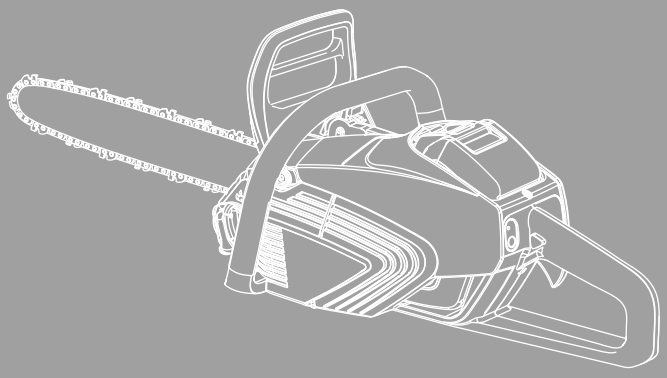
ECHO shindaiwa®



SERVICE MANUAL

ECHO: DCS-1600

(Serial number: 24000001 and after)
(Serial number: 35000001 and after)

REVISED Aug. 2020
Ref. No. 401-43

INTRODUCTION

This service manual contains information for service and maintenance of **ECHO BATTERY CHAINSAW, model DCS-1600**.

For systematic diagnosis, to avoid extra work and time loss, please refer to “Troubleshooting chart” that describes problems, testing, remedies and references. We recommend you make use of Operator’s Manual and Parts Catalogue 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 product information available at the time of publication.

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1 SERVICE INFORMATION

1-1 Specifications

Dimensions*	Length	mm(in)	459 (18.1)
	Width	mm(in)	219 (8.6)
	Height	mm(in)	262 (10.3)
Dry weight**		kg(lb)	3.1 (6.8)
Motor	Type		DC electric motor
	Rotation		Clockwise as viewed from the output end
	Rated current	A	42.5
	Rated voltage	V	50.4
	Rated output	kW	1.73
Li-Ion Battery	Standard battery		LBP-560-200
	Rated voltage	V	50.4
	Capacity	Ah, Wh	3.66, 185
	Weight	kg(lb)	1.8 (4.0)
Battery charger	Standard charger		LCJQ-560C
	Input voltage	V	AC220-240
	Rated output	V	58.1
Guide bar / Saw chain lubrication type			Automatic oil pump
Oil	Tank capacity	L (UK.fl.oz.)	0.38 (13.4)
Auto oiler	Type		Motor driven type
Sprocket	Type		Spur
	Number of teeth		6
	Pitch		3/8

* Without guide bar and saw chain ** Without battery, guide bar and saw chain

Cutting devices			
Guide bar	Type		C35S90-52SA
	Called length	cm	35
	Gauge	in	0.043
Saw chain	Type		OREGON 90PX
	Number of drive links		52
	Pitch	in	3/8
	Gauge	in	0.043

1-2 Technical data

Motor	Speed at maximum power	r/min	8,940
Speed control		r/min	Low (6,000 r/min) - High (10,000 r/min)
Battery	Charging time	min.	48 (80%) / 88 (100%)
	Operating time/one charge*	min.	32

*It varies according to work.

1-3 Torque limits

Descriptions		Size	kgf•cm	N•m	lbf•in
Motor	Motor assembly (w/ Motor cover assembly)	M5	30 - 45	3 - 4.5	25 - 40
Others	Cover	M4	20 - 30	2 - 3	20 - 25
	Stud bolt	M8*	80 - 100	8 - 10	70 -87
Regular bolt, nut and screw		M4	15 - 25	1.5 - 2.5	13 - 22
		M5	25 - 45	2.5 - 4.5	22 - 40

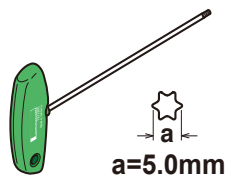
*Apply thread locking sealant described in “1-4 Special repairing materials”

1-4 Special repairing materials

Material	Location	Remarks
Thread locking sealant	Stud bolt	Loctite #272 or equivalent
Grease	Worm gear	Lithium based grease
	Chain brake (metal contact part)	Molybdenum grease (approx. 1 gram)

1-5 Special tool

1



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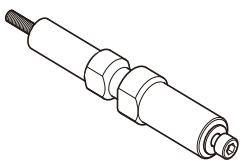

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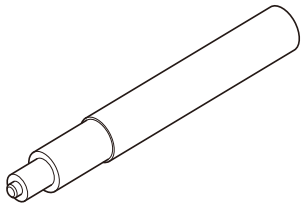
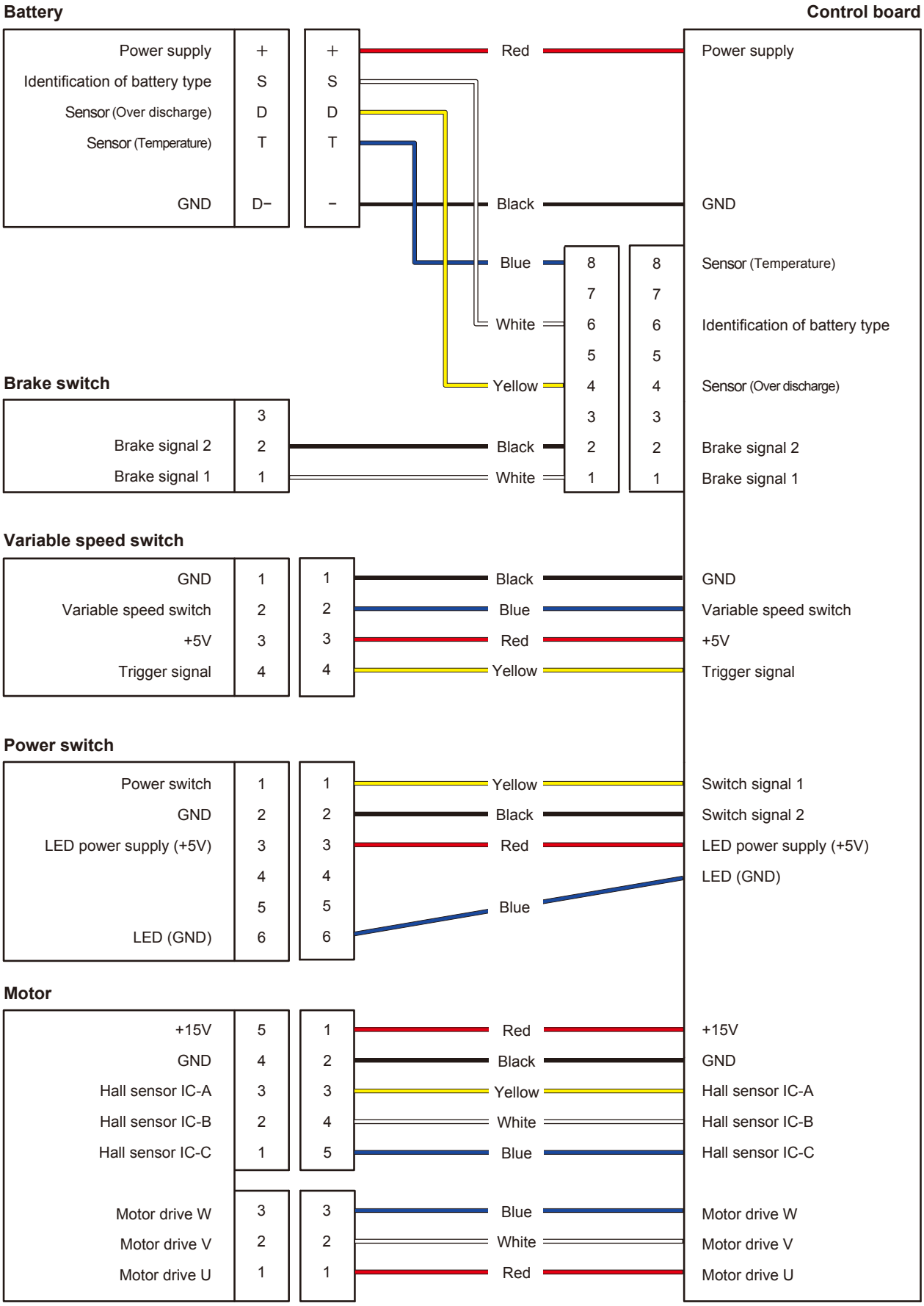


Key	Part Number	Description	Reference
1	X602-000340	Torx wrench (T27)	Removing and installing torx bolts
2	Y089-000131	Auto-oiler puller	Removing pencil type auto-oiler
3	91073A	Auto-oiler installer	Installing pencil type auto-oiler

1-6 Wiring diagram



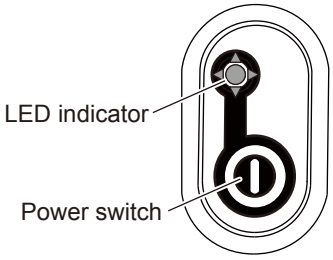
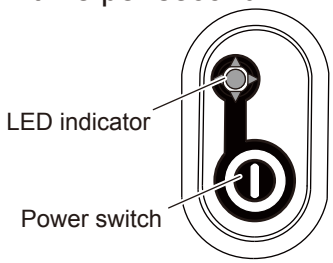
2 TROUBLESHOOTING

WARNING ⚠ DANGER

Do not open, crush, heat above 60°C or incinerate batteries. Do not use damaged or deformed batteries. Failure to follow these rules may result in electric shock, fire, and/or serious personal injury.

2-1 Error indicator

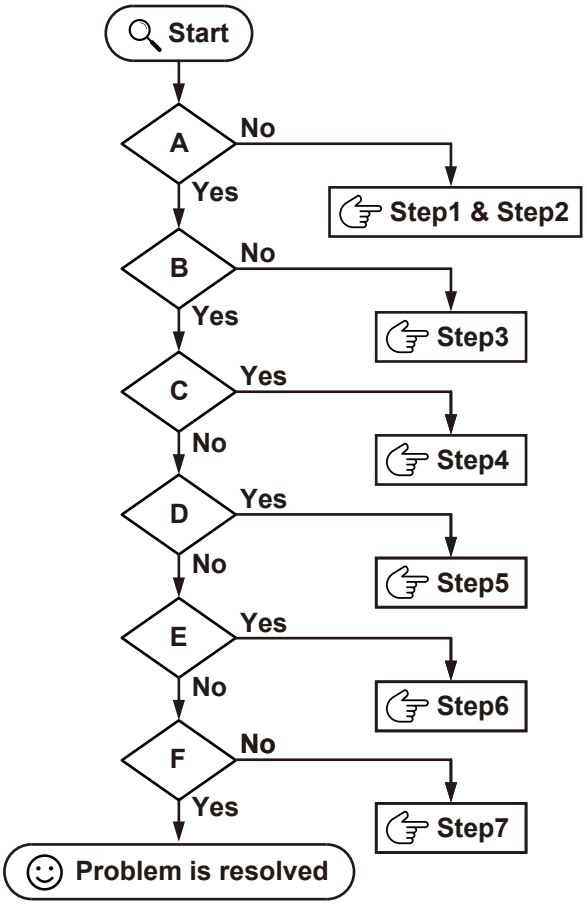
Power indicator LED on power switch flashes as shown when trouble occurs.(Refer to section 2-2)

LED indicator	Cause	How to recover
Flashing ***4*** times per second  	Unit and/or battery is/are too hot or cold.	Warm or cool them to normal temperature.
	Chain brake is activated	Release the chain brake.
	Contact of power switch is defective. (Refer to Troubleshooting STEP 5 described in Section 2-2)	Replace the power switch with new one.
	Contact or resistance of variable speed switch is defective. (Refer to Troubleshooting STEP 5 described in Section 2-2)	Replace the variable speed switch with new one.
	Motor sensor detects abnormality or its defective. (Refer to Troubleshooting STEP 5 and STEP6 described in Section 2-2)	Repair or replace defective items as needed.
Flashing ***1*** time per second  	Battery capacity is too low.	Charge the battery.
	Battery is defective due to over-discharging, degradation or sensor failure. (Refer to Troubleshooting STEP 4 described in Section 2-2)	Replace the battery with new one.

2-2 Troubleshooting chart

Be sure to begin with “STEP0” when troubleshooting.

Troubleshooting "STEP0"



NOTE: Be sure to release chain brake.

A: Is battery fully charged?

B: Press power switch. Is LED indicator lighting or flashing?

C: Press power switch. Is LED indicator flashing ***1*** time per second?

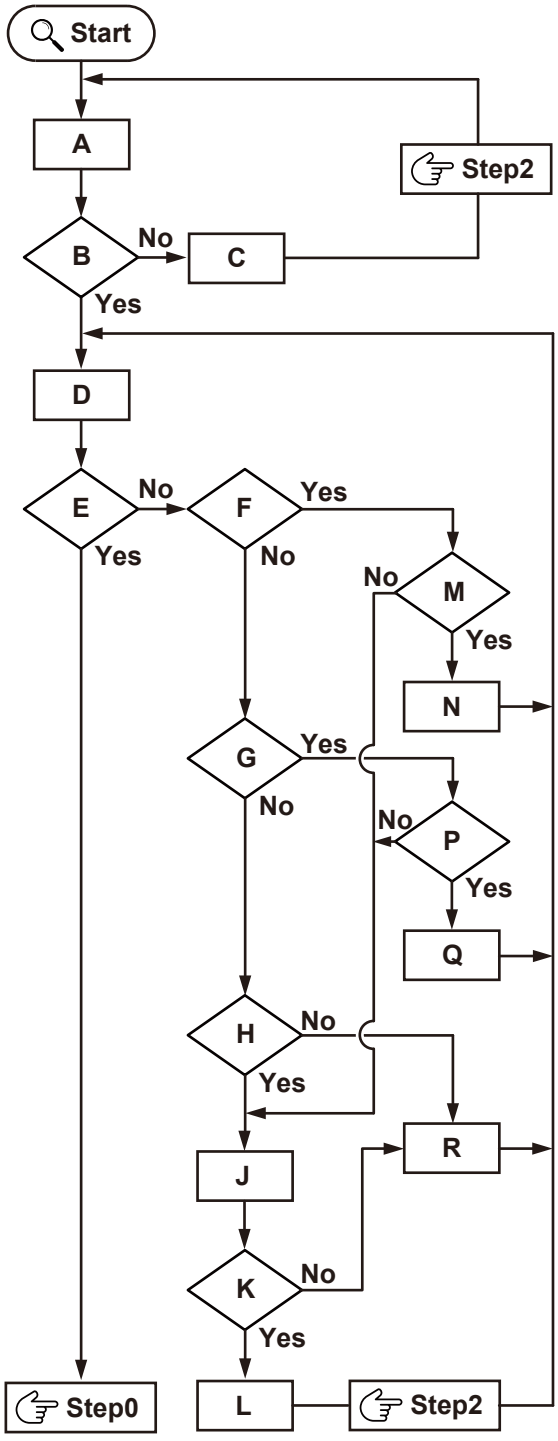
D: Press power switch. Is LED indicator flashing ***4*** time per second?

E: Press power switch and then hold trigger lever. Is LED indicator flashing ***4*** times per second?

F: Does unit run normally?

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP1" ~Checking battery and charger~



A: Press battery buttton ▶ to indicate charging status.

B: Is LED indicator of battery lighting?

C: Go to “Step 2” to find cause of battery failure. After passing Step2 then replace the battery to new one and continue to diagnosis. *.

**** Be sure to check Troubleshooting “Step2” before installing new battery. If the unit has something wrong, the battery can be damaged again.***

D: Charge the battery.

E: Is battery fully charged?

F: Does LED indicator of charger remain red?

G: Is LED indicator of charger flashing red?

H: Does LED indicator of charger light?

J: Prepare good battery and charger and then cross-check.

K: Battery failure?

L: Go to “Step 2” to find cause of battery failure. After passing Step2 then replace the battery to new one and continue to diagnosis. *.

**** Be sure to check Troubleshooting “Step2” before installing new battery. If the unit has something wrong, the battery can be damaged again.***

M: Is battery hot or cold?

N: Cool or warm battery as needed.(Rechargeble temperature of battery inside is 5 to 40°C.)

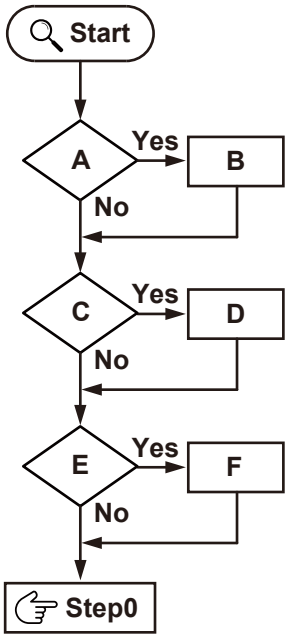
P: Are connectors of battery and charger dirty?

Q: Clean connectors of battery and charger.

R: Replace the charger with new one.

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP2" ~Checking unit in case of battery failure~



A: Are there conductive substances (water, metal pieces, etc.) on the surface of control board? (Refer to Section 6-1)

B: Remove conductive substances (water, metal pieces, etc.) on the surface of control board.

C: Is control board damaged? (Refer to Section 6-1)

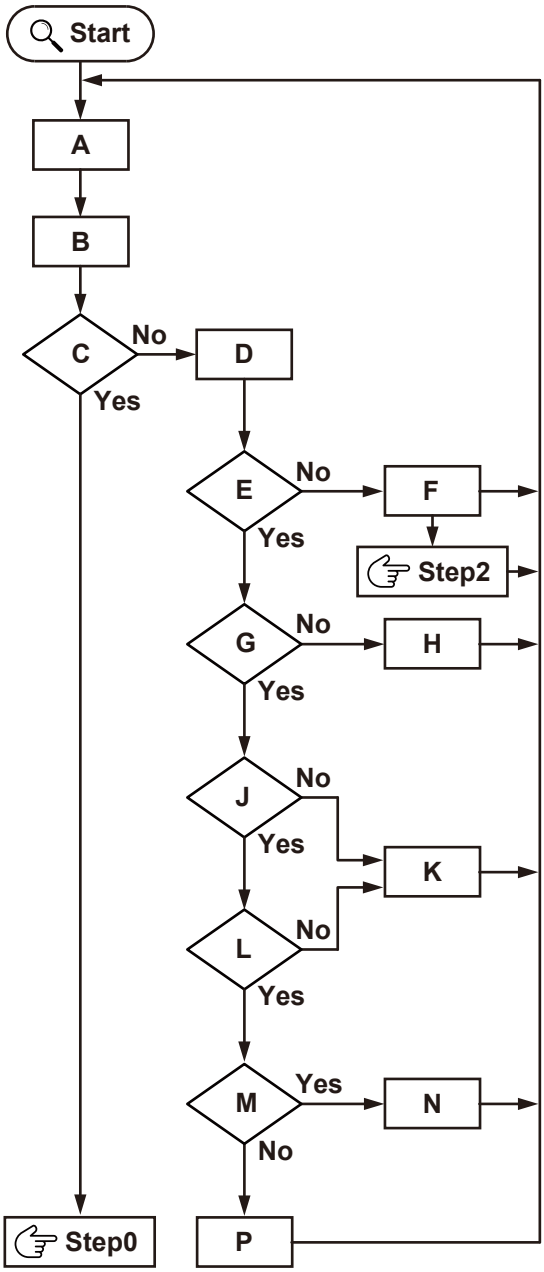
D: Replace the control board with new one. (Refer to Section 6-2)

E: Is control board short-circuited between battery connection terminal (+) and (-)? (Refer to Section 6-1)

F: Replace the control board with new one. (Refer to Section 6-2)

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP3" ~Checking power supply circuit~



WARNING DANGER

Verify the safety of the surroundings when doing Troubleshooting STEP3. The machine may run unexpectedly.

A: Install battery on the unit correctly.

B: Release chain brake and press power switch without holding trigger lever.

C: Is LED indicator lighting or flashing?

D: Remove battery from the unit.

E: Is resistance between battery terminal (T) and (D-) 20 kΩ or less when temperature of battery inside is 10°C or higher? (Refer to Section 9-4)

F: Go to "Step 2" to find cause of battery failure. After passing Step2 then replace the battery to new one and continue to diagnosis. *.

**** Be sure to check Troubleshooting "Step2" before installing new battery. If the unit has something wrong, the battery can be damaged again.***

G: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

H: Repair or replace defective objects as needed.

J: Inspect power switch as follows: (Refer to Section 5-1)

1) Electrical current can flow between terminal "1" and "2" when pressing power switch.

2) Electrical current can not flow between terminal "1" and "2" when not pressing power switch.

K: Replace the power switch with new one. (Refer to Section 2-2)

L: Does LED indicator of power switch light when electrical current flow between terminal "3" and "6" using diode check function of degital multimeter? (Refer to Section 5-1)

M: Is there any short circuit in the following parts?

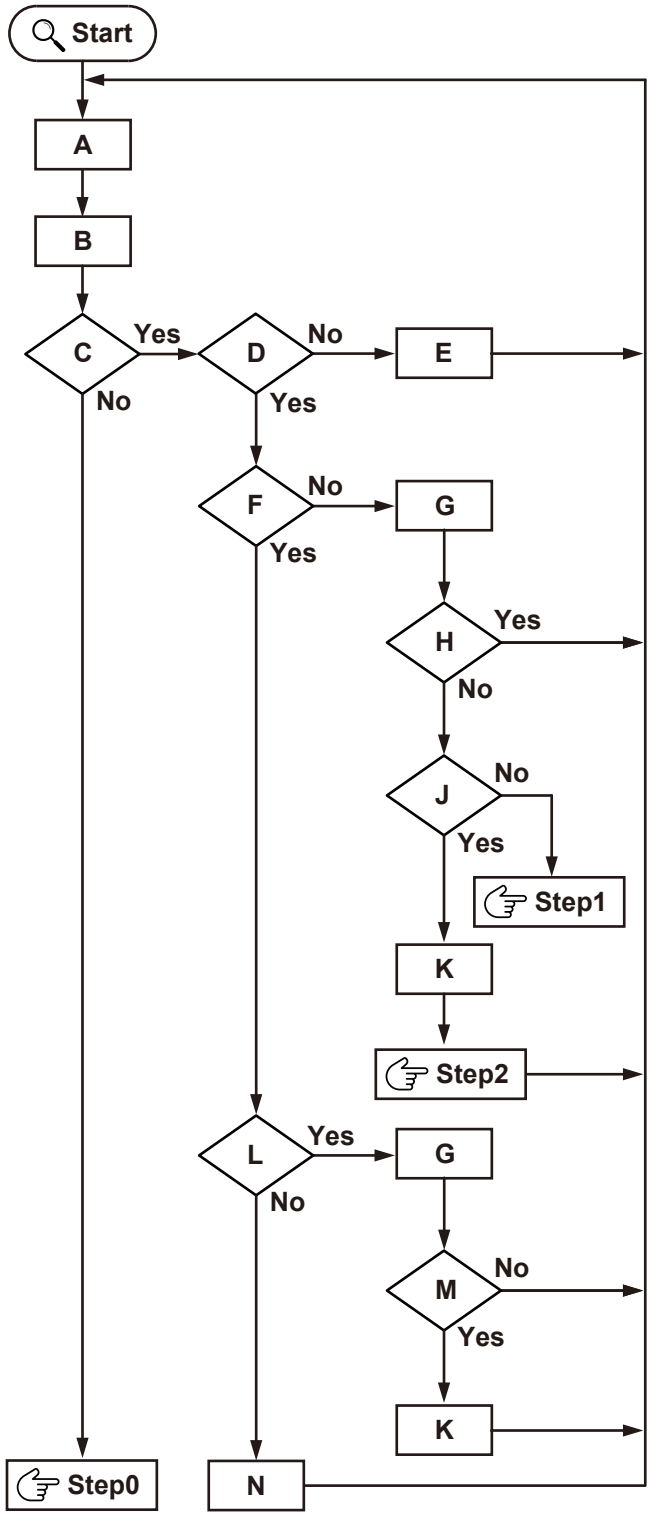
1) Between terminal "2" and "3" of power switch (Refer to Section 5-1)
2) Between terminal "1" and "3" of variable speed switch (Refer to Section 5-1)
3) Between terminal "4" and "5" of motor's 5-pin connector (Refer to Section 6-1)

N: Repair or replace defective object(s) as needed.

P: Replace the control board with new one.(Refer to Section 6-2)

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP4" ~Checking degradation and overdischarge of battery~



A: Install battery on the unit correctly.

B: Release chain brake and press power switch without holding trigger lever.

C: Press power switch. Is LED indicator flashing ***1*** time per second?

D: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

E: Repair or replace defective object(s) as needed.

F: Is voltage between battery terminal (+) and (D-) 45V or more? (Refer to Section 9-4)

G: Fully charge the battery.

H: Is voltage between battery terminal (+) and (D-) 45V or more? (Refer to Section 9-4)

J: Has Troubleshooting "Step 1" already been done?

K: Go to "Step 2" to find cause of battery failure. After passing Step2 then replace the battery to new one and continue to diagnosis. *.

**** Be sure to check Troubleshooting "Step2" before installing new battery. If the unit has something wrong, the battery can be damaged again.***

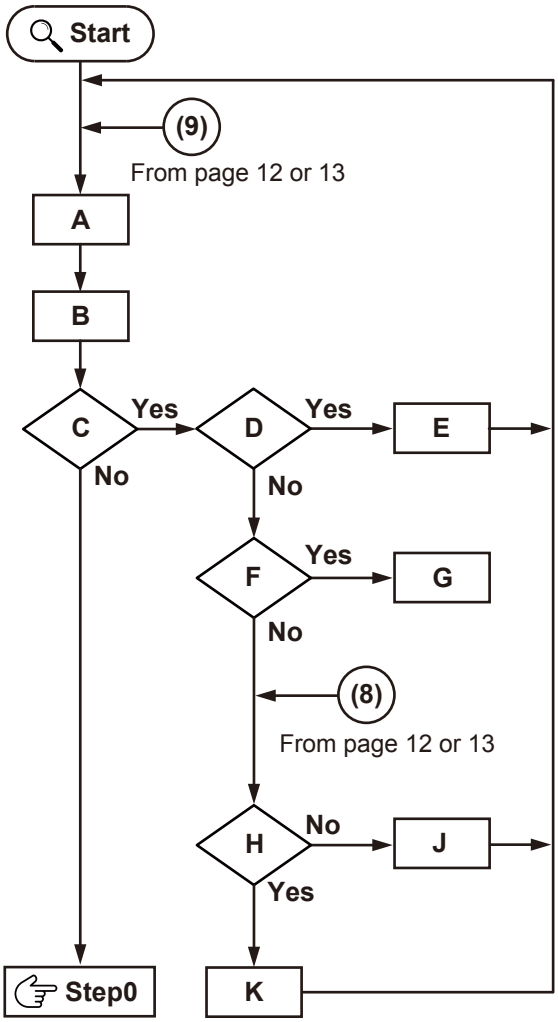
L: Is resistance between battery terminal (D) and (D-) 12 kΩ or more? (Refer to Section 9-4)

M: Has this check (resistance measurement between terminal (D) and (D-) and charging the battery) already been done three times or more?

N: Replace the control board with new one. (Refer to Section 6-2)

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP5" ~Checking each sensor and switch~



WARNING DANGER

Verify the safety of the surroundings when doing Troubleshooting STEP5. The machine may run unexpectedly.

A: Install battery on the unit correctly.

B: Release chain brake and press power switch without holding trigger lever.

C: Press power switch. Is LED indicator flashing ***4*** time per second?

D: Are battery and unit cold?

E: Warm the battery and the unit to normal temperature.

F: Conduct diagnosis of abnormal condition.(Refer to Section 2-3) Is LED indicator flashing or ligiting?

G: Go to the next step according to the numbe of continuously flashing of LED indicator.

2 times: Go to page12 (1)
5 times: Go to page12 (2)
7 times: Go to page12 (3)
8 times: Go to page13 (4)
9 times: Go to page13 (4)
16 times: Go to page13 (5)
17 times: Go to page13 (6)

H: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

4) There are **no** any short curcuits.

5) There are not any conductive substances (water, metal pieces, etc.) on the surface of control board.

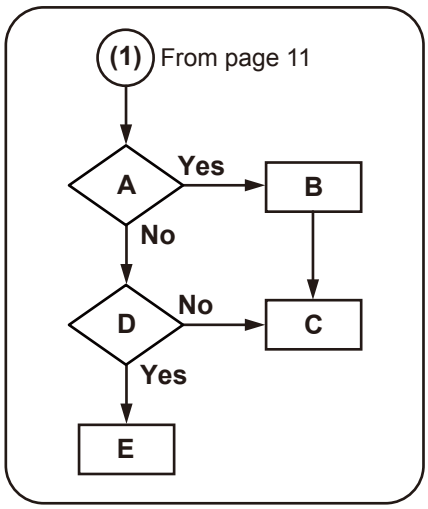
J: Repair or replace defective object(s) as needed.

K: Control board or motor may be defective.Prepare control board and motor and then cross-check. Replace the defective one with new one.

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP5" ~Checking each sensor and switch (Continued)~

Inspecting temperature sensor of battery



A: Is battery hot?.

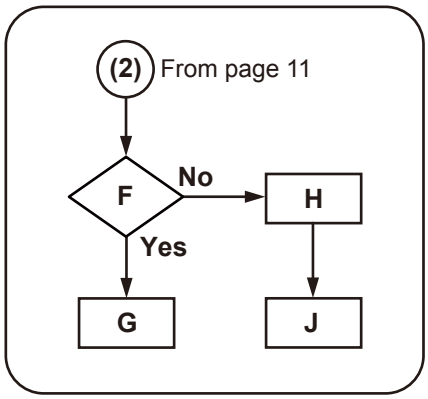
B: Cool the battery to normal temperature.

C: Go to page 11 (9).

D: Is resistance between battery terminal (T) and (D-) 20 kΩ or less when temperature of battery inside is 10°C or higher? (Refer to Section 9-3)

E: Go to page 11 (8).

Inspecting contact of power switch



F: Inspect power switch as follows: (Refer to Section 5-1)

1) Electrical current can flow between terminal “1” and “2” when pressing the switch.

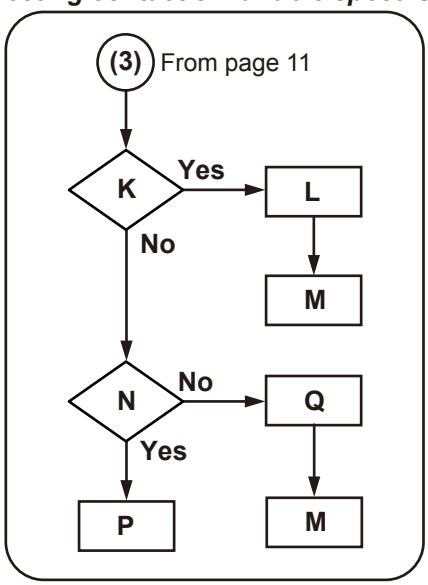
2) Electrical current can not flow between terminal “1” and “2” when not pressing the switch.

G: Go to page 11 (8).

H: Replace the power switch with new one. (Refer to Section 5-2)

J: Go to page 11 (9).

Inspecting contact of variable speed switch



K: Is there any trouble in terminals and leads of variable speed switch?

L: Repair or replace defective objects as needed. (Refer to Section 5-2)

M: Go to page 11 (9).

N: Inspect variable speed switch as follows: (Refer to Section 5-1)

1) Electrical current can flow between terminal “1” and “4” when pressing the switch.

2) Electrical current can not flow between terminal “1” and “4” when not pressing the switch.

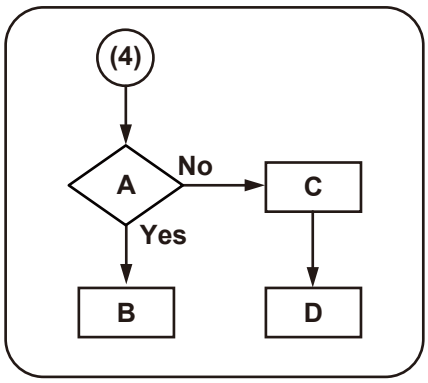
P: Go to page 11 (8).

Q: Replace the variable speed switch with new one. (Refer to Section 5-2).

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP5" ~Checking each sensor and switch (Continued)~

Inspecting variable resistance part



A: Inspect resistance between terminal “1” and “2” of variable speed switch as follows: (Refer to Section 5-1)

1) Its value is 100 Ω or less when pressing the switch to the end.

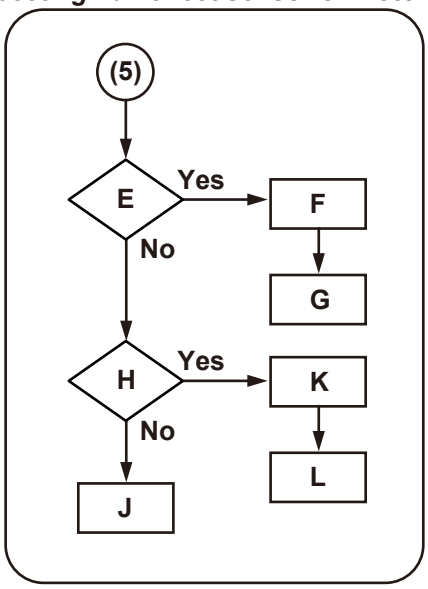
2) Its value is between 70 kΩ and 130 kΩ when not pressing the switch.

B: Go to page 11 (8).

C: Replace the variable speed switch with new one. (Refer to Section 5-2)

D: Go to page 11 (9).

Inspecting hall effect sensor of motor



E: Is there any trouble in terminals and leads of motor’s 5-pole terminal ?(Refer to Section 6-1)

F: Repair or replace defective objects as needed. (Refer to Section 6-2)

G: Go to page 11 (9).

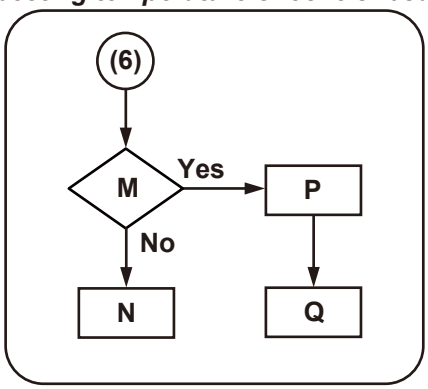
H: Is resistance between terminal “4” and “5” of motor’s 5-pole terminal about 0Ω (short circuit) ? (Refer to Section 6-1)

J: Go to page 11 (8).

K: Replace the motor with a new one. (Refer to Section 6-2)

L: Go to page 11 (9)

Inspecting temperature of control board



M: Is control board hot?

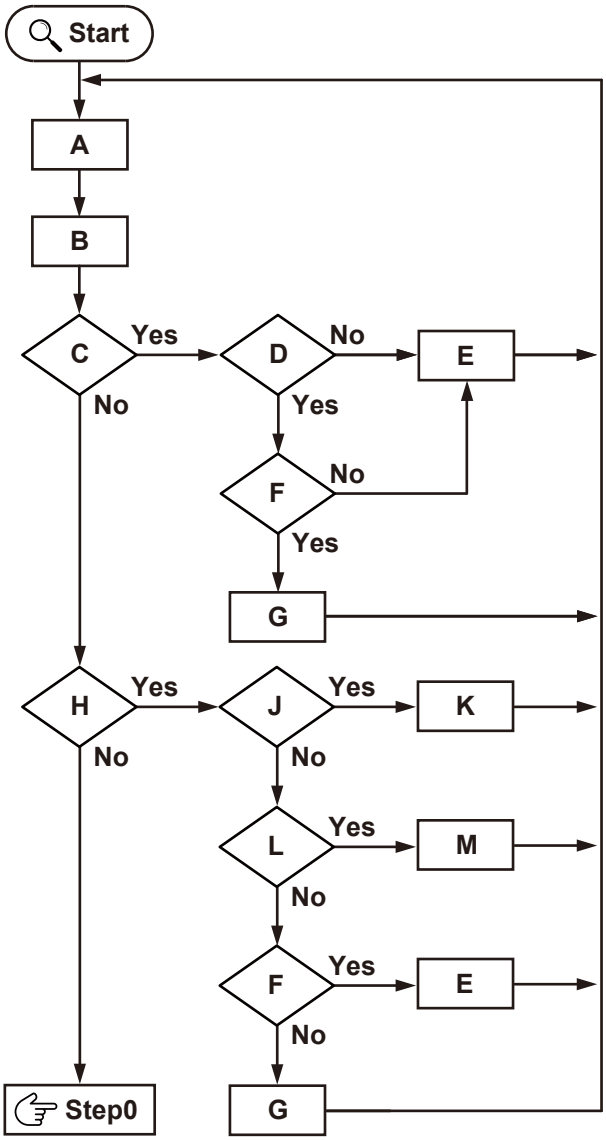
N: Go to page 11 (8).

P: Cool the control board to normal temperature.

Q: Go to page 11 (9).

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP6" ~Checking brake switch and over load ~



WARNING DANGER

Verify the safety of the surroundings when doing Troubleshooting STEP6. The machine may run unexpectedly.

A: Install battery on the unit correctly.

B: Release chain brake and press power switch without holding trigger lever. And then hold trigger lever.

C: Motor does not run and LED indicator is flashing ***4*** times per second.

D: Inspect brake switch as follows: (Refer to Section 3-1)

1) Electrical current can flow between terminal "1" and "2" when pressing brake switch.

2) Electrical current can not flow between terminal "1" and "2" when not pressing brake switch.

E: Repair or replace defective object(s) as needed.

F: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

4) There are **no** any short curcuits.

G: Control board or motor may be defective.Prepare control board and motor, and then cross-check.Replace the defective one with new one.

H: Motor stops after running and LED indicator is flashing ***4*** times per second.

J: Conduct diagnosis of abnormal condition. Is LED indicator continuously flashing ***2*** or ***17*** times?(Refer to Section 2-3)

K: Cool the unit.

L: Inspect the unit as follows:

1) Sprocket is clogged with saw dust or something.

2) Unsuitable saw chain or guide bar is used.

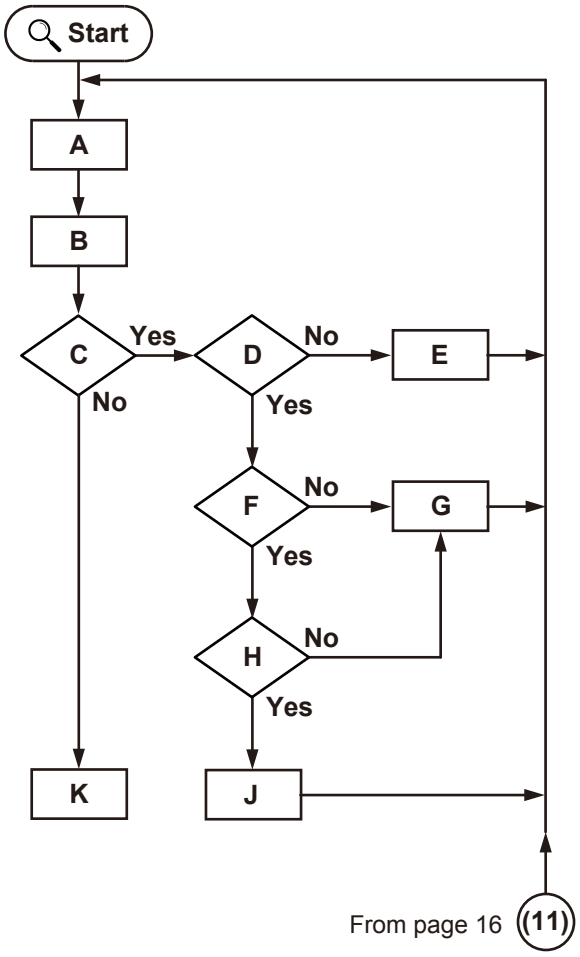
3) Saw chain tension is too tight.

4) There is trouble in drive system.

M: Clean, repair or replace the object(s) as needed.

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP7" ~Checking other failure~



WARNING DANGER

Verify the safety of the surroundings when doing Troubleshooting STEP7. The machine may run unexpectedly.

A: Install battery on the unit correctly.

B: Release chain brake and press power switch without holding trigger lever. And then hold trigger lever.

C: Motor does not run and LED indicator is lighting.

D: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

4) There are **no** any short curcuits.

E: Repair or replace defective object(s) as needed.

F: Inspect variable speed switch as follows: (Refer to Section 5-1)

1) Electrical current can flow between terminal “1” and “4” when pressing the switch.

2) Electrical current can not flow between terminal “1” and “4” when not pressing the switch.

G: Replace the variable speed switch with new one. (Refer to Section 5-2).

H: Inspect resistance between terminal “1” and “2” of variable speed switch as follows: (Refer to Section 5-1)

1) Its value is 100 Ω or less when pressing the switch.

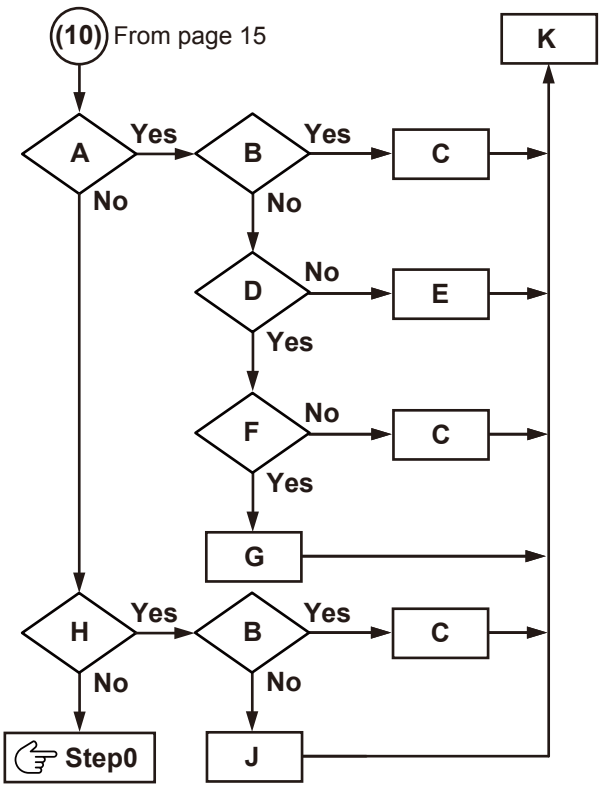
2) Its value is between 70 kΩ and 130 kΩ when not pressing the switch.

J: Replace control board with new one. (Refer to Section 6-2)

K: Go to page 16 (10).

2-2 Troubleshooting chart (Continued)

Troubleshooting "STEP7" ~Checking other failure (Continued)~



A: Motor speed can not be increased or is not stable.

B: Inspect the unit as follows:

1) Sprocket is clogged with saw dust or something.

2) Unsuitable saw chain or guide bar is used.

3) Saw chain tension is too tight.

4) There is trouble in drive system.

C: Clean, repair or replace the object(s) as needed.

D: Can variable speed switch be pushed to the end? Check the position and the part itself. (Refer to Section 5-2)

E: Repair or replace the variable speed as needed. (Refer to Section 5-2)

F: Inspect the unit as follows:

1) Each connection between terminals is secure.

2) Each connection of terminal housing and lead is secure.

3) Electrical current can flow through each lead.

4) There are **no** any short curcuits.

G: Control board or motor may be defective. Prepare control board and motor and then cross-check.Replace the defective one with new one.

H: Abnormal noise occurs when runnning.

J: Replace motor with new one.(Refer to Section 6-2)

K: Go to page 15 (11).

2-3 Diagnosis of abnormal condition

DCS-1600 has a function that records abnormalities when they occur. It also diagnoses the type of abnormality in the following procedure.

NOTE: Before you do this diagnosis, make a note the following.

1. Diagnose the failure by following Troubleshooting chart (Section 2-2) when the unit has trouble.
2. Conduct this diagnosis when Troubleshooting “STEP5” is done.
   - Be sure to follow the diagnosis procedure, otherwise result is not displayed.
   - DCS-1600 can only record limited type of abnormalities. DCS-1600 cannot diagnoses all types of abnormality.
   - Latest information about abnormalities is saved in control board and is displayed as the result.
   - DCS-1600 will hold the latest data about abnormalities after the problem is resolved. The data is rewritten when the next recordable abnormality occurs.

[Diagnosis procedure]

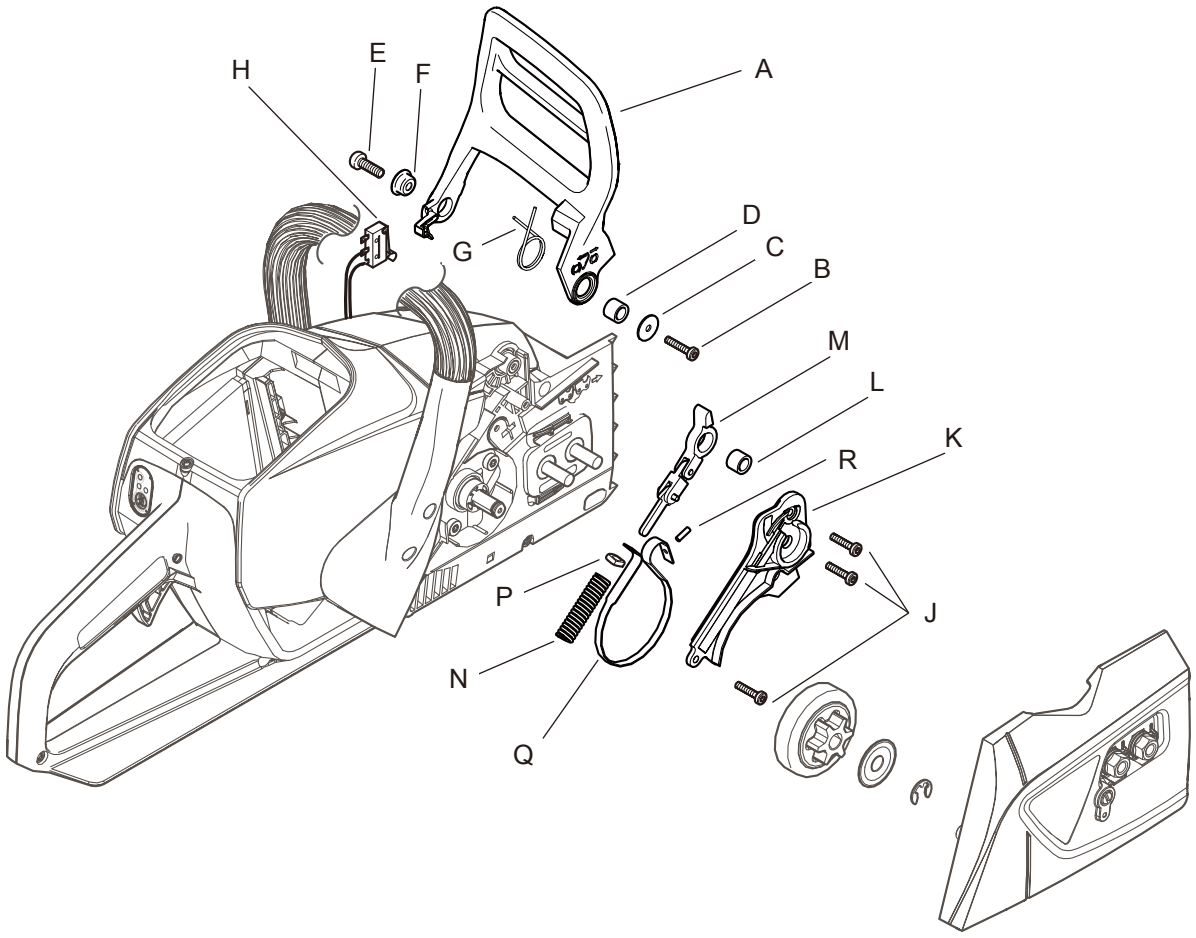
1. Install battery on the unit correctly.
2. Pull brake lever (A) to release chain brake.
3. Press power switch (B). LED indicator (C) on power switch will flash 4 times per second when trouble is still present.
4. Move brake lever (A) forward to activate chain brake.
5. Hold lockout button (D) and trigger lever (E) together.

6. About 10 seconds after lockout (D) and trigger lever (E) are held, LED indicator (C) on power switch will flash 1 time per second. Then count how many times LED indicator (C) continuously flash 1 time per second. When this flashing stops, LED indicator (C) flashes 5 times per second. The number of continuously flashing 1 time per second shows result of this diagnosis.

NOTE: While holding lockout button (D) and trigger lever (E), this action can be repeated.

7. Return to Troubleshooting “STEP5” (Section 2-2) and continue Troubleshooting according to the result above.

3 CHAIN BRAKE SYSTEM

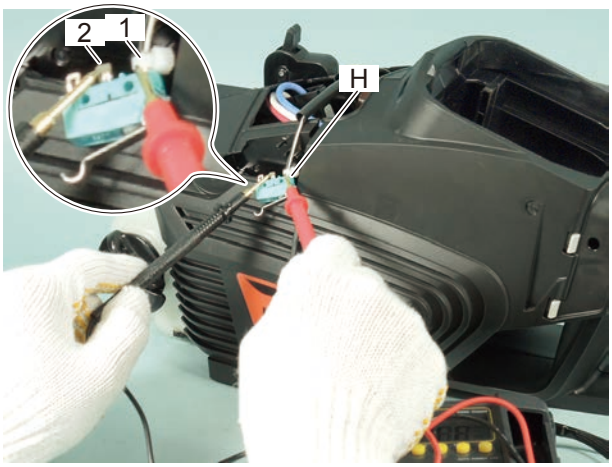


(A) Brake lever
(B) Tapping bolt (M4)
(C) Washer
(D) Collar
(E) Tapping bolt (M5)
(F) Collar
(G) Torsion spring
(H) Brake switch
(J) Tapping bolt (M4)
(K) Brake cover
(L) Collar
(M) Brake connector
(N) Compression spring
(P) Spacer
(Q) Brake band
(R) Pin

3-1 Inspecting brake switch

1. Remove cover (S).

2. Clean saw dust and/or dirt around brake switch (H).

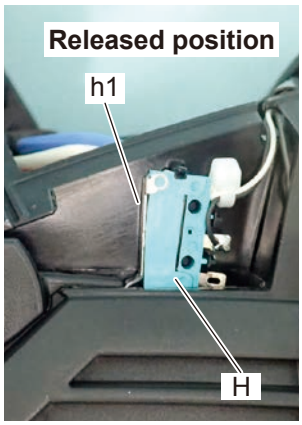


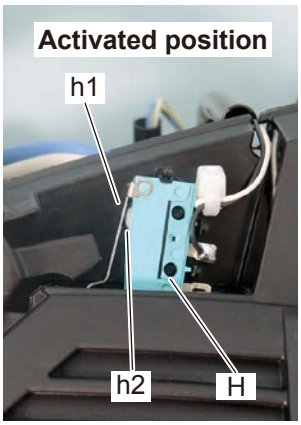
3. Connect one probe of multimeter to terminal “1” of brake switch (H). Connect the other probe to terminal “2” .

4. When pressing brake switch (H), multimeter should show that the circuit is in conducted state. (Electrical current can flow between terminal “1” and “2”.) Also, when not pressing brake switch (H), multimeter should indicate infinite resistance.(Electrical current can not flow between terminal “1” and “2”.)

5. If brake switch (H) is defective, replace control board connected to the switch (H) with new one.

NOTE: Brake switch (H) can not be supplied separately.





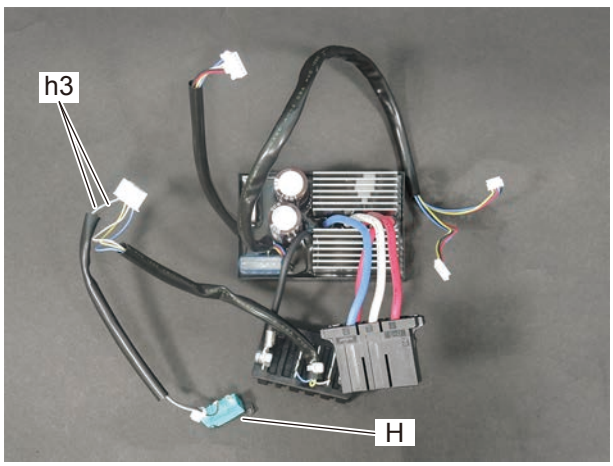
6. Inspect brake switch (H) as follows. If the unit is not as follows, install brake switch (H) and brake lever correctly.

Chain brake released position :

Lever (h1) of chain brake switch press button (h2).

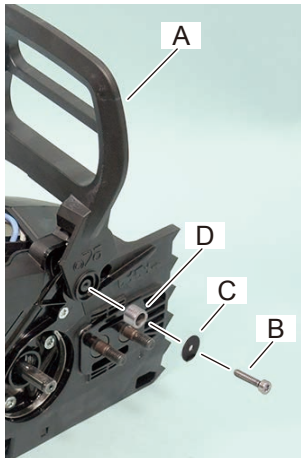
Chain brake activated position :

Lever (h1) of chain brake switch does not touch button (h2).



7. If leads (h3) of brake switch (H) do not have continuity, remove control board from the unit and inspect it.

3-2 Replacing brake lever



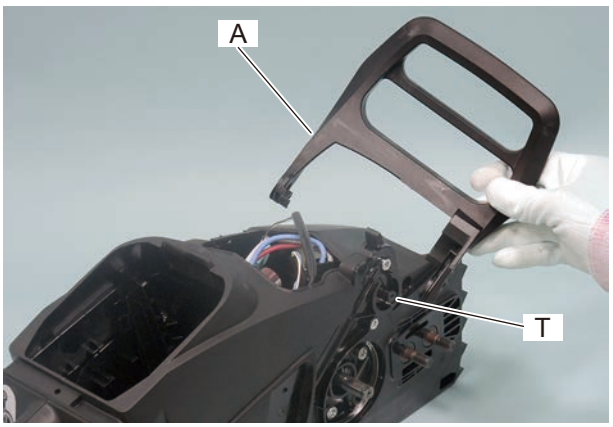
[Disassembling]

1. Remove brake switch from motor cover.
2. Remove bolt (E) and collar (F).
3. Remove bolt (B), washer (C) and collar (D).
4. Remove brake lever (A).

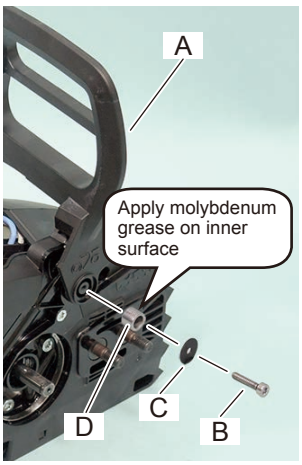
5. Check torsion spring (G). If deformed or broken, replace with new one.

[Assembling]

6. Install torsion spring (G) to brake lever (A) as shown.

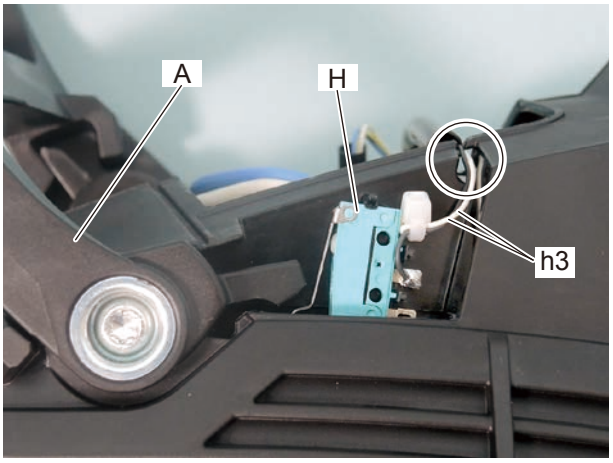


7. Set hole of brake lever (A) on boss (T) of motor cover and install brake lever (A) to motor cover.



8. Apply molybdenum grease on inner surface of collar (D).
9. Install collar (D) in boss of brake lever (A).
10. Place washer (C) on brake lever (A) and secure the washer (C) with bolt (B).
11. Place callor (F) in boss of brake lever (A) and secure the collar (C) with bolt (E).

3-2 Replacing brake lever (Continued)



11. Move brake lever (A) forward to activate chain brake.

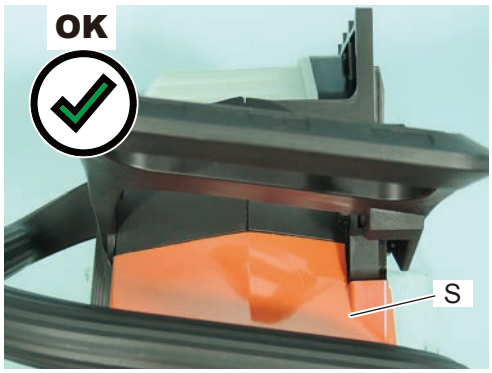
12. Place brake switch (H) on motor cover as shown.

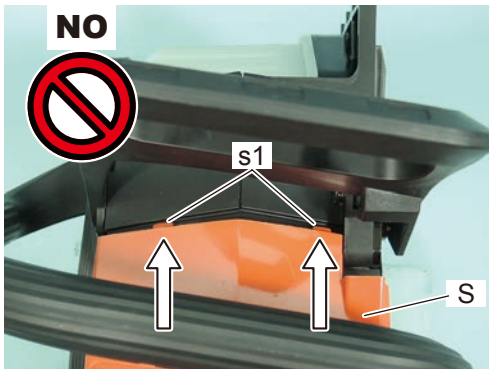
13. Pass leads (h3) of brake switch (H) through cutout of motor cover as shown.

14. Be sure not to pinch leads and assemble cover (S) to unit.

NOTE: Check the followings after assembling cover (S).

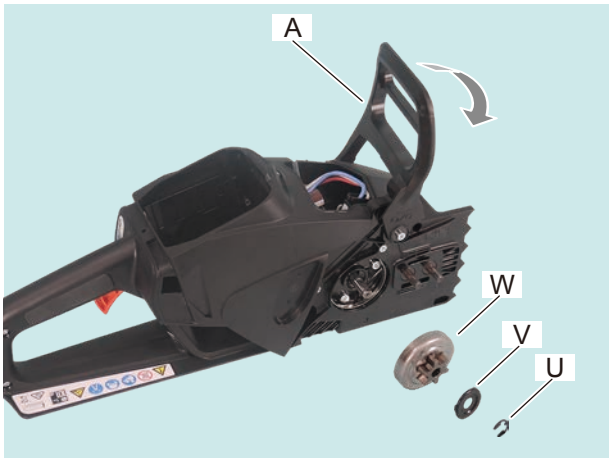
(1) Two ribs (s1) of cover (S) are inside of motor cover.

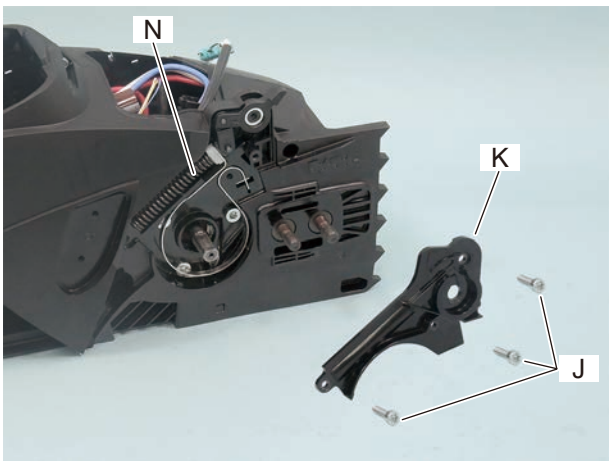


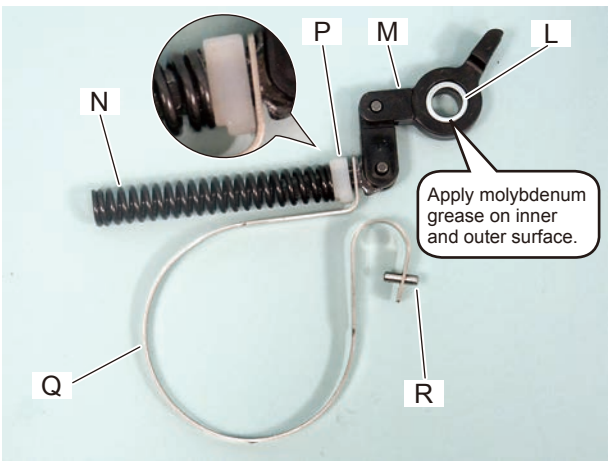


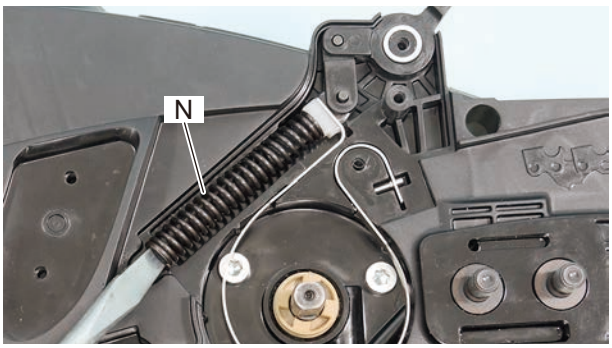
(2) Both sides of cover (S) are set into motor cover.

3-3 Replacing chain brake parts









WARNING ⚠ DANGER

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

[Disassembling]

1. Remove E-ring (U), washer (V) and drum (W).

2. Move brake lever (A) forward to activate chain brake.

NOTE: Make sure that brake lever (A) is in activated position before removing brake cover (K), otherwise compression spring (N) may jump out.

3. Remove brake lever (A). (Refer to section 3-2)

4. Remove three bolts (J) and brake cover (K).

5. If blocked with dirt and/or dust, clean around brake parts. Inspect all the brake parts for damage. Replace with new part(s) as required.

[Assembling]

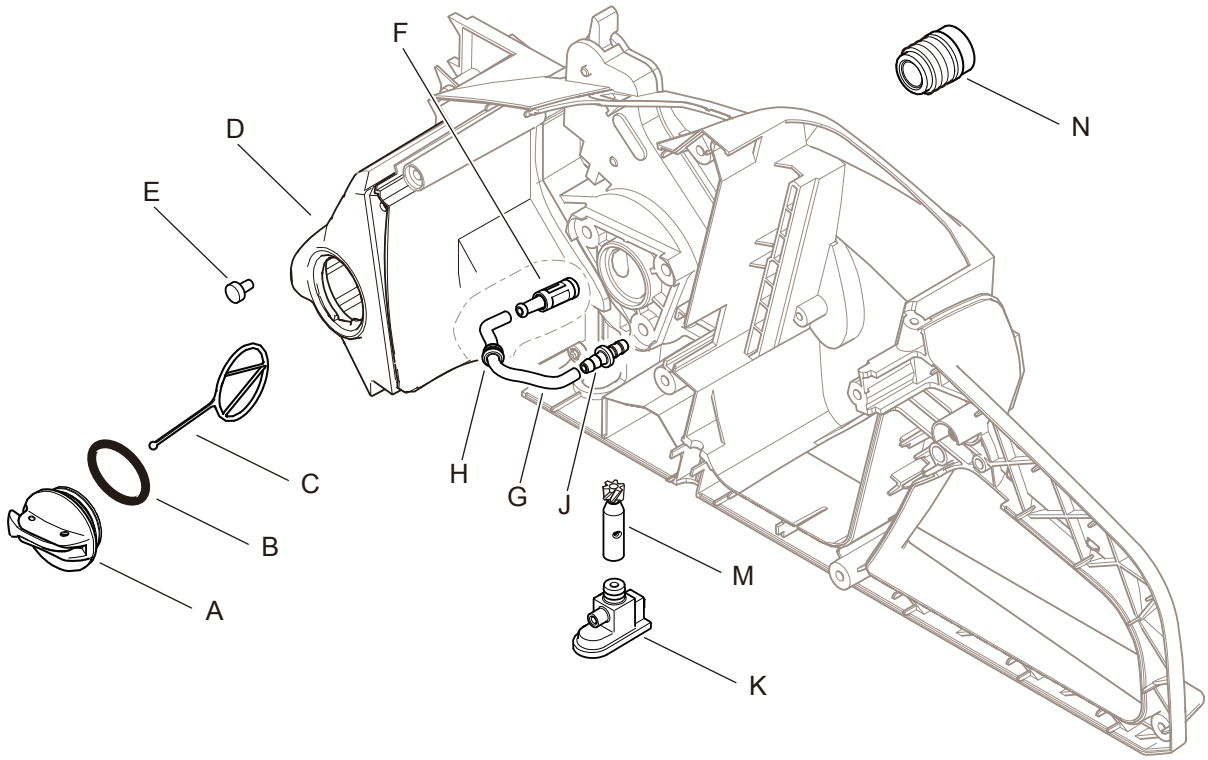
6. Apply molybdenum grease on inner and outer surface of collar (L). And then, set the collar (L) into brake connector (M) as shown.

7. Assemble brake connector (M), brake band (Q), spacer (P), compression spring (N) and pin (R) as shown. And then, set them on motor cover.

8. Push compression spring (N) with flat head screw driver or other suitable tool and install compression spring (N) in motor cover as shown.

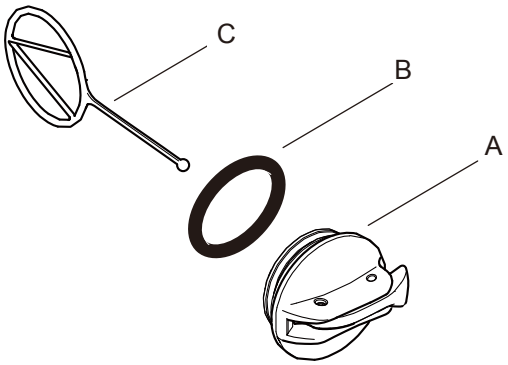
9. Reassemble removed parts.

4 SAW CHAIN LUBRICATION SYSTEM



(A) Oil cap
(B) O-ring
(C) Cap connector
(D) Oil tank
(E) Oil tank vent
(F) Oil strainer
(G) Oil line
(H) Grommet
(J) Pipe joint
(K) Oil line
(M) Auto-oiler
(N) Worm gear

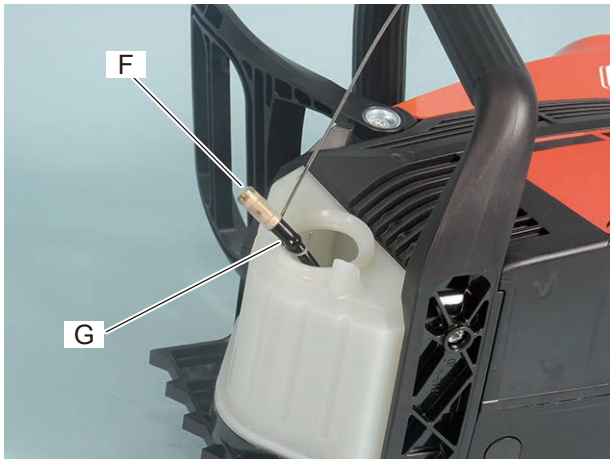
4-1 Inspecting oil cap and strainer



1. Remove oil cap (A).

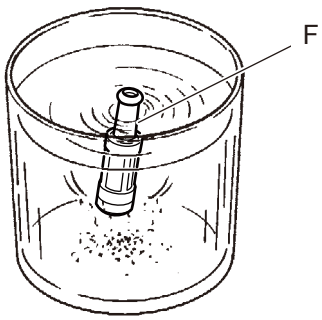
2. Inspect oil cap (A) for cracks and O-ring (B) for cuts or damage. Replace worn or damaged part(s) as required.

3. Replace cap connector (C) if damaged.

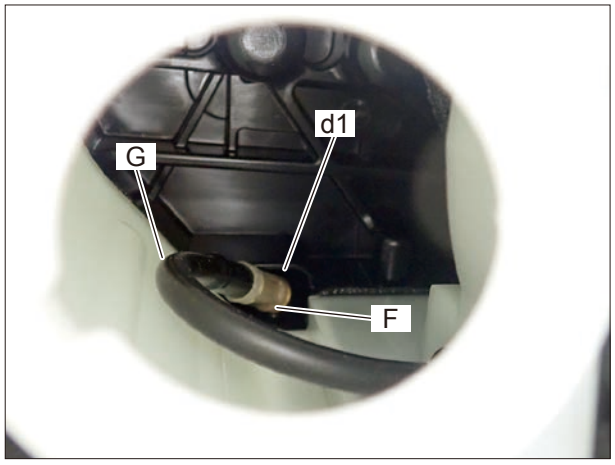


4. Pull oil strainer (F) from oil tank using wire hook.

NOTE: Be careful not to puncture oil line by wire hook.



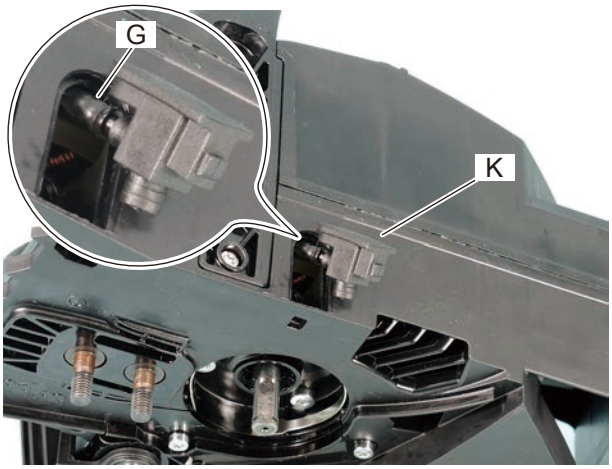
5. Remove oil strainer (F) from oil line and clean oil strainer in suitable solvent, or replace if damaged.



6. Reconnect oil strainer (F) to oil line and return the oil strainer (F) into oil tank.

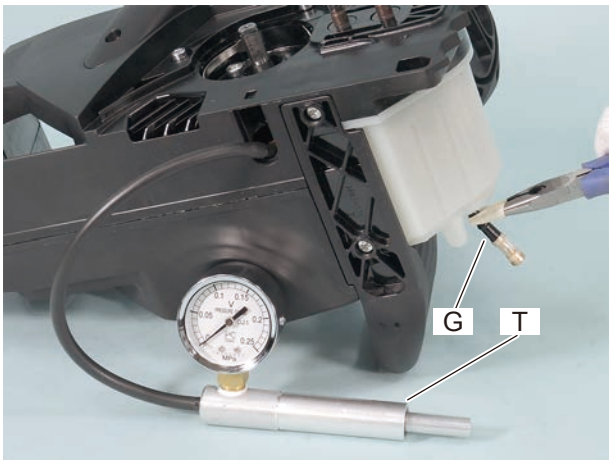
NOTE: Set oil strainer (F) into pocket (d1) of oil tank so that chain oil can be supplied to the end.

4-2 Inspecting oil line



1. Remove oil line (K) from oil line (G).

NOTE: Be careful not to enter oil line (G) into motor cover. Otherwise, it's difficult to reconnect oil line (G) and oil line (K).



2. Connect oil line (G) to pressure tester 897803-30133 (T).

3. Remove fuel cap and pull out oil strainer from oil tank.

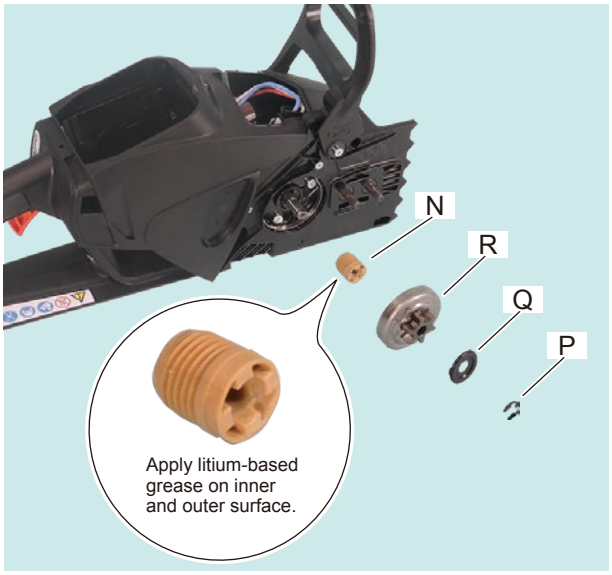
4. Pinch oil line (G) with longnose pliers as shown.

NOTE: Wrap the ends of longnose pliers with tape(or cover with soft pipes) to protect oil line from damage.

5. Apply pressure approx. 49 kPa (0.5 kgf/cm^2) (7psi).

6. If pressure drops, replace oil line (G) with new one. (Refer to Section 4-5)

4-3 Inspecting and replacing worm gear



[Disassembling and inspecting]

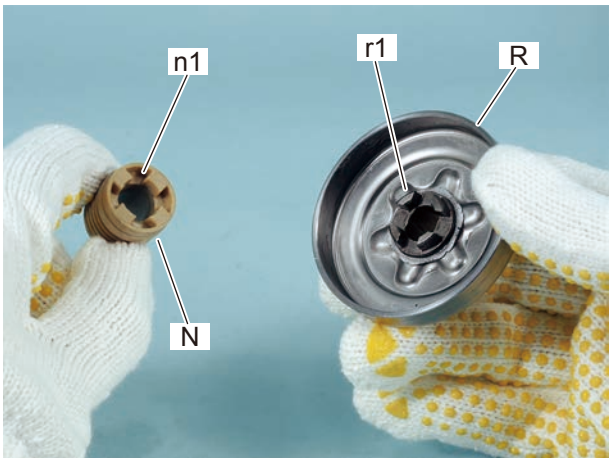
1. Remove E-ring (P), washer (Q), drum (R) and worm gear (N).

2. Inspect worm gear (N). If worn, damaged or deformed, replace with new one.

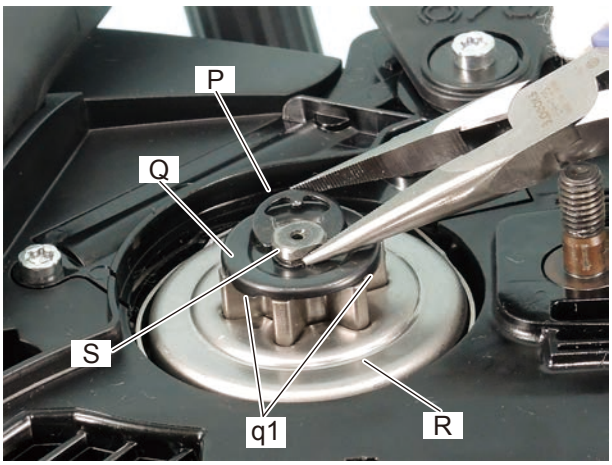
NOTE: If worm gear (N) is replaced, inspect gear of auto-oiler and replace the auto-oiler as needed.

[Assembling]

3. Apply lithium-based grease to inner and outer surface of worm gear (N).



4. Assemble worm gear (N) and drum (R) placing convex parts (r1) of drum (R) in grooves (n1) of worm gear (N).



5. Install drum (R) assembled worm gear (N) to rotor shaft (S).

6. Place washer (Q) on drum (R) as shown.

NOTE: Set claws (q1) of washer (Q) in concave parts of drum sprocket.

7. Put E-ring (P) on groove of rotor shaft (S).

NOTE: When reinstalling E-ring (P), use new one.

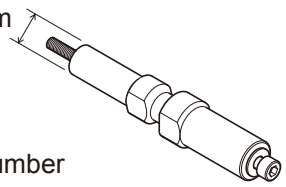
4-4 Replacing auto-oiler

NOTE: Changed auto-oiler to use for auto-oiler of DCS-1600

Auto-oiler puller

【Before change】

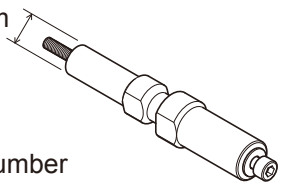
dia.13mm



Part number
Y089-000130

【After change】 **For DCS-1600**

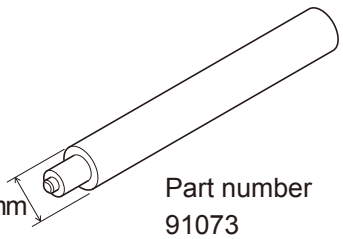
dia.11.5mm



Part number
Y089-000131

Auto-oiler installer

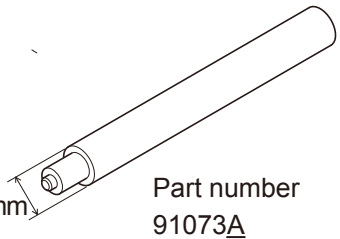
【Before change】



dia. 12.7mm

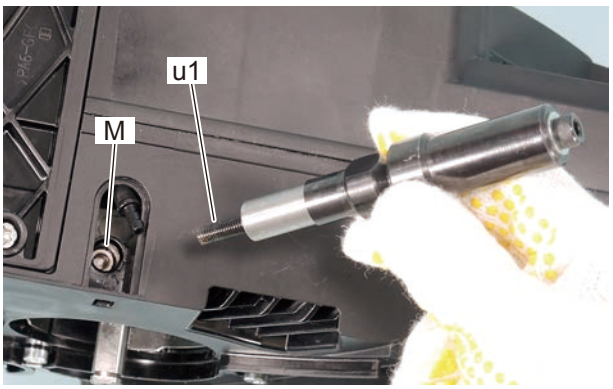
Part number
91073

【After change】 **For DCS-1600**



dia. 11.5mm

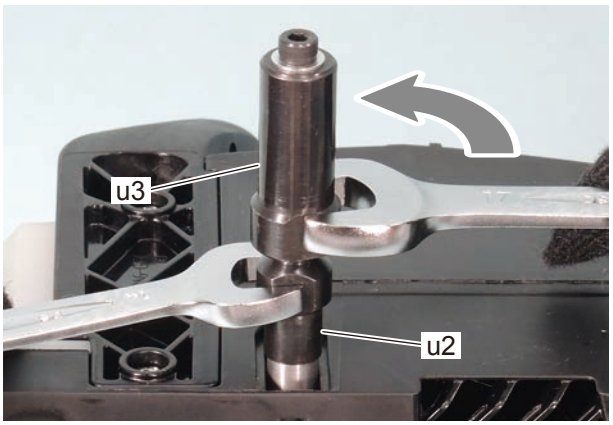
Part number
91073A



[Disassembling]

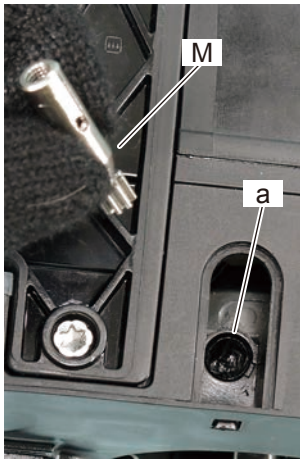
1. Remove E-ring (P), washer (Q), drum (R) and worm gear (N). (Refer to Section 4-3)

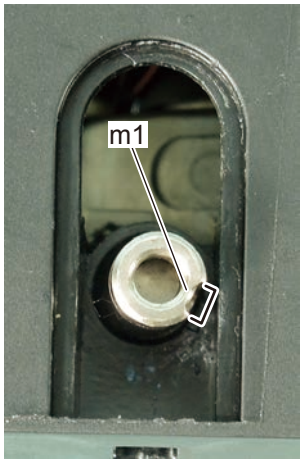
2. Screw bolt tip (u1) of auto-oiler puller Y089-000131 into female thread part of auto-oiler (M).



3. Holding inner pipe (u2) with a 14 mm wrench, rotate outer pipe (u3) counterclockwise by 17mm wrench to pull out the auto-oiler.

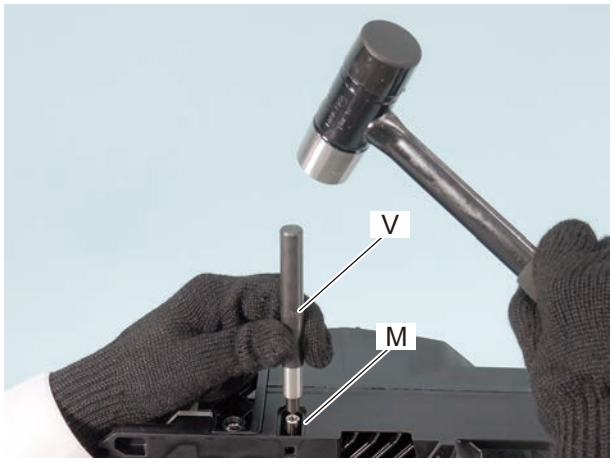
4-4 Replacing auto-oiler (Continued)





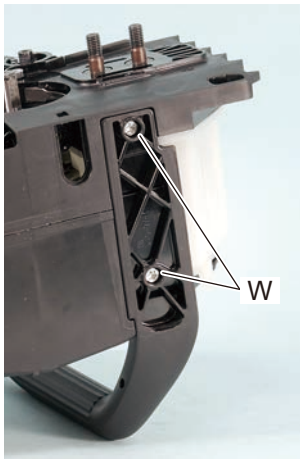
[Assembling]

4. Place auto-oiler (M) on hole (a) of motor cover while aligning groove (m1) of auto-oiler with mark of motor cover as shown.



5. Push auto-oiler (M) in hole of motor cover until it bottoms out using the oiler installer 91073A (V) as shown.

4-5 Seperating motor cover and replacing oil line

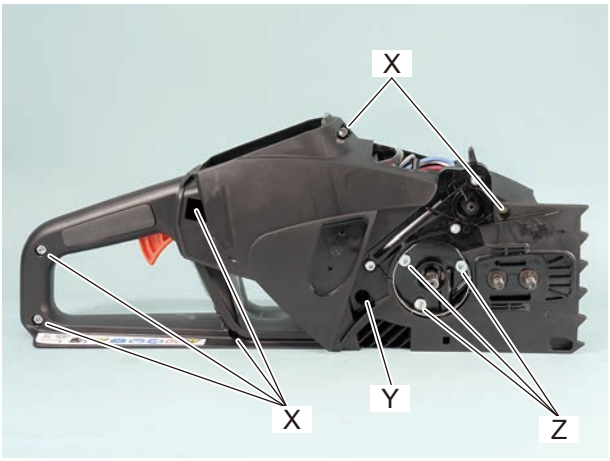


[Disassembling]

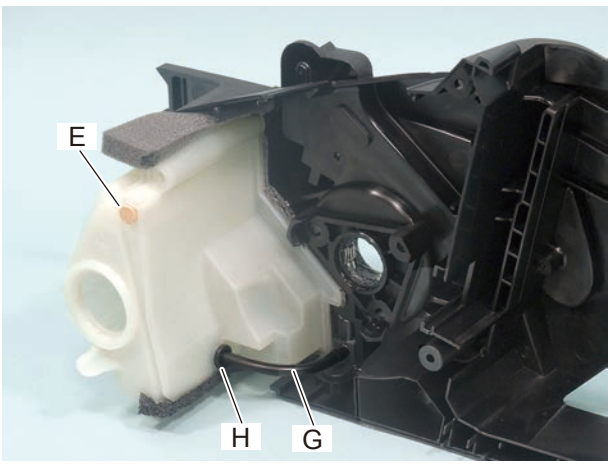
1. Remove cover and brake lever. (Refer to Section 3-2)

2. Remove drum and worm gear. (Refer to Section 4-3)

3. Remove four bolts (W) and front handle.



4. Remove six bolts (X) (size : M4x16mm length), bolt (Y) (size : M4x20mm length) and three bolts (Z) (size : M5x20mm length) and seperate motor cover.

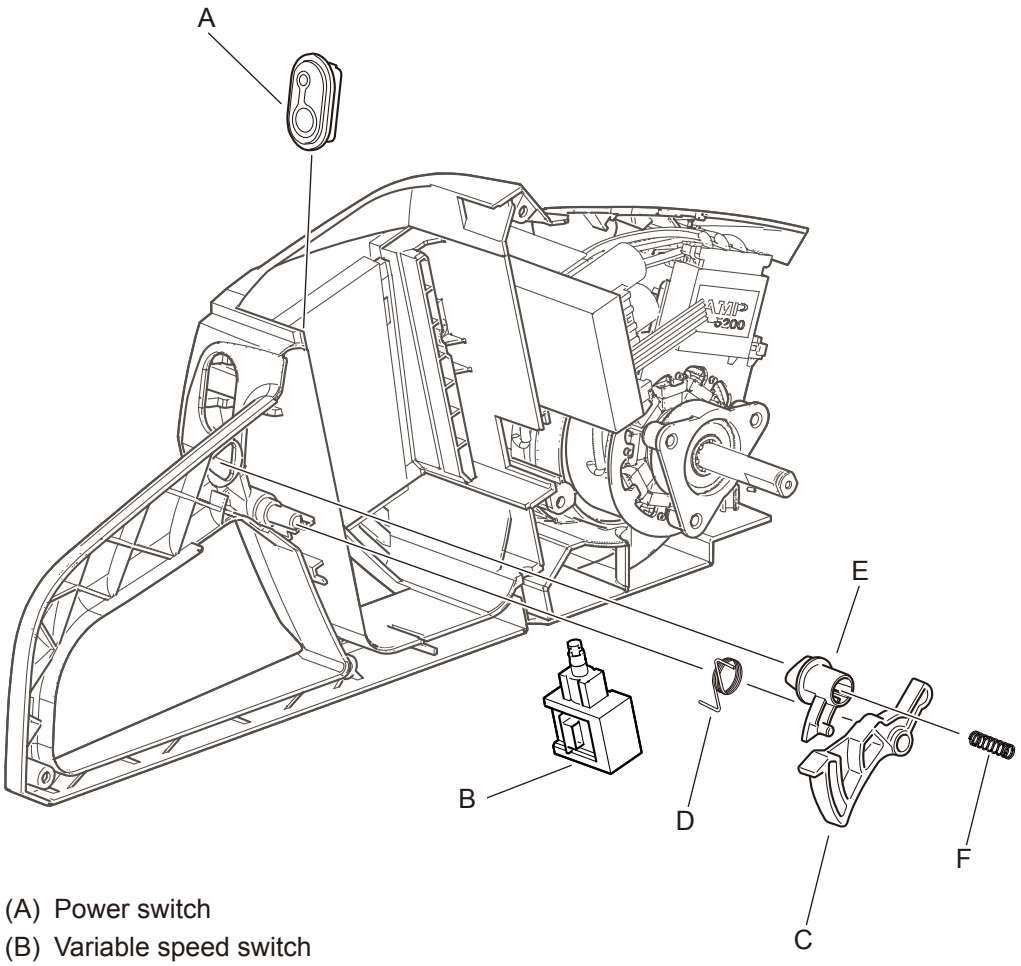


5. Remove oil strainer. (Refer to Section 4-1)

6. Remove grommet (H) and oil line (G). If worn, damaged or deformed, replace with new part(s) as required.

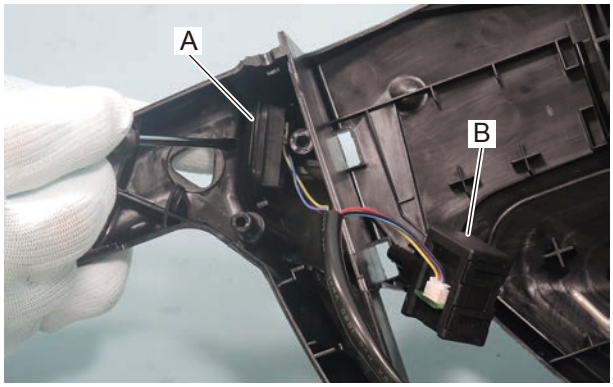
7. Check oil tank vent (E). If blocked with dirt and/or dust, clean around it.

5 SWITCH AND TRIGGER



(A) Power switch
(B) Variable speed switch
(C) Trigger lever
(D) Torsion spring
(E) Lockout button
(F) Compression spring

5-1 Inspecting power switch and variable speed switch

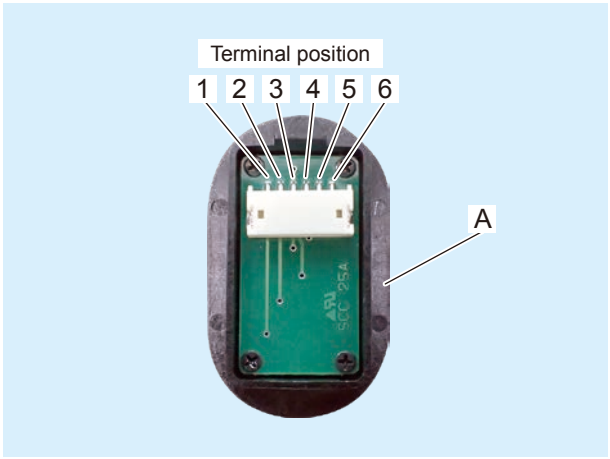


[Disassembling]

1. Separate motor cover. (Refer to Section 4-5)

2. Remove power switch (A) from motor cover putting flat head screw driver or suitable tool between power switch (A) and motor cover as shown.

3. Disconnect power switch (A) and variable speed switch (B) from wire harness.



[Inspecting power switch]

4. Inspect power switch (A) as follows. If the switch (A) is not as follows, replace with new one.

(1) Inspecting of electrical contact

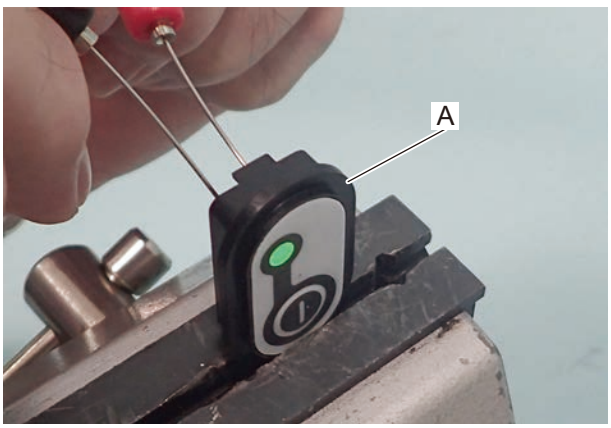
Connect one probe of multimeter to terminal “1” of power switch (A). Connect the other probe to terminal “2” .

When pressing power switch (A), multimeter should show that the circuit has continuity.(Electrical current can flow between terminal “1” and “2”.)
When not pressing power switch (A), multimeter should indicate infinite resistance.(Electrical current can not flow between terminal “1” and “2”.)

(2) Inspecting of LED

Turn dial to diode symbol on **digital** multimeter.

Connect one probe of multimeter to terminal “3” of power switch (A). Connect the other probe to terminal “6”. LED should light up. If not lighting, reconnect each probe to the opposite terminal. (Terminal “3” is positive(+). Terminal “6” is negative(-)

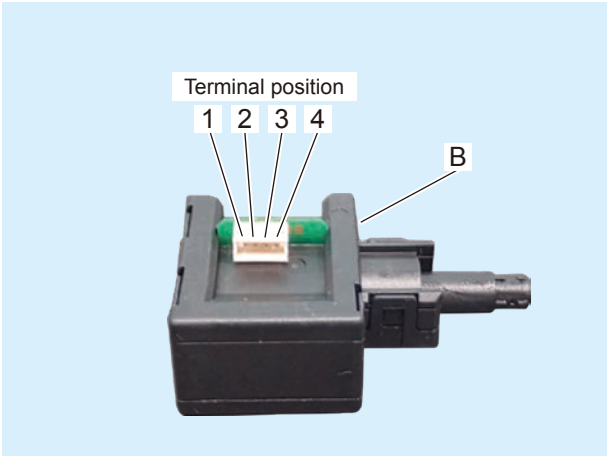


NOTE: When inspecting above, be sure to use the diode test function of digital multimeter. Voltages more than 5 volts and/or electric current more than 150mA can cause to damage to the LED in power switch (A).

(3) Inspecting of short circuit

Connect one probe of multimeter to terminal “2” of power switch (A). Connect the other probe to terminal “3”.Multimeter should indicate infinite resistance.(Electrical current can not flow between terminal “2” and “3”.)

5-1 Inspecting power switch and variable speed switch (Continued)



[Inspecting variable speed switch]

5. Inspect variable speed switch (B) as follows. If the switch (B) is not as follows, replace with new one.

(1) Inspecting of short circuit

Connect one probe of multimeter to terminal “1” of variable speed switch (B). Connect the other probe to terminal “3”. Multimeter should show that the resistance value is between 70 kΩ and 130 kΩ.

(2) Inspecting of electrical contact

Connect one probe of multimeter to terminal “1” of variable speed switch (B). Connect the other probe to terminal “4” .

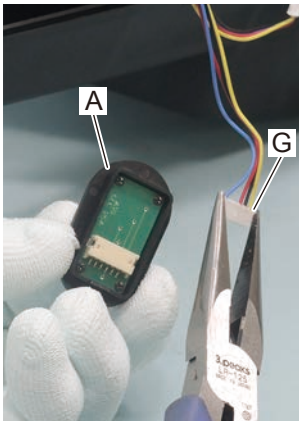
When pressing variable speed switch (B), multimeter should show that the circuit has continuity. (Electrical current can flow between terminal “1” and “4”.)
When not pressing variable speed switch (B), multimeter should indicate infinite resistance. (Electrical current can not flow between terminal “1” and “4”.)

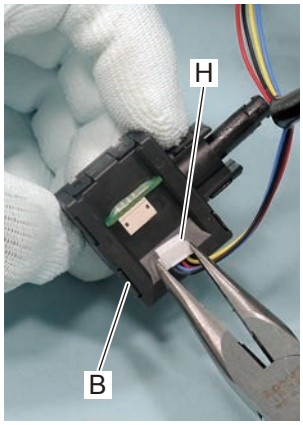
(3) Inspecting variable resistance part

Connect one probe of multimeter to terminal “1” of variable speed switch (B). Connect the other probe to terminal “2” .

When pressing variable speed switch (B) to the end, multimeter should show that the resistance value is 100 Ω or less.
When not pressing variable speed switch (B), multimeter should show that the resistance value is between 70 kΩ and 130 kΩ.

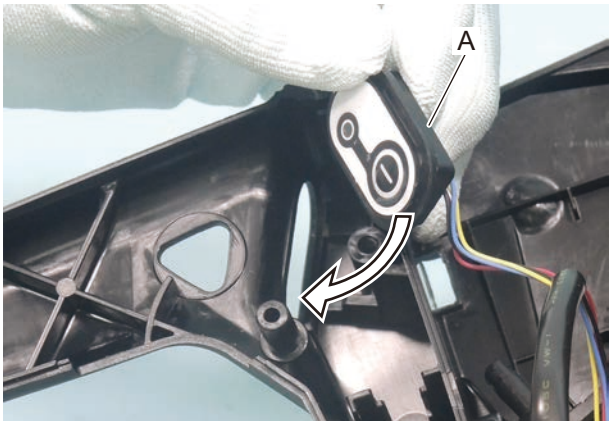
5-2 Installing switches and trigger lever



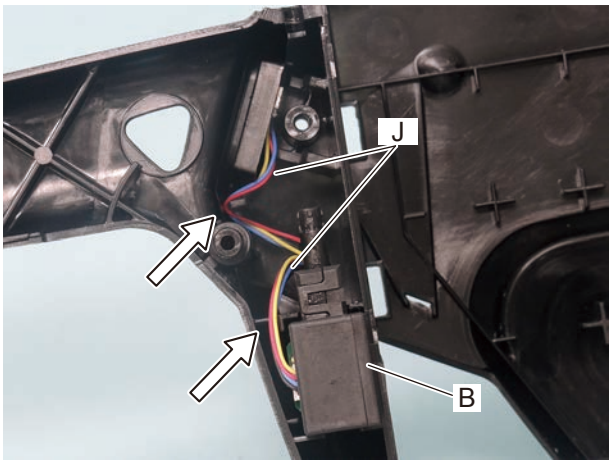


1. Connect power switch (A) and 6-pole terminal (G) of wire harness.

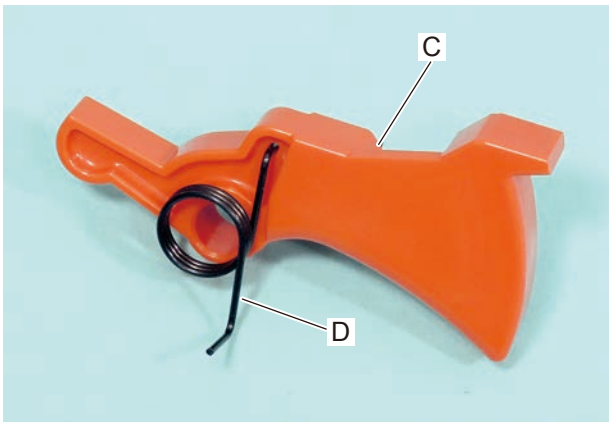
2. Connect variable speed switch (B) and 4-pole terminal (H) of wire harness.



3. Install power switch (A) on motor cover as shown.

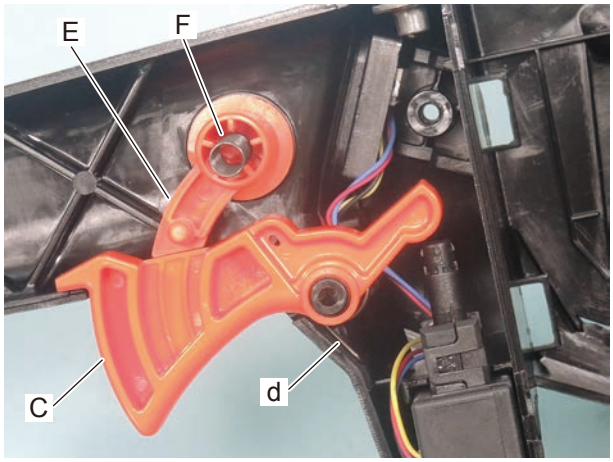


4. Place variable speed switch (B) on motor cover while passing leads (J) of wire harness through slits of motor cover as shown.



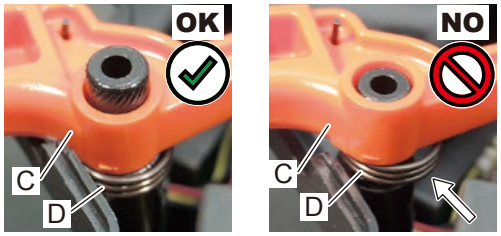
5. Set torsion spring (D) on trigger lever (C) as shown.

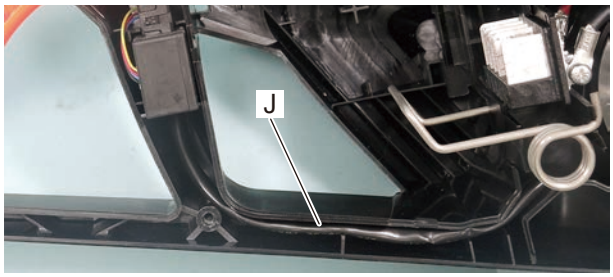
5-2 Installing switches and trigger lever (Continued)



6. Install trigger lever (C) on motor cover while placing the end (d) of torsion spring on motor cover as shown.

NOTE: Check the position of trigger lever (C) and torsion spring (D).

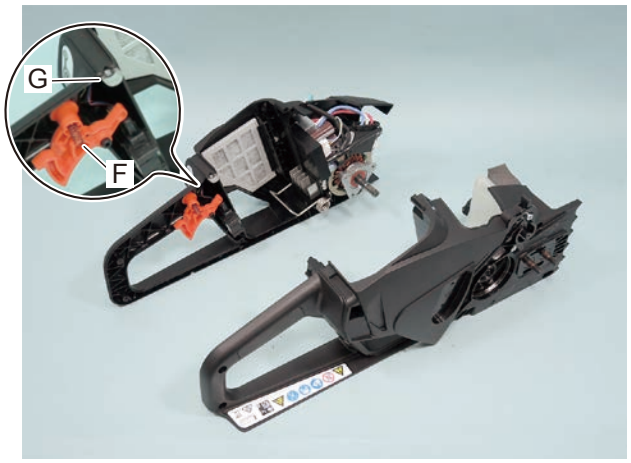




7. Install lockout button (E) on motor cover as shown.

8. Install compression spring (F) on lockout button (E) as shown.

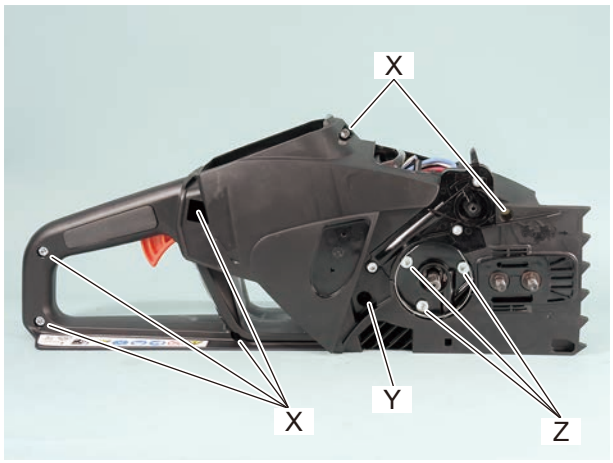
9. Pass lead (J) of wire harness between ribs of motor cover as shown.



10. Assemble motor cover halves.

NOTE: Be careful when assembling the covers:

- Do not to pinch each lead by the covers
- Do not to drop compression spring (F) off
- Do not to misplace weld nut (G)

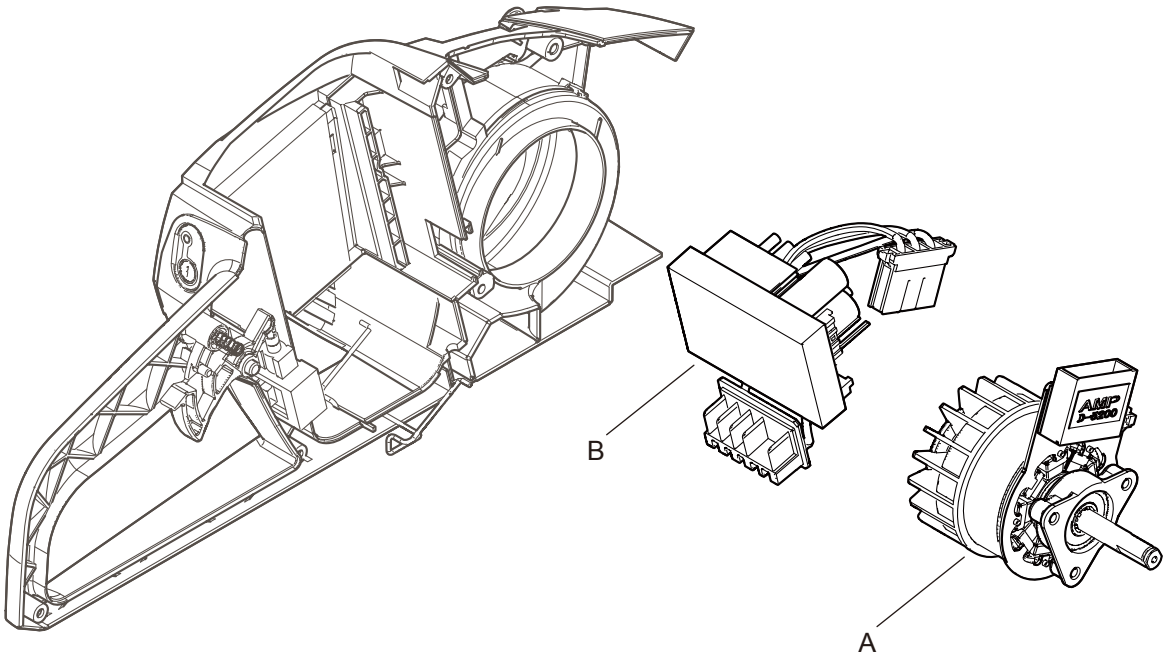


11. Tighten six bolts (X) (size : M4x16mm length), bolt (Y) (size : M4x20mm length) and three bolts (Z) (size : M5x20mm length) to secure motor cover.

12. Reassemble removed parts.

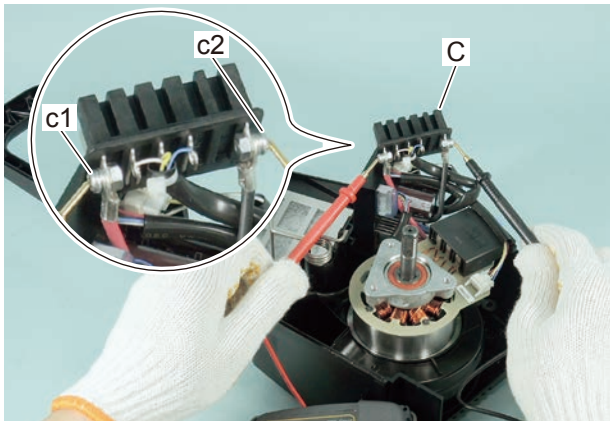
- Worm gear and drum (Refer to Section 4-3)
- Brake lever and switch (Refer to Section 3-2)

6 MOTOR AND CONTROL SYSTEM



(A) Motor
(B) Control board

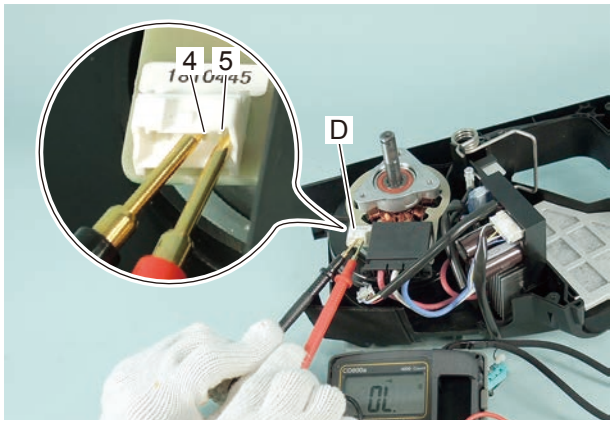
6-1 Inspecting motor and control board



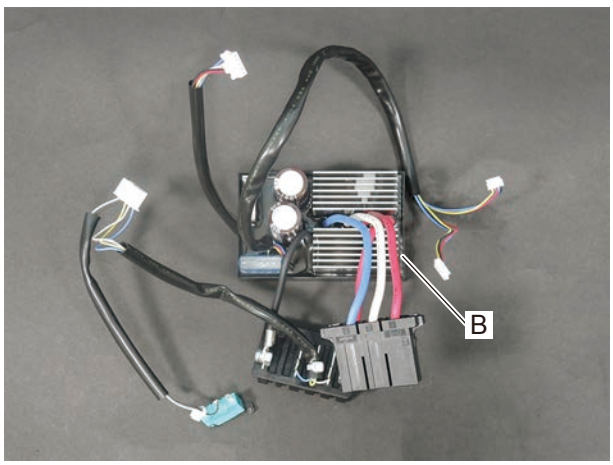
1. Separate motor cover. (Refer to section 4-5)

2. Remove battery connection terminal (C) of control board from motor cover.

3. Determine whether control board is short-circuited between positive terminal (c1) and negative terminal (c2).
Connect one probe of multimeter to terminal (c1). Connect the other probe to terminal (c2). Multimeter should indicate infinite resistance. If not, replace control board with new one.



4. Determine whether motor is short-circuited between terminal “4” and “5” of motor’s 5-pole terminal (D).
Connect one probe of multimeter to terminal “4”. Connect the other probe to terminal “5”. Multimeter should indicate infinite resistance. If not, replace motor with new one.



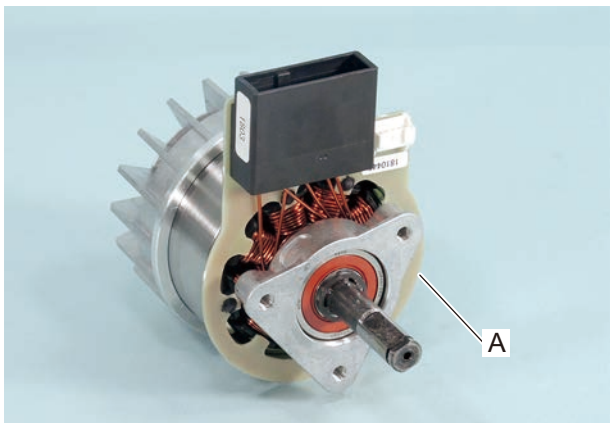
5. Remove control board (B) from motor cover.

6. Inspect the following:

- Conductive substances (water, metal pieces, etc.) on the surface of control board (B)
→ Remove debris, clean and dry components

- Burnout and/or damage of control board (B)
→ Replace

- Damage of each terminal on control board (B)
→ Replace



7. Remove motor (A) from motor cover.

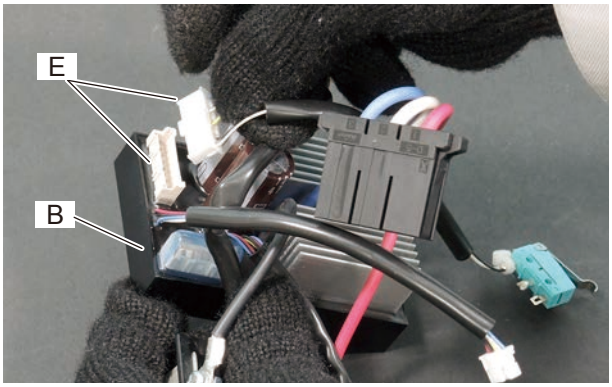
8. Inspect the following:

- Damage to terminals on motor → Replace

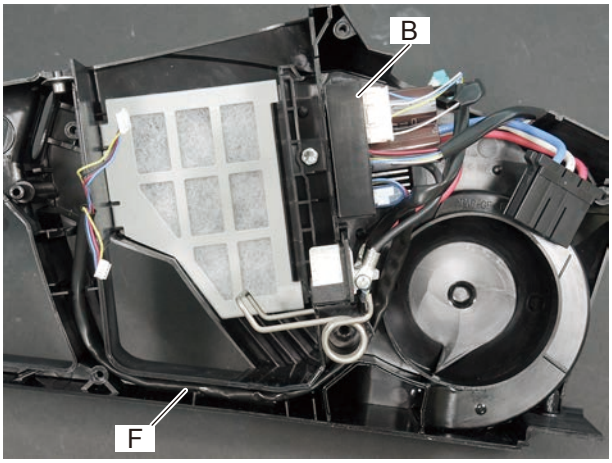
- Burnout of motor windings → Replace

- Hard rotation and damage → Replace

6-2 Installing motor and control board

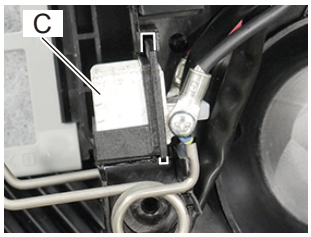


1. Reconnect 8-pole terminal (E) of control board (B).

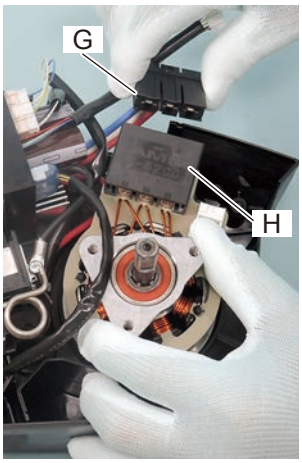


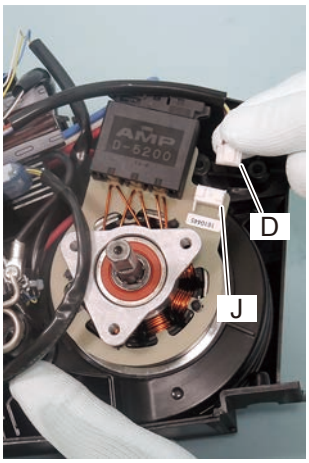
2. Install control board (B) on motor cover as shown.

3. Place battery connection terminal (C) between ribs of motor cover as shown.



4. Pass lead (F) of wire harness between ribs of motor cover as shown.

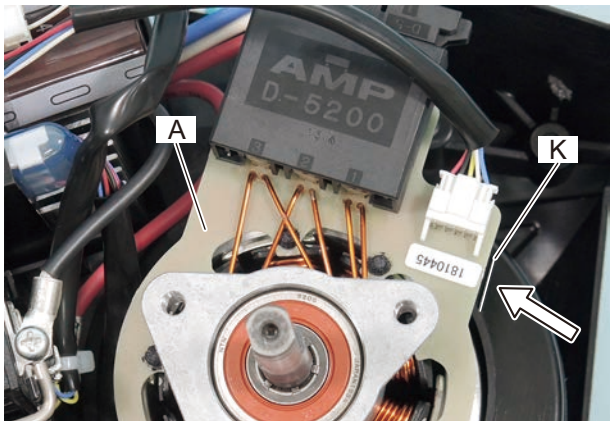




5. Install motor on motor cover.

6. Connect 3-pole terminal (G) of control board and 3-pole terminal (H) of motor.

7. Connect 5-pole terminal (D) of control board and 5-pole terminal (J) of motor.

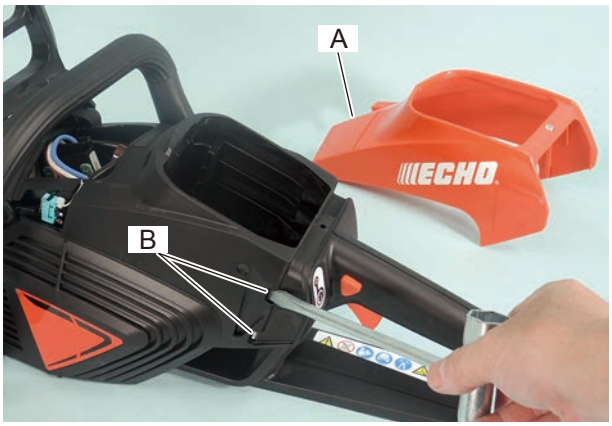


8. Adjust position of motor (A) along the line (K) of fan case.

9. Reassemble removed parts.
   - Switches, trigger lever and motor cover (Refer to Section 5-2)
   - Worm gear and drum (Refer to Section 4-3)
   - Brake lever and brake switch (Refer to Section 3-2)

7 AIR FILTER

7-1 Cleaning and replacing air filter



1. Remove cover (A) from unit.

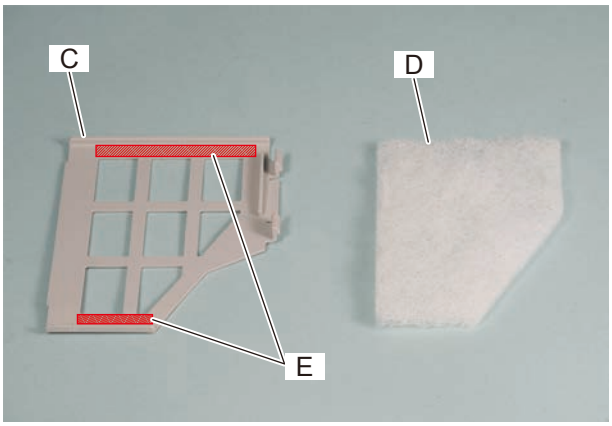
2. Push two hooks (B) inside using flat head screw driver or suitable tool as shown.

3. Remove cleaner lid (C) and air filter (D) together as shown.

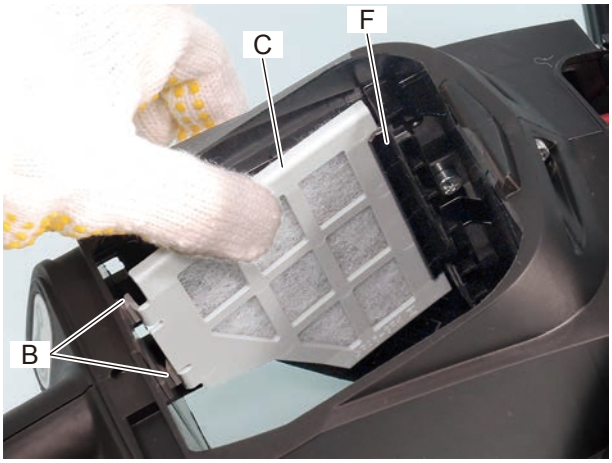
4. Inspect air filter (D). If blocked with dirt and/or saw dust, remove the obstruction with brush or compressed air. If heavily blocked with dirt and/or saw dust, replace air filter (D).

WARNING ⚠ DANGER

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



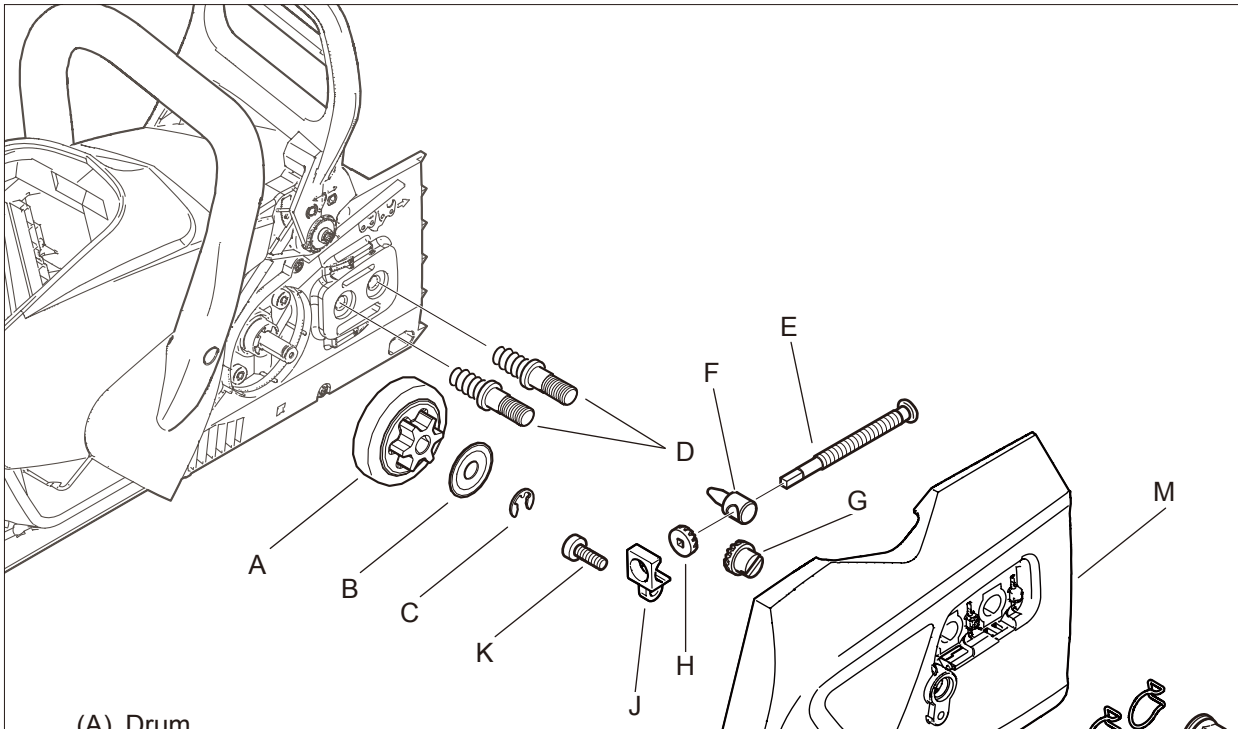
5. If double sided adhesive tapes (E) of cleaner lid (C) are no longer sticky, replace with new tapes (E). And then, place air filter (D) on cleaner lid (C).



6. Put cleaner lid (C) between ribs (F) of motor cover. And then, push two hooks (B) in holes of motor cover.

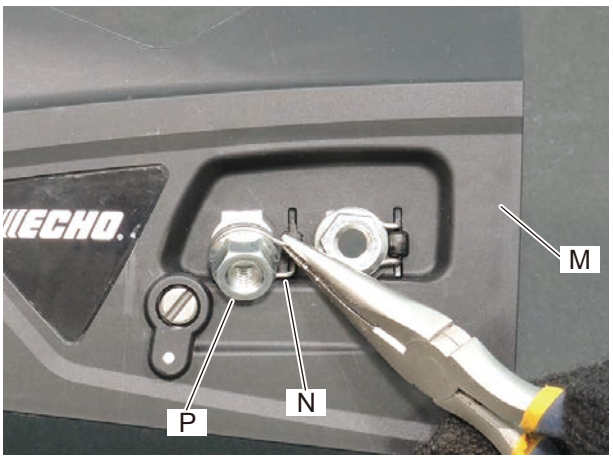
7. Install cover (A) on unit. (Refer to Section 3-2)

8 GUIDE BAR MOUNTING SYSTEM



(A) Drum
(B) Washer
(C) Retaining ring
(D) Stud
(E) Tensioner screw
(F) Chain tensioner
(G) Bevel gear
(H) Bevel gear
(J) Collar
(K) Tapping bolt
(M) Sprocket guard
(N) Hook
(P) Nut

8-1 Replacing nut for fixing guide bar



[Disassembling]

1. Pinch hook (N) with pliers and remove hook (N) and nut (P) together from sprocket guard (M).

2. Remove nut (P) from hook (N).

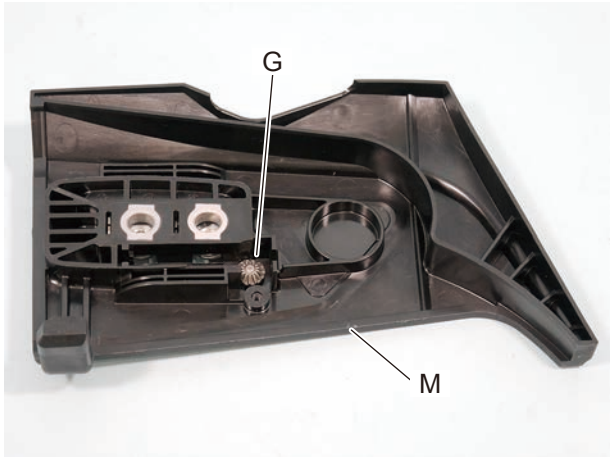
3. Check removed parts and replace defective parts with new one(s) as needed.

[Assembling]

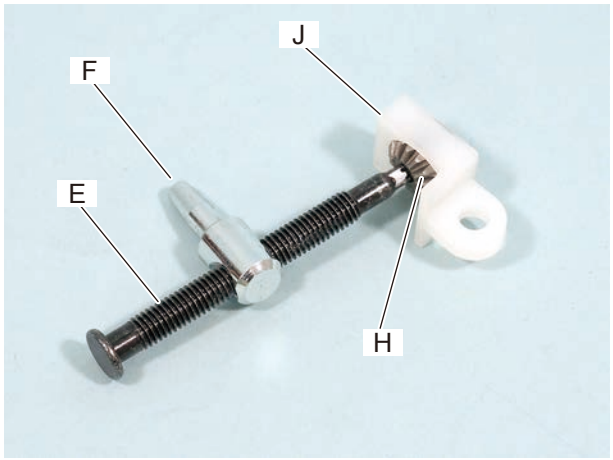
4. Assemble nut (N) and hook (P).

5. Insert both ends of hook (N) in holes of sprocket guard (M).

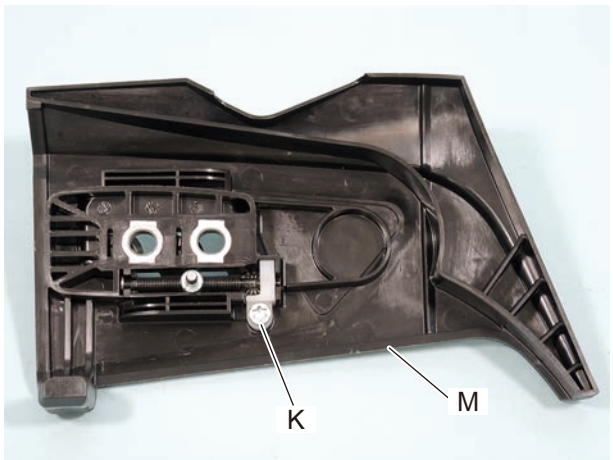
8-2 Assembling chain tensioner



1. Place bevel gear (G) on sprocket guard (M).

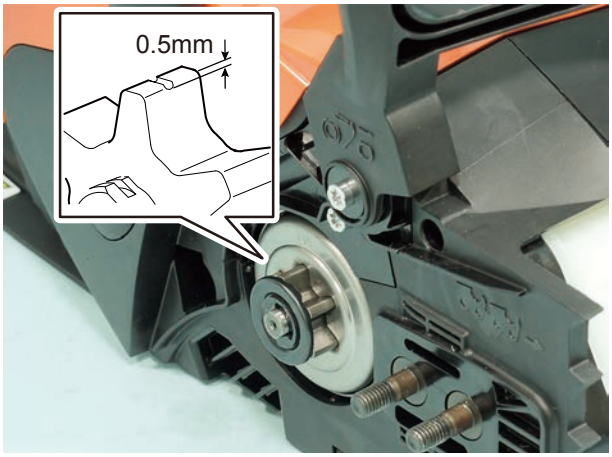


2. Screw chain tensioner (F) on tensioner screw (E).
3. Install beval gear (H) into collar (J).
4. Put bevel gear (H) on the end of tensioner screw (E).



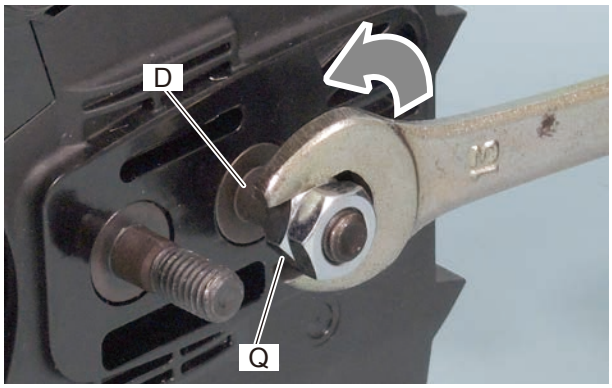
5. Install sub assembled tensioner screw in slot of sprocket guard (M) confirming engagement of bevel gear (G) and (H).
6. Tighten tapping bolt (K).

8-3 Inspecting sprocket



Inspect sprocket of drum. If worn out 0.5 mm (0.02in.) or more, replace with new one. (Refer to section 4-3)

8-4 Replacing guide bar stud

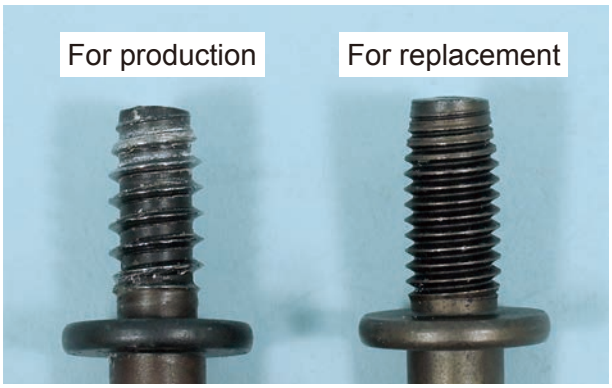


[Disassembling]

1. Install two nuts on defective stud (D) and tighten them against each other.

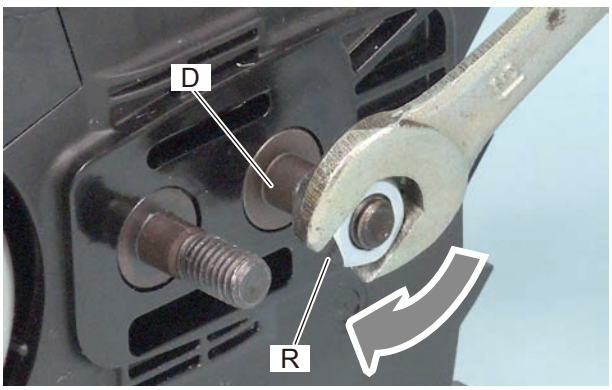
2. Turn nut (Q) counterclockwise to remove stud (D).

NOTE: If it is hard to remove or broken stud is too short for tightening two nuts, hold defective stud in a vise and turn the chain saw body counterclockwise, or use a suitable stud remover.



[Assembling]

NOTE: Replacement studs have a smaller self-tapping thread pitch. The smaller self-tapping thread will increase security by making new female threads on the motor cover.



3. Install two nuts on new stud (D) and tighten them against each other.

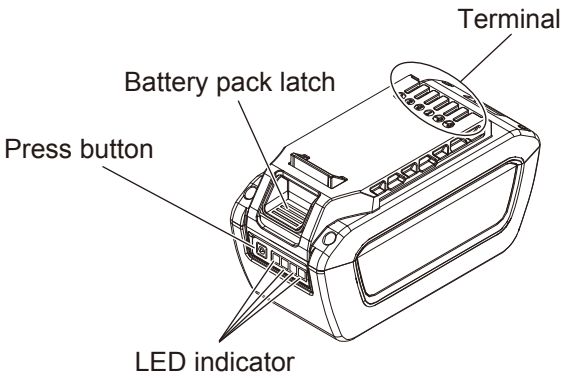
NOTE: Apply a small amount of thread locking sealant in the thread hole (locktite #272 or equivalent).

4. Turn nut (R) clockwise to install stud (D).

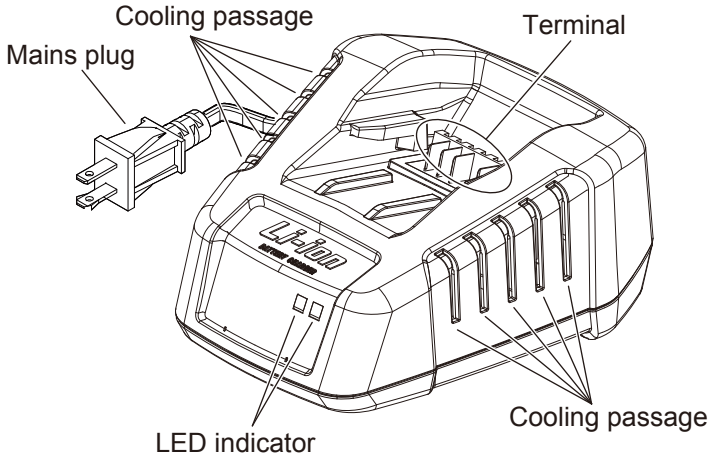
5. Reassemble removed parts.

9 BATTERY AND CHARGER

Battery



Charger



WARNING ⚠ DANGER

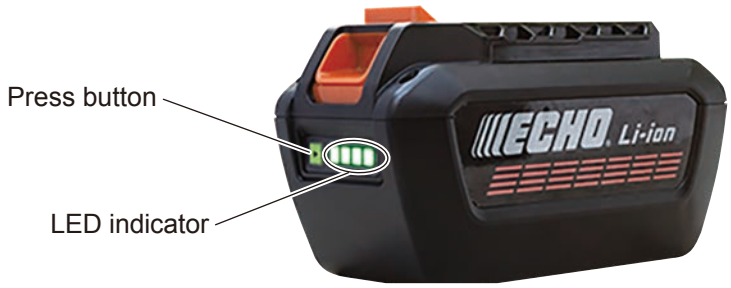
Do not open, crush, heat above 60°C or incinerate batteries and do not use damaged or deformed batteries. Failure to follow these rules may result in electric shock, fire, and/or serious personal injury.

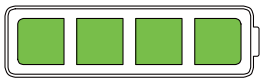
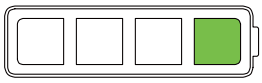
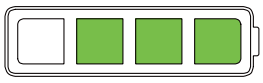
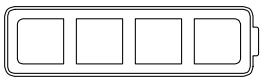
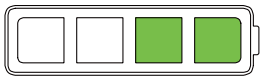
NOTE:

- Charge battery in ambient temperature of 5 - 40°C (41 - 104°F).
- Repeated discharges and recharges can cause reduced battery capacity. By 500 times of recharges, charge capacity falls to about 60%, but this is not trouble normally. If capacity is significantly reduced, replace the battery.

9-1 Battery LED indicator

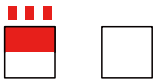
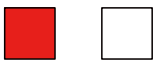
Battery LED indicator shows battery charging capacity as follows when pressing button.



Battery LED indicator		Capacity	Battery LED indicator		Capacity
	4 LED is lighting	80 - 100%		1 LED is lighting	0 - 25%
	3 LED is lighting	55 - 80%		LED is **not** lighting	< 0
	2 LED is lighting	25 - 55%			

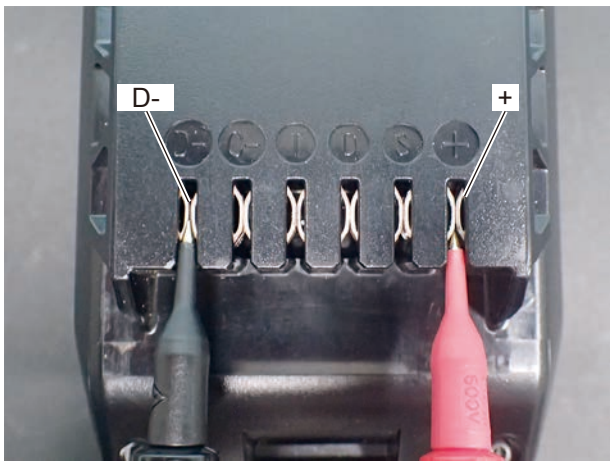
9-2 Charger LED indicator

Charger LED indicator shows charging situation as follows.

Charger LED indicator		Situation	Reason and how to recover
	Green flash	Charging	Normal charging
	Green ON	Charging complete	Charging completed
	Red flash	Defective battery or charger	Contacts of battery and charger are dirty → Clean them and reinsert battery
			Battery and/or charger trouble → Crosscheck them with known good ones
	Red ON	Charging delay	Battery is too hot or cold to charge → Cool or warm the battery

9-3 Inspecting battery

NOTE: This check must be done when the battery can be fully charged but has a shorted cell or does not have capacity to run the unit.
If battery is found defective by the following check, do Troubleshooting “Step2” (Refer to section 2-2) before installing a new battery. If the unit has something wrong, the new battery can be damaged again.



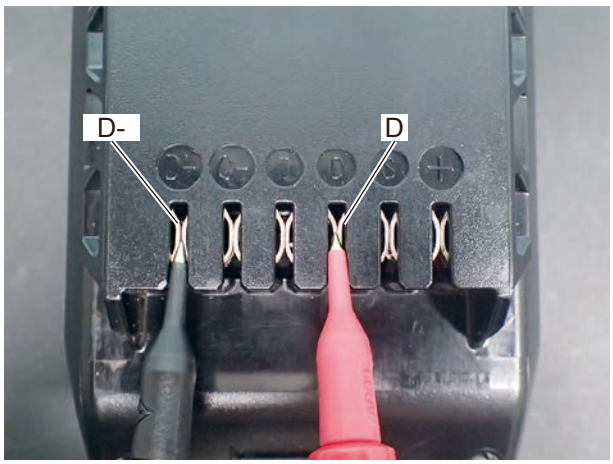
[Inspecting for weaken battery and overcharging]

1. Charge battery fully.

2. Connect one probe of multimeter to terminal (+) of battery. Connect the other probe to terminal (D-). Measure the voltage.

If the voltage is 45 V or lower, the battery cells have been weakened. Replace the battery with new one.

If the voltage is 62.5 V or more, the battery have been overcharged due to malfunction of charger. Replace the battery and the charger with new ones.



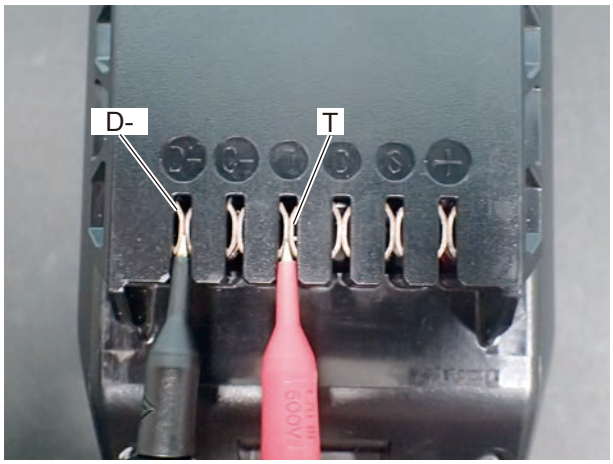
[Inspecting for damage by over discharge]

3. Charge battery fully.

4. Connect one probe of multimeter to terminal (D) of battery. Connect the other probe to terminal (D-). Mesure the resistance. The resistance should be about 10kΩ.

5. If the resistance is 12kΩ or more, recharge the battery fully and remeasure the resistance.

6. If the resistance is 12kΩ or more after repeating above check three times, the battery is damaged from over discharge.



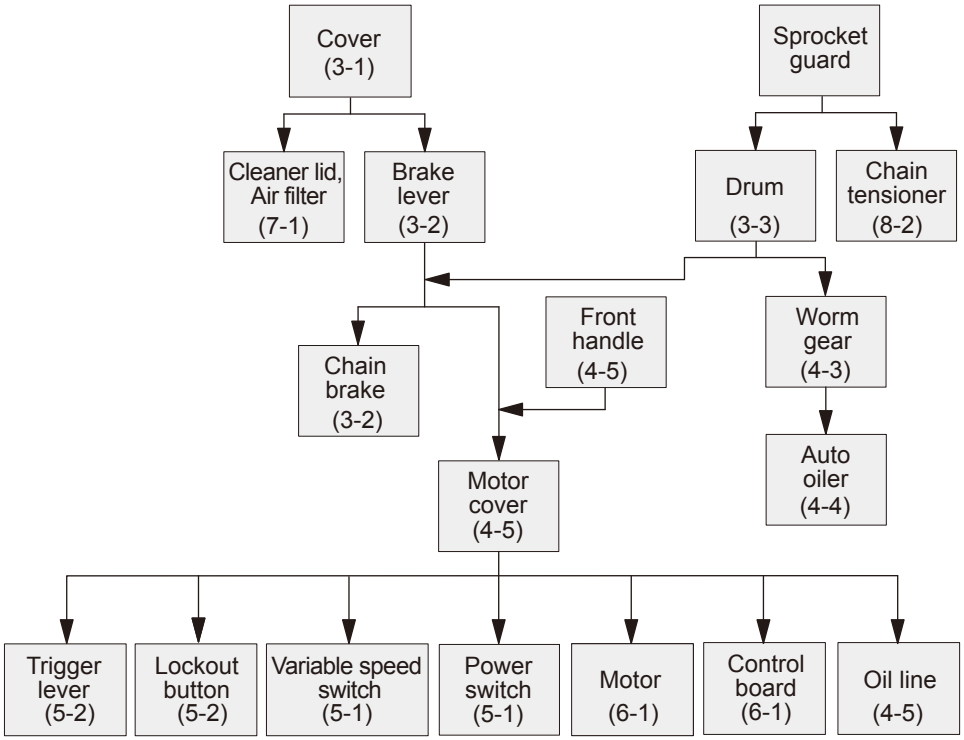
[Inspecting for damage of temperature sensor]

7. If battery is hot, cool it to 10 ~ 30°C (50 ~ 86°F).

8. Connect one probe of multimeter to terminal (T) of battery. Connect the other probe to terminal (D-). Mesure the resistance. The resistance should be 20kΩ or lower. If not, temperature sensor of the battery is damaged.

10 MAINTENANCE GUIDE

10-1 Disassembly chart



10-2 Service intervals

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

Inspecting point	Service Reference	Intervals	
		Before use	Monthly
Battery	Inspect / Clean / Charge 9-3	✓	
Chain brake	Inspect / Clean / Replace 3-1, 3-2, 3-3	✓	
Saw chain	Inspect / Clean / Sharpen / Replace	✓	
Guide bar	Inspect / Clean / Replace	✓	
Air filter	Inspect / Clean / Replace 7-1	✓	
Cooling system	Inspect / Clean / Replace	✓	
Oil strainer	Inspect / Clean / Replace 4-1		✓
Oil tank	Inspect / Clean / Replace	✓ (The amount of remaining)	✓
Sprocket	Inspect / Clean / Replace 8-3		✓
Screws, bolts and nuts	Inspect / Tighten / Replace	✓	

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