		Deflection	mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
			Force (3)	kg (lbf)	7.3 (16)	7.3 (16)
Suspension type			Track		Skandic SUV	Skandic SUV
			Ski		SUV	SUV

SKANDIC SUV			552	593
ELECTRICAL				
Battery		V (Ah)	12 (18)	12 (20)
Headlamp		W	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27
Tachometer and speedometer bulbs		W	3	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.
Fuse	Starter solenoid	A	20	15
	Fuel level sensor	A	N.A.	N.A.
CAPACITIES				
Fuel tank		L (U.S. gal)	40 (10.6)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	400 (13.5)	400 (13.5)
Cooling system		L (U.S. oz)	N.A.	4.5 (152)
Injection oil reservoir		L (U.S. oz)	2.5 (84.5)	2.5 (84.5)
VEHICLE INFORMATIONS				
Mass (dry)		kg (lb)	274 (603)	291 (640)
Length		mm (in)	3150 (124)	3150 (124)
Width		mm (in)	110 (43.3)	110 (43.3)
Height		mm (in)	1220 (48)	1220 (48)
Ski stance (carbide to carbide)		mm (in)	900 (35.4)	900 (35.4)
Toe-out		mm (in)	5 (3/16)	5 (3/16)
Camber		mm (in)	N.A.	N.A.
Ground contact area		cm^2 (in^2)	12335 (1912)	12335 (1912)
Ground contact pressure		kPa (PSI)	2.25 (.320)	2.36 (.342)
Frame material			Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density
Hood material			RRIM	RRIM

SKANDIC EXPEDITION TUV					600 HO SDI	V-1000 4–TEC
DRIVE						
Gear ratio			1st		1: 2.82	1: 2.82
			2nd		1: 1.70	1: 1.89
			R		1: 3.44	1: 3.44
Drive pulley	Type				TRA III	TRA IV
	Calibration	Clutch engagement		±100 RPM	2700	2500
		Spring color			violet/blue	Red/Yellow
		Spring length		± 1.5 mm (± .060 in)	120 (4.724)	87.9 (3.46)
		Weight			N.A.	N.A.
		Block			N.A.	N.A.
		Cap			N.A.	N.A.
		Pin			Solid	417 222 594 (long)
		Ramp			410	607
		Screw position			3	3(5)
Driven pulley	Type				Cvtech VSA	Cvtech VSA
	Spring preload			± 0.7 kg (± 1.5 lb)	7.7	7.5 - 9.0
	Cam angle			degree	35-30	40-30
Pulley distance	Z			mm (in)	61 ± 0.75 (2.402 ± 0.030)	61 ± 0.75 (2.402 ± 0.030)
Offset	X			mm (in)	37 (1.457)	37 (1.457)
	Y – X	MIN.-MAX.		mm (in)	0.75 - 2.25 (.03 - .09)	0.75 - 2.25 (.03 - .09)
Drive belt part number (P/N)					605 348 425	605 348 425
Drive belt width		Wear limit		mm (in)	35.5 (1.398)	35.5 (1.398)
Drive belt adjustment		Deflection		mm (in)	32 (1-1/4)	32 (1-1/4)
		Force (2)		kg (lbf)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	508 (20)	508 (20)
	Length			mm (in)	3960 (156)	3960 (156)
	Profile height			mm (in)	31.8 (1.25)	31.8 (1.25)
	Adjustment	Deflection		mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
		Force (3)		kg (lbf)	7.3 (16)	7.3 (16)
Suspension type		Track			SUV	SUV
		Ski			SUV	SUV

SKANDIC EXPEDITION TUV				600 HO SDI	V-1000 4–TEC
ELECTRICAL					
Battery			V (Ah)	12 (18)	12 (18)
Headlamp			W	60/55	60/55
Taillight and stoplight			W	8/27	8/27
Tachometer and speedometer bulbs			W	N.A.	N.A.
Fuel and temperature gauge bulbs			W	N.A.	N.A.
Fuse	Starter solenoid		A	5	5
	Fuel level sensor		A	N.A.	N.A.
CAPACITIES					
Fuel tank			L (U.S. gal)	42 (11)	42 (11)
Chaincase/gearbox			mL (U.S. oz)	400 (13.5)	400 (13.5)
Cooling system			L (U.S. oz)	4.5 (15.2)	4.5 (15.2)
Engine oil		Engine	L (U.S. oz)	N.A.	3.4 (115)
		Reservoir	L (U.S. oz)	2.5 (84.5)	N.A.
VEHICLE INFORMATIONS					
Mass (dry)			kg (lb)	325 (717)	345 (761)
Length			mm (in)	3150 (124)	3060 (120.5)
Width			mm (in)	1185 (46.7)	1185 (46.7)
Height			mm (in)	1320 (52)	1320 (52)
Ski stance (carbide to carbide)			mm (in)	985 (38.8)	985 (38.8)
Toe-out			mm (in)	5 (3/16)	5 (3/16)
Camber			mm (in)	N.A.	N.A.
Frame material				Steel	Steel
Bottom pan material				High density polyethylene	High density polyethylene
Hood material				RRIM	RRIM

TECHNICAL DATA LEGENDS

ENGINE TECHNICAL DATA LEGEND

A: Ampere

ABDC: After Bottom Dead Center

ATDC: After Top Dead Center

BBDC: Before Bottom Dead Center

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

IACV: Idle Air Control Valve

k: Kilo (X 1000)

MAG: Magneto Side

N.A.: Not Applicable

PSI: Pound per square inch

PTO: Power Take Off Side

R: Rectangular

SDI: Semi-direct injection

ST: Semi-Trapezoidal

V: Volt

W: Watt

(1) The maximum horsepower RPM applicable on the vehicle. It may be different under certain cricumstances and BOMBARDIER 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 80 to 100 N•m (59 to 74 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 90 to 100 N•m (66 to 74 lbf•ft).

(6) Drive pulley retaining screw: torque to 125 to 135 N•m (92 to 100 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 125 to 135 N•m (92 to 100 lbf•ft).

(7) **CAUTION: Do not attempt to adjust gap on spark plug BR9ECS. The specification is given for verification purpose only. If found out of specification, replace with a new one.**

(8) Use Bombardier premixed coolant (P/N 293 600 038) or a solution of ethylene glycol antifreeze for aluminum engines with demineralized water (50% antifreeze, 50% demineralized water).

(9) At 4000 RPM with APS disconnected.

VEHICLE TECHNICAL DATA LEGEND

RRIM: Reinforced Reaction Injection Molding

TRA: Total Range Adjustable drive pulley

N.A.: Not Applicable

(1) For Bombardier Lite drive pulleys:

1157 = Red block, push type 38 g (P/N 417 115 700).

1181 = Black block, screw type 39.6 g (P/N 417 118 100).

1143 = Red block, screw type 41.8 g (P/N 417 114 300)

W = Washer 1.8 g (P/N 417 115 800)

(2) Force applied midway between pulleys to obtain specified deflection.

(3) Force or downward pull applied to track to obtain specified tension deflection.

(4) Lever with roller pin (P/N 417 222 594) (long and solid).

(5) From factory TRA IV drive pulley adjustment screws are set to **position 3**. This position allows the best compromise between acceleration, top speed and fuel economy.
Position 1 or 2 would provide the best fuel economy. Top speed would be reduce.
Position 4 would give the best acceleration. Fuel economy would be reduced.

WIRING DIAGRAMS

Wiring diagrams can be found at the end of this subsection.

WIRE COLORS AND CIRCUIT

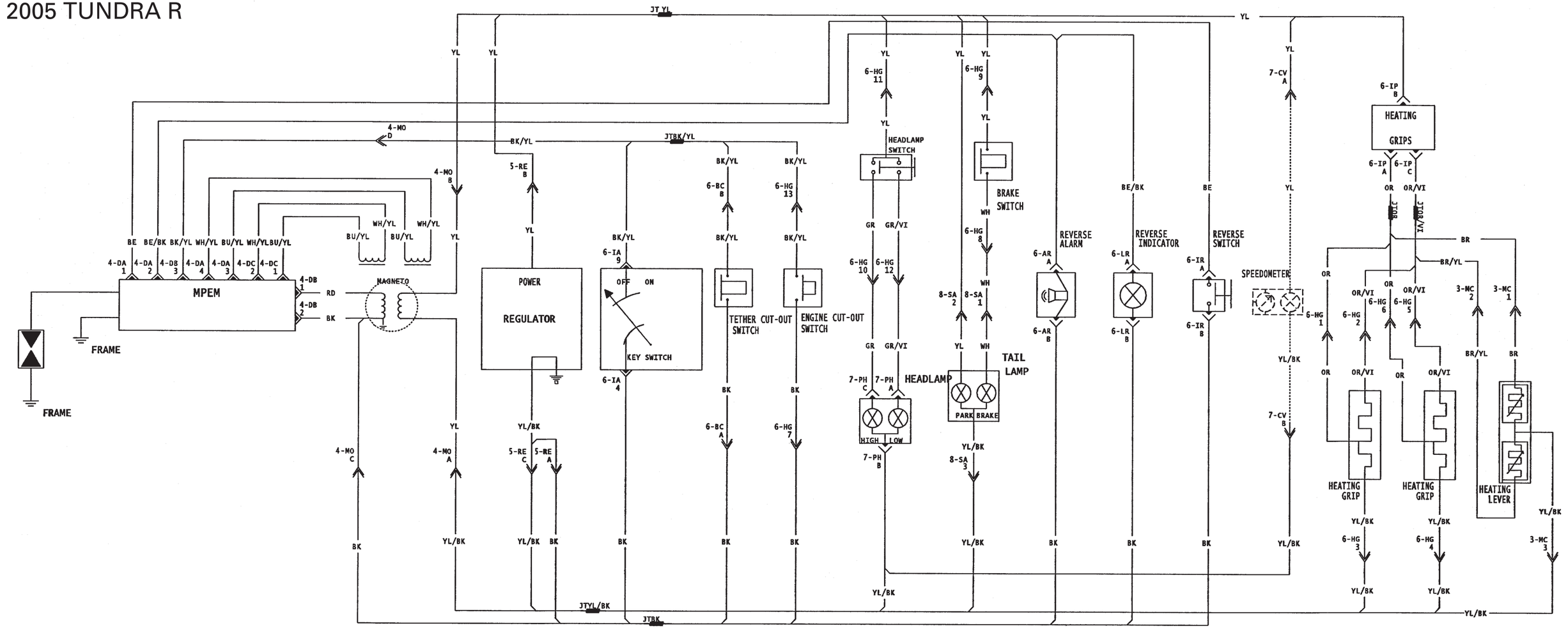
All Models except Expedition TUV 600 HO SDI and V-1000

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.

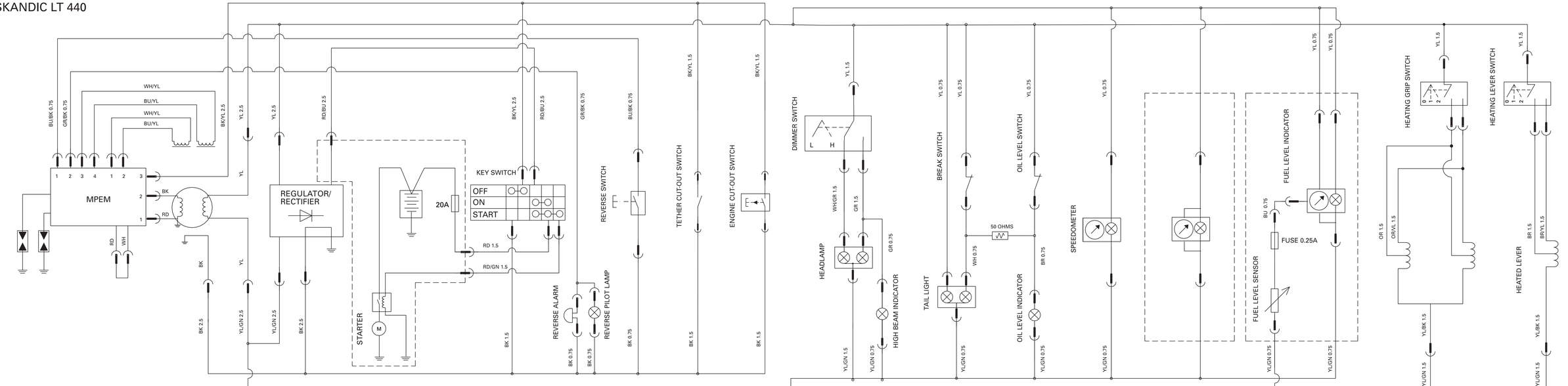
COLOR CODE	
BE = BEIGE	OR = ORANGE
BK = BLACK	RD = RED
BL or BU = BLUE	VI or VL = VIOLET
BR = BROWN	WH = WHITE
GN = GREEN	YL= YELLOW
GY or GN = GREY	

2005 TUNDRA R



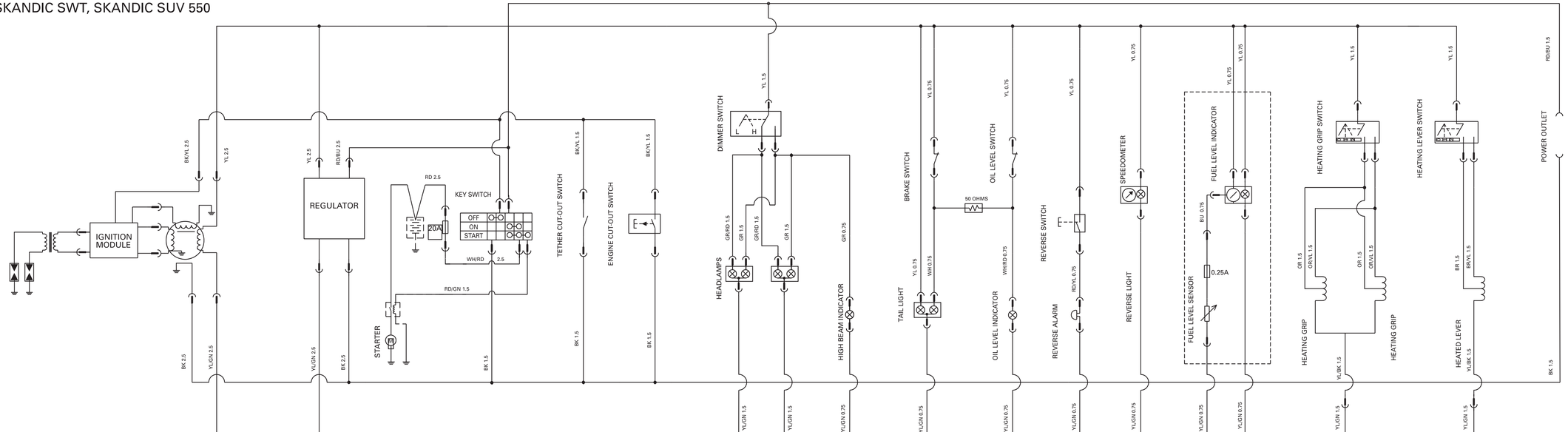
A05Z03

2005 SKANDIC LT 440



A29Z0C8

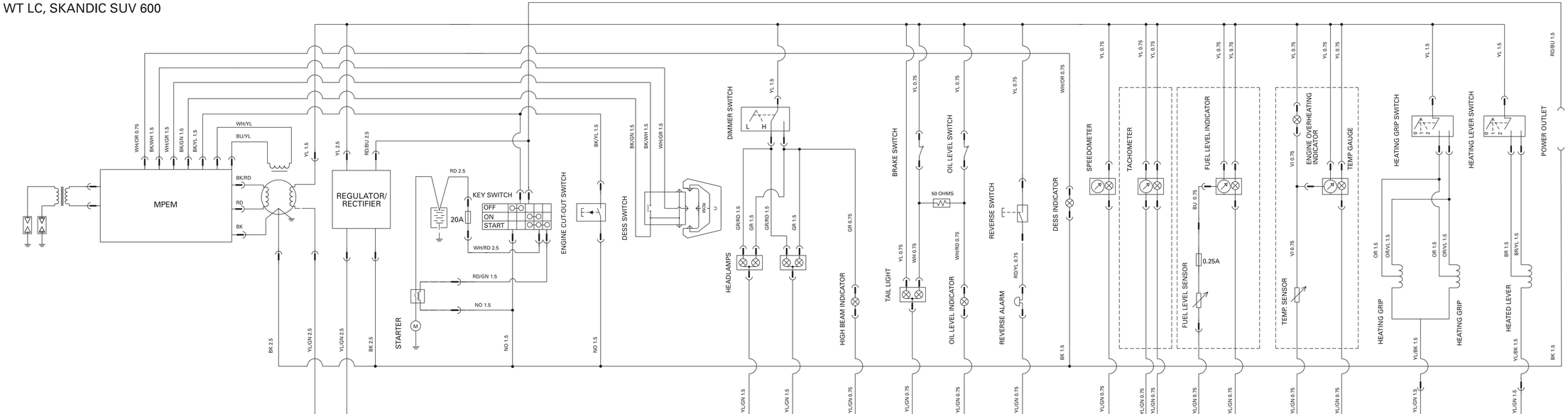
2005 SKANDIC WT, SKANDIC SWT, SKANDIC SUV 550



IGNITION SYSTEM | POWER SUPPLY | STARTER AND IGNITION SWITCHES | LIGHTING | INSTRUMENTS | HEATING ELEMENTS

A29Z0E8

2005 SKANDIC WT LC, SKANDIC SUV 600

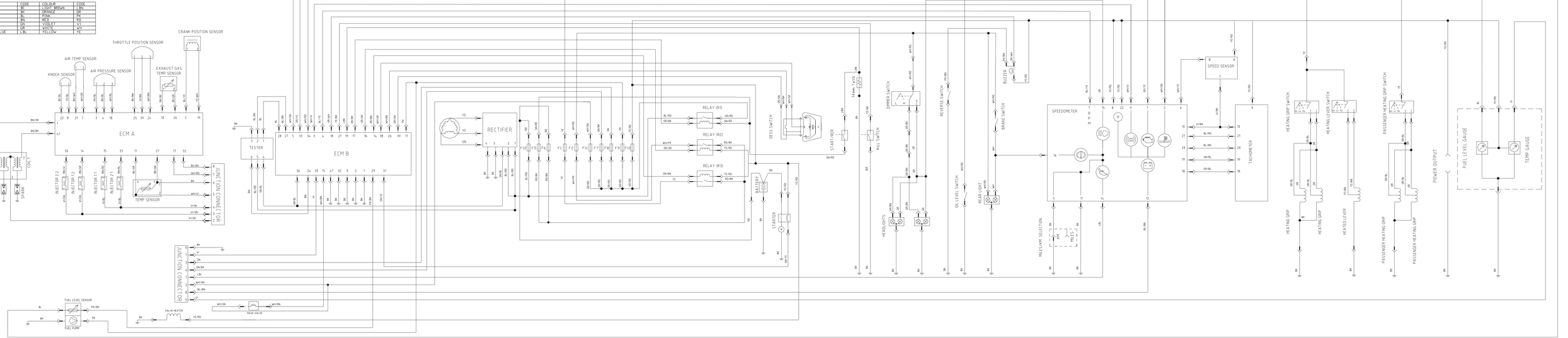


IGNITION SYSTEM | POWER SUPPLY | STARTER AND IGNITION SWITCHES | LIGHTING | INSTRUMENTS | HEATING ELEMENTS

A29Z0D8

2005 EXPEDITION 600 TUV SDI

COLOUR	CODE	COLOUR	CODE
BEIGE	BE	LIGHT BROWN	LBN
BLACK	BK	ORANGE	OR
BLUE	BL	PINK	PK
BROWN	BN	RED	RD
GREEN	GN	VIOLET	VI
GREY	GR	WHITE	WH
LIGHT BLUE	LBL	YELLOW	YE

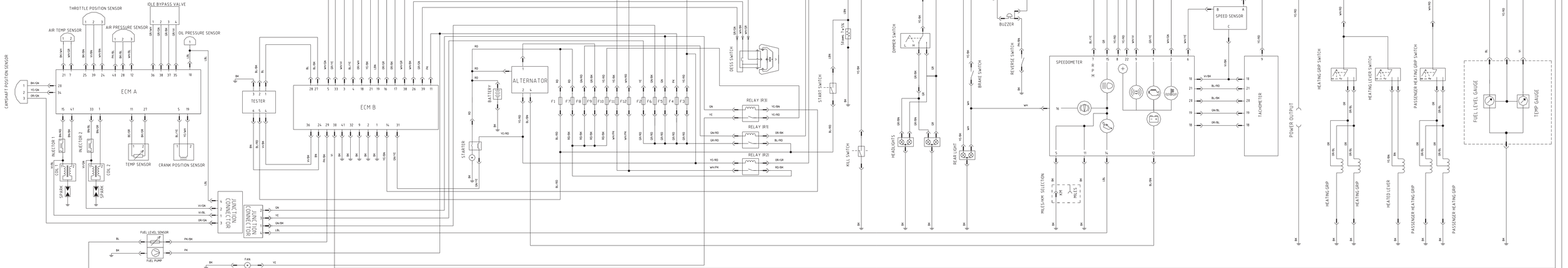


- MOTOR - | - IGNITION SYSTEM - | - POWER SUPPLY - | - STARTER AND IGNITION SWITCHES - | - LIGHTING - | - INSTRUMENTS - | - HEATING ELEMENTS - | - OPTIONAL -

A2920IG

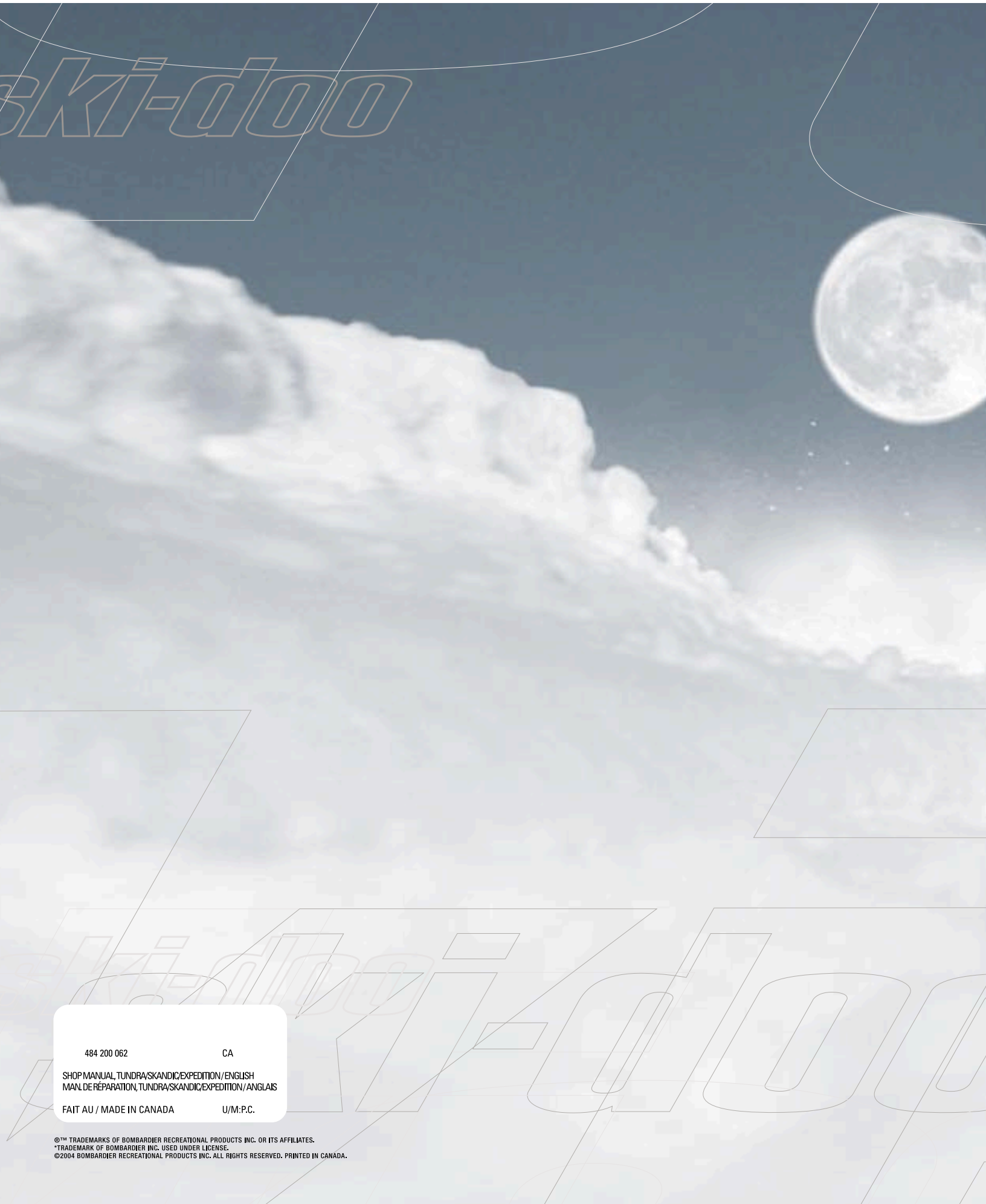
2005 EXPEDITION V-1000 TUV

COLOUR	CODE	COLOUR	CODE
BEIGE	BE	LIGHT BROWN	LBN
BLACK	BK	ORANGE	OR
BLUE	BL	PINK	PK
BROWN	BN	RED	RD
GREEN	GN	VIOLET	VI
GRAY	GR	WHITE	WH
LIGHT BLUE	LBL	YELLOW	YE



- MOTOR - | - IGNITION SYSTEM - | - POWER SUPPLY - | - STARTER AND IGNITION SWITCHES - | - LIGHTING - | - INSTRUMENTS - | - HEATING ELEMENTS - | - OPTIONAL -

A2620F



484 200 062 CA

SHOP MANUAL, TUNDRA/SKANDIC/EXPEDITION / ENGLISH
MAN. DE RÉPARATION, TUNDRA/SKANDIC/EXPEDITION / ANGLAIS

FAIT AU / MADE IN CANADA U/M:P.C.