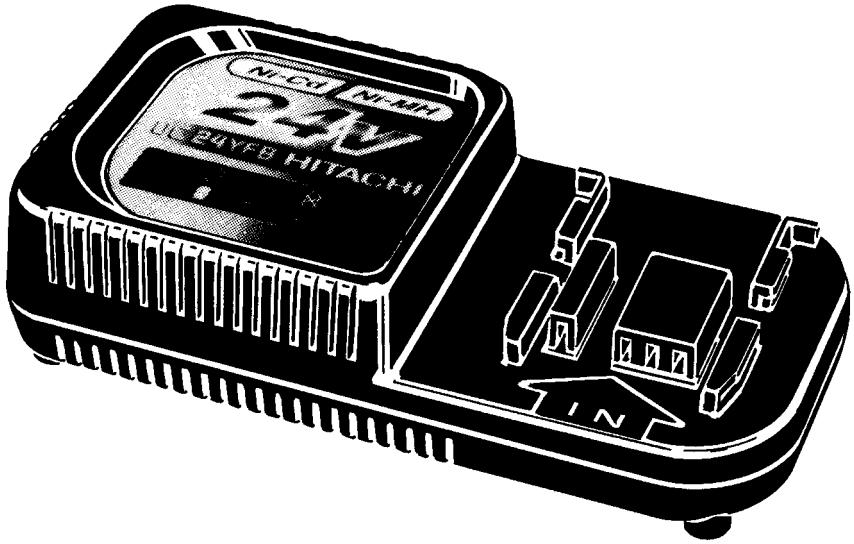
MODEL

UC 24YFB

HITACHI
POWER TOOLS

CHARGER
UC 24YFB

TECHNICAL DATA
AND
SERVICE MANUAL



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LIST No. F846 Mar. 2001

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1. PRODUCT NAME

Hitachi Charger, Model UC 24YFB

2. MARKETING OBJECTIVE

As the cordless tool market expands year by year, customers have come to expect a wider range of high-voltage products with excellent appearance, operability and durability. To satisfy these needs, it is necessary to develop slide-in battery packs as well as the conventional plug-in battery packs, and corresponding chargers and multi-purpose cordless tools featuring the following:

- Improved operability and appearance designed free from the handle shape constraints
- Improved stability in mounting battery packs to cordless tools and improved stability in electric contact

The Model UC 24YFB Charger that has been developed to meet these needs is capable of recharging either a 24 V slide-in nickel cadmium (Ni-Cd) battery or a 24 V slide-in nickel metal hydride (Ni-MH) battery in about one hour. The rechargeable range is from 7.2 V to 24 V to correspond to the future slide-in battery packs.

3. APPLICATIONS

Recharging of Hitachi batteries

Applicable batteries:

Ni-Cd battery	EB 2420	[24 V, 2.0 Ah]
Ni-MH battery	EB 2430HA	[24 V, 3.0 Ah]

4. SELLING POINTS

(1) Accepts both Ni-MH and Ni-Cd batteries

(2) Rapidly charges Hitachi EB 2420 and 2430 HA batteries

Charging time:

24 V, 2.0 Ah ····· 50 minutes

24 V, 3.0 Ah ····· 70 minutes

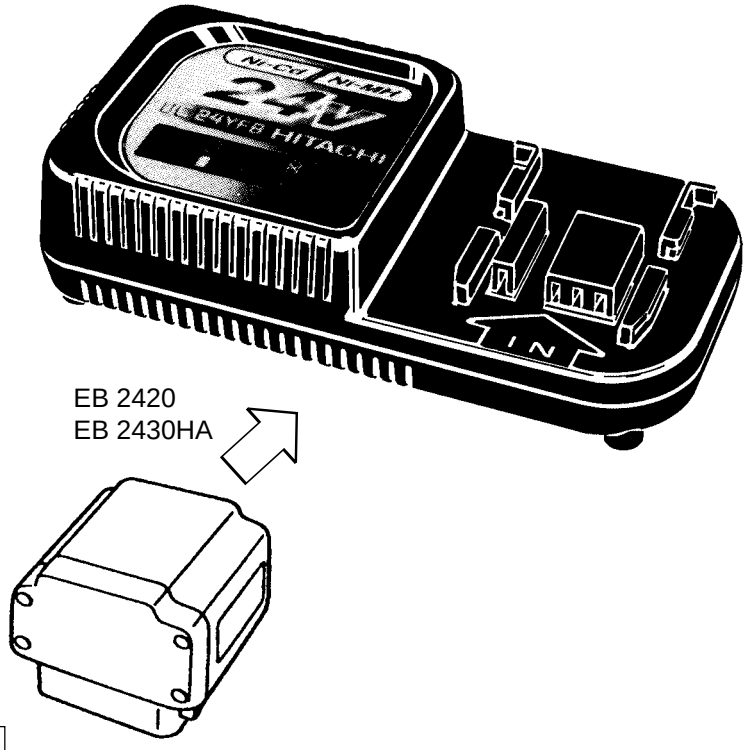
(3) Hitachi original charge control mechanism for longer battery life

Recharging/discharging cycles of battery

(ambient temperature range between 10 ˚C and 30 ˚C)

• Ni-Cd: about 1,000 times

• Ni-MH: about 500 times



3-way overcharging protection systems for longer battery and charger life

Easy-to-read visual display of charging status through constant lighting or flashing of red and green pilot lamps

Fig. 1

4-1. Selling Point Descriptions

4-1-1. Capable of handling both nickel cadmium (Ni-Cd) and nickel metal hydride (Ni-MH) batteries

Through application of HITACHI-microcomputer and electronic-circuit control technology, Model UC 24YFB is capable of handling both Ni-Cd and Ni-MH batteries.

4-1-2. Rapidly charges Hitachi EB 2420 and 2430 HA batteries

Table 1 Recharging time (approx. min.) at 20 ˚C

Battery voltage	Battery capacity			
	2.0 Ah		3.0 Ah	
24 V	EB2420	50 min.	EB2430HA	70 min.

NOTE: The recharging time may vary depending on the ambient temperature and the power supply voltage.
: Ni-MH batteries

4-1-3.Recharging/discharging cycles of battery (ambient temperature range between 10˚C and 30˚C)

- Ni-Cd battery: about 1,000 times
- Ni-MH battery: about 500 times

4-1-4. Capable of recharging batteries with internal temperatures as high as 60 ˚C

When a battery with S terminal is used, as shown in Fig. 2, the 60 ˚C thermistor operates to permit recharging of batteries heated up to 60 ˚C, and as shown in Fig. 3, the 55 ˚C thermistor operates heated up to 55 ˚C.

(Note 1)
- Wiring diagrams for batteries are shown below.
- The 95 ˚C thermal protector in the batteries EB 2420 and 2430 HA interrupts the recharging circuit when the battery temperature reaches 95 ˚C.
- A discriminating resistor is provided in Ni-MH batteries EB 2430HA and EB 2430H to distinguish them from Ni-Cd batteries.
- Because Ni-MH battery EB 2430HA is heated to high temperatures during recharging, this charger operates within a range of a 10 ˚C temperature difference between the maximum battery temperature when starting recharging (45 ˚C) and the temperature when stopping recharging (55 ˚C).

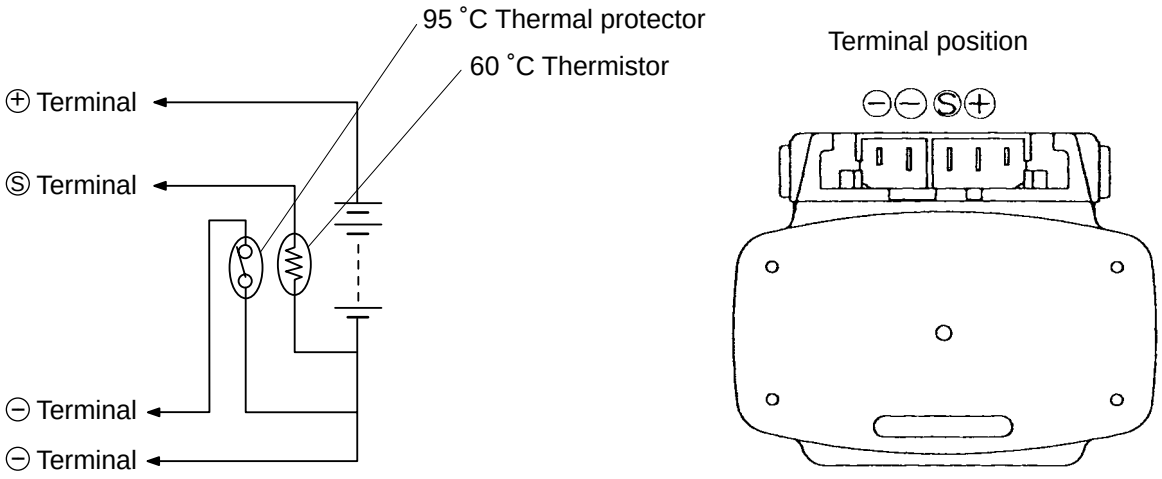


Fig. 2 Ni-Cd battery (EB 2420)

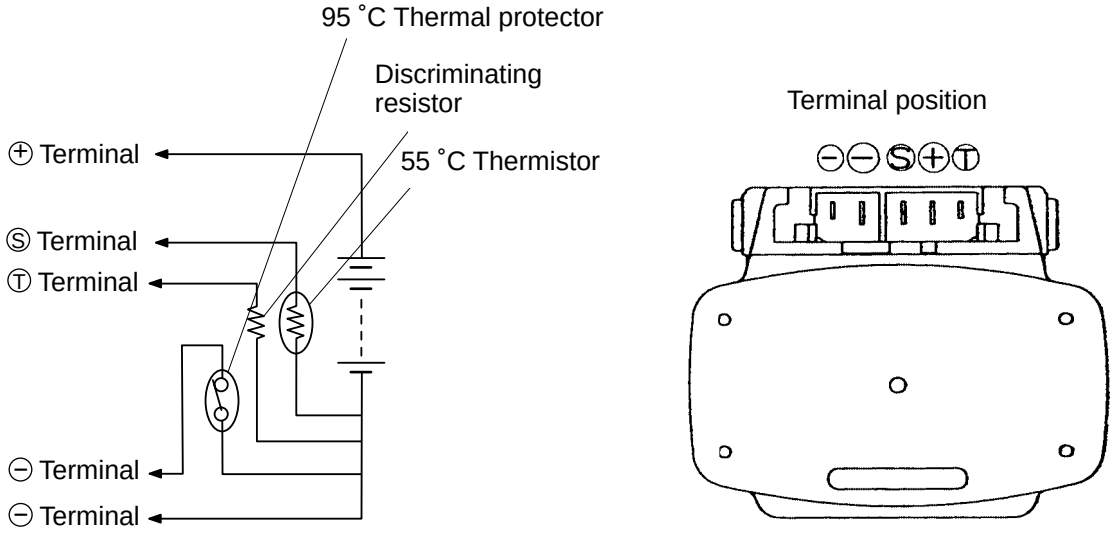


Fig. 3 Ni-MH battery (EB 2430HA)

4-1-5. 3-way overcharge protection system

Overcharge protection is ensured by a (A) $\triangle^2V$ system or dT/dt system (for Ni-MH battery), (B) built-in battery temperature sensors (thermostat and thermistor) and (C) a timer.

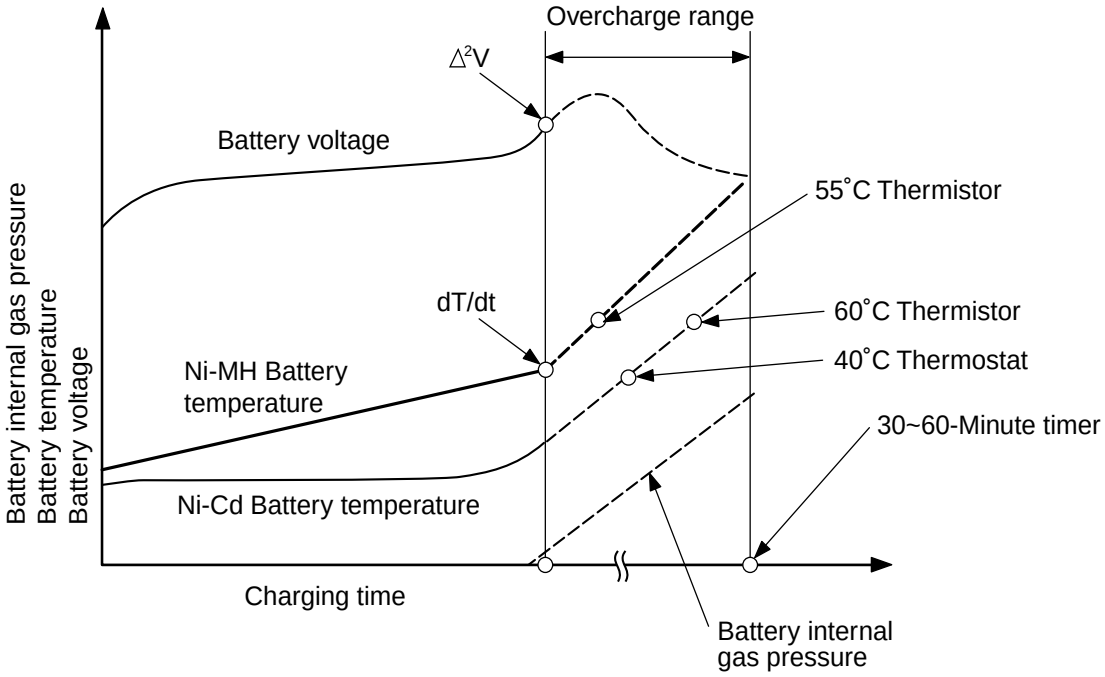


Fig. 4 Relationships of time, voltage, temperature and gas pressure while charging

(A) • $\triangle^2V$: This detects the increase in battery voltage at the end of charging using the value $\triangle^2V$ and suspends charging.

dT/dt : This system is applicable to Ni-MH batteries. This detects the variation of Ni-MH battery temperature by the value dT/dt at the end of charging and suspends charging.

(B) • Built-in battery temperature sensors : In the event the $\triangle^2V$ system fails to detect the voltage change, the 40 ˚C thermostat or the 60 ˚C thermistor stops charging when battery temperatures reach their respective values.

(C) • Timer : Should both the $\triangle^2V$ system, dT/dt system and the temperature sensors fail, the timer automatically stops charging within 120 minutes from the beginning of charging.

(Note 2) The voltage of the battery increases during charging and begins to fall when further charging is not possible. The $\triangle^2V$ system detects the point where the voltage begins to fall, and suspends charging to protect the battery from overcharging.

(Note 3) The temperature rise during charging of a Ni-MH battery is higher than with a Ni-Cd battery, and a sudden temperature rise occurs just before the battery is fully charged. The dT/dt system detects the point where the temperature rises suddenly and suspends charging to minimize the temperature rise.

(Note 4) As shown in Fig. 7, the pressure of gas generated after a battery has become fully charged rises rapidly to cause high temperature and high gas pressure that degrade the effectiveness of the battery. If charging is allowed to continue, the pressure of the gas will activate the safety valve in the battery, and the electrolyte will begin leaking.

4-1-6. Easy-to-read visual display of charging status through constant lighting or flashing of red and green pilot lamps

Pilot lamp indications

Red pilot lamp remains lit or flashes	Prior to charging	Blinks 0.5 sec. ON 0.5 sec. OFF 	
	During charging	Lights Stays ON constantly 	
	Charging completed	Blinks 0.5 sec. ON 0.5 sec. OFF 	
	Charging not possible	Flickers 0.1 sec. ON 0.1 sec. OFF 	Battery or charger is faulty.
Green pilot lamp is lit	High battery temperature	Lights Stays ON constantly 	Charging not possible because battery temperature is too high.

Charging of heated (high temperature) batteries

Battery Type	Battery temperature range during charging	Heated (high temperature) battery
EB 2420	–5 ˚C – 60 ˚C	Green pilot lamp lights. When battery temperature is reduced to 60 ˚C, green pilot lamp goes OFF and charging begins.
EB 2430HA	0 ˚C – 45 ˚C	Green pilot lamp lights. When battery temperature is reduced to 45 ˚C, green pilot lamp goes OFF and charging begins.

5. SPECIFICATIONS

5-1. Specifications

Item	Descriptions
Power source	AC single-phase, 50 Hz or 60 Hz
Power input	90 W
Charging system	Constant current charge with feedback control
Overcharging protection system	(1) Battery voltage detection ($\triangle^2V$ system) for Ni-Cd battery Ni-MH battery temperature detection (dT/dt system) for Ni-MH battery (2) Battery surface temperature detection (thermostat or thermistor) (3) 120 minutes timer
Charging voltage	24 V
Charging current	2.5 A
Charging time	Approx. 50 minutes (for Ni-Cd 2.0 Ah, 24 V)
Product weight	0.6 kg
Operating ambient temperature range	0 ˚C – 40 ˚C

5-2. Comparisons with Similar Products

		HITACHI	D
		UC 24YFB	
Charging time	min.	50 (EB 2420)	50 (2.0 Ah, 24 V Ni-Cd)
Charging voltage	V	24	24
Charging current	A	2.5	2.5
Power input	VA	120 V, 1.5 A	120 V, 2.2 A
Operating ambient temperature range	˚C	0 – 40	4.5 – 40.5
Chargeable battery temperature range	˚C	(*1) –5 – 60 (*2) 0 – 45	4.5 – 40.5
Overcharge protection system	–	$\triangle^2V$ system, dt/dt system, battery surface temperature detection, timer	Peak cut
External dimensions (length x width x height)	mm	226 x 110 x 75	165 x 201 x 56
Weight	kg	0.6 (1.3 lbs.)	0.6 (1.3 lbs.)

(*1): Chargeable Ni-Cd battery temperature range
(*2): Chargeable Ni-MH battery temperature range

6. PRECAUTIONS IN SALES PROMOTION

6-1. Safety Instructions

In the interest of promoting the safest and most efficient use of the Model UC 24YFB Charger by all of our customers, it is very important that at the time of sale the salesperson carefully ensures that the buyer seriously recognizes the importance of the contents of the Handling Instructions.

6-1-1. Handling instructions

Salespersons must be thoroughly familiar with the contents of the Handling Instructions in order to give pertinent advice to the customer.

(1) Connect the charger to an AC power outlet only.
Use of any other power source (DC outlet, fuel-powered generator, etc.) will cause the charger to overheat and burn out.

(2) Do not use any voltage-increasing equipment (transformer, voltage regulator, etc.) between the power source and the charger.
If the charger is used with voltage over and above that indicated on the unit, it will not function properly.

(3) Conduct battery charging in an ambient temperature range of 0 ˚C ─ 40 ˚C.
If charging is attempted when the ambient temperature is below 0 ˚C, overcharging occurs because the thermistor and thermostat do not function properly, thereby reducing the service life of the battery.
While it is possible to charge batteries with an Ⓢ terminal at higher temperatures, the service life of the batteries may be considerably reduced.

(4) Do not use the charger for successive charging.
In very hot locations, if two or more batteries are charged successively the temperature of the charger will rise excessively, and might cause the charger to fail. Instruct the customer to wait at least 15 minutes before commencing next charging. Particular care is necessary in summer or tropical countries when the power source voltage is high.

(5) Do not insert foreign objects into the air vent on the charger.
The charger case is equipped with air vents to protect the internal electronic components from overheating. Caution the customer not to allow foreign materials, such as metallic or inflammable objects, to be dropped or inserted into the air vents. This could cause electrical shock, fire or other serious hazards.

(6) Do not attempt to disassemble the charger.
Incorrect parts replacement and/or wiring will cause malfunctions which could result in fire or other hazards. Instruct the customer to bring the charger to an authorized service center in the event repair or replacement is necessary.

6-2. Extra Precautions in Sales Promotion

The following points must be given during sales promotion.

6-2-1. Charging may not be possible when the battery temperature is high

Charging may not be possible if the temperature of the battery is high after it has been exposed to direct sunlight for a long time or immediately after it has been used.

The customer should be advised in such a case to place the battery in a shaded area with good airflow, and allow sufficient cooling before recharging. This phenomenon is common to all existing batteries and chargers which employ temperature sensitive overcharge protection devices. The cooling time required before recharging varies from a few minutes to about 30 minutes, depending on the load, duration of use and ambient temperature.

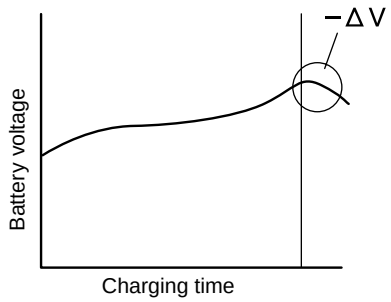
7. QUESTIONS AND ANSWERS ON MODEL UC 24YFB

Q1 What are typical charging methods?

A1 The most recent electronic charging methods are outlined below.

Method A

UC 12Y
UC 12YA

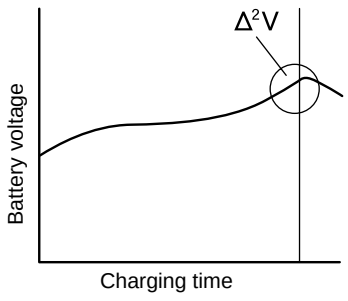


The descending voltage (− ΔV) of the battery in the final stage of charging is detected, and charging is automatically suspended.

− ΔV Charging method

Method B

UC 24YFA
UC 24YFB
UC 24YC
UC 24YF
UC 14YF2
UC 14YF
UC 12YF
UC 12YD
UC 12YB

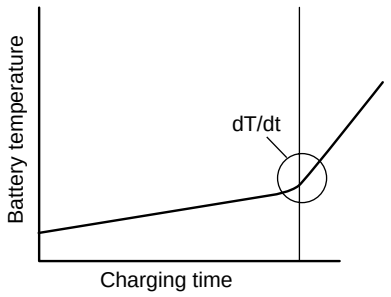


Voltage variation factor immediately before battery becomes fully charged is detected, and charging is automatically suspended.

$\triangle^2$V Charging method

Method C

UC 24YFA
UC 24YFB
UC 24YC



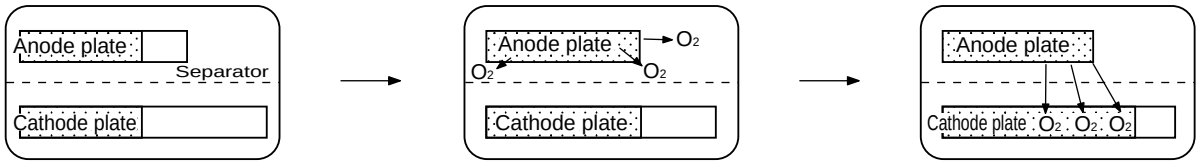
Sudden temperature rise just before full charging is detected and charging is suspended (Ni-MH battery)

dT/dt Charging method

Q2 Why was the $\triangle^2V$ microcomputer control system adopted for the Model UC 24YFB?

A2 If charging is continued after the battery has been fully charged, it will cause a large amount of oxygen gas (O_2) to be generated in a short period of time, as shown below. This proportionately accelerates degradation of the plates.

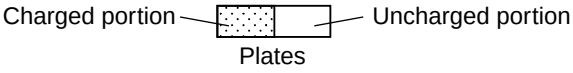
The $\triangle^2V$ microcomputer control system was adopted for the Model **UC 24YFB** charger in order to stop charging immediately before the battery is fully charged, thereby avoiding the generation of oxygen gas. This charging method applies no stress to the batteries.



Up to full charge. (Charging proceeds almost without deviation.)

Oxygen gas is generated when full charge is reached. (Anode is fully charged.)

Enters overcharge state and begins gas degradation with the cathode.



Q3 What is the difference between the $\triangle^2V$ microcomputer control system and the dT/dt system?

A3 Both systems cut off charging at almost the same point before the battery becomes fully charged.

The $\triangle^2V$ microcomputer control system detects a sudden voltage change which occurs just before the battery is fully charged and then suspends charging. The dT/dt system detects a sudden temperature rise which occurs just before the battery is fully charged and then suspends charging.

Q4 Is there any difference in the amount of work possible per charge of batteries charged with the $\triangle^2V$ microcomputer control system and those charged with dT/dt microcomputer control system?

A4 The dT/dt microcomputer control system may have a slightly shorter charging capacity (approx. 3 to 5 %). However, the amount of work possible per charge varies widely depending on the ambient temperature, the efficiency with which the battery charge is used, etc., so that there is essentially no difference between batteries charged with either system.

Q5 The battery charger is supposed to be used within a temperature range of 0 to 40 ˚C. What happens if it is used for charging at under 0 ˚C or above 40 ˚C?

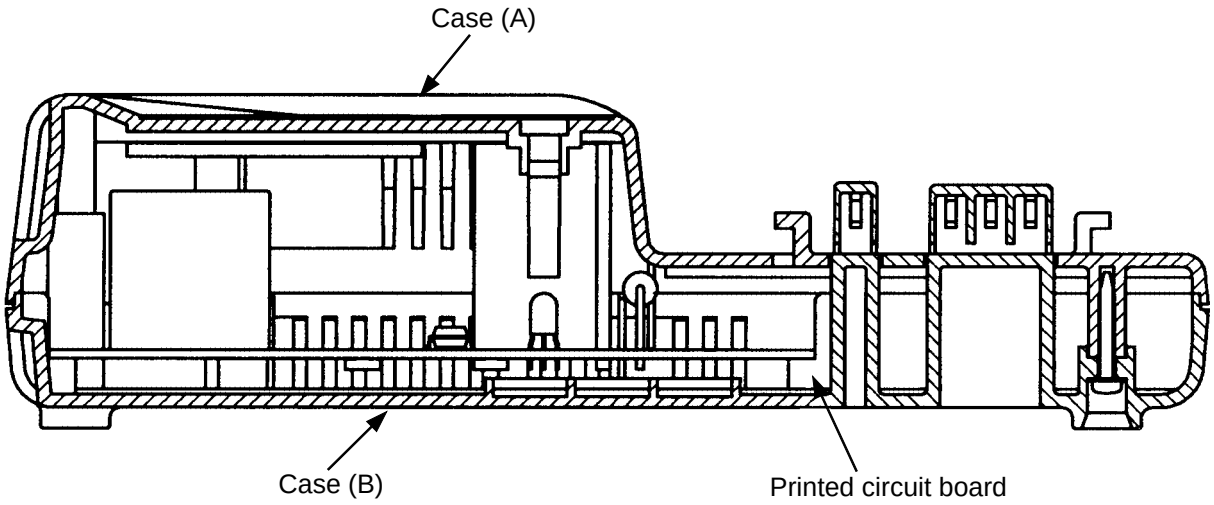
A5 At temperatures of under 0 ˚C, battery overcharge will occur, resulting in damage to the battery plates because the plates may not function properly. At temperatures over 40 ˚C, sufficient charging cannot be attained, or the plates will be damaged and the recharging/discharging cycles of the batteries will be reduced by half compared to low-temperature charging, even if the battery is fully recharged.

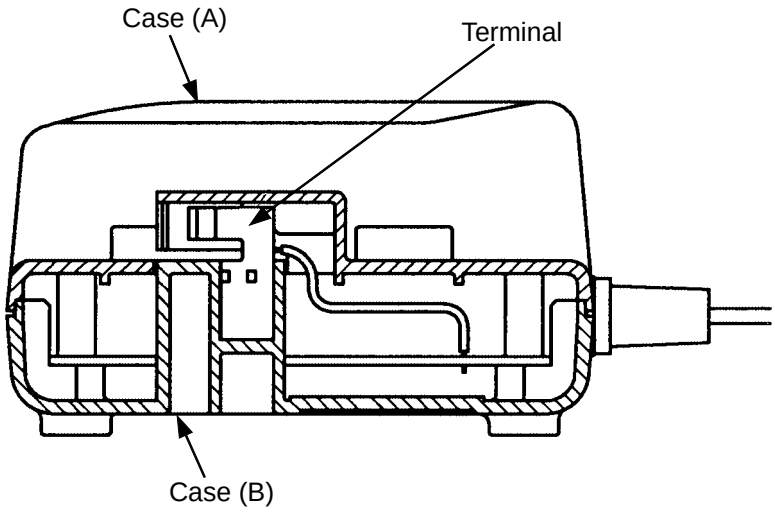
8. GENERAL PRECAUTIONS

8-1. Model UC 24YFB

(1) The outer frame consists of case (A) and case (B). Inside the frame there are the print circuit board and terminals.

(2) The print circuit board consists of high-frequency power transformer, microcomputer and other electronic devices to permit rapid charging and to protect against overcharging.





8-2. Pilot Lamp Indications

Pilot lamp indications

Red pilot lamp remains lit or flashes	Prior to charging	Blinks	0.5 sec. ON 0.5 sec. OFF 	
	During charging	Lights	Stays ON constantly 	
	Charging completed	Blinks	0.5 sec. ON 0.5 sec. OFF 	
	Charging not possible	Flickers	0.1 sec. ON 0.1 sec. OFF 	Battery or charger is faulty.
Green pilot lamp is lit	High battery temperature	Lights	Stays ON constantly 	Charging not possible because battery temperature is too high.

Pilot lamp indications during charging of heated (high temperature) batteries

Battery Type	Battery temperature range during charging	Heated (high temperature) battery
EB 2420	–5 ˚C – 60 ˚C	Green pilot lamp lights. When battery temperature is reduced to 60 ˚C, green pilot lamp goes OFF and charging begins.
EB 2430H	0 ˚C – 45 ˚C	Green pilot lamp lights. When battery temperature is reduced to 45 ˚C, green pilot lamp goes OFF and charging begins.

9. PRECAUTIONS IN DISASSEMBLY AND REASSEMBLY

The **[Bold]** numbers in the descriptions below correspond to the item numbers in the Parts List and exploded assembly diagram for UC 24YFB.

9-1. Disassembly

(1) Remove the four Tapping Screws (W/Flange) D3 x 20 **[6]** and take off Case (A) **[2]**.
The Printed Circuit Board Ass'y **[4]** and the Cord **[9]** can then be taken out in an assembled body.

(2) To separate the Printed Circuit Board Ass'y **[4]** and the Cord **[9]**, melt the soldered portions with a soldering iron.
(NOTE) Ideally, the soldered portions should be free with a solder absorber. If a soldering iron must be used, use one with a rated power of 35 W.

9-2. Reassembly

Reassembly can be accomplished by following the disassembly procedures in reverse; however, special attention should be given to ensure that lamps, cord armor and charging terminals are properly installed in their prescribed grooves.

9-3. Confirmation after Reassembly

(1) Confirm the following when the battery is fully charged.
- Confirm that the red pilot lamp on the charger lights up.
- When charging an EB 2430H battery, confirm that the red pilot lamp flashes at 1 second intervals approx. 60 minutes from commencing charging.

(2) Measure the insulation resistance and conduct a dielectric strength test.
- Insulation resistance: 10 MΩ or more between the plug blade of cord and the Name Plate or case fastening screws, with DC 500 V Megohm Tester.
- Dielectric strength test:
  (a) Between the plug blade of cord and the charging terminal blade.
  (b) Between the plug blade of cord and the Name Plate or fastening screws on the case.

Based on the voltage listed on the Name Plate, dielectric strength test should be conducted.

Voltage on the name plate	Test voltage
120 V	AC 1,240 V (1 minute)
230 V, 240 V	AC 3,750 V (1 minute)

CAUTION: Without fail, insulation resistance must be measured between the plug blade of cord and the Name Plate or fastening screws, and dielectric strength test must be conducted between the plug blade of cord and the charging terminal blade or between the plug blade of cord and the Name Plate or fastening screws on the case. Under no circumstances should testing be conducted between both blades of the plug, or both blades of the charging terminal, which may cause burn-out of the charger.

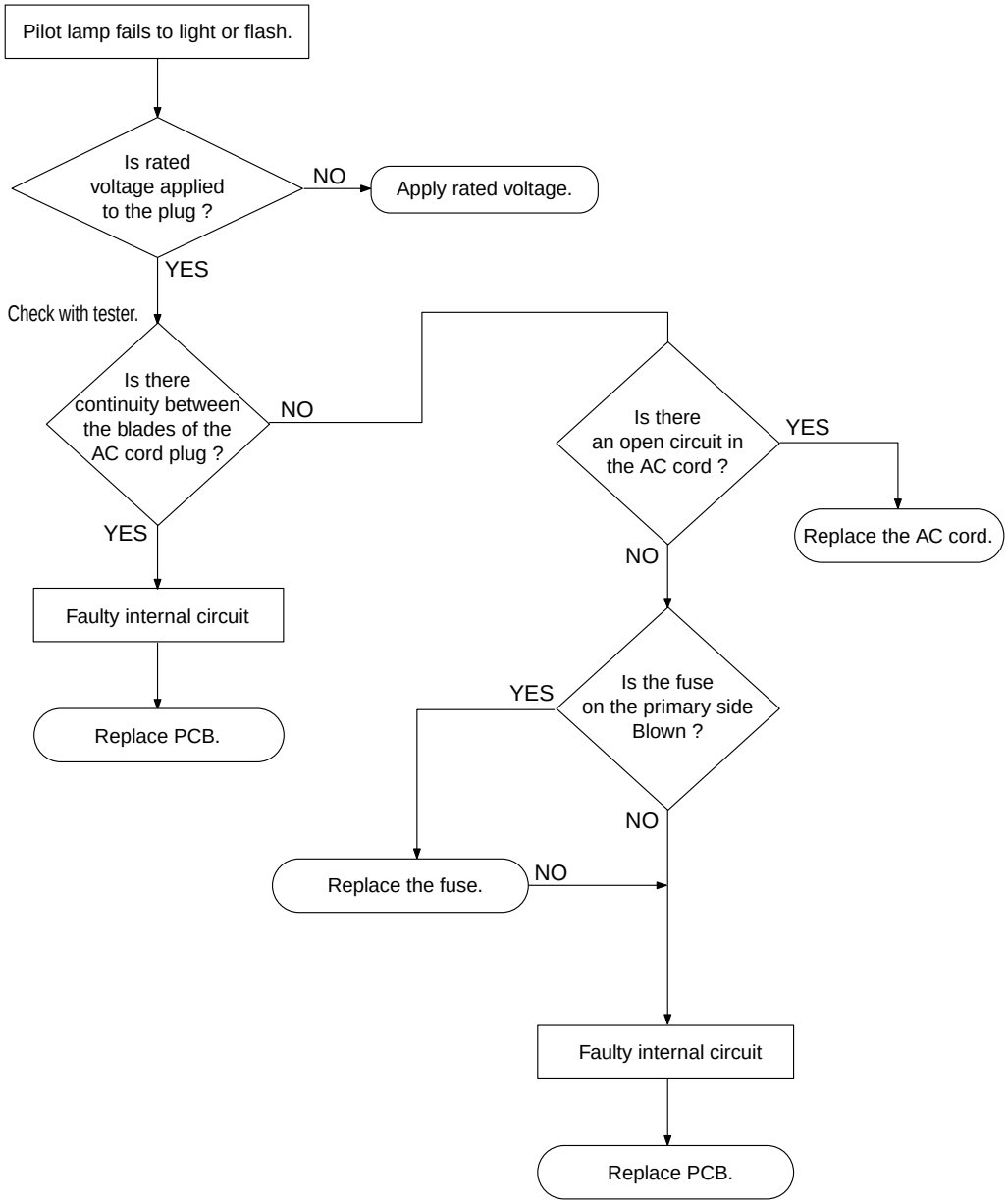
10. TROUBLESHOOTING GUIDE

10-1. Troubleshooting Based on Pilot Lamp Indications

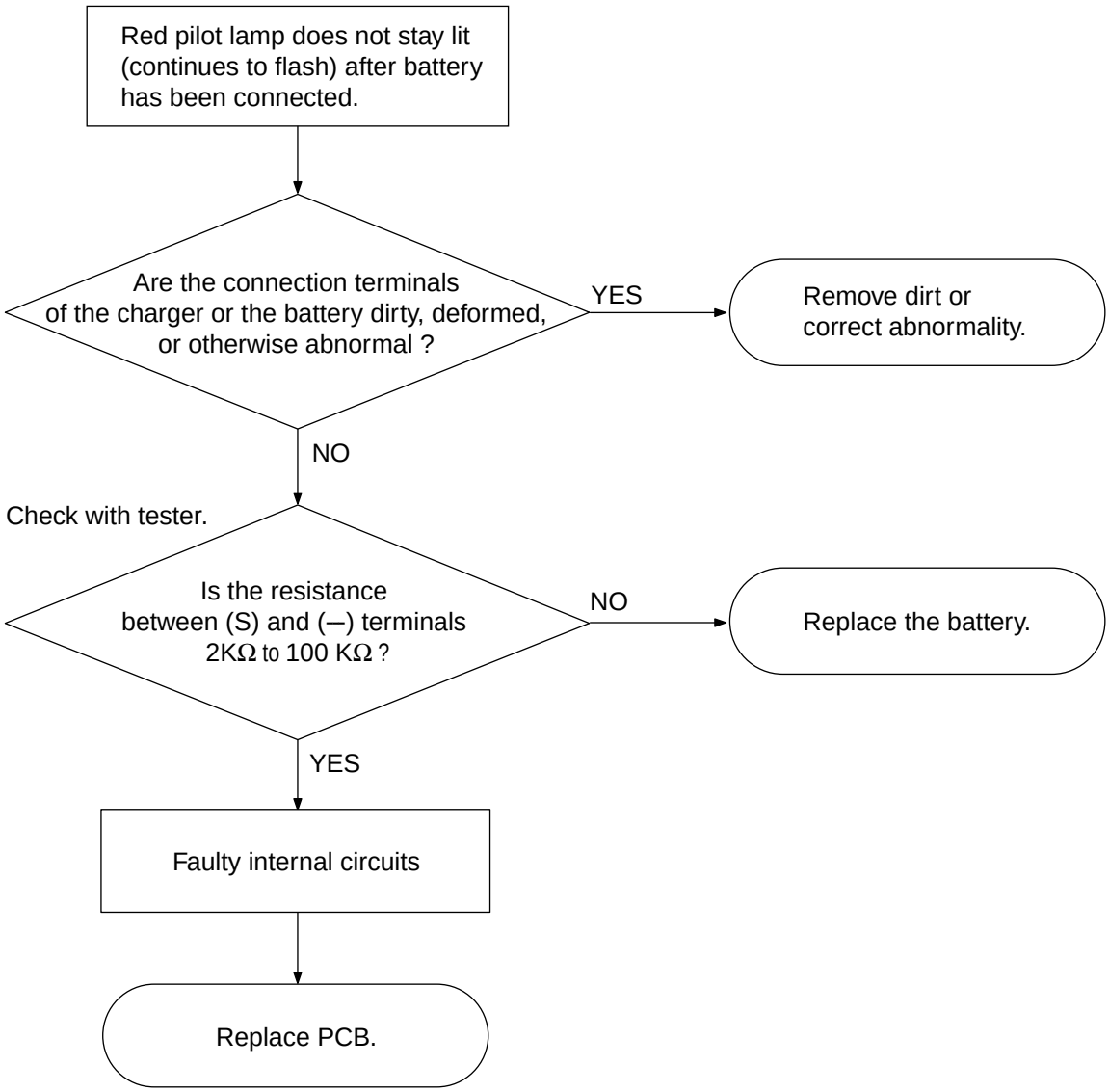
Phenomenon	Typical causes	Check procedures
Pilot lamp fails to light or flash.	(1) Faulty AC cord (2) Blown fuse (3.15 A) on primary side	Refer to trouble mode (A).
Red pilot lamp does not stay lit (continues to flicker) after battery has been connected.	(1) Poor connection of (T) or (S) terminal (2) Faulty battery (open circuit) (3) Faulty PCB	Refer to trouble mode (B).
Pilot lamp remains green (red fails to light) after battery has been connected.	(1) Poor connection of (T) or (S) terminal (2) Faulty PCB	Refer to trouble mode (C).
Pilot lamp indicates abnormality by flashing red rapidly (at 0.2 second intervals).	(1) Faulty battery (short-circuit, or open circuit) (2) Faulty PCB	Refer to trouble mode (D).

10-2. Troubleshooting and Repair Procedures

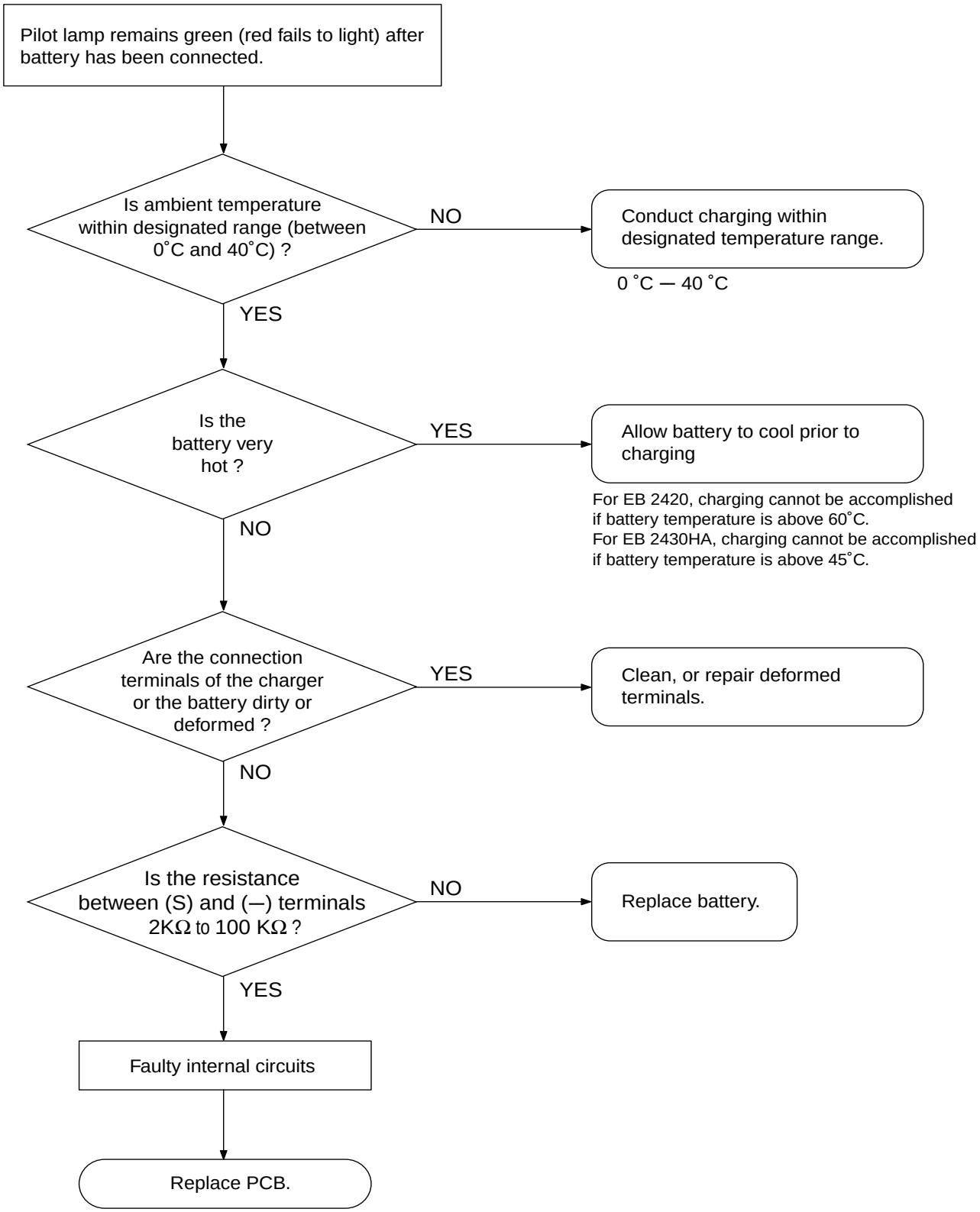
(1) Trouble mode (A)



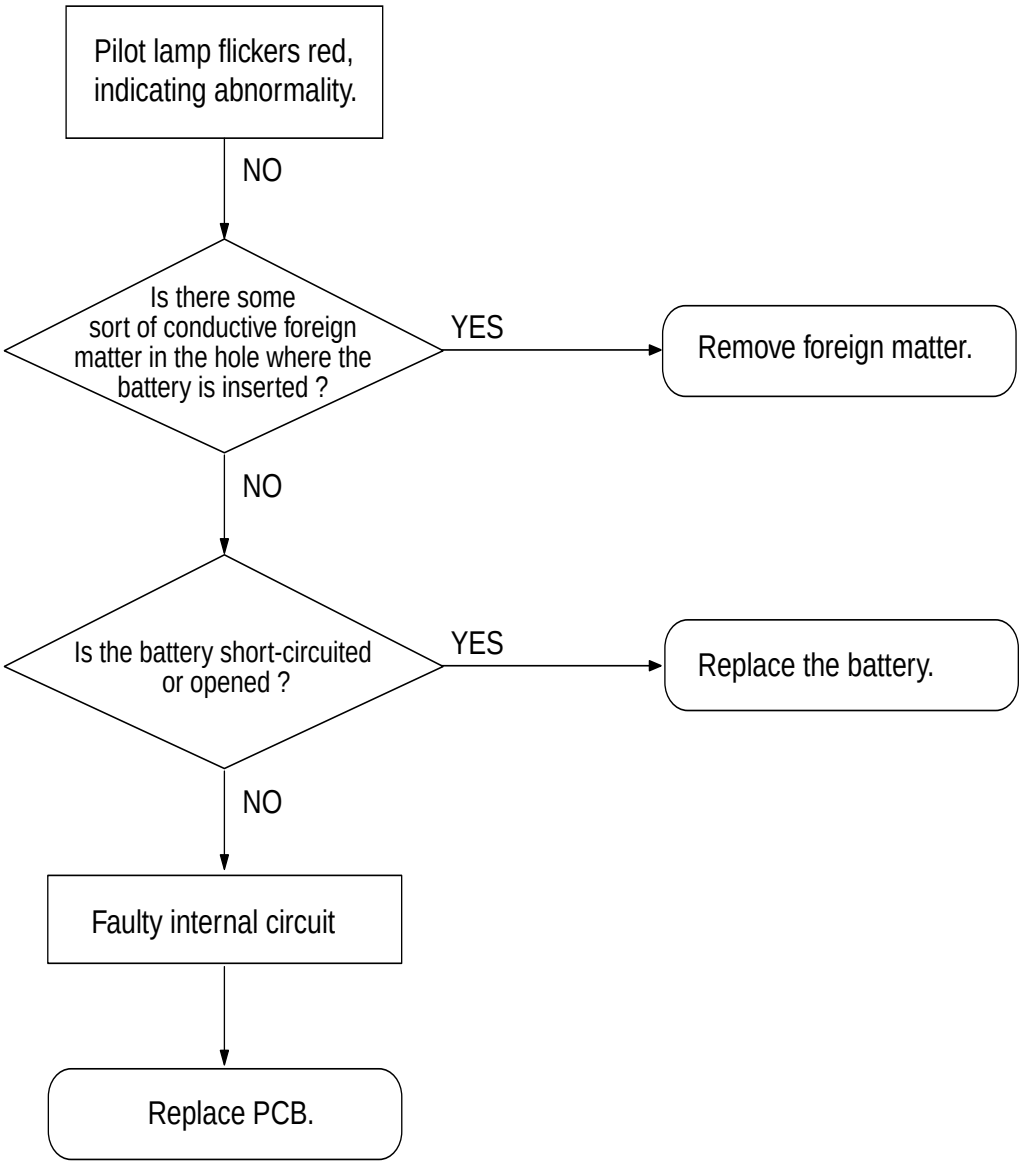
(2) Trouble mode (B)



(3) Trouble mode (C)



(4) Trouble mode (D)



11. STANDARD REPAIR TIME (UNIT) SCHEDULES

MODEL	Variable / Fixed	10	20	30	40	50	60 min.
		Work Flow					
UC 24YFB	General Assembly →	Case (A) Fuse (3.15 A) Light Bar	Case (B) Printed Circuit Board Ass'y Cord				

HITACHI

LIST NO. F846

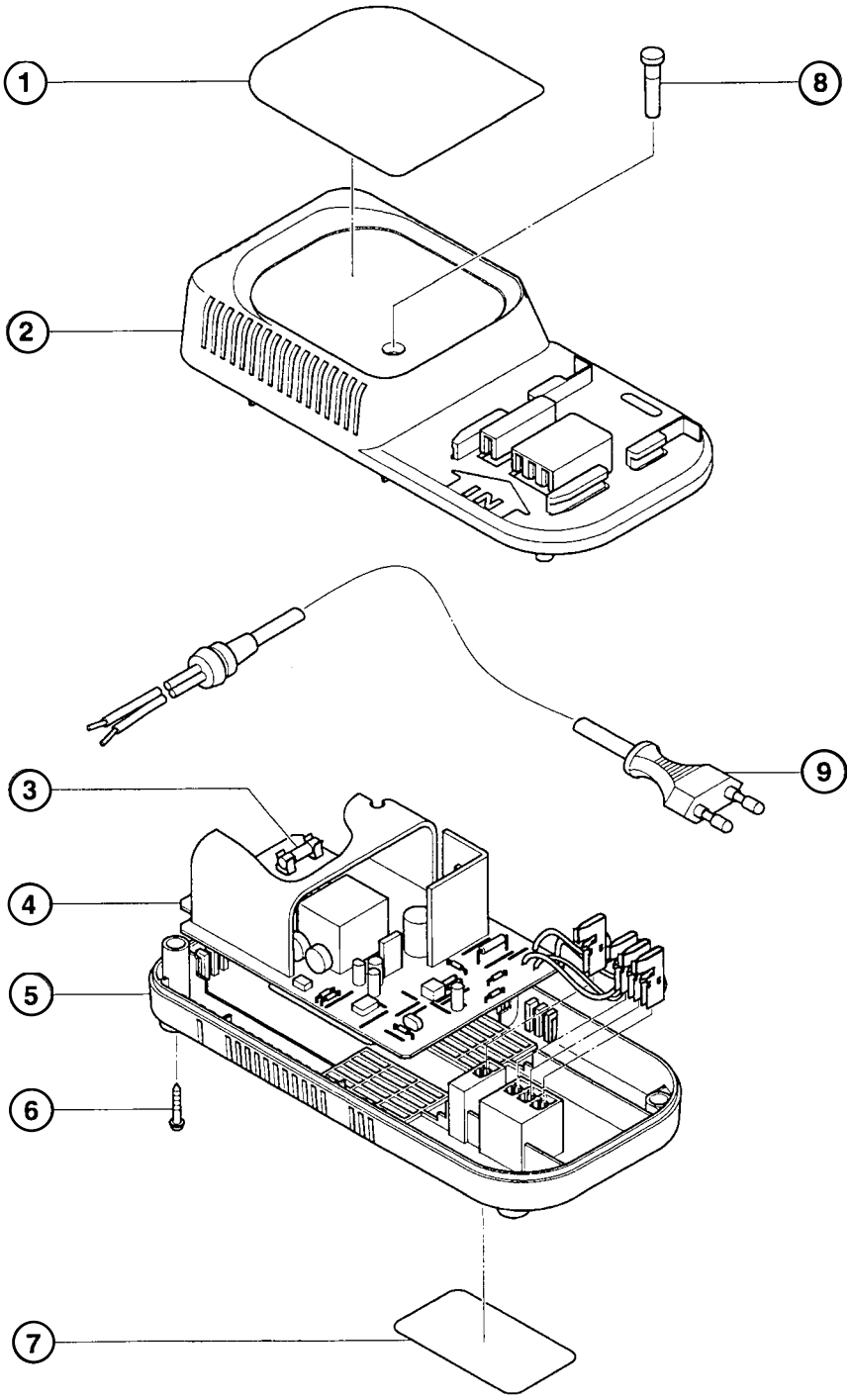
ELECTRIC TOOL PARTS LIST

■ CHARGER

2001・1・30

Model UC 24YFB

(E1)



PARTS

	ITEM NO.	CODE NO.	DESCRIPTION	NO. USED	REMARKS	
	1		HITACHI LABEL	1		
	2	319-935	CASE (A)	1		
*	3	319-781	FUSE (125V-3.15A)	1	FOR 120V	
*	3	319-780	FUSE (250V-3.15A)	1	FOR 230V-240V	
*	4	319-937	PRINTED CIRCUIT BOARD ASS'Y 120V	1	INCLUD.3	
*	4	319-938	PRINTED CIRCUIT BOARD ASS'Y 230V-240V	1	INCLUD.3	
	5	319-936	CASE (B)	1		
	6	300-036	TAPPING SCREW (W/FLANGE) D3X20	4		
	7		NAME PLATE	1		
	8	319-934	LIGHT BAR	1		
*	9	318-262	CORD	1		
*	9	318-259	CORD	1	FOR USA	
*	9	318-261	CORD	1	FOR GBR	
*	9	318-260	CORD	1	FOR AUS	

* ALTERNATIVE PARTS

Printed in Japan 1 -- 01
(010130N)

Hitachi Koki Co., Ltd.

Tokyo Japan