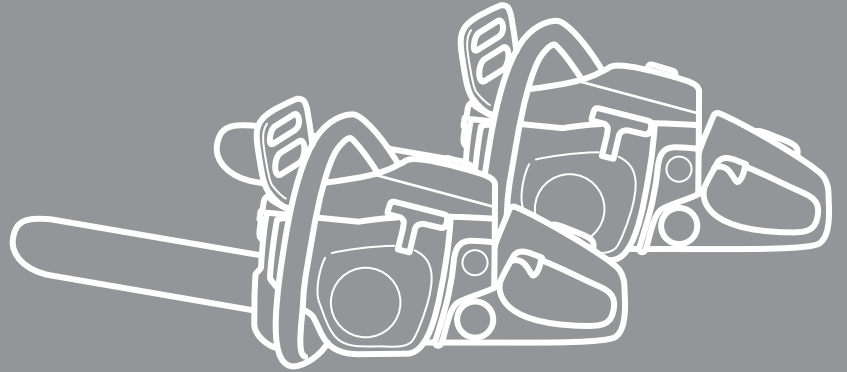


# **ECHO**®



## **SERVICE MANUAL**

**CS-370ES**  
**CS-420ES**

## INTRODUCTION

This service manual contains information for service and maintenance of **ECHO CHAIN SAW**, model **CS-370ES, CS-420ES**.

For systematic diagnosis, to avoid extra work, time loss and to meet Emission regulation, please refer to "Troubleshooting guide" that describes problems, testing, remedies and references. We recommend you make use of Operator's Manual and Parts Catalog together with this manual when servicing.

We are constantly working on technical improvement of our products. For this reason, technical data, equipment and design are subject to change without notice. All specifications, illustrations and directions in this manual are based on the latest products information available at the time of publication.

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## 1 SERVICE INFORMATION

## 1-1 Specifications

Model		CS-370ES	CS-420ES	
Dimensions	Length*	393 (15.5)		
	Width	245 (9.6)		
	Height	277 (10.9)		
Dry weight*	kg(lb)	4.6 (10.1)	4.6 (10.1)	
Engine	Type	KIORITZ, air-cooled, two-stroke, single cylinder		
	Rotation	Clockwise as viewed from the output end		
	Displacement	cm <sup>3</sup> (in <sup>3</sup> )	36.3 (2.22)	40.2 (2.45)
	Bore	mm(in)	38.0 (1.50)	40.0 (1.58)
	Stroke	mm(in)	32.0 (1.26)	32.0 (1.26)
	Compression ratio		7.6	6.5
Carburetor	Type	Diaphragm horizontal-draft, with auto-return choke**		
	Model	Walbro WT-820A		
	Venturi size-Throttle bore	mm(in)	13.5 - 15.85 (0.532 - 0.624)	
Ignition	Type	Digital magneto : CDI system		
	Spark plug	BPMR8Y		
Starter	Type	ES (effortless)-start		
	Rope diameter x length	mm(in)	3.0 x 950 (0.12 x 37.4)	
Fuel	Type	Premixed two-stroke fuel		
	Mixture ratio	50 : 1 (2 %)		
	Gasoline	Minimum 89 octane gasoline		
	Two-stroke air cooled engine oil	ISO-L-EGD (ISO/CD13738), JASO M345-FC/FD		
	Tank capacity	L (U.S.fl.oz.)	0.41 (13.9)	
Clutch	Type	Centrifugal, 3-shoe slide with 3-tension spring		
Guide bar / Saw chain lubrication type		Automatic with volume adjuster		
Oil	Tank capacity	L (U.S.fl.oz.)	0.28 (9.5)	
Auto oiler	type	Clutch related type		
Sprocket	Type	Spur		
	Number of teeth	6	7	
	Pitch	in	3/8	0.325

\* Without guide bar and saw chain.

\*\* Auto-return choke is on switch bracket.

Cutting devices		CS-370ES		
Guide bar	Part No.	30RC50M-3/8	35RC50M-3/8	
	Called length	cm	30	35
	Gauge	in	0.050	
Saw chain	Type	OREGON 91VG		
	Number of drive links	47	53	
	Pitch	in	Low profile 3/8	
	Gauge	in	0.050	

1-1 Specifications (continued)

Cutting devices		CS-420ES	
Guide bar	Part No.	38RD58-325	43RD58-325
	Called length	cm	38
	Gauge	in	0.058
Saw chain	Type	CARLTON K2L	OREGON 21BP
	Number of drive links	64	72
	Pitch	in	0.325
	Gauge	in	0.058

1-2 Technical data

Model	CS-370ES	CS-420ES	
<b>Engine</b>			
Idling speed	rpm	2400 - 2900	
Wide open throttle speed*	rpm	11500 - 12500	
Clutch engagement speed	rpm	3800 - 4300	
Compression pressure	MPa (kgf/cm <sup>2</sup> ) (psi)	1.02 (10.4) (148)	
<b>Ignition system</b>			
Spark plug gap	mm(in)	0.6 - 0.7 (0.024 - 0.028)	
Minimum secondary voltage at 1000 rpm	kV	15	
Secondary coil resistance	kΩ	1.5 - 2.2	
Pole shoe air gaps	mm(in)	0.3 - 0.4 (0.012 - 0.016)	
Ignition timing	at 3,000 rpm	°BTDC	10
	at 8,000 rpm	°BTDC	32
	at 10,000 rpm	°BTDC	34
	at 12,000 rpm	°BTDC	15
<b>Carburetor</b>			
Idle adjust screw initial setting	turns in**	1 5/8	
L mixture needle initial setting	turns back	1 1/4	
H mixture needle initial setting	turns back	2 3/8	
Test Pressure, minimum	MPa (kgf/cm <sup>2</sup> ) (psi)	0.05 (0.5) (7.0)	
Metering lever height	mm(in)	1.65 (0.06) lower than diaphragm seat	
Chain oil discharge volume at 7000 rpm	mL/min(U.S.fl.oz./min)	Adjustable : 1.5 - 13 (0.05 - 0.40) (Factory set 7 mL/min)	

BTDC: Before top dead center.

\* With 35/38 cm guide bar and saw chain.

\*\* Set idle adjust screw to contact throttle plate before initial setting.

## 1-3 Torque limits

Descriptions		Size	kgf•cm	N•m	in•lbf
Starter system	Starter pawl	M5	40 - 60	4 - 6	35 - 50
	Starter case	M5**	25 - 35	2.5 - 3.5	22 - 30
Ignition system	Magneto rotor (Flywheel)	M8	250 - 290	25 - 29	220 - 250
	Ignition coil	M5	40 - 60	4 - 6	35 - 50
	Ignition switch	M14	15 - 30	1.5 - 3	13 - 26
	Spark plug	M14	150 - 170	15 - 17	130 - 150
Fuel system	Carburetor	M5	30 - 45	3 - 4.5	26 - 40
	carburetor elbow	M5**	20 - 30	2 - 3	17 - 26
	Intake bellows	M5	30 - 45	3.0 - 4.5	26 - 40
Clutch	Clutch hub	LM10	300 - 400	30 - 40	260 - 350
Engine	Crankcase***	M5*	70 - 110	7 - 11	60 - 95
	Engine mount	M5	70 - 110	7 - 11	60 - 95
	Muffler	M5	80 - 110	8 - 11	70 - 95
	Cylinder cover	M5	25 - 45	2.5 - 4.5	22 - 40
Others	Auto-oiler	M4	20 - 35	2.5 - 3.5	17 - 30
	Front handle	M5**	45 - 65	4.5 - 6.5	40 - 55
	Rear handle assembly	M5	30 - 50	3 - 5	26 - 45
		M4	35 - 50	3.5 - 5	30 - 45
	Handle lid	M4	10 - 20	1 - 2	9 - 17
	Brake lever (Hand guard)	M5**	10 - 20	1 - 2	9 - 17
		M4**	45 - 65	4.5 - 6.5	40 - 55
	Sprocket guard plate	M4**	10 - 20	1 - 2	9 - 17
	Chain catcher	M5	45 - 60	4.5 - 6	40 - 52
	Guide bar	M8	200 - 230	20 - 23	175 - 200
Regular bolt, nut, and screw	M3	6 - 10	0.6 - 1	5 - 9	
	M4	15 - 25	1.5 - 2.5	13 - 22	
	M5	25 - 45	2.5 - 4.5	22 - 40	
	M6	45 - 75	4.5 - 7.5	40 - 65	

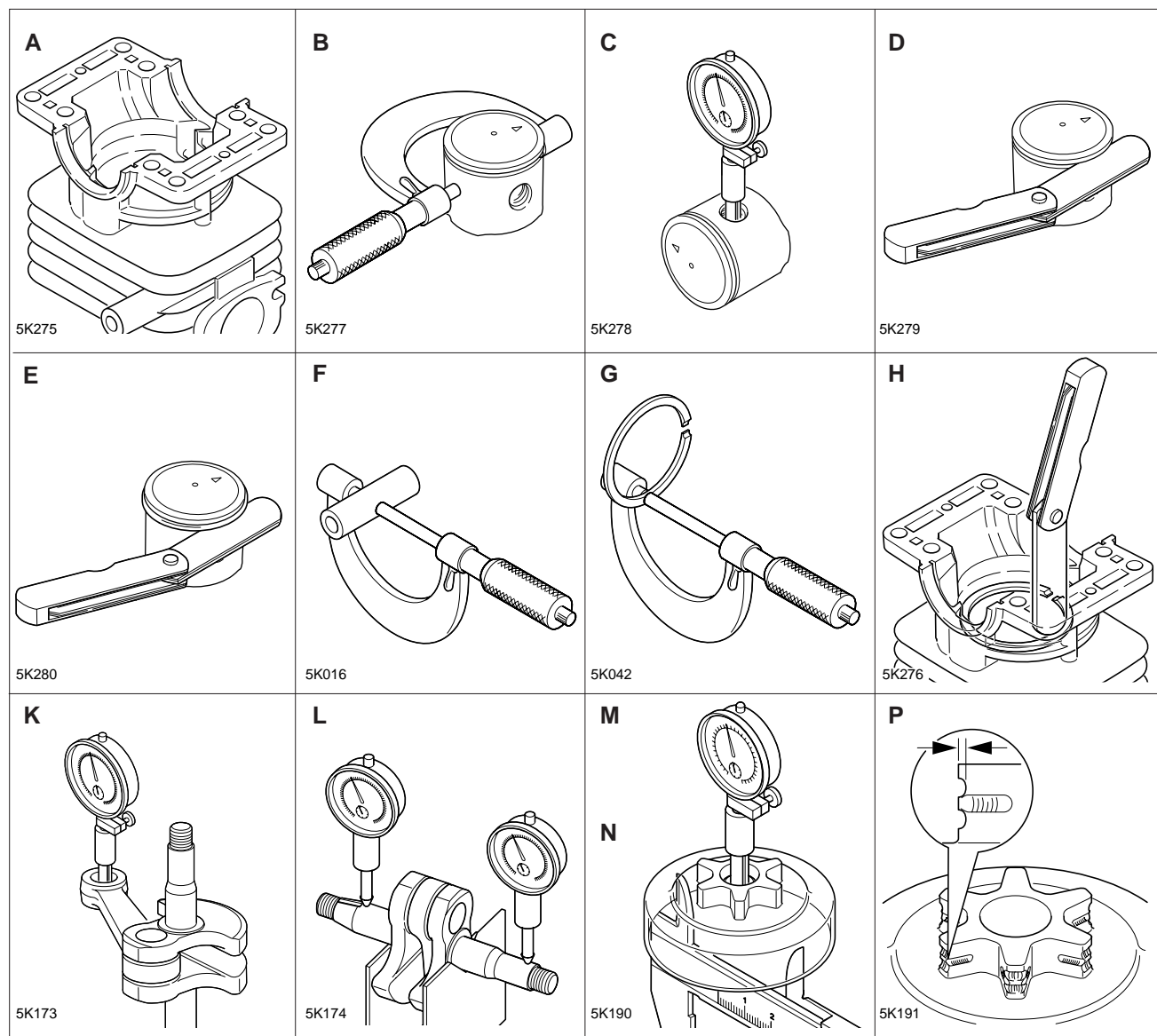
LM: Left-hand thread \*Apply thread locking sealant (See below) \*\* Tapping screw

\*\*\* The torque differences among four bolts should not exceed 20 kgf•cm (2N•m, 17in•lbf) on crankcase

## 1-4 Special repairing materials

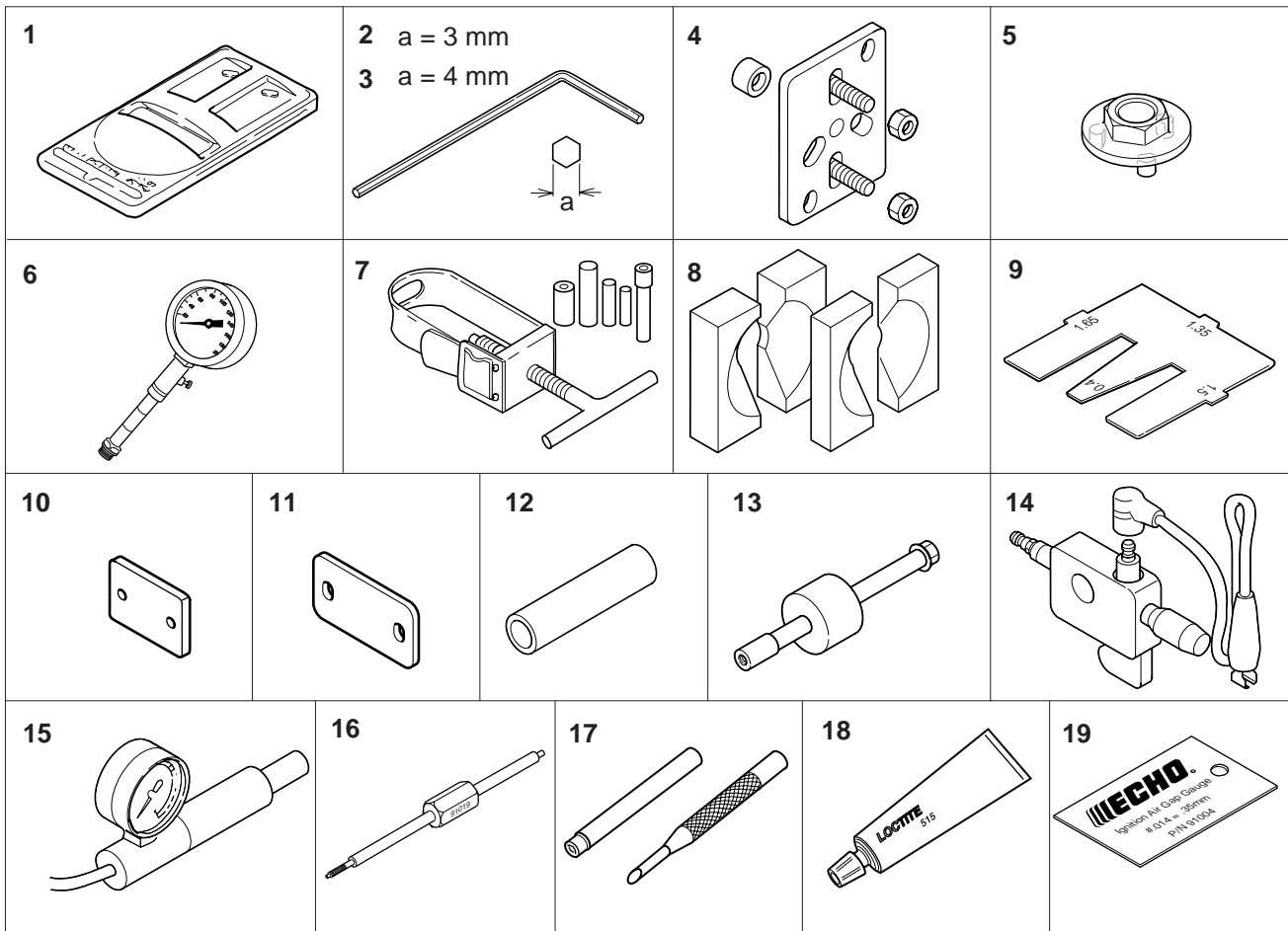
Material	Location	Remarks
Adhesive	Ball bearing outer / crankcase	Loctite #675 or equivalent
	Pulse pipe joint	
	Cushions	Loctite #424, ThreeBond #1741 or equivalent
Liquid gasket	Crankcase seams	Loctite #515 or equivalent
Grease	Auto-oiler worm	Lithium based grease
	Clutch needle bearing	
	Handle cushions	
	Rewind spring	
	Starter center shaft	
	Chain brake (metal contact part)	Molybdenum grease (approx. 1 gram)

1-5 Service Limits



Description		mm (in)	
		CS-370ES	CS-420ES
A	Cylinder bore	When plating is worn and aluminum can be seen	
B	Piston outer diameter	Min. 37.91 (1.493)	39.89 (1.570)
C	Piston pin bore	Max. 9.075 (0.3573)	9.030 (0.3555)
D	Piston ring groove	Max. 1.6	(0.063)
E	Piston ring side clearance	Max. 0.1	(0.004)
F	Piston pin outer diameter	Min. 8.98	(0.3535)
G	Piston ring width	Min. 1.45	(0.057)
H	Piston ring end gap	Max. 0.5	(0.02)
K	Con-rod small end bore	Max. 12.025	(0.4734)
L	Crankshaft runout	Max. 0.05	(0.002)
M	Sprocket bore	Max. 13.07	(0.5146)
N	Clutch drum bore	Max. 71.5	(2.81)
P	Sprocket wear limit	Max. 0.5	(0.02)

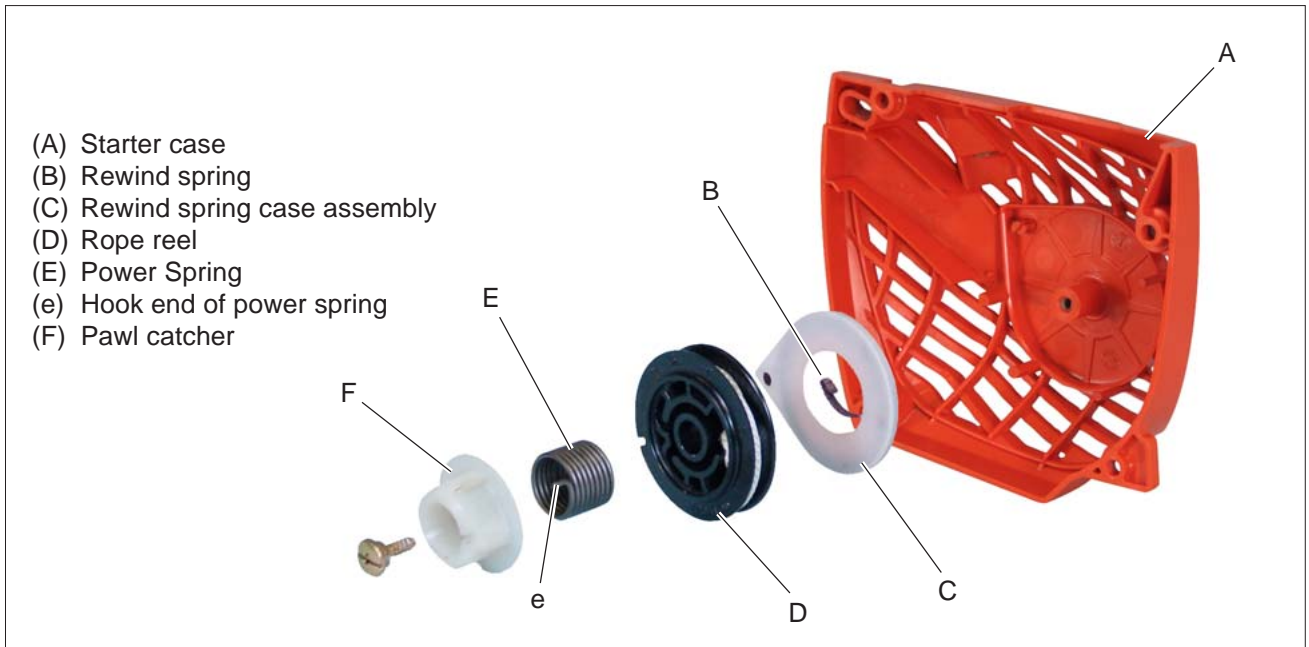
## 1-6 Special tools



Key	Part Number	Description	Reference
1	990511-30017	Tachometer PET-1000	Measuring engine speed
2	895612-79920	L-hex wrench (3 mm)	Removing and installing hex. socket bolts (M4)
3	895610-79920	L-hex wrench (4 mm)	Removing and installing hex. socket bolts (M5)
4	897501-03938	Puller	Removing magneto rotor
5	897505-16133	Clutch tool	Removing and assembling clutch assembly
6	91037	Compression gauge	Measuring cylinder compression
7	897702-30131	Piston pin tool	Removing and installing piston pin
8	897701-06030	Bearing wedge	Removing and crankshaft ball bearings
9	897563-19830	Metering lever gauge	Measuring metering lever height on carburetor
10	897826-16131	Pressure rubber plug	Testing crankcase and cylinder sealings
11	897831-16131	Pressure rubber plug	Testing crankcase and cylinder sealings
12	897726-09130	Oil seal tool	Installing oil seals
13	897603-23030	PTO shaft puller	Removing auto-oiler cap
14	897800-79931	Spark tester	Checking ignition system
15	897803-30133	Pressure tester	Testing carburettor and crankcase leakage
16	91019	Limiter cap tool	Removing and installing limiter cap
17	500-500	Welch plug tool	Removing and installing welch plug tool
18	990610-00051	Loctite #515	Applying crankcase seam
19	91004	Module air gap gauge	Adjusting pole shoe air gaps



2 STARTER SYSTEM (ES starter)



Construction

1. Rewind spring case assembly (C) is installed inside starter case (A).
2. Rope reel (D) with starter rope is installed on rewind spring case assembly.
3. Hook located on the backside of rope reel engages with end of rewind spring (B).
4. Power spring (E) is installed on rope reel.
5. Hook of power spring engages with rope reel and top end hook (e) of power spring engages with pawl catcher (F).

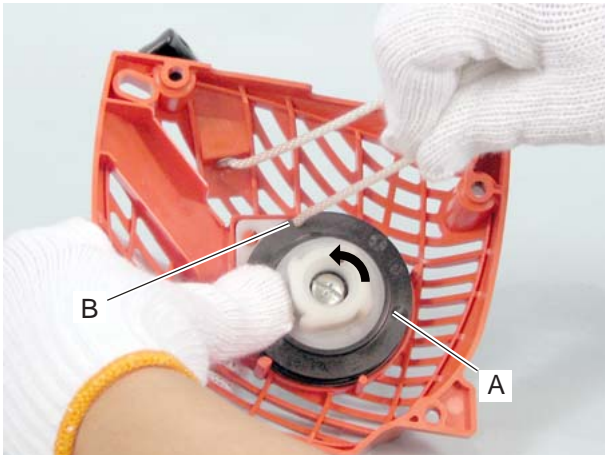
Working principle

1. When starter grip is pulled, rope reel (D) rotates.
2. The rotation force of rope reel (D) is transmitted to pawl catcher (F) by power spring (E) that is connected with rope reel (D) and pawl catcher (F).
3. Pawl catcher (F) engages with starter pawls on flywheel to turn crankshaft.
4. The load from compression pressure in cylinder will keep crankshaft from rotating as power spring (E) is twisted and accumulates energy.
5. Starter grip is pulled further; more energy is stored in power spring (E) until the accumulated energy is enough to overcome the compression pressure in cylinder.
6. When accumulated energy in power spring (E) overcomes the load from compression pressure in cylinder, crankshaft will be rotated.
7. Power spring absorbs compression resistance of cylinder and snatch back of engine during starting action.
8. When starter rope is released, rope reel (D) is returned together with power spring (E) and pawl catcher (F) by rewind spring tension.
9. After engine starts, starter pawls pivot outward by centrifugal force and disengage from pawl catcher (F).

## 2-1 Disassembling starter assembly

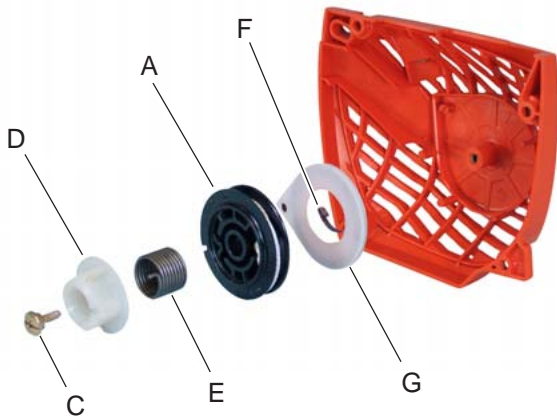


1. Remove four bolts securing recoil starter assembly. Remove recoil starter assembly from unit.



2. Pull out starter rope about 30 centimeters (12 in) and hold rope reel (A). Loop excess rope in rope reel notch (B) as shown.

3. Rotate rope reel (A) counterclockwise to release tension of rewind spring.



4. Remove screw (C).

5. Remove pawl catcher (D) and power spring (E).

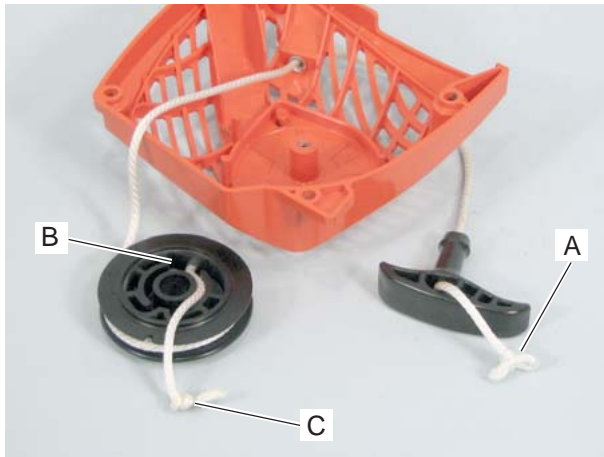
6. Remove rope reel (A) from starter case slowly to prevent rewind spring (F) from unwinding.

7. Remove rewind spring case (G) from starter case.

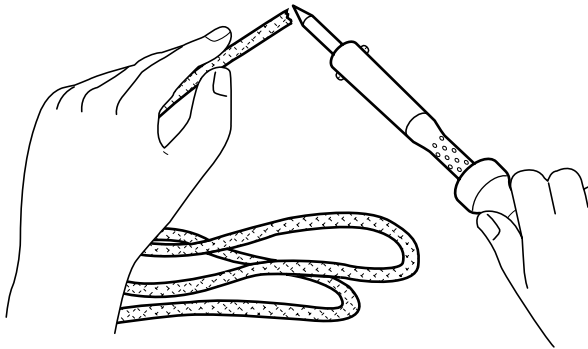
**WARNING**  **DANGER**

**Wear eye protection and take care when removing starter drum, because rewind spring may unwind suddenly and cause injury to eyes and body.**

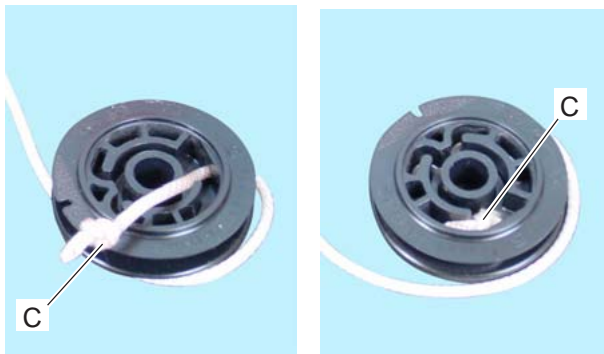
2-2 Replacing starter rope



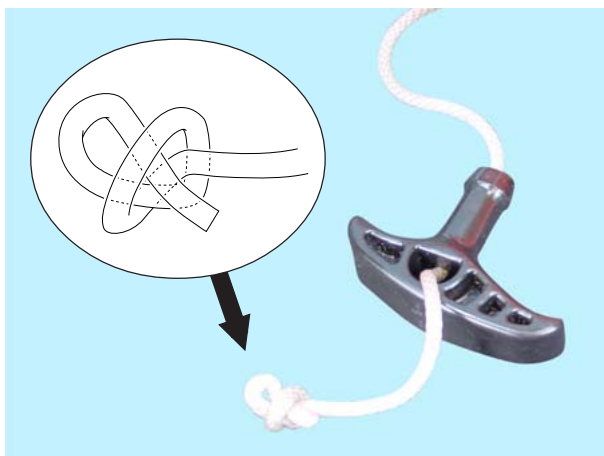
1. Pull out and untie knot (A).
2. Pull out knot (C) from rope reel (B).



3. When installing a new starter rope, singe both ends of the rope to prevent fraying.

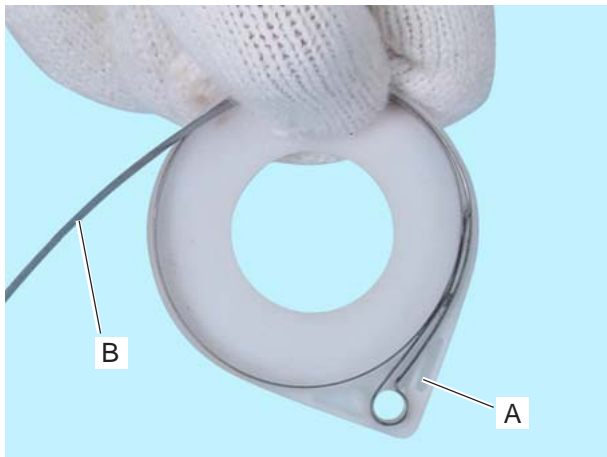


4. Make a knot (C) at end of starter rope and pass the rope through hole of rope reel, then press the knot (C) into reel well as shown.

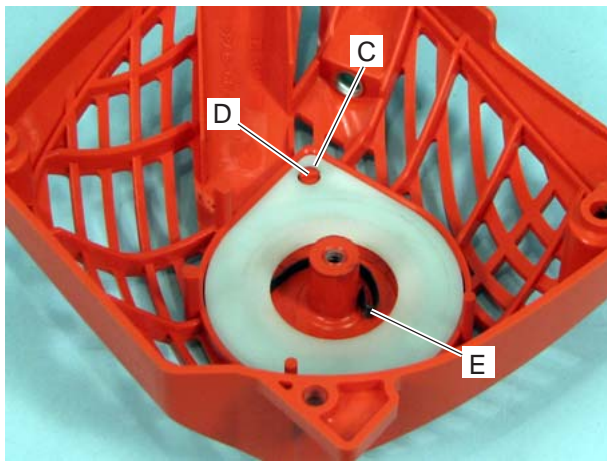


5. Pass the other end of starter rope through rope guide on starter case, then pass starter rope through starter grip and make a knot as shown.

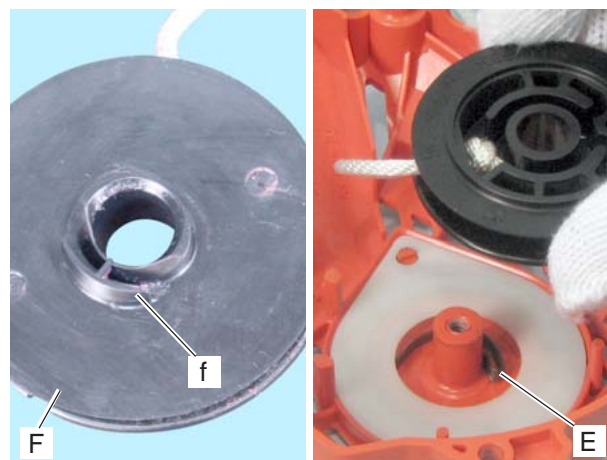
## 2-3 Assembling starter



1. If rewind spring (B) is unwound from rewind spring case (A), wind the spring inside case as shown.



2. Install rewind spring case assembly on starter case matching hole (C) with post (D). Hook (E) of rewind spring should contact with post of starter case.

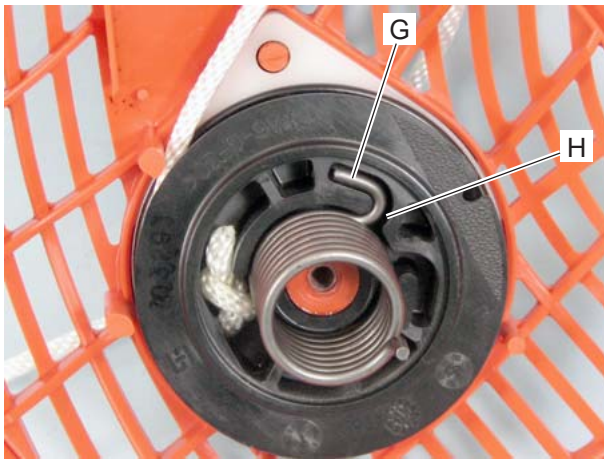


3. Assemble rope reel (F) engaging hook (f) of rope reel with hook (E) of rewind spring.

2-3 Assembling starter (continued)



4. Check for proper engagement of rewind spring and rope reel by turning rope reel (F) clockwise and counterclockwise.

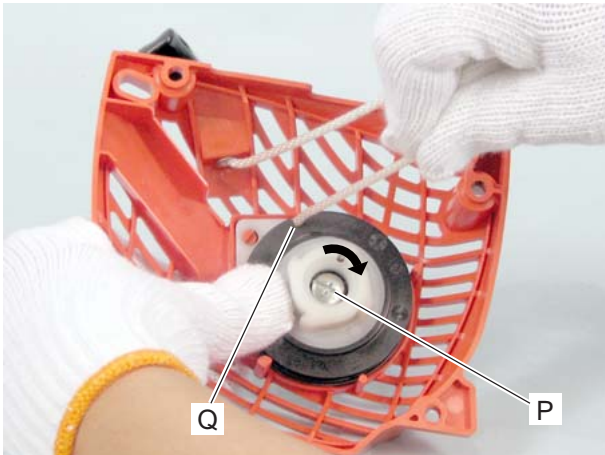


5. Install power spring assembling hook (G) of power spring into rope reel cutout (H).



6. Install pawl catcher, assembling power spring hook (J) into pawl catcher hole (I).

## 2-3 Assembling starter (continued)



7. Fasten screw (P) on starter post.

8. Pull out starter rope inside starter case. Rotate rope reel clockwise several turns with starter rope hooked at notch (Q) as shown. Hold rope reel to prevent it from rewinding and pull out starter grip to take the rope slack.

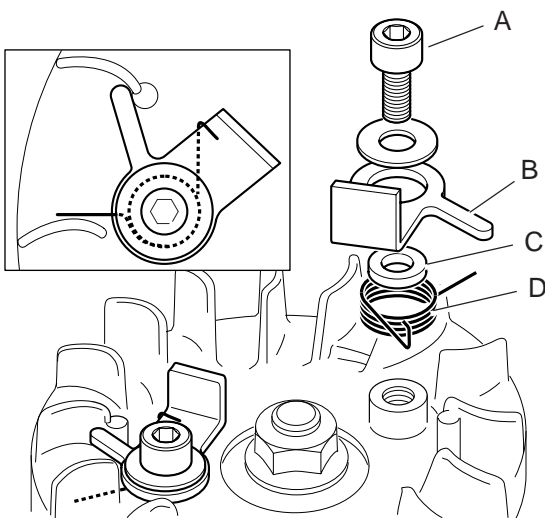


9. Pull starter several times to check rewind spring tension. If starter is not rewinding fully, rotate rope reel one more turn clockwise following above step (8).

10. Pull out starter rope all the way, and check that rope reel can be rotated an additional half or more turn clockwise as shown.

11. If it is less than half turn, there is a chance to break rewind spring. In that case, reduce tension by rotating rope reel counterclockwise one turn with starter rope hooked at notch (Q).

## 2-4 Replacing starter pawl



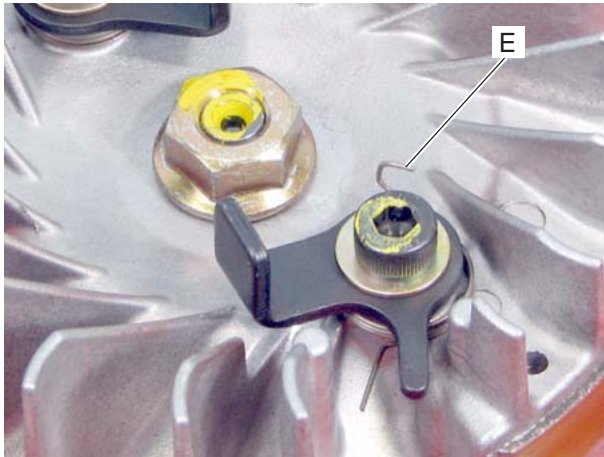
1. Remove starter assembly from unit.

2. Loosen bolt (A) and remove washer, pawl (B), spacer (C) and torsion spring (D). Replace damaged or worn parts.

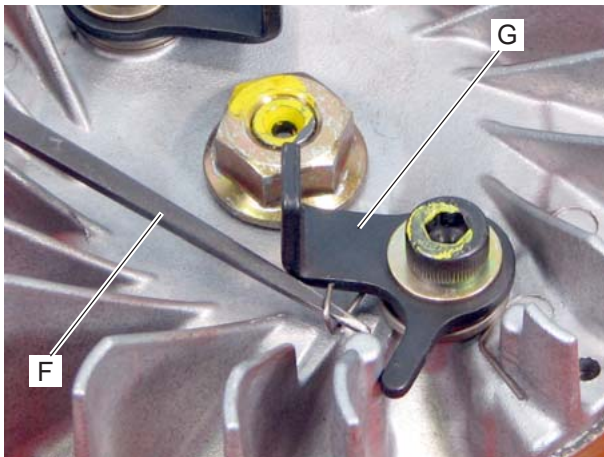
**NOTE:** When it is hard to loosen bolt, use flexible wrench 897709-79920 (E) to hold flywheel to remove the bolt easily.



2-4 Replacing starter pawl (continued)



3. Install torsion spring, spacer, pawl, washer and bolt. To avoid pinching of torsion spring, install these parts without setting the hook (E) of torsion spring on starter pawl. The bolt is pre-coated with sealant on the thread. If the coat is peeled off, apply thread locating sealant (Loctite #242, ThreeBond #1324 or equivalent).

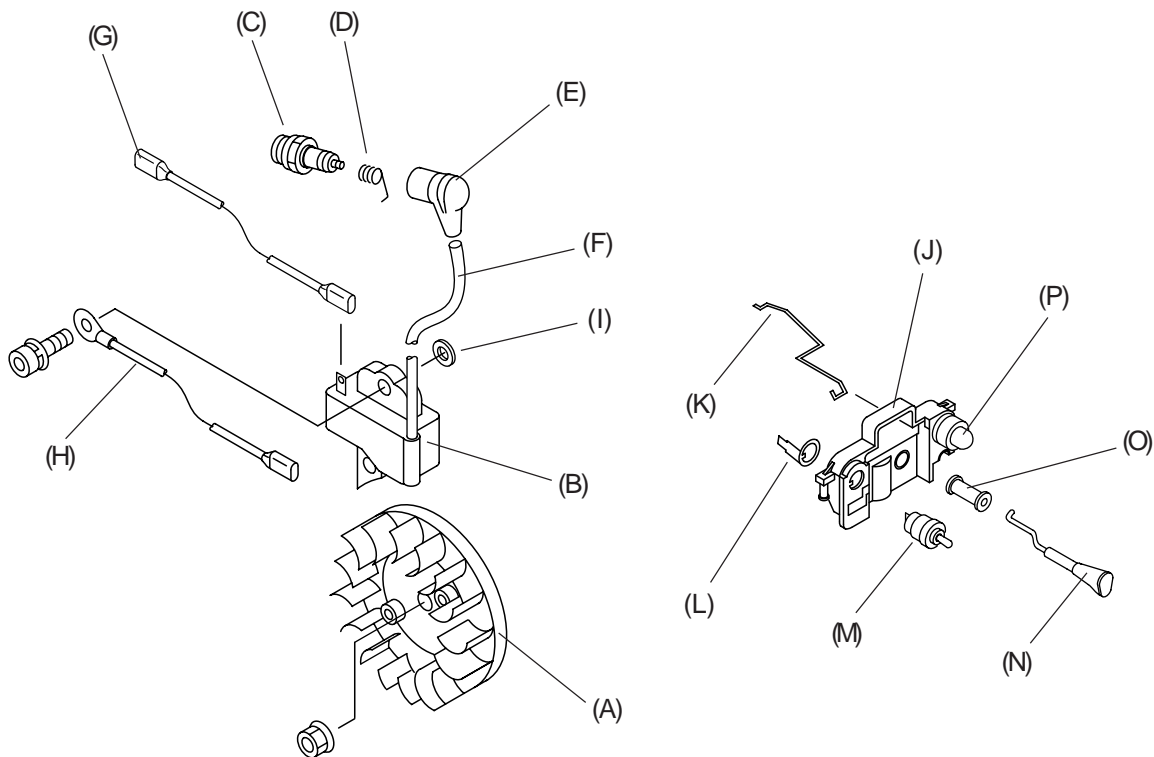


4. Using fine wire or hook tool (F), place hook of torsion spring on pawl (G) as shown.

5. Make sure pawl can move smoothly. If it does not move smoothly, check parts for correct installation.

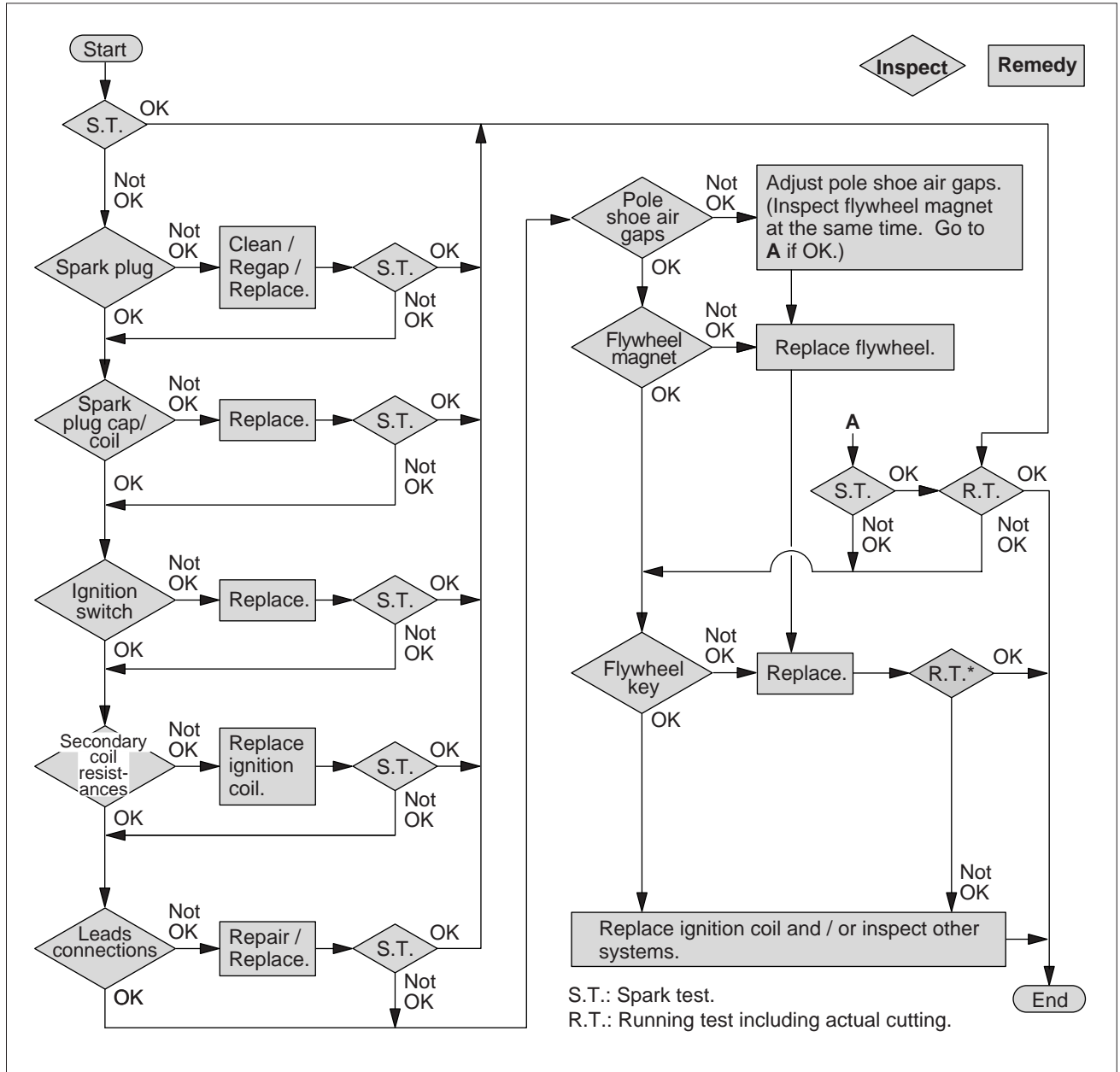
### 3 IGNITION SYSTEM

- (A) Flywheel
- (B) Ignition coil
- (C) Spark plug
- (D) Spark plug cap coil
- (E) Spark plug cap
- (F) High tension lead
- (G) Primary lead
- (H) Ground lead
- (I) Spacer
- (J) Switch bracket
- (K) Throttle rod
- (L) Lead terminal
- (M) Ignition switch
- (N) Choke knob
- (O) Choke grommet
- (P) Purge bulb

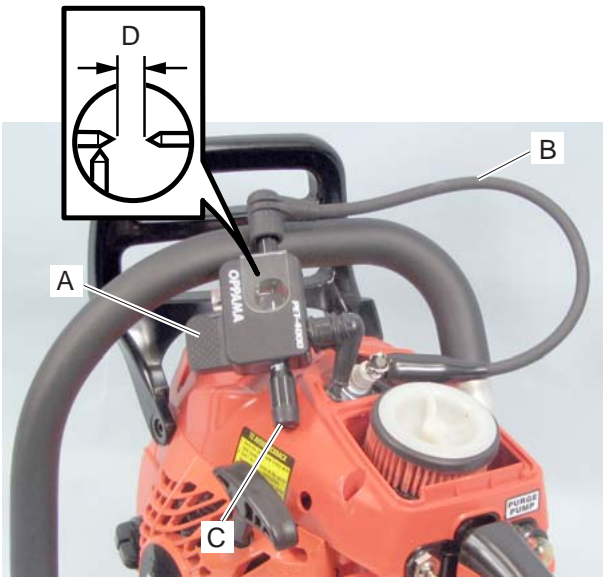




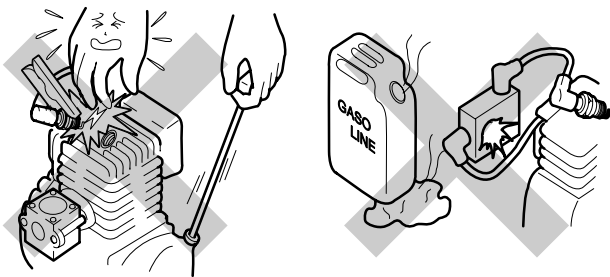
3-1 Troubleshooting guide



## 3-2 Testing spark



1. Remove air cleaner cover and remove spark plug cap from spark plug.
2. Connect spark tester 990511-30023 (A) to high tension lead and connect tester lead (B) on spark plug.
3. Screw in adjuster (C) until the needle tips contact. Turn out adjuster (C) 4 turns to set spark tester gap (D) to 4 mm (0.16 in).
4. Turn ignition switch to "RUN" position. Pull starter grip several times.
5. If spark is steady in blue or white at the tester gap, ignition system is considered good. Go to inspecting spark plug.
6. If no spark exists or spark is intermittent in yellow, orange, or red, continue with further inspection.



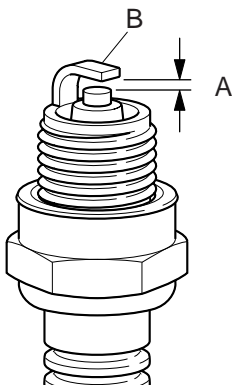
**! DANGER**

- \*Do not test near spark plug hole without spark plug installed, otherwise there is a chance to ignite fuel mixture inside cylinder and cause serious personal injury.
- \*Do not touch metal parts of spark tester while performing the test to avoid receiving electrical shock.

**! DANGER**

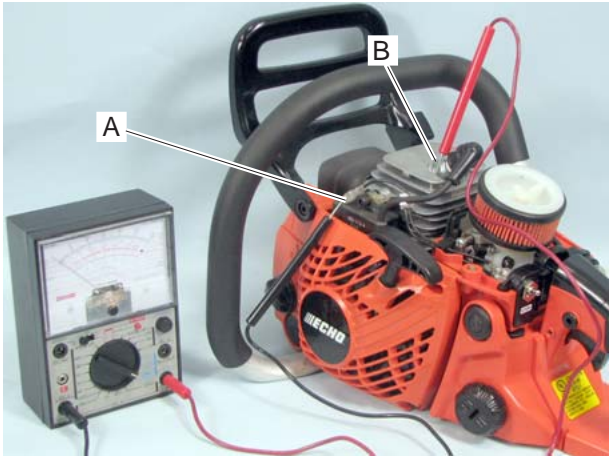
- Do not check spark in area where gasoline is spilled or flammable gases may exist.

## 3-3 Inspecting spark plug



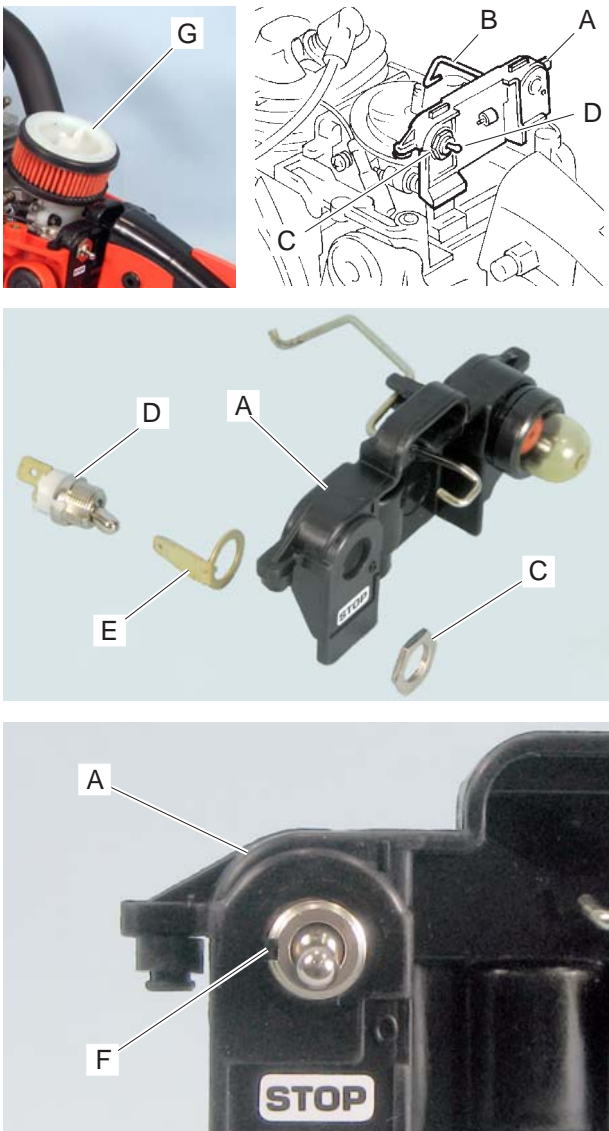
1. Remove spark plug to inspect for fouling, cracked or broken insulator, or rounded center electrode. Clean or replace spark plug as required.
2. Set spark plug gap (A) by bending outer electrode (B).  
Standard : 0.6 to 0.7 mm (0.024 to 0.028 in)
3. If engine does not start after cranking several times, inspect if spark plug is wet or dry. If it is excessively wet or dry, inspect fuel system.

3-4 Inspecting ignition switch



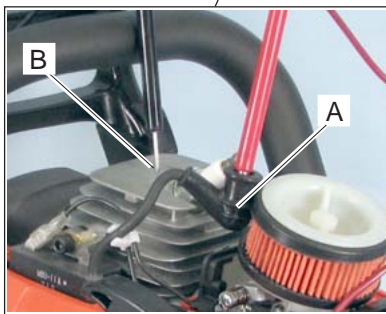
1. Remove cylinder cover.
2. Connect one probe of Ohm-meter or multi-meter to primary lead (A) and the other probe to cylinder fin.
3. When ignition switch is in "RUN" position, tester should indicate infinite resistance.
4. When ignition switch is in "STOP" position, tester should show that the circuit is in conducting state (closed circuit).
5. If ignition switch is defective, replace with a new one.

3-5 Replacing ignition switch



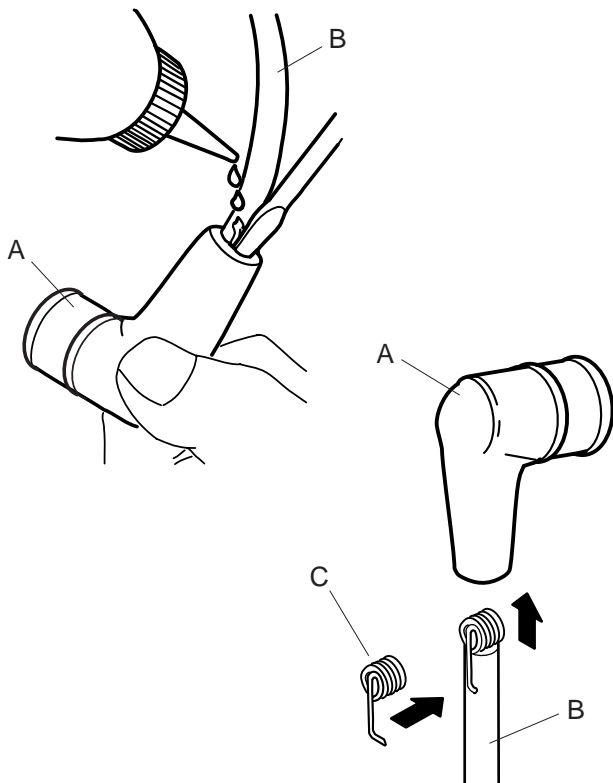
1. Remove air cleaner bracket (G) and air filter. Disconnect primary lead and ground lead from ignition switch.
2. Disconnect throttle rod (B) from carburetor (Refer to "9-4 Replacing throttle trigger") and remove switch bracket (A) from engine cover.
3. Loosen nut (C), and remove ignition switch (D) and switch plate (E) from switch bracket (A).
4. Inspect switch plate (E) and switch bracket (A). If damaged, replace with new parts.
5. Align notch (F) of new ignition switch with tabs of switch plate (E) and switch bracket (A). Fasten nut (C) on ignition switch.
6. Connect throttle rod to carburetor.
7. Put switch bracket (A) into engine cover correctly. Connect primary lead and ground lead to ignition switch.

## 3-6 Inspecting ignition coil resistance



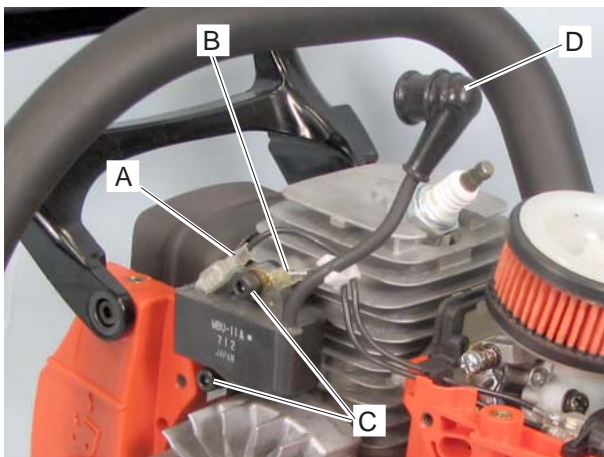
1. Remove cylinder cover.
2. Connect one probe of Ohm-meter or multimeter (Power source DC 1.5V) to spark plug cap coil (A).
3. Connect the other probe to cylinder (B) to measure secondary coil resistance. Secondary coil resistance should be in the range of 1.5 to 2.2 k $\Omega$ .
4. If the meter reading indicates infinite resistance, remove spark plug cap and spark plug cap coil, and measure resistance between the conduction wire of high tension lead and ignition coil core.
5. If the reading at step 3 or 4 is not in the range of 1.5 to 2.2 k $\Omega$ , replace with a new ignition coil (Go to "3-7 Replacing spark plug cap and coil").

## 3-7 Replacing spark plug cap and coil



1. Disconnect spark plug cap (A) from spark plug.
  2. Apply some oil in spark plug cap (A) for easy removal from high tension lead (B).
  3. Pull spark plug cap away from high tension lead.
  4. Inspect spark plug cap coil (C) for correct connection and corrosion. Inspect spark plug cap for cracks. Replace as required.
- NOTE: Make sure spark plug cap coil (C) contacts conductor core of high tension lead when reinstalling it.
5. Apply oil to spark plug cap (A) and insert high tension lead (B) as shown until the spark plug cap coil is properly seated in the cap.

### 3-8 Replacing ignition coil



1. Disconnect spark plug cap from spark plug and remove starter assembly and cylinder cover.
2. Disconnect primary lead (A) and ground lead (B) from ignition coil. Loosen bolts (C) of ignition coil.
3. Remove ignition coil and spacers (refer to P14, "3 IGNITION SYSTEM") from cylinder.
4. Disconnect spark plug cap (D) and spark plug cap coil from high tension lead (Refer to "3-7 Replacing spark plug cap and coil").
5. Connect spark plug cap (D) and spark plug cap coil, primary lead (A) and ground lead (B) to new ignition coil.
6. Install ignition coil and spacers by two bolts (C) loosely. After adjusting air gap using Module air gap gauge : 91004 (Refer to "3-9 Setting pole shoe air gauge"), tighten bolts (C) to specified torque.
7. Connect spark plug cap (D) to spark plug and reinstall starter assembly and cylinder cover in place.

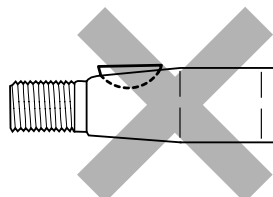
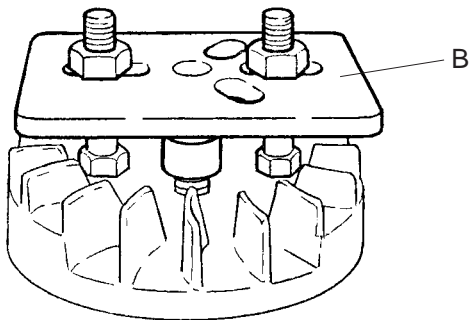
### 3-9 Setting pole shoe air gaps



1. Insert Module air gap gauge : 91004 (A) or 0.3 - 0.4 mm (0.012 - 0.016 in) thick feeler gauge between flywheel and ignition coil.
2. Rotate flywheel until magnetic poles of flywheel face ignition coil core legs.
3. Hold ignition coil against flywheel and tighten the bolts. After tightening bolts, remove Module air gap gauge : 91004 (A) (or feeler gauge) (Refer to "Service information 1-3 Torque limits").

**NOTE :** When air gap is too narrow, there is a chance of interference with flywheel. When the air gap is too wide, spark is weak.

## 3-10 Inspecting flywheel and key



1. Inspect magnetic force of flywheel using flux meter, or bridging with a screwdriver.

2. If magnetic force is weak, replace flywheel as follows.

3. Install piston stopper 897537-30130 (A) into spark plug hole by hand, to stop crankshaft rotation.

**NOTE:** Do not use power tool. Otherwise, piston damage may occur.

4. Remove starter pawls. Then set puller 897501-03938 (B) on flywheel as shown.

5. Tighten 2 nuts on the puller alternately to remove flywheel.

6. Inspect woodruff key for damage or shearing. Replace as required.

7. Wipe off oil from taper part of crankshaft before assembling flywheel.

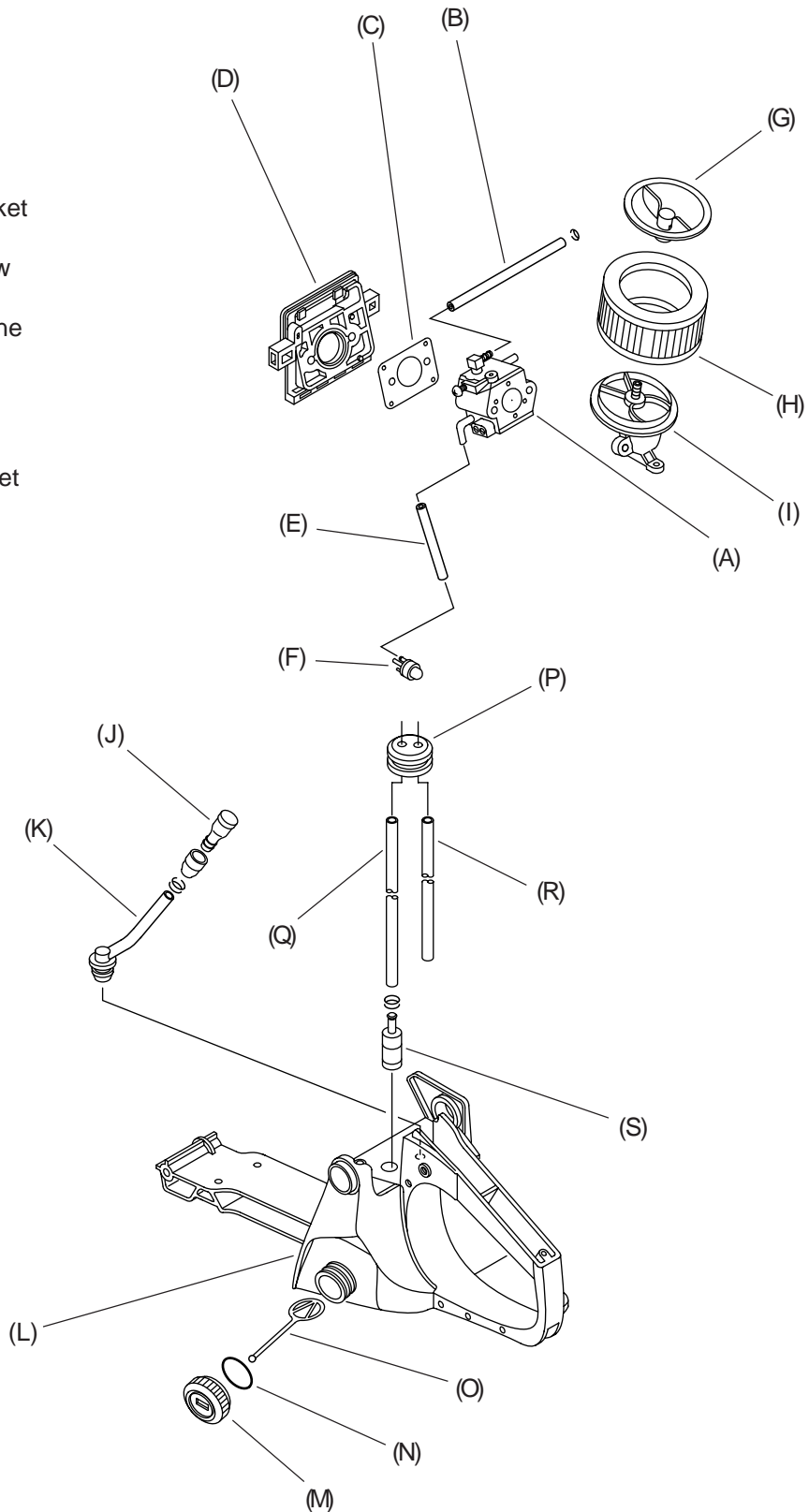
8. Install woodruff key into key groove.

9. Reinstall starter pawls (Refer to "2-4 Replacing starter pawl").

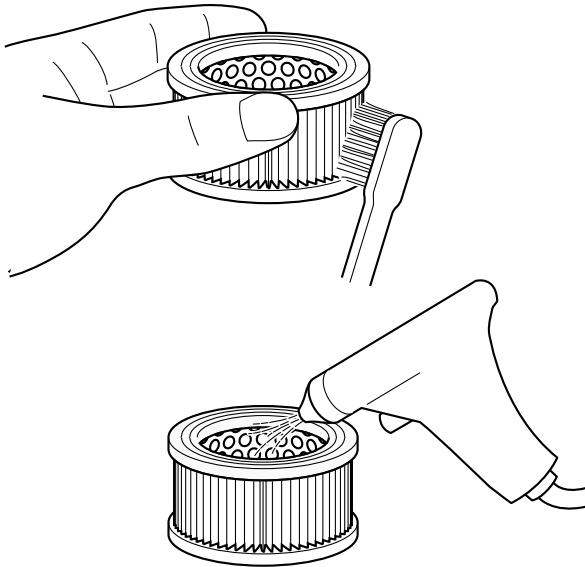
10. Align flywheel key groove with woodruff key on crankshaft. Install flywheel and fasten flywheel nut.

4 FUEL SYSTEM

- (A) Carburetor
- (B) Pulse line
- (C) Intake gasket
- (D) Intake insulator
- (E) Fuel inlet line
- (F) Purge bulb
- (G) Air cleaner bracket
- (H) Air filter
- (I) Carburetor elbow
- (J) Fuel tank vent
- (K) Fuel tank vent line
- (L) Fuel tank
- (M) Fuel cap
- (N) O-ring
- (O) Connector
- (P) Fuel line grommet
- (Q) Fuel line
- (R) Fuel return line
- (S) Fuel strainer



## 4-1 Inspecting air filter



1. Close choke shutter. Remove cleaner lid, air cleaner bracket and air filter.

**DANGER**

**Wear eye protection when working with compressed air. Eye damage can occur from flying particles.**

2. Inspect the surface of air filter. If blocked with dirt or dust, remove the obstruction using brush.

**NOTE :** When cleaning the surface of air filter, use brush lightly.

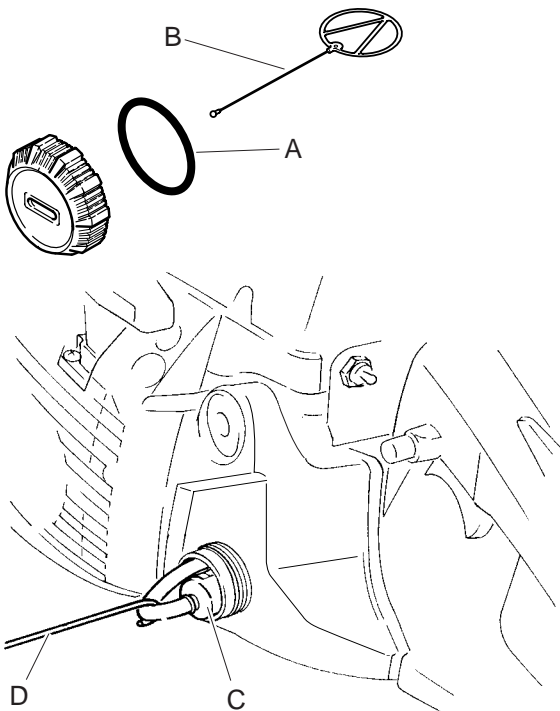
3. If heavily blocked with dirt or dust, clean air filter with compressed air.

**NOTE :** Blow with compressed air from inside of filter. If blowing with compressed air from outside of air filter, filter paper may be clogged with particles.

**NOTE :** Do not wash air filter by solvent or gasoline to avoid damaging it.

4. Replace air filter with new one if heavily soiled or damaged.

## 4-2 Inspecting fuel cap and strainer



1. Remove fuel cap.
2. Inspect fuel cap for cracks and O-ring (A) for cuts or damage.
3. Replace connector (B) if damaged.

4. Pull fuel strainer (C) from fuel tank using a wire hook (D) and clean fuel strainer. Replace if defective or heavily soiled. Install fuel cap.

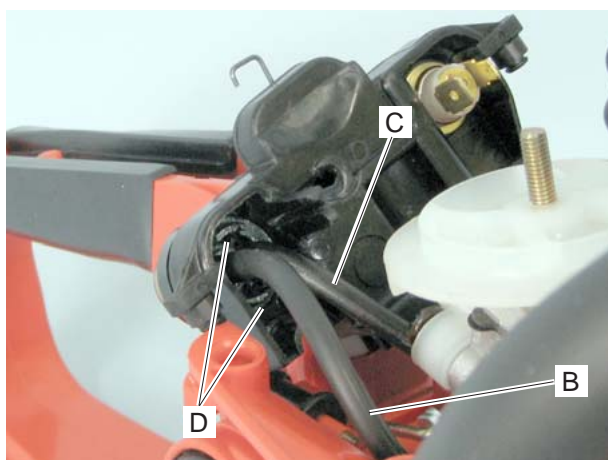


### 4-3 Replacing purge bulb



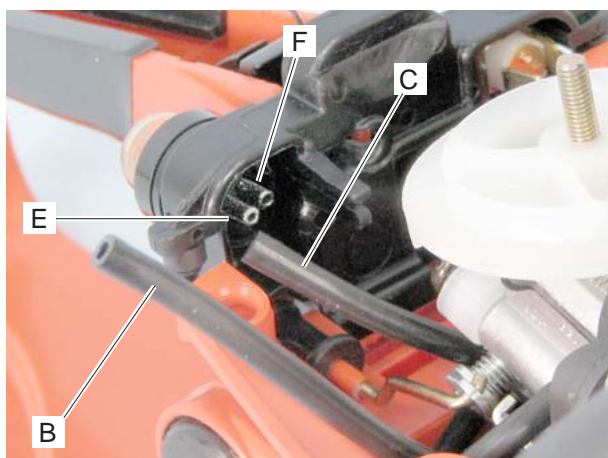
**NOTE:** It is possible to replace purge bulb, without removing carburetor from the unit.

1. Remove switch bracket (A) from engine cover (Refer to “3-5 Replacing ignition switch”).



2. Remove fuel return line (B) and fuel inlet line (C) from purge bulb.

3. Pinch hooks (D) of purge bulb with needlenose pliers and remove purge bulb.

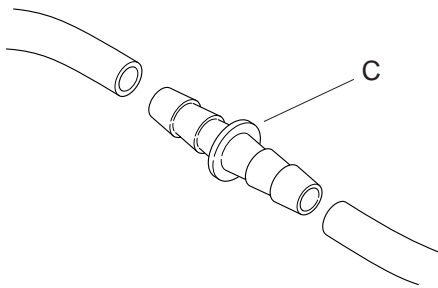


4. Install new purge bulb.

5. Connect fuel inlet line (C) to shorter fitting (F).

6. Connect fuel return line (B) to the other fitting (E).

## 4-4 Inspecting fuel tank and line



1. Clean fuel tank inside as required.
2. Remove cylinder cover, disconnect fuel line (A) from carburetor.

3. Connect pressure tester 897803-30133 (B) to fuel line.

**NOTE:** To connect pressure tester to fuel line easily, it is recommended to use pipe joint V186-000020 (C).

4. Remove fuel cap and pull out fuel strainer from fuel tank.

5. Pinch fuel line with needlenose pliers as shown.

**NOTE:** Wrap the ends of needlenose pliers with tape (or cover with soft pipes) to prevent damage to fuel line.

6. Apply pressure approx. 49 kPa (0.5 kgf/cm<sup>2</sup>) (7 psi).

7. If pressure drops, replace fuel line.

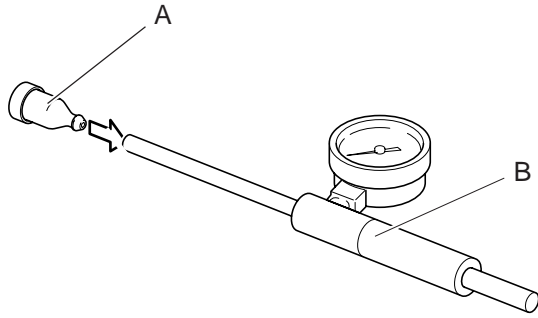
8. Put fuel strainer in fuel tank and fasten fuel cap securely.

9. Apply pressure approx. 9.8 kPa (0.1 kgf/cm<sup>2</sup>) (1.4 psi).

10. Pressure should not drop. If the pressure drops, leakage may occur from fuel cap, fuel cap O-ring, mating surface of fuel tank on rear handle, grommet, or tank vent. Inspect and replace defective part(s) with new one.

11. Remove pressure tester and connect fuel line to carburetor.

4-5 Inspecting and replacing tank vent



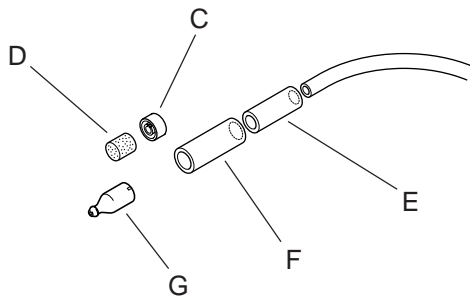
**NOTE:** Tank vent prevents a vacuum from forming in fuel tank when fuel in fuel tank is being consumed. When pressure in fuel tank becomes too high, tank vent releases the pressure.

1. Remove rear handle from engine cover (Refer to “9-2 Inspecting cushions”). Remove tank vent (A) from tank vent line and connect pressure tester 897803-30133 (B).

2. Apply pressure approx. 49 kPa (0.5 kgf/cm<sup>2</sup>) (7 psi), make sure pressure is stable in range of 9.8 kPa - 39.2 kPa (0.1 - 0.4 kgf/cm<sup>2</sup>) (1.4 - 5.7 psi).

3. If it is not in the range, gently clean tank vent with compressed air or replace with new one.

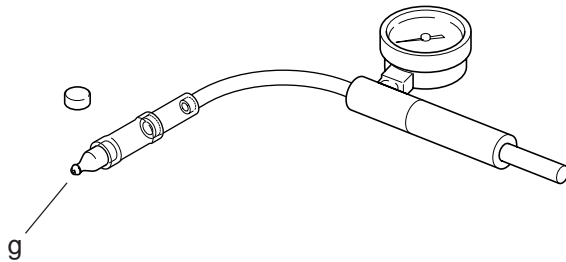
**NOTE:** Do not disassemble valves in tank vent assembly. Damage to valves will occur.



4. Remove cap (C) of tank vent, and clean sponge (D).

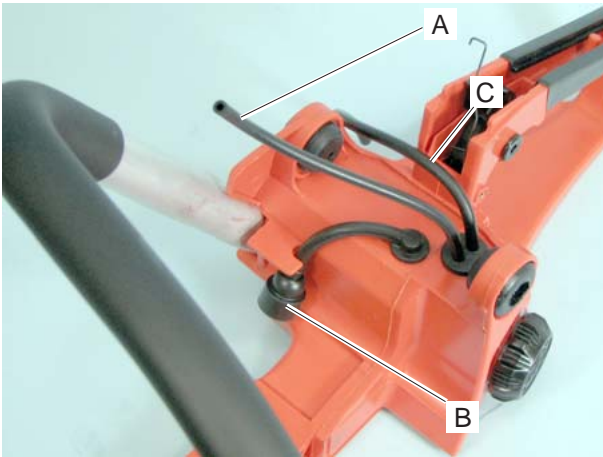
5. Cut pipe 363024-04010 (E: 7x11x170 mm) and 382011-01110 (F: 9x13x350 mm) in approx. 30 mm (1 1/4 in) length, and connect them to pressure tester as shown. Connect tank vent (G) without cap to pipe as shown.

6. Plug hole (g) by finger and apply pressure 19.6 kPa (0.2 kgf/cm<sup>2</sup>) (3 psi). The pressure should be hold steady.



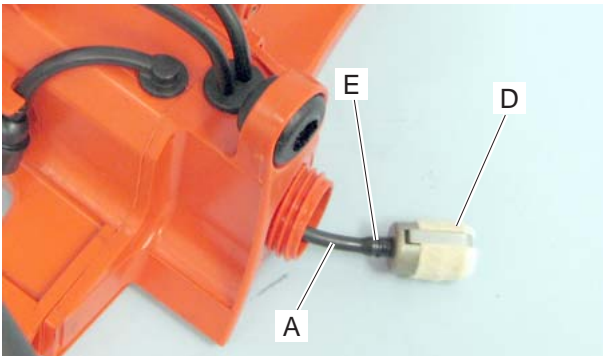
7. When the finger is removed from hole (g), tank vent should pass air freely without holding any pressure. If it does not, replace tank vent with new one.

## 4-6 Replacing fuel line, fuel tank vent assembly and grommet

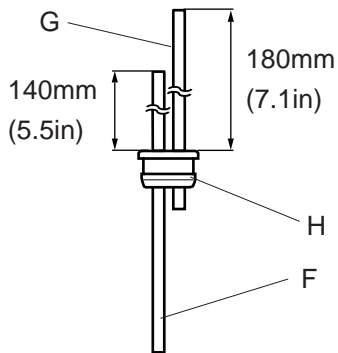


1. Remove engine cover and engine block from rear handle (Refer to "9-2 Inspecting cushions").

2. Inspect fuel line (A), fuel tank vent assembly (B), fuel return line (C) and fuel tank. Replace them if defective.



3. To replace fuel line and fuel return line, remove fuel cap and remove fuel strainer (D) and clip (E) from fuel line (A).



4. Install fuel line (F) and fuel return line (G) on the grommet (H) as shown.



5. Install assembled grommet in fuel tank.

**NOTE:** Assemble grommet, with fuel return line (G) oriented towards rear handle.

6. Pull out fuel line from fuel tank and install clip and fuel strainer to fuel line.

7. Install engine cover and engine block on rear handle. Reassemble carburetor, switch bracket and related parts (Refer to "9-2 Inspecting cushions").

#### 4-7 Adjusting carburetor

##### 4-7-1 General adjusting rules

A. Before starting the unit for adjustment, check the following items.

1. The correct spark plug must be clean and properly gapped.
2. The air filter element must be clean and properly installed.
3. The muffler exhaust port must be clear of carbon.
4. The fuel lines, tank vent and fuel filter are in good condition and clear of debris.
5. The fuel is fresh ( > 89 octane : RON ) and properly mixed at 50 : 1 with "ISO L-EGD" or "JASO-FC/FD" 2-stroke oil.
6. The recommended bar and chain must be installed, and properly tensioned.

**NOTE :** In order to achieve proper carburetor adjustment, 35 or 38 cm bar and chain should be installed on the unit. Otherwise serious engine damage will occur due to overspeeding.

B. Start and run engine for two minutes alternating rpm between WOT and idle every 5 seconds. Turn L and H mixture needles full anticlockwise. Adjust idle speed screw to 2,650 +/- 250 rpm. If engine does not run correctly after this adjustment, proceed to the next step 4-7-2.

**IMPORTANT :** After adjusting carburetor according to the steps 4-7-2 and 4-7-3, the limiter cap(s) must be installed on L and H mixture needle(s) to comply with Emission Directive.

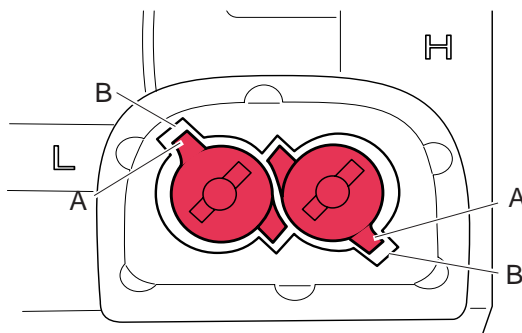
##### 4-7-2 Presetting idle adjust screw, L mixture needle and H mixture needle



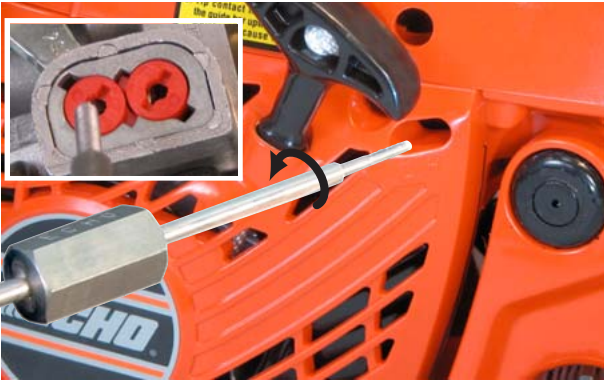
Tools Required: Small screwdriver with 2.5 mm blade, P/N 897801-33330 electronic tachometer, P/N 91019 limiter cap removal tool.  
Parts Required : (2) P/N P003-000010 limiter caps.

1. Turn the L and H mixture needles anticlockwise to rich side stop to align limiter cap tab (A) with locating slot (B), using 2.5 mm blade screwdriver.

**NOTE:** If cap tabs (A) misalign with locating slots (B), there is possibility of stripping the threads made by the removal tool when removing the limiter caps.



## 4-7 Adjusting carburetor (continued)



2. Screw threaded end of limiter cap removal tool 91019 with 2.5 mm left-hand thread into center hole of limiter cap anticlockwise until tab of the limiter cap just comes out of the locating slot.

**NOTE : DO NOT COMPLETELY REMOVE LIMITER CAP FROM CARBURETOR!**

If the limiter cap was pulled out completely, there is a chance that the other mixture needle would turn and limiter cap tab would misalign with locating slot when screwing the limiter cap removal tool into center hole of the limiter cap. As a result, the thread of the limiter cap would be stripped. Use 3 mm diameter thread wood screw to remove a stripped limiter cap.



3. Remove the limiter cap removal tool from the limiter cap by turning the tool clockwise, leaving the limiter cap in place.



4. Screw threaded end of limiter cap removal tool 91019 into center hole of the other limiter cap anticlockwise until the limiter cap is removed from the mixture needle completely. Remove the limiter cap from limiter cap removal tool turning clockwise, and screw thread of limiter cap removal tool 91019 into center hole of previous limiter cap to pull out completely.

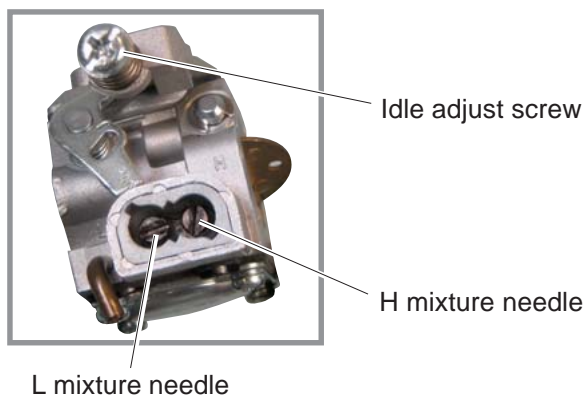
5. Turn L and H mixture needles clockwise until lightly seated, and then turn out both mixture needles following turns.

CS-370ES: L mix. needle 1 1/4, H mix. needle 2 3/8

CS-420ES: L mix. needle 1 3/8, H mix. needle 2 3/4

**NOTE:** If needles are overtighten during seating, damage to carburetor may occur.

6. Remove air filter cover and air filter to see that idle adjust screw contacts the throttle plate. Turn idle adjust screw anticlockwise and set the screw until the tip just contacts the throttle plate. Then turn idle adjust screw 1 5/8 (CS-370ES), 1 3/8 (CS-420ES) turns clockwise. Reinstall air filter, and air filter cover.



L mixture needle

4-7 Adjusting carburetor (continued)

**4-7-3 Adjusting carburetor**

1. Start engine and warm it up for two minutes alternating rpm between WOT (Wide Open Throttle) and idle every 5 seconds. Turn H mixture needle anticlockwise until engine speed drops to approx. 11,000 rpm (CS-370ES), 12,000 rpm (CS-420ES).

2. Then continue warm up cycling engine speed between WOT for 5 seconds, and idle for 5 seconds for another minute and a half.

**NOTE:** Do not run engine at high speed without load longer than 10 seconds, or engine damage may occur.

3. Adjust L mixture needle to reach maximum engine rpm just before lean drop off.

4. Set idle engine speed to 3,800 rpm (CS-370ES, CS-420ES) by turning idle adjust screw. Engine rpm should be stable at 3,800 +/- 10 rpm after idle adjust screw adjustment.

5. Turn L mixture needle anticlockwise reducing engine idle speed 1,200 rpm to set idle speed at 2,600 rpm. The engine idle speed range is 2,400 - 2,800 rpm.

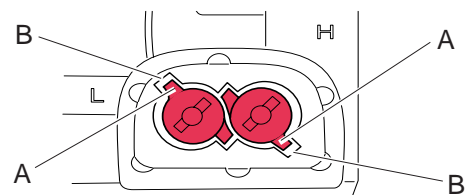
**NOTE:** Engine speed must be allowed to stabilize a minimum of 20 seconds after each adjustment of L mixture needle to assure accurate tachometer readings.

6. Before adjusting H mixture needle, WOT engine speed should be less than or equal to 11,000 rpm (CS-370ES), 12,000 rpm (CS-420ES). If rpm is higher, turn H mixture needle anticlockwise until 11,000 rpm (CS-370ES), 12,000 rpm (CS-420ES) is achieved. To make the final WOT engine speed adjustment, turn H mixture needle clockwise 1/8 turn increments with the engine at idle, then squeeze throttle trigger and check WOT engine speed. The final WOT engine speed should fall within 11,700 to 12,300 rpm (CS-370ES), 12,400 to 12,800 rpm (CS-420ES) range.



7. After adjusting carburetor, screw new limiter cap on the limiter cap removal tool 91019 (C) anticlockwise approx. 2 turns as shown, and put the limiter caps on L and H mixture needles respectively and remove the limiter cap tool. And then press the caps on L and H mixture needles with bar tool.

**NOTE :** Align the limiter cap's tabs (A) with locating slots (B) in extended housing of carburetor.



**IMPORTANT:** The limiter caps must be installed L and H mixture needles to comply with Emission Directive.

8. Start engine, and verify engine idle speed ranges from 2,400 to 2,900 rpm (CS-370ES, CS-420ES), and WOT engine speed ranges from 11,500 to 12,500 rpm (CS-370ES), 12,300 to 13,000 rpm (CS-420ES). Make sure chain does not rotate when engine is idling. When final adjustment is completed, the engine should idle, accelerate smoothly, and attain WOT per above specification.

**NOTE:** Initial carburetor settings for idle adjust screw, L and H mixture needles are intended to start and run the engine before final carburetor adjustments are made to conform the unit to meet Emission Directive. Actual turns required for engine operation may vary.

**NOTE:** Engine WOT and idle speed rpm in field operation may vary from final adjustment specifications due to changing ambient conditions and fuel. Safe engine rpm variances should be within the WOT, idle speed ranges listed in section 1-1, otherwise carburetor should be readjusted.

## 4-8 Positioning plug of air cleaner cover

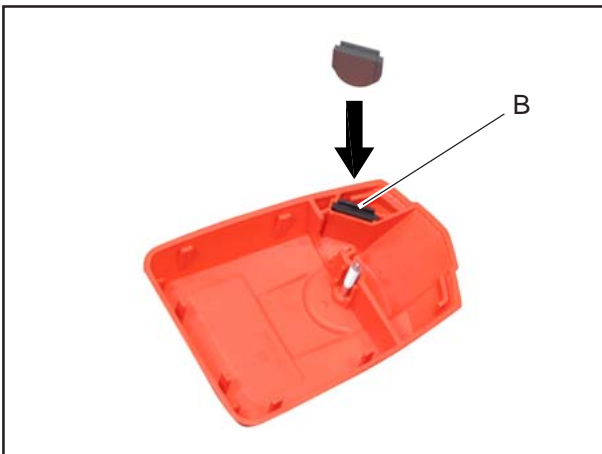


When it is cold weather lower than 10 °C and acceleration is poor, change place of the plug on air cleaner cover from closed position (normal) to opened position.

1. Air cleaner cover on CS-370ES and CS-420ES has plug.



2. The picture shows normal position of the plug (A).

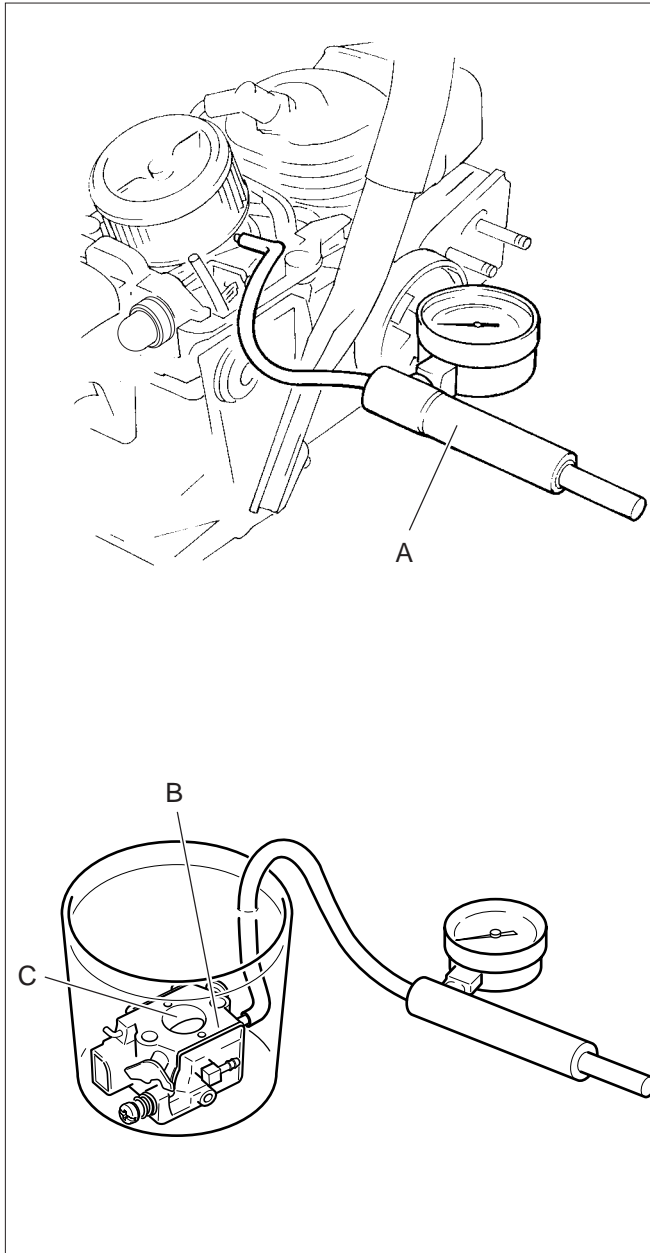


3. Remove the plug from air cleaner cover to open the warm air intake and introduce warm air from cylinder side to carburetor room. And place the plug in holder (B) on air cleaner cover to avoid losing as shown.

**NOTE:** Replace the plug to normal position when the temperature is over 10 °C to avoid carburetor vapor lock.



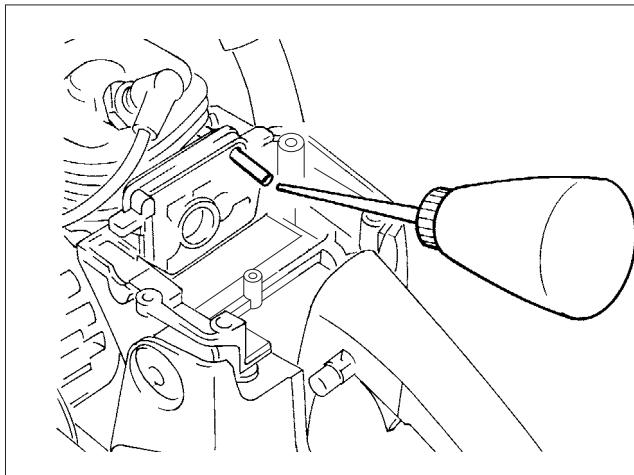
4-9 Testing carburetor



**NOTE:** To perform this test, fuel should be inside carburetor. If not, a little leakage may occur from dry diaphragm and/or inlet needle seat.

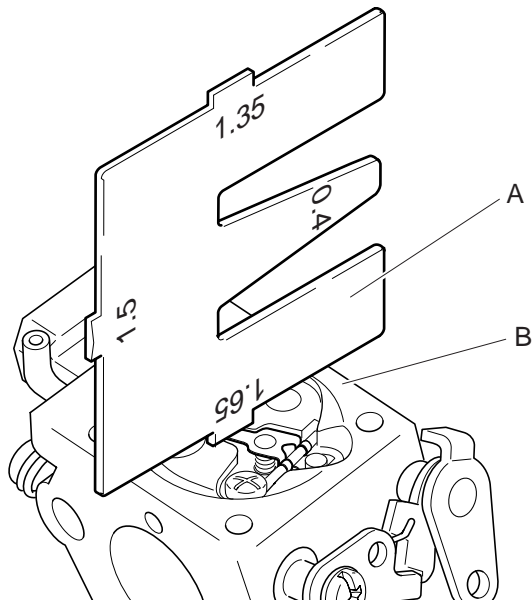
1. Remove cylinder cover and disconnect fuel line from carburetor. Connect pressure tester 897803-30133 (A) to carburetor fuel inlet.
2. Apply pressure approx. 98 kPa (1 kgf/cm<sup>2</sup>) (14 psi).
3. If pressure remains steady, follow step 4 and 5. If pressure drops, proceed to step 6.
4. Pull starter grip. Pressure tester reading should drop and remain above 49 kPa (0.5 kgf/cm<sup>2</sup>) (7 psi).
5. If reading does not drop, inspect inlet needle valve for sticking or metering lever height is too low.
6. If pressure drops at step 2, disconnect throttle rod from carburetor (Refer to "9-4 Replacing throttle trigger") and remove switch bracket. Disconnect choke rod from carburetor. Remove carburetor from the unit.
7. Submerge carburetor in suitable clean solvent to locate the leak by applying pressure approx. 98 kPa (1 kgf/cm<sup>2</sup>) (14 psi).
8. If air bubbles come out between pump cover and carburetor body (B), inspect pump diaphragm, pump gasket, and diaphragm seat of carburetor body (Refer to "4-13 Inspecting diaphragm").
9. If air bubbles come out from throttle bore (C), inspect inlet valve, metering lever spring, and metering lever height (Refer to "4-11 Inspecting inlet needle valve").

4-10 Inspecting crankcase pulse passage



1. Drop a little oil in the end of pulse line as shown.
2. Remove spark plug and pull starter grip several times. Oil should spit back from the hole.
3. If not, inspect whether pulse passage is blocked. Repair as required.

## 4-11 Inspecting metering lever height



1. Remove carburetor.
2. Remove metering diaphragm cover, metering diaphragm and gasket.
3. Inspect metering lever height by Metering lever gauge 897563-19830 (A).

Metering lever height: 1.65 mm (0.068 in) lower than diaphragm seat (B)

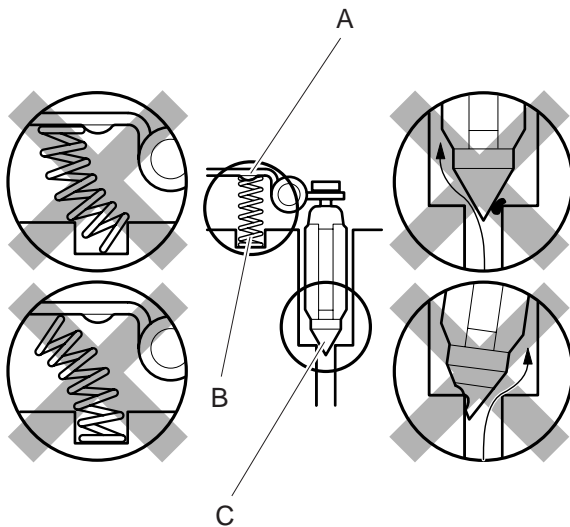
4. If necessary, gently bend metering lever up or down to set metering lever to proper position.

**NOTE:** When metering lever is:

Too high      Fuel flooding occurs

Too low      Fuel starvation / overheating occurs

## 4-12 Inspecting inlet needle valve



1. Remove metering lever (A) and pivot pin. Remove spring (B) and inlet needle valve (C).

2. Inspect inlet needle valve if worn or sticky. Clean or replace as required.

**NOTE:** Causes of fuel flooding from carburetor to cylinder are as follows:

- Improper assembling of metering lever and spring.
- Dirt between inlet needle valve and valve seat.
- Worn inlet needle valve tip.

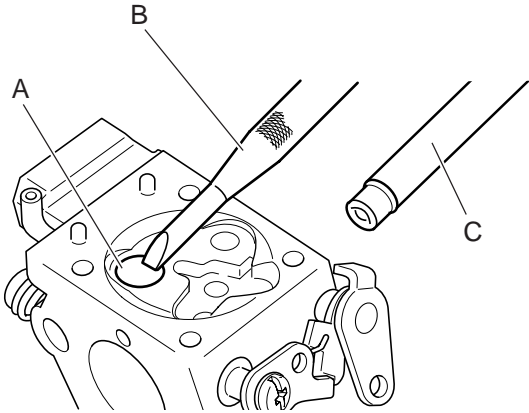
3. Clean inlet needle valve seat using suitable clean solvent. (Do not use metal tools.)

4. Reassemble inlet needle valve, spring, metering lever and pivot pin.

**NOTE:** Make sure of metering lever installation as follows:

- (1) Spring is seated in its hole at chamber floor.
- (2) Spring is under dimple of metering lever.
- (3) Metering lever fork is holding inlet needle valve.

4-13 Replacing Welch plug



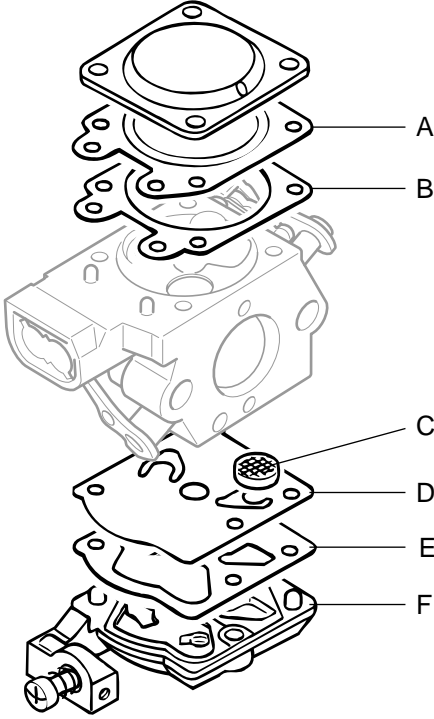
If engine does not run smoothly even after readjusting carburetor and inspecting carburetor parts, inspect low speed ports on carburetor as follows:

1. Remove metering lever and related parts to protect them from damage.
2. To remove Welch plug (A), punch the remover tool (B) through Welch plug at low angle and pry it out.

**NOTE:** Remover tool (B) is included in Welch plug tool (Part number: 500-500).

3. Clean low speed ports with compressed air.
4. Place a new Welch plug over the opening and gently tap it until flush using welch plug installer (C).
5. Install all removed parts to carburetor body.

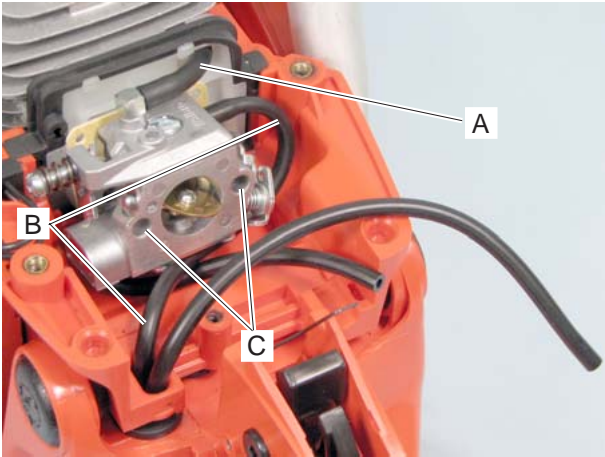
4-14 Inspecting diaphragm



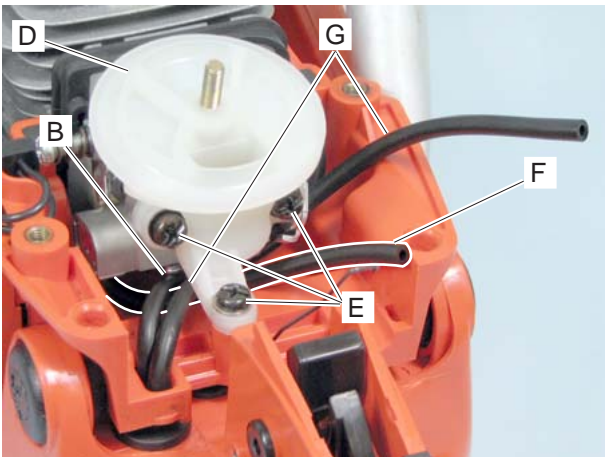
1. Inspect metering diaphragm (A) for hardening, distortion, or pin hole. Replace as required.
2. Remove pump cover (F), pump diaphragm (D) and pump gasket (E).
3. Inspect pump diaphragm (D) and replace if hardened or curled at valve tabs.
4. Inspect metering gasket (B) and pump gasket (E) and replace if defective.
5. Inspect inlet screen (C) if blocked, remove and clean it, or replace.
6. Clean fuel passages in carburetor body with compressed air.

**NOTE:** Before cleaning metering side with compressed air, turn "H" needle clockwise until lightly seated and remove inlet needle valve. Otherwise, main nozzle check valve and inlet needle valve spring may be damaged by the compressed air.

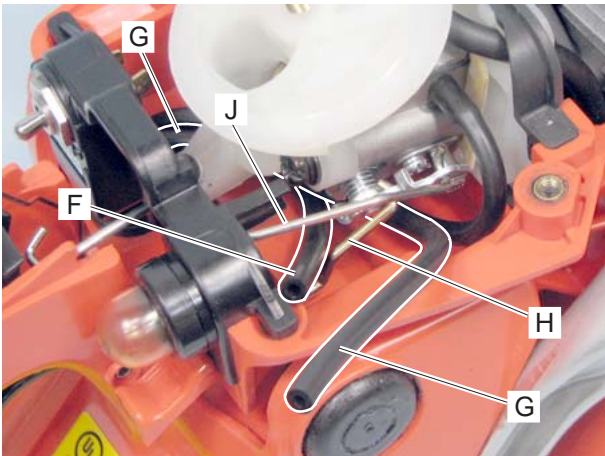
## 4-15 Installing carburetor



1. Connect pulse line (A) and fuel line (B) to fittings on carburetor.
2. Place carburetor elbow on carburetor and pass two screws through the holes (C).



3. Install carburetor and carburetor elbow (D) with three screws (E), passing fuel inlet line (F) under fuel line (B) and fuel return line (G) as shown.

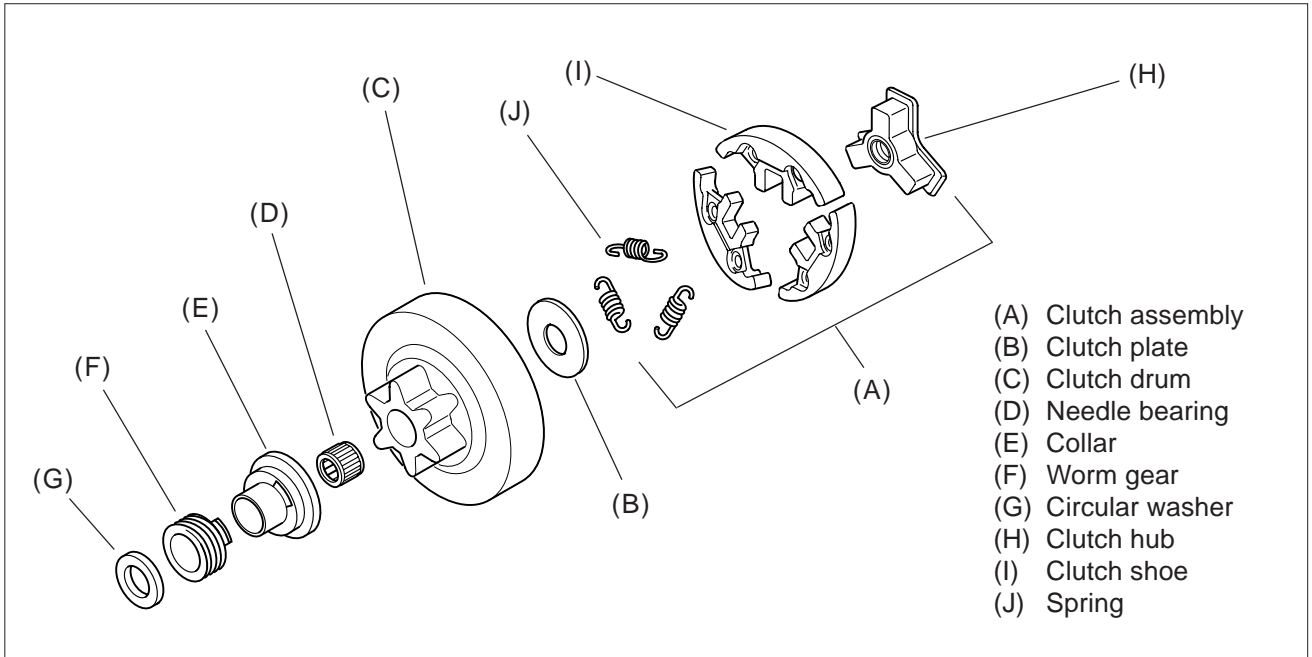


4. Connect choke rod (H) with carburetor, passing fuel return line (G) as shown.
5. Connect throttle rod (J) with carburetor, passing fuel inlet line (F) as shown. Set switch bracket in place (Refer to "3-5 Replacing ignition switch").

6. Connect fuel inlet line (F) and fuel return line (G) with fittings of purge bulb referring to "4-3 Replacing purge bulb").

7. Reassemble air filter, cylinder cover and cleaner lid.

5 CLUTCH SYSTEM



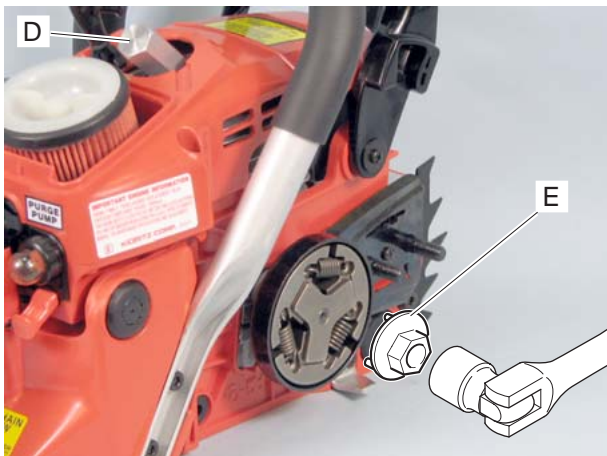
5-1 Inspecting clutch parts



1. Remove sprocket guard (A) and cleaner lid (B).
2. Disconnect spark plug cap and remove spark plug.

**NOTE:** If starter assembly is installed, pull starter rope out about 20 cm (8 in), and make a temporary knot (C) to prevent starter damage when installing clutch assembly.

3. Install piston stopper 897537-30130 (D) in spark plug hole to stop crankshaft rotation.
4. Rotate clutch assembly clockwise by hand until it cannot be rotated further.

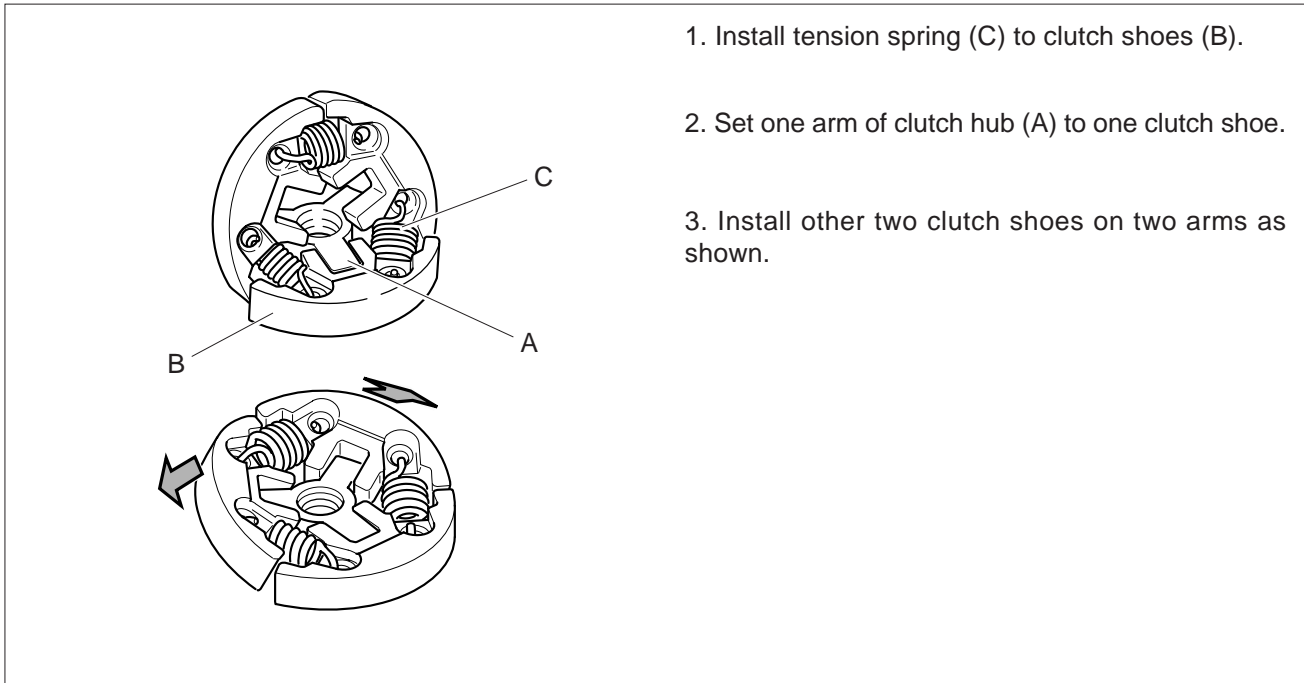


5. Loosen clutch assembly (Left-hand thread) rotating clockwise with clutch tool 897505-16133 (E) and remove it.

**NOTE:** Do not use power tools. Otherwise, piston damage may occur.

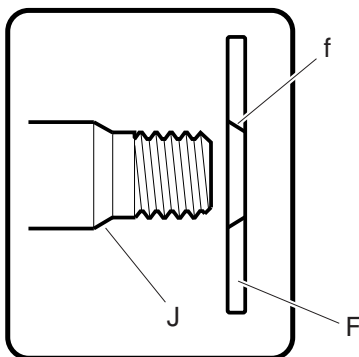
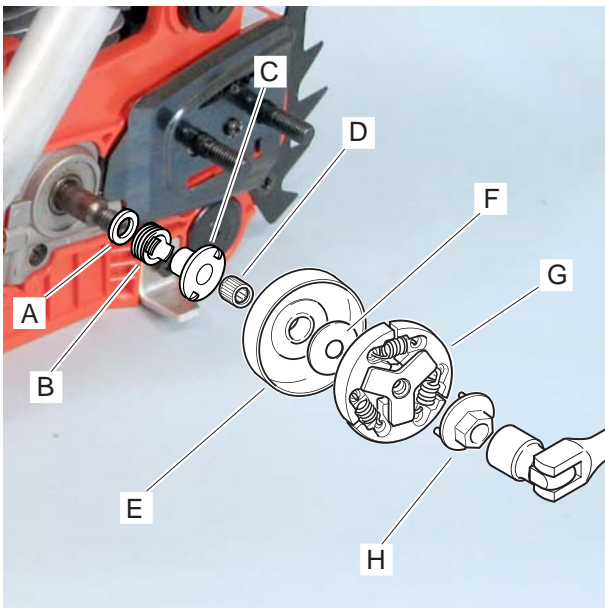
6. Remove clutch drum, clutch plate, needle bearing, collar, worm gear and circular washer.
7. Inspect clutch shoes for wear and spring for weakness or damage. Replace clutch parts as required.
8. Inspect clutch drum and sprocket. Replace if deformed or worn out.
9. Inspect needle bearing, collar and worm gear for damage, discoloration or deformation. Replace as required.

## 5-2 Replacing clutch parts



1. Install tension spring (C) to clutch shoes (B).
2. Set one arm of clutch hub (A) to one clutch shoe.
3. Install other two clutch shoes on two arms as shown.

## 5-3 Installing clutch assembly



1. Apply lithium-based grease to needle bearing (D) and install circular washer (A), worm gear (B), collar (C), needle bearing and clutch drum (E) on crankshaft as shown order.

2. Install clutch plate (F) and clutch assembly (G) to crankshaft turning counterclockwise by hand.

**NOTE:** Chamfered corner (f) of clutch plate (F) should face inside, against crankshaft chamfer (J).

**NOTE:** If starter assembly is installed, untie temporary knot in the first NOTE of "5-1 Inspecting clutch parts". Hold starter grip as the rope is pulled out.

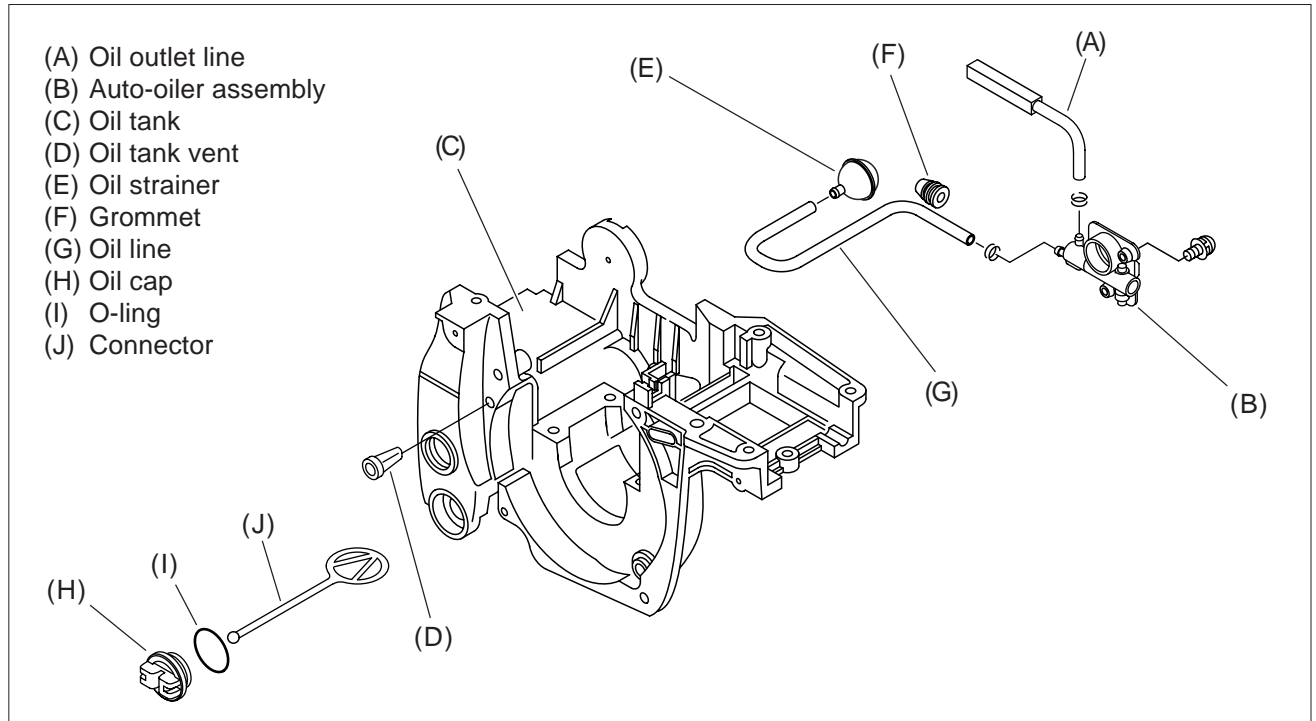
3. Turn clutch assembly counterclockwise using clutch tool 897505-16133 (H) by hand until it can not be turned further.

4. Tighten clutch assembly (Left-hand thread) with clutch tool 897505-16133.

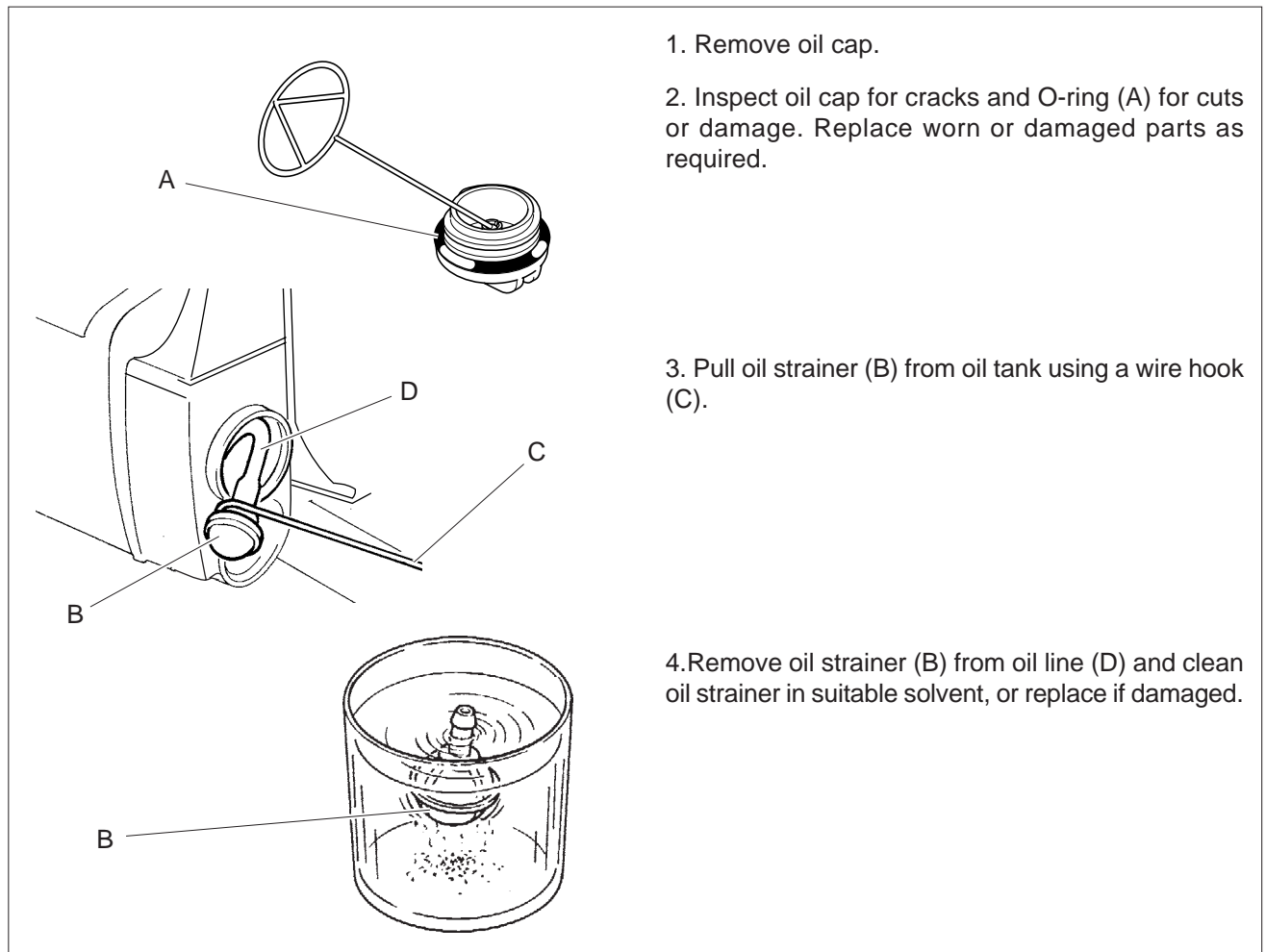
**NOTE:** If starter assembly is installed, release starter grip to return starter rope into starter assembly.

5. Remove piston stopper and reinstall all removed parts.

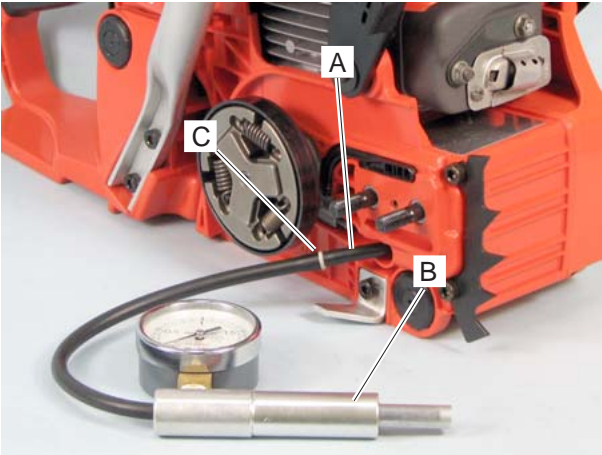
6 SAW CHAIN LUBRICATION SYSTEM



6-1 Inspecting oil cap and strainer

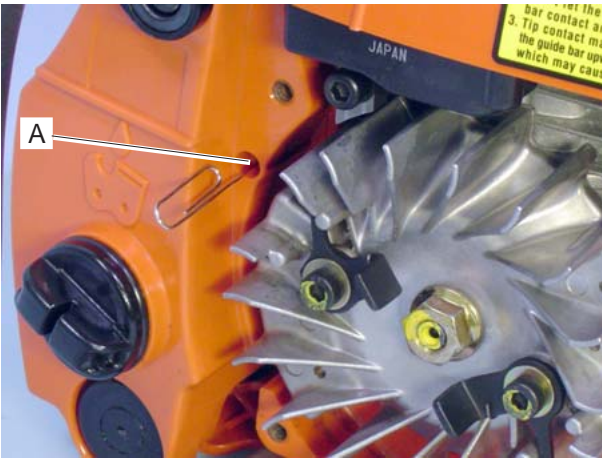


## 6-2 Inspecting oil line



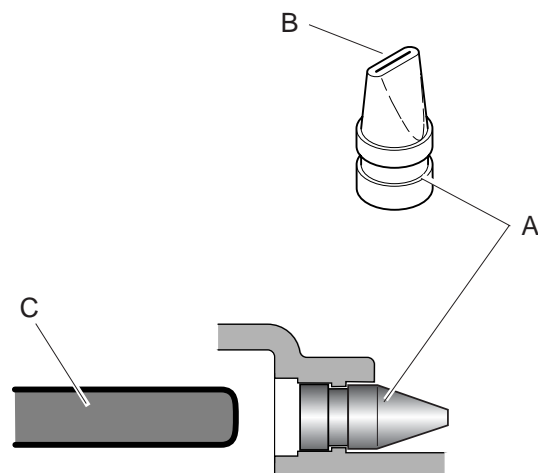
1. Remove sprocket guard.
2. Remove inner sprocket guard plate.
3. Disconnect lower oil line (A) from auto-oiler assembly and connect pressure tester 897803-30133 (B) to oil line (A) with pipe joint V186-000020 (C).
4. Tighten oil cap and apply pressure approx. 9.8 kPa (0.1kgf/cm<sup>2</sup>) (1.4psi).
5. Pressure should not drop. If the pressure drops, leakage may occur at oil cap, oil cap O-ring, mating surface of oil tank, oil line, grommet, or oil tank vent. Inspect them and replace defective part(s) with new parts as required.

## 6-3 Inspecting oil tank vent



**NOTE:** Oil tank vent prevents a vacuum from forming in oil tank when chain oil in the tank is consumed.

1. Remove oil tank vent (A) using paper clip and clean it.

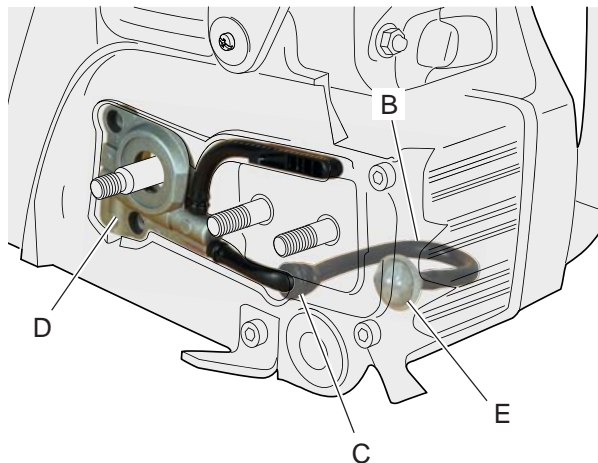
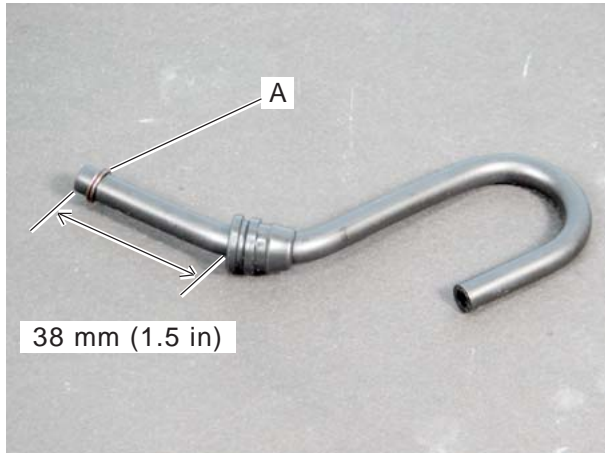


2. Inspect oil tank vent lips (B) for hardness or are opened. Replace as required.

3. Install oil tank vent (A) using suitable pusher (C) as shown.



6-4 Replacing oil line and grommet



1. Remove clutch assembly referring to “5-1 Inspecting clutch parts”.
2. Remove clutch plate, clutch drum, needle bearing and washer.
3. Pull out oil strainer from oil tank (Refer to “6-1 Inspecting oil cap and strainer”) and remove oil strainer from oil line.
4. Remove auto-oiler assembly from engine cover.
5. Remove oil line and grommet from engine cover.
6. Remove oil line from auto-oiler assembly.
7. Insert new oil line to grommet, install clip (A) on the end of oil line as shown.

**NOTE:** Apply sealant (Loctite #242, Threebond #1324 or equivalent) between grommet and oil line to prevent oil line movement.

8. Insert oil line (B) and grommet (C) in engine cover, and install as shown.

**NOTE:** Oil strainer (E) will be installed at step 11.

**NOTE:** If oil line is not positioned correctly, chain oil may not be supplied properly because oil strainer cannot move freely in oil tank.

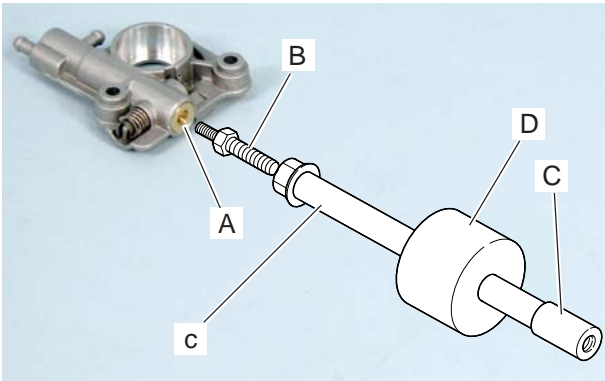
9. Reinstall auto-oiler assembly (D) to engine cover.
10. Install oil line to auto-oiler assembly.
11. Remove oil cap. Pull out oil line from oil tank and reinstall oil strainer (E).

## 6-5 Disassembling auto-oiler assembly



1. Remove auto-oiler assembly from the unit.

2. Tap 5-mm (M5 - Pitch 0.8mm) thread in the hole of plug (A).



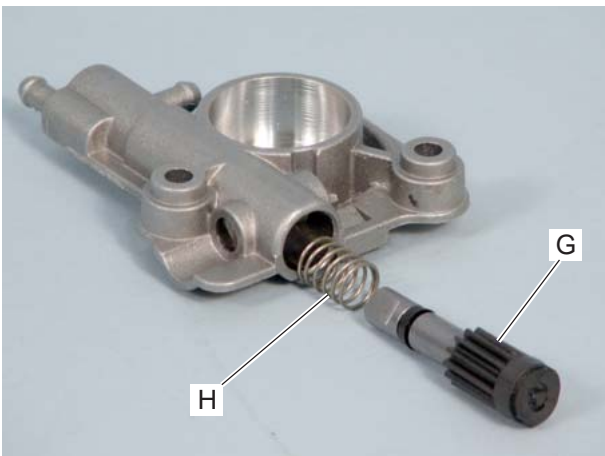
3. Screw the bolt (B) of puller 897501-03938 into the hole of plug (A), and connect PTO shaft puller 897603-23030 (C) as shown.

4. Hold auto-oiler body by one hand. Hold puller shaft end (c) by another hand. Hold auto-oiler body upper side and shake the weight (D) up and down several times to remove the plug (A).



5. Pull out spring pin (E) from adjuster needle (F) with pliers.

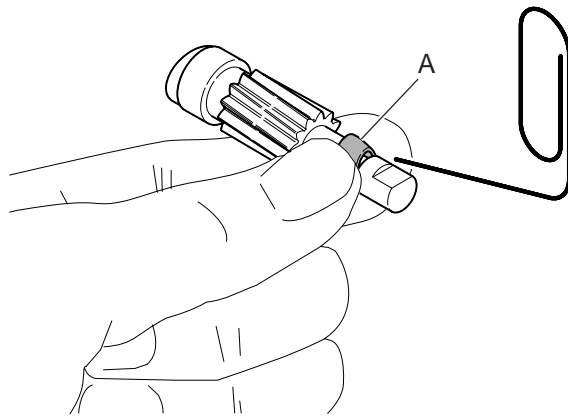
6. Pull out adjuster needle (F) from auto-oiler body.



7. Remove plunger (G) and spring (H).

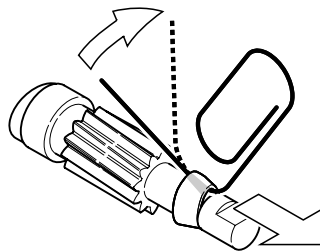
8. Check plunger if worn out or broken, and spring if fatigued or broken. Replace parts if defective.

6-6 Replacing V-ring



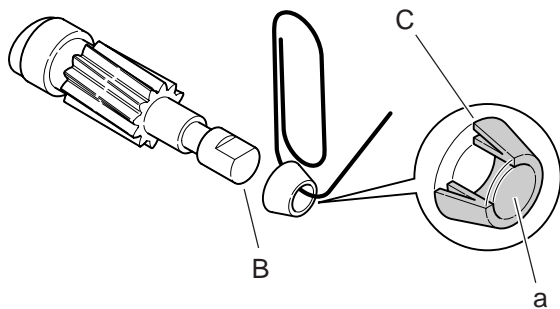
1. Inspect V-ring on plunger for hardness or damage. Replace as follows if required.

2. Secure V-ring (A) and insert thin steel wire such as paper clip through the opening as shown.



3. Bend steel wire and lift up V-ring from the groove.

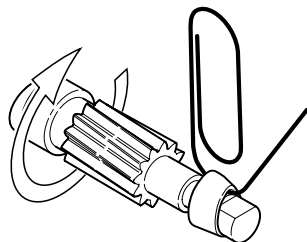
4. Slowly rotate plunger while pulling V-ring all the way out.



5. Oil inner wall (a) of new V-ring. Hook V-ring with steel wire as shown.

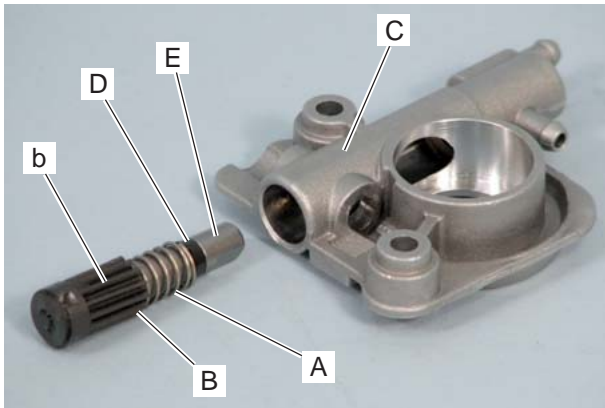
6. Put V-ring on the end (B) of plunger.

**NOTE:** Lips (C) of V-ring should face gear.



7. Move V-ring into the groove while carefully rotating plunger.

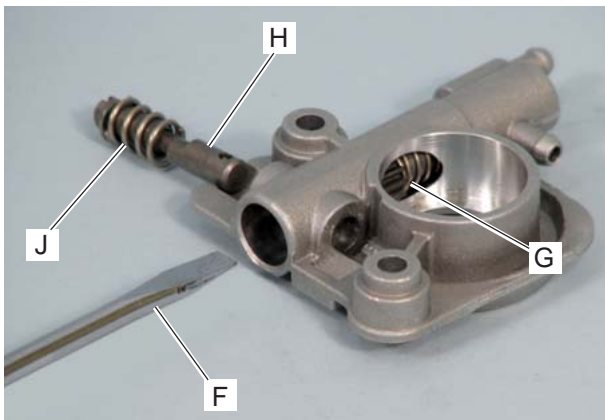
## 6-7 Assembling auto-oiler parts



1. Assemble spring (A) to plunger (B) as shown.

2. Coat plunger gear (b) and spring (A) with grease and insert into cylinder (C) of auto-oiler body.

**NOTE:** Do not apply grease on V-ring (D) and plunger shaft end (E), because these are a part of chain oil passage.

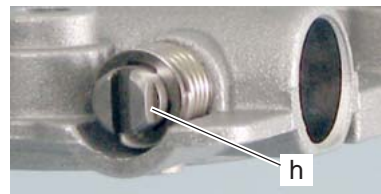


3. Push in plunger with small screwdriver (F), and hold plunger in place with finger through the center hole (G) of auto-oiler body. Remove screwdriver (F).

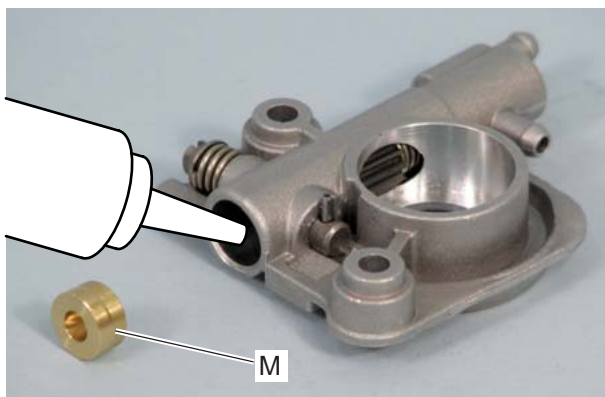
4. Install adjuster needle (H) with spring (J) into oiler body.



5. Press adjuster needle (H) to the bottom, orienting the flat surface (h) as shown.



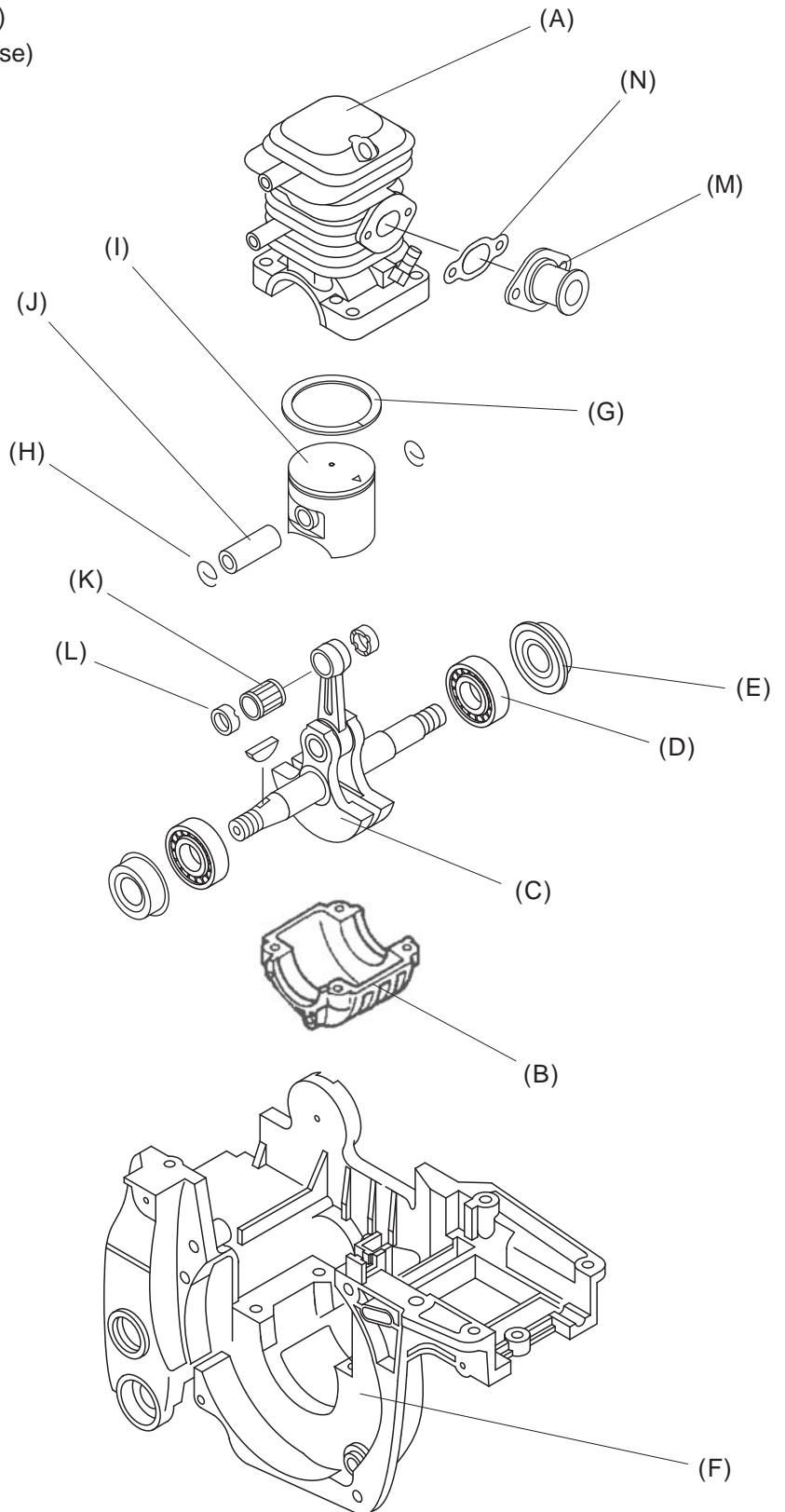
6. Tap in new spring pin (K) into hole (L) of adjuster needle, until spring pin bottoms.



7. Apply grease in plunger hole. Tap plug (M) into hole with plastic mallet until plug is flush with the outer hole wall circumference.

7 ENGINE

- (A) Cylinder (Upper crankcase)
- (B) Crankcase (Lower crankcase)
- (C) Crankshaft assembly
- (D) Ball bearing
- (E) Oil seal
- (F) Engine cover
- (G) Piston ring
- (H) Snap ring
- (I) Piston
- (J) Piston pin
- (K) Needle bearing
- (L) Piston pin spacer
- (M) Intake bellows
- (N) Intake gasket



## 7-1 Testing cylinder compression



**NOTE:** Test cylinder compression when engine is cold.

1. Move ignition switch to STOP position. Then remove spark plug.
2. Install compression gauge 91037 (A) in spark plug hole and tighten by hand. Pull starter several times to stabilize reading on compression gauge.
3. If pressure is lower than approx. 75% of standard compression pressure (Refer to "1-2 technical data"), inspect cylinder bore, piston and piston ring for wear or damage.

4. If pressure is more than approx. 125% of standard compression pressure, inspect cylinder combustion chamber and exhaust port, piston crown, and muffler for carbon deposits.

**NOTE:** Compression pressure varies with volume of compression gauge tip occupying cylinder combustion chamber. If gauge tip volume is considerably different from spark plug volume, it is recommended to measure and note compression pressure of brand-new engines as standard pressure in advance.

## 7-2 Cleaning cooling air passage



1. Remove cylinder cover and starter assembly from the unit.

**WARNING**  **DANGER**

**Always wear eye protection when using compressed air for cleaning. Otherwise, eye damage can occur from flying particles**

2. Inspect cylinder cooling fins (A) for blockage with dirt and/or saw dust. Clean them with wooden or plastic stick or compressed air as required.
3. Install all removed parts.

### 7-3 Inspecting muffler and exhaust port



1. Remove cylinder cover and muffler.
2. Inspect cylinder exhaust port and clean the port using wooden or plastic stick if carbon is found.

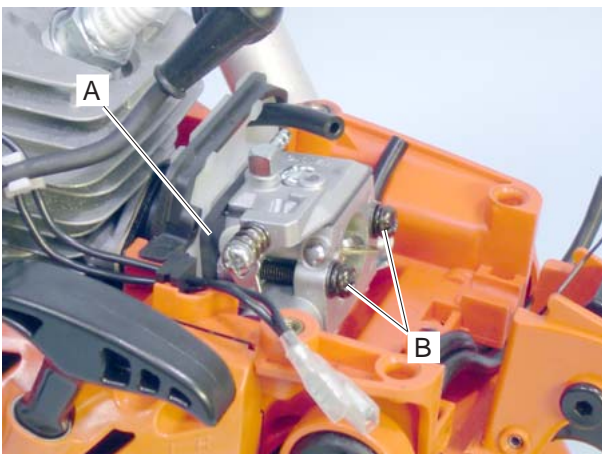
**NOTE:** When cleaning exhaust port, always position piston at Top Dead Center (TDC) to prevent carbon from entering cylinder. Do not use metal tool and be careful not to scratch piston or cylinder.

**NOTE:** Replace exhaust gasket with new one when removing muffler.



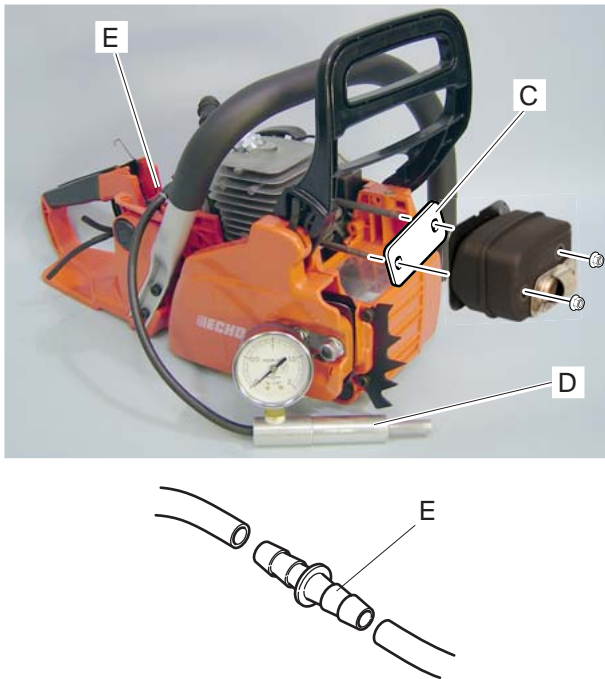
3. Remove muffler lid (A) and spark arrestor screen (B) from muffler.
4. Remove carbon deposits from spark arrestor screen and muffler lid. If screen has heavy deposits, replace with a new screen.
5. Reinstall muffler with new gasket and cylinder cover.

### 7-4 Testing crankcase and cylinder sealing



1. Remove cylinder cover.
2. Remove air filter bracket and air filter. Disconnect fuel return line and fuel inlet line from purge bulb (Refer to "4-3 Replacing purge bulb"). Remove switch bracket (Refer to "3-5 Replacing ignition switch"). Disconnect fuel line and pulse line from carburetor, and remove carburetor from the unit.
3. To seal intake port, install pressure rubber plug 897826-16131 (A) between insulator and carburetor, and fasten with 2 screws (B) as shown.

## 7-4 Testing crankcase and cylinder sealing (continued)



4. Remove muffler. Install pressure rubber plug 897831-16131 (C) on exhaust port, then reinstall muffler to seal port.

5. Connect pressure tester 897803-30133 (D) to pulse line using pipe joint V186-000020 (E).

6. Apply pressure approx. 9.8 kPa (0.1 kgf/cm<sup>2</sup>) (1.4 psi) by hand pumping pressure tester.

**NOTE:** Do not exceed 30 kPa (0.3 kgf/cm<sup>2</sup>) (4.3 psi). Otherwise, damage to oil seal may occur.

7. If the reading drops, leakage may occur.

8. Leakage may occur from crankcase seam and oil seal. Use soap water to locate leakage.

9. Remove pressure tester (D), pipe joint (E) from pulse pipe and pressure rubber plugs (A) (C) from intake insulator and exhaust port.

## 7-5 Removing engine block



1. Remove starter assembly, cylinder cover, sprocket guard and front handle from unit.

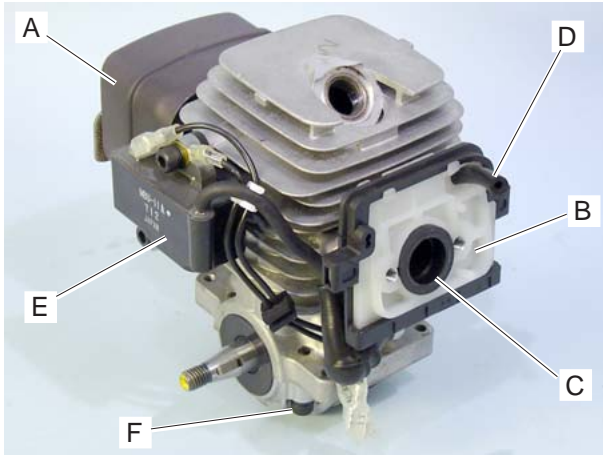
2. Remove air filter bracket and air filter. Disconnect fuel return line and fuel inlet line from purge bulb (Refer to "4-3 Replacing purge bulb"). Remove switch bracket (Refer to "3-5 Replacing ignition switch"). Disconnect fuel line and pulse line from carburetor, and remove carburetor from the unit.

3. Remove flywheel (Refer to "3-10 Inspecting flywheel and key"), clutch assembly (Refer to "5-1 Inspecting clutch parts") and auto-oiler assembly (Refer to "6-5 Inspecting auto-oiler assembly").

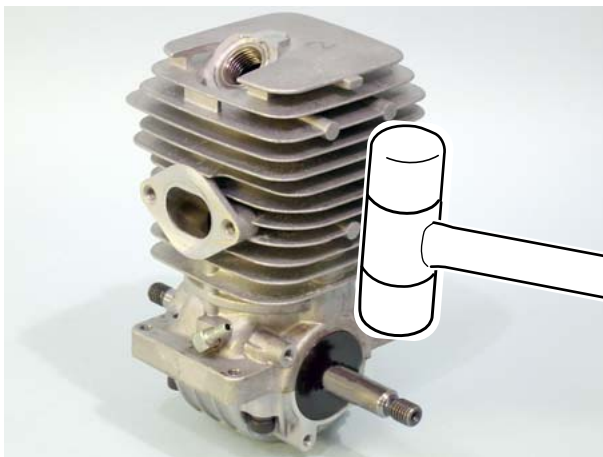
4. Remove 4 bolts (D), securing engine block from bottom of unit. Remove engine block with muffler (A), ignition coil (B) and intake insulator (C) attached.



7-6 Inspecting cylinder



1. Remove muffler (A) and muffler gasket from cylinder.
2. Disconnect intake insulator (B) from intake bellows (C) and pulse line (D) taking care not to damage them.
3. Remove intake bellows (C) and pulse line (D) from cylinder. Remove ignition coil (E).
4. Remove 4 bolts (F) securing crankcase.

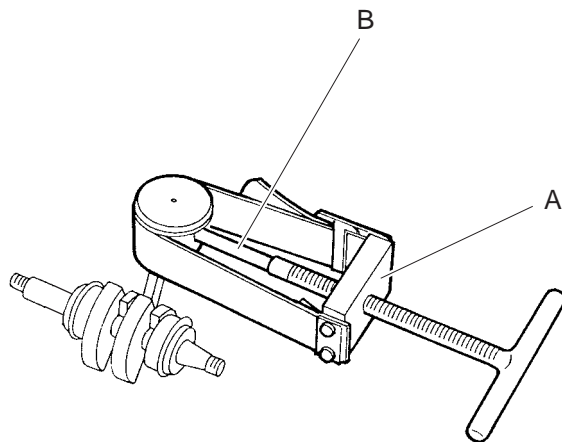


5. Gently tap both crankshaft ends evenly using plastic mallet to remove lower crankcase with crankshaft and piston assembly.
6. Inspect cylinder combustion chamber and clean with a plastic or wooden scraper if carbon is deposited.

**NOTE:** Do not use metal tools, or damage to cylinder wall may result.

7. Inspect cylinder wall and replace crankcase as a set if plating is worn, peeled away, scored or exposing cylinder base metal.

7-7 Inspecting piston and piston ring



1. Inspect piston ring and replace it if broken or scored, or if it exceeds service limits. Refer to "1-5".
2. Inspect piston crown, top land, ring groove and skirt. Clean them with fine sand paper, oil stone, or ring groove cleaning tool if carbon is found.

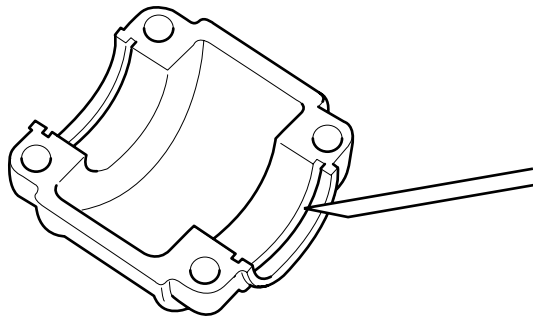
**NOTE:** Do not use square end of broken piston ring when cleaning piston ring groove, otherwise piston ring groove might be damaged.

3. Remove snap rings from both sides of piston pin.
4. Push piston pin out from piston.

**NOTE:** If piston pin is tight, use piston pin tool 897702-30131 (A) with adapter (B) stamped "8" on an end.

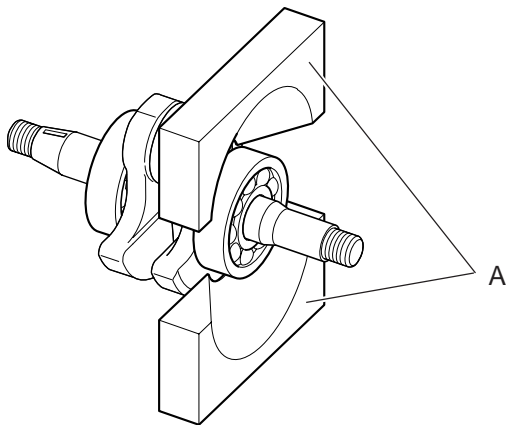
5. Inspect needle bearing and spacers, and replace if wear or discoloration is noted.

## 7-8 Inspecting crankcase and crankshaft



1. Clean crankcase. Replace as a set of cylinder and crankcase if damaged.
2. Completely remove sealant residue on mating surfaces and bearing bore of crankcase using wooden or plastic scraper, or chemical gasket remover.
3. Measure crankshaft runout and replace if it exceeds service limits (Refer to "1-5"). Replace crankshaft if the connecting rod bearing is rough, damaged, or discolored.

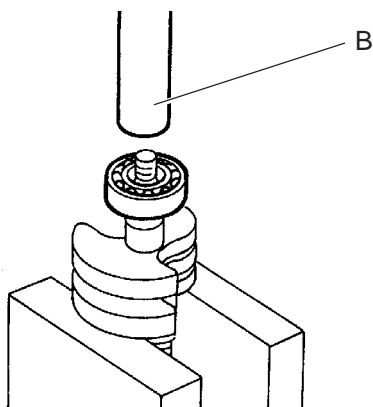
## 7-9 Replacing oil seal and ball bearing



1. Check oil seal(s) and replace if defective.

2. Check ball bearing(s) for smooth rotation. If not, remove ball bearing(s) using bearing wedge (A) 897701-02830.

**NOTE:** When removing the oil seal or ball bearing at clutch side, worm gear should be removed in advance (Refer to "6-8 Removing worm gear").

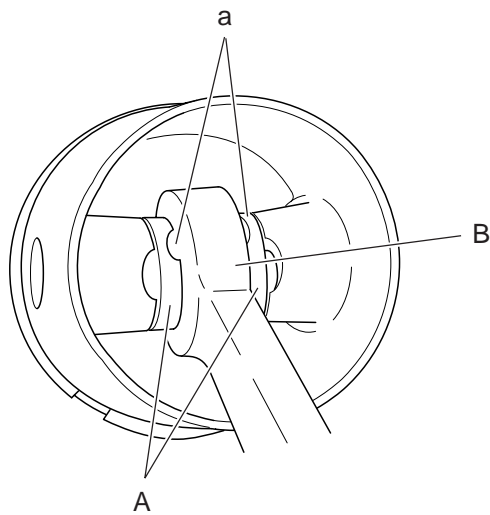


3. Install new ball bearing(s) onto crankshaft using bearing/seal tool 897726-09130 (B). Bearing should be completely seated against crankshaft counterweights.

**NOTE:** Preheat ball bearing using heating gun, heat lamp, or suitable heater for easier installation.

4. Install oil seals onto both ends of crankshaft insuring proper direction of oil seal.

7-10 Installing piston and piston ring

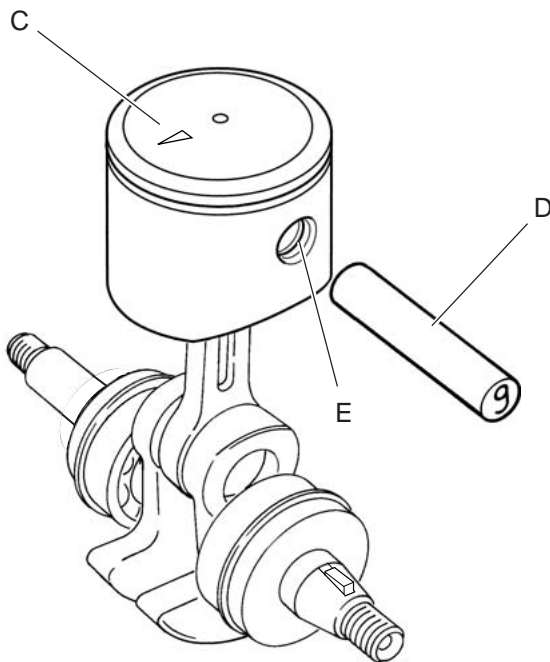


1. Lubricate needle bearing with 2-stroke engine oil.

2. Set needle bearing and piston pin spacers (A) on small end of connecting rod (B) as shown.

**NOTE:** Place piston pin spacers on connecting rod with dents (a) inside as shown.

**NOTE:** Place piston over connecting rod with piston arrow mark (C) pointing as shown.



3. Insert pin guide tool (D) stamped "9", through piston, piston pin spacers and needle bearing set at step 2.

4. Insert piston pin in piston pushing out pin guide tool until the pin end comes up to snap ring groove (E).

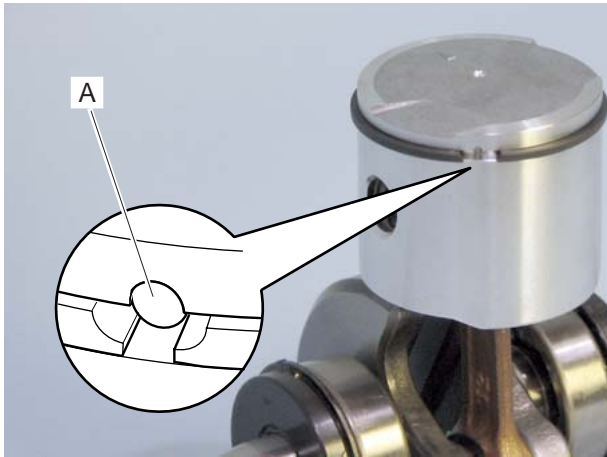
**NOTE:** If piston pin is tight, use piston pin tool 897702-30131 with pusher adapter stamped "8".

5. Install new snap rings on both end of piston pin. Make sure that they are properly seated in snap ring grooves.

**NOTE:** Always use new snap rings.

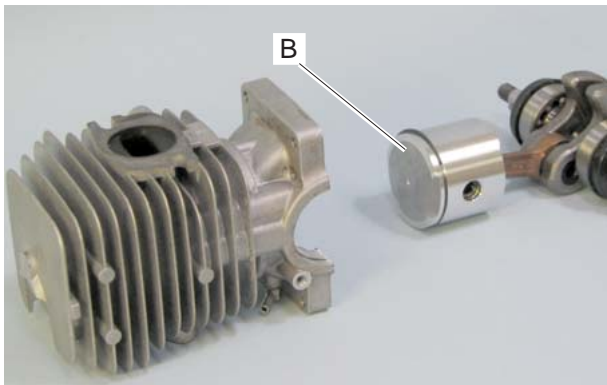
6. Install piston ring on piston.

## 7-11 Installing piston into cylinder



1. Apply 2-stroke oil on cylinder walls, oil seal grooves, piston ring, ball bearing, and both sides of con-rod.

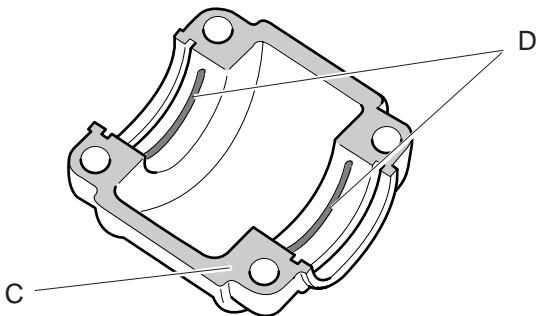
2. Position end gap of piston ring with locating pin (A).



3. Install piston in cylinder with arrow (B) pointing to muffler side.

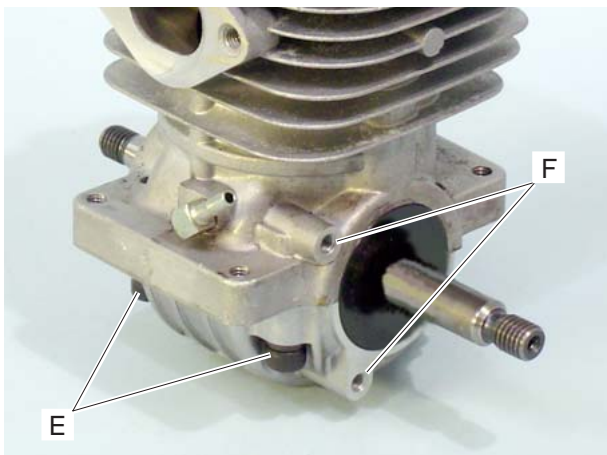
**NOTE:** When installing piston in cylinder, do not twist cylinder to avoid breakage of piston ring and scoring cylinder bore.

4. Make sure that rims of oil seal are properly seated in the grooves of cylinder (upper crankcase).



5. Apply liquid gasket (Loctite #515: Parts No. 890610-00051, or equivalent) on seams (C) of lower crankcase half.

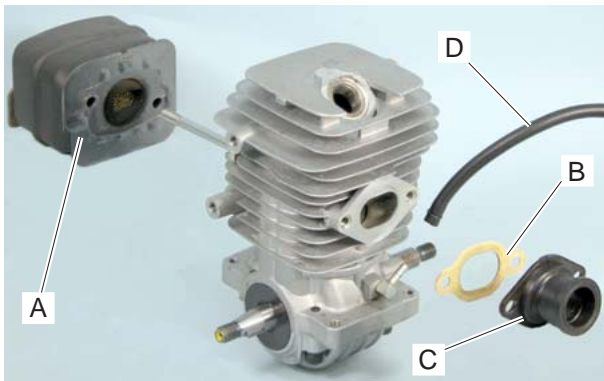
6. Apply adhesive (Loctite #675 or equivalent) on bearing bores (D) of lower crankcase half as shown.



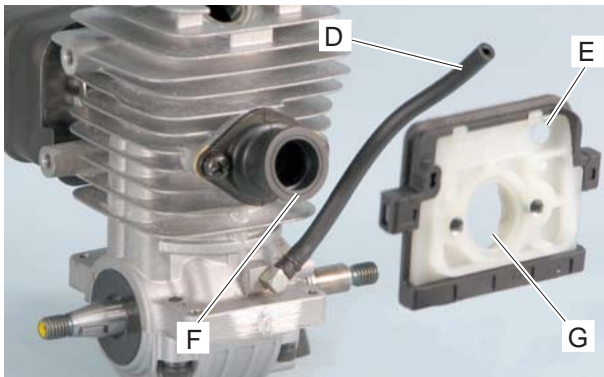
7. Set crankcase halves as shown. Fasten 4 bolts (E).

**NOTE:** When assembling cylinder to lower crankcase, match them together in correct direction referring to two threaded holes (F) for auto-oiler assembly.

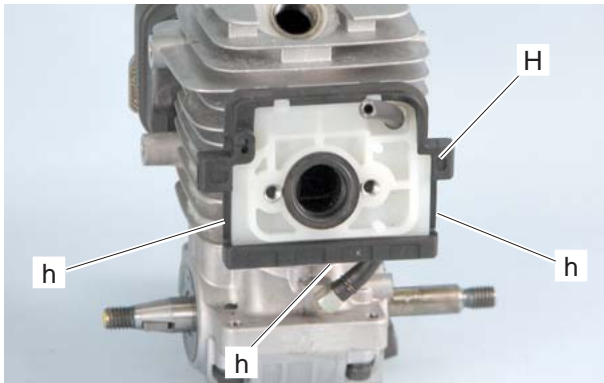
7-12 Installing engine block



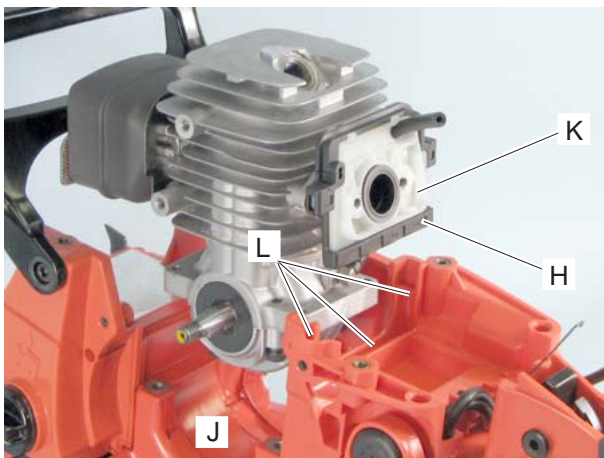
1. Assemble muffler gasket and muffler (A) to cylinder.
2. Assemble gasket (B), intake bellows (C) and pulse line (D) to cylinder.



3. Pass pulse line (D) through hole (E) of intake insulator. Install the flange (F) of intake bellows in hole (G) of intake insulator.

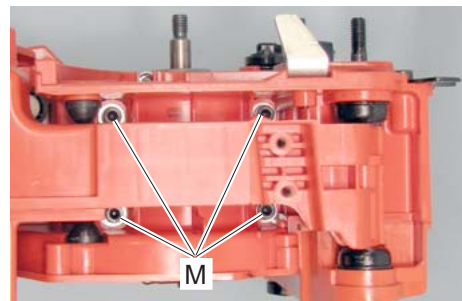


4. Apply 2 stroke engine oil to the both sides and bottom (h) of intake insulator cushion (H).



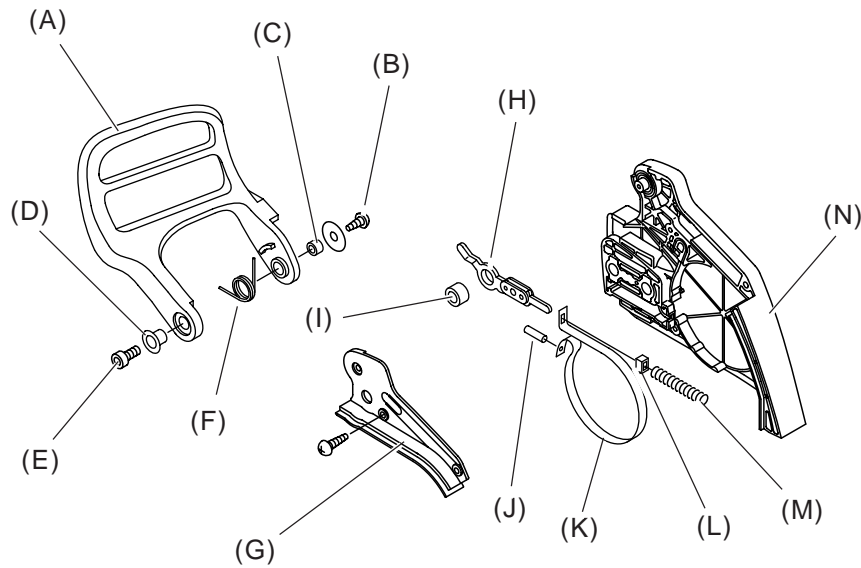
5. Mount engine block on engine cover (J) while installing intake insulator cushion (H) with intake insulator (K) into the grooves (L) of engine cover.

6. Tighten 4 bolts (M) at unit bottom to secure engine block to engine cover. Install all other removed parts.



## 8 CHAIN BRAKE SYSTEM

- (A) Brake lever
- (B) Screw
- (C) Collar
- (D) Collar
- (E) Bolt
- (F) Torsion spring
- (G) Brake cover
- (H) Brake connector
- (I) Spacer
- (J) Roller
- (K) Brake band
- (L) Spacer
- (M) Compression spring
- (N) Sprocket guard



## 8-1 Disassembling chain brake



Released position



Engaging position

**WARNING**  **DANGER**

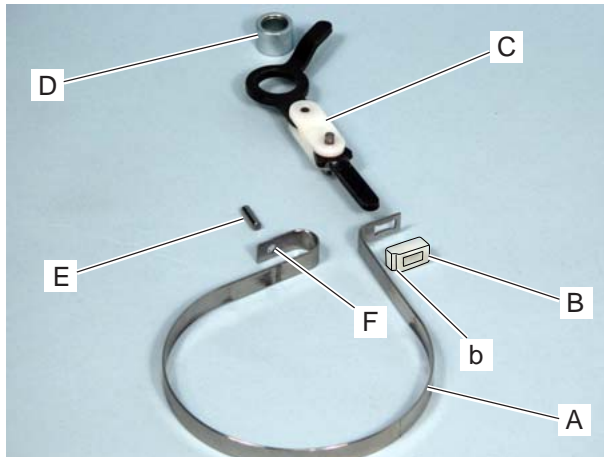
Wear eye protection and safety gloves, when disassembling or assembling chain brake to prevent eye, and hand, from injury.

1. Move brake lever (A) to released position. Remove sprocket guard from the unit.
2. Move lever (B) of sprocket guard to engaging position.

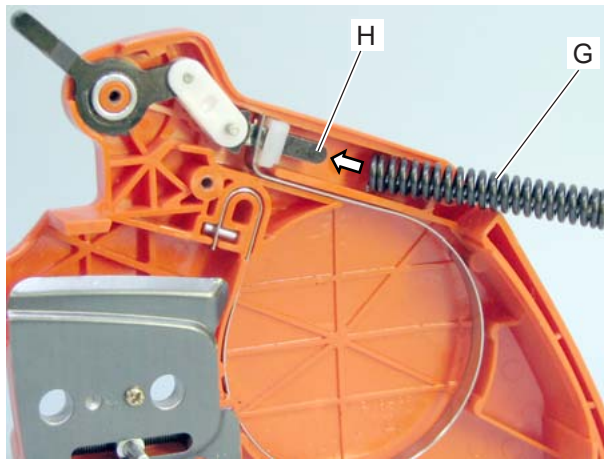
**NOTE:** Make sure that lever (B) is in engaging position before removing brake cover (C), otherwise compression spring may jump out.

3. Loosen three screws securing brake cover (C) and remove brake cover.
4. Inspect all the brake parts for damage. Replace them as required.

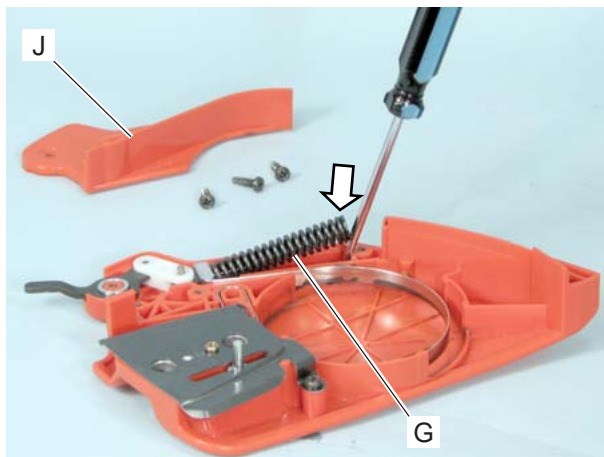
8-2 Assembling brake parts



1. Assemble brake band (A) together with spacer (B), brake connector (C) and collar (D), placing the notch (b) of spacer as shown. Install roller (E) through brake band hole (F).



2. Set the above assembly into sprocket guard as shown. Slide in compression spring (G) to the end (H) of brake connector as shown.



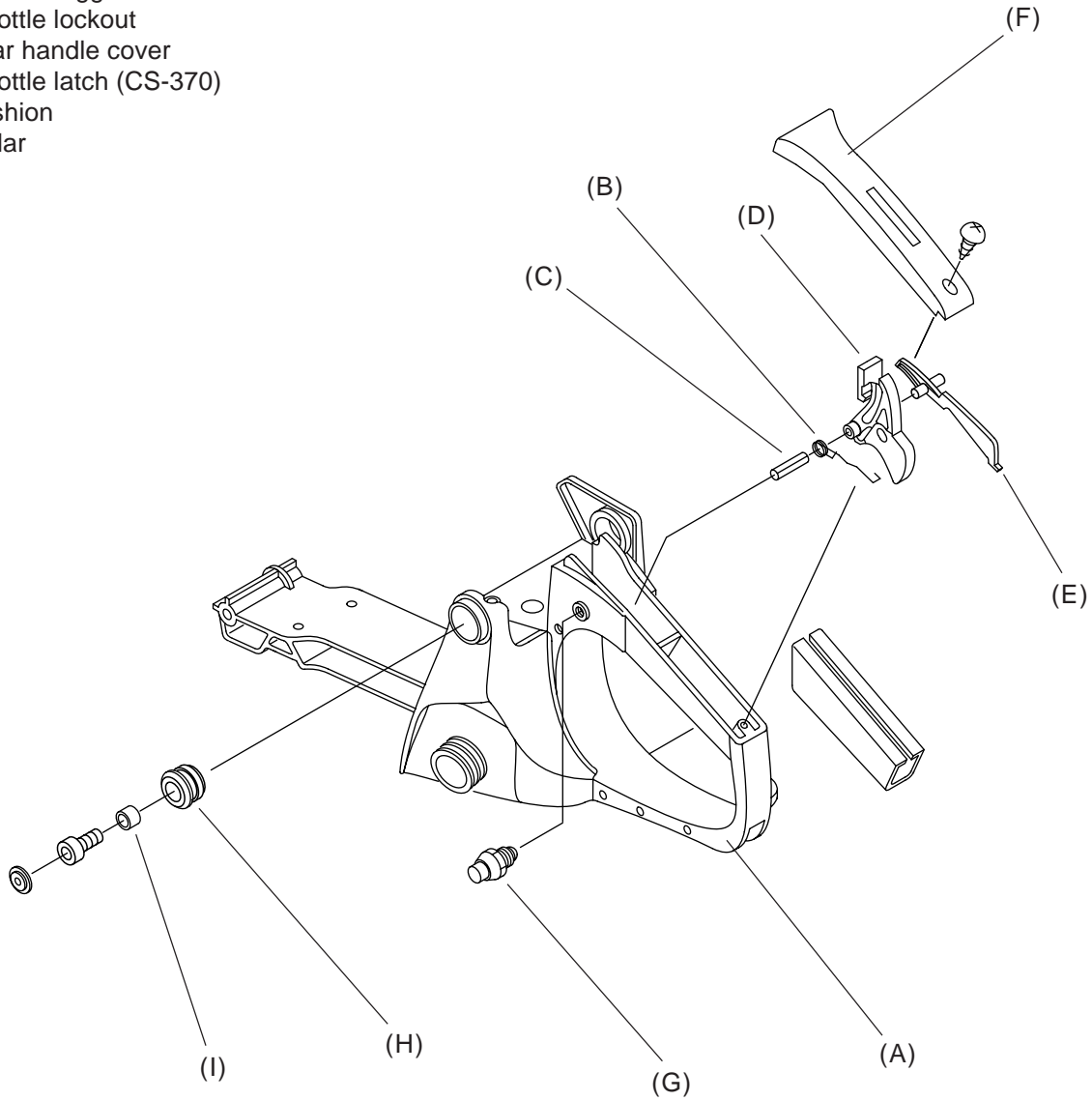
3. Install compression spring (G) into sprocket guard using flat-blade screwdriver as shown.

4. Apply molybdenum grease on whole of compression spring (G) and other friction parts.

5. Install brake cover (J).

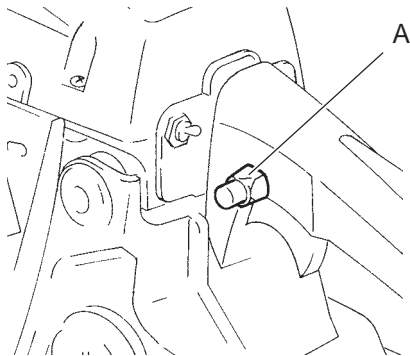
## 9 REAR HANDLE AND CONTROL SYSTEM

- (A) Rear handle
- (B) Torsion spring
- (C) Spring pin
- (D) Throttle trigger
- (E) Throttle lockout
- (F) Rear handle cover
- (G) Throttle latch (CS-370)
- (H) Cushion
- (I) Collar





9-1 Replacing throttle latch (CS-370)



1. Remove throttle latch (A) from rear handle with 13 mm wrench.



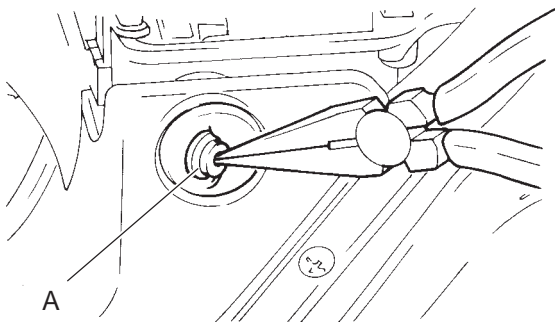
**WARNING**

Always wear eye protection when using compressed air for cleaning. Otherwise, eye damage can occur from flying particles

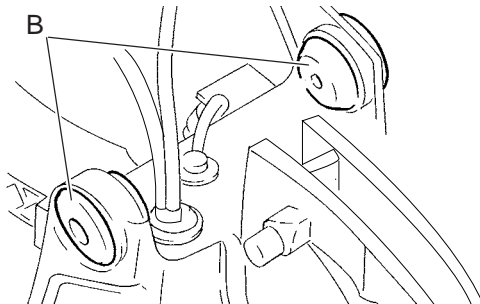
2. Inspect throttle latch for blockage with dirt and / or saw dust. Clean it with brush or compressed air as required. Replace if defective.

**NOTE:** When installing throttle latch, do not exceed 6-10 kgf•cm (0.6-1.0 N•m) (5-9 in•lbf) of torque. If torque exceeds this standard, throttle latch damage may occur.

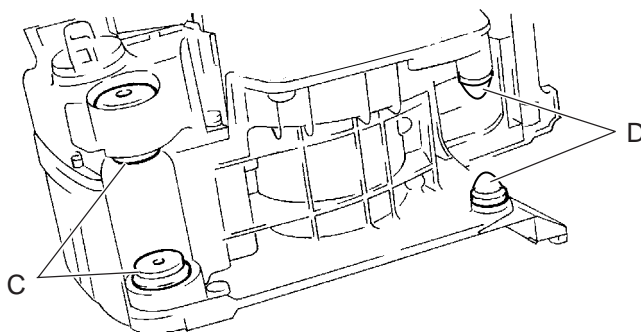
9-2 Replacing cushions



1. Remove cylinder cover from the unit.
2. Remove switch bracket (Refer to "3-5 Replacing ignition switch"). Remove air filter bracket and air filter. Disconnect fuel lines from carburetor, and remove carburetor from the unit.
3. Remove cushion caps (A) using needle-nose pliers as shown.

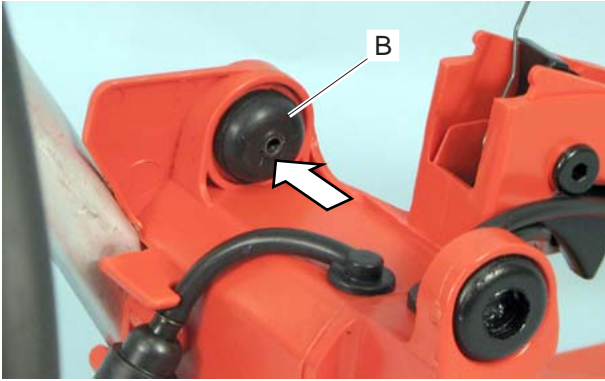


4. Remove bolts inside cushions.
5. Remove rear handle from the unit.

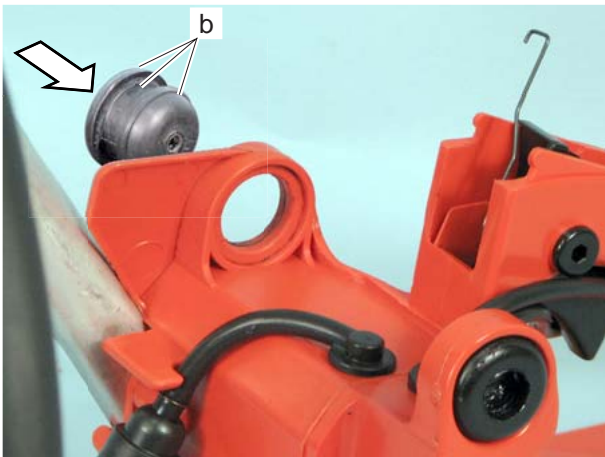


6. Inspect cushions (B), (C) and (D) for cracking, wear or separation from metal part. If damaged, replace with new cushion(s) as follows.

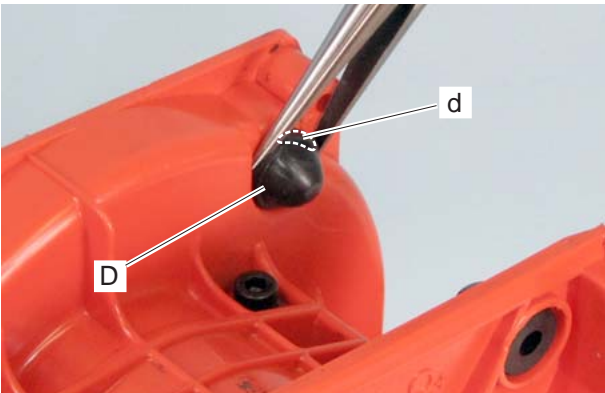
## 9-2 Replacing cushions (continued)



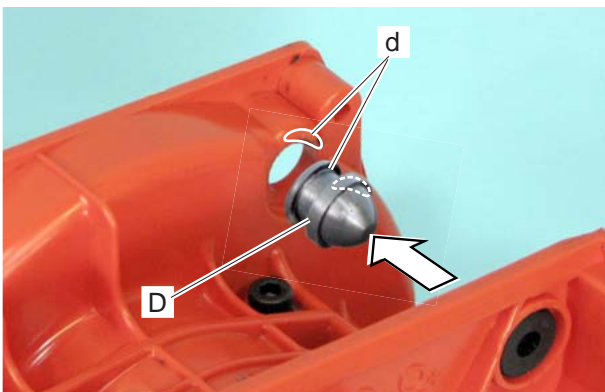
7. To remove cushion (B) and (C), push out cushion as shown.



8. Apply lithium-based grease on outer surfaces (b), then push in cushion as shown.



9. Remove cushion (D) with needle-nose pliers, cutting off glued part (d) with cutter.

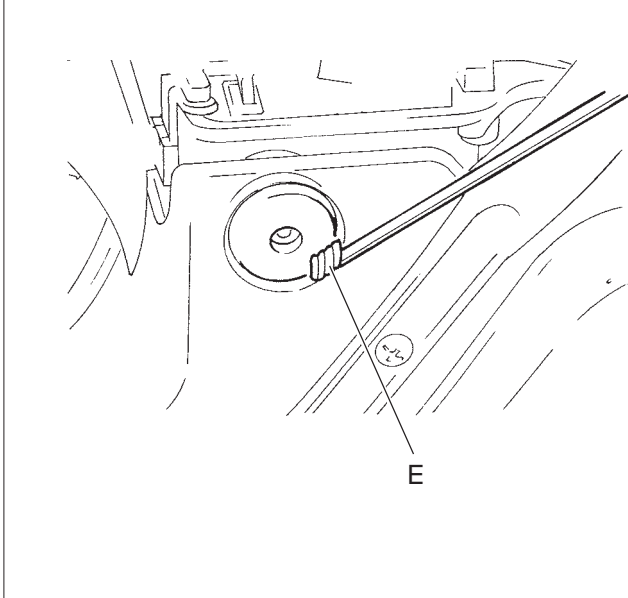


10. Push in cushion (D) without applying grease/oil.

11. Apply adhesive (Loctite #424, ThreeBond #1741 or equivalent) on the part (d) between cushion and engine cover.

**NOTE:** If grease/oil is applied on cushion, adhesive force may be weak.

9-2 Replacing cushions (continued)



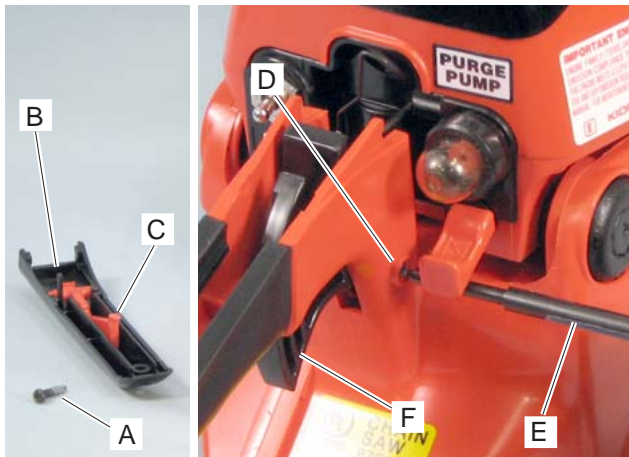
12. Put rear handle on the unit.

13. Tighten cushion bolts. Apply approximately 0.5 g (0.001 lb) lithium-based grease (E) inside cushion.

14. Install cushion caps to cushions using needlenose pliers.

15. Reassemble carburetor (Refer to “4-14 Installing carburetor”), switch bracket (Refer to “3-5 Replacing ignition switch”) and related parts.

9-3 Replacing throttle trigger



1. Loosen screw (A) and remove rear handle cover (B).

2. Inspect rear handle cover (B) and throttle lockout (C) for cracking or wear. If damaged, replace it as required.

3. Push out spring pin (D) from rear handle using spring pin tool 897724-01361 (E).

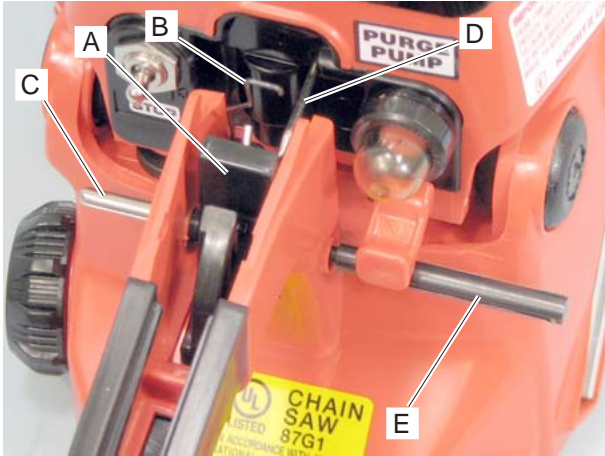
**NOTE:** Spring pin will stop before completely coming off from rear handle, because of effective length of spring pin tool.

4. Remove throttle trigger (F) together with torsion spring.

5. Set torsion spring (G) on throttle trigger (F) as shown.



## 9-3 Replacing throttle trigger (continued)

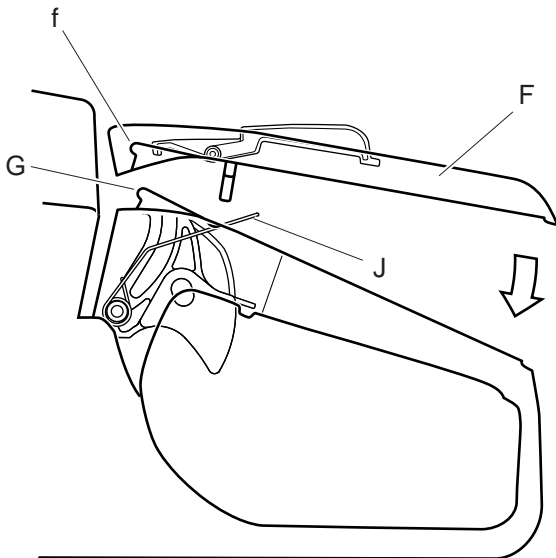


6. Install throttle trigger (A) with torsion spring (B) and insert spring pin (C) as follows.

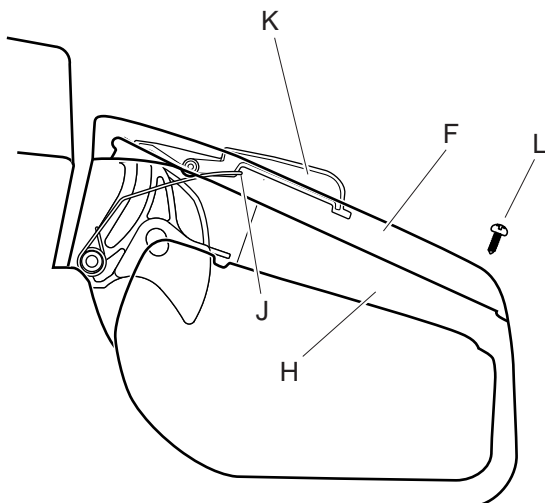
1) Insert spring pin (C) in the hole of rear handle so the tip of spring pin does not protrude inside handle.

2) Hold throttle trigger (A) with torsion spring (B) in place, and insert spring pin tool 897724-01361 (E) from the other side of handle through the hole of throttle trigger.

3) Lightly tap in spring pin (C), pushing out spring pin tool (E).



7. Hook the inside notch (f) of rear handle cover (F) on the tab (G) of rear handle.

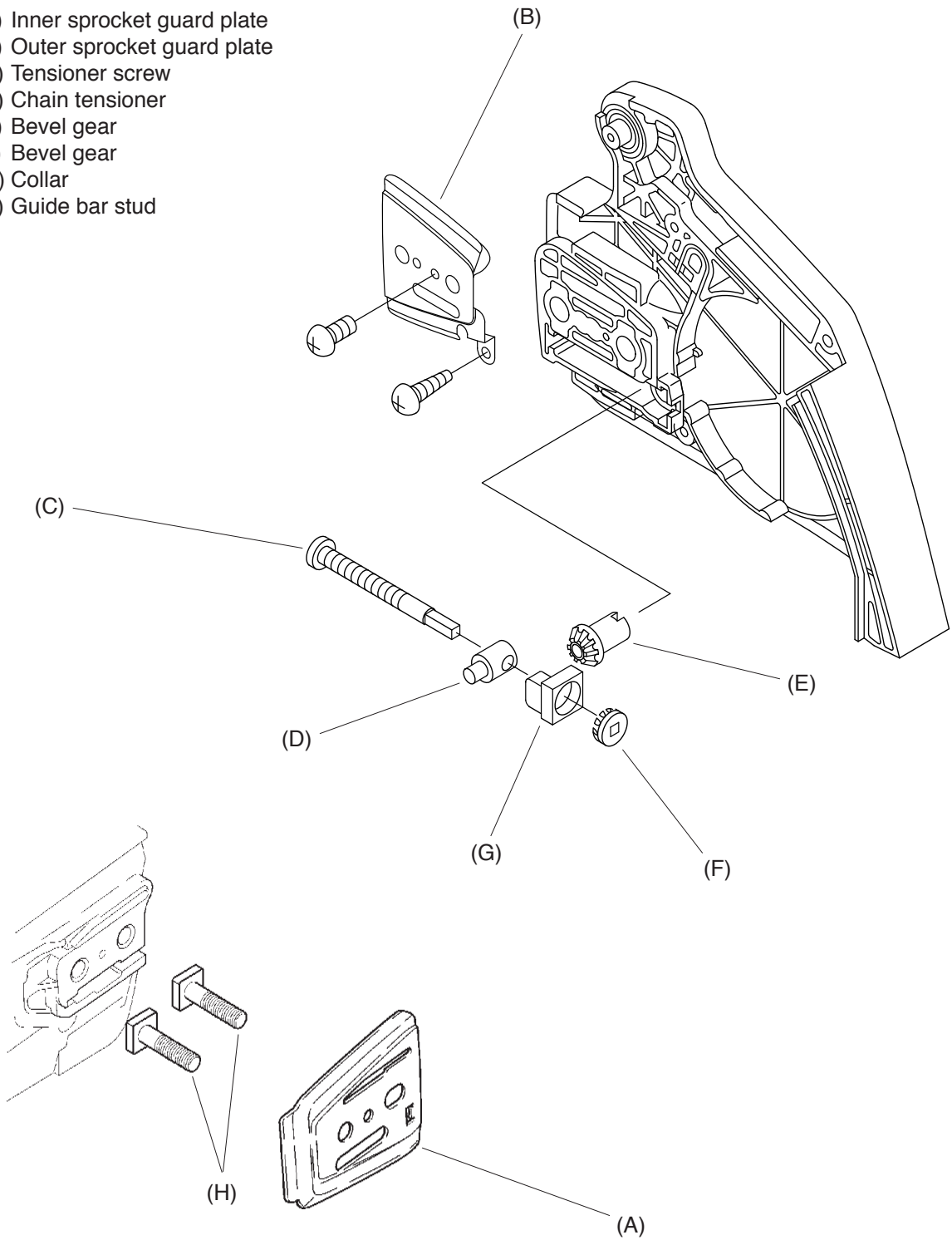


8. Install rear handle cover (F) on rear handle (H), setting torsion spring (J) with throttle lockout (K) as shown.

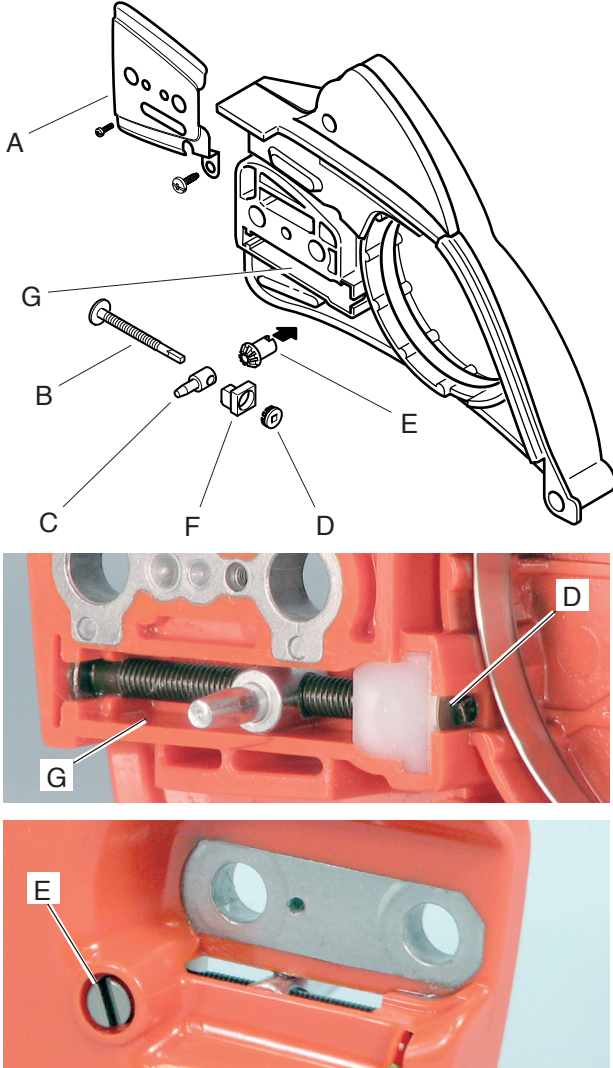
9. Tighten screw (L) to secure rear handle cover (F). Check throttle trigger and throttle lockout for correct movement.

10 GUIDE BAR MOUNTING SYSTEM

- (A) Inner sprocket guard plate
- (B) Outer sprocket guard plate
- (C) Tensioner screw
- (D) Chain tensioner
- (E) Bevel gear
- (F) Bevel gear
- (G) Collar
- (H) Guide bar stud

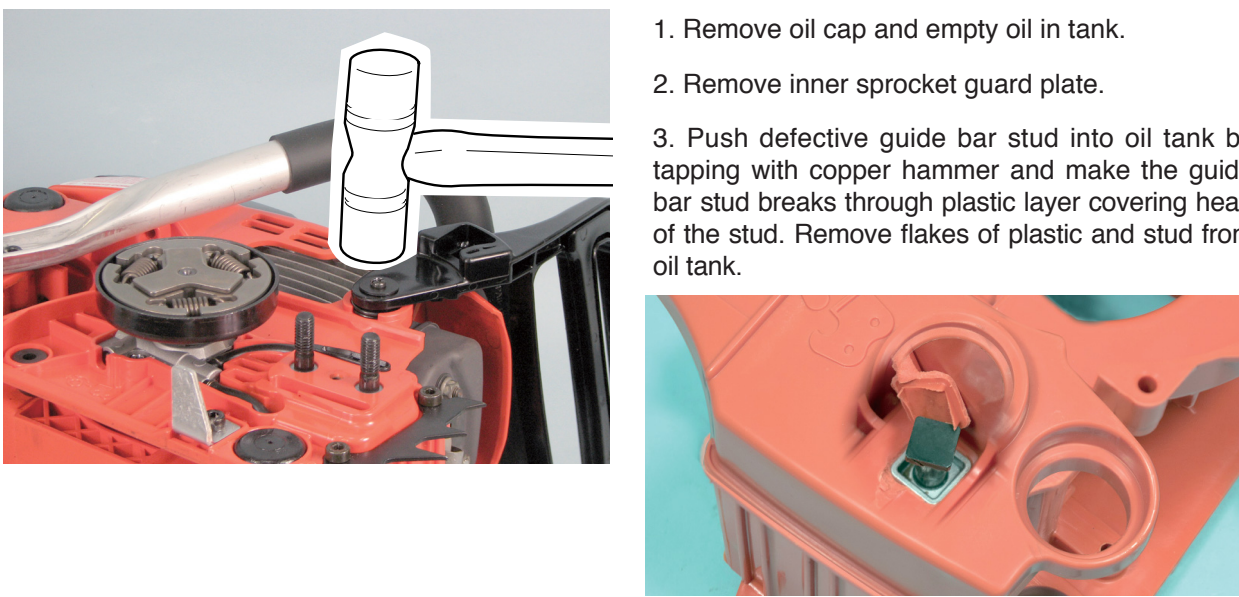


## 10-1 Replacing chain tensioner



1. Remove sprocket guard from the unit.
2. Remove outer sprocket guard plate (A) from sprocket guard. Remove tensioner screw (B), chain tensioner (C) and bevel gears (D) (E) and collar (F).
3. Inspect them for damage or wear. Replace as required.
4. Install bevel gear (E) into sprocket guard.
5. Screw chain tensioner (C) on tensioner screw (B).
6. Set bevel gear (D) in collar (F) and insert tensioner screw (B) with chain tensioner (C) in bevel gear with collar (F).
7. Install sub-assembled tensioner screw in slot (G) of sprocket guard, confirming engagement of bevel gear (D) and (E).
8. Reinstall outer sprocket guard plate (A).

## 10-2 Replacing guide bar stud



1. Remove oil cap and empty oil in tank.
2. Remove inner sprocket guard plate.
3. Push defective guide bar stud into oil tank by tapping with copper hammer and make the guide bar stud breaks through plastic layer covering head of the stud. Remove flakes of plastic and stud from oil tank.

10-3 Installing guide bar stud

1. Apply adhesive (Loctite #675, or equivalent) to un-threaded part (A) of new guide bar stud.
2. Install new stud to the stud-hole of oil tank using a pair of tweezers (B).
3. Lightly tap square head of stud with long bar tool (C) and hammer.
4. Install spacer [Bore: 8 to 10 mm (0.32 to 0.40 in), Height: 7 to 9 mm (0.28 to 0.35 in)] (D). Thread M8 nut (E) clockwise onto stud. Turn nut clockwise to pull stud through the engine housing mounting hole. The square head of the stud should seat against the oil tank wall parallel with inner ribs.
5. Look into oil tank and check if square head (F) of the stud is properly seated inside engine cover. If not, install two nuts to the stud and secure them against each other.
6. Turn nut (G) counterclockwise or nut (H) clockwise to correct the position of the square head.
7. Repeat step 4 to seat the stud correctly in square hollow inside engine cover.
8. Install all removed parts.

## 11 MAINTENANCE GUIDE

## 11-1 Service Intervals

Inspecting point	Service	Reference	Intervals		
			Daily	3 months or 100 hours	6 months or 300 hours
Screws and bolts *	Retighten / Replace			○	
Air filter	Clean	4-1	○		
	Inspect / Replace	4-1		○	
Carburetor	Inspect / Repair	4-8 to 4-14			○
Fuel leaks	Inspect / Repair	4-2, 4-4	○ **		
Fuel line	Inspect / Repair	4-6		○	
Cooling system	Inspect / Clean	7-2	○		
Spark plug	Clean / Regap	3-2, 3-3		○	
	Inspect / Replace	3-3			○
Fuel strainer	Clean / Replace	4-2		○	
Leads and connections	Inspect / Repair	3-5		○	
Fuel tank	Clean inside.	4-4		○	
Muffler and exhaust port	Clean	7-3		○	
Starter system	Inspect / Repair	2-2		○	
Oil tank	Clean inside.			○	
Oil strainer	Clean / Replace	6-1		○	
Sprocket	Inspect / Replace	1-5, 5-1		○	
Guide bar	Inspect / Clean		○		
Chain brake	Inspect / Repair	8-1, 8-2	○		

**Daily:** Inspecting in every services.

**IMPORTANT:** Service intervals shown above are maximum. Actual use and your experience will determine the frequency of required maintenance.

\* Retighten the following screws and bolts after first 1 week use, and every 3 months.

- Cylinder cover screws (3 pcs.)
- Starter assembly screws (4 pcs.)
- Cushion screws and bolts (2 pcs. each)
- Front handle screws (4 pcs.)
- Engine block mount bolts (4 pcs.)

\*\* Inspect after every refuel.



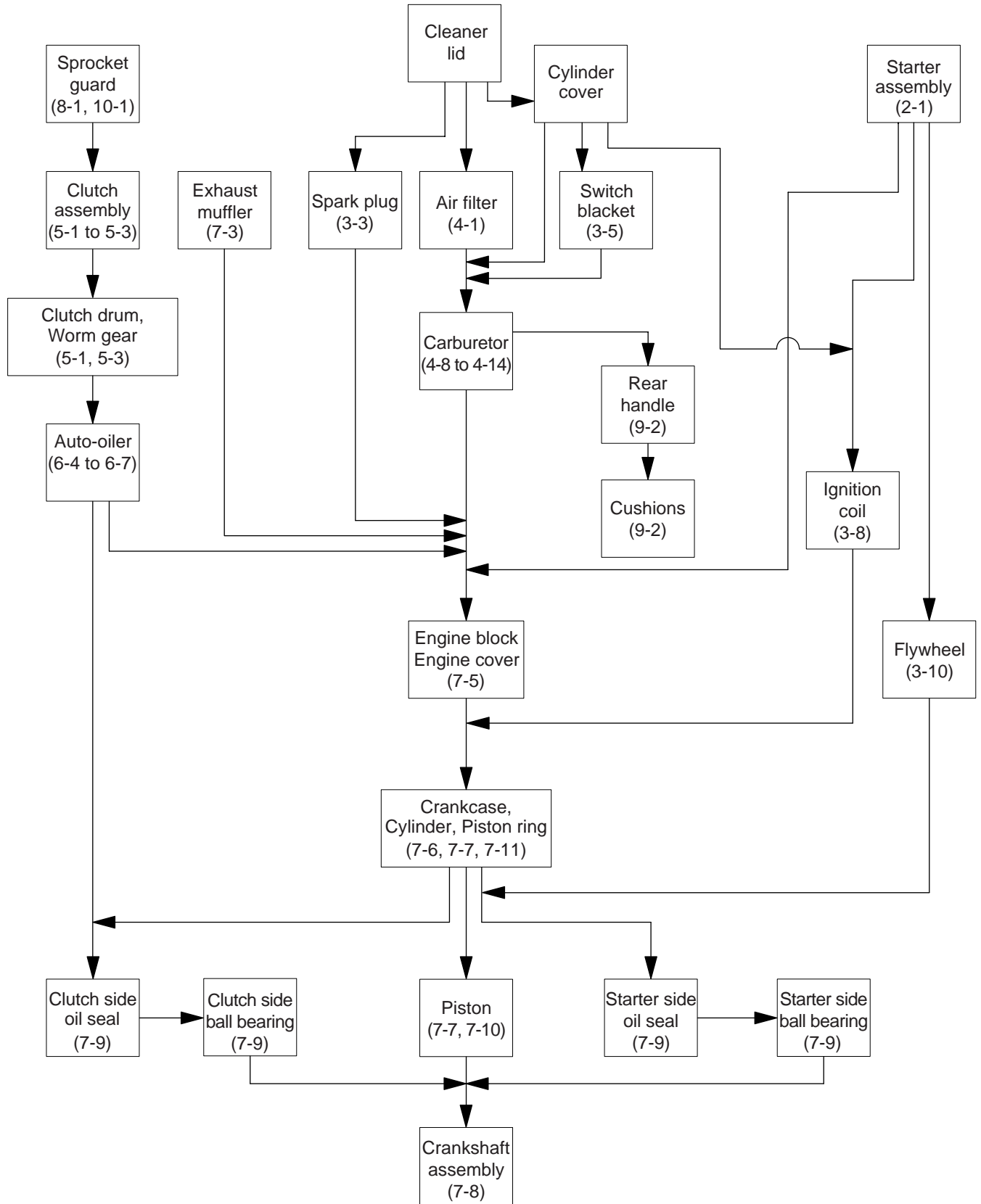
11-2 Troubleshooting Guide

TROUBLE	
Engine does not crank.	01
Engine does not start.	02
Fuel leaks.	03
Idling is not stable.	04
Acceleration is poor.	05
Engine stalls at high speed.	06
Engine lacks power.	07
Engine overheats.	08
Engine misfires.	09
Engine/others are extremely noisy.	10
Fuel consumption is excessive.	11
Vibration is excessive.	12
Engine does not stop.	13
Oiler does not function.	14
Saw chain does not cut well.	15

INSPECTING	REFERENCES	Inspecting ☉ first.														
		15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
<b>Starter system</b>																
Starter pawl / spring	2-4															☉
Starter drum / rope	2-2															○
Rewind spring	2-3															○
<b>Ignition system</b>																
Sparks	3-2							☉			○	○	○			☉
Spark plug	3-3							○			○	○	○			○
Spark plug cap / coil	3-7							○								○
Ignition switch	3-4			☉				○								○
Ignition coil	3-6, 3-8							○			○	○	○			○
Pole shoe air gaps	3-9							○		○			○			○
Flywheel	3-10							○					○			○
Flywheel key	3-10								○	○			○			○
(Continued)																



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