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Section 04

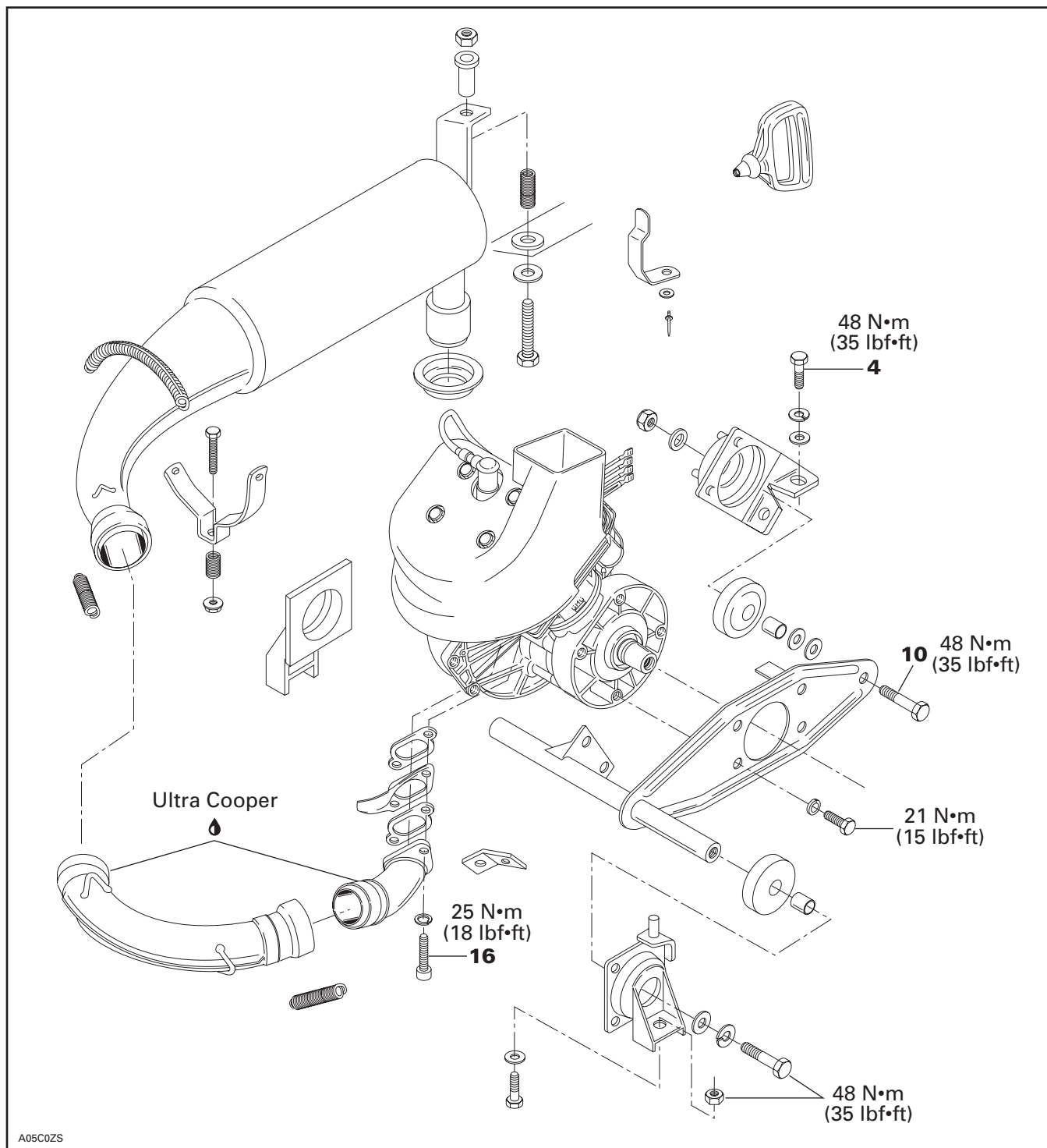
ENGINE

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277 ENGINE TYPE

ENGINE REMOVAL AND INSTALLATION



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Subsection 02 (277 ENGINE TYPE)

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 engine support screws **nos. 4 and 10** to 48 N•m (35 lbf•ft).

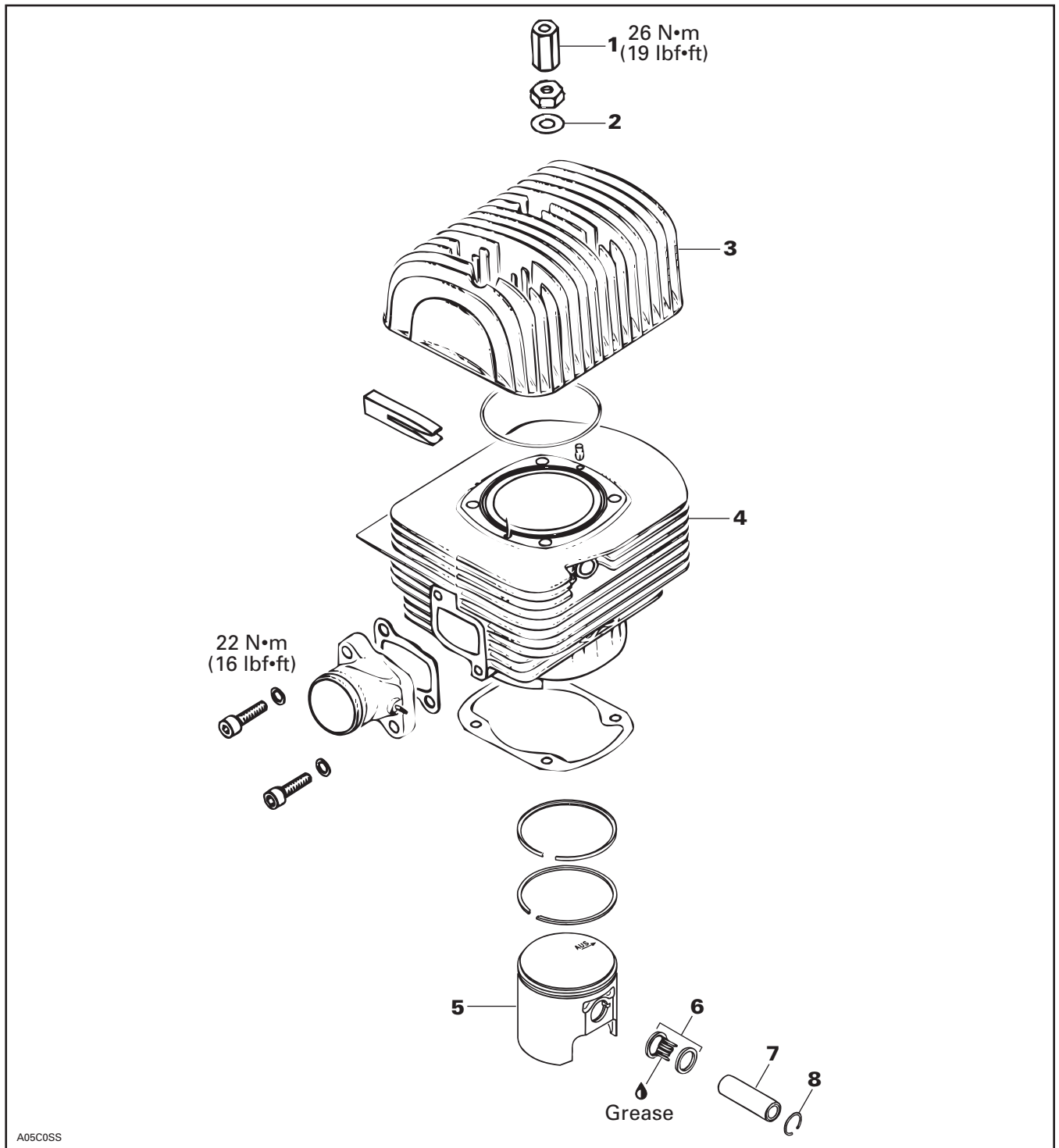
Torque the engine mount screws to 21 N•m (15 lbf•ft).

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.
- Should a light exhaust leak is experienced at muffler ball joint, Ultra Cooper (P/N 413 710 300) can be used.

TOP END



Section 04 ENGINE

Subsection 02 (277 ENGINE TYPE)

TROUBLESHOOTING

Before completely disassemble engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT 04-05.

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).

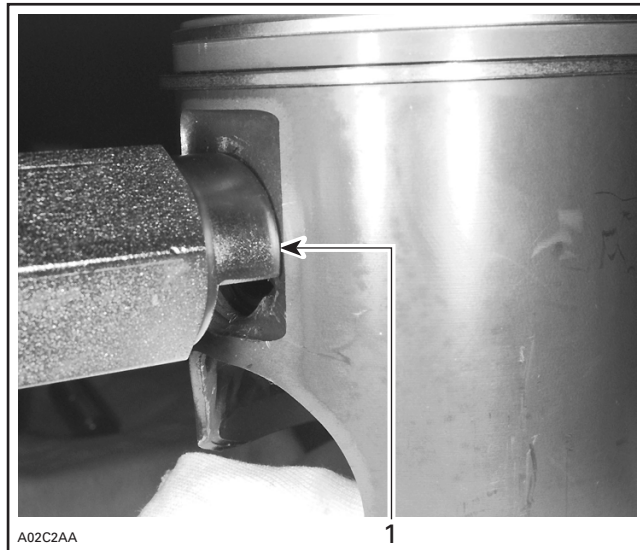
NOTE: The locating sleeve is the same that contains new cageless bearing.

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

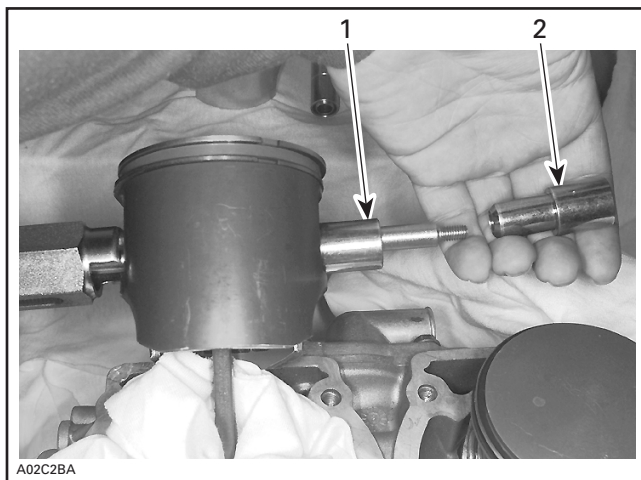
Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



TYPICAL

1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.



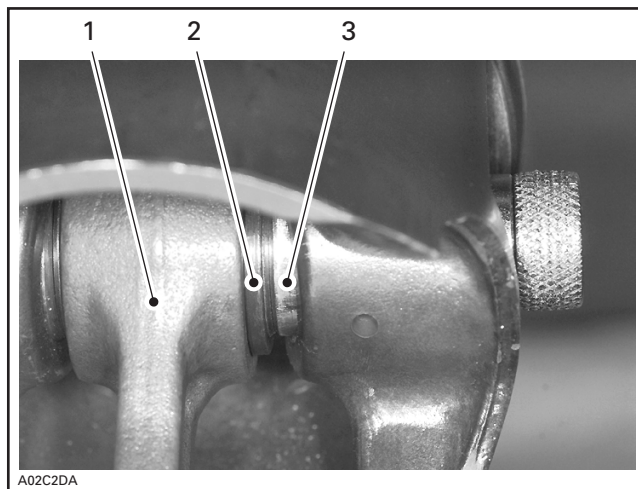
TYPICAL — INSTALLATION OF SLEEVE KIT

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.



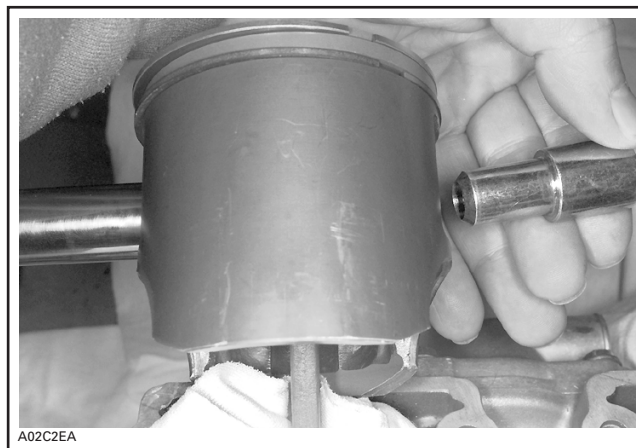
TYPICAL — PISTON PIN EXTRACTION



TYPICAL

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

Remove puller. Pull out shouldered sleeve carefully.

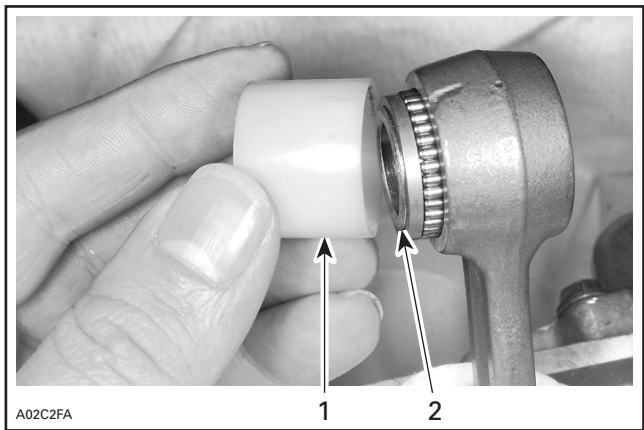


TYPICAL

Remove piston from connecting rod.

Section 04 ENGINE
Subsection 02 (277 ENGINE TYPE)

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



TYPICAL
1. Locating sleeve
2. Sleeve

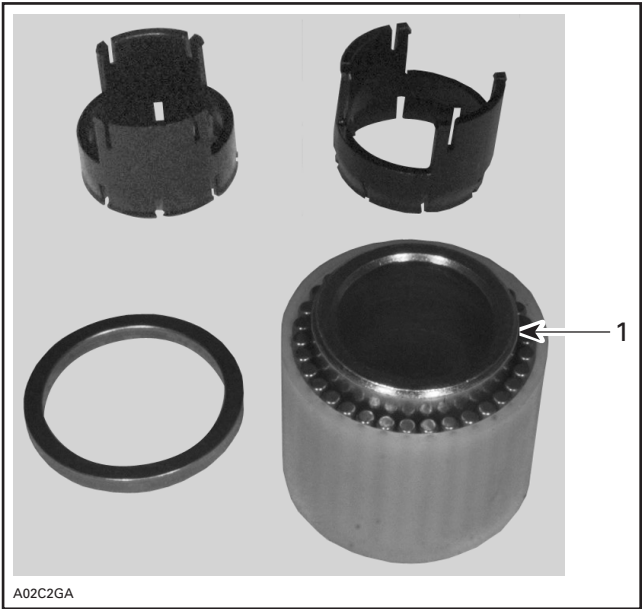
NOTE: 0.25 and 0.5 mm oversize pistons and rings are available if necessary.
Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

INSPECTION

Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT 04-05.

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.

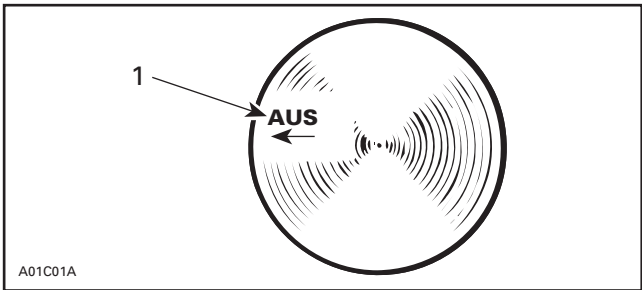


TYPICAL
1. Sleeve

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.



1. Exhaust

Install shouldered sleeve.



TYPICAL — SHOULDERED SLEEVE INSTALLATION

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

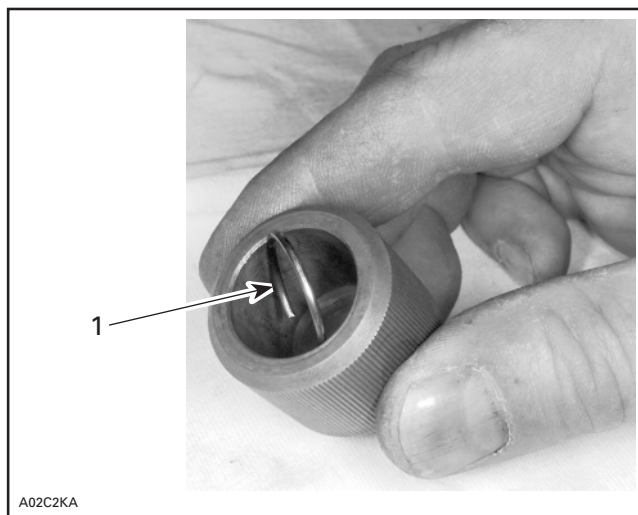


TYPICAL

Remove piston pin puller and sleeve kit.

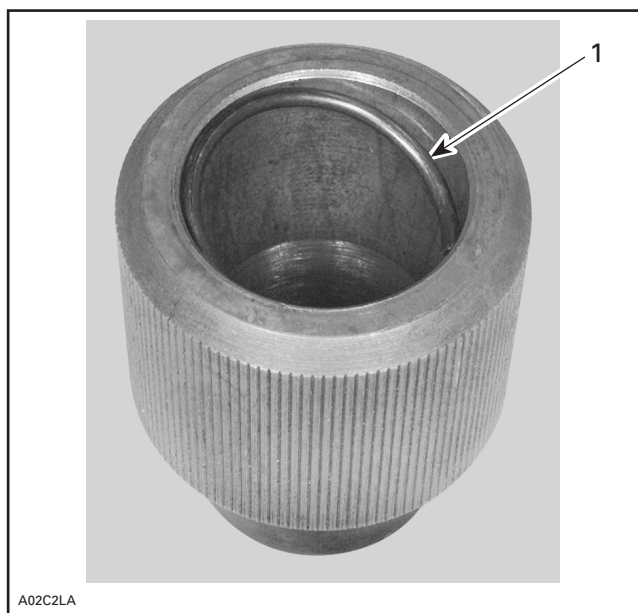
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



1. Circlip

Square it up using a finger.



1. Circlip

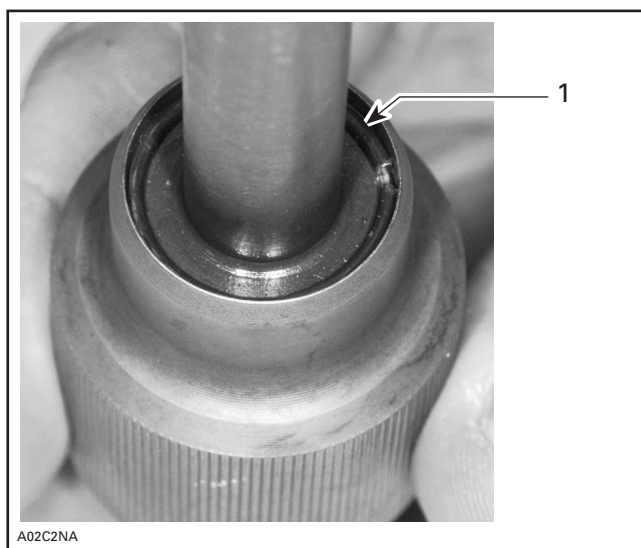
Section 04 ENGINE

Subsection 02 (277 ENGINE TYPE)

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

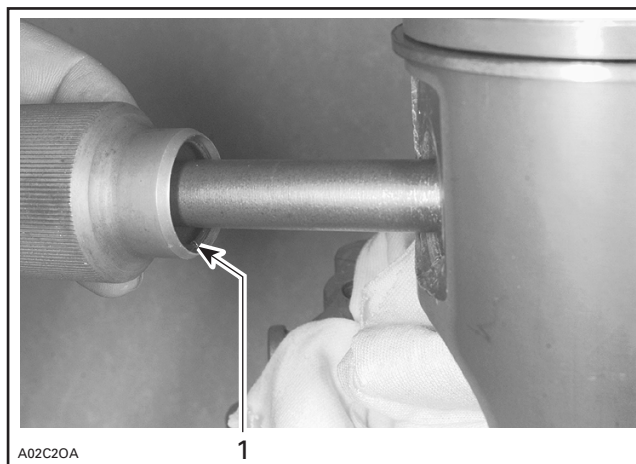


Using square end of tool, push circlip in until it rests in groove.



1. Circlip in groove

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



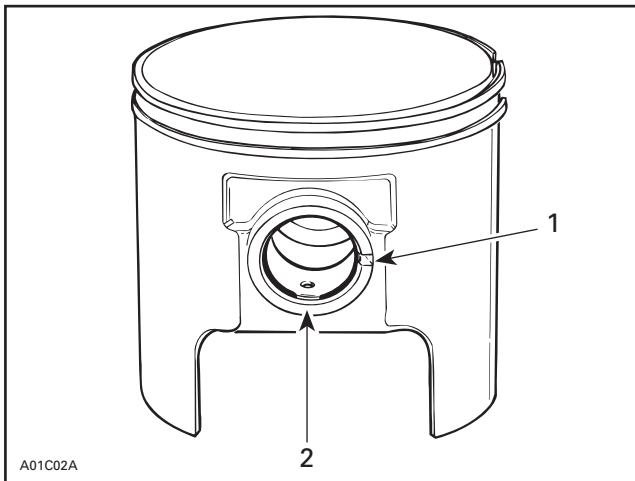
TYPICAL

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.

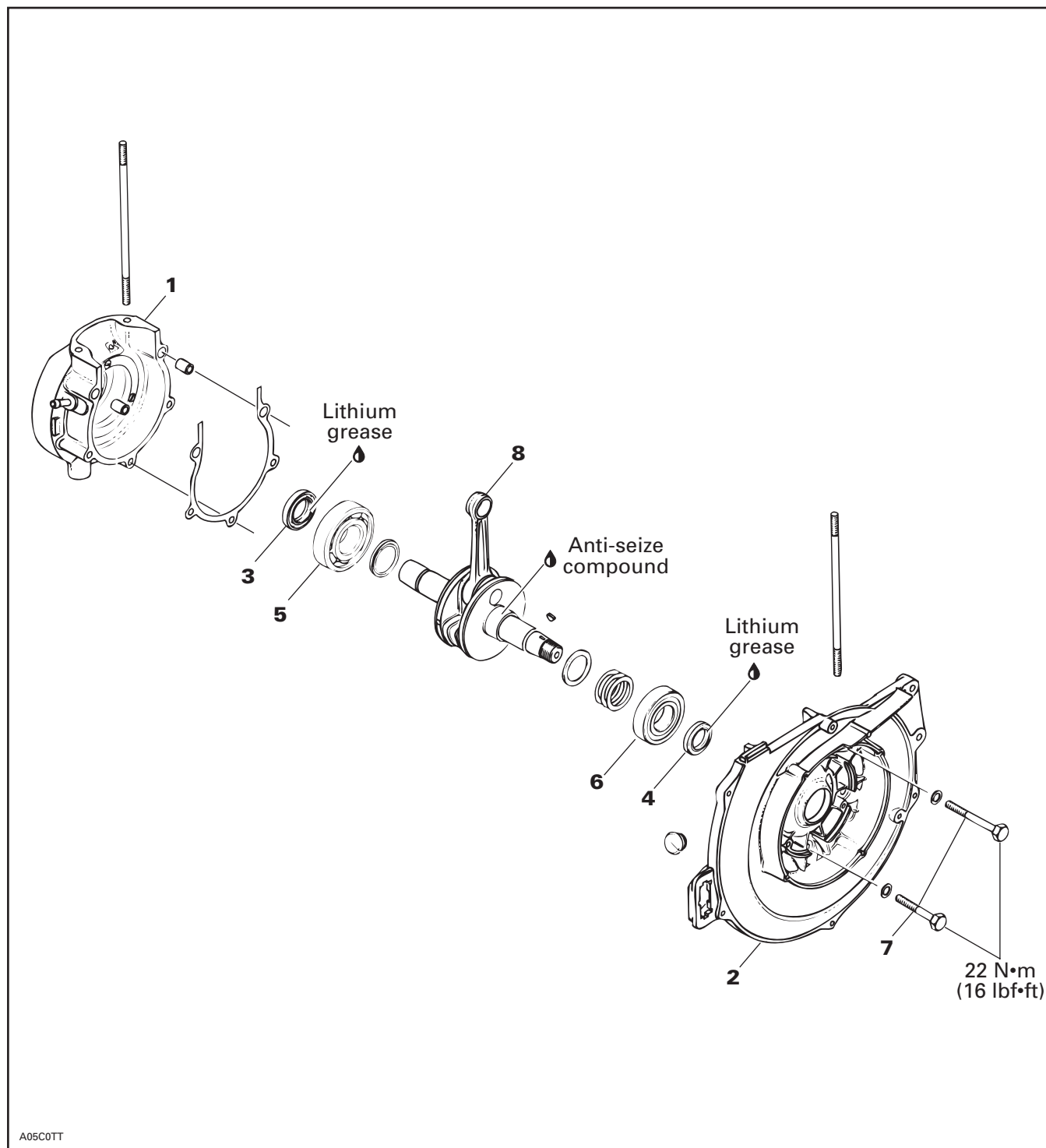
Before inserting piston in the cylinder, lubricate the cylinder with new injection oil or equivalent.

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

Section 04 ENGINE

Subsection 02 (277 ENGINE TYPE)

BOTTOM END



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

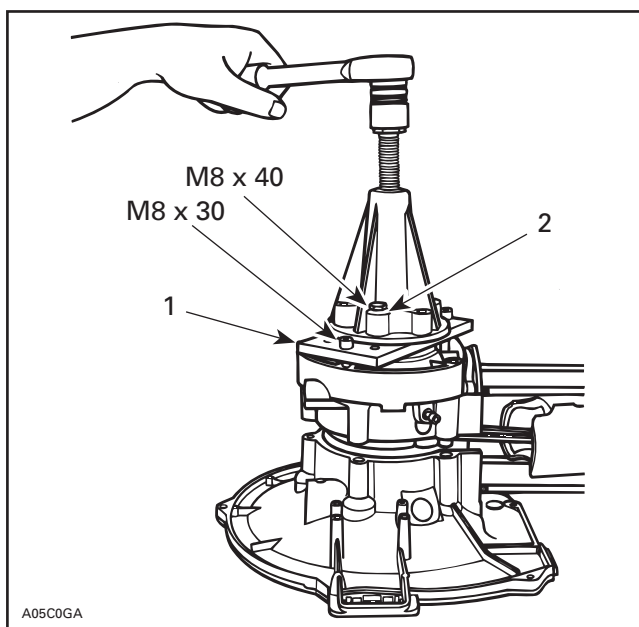
General

To remove drive pulley, refer to DRIVE PULLEY 05-03.

To remove magneto, refer to MAGNETO 04-06.

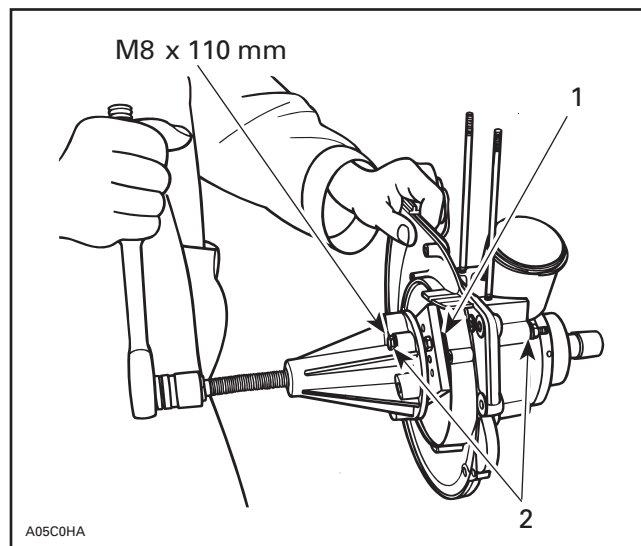
2,6, Crankcase Half

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 washer under screw heads and extract PTO side crankcase half **no. 1**.



1. Plate
2. Flat washer

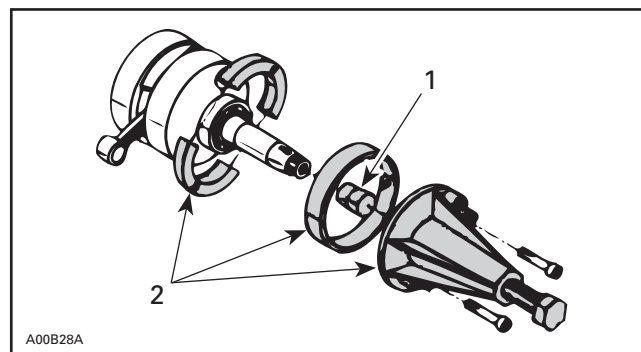
Heat to 110 - 120°C (230 - 248°F) all around bearing seat on MAG side. Install puller with plate, long bolts M8 x 110 mm and flat washers. Extract MAG side crankcase half **no. 2**.



1. Plate
2. Flat washers

To remove seals **nos. 3 and 4**, push from outside the crankcase towards the inside.

To remove bearings **nos. 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 04-05.

ASSEMBLY

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

Smear anti-seize lubricant (P/N 413 701 000) 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.

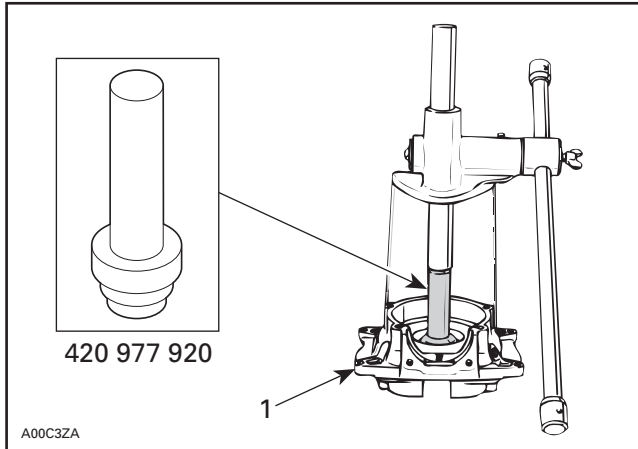
Section 04 ENGINE

Subsection 02 (277 ENGINE TYPE)

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 04-05.

To install new seal **nos. 3 and 4** into crankcase use oil seal pusher (P/N 420 977 920).



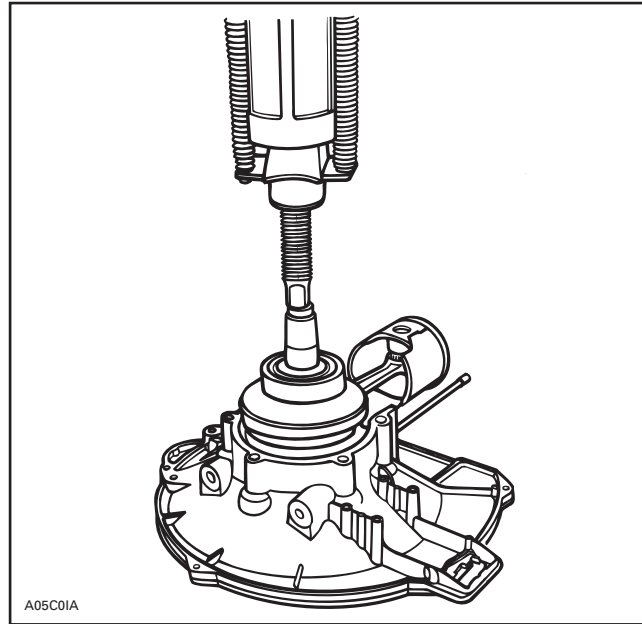
1. Crankcase half

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.

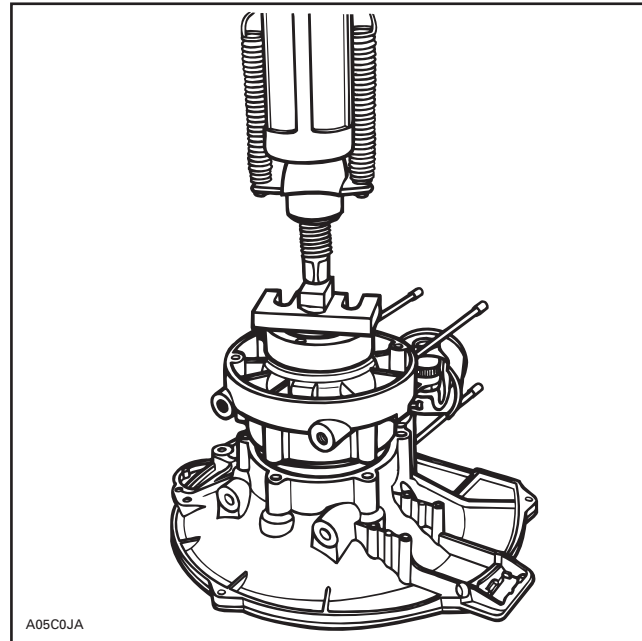
Install crankshaft seals with pusher (P/N 420 277 875) for MAG side seal **no. 4** and (P/N 420 876 660) for PTO side seal **no. 3**.

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

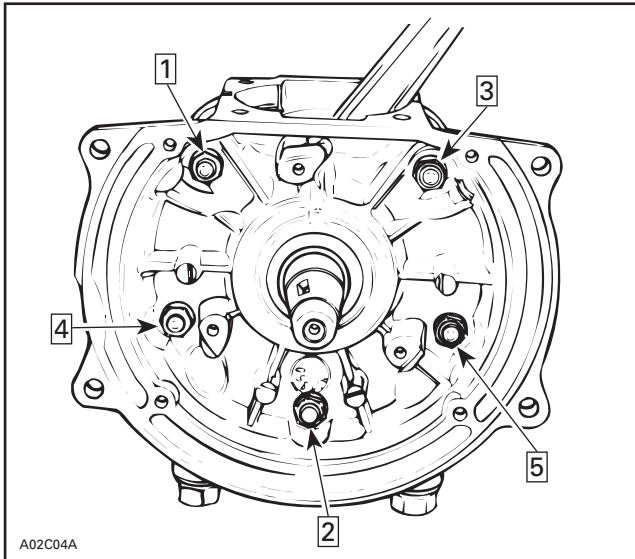
Using a press, install crankshaft into MAG side crankcase half.



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



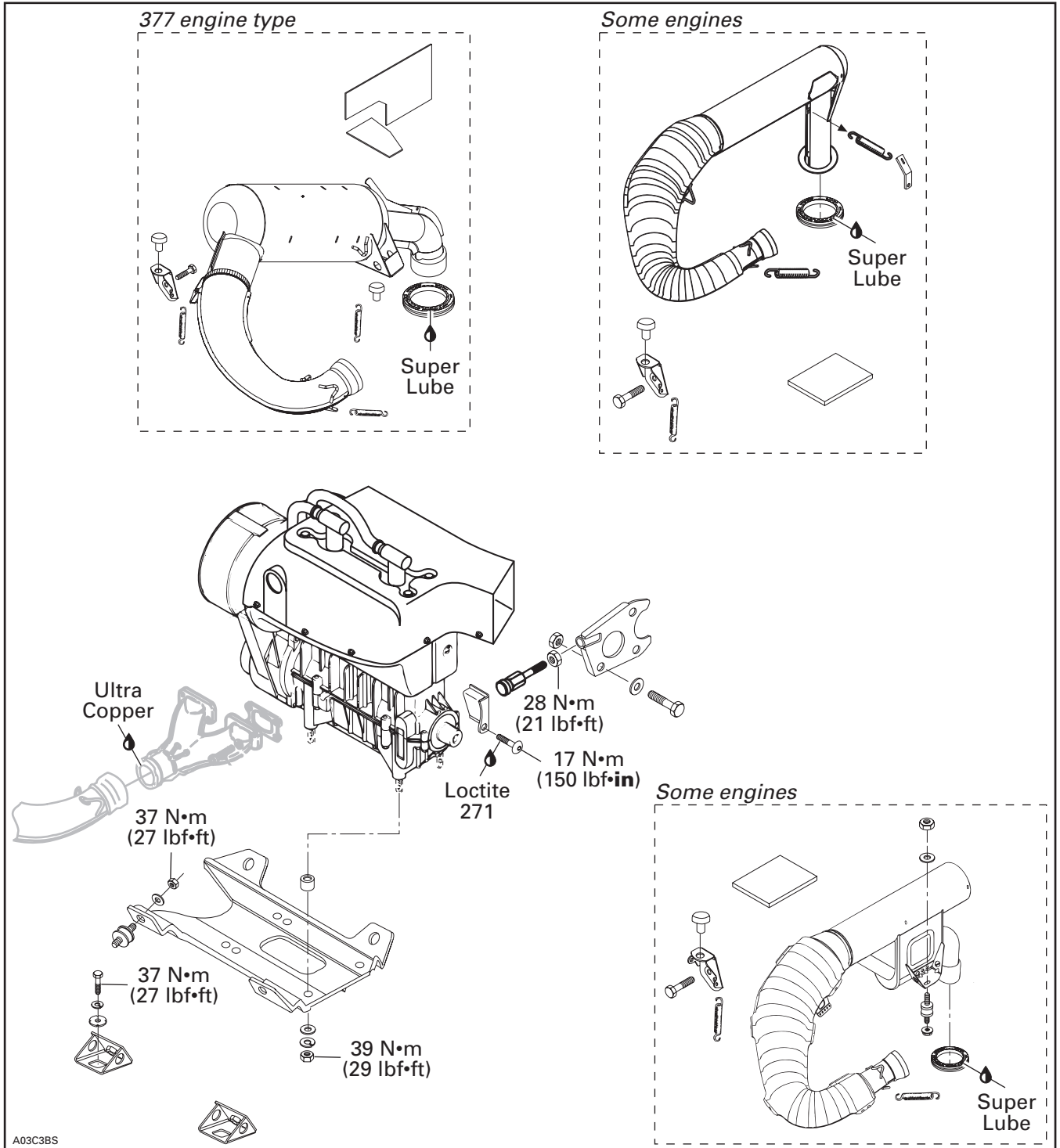
Torque the screws **no. 7** to 22 N•m (16 lbf•ft) following illustrated sequence.



377, 443 AND 503 ENGINE TYPES

ENGINE REMOVAL AND INSTALLATION

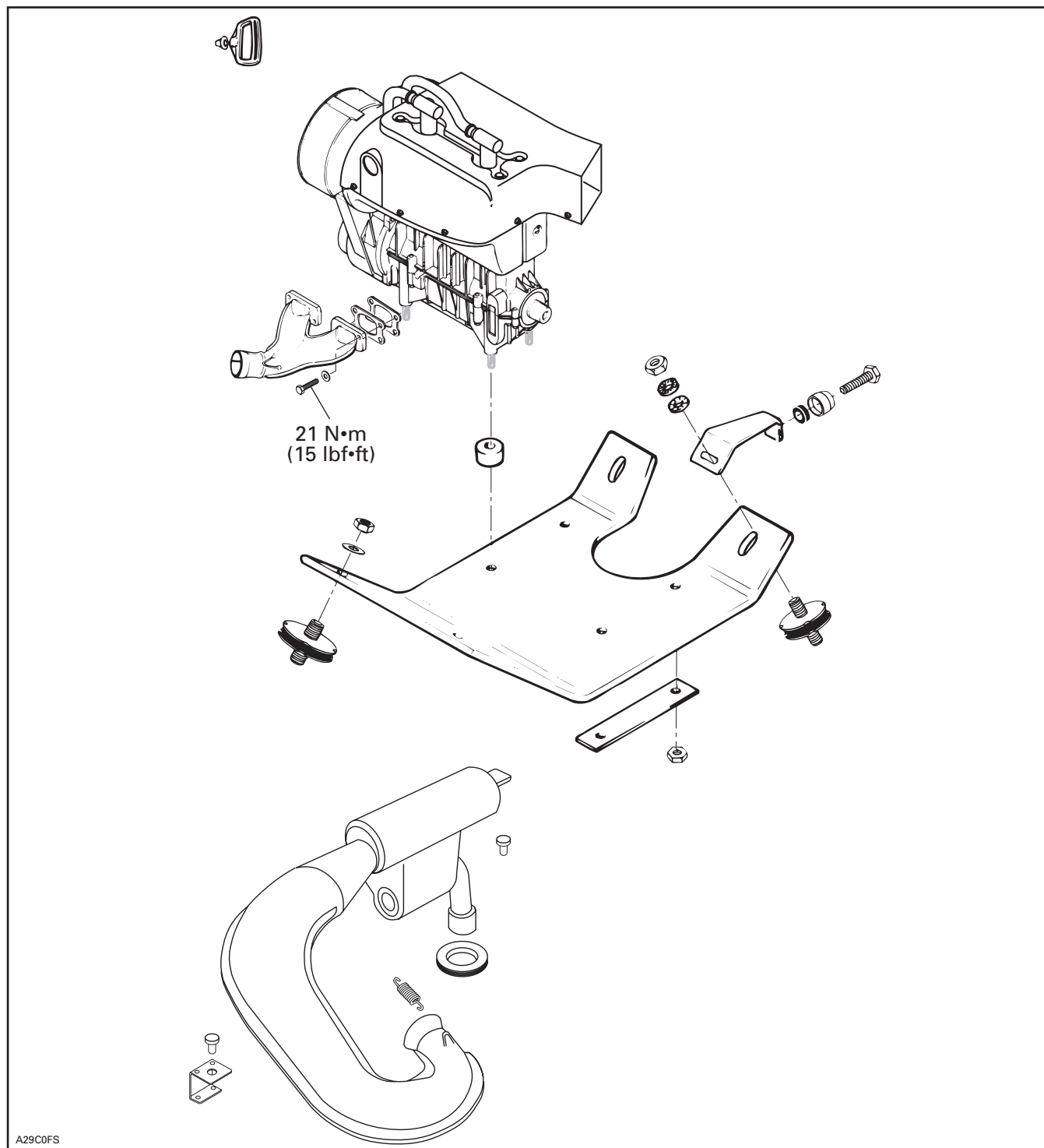
S-Series 377, 443 and 503 Engine Types



Section 04 ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

Skandic WT/SWT 503 Engine Type



ENGINE REMOVAL AND INSTALLATION

Disconnect or remove the following:

WARNING

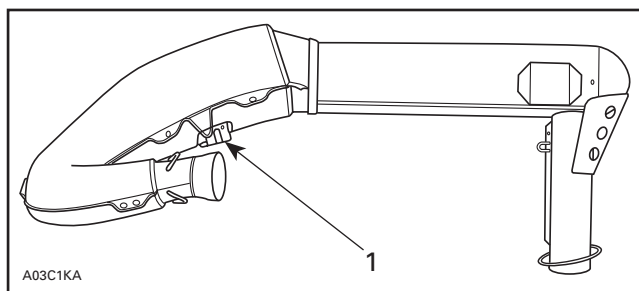
Before disconnecting any electrical wire in starter system always first disconnect the **BLACK** negative battery cable (on electric starting models).

- negative cable from battery (on electric starting models)
- guard
- drive belt
- drive pulley using appropriate puller, refer to DRIVE PULLEY 05-03
- 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

TUNED PIPE IDENTIFICATION

This part is identified on welded support.

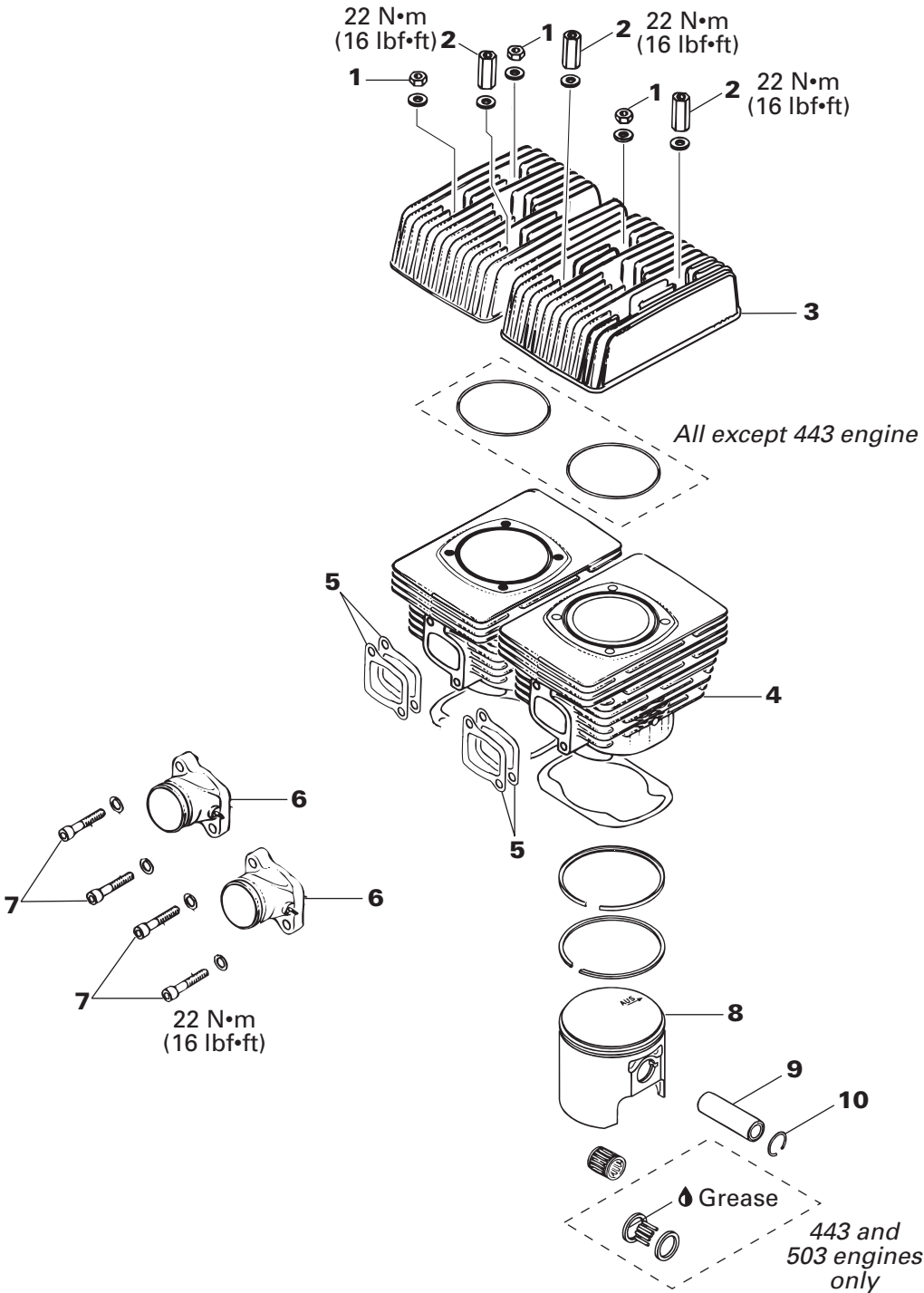
Second number sequence of P/N is stamped on part.



1. Identification: 0467 for 514 046 700

Section 04 ENGINE
Subsection 03 (377, 443 AND 503 ENGINE TYPES)

TOP END



A23C08S

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

CLEANING

Discard all gaskets. Use Gasket Remover (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.

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**.



TYPICAL

377 Engine

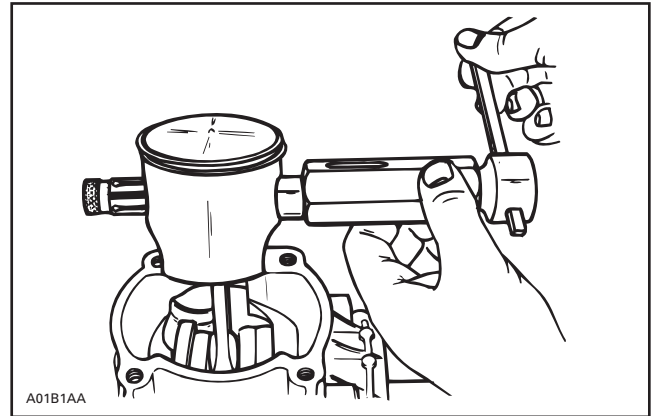
To remove piston pin **no. 9**, use piston pin puller (P/N 529 035 503).

Fully screw puller handle.

Insert puller end into piston pin.

Screw (LH threads) extracting nut.

Hold puller firmly and rotate puller handle counter-clockwise to pull piston pin.



TYPICAL

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

443 and 503 Engines

On these engines, piston pin needle bearing 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).

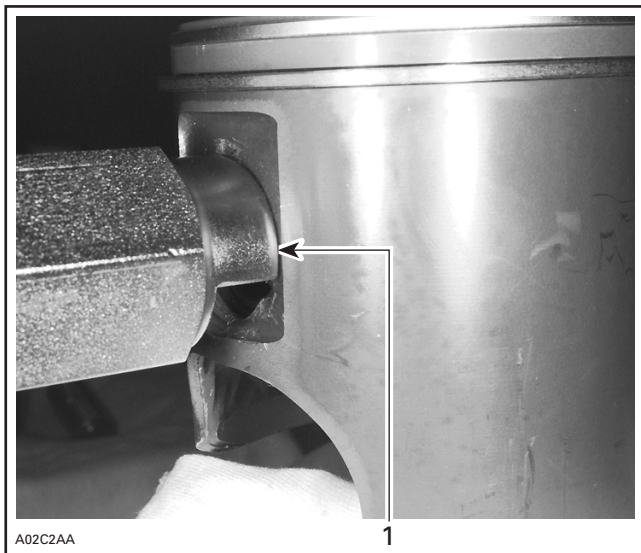
NOTE: The locating sleeve is the same that contains new cageless bearing.

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

Section 04 ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

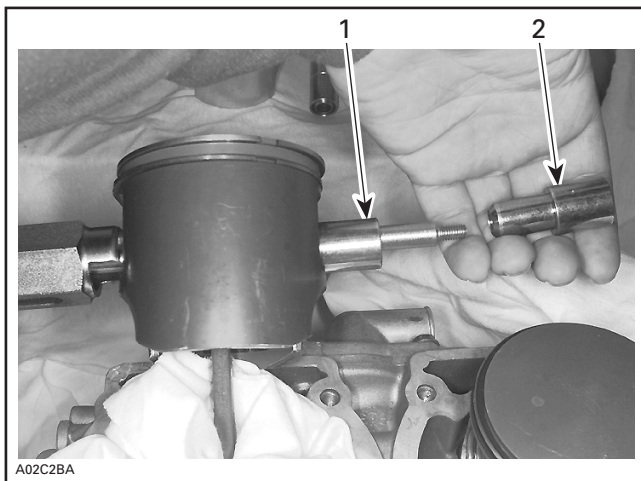
Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



TYPICAL

1. Properly seated all around

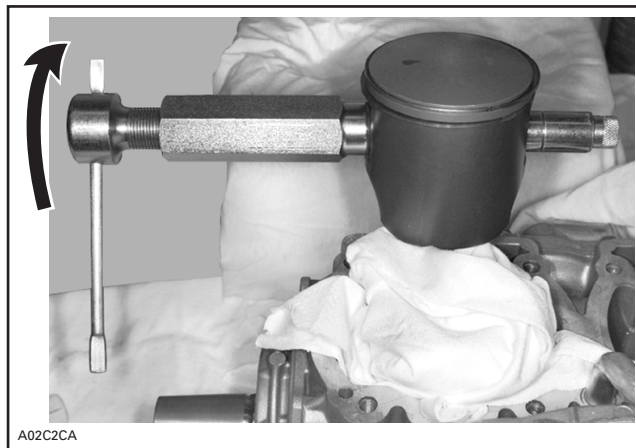
Install sleeve then shouldered sleeve over puller rod.



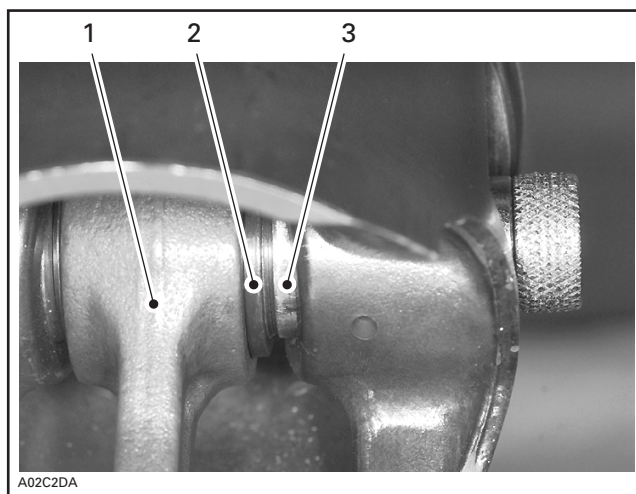
TYPICAL — INSTALLATION OF SLEEVE KIT

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.



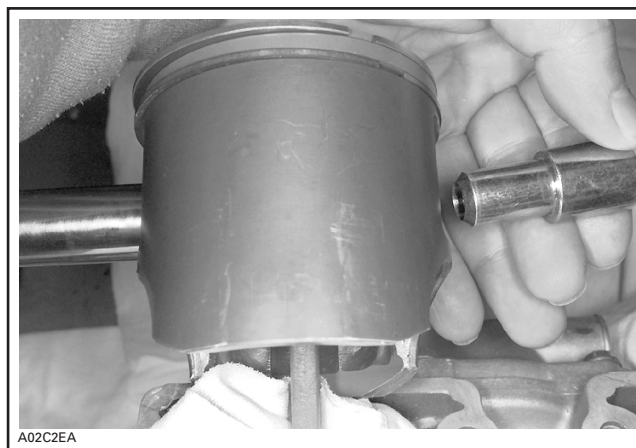
TYPICAL — PISTON PIN EXTRACTION



TYPICAL

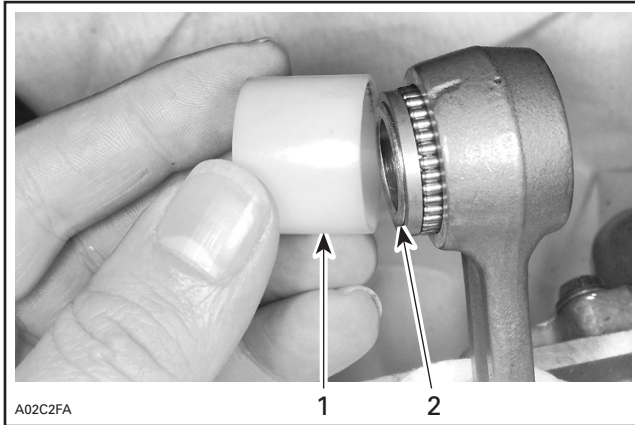
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

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

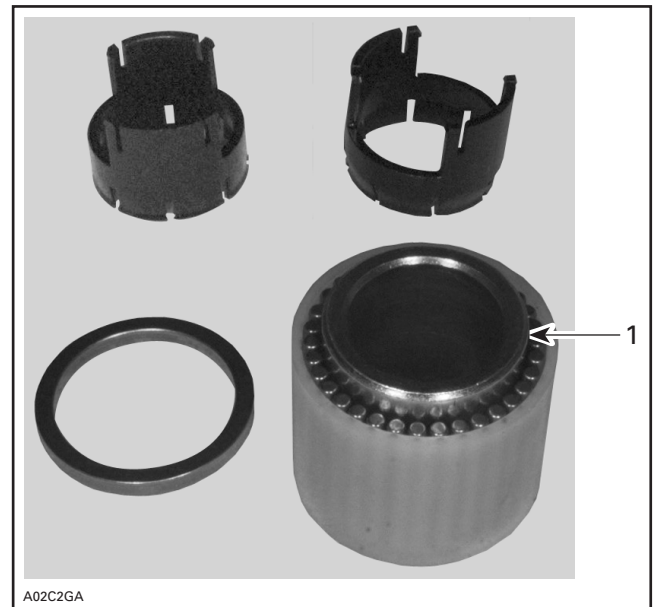
Refer to ENGINE DIMENSIONS MEASUREMENT 04-05.

ASSEMBLY

443 and 503 Engines

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.

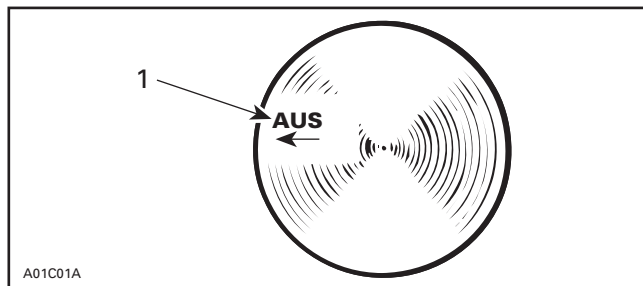


TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Section 04 ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

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



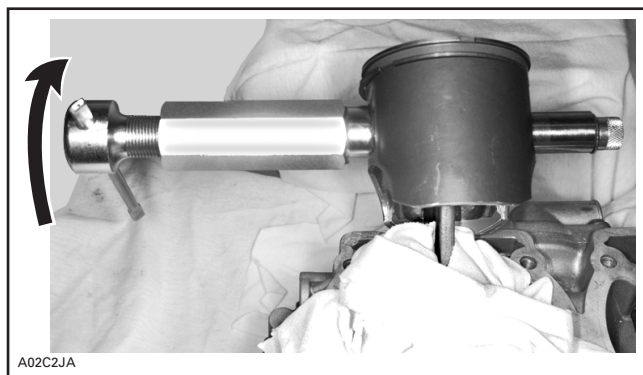
1. Exhaust

Install shouldered sleeve.



TYPICAL — SHOULDERED SLEEVE INSTALLATION

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

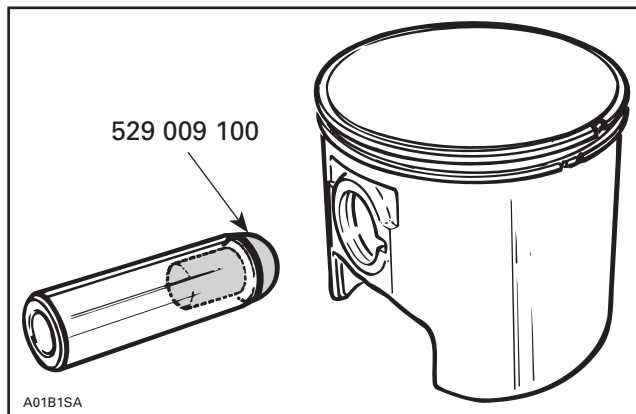


TYPICAL

– Remove piston pin puller and sleeve kit.

377 Engine

To center the piston pin with the connecting rod bearing, use centering tool (P/N 529 009 100).



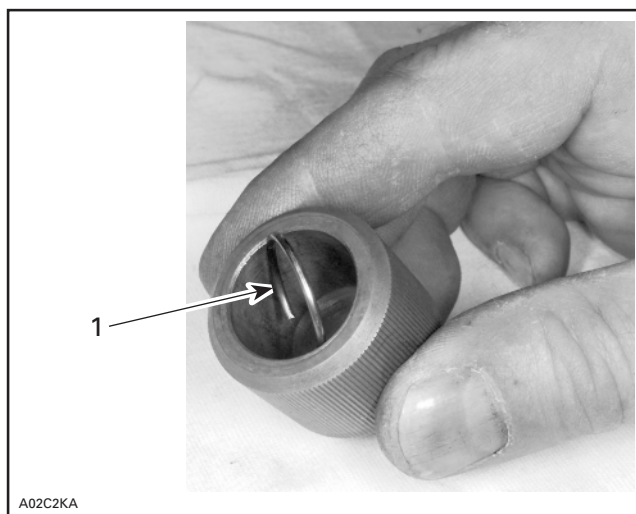
NOTE: The circlip on the opposite side can be installed before pin installation, the tool will easily go out.

Use piston pin puller (P/N 529 035 503) to install a piston pin that cannot be installed as described above.

All Models

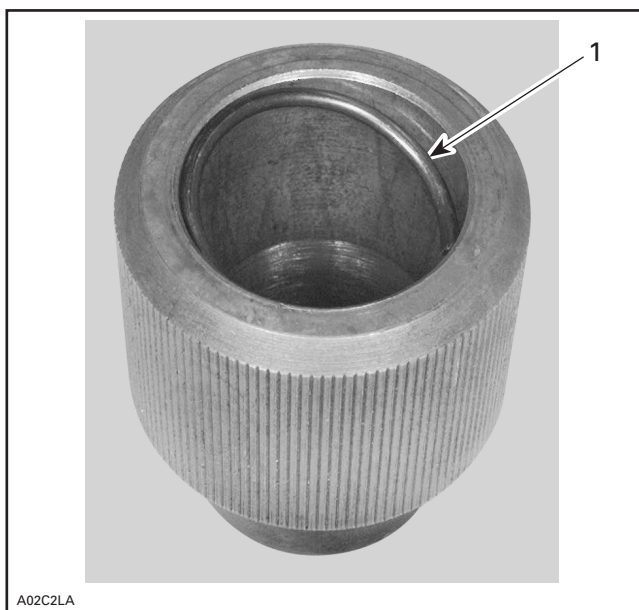
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



1. Circlip

Square it up using a finger.

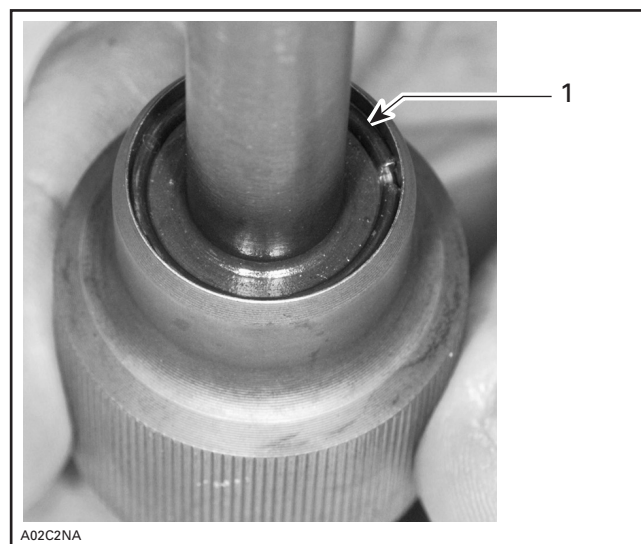


1. Circlip

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

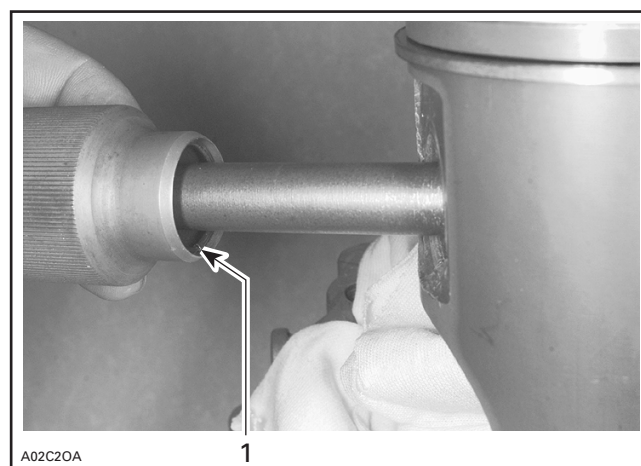


Using square end of tool, push circlip in until it rests in groove.



1. Circlip in groove

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



TYPICAL

1. Circlip break facing down

Section 04

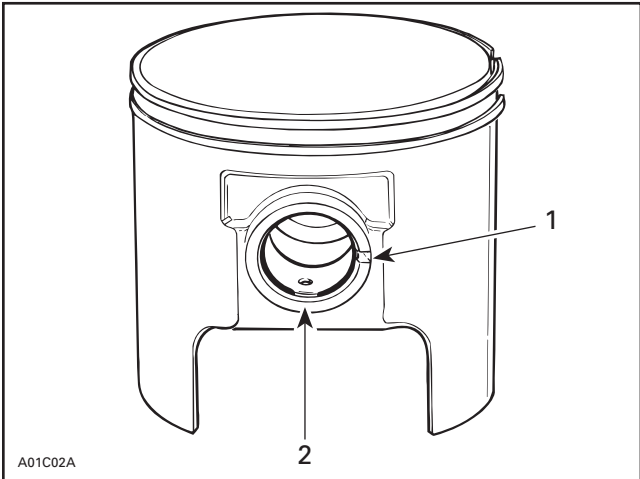
ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

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 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.

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

Install proper ring compressor on piston assembly.

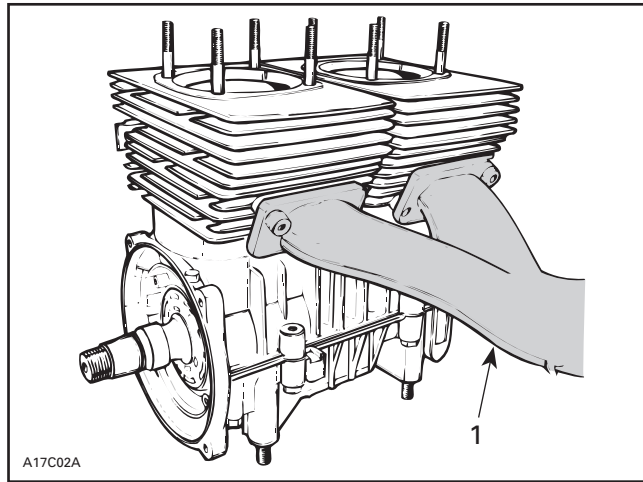
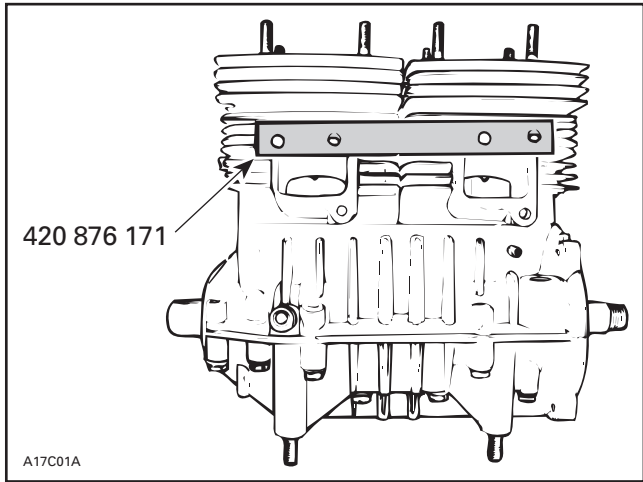
ENGINE TYPE	RING COMPRESSOR P/N
377 and 443	420 876 090
503	420 876 970

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

Check flatness of intake sockets **no. 6**. Refer to ENGINE DIMENSION MEASUREMENT 04-05 and look for **Checking Surface Flatness**.

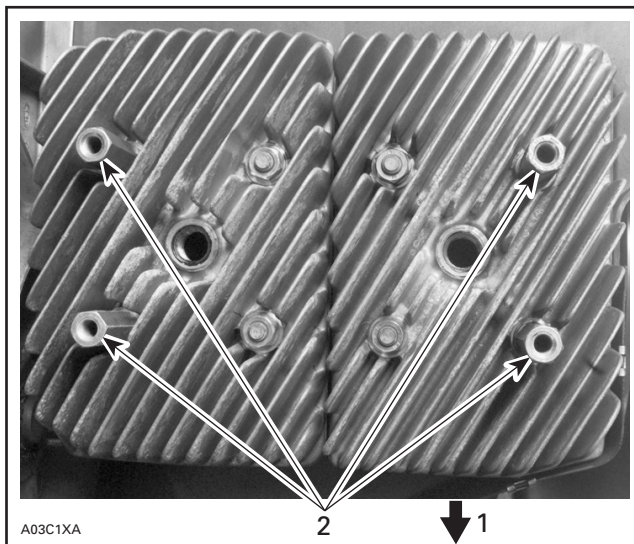
At cylinder **no. 4** and/or cylinder head **no. 3** installation, use aligning tool or exhaust manifold itself to ensure sealing of intake manifold and exhaust before tightening cylinder head nuts.

ENGINE TYPE	ALIGNING TOOL P/N
377, 443 and 503	420 876 171



- 1. Or use exhaust manifold to align cylinders

Position distance nuts **no. 2** as illustrated.



1. Exhaust
2. Distance nuts

Cross torque cylinder head nuts **nos. 1** and **2** to 22 N•m (16 lbf•ft); torque each cylinder head individually.

Install armature plate, fan housing and then air deflector.

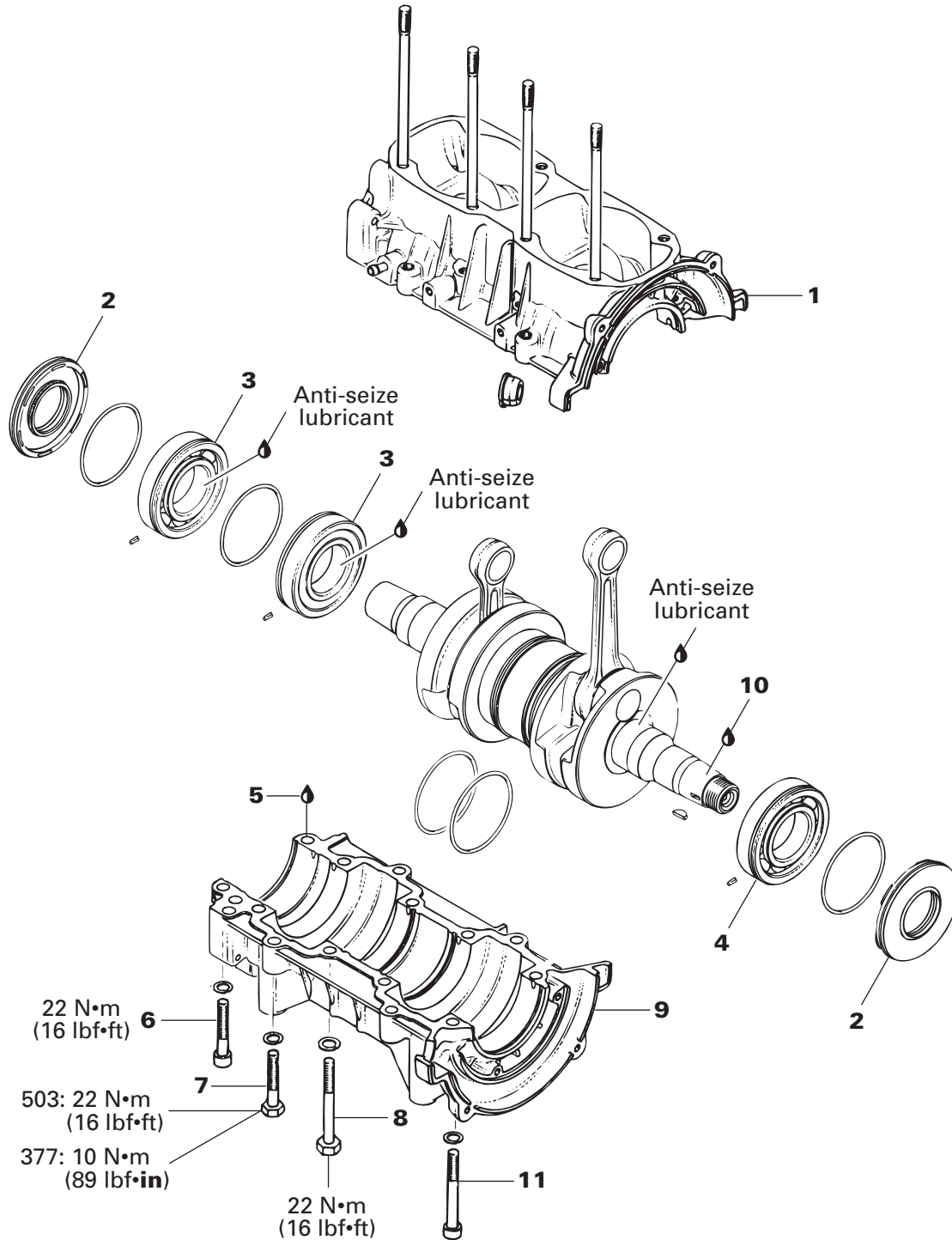
Install a gasket on each side of the air deflector.

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

Section 04 ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

BOTTOM END



A03C1IS

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 gasket remover (P/N 413 708 500) accordingly.

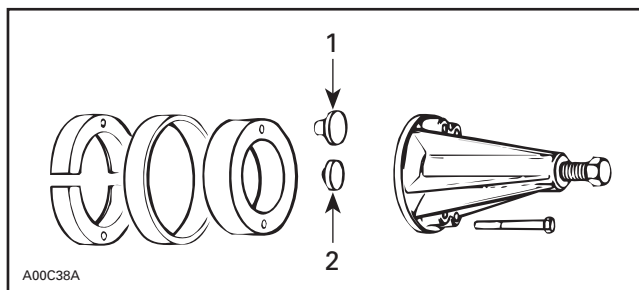
Remove all trace of Loctite 242 from crankshaft taper.

Remove old sealant from crankcase mating surfaces with Bombardier gasket remover (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 bearings nos. 3 and 4 from crankshaft, use a protective cap and a special puller, as illustrated.



1. PTO side
2. MAG side

INSPECTION

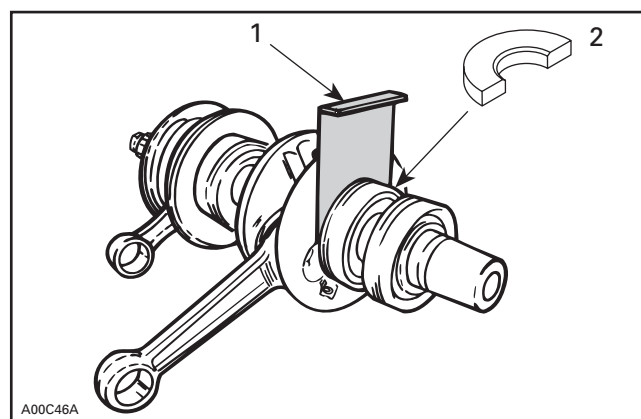
Refer to ENGINE DIMENSIONS MEASUREMENT 04-05.

ASSEMBLY

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

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

Mount second bearing with distance gauge (P/N 420 876 822) for 377 and 443 and (P/N 420 876 824) for 503 for proper positioning.



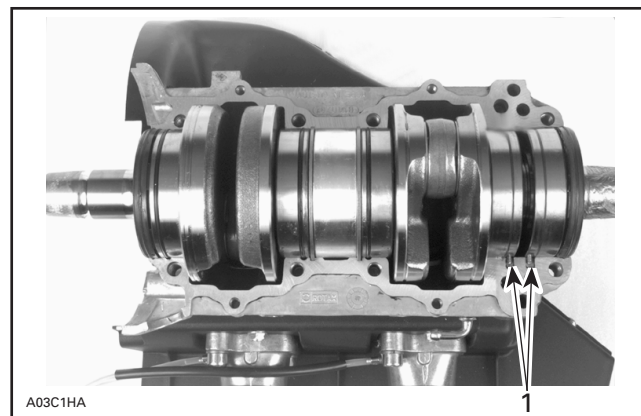
1. Feeler gauge
2. Distance gauge

Prior to installation, place bearings into an oil container filled with oil heated to 75°C (167°F).

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

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. 10 as illustrated.



TYPICAL

1. Drive pins

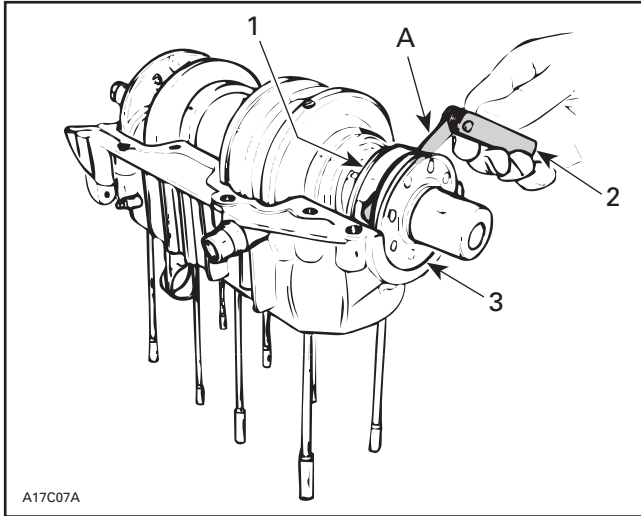
Section 04 ENGINE

Subsection 03 (377, 443 AND 503 ENGINE TYPES)

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 nos. 1 and 9 are factory matched and therefore, are not interchangeable as single halves.

Prior to joining of crankcase halves, spray some new injection oil (or equivalent) on all moving parts of the crankshaft. Spray Primer N (P/N 413 708 100) on one of mating surfaces. Let it dry for 10 to 20 minutes.

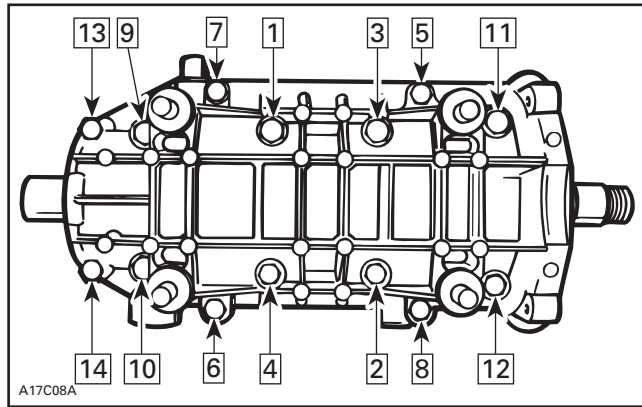
Apply paste gasket (P/N 413 702 700) no. 5 on the other mating surface.

NOTE: Primer N allows Loctite 515 to fully cure on aluminum surfaces. It increases filling capacity and reduce curing time.

Position the crankcase halves together and tighten bolts by hand then install and tighten armature plate on magneto side to correctly align the crankcase halves.

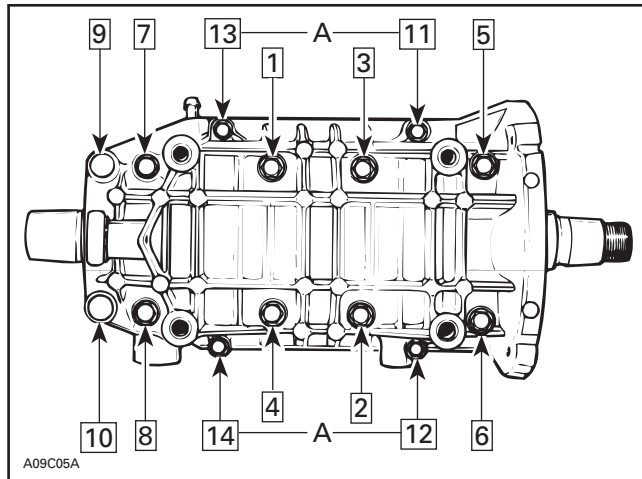
503 Engine Type

Torque screws nos. 6, 7, 8 and 11 to 10 N•m (89 lbf•in) then to 22 N•m (16 lbf•ft) following illustrated sequence.



377 and 443 Engines

Torque screws to proper torque in the following sequence.



- A. 10 N•m (89 lbf•in)
- All the other screws are torqued to 21 N•m (15 lbf•ft)

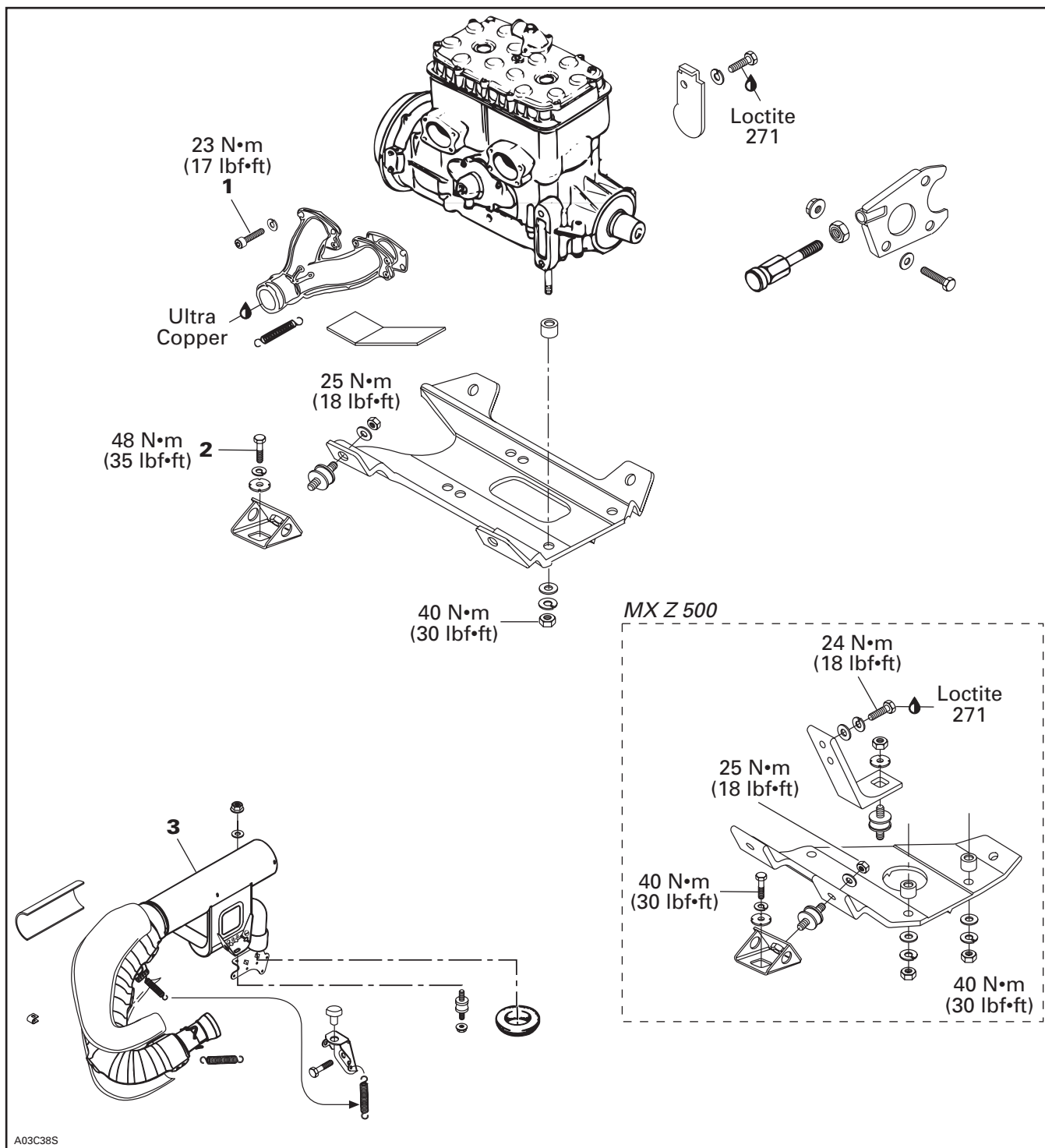
All Engines

To install magneto, refer to CDI MAGNETO 04-06.

494 ENGINE TYPE

ENGINE SUPPORT AND MUFFLER

All Models



Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

REMOVAL FROM VEHICLE

Disconnect or remove the following from vehicle.

- air intake silencer
- belt guard and drive belt
- drive pulley
- carburetors and throttle cable at oil injection pump
- impulse line, oil supply line and rotary valve shaft lubrication hoses then plug all these hoses
- ignition coils and ignition module
- electrical connector housings
- drain the cooling system and disconnect hoses from the engine. Refer to COOLING SYSTEM 04-09
- 4 screws retaining support to frame

ENGINE SUPPORT AND MUFFLER DISASSEMBLY AND ASSEMBLY

1,2, Manifold Screw and Engine Support Screw

Torque the engine support screws to 48 N•m (35 lbf•ft).

Torque the manifold screws to 23 N•m (17 lbf•ft).

INSTALLATION ON VEHICLE

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

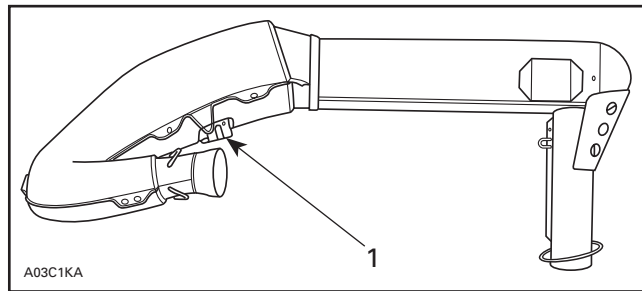
- Check tightness of engine rubber mount nuts. Torque to 25 N•m (18 lbf•ft).
- After throttle cable installation, check carburetor maximum throttle opening and oil injection pump adjustment.
- Check pulley alignment and drive belt tension.

CAUTION: When jetting is different each carburetor is identified by a color dot. Magneto side carburetor has a red dot and PTO side one has a blue dot. Install accordingly.

3, Tuned Muffler

This part is identified on welded support.

Second number sequence of P/N is stamped on part.



TYPICAL

1. Identification

- Should a light exhaust leak be experienced at any ball joints, Ultra Copper (P/N 413 710 300) can be used.

TOP END



Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

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

CLEANING

Discard all gaskets and O-rings.

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

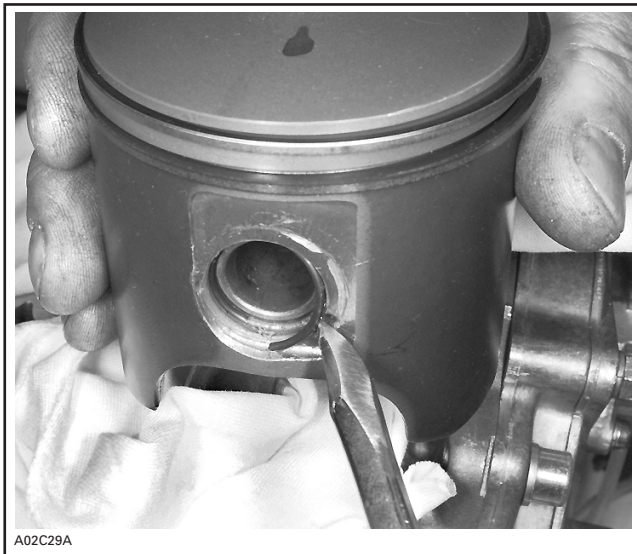
Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

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.

DISASSEMBLY

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase then with a pointed tool inserted in piston notch, remove circlip **no. 20** from piston **no. 21**.



TYPICAL

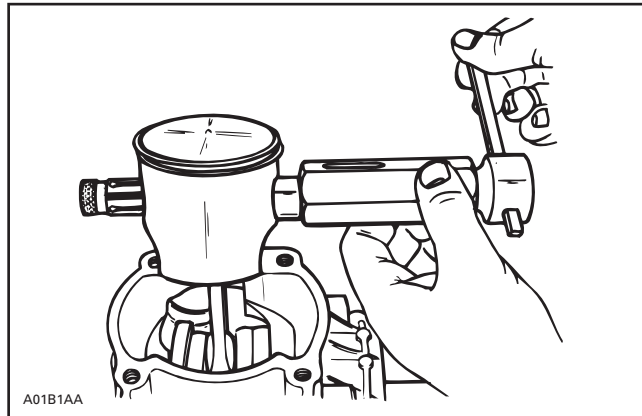
To remove piston pin **no. 19**, use piston pin puller (P/N 529 035 503) as follows:

Fully screw puller handle.

Insert puller end into piston pin.

Screw (LH threads) extracting nut.

Hold puller firmly and rotate puller handle counter-clockwise to pull piston pin.



TYPICAL

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

Remove piston from connecting rod.

RAVE System

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

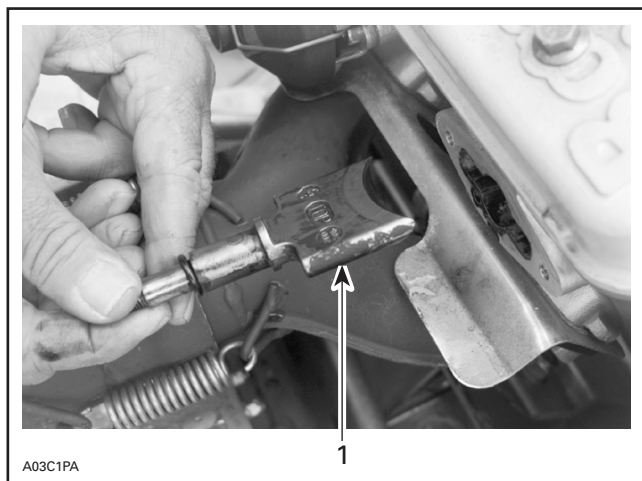
Remove spring clip **no. 3**, cover **no. 5** and spring **no. 6**.

Remove spring **no. 8** and unscrew valve piston **no. 7**.

Spread clamp **no. 10** and remove bellows **no. 9**.

Remove cylindrical screws **no. 11** then valve rod housing **no. 13**.

Pull out exhaust valve **no. 16**.



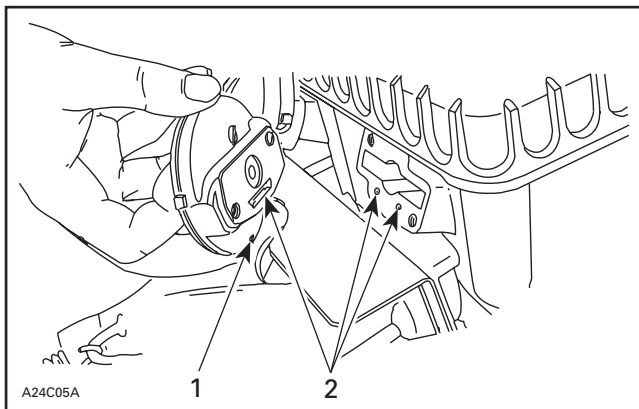
1. Exhaust valve

INSPECTION

Refer to ENGINE DIMENSIONS MEASUREMENT 04-05.

RAVE System

Check valve rod housing and cylinder for clogged passages.



TYPICAL

1. Draining hole
2. Passages

NOTE: Oil dripping from draining hole indicates a loosened clamp or damaged bellows.

Check for cracked, dried or perforated bellows no. 9.

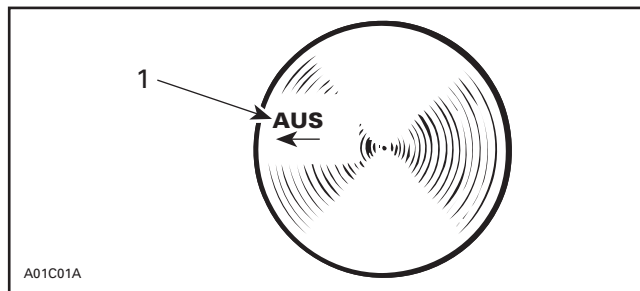
6, Spring

ENGINE TYPE	SPRING P/N	WIRE DIA.	FREE LENGTH	PRELOAD IN N (LBF) AT COMPRESSED LENGTH
		mm (in)	mm (in)	OF 14.7 mm (.579 in)
494	420 239 944	0.9 (.035)	48.5 (1.909)	0.0169 (.00379)

Make sure both springs installed on the engine have same characteristics.

ASSEMBLY

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



1. Exhaust

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

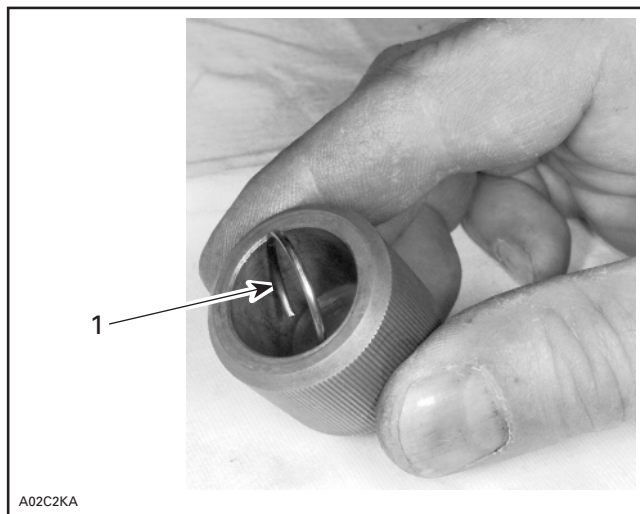


TYPICAL

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 piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



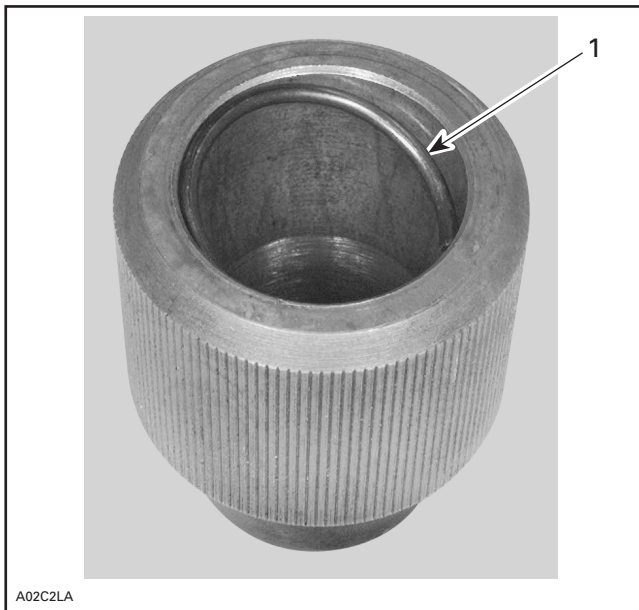
TYPICAL

1. Circlip

Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

Square it up using a finger.



TYPICAL

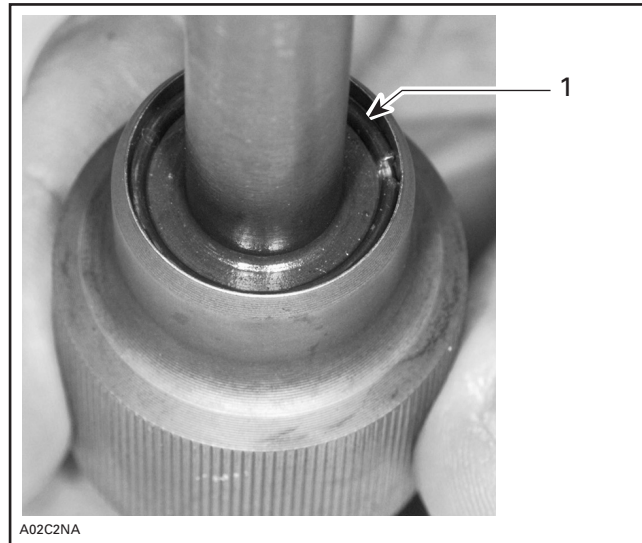
1. Circlip

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



TYPICAL

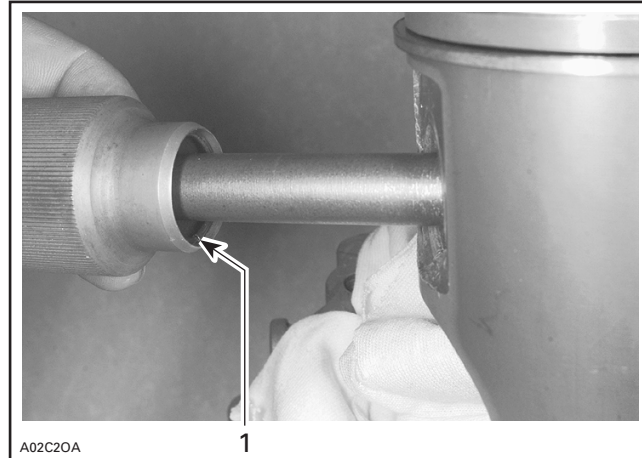
Using square end of tool, push circlip in until it rests in groove.



TYPICAL

1. Circlip in groove

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



TYPICAL

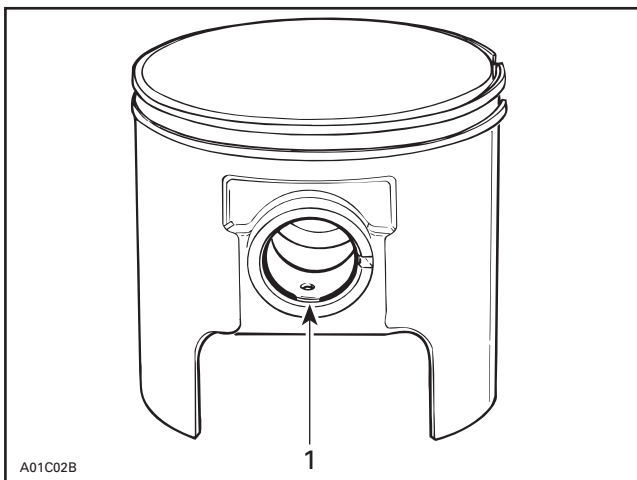
1. Circlip break facing down

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



A02C2PA

TYPICAL



A01C02B

TYPICAL

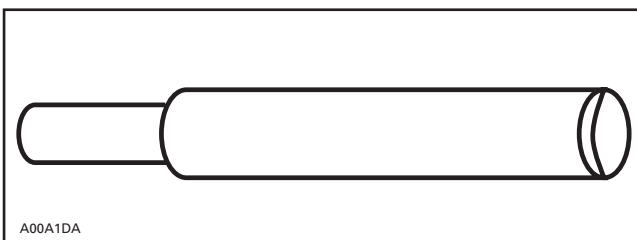
1. Circlip break

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

22, Cylinder

To avoid pinching or cutting of O-ring **no. 18** between cylinder and cylinder head, it is necessary to use a special tool and to proceed as follows:

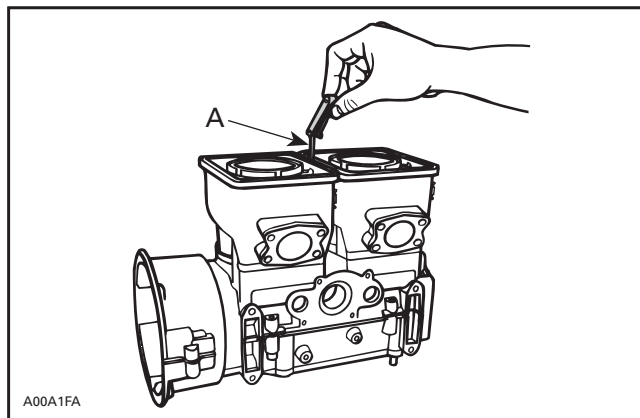
Use aligning pin (P/N 529 018 900).



A00A1DA

NOTE: Neither exhaust manifold nor cylinder aligning tools (flat bars) must be installed on exhaust flanges to perform this procedure.

1. Place a 0.43 mm (.017 in) feeler gauge between cylinders and slide it back and forth to have the good spacing along cylinders.



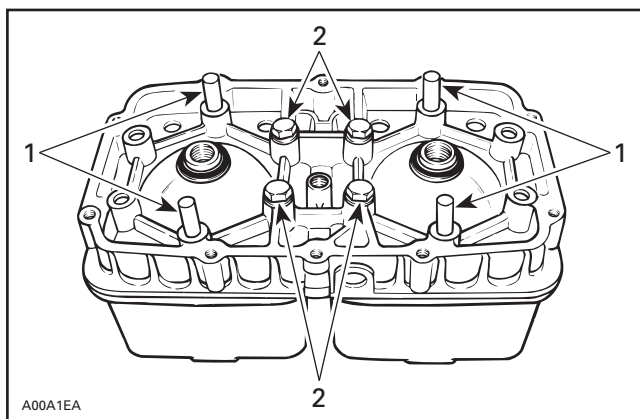
A00A1FA

A. 0.43 mm (.017 in) feeler gauge

2. Apply Loctite 242 to screw threads. Properly torque cylinders screws.
3. Lay down cylinder head and insert aligning pins in holes as shown.

NOTE: If pins can not be inserted in cylinder head holes, enlarge them with a 8.75 mm (11/32 in) drill bit.

4. Install 4 screws in center holes. Torque to 10 N•m (89 lbf•in).



A00A1EA

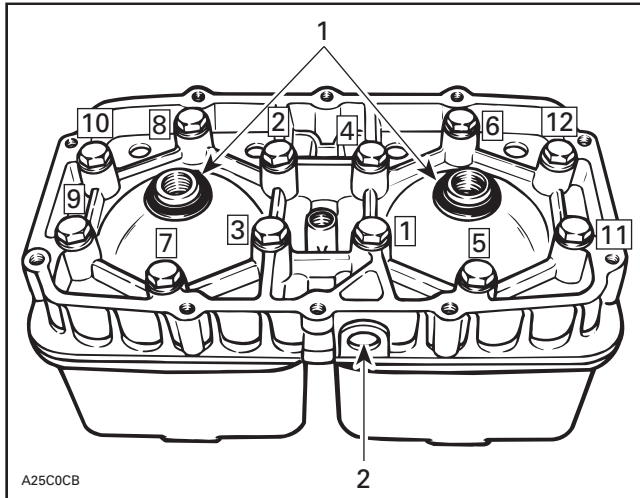
1. Pins
2. Screws

5. Remove pins and install remaining screws.
6. Tighten all screws in the above-recommended sequence and torque as specified.

Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

Position O-rings over cylinders then install cylinder head with its temperature sensor hole on rotary valve side. Install and torque screws to 29 N•m (21 lbf•ft) as per following illustrated sequence. Make sure to install O-rings around spark plug holes.

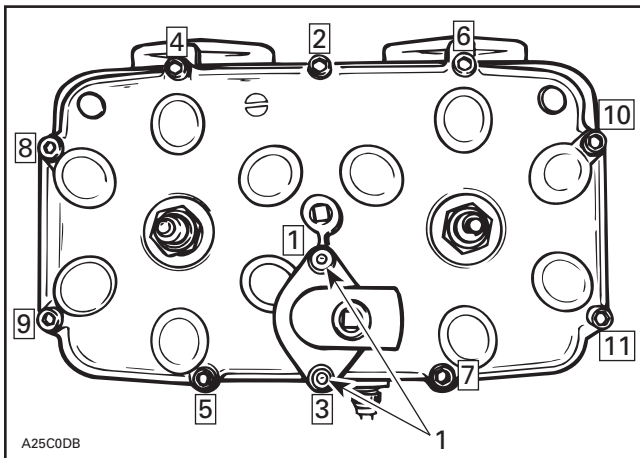


TYPICAL

1. O-rings
2. Temperature sensor hole

1, Screw

Torque cylinder head cover screws to 10 N•m (90 lbf•in) as per following illustrated sequence.



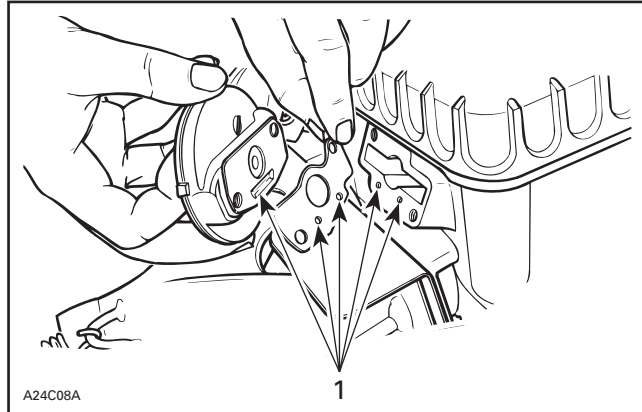
TYPICAL

1. Longer screws

RAVE SYSTEM

Install exhaust valve in cylinder with its mention **TOP** upward (see illustration at removal).

Install gasket and valve rod housing with their passages toward bottom.



1. Passages

Torque socket screws to 10 N•m (90 lbf•in). Check free sliding action of valve.

Install bellows over valve rod housing groove and secure with a clamp.

Screw by hand valve piston on valve rod until it bottoms.

Secure bellows to valve piston with a spring.

Install spring, cover and spring clip. Turn adjustment screw by hand until it bottoms.

Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

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 gasket remover (P/N 413 708 500) accordingly.

Remove all trace of Loctite from crankshaft taper.

Remove old paste gasket from crankcase mating surfaces with gasket remover (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

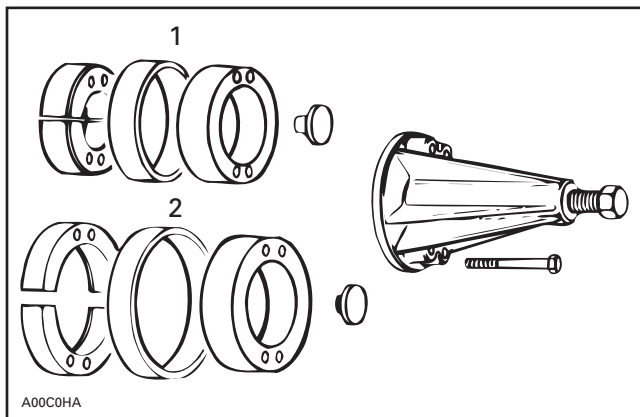
General

To remove drive pulley, refer to DRIVE PULLEY 05-03.

To remove magneto, refer to CDI MAGNETO 04-06.

2,4,6,9, Crankshaft Bearing

To remove bearings from crankshaft, use a protective cap and special puller, as illustrated.



INSPECTION

Refer to ENGINE DIMENSIONS MEASUREMENT 04-05.

ASSEMBLY

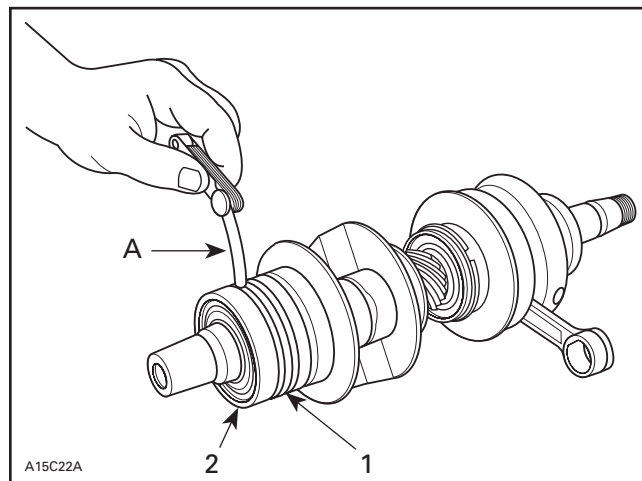
2,4,5,6,9, Crankshaft Bearing and Labyrinth Sleeve

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

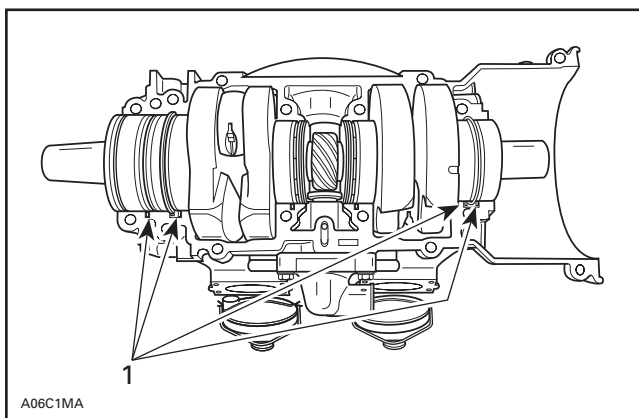
Prior to installation, place bearings into an oil container filled with BOMBARDIER-ROTAX injection oil previously heated to 75°C (167°F).

CAUTION: Do not exceed 75°C (167°F).

This will expand bearing and ease installation. Install bearings and labyrinth sleeve with groove as per the following illustration. Keep a 0.3 mm (.012 in) gap between outer bearing and labyrinth sleeve.



Install bearing drive pins **no. 2** as illustrated.



494 ENGINE — EXHAUST SIDE

1. Drive pins

CAUTION: Make sure drive pins of bearings are on exhaust side of crankcase for proper seating in recesses.

3,7, Seal

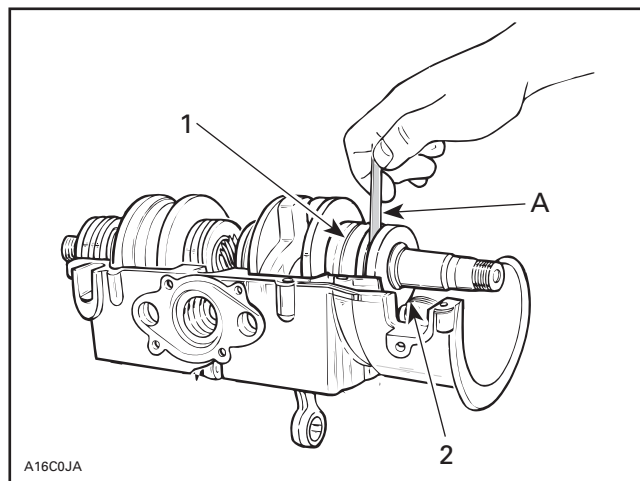
At seal assembly, apply a light coat of Molykote 111 (P/N 413 707 000) on seal lip.

PTO side seal **no. 3** must be filled up with Molykote 111.

CAUTION: Do not overfill seal with Molykote 111. The lubrication hole in crankcase must not be obstructed by Molykote 111.

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 a 1.0 mm (.040 in) gap. For seals with spacing legs, install them against the bearing.



TYPICAL

- 1. Bearing
- 2. Oil seal
- A. 1 mm (.040 in)

1,8, Upper Crankcase and Lower Crankcase

Crankcase halves are factory matched and therefore, are not interchangeable or available as single halves.

Prior to joining of crankcase halves, spray some new injection oil (or equivalent) in bearings and on all moving parts of the crankshaft.

Spray Primer N (P/N 413 708 100) on one of mating surfaces. Let it dry for 10 to 20 minutes.

Apply paste gasket (P/N 413 702 700) **no. 5** on the other mating surface.

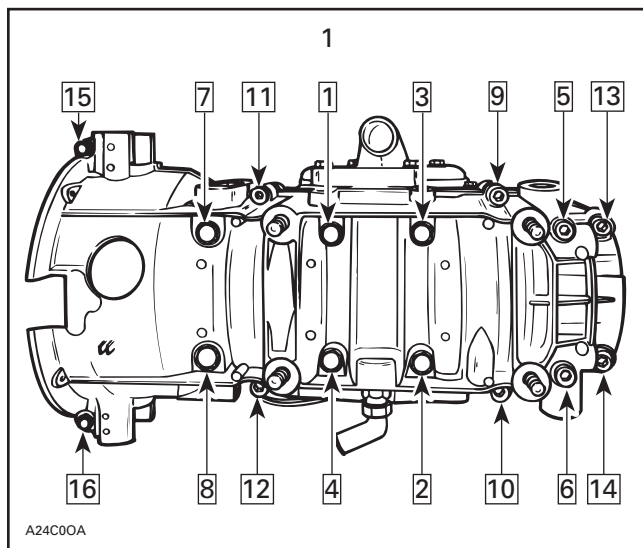
NOTE: Primer N allows Loctite 515 to fully cure on aluminum surfaces. It increases filling capacity and reduces curing time.

CAUTION: Before joining crankcase halves be sure that crankshaft rotary valve gear is well-engaged with rotary valve shaft gear.

Section 04 ENGINE

Subsection 04 (494 ENGINE TYPE)

Position the crankcase halves together and tighten screws by hand then install and tighten armature plate on magneto side to correctly align crankcase halves. Apply Loctite 242 on screw threads and under head. Torque screws as specified following illustrated sequence.



1. Follow sequence shown 1 to 14: Torque to 29 N•m (21 lbf•ft)
15 and 16: Torque to 10 N•m (90 lbf•in)

NOTE: Torque the 2 smaller screws (15 and 16) on magneto side to 10 N•m (90 lbf•in).

Apply pipe sealant (P/N 413 702 300) on threads prior to assembly angular tube no. 11.

At assembly on crankcase, apply Loctite 242 (P/N 413 703 000) on stud threads no. 12.

Torque the crankcase/engine bracket nut no. 13 to 38 N•m (28 lbf•ft).

To install magneto, refer to CDI MAGNETO 04-06.

LEAK TEST AND ENGINE DIMENSION MEASUREMENT

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 crankcase rotary valve gear reservoir/components.

On twin-cylinder engines, each cylinder cannot be verified individually due to leakage from one cylinder to the other through rotary valve (except on engines with separate intake manifolds). Besides, on FC engines, leak will occur through labyrinth sleeve in center of crankshaft.

PREPARATION

1. Remove tuned pipe/muffler and exhaust manifold.
2. Install plugs over exhaust flanges. Tighten with previously removed screws.
3. On engines with RAVE system, remove RAVE valves and install plugs over flanges. Tighten with previously removed screws.
4. Remove carburetor(s).
5. Insert plug(s) in intake rubber boot(s). Tighten with clamps already there.
6. Using a hose pincher(s) (P/N 295 000 076), block impulse hose(s).

NOTE: Do not block large hoses of rotary valve gear lubrication system.

7. Install air pump on any valve of exhaust plug.

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

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

8. Rotate crankshaft so that piston goes to BDC (Bottom Dead Center) on side where the pump is installed. This will open exhaust port.
9. Activate pump and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.
10. Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, check tester kit by spraying a soapy solution on pump piston, 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.

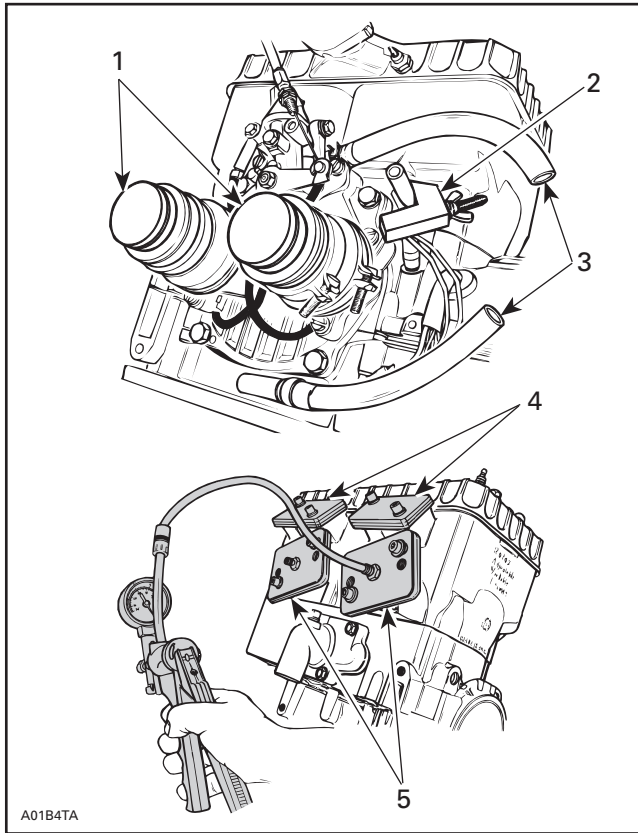
**TEST PRESSURE: 34 kPa (5 PSI)
for 3 minutes**

- 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.

Section 04 ENGINE

Subsection 05 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

Engine



TYPICAL

1. Blocked intake flanges
2. Blocked impulse fitting
3. Open ends (if applicable)
4. Blocked RAVE valve flanges (if applicable)
5. Blocked exhaust flanges

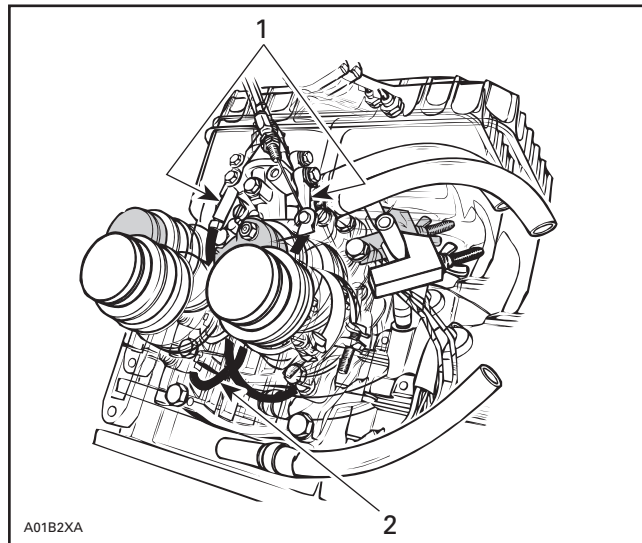
When exhaust manifold is installed, use rubber plug. (In this case it is not necessary to move piston to BDC).



1. Rubber plug

Check the following:

1. All jointed surfaces and screw/stud threads of engine:
 - spark plug base, insulator
 - cylinder head
 - cylinder base
 - crankcase halves (joint)
 - rotary valve cover
 - oil injection pump mounting flange (O-ring, seal)
 - coolant pump housing
 - bleed screws/plugs
2. Small injection oil lines coming from pump.



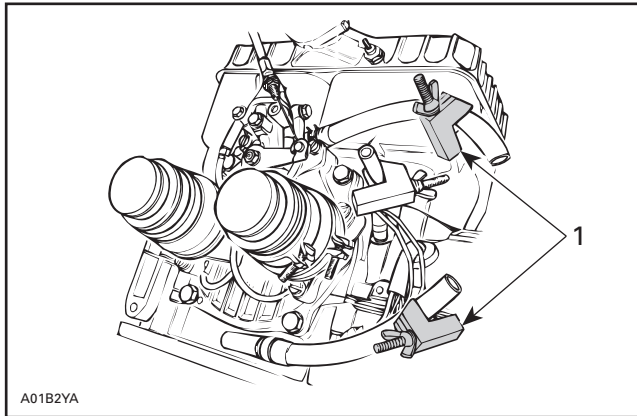
1. Banjo fittings
2. Small injection oil lines

Check for air bubbles or oil column going toward pump. It indicates defective check valve in banjo fitting (or lines).

3. Remove cooling system cap.

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

4. Block both hoses of rotary valve gear lubrication system with hose pinchers.



1. Block both hoses

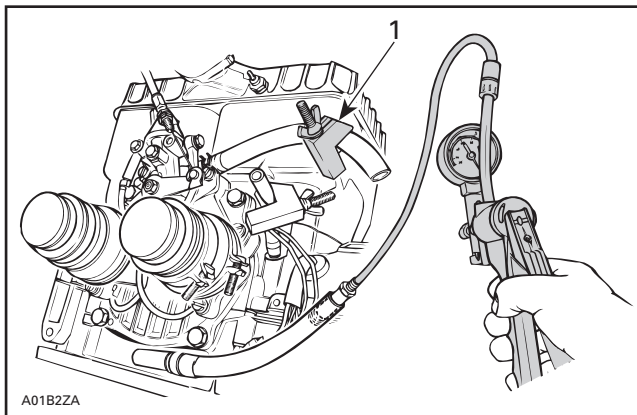
If leakage stops, ignore remaining items and check crankcase rotary valve gear reservoir as per **Crankcase Rotary Valve Gear Reservoir** of this section.

5. Remove drive pulley then check crankshaft outer seal.
6. Remove rewind starter and magneto system then check crankshaft outer seal.
7. Check crankcase rotary valve gear reservoir.

Crankcase Rotary Valve Gear Reservoir

Block one hose of rotary valve gear lubrication system with a hose pincher and install an adapter in remaining hose.

Install air pump on adapter and pressurize as before.



1. Blocked hose

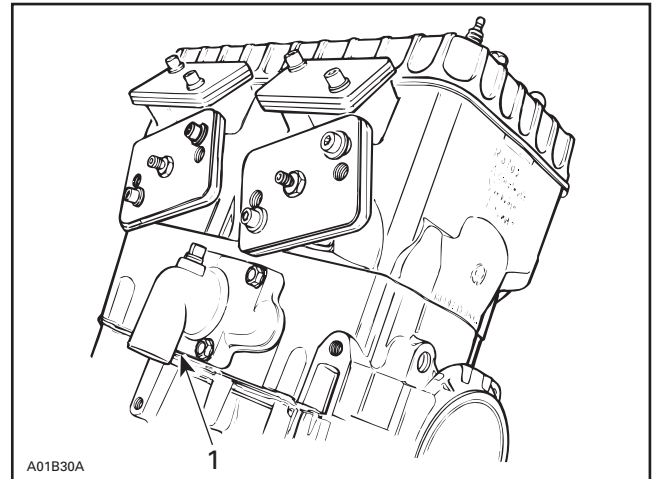
1. Remove a spark plug or any plug of leak tester kit on PTO side.

If pressure drops, it indicates defective crankshaft inner seal on PTO side.

2. Remove a spark plug or any plug of leak tester kit on MAG side.

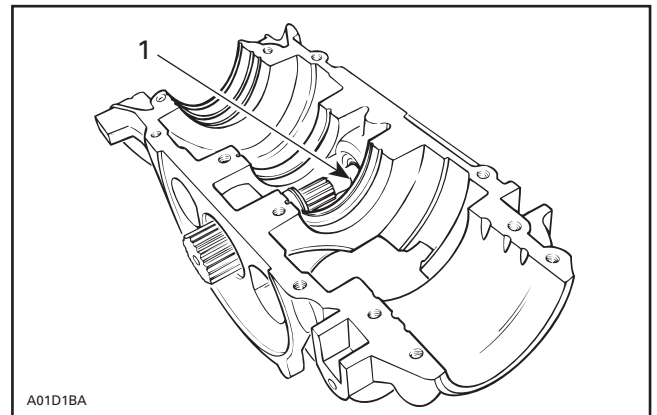
If pressure drops, it indicates defective crankshaft inner seal on MAG side.

3. Check drain hole below coolant pump housing with soapy water.



1. Drain hole

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

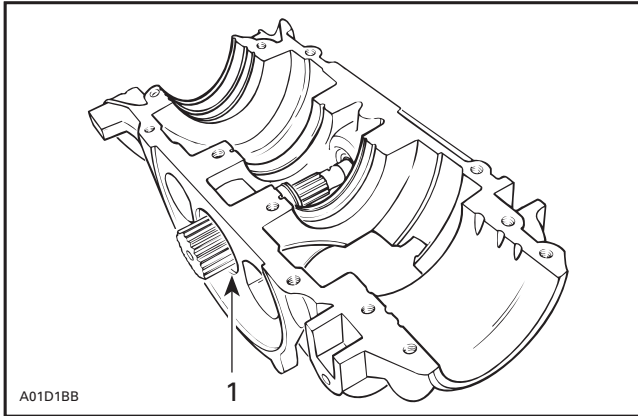


1. Oil seal

Section 04 ENGINE

Subsection 05 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

4. Remove rotary valve cover and check for leak of rotary valve seal with soapy water.



1. *Seal*

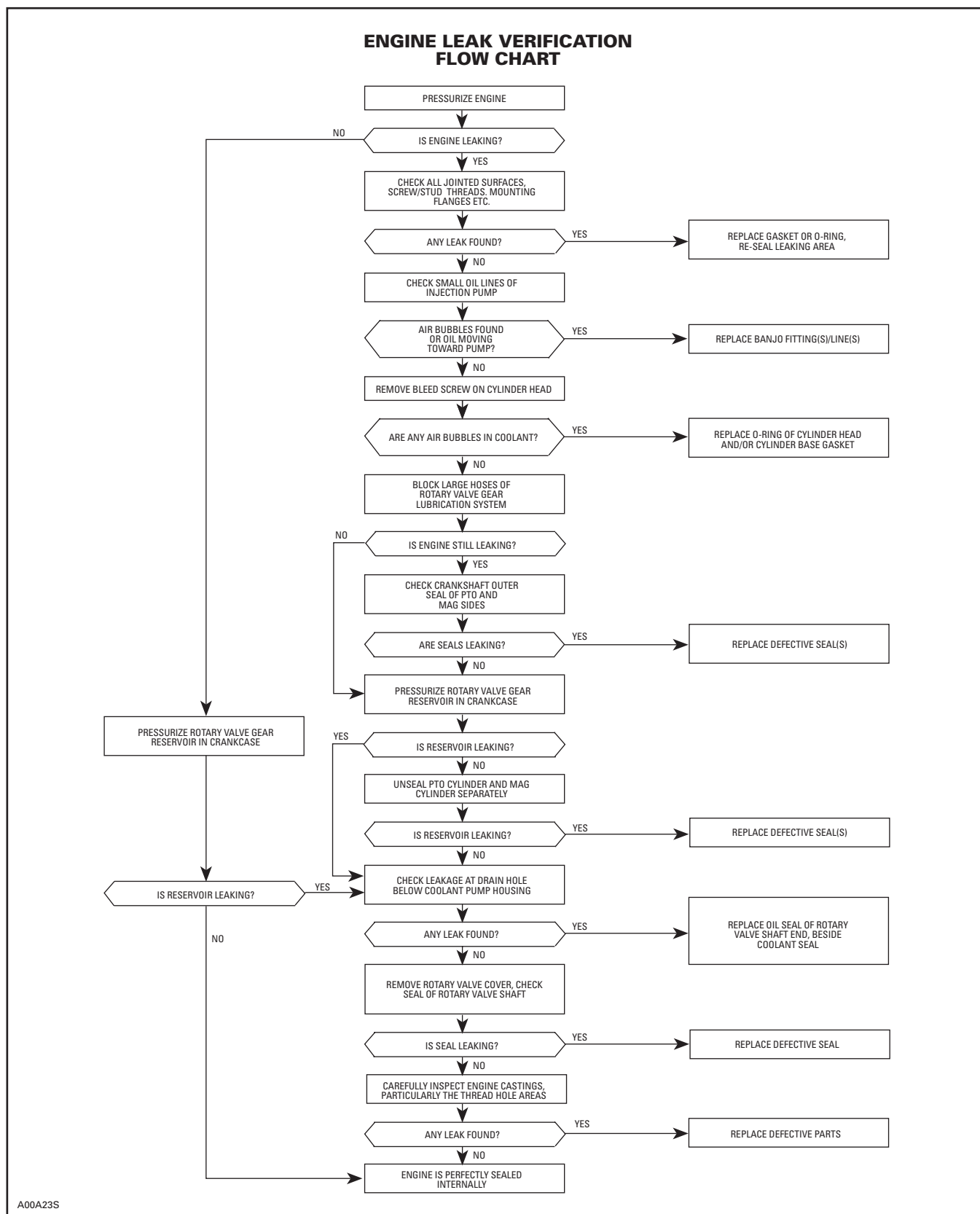
5. If leak still persists, it indicates a defective casting somewhere in engine.

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)

CYLINDER TAPER

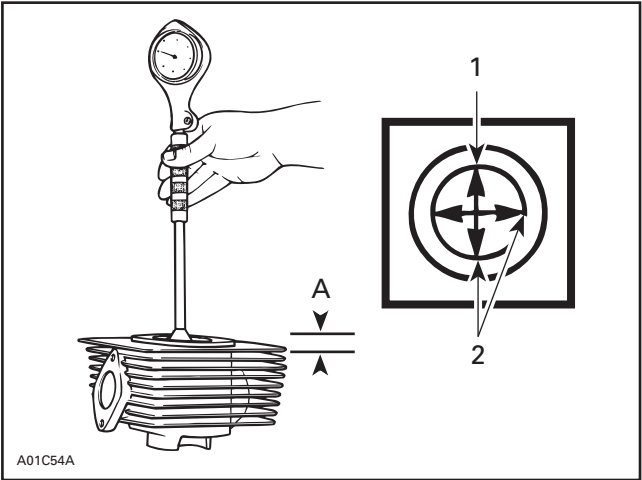
ENGINE TYPE	MAXIMUM
All	0.10 mm (.004 in)

Compare cylinder diameter 16 mm (5/8 in) from top of cylinder to just below its intake port area.

On rotary valve engines, measure just below auxiliary transfer port, facing exhaust port. If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced.

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

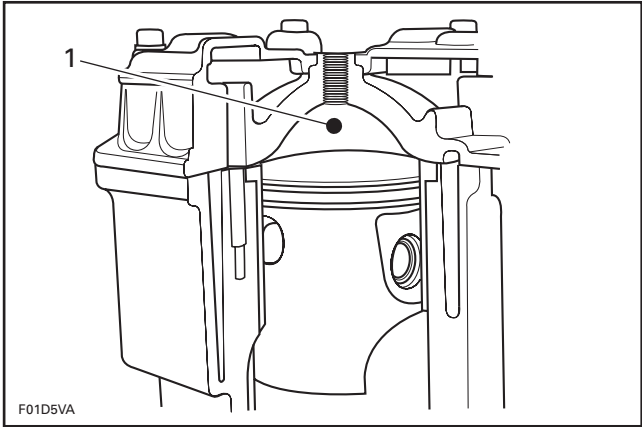
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



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

COMBUSTION CHAMBER VOLUME MEASUREMENT

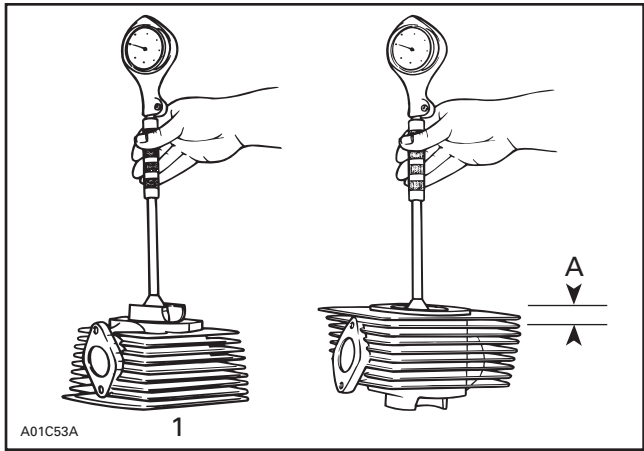
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



- 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.

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

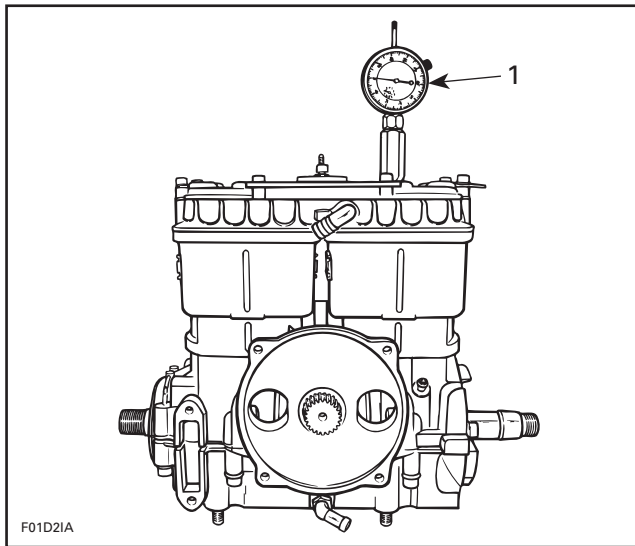


- 1. Below the intake port
- A. 16 mm (5/8 in) from top

CYLINDER OUT OF ROUND

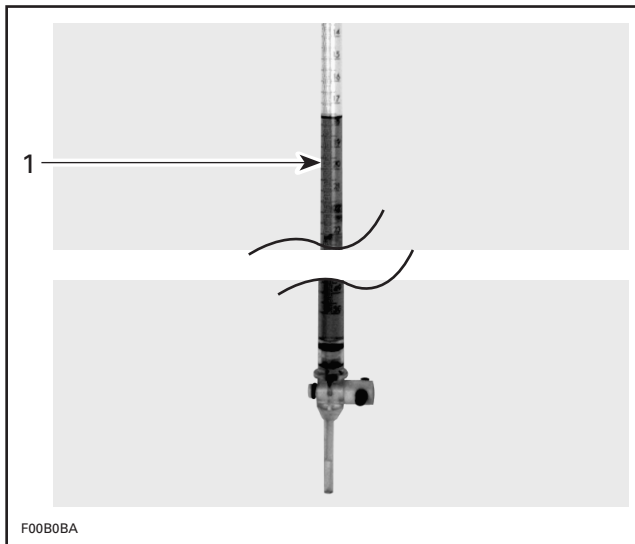
ENGINE TYPE	MAXIMUM
All	0.05 mm (.002 in)

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.



1. Bring piston to TDC

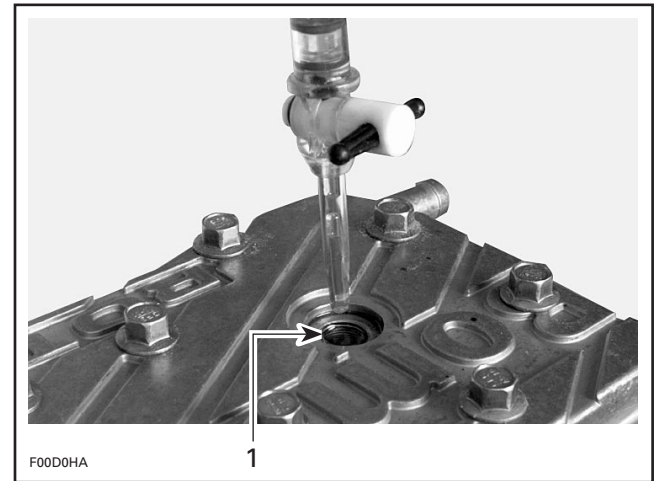
- Obtain a graduated burette (capacity 0-50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0-50 cc)

- Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.

- Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



TYPICAL

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 tip.

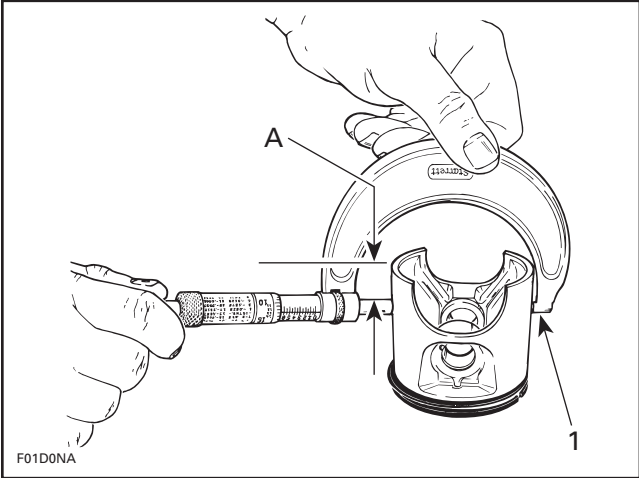
- Repeat the procedure for the other cylinder.

ENGINE TYPE	COMBUSTION CHAMBER VOLUME (cc) (up to top thread of spark plug hole)
443	24.1 ± 1.0
494	25.0 ± 1.0
503	27.6 ± 1.0

If the measured volume is out of specifications install genuine parts.

USED PISTON MEASUREMENT

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



1. Measuring perpendicularly (90°) to piston pin axis
A. See table below

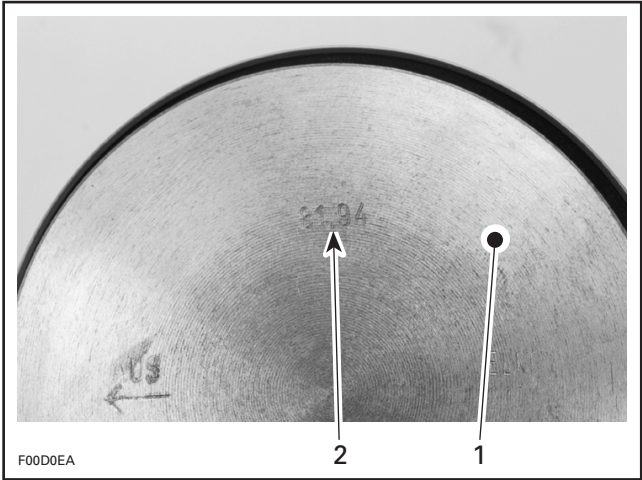
ENGINE TYPE	DIMENSION A mm (in)
443	20.8 (.82)
494	30 (1.18)
503	18 (.71)

The measured dimension should be the same as the one scribed on piston dome. If not, install a new piston.

CYLINDER/PISTON CLEARANCE

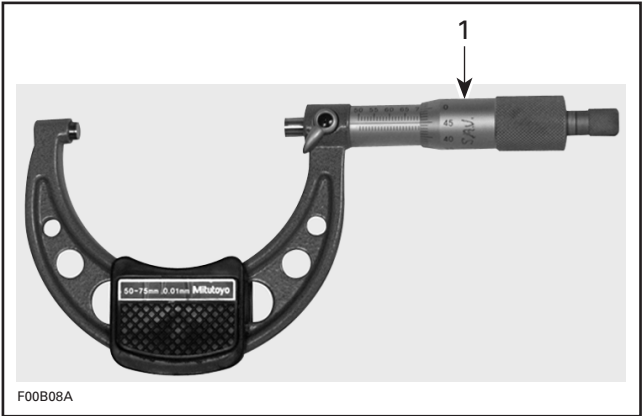
Used and New Pistons

NOTE: Make sure used piston is not worn. See USED PISTON MEASUREMENT above.
Take the measurement on the piston dome.



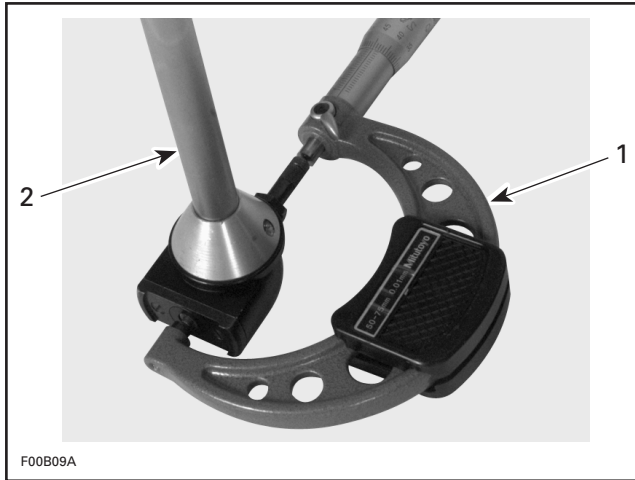
1. Piston dome
2. Piston measurement

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

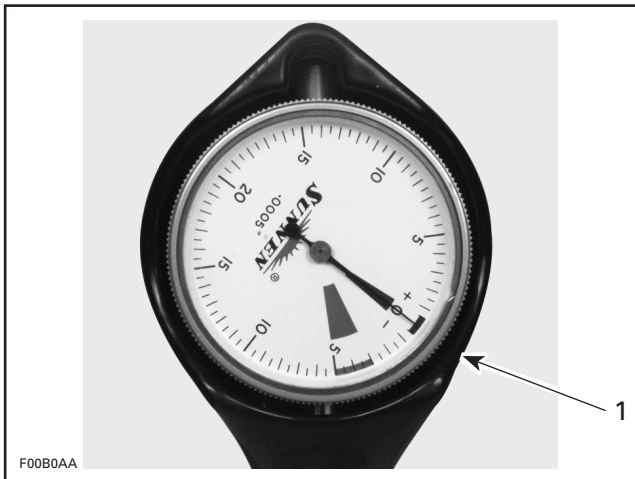


1. Micrometer set to the piston dimension

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

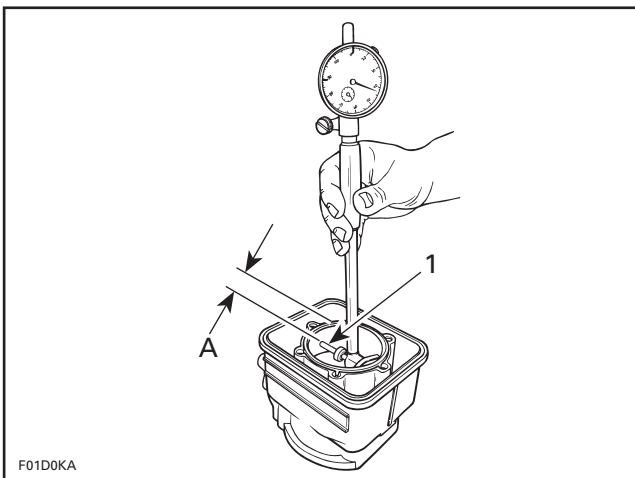


1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0

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



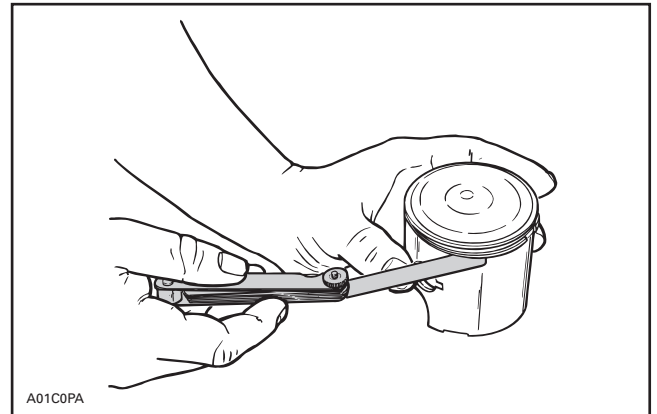
1. Measuring perpendicularly (90°) to piston pin axis
- A. 16 mm (5/8 in)

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 10.

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance. Refer to TECHNICAL DATA 10-02.



RING END GAP

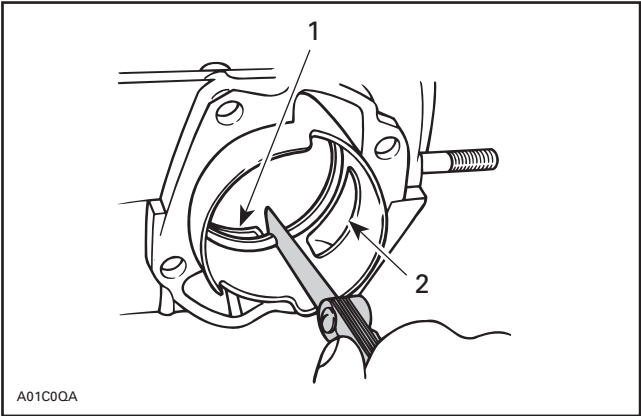
Position ring half-way between transfer ports and intake port. On rotary valve engines, position ring just below transfer ports.

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 10-02.

Section 04 ENGINE

Subsection 05 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

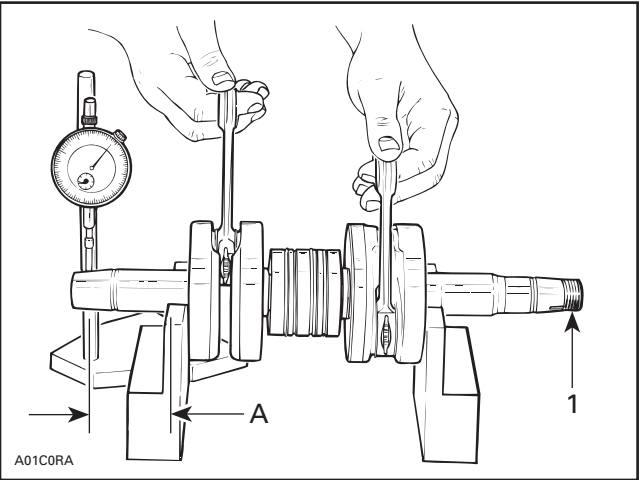
Crankshaft deflection is measured with a dial indicator.

Measuring (in engine)

First, check deflection with crankshaft in engine. If deflection exceeds the specified tolerance, re-check 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. See table below

Crankshaft Deflection on PTO Side

ENGINE TYPE	DISTANCE A mm (in)	MAXIMUM ON PTO SIDE mm (in)
443	75.5 (2.972)	0.06 (.002)
494	86 (3.386)	
503	82.5 (3.248)	

Crankshaft Deflection on MAG Side

ENGINE TYPE	MAXIMUM ON MAG SIDE mm (in)
All	0.03 (.001)

Crankshaft Deflection in Center of Crankshaft

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

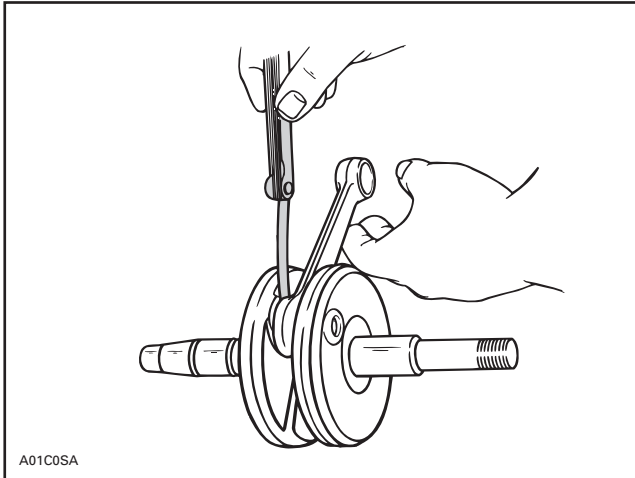
NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

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

CONNECTING ROD BIG END
AXIAL PLAY

ENGINE TYPE	NEW PARTS MIN. - MAX.	WEAR LIMIT
443 and 503	0.20 - 0.53 mm (.008 - .021 in)	1.00 mm (.039 in)
494	0.40 - 0.75 mm (.016 - .029 in)	1.20 mm (.047 in)

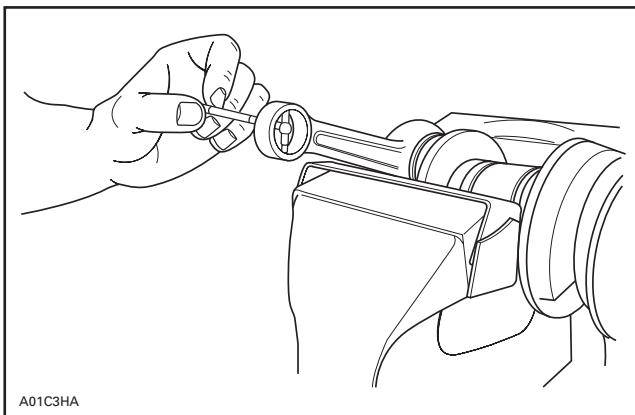
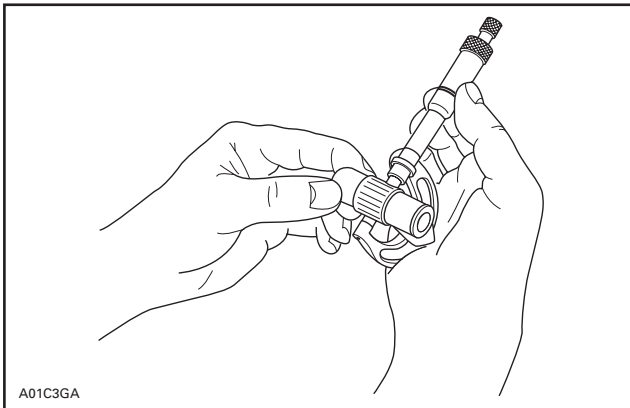
Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.



TYPICAL

CONNECTING ROD/PISTON PIN CLEARANCE

Measure piston pin with its needle bearing. Compare to inside diameter of connecting rod.



When worn out these needle bearings are noisy.

ENGINE TYPE	NEW PARTS MIN. - MAX.	WEAR LIMIT
All	0.03 - 0.012 mm (.0001 - .0005 in)	0.015 mm (.0006 in)

CONNECTING ROD/CRANKPIN CLEARANCE

ENGINE TYPE	NEW PARTS MIN. - MAX.	WEAR LIMIT
443 and 503	0.020 - 0.033 mm (.0008 - .0013 in)	0.05 mm (.0020 in)
494	0.038 - 0.050 mm (.0015 - .0020 in)	0.06 mm (.0024 in)

CRANKSHAFT END-PLAY

All Engine Types

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

CRANKCASE/ROTARY VALVE GAP

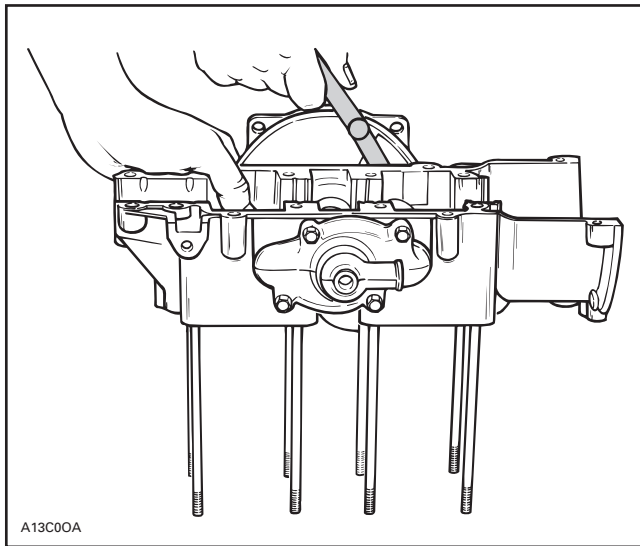
ENGINE TYPE	MINIMUM	MAXIMUM
494	0.27 mm (0.011 in)	0.40 mm (0.016 in)

First Method

To measure this gap use a feeler gauge inserted between rotary valve and upper crankcase with the rotary valve cover in place **without its O-ring**. Check the most surface as possible. Follow the same procedure with the lower crankcase.

Section 04 ENGINE

Subsection 05 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)



TYPICAL

The gap can be measured with the engine installed on vehicle. Use 45° bent blade feeler gauge (Snap-on FB300A) inserted through intake socket of valve cover.

If gap is under tolerances, rotary valve cover can be refaced to increase clearance.

If gap is over tolerances, cover replacement may be necessary. Check if surfaces on crankcase halves are damaged, replacement wear plate is available.

Second Method

Remove rotary valve cover and its O-ring.

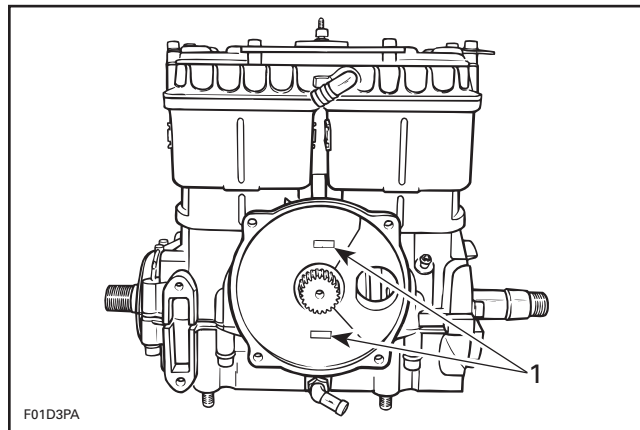
Use the following type of solder:

- resin core
- diameter: 0.5 mm (.020 in)
- electronic application
(available at electronic stores)

Install 2 short pieces (13 mm (1/2 in) long) of solder directly on rotary valve, one above and one below rotary valve gear. Apply grease to hold solder in position.

Reinstall cover in place WITHOUT its O-ring and torque screws to 20 N•m (15 lbf•ft).

Remove cover then clean and measure compressed solder thickness, it must be within the specified tolerance.



TYPICAL

1. Solder

CHECKING SURFACE FLATNESS

Intake manifold, intake manifold cover, rotary valve 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.

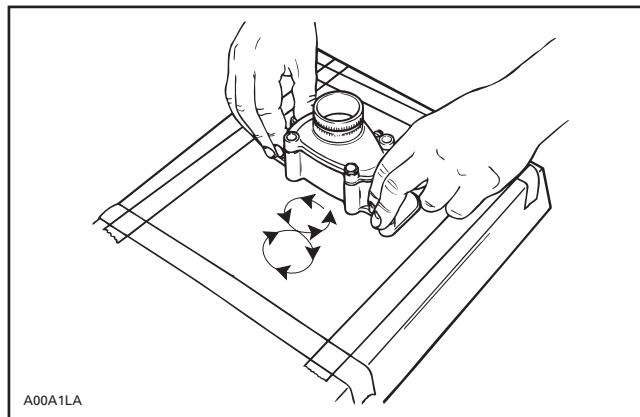
If any play is felt, part must be rectified.

RECTIFYING SURFACES

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

Rub manifold 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.

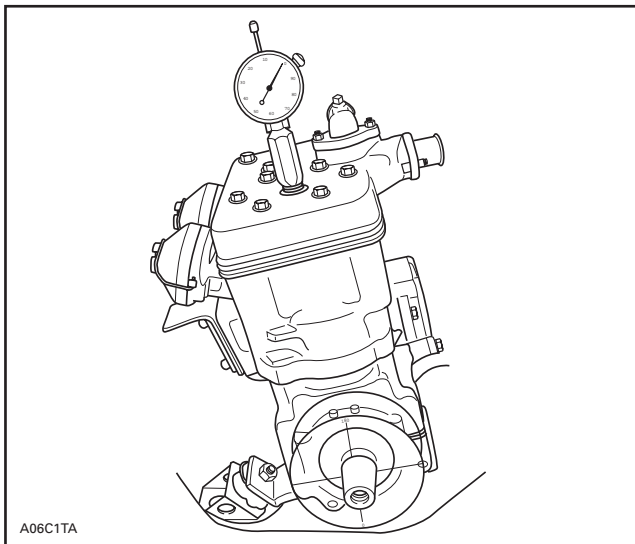
Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.

Bring MAG piston at top dead center.

Rotate degree wheel (not crankshaft) so that 360° mark aligns with center of crankcase. Scribe a mark on crankcase.

Remove TDC gauge and install it on PTO side.

Bring PTO piston to top dead center.



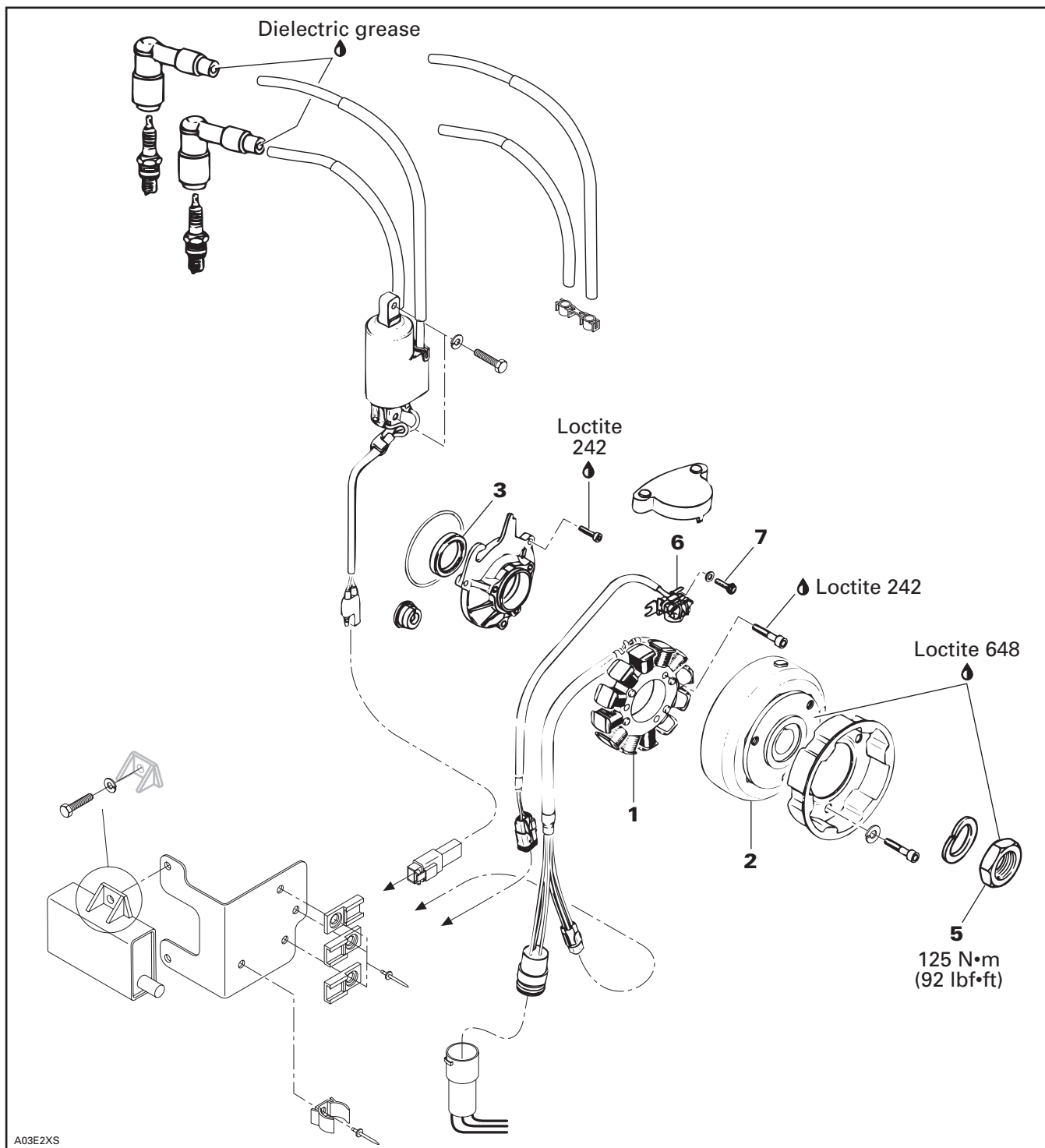
Interval between cylinders must be exactly 180°.

Any other reading indicates a misaligned (twisted) crankshaft.

CDI SYSTEM

NIPPONDENSO TRIGGER COIL IGNITION SYSTEM

494 Engine



Section 04 ENGINE

Subsection 06 (CDI SYSTEM)

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

CDI means Capacitor Discharge Ignition system.

CLEANING

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

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

DISASSEMBLY

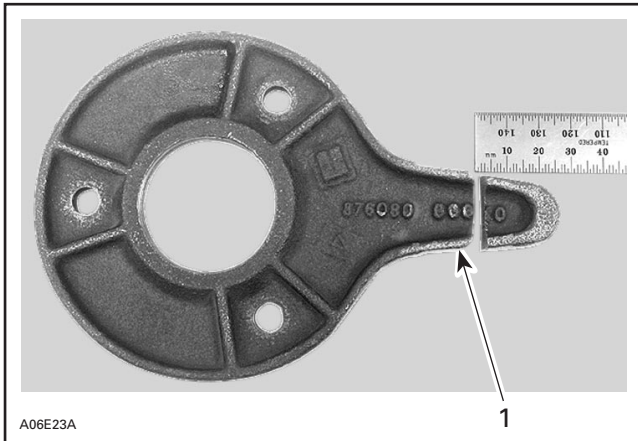
2,5, Magneto and Magneto Flywheel Nut

To gain access to magneto assembly, remove the following parts as needed on different engines:

- muffler
- rewind starter
- starting pulley

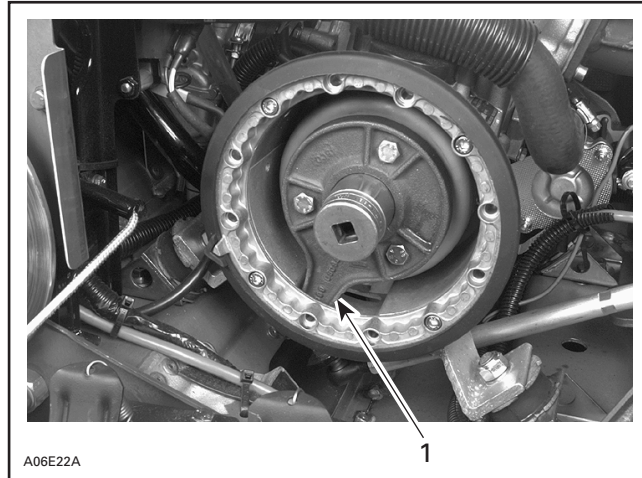
To remove magneto flywheel retaining nut:

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



1. Cut by 25 mm (1 in)

Install puller with its tab in magneto housing opening.



TYPICAL

1. Tab in magneto housing opening

- 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 it is first necessary to tap on the fastener to break threadlocker bond. This will eliminate the possibility of thread breakage.

To remove magneto flywheel, install the puller (P/N 529 022 500).

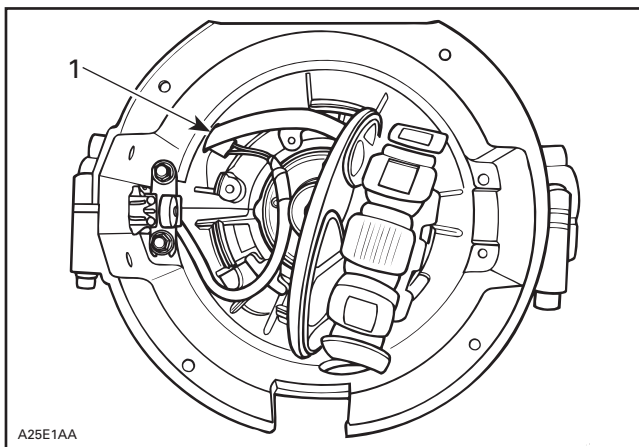
- Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.

6,7, Trigger Coil and Screw

Magneto and stator plate must be removed before trigger coil removal.

To replace trigger coil:

- Disconnect trigger coil connector housing.
- Remove grommet from crankcase where trigger coil wire exits magneto housing.
- Remove retaining screws.
- Remove trigger coil and carefully pull wires.
- Thread magneto harness through crankcase hole before trigger coil harness.



1. Magneto harness through crankcase hole

- Install new trigger coil and other parts removed.

PRELIMINARY ADJUSTMENT

NOTE: The final trigger coil adjustment will be done when checking ignition timing.

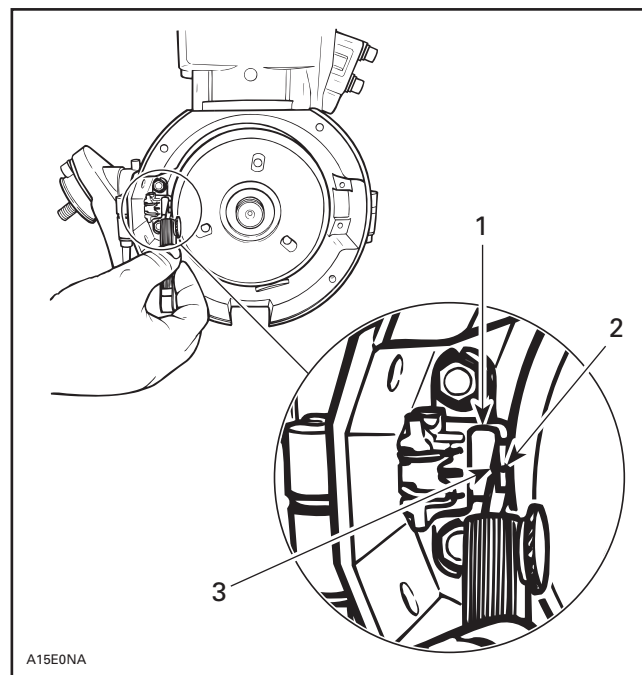
Whenever the trigger coil or the magneto flywheel is removed or replaced, the air gap between the trigger coil and the flywheel protrusion must be checked and adjusted. The purpose of this adjustment is to obtain the minimum clearance between these parts — without touching at any RPM — so that the trigger coil produces its proper electrical output. Ignition timing must also be checked. Refer to IGNITION TIMING 06-02 then look for **Checking Ignition Timing**.

CAUTION: Each time trigger coil air gap is adjusted, ignition timing must be checked.

Proceed as follows:

1. Rotate flywheel so that the protrusion aligns with trigger coil.
2. Using a feeler gauge of 0.75 mm (.030 in) thick (allowable range is 0.55 mm (.022 in) to 1.45 mm (.057 in)), check air gap between center pole of trigger coil and flywheel protrusion.

3. If necessary, adjust by loosening retaining screws and moving trigger coil toward or away of protrusion.
4. Retighten screws and recheck air gap.



PRELIMINARY TRIGGER COIL AIR GAP ADJUSTMENT

1. Trigger coil
2. Flywheel protrusion
3. Measure at center pole of trigger coil 0.75 mm (.030 in)

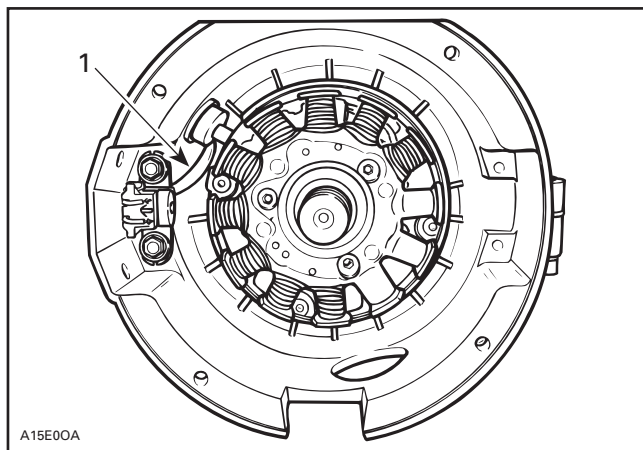
1, Stator

To replace stator:

- Disconnect the 3-wire connector (BLACK, RED and BLACK/RED wires).
- Disconnect both YELLOW wires.
- Remove grommet from crankcase where magneto harness exits magneto housing.
- Remove stator plate retaining screws.
- Remove stator plate with stator and carefully pull wires.
- Install new parts and other parts removed taking care not to squeeze trigger coil harness.

Section 04 ENGINE

Subsection 06 (CDI SYSTEM)



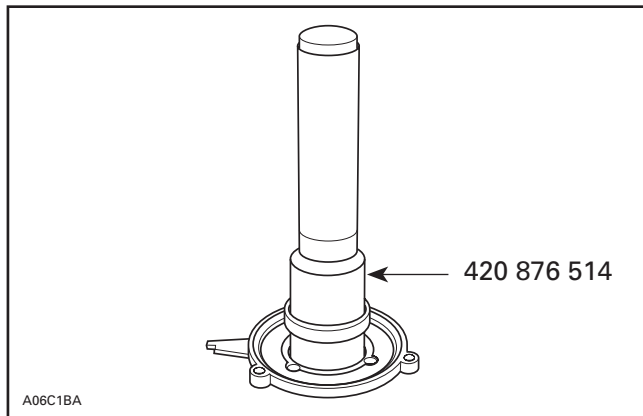
1. Trigger coil harness

ASSEMBLY

3, Oil Seal

Use pusher (P/N 420 876 514) to install oil seal into stator.

CAUTION: Make sure oil seal is fully pushed against stator shoulder.



2,5, Magneto Flywheel and Nut

Clean crankshaft extension (taper) and apply Loctite 242 (blue) on taper, then position Woodruff key, flywheel and lock washer on crankshaft.

Clean nut threads and apply Loctite 242 (blue) then tighten nut to 125 N•m (92 lbf•ft).

At reassembly coat all electric connections with silicone dielectric grease (P/N 413 701 700) to prevent corrosion or moisture penetration.

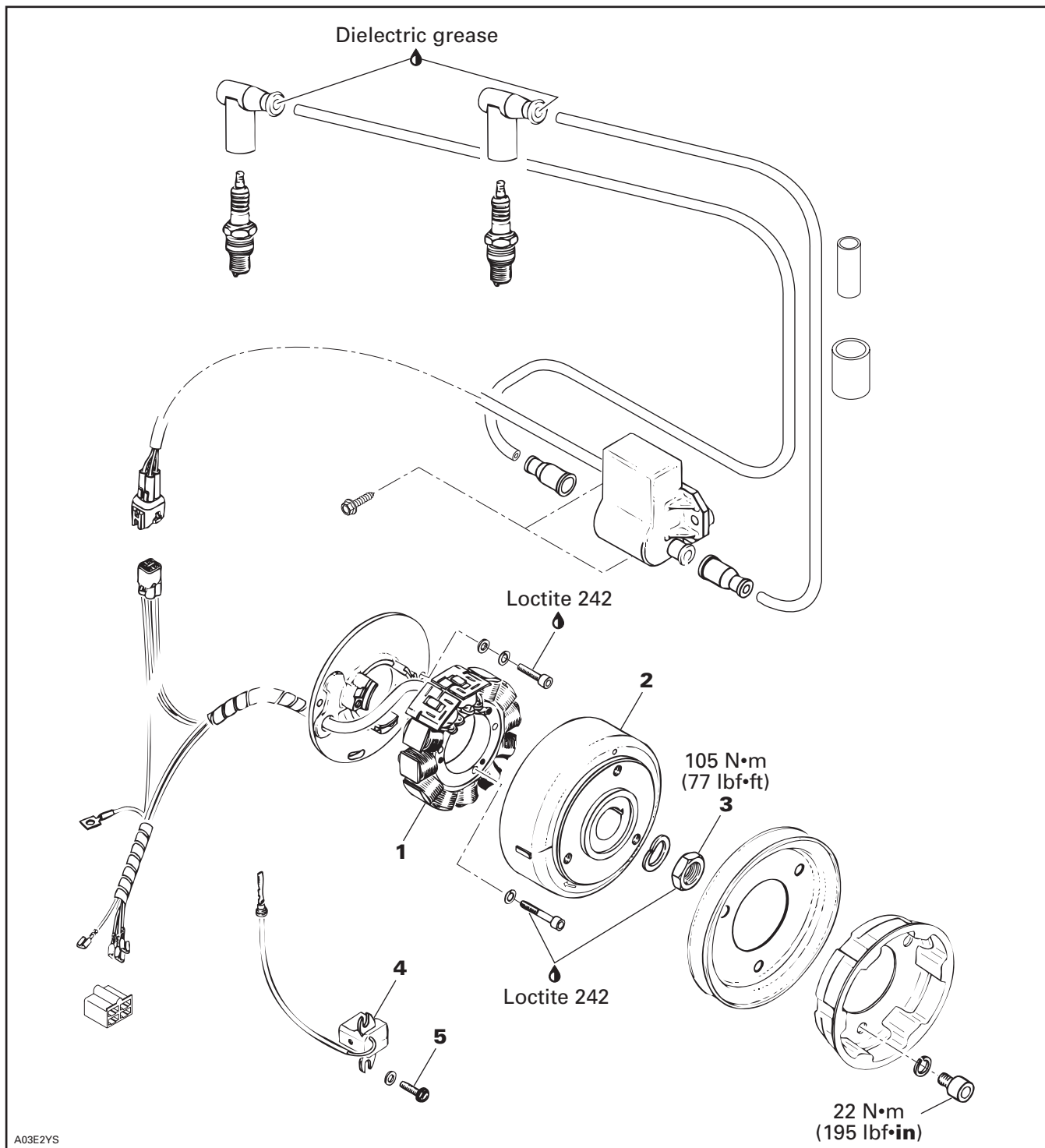
CAUTION: Do not use silicone "sealant", this product will corrode contacts.

Ignition Timing

Check as described in IGNITION TIMING 06-02.

DUCATI IGNITION SYSTEM

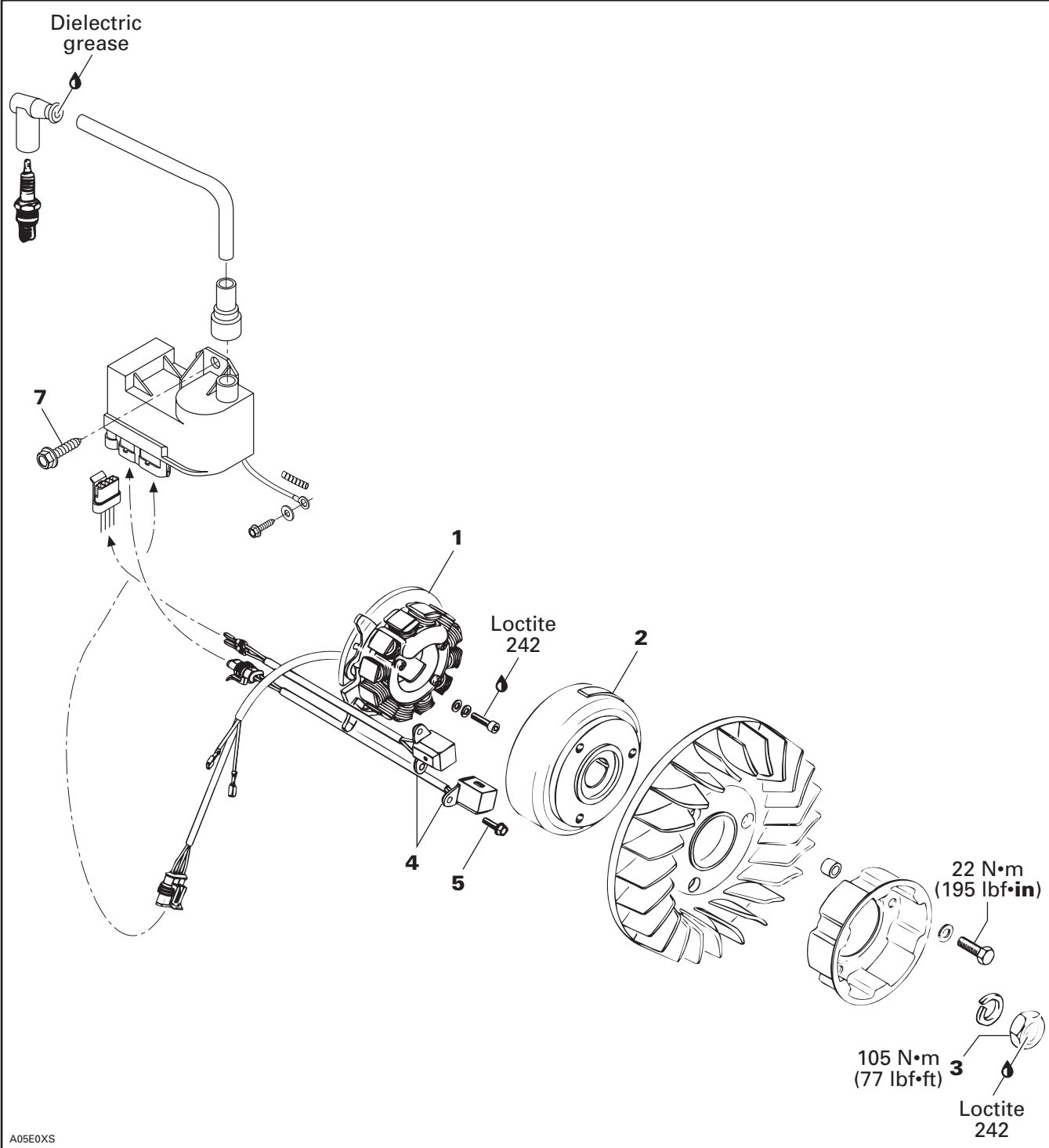
Formula S, MX Z 440 and Skandic WT/SWT



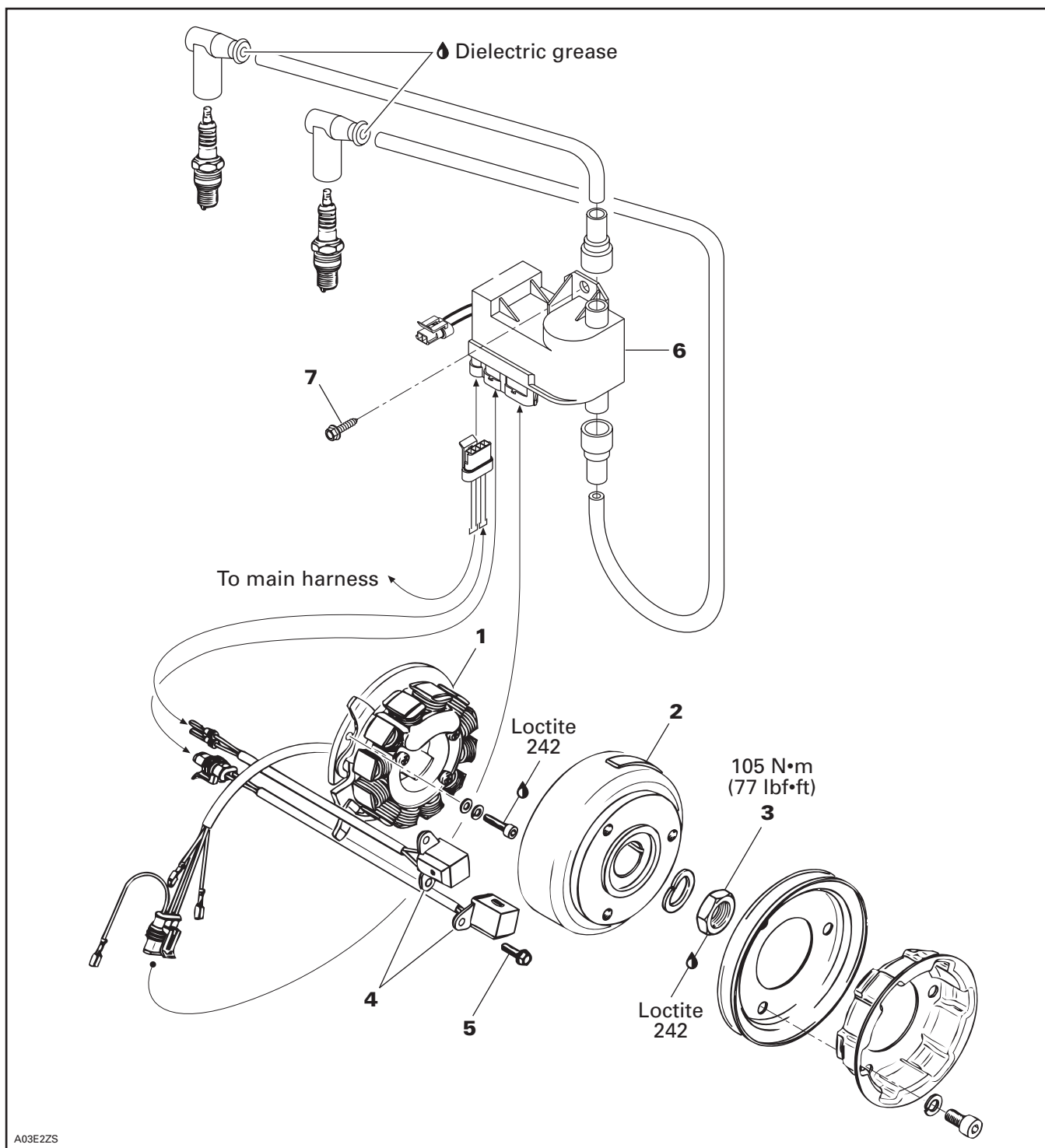
Section 04 ENGINE

Subsection 06 (CDI SYSTEM)

RER IGNITION SYSTEM

Tundra R

Skandic 380/500, Touring E/LE/SLE and Formula DLX 380/500



Section 04 ENGINE

Subsection 06 (CDI SYSTEM)

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

CLEANING

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

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

DISASSEMBLY

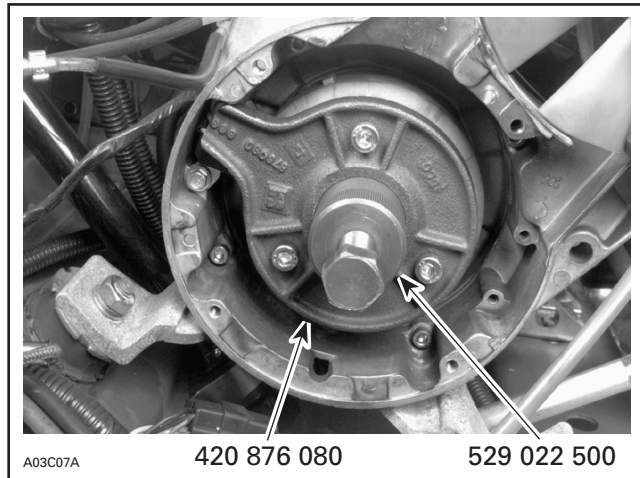
To gain access to magneto assembly, remove the following parts as needed on different engines:

- tuned pipe and muffler
- oil injection pump mounting plate from rewind starter
- rewind starter
- starting and V-belt pulleys

To remove magneto flywheel retaining nut **no. 3**, install puller ring (P/N 420 876 080) and M8 x 20 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 it is first necessary to tap on the fastener to break threadlocker bond. This will eliminate the possibility of thread breakage.



TYPICAL

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

NOTE: Before disassembling armature plate, indexing marks should be scribed to facilitate reassembly.

To replace generator coil **no. 1**:

- Heat the armature plate to 93°C (200°F) around the screw holes to break the threadlocker bond.

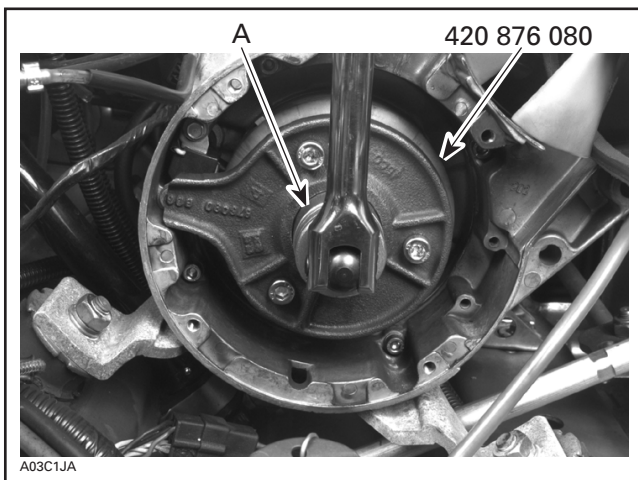
To replace trigger coil **no. 4**:

- Disconnect trigger coil wire (RED).
- Remove grommet from crankcase where trigger coil wire exits magneto housing.
- Remove retaining screws **no. 5**.
- Remove trigger coil and carefully pull wire.
- Install new trigger coil and other parts removed.

ADJUSTMENT

Formula S, MX Z 440 and Skandic WT/SWT Only

Whenever the trigger coil or the magneto flywheel is removed or replaced, the air-gap between the trigger coil and the flywheel protrusion must be checked and adjusted. The purpose of this adjustment is to obtain the minimum clearance between these parts — without touching at any RPM — so that the trigger coil produces its proper electrical output. Ignition timing must also be checked. Refer to IGNITION SYSTEM 06-02.



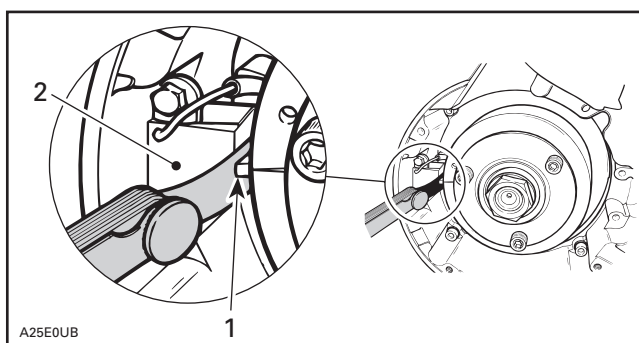
TYPICAL

A. 30 mm socket

To remove magneto flywheel **no. 2**, install the magneto puller (P/N 529 022 500).

Proceed as follows:

1. Rotate flywheel so that one protrusion aligns with trigger coil.
2. Using a feeler gauge of 0.45 mm (.018 in) to 0.55 mm (.022 in) thick, check air-gap between center pole of trigger coil and flywheel protrusion.
3. If necessary, adjust by slackening retaining screws and moving trigger coil toward or away of protrusion.
4. Retighten screws and recheck air-gap.



ADJUSTING TRIGGER COIL AIR-GAP

1. Flywheel protrusion
2. Trigger coil

To replace armature:

- Disconnect the 2-wire connector (GREEN and WHITE wires).

- Disconnect YELLOW/BLACK and YELLOW wires.
- Remove grommet from crankcase where magneto harness exits magneto housing.
- Remove armature plate retaining screws.
- Remove armature plate with armature and carefully pull wires.
- Install new parts and other parts removed.

ASSEMBLY

All Models

Clean crankshaft extension (taper).

Apply Loctite 242 (blue) on taper.

Position Woodruff key, flywheel and lock washer on crankshaft.

Clean nut threads and apply Loctite 242 (blue) before tightening nut to 105 N•m (77 lbf•ft).

At reassembly coat all electric connections with silicone dielectric grease (P/N 413 701 700) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone “sealant”, this product will corrode contacts.

Ignition Timing

Check as described in IGNITION TIMING 06-02.

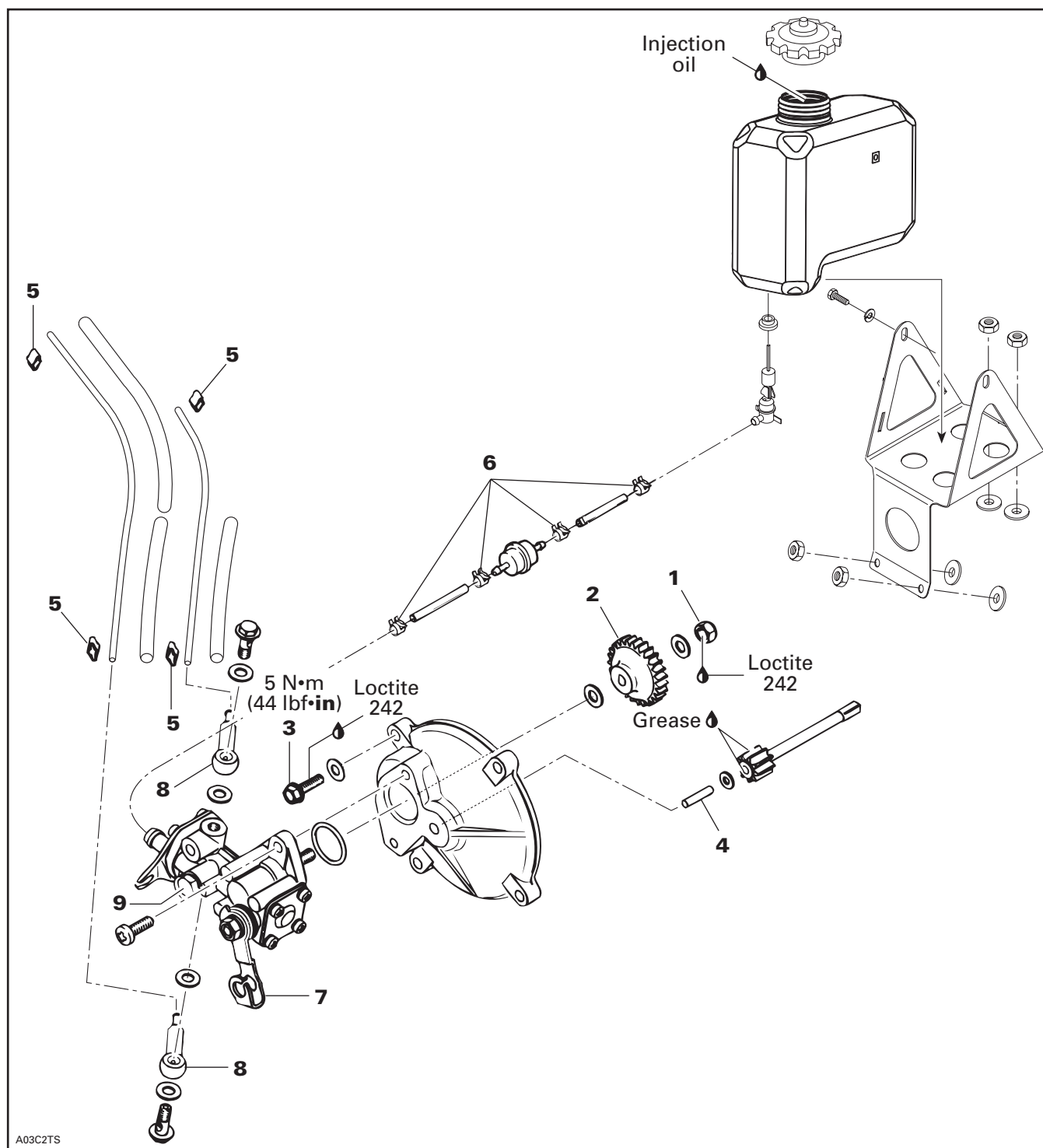
277 Engine



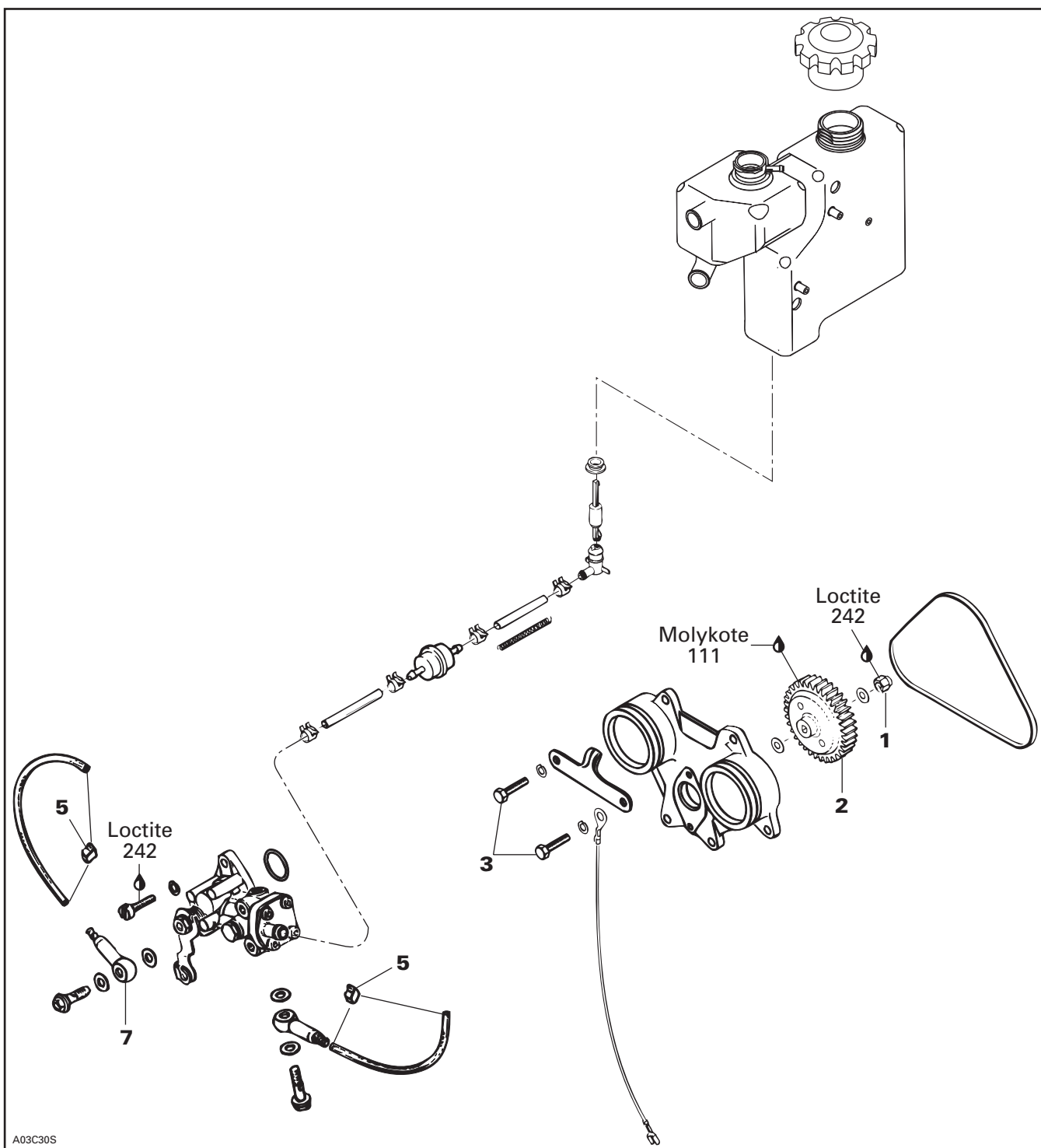
Section 04 ENGINE

Subsection 07 (OIL INJECTION SYSTEM)

377, 443 and 503 Engines



494 Engine



TYPIQUE

OIL SYSTEM LEAK TEST

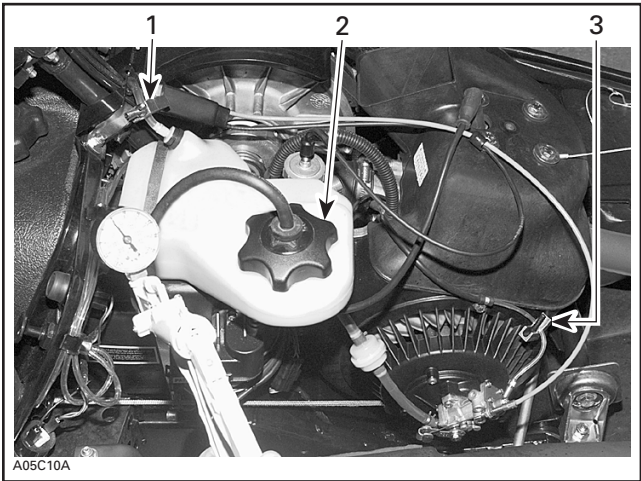
All Models

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).

Tundra R

Install hose pinchers (P/N 295 000 076) on oil reservoir vent line and outlet hose.

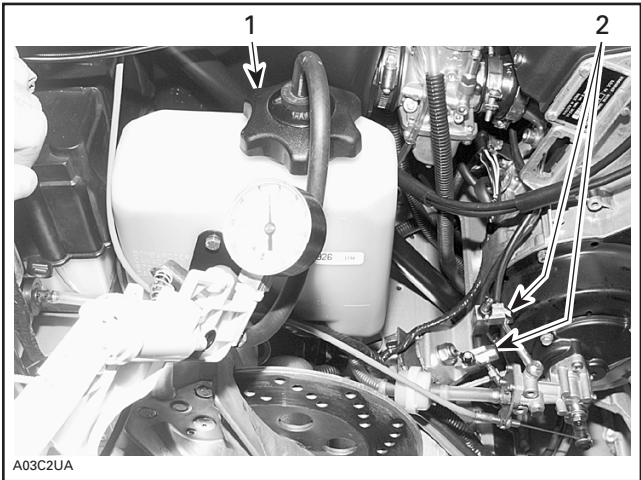


TUNDRA R

- 1. Hose pincher on vent line
- 2. Special cap on reservoir
- 3. Hose pincher on outlet hose

S-Series

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



TYPICAL

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

All Models

Connect pump of leak testing kit to special cap.

Pressurize oil system to 34 kPa (5 PSI). That pressure must not drop during 3 minutes.

If pressure drops, locate leak(s) and repair/replace leaking component(s). To ease locating leak(s) spray soapy water on components, bubbles will indicate leak location(s).

OIL PUMP IDENTIFICATION

Different engines use different pumps. See identification on lever no. 7.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
277	132 J
377 (Formula S)	L4, L5*or L12
377 (Formula DLX 380, Touring E and Skandic 380)	L6*or L13
443 (Touring LE)	E7*or E8
443 (MX Z 440)	E6*
494 Skandic WT LC	N11
494 S-Series	N8*
503 (Skandic 500, Touring SLE and Formula DLX 500)	E7*or E8
503 Skandic WT/SWT	E6

* These oil pumps do not supply any oil at idle. They are called zero oil delivery at idle.

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

CLEANING

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

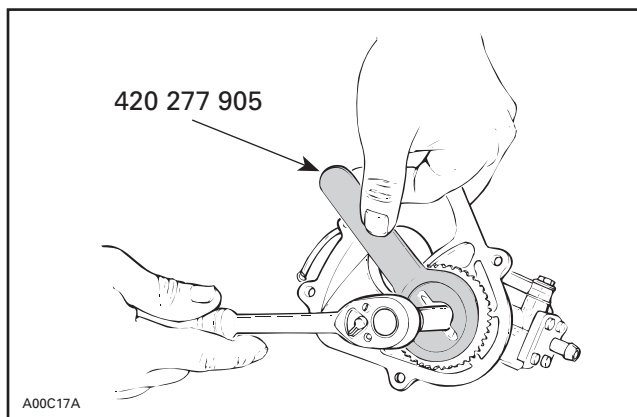
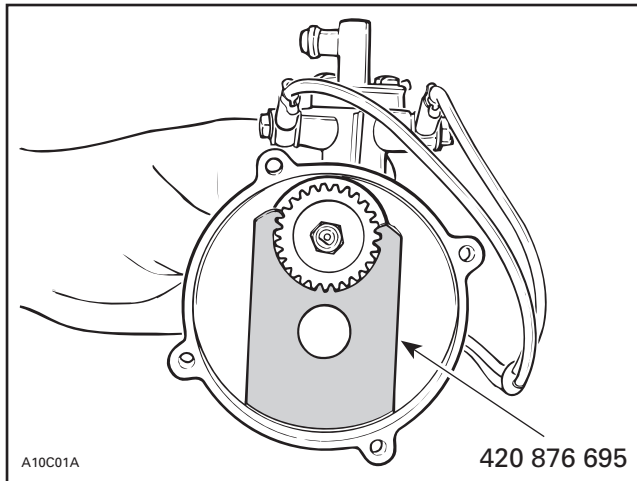
DISASSEMBLY

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

1,2, Gear Retaining Nut and Oil Pump Gear

To remove gear retaining nut, first extract the needle roller with pliers then lock gear in place using one of the following gear holder.

ENGINE TYPE	TOOL P/N
377/443/503	420 876 695
494	420 277 905



TYPICAL

ASSEMBLY

2, Oil Pump Gear

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

4, Needle Roller (fan cooled engine only)

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

5,6, Spring Clip and Clamp

Always check for spring clips and clamps tightness.

3, Screw

Torque to 9 N•m (80 lbf•in).

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

Secure barrel with plastic washer and circlip.

Verify cable and oil pump lever operation.

ADJUSTMENT

Prior to adjusting the pump, make sure all carburetor adjustments are completed.

Synchronizing Pump with Carburetor

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

Pumps Identified 132J, E6, E7, L5, L6 and N8

The marks on the pump casting and on the lever must align. Pump lever mark may be up to 2 mm (.080 in) at right of casting mark. So pump may be partially opened at idle.

Pump Identified N11

Pump lever mark must be from 1 to 2 mm (.039 to .078 in) at right of casting mark. So pump must be partially opened at idle.

Pump Identified N4

Pump lever mark must be from 0 to 2 mm (0 to .078 in) at right of casting mark. So pump must be partially opened at idle.

Section 04 ENGINE

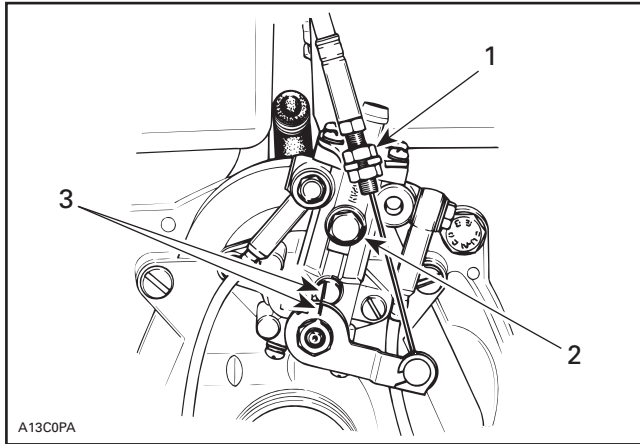
Subsection 07 (OIL INJECTION SYSTEM)

Pumps Identified E4, E8, L12 and L13

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

All Models

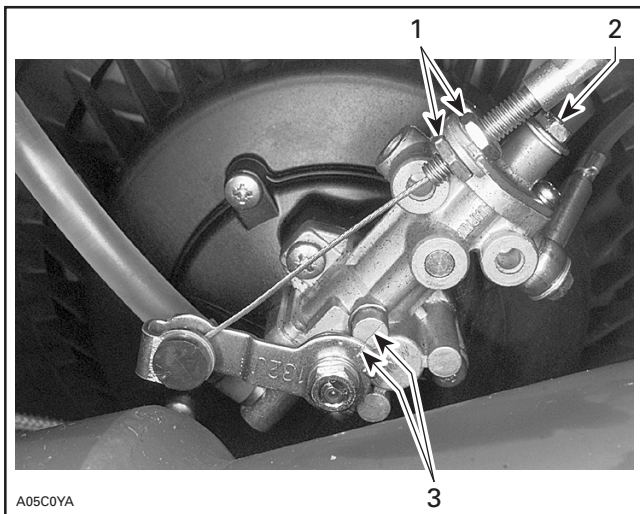
Loosen the adjuster nut and adjust accordingly. Retighten the adjuster nut.



TYPICAL — S-SERIES AND SKANDIC WT/SWT/WT LC

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.



TYPICAL — TUNDRA R

1. Adjuster nuts
2. Bleeder screw
3. Marks

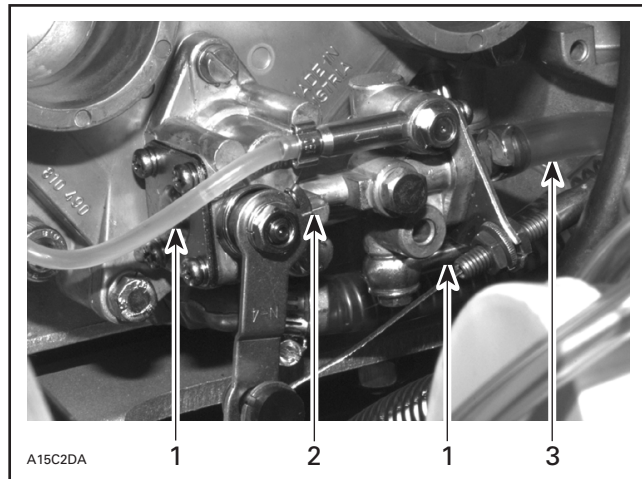
Bleeding Oil Lines

S-Series Liquid-Cooled Models Only

Remove air silencer and move carburetors aside.

All Models

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

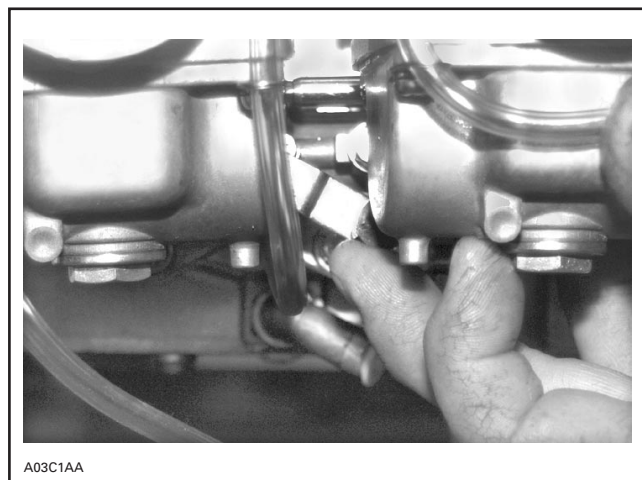


1. Small oil line
2. Marks aligned
3. Main oil line

Reinstall all parts except air silencer.

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

NOTE: If the air silencer has been reinstalled, make a J hook out of mechanical wire to lift the lever.



TYPICAL — ENGINE AT IDLE

S-Series Liquid-Cooled Models Only

Reinstall air silencer.

⚠ WARNING

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

CHECKING OPERATION

Oil Pump

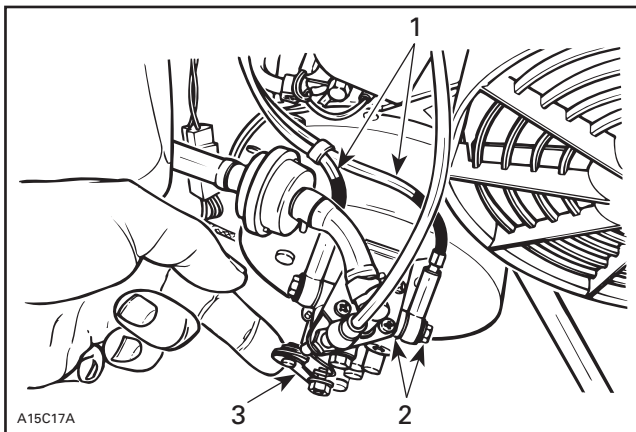
On Vehicle

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

Lift rear of vehicle and support with a mechanical stand. Unbolt banjo fittings from pump. Start engine and stop it as soon as it fires.

Check that oil level in small oil lines is passed banjo fittings end by about 25 mm (1 in) (this will be indicated by a clear section of small oil lines of about 25 mm (1 in)). Repeat the procedure until this condition is attained.

Reconnect banjo fittings with a washers on each side, start engine and run at idle while holding the pump lever in fully open position. Oil columns must advance into small oil lines.



TYPICAL — ENGINE AT IDLE

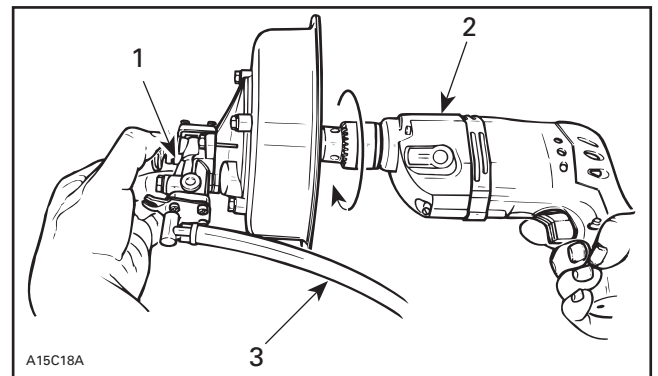
1. Oil columns advancing
2. Washer on each side
3. Fully open position

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 tubes. If oil drops, verify check valve operation in banjo fittings.

Test Bench

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a counterclockwise rotating drill rotate pump shaft. Oil must drip from outer holes while holding lever in a fully open position. If not replace pump.



TYPICAL

1. Fully open position
2. Counterclockwise rotating drill
3. Main line

Banjo Fitting

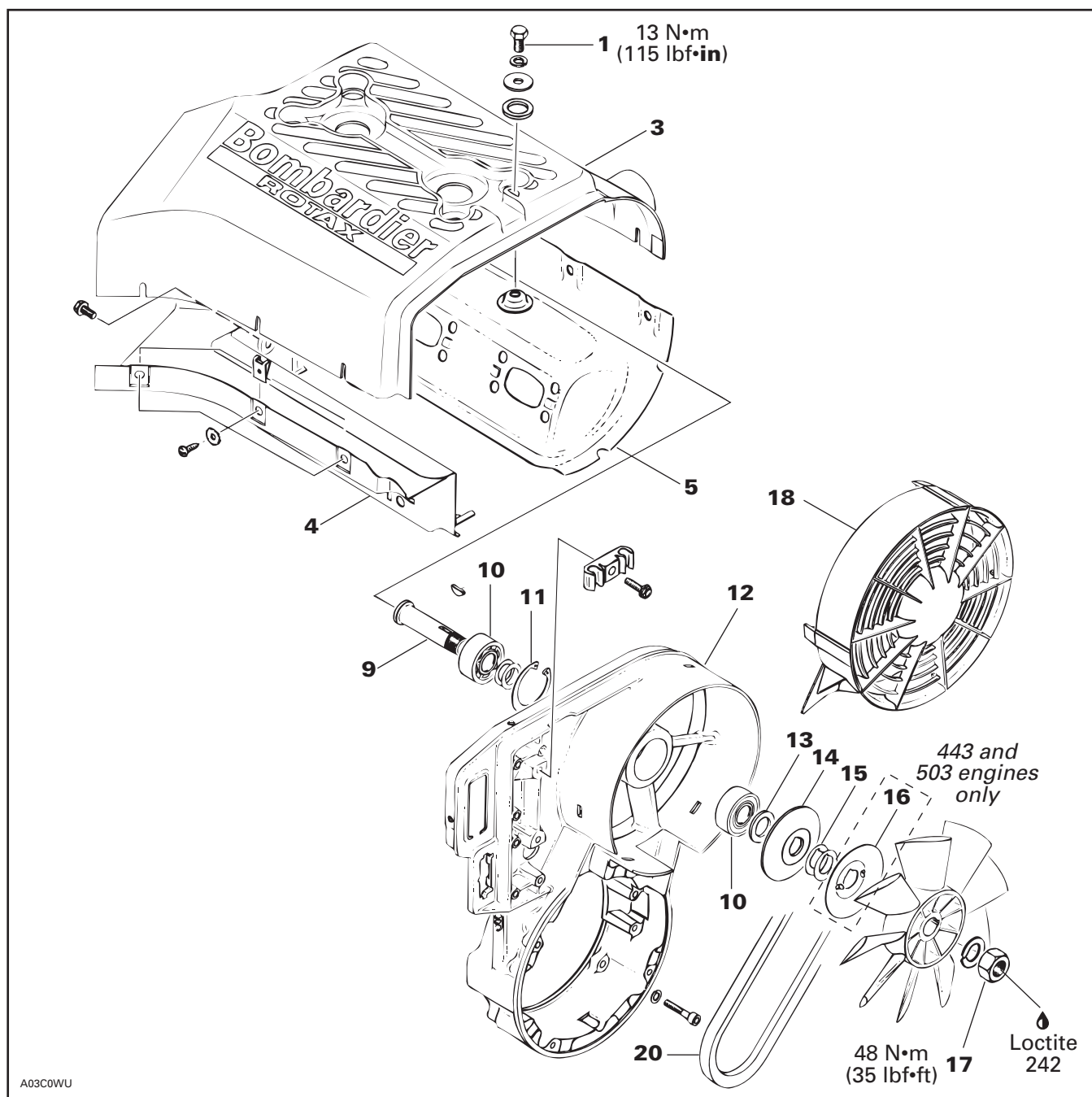
Inside the banjo fitting, there is a ball that acts as a check valve. To verify this check valve, proceed the same as for checking pump operation on vehicle. First unbolt banjo fitting from pump. After restarting the engine, check that a clear section in small oil line is present. Reconnect banjo fitting.

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

377, 443 and 503 Engines

NOTE: For 277 engine radial fan cooling system, refer to CDI SYSTEM 04-06.



Section 04 ENGINE

Subsection 08 (AXIAL FAN COOLING 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.

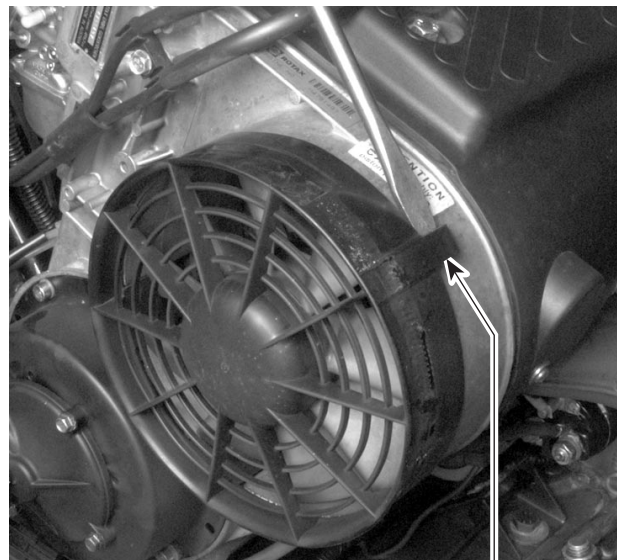
Remove rewind starter, starting pulley, trigger coil wire from 4-connector housing then fan housing ass'y.

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.

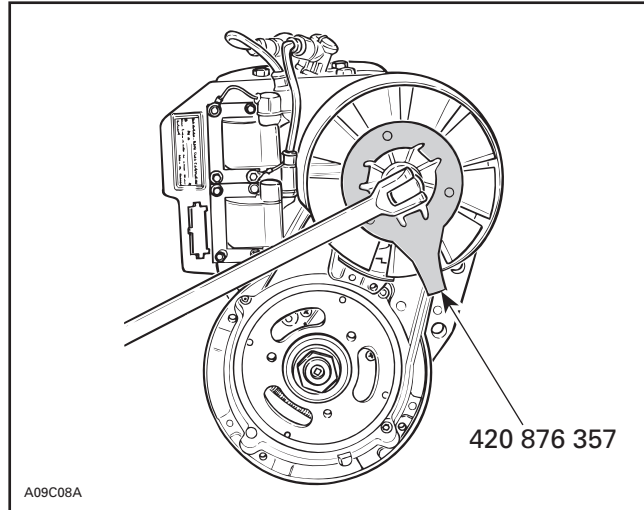


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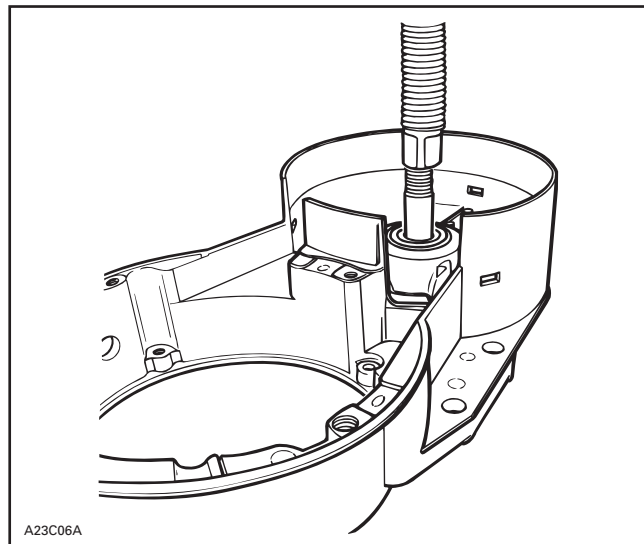
1. Lift tab and remove fan protector

To remove or install fan pulley retaining nut **no. 17**, lock fan pulley with special holder wrench (P/N 420 876 357). At assembly, torque nut to 48 N•m (35 lbf•ft).

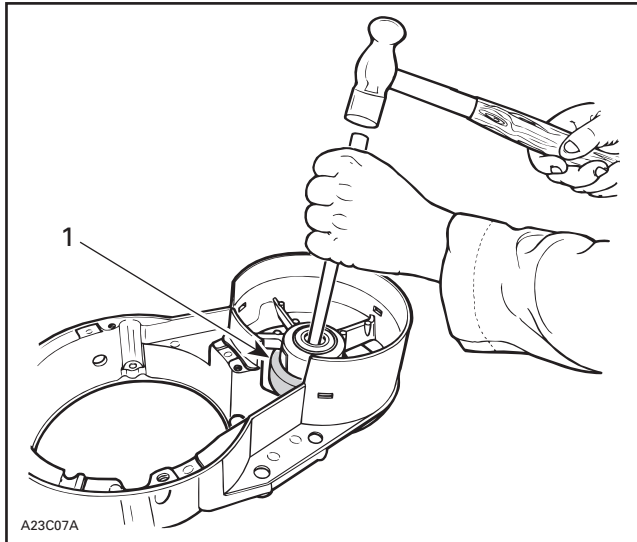


TYPICAL

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 242 (blue) on screw **no. 1** threads.

A gasket must be placed on both sides (inner and outer) of intake and exhaust holes of cylinder cowl **nos. 4 and 5**.

Reinstall fan protector **no. 18** properly.

WARNING

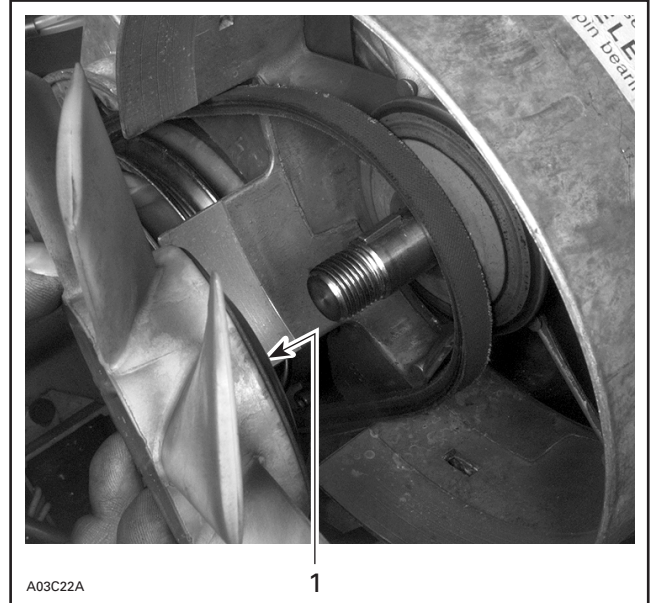
Always reinstall fan protector after servicing.

FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT

Remove muffler, rewind starter and on so equipped models connecting flange. Following procedure described above.

Using fan holder tool (P/N 420 876 357), remove fan nut.

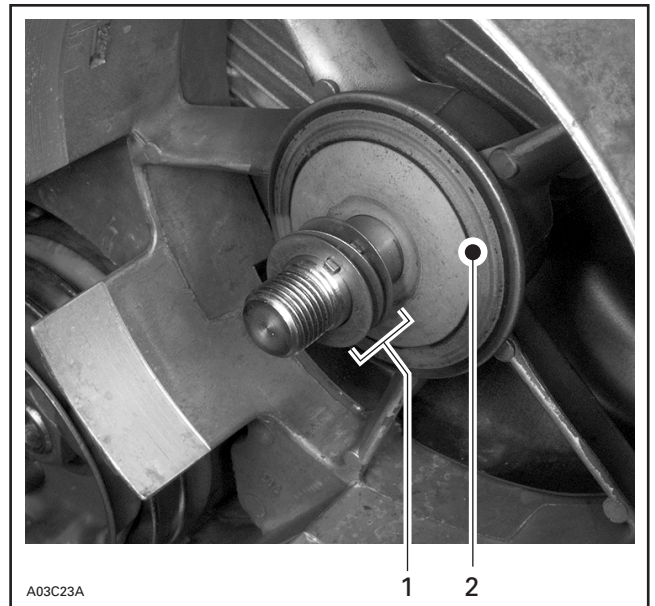
Remove fan with pulley half.



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

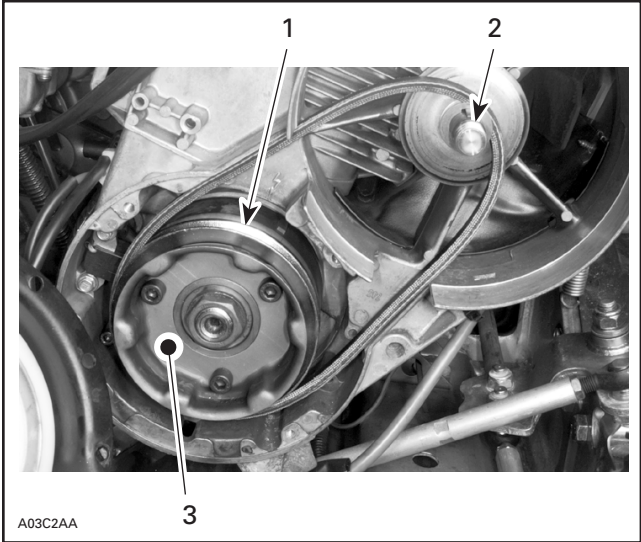
Section 04

ENGINE

Subsection 08 (AXIAL FAN COOLING SYSTEM)

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

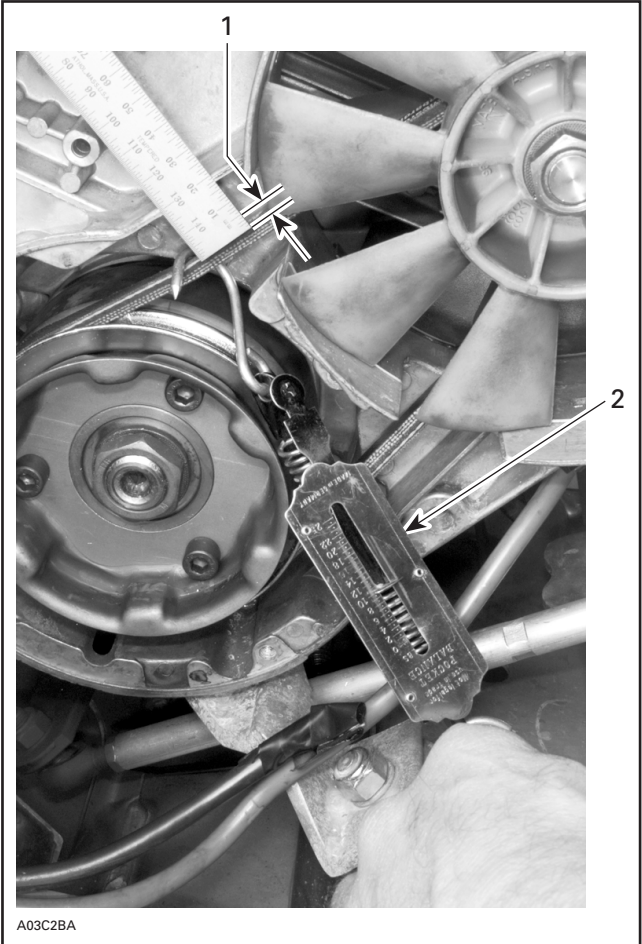
- 1. Bottom pulley
- 2. Fan shaft
- 3. Starting pulley

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.



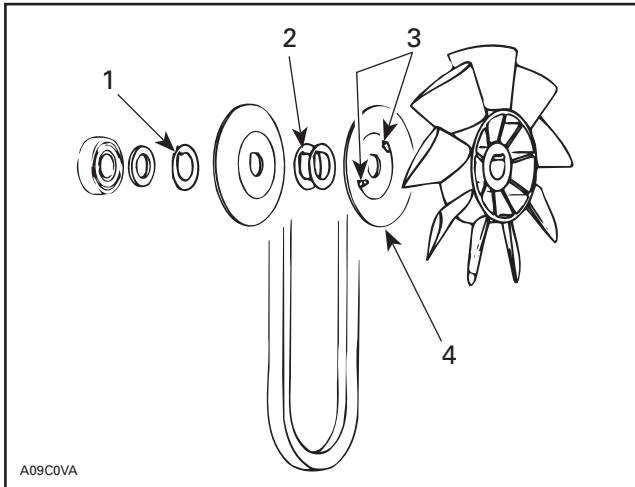
TYPICAL

- 1. Measure deflection here
- 2. Fish scale

Belt deflection must be according to the following specifications:

ENGINE TYPE	BELT DEFLECTION	FORCE APPLIED
377	8.5 mm (11/32 in)	5 kg (11 lb)
443 and 503	9.5 mm (3/8 in)	

To adjust deflection tension, add or remove shim(s) no. 15 between pulley halves nos. 14 and 16. Install excess shim(s) between distance sleeve no. 13 and half pulley no. 14 (housing side).



1. Unused shim(s) here
2. Adjust here
3. Positioning noses
4. Some engines only

Some engines have a separate metal pulley half instead of using back of fan as pulley half. On first mentioned engines, 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 fan holder tool (P/N 420 876 357), as shown in the following photo.

NOTE: Apply Loctite 242 (blue) on fan nut threads.

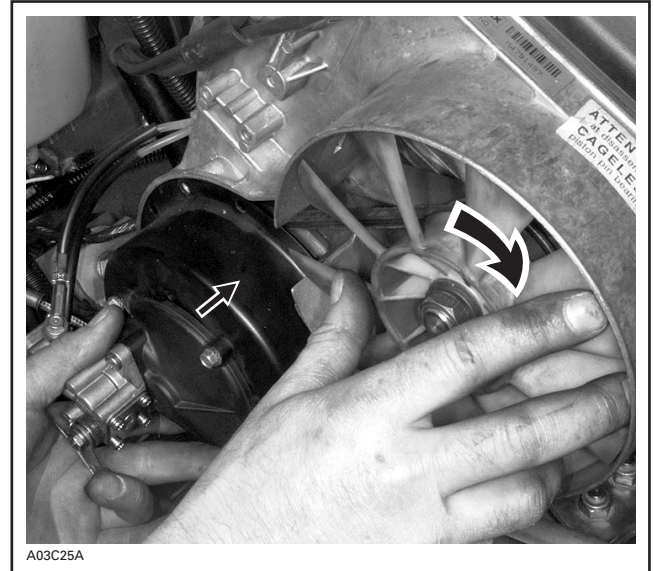


TORQUE FAN NUT USING FAN HOLDER TOOL

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.

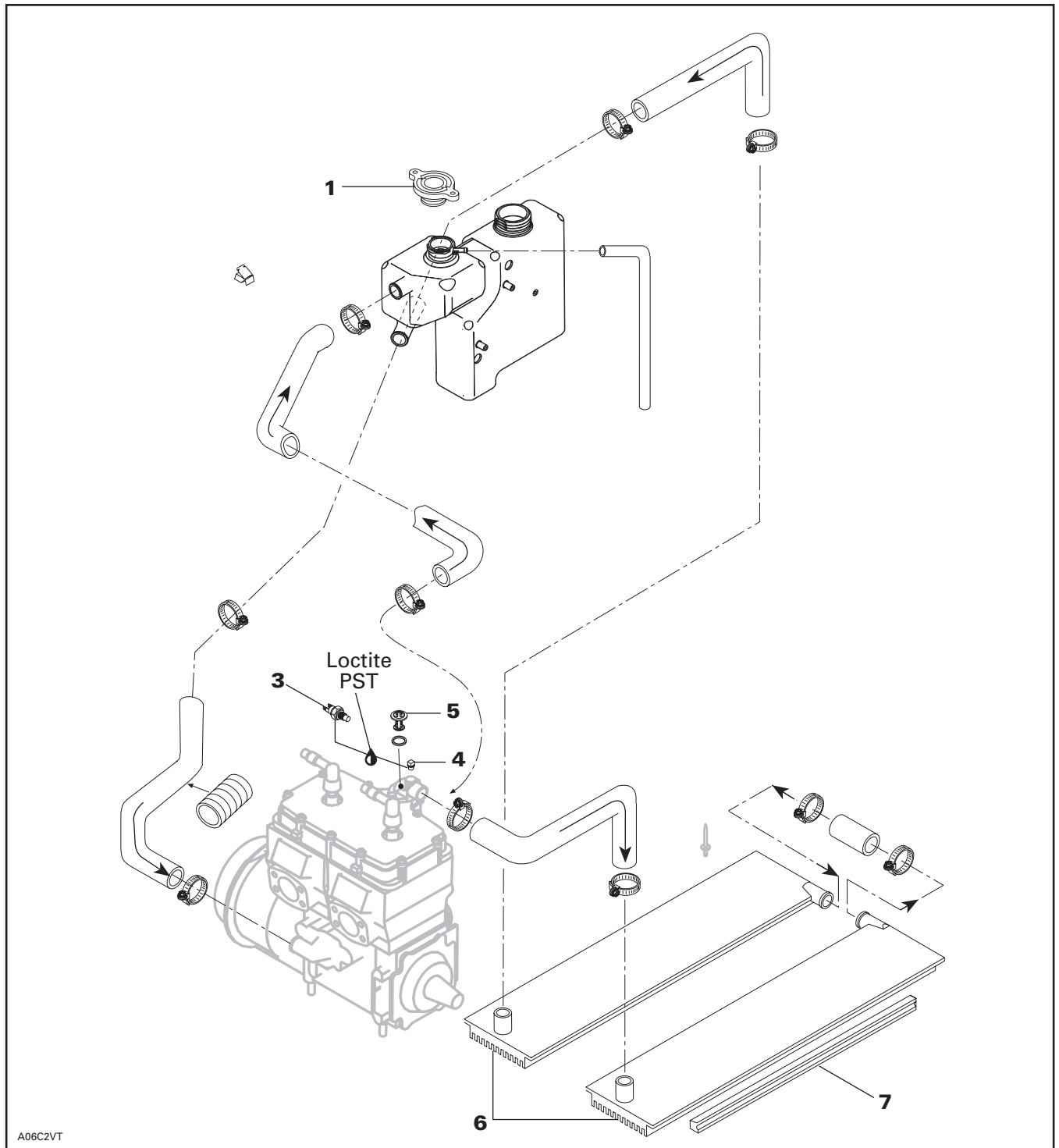
⚠ WARNING

Always reinstall fan protector after servicing.

Reinstall muffler.

LIQUID COOLING SYSTEM

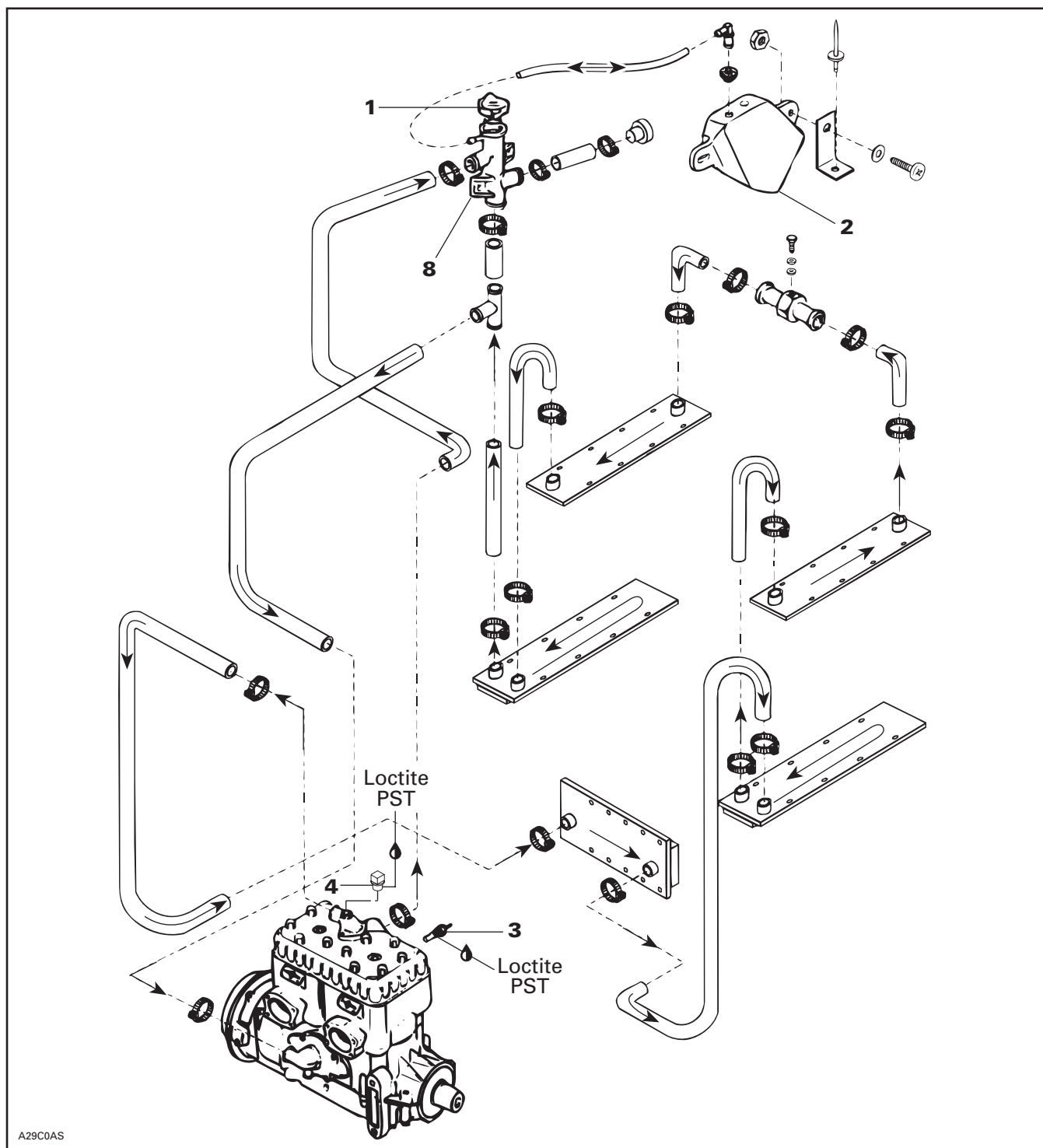
S-Series 494 Engine Type



Section 04 ENGINE

Subsection 09 (LIQUID COOLING SYSTEM)

Skandic WT LC 494 Engine Type

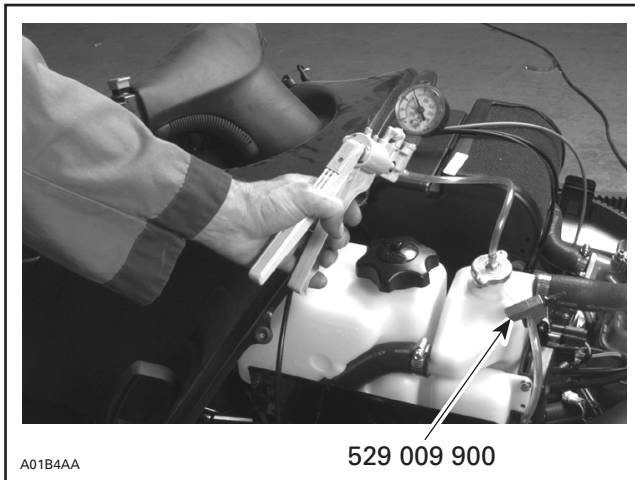


TYPICAL

LIQUID COOLING SYSTEM LEAK TEST

Install special plug (radiator cap) (P/N 529 021 400) and hose pincher (P/N 529 009 900) on overflow hose. Pressurize all system through coolant reservoir to 15 PSI.

Check all hoses and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.



TYPICAL

INSPECTION

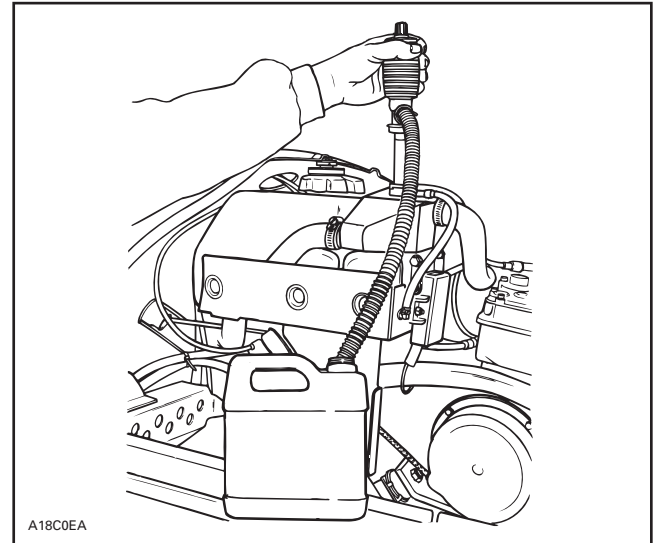
Check general condition of hoses and clamp tightness.

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. Use a primer pump with a plastic hose inserted as deep as possible into the lower hose.



TYPICAL

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

DISASSEMBLY AND ASSEMBLY

3,4, Sender and Plug

Apply thread sealant on sender and plug 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).

6,7, Radiator and Radiator Protector

Insert radiator protector into radiator C-rail and crimp C-rail at both ends. Refer to FRAME 09-02 for radiator removal.

5, Thermostat

To check thermostat, put in water and heat water. Thermostat should open when water temperature reaches the following degree.

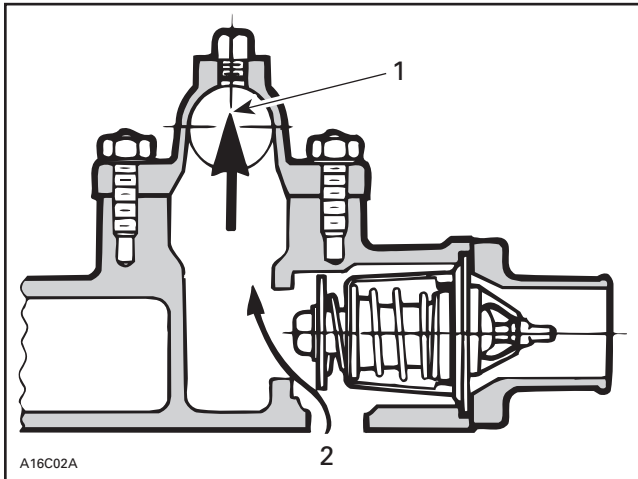
ENGINE	TEMPERATURE
494	42°C (108°F)

On 494 engine, the thermostat is a double action type.

Section 04 ENGINE

Subsection 09 (LIQUID COOLING SYSTEM)

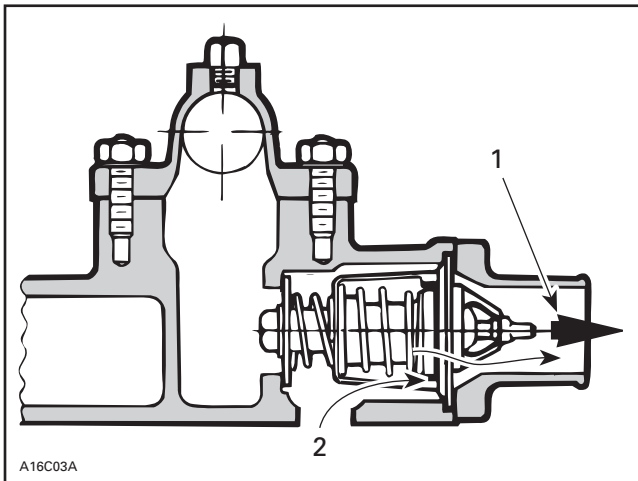
- a. Its function is to give faster warm up of the engine by controlling a circuit; water pump — engine — coolant tank. This is done by bypassing the radiator circuit.



TYPICAL — CLOSED THERMOSTAT, COLD ENGINE

1. To reservoir
2. From cylinders

- b. When the liquid is warmed enough, the thermostat opens 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.

2, Overflow Coolant Tank

Skandic WT LC Only

The coolant expands as the temperature (up to 90 - 100°C (195 - 212°F)) and pressure rise in the system. When the limiting system working pressure (cap) is reached (90 kPa (13 PSI)), the pressure relief valve in the pressure cap is lifted from its seat and allows coolant to flow through the overflow hose into the overflow coolant tank.

When the system temperature drops, the coolant contracts in volume and the pressure in the system is reduced. The coolant in the overflow coolant tank will then flow back into the filling neck no. 8 through the vacuum relief valve in the pressure cap.

COOLING SYSTEM REFILLING PROCEDURE

Recommended Coolant

Use a blend of 60% antifreeze with 40% water. Do not reinstall pressure cap.

CAUTION: To prevent rust formation or freezing condition, always replenish the system with 60% antifreeze and 40% water. Pure antifreeze without water freezes. Always use ethylene-glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

System Capacity

Refer to TECHNICAL DATA 10-03.

Refilling Procedure

S-Series

With vehicle on a flat surface, engine cold, refill coolant tank up to cold level mark. Wait a few minutes then refill to mark. Install pressure cap. Run engine until thermostat opens then stop engine. Refill up to mark.

To make sure coolant flows through radiators, touch them by hand. They must feel warm.

Reinstall pressure cap.

When engine has completely cooled down, recheck coolant level in coolant tank and top up if necessary.

Check coolant concentration (freezing point) with proper tester.

Skandic WT LC

Open cap and fill filler neck **no. 8** completely.

Tilt seat and unscrew bleeding screw on top of connecting hose. Coolant must flow. Refill through filler neck **no. 8** as necessary.

Reinstall bleeding screw.

Proceed the same for bleeding screw on thermostat housing.

Start engine and let it warm until thermostat opens.

To make sure coolant flows through radiators, touch them by hand. They must feel warm.

Turn engine off. Let it cool down for 15 to 20 minutes.

Open cap and refill filler neck completely.

Start engine and let it idle. Do not race engine.

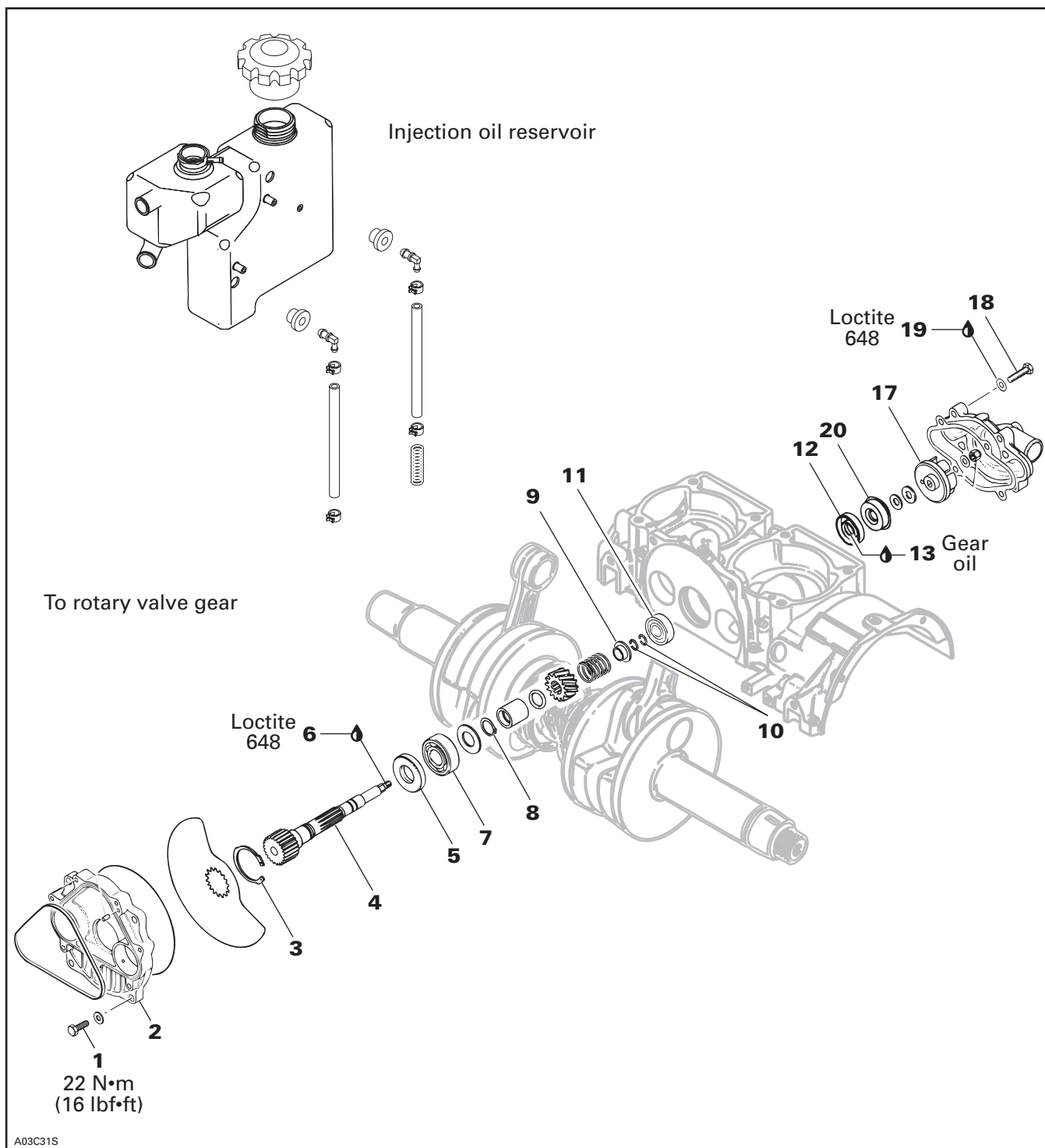
If coolant level gets down, add more coolant in filler neck.

Turn off engine and close cap.

IMPORTANT: After first drive let engine completely cool down. Check that coolant level is at top of filler neck. Add coolant as necessary. This is to ensure that coolant circulation from and back to overflow coolant tank works properly. Overflow coolant tank should be half full when engine is cold.

ROTARY VALVE, COOLANT PUMP AND RESERVOIR

494 Engine



A03C31S

TYPICAL

Section 04 ENGINE

Subsection 10 (ROTARY VALVE, COOLANT PUMP AND RESERVOIR)

NOTE: Some verifications can be performed with engine in vehicle. Refer to ENGINE DIMENSION MEASUREMENT 04-05.

GENERAL

Engine must be removed from vehicle to work on rotary valve shaft/components. Refer to **Removal and Installation** of appropriate engine for procedures.

Bottom end must be opened to remove rotary valve shaft.

CLEANING

Discard all seals and O-rings.

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

DISASSEMBLY

1,2, Screw and Rotary Valve Cover

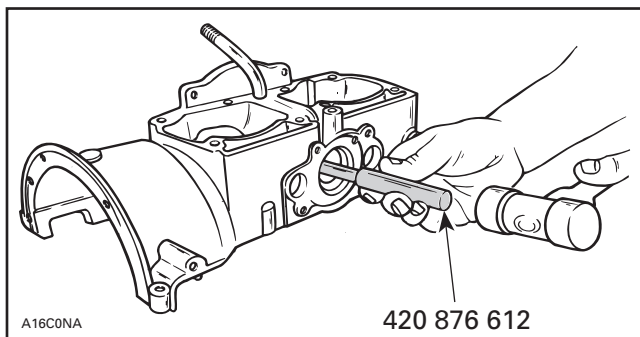
NOTE: Before removing rotary valve, check valve timing as described in **Rotary Valve Timing** at the end of this subsection.

Unscrew 4 retaining screws and withdraw rotary valve cover and valve.

3,17, Circlip and Pump Impeller

CAUTION: Bottom end must be opened to remove rotary valve shaft.

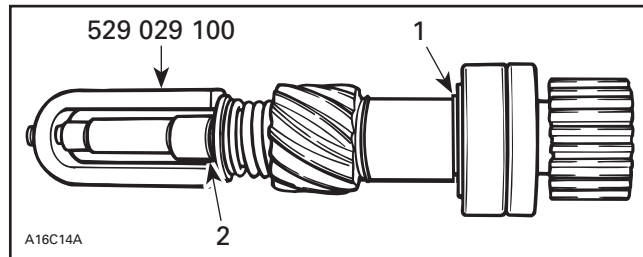
To remove rotary valve shaft assembly from crankcase, first remove coolant pump impeller and circlip on valve side. Using the suitable pusher (P/N 420 876 612) and a fiber hammer, push shaft assembly.



CAUTION: To prevent damage to the end of the rotary valve shaft, use pusher (P/N 420 876 612).

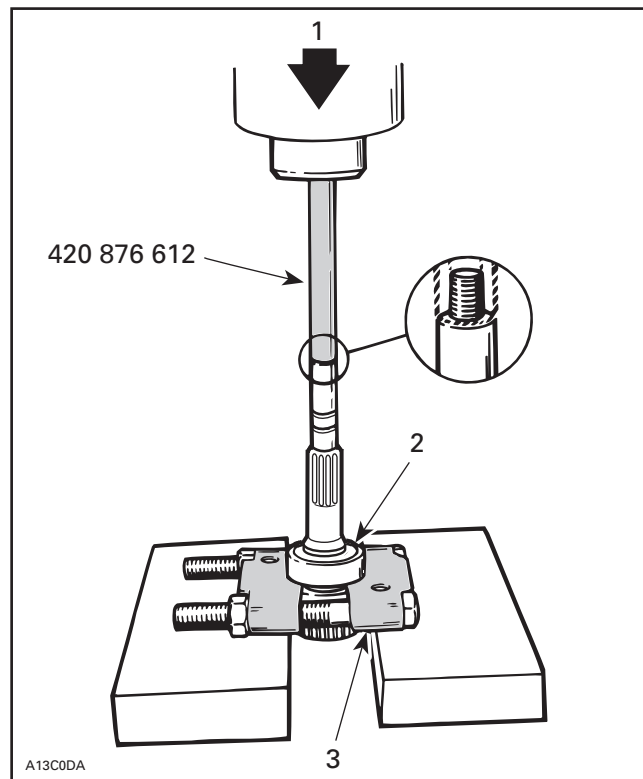
8,9,10, Circlip and Spring Retaining Cup

If it is necessary to disassemble components of rotary valve shaft assembly, compress spring retaining cup with rotary valve circlip tool (P/N 529 029 100) in order to remove circlip. Remove gear and distance sleeve then external circlip.



1. External circlip
2. Circlip

To remove bearing, use a bearing puller (ex.: Snap-on no. CJ 950) and pusher (P/N 420 876 612) as illustrated.

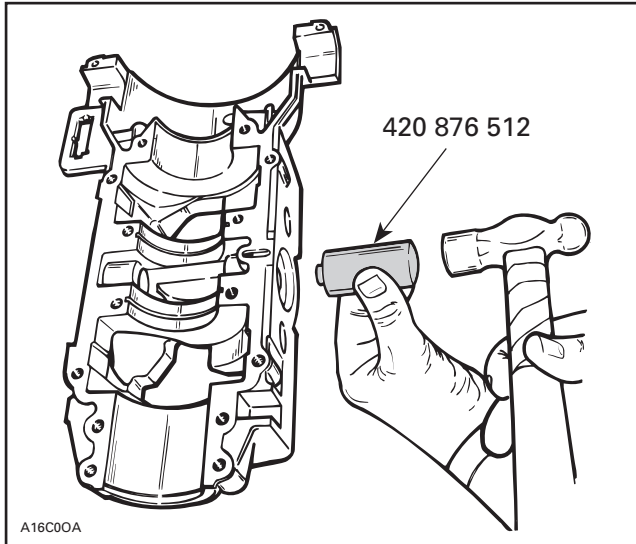


1. Press
2. Bearing
3. Bearing puller. Ex.: Snap-on no. CJ 950

CAUTION: Ensure that the rotary valve shaft is perfectly perpendicular with the press tip or damage will occur.

11,20, Bearing 6201 and Seal

To remove bearing 6201 (the smallest one) and seal, use seal pusher (P/N 420 876 512).



INSPECTION

Inspect rotary valve cover for warpage. Small deformation can be corrected by surfacing with fine sand paper on a surface plate. Surface part against oiled sand paper.

Inspect bearings. Check for scoring, pitting, chipping or other evidence of wear. Make sure plastic cage (on bigger bearing) is not melted. Rotate them and make sure they turn smoothly.

Check for presence of brass fillings in gear housing.

Visually check gear wear pattern. It should be even on tooth length all around. Otherwise it could indicate a bent shaft; check deflection. Replace gear if damaged.

Refer to ENGINE DIMENSION MEASUREMENT 04-05.

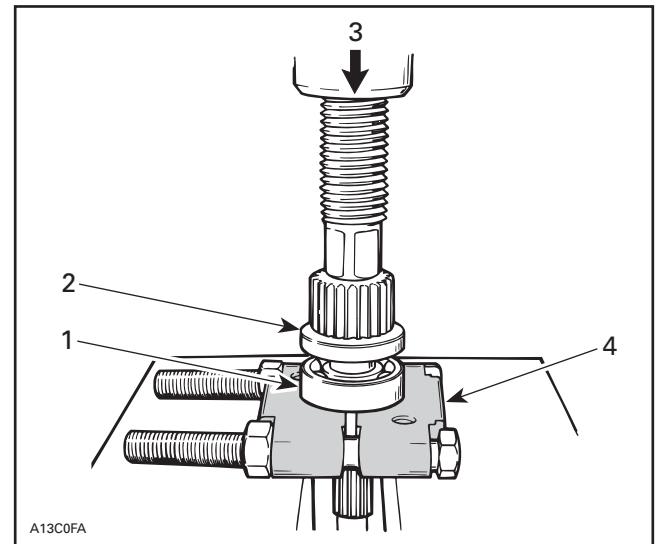
ASSEMBLY

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

4,5,7, Rotary Valve Shaft, Seal and Bearing 6203

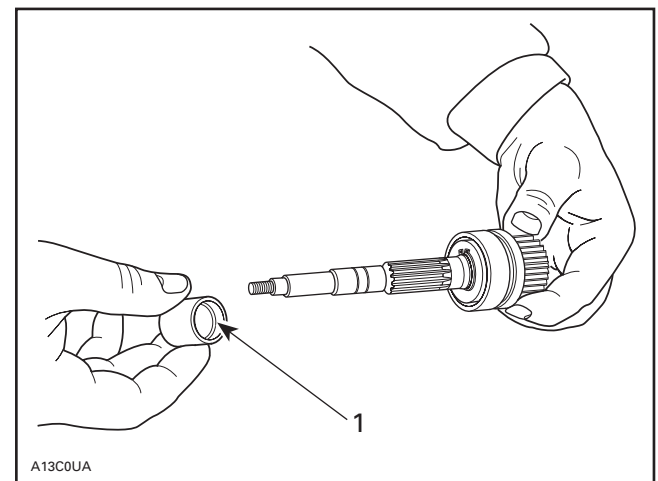
At assembly apply lithium grease on seal lips. Position the seal with shielded portion against splines of shaft.

Install bearing as illustrated.



1. Bearing
2. Shielded portion of seal here
3. Press
4. Bearing puller. Ex.: Snap-on no. CJ 950

Install distance sleeve with its counterbore first.



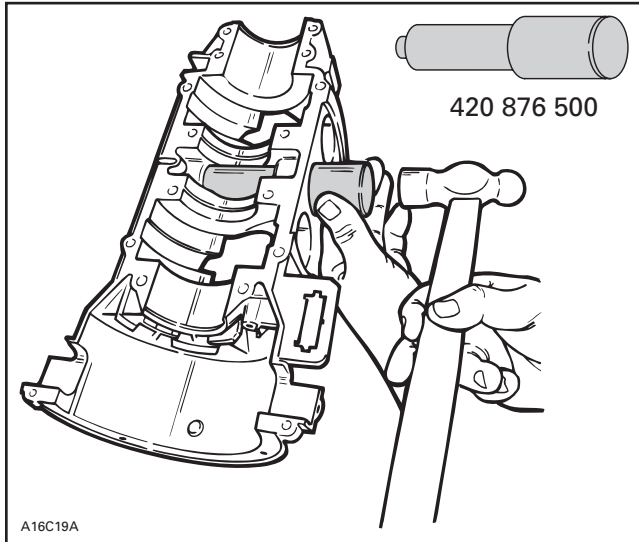
1. Counterbore first

Section 04 ENGINE

Subsection 10 (ROTARY VALVE, COOLANT PUMP AND RESERVOIR)

11, Bearing 6201

To install bearing 6201, use bearing pusher (P/N 420 876 500).



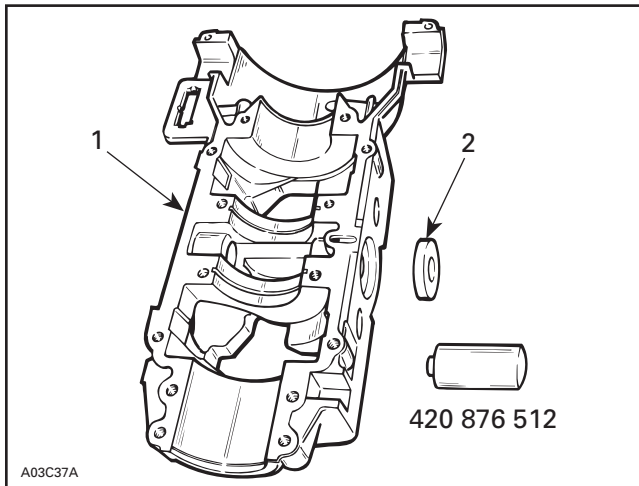
NOTE: Bearing shielded side must be facing rotary valve.

Refer to **Rotary Valve Timing** at the end of this subsection to properly install gear on rotary valve shaft.

12, Seal

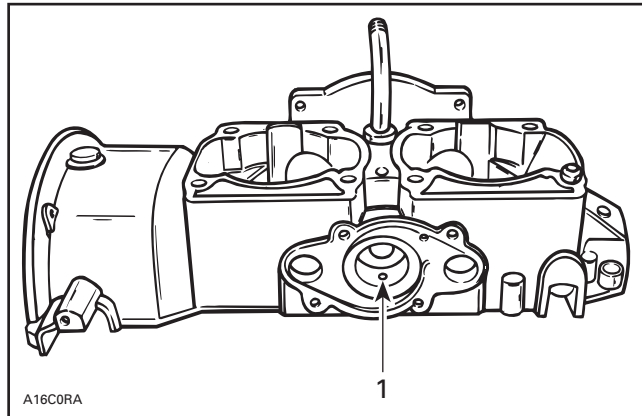
To install oil seal on coolant pump side proceed as follows:

- Apply synthetic chaincase oil (P/N 413 803 300) on lip of seal.
- Position **oil seal** shielded portion towards pump impeller. Drive in place with a seal pusher (P/N 420 876 512).



1. Rotary valve side
2. Oil seal

Make sure not to obstruct draining hole. Position oil seal so that hole is free.



1. Draining hole

CAUTION: Failure to position the seal as specified may cause the seal spring to be corroded by coolant. Severe damage may occur if these notices are disregarded.

NOTE: The draining hole is used to detect seal malfunction. If you notice oil or coolant at the exit of the draining hole, this means that oil seal or coolant seal leaks.

20, Coolant Seal

At time of printing there is no tool available to install that new type of seal.

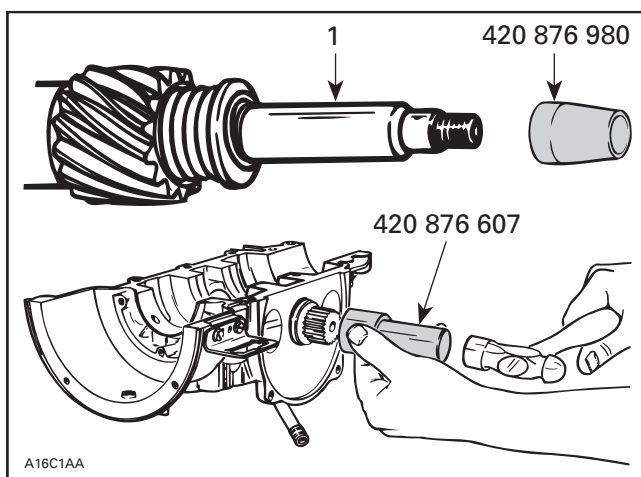
Do not apply any grease or oil on that coolant seal.

4,6, Rotary Valve Shaft and Loctite 648

CAUTION: Crankcase halves must be separated and crankshaft must not be present to install rotary valve shaft ass'y in crankcase.

To install rotary valve shaft proceed as follows with the suitable tools:

- rotary valve seal pusher (P/N 420 876 607)
- seal protector sleeve (P/N 420 876 980)



1. Rotary valve shaft

Apply Loctite 648 (P/N 420 899 788) on shaft threads.

18,19, Pump Housing Bolt and Loctite 242 (blue)

Apply Loctite 242 (blue) on bolt threads.

Rotary Valve

The rotary valve controls the opening and closing of the inlet ports. Therefore its efficiency will depend on the precision of its installation.

IDENTIFICATION OF THE ROTARY VALVE

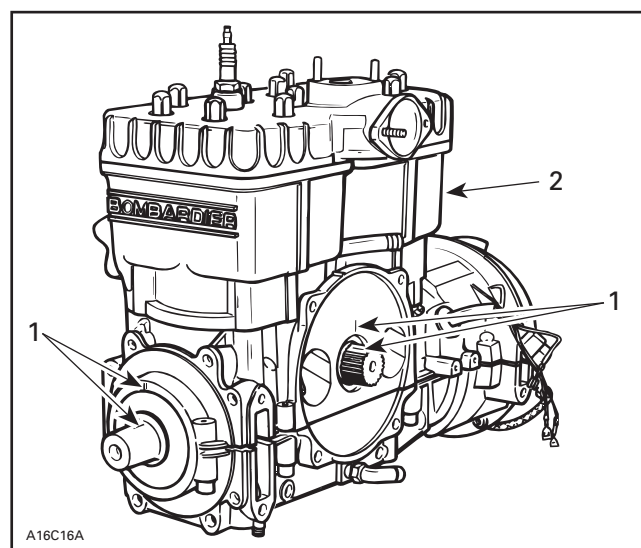
There is no identification code on the valve. To find out the duration, place an angle finder on the valve and measure the valve cut-out angle.

ENGINE TYPE	ROTARY VALVE (P/N)	VALVE DURATION (CUT-OUT ANGLE) °
494	420 924 509	147

ROTARY VALVE TIMING

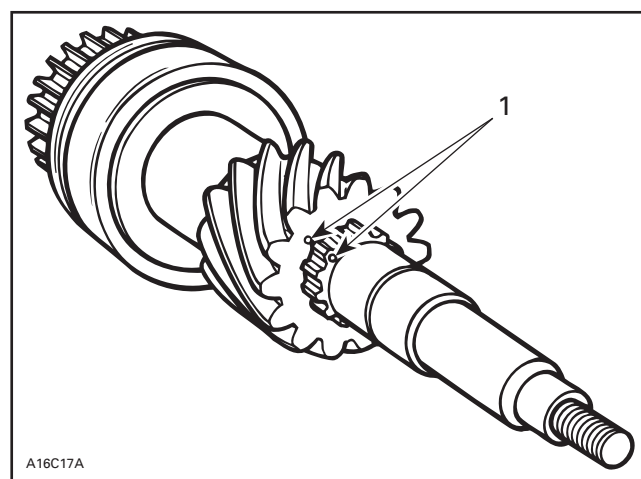
At disassembly, before removing rotary valve, note original rotary valve timing: it may be out of specifications by 1 to 4 degrees of retard or advance. To do so, bring MAG piston to TDC and scribe a mark on crankshaft end at top (12 o'clock) and also on upper crankcase half.

Mark position of rotary valve shaft gear in relation to upper crankcase.



1. Mark here
2. MAG piston at TDC

After removing rotary valve shaft but before disassembling, mark brass gear in relation to shaft.



1. Mark here

These marks will be useful to time rotary valve exactly to the specifications.

NOTE: Tolerance of rotary valve timing is ± 5 degrees.

When the same crankcase is reassembled, the first timing method is to be followed. However, since replacement crankcases do not have timing marks (ridge), the second method is required. Take note that the second method is more accurate and may be used any time.

Section 04 ENGINE

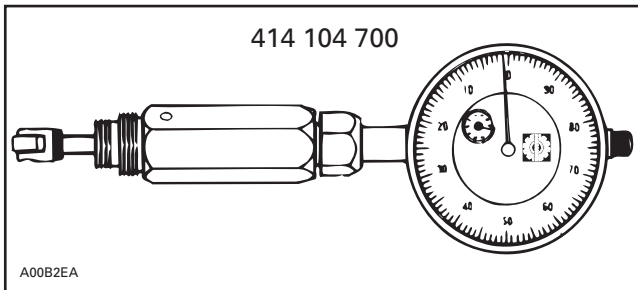
Subsection 10 (ROTARY VALVE, COOLANT PUMP AND RESERVOIR)

Installation

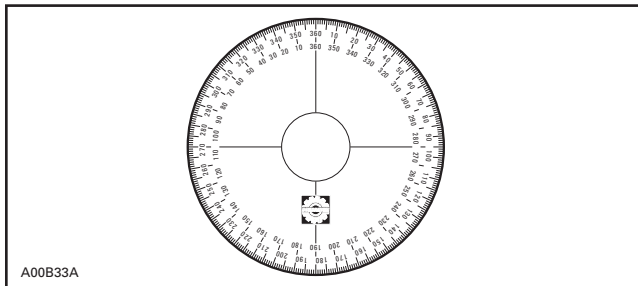
To correctly install rotary valve, proceed as follows:

- Turning crankshaft, bring **MAG side** piston to Top Dead Center.

Use a dial indicator (P/N 414 104 700).



A degree wheel (P/N 414 352 900) is required to measure rotary valve opening and closing angles in relation with **MAG side** piston. Degree wheel will be installed on rotary valve shaft for measurements.



Rotary valve must be set as specified in TECHNICAL DATA 10.

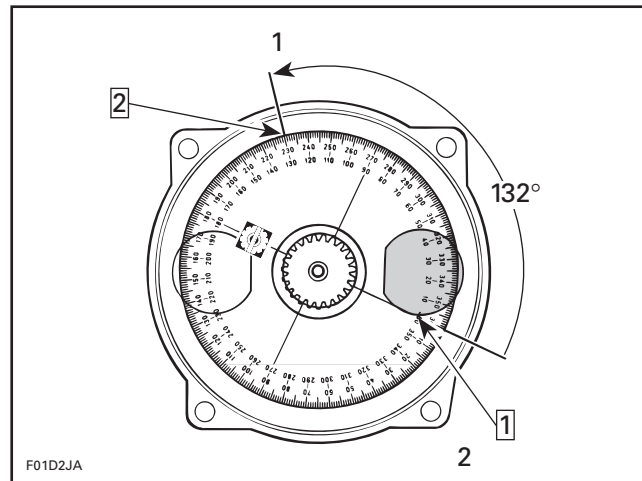
For the following instructions, use these specifications as an example:

OPENING: 132° BTDC

CLOSING: 52° BTDC

Proceed as follows:

- Turning crankshaft, bring **MAG side** piston to Top Dead Center as done before with a crankcase having a ridge.
- For opening mark, first align 360° line of degree wheel with **BOTTOM** of **MAG side** inlet port. Then, find 132° line on degree wheel and mark crankcase at this point.

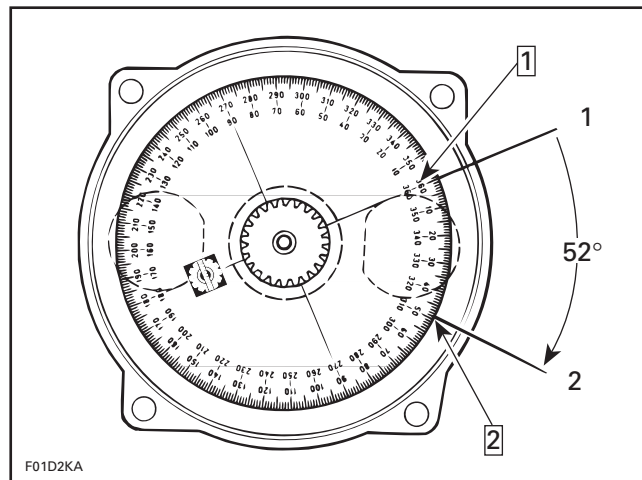


Step 1: Align 360° line of degree wheel here

Step 2: Find 132° on degree wheel and mark here

1. Opening mark
2. Bottom of **MAG** inlet port

- For **closing** mark, first align 360° line of degree wheel with **TOP** of **MAG side** inlet port. Then, find 52° line on degree wheel and mark crankcase at this point.



Step 1: Align 360° line of degree wheel here

Step 2: Find 52° on degree wheel and mark here

1. Top of **MAG** inlet port
2. Closing mark

- Position rotary valve on shaft splines to have edges as close as possible to marks.

NOTE: Rotary valve is asymmetrical. Therefore, try turning it inside out then reinstall on splines to determine best installation position.

Apply injection oil on rotary valve before closing rotary valve cover.

To Time Rotary Valve Exactly to Specifications

NOTE: If desynchronization (out of spec.) is unknown, install rotary valve to determine it before proceeding with the following.

First Method

Turn crankshaft to bring **MAG** piston to TDC. Scribed marks of crankshaft and upper crankcase must align. These marks were scribed to determine desynchronization.

Install brass gear on rotary valve shaft with its marked spline 4 positions (splines) away for one degree of desynchronization. Turn in the opposite direction of desynchronization. For instance, a rotary valve is retarded by 2.5° , turn brass gear by 10 splines counterclockwise.

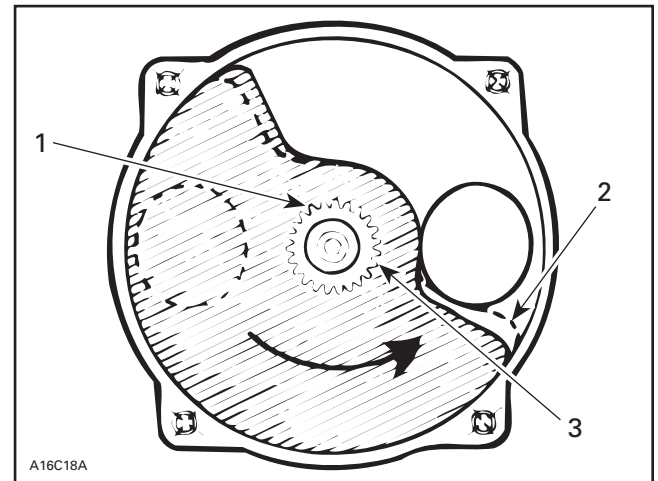
Second Method

Turn crankshaft to bring **MAG** piston to TDC. Scribed marks of crankshaft and upper crankcase must align. These marks were scribed while determining desynchronization.

For each degree of desynchronization, rotary valve shaft should be turned in the opposite direction by about 5 splines on the rotary valve gear.

Note position of rotary valve gear mark when brass gear disengages worm gear of crankshaft at removal of rotary valve shaft. From this position, turn shaft accordingly then reinstall.

For instance, take a valve advanced by 2° .



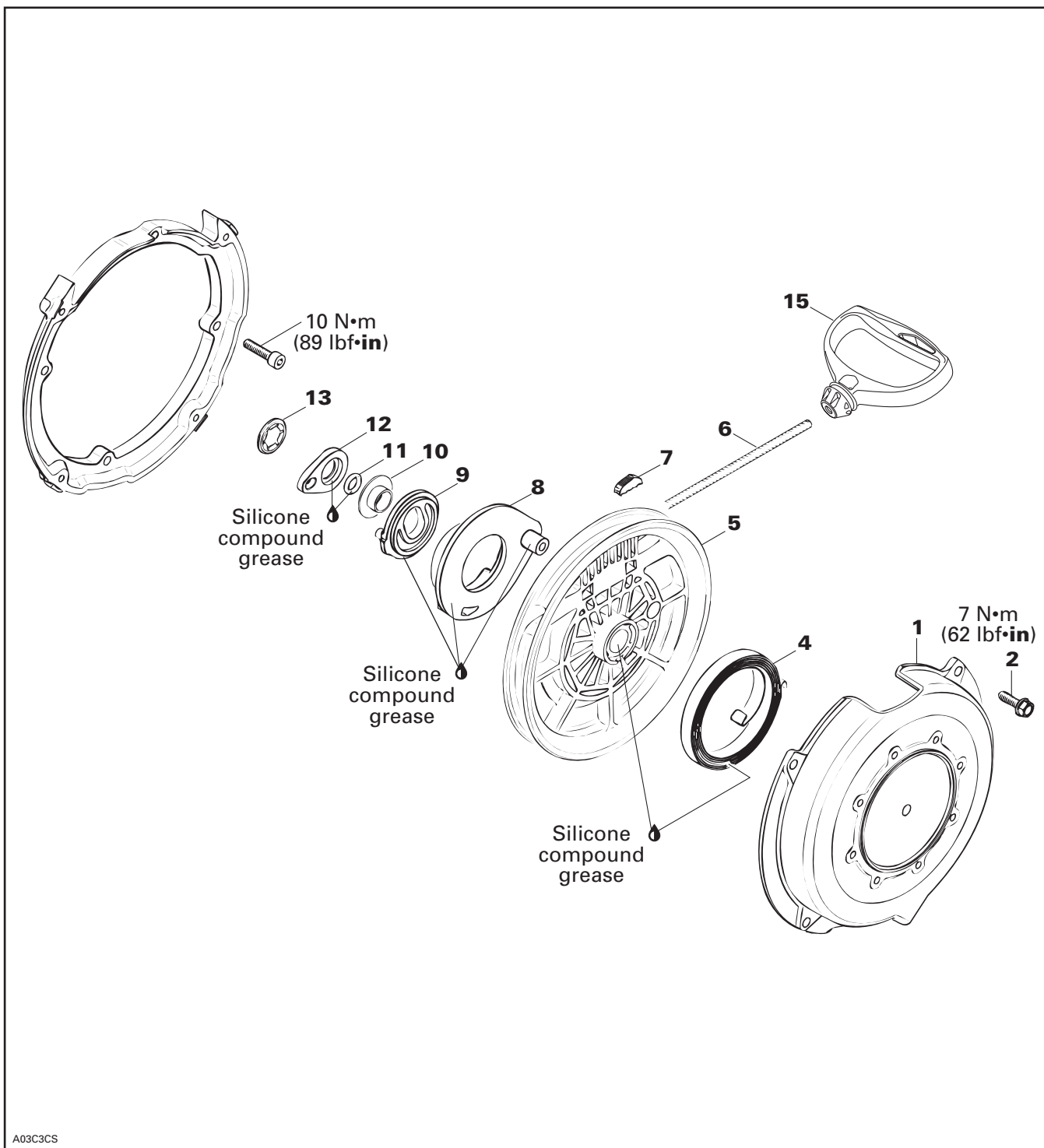
1. Position of mark when brass gear disengages worm gear
2. Advanced by 2°
3. Position of mark before installation (about 10 splines from original position)

1,2, Screw and Rotary Valve Cover

Install O-ring and cover then torque screws to 22 N•m (16 lbf•ft) in a criss-cross sequence.

REWIND STARTER

Plastic Rewind Starter on All S-Series Fan Cooled Models



Section 04 ENGINE

Subsection 11 (REWIND STARTER)

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

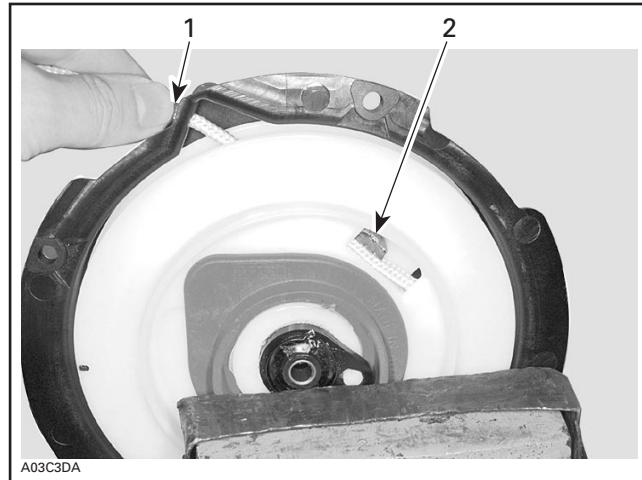
Using a small screwdriver, extract rope knot from starter grip **no. 15**. Cut rope close to knot. Tie a knot near starter.

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

Remove pump from rewind starter cover.

ROPE REPLACEMENT

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**.

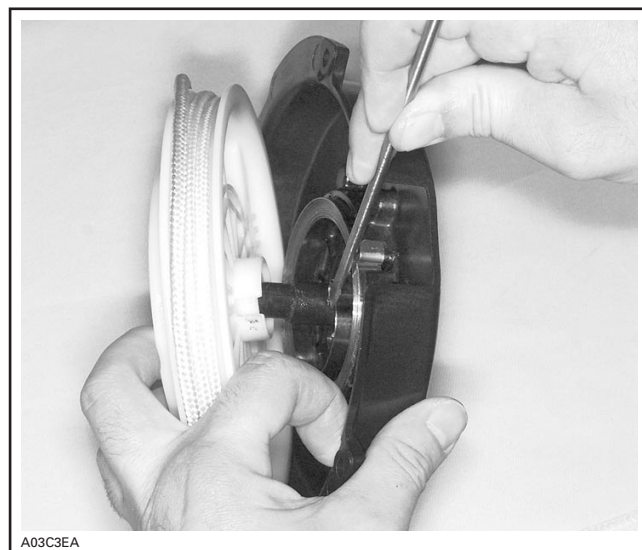
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

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**.

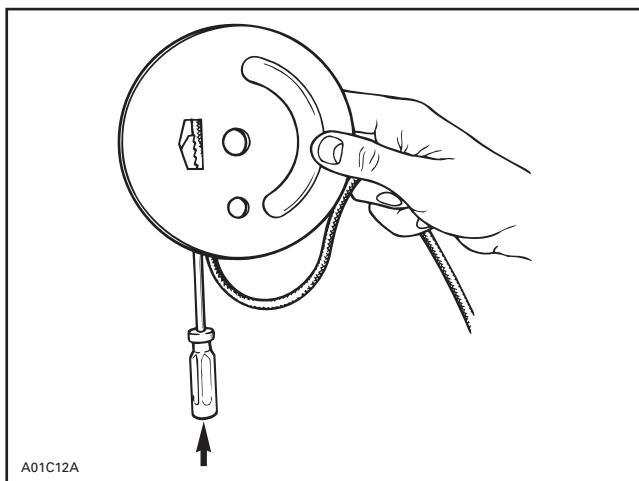
Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.



- Disengage key **no. 7** and pull out rope **no. 6**.

Section 04 ENGINE

Subsection 11 (REWIND STARTER)



GENTLY TAP ON KEY

ASSEMBLY

At assembly, position spring no. 4 outer end into spring guide notch then wind the spring counterclockwise into guide.

WARNING

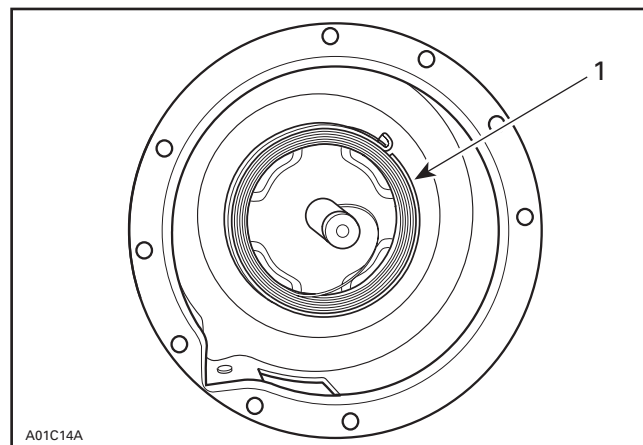
Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.



1. Outer end into guide notch

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.

Lubricate spring assembly with silicone compound grease (P/N 420 897 061).

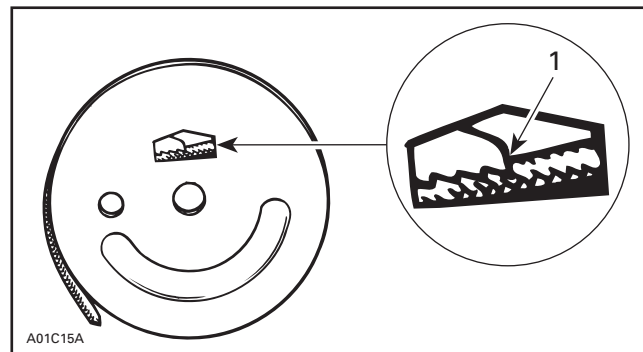


TYPICAL

1. Grease inside spring guide

CAUTION: The use of standard multi-purpose grease could result in rewind starter malfunction.

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.

To adjust rope tension:

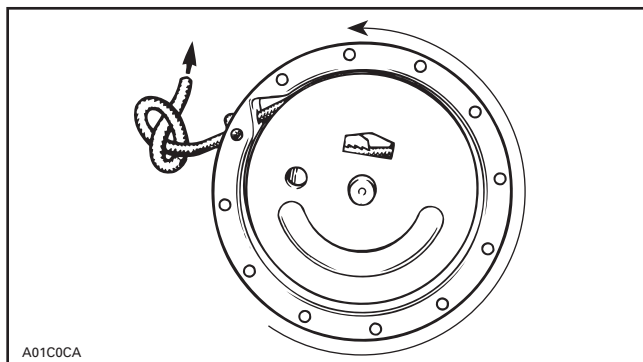
Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

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

Section 04 ENGINE

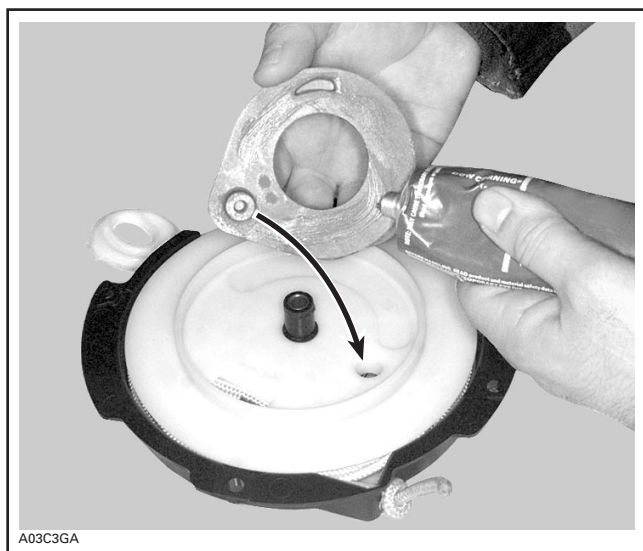
Subsection 11 (REWIND STARTER)

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

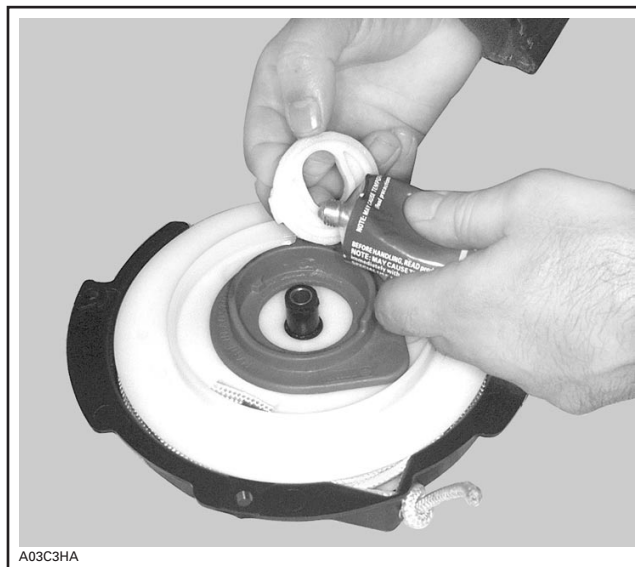


TYPICAL

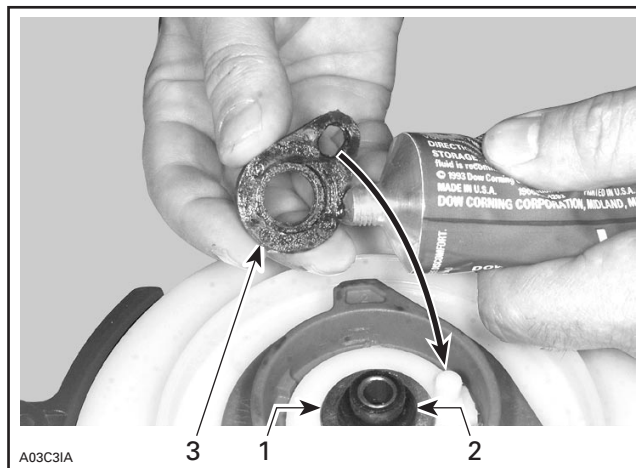
Lubricate pawl **no. 8** with silicone compound grease (P/N 420 897 061) then install over rope sheave.



Lubricate pawl lock **no. 9** with silicone compound grease (P/N 420 897 061). Install over pawl.



Install step collar **no. 10** with its sleeve first. Lubricate a new O-ring **no. 11** and locking element **no. 9** with silicone compound grease (P/N 420 897 061). Install over pawl lock.



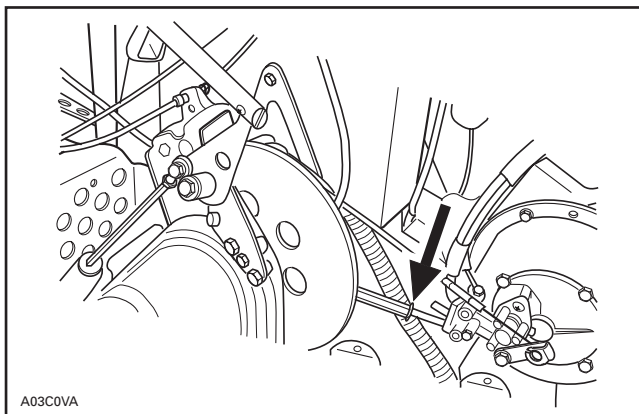
1. Step collar
2. O-ring
3. Locking element

Position a new push nut **no. 13**.

INSTALLATION

Reinstall oil pump on rewind starter assembly.

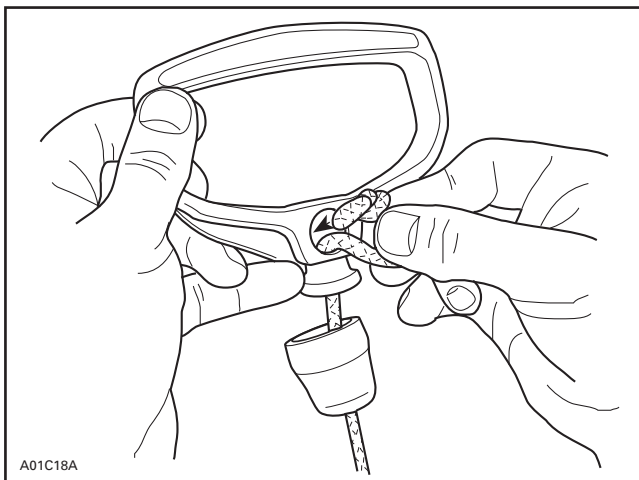
Thread starter rope **no. 6** through rope guide when applicable.



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.

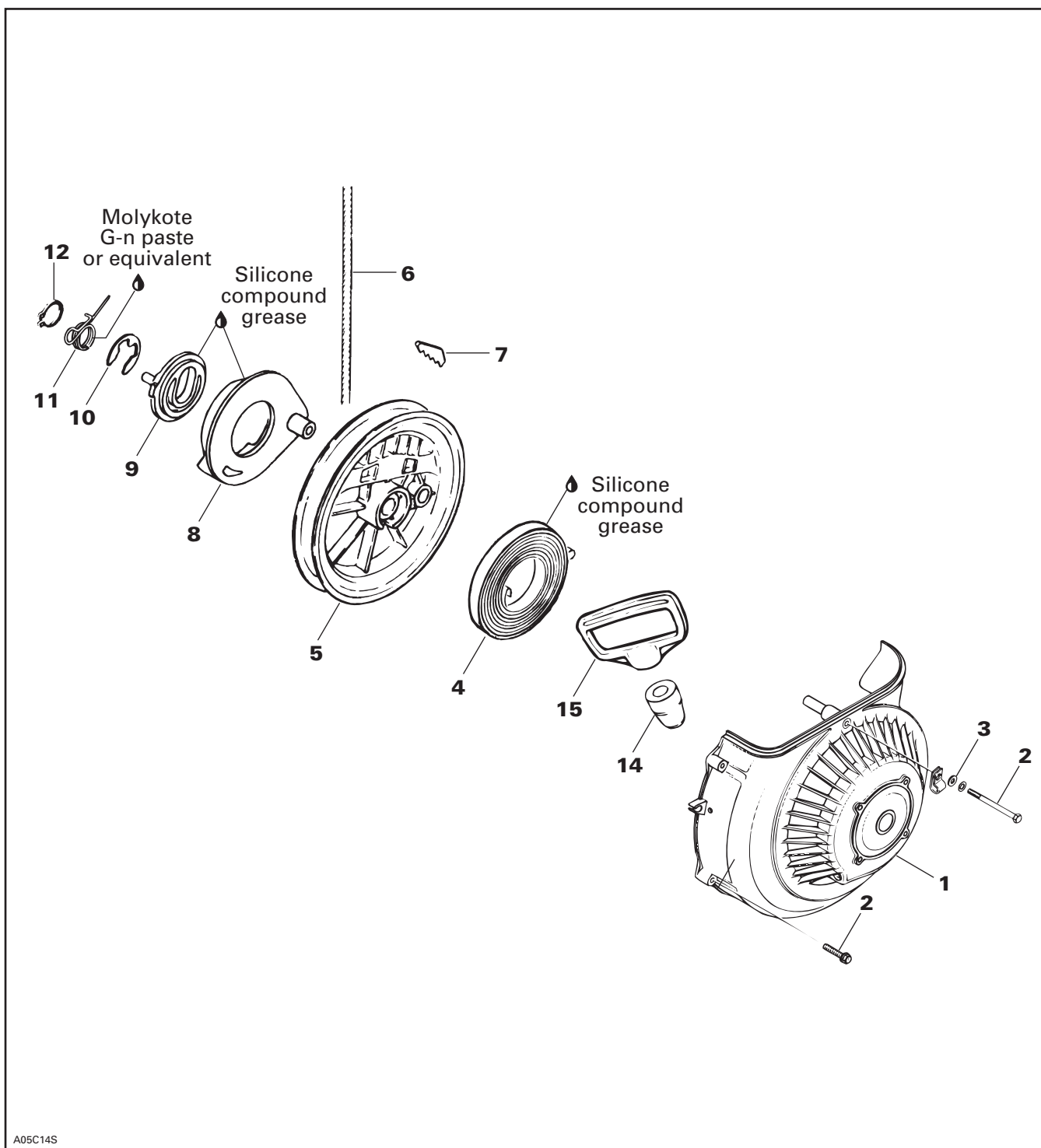


TYPICAL

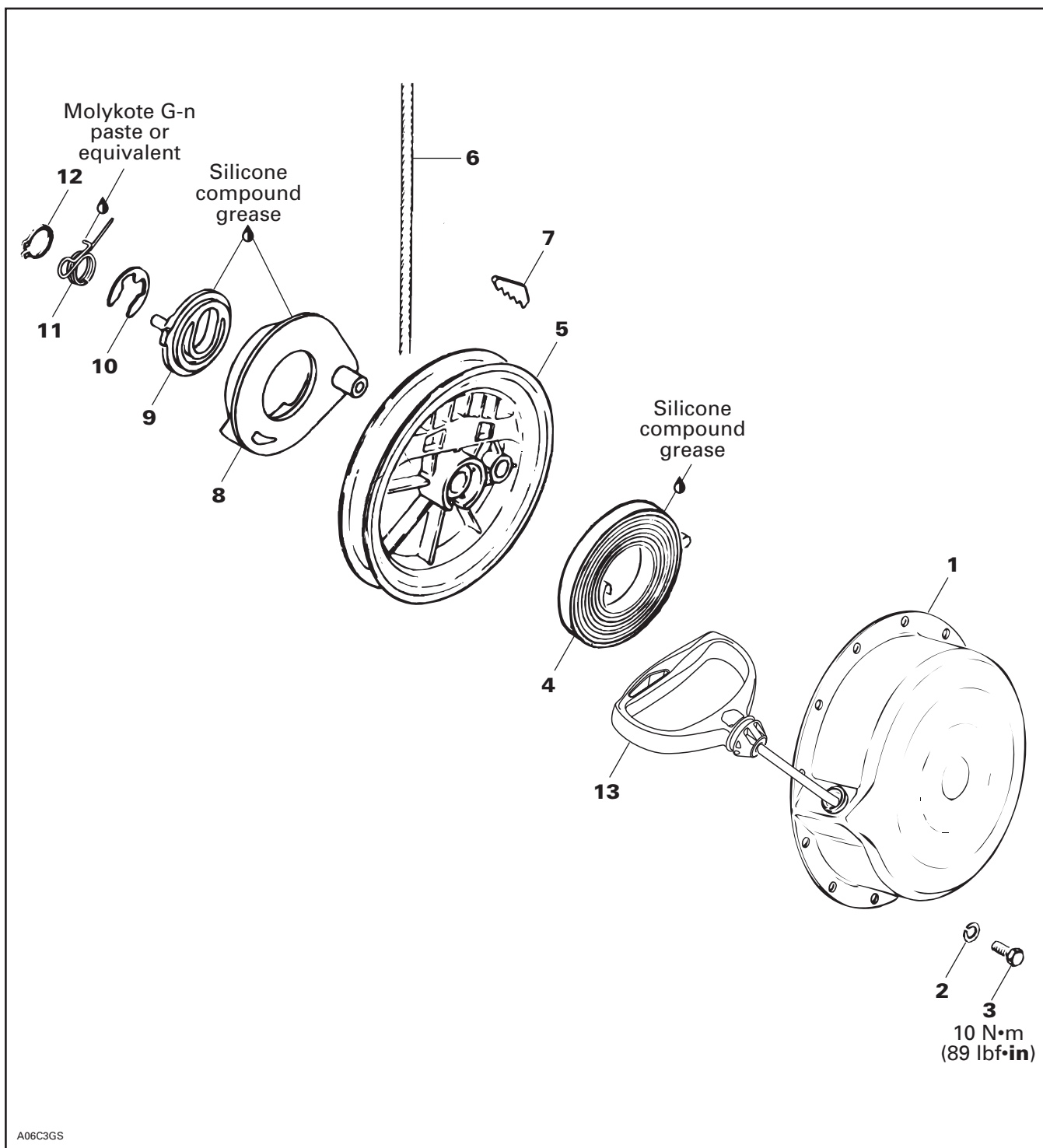
Section 04 ENGINE

Subsection 11 (REWIND STARTER)

Tundra R



All Liquid Cooled Models



Section 04 ENGINE

Subsection 11 (REWIND STARTER)

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(s) be lubricated periodically using specific lubricants. 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 melted plastic parts. Replace as required, lubricate, reassemble and recheck.

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.

REMOVAL

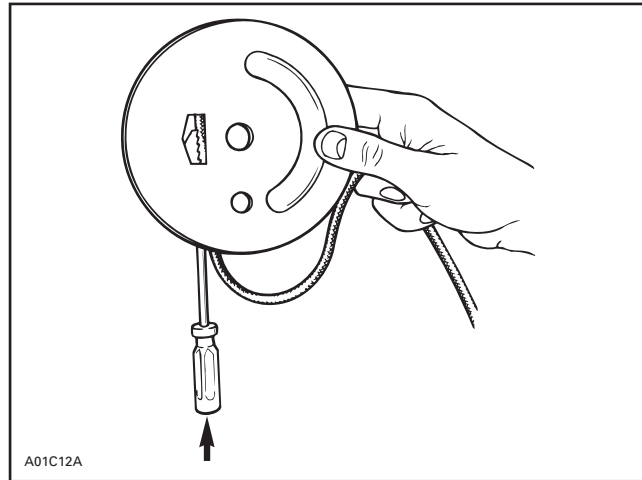
Using a small screwdriver, extract rope knot from starter grip **no. 15**. Cut rope close to knot. Tie a knot near starter.

Remove screws **no. 3** and washers **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

DISASSEMBLY

To remove rope from rewind starter mechanism:

- First remove locking ring **no. 12**, locking spring **no. 11**, circlip **no. 10**, pawl lock **no. 9** and pawl **no. 8**.
- Remove sheave **no. 5** from starter housing **no. 1**.
- Disengage key **no. 7** and pull out rope **no. 6**.



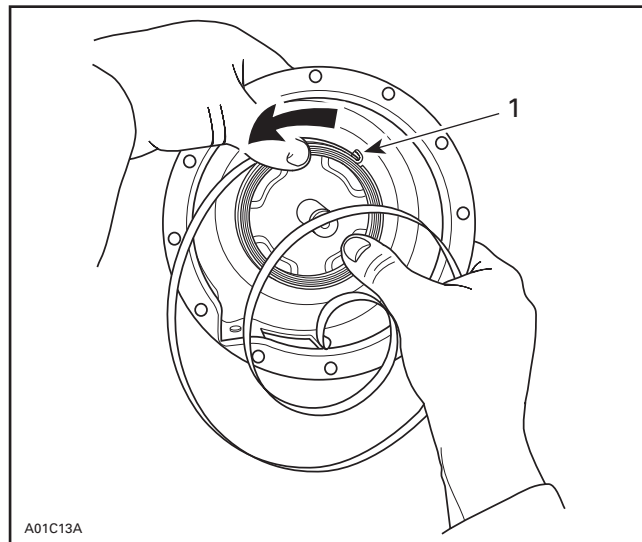
GENTLY TAP ON KEY

ASSEMBLY

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counter-clockwise into guide.

WARNING

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



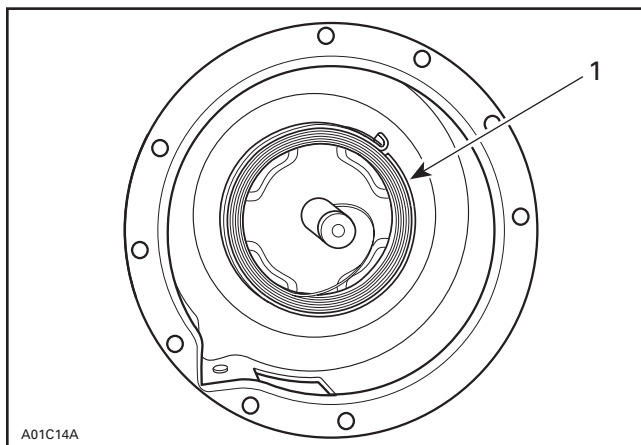
1. Outer end into guide notch

Section 04 ENGINE

Subsection 11 (REWIND STARTER)

Lubricate spring assembly with silicone compound grease (P/N 420 897 061) and position into starter housing as illustrated.

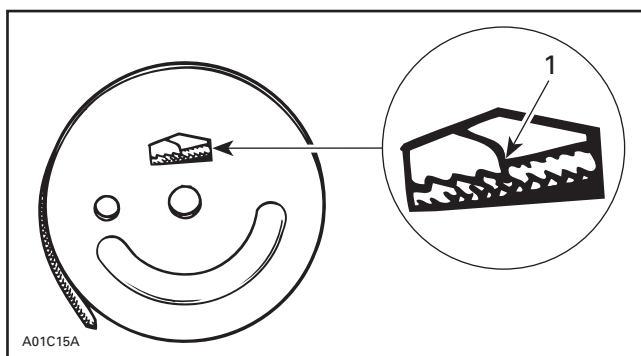
CAUTION: This lubricant must NOT be used on rewind starter locking spring as it does not stay on under vibration.



1. Grease inside spring guide

CAUTION: The use of standard multi-purpose grease could result in rewind starter malfunction.

To install a new rope no. 6, insert rope into sheave no. 5 orifice and lock it with the key no. 7 as illustrated.



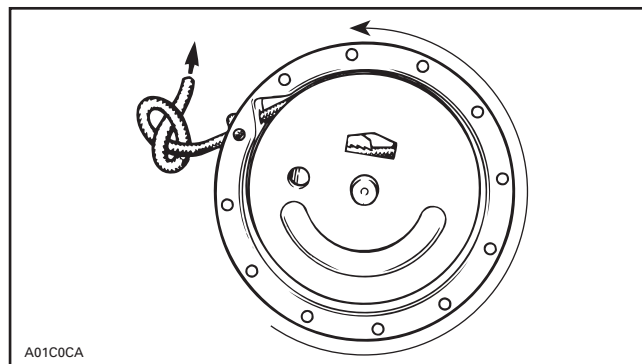
1. Push to lock

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 starter housing orifice.

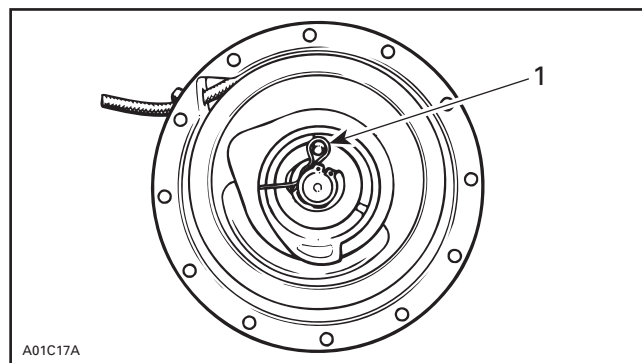
Pull the rope out of the starter housing and temporarily make a knot to hold it. One turn preload will give 7 turns of tension when fully extended.



Position pawl no. 8, pawl lock no. 9 and circlip no. 10.

Install locking spring no. 11 and lubricate with MOLYKOTE G-n paste from Dow Corning® or equivalent.

CAUTION: This lubricant must NOT be used on rewind springs as it does not stay on when dry.



1. Spring coated with MOLYKOTE G-n paste

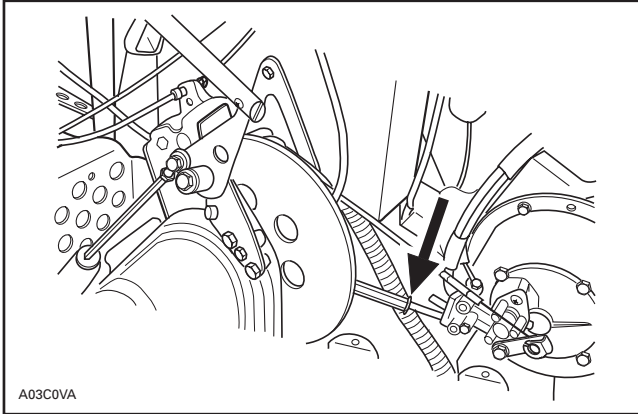
Install locking ring.

Section 04 ENGINE

Subsection 11 (REWIND STARTER)

INSTALLATION

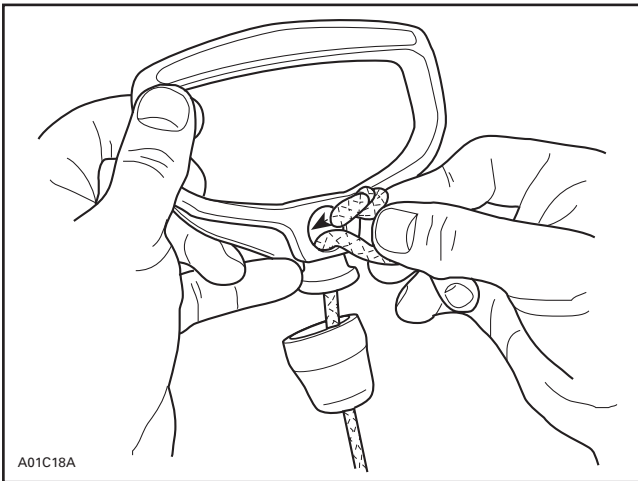
Thread starter rope **no. 6** through rope guide when applicable.



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.

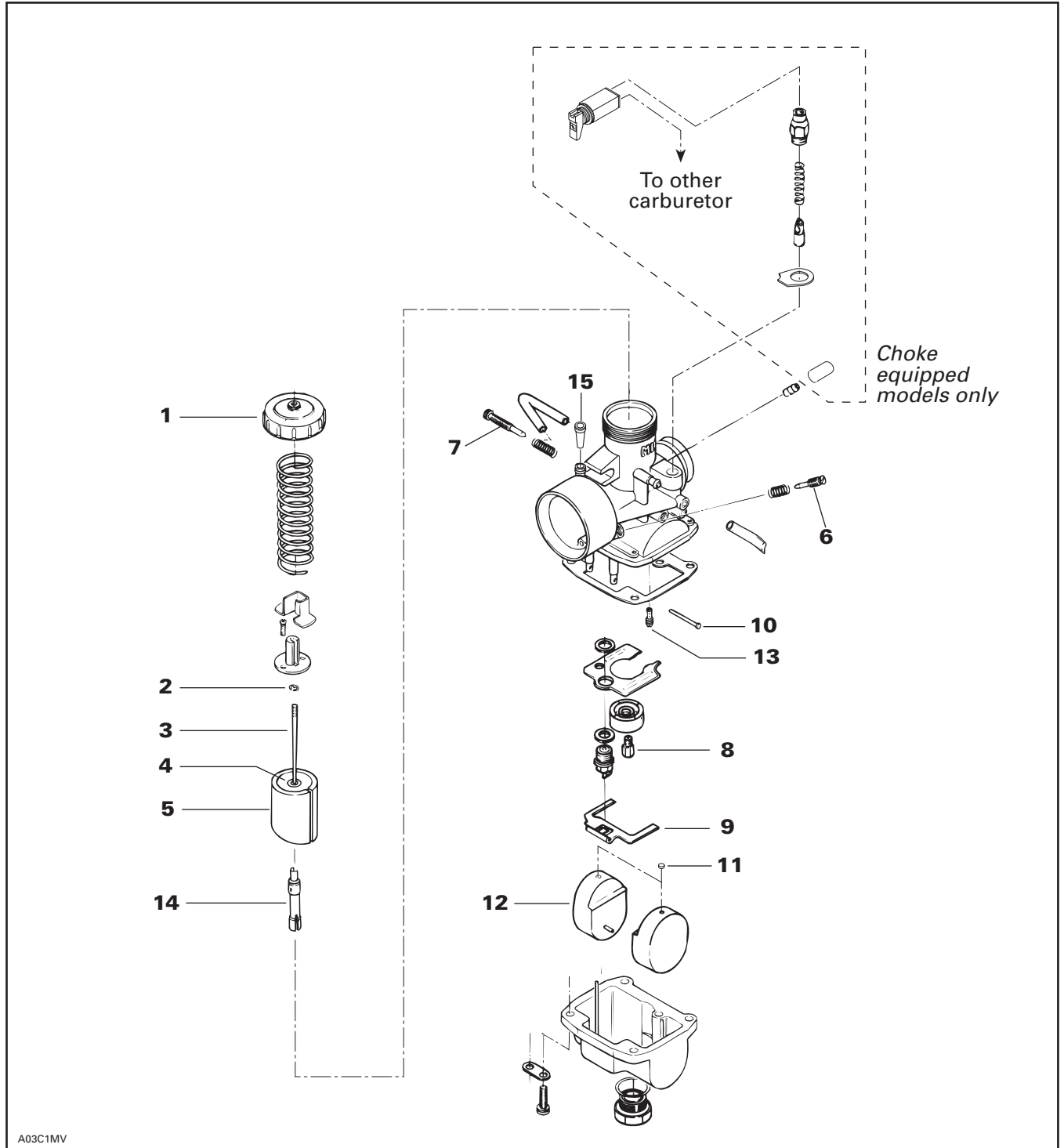


TYPICAL

CARBURETOR AND FUEL PUMP

CARBURETOR

All Models



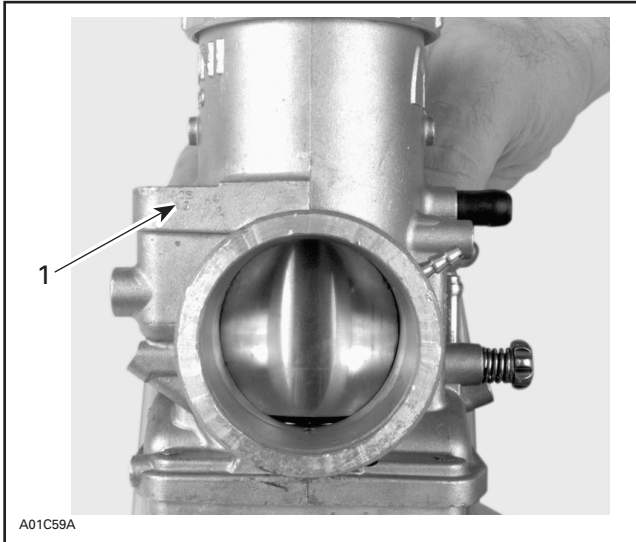
A03C1MV

Section 04 ENGINE

Subsection 12 (CARBURETOR AND FUEL PUMP)

IDENTIFICATION

All carburetors are identified on their body.

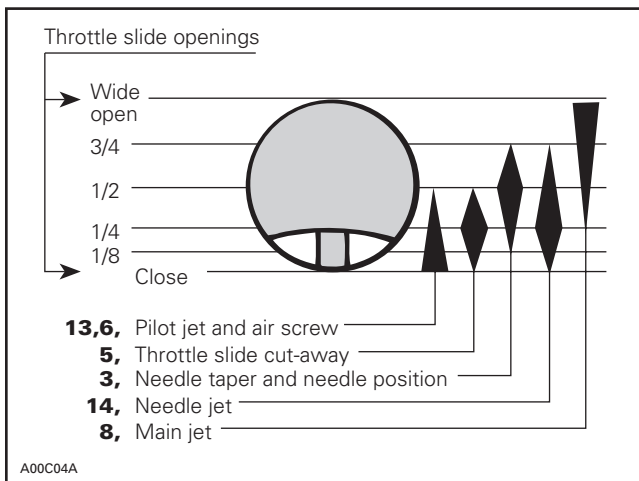


1. Identification: 34-482

CARBURETOR CIRCUIT OPERATION VERSUS THROTTLE OPENING

The following illustration shows the part of the carburetor which begins and stops to function at different throttle slide openings.

Note that the wider part of symbol corresponds to the opening mostly affected. For instance, throttle slide cut-away begins to function at closed position but it is most effective at 1/4 opening and decreases up to 1/2 opening.



VIEW FROM AIR INTAKE OPENING

NOTE: For proper calibration refer to TECHNICAL DATA 10 and to SPARK PLUG 06-03.

NOTE: For high altitude regions, the *High Altitude and Sea Level Technical Data Booklet* (P/N 484 200 019 and 484 054 500 for binder) gives information about calibration according to altitude and temperature.

REMOVAL

Remove air silencer(s). Refer to BATTERY 06-04.

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.

WARNING

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

Check for clogged filter **no. 15**. Clean or replace as required.

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 that idle speed screw **no. 7** is straight. Replace as necessary.

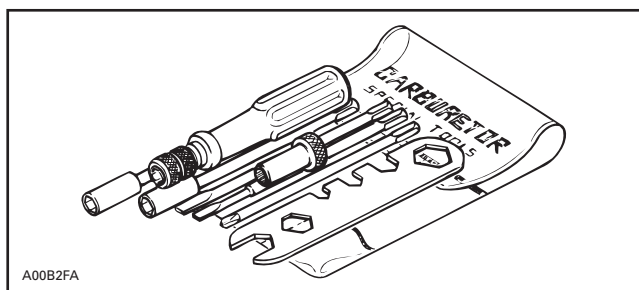
Check for fuel soaked into float **no. 12**; replace as necessary.

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).



2,3, E-Clip and Needle

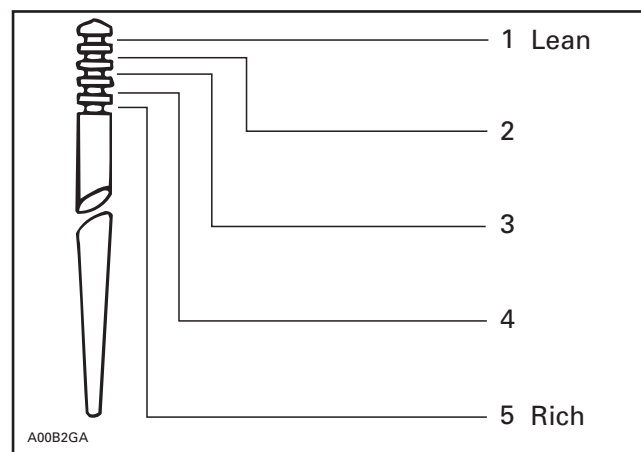
Remove screws from needle retaining plate to withdraw the needle.

The position of the needle in the throttle slide is adjustable by means of an E-clip 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.

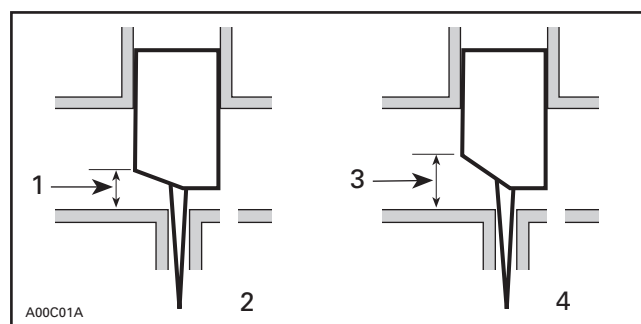
Example 6DH4-3

Needle identification ↑ Recommended position of the E-clip **from top**



CLIP POSITIONS

The size of the throttle slide cut-away affects the fuel mixture between 1/8 to 1/2 throttle opening.



1. Low cut-away low
2. Rich mixture
3. High cut-away high
4. Lean mixture

8, Main Jet

The main jet 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. Always check spark plug tip and/or piston dome color to find out correct jetting.

CARBURETOR FLOAT LEVEL ADJUSTMENT

9,10, Float Arm and Float Arm Pin

Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

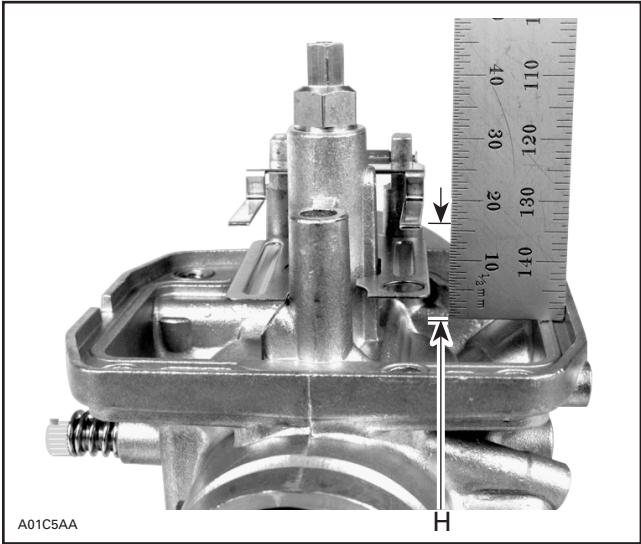
- Make sure that float arm is symmetrical — not distorted.
- Remove float bowl and gasket from carburetor.

Section 04

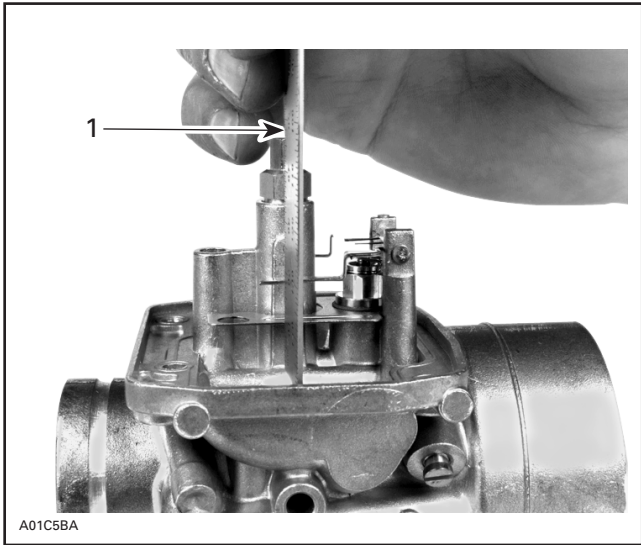
ENGINE

Subsection 12 (CARBURETOR AND FUEL PUMP)

- With carburetor chamber upside-down on a level surface, measure height H between bowl seat and top edge of float arm. Keep ruler perfectly vertical and in line with main jet hole.



TYPICAL
H: Float height

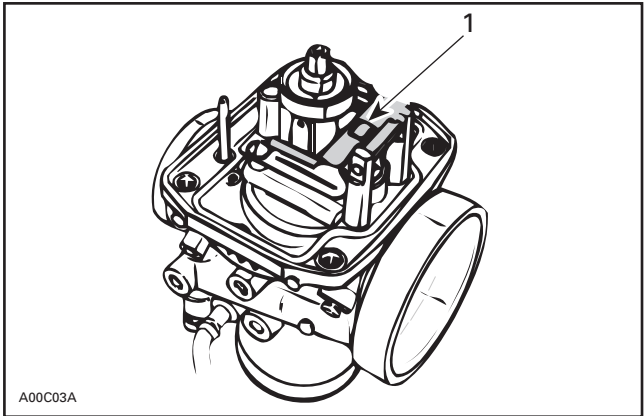


1. Ruler vertical and in line with main jet

CARBURETOR MODEL	FLOAT HEIGHT H	
	± 1 mm	(± .040 in)
Tundra R Skandic 380/500 Formula S Formula DLX 380/500 Touring E/LE/SLE MX Z 440	23.9	(.941)
Formula 500 LC/ DLX 500 LC Touring 500 LC	18.1	(.713)
Skandic WT/SWT/WT LC	36.5	(1.437)

To Adjust Height H

- Bend the contact tab of float arm until the specified height is reached.

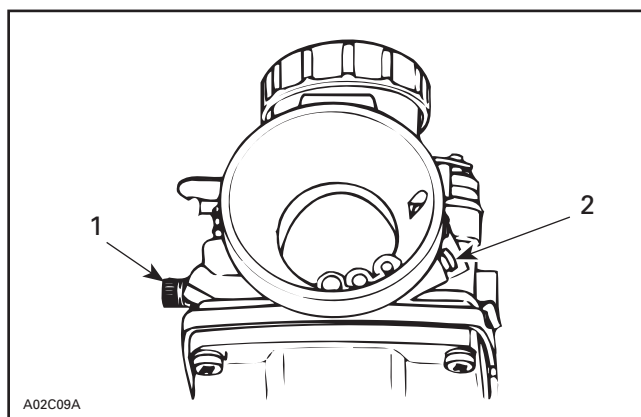


1. Contact tab

CARBURETOR ADJUSTMENTS

Adjustments should be performed following this sequence:

- air screw adjustment
- throttle slide height (preliminary idle speed adjustment)
- throttle cable adjustment
- carburetor synchronization (dual carburetor models)
- final idle speed adjustment (engine running)
- oil pump and carburetor synchronization



1. Idle speed screw
2. Air screw

6, Air Screw

Completely close the **air screw** (until a slight seating resistance is felt) then back off as specified.

Turning screw in clockwise enrichens mixture and conversely, turning it out counterclockwise leans mixture.

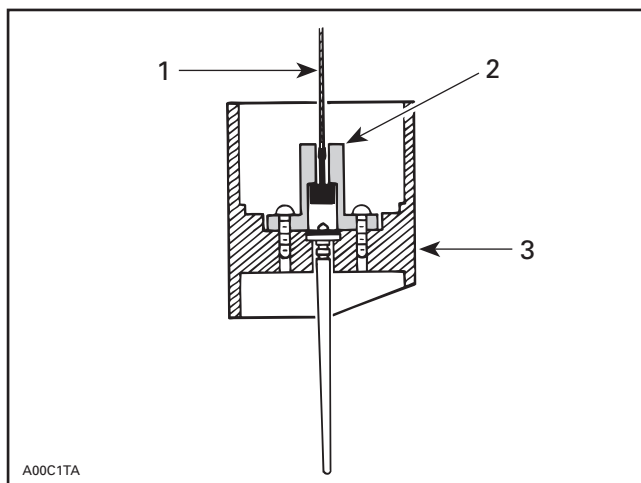
Refer to TECHNICAL DATA 10 for the specifications.

7, Idle Speed Screw

Throttle Slide Opening
(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 allow air escaping through and thus allowing a quick response.

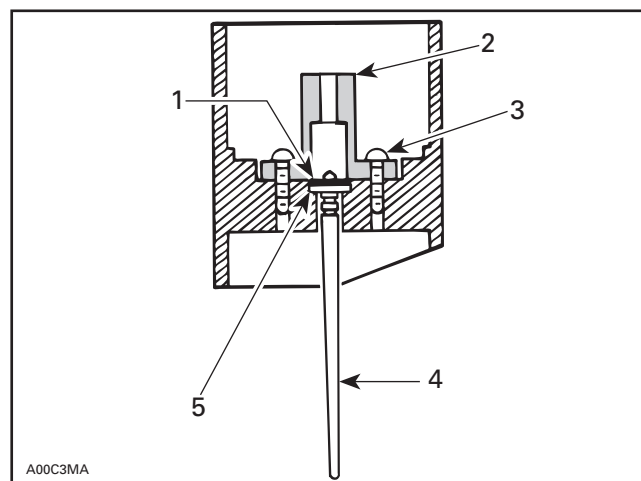


CENTER POST TYPE

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

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).

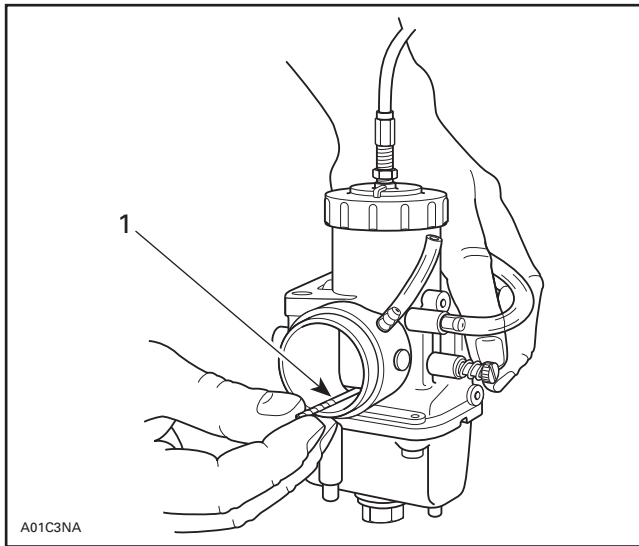
NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly. Throttle cable adjustment will be done during adjustment of throttle-slide-to-cover free play.

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 mm (in)
Tundra R Skandic 500, Formula DLX 500, Touring LE/SLE	1.5 (.059)
Skandic 380, Touring E, Formula S/DLX 380	1.3 (.051)
MX Z 440	1.5 (.059)
Formula 500 LC/DLX 500 LC	1.8 (.071)
Touring 500 LC	1.8 (.071)
Skandic WT/SWT/WT LC	1.5 (.059)

Section 04 ENGINE

Subsection 12 (CARBURETOR AND FUEL PUMP)



TYPICAL

1. Drill bit used as gauge for throttle slide height

INSTALLATION

CAUTION: Never allow throttle slide(s) to snap shut.

Prior to install 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 Adjustment

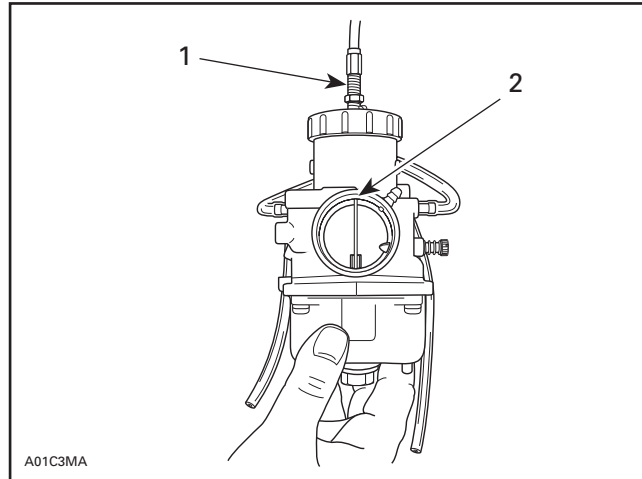
WARNING

Ensure the engine is turned OFF, prior to performing the throttle cable adjustment.

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).

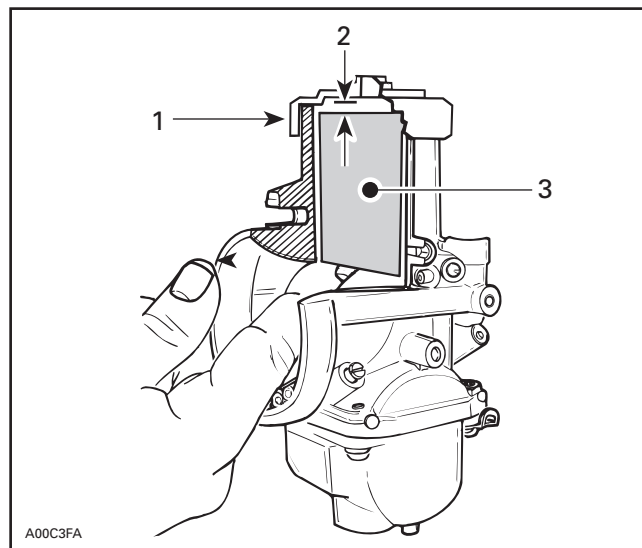
First loosen adjuster nut then turn throttle cable adjuster accordingly.



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)

Check that **with the throttle lever fully depressed**, 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

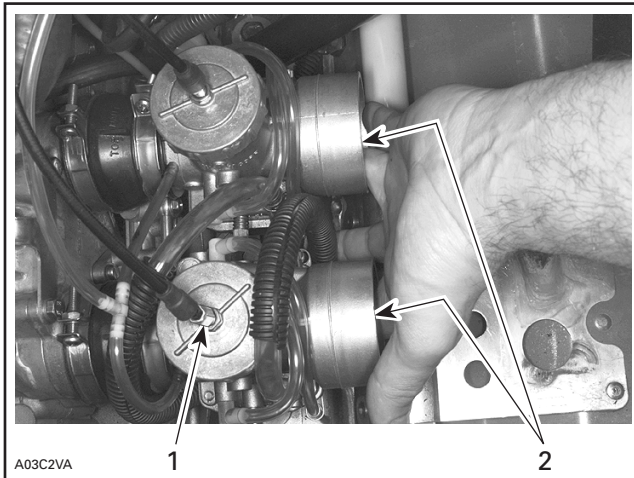
This gap is very important. If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

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. Beside do not interchange carburetors, 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: On oil injection models, the oil injection pump adjustment must be checked each time carburetor is adjusted. Refer to OIL INJECTION SYSTEM 04-07.

IDLE SPEED FINAL ADJUSTMENT**7, 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 04-07.

Start engine and allow it to warm then adjust idle speed 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.

Refer to TECHNICAL DATA 10 for the specifications.

CAUTION: Do not attempt to set the idle speed by using the air screw. Severe engine damage can occur.

Section 04 ENGINE

Subsection 12 (CARBURETOR AND FUEL PUMP)

CHOKE

S-Series and Skandic WT/SWT/WT LC

Choke Plunger Adjustment

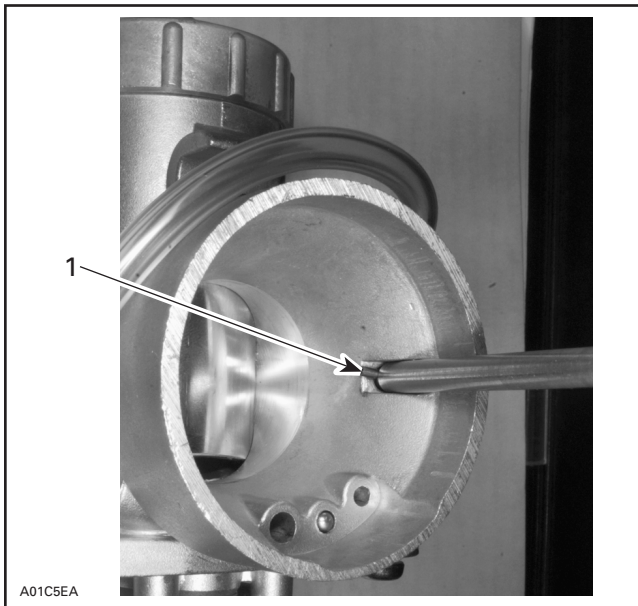
Set choke lever to fully open position.



CHOKE LEVER — FULLY OPEN POSITION

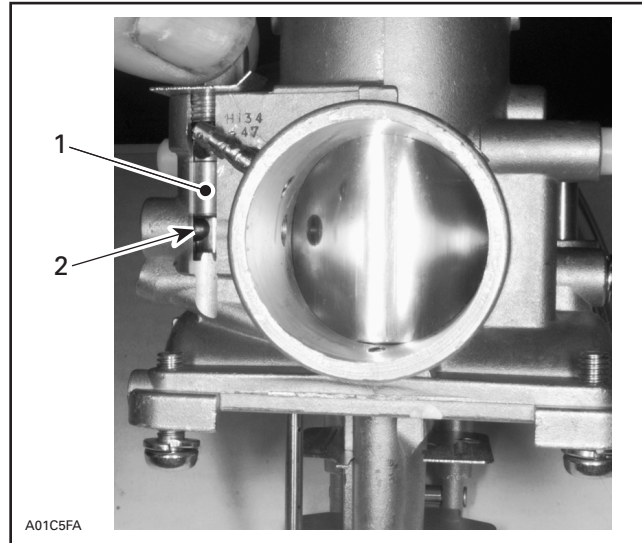
Use small diameter (for VM 34 carburetors) of choke plunger tool (P/N 529 032 100).

Insert choke plunger tool 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



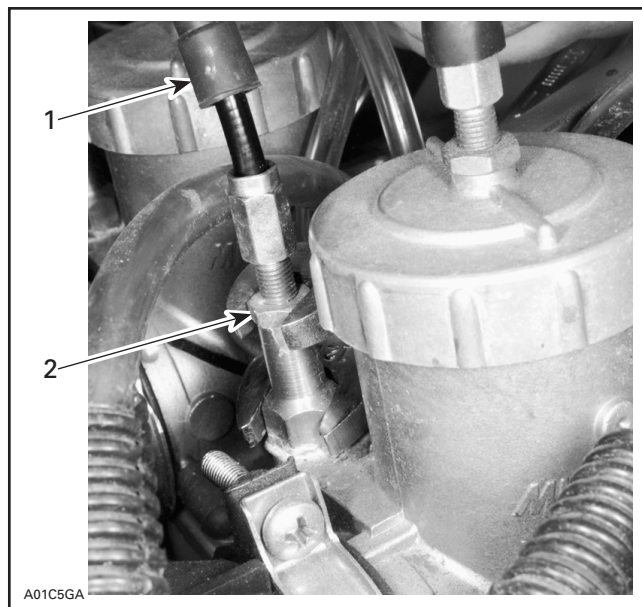
CUT-AWAY (ENGINE SIDE SHOWN)

1. Choke plunger
2. Tool properly seated under choke plunger

If tool tip does not seat under choke plunger **no. 15**, adjust as follows:

Make sure choke lever is at fully open position.

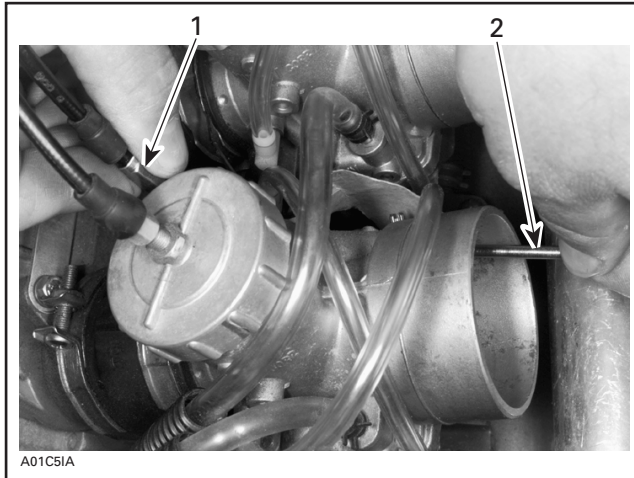
Lift up protector cap and loosen choke cable lock nut, as shown in the next photo.



1. Lift up protector cap
2. Loosen lock nut

Turn choke cable adjustment nut by hand until tool properly seats under choke plunger.

NOTE: A light pressure should 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).



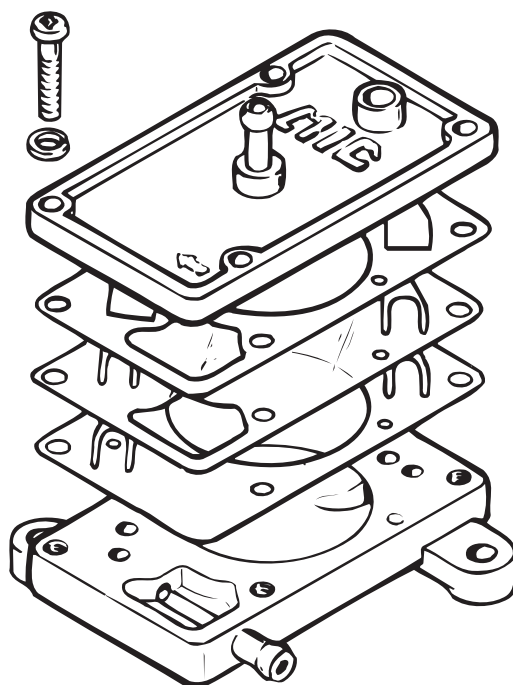
CHOKE LEVER — CLOSED POSITION

Section 04 ENGINE

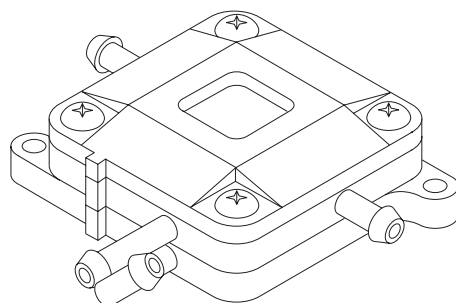
Subsection 12 (CARBURETOR AND FUEL PUMP)

FUEL PUMP

277 engine



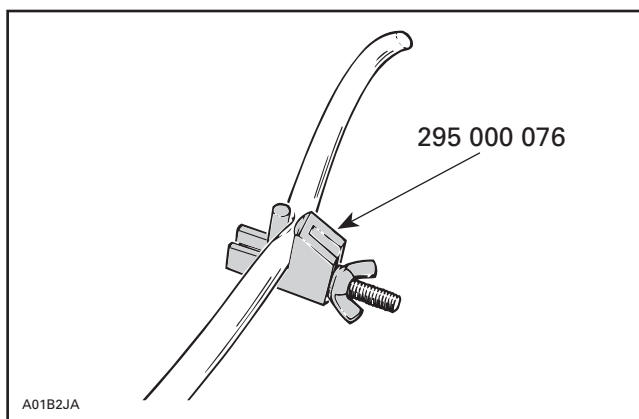
494 engine



A06C45T

REMOVAL

Install a hose pincer (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.

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

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover. Either apply pressure or vacuum. 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

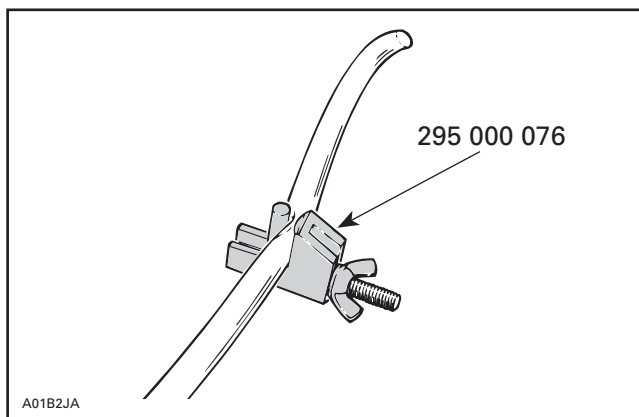
Pressure test to ensure there is no leak in fuel system.

FUEL TANK AND THROTTLE CABLE

Fuel Tank Lines

WARNING

When draining a fuel tank or whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 529 000 076) 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

All Models

Always reposition spring clips after any repair to prevent possible leaks.

Throttle Cable Circlip at Handlebar

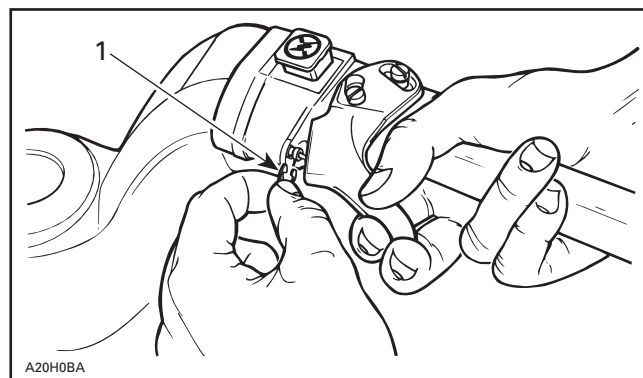
All Models

Put silicone grease (P/N 413 701 700) around cable barrel. Locate circlip as per illustration.

WARNING

If this procedure is disregarded, throttle might be half-open at normally closed position and the engine will speed up when starting.

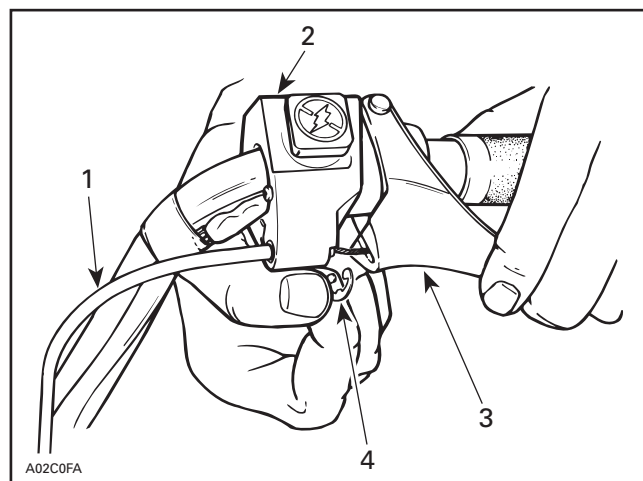
Models with Easy Action Throttle Lever



TYPICAL

1. Circlip

Other Models



TYPICAL

1. Throttle cable housing
2. Throttle handle housing
3. Throttle handle
4. Circlip

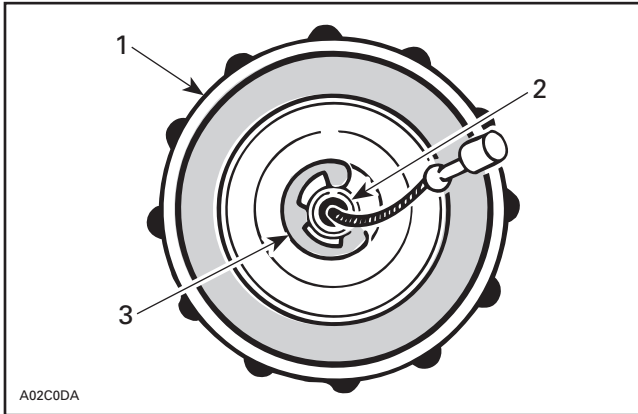
Section 04 ENGINE

Subsection 13 (FUEL TANK AND THROTTLE CABLE)

Throttle Cable O-Ring and Retaining Ring at Carburetor

Some Models

Locate O-ring outside of carburetor cover and retaining ring inside.



- 1. Carburetor cover
- 2. Throttle cable housing
- 3. Retaining ring

Adjust throttle cable as specified in CARBURETOR AND FUEL PUMP 04-12.

Throttle Cable Routing

CAUTION: Check that throttle cable is routed away from sharp edges, hot or vibrating parts. When turning steering while engine is running, idle speed must not vary.