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Section 04 ENGINE

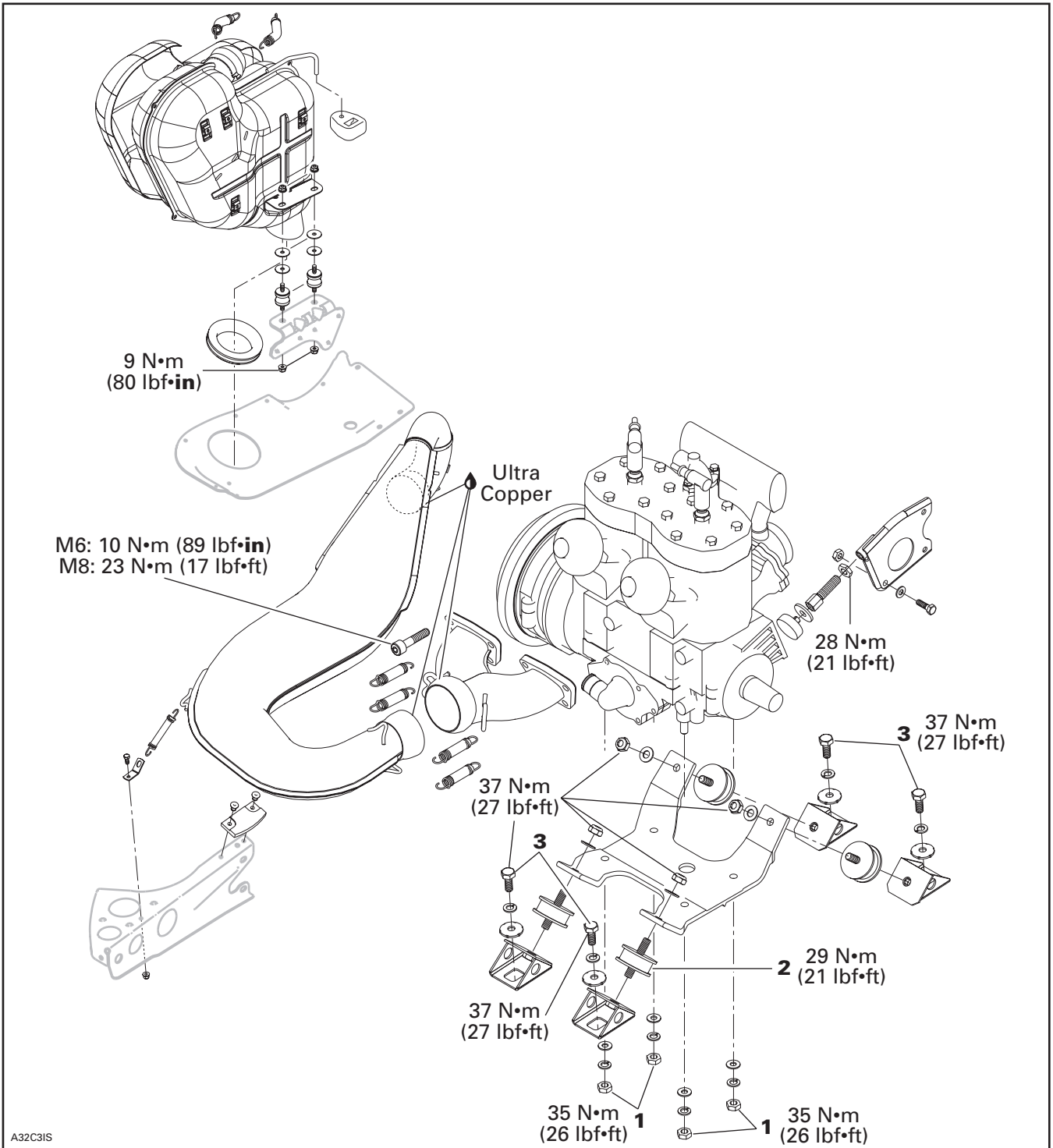
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493, 593, 693 AND 793 ENGINE TYPES

ZX Series



TYPICAL

Section 04 ENGINE

Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

MAINTENANCE

Tuned pipe gear clamps must be retightened to 3.5 N•m (31 lbf•in) after the first 10 hours of use, then every 3200 km (2000 mi).

CAUTION: Do not over tighten.

NOTE: Replace with new ones any damaged gear clamps. Refer to appropriate *Parts Catalogs* to order new gear clamps.

REMOVAL FROM VEHICLE

Open hood.

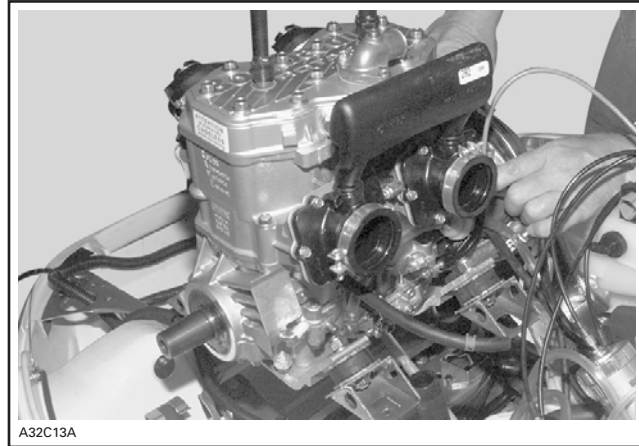
Remove tuned pipe and muffler.

Drain engine coolant.

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

NOTE: Use of a hoist is recommended.

- guard
- air silencer
- drive belt
- rewind starter handle
- drive pulley (not necessary if engine has not to be disassemble)
- hood, refer to BODY
- carburetors
- impulse hose and electrical connectors
- oil injection inlet line at oil injection pump, install hose pincher
- oil pump cable
- coolant hoses between cylinder head and radiator
- coolant by-pass hose
- coolant hose at front of coolant reservoir
- engine support screws
- engine stopper (left rear of engine).



TYPICAL — ENGINE REMOVAL

1,2,3,4, Engine Support Nut and Manifold Screw

Torque the engine/support nuts **no. 1** to 35 N•m (26 lbf•ft).

Torque rubber mounts **no. 2** to support bracket to 29 N•m (21 lbf•ft).

Torque rubber mount/support nuts to 37 N•m (27 lbf•ft).

Torque support brackets/chassis screws **no. 3** to 37 N•m (27 lbf•ft).

Torque manifold screws **no. 4** to:

M6 = 10 N•m (89 lbf•in)

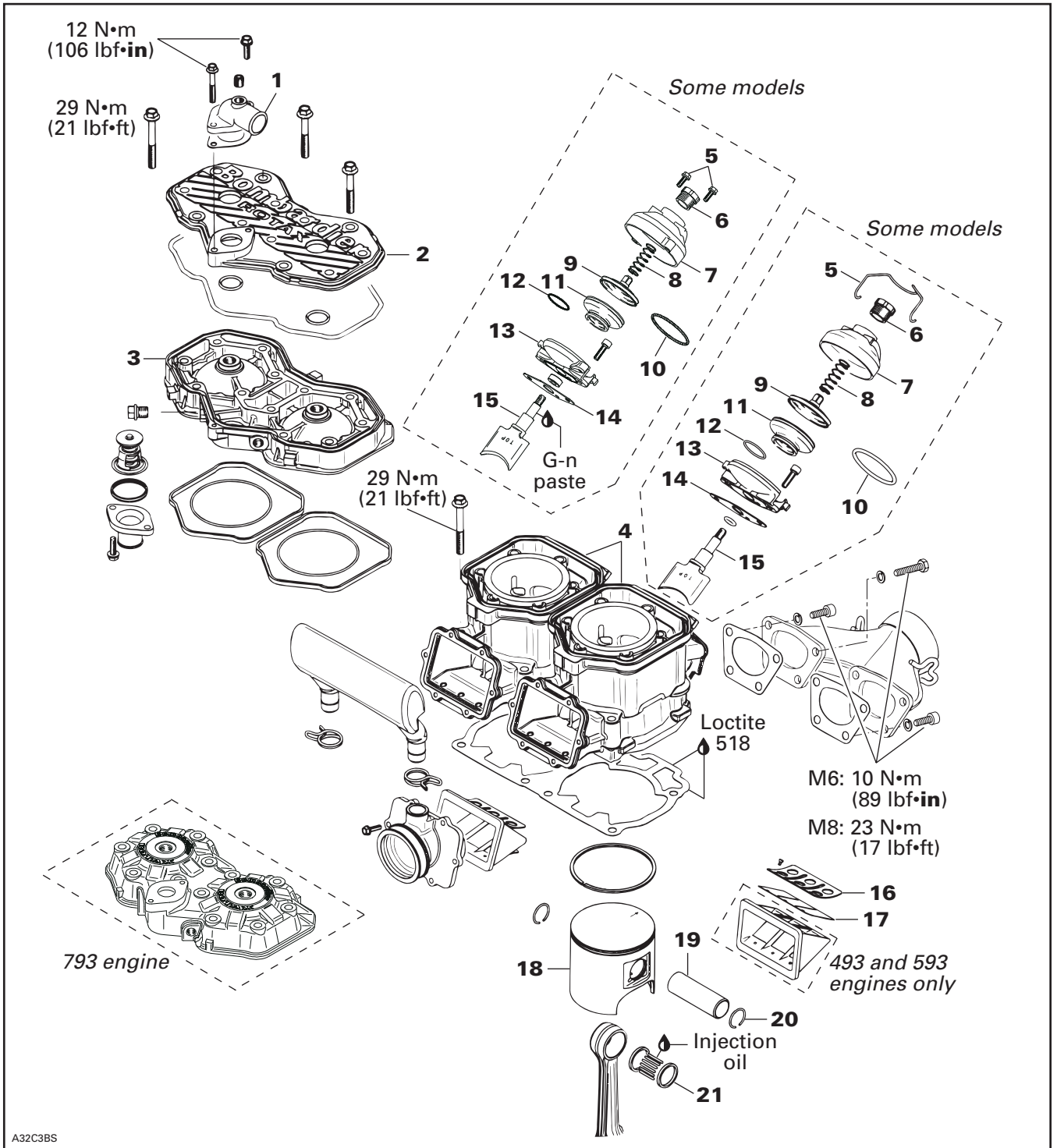
M8 = 23 N•m (17 lbf•ft)

INSTALLATION ON VEHICLE

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

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

TOP END



A32C3BS

Section 04 ENGINE

Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

COMPONENT REMOVAL

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

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

CLEANING

Discard all gaskets and O-rings.

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

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

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

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

DISASSEMBLY

RAVE System

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

Remove spring clip or screws **no. 5**, cover **no. 7** and spring **no. 8**.

Remove spring **no. 10**.

Unscrew valve piston **no. 9**.

Remove bellows **no. 11** and spring **no. 12**.

Remove cylindrical screws. Remove valve housing **no. 13**.

Pull out exhaust valve **no. 15**.



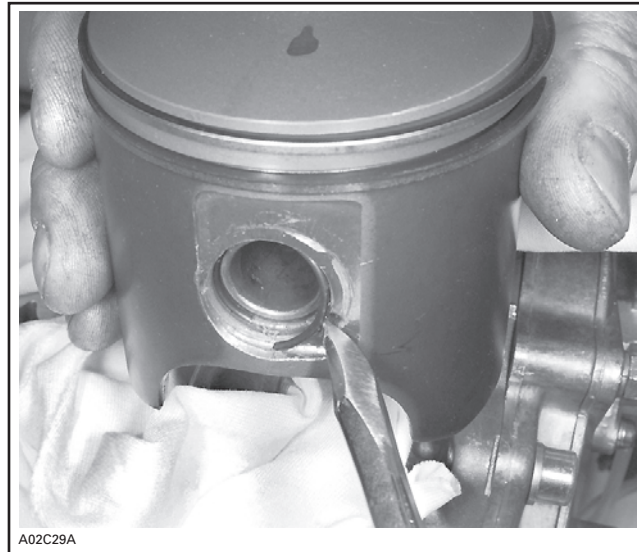
RAVE VALVE PARTIALLY REMOVED

2, Cylinder

Remove spark plugs, coolant outlet **no. 30**. Unscrew cylinder head cover **no. 2** then cylinder head **no. 3**.

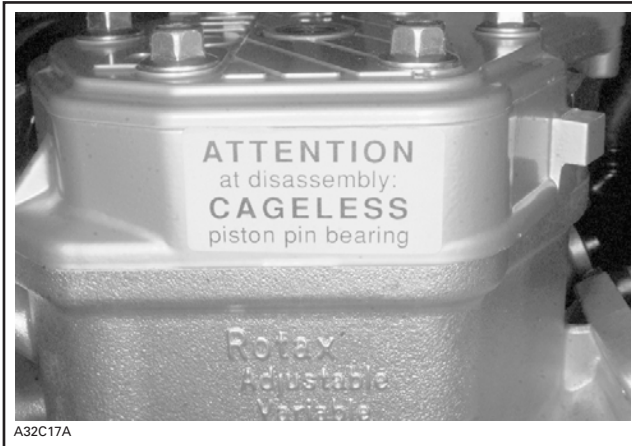
18, Piston

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



TYPICAL

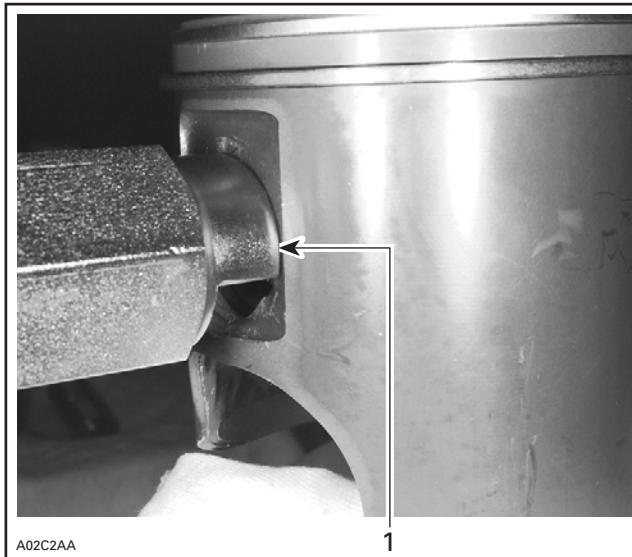
All engines are equipped with cageless piston pin bearings.



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

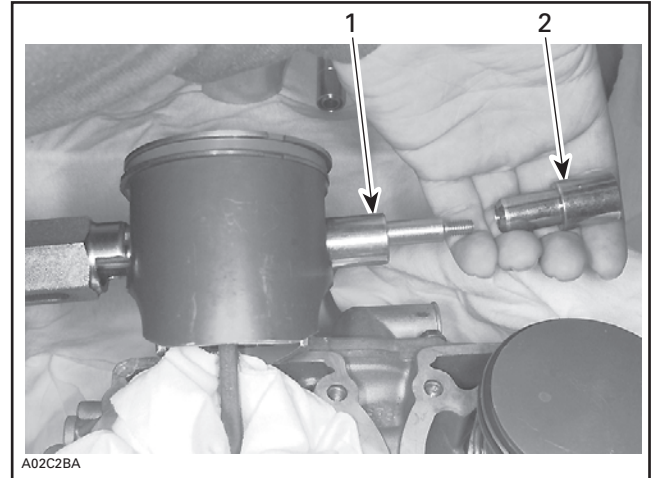
NOTE: The locating sleeve is the same that contains new cageless bearing.

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

Screw (LH threads) extracting nut.

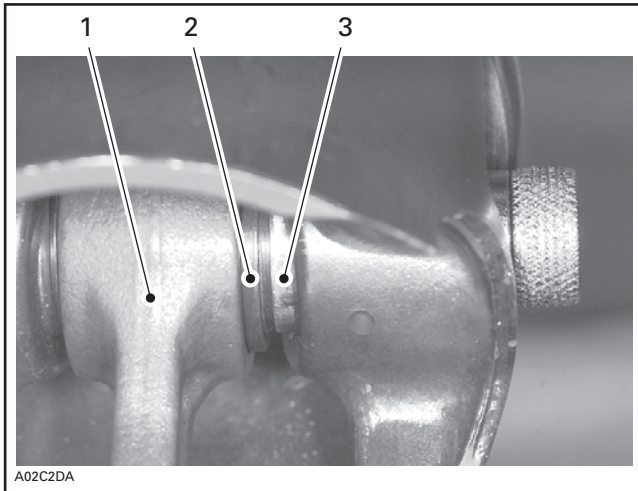
Pull out piston pin **no. 19** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.



TYPICAL — PISTON PIN EXTRACTION

Section 04 ENGINE

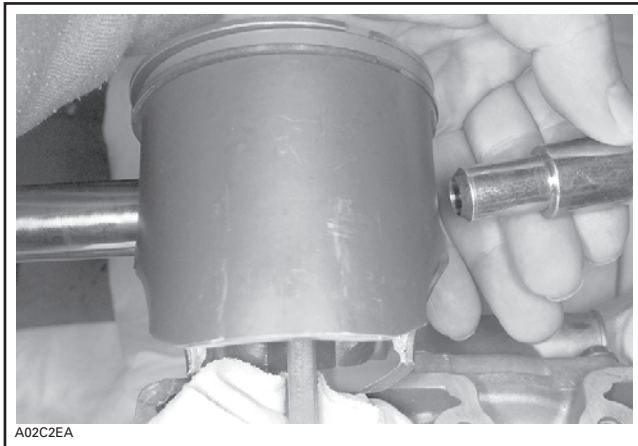
Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)



TYPICAL

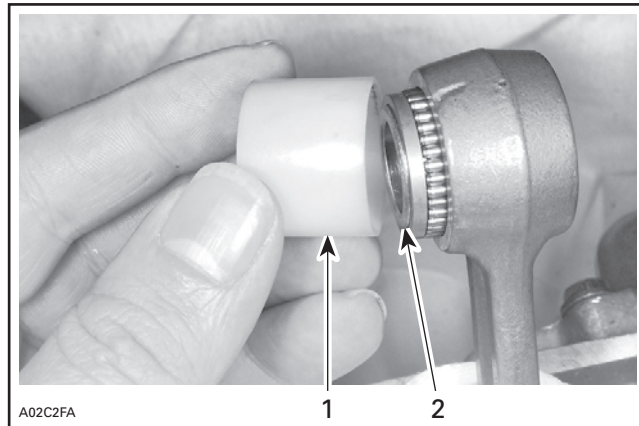
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

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

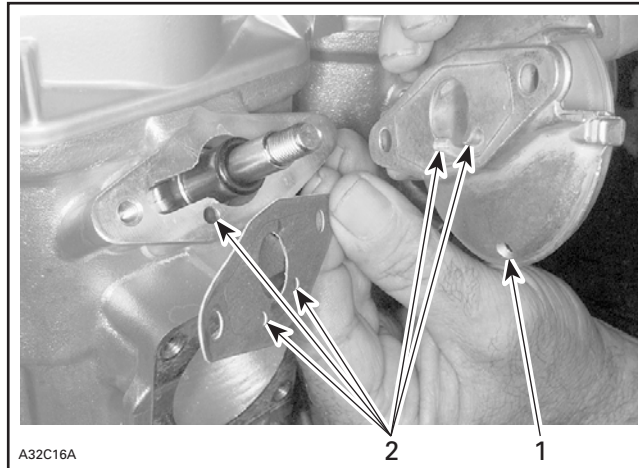
1. Locating sleeve
2. Sleeve

INSPECTION

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

RAVE System

Check valve rod housing and cylinder for clogged passages.



1. Draining hole
2. Passages

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

11, Bellows

Check for cracked, dried or perforated bellows.

8, Spring

ENGINE TYPE	SPRING P/N	WIRE DIA. mm (in)	FREE LENGTH mm (in)	PRELOAD IN N (LBF) AT COMPRESSED LENGTH OF 14 mm (.551 in)
493	420 239 948	1.0 (.039)	38.0 (1.50)	19.5 (4.37)
593 and 693	420 239 944	0.9 (.035)	48.5 (1.91)	15.9 (3.56)
793 on all Summit	420 239 942	0.8 (.031)	42.5 (1.67)	7.3 (1.64)
793 on all MX Z	420 239 941	0.8 (.031)	52.5 (2.07)	10.5 (2.36)

ASSEMBLY

RAVE System

Install RAVE valve with its mention top as illustrated in the removal photo. Tighten red cap **no. 6** screw to bottom.

4,18, Cylinder and Piston

493 and 593 Engines Only

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

All Engines

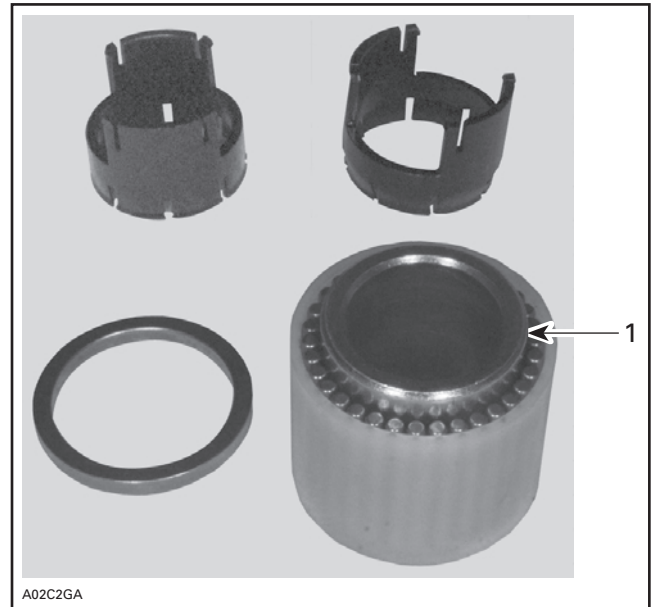
Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

2,3,4, Cylinder Head Cover, Cylinder Head and Cylinder

Check flatness of part sealing surfaces. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT and look for **Checking Surface Flatness**.

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

NOTE: 493 engine cageless bearings have 31 needles. 593, 693 and 793 engine cageless bearings have 28 needles.



TYPICAL

1. Sleeve

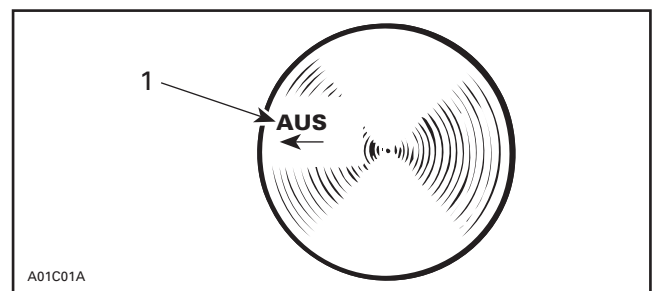
Grease thrust washers and install them on each end of needles.

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

Section 04 ENGINE

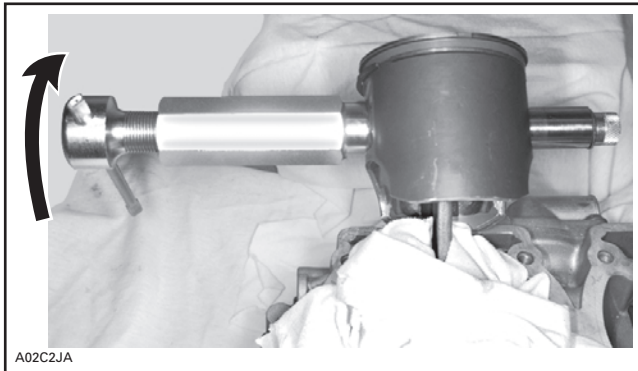
Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

Install shouldered sleeve.



TYPICAL — SHOULDERED SLEEVE INSTALLATION

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



TYPICAL

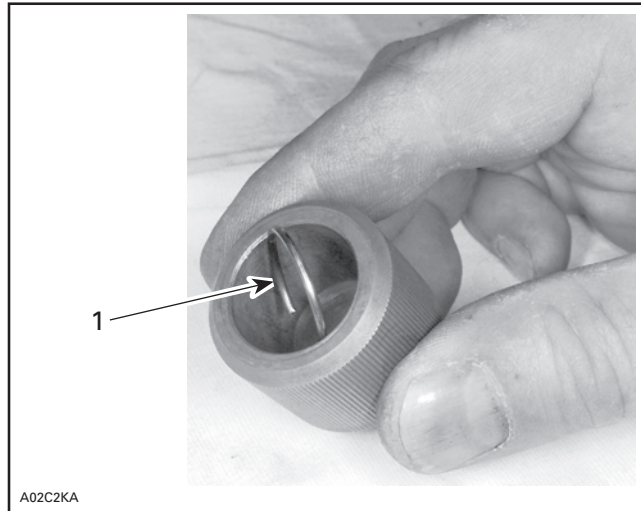
All Models

CAUTION: Always install new circlips.

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

ENGINE TYPE	PISTON CIRCLIP INSTALLER (P/N)
493	529 035 561
593 and 693	529 035 562
793	529 035 563

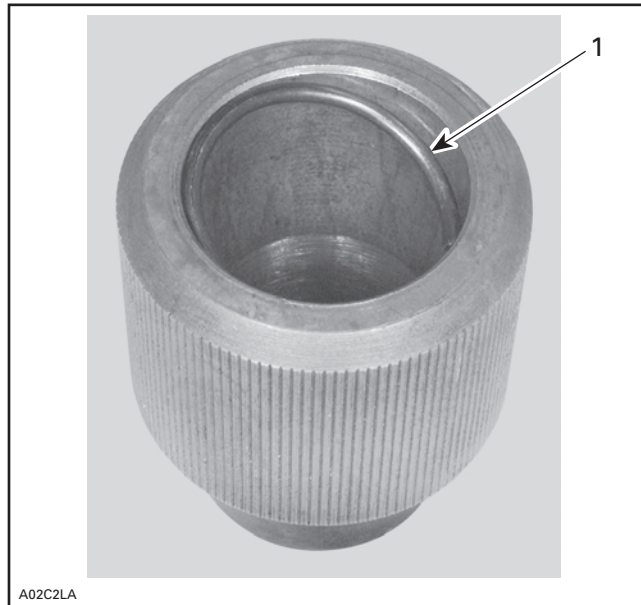
Insert circlip in tool at an angle.



TYPICAL

1. Circlip

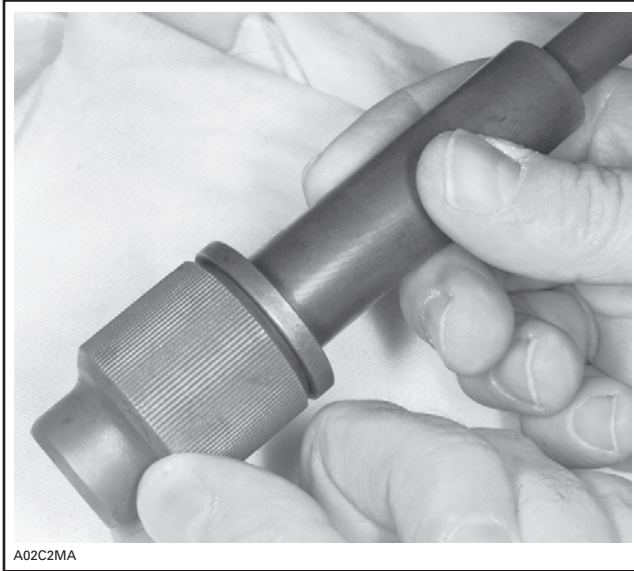
Square it up using a finger.



TYPICAL

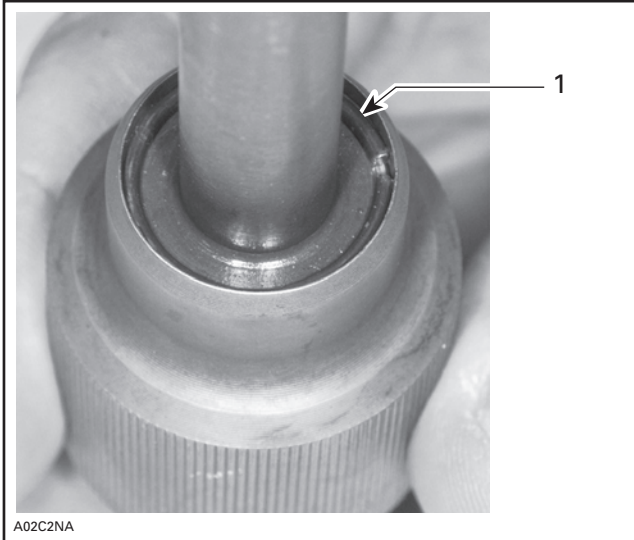
1. Circlip

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



TYPICAL

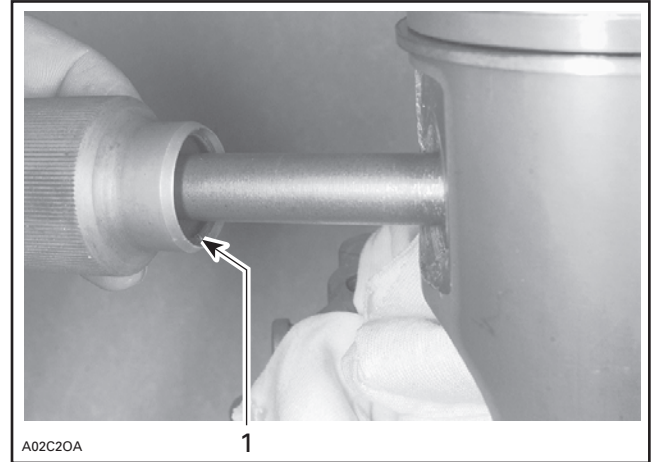
Using square end of tool, push circlip in until it rests in groove.



TYPICAL

1. Circlip in groove

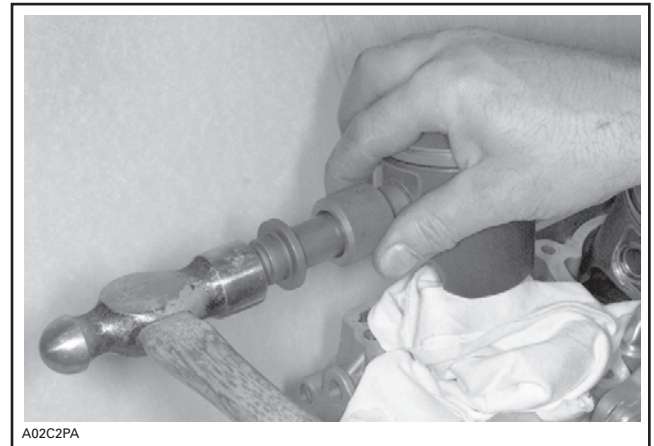
Mount tool in piston making sure that circlip break is facing down.



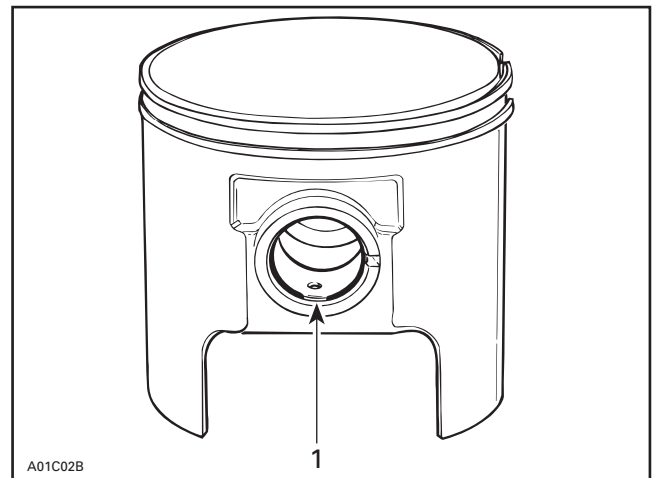
TYPICAL

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

Section 04 ENGINE

Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

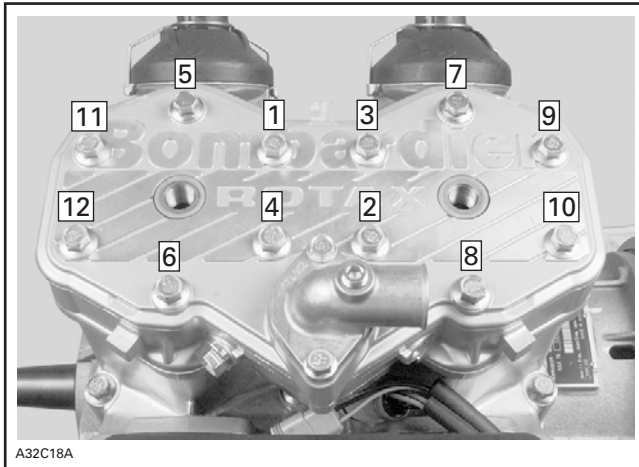
CAUTION: Circlips must not move freely after installation; if so, replace them.

Coat both sides of a new cylinder gasket with Loctite 518 then, install it on crankcase.

Loosely install cylinders.

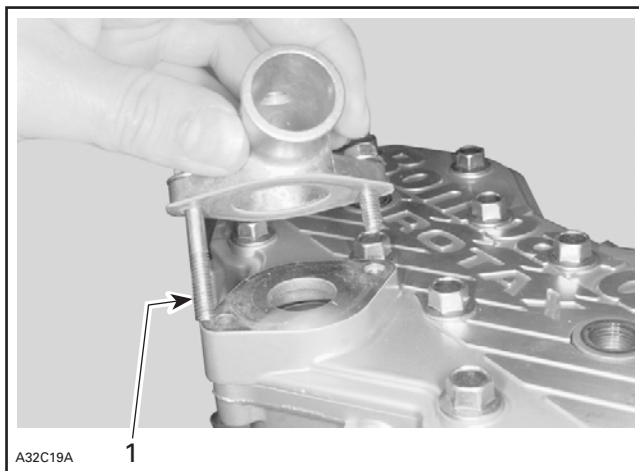
Install exhaust manifold then, tighten cylinder retaining screws to 29 N•m (21 lbf•ft) in a criss-cross sequence.

At assembly, torque cylinder head screws to 29 N•m (21 lbf•ft) in the following illustrated sequence.



TYPICAL

Install outlet socket and tighten screws to 12 N•m (106 lbf•in). Note position of longer screw.



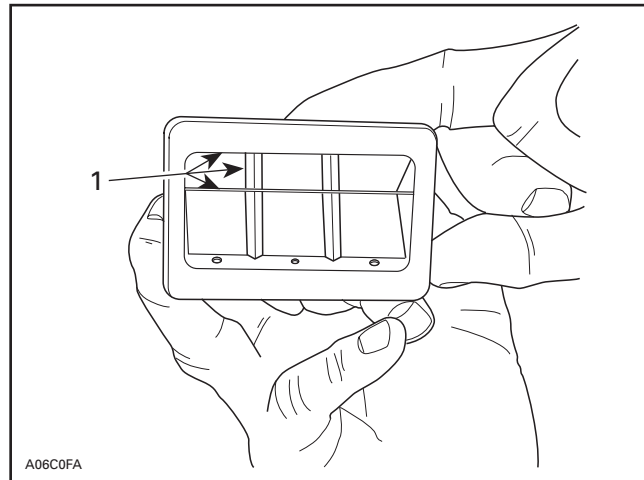
1. Longer screw

17, Reed Valve

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

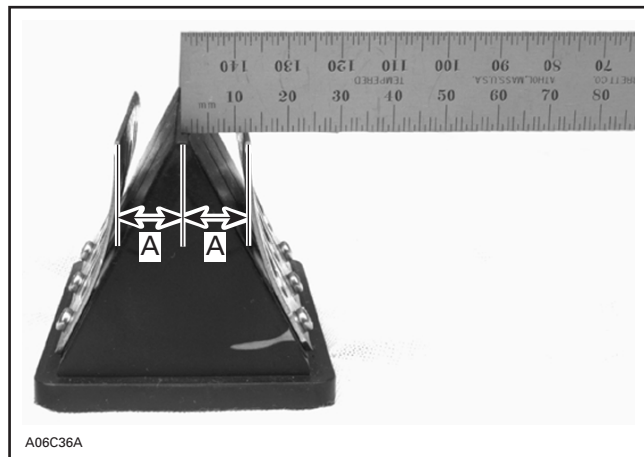
With blade stopper no. 16 removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

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



1. No play

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



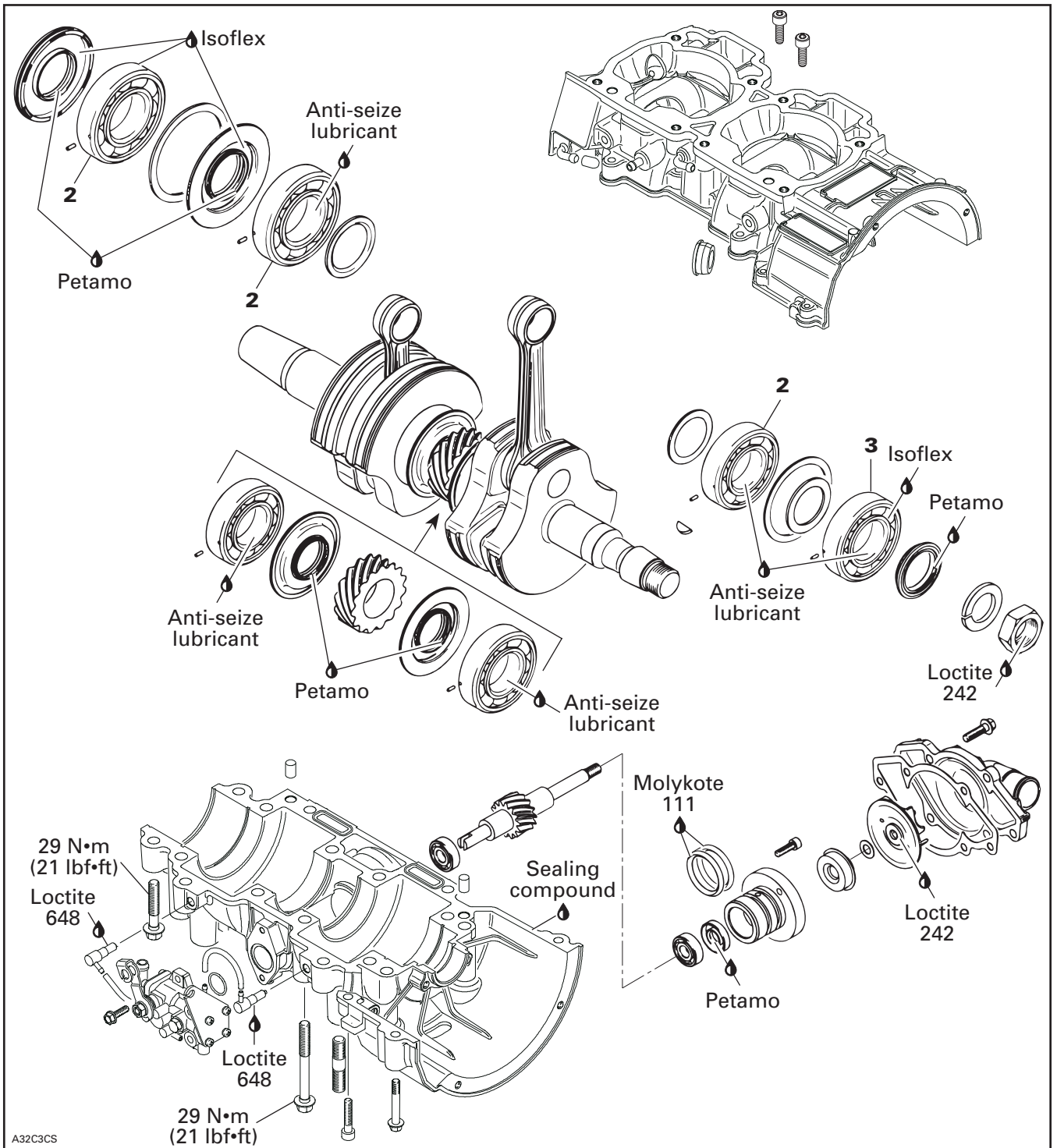
TYPICAL

A. 17.0 - 0, + 0.75 mm (.669 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

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

BOTTOM END



A32C3CS

Section 04 ENGINE

Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

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 old paste gasket from crankcase mating surfaces with Gasket remover (P/N 413 708 500).

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

DISASSEMBLY

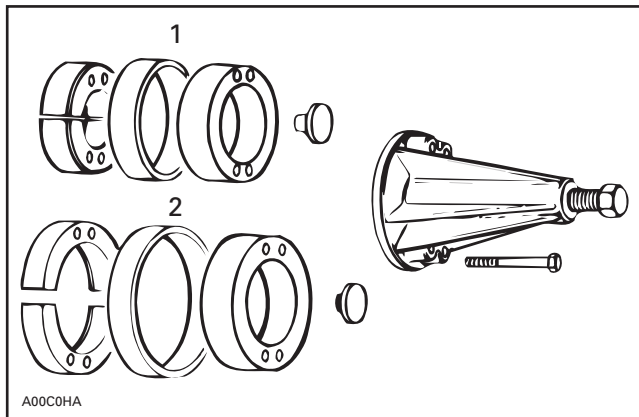
General

To remove drive pulley, refer to DRIVE PULLEY.

To remove magneto, refer to CDI SYSTEM.

2,3, Crankshaft Bearing

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



1. PTO side
2. MAG side

INSPECTION

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

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

2, Crankshaft Bearing

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 injection oil previously heated to 75°C (167°F). This will expand bearing and ease installation.

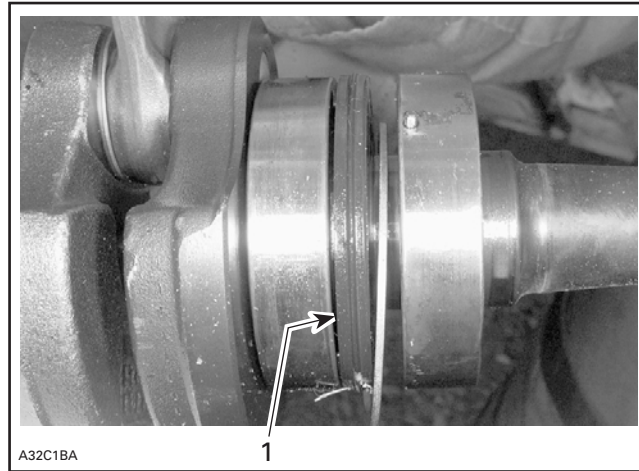
Some bearings must be lubricated with Isoflex grease (P/N 293 550 021).

CAUTION: Use only the recommended Isoflex grease. Make sure not to push Isoflex grease between outside bearing race and half crankcase.

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

Put 45 to 50 mL of grease in a syringe.

Fill PTO side inner seal with Isoflex grease (about 10 mL).

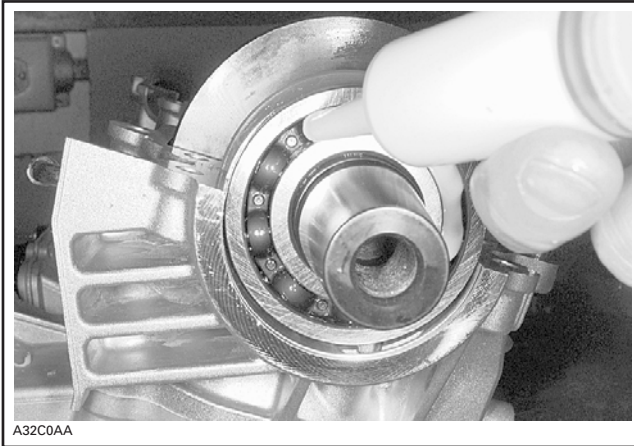


TYPICAL

1. PTO side inner seal filled with Isoflex grease

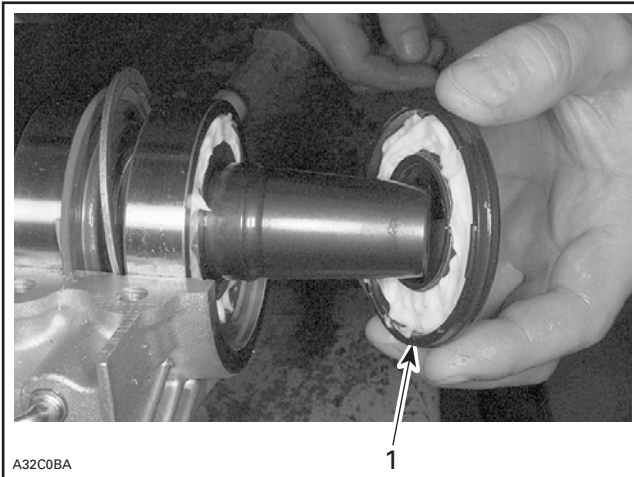
Put 35 to 40 mL of grease in a syringe.

With the syringe, fill the outer ball bearing with grease.



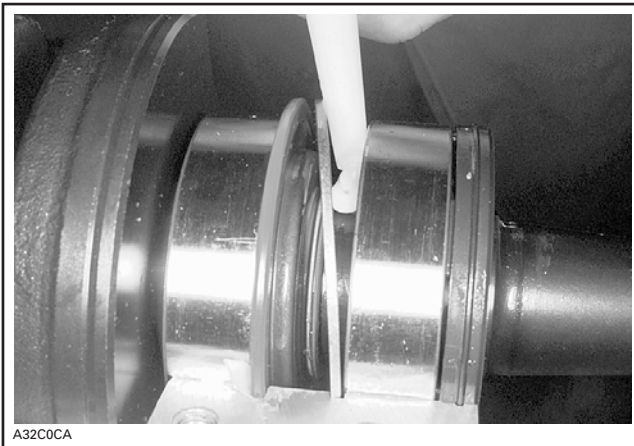
BALLS COATED WITH A SEAM OF GREASE

Coat inner side of outer seal (about 35 mL for 493 and 593 engine types and 40 mL for 693 and 793 engine types) and set it in place.



1. Fill with grease and set in place

Use the remaining grease to coat the inner side of the ball bearing.

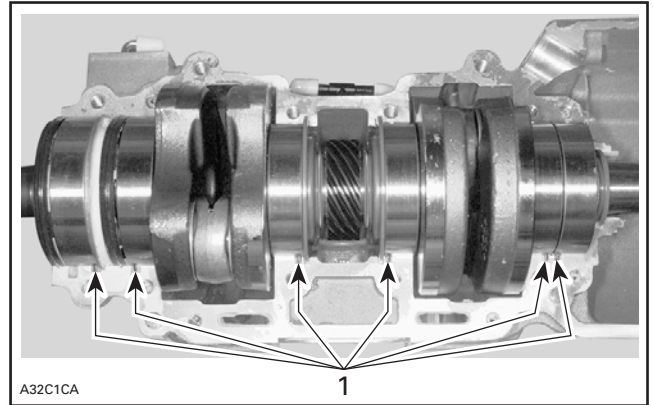


693 and 793 Engines

Apply 6 mL of grease to MAG side outer bearing.

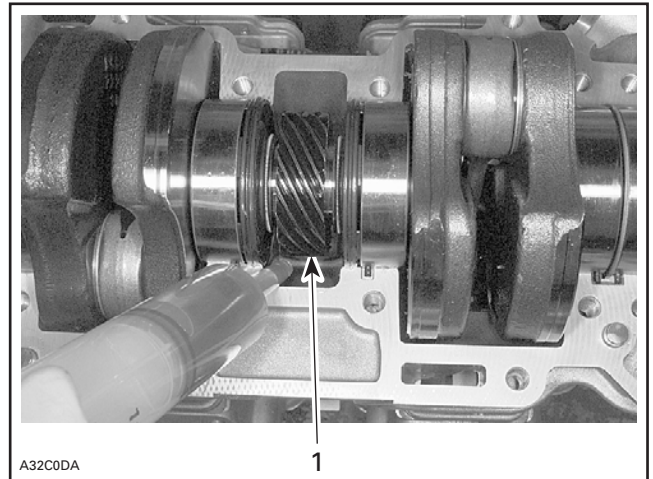
All Engines

At crankshaft installation, position drive pins as illustrated.



1. Position pins

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



1. Oil bath

Crankcase Assembly

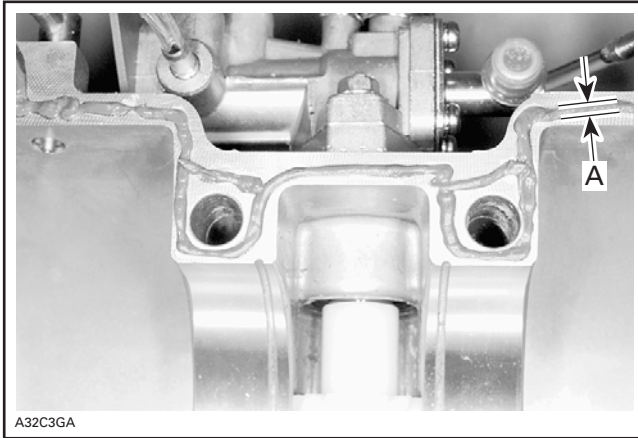
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

Before screwing both parts of crankcase, seal it with sealing compound (P/N 420 297 905). Make sure surfaces are clean and degreased before applying sealing compound.

Section 04 ENGINE

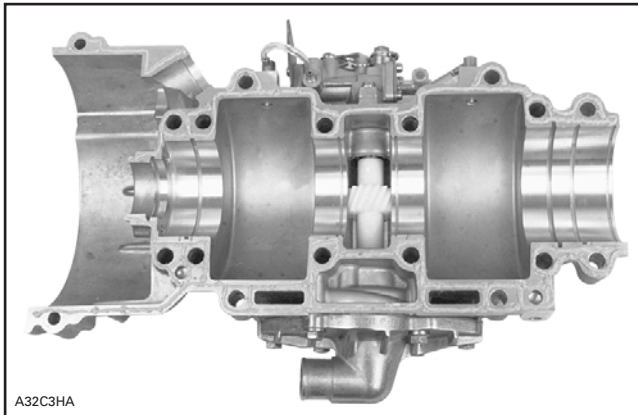
Subsection 02 (493, 593, 693 AND 793 ENGINE TYPES)

Spread a seam of 2 to 3 mm (1/16 to 1/8 in) maximum in diameter on surface of lower crankcase half.



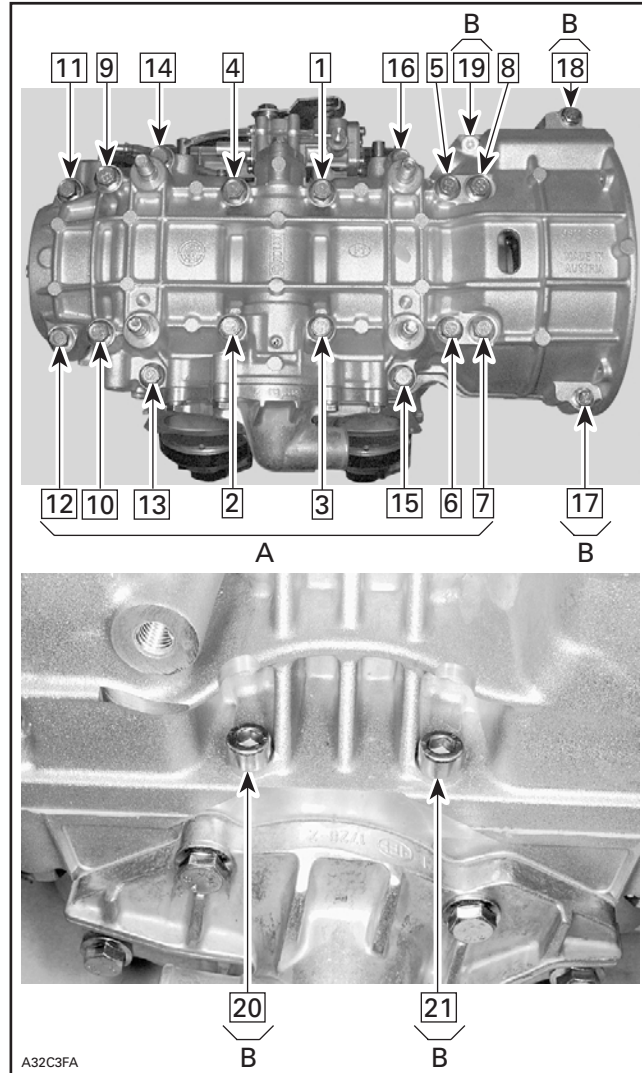
A. 2 to 3 mm (1/16 to 1/8 in) max.

As far as possible, sealing compound must be applied in one run to avoid any risks of leaking through the crankcase.



SEAMING COMPLETED — CONTACT SURFACES COVERED AND SCREW HOLES SURROUNDED

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



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

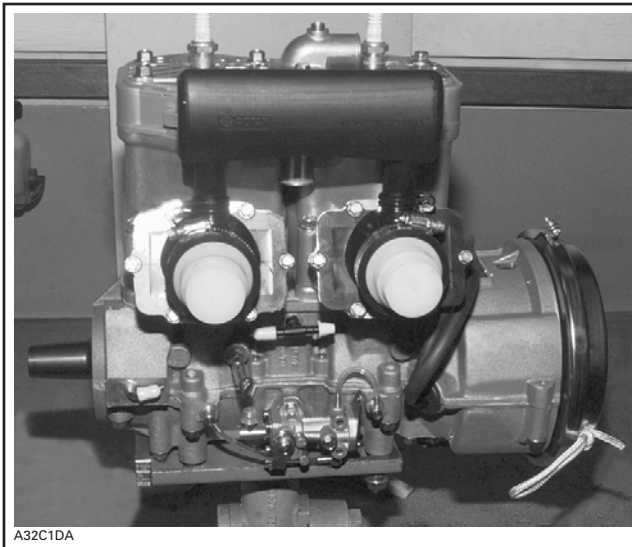
LEAK TEST AND ENGINE DIMENSION MEASUREMENT

LEAK TEST

The following gives verification procedures for 2-cylinder reed valve liquid cooled engines.

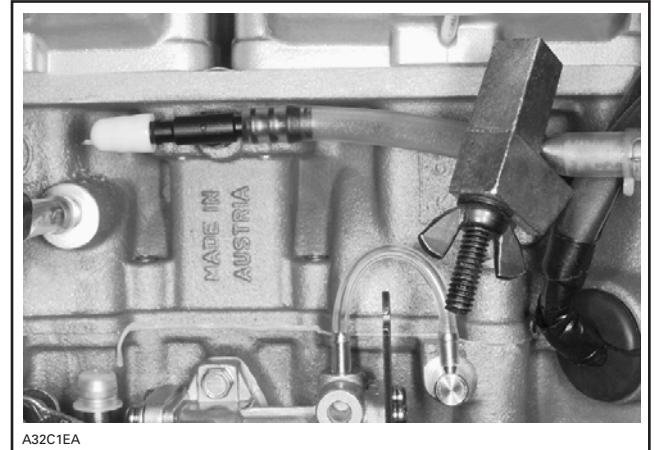
PREPARATION

1. Remove tuned pipe.
2. Install plug over exhaust manifold.
3. Remove carburetors.
4. Insert plugs in intake rubber boots. Tighten with clamps already there.



A32C1DA

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

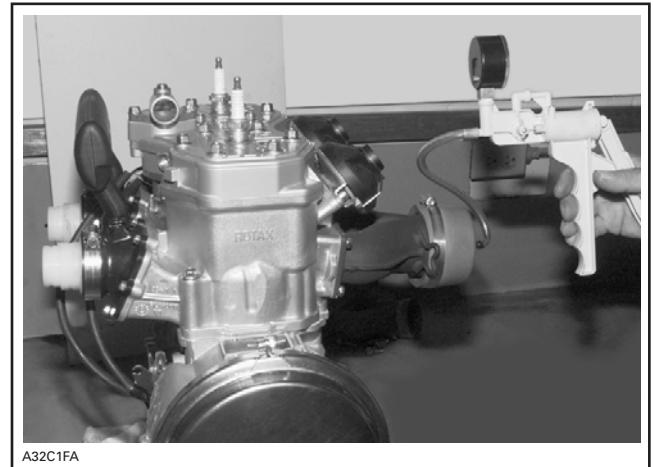


A32C1EA

7. Install air pump on 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.



A32C1FA

Section 04 ENGINE

Subsection 03 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

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

PROCEDURE

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

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

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

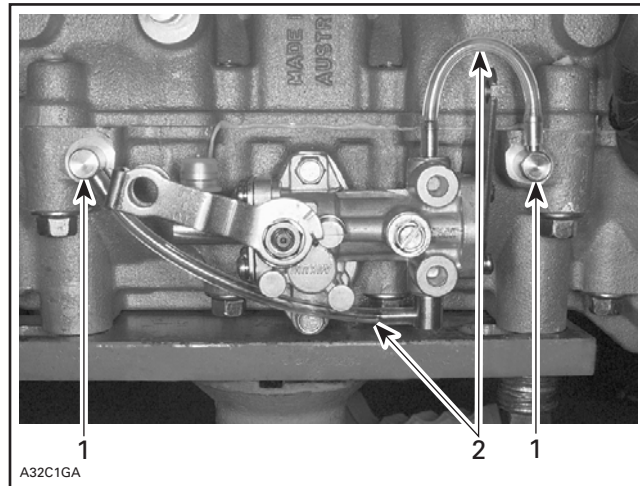
- If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.
- If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

Engine

Check the following:

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

2. Small injection oil lines coming from pump.



1. Injection nipples
2. Small injection oil lines

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

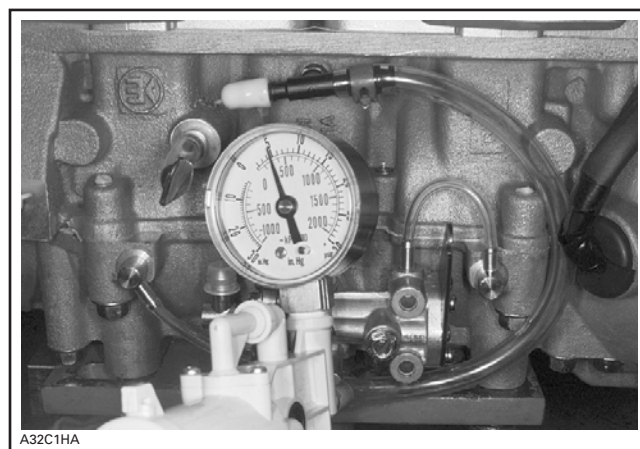
3. Remove cooling system cap.

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

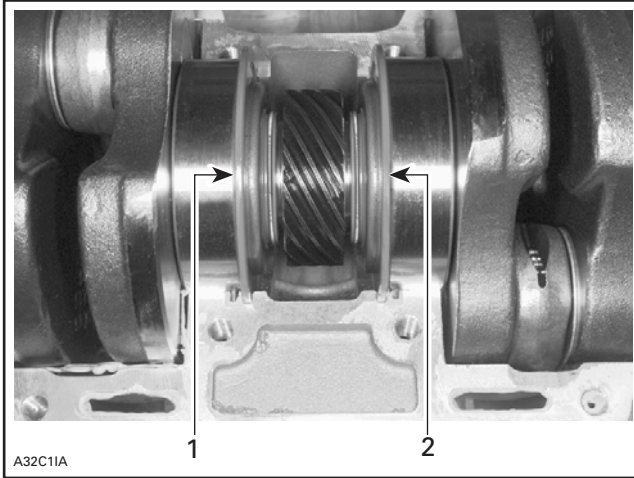
4. Remove drive pulley then check crankshaft outer seal.
5. Remove rewind starter and magneto system then check crankshaft outer seal.
6. Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install air pump on adapter and pressurize as before.



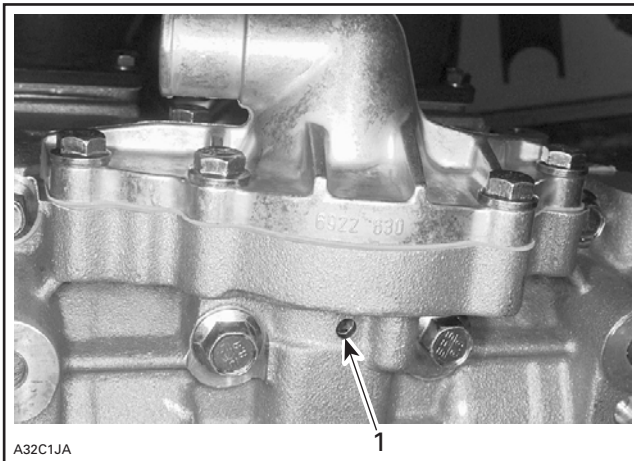
If pressure drops, it indicates a defective crankshaft inner seal.



CRANKSHAFT INSTALLED IN UPPER HALF CRANKCASE

- 1. Crankshaft inner seal on PTO side
- 2. Crankshaft inner seal on MAG side

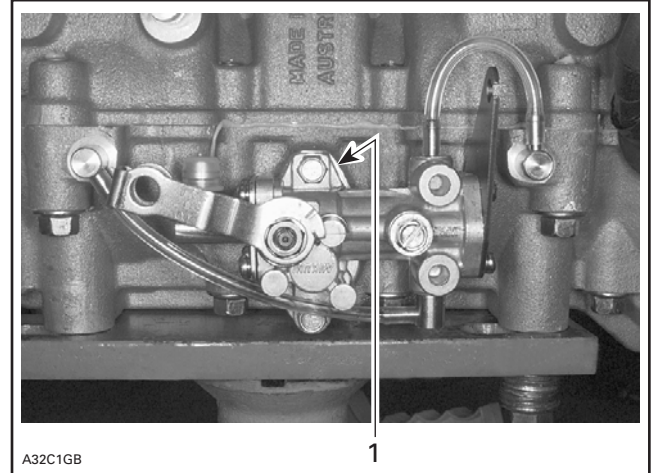
- 1. Check drain hole below coolant pump housing with soapy water.



- 1. Drain hole

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

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



- 1. Check mounting area

- 3. 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.

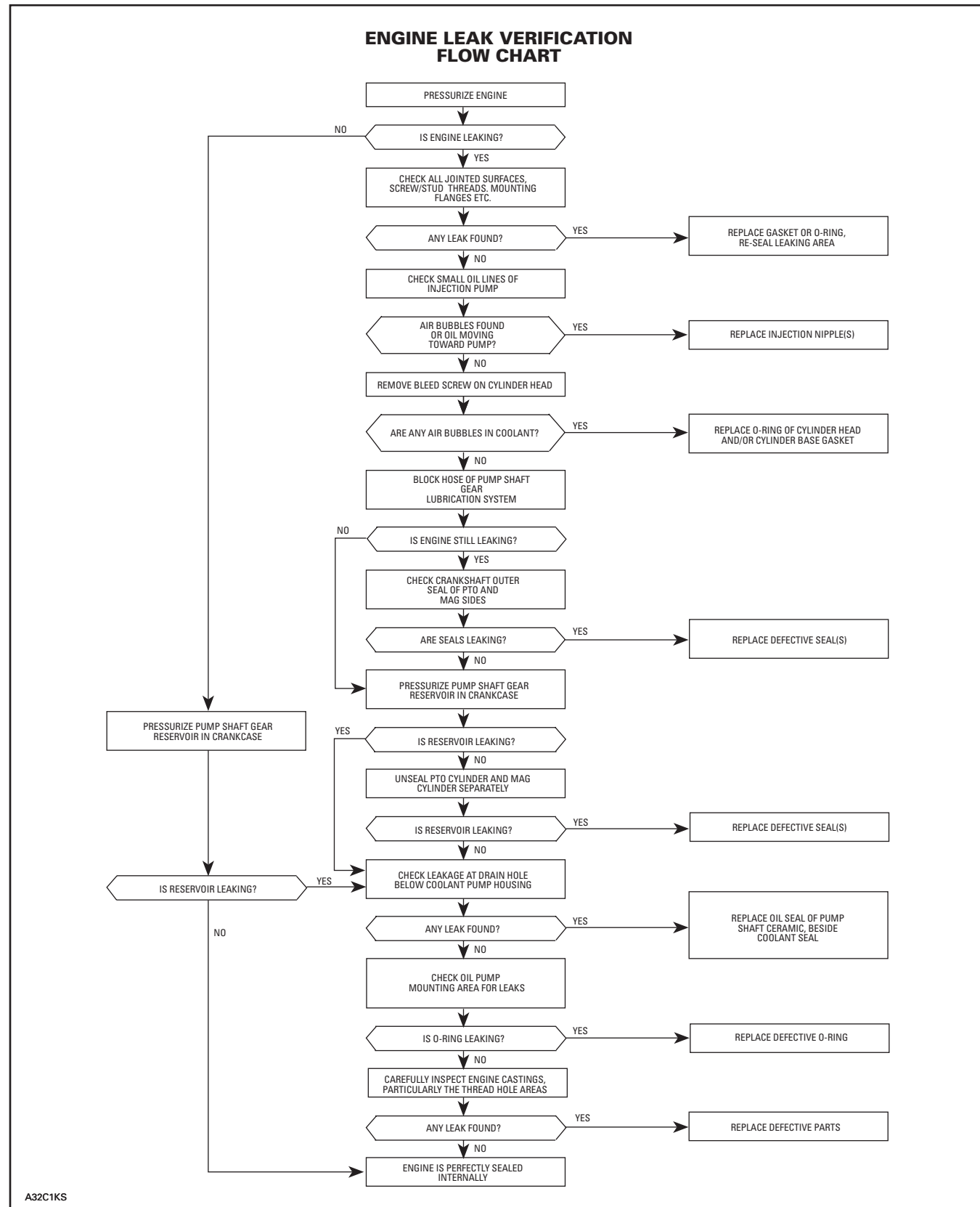
FINALIZING REASSEMBLY

After reassembling engine, always recheck for leakage.

Section 04 ENGINE

Subsection 03 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

ENGINE LEAK VERIFICATION FLOW CHART



ENGINE DIMENSION MEASUREMENT

This section covers all engine types.

CYLINDER HEAD WARPAGE

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

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

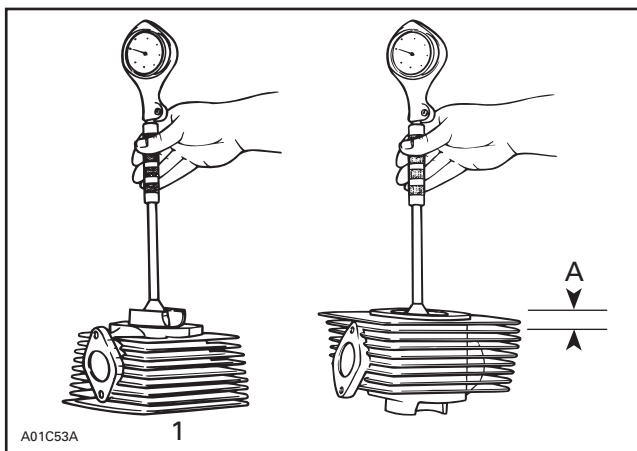
CYLINDER TAPER

ENGINE TYPE	MAXIMUM
All	0.10 mm (.004 in)

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

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

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



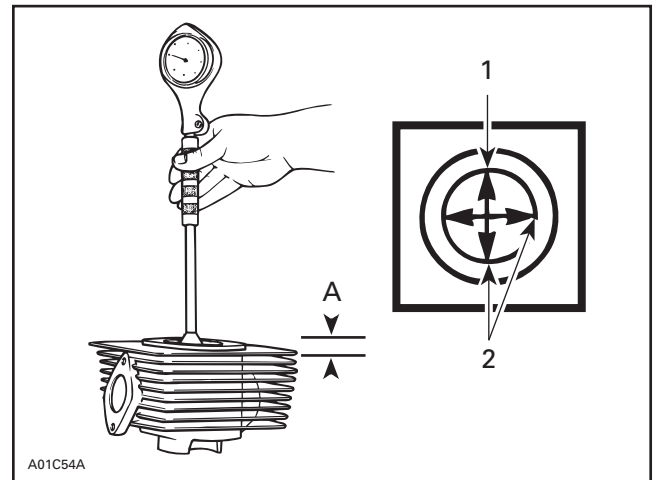
1. Below the intake port
A. 16 mm (5/8 in) from top

CYLINDER OUT OF ROUND

ENGINE TYPE	MAXIMUM
All	0.08 mm (.003 in)

Measuring 16 mm (5/8 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone and can not be rebored.

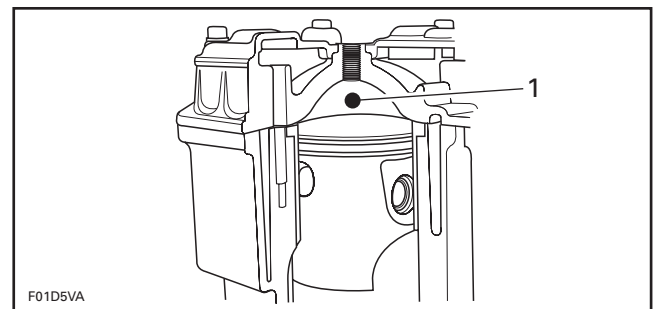
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



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

COMBUSTION CHAMBER VOLUME MEASUREMENT

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



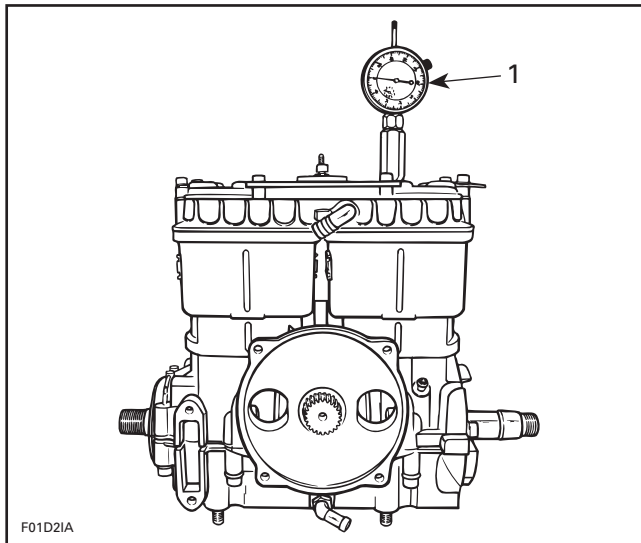
1. Combustion chamber

Section 04 ENGINE

Subsection 03 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

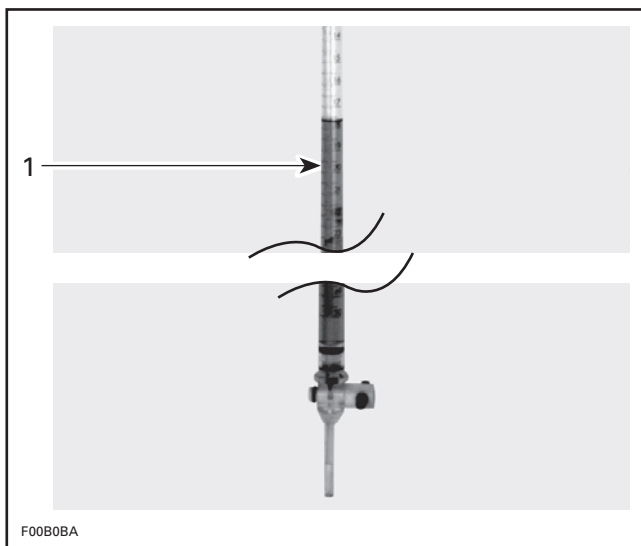
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposit and cylinder head must be leveled.

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



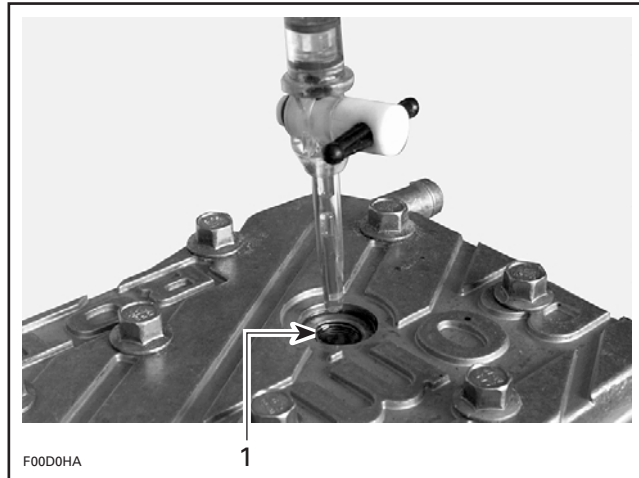
1. Bring piston to TDC

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.



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 well.

7. Repeat the procedure for the other cylinder.

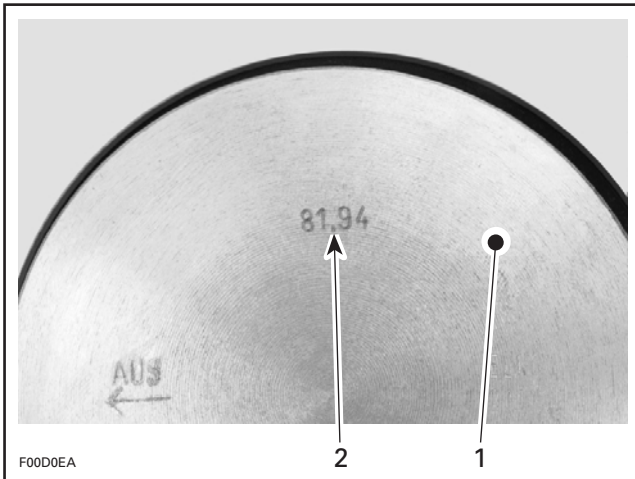
ENGINE TYPE	COMBUSTION CHAMBER VOLUME (CC) (up to top thread of spark plug hole)
493	24.88 ± 1.00
593	28.86 + 1.30 - 1.20
693	33.90 + 1.51 - 1.38
793	36.34 + 1.73 - 1.58

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

ENGINE TYPE	CHANGE IN COMBUSTION CHAMBER VOLUME (CC) FOR EVERY 0.1 mm (.004 in) OF GASKET THICKNESS
493	0.38
593	0.45
693	0.48
793	0.53

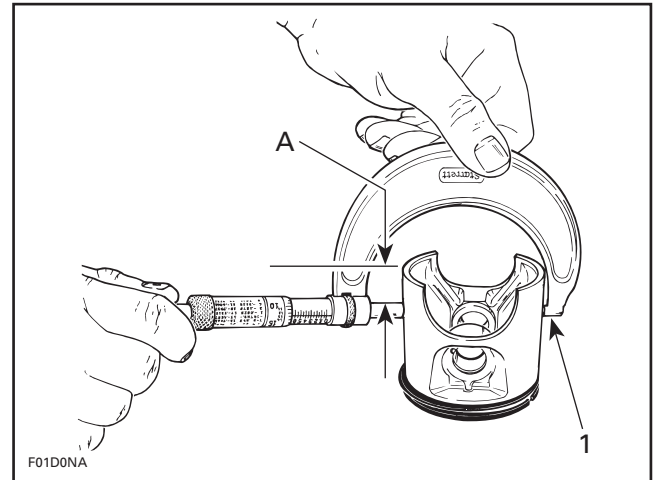
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

Using a micrometer, measure piston skirt at 15 mm (.590 in) perpendicularly (90°) to piston pin.



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

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

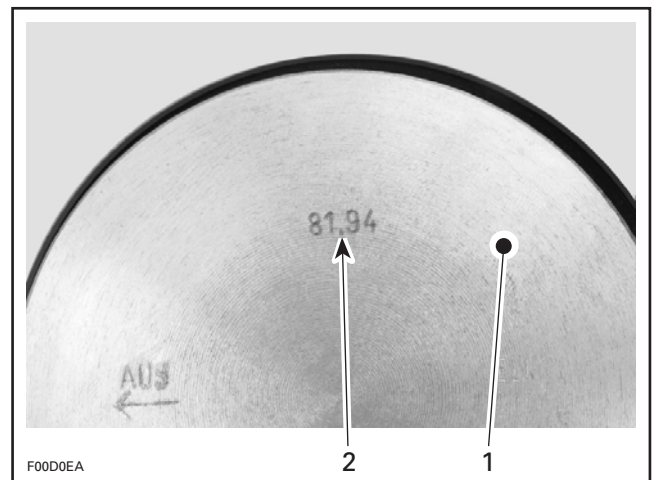
The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

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

Take the measurement on the piston dome.

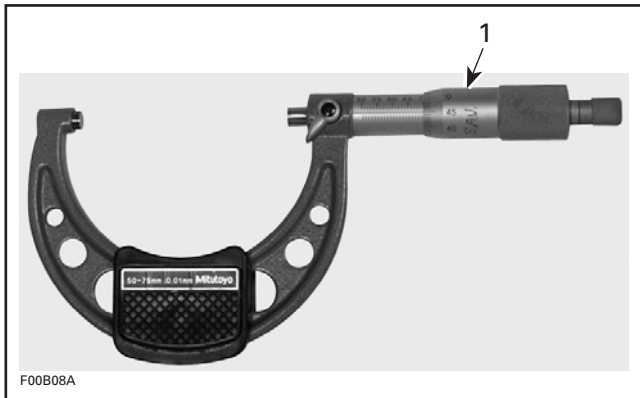


1. Piston dome
2. Piston measurement

Section 04 ENGINE

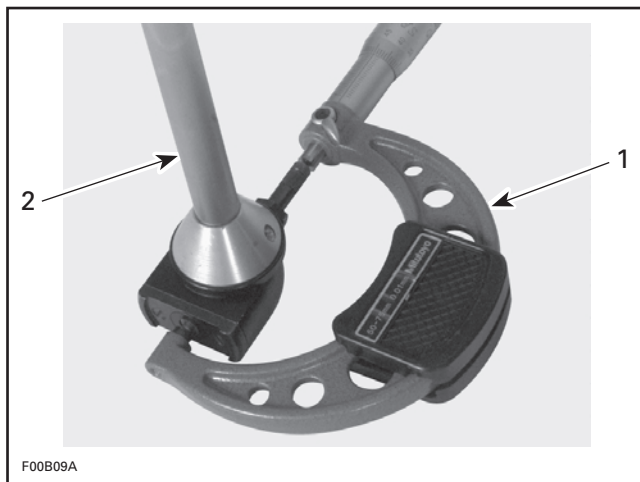
Subsection 03 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

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



1. Micrometer set to the piston dimension

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



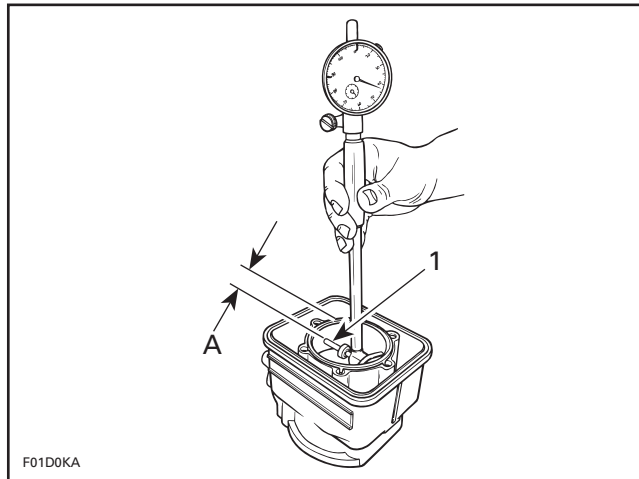
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0 (zero)

IMPORTANT: Always remove cylinders from crankcase before measuring.

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



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

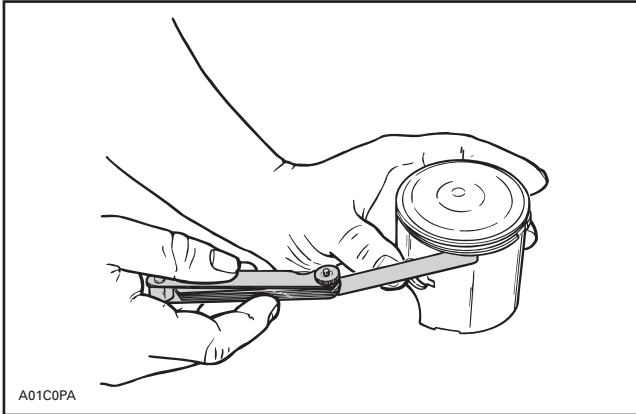
Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder or rebores and install oversize piston depending on engine type. Refer to TECHNICAL DATA.

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

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

RING/PISTON GROOVE CLEARANCE

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

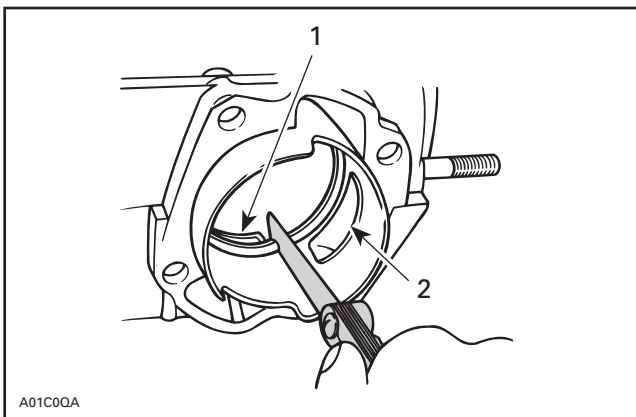


RING END GAP

Position ring half-way between transfer ports and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance. Refer to TECHNICAL DATA.



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

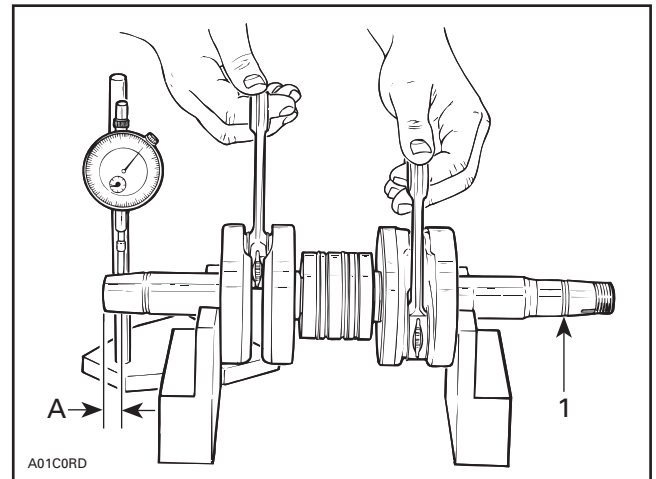
Crankshaft deflection is measured with a dial indicator.

Measuring (in crankcase)

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

Measuring (on bench)

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



TYPICAL

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

Section 04 ENGINE

Subsection 03 (LEAK TEST AND ENGINE DIMENSION MEASUREMENT)

Crankshaft Deflection on PTO Side

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

Crankshaft Deflection on MAG Side

ENGINE TYPE	MAXIMUM ON MAG SIDE mm (in)
All	0.05 (.002)

Crankshaft Deflection in Center of Crankshaft

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

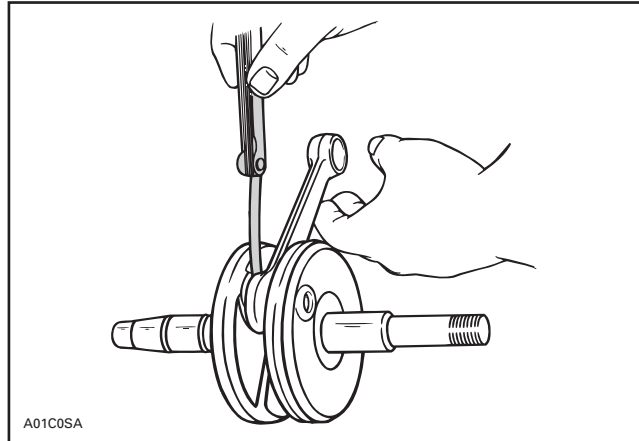
NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

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
All	0.39 - 0.74 mm (.015 - .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

CRANKSHAFT END-PLAY

All Engine Types

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

CHECKING SURFACE FLATNESS

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

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

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

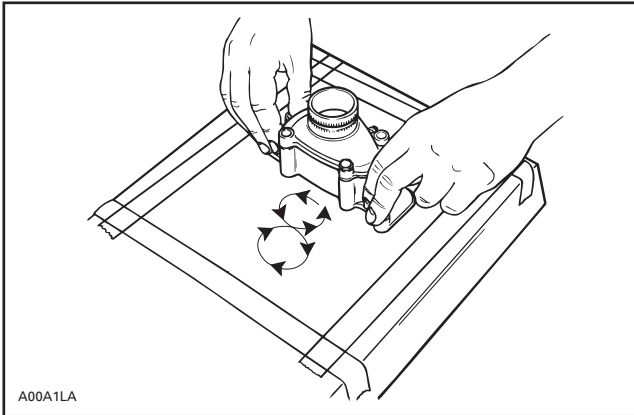
If any play is felt, part must be rectified.

RECTIFYING SURFACES

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

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

Sand until mating surface is perfectly straight.



TYPICAL

CHECKING CRANKSHAFT ALIGNMENT

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

Remove both spark plugs.

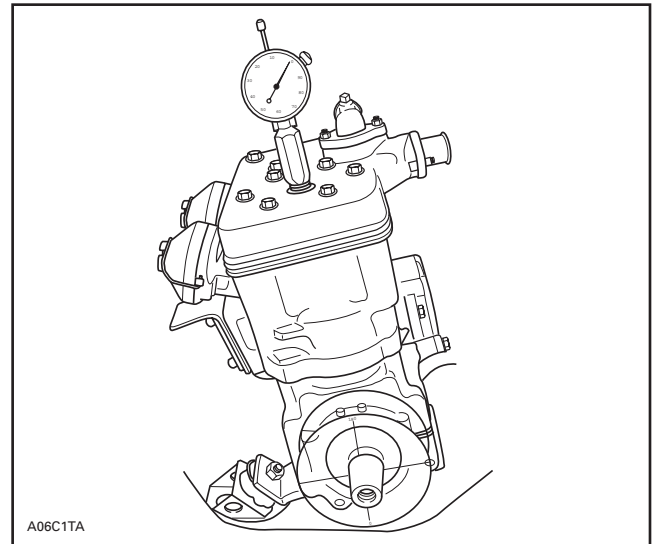
Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.

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 center cylinder.

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



TYPICAL

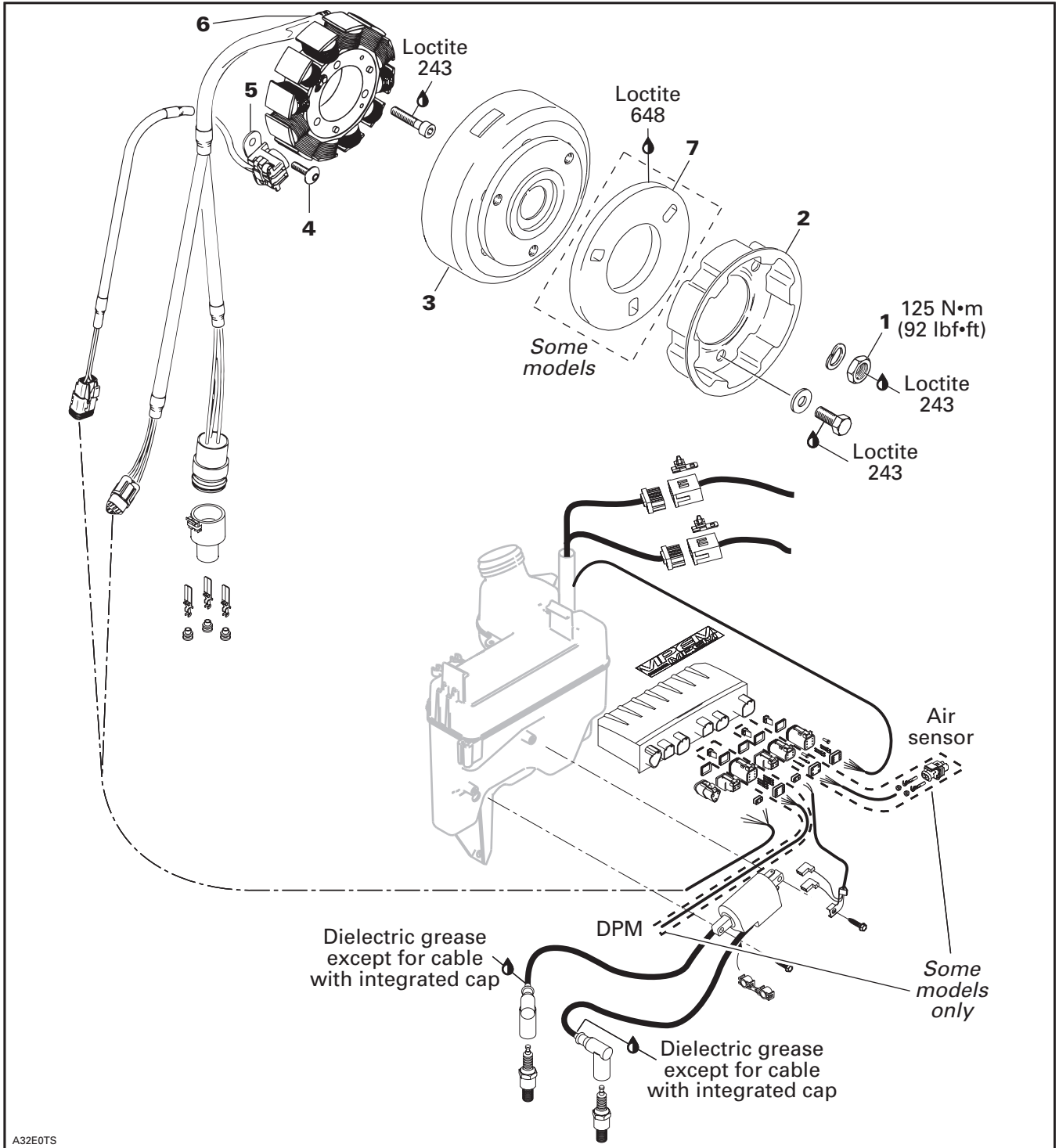
Interval between cylinders must be $180^\circ \pm 0.5$.

Any other reading indicates a misaligned (twisted) crankshaft.

CDI SYSTEM

NIPPONDENSO TRIGGER COIL IGNITION SYSTEM

290 W on ZX Series



A32E0TS

Section 04 ENGINE

Subsection 04 (CDI SYSTEM)

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

CDI means Capacitor Discharge System.

CLEANING

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

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

DISASSEMBLY

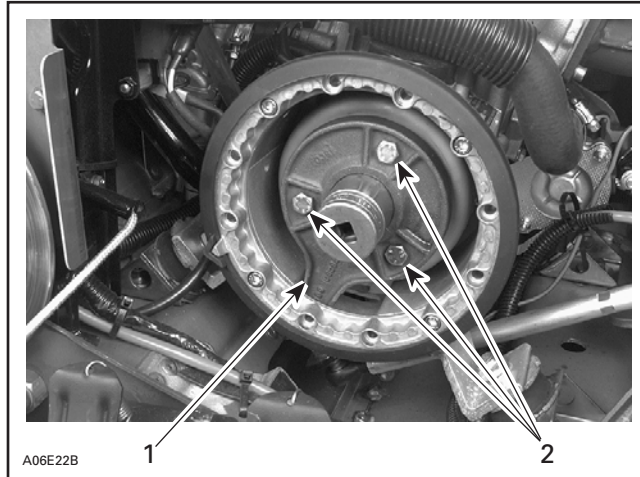
3, Magneto Flywheel

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

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

To remove magneto flywheel retaining nut **no. 1**:

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

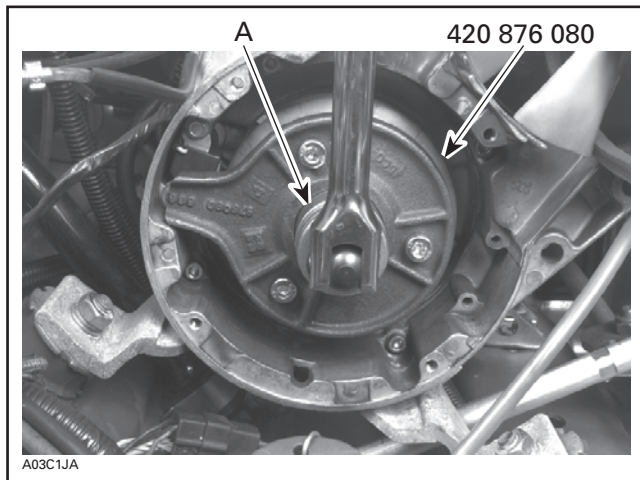


TYPICAL

1. Tab in magneto housing opening
2. M8 screws

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

NOTE: To correctly remove a threadlocked fastener it is first necessary to tap on the fastener to break threadlocker bond. This will eliminate the possibility of thread breakage.

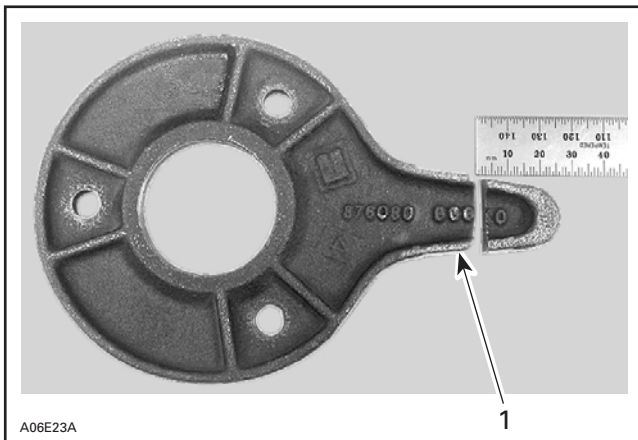


TYPICAL

- A. 30 mm socket

To remove magneto flywheel, screw puller (P/N 529 022 500) into puller ring.

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



1. Cut by 25 mm (1 in)

- Install puller ring with its tab in magneto housing opening.

CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto. When a flywheel **no. 7** is installed on magneto flywheel use M8 x 30 mm screws.

5, Trigger Coil

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

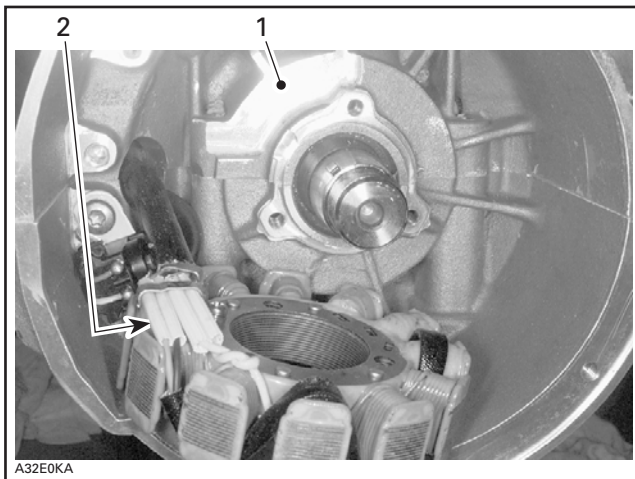
To replace trigger coil:

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

ASSEMBLY

7, Stator Plate

Make sure to position stator plate in a way that its wire protectors are over recess of crankcase.



1. Crankcase recess
2. Wire protectors

3, Magneto Flywheel

Clean crankshaft extension (taper) and apply Loctite 243 (blue) on taper, then position Woodruff key, flywheel and lock washer on crankshaft.

Clean nut threads and apply Loctite 243 (blue) then tighten nut 125 N•m (92 lbf•ft).

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

CAUTION: Do not use silicone “sealant”, this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch (gray) housing otherwise housing seal will be damaged.

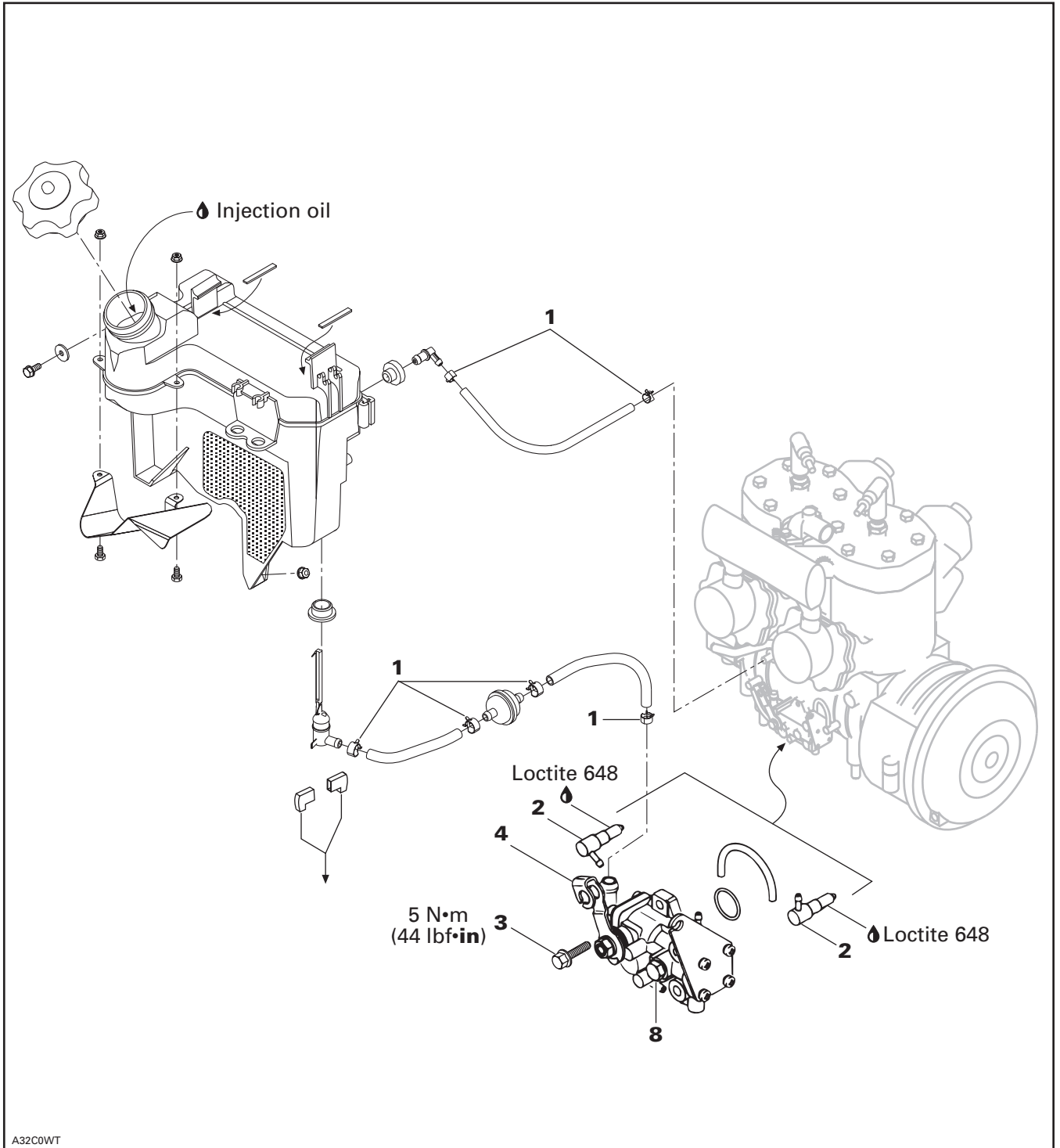
Ignition Timing

Check as described in IGNITION TIMING.

OIL INJECTION SYSTEM

OIL INJECTION PUMP

493, 593, 693 and 793 Engines



Section 04 ENGINE

Subsection 05 (OIL INJECTION SYSTEM)

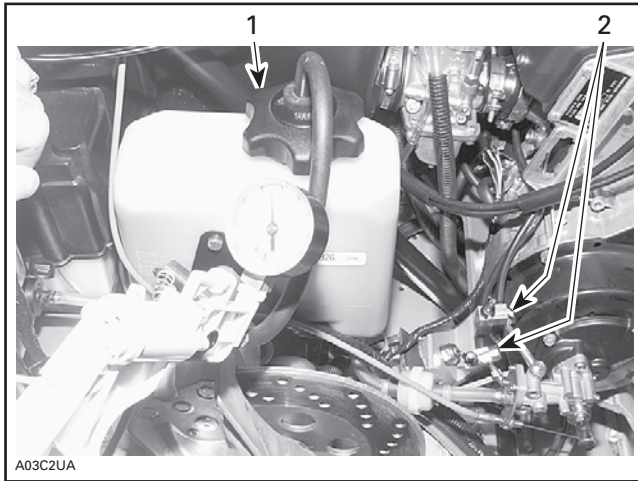
OIL SYSTEM LEAK TEST

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

4, Pump Lever

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

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
493	L7
593	L9
693	L14
793	L14

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.

ASSEMBLY

1, Spring Clip

Always check for spring clips tightness.

3, Screw

Torque to 5 N•m (44 lbf•in).

Cable plastic elbow must be fastened and fully inserted.

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

Secure barrel with plastic washer and circlip.

Install cable lock washer on left side of support.

Verify cable and oil pump lever operation.

ADJUSTMENT

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

Synchronizing Pump with Carburetor

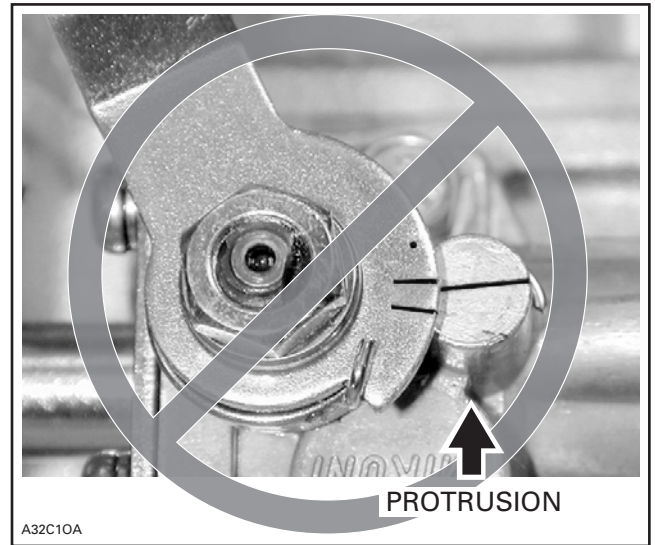
Because the oil pump is mounted low on engine, it is very difficult to avoid parallax problem and set a good adjustment.

Parallax Problem

When adjusting pump lever, since the mechanic can not view the pump perpendicularly, the adjustment will not be accurate. Following photos show three different views of the same properly adjusted pump.



VIEW TOO HIGH — ADJUSTMENT SEEMS TO BE TOO RICH WHEN TOP OF BODY'S PROTRUSION CAN BE SEEN



VIEW TOO LOW — ADJUSTMENT SEEMS TO BE TOO LEAN WHEN BOTTOM OF BODY'S PROTRUSION CAN BE SEEN

To avoid a bad adjustment, follow procedure below.

Procedure for Oil Pump Adjustment

Ensure carburetors are synchronized according to the technical specifications.

Remove air box. Carburetors may also be removed to improve visibility and ease adjustment of oil pump cable.

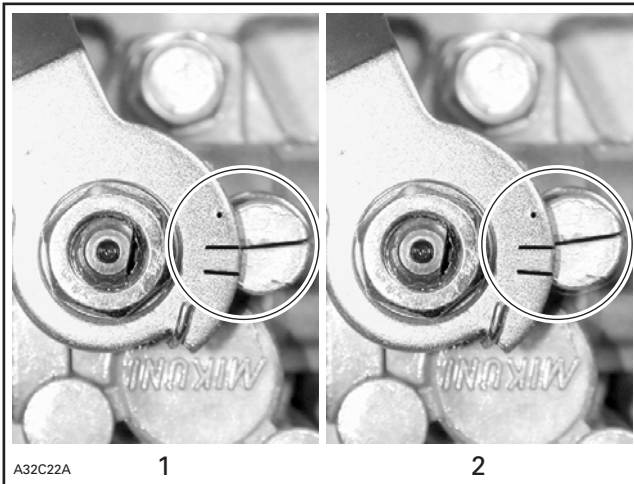
NOTE: Place carburetors on top of intake boots to keep cable routing near original location.

Lightly depress throttle lever to remove free play from cable.

Use a small round or oblong mirror to see the marks.

The second mark on pump lever must be aligned or up to 1 mm (.039 in) below pump casting mark. If not, loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.

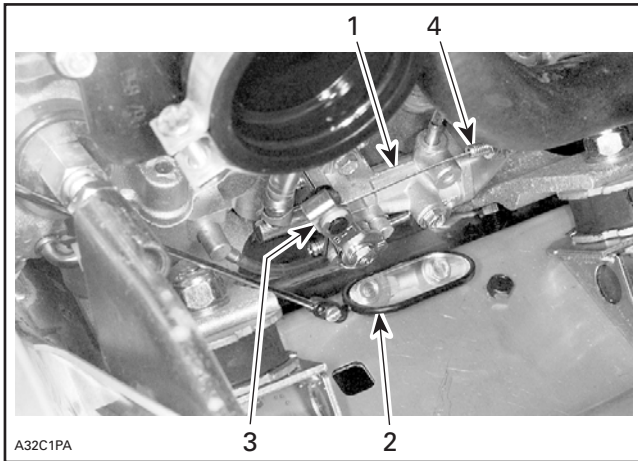


VIEW STRAIGHT AHEAD — BODY'S PROTRUSION LOOKS LIKE A CIRCLE, MARK ON PUMP ALIGN WITH SECOND MARK ON LEVER (MARK ON DOT SIDE)

1. Minimum setting
2. Maximum setting

Section 04 ENGINE

Subsection 05 (OIL INJECTION SYSTEM)

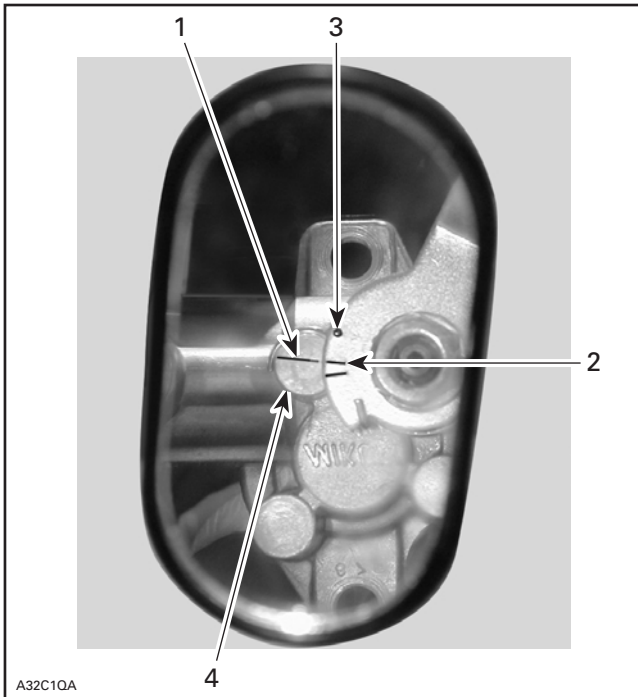


VIEW WITH AIR BOX, CARBURETORS AND FUEL PUMP REMOVED

1. Oil pump
2. Mirror
3. Lever
4. Adjustment screw

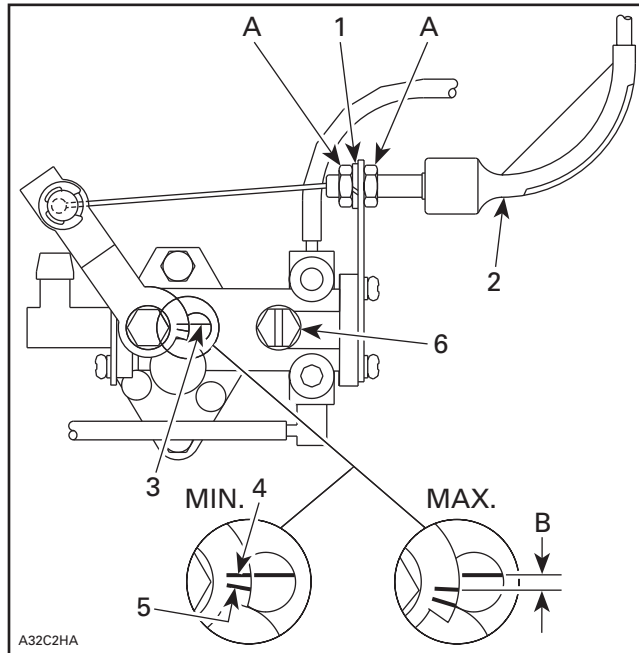
Make sure that view in mirror is straight ahead, without parallax problem.

Protrusion with fixed mark on pump must look like a full circle. See next photo.



VIEW FROM MIRROR SHOULD LOOK LIKE THIS

1. Mark on pump casting
2. Second mark on lever
3. Dot
4. Pump protrusion as a circle, not a cylinder



1. Lock washer
2. Plastic elbow fastened and fully inserted
3. Pump casting mark
4. Second mark aligned or below
5. First mark
6. Bleeder screw
- A. 5 N•m (44 lbf•in)
- B. Up to 1 mm (.039 in)

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

To Bleed Oil Lines

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.

Reinstall all parts.

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

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

WARNING

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. Unplug small oil lines from pump. Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever in fully open position. Oil columns must advance into small oil lines.

If not, remove pump assembly and check the pump gear and drive shaft (if applicable) for defects, replace as necessary. Test pump as describes below.

NOTE: Through normal use, oil level must not drop in small tubes. If oil drops, verify check valve operation in injection nozzle. Replace as necessary.

Test Bench

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

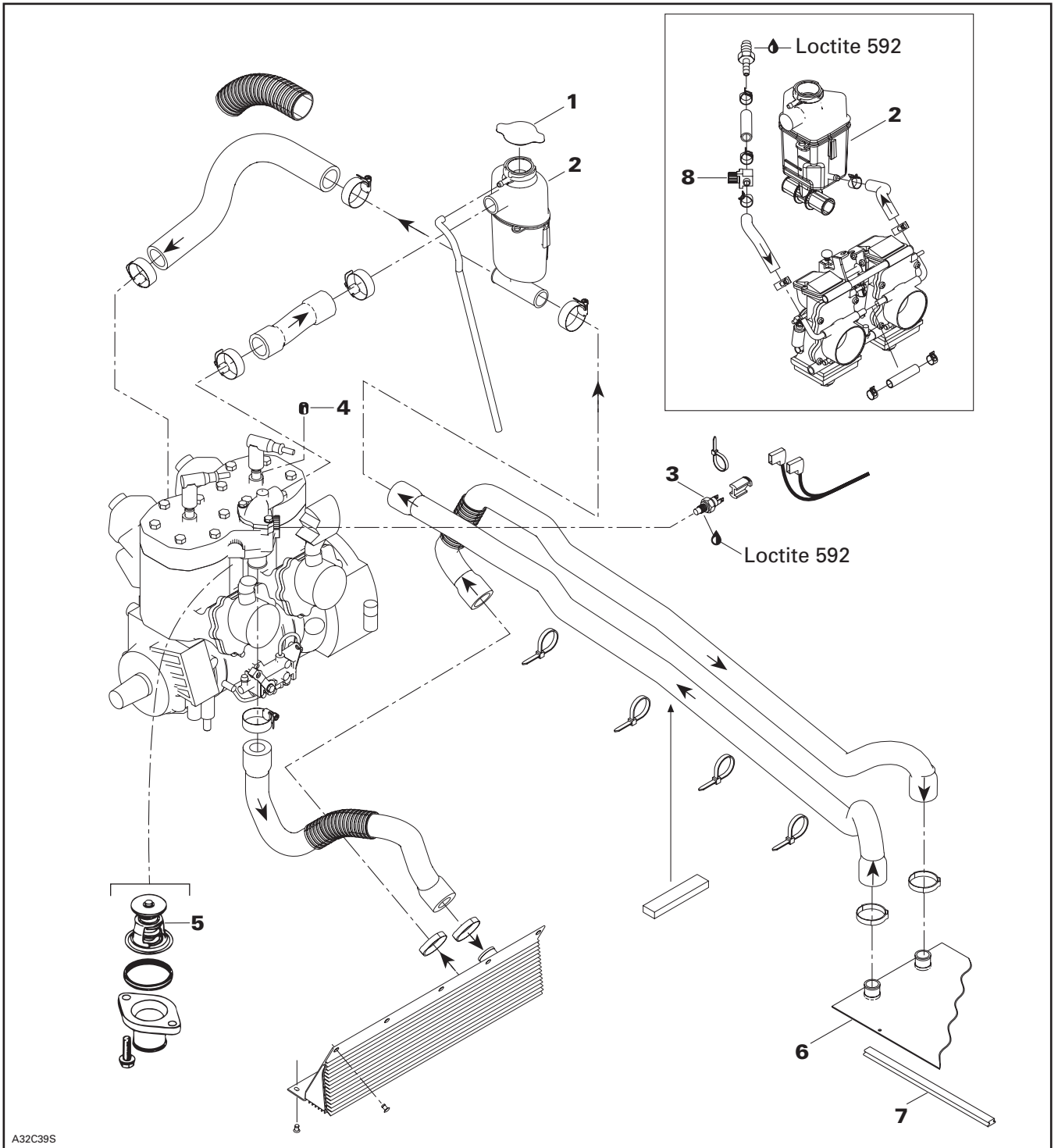
2, Check Valve

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

Run engine at idle. Oil column must advance. If the check valve is faulty, oil column will go back and forth. Replace if so.

LIQUID COOLING SYSTEM

493, 593, 693 and 793 Engines



A32C39S

Section 04 ENGINE

Subsection 06 (LIQUID COOLING SYSTEM)

COOLING SYSTEM LEAK TEST

Install special radiator cap (P/N 529 021 400) included in engine leak tester kit (P/N 861 749 100) on coolant tank. Install hose pincher (P/N 295 000 076) on overflow hose. Using pump also included in kit pressurize all system through coolant reservoir to 100 kPa (15 PSI).

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



INSPECTION

Check general condition of hoses and clamp tightness.

DRAINING THE SYSTEM

⚠ WARNING

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

To drain the cooling system, siphon the coolant mixture from the coolant tank. Disconnect hose at water pump.

DISASSEMBLY AND ASSEMBLY

3,4, Sender and Plug

Apply Loctite 592 (P/N 413 702 300) 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 rear end. Refer to FRAME for radiator removal.

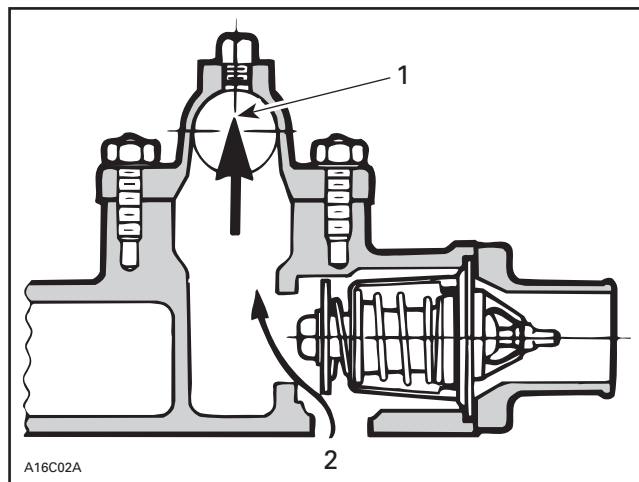
5, Thermostat

To check thermostat, put in water and heat water. Thermostat should start to open when water temperature reaches the following degree. It will be almost fully open at 50°C (122°F).

ENGINE	TEMPERATURE
493, 593, 693 and 793	42°C (108°F)

Thermostat is a double action type.

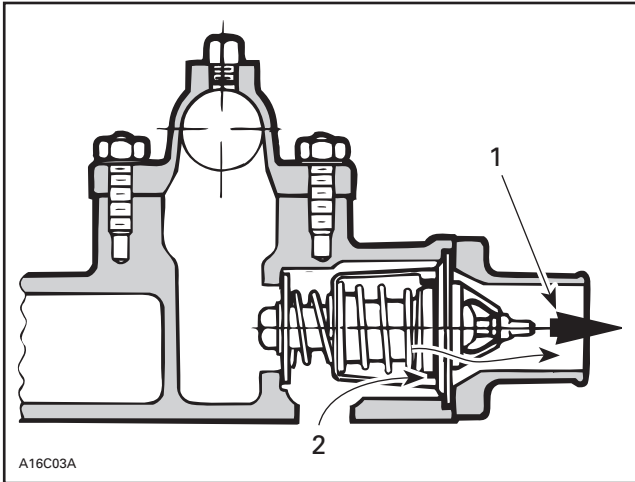
- Its function is to give faster warm up of the engine by controlling a circuit; water pump — engine — coolant tank. This is done by bypassing the radiator circuit.



TYPICAL — CLOSED THERMOSTAT, COLD ENGINE

- To reservoir
- From cylinders

b. When the liquid is warmed enough, the thermostat opens progressively the circuit, water pump — engine — radiators — coolant tank to keep the liquid at the desired temperature. (See the diagram of the exploded view).



TYPICAL — OPEN THERMOSTAT, WARM ENGINE

- 1. To radiators
- 2. From cylinders

These 2 functions have the advantage of preventing a massive entry of cold water into the engine.

COOLING SYSTEM REFILLING PROCEDURE

Recommended Coolant

Use premixed coolant - 52°C (- 62°F) (P/N 413 711 802) (16 x 1 L). Do not reinstall pressure cap.

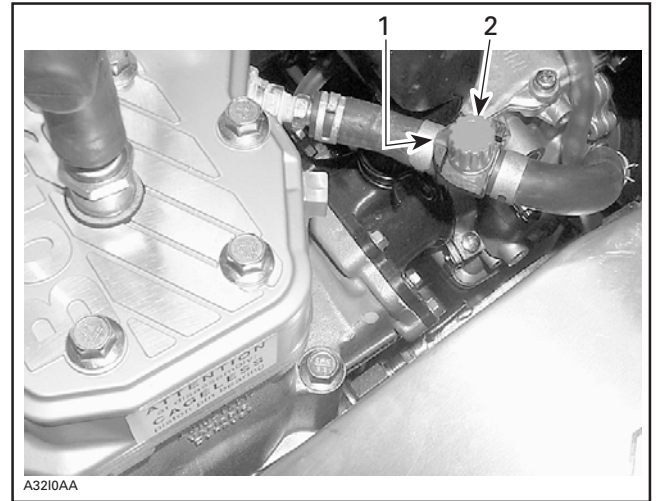
CAUTION: To prevent rust formation or freezing condition, always replenish the system with recommended premixed coolant.

System Capacity

Refer to TECHNICAL DATA.

Refilling Procedure

Open heated carburetor valve no. 8 on so equipped models.



HEATED CARBURETOR VALVE

- 1. ON
- 2. OFF

Lift front of vehicle until the tunnel is horizontal. With engine cold, refill coolant tank no. 2 up to COLD LEVEL line. Wait a few minutes then refill to line. Start engine. Refill up to line while engine is idling until all air bubbles have escaped from system (about 4 to 5 minutes). Install pressure cap.

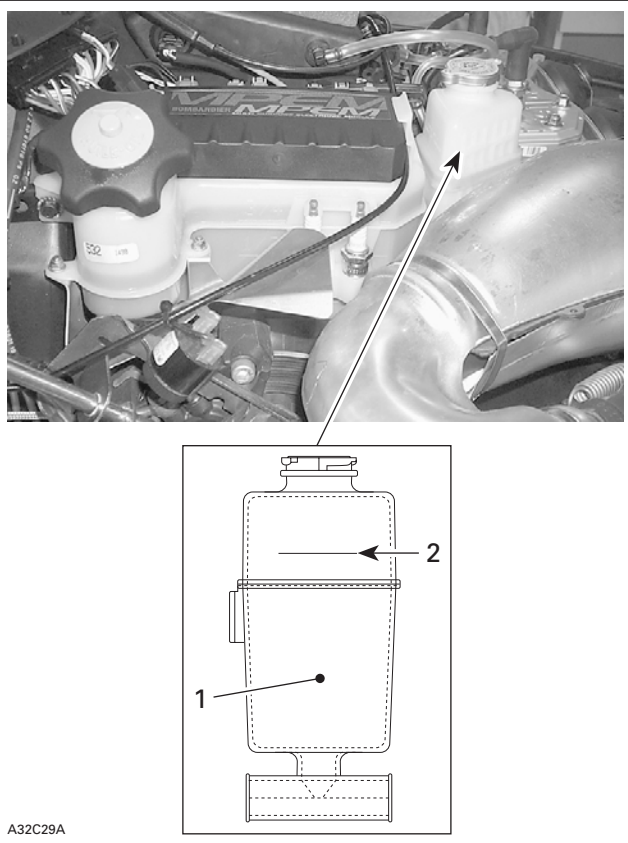
Section 04 ENGINE

Subsection 06 (LIQUID COOLING SYSTEM)

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

Put back front of vehicle on the ground.

When engine has completely cooled down, re-check coolant level in coolant tank and refill up to line.

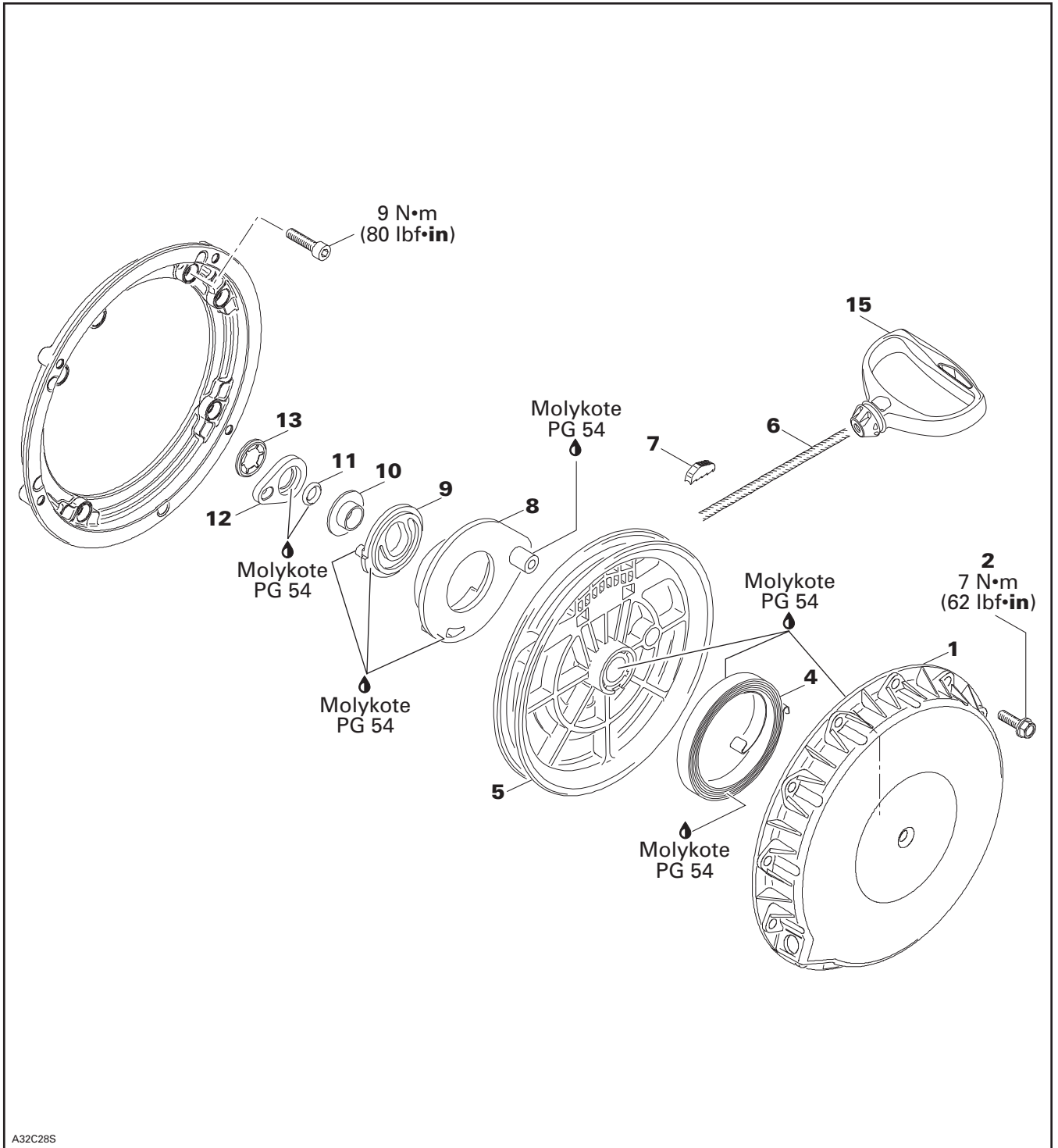


1. Coolant tank
2. COLD LEVEL line

Check coolant concentration (freezing point) with proper tester.

REWIND STARTER

Plastic Rewind Starter on All Models



Section 04 ENGINE

Subsection 07 (REWIND STARTER)

INSPECTION

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

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

Check if rope no. 6 is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring no. 11 every time rewind starter is disassembled.

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

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

REMOVAL

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

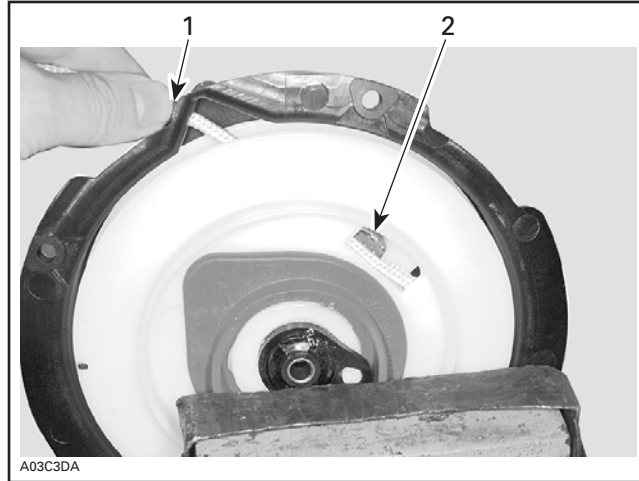
Remove screws no. 2 securing rewind starter no. 1 to engine then remove rewind starter.

Fan Cooled Engines Only

Remove pump from rewind starter cover.

ROPE REPLACEMENT

Completely pull out rope. Hold rewind starter in a vise.



1. Rope exit hole
2. Key to be removed

With a long thin pin punch inserted through rope exit hole, push key no. 7. Remove key and rope. Install a new rope and lock it using key no. 7.

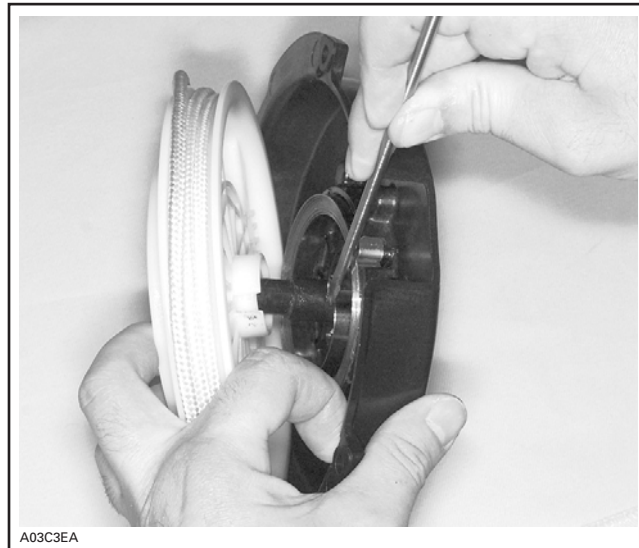
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

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

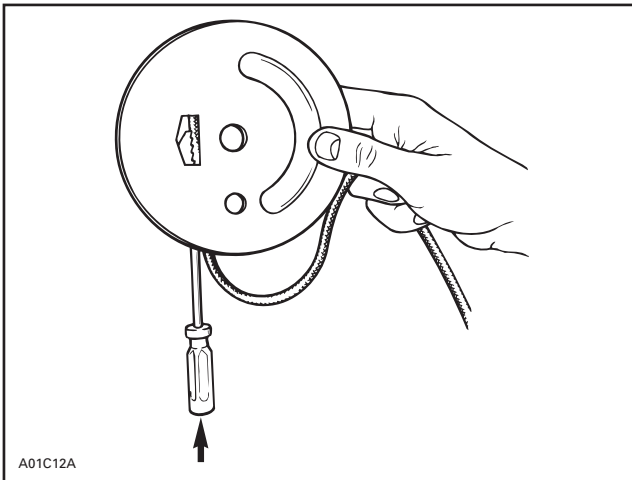
Cut push nut no. 13 and discard. Remove locking element no. 12, O-ring no. 11, step collar no. 10, pawl lock no. 9 and pawl no. 8.

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



Section 04 ENGINE
Subsection 07 (REWIND STARTER)

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



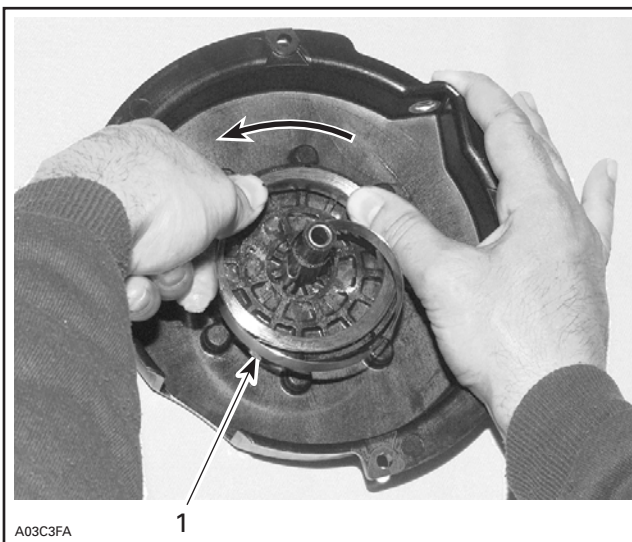
GENTLY TAP ON KEY

ASSEMBLY

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

⚠ WARNING

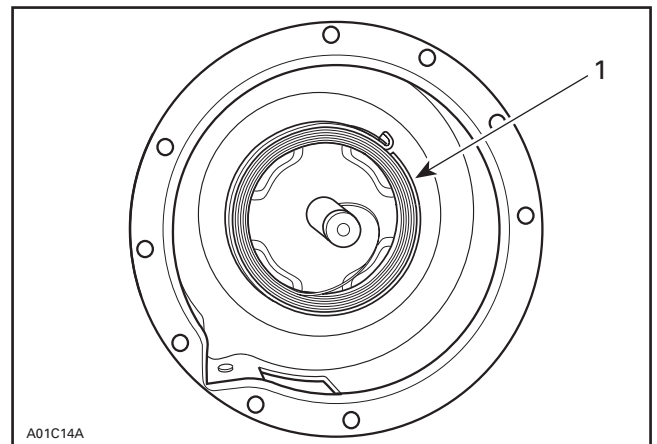
Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.



1. Outer end into guide notch

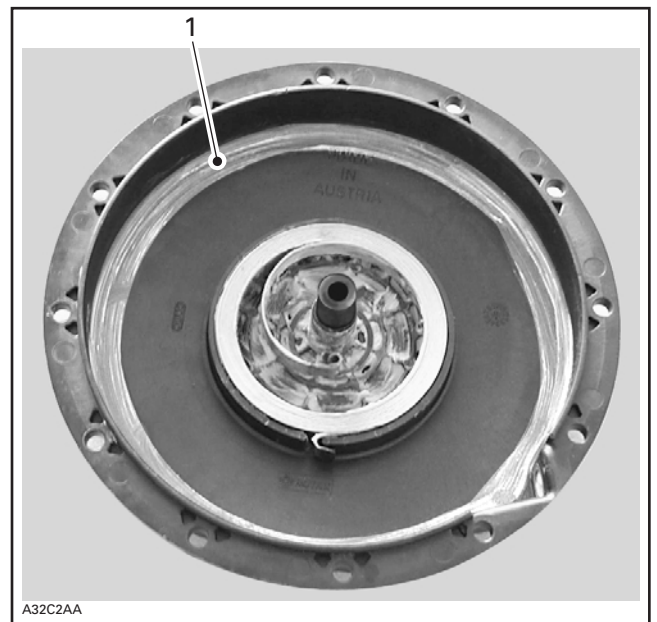
CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

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



TYPICAL

1. Molykote PG 54 inside spring guide



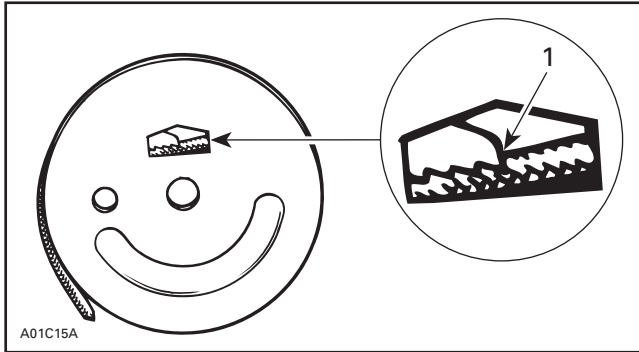
1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

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

Section 04 ENGINE

Subsection 07 (REWIND STARTER)

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



1. Push to lock

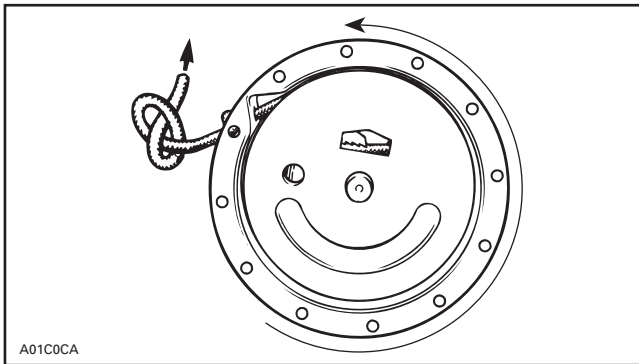
Lubricate housing post with silicone compound grease. Install sheave.

To adjust rope tension:

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

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

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



TYPICAL

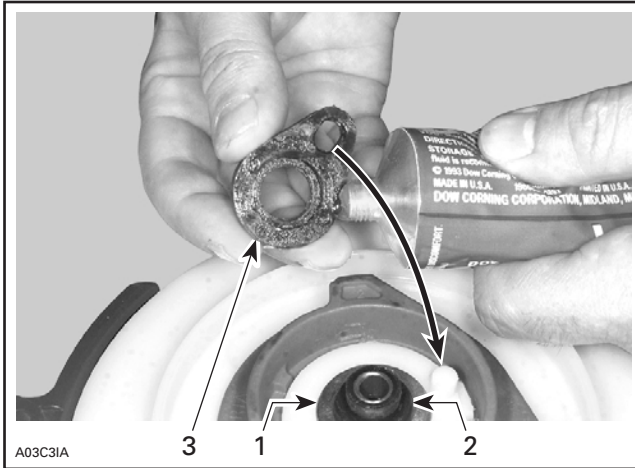
Lubricate pawl no. 8 with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



Lubricate pawl lock no. 9 with Molykote PG 54 (P/N 420 899 763). Install over pawl.



Install step collar no. 10 with its sleeve first. Lubricate a new O-ring no. 11 and locking element no. 9 with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.



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

Position a new push nut no. 13.

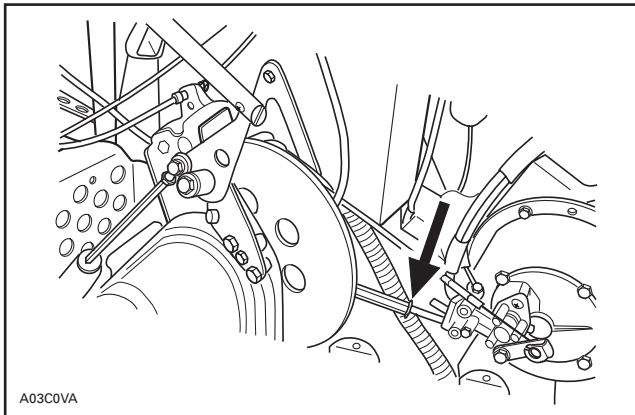
INSTALLATION

Fan Cooled Engines Only

Reinstall oil pump on rewind starter assembly.

All Models

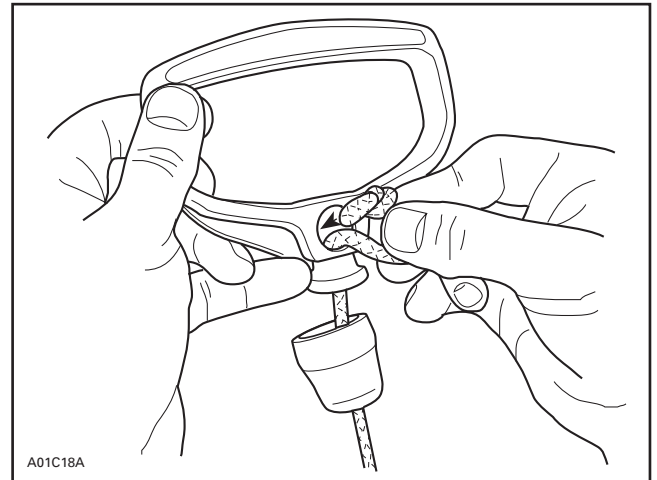
Thread starter rope no. 6 through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

Prior to installing starter grip no. 15 on new rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter grip and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter grip over the knot.

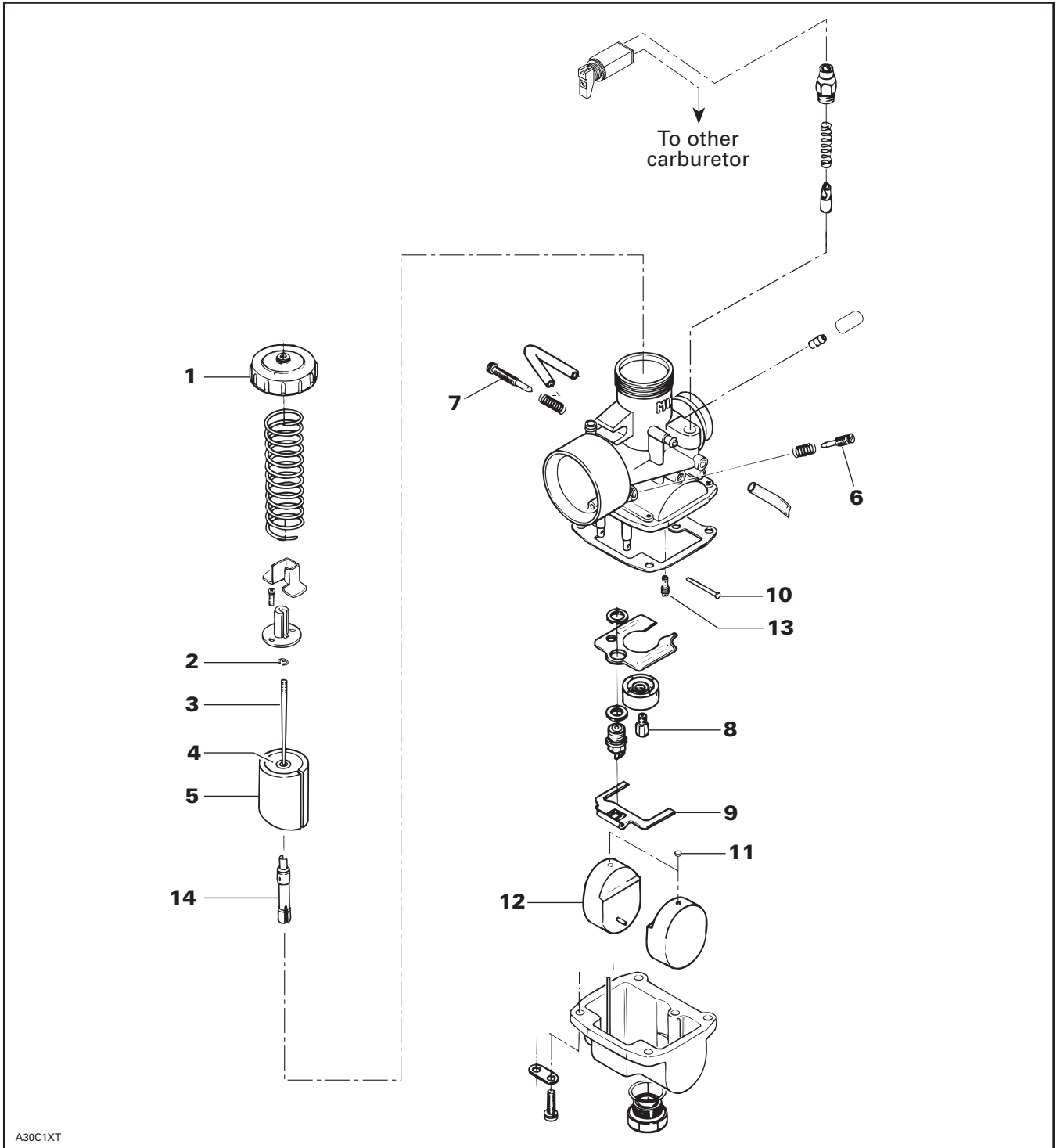


TYPICAL

CARBURETOR AND FUEL PUMP

CARBURETOR

VM Type



A30C1XT

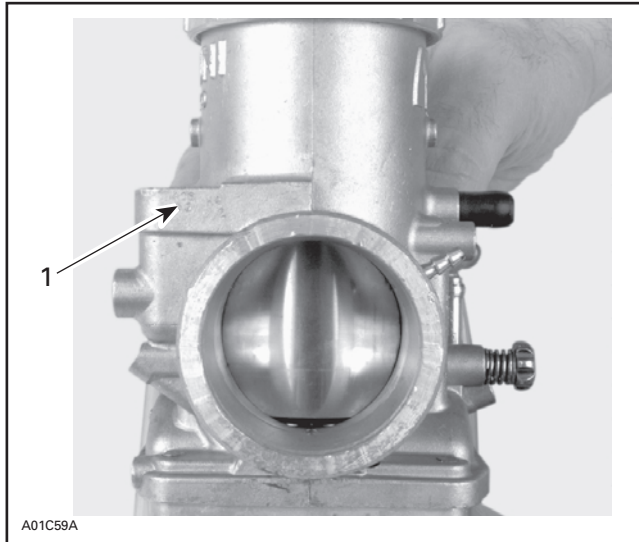
TYPICAL

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

IDENTIFICATION

All carburetors are identified on their body.



TYPICAL

1. Identification: 34-482

REMOVAL

Unfasten clamps then, remove air intake silencer from left hand side.

Disconnect fuel inlet lines.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

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.

Remove carburetors from engine.

Unscrew choke plunger from each carburetor.

CLEANING AND INSPECTION

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and jets should be cleaned in a carburetor cleaner following manufacturer's instructions.

⚠ WARNING

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

Check 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 idle speed screw straightness. Replace as necessary.

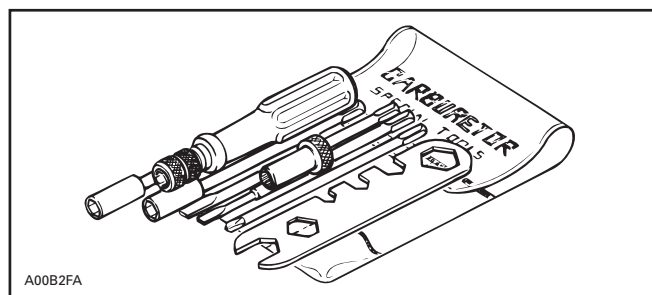
Check for fuel soaked into float no. 12; replace as necessary.

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).

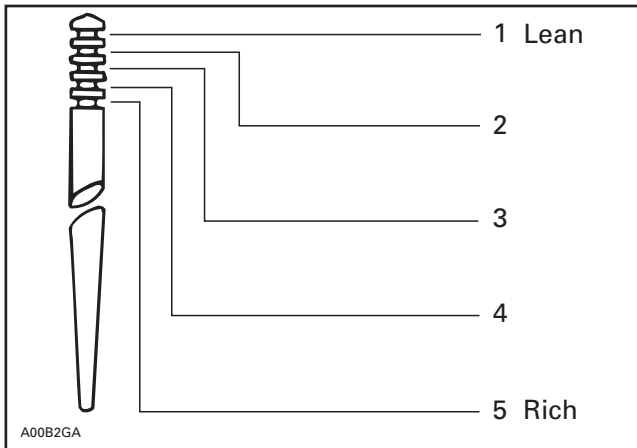
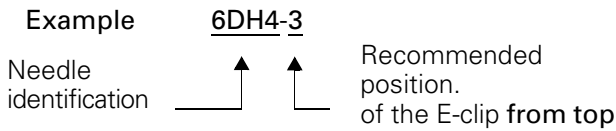


2,3, E-Clip and Needle

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 calibrated position of the E-clip **from the top** of the needle.



CLIP POSITIONS

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. A Service Bulletin will give information about calibration according to altitude and temperature.

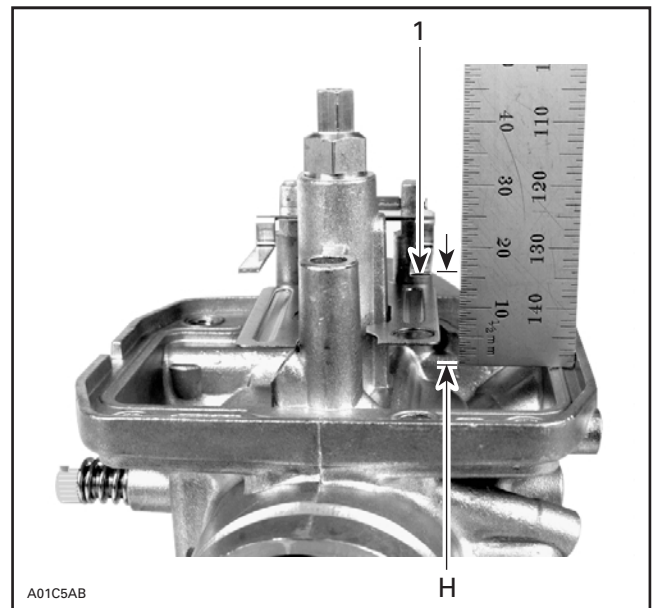
CARBURETOR FLOAT LEVEL ADJUSTMENT

CAUTION: Spark plugs will foul if float is adjusted too low. Engine may be damaged if float is adjusted too high.

9,10, Float Arm and Float Arm Pin

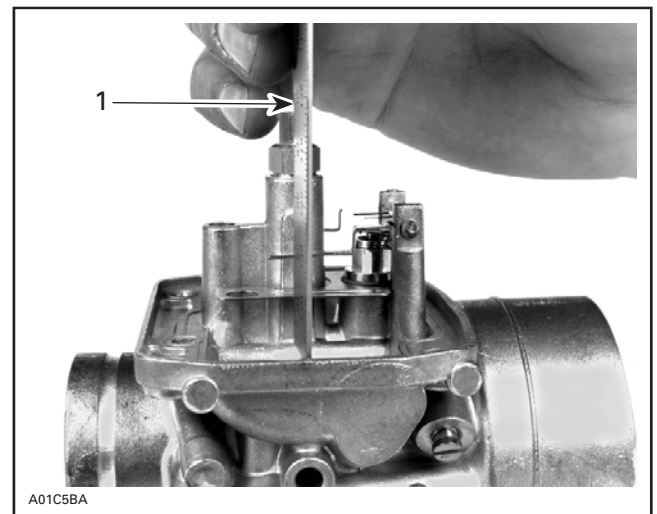
Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

- 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 — VM TYPE

- 1. Measure from top of float arm
- H: Float height (including float arm thickness)



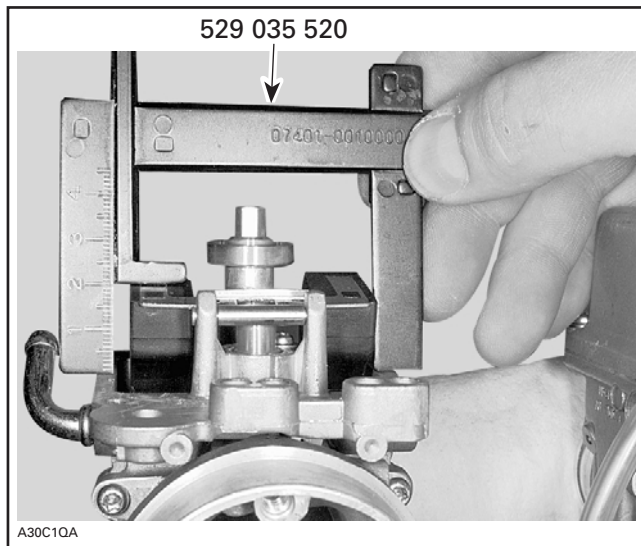
TYPICAL — VM TYPE

- 1. Ruler vertical and in line with main jet

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

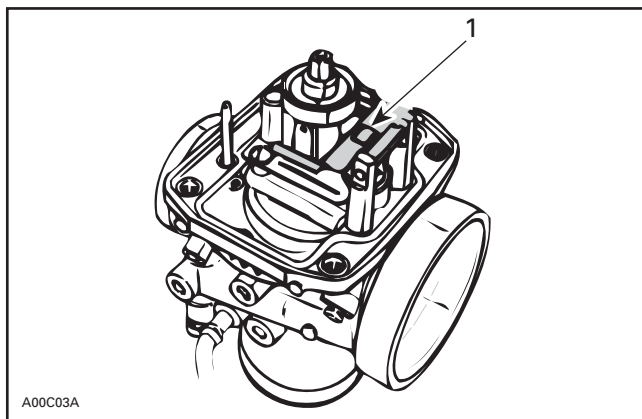
Float level height can be check using tool (P/N 529 035 520). Keep tool in line with main jet as explained above.



CARBURETOR IDENTIFICATION	FLOAT HEIGHT H	
	± 1 mm	(± .040 in)
VM 38-429	22.9	(.902)

To Adjust Height H

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



TYPICAL

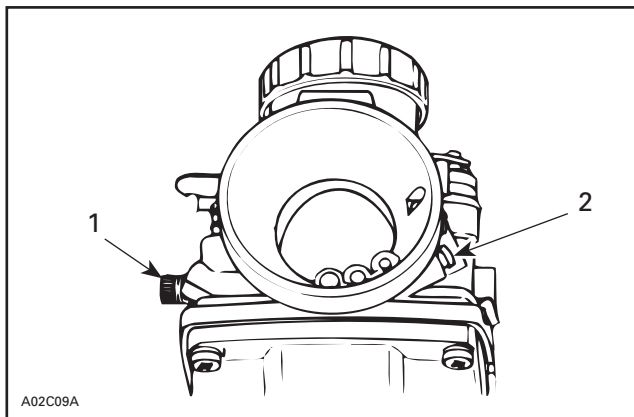
1. Contact tab

CARBURETOR ADJUSTMENTS

NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude and temperature.

Adjustments should be performed following this sequence:

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



1. Idle speed screw
2. Air screw

6, Air Screw Adjustment

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

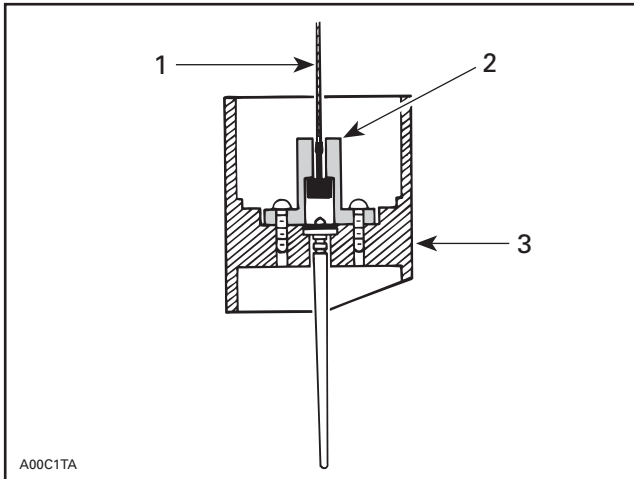
Turning screw in clockwise enrichens mixture and conversely, turning it out counterclockwise leans mixture.

Refer to TECHNICAL DATA for the specifications.

**Throttle Slide Height
(preliminary idle speed adjustment)**

Hook throttle cable into the needle retainer plate.

NOTE: Do not obstruct hole in throttle slide when installing needle retaining plate. This is important to allow air escaping through and thus allowing a quick response.

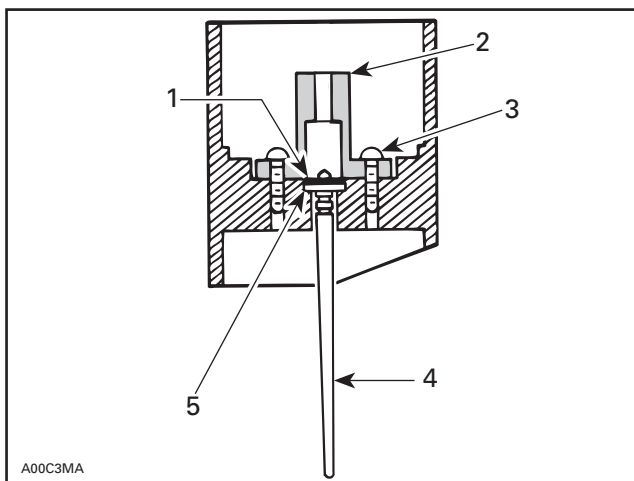


CENTER POST TYPE

- 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

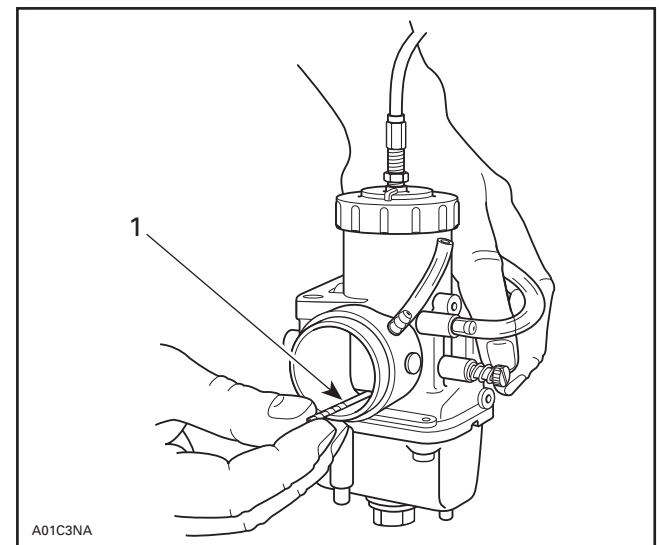
Using a drill bit adjust throttle slide height (see following table) by turning idle speed screw **no. 7**.

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.

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

MODELS	THROTTLE SLIDE HEIGHT ± 0.2 mm (± .008 in)
MX Z 500 Formula DLX 500 Grand Touring 500	1.4 (.055)



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.

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

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

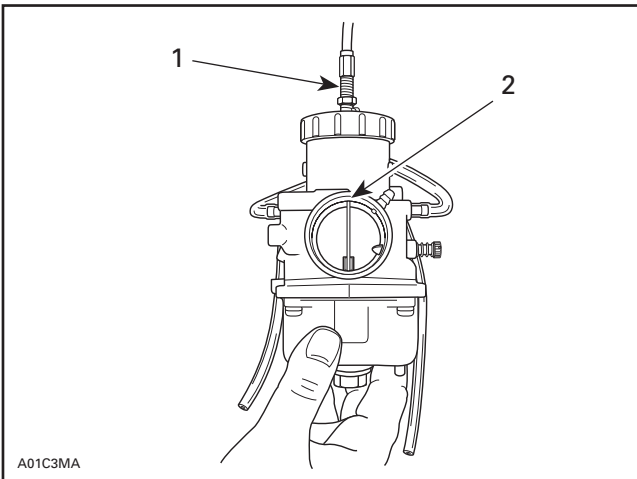
Ensure the engine is turned OFF, prior to performing the throttle cable adjustment.

Carburetors must be installed on engine and throttle cable properly routed.

For maximum performance, correct cable adjustment is critical.

At full opening throttle slide must be flush or 1.0 mm (.040 in) lower than the top of carburetor **outlet** bore (engine side). Use a mirror and look through air silencer.

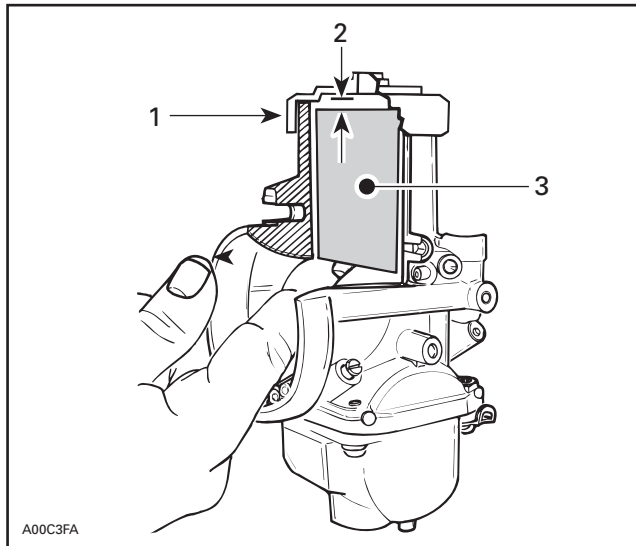
First loosen adjuster nut then turn throttle cable adjuster accordingly.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)

1. Throttle cable adjuster
2. Throttle slide flush or 1.0 mm (.040 in) lower than carburetor outlet bore (engine side)

Check that with the throttle lever fully depressed, there is a free play between the carburetor cover and top of throttle slide.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)

1. Cover
2. Free play
3. Throttle slide

⚠ WARNING

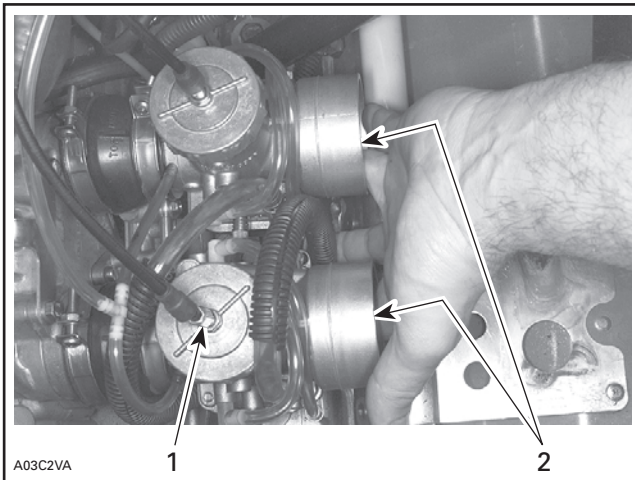
This gap is very important. If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

Carburetor Synchronization

When depressing throttle lever, both carburetor slides must start to open at same time.

Unlock cable adjustment lock nut on one carburetor.

Screw or unscrew cable adjuster until all carburetor slides start to open at same time. Cable play will be identical on all carburetors. Retighten jam nut.



TYPICAL

1. Screw or unscrew adjuster
2. Check that all slides start to open at the same time

Check throttle slide position at wide open throttle. Throttle slide must be flush or 1.0 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: Make sure all carburetors start to operate simultaneously.

Idle Speed Final Adjustment

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked after each time carburetor idle is adjusted. Refer to OIL INJECTION SYSTEM.

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.

Refer to TECHNICAL DATA for the specifications.

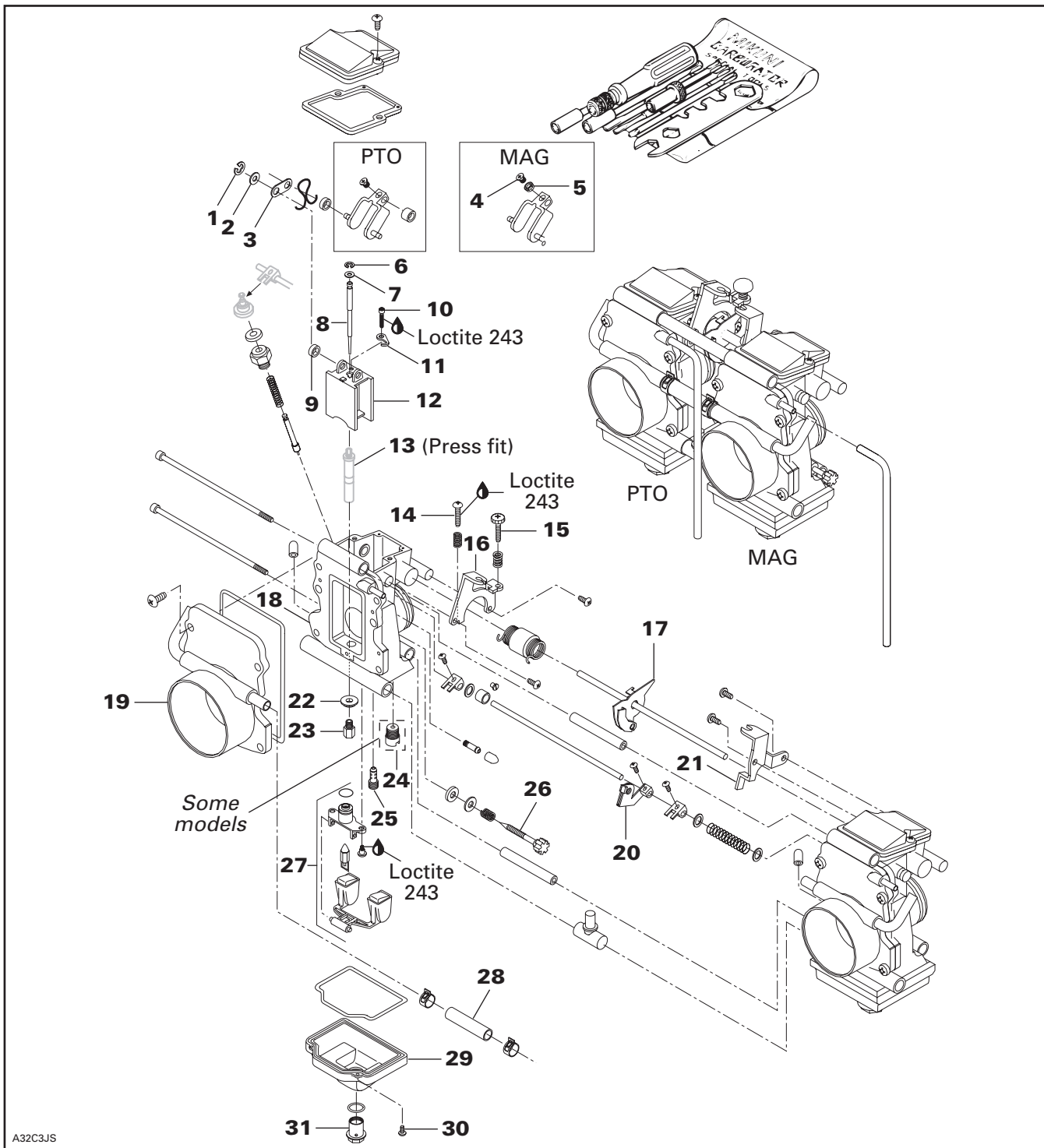
NOTE: Turn adjustment screw the same amount to keep carburetors synchronized.

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

Section 04 ENGINE

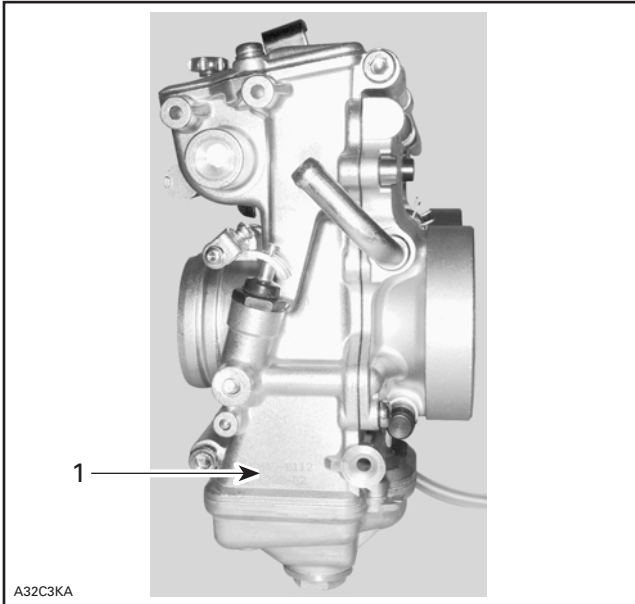
Subsection 08 (CARBURETOR AND FUEL PUMP)

TM Type



IDENTIFICATION

TM type dual carburetor ass'y is identified on PTO side carburetor body.



TYPICAL

1. Identification: TM 40-B112

REMOVAL

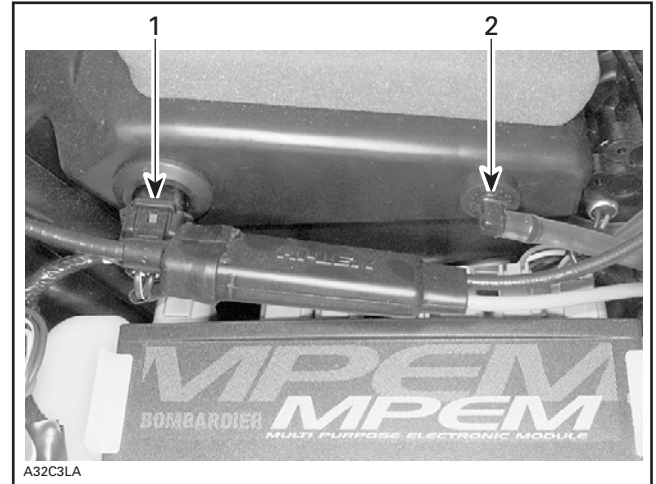
All Models

Lift hood.

DPM Models

Disconnect air temperature sensor connector at air silencer.

Disconnect DPM air vent hose nipple from air silencer.



DPM EQUIPPED MODELS

1. Air temperature sensor
2. DPM air vent hose nipple

Non-DPM Models

Disconnect carburetor float bowl vent hose nipple from air silencer.

DPM Models

Unhook DPM manifold from its supports.

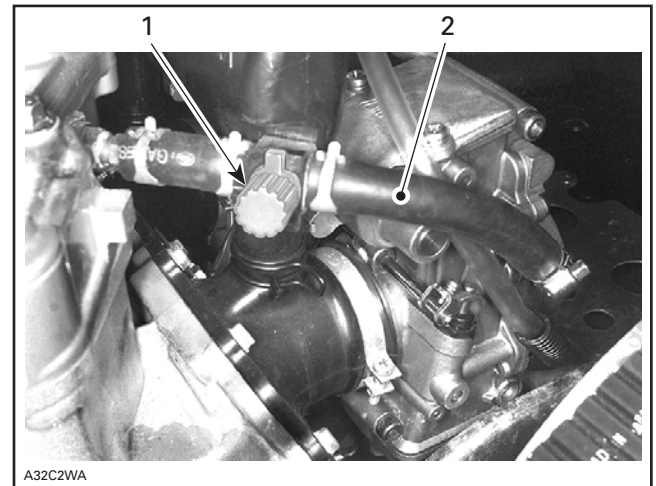
Remove DPM supports from air silencer.

All Models

Loosen clamps retaining air silencer adapter to carburetor assembly and remove air silencer.

Heated Carburetor Models

Close valve at heated carburetor coolant inlet line.

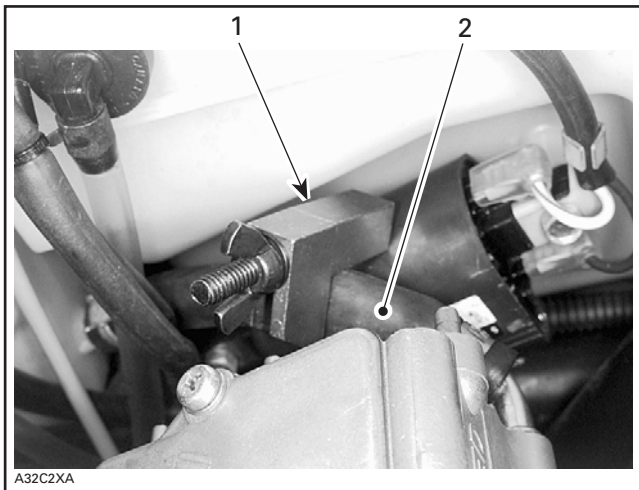


1. Valve
2. Inlet line

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

Pinch heated carburetor coolant outlet line.



1. Pincher (P/N 295 000 076)
2. Outlet line

Disconnect both lines from carburetor assembly taking care to recuperate coolant.

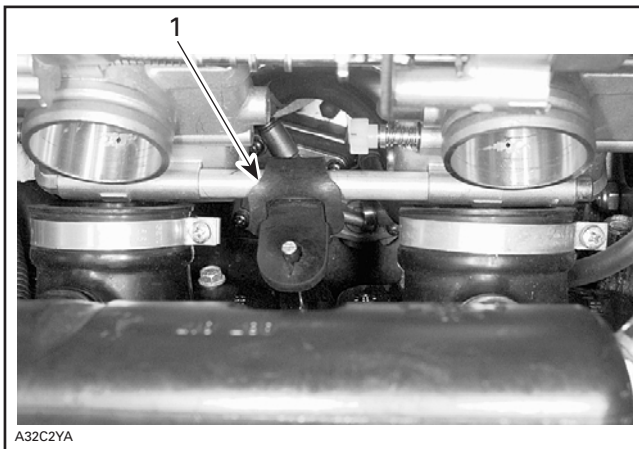
All Models

Disconnect throttle and choke cables.

Loosen clamps retaining dual carburetor assembly to carburetor sockets.

Gently slid out securing strap.

CAUTION: Securing strap between 2 carburetors has to be gently slid out to avoid breakage.



1. Securing strap

Remove dual carburetor assembly, pinch and disconnect fuel line. Take care to recuperate fuel.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

CLEANING AND INSPECTION

All Models

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. When jets are very dirty or coated with varnish and gum, replace them.

⚠ WARNING

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

Check throttle slide for wear. Replace as necessary.

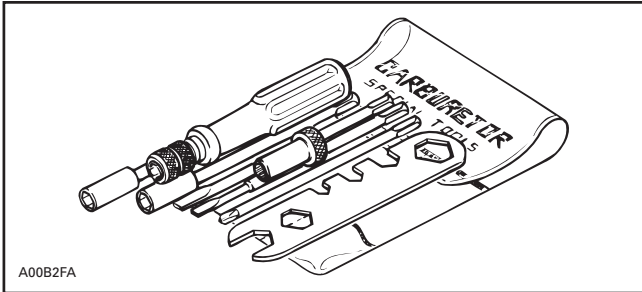
Check for fuel soaked into float no. 27; replace as necessary.

Check float for cracks or other damages affecting free movement; replace as necessary.

Inspect throttle and choke cables and housings 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).



29, Float Bowl

Unscrew drain screw **no. 31** and screw **no. 30**. Remove float bowl.

Some float bowls have an integrated starter jet **no. 24**. In these cases do not mismatch float bowl.

27, Float and Needle Valve Ass’y

Unfasten both screws then, pull out float and needle valve ass’y **no. 27**.

At assembly, apply Loctite 243 on screw threads.

23, 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. A Service Bulletin will give information about calibration according to altitude and temperature.

Main jet **no. 23** may be removed without removing float bowl **no. 29** by first removing drain screw **no. 31**. At installation, make sure to install brass washer **no. 22** underneath main jet.

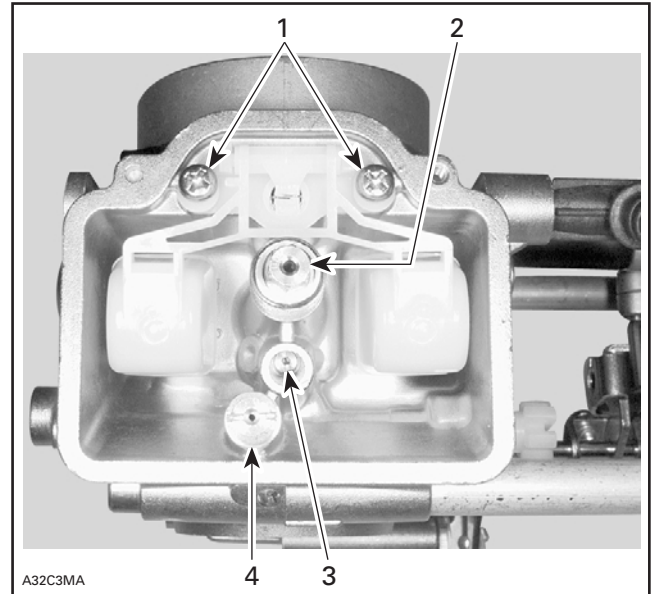
25, Pilot Jet

Use narrow screwdriver from carburetor tool kit (P/N 404 112 000) to unfasten pilot jet **no. 25**.

24, Starter Jet

Starter jet is part of choke system. Use a wide flat screwdriver for disassembly and assembly.

On some models there is no starter jet **no. 24**; instead, a hole in float bowl **no. 29** acts as a starter jet.



- 1. Float and needle valve ass’y screws
- 2. Main jet
- 3. Pilot jet
- 4. Starter jet located on carburetor body

12, Throttle Slide

Do not disassemble throttle slide needlessly.

CAUTION: After throttle slide reassembly, proceed with a leak test. See below for procedure.

Heated Carburetor Models

Disassemble both carburetors at the same time. Coolant hose between carburetor throttle slide covers must remain in place during the complete disassembly and assembly.

Section 04 ENGINE

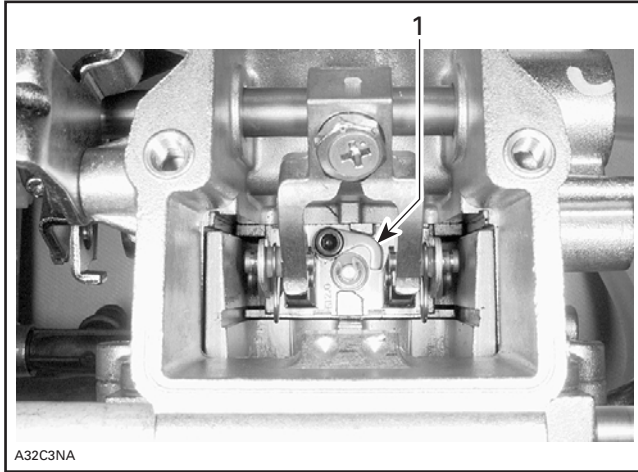
Subsection 08 (CARBURETOR AND FUEL PUMP)

All Models

Remove carburetor cover.

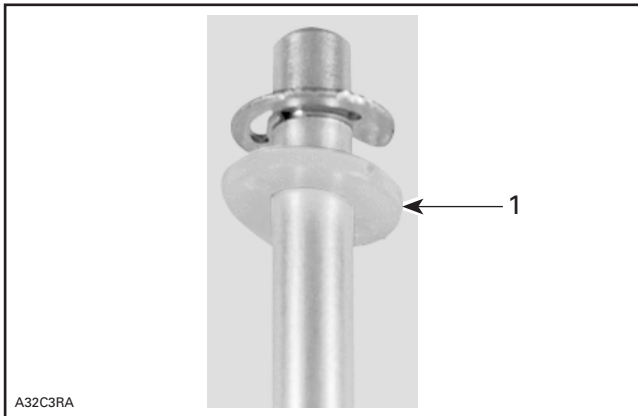
Loosen needle retainer screw no. 10.

Move aside needle retainer no. 11.



1. Needle retainer moved aside

Turn dual carburetor ass'y upside down to free needle no. 8. Take care not to loose plastic washer no. 7 under needle circlip no. 6.

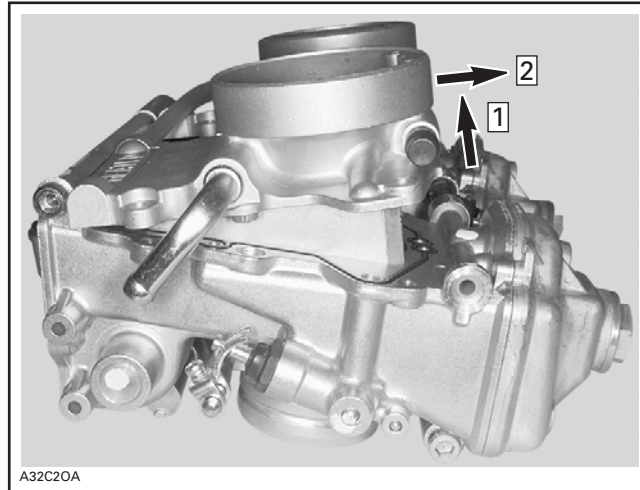


1. Plastic washer

Unscrew throttle slide cover no. 19 screws.

Open throttle 3/4 wide and keep that opening.

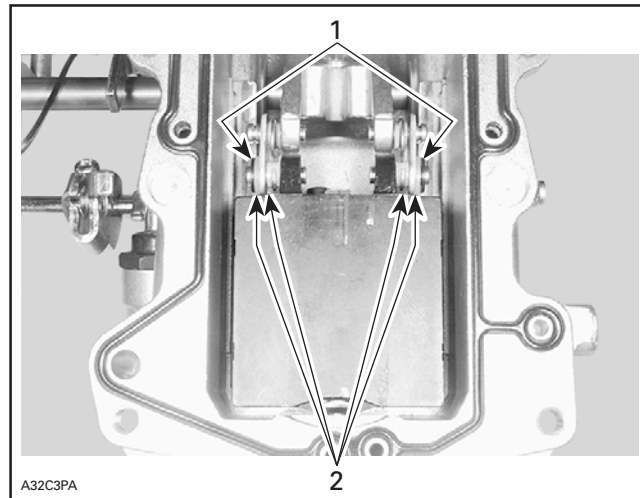
Lift throttle slide covers bottom first until there are free from carburetor bodies. Then, slide them out.



Step 1: Lift bottom first

Step 2: Slide out

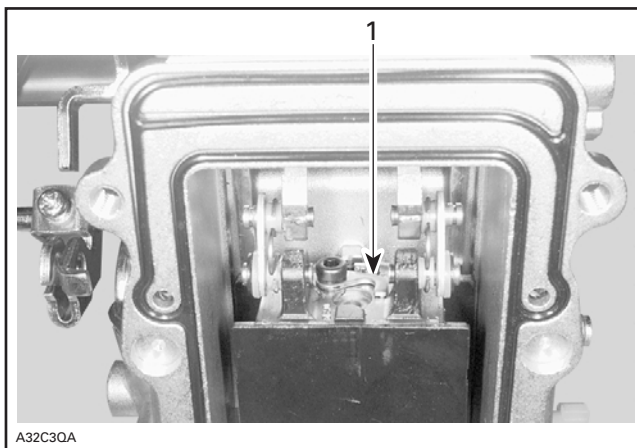
Remove both circlips no. 1 retaining throttle slide. Take care not to loose plastic washers nos. 2 and 9.



1. Circlips

2. Plastic washers

At throttle slide assembly, needle retainer must face carburetor body.



1. Needle retainer

Float Bowl Ventilation Leak Test

Plug fuel inlet line. Plug other carburetor ventilation nipple.

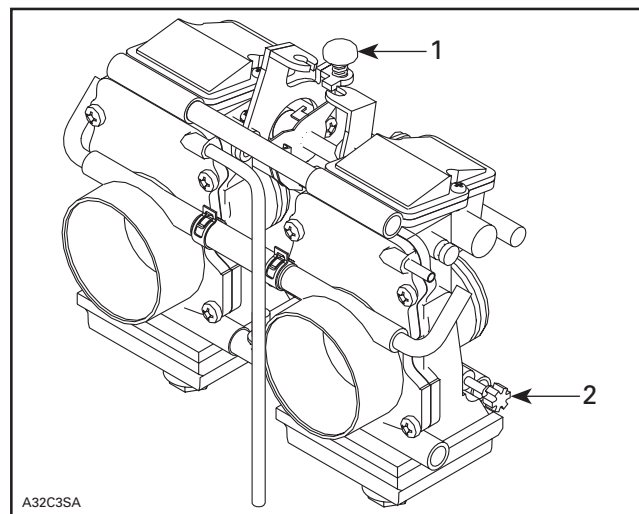
Connect a long tube to ventilation nipple on top side of throttle slide cover.

Float bowl ventilation circuit must hold a vacuum of 600 mm (24 in) of water.

CARBURETOR ADJUSTMENTS

Adjustments should be performed following this sequence:

- pilot screw adjustment
- carburetor synchronization and throttle slide height (preliminary idle speed adjustment)
- throttle cable adjustment
- choke cable adjustment
- oil pump and carburetor synchronization
- final idle speed adjustment (engine running).



1. Idle speed screw
2. Pilot screw (one on each carburetor)

Pilot Screw Adjustment

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

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

Refer to TECHNICAL DATA for the specifications.

Carburetor Synchronization and Throttle Slide Height (preliminary idle speed adjustment)

Remove MAG side carburetor cover.

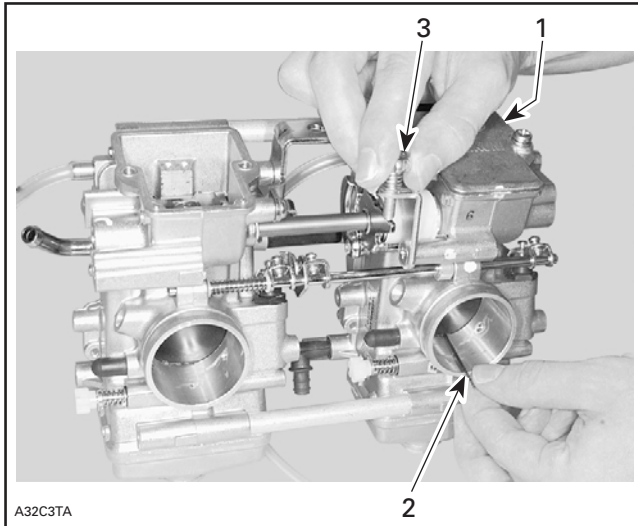
First proceed on PTO carburetor.

Using a drill bit to measure throttle slide height (see following table) on **outlet** side of carburetor (engine side).

Section 04 ENGINE

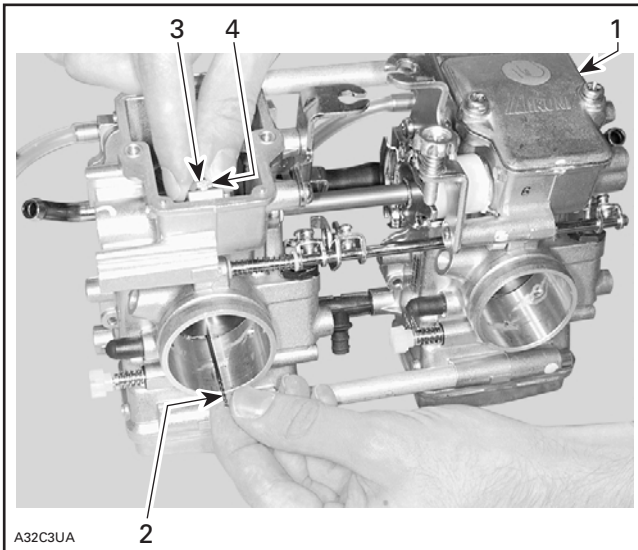
Subsection 08 (CARBURETOR AND FUEL PUMP)

Adjust by turning idle speed screw no. 15.



1. Adjust PTO carburetor first
2. Drill used as a gauge to measure throttle height
3. Idle speed screw

For MAG carburetor loosen locking screw. Use same drill bit as for PTO carburetor to measure throttle slide height. Turn adjusting nut to adjust.



1. PTO carburetor adjusted first
2. Drill used as a gauge to measure throttle height
3. Locking screw
4. Adjusting nut

Tighten locking screw and recheck throttle height.

NOTE: By adjusting both throttle slides at same height TM carburetors synchronization is done at same time.

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly.

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

MODELS	THROTTLE SLIDE HEIGHT ± 0.2 mm (± .008 in)
MX Z 600 Summit 700	1.8 (.071)
Grand Touring 600 Formula DLX 600/GSE	1.8 (.071)
Summit 600/800	2.2 (.087)
Formula DLX 700 GS/GSE MX Z 700 Grand Touring 700 GS	1.5 (.059)
MX Z 800	1.7 (.067)

INSTALLATION

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

Install dual carburetor assembly making sure to align securing strap in its bracket.

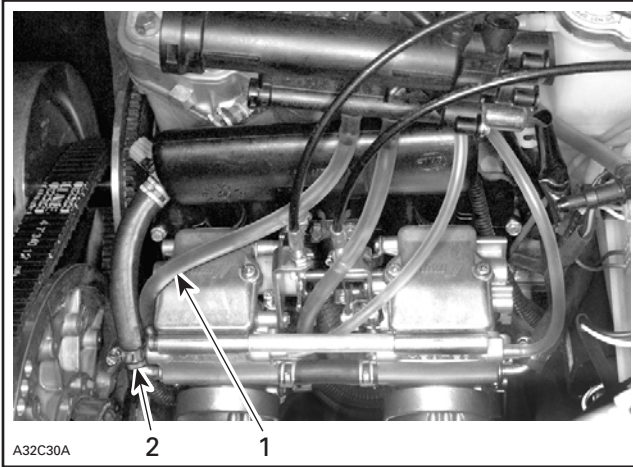
Make sure dual carburetor assembly is properly inserted into carburetor sockets, hold it in place and tighten retaining clamps.

Secure heated carburetor inlet and outlet lines with clamps, tighten to 1.5 to 2.0 N•m (13 to 18 lbf•in) and remove pincher on outlet line.

Allow coolant to flow from coolant tank to carburetor before opening valve.

Connect all hoses to dual carburetor assembly and to DPM, making sure there is no kinked hoses after reconnection.

NOTE: Left side DPM hose must be routed under heated carburetor coolant inlet hose.



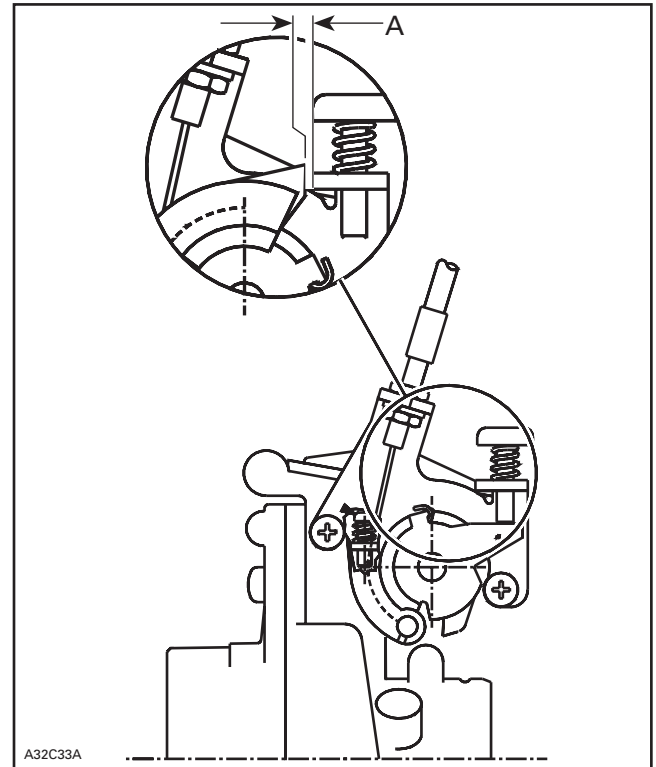
1. Left side DPM hose
2. Heated carburetor coolant inlet hose

Throttle Cable Adjustment

Adjust throttle cable as per following procedure:
Loosen throttle cable housing adjusting and locking nuts.

Connect throttle cable barrel to carburetor cam lever **no. 17**.

While holding throttle lever to wide open throttle position, pull on the throttle cable until cam lever touches the stopper **no. 16**. In this position, tighten cable housing adjusting and locking nuts. As a confirmation, the gap should be in between 0.5 and 1 mm (1/64 and 1/32 in).



A. Between 0.5 and 1 mm (1/64 and 1/32 in)

Choke Cable Adjustment

Adjust choke cable as per following procedure:

Loosen choke cable housing adjusting and locking nuts.

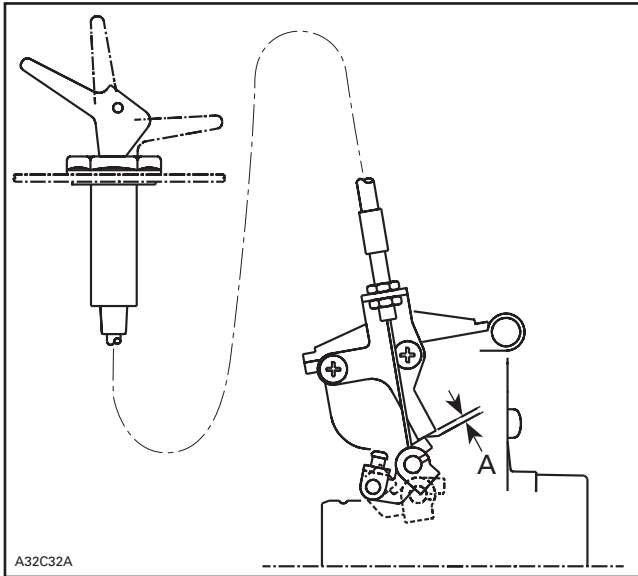
Connect choke cable on starter lever **no. 20**.

While choke lever is fully open, adjust choke cable until starter lever reaches the stopper. Tighten cable housing adjusting and locking nuts in this position.

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

As a confirmation, the gap between the stopper and the bracket should be in between 0 and 0.5 mm (0 and 1/64 in).



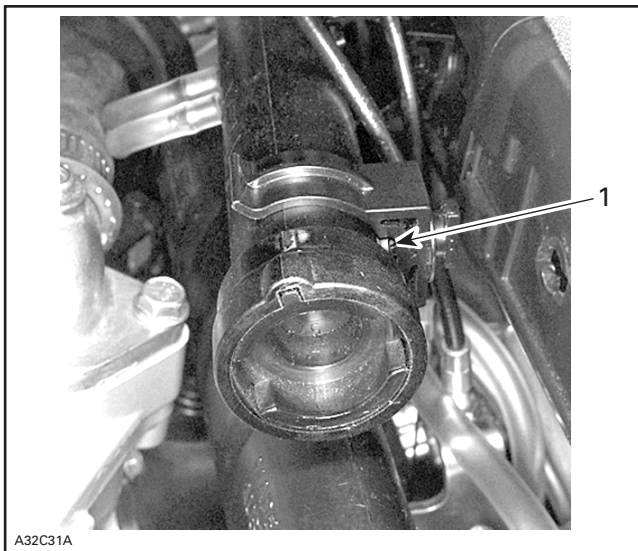
A. Between 0 and 0.5 mm (0 and 1/64 in)

Reinstall air silencer and DPM.

Reconnect DPM air vent hose at air silencer.

Make sure dual carburetor assembly properly slides into air silencer adapters; hold it in place and tighten clamps.

NOTE: DPM must be installed with its protrusion in higher support slot.



1. Protrusion in higher support slot

Reconnect DPM air vent hose nipple to air silencer.

Reconnect air temperature sensor connector to air silencer.

Idle Speed Final Adjustment

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked after each time carburetor idle is adjusted. Refer to OIL INJECTION SYSTEM.

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.

Refer to TECHNICAL DATA for the specifications.

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

DPM

Some Models

TESTING

MPEM

Solenoid is supplied by the MPEM. If this MPEM does not work, there will be no current on the compensation solenoid.

Air temperature sensor must be at room temperature. Operate the engine at 4000 RPM. The solenoid must vibrate.

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

Dynamic Test

Air temperature sensor must be at room temperature. Operate the engine at 3500 RPM. The solenoid must vibrate.

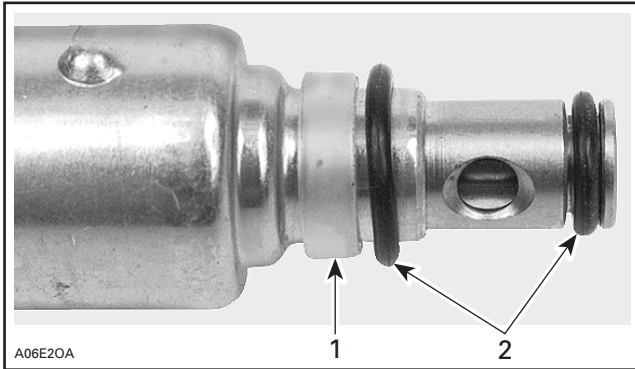
Air Temperature Sensor

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

PARTS REMOVAL AND INSTALLATION

Solenoid

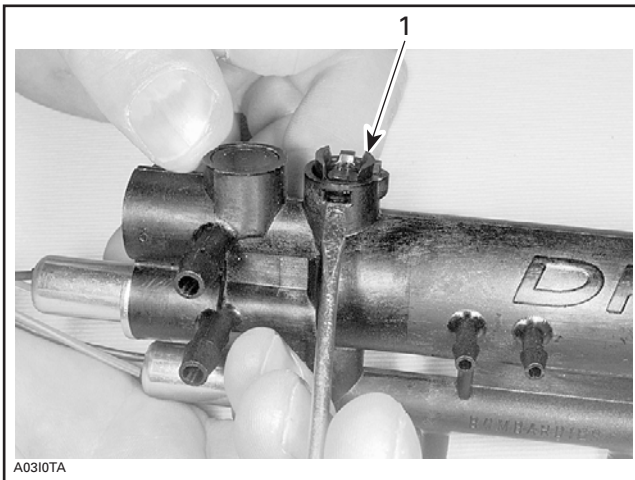
At reassembly, ensure that solenoid seals are in place.



- 1. Plastic seal
- 2. O-rings

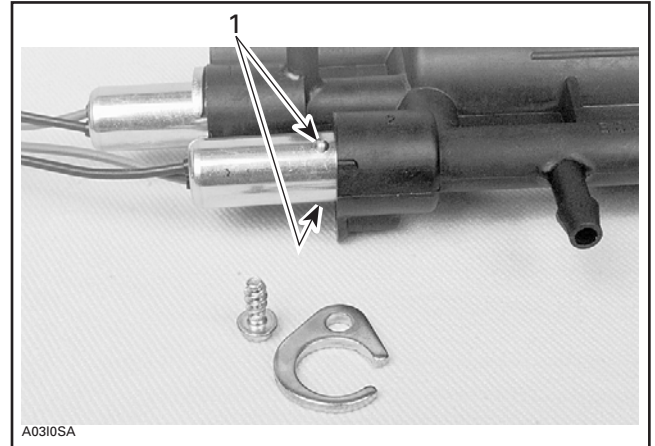
Installation of compensation solenoid must be done as follows:

Remove transfer gallery plug by pushing 2 tabs.



- TYPICAL**
- 1. Transfer gallery plug

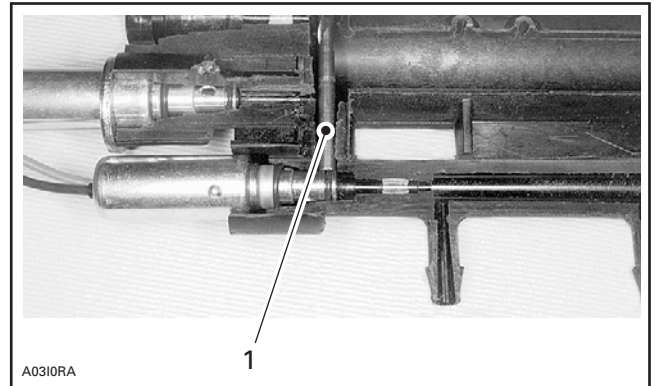
Partially insert compensation solenoid into DPM manifold.



- TYPICAL**
- 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 maintaining a pressure on drill bit. This will guide the solenoid O-ring.



- TYPICAL — CUT-AWAY**
- 1. Drill bit round end guiding solenoid O-ring

DPM MANIFOLD LEAK TESTING

Disconnect all carburetor venturi hoses from DPM. Plug one venturi inlet nipple.

Proceed with air tightness test by connecting tester onto the other nipple; must hold 35 kPa (5 PSI) vacuum for 10 seconds.

Repair leaks (if any).

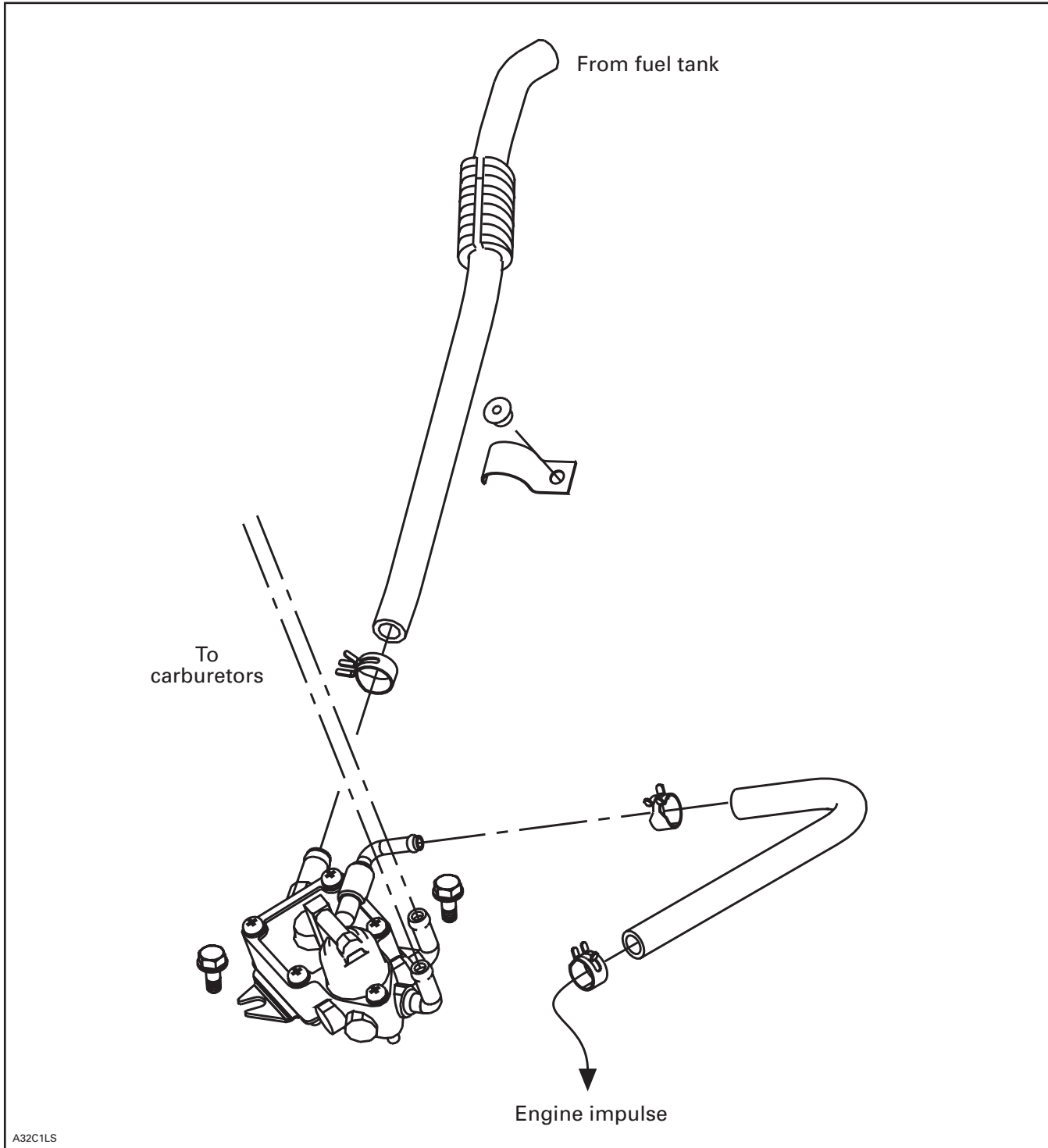
Reconnect carburetor venturi hoses to DPM.

Section 04 ENGINE

Subsection 08 (CARBURETOR AND FUEL PUMP)

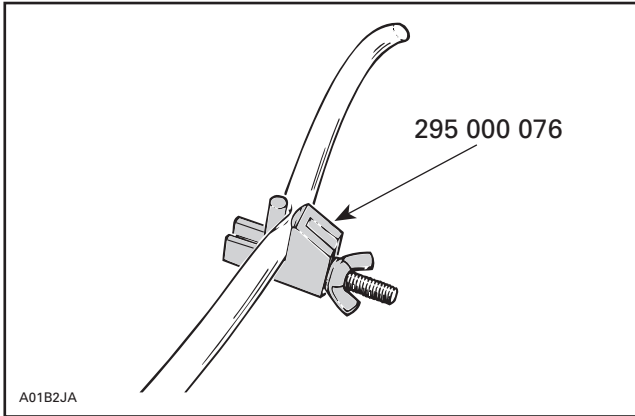
FUEL PUMP

All Models



REMOVAL

Install a hose pincer (P/N 295 000 076) on fuel supply line close to pump inlet.



- Disconnect fuel outlet line(s).
- Disconnect impulse line.
- Remove screws securing fuel pump to chassis.

PUMP VERIFICATION

Check fuel pump valves operation as follows:

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

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

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

Check impulse diaphragm and gasket on 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 on so equipped models. 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.

INSTALLATION

Inverse removal procedure.

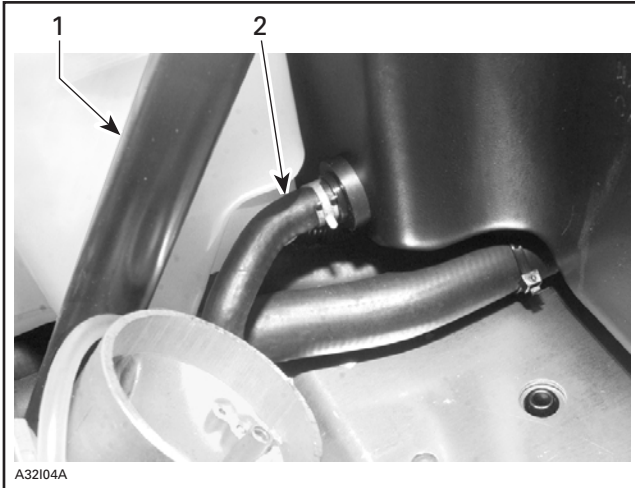
WARNING

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

FUEL TANK AND THROTTLE CABLE

Fuel Tank

After draining fuel tank, unplug fuel line.

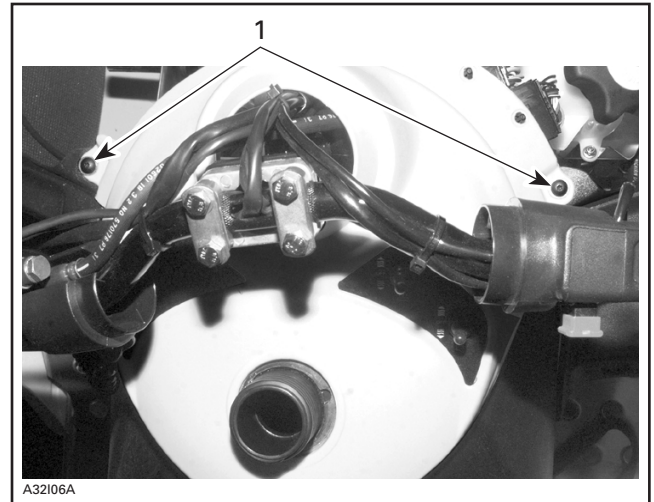


- 1. Steering column
- 2. Fuel line

Remove console nut using console nut key (P/N 529 035 603).



Unscrew console and move it toward front.

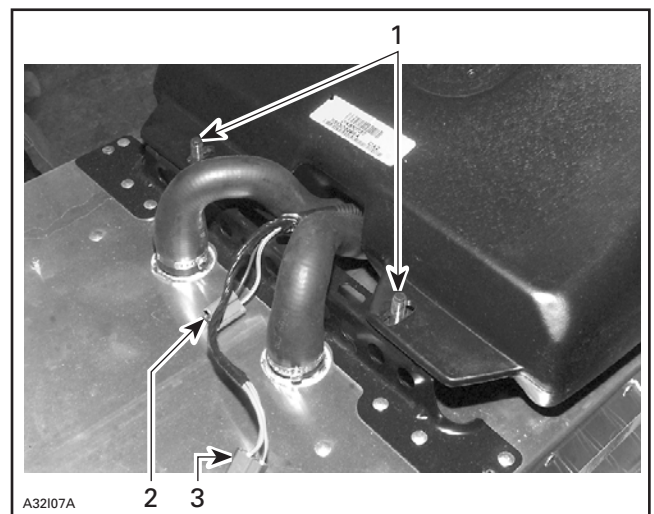


- 1. Remove these screws

Open storage compartment at rear of seat. Remove nuts and washers retaining rear of seat then move seat rearward.

Disconnect taillight connector housing located between seat and fuel tank.

Remove seat then unbolt rear of fuel tank. Unplug electric fuel level gauge on so equipped models.

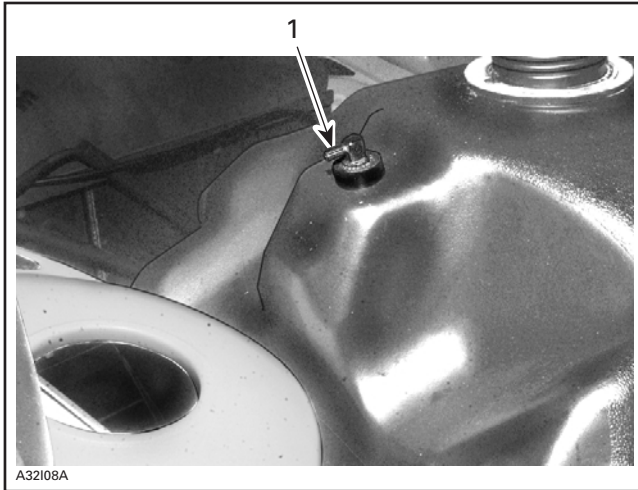


- 1. Nuts retaining rear of fuel tank removed
- 2. Connector housing of electric fuel level gauge
- 3. Connector housing of taillight

Section 04 ENGINE

Subsection 09 (FUEL TANK AND THROTTLE CABLE)

Move fuel tank rearward then, unplug vent tube from vent fitting at top front of fuel tank.

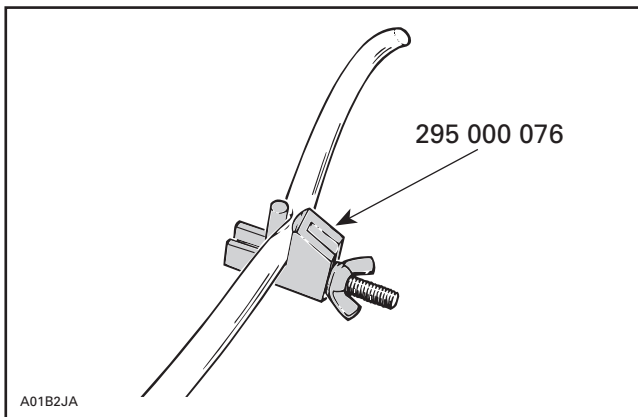


1. Vent fitting

Fuel Tank Lines

⚠ WARNING

Whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or equivalent device. Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.



Impulse/Fuel Lines Spring Clips (all models)

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

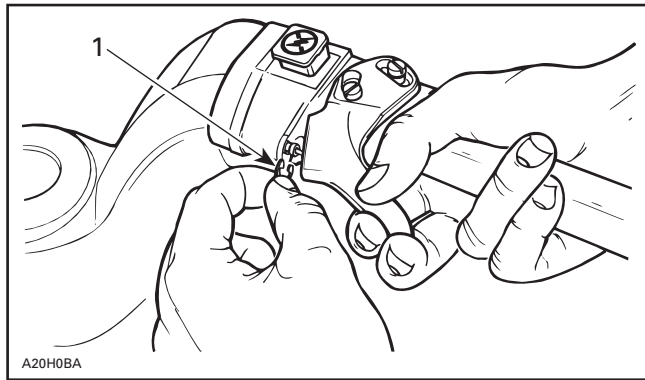
Throttle Cable Circlip at Handlebar (all models)

Put silicone grease (P/N 293 550 004) 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.

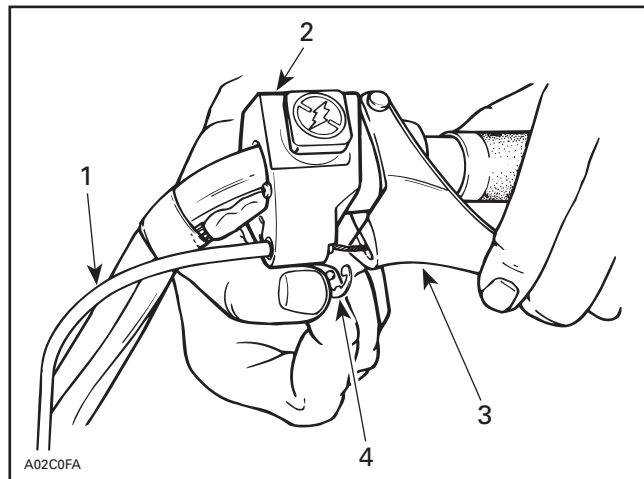
Models with Easy Action Throttle Lever



TYPICAL

1. Circlip

Other Models



TYPICAL

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

Adjust throttle cable as specified in CARBURETOR AND FUEL PUMP.

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

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.

Fuse Replacement

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

Fuel Level Sensor Screws

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.

