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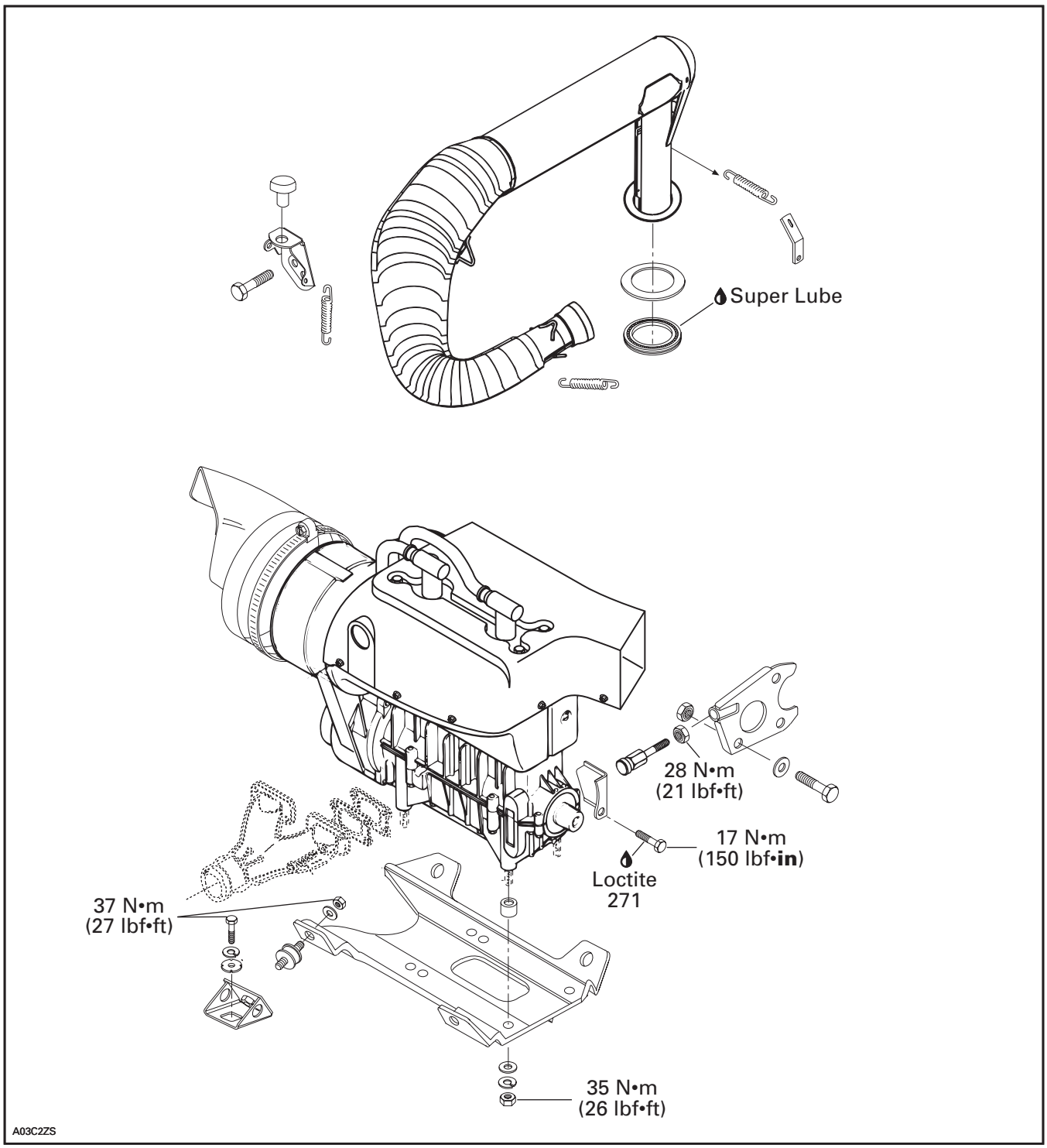
443 AND 503 ENGINE TYPES

ENGINE REMOVAL AND INSTALLATION

443 Engine Type



PARTS

ENGINE REMOVAL AND INSTALLATION

Disconnect or remove the following:

◆ WARNING

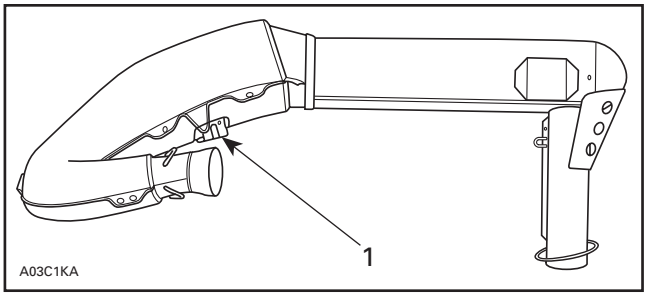
Before disconnecting any electrical wire in starter system always first disconnect the BLACK negative battery cable (on electric starting models).

- negative cable from battery (on electric starting models)
- belt guard
- drive belt
- drive pulley using appropriate puller, refer to 05-03 DRIVE PULLEY
- air silencer and carburetors
- impulse line from engine crankcase
- 4-connector housing
- exhaust pipe and exhaust cooling hose on so equipped models
- oil pump inlet tube and plug it
- oil pump cable
- rewind cable: tie a knot near rewind housing and remove starting grip

TUNED PIPE IDENTIFICATION

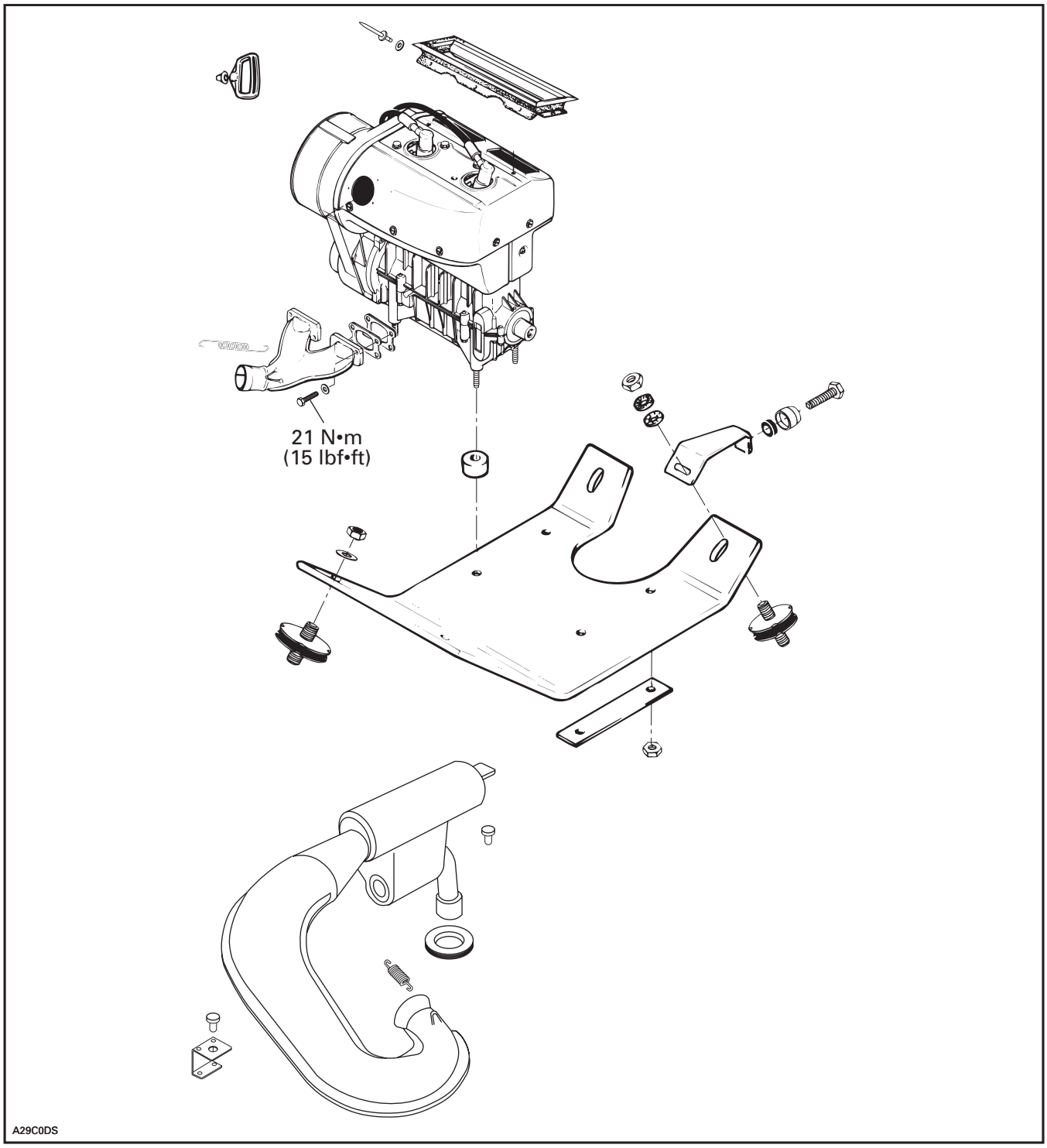
This part is identified on welded support.

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



1. Identification: 0464 for 514 046 400

Skandic WT/SWT 503 Engine Type



ENGINE REMOVAL AND INSTALLATION

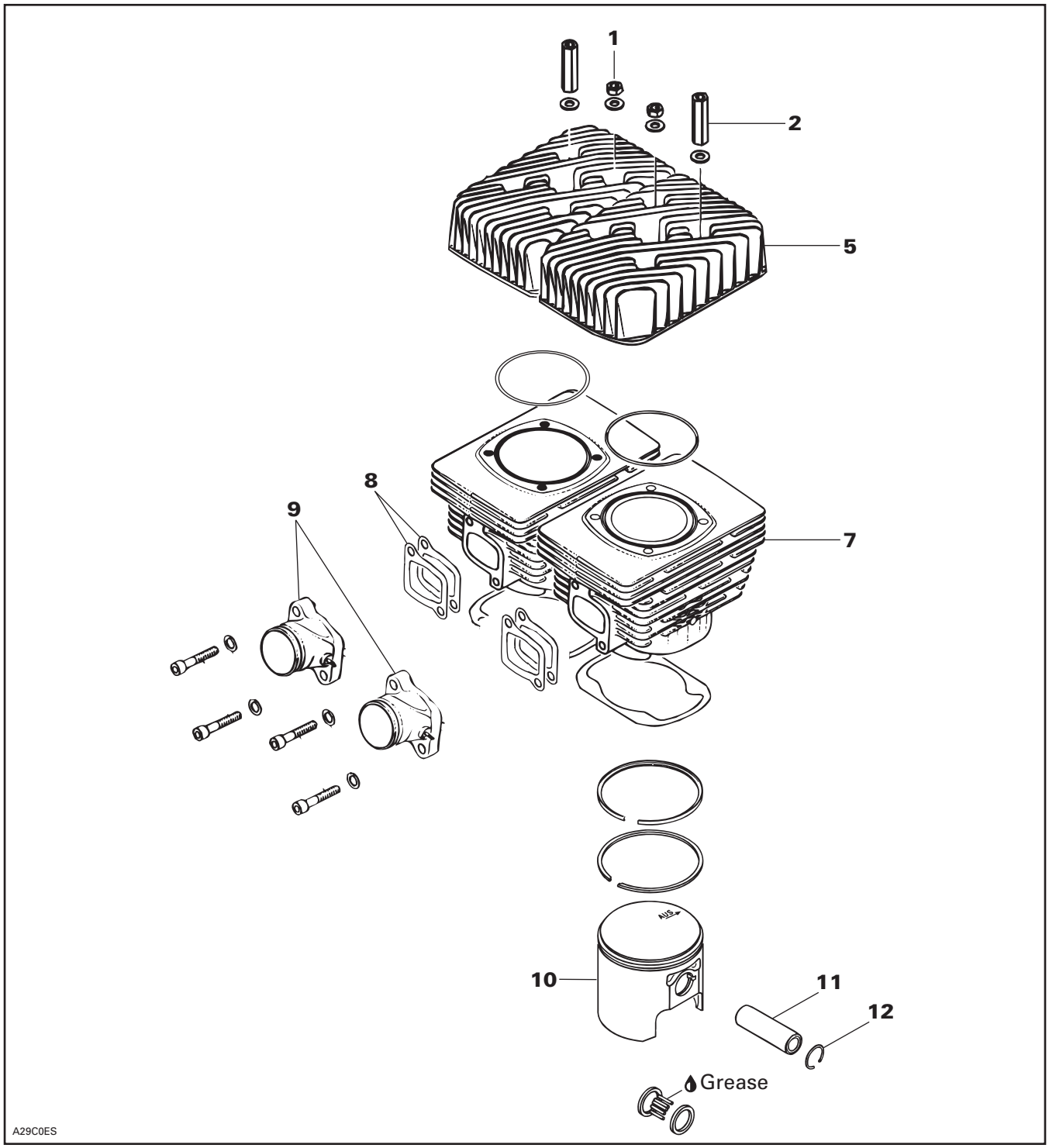
Disconnect or remove the following:

◆ 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
- positive cable and wire from starter then from engine
- belt guard
- drive belt
- drive pulley using appropriate puller, refer to 05-03 DRIVE PULLEY
- air silencer and carburetor
- impulse line from engine crankcase
- electrical connector housings
- exhaust pipe
- oil pump inlet tube and plug it
- oil pump cable
- rewind cable: tie a knot near rewind housing and remove starting grip

TOP END



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.

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

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips no. 12 from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston no. 10.

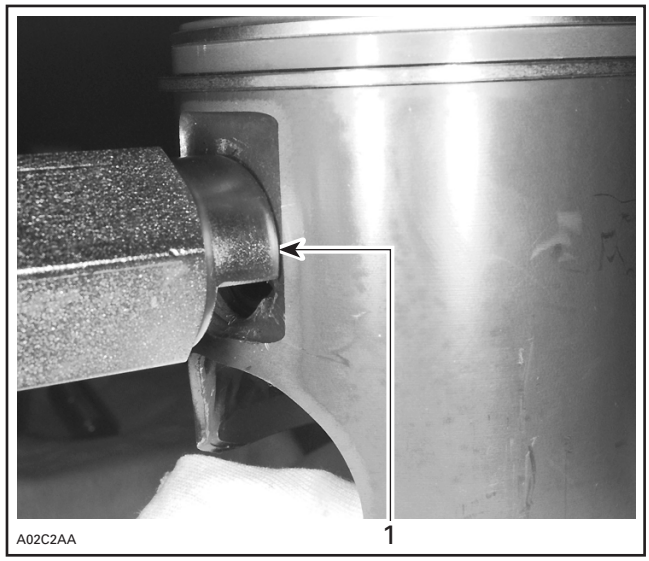

A02C29A

TYPICAL

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.

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

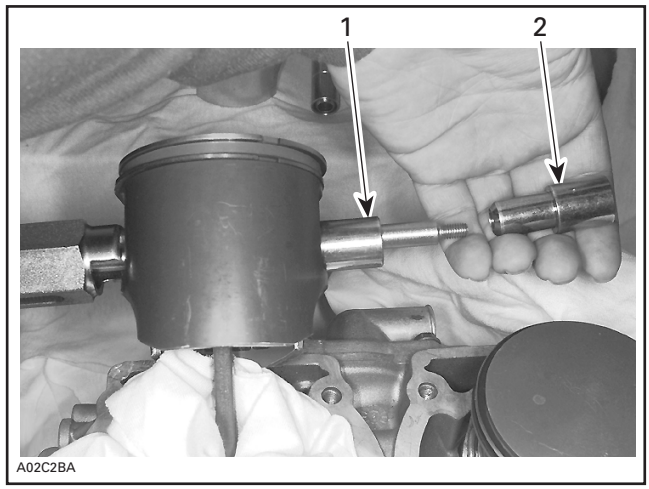


A02C2AA

TYPICAL

1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

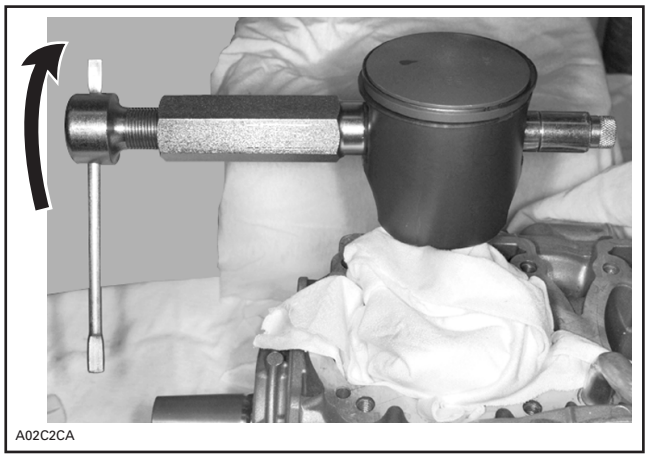


A02C2BA

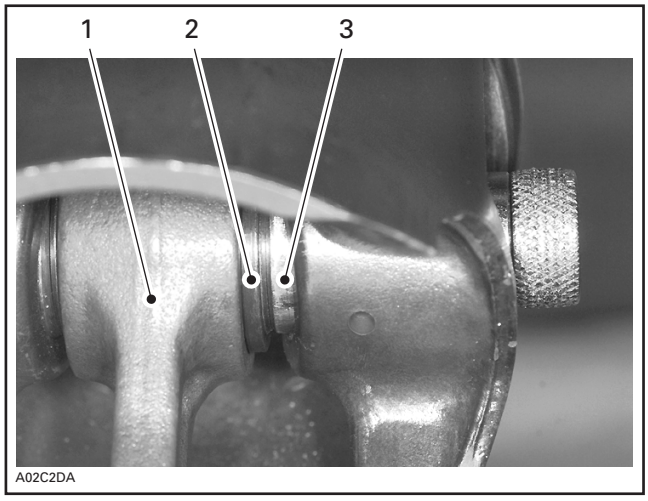
TYPICAL — INSTALLATION OF SLEEVE KIT

1. Sleeve
2. Shouldered sleeve

Pull out piston pin **no. 11** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.



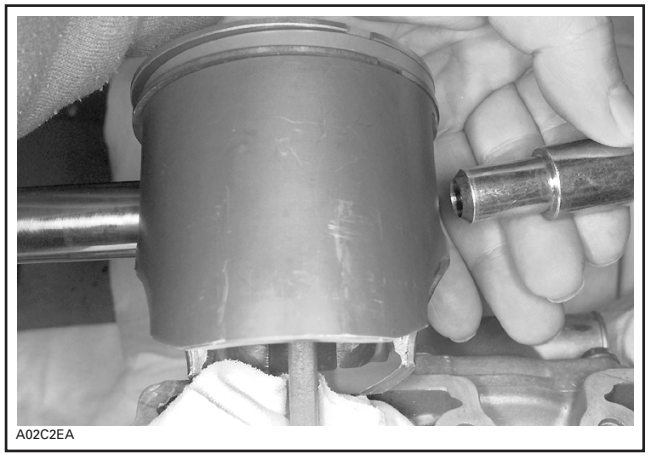
TYPICAL — PISTON PIN EXTRACTION



TYPICAL

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

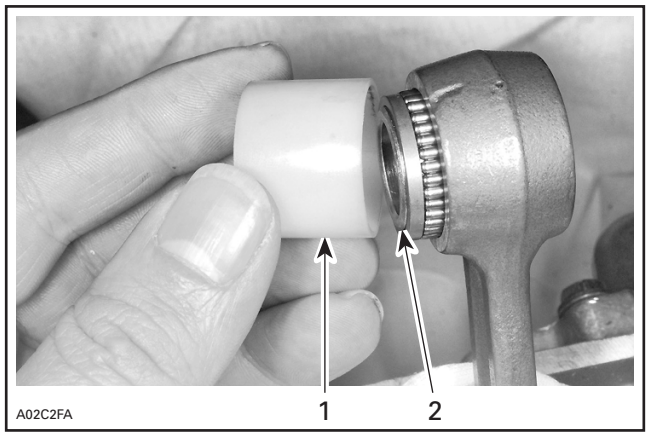
Remove puller. Pull out shouldered sleeve carefully.



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*

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

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

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

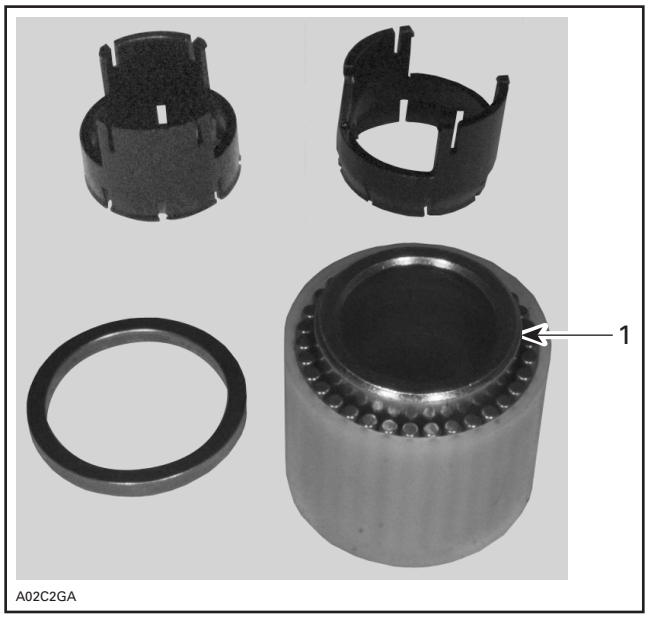
INSPECTION

Refer to ENGINE DIMENSIONS MEASUREMENT 04-04.

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.



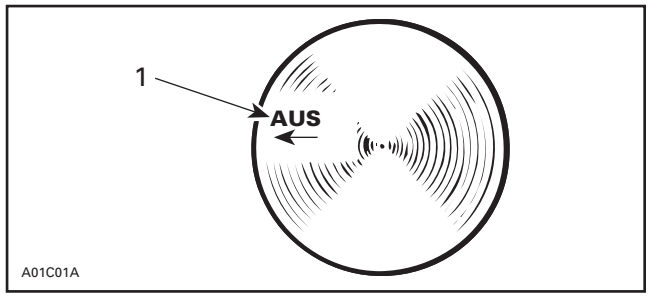
TYPICAL
1. Sleeve

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.

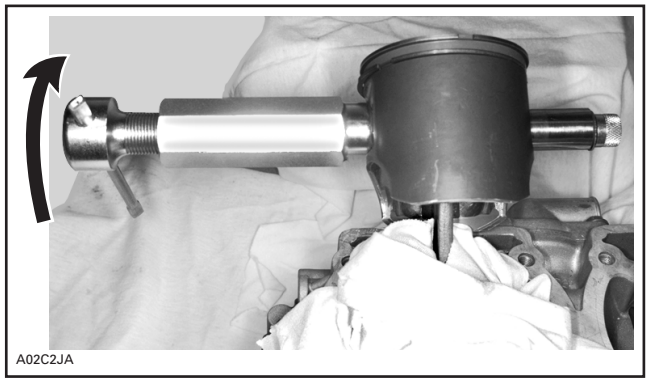


1. Exhaust

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

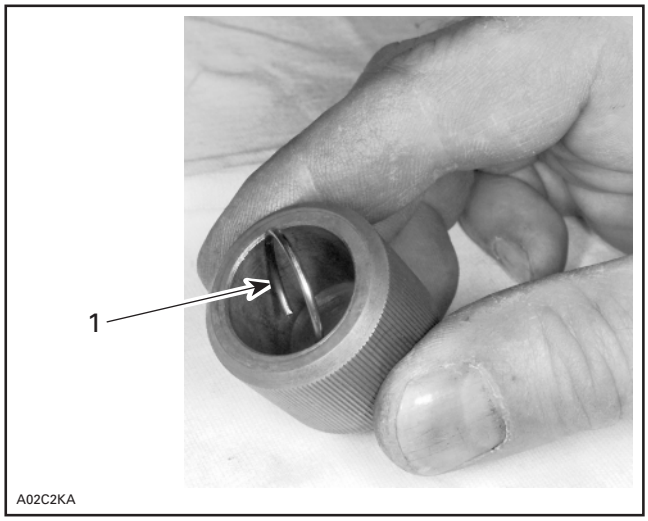
Install piston pin puller and turn handle until piston pin is correctly positioned in piston.



TYPICAL

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).

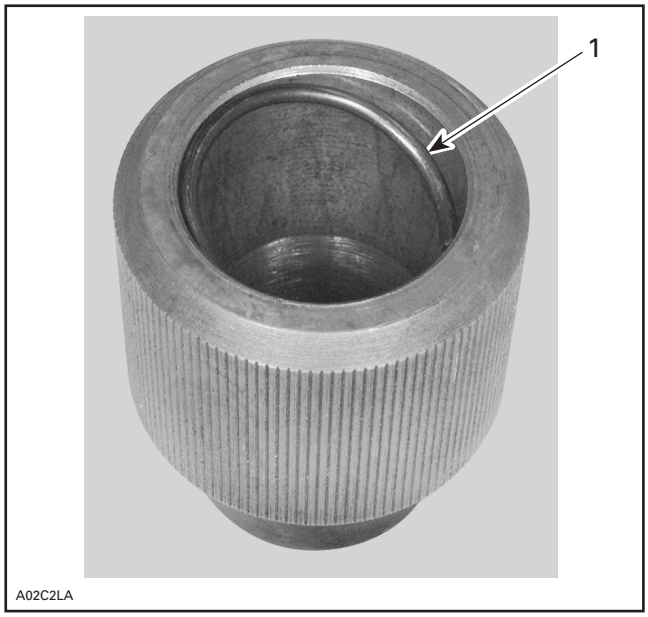
Insert circlip in tool at an angle.



TYPICAL

1. Circlip

Square it up using a finger.



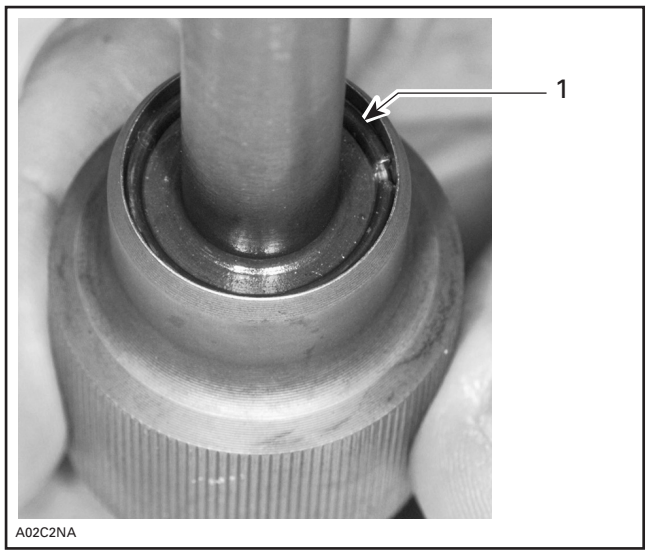
TYPICAL

1. Circlip

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

TYPICAL

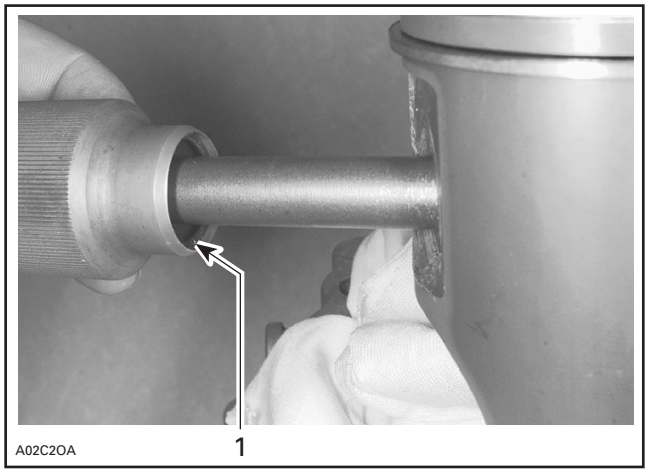
Using square end of tool, push circlip in until it rests in groove.



TYPICAL

1. Circlip in groove

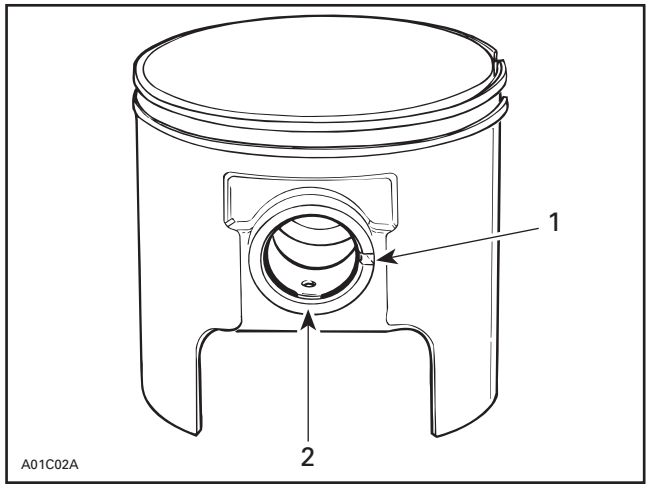
Mount tool in piston making sure that circlip break is facing down.



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.

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. 7**, lubricate the cylinder with new injection oil or equivalent.

Install proper ring compressor on piston assembly.

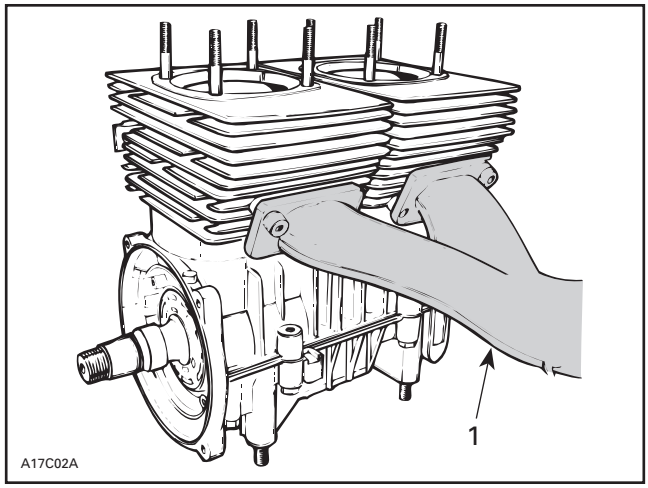
ENGINE TYPE	RING COMPRESSOR P/N
443	420 876 090
503	420 876 970

NOTE: The ring compressor will not fit on oversize pistons.

Check flatness of intake sockets **no. 9**. Refer to ENGINE DIMENSION MEASUREMENT 04-04 and look for **Checking Surface Flatness**.

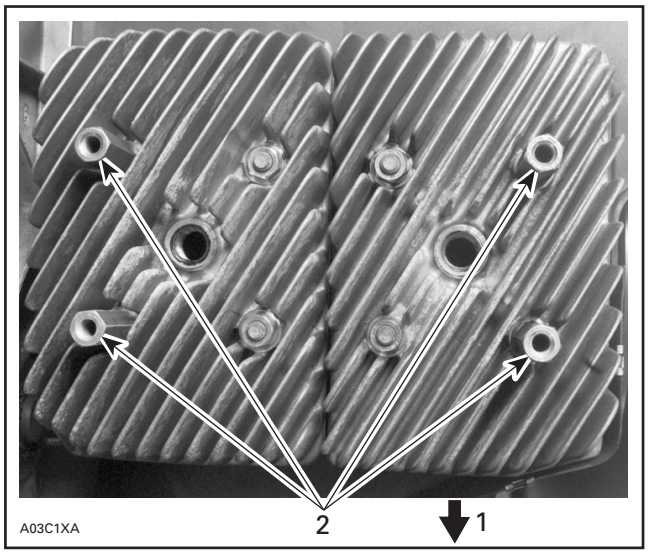
At cylinder **no. 7** and/or cylinder head **no. 5** installation, use aligning tool or exhaust manifold itself to ensure sealing of intake manifold and exhaust before tightening cylinder head nuts.

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



1. Or use exhaust manifold to align cylinders

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



1. Exhaust side
2. Distance nuts

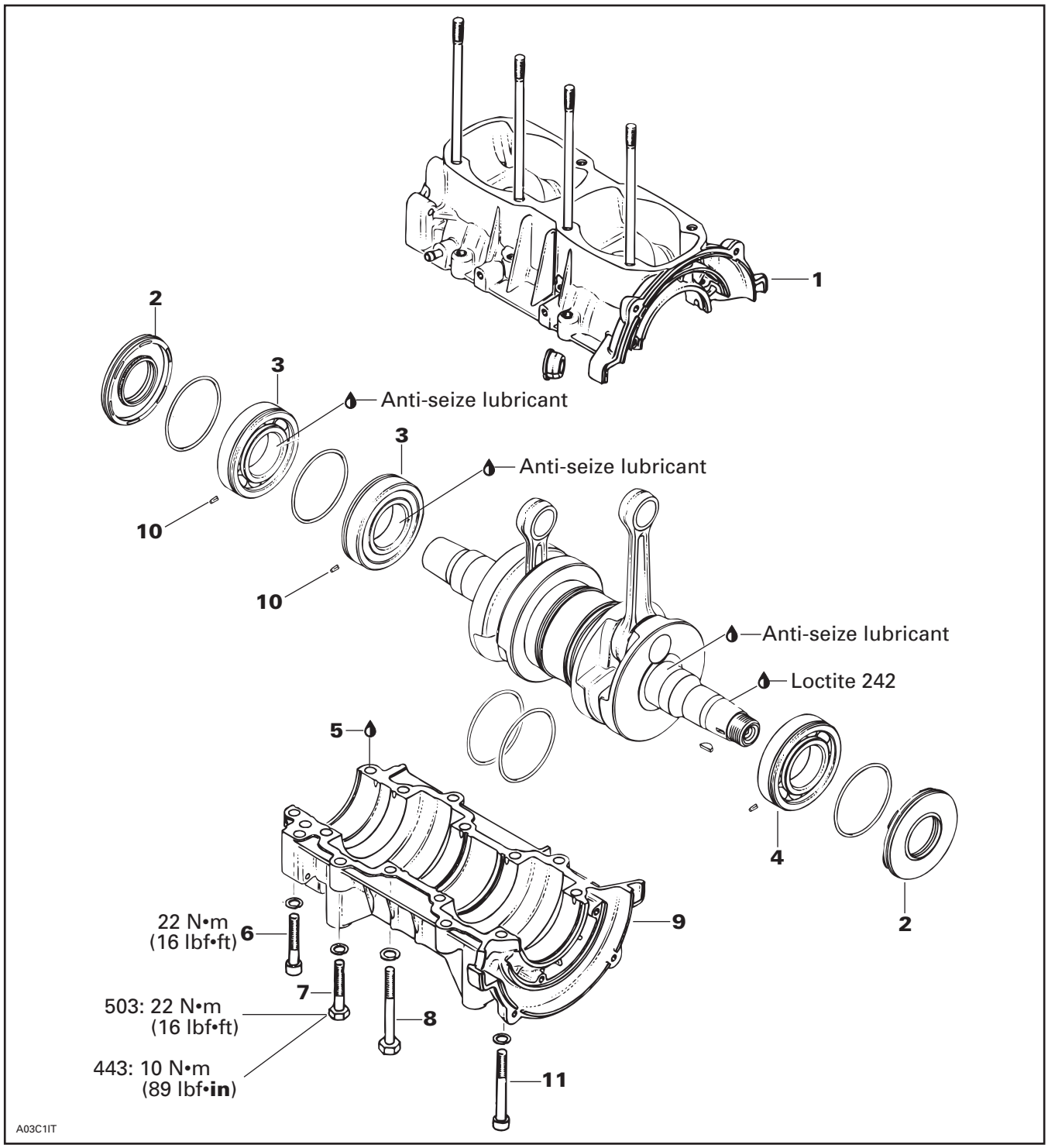
Cross torque cylinder head nuts **nos. 1** and **2** to 22 N•m (16 lbf•ft); torque each cylinder head individually.

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).

BOTTOM END


1
2
3
Anti-seize lubricant
3
Anti-seize lubricant
10
10
Anti-seize lubricant
Loctite 242
5
4
2
22 N•m
(16 lbf•ft)
6
9
7
503: 22 N•m
(16 lbf•ft)
8
443: 10 N•m
(89 lbf•in)
11
A03C1IT

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.

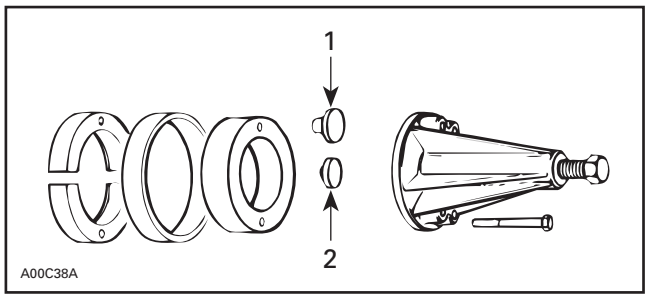
Remove old sealant from crankcase mating surfaces with Bombardier gasket remover (P/N 413 708 500).

▼ 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

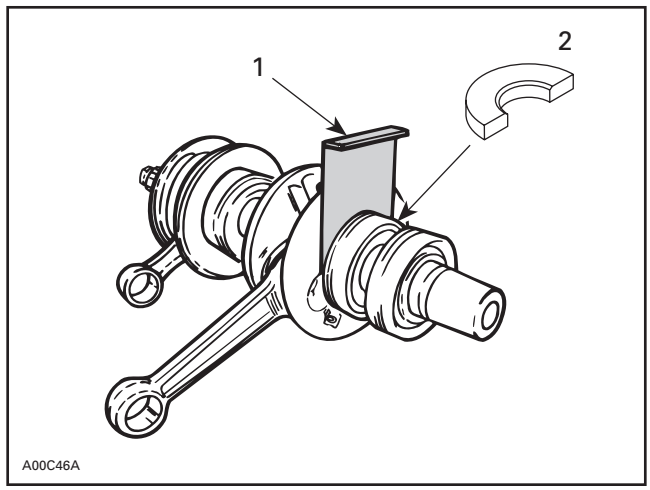
Refer to ENGINE DIMENSIONS MEASUREMENT 04-04.

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 443 engine and (P/N 420 876 824) for 503 engine for proper positioning.



1. Feeler gauge
2. Distance gauge

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

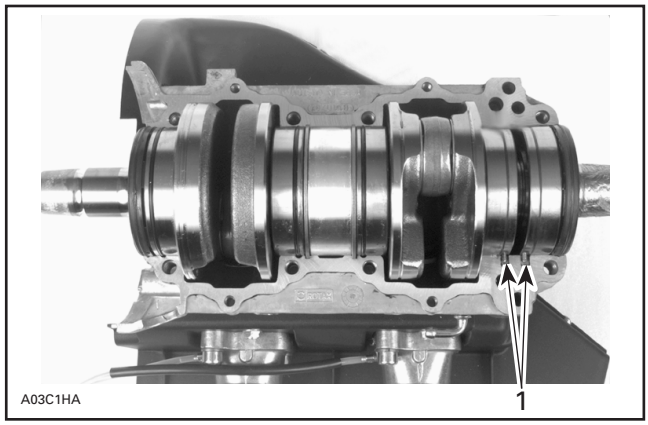
▼ CAUTION

Do not exceed 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.



1. Drive pins

At seal **no. 2** assembly, apply a light coat of Molykote 111 (P/N 413 707 000) on seal lip.

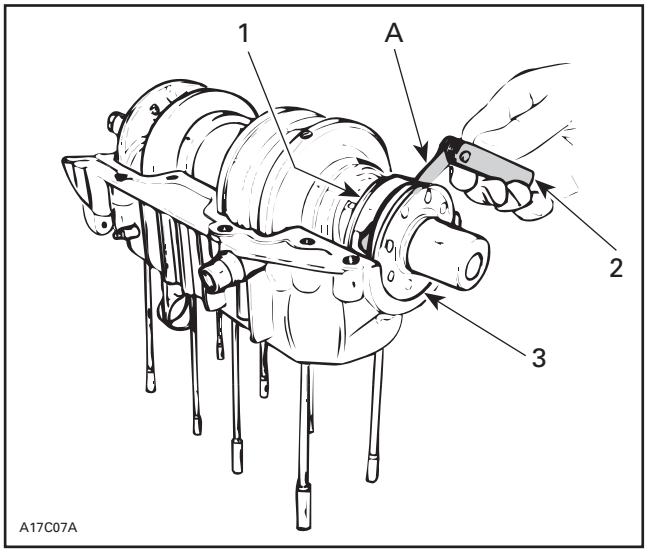
PTO side seal must be filled up with Molykote 111.

▼ 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 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) 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.

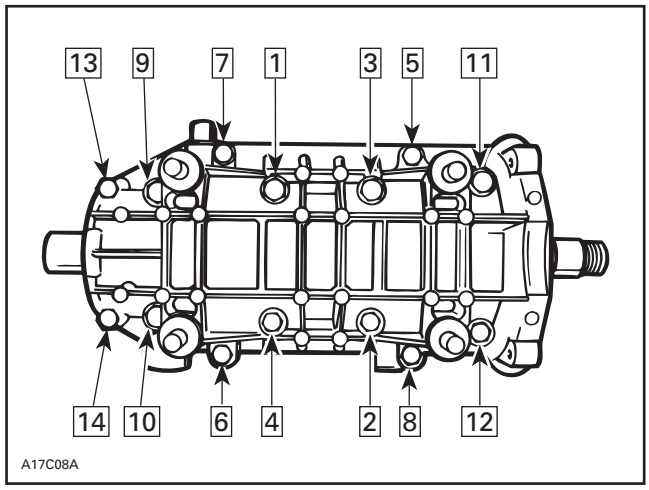
Apply paste gasket (P/N 413 702 700) **no. 5** on the other mating surface.

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

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.

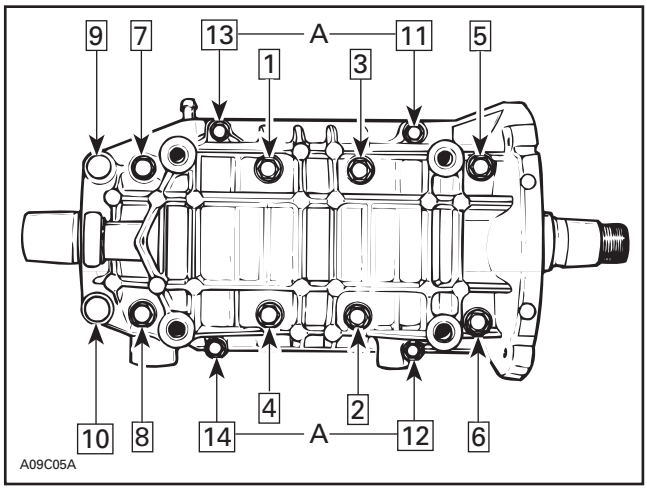
503 Engine

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



443 Engine

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)*

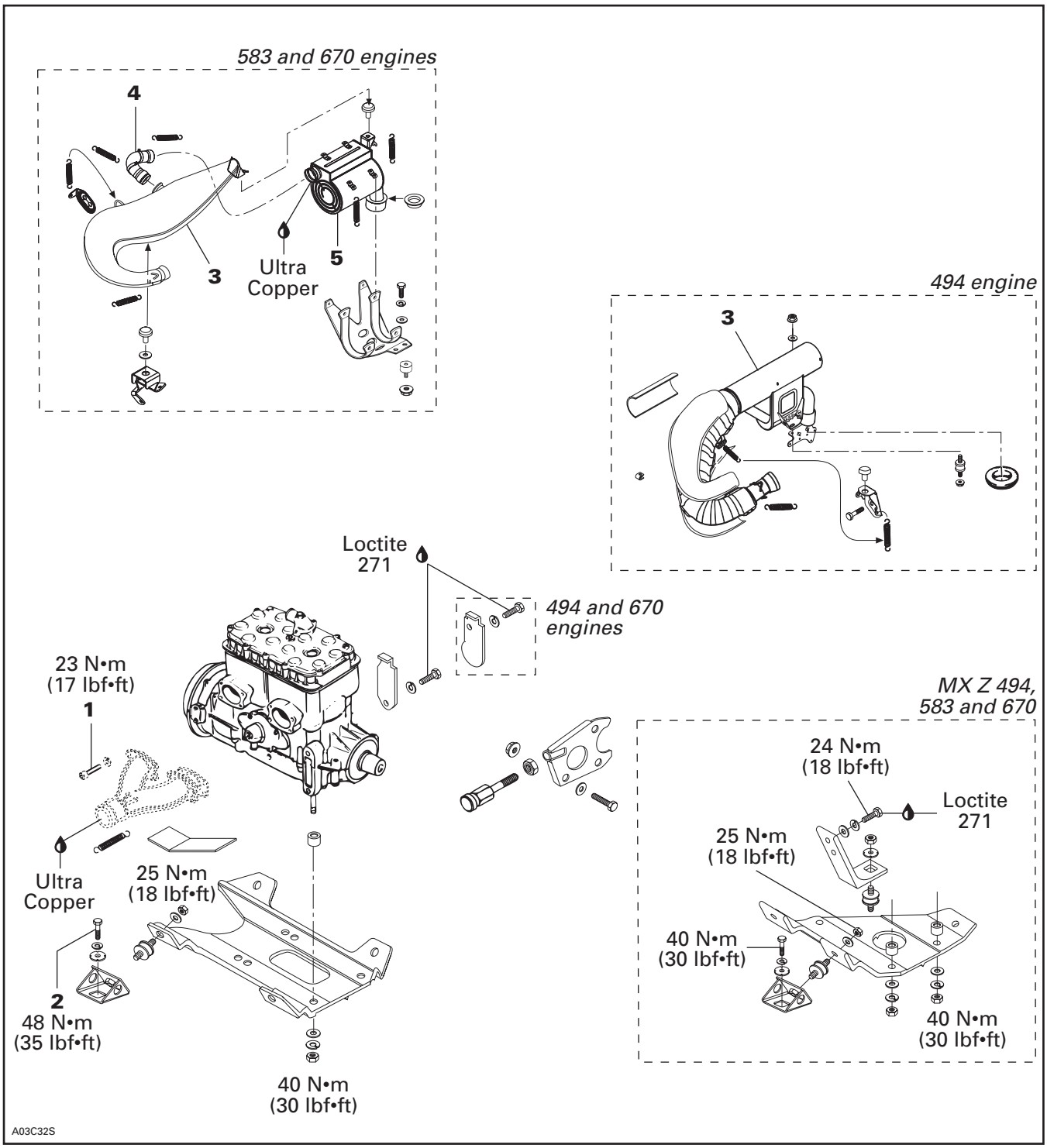
All Engines

To install magneto, refer to CDI MAGNETO 04-05.

494, 583 AND 670 ENGINE TYPES

ENGINE SUPPORT AND MUFFLER

All Models



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 04-08
– 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.

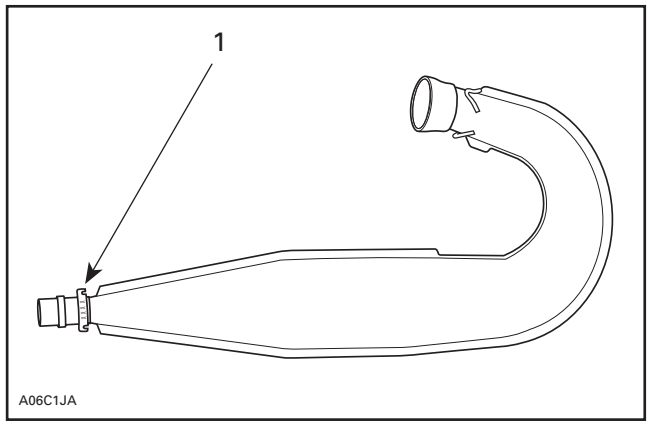
▼ CAUTION

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.

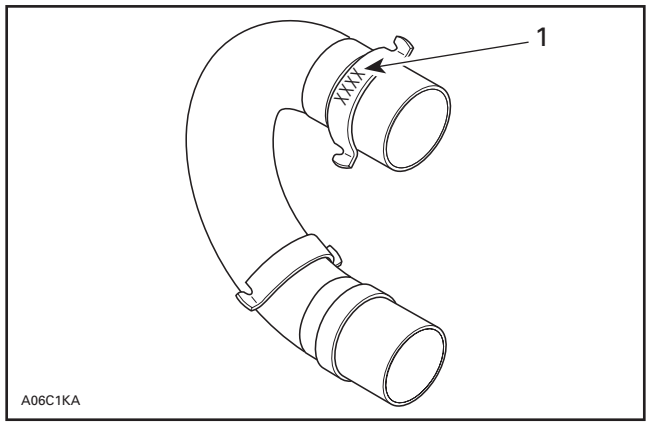
3,4,5, Tuned Pipe, Tail Pipe and Muffler

These parts are identified on welded hook.

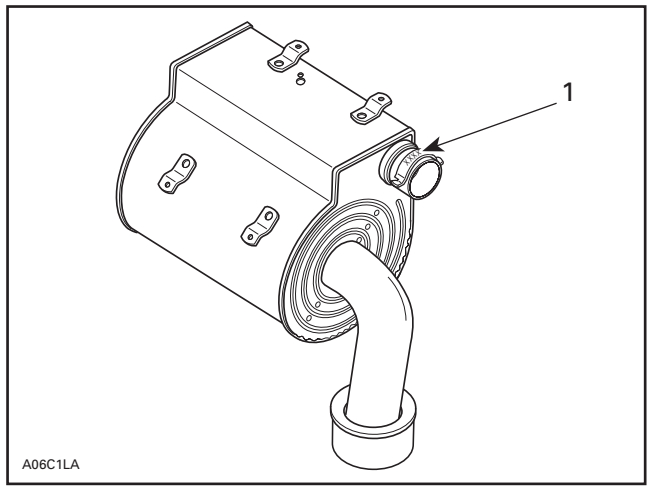
Second number sequence of P/N is stamped on part.



1. Example: 0392 for 514 039 200



1. Number sequence

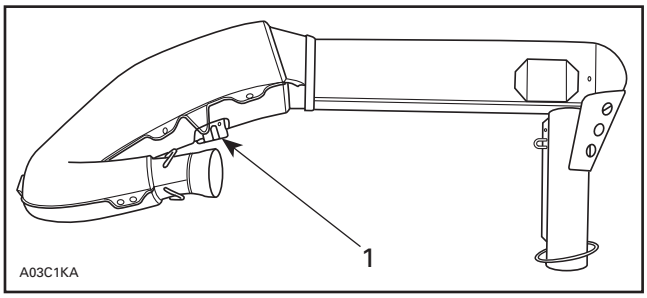


1. Number sequence

3, Tuned Muffler

This part is identified on welded support.

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

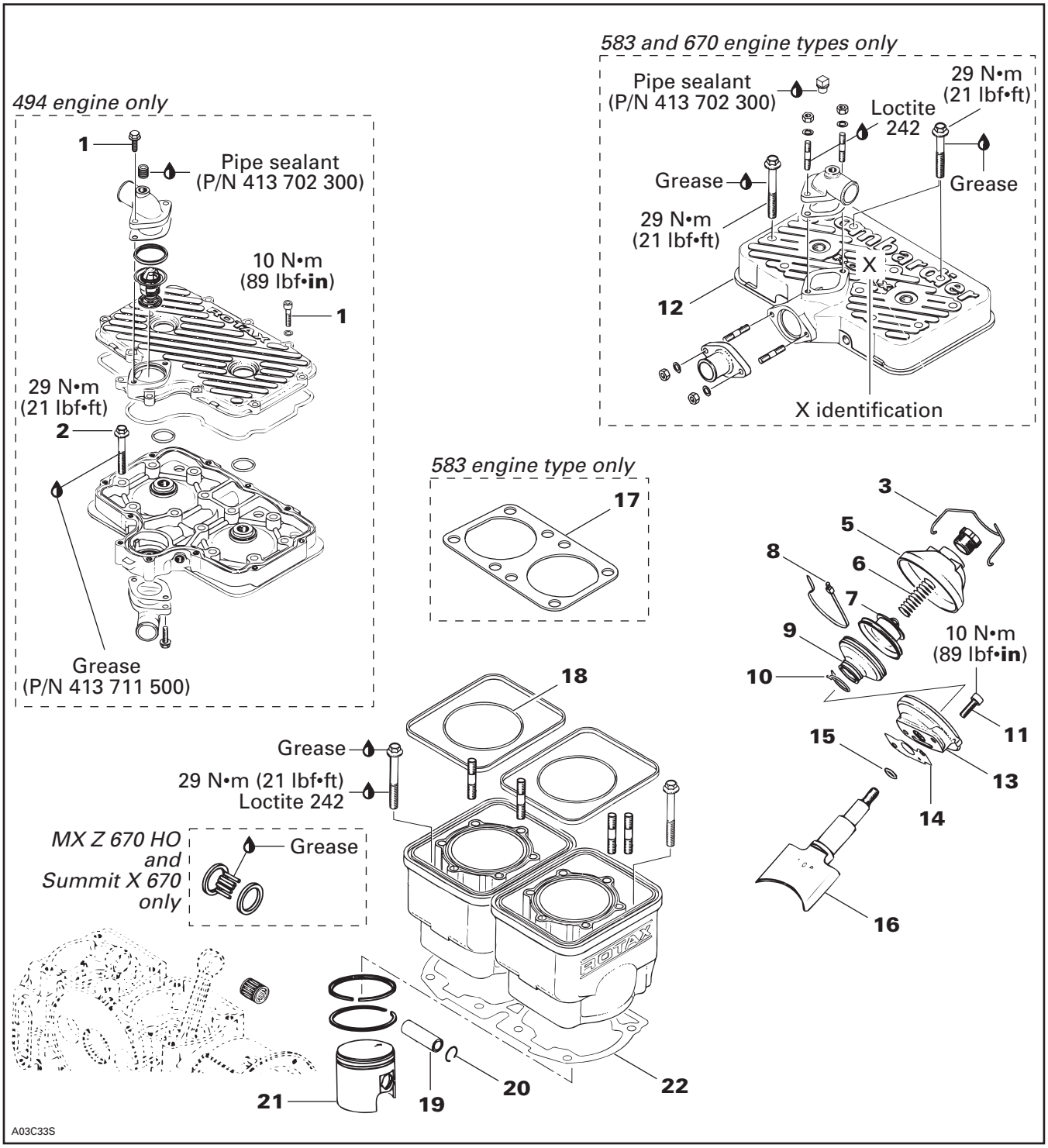


TYPICAL

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



PARTS

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

All Models Except MX Z 670 and Summit X 670

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

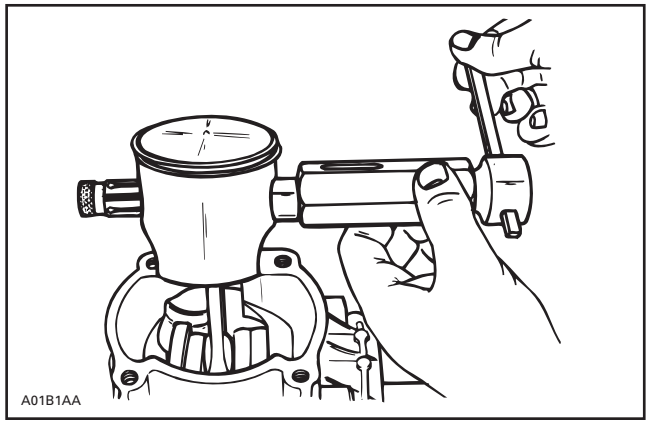
To remove piston pin no. 19, use piston pin puller (P/N 529 035 503) as follows:

Fully screw puller handle.

Insert puller end into piston pin.

Screw (LH threads) extracting nut.

Hold puller firmly and rotate puller handle counterclockwise to pull piston pin.



TYPICAL

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

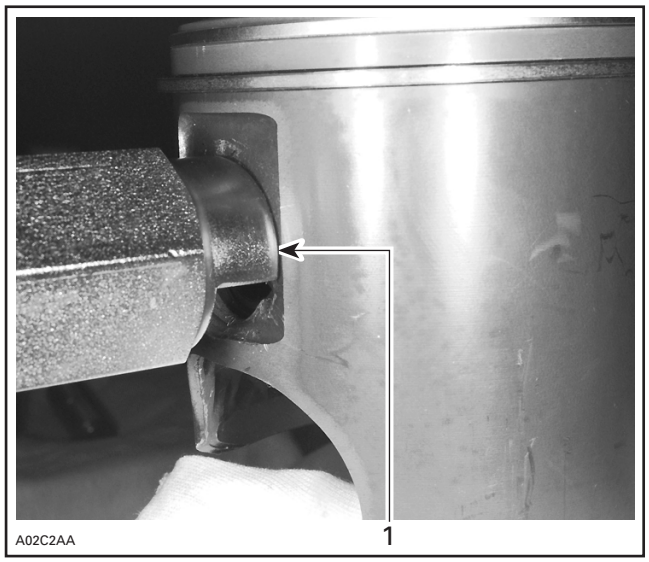
MX Z 670 and Summit X 670 Only

Remove both circlips as decribe above.

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

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

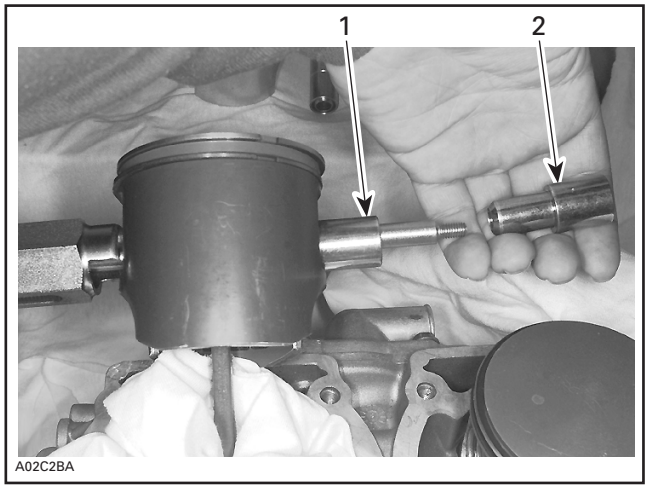
Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



TYPICAL

1. Properly seated all around

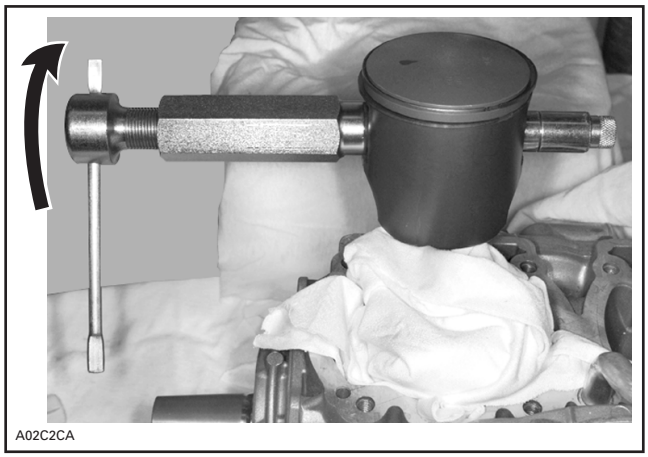
Install sleeve then shouldered sleeve over puller rod.



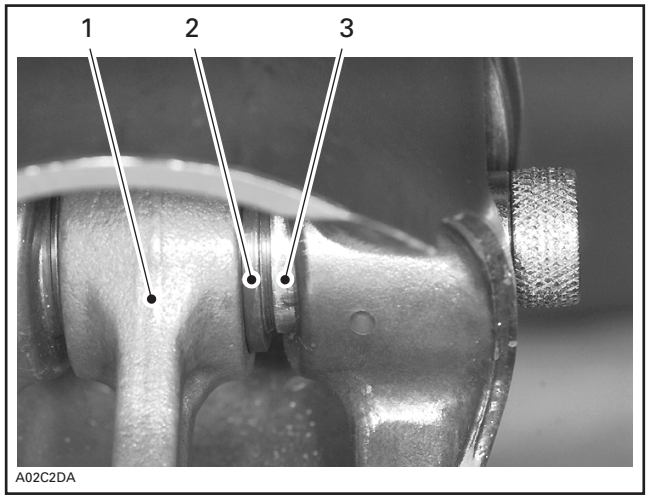
TYPICAL — INSTALLATION OF SLEEVE KIT

1. *Sleeve*
2. *Shouldered sleeve*

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



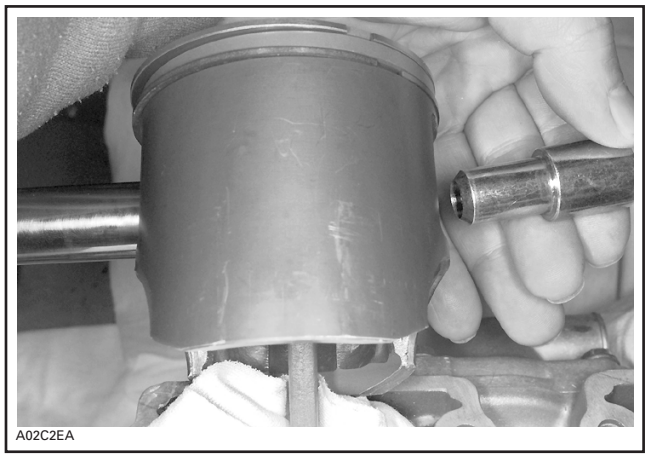
TYPICAL — PISTON PIN EXTRACTION



TYPICAL

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

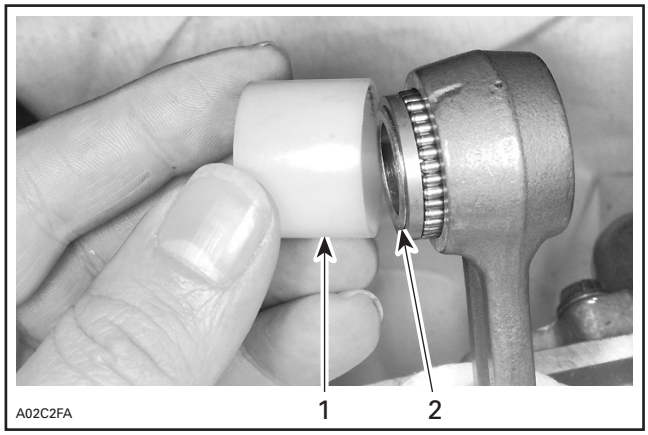
Remove puller. Pull out shouldered sleeve carefully.



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*

RAVE System

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

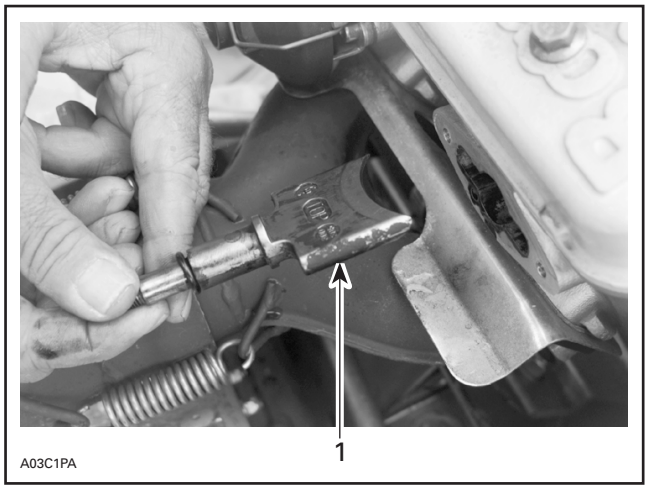
Remove spring clip **no. 3**, cover **no. 5** and spring **no. 6**.

Cut clamp **no. 8** (remove spring on 494) 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**.



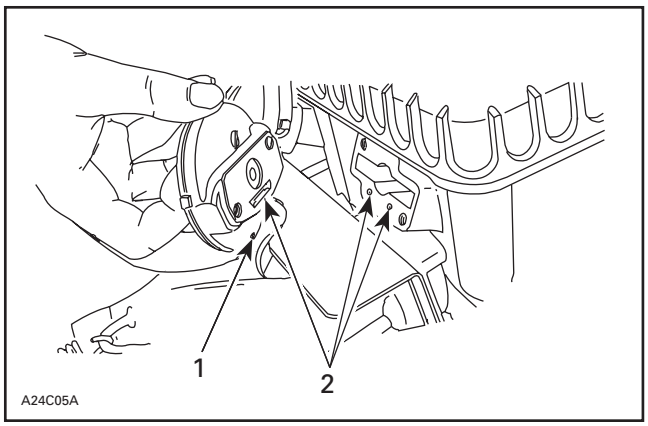
1. *Exhaust valve*

INSPECTION

Refer to ENGINE DIMENSIONS MEASUREMENT 04-04.

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)
583 and 670 on Formula Z 670/DLX 670	420 239 948	1.0 (.039)	38.0 (1.496)	0.0163 (.00365)
670 on MX Z 670 HO and Summit X 670	420 239 941	0.8 (.031)	52.5 (2.067)	0.0110 (.00246)

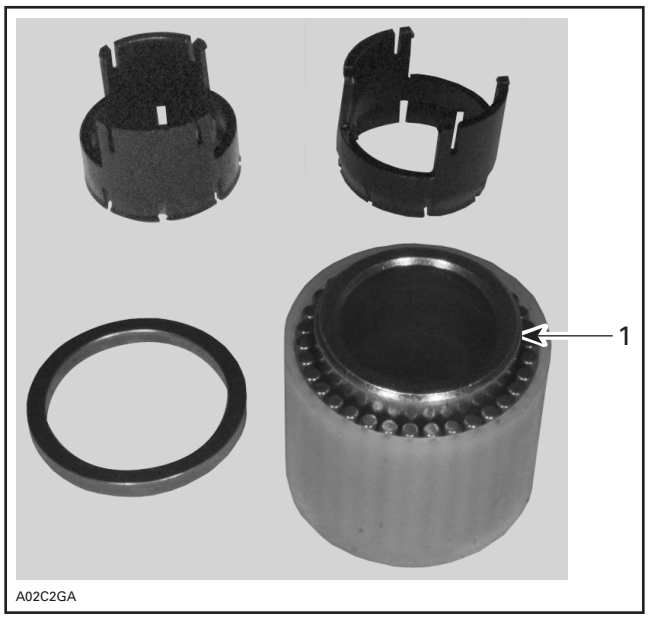
Make sure both springs installed on the engine have same characteristics.

ASSEMBLY

MX Z 670 and Summit X 670 Only

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

NOTE: 670 engine cageless bearing has 28 needles.



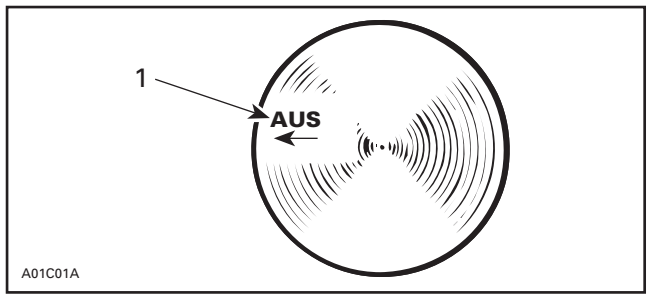
TYPICAL
1. Sleeve

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

Insert cageless bearing into connecting rod.

TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

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.



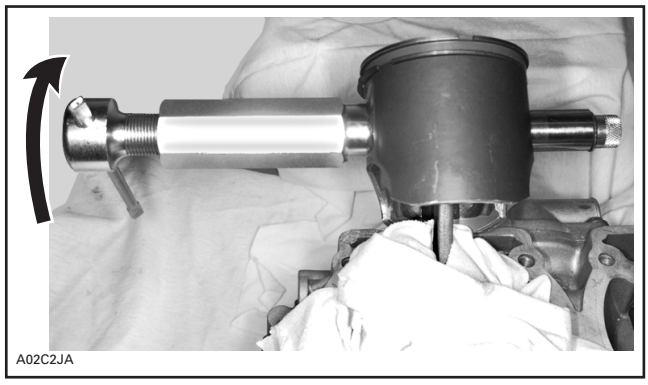
1. Exhaust

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

All Models

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



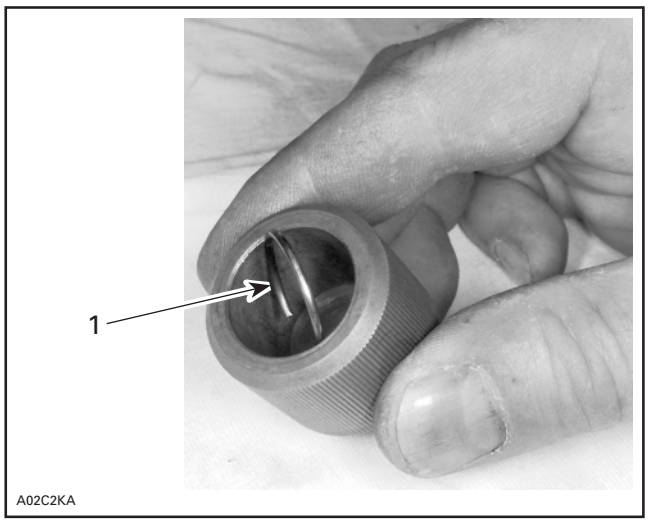
TYPICAL

▼ 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) for all engines except 670 and (P/N 290 877 016) for 670 engine.

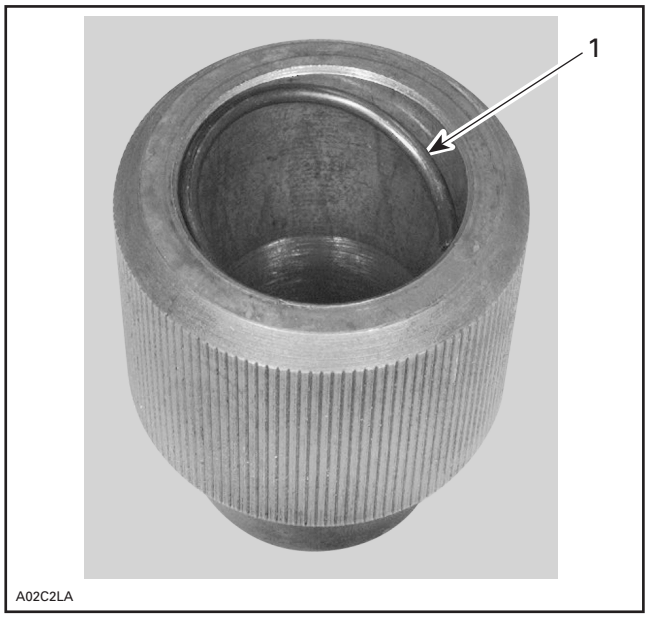
Insert circlip in tool at an angle.



TYPICAL

1. Circlip

Square it up using a finger.



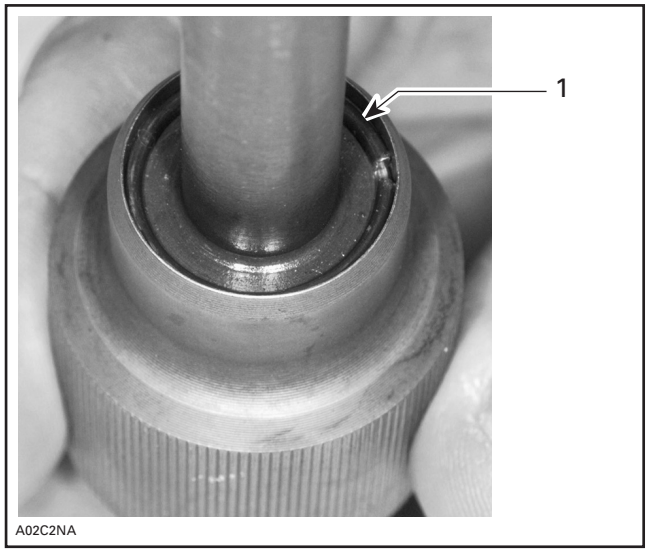
TYPICAL

1. Circlip

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

TYPICAL

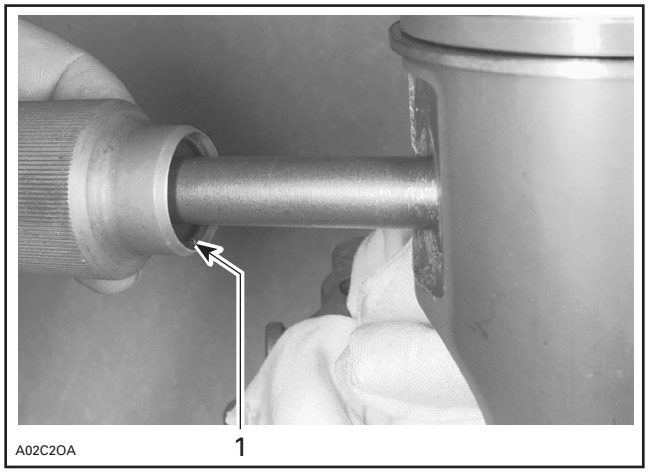
Using square end of tool, push circlip in until it rests in groove.



TYPICAL

1. Circlip in groove

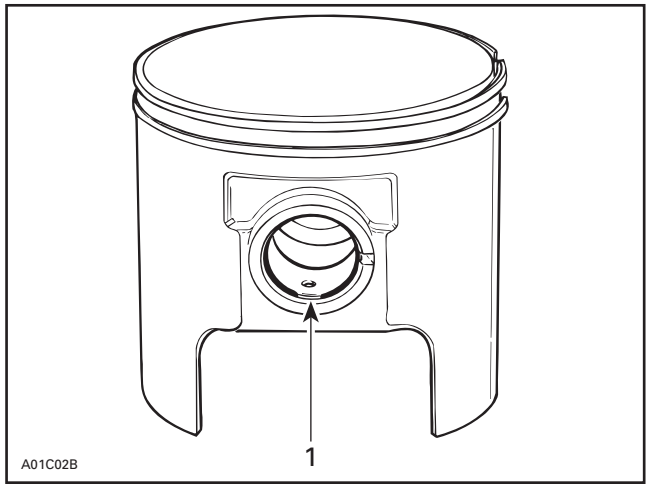
Mount tool in piston making sure that circlip break is facing down.



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.

TYPICAL



TYPICAL
1. Circlip break

▼ CAUTION

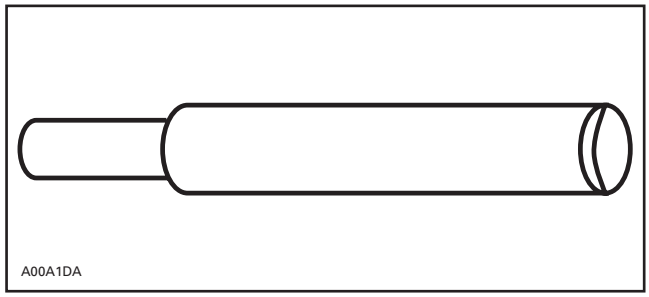
Circlips must not move freely after installation; if so, replace them.

22, Cylinder

494 Engine Only

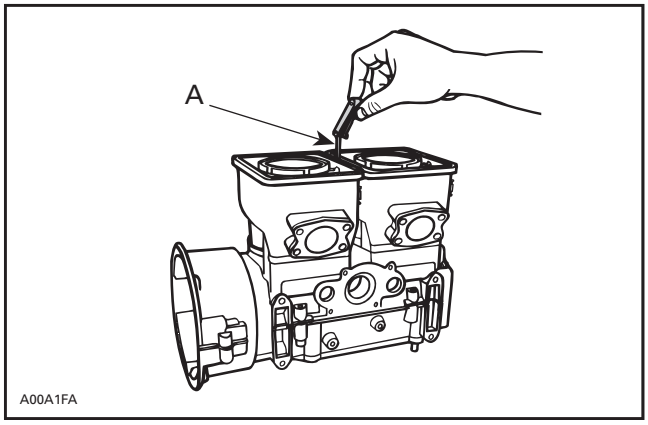
To avoid pinching or cutting of O-ring no. 18 between cylinder and cylinder head, it is necessary to use a special tool and to proceed as follows:

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



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.

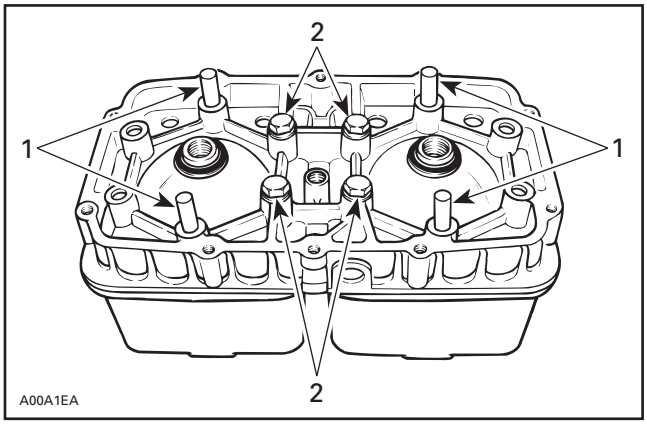


A. 0.43 mm (.017 in) feeler gauge

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.

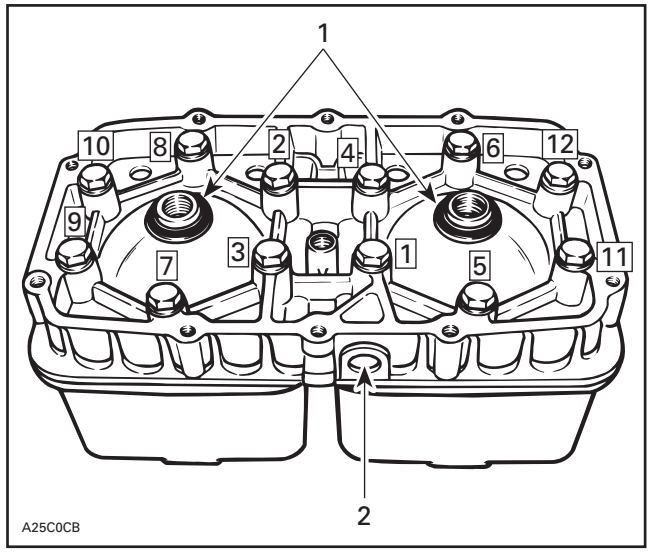
4. Install 4 screws in center holes. Torque to 10 N•m (89 lbf•**in**).



1. Pins
2. Screws

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

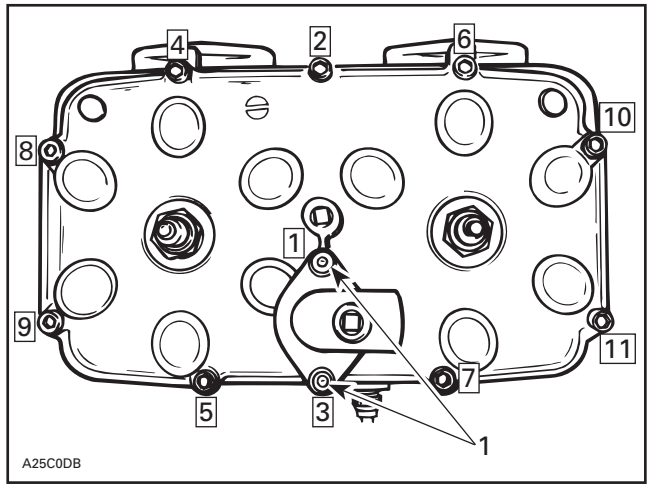
Position O-rings over cylinders then install cylinder head with its temperature sensor hole on rotary valve side. Install and torque screws to 29 N•m (21 lbf•ft) as per following illustrated sequence. Make sure to install O-rings around spark plug holes.



TYPICAL
1. O-rings
2. Temperature sensor hole

1, Screw

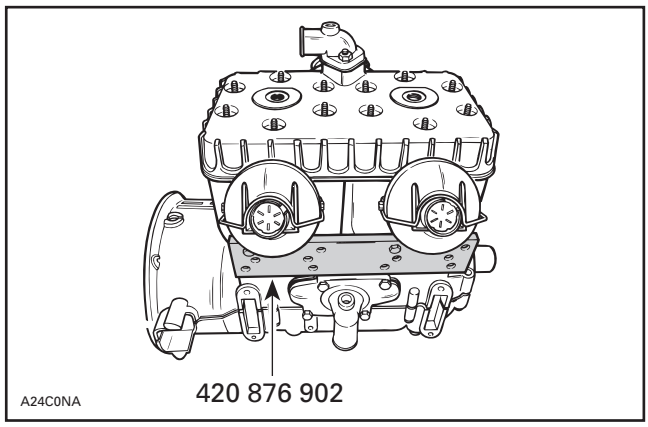
Torque cylinder head cover screws to 10 N•m (90 lbf•**in**) as per following illustrated sequence.



TYPICAL
1. Longer screws

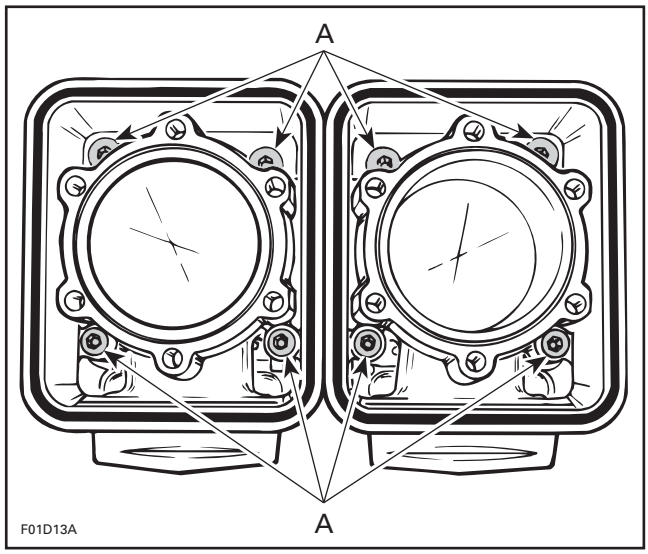
583 and 670 Engines Only

When reassembling the cylinders to the crankcase, it is important to have them properly aligned so that the cylinder head holes will match up with the studs. Cylinder head itself can be used to align the cylinders. Prior to torquing crankcase/cylinder nuts, install exhaust manifold to properly align exhaust flanges or use exhaust flange aligning tool (P/N 420 876 902).



Apply Loctite 242 (P/N 413 703 000) on cylinder screw threads.

Install and torque screws in a criss-cross sequence for each cylinder to 29 N•m (21 lbf•ft). For 670 engine longer screws go on exhaust side.

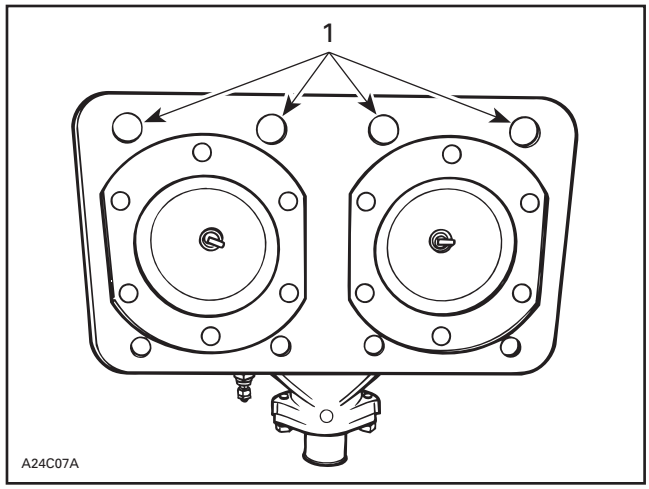


TYPICAL
A. Torque screws to 29 N•m (21 lbf•ft)

17, Gasket

583 Engine Only

Install gasket with its larger holes on exhaust side.



EXHAUST SIDE
1. Larger holes

12, Cylinder Head

MX Z 670 Only

The cylinder head is identified by an X. See exploded view for location.

Summit X 670 Only

The cylinder head has a very high compression ratio.

▼ CAUTION

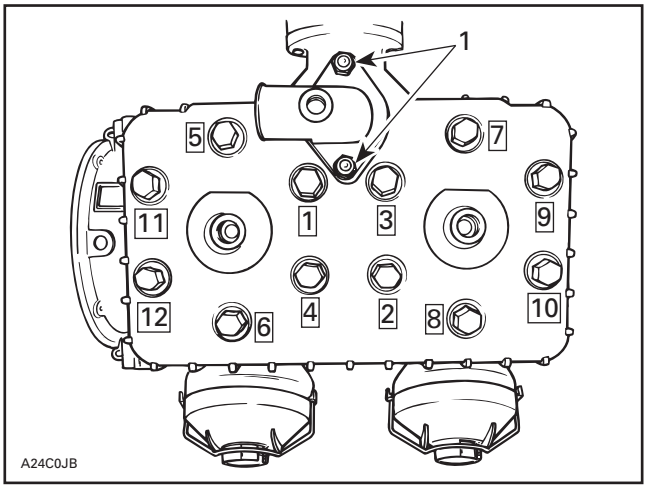
Install proper cylinder head.

All Models

2, Cylinder Head Screw

ENGINE TYPE	CYLINDER HEAD SCREWS TIGHTENING TORQUE
494, 583 and 670	29 N•m (21 lbf•ft) Apply grease under screw head

Torque cylinder head screws following illustrated sequence. On 583 and 670 engines longer screws go on intake side.

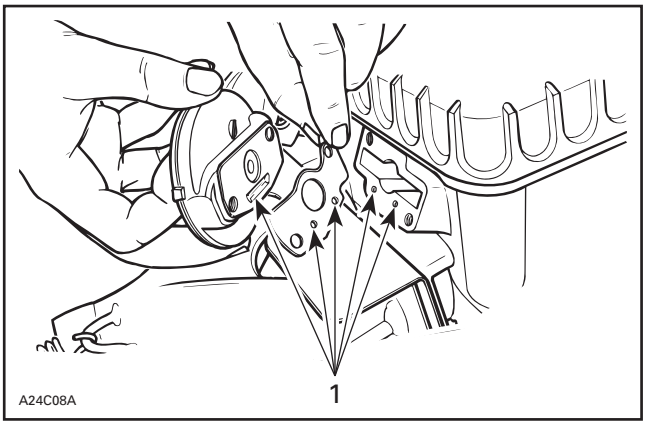


*1. Torque these screws to 10 N•m (90 lbf•**in**).*

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.

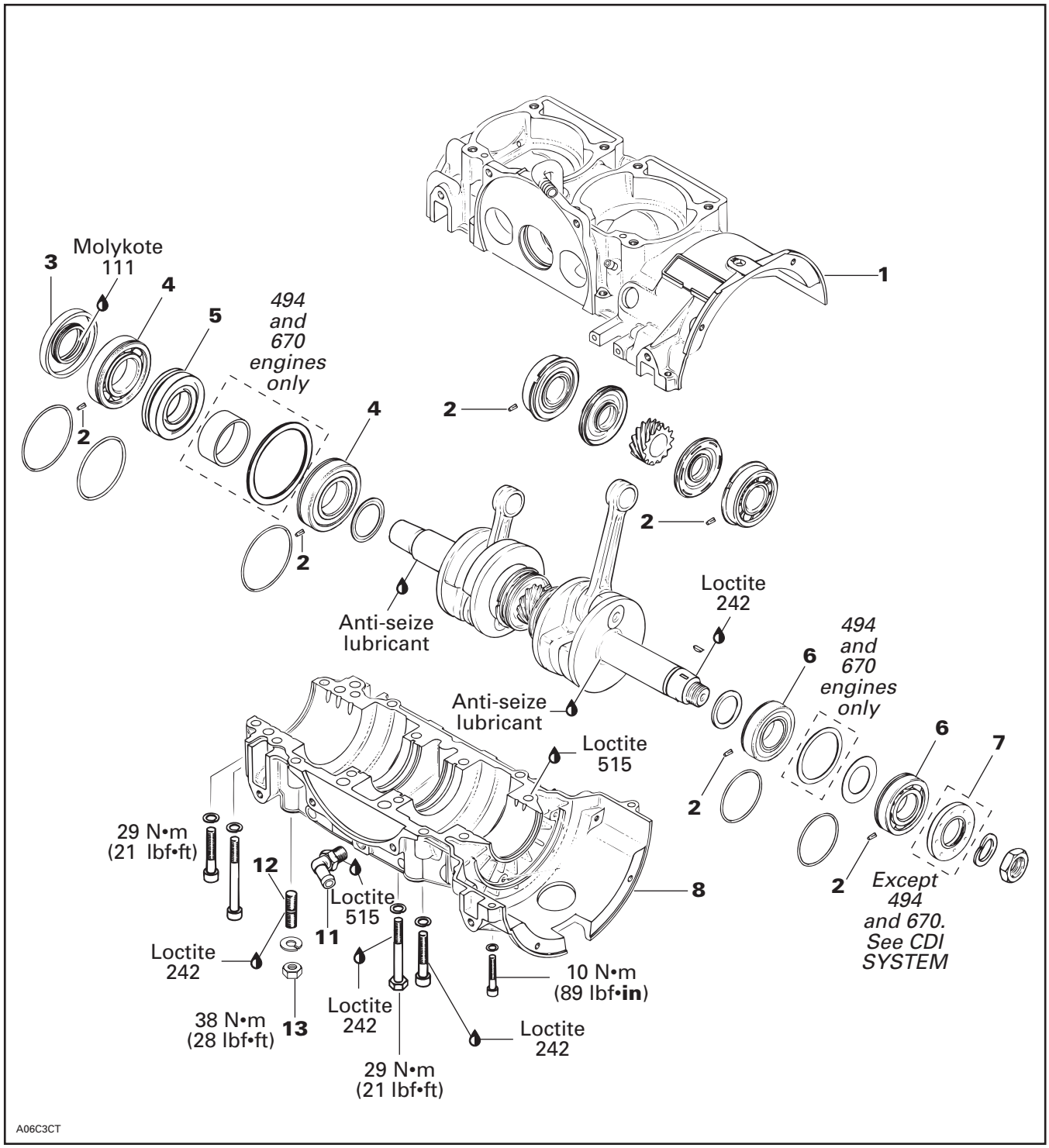
Install bellows over valve rod housing groove and secure with a clamp.

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

Secure bellows to valve piston with a clamp (spring on 494 engine).

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

BOTTOM END



TYPICAL

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 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

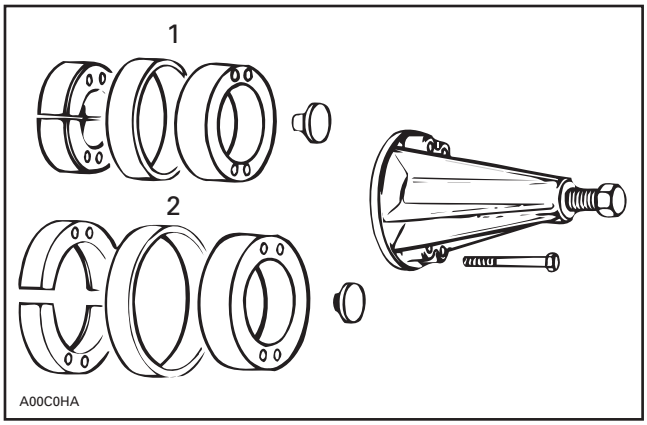
General

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

To remove magneto, refer to CDI MAGNETO 04-05.

2,4,6,9, Crankshaft Bearing

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



1. PTO side
2. MAG side

INSPECTION

Refer to ENGINE DIMENSIONS MEASUREMENT 04-04.

ASSEMBLY

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

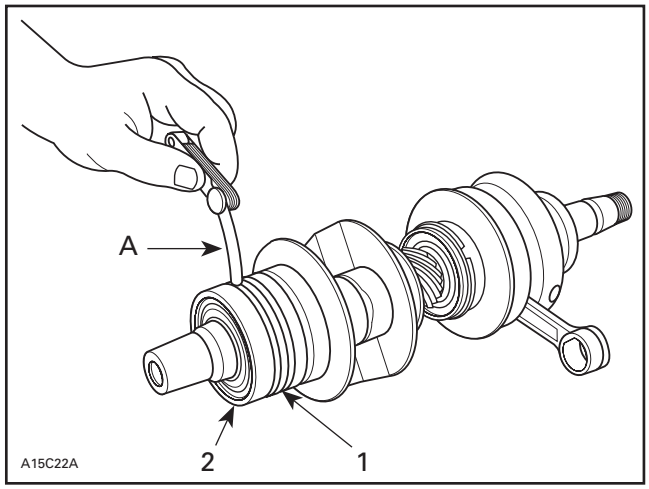
Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.

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

▼ CAUTION

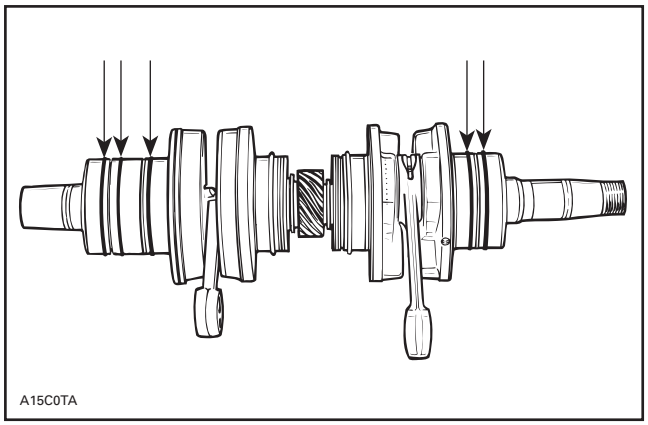
Do not exceed 75°C (167°F).

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.



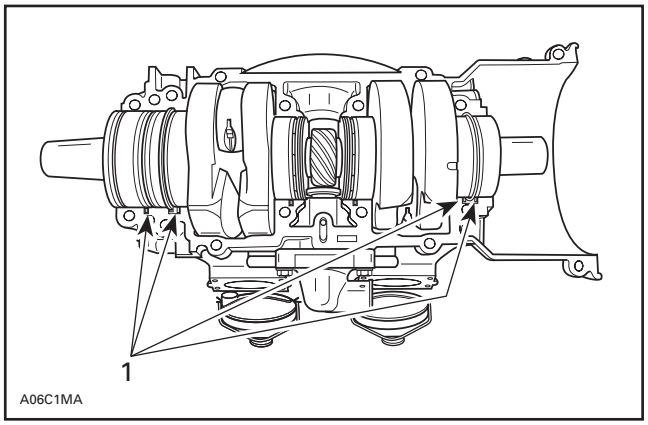
1. Labyrinth sleeve
2. Outer bearing
A. 0.3 mm (.012 in)

Install O-rings as illustrated.



583 ENGINE

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



494 AND 670 ENGINES — 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.

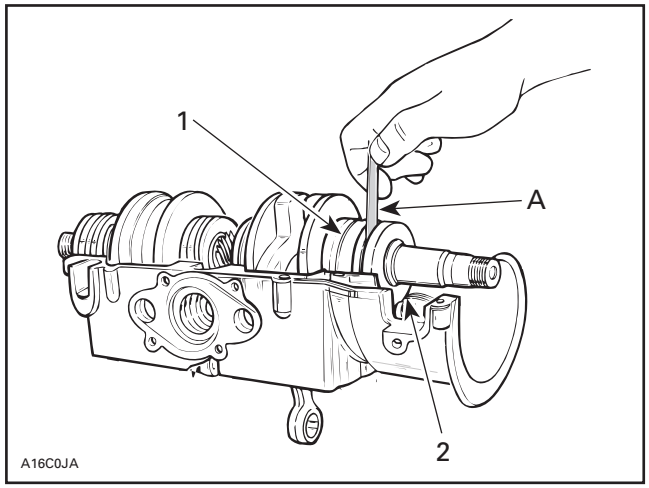
PTO side seal **no. 3** must be filled up with Molykote 111.

▼ 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.



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.

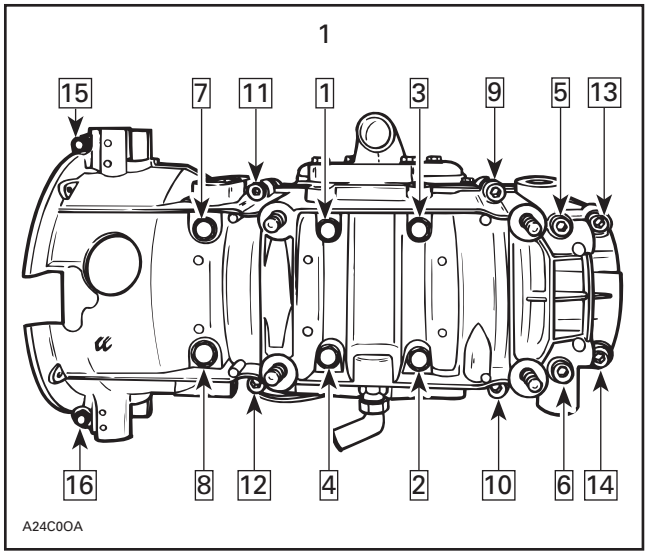
Apply paste gasket (P/N 413 702 700) **no. 5** on the other mating surface.

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.

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 04-05.

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 529 009 900), 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

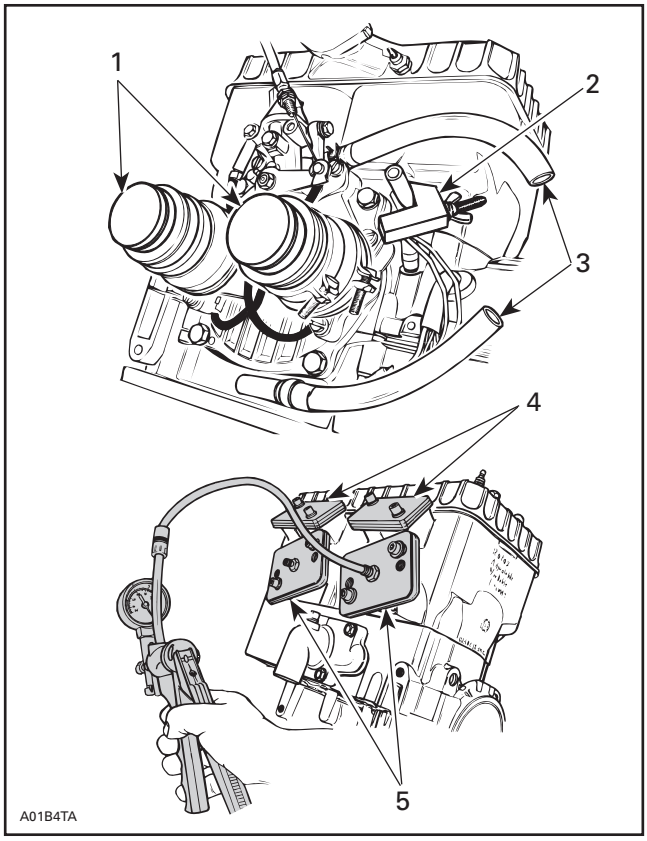
NOTE: A flow chart has been prepared as a visual reference. See last page of this chapter.

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.

Engine



TYPICAL

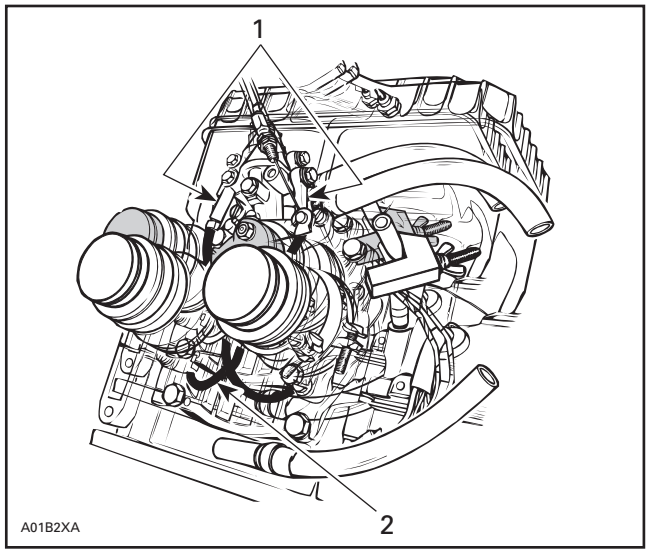
1. *Blocked intake flanges*
2. *Blocked impulse fitting*
3. *Open ends (if applicable)*
4. *Blocked RAVE valve flanges (if applicable)*
5. *Blocked exhaust flanges*

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.



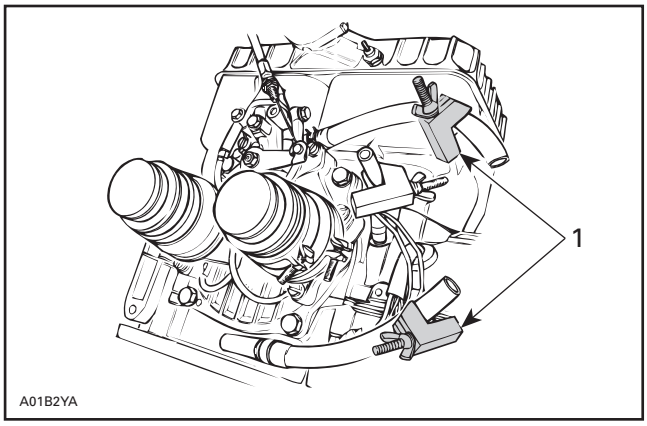
1. *Banjo fittings*
2. *Small injection oil lines*

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

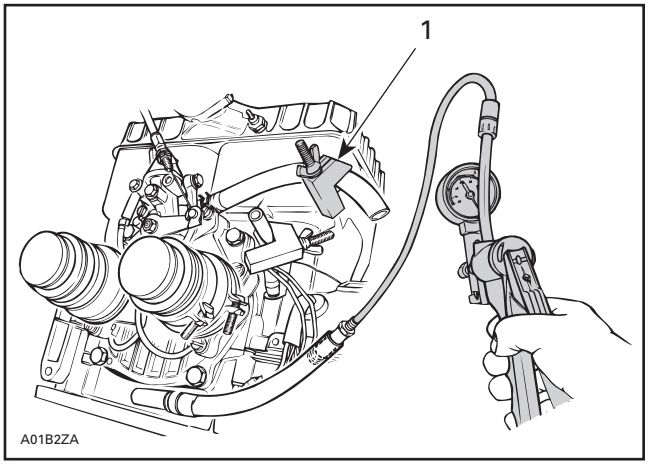
If leakage stops, ignore remaining items and check crankcase rotary valve gear reservoir as per Crankcase Rotary Valve Gear Reservoir of this section.

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.

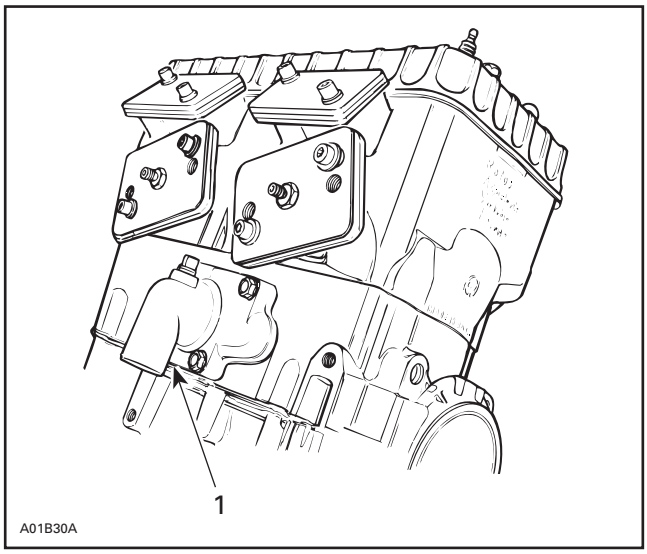


1. Blocked hose

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

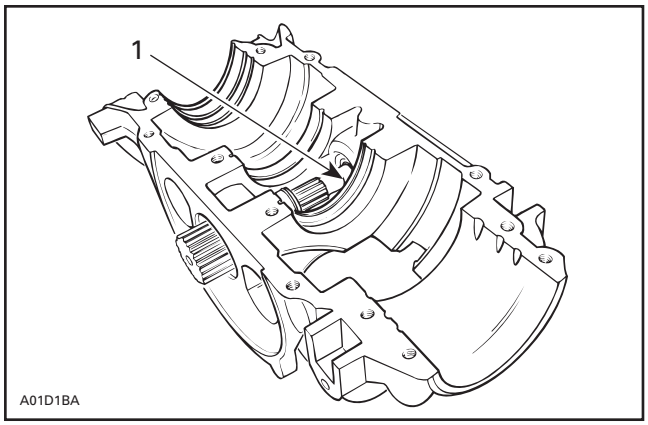
   If pressure drops, it indicates defective crankshaft inner seal on PTO side.
2. Remove a spark plug or any plug of leak tester kit on MAG side.

   If pressure drops, it indicates defective crankshaft inner seal on MAG side.
3. Check drain hole below coolant pump housing with soapy water.



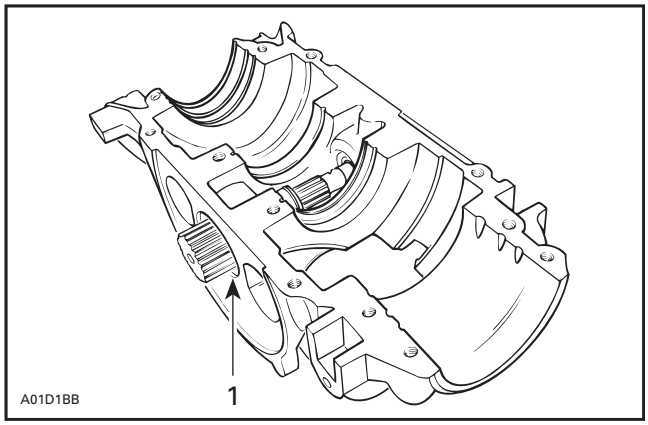
1. Drain hole

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



1. Oil seal

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



1. Seal

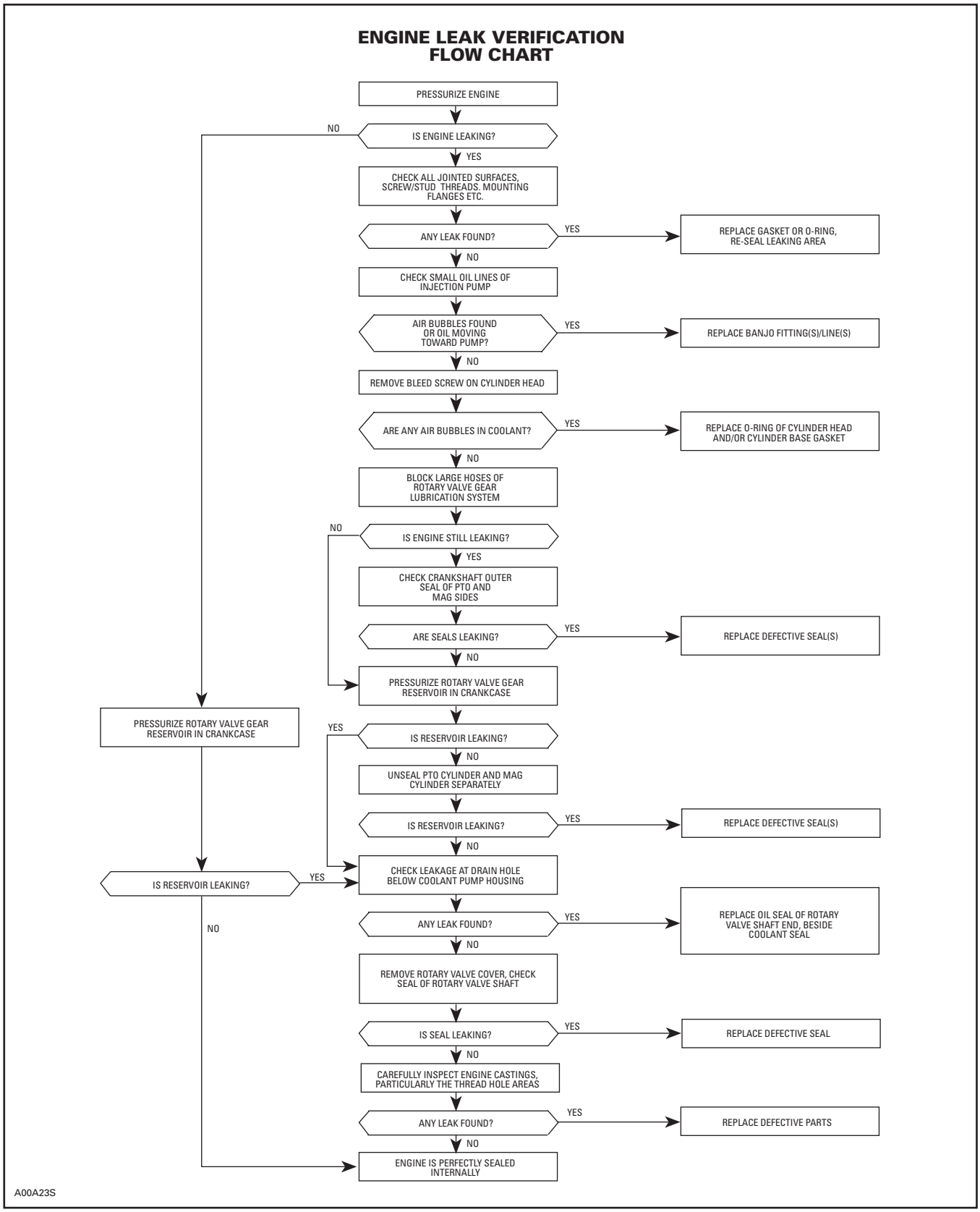
5. If leak still persists, it indicates a defective casting somewhere in engine.

   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)

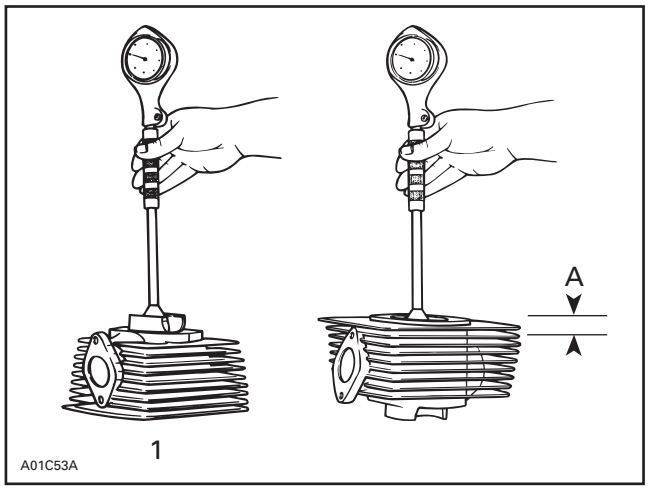
CYLINDER TAPER

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.



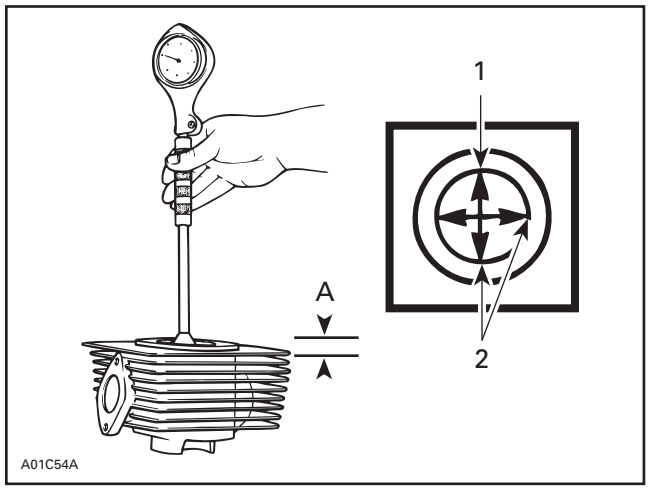
1. Below the intake port
A. 16 mm (5/8 in) from top

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.

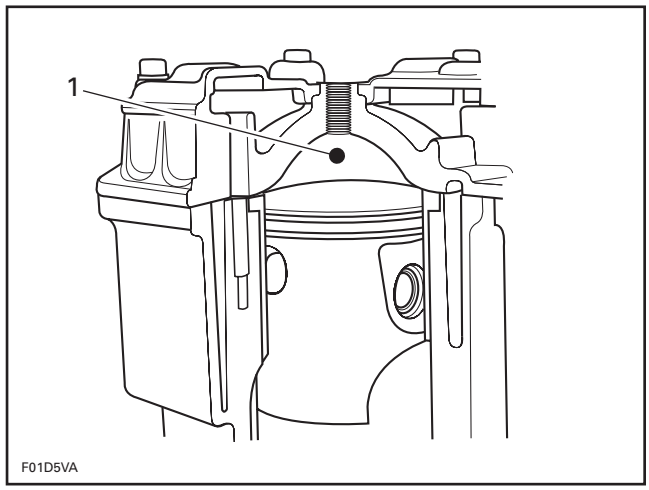
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



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

COMBUSTION CHAMBER VOLUME MEASUREMENT

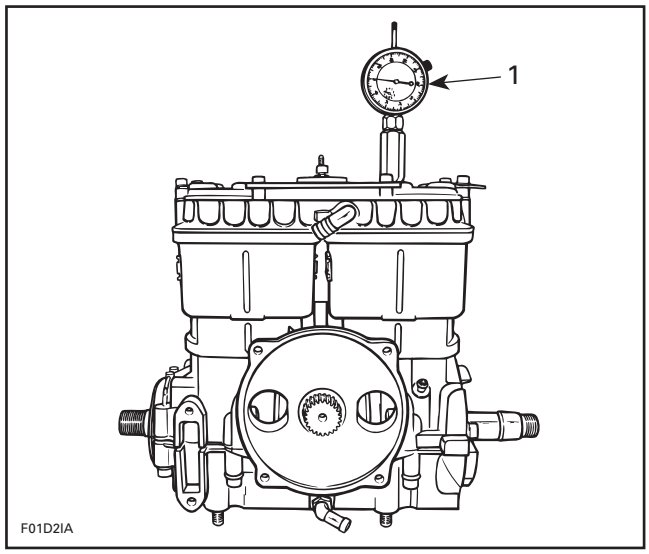
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



1. Combustion chamber

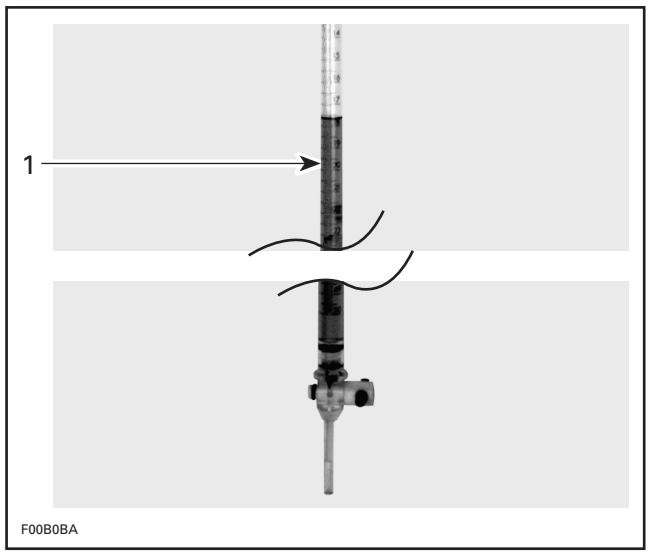
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposit and cylinder head must be leveled.

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



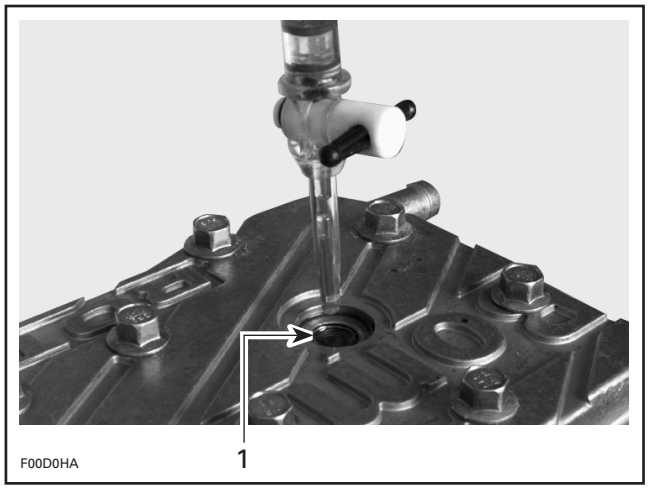
1. Bring piston to TDC

2. 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)

3. Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
4. 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.

5. Let burette stand upward for about 10 minutes, until liquid level is stabilized.
6. 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.

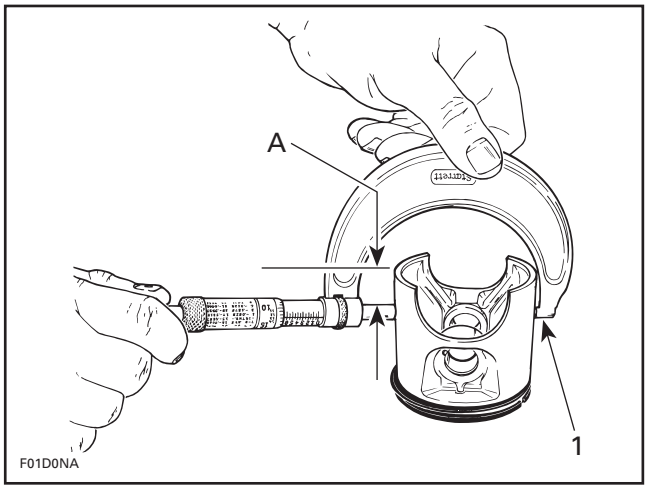
7. Repeat the procedure for the other cylinder.

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
583	28.7 ± 1.2
670	32.7 ± 0.7
670 on Summit X 670	30.15 ± 0.60

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)
503	18 (.71)
494	30 (1.18)
583	27 (1.06)
670	29 (1.14)

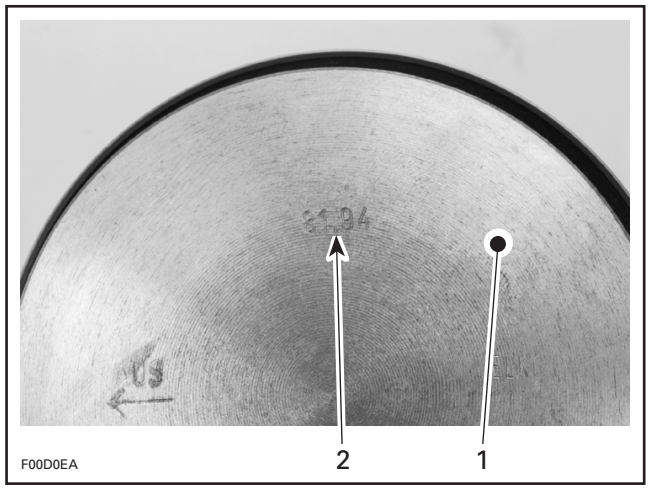
The measured dimension should be the same as the one scribed on piston dome. If not, install a new piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

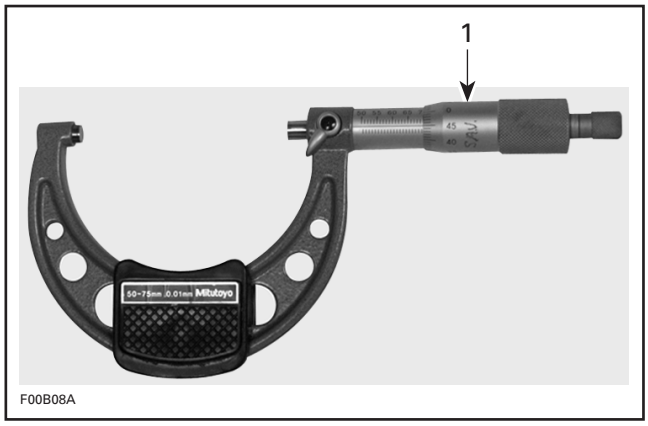
NOTE: Make sure used piston is not worn. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



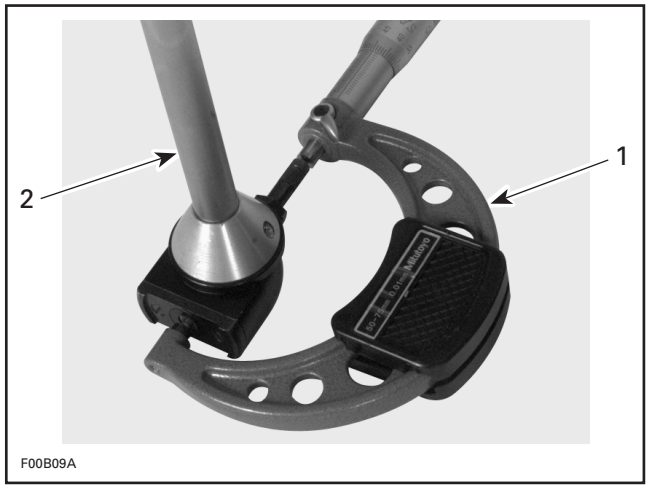
1. Piston dome
2. Piston measurement

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

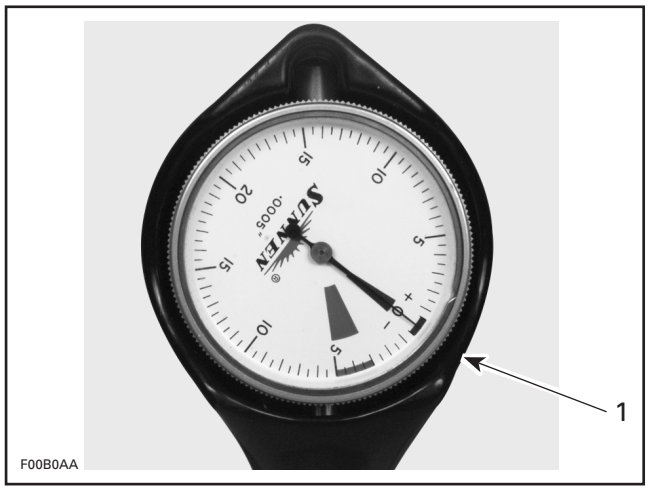


1. Micrometer set to the piston dimension

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

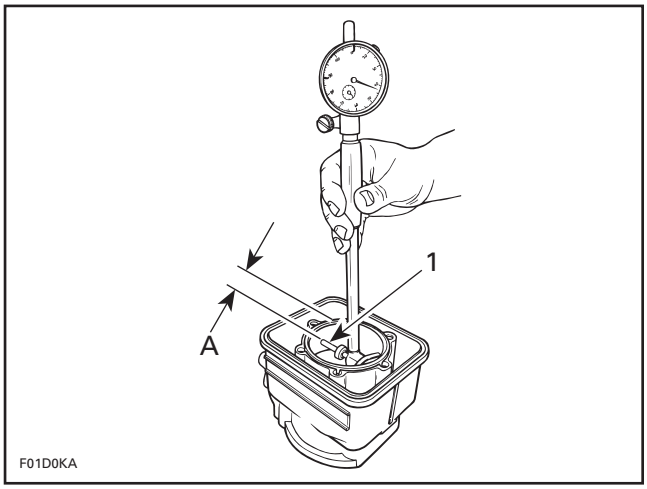


1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0

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



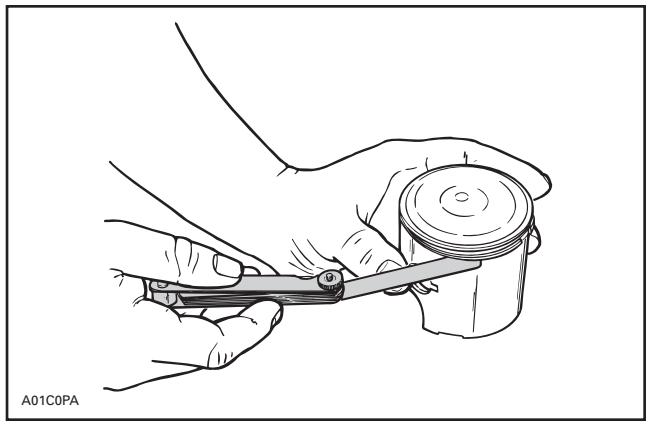
1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

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.

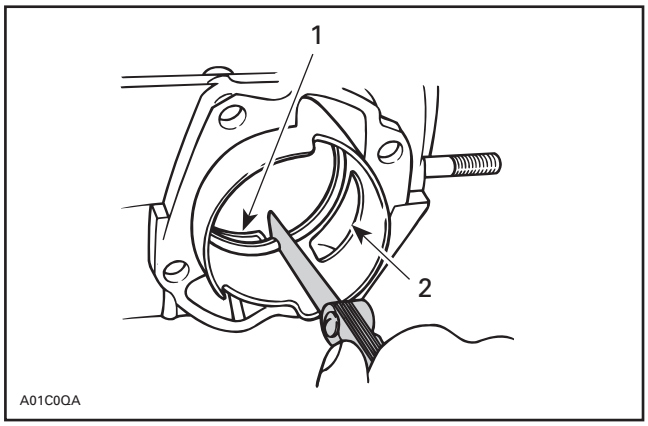


RING END GAP

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.



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

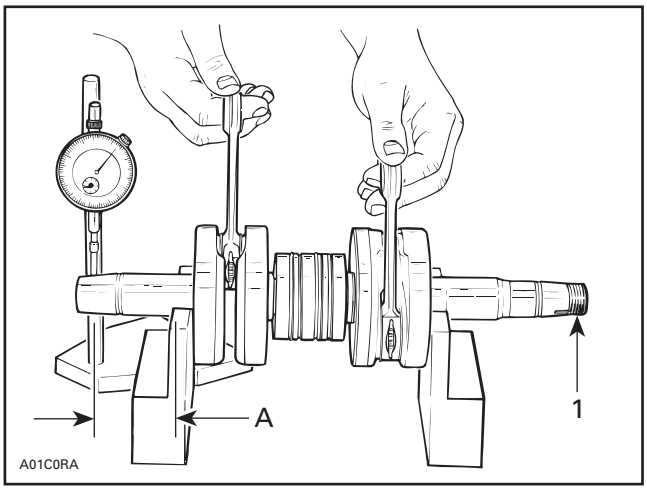
Crankshaft deflection is measured with a dial indicator.

Measuring (in engine)

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

Measuring (on bench)

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



TYPICAL

1. Measure at mid point between the key and the first thread
A. 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 and 583	86 (3.386)	
503	82.5 (3.248)	
670	100 (3.937)	

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)

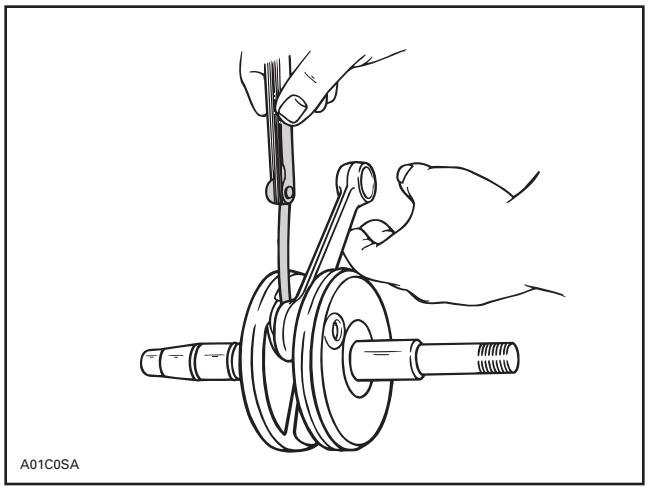
NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

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, 583 and 670	0.40 - 0.75 mm (.016 - .029 in)	1.20 mm (.047 in)

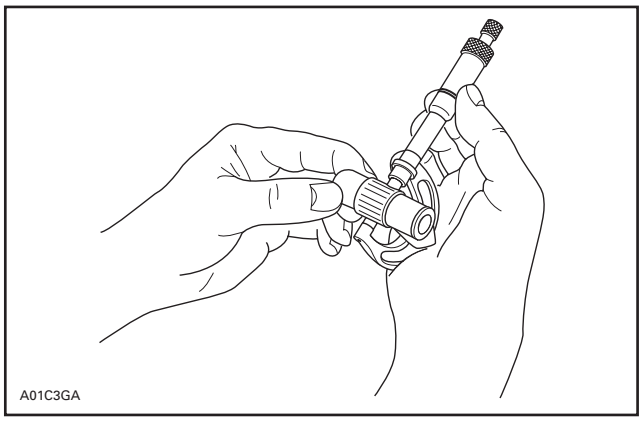
Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.

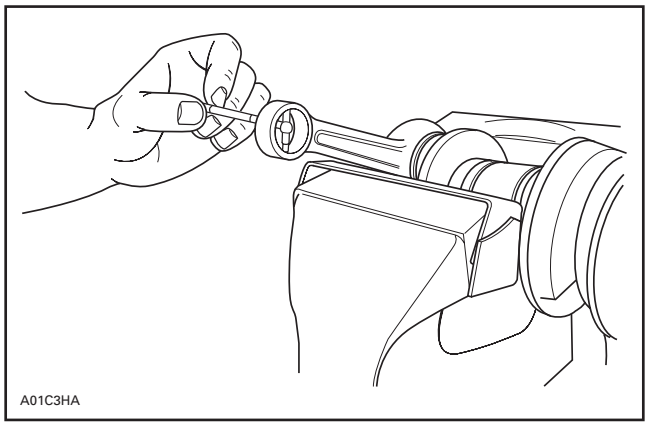


TYPICAL

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, 583 and 670	0.038 - 0.050 mm (.0015 - .0020 in)	0.06 mm (.0024 in)

CRANKSHAFT END-PLAY

All Engine Types

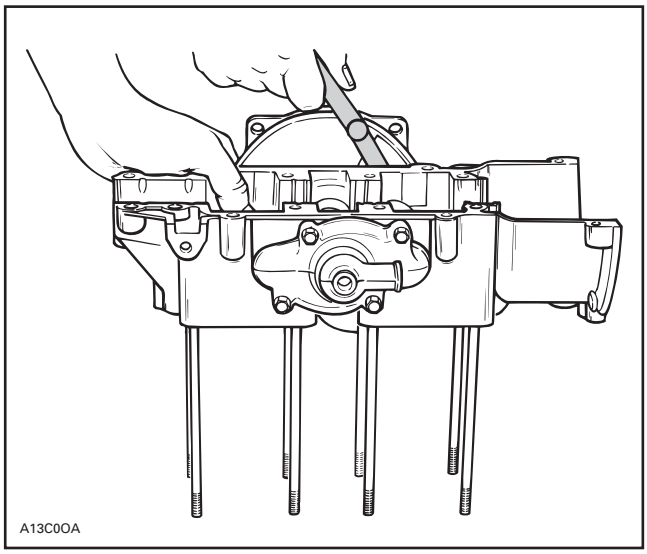
End-play is not adjustable but it should be between 0.10 - 0.30 mm (.004 - .012 in).

CRANKCASE/ROTARY VALVE GAP

ENGINE TYPE	MINIMUM	MAXIMUM
Liquid cooled engines	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.



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.

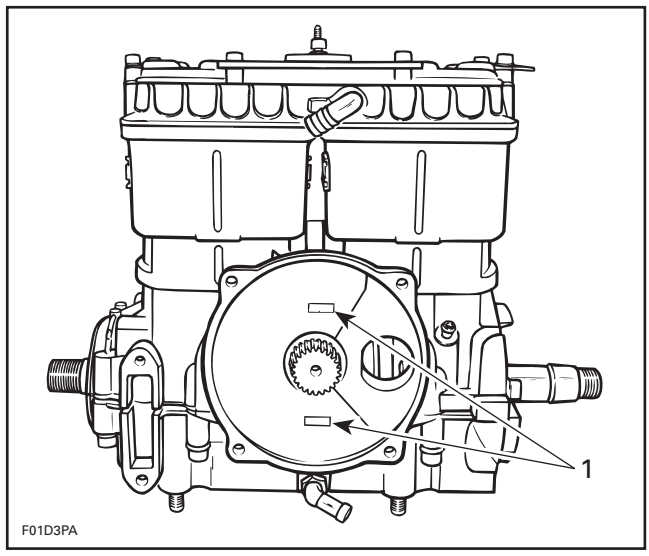
Use the following type of solder:

– rosin 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.

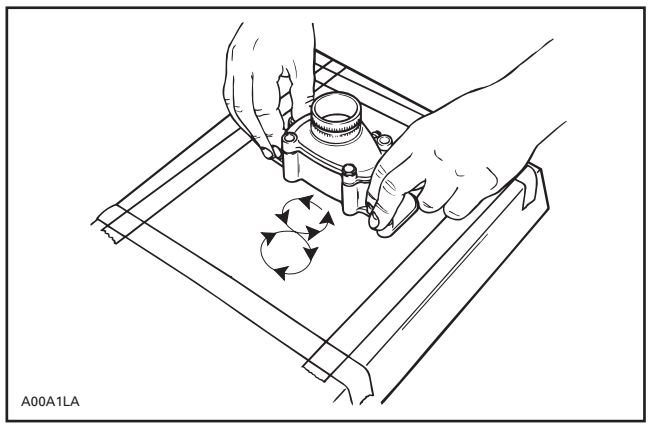
If any play is felt, part must be rectified.

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.

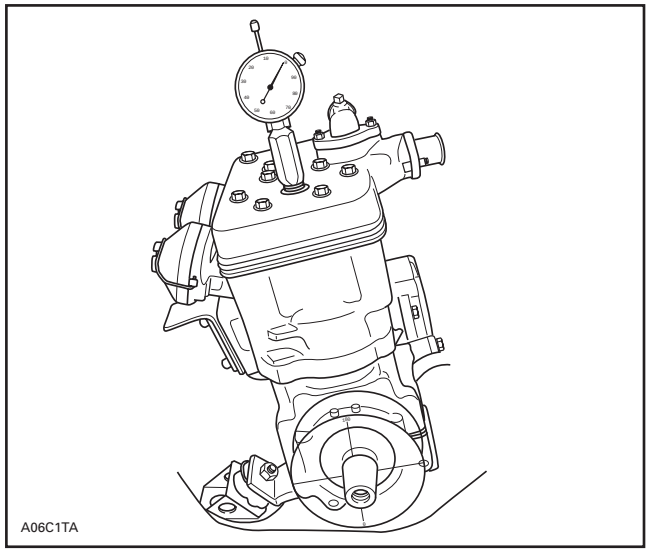
Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.

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.



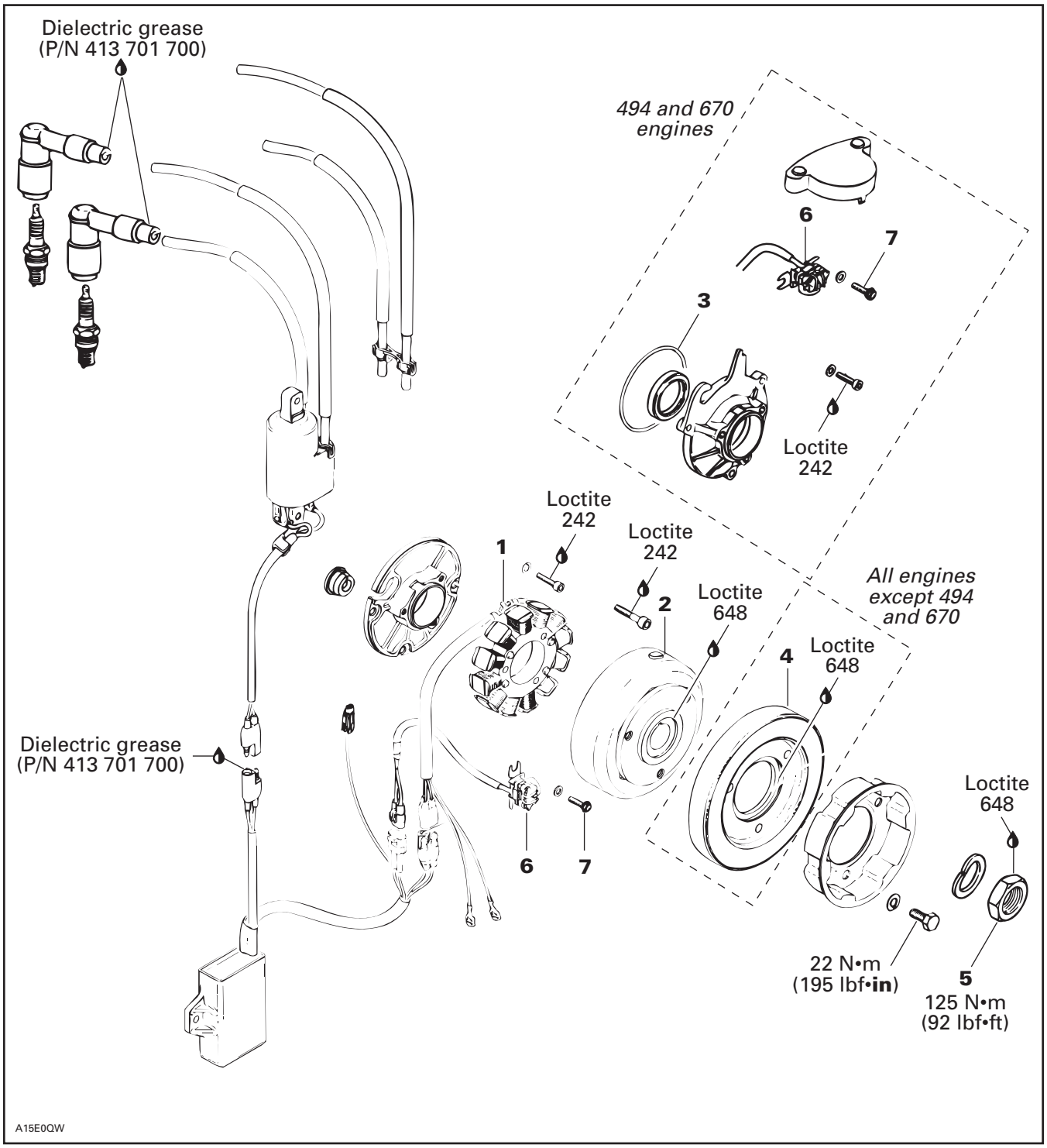
Interval between cylinders must be exactly 180°.

Any other reading indicates a misaligned (twisted) crankshaft.

CDI SYSTEM

NIPPONDENSO TRIGGER COIL IGNITION SYSTEM

494, 583 and 670 Engines



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

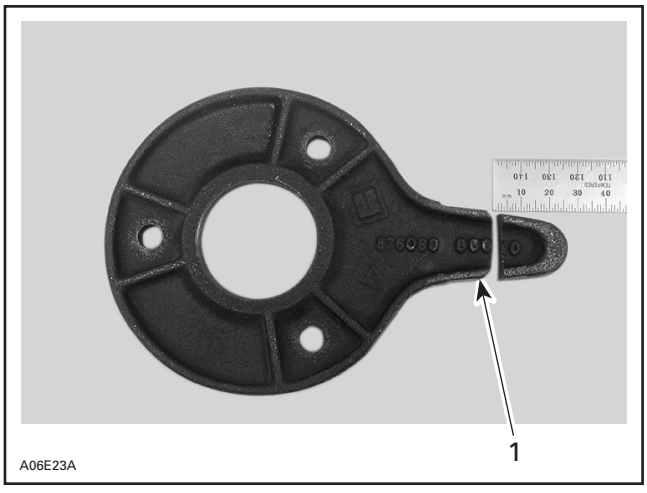
2,5, Magneto and Magneto Flywheel Nut

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

– muffler
– rewind starter
– starting pulley

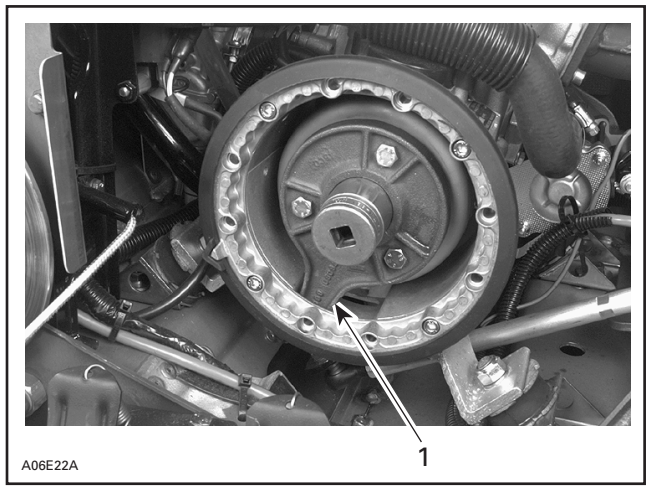
To remove magneto flywheel retaining nut:

Use magneto puller ring (P/N 420 876 080) 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.

4, Hydro Damper Ass'y

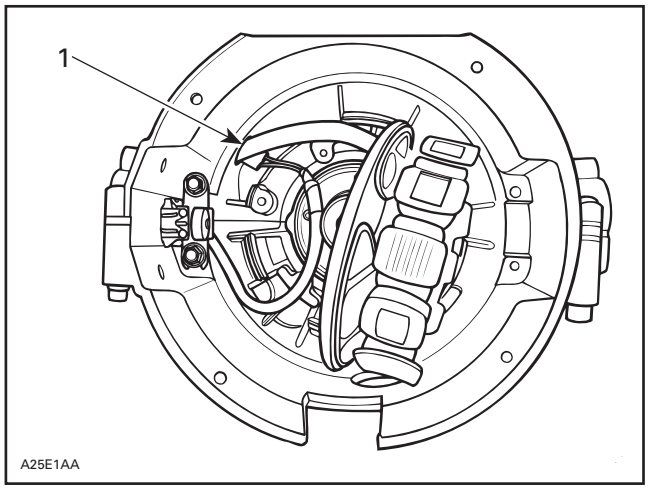
Check for oil leaks and for noisy ring inside. Replace it in both cases.

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.

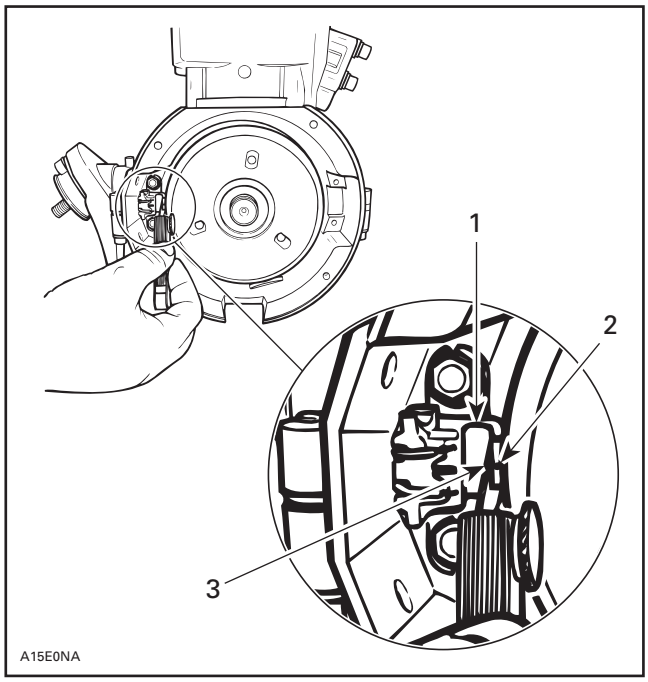
Whenever the trigger coil or the magneto flywheel is removed or replaced, the air gap between the trigger coil and the flywheel protrusion must be checked and adjusted. The purpose of this adjustment is to obtain the minimum clearance between these parts — without touching at any RPM — so that the trigger 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.



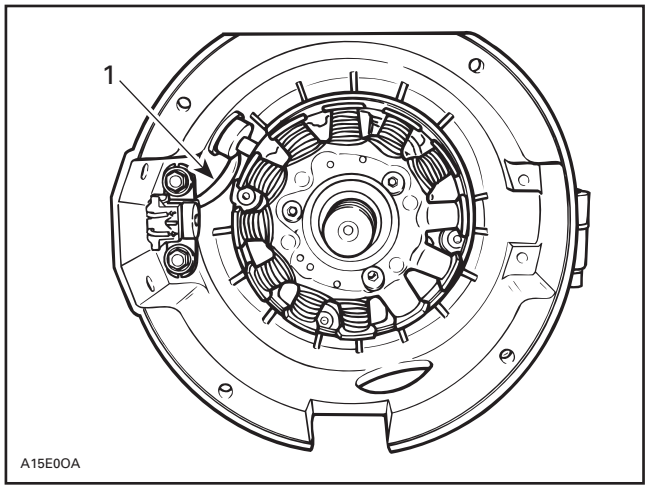
PRELIMINARY TRIGGER COIL AIR GAP ADJUSTMENT

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.



1. Trigger coil harness

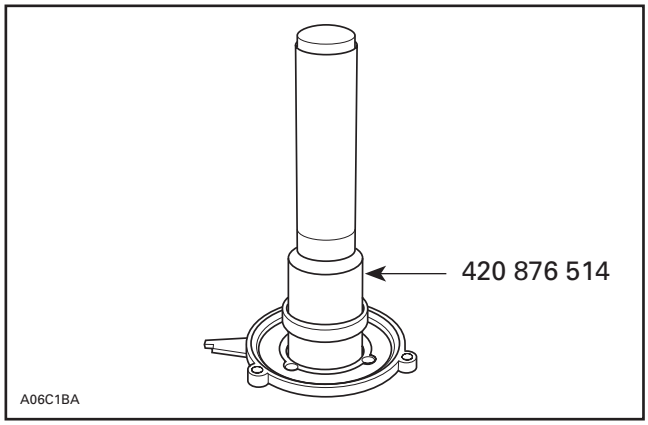
ASSEMBLY

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

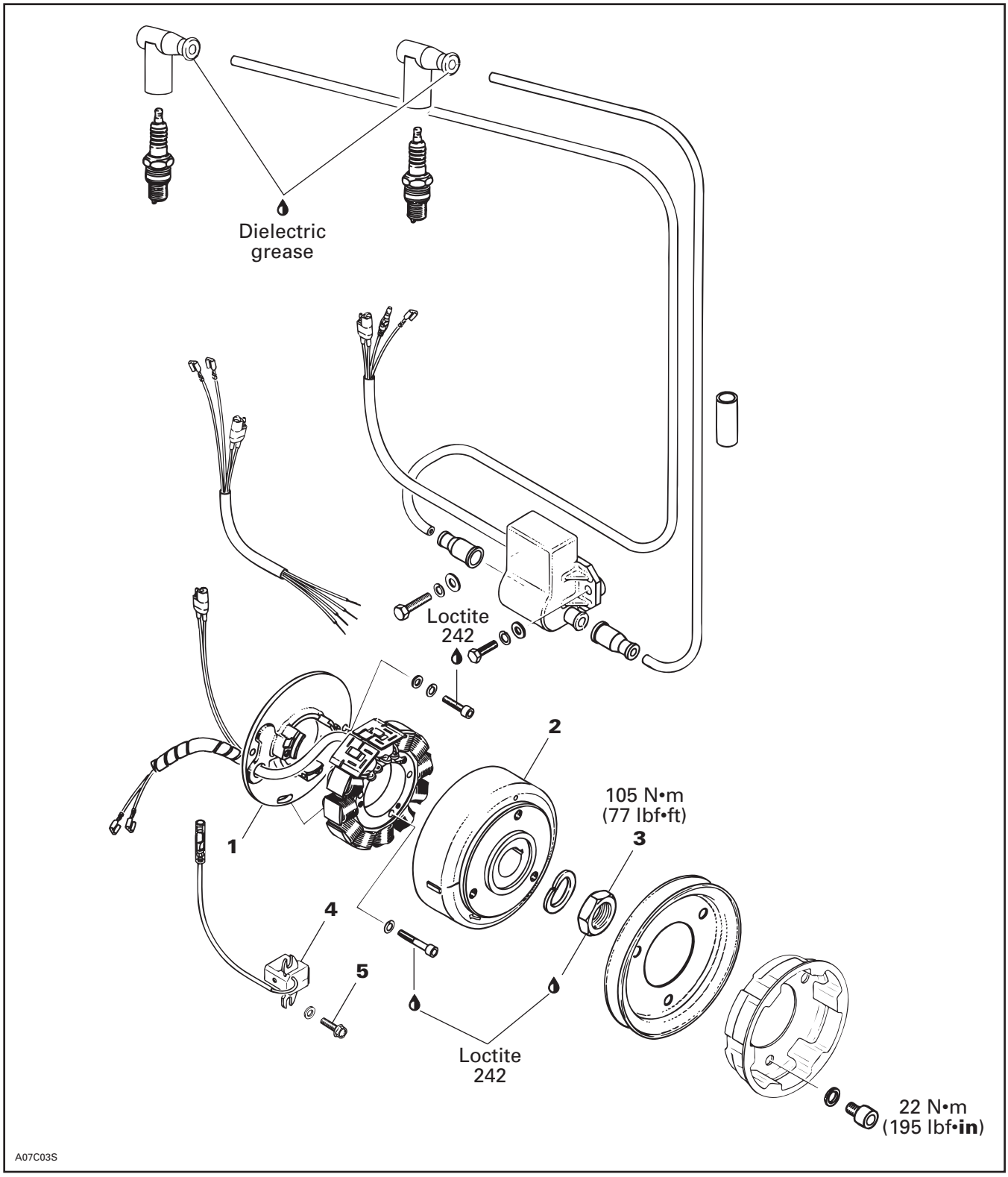
Do not use silicone "sealant", this product will corrode contacts.

Ignition Timing

Check as described in IGNITION TIMING 06-02.

DUCATI IGNITION SYSTEM

443 and 503 Engines



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

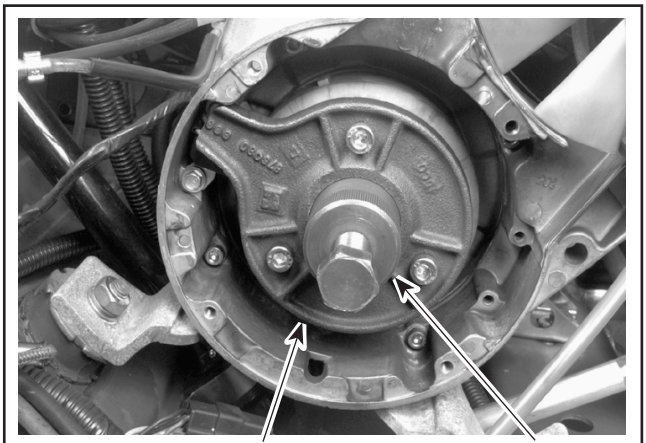
Clean armature and magneto using only a clean cloth.

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

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



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.

To remove magneto flywheel no. 2, install the magneto 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.

REPAIR

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. 9.
– Remove trigger coil and carefully pull wire.
– Install new trigger coil and other parts removed.

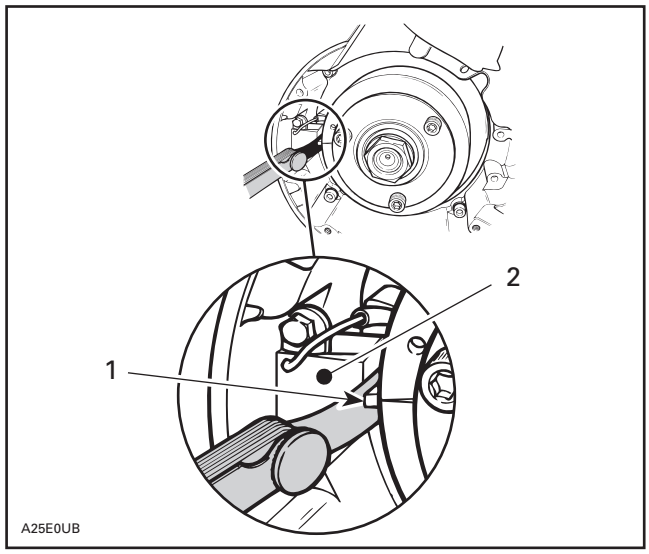
Preliminary Adjustment

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.**

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 loosening 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

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.

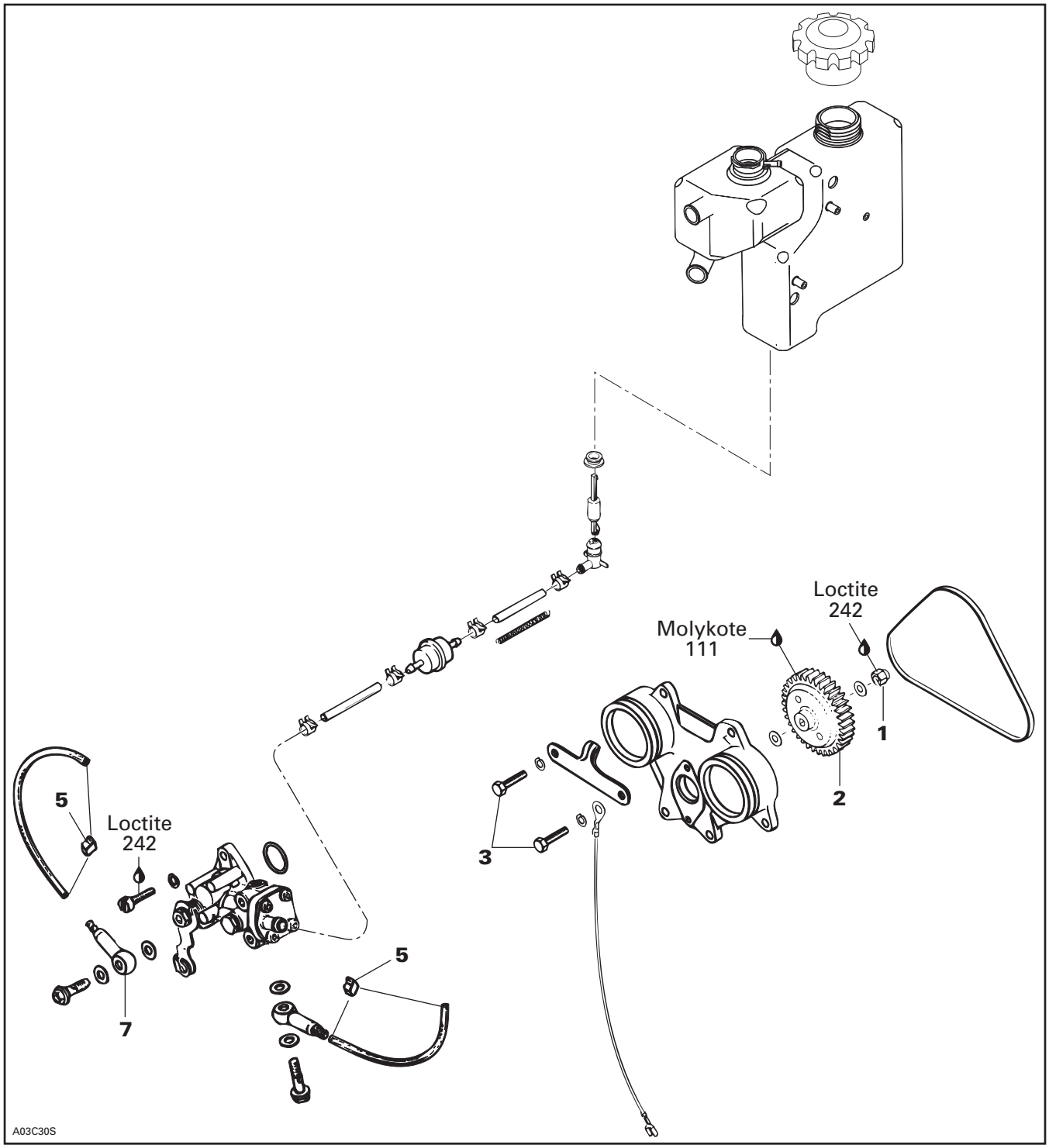
Ignition Timing

Check as described in IGNITION TIMING 06-02.

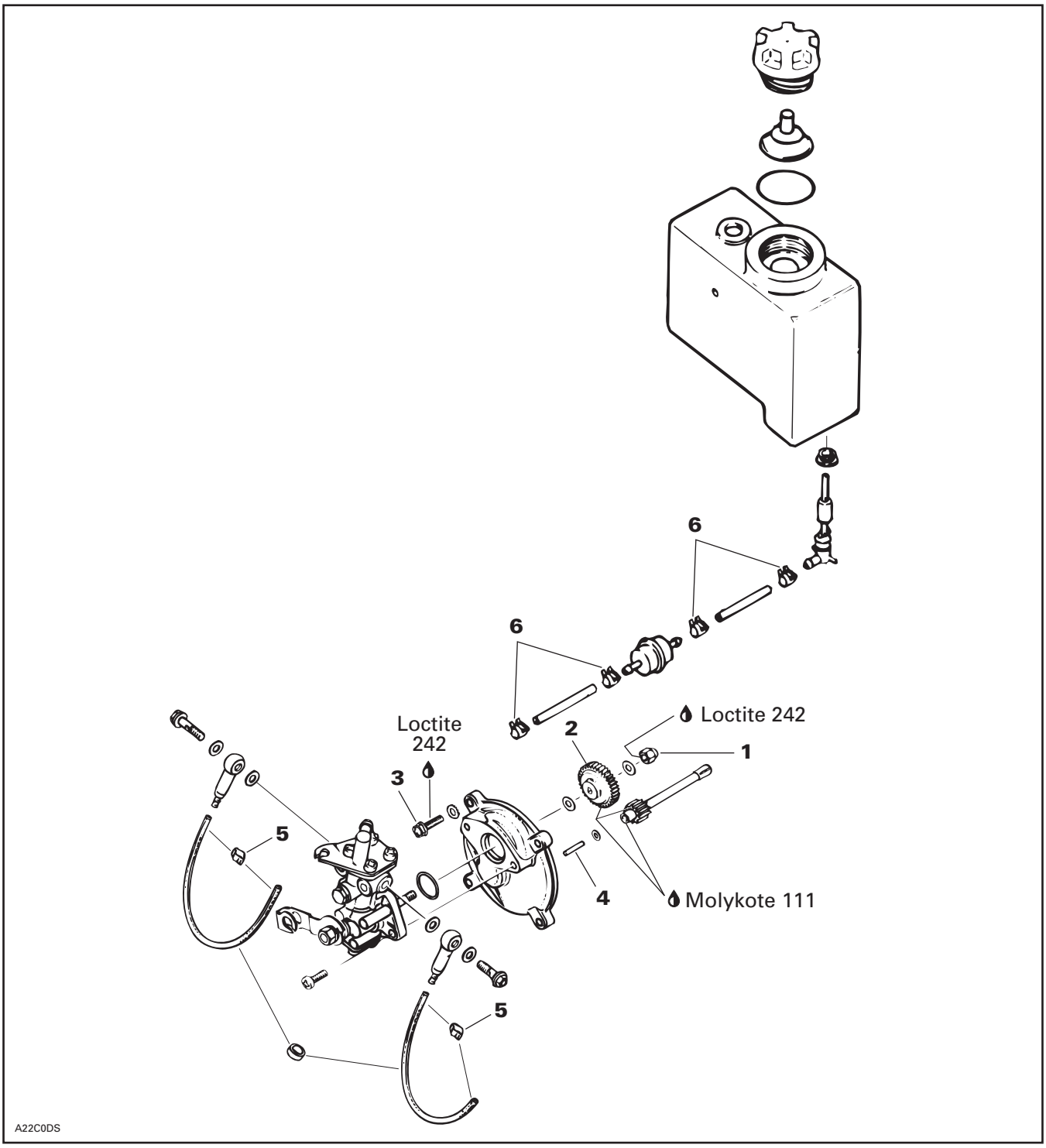
OIL INJECTION SYSTEM

OIL INJECTION PUMP

494, 583 and 670 Engines



443 and 503 Engines



TYPICAL

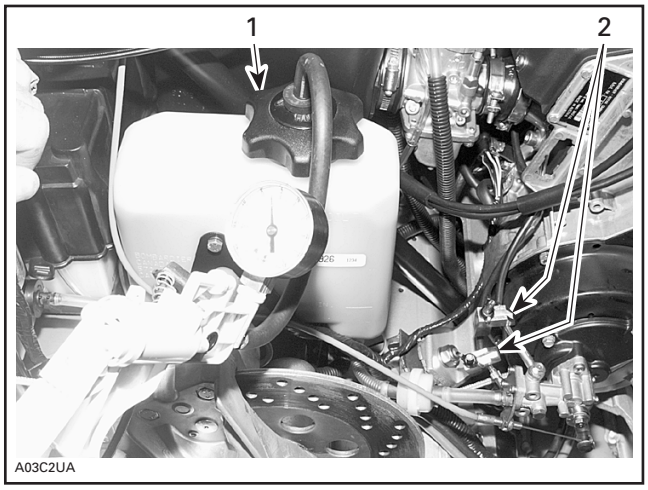
OIL SYSTEM LEAK TEST

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).

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



TYPICAL

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

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
443	E6*
494 Skandic WT LC	N4
494 Formula/GT/ MX Z/Summit	N8*
503 Skandic WT/SWT	E4
583	N9*
670 on Formula Z 670/DLX 670	N9*
670 on MX Z 670 HO and Summit X 670	12

* E6, N8 and N9 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.

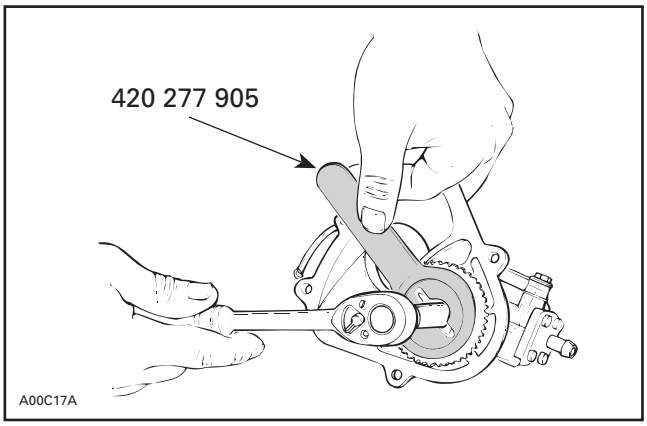
DISASSEMBLY

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
443/494/503/583/670	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.

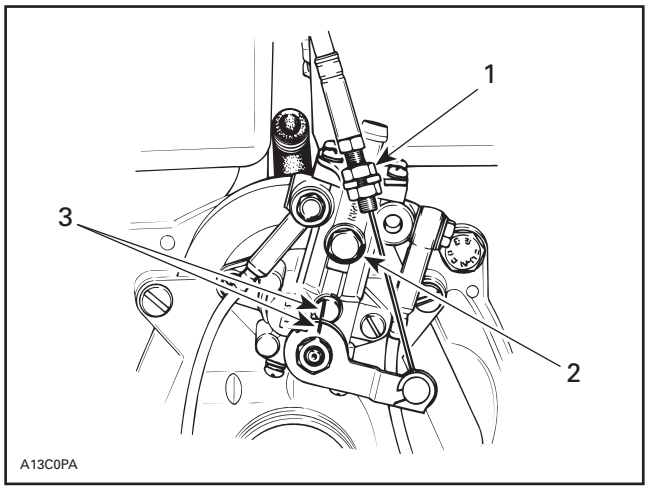
ADJUSTMENT

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. 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. Loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.



1. *Adjuster nut*
2. *Bleeder screw*
3. *Marks in line*

▼ CAUTION

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

Bleeding Oil Lines

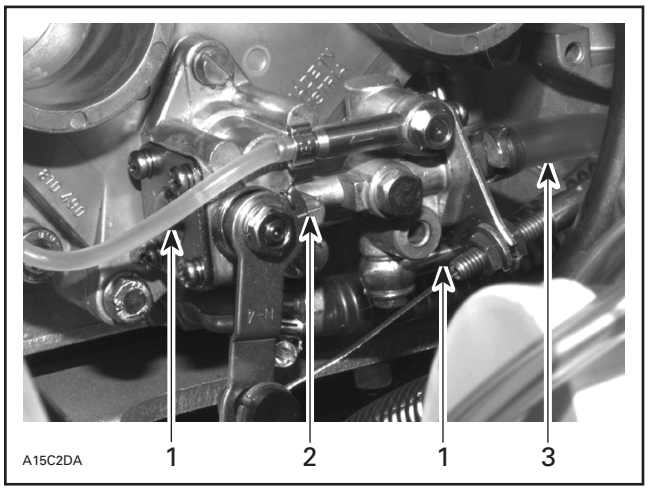
S-Series Only

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.

Check also for proper pump lever adjustment. Marks must be aligned when throttle lever is activated just enough to take all cable play.

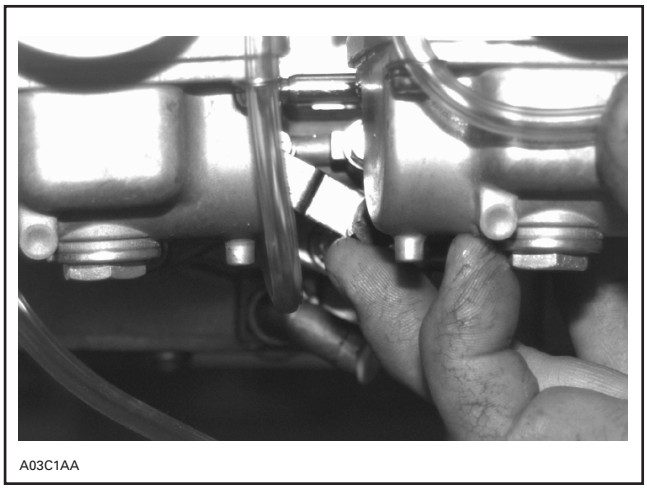


1. Small oil line
2. Marks aligned
3. Main oil line

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 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

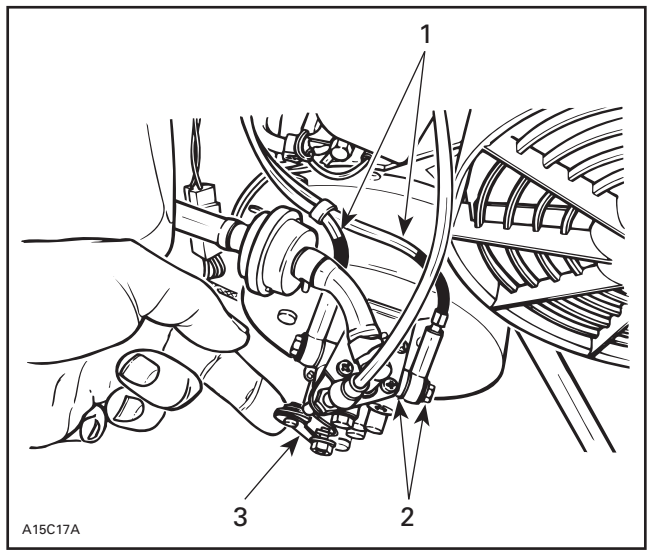
On Vehicle

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

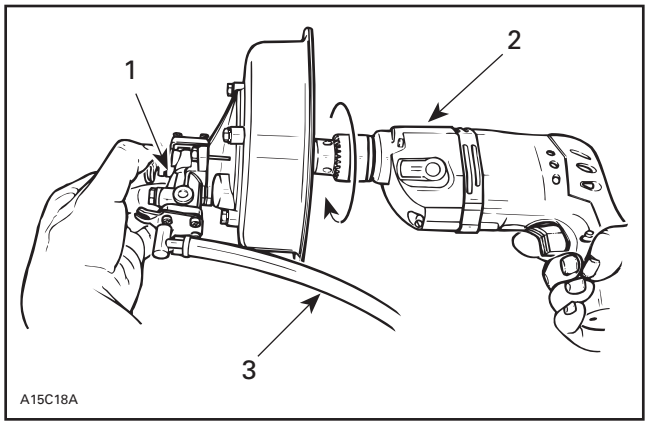
1. Oil columns advancing
2. Washer on each side
3. Fully open position

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*

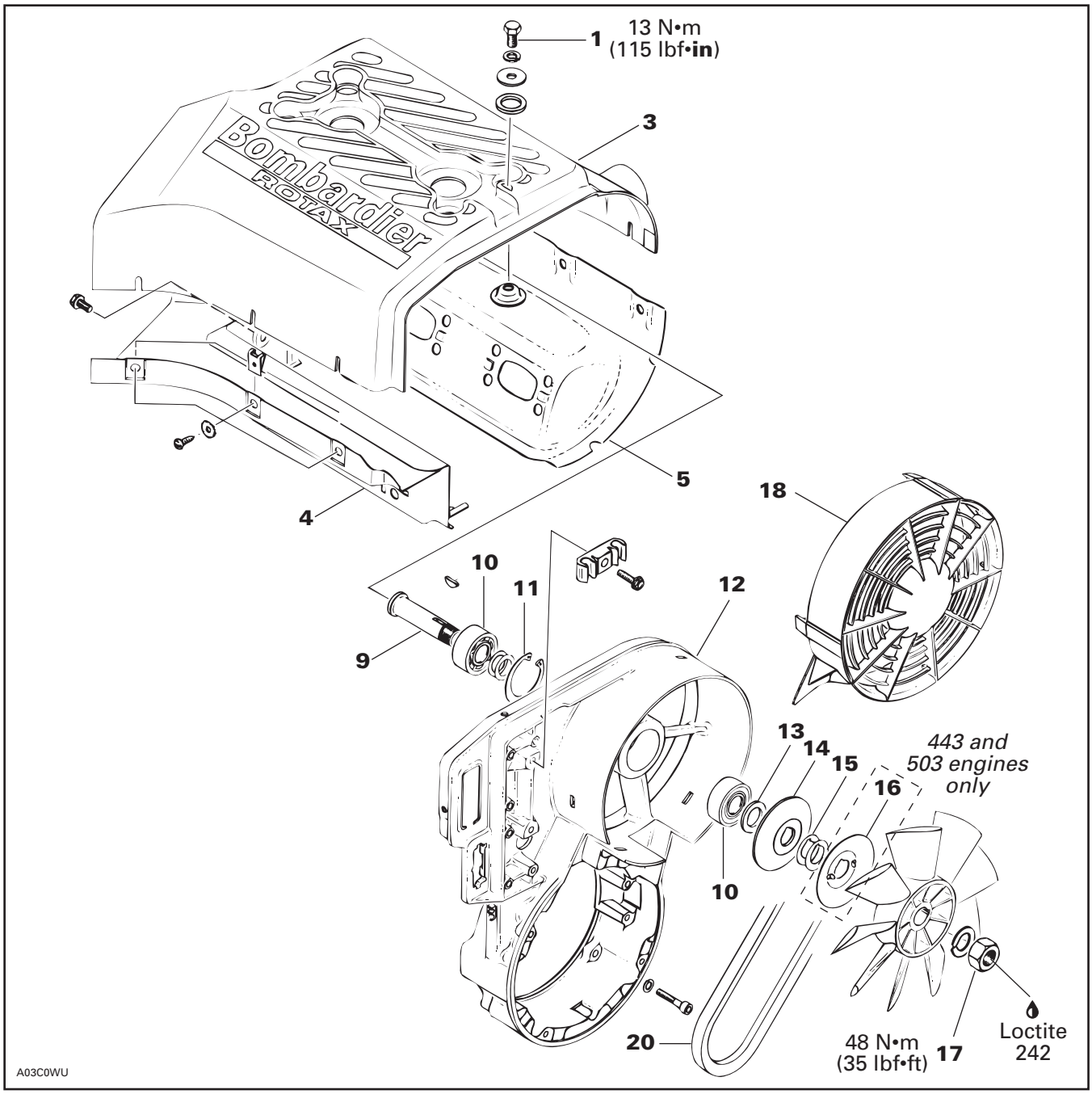
Banjo Fitting

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

443 and 503 Engines



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

REMOVAL

NOTE: To facilitate further disassembly, fan nut may be removed before removing fan housing.

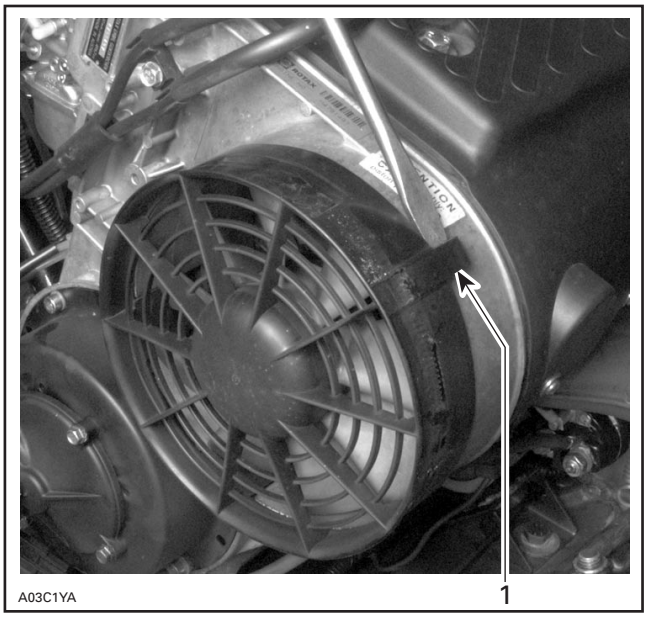
Remove rewind starter, starting pulley, trigger coil wire from 4-connector housing then fan housing ass'y.

CLEANING

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

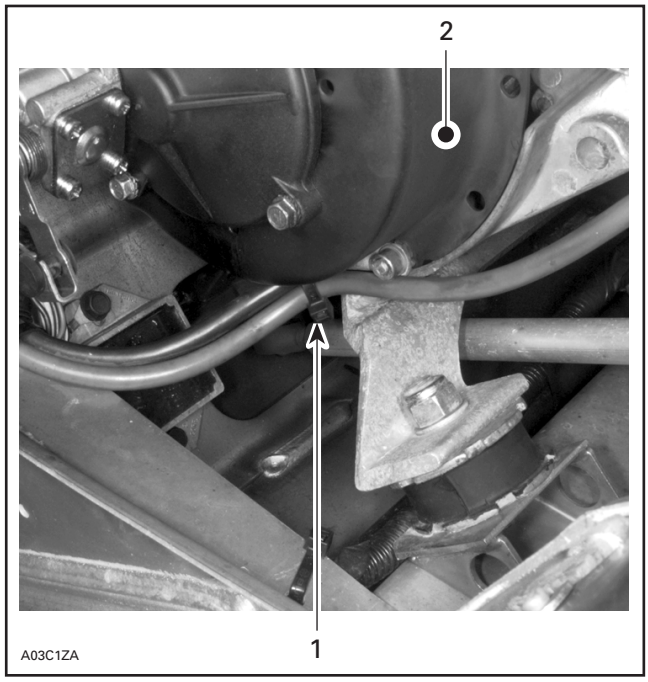
DISASSEMBLY AND ASSEMBLY

Using a flat screwdriver, lift fan protector tabs as shown in the following photo, then remove fan protector.



1. Lift tab and remove fan protector

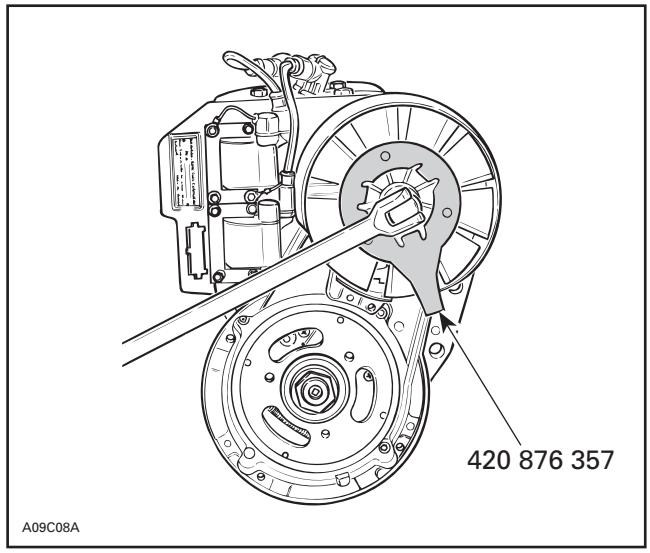
Cut locking tie located under rewind starter (electric start models only).



ELECTRIC START MODELS ONLY

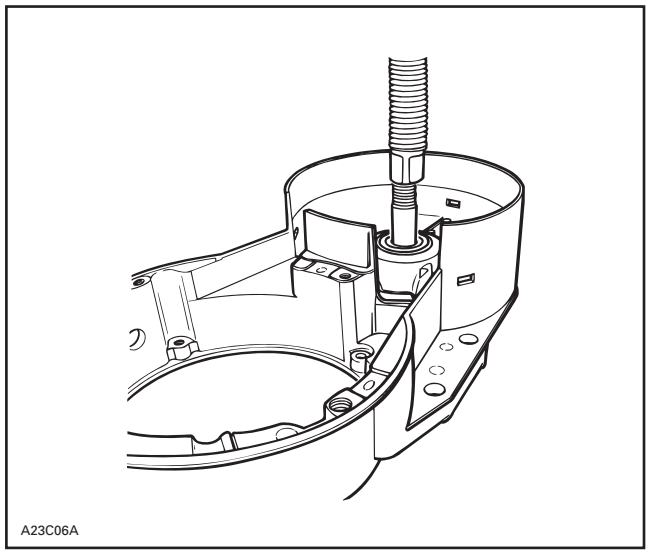
1. Cut this locking tie
2. Rewind starter

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).

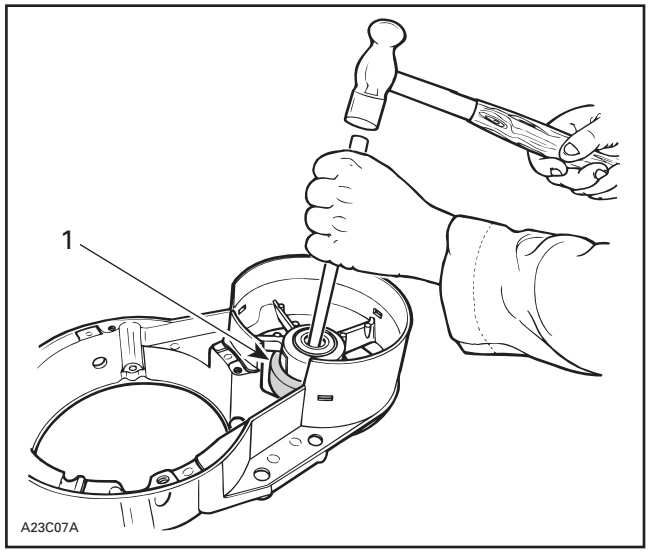


TYPICAL

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

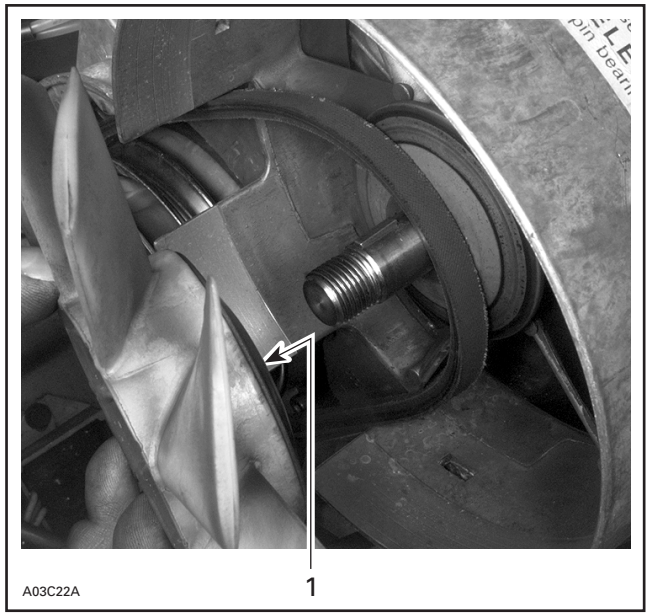
Always reinstall fan protector after servicing.

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.

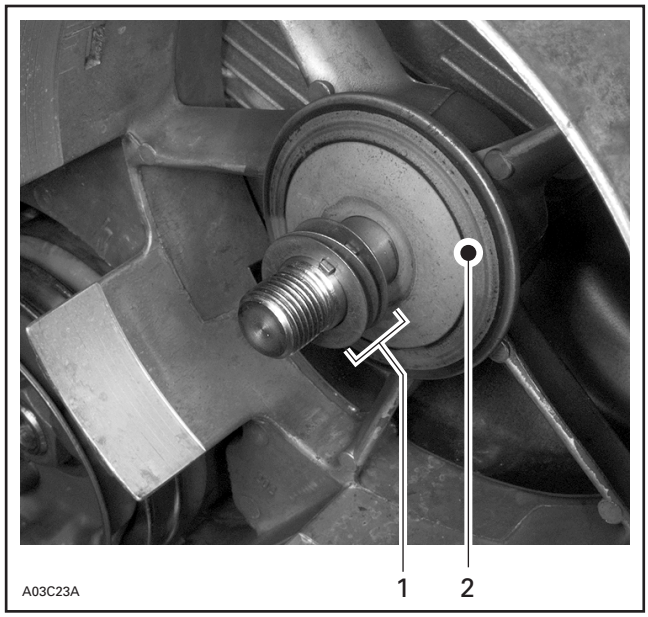
Remove fan with pulley half.



1. Remove fan with pulley half

Remove fan belt.

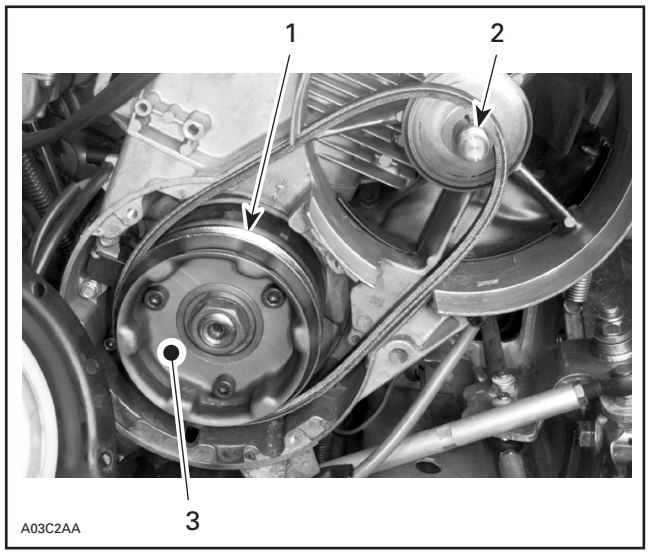
Leave shims and second half pulley in place. Refer to the following photo.



1. Keep shims
2. Leave second half pulley in place

Reassembly

Install fan belt on bottom pulley first then position onto fan shaft, as shown in the next photo.



FAN BELT PROPERLY INSTALLED ON BOTTOM PULLEY AND FAN SHAFT

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

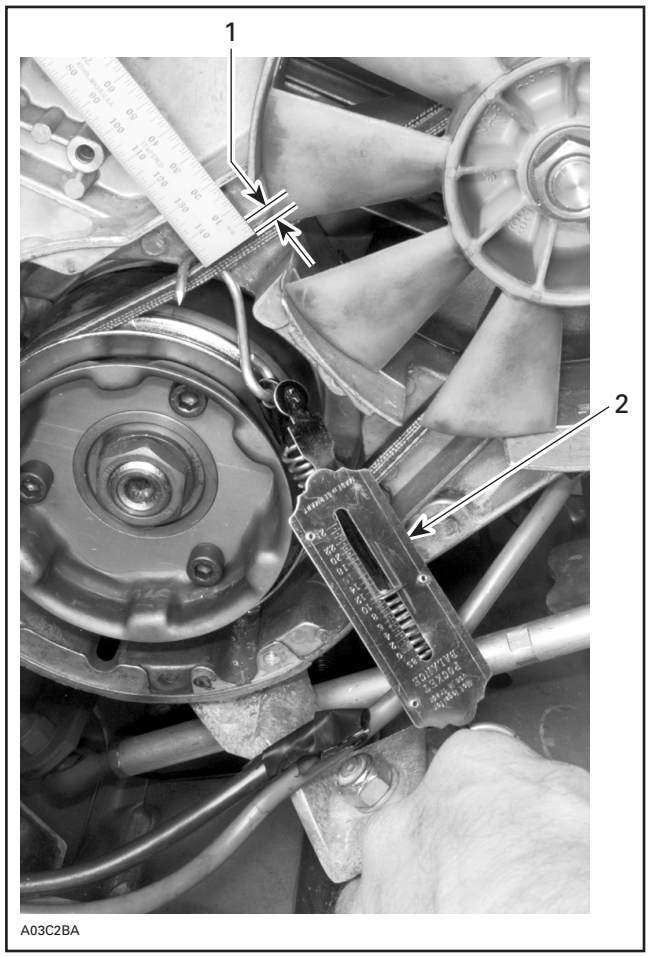
Reinstall fan assembly on fan shaft. Temporarily tighten fan nut.

▼ CAUTION

When reinstalling fan assembly, ensure that key is properly positioned into fan shaft keyway.

Fan Belt Deflection Adjustment

Check fan belt deflection using a ruler and a fish scale positioned midway between pulleys as per following photo.



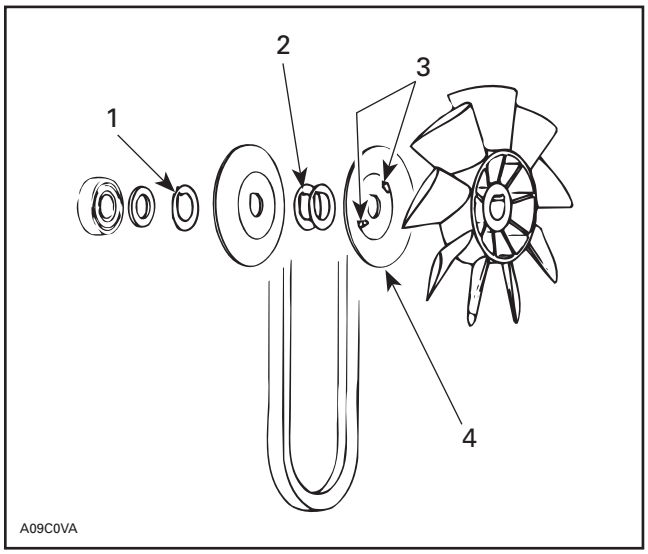
TYPICAL

1. Measure deflection here
2. Fish scale

Belt deflection must be according to the following specifications:

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

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).

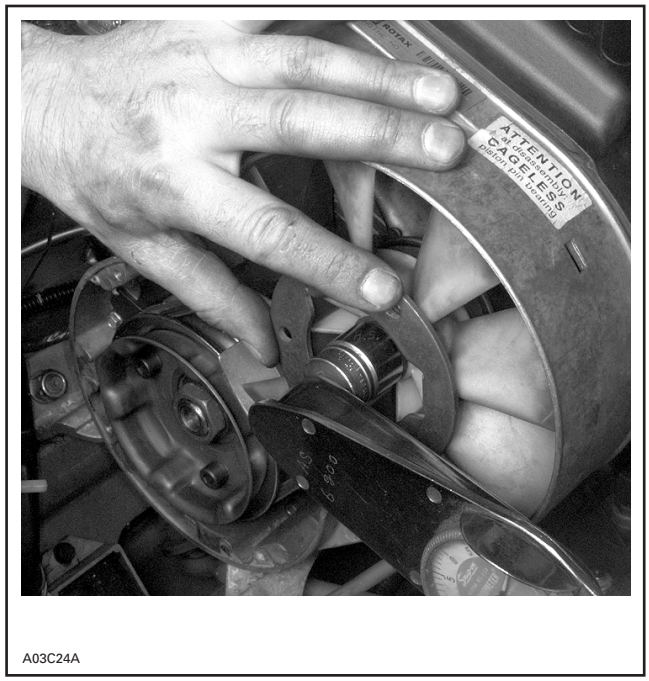


1. *Unused shim(s) here*
2. *Adjust here*
3. *Positioning noses*
4. *Some engines only*

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 nose' 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.



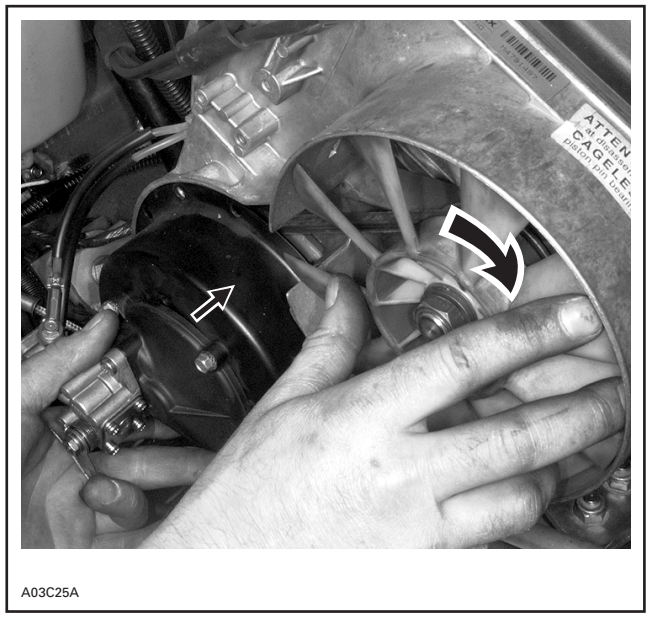
TORQUE FAN NUT USING FAN HOLDER TOOL

Finalizing Reassembly

Reinstall rewind starter.

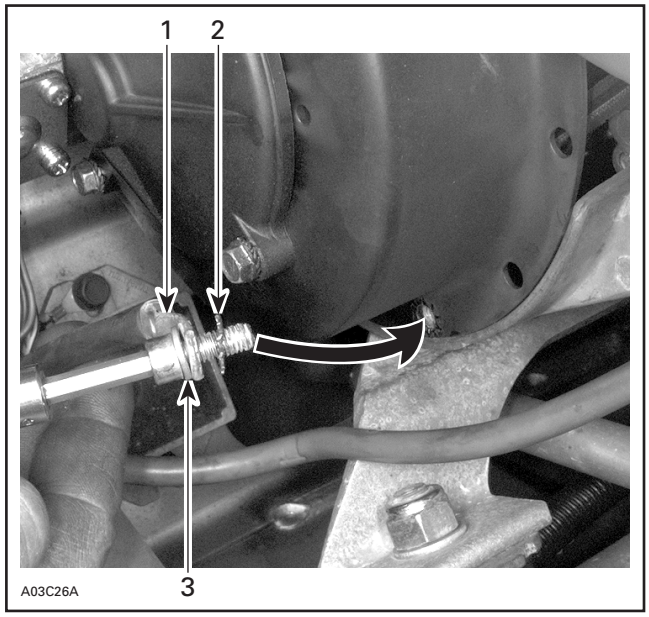
▼ CAUTION

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

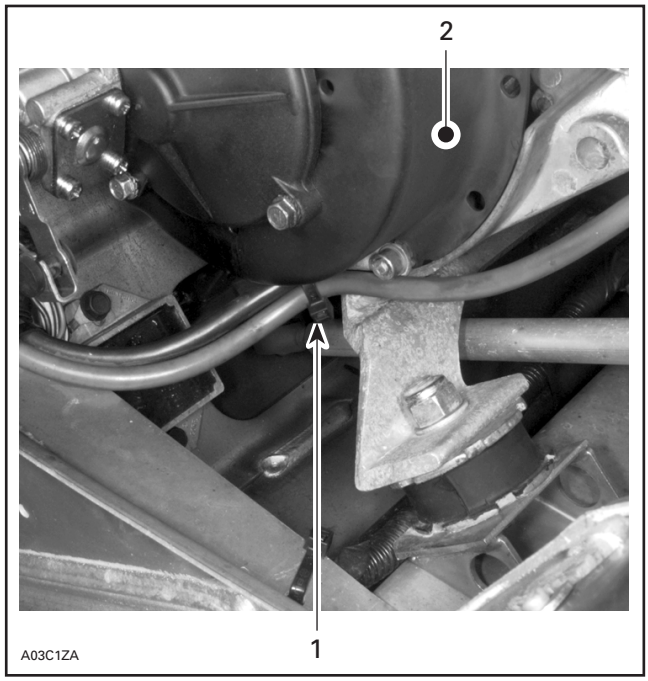
Secure rewind starter with original screws and ensure that ground cable (electric start models only) is properly installed, as shown in the following photo.



ELECTRIC START MODELS ONLY

1. *Ground cable*
2. *Tooth washer*
3. *Washer*

On electric start models, secure cables with a locking tie.



ELECTRIC START MODELS ONLY

1. *Secure cables with a locking tie*
2. *Rewind starter*

Reinstall fan protector no. 18 properly.

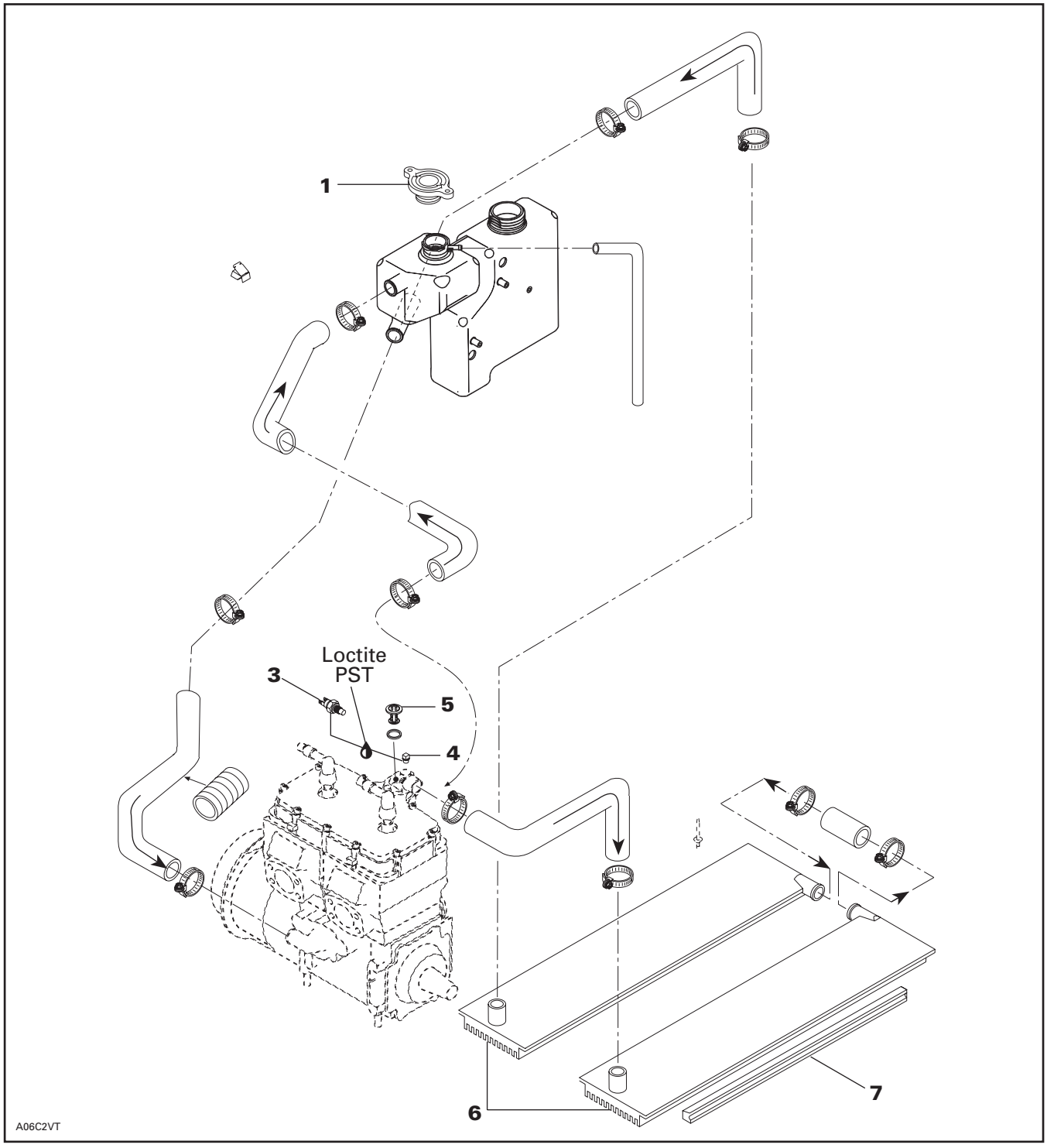
◆ WARNING

Always reinstall fan protector after servicing.

Reinstall muffler.

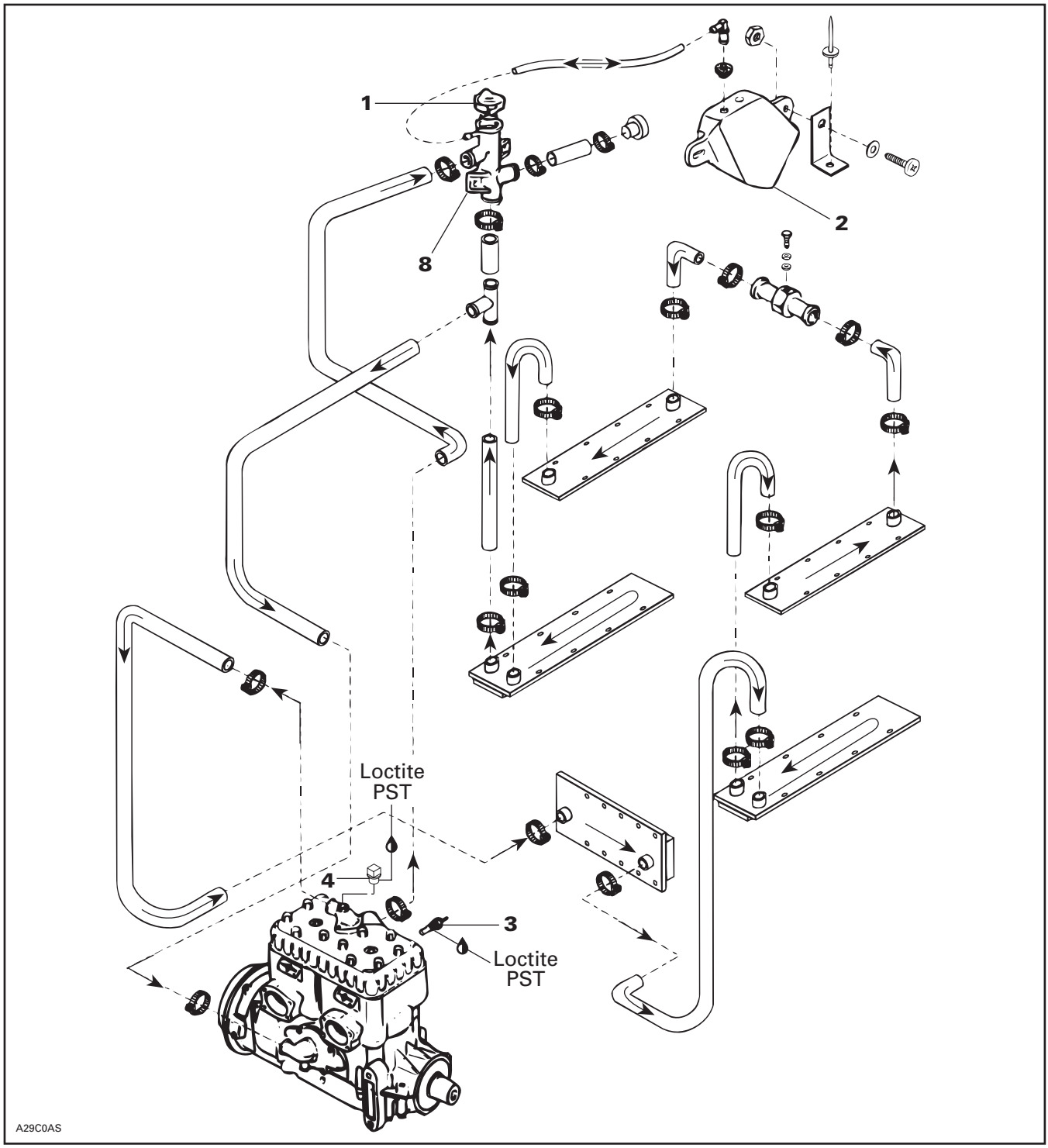
LIQUID COOLING SYSTEM

All S-Series Engines



PARTS

Skandic WT LC



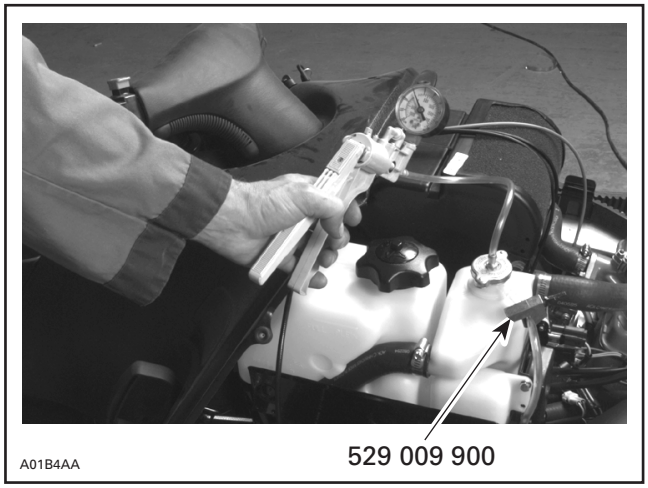
TYPICAL

PARTS

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

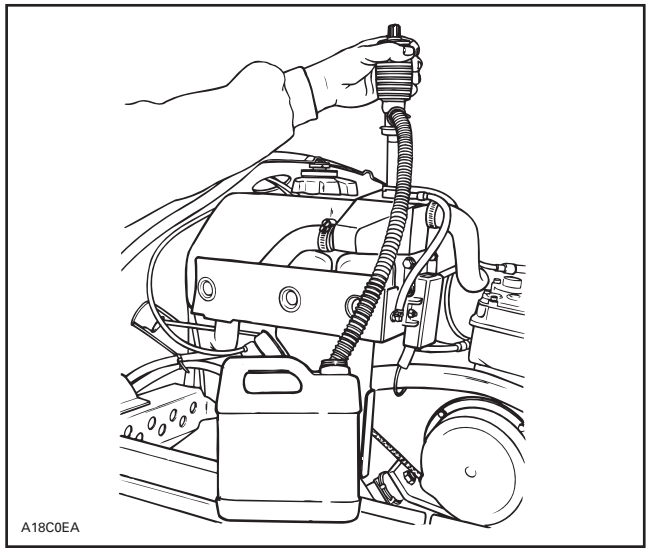
Check general condition of hoses and clamp tightness.

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.

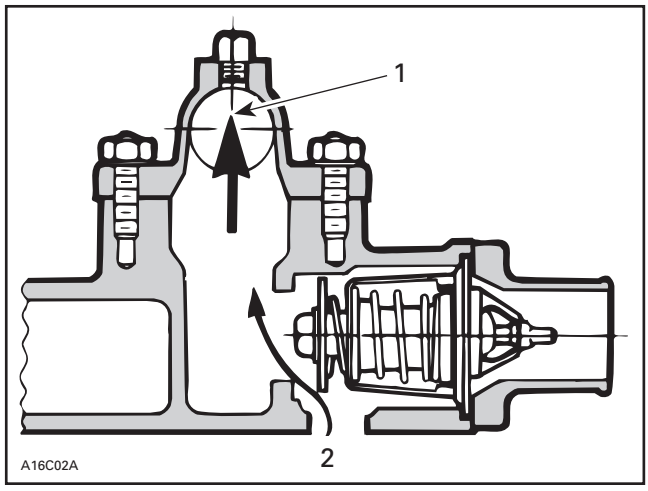
5, Thermostat

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

ENGINE	TEMPERATURE
494, 583 and 670	42°C (108°F)

On 494, 583 and 670 engines, the thermostat is a double action type.

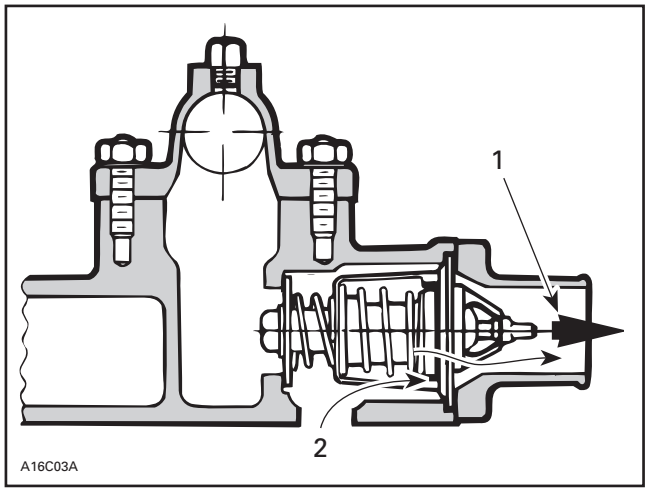
a. Its function is to give faster warm up of the engine by controlling a circuit; water pump — engine — coolant tank. This is done by bypassing the radiator circuit.



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 coolesd 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.

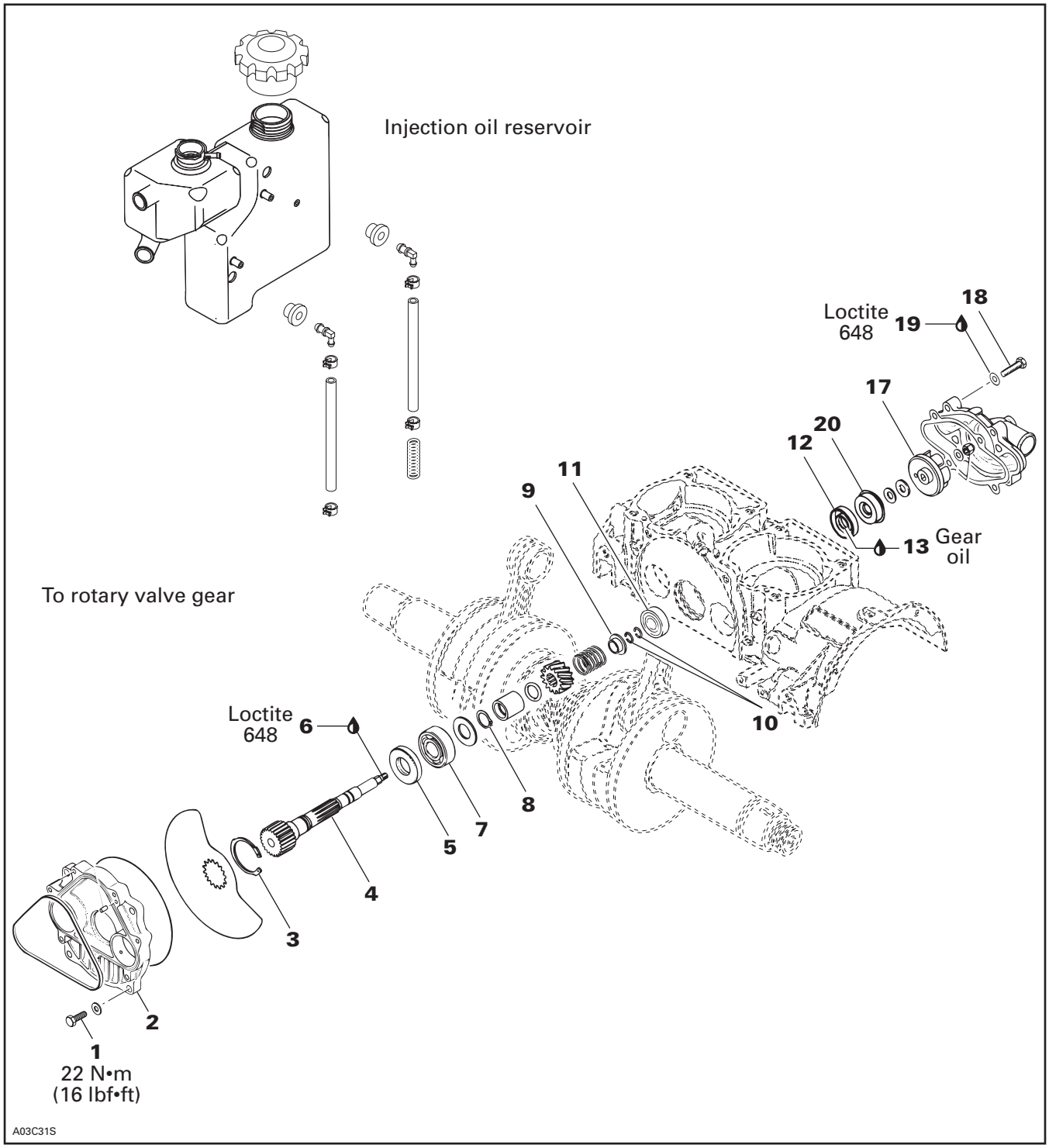
If coolant level gets down, add more coolant in filler neck.

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.

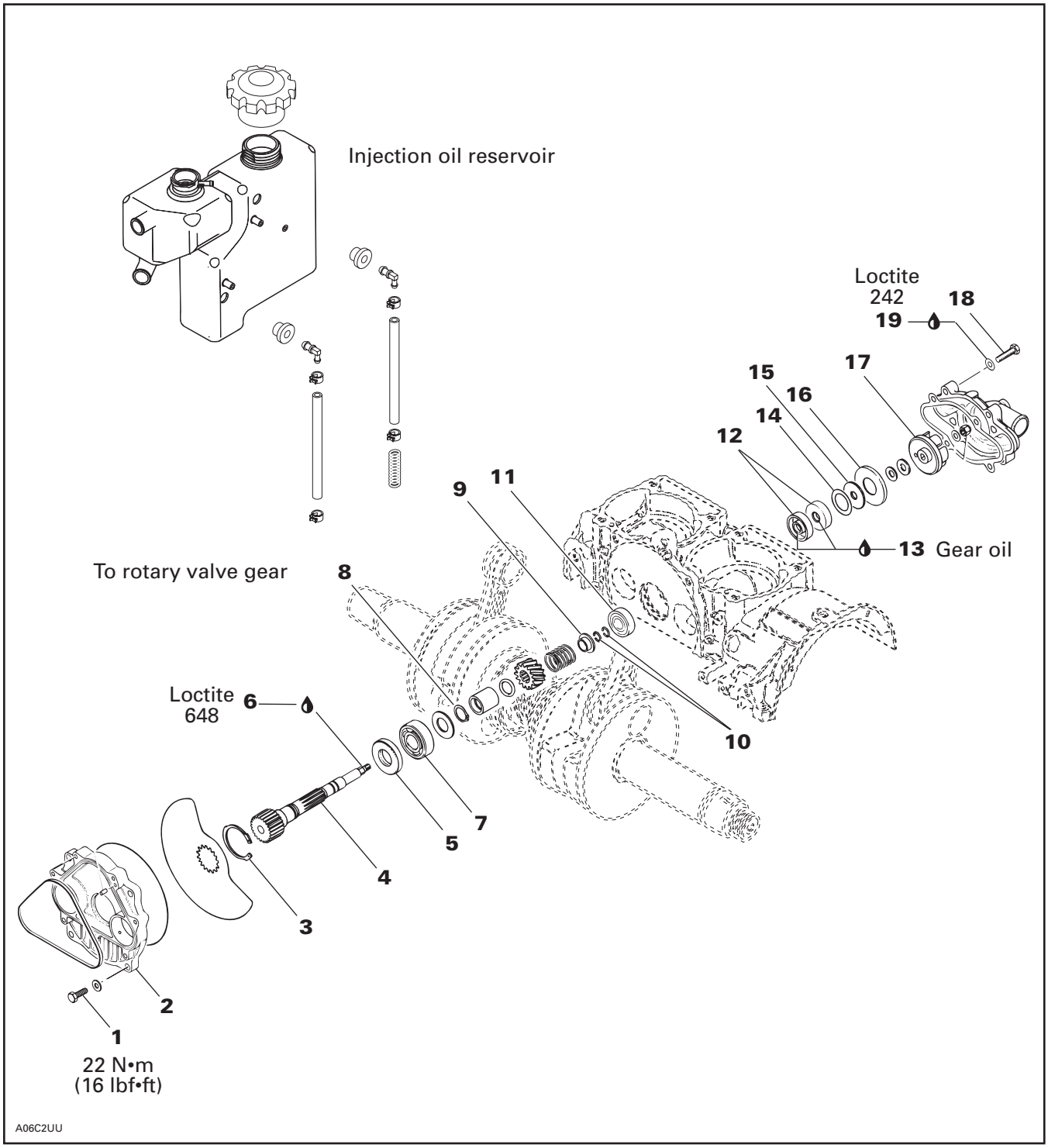
ROTARY VALVE, COOLANT PUMP AND RESERVOIR

494 and 670 Engines



TYPICAL

583 Engine



TYPICAL

PARTS

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

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.

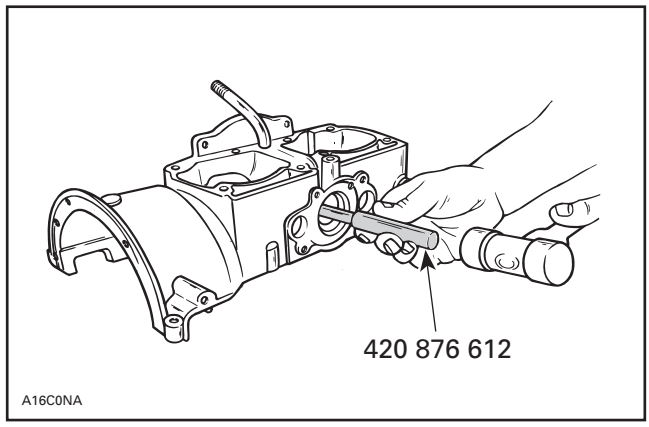
Unscrew 4 retaining screws and withdraw rotary valve cover and valve.

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.

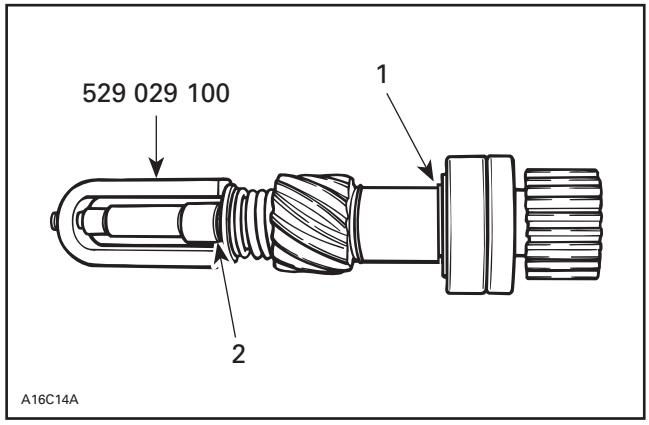


▼ CAUTION

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

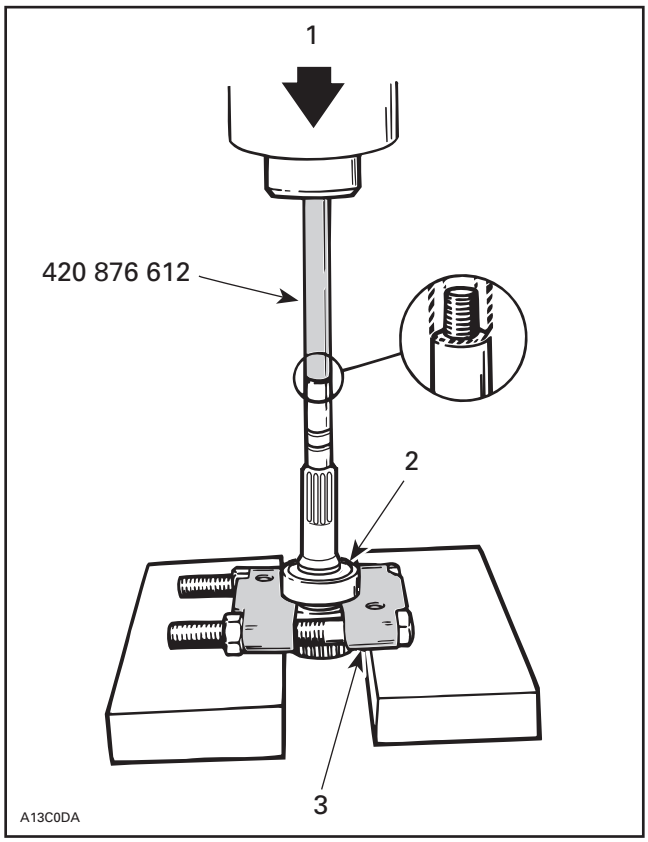
8,9,10, Circlip and Spring Retaining Cup

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

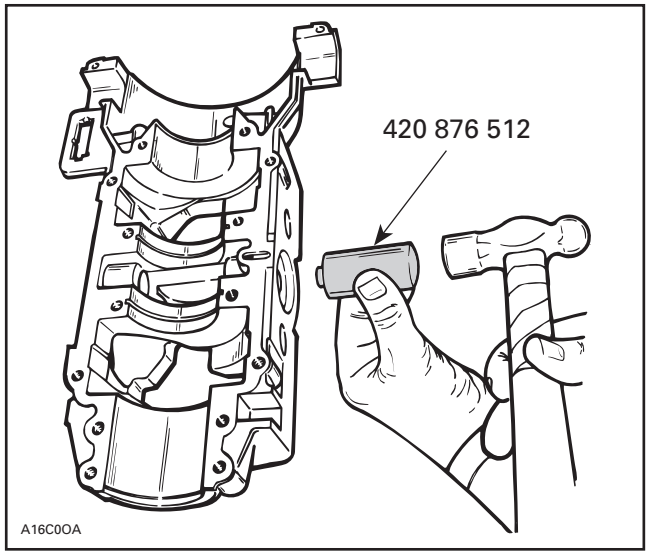
Ensure that the rotary valve shaft is perfectly perpendicular with the press tip or damage will occur.

14,15,16, Shim, Rubber Washer and Support Plate

Pry support plate out of crankcase and remove rubber washer and shim.

11,12,14,15, Bearing 6201 and Seal

To remove bearing 6201 (the smallest one), seals and rubber washer, 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 04-04.

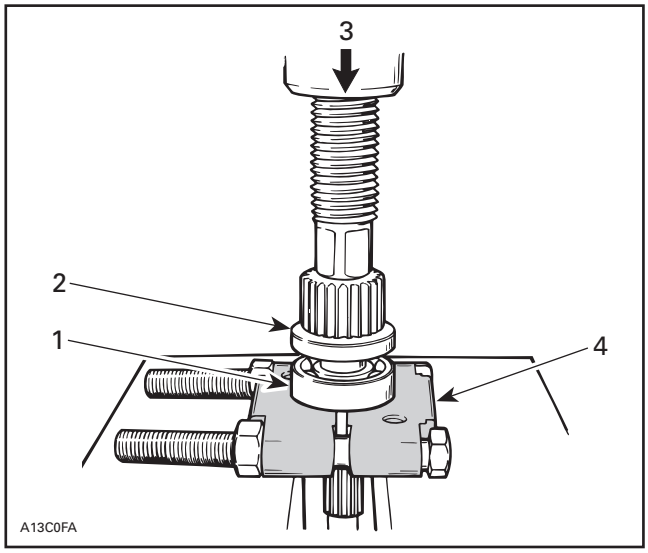
ASSEMBLY

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

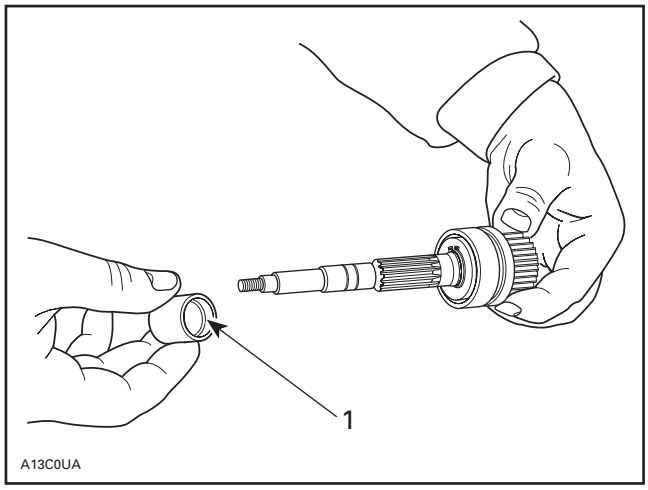
At assembly apply lithium grease on seal lips. Position the seal with shielded portion against splines of shaft.

Install bearing as illustrated.



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

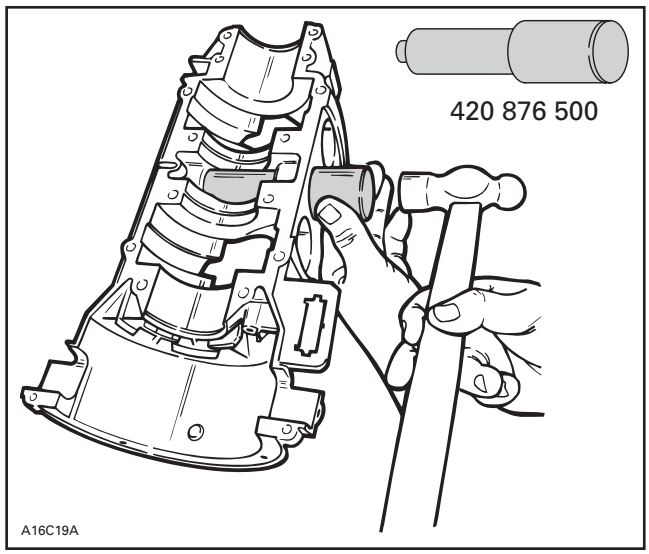
Install distance sleeve with its counterbore first.



1. Counterbore first

11, Bearing 6201

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



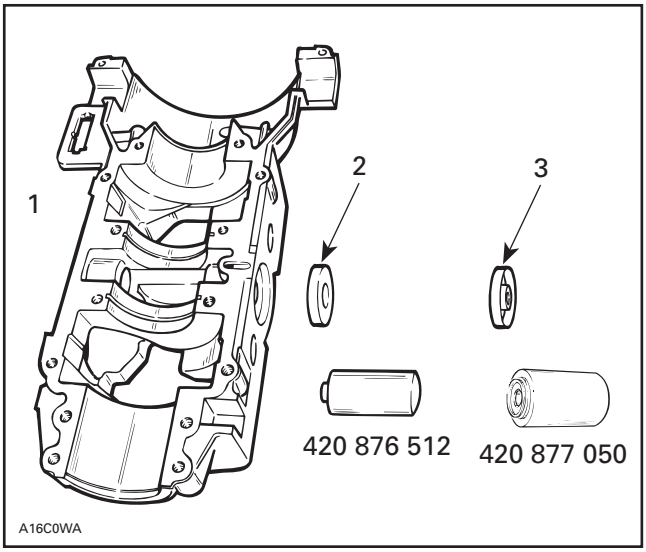
NOTE: Bearing shielded side must be facing rotary valve.

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

12,13,14,15, Seals, Shim and Rubber Washer

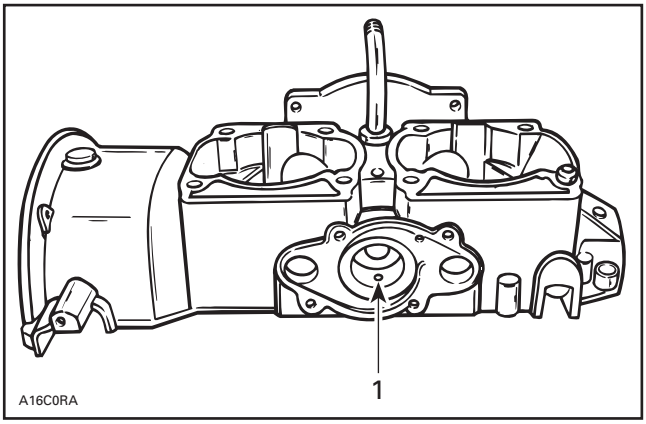
To install seals on coolant pump side proceed as follows:

– Apply synthetic chaincase oil (P/N 413 803 300) on lip of both seals.
– Position **oil seal** shielded portion towards pump impeller. Drive in place with a seal pusher (P/N 420 876 512).
– Position **coolant seal** shielded portion towards rotary valve. Drive in place with the rotary valve shaft seal pusher (P/N 420 877 050).



1. Rotary valve side
2. Oil seal
3. Coolant seal

Make sure not to obstruct draining hole. Position seals so that hole is between them.



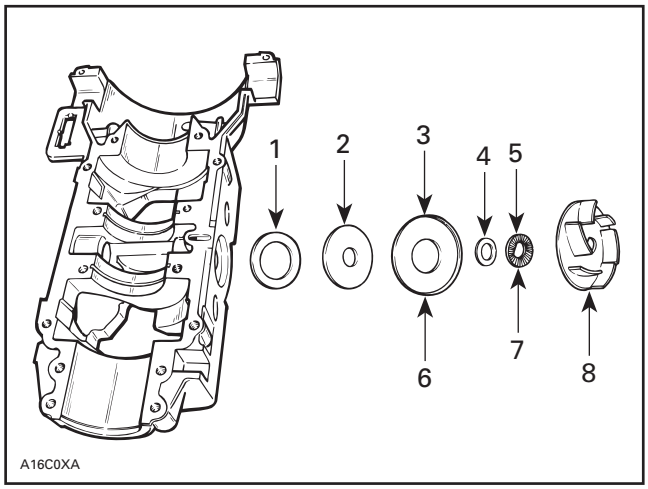
1. Draining hole

▼ CAUTION

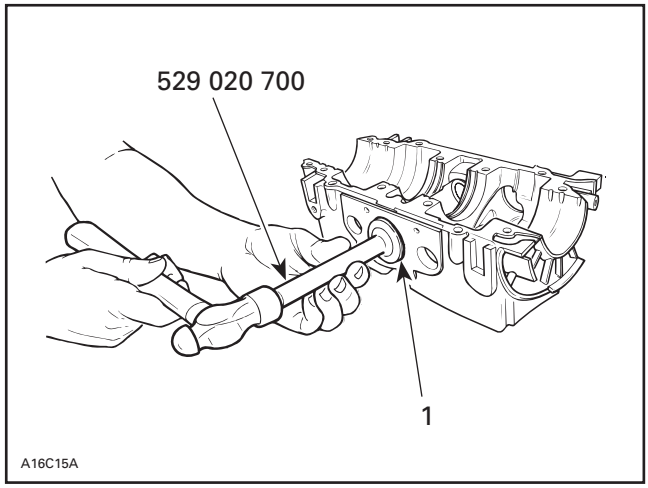
Failure to position the seals as specified may cause the seal spring to be corroded by coolant. Severe damage may occur if these notices are disregarded.

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.

– Install large shim and pack space with Molykote 111 (P/N 413 707 000).
– Install rubber washer then support plate with its flange towards pump impeller. Use impeller support plate pusher (P/N 529 020 700) for proper installation.
– Install small thrust washer then friction washer positioning its grooves against pump impeller.

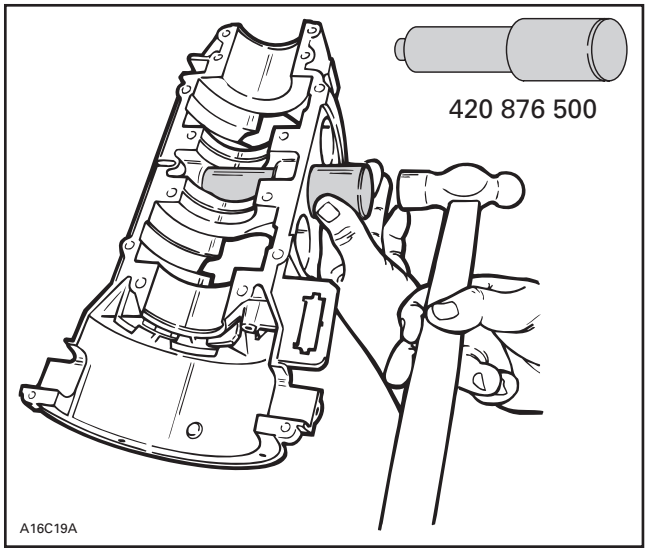


1. Large shim
2. Rubber washer
3. Support plate
4. Small thrust washer
5. Friction washer
6. Flange this side
7. Grooves this side
8. Pump impeller



1. Support plate

NOTE: After seals installation, check if the coolant pump end bearing is correctly positioned with bearing pusher (P/N 420 876 500).



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

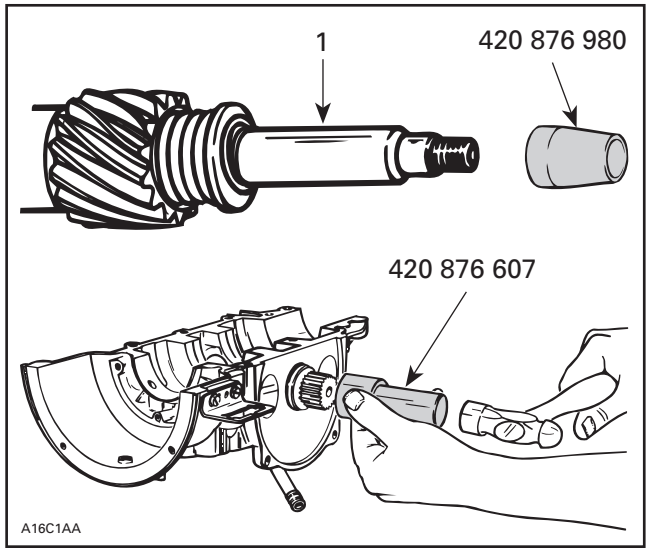
▼ CAUTION

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

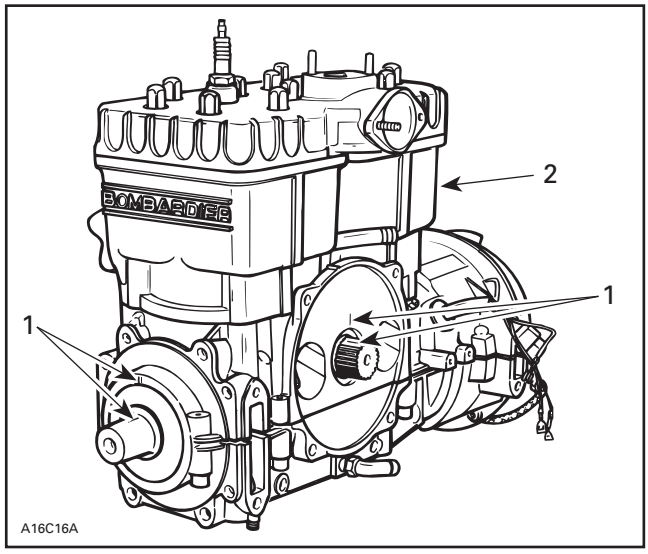
There is no identification code on the valve. To find out the duration, place an angle finder on the valve and measure the valve cut-out angle.

ENGINE TYPE	ROTARY VALVE P/N 420 924 XXX	VALVE DURATION (CUT-OUT ANGLE) °
494 MX Z	502	159
494 All models except MX Z	509	147
583 GT and Formula Z 583/DLX 583	502	159
670	500	164

ROTARY VALVE TIMING

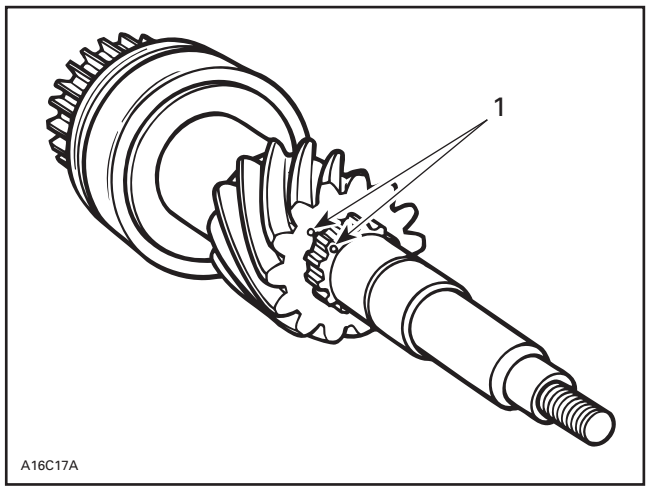
At disassembly, before removing rotary valve, note original rotary valve timing: it may be out of specifications by 1 to 4 degrees of retard or advance. To do so, bring MAG piston to TDC and scribe a mark on crankshaft end at top (12 o'clock) and also on upper crankcase half.

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.

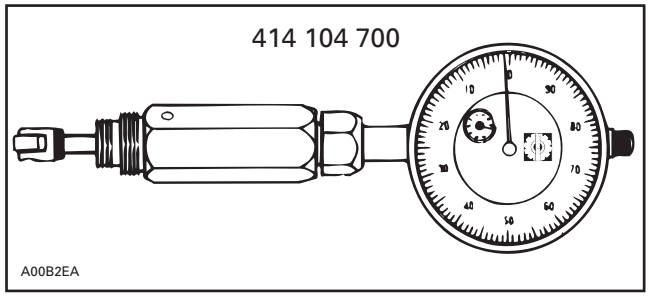
When the same crankcase is reassembled, the first timing method is to be followed. However, since replacement crankcases do not have timing marks (ridge), the second method is required. Take note that the second method is more accurate and may be used any time.

Installation

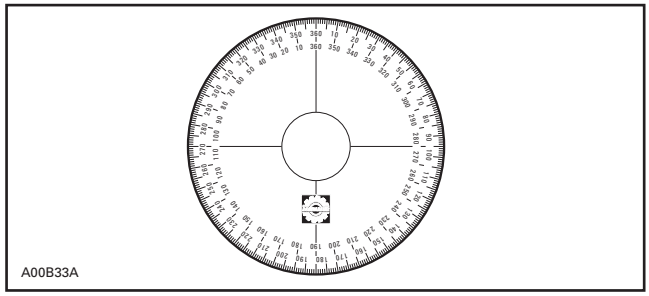
To correctly install rotary valve, proceed as follows:

– 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:

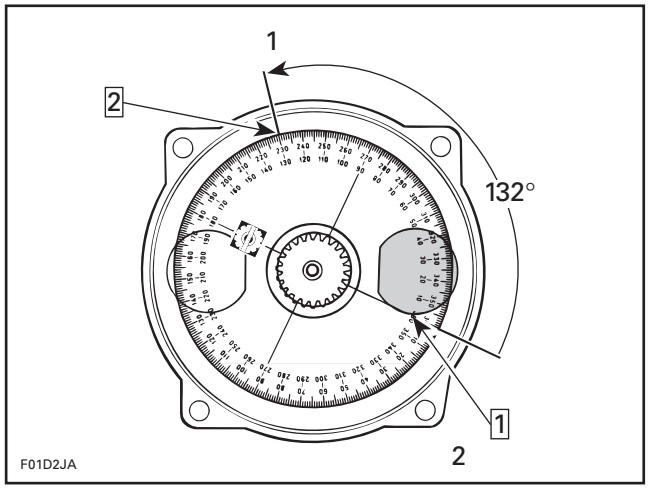
OPENING: 132° BTDC

CLOSING: 52° BTDC

Proceed as follows:

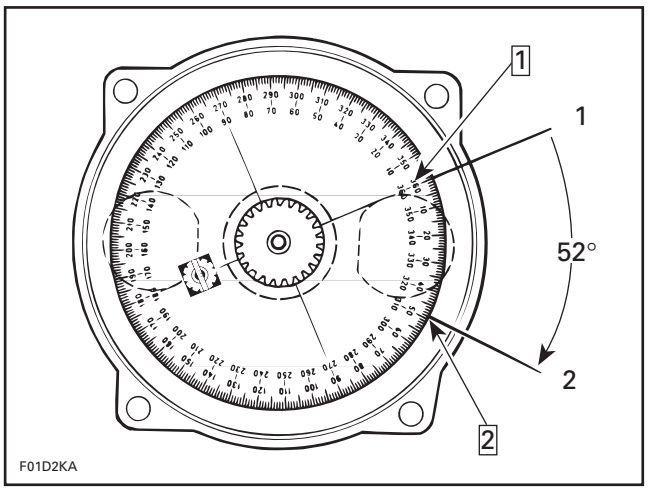
– Turning crankshaft, bring **MAG side** piston to Top Dead Center as done before with a crankcase having a ridge.

– 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.

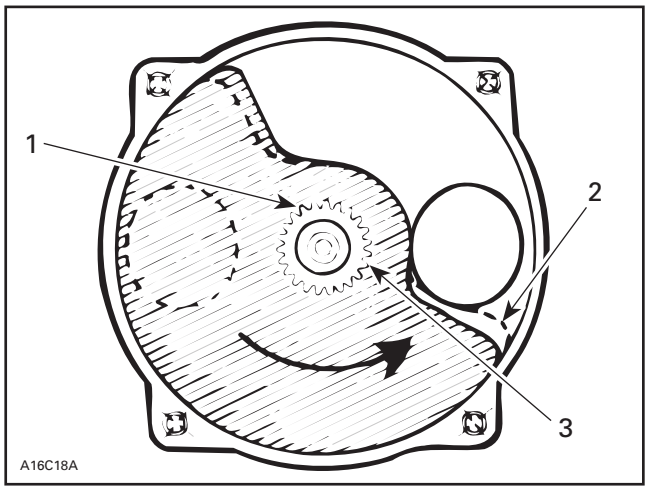
Second Method

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



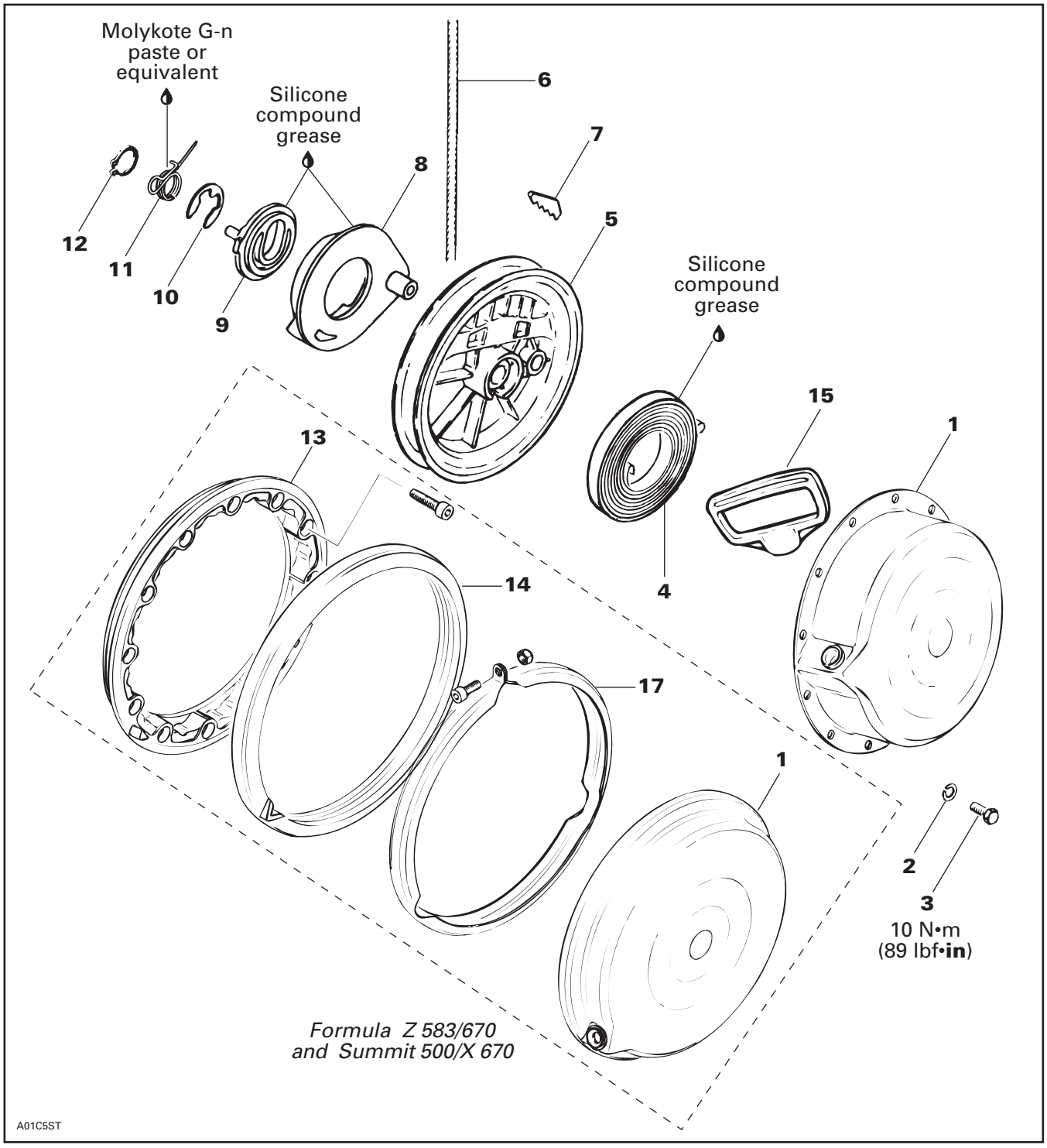
1. *Position of mark when brass gear disengages worm gear*
2. *Advanced by 2°*
3. *Position of mark before installation (about 10 splines from original position)*

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.

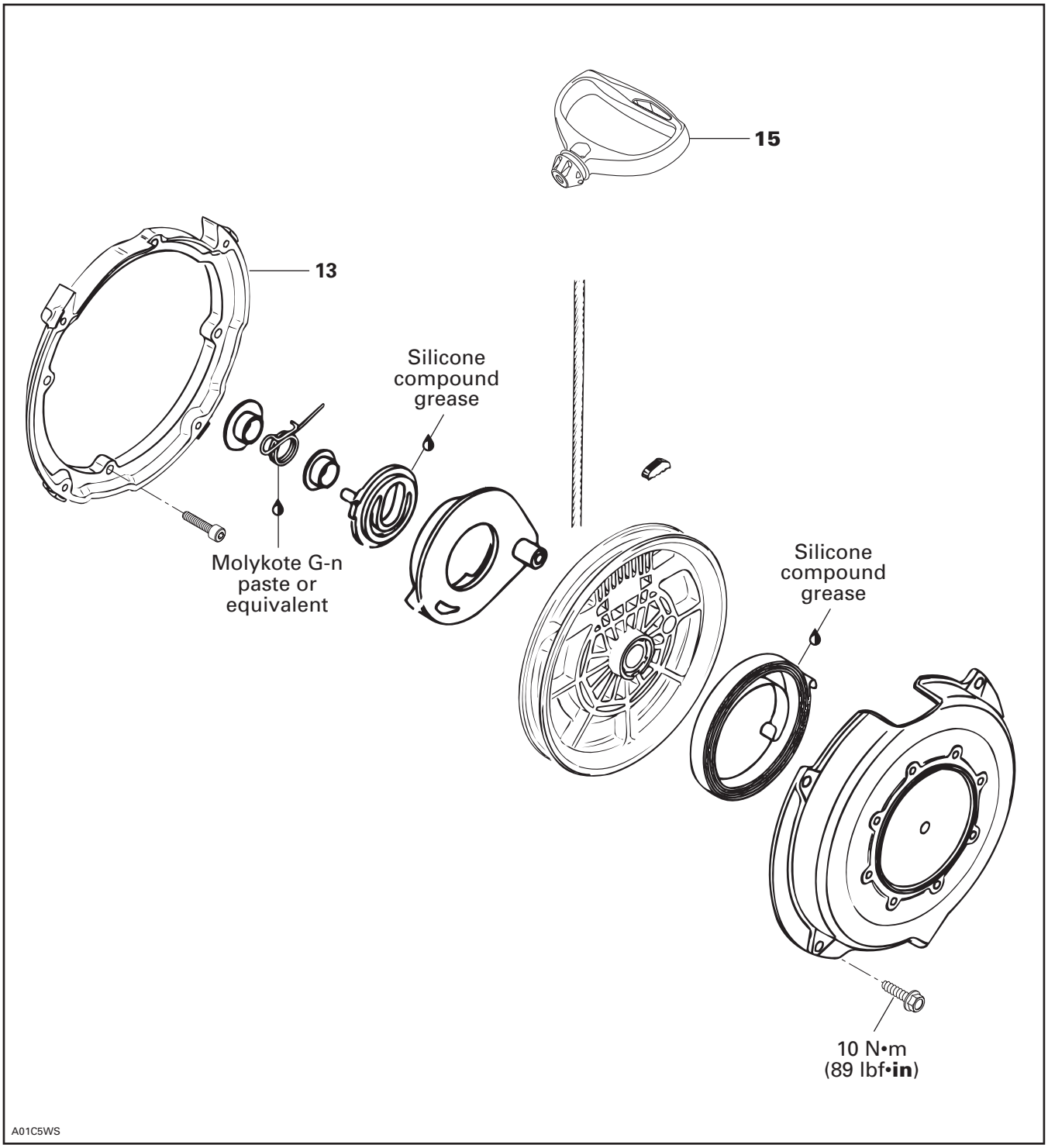
REWIND STARTER

All Liquid Cooled Models



TYPICAL

All Fan Cooled Engines



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.

On fan cooled models with oil injection pump remove pump from rewind starter cover.

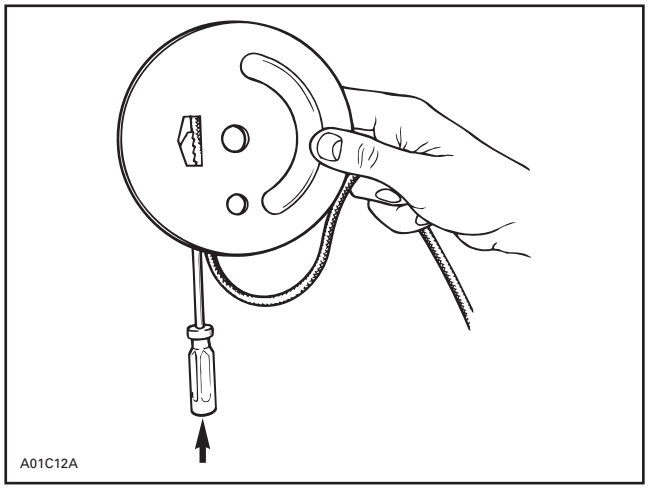
DISASSEMBLY

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**.



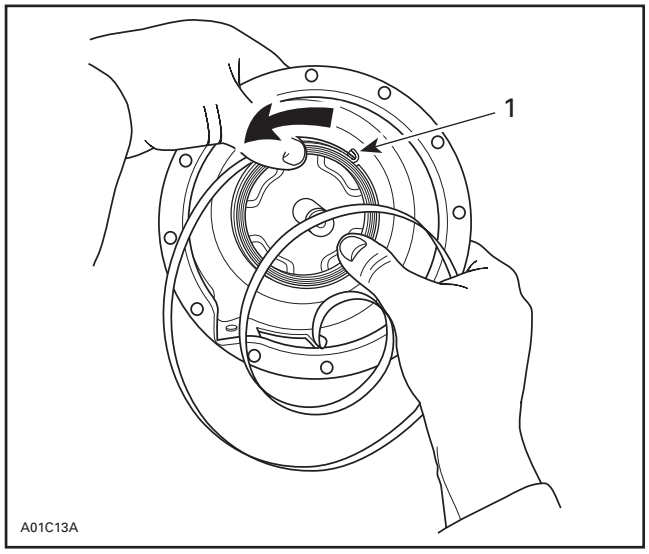
GENTLY TAP ON KEY

ASSEMBLY

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

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

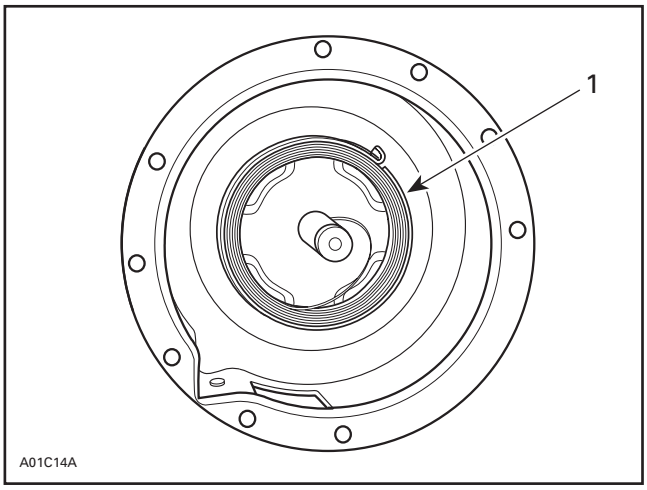
▼ CAUTION

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.

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.

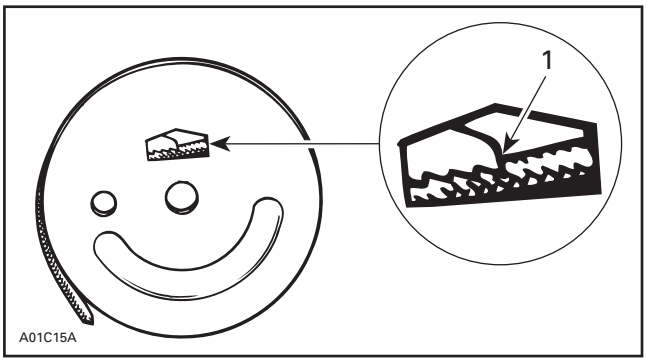


1. Grease inside spring guide

▼ 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.



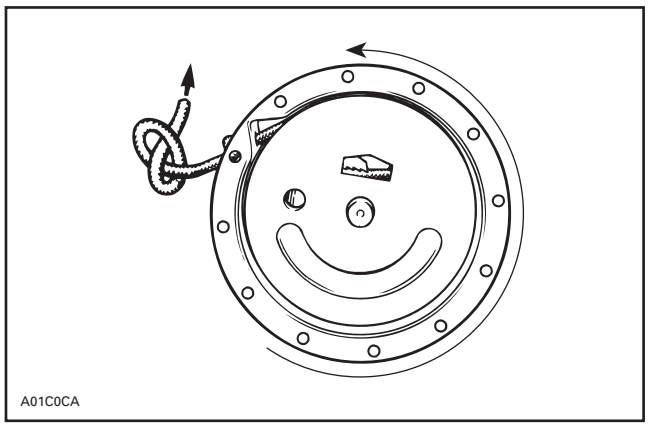
1. Push to lock

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.

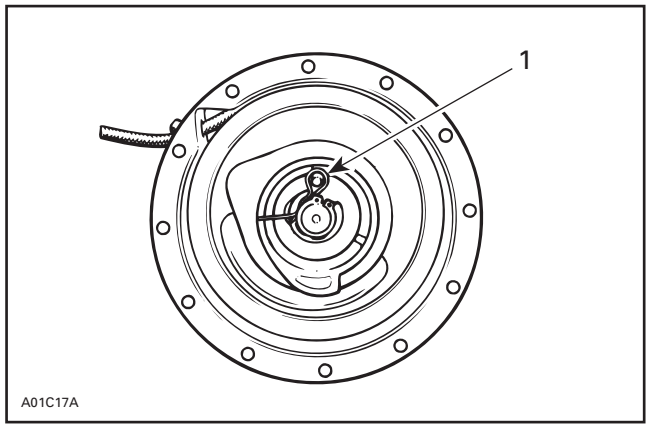
Rotate the sheave counterclockwise until rope end is accessible through starter housing orifice.

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.



1. Spring coated with MOLYKOTE G-n paste

Install locking ring.

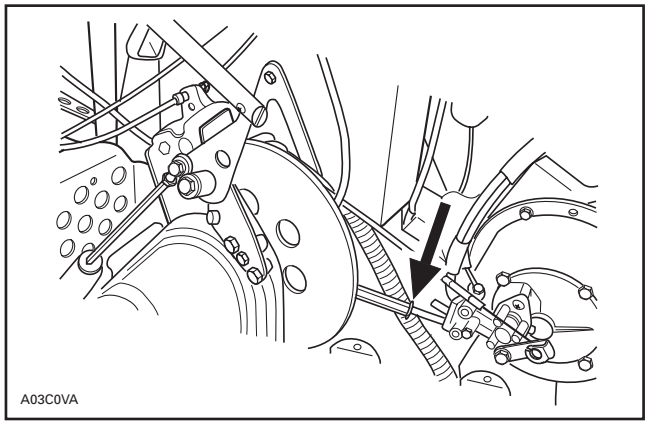
▼ CAUTION

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

INSTALLATION

On fan cooled models with oil injection pump, reinstall oil pump on rewind starter assembly.

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



All Models Except Formula Z 583/670 and Summit 500/X 670

Reinstall rewind starter assembly on engine.

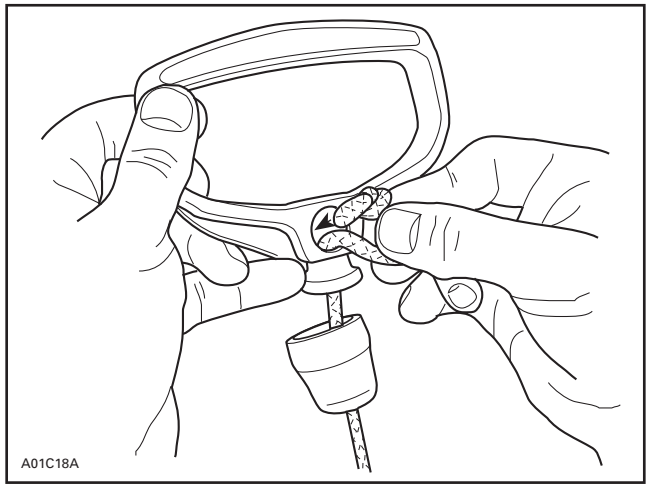
Formula Z 583/670 and Summit 500/X 670 Only

Install rewind starter on damper ring matching notches and embosses.

1. Notch

All Models

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.

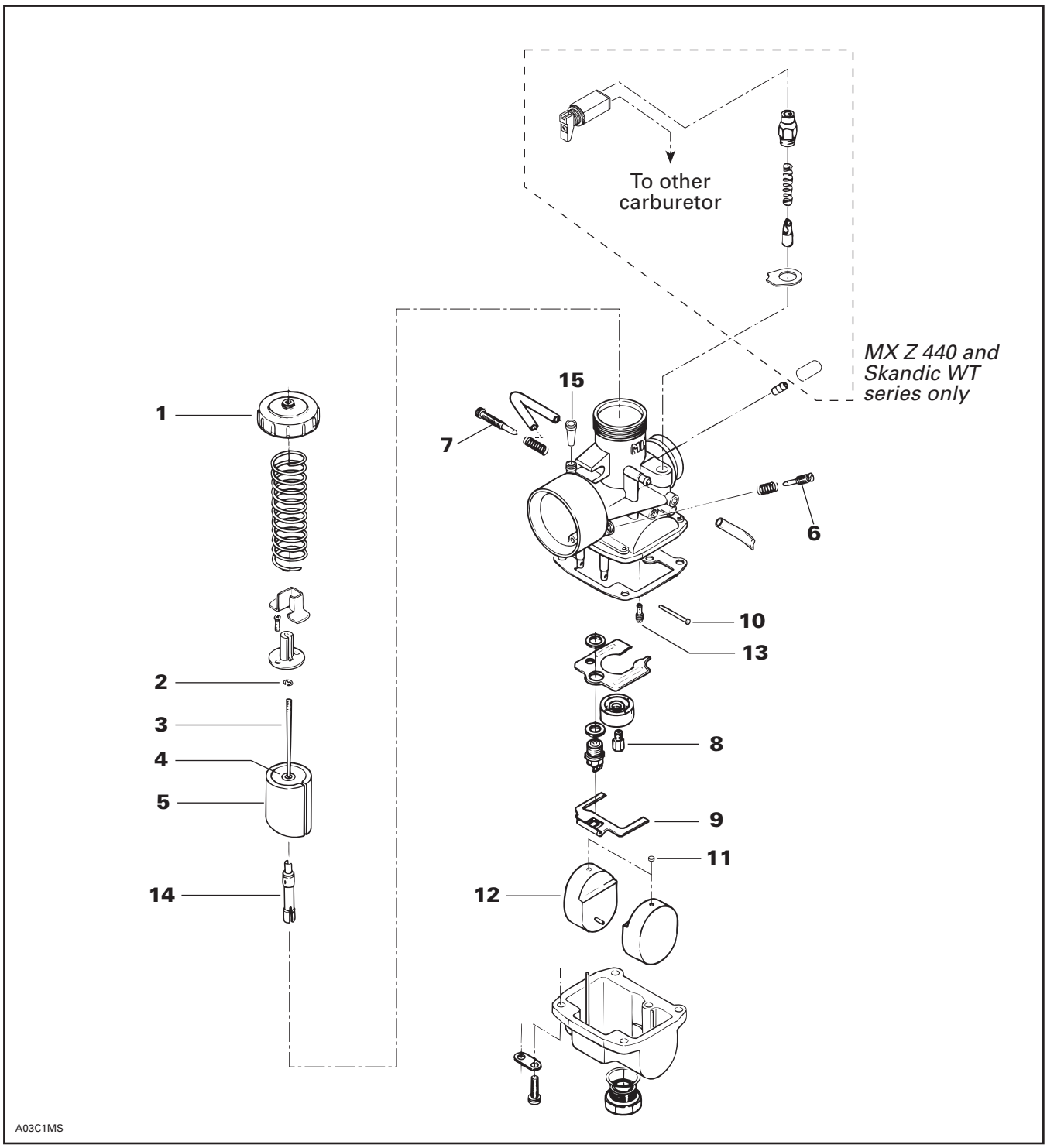


TYPICAL

CARBURETOR AND FUEL PUMP

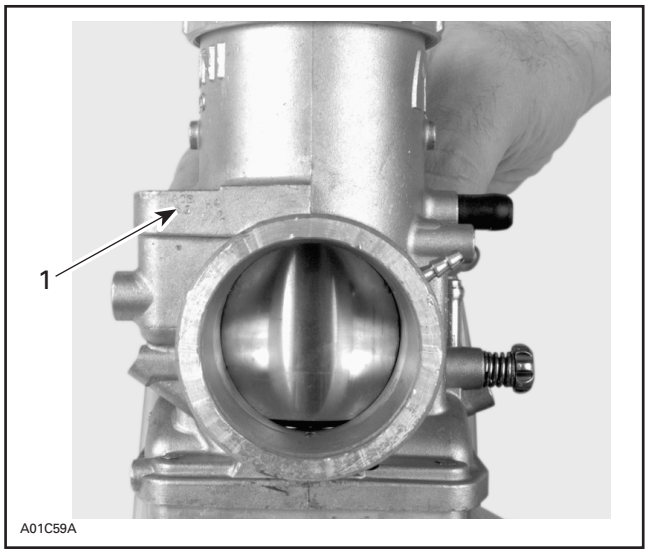
CARBURETOR

All Models



IDENTIFICATION

All carburetors are identified on their body.

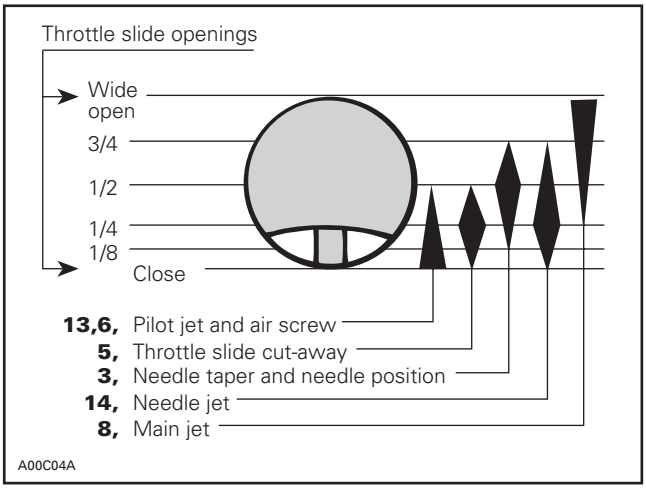


1. Identification: 34-482

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 484 300 003 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.

15, Filter

Check for clogged filter. 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 for wear. Replace as necessary.

Check that idle speed screw is straight. Replace as necessary.

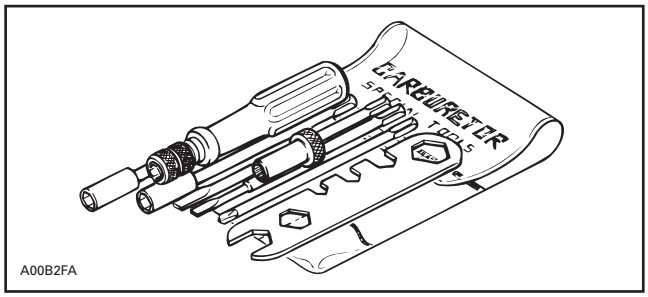
Check for fuel soaked into float **no. 12**; replace as necessary.

Check float 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

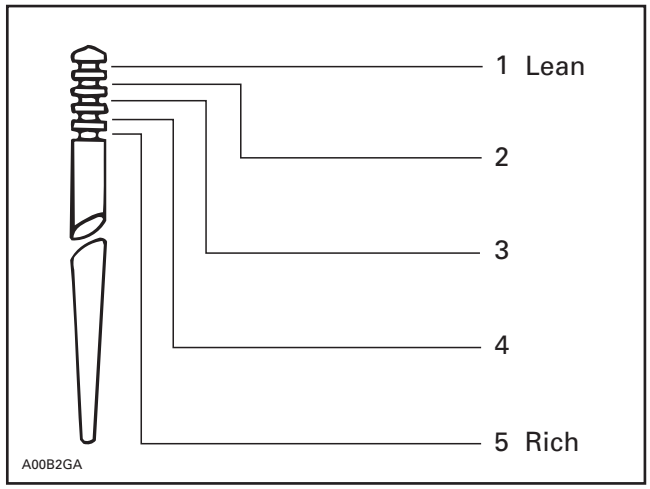
Remove screws from needle retaining plate to withdraw the needle.

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.

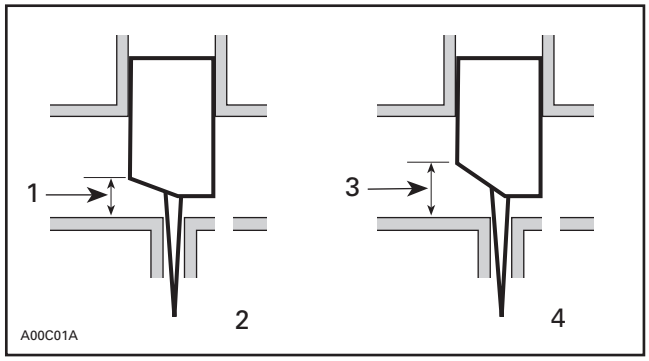
Example: 6DH4-3

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

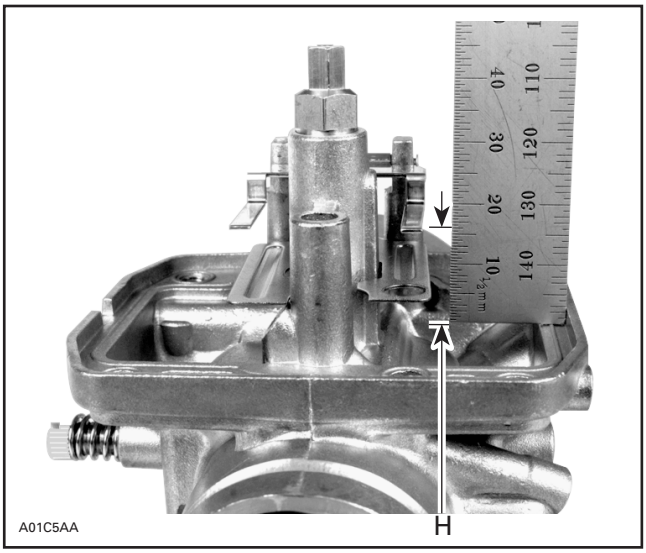
The main jet installed in the carburetor has been selected for a temperature of - 20°C (0°F) at sea level. Different jetting can be installed to suit temperature and/or altitude changes. Always check spark plug tip and/or piston dome color to find out correct jetting.

CARBURETOR FLOAT LEVEL ADJUSTMENT

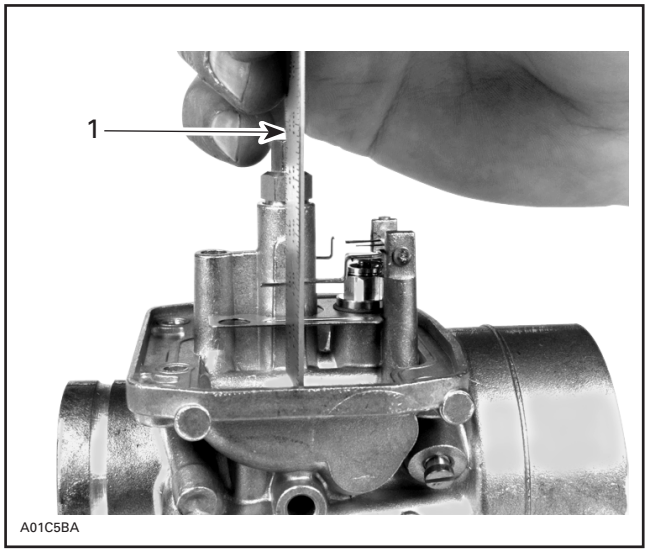
9,10, Float Arm and Float Arm Pin

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.
– 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

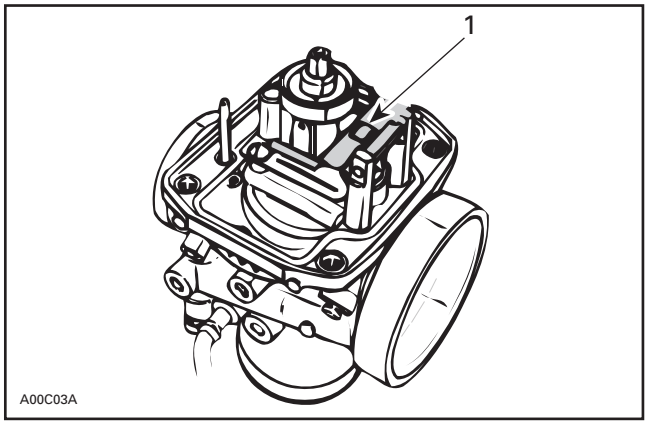


1. Ruler vertical and in line with main jet

CARBURETOR MODEL	FLOAT HEIGHT H	
	± 1 mm	(± .040 in)
MX Z 440	23.9	(.941)
MX Z 494	18.1	(.713)
MX Z 670 HO	22.9	(.902)
Formula Z 500/ DLX 500 LC	18.1	(.713)
Formula Z 583/ DLX 583	18.1	(.713)
Formula Z 670 DLX 670	18.1	(.713)
Summit 500	18.1	(.713)
Summit X 670	22.9	(.902)
Grand Touring 500	18.1	(.713)
Grand Touring 583	18.1	(.713)
Skandic WT	36.5	(1.437)
Skandic SWT	23.9	(.941)
Skandic WT LC	36.5	(1.437)

To Adjust Height H

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

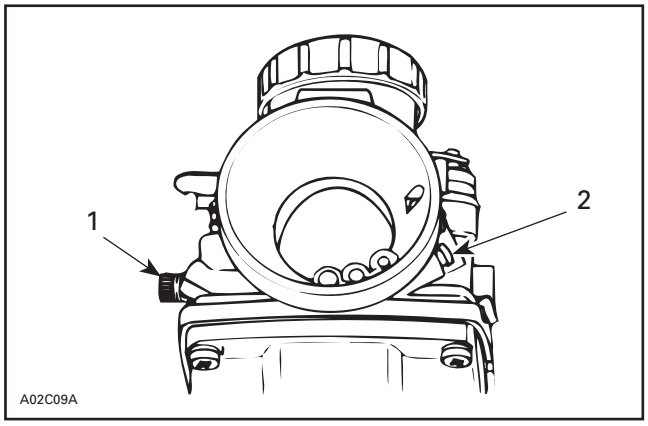


1. Contact tab

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 enrichners mixture and conversely, turning it out counterclockwise leans mixture.

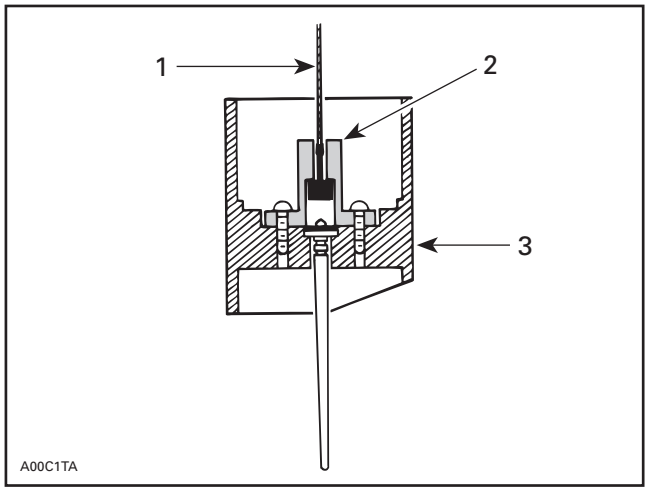
Refer to TECHNICAL DATA 10 for the specifications.

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.



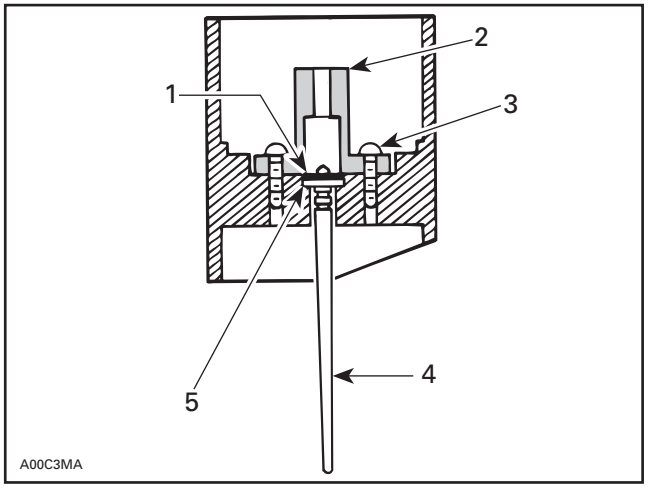
CENTER POST TYPE

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

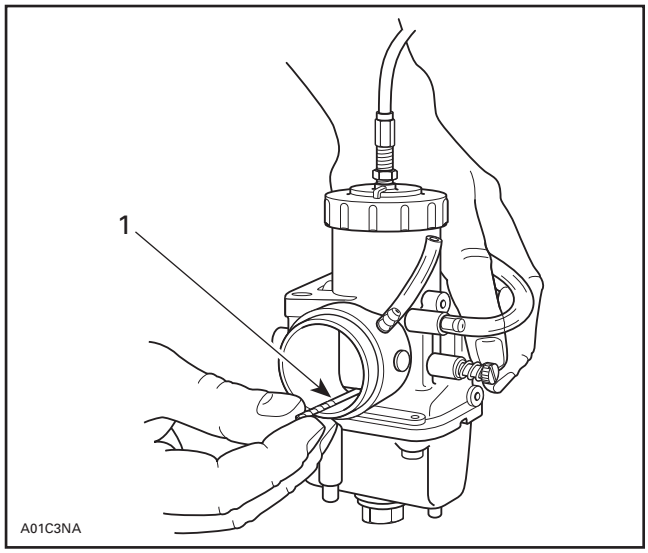
1. E-clip
2. Needle retaining plate
3. Screw
4. Needle
5. Nylon packing

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)
MX Z 440	1.5 (.059)
MX Z 500	1.8 (.071)
MX Z 670 HO	1.9 (.075)
Formula Z 500/DLX 500	1.8 (.071)
Formula Z 583/DLX 583	2.0 (.078)
Formula Z 670/DLX 670	2.1 (.083)
Summit 500	2.2 (.087)
Summit X 670	2.4 (.094)
Grand Touring 500	1.8 (.071)
Grand Touring 583	2.0 (.078)
Skandic WT	1.5 (.059)
Skandic SWT	1.3 (.051)
Skandic WT LC	1.5 (.059)



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

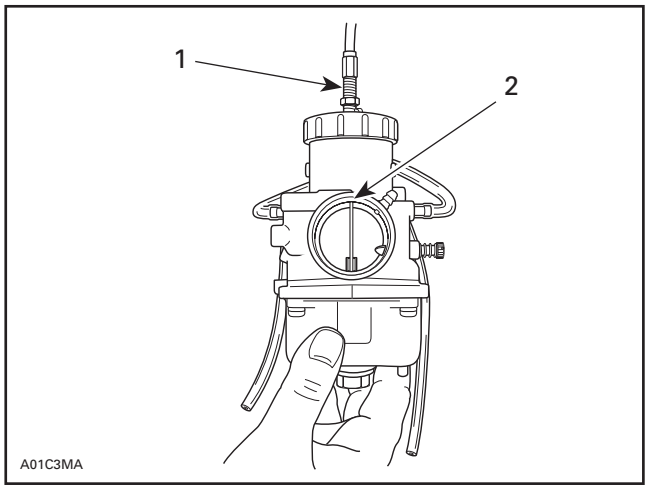
◆ WARNING

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).

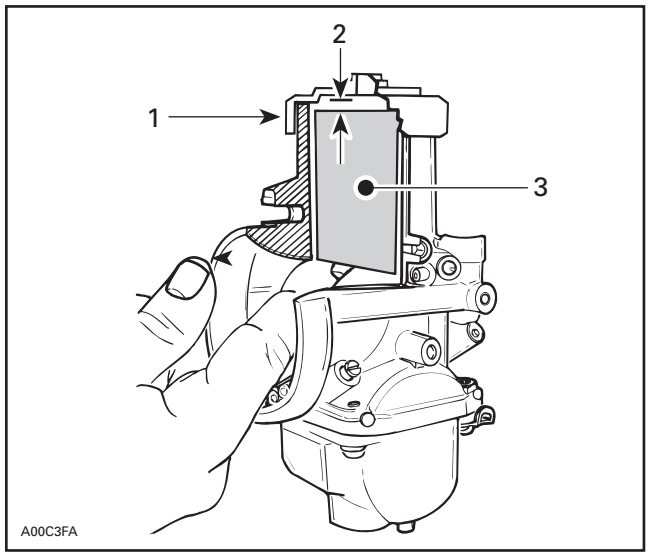
First loosen adjuster nut then turn throttle cable adjuster accordingly.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)

1. *Throttle cable adjuster*
2. *Throttle slide flush or 1.0 mm (.040 in) lower than carburetor oulet 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.

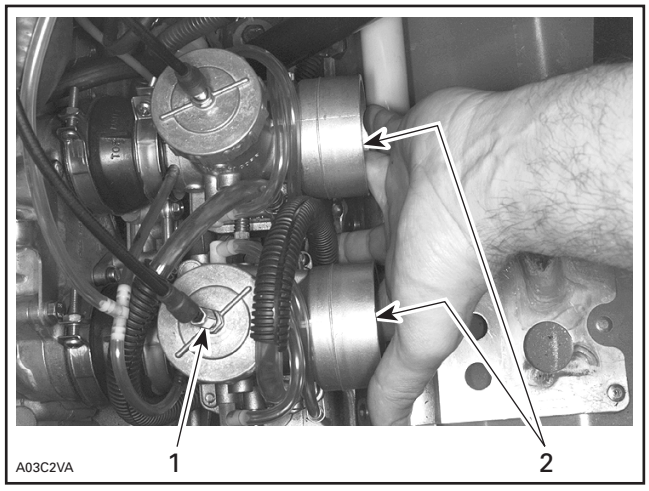
Carburetor Synchronization

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 04-06.

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 04-06.

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.

CHOKE

S-Series

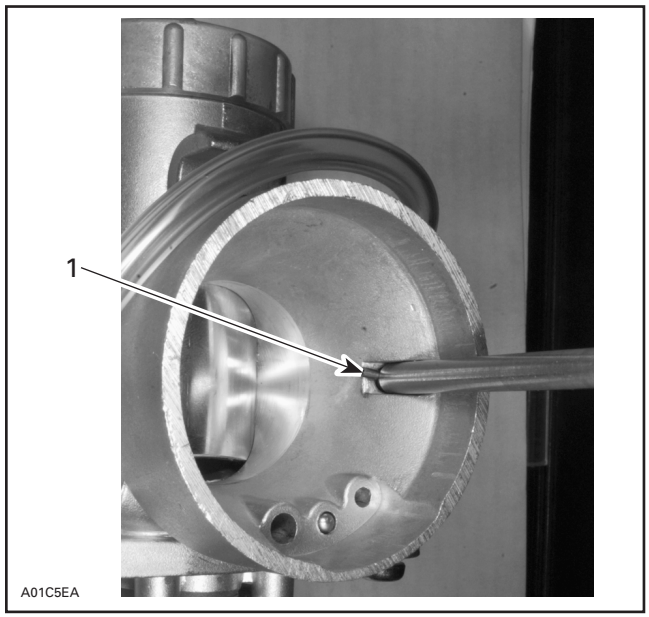
Choke Plunger Adjustment

Set choke lever to fully open position.

CHOKE LEVER — FULLY OPEN POSITION

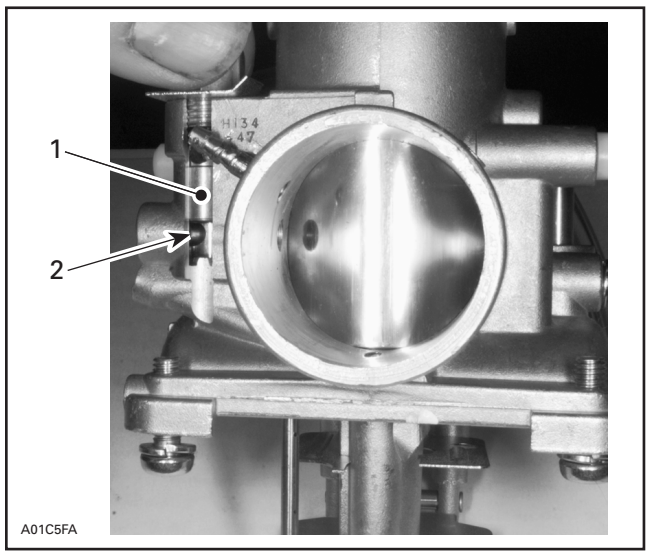
Use small diameter of tool for VM 34 carburetors.

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*



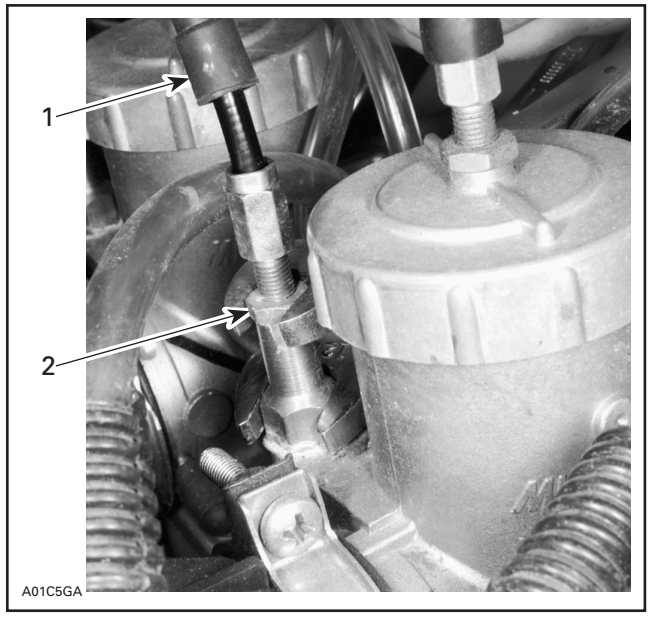
CUT-AWAY (ENGINE SIDE SHOWN)

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.

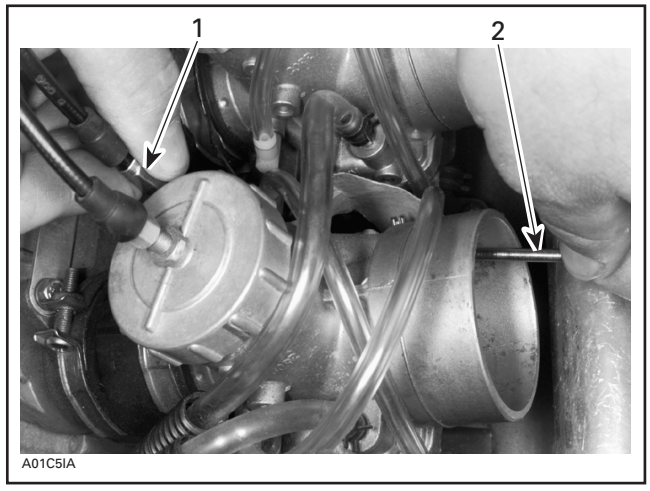
Lift up protector cap and loosen choke cable lock nut, as shown in the next photo.



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*

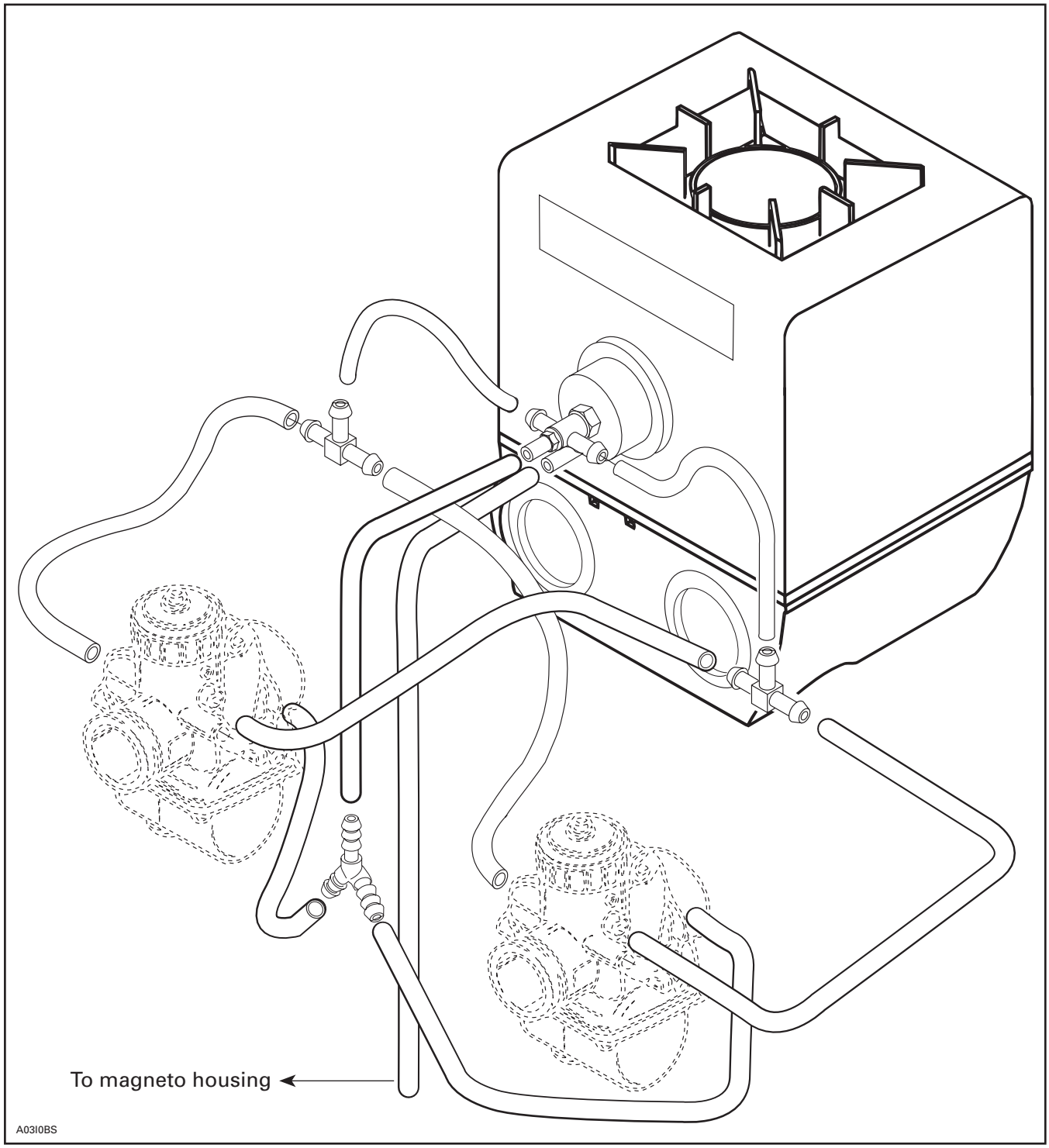
Tighten choke cable lock nut and reinstall protector cap.

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

H.A.C. SYSTEM



H.A.C. SYSTEM

Summit 500 Only

H.A.C. (High Altitude Compensator) is a maintenance free device.

No adjustment and verification can be done to H.A.C.

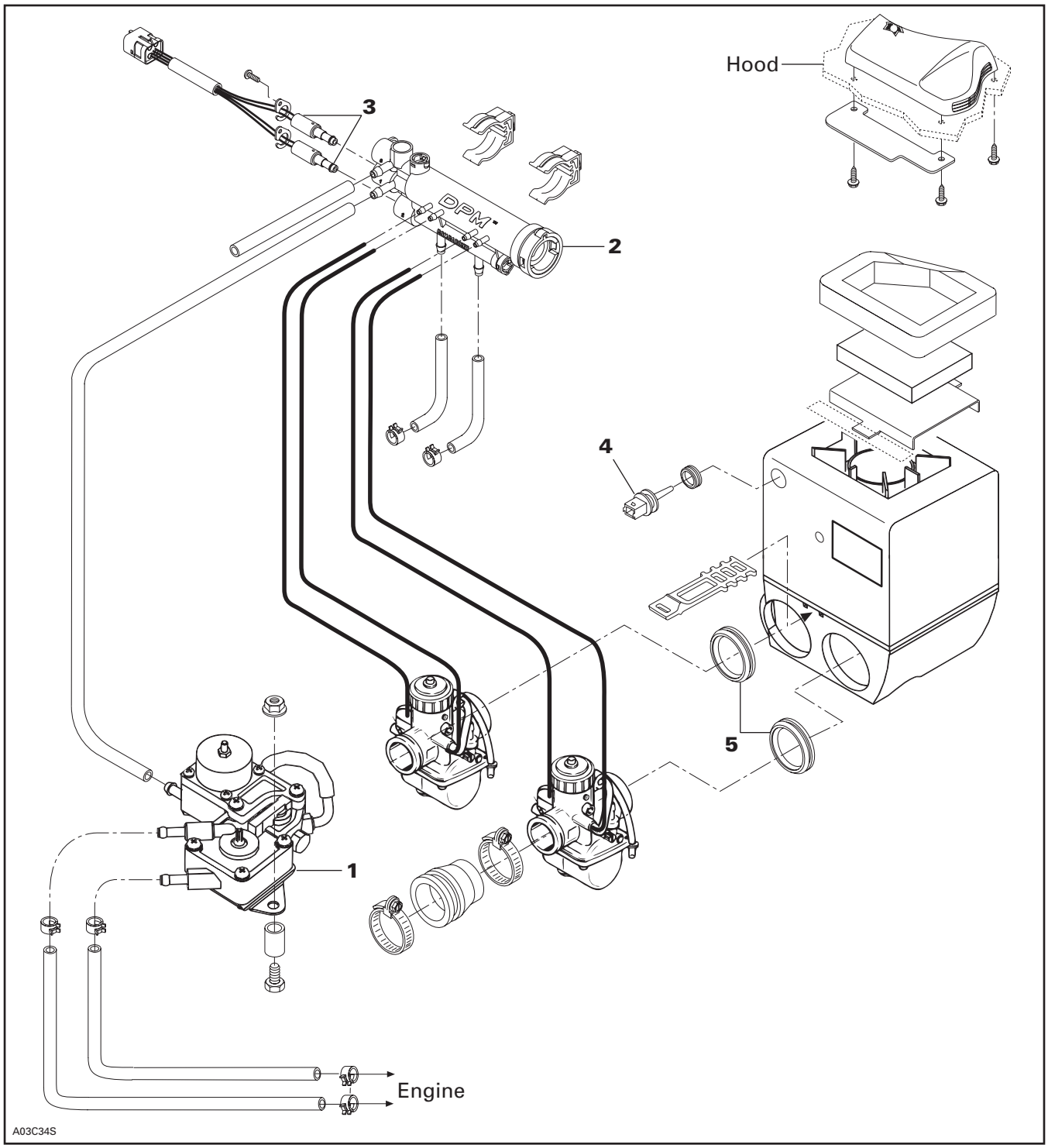
If H.A.C. is suspected to be faulty, replace it and check for improvement.

Hoses connected to H.A.C. must not be altered in length or size. Check for kinked or loose hoses. Tighten or replace as necessary. See below illustration for routing.

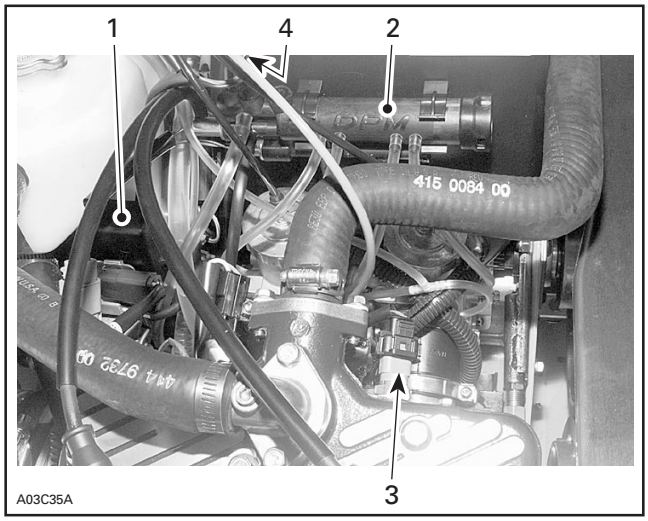
Nut holding T-fitting must be torqued to 6 N•m (53 lbf•**in**).

DIGITAL PERFORMANCE MANAGEMENT (DPM) SYSTEM

Summit X 670 and MX Z 670 HO



COMPONENT LOCATION



1. MPEM
2. Manifold
3. Engine coolant temperature DPM sensor
4. Air temperature DPM sensor

PURPOSE

Calibrate the air/fuel mixture in order to optimize the engine output while reducing fuel consumption.

METHOD

The system makes the pressure vary within the carburetor bowl.

OVERALL SYSTEM OPERATION

Introduction

The Digital Performance Management (DPM) system increases pressure within all 2 carburetor bowls thus the air/fuel mixture is enriched. This is what we call the enrichment mode.

As soon as the spark plug gives off its first spark, the DPM system calculates the enrichment time and rate based on the engine coolant temperature.

Once enrichment mode is completed carburetor bowls return to atmospheric pressure (DPM in standby mode), and the air/fuel mixture is identical to that of carburetors without the DPM system.

Over 3000 RPM, compensation mode is activated but will compensate only if the air temperature exceeds - 20°C (- 4°F) and the air pressure is lower than 1000 mbar.

Float bowls are now under vacuum (lower than atmospheric pressure) and the air/fuel mixture is leaner.

BLACK and WHITE/GRAY wires (2-05 housing) are used for programming by the manufacturer. Nothing must be plugged to this housing.

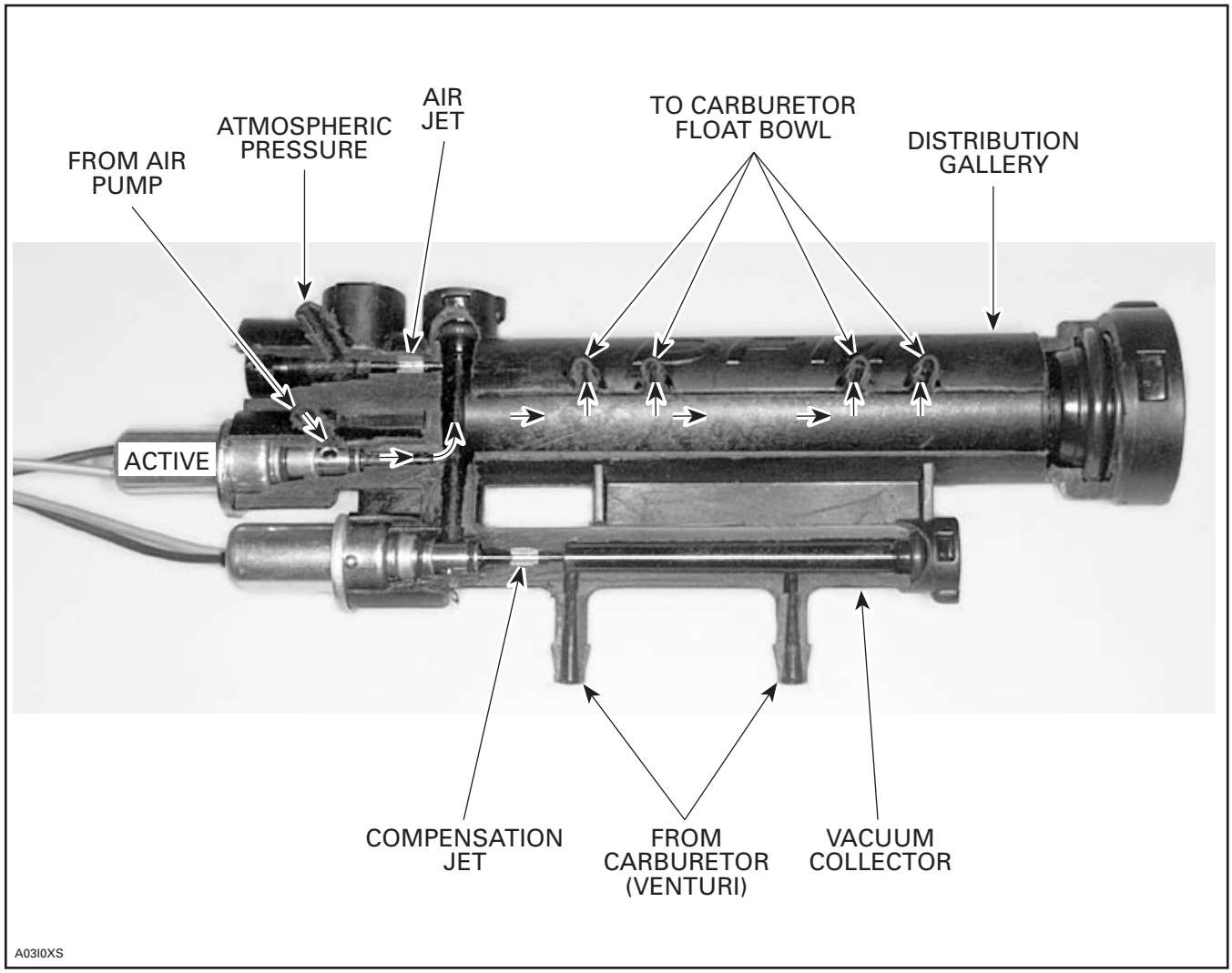
NOTE: During enrichment mode only both modes (enrichment or compensation) **can** operate at the same time.

Enrichment Mode (starting)

Turning the ignition key to the ON position will not energize DPM system. The DPM system is energized only once the engine turns over 250 RPM.

The DPM system then comes on by reading the engine coolant temperature through the sensor located on the cylinder head. The DPM system calculates the enrichment solenoid opening time (duty cycle) and the enrichment rate according to the temperature. The air/fuel mixture is then enriched in order to facilitate starting.

The system pressurizes both carburetor bowls in order to enrich the air/fuel mixture. This is accomplished with the help of an air pump.



ENRICHMENT MODE — DPM MANIFOLD ASSEMBLY

This enrichment mode of the air/fuel mixture takes place at start-up and during engine warm-up, and it depends on engine coolant temperature.

The higher the engine coolant temperature upon start-up, the leaner the mixture.

This enrichment mode progressively decreases (with time) by reducing the solenoid duty cycle. The warmer the engine, the shorter the enrichment mode.

If the throttle opening exceeds one quarter before engine runs, the enrichment mode is interrupted by a switch during the starting process, which allows unflooding the engine.

However, the enrichment mode is restored when releasing the throttle.

Following the enrichment mode, carburetors are operating normally, i.e. without additional pressure within bowls.

NOTE: Calibration is normally the same on engines with a DPM system and those without.

Compensation Mode

Two conditions must be met for the compensation mode to operate:

1. Engine must rev over 3000 RPM.
2. Air temperature must exceed - 20°C (- 4°F) and/or atmospheric pressure must be lower than 1000 mbar.

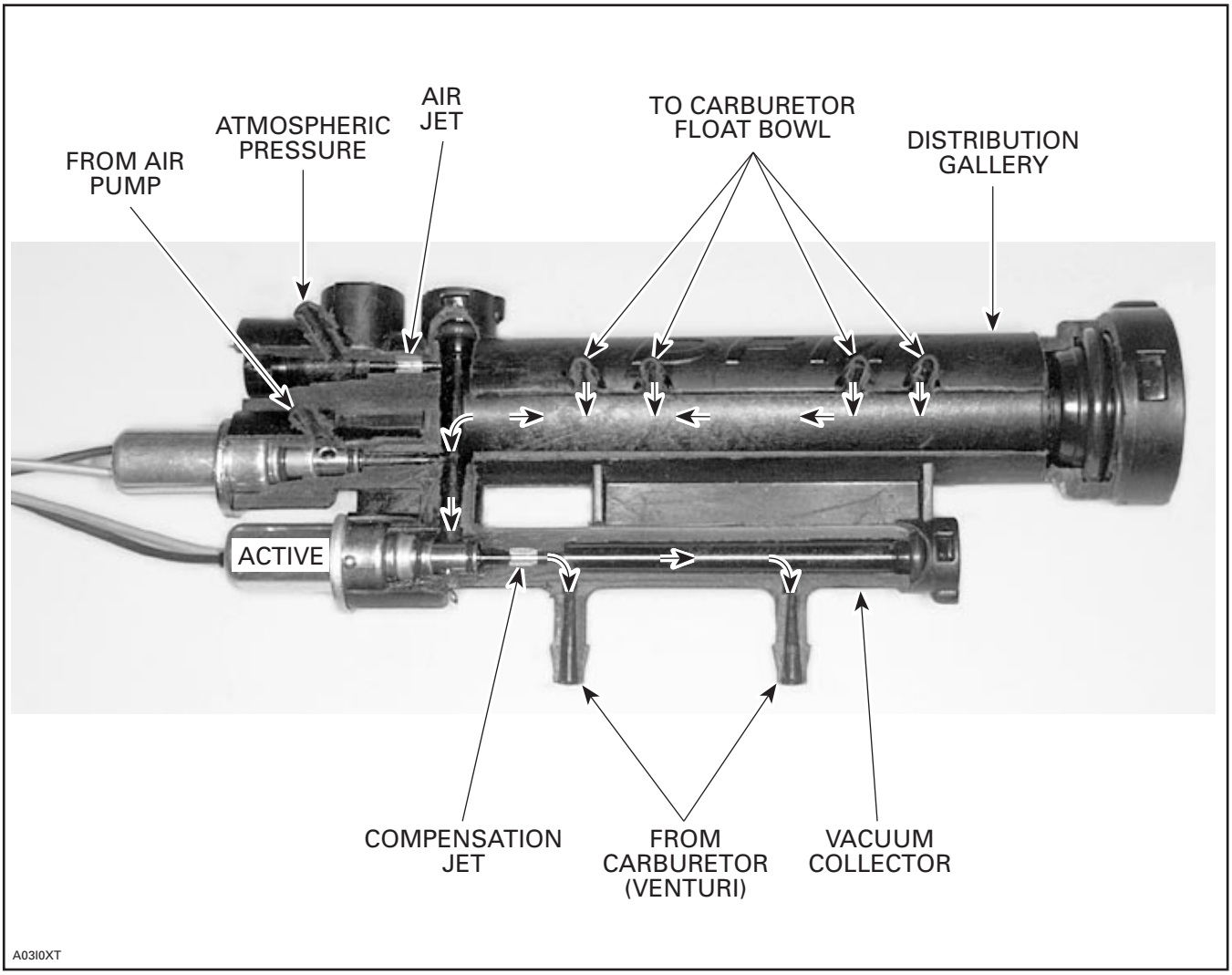
The compensation system brings both carburetor bowls under vacuum (lower than atmospheric pressure) in order to make the air/fuel mixture leaner. The required vacuum is produced within the needle jet air inlet.

The compensation ratio will depend on the air temperature and the atmospheric pressure.

The higher the air temperature, the leaner the air/fuel mixture.

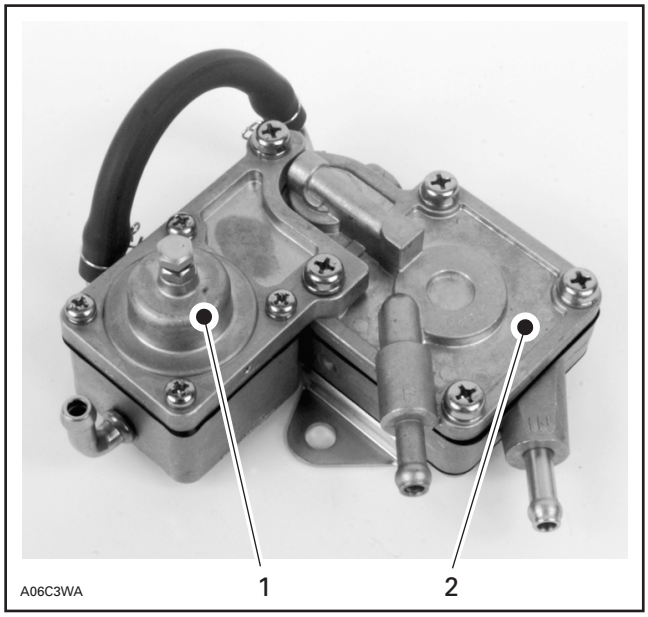
The lower the atmospheric pressure, the leaner the air/fuel mixture.

NOTE: The atmospheric pressure decreases as the altitude increases.



COMENSATION MODE — DPM MANIFOLD ASSEMBLY

AIR PUMP OPERATION



TYPICAL

1. *Regulator*
2. *Pump*

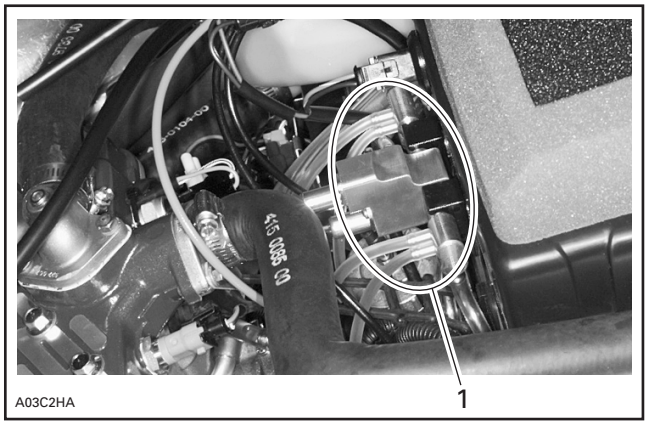
Air pump supplies the distribution gallery through a unique hose.

Pump diaphragm is activated by the alternating pressure/vacuum within the engine crankcase. Two hoses connect the crankcase (cylinders nos. 1 and 2) to the pump.

A regulator within the pump stabilizes the pump pressure.

Since the pump pressure is insufficient upon starting, the regulator is fed directly by the crankcase pressure.

DPM MANIFOLD OPERATION

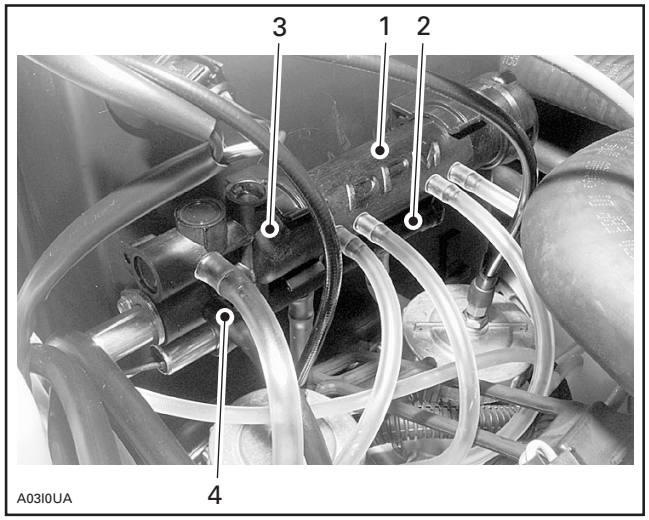


1. *Manifold*

The DPM manifold consists of 2 tubes. Depending on the mode, the upper tube (distribution gallery) distributes pump pressure or vacuum to each bowl through 2 hoses. The passage is then opened by the enrichment or the compensation solenoid, depending on the mode.

The lower tube (vacuum collector) receives the vacuum created by each carburetor within the needle jet air inlet.

An air jet (manifold air jet) also allows the atmospheric pressure to enter.



MANIFOLD ASS'Y

1. *Upper tube: distribution gallery*
2. *Lower tube: vacuum collector*
3. *Manifold air jet — atmospheric pressure*
4. *From air pump*

Enrichment Solenoid

Solenoid Operating Principle

A solenoid is a winding coiled in order to produce a magnetic field. A metal rod crosses the coil and cuts the magnetic field. Each time the coil is activated, the magnetic field attracts the rod. If the supply current is interrupted, a spring pushes the rod.

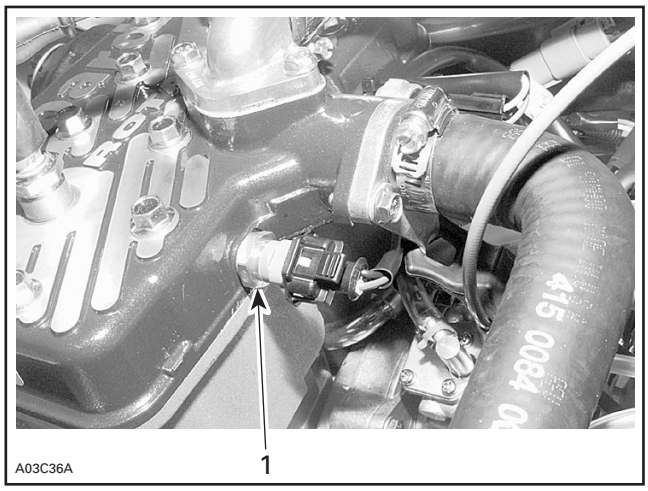
Solenoid Function within the DPM System

The DPM system turns the solenoid **no. 3** ON and OFF 10 times per second, which means that it operates at 10 cycles/second or 10 Hertz (Hz). The solenoid therefore opens and closes 10 times per second, thus allowing the pump pressure to reach the distribution gallery (upper tube).

For the pressure to vary within the bowls, the solenoid is activated in part by the DPM during each cycle. This is what is called the duty cycle. In other words, the solenoid will not open throughout the whole cycle. The duty cycle depends on the engine coolant temperature.

The colder the engine, the longer the duty cycle. Therefore, the solenoid will stay open longer, thus giving way to pressure.

MPEM reads engine temperature at once (when starting) through a sensor.



1. Engine temperature DPM sensor

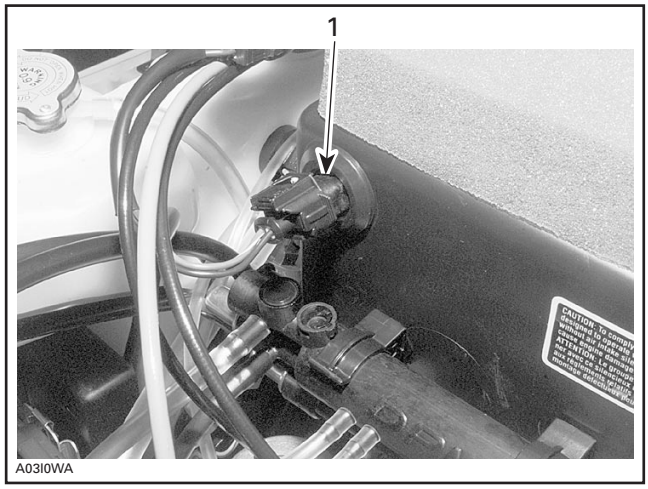
Compensation Solenoid

NOTE: Same principle as enrichment solenoid. Read **Solenoid Operating Principle** at the beginning of the chapter.

The duty cycle of the compension solenoid depends on the air temperature and the atmospheric pressure.

The warmer the air, the longer the duty cycle. Therefore, the solenoid will stay open longer, thus giving way to vacuum. The same applies when the altitude increases.

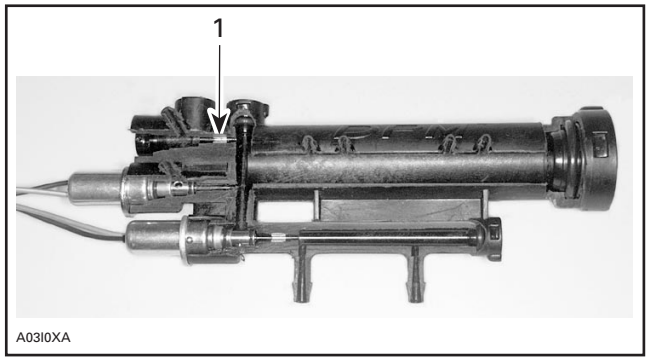
MPEM reads air temperature through a sensor.



1. Air temperature sensor

Manifold Air Jet

This jet allows the atmospheric pressure to reach carburetor bowls when the DPM SYSTEM is on standby (returned to atmospheric pressure).



1. Atmospheric pressure air jet

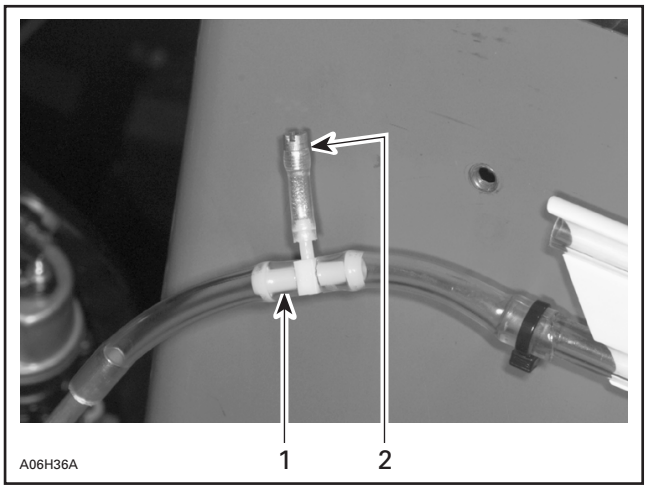
TESTING PROCEDURE

Pump

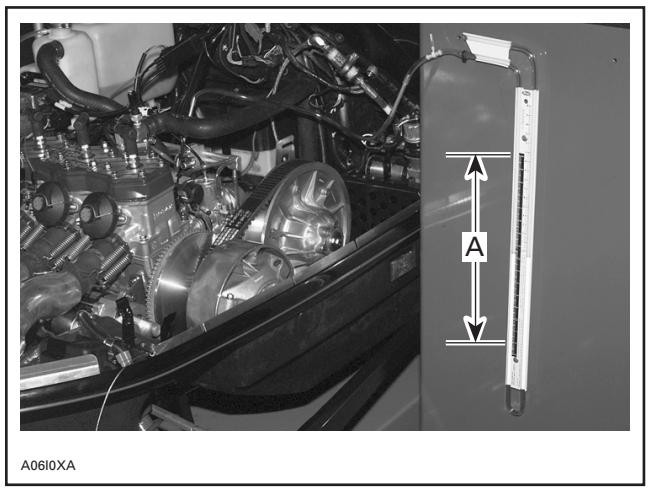
Pressure Test

The pump must create a minimum pressure of 400 ± 50 mm of water.

Connect a jet (P/N 270 500 157) to a hose then connect that little tube to the small nipple of a T-fitting (P/N 414 222 500). Install that T-fitting between a U-tube and air pump outlet.



1. T-fitting (P/N 414 222 500)
2. Jet (P/N 270 500 157)



TYPICAL
A. 400 ± 50 mm of water

Start engine and note water height.

DPM System

Solenoids are supplied by the MPEM. If MPEM does not work, there will be no current on compensation solenoid RD/BL and BK connectors; and on enrichment solenoid RD/GR and BK connectors.

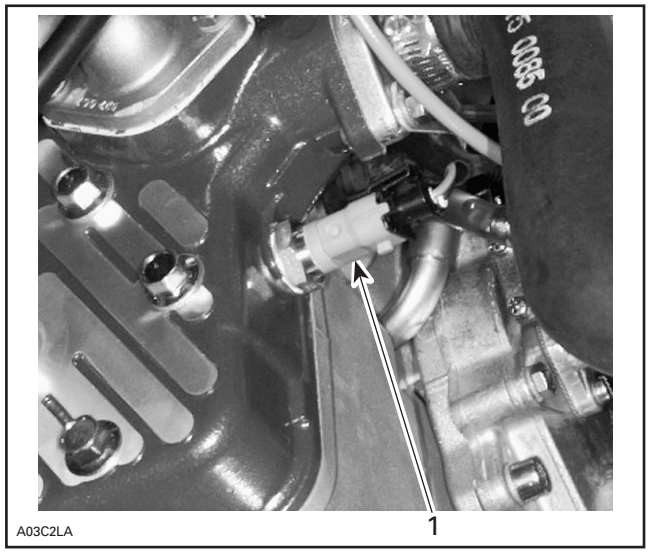
Unplug upper solenoid wire (enrichment). Connect a good solenoid to MPEM output connector.

▼ CAUTION

Do not disconnect both DPM connectors. The compensation solenoid must remain plugged.

Disconnect engine temperature sensor connector. The DPM system now operates as though the engine temperature was - 20°C (- 4°F) to allow maximum mixture enrichment.

For the compensation solenoid, the air temperature sensor **no. 4** must be at room temperature. Operate the engine at 3500 RPM. The solenoid must vibrate.



1. Engine temperature sensor

Start the engine and observe the solenoid. A vibrating solenoid indicates that the MPEM is in good working order. If not, replace the MPEM and repeat test.

Solenoid

Static Test

Unplug electrical connector of the solenoid and connect it to a 12 V battery. The solenoid must sound when it opens. Repeat test several times.

Dynamic Test

When checking the enrichment solenoid, disconnect engine temperature sensor connector. The DPM system now operates as though the engine temperature was - 20°C (- 4°F) to allow maximum mixture enrichment.

Remove the solenoid, hold it in hand and start the engine.

For the enrichment solenoid, check if it vibrates as soon as the engine is started.

For the compensation solenoid, the air temperature sensor **no. 4** must be at room temperature. Operate the engine at 3500 RPM. The solenoid must vibrate.

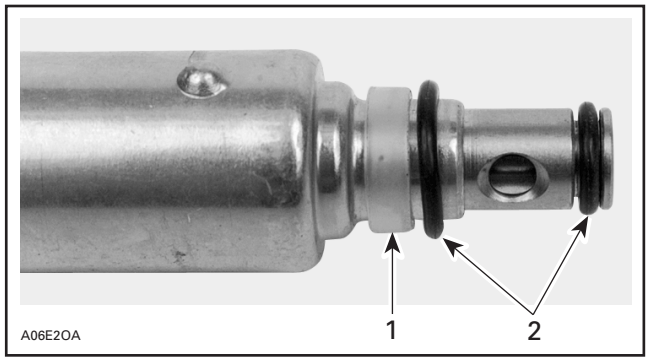
Temperature Sensor (air and engine)

At room temperature 20°C (68°F), the sensor resistance must be 2500 Ω ± 300.

PARTS REMOVAL AND INSTALLATION

Solenoid

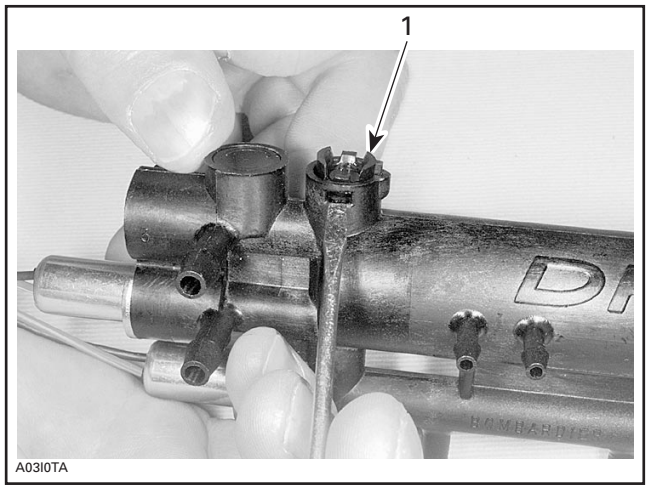
At reassembly, ensure that solenoid seals are in place.



1. Plastic seal
2. O-rings

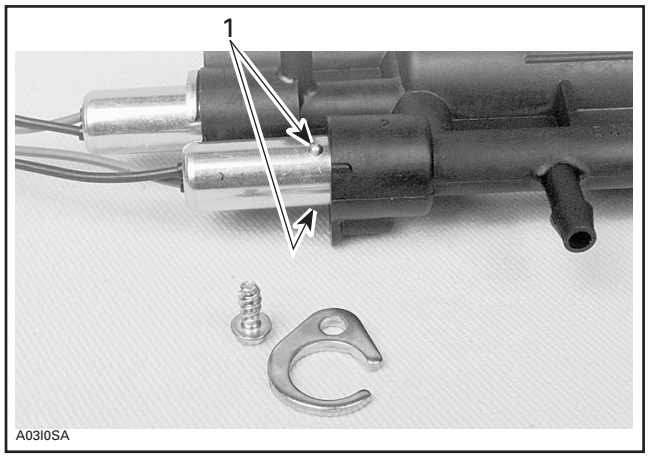
Installation of compensation solenoid must be done as follows:

Remove transfer gallery plug by pushing 2 tabs.



1. Transfer gallery plug

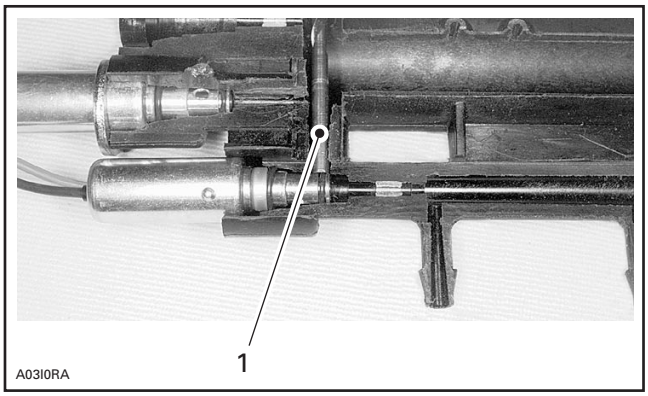
Partially insert compensation solenoid into DPM manifold.



1. Embosses not engaged

Insert a 5/32 in drill bit with its round end first into the transfer gallery.

Fully push solenoid into DPM manifold while maintaning a pressure on drill bit. This will guide the solenoid O-ring.

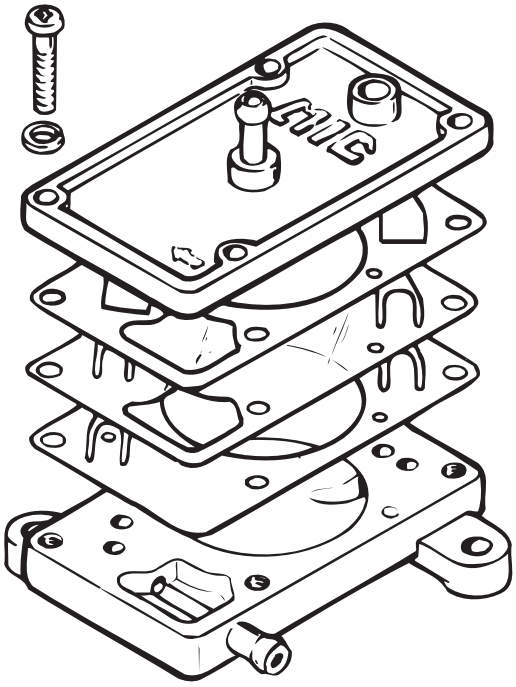


TYPICAL — CUT-AWAY

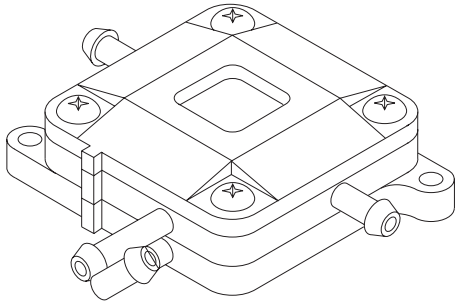
1. Drill bit round end guiding solenoid O-ring

FUEL PUMP

443 and 503 engines



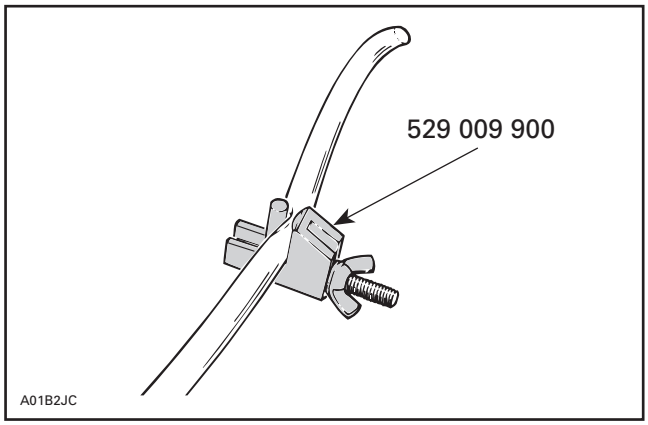
494, 583 and 670 engines



A06C45S

REMOVAL

Install a hose pincer (P/N 529 009 900) 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

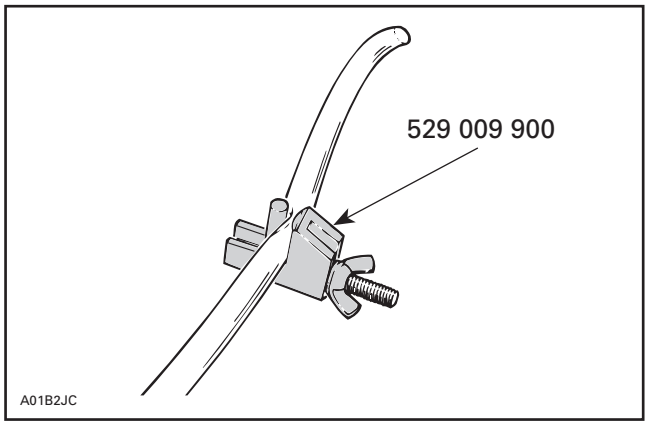
Pressure test to ensure there is no leak in fuel system.

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 529 009 900) 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

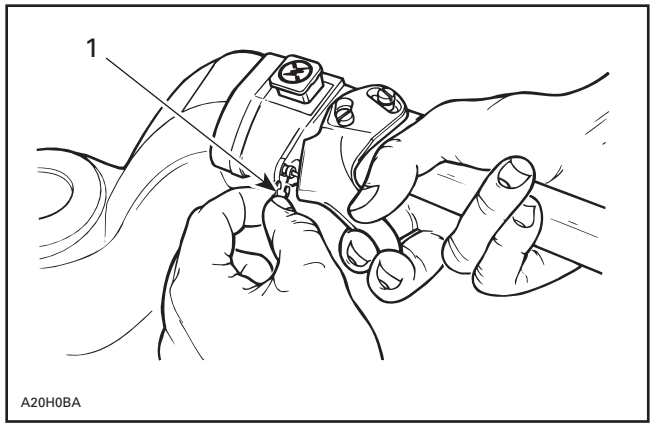
All Models

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.

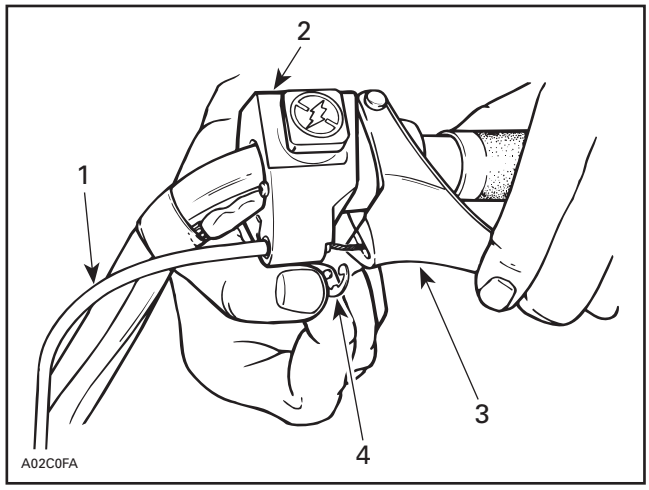
Models with Easy Action Throttle Lever



TYPICAL

1. *Circlip*

Other Models



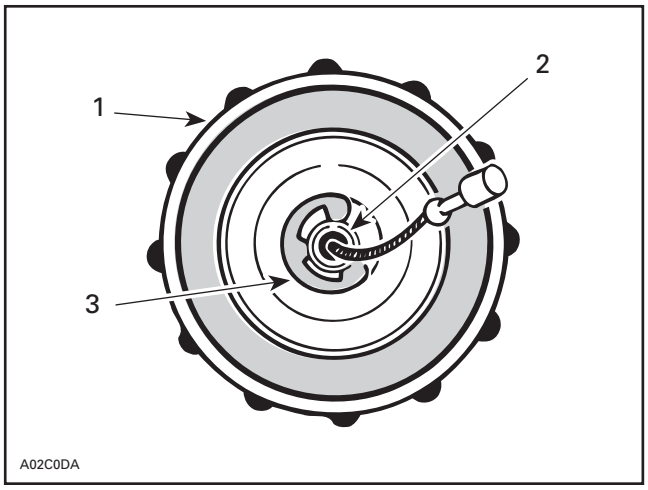
TYPICAL

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

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 04-11.

Throttle Cable Routing

▼ CAUTION

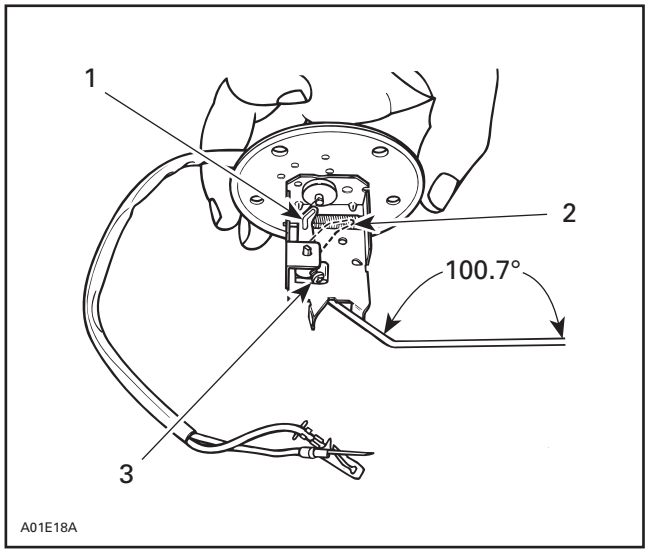
Check that throttle cable is routed away from sharp edges, hot or vibrating parts. When turning steering while engine is running, idle speed must not vary.

Fuel Level Sensor

Grand Touring 500/583 and Formula Z 583/ DLX 583/Z 670/DLX 670

INSPECTION

Visually inspect the condition of connectors and wiring throughout the circuit. Connections must be clean and tight, and wiring free of damage. Repair as necessary. Use silicone dielectric grease to prevent corrosion at the connectors. Operate the engine to see if the problem has been corrected. If not, remove fuel level sensor from fuel tank and check rod angle (100.7°), resistance at full position (3 ± 2 Ω) and resistance at empty position (110 ± 7 Ω).



1. *Full position (3 ± 2 Ω)*
2. *Empty position (110 ± 7 Ω)*
3. *Loosen to adjust*

FUSE REPLACEMENT

A 0.25 ampere fuse protects fuel level sensor circuitry. Remove seat to gain access.

Fuel Level Sensor Screws

Grand Touring 500/583 and Formula Z 583/ DLX 583/Z 670/DLX 670

Torque fuel level sensor retaining screws to 1 N•m (8 lbf•**in**) in the sequence shown and then to 2.5 N•m (22 lbf•**in**), using the same sequence.