

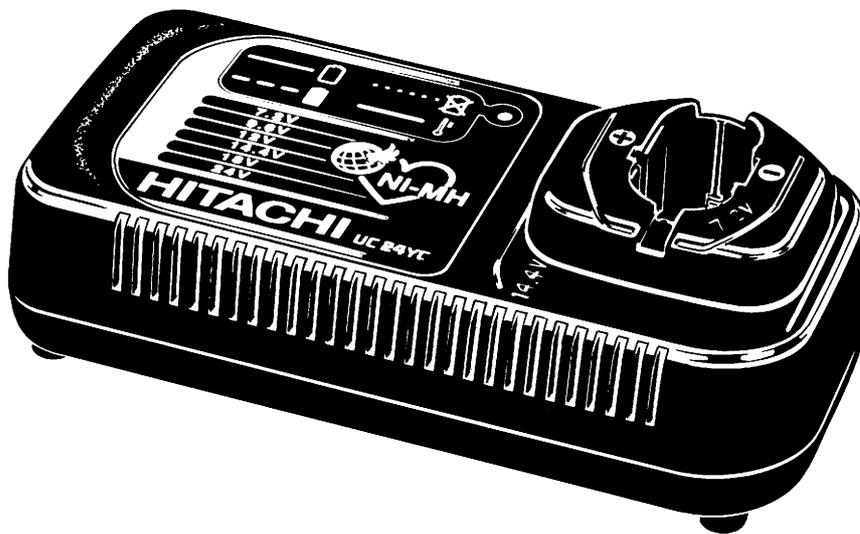
MODEL

UC 24YC

HITACHI
POWER TOOLS

CHARGER
UC 24YC

TECHNICAL DATA
AND
SERVICE MANUAL



LIST No. F840

Jun. 2000

Notice for use

Specifications and parts are subject to change for improvement.
Refer to Hitachi Power Tool Technical News for further information.

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1. PRODUCT NAME

Hitachi Charger, Model UC 24YC

2. MARKETING OBJECTIVE

As the cordless tool market expands year by year, customers have come to expect a wider range of high-voltage products, longer run time with high-capacity batteries, and shorter charging time. The Model UC 24YC is a rapid charger that has been developed to meet these needs — and with a wider charging range from 7.2 V to 24 V to take the place of the current UC 12YB charger (7.2 V to 12 V). The sales of the Model UC 24YF (7.2 V to 24 V) for general purpose will continue. The Model UC 24YC will be sold as an accessory for after market purposes. Plans to bundle it with electric power tools will be put on hold for the time being because the Model UC 24YC is more costly than the Model UC 24YF.

3. APPLICATIONS

Recharging of Hitachi batteries

Applicable batteries:

Ni-Cd batteries	EB 7	[7.2 V,	1.3 Ah]
	EB 9	[9.6 V,	1.3 Ah]
	EB 12	[12 V,	1.3 Ah]
	EB 7S	[7.2 V,	1.3 Ah]
	EB 9S	[9.6 V,	1.3 Ah]
	EB 12S	[12 V,	1.3 Ah]
	EB 14S	[14.4 V,	1.3 Ah]
	EB 7G	[7.2 V,	1.7 Ah]
	EB 9G	[9.6 V,	1.7 Ah]
	EB 12G	[12 V,	1.7 Ah]
	EB 9B	[9.6 V,	2.0 Ah]
	EB 12B	[12 V,	2.0 Ah]
	EB 14B	[14.4 V,	2.0 Ah]
	EB 18B	[18 V,	2.0 Ah]
	EB 24B	[24 V,	2.0 Ah]
	EB 9M	[9.6 V,	2.0 Ah]
	EB 12M	[12 V,	2.0 Ah]
	EB 924	[9.6 V,	2.4 Ah]
EB 1224	[12 V,	2.4 Ah]	
EB 1424	[14.4 V,	2.4 Ah]	
Ni-MH batteries	EB 9H	[9.6 V,	2.2 Ah]
	EB 12H	[12 V,	2.2 Ah]
	EB 14H	[14.4 V,	2.2 Ah]
	EB 930H	[9.6 V,	3.0 Ah]
	EB 1230H	[12 V,	3.0 Ah]
	EB 1430H	[14.4 V,	3.0 Ah]
	EB 2430H	[24 V,	3.0 Ah]

4. SELLING POINTS

- (1) Accept both Ni-MH and Ni-Cd batteries
- (2) Rapidly charges all Hitachi EB-series batteries.

Charging time:

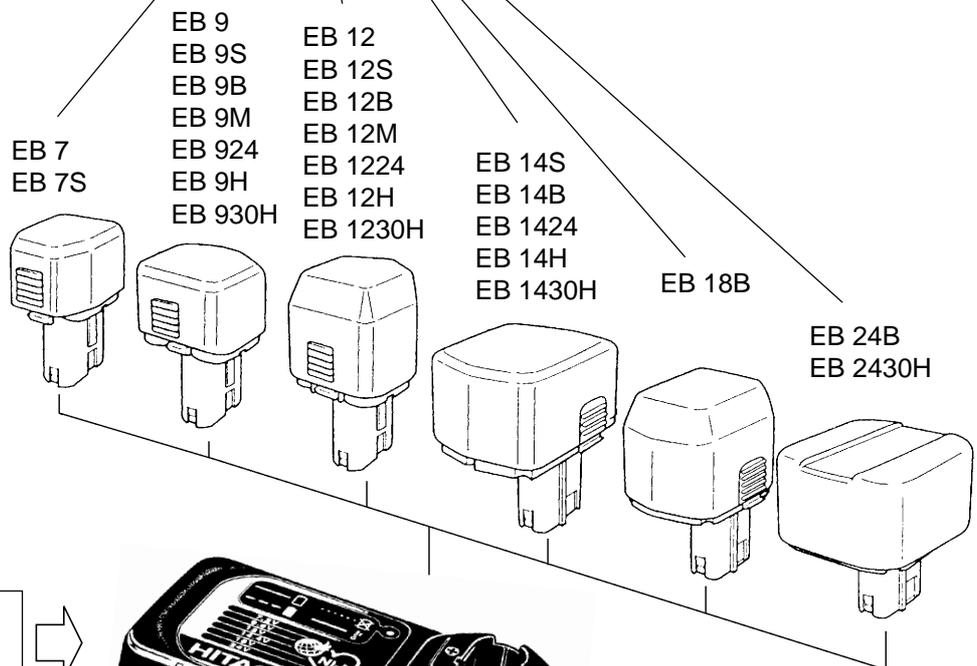
- 14.4 V, 2.0 Ah 20 minutes
- 24 V, 2.0 Ah 30 minutes
- 14.4 V, 3.0 Ah 36 minutes
- 24 V, 3.0 Ah 60 minutes

- (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

General-purpose charger capable
recharging 7.2 V to 24 V batteries



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 24YC is capable of handling both Ni-Cd and Ni-MH batteries.

4-1-2. Rapidly charges all Hitachi EB-series batteries:

Recharging time for EB 2430H battery has been reduced to approx. 60 minutes and 2.4 Ah Ni-Cd battery to approx. 24 minutes. Table 1 shows the charging time for each battery.

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

Battery voltage	Battery capacity											
	1.3 Ah		1.7 Ah		2.0 Ah		2.2 Ah		2.4 Ah		3.0 Ah	
7.2 V	EB7 EB7S	13 min.	EB7G	17 min.								
9.6 V	EB9 EB9S	13 min.	EB9G	17 min.	EB9B EB9M	20 min.	EB9H	30 min.	EB924	24 min.	EB930H	36 min.
12 V	EB12 EB12S	13 min.	EB12G	17 min.	EB12B EB12M	20 min.	EB12H	30 min.	EB1224	24 min.	EB1230H	36 min.
14.4 V	EB14S	13 min.			EB14B	20 min.	EB14H	30 min.	EB1424	24 min.	EB1430H	36 min.
18 V					EB18B	30 min.						
24 V					EB24B	30 min.					EB2430H	60 min.

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

■ : Ni-MH batteries

4-1-3. Capable of recharging batteries with internal temperatures as high as 60 °C

When a battery with S terminal is used, as shown in Fig. 3, Fig. 4 and Fig. 5, the 60 °C thermistor operates to permit recharging of batteries heated up to 60 °C, and as shown in Fig. 6, 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 14S, EB 14B, EB 1424, EB 14H, EB 1430H, EB 18B, EB 24B and EB 2430H interrupts the recharging circuit when the battery temperature reaches 95 °C.
- A discriminating resistor is provided in Ni-MH batteries EB 9H, EB 930H, EB 12H, EB 1230H, EB 14H, EB 1430H and EB 2430H to distinguish them from Ni-Cd batteries.
- Because Ni-MH batteries EB 9H, EB 930H, EB 12H, EB 1230H, EB 14H, EB 1430H and EB 2430H are 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).

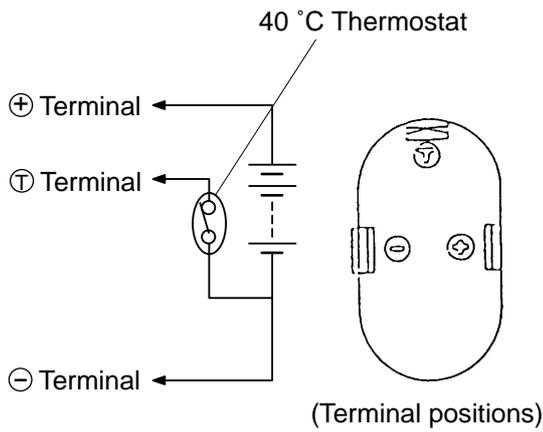


Fig. 2 Ni-Cd batteries (EB 7, EB 9 and EB 12)

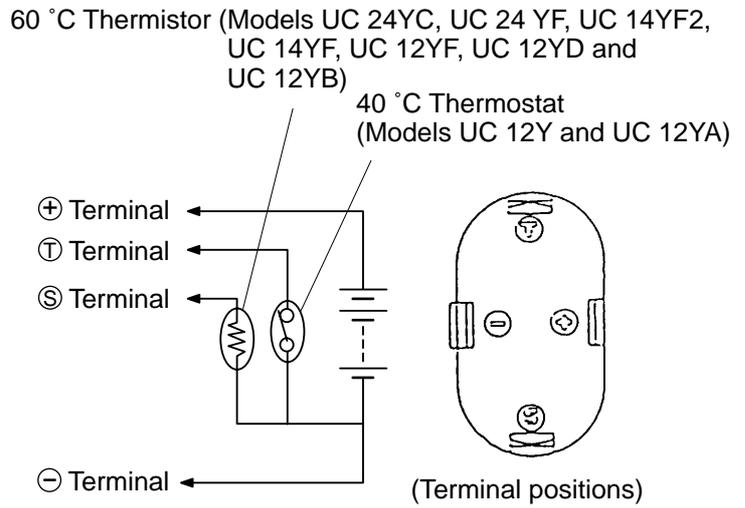


Fig. 3 Ni-Cd batteries (EB 7S, EB 9S and EB 12S, EB 7G, EB 9G, EB 12G, EB 9B, EB 12B, EB 9M, EB 12M, EB 924 and EB 1224)

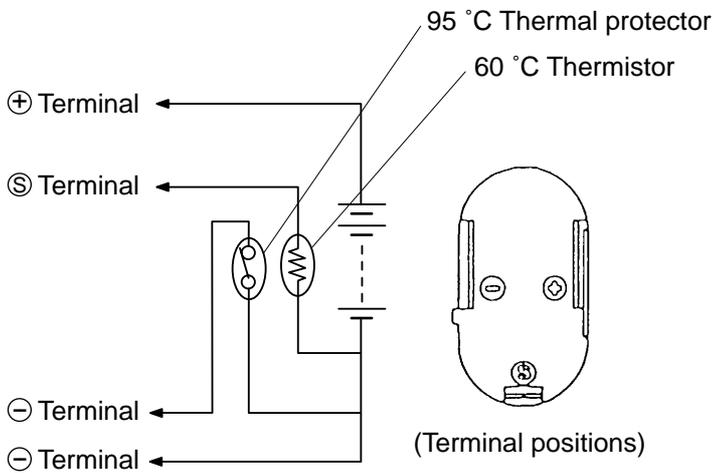


Fig. 4 Ni-Cd batteries (EB 14S, EB 14B, EB 1424, EB 18B and EB 24B)

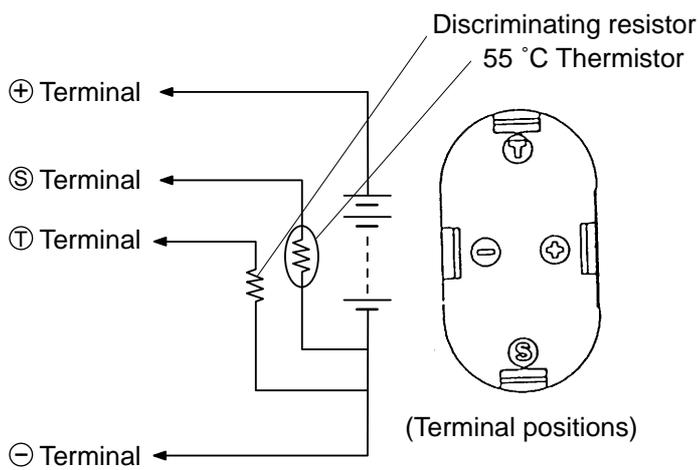


Fig. 5 Ni-MH batteries (EB 9H, EB 12H, EB 930H, and EB 1230H)

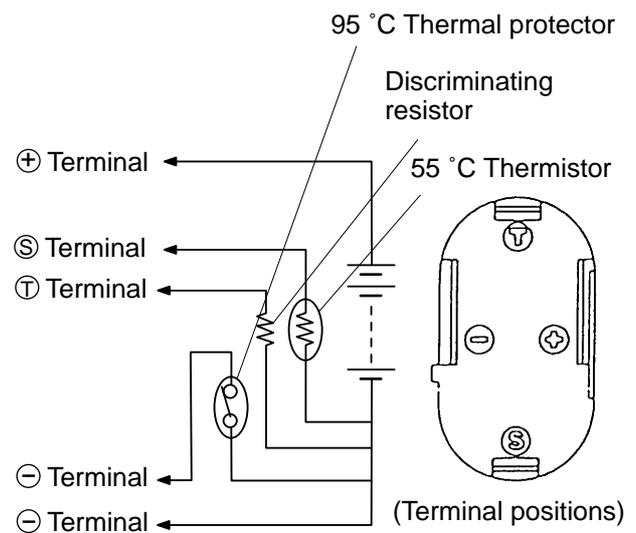


Fig. 6 Ni-MH batteries (EB 14H, EB 1430H, EB 2430H)

4-1-4. 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

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

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

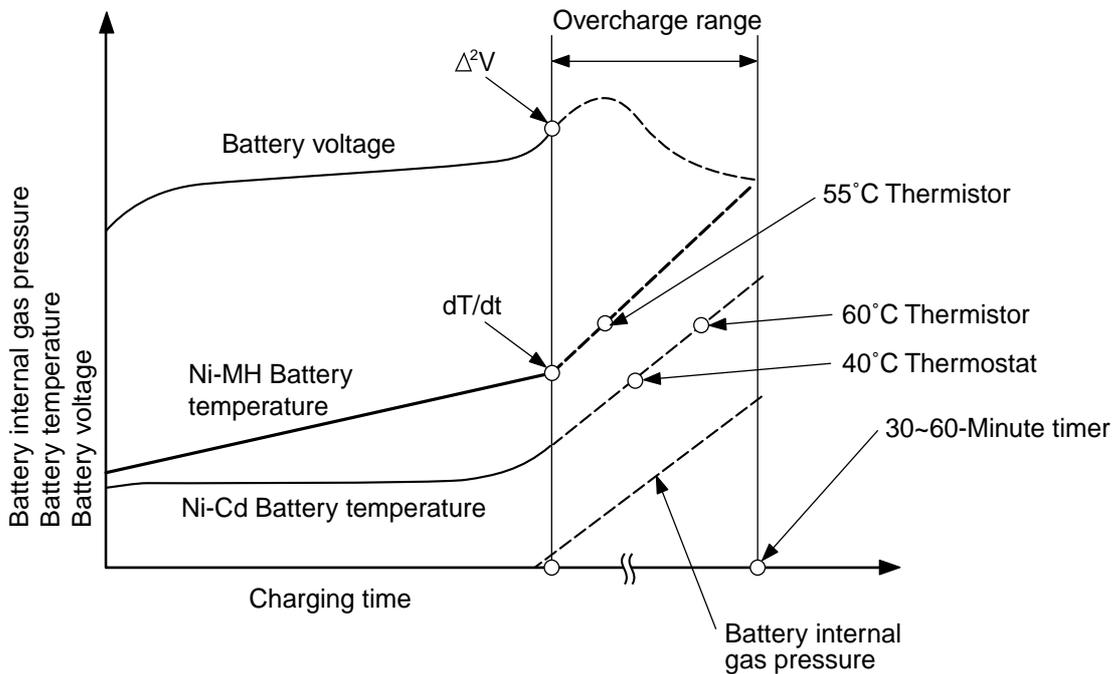


Fig. 7 Relationships of time, voltage, temperature and gas pressure while charging

- (A) • Δ^2V : This detects the increase in battery voltage at the end of charging using the value Δ^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 Δ^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 Δ^2V system, dT/dt system and the temperature sensors fail, the timer automatically stops charging within 30 – 60 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 Δ^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 7, EB 9, EB 12	-5 °C – 40 °C	Green pilot lamp lights. When battery temperature is reduced to 40 °C, green pilot lamp goes OFF and charging begins.
EB 7S, EB 7G EB 9S, EB 9G, EB 9B, EB 9M, EB 924 EB 12S, EB 12G, EB 12B, EB 12M, EB 1224 EB 14S, EB 14B, EB 1424, EB 18B, EB 24B	-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 9H, EB 930H EB 12H, EB 1230H EB 14H, EB 1430H, 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.

5. SPECIFICATIONS

5-1. Specifications

Item	Descriptions
Power source	AC single-phase, 50 Hz or 60 Hz
Power input	130 W
Charging system	Constant current charge with feedback control
Overcharging protection system	(1) Battery voltage detection (Δ^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) 30 – 60 minutes timer
Charging voltage	7.2 V – 24 V
Charging current	4 A – 6 A
Charging time	Approx. 60 minutes (for Ni-MH 3.0 Ah, 24 V)
Product weight	1.1 kg
Operating ambient temperature range	0 °C – 40 °C

5-2. Comparisons with Similar Products

		HITACHI		B
		UC 24YC	UC 24YF	
Charging time	min.	60 (EB 2430H)	90 (EB 2430H)	22 (2.5 Ah, 24 V Ni-Cd)
Charging voltage	V	7.2 – 24	7.2 – 24	7.2 – 24
Charging current	A	4 – 6	2.1	2 – 10
Power input	W	130	70	270
Operating ambient temperature range	°C	0 – 40	0 – 40	
Chargeable battery temperature range	°C	(*1) –5 – 60 (*2) 0 – 45	(*1) –5 – 60 (*2) 0 – 45	(*3) 5 – 60
Overcharge protection system	–	Δ^2V system, dt/dt system, battery surface temperature detection, timer	Δ^2V system, battery surface temperature detection, timer	Peak cut
External dimensions (length x width x height)	mm	226 x 110 x 87.5	226 x 110 x 87.5	160 x 202 x 79
Weight	kg	1.1 (2.4 lbs.)	1.0 (2.2 lbs.)	1.0 (2.2 lbs.)

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

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

(*3): Presumption

6. PRECAUTIONS IN SALES PROMOTION

6-1. Safety Instructions

In the interest of promoting the safest and most efficient use of the Model UC 24YC 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.

If charging is attempted when the ambient temperature is above 40 °C, charging is not possible for the EB 7, EB 9 and EB 12 batteries because the thermostat is immediately activated to stop charging.

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.

6-2-2. Inserting a battery into a charger in reverse direction can cause serious damage to the battery and the charger

Inadvertently inserting a battery into the charger in the reverse direction will not only make it impossible to charge the battery, it can also cause such damage as deformed terminals on the charger and the battery. Customers should be advised to confirm that the battery terminals are correctly aligned before inserting the battery into the charger.

6-2-3. B-2 (7.2 V) and B-3 (9.6 V) batteries cannot be recharged with the Model UC 24YC

- (1) Because the shape of the B-2 (7.2 V) battery is different from others, it cannot be connected to the Model UC 24YC.
- (2) Even if the B-3 (9.6 V) battery is connected to the Model UC 24YC using the optional accessory adapter, recharging is not possible because the internal wiring of the battery is different from the others.

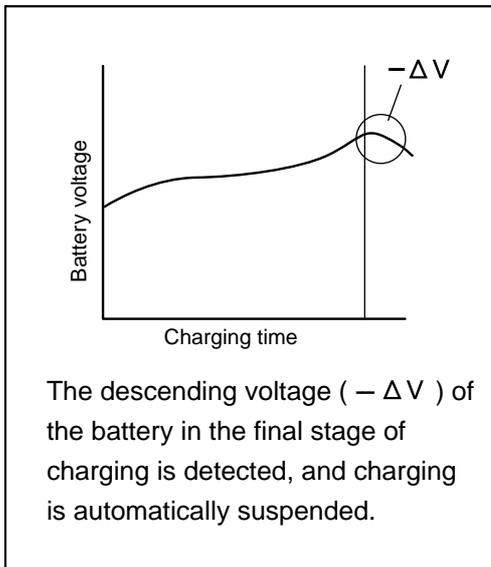
7. QUESTIONS AND ANSWERS ON MODEL UC 24YC

Q1 What are typical charging methods?

A1 The most recent electronic charging methods are outlined below.

Method A

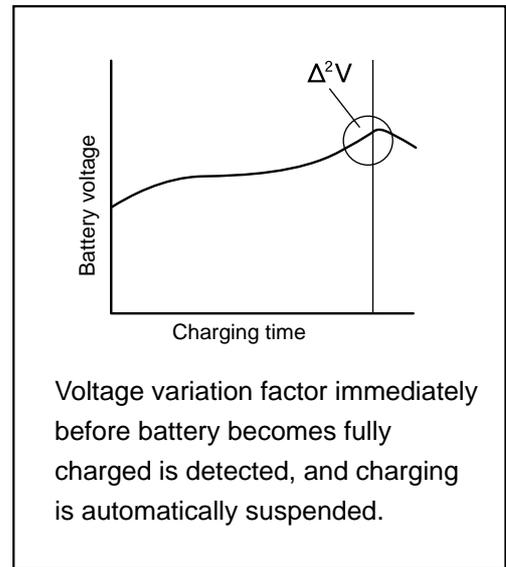
UC 12Y
UC 12YA



$-\Delta V$ Charging method

Method B

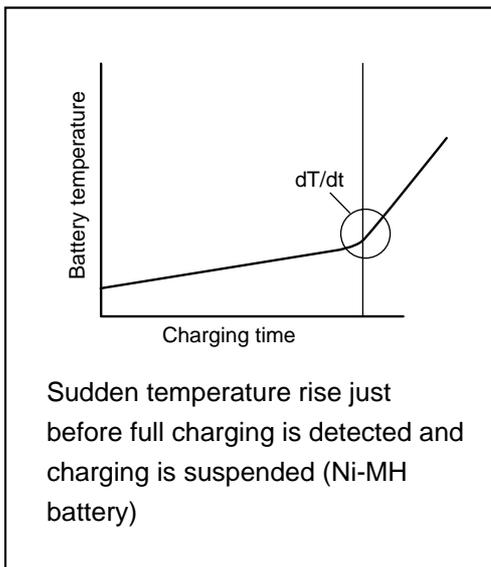
UC 24YC
UC 24YF
UC 14YF2
UC 14YF
UC 12YF
UC 12YD
UC 12YB



$\Delta^2 V$ Charging method

Method C

UC 24YC

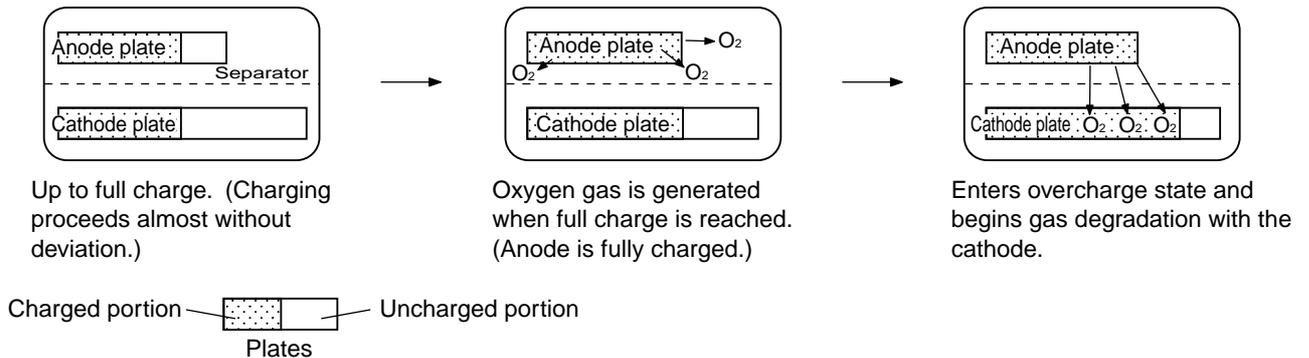


dT/dt Charging method

Q2 Why was the Δ^2V microcomputer control system adopted for the Model UC 24YC?

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 Δ^2V microcomputer control system was adopted for the Model UC 24YF 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.



Q3 What is the difference between the Δ^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 Δ^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 Δ^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.

Q6 What is the relationship between the upper limit of the chargeable temperature of the battery and of the battery charger?

A6 Relationships are indicated in the following table:

	Ni-Cd Battery				Ni-MH Battery	
	EB 7 EB 9 EB 12	EB 7S, EB 7G EB 9S, EB 9B, EB 9M EB 924, EB 12S EB 12G, EB 12B EB 12M, EB 1224	EB 14S EB 14B EB 1424	EB 18B EB 24B	EB 9H, EB 930H EB 12H, EB 1230H EB 14H, EB 1430H	EB 2430H
UC 24YC	40 °C	60 °C	60 °C	60 °C	45 °C	45 °C
UC 24YF	40 °C	60 °C	60 °C	60 °C	45 °C	45 °C
UC 14YF2	40 °C	60 °C	60 °C	Charging impossible	45 °C	Charging impossible
UC 14YF	40 °C	60 °C	60 °C	Charging impossible	Charging impossible	Charging impossible
UC 12YF	40 °C	60 °C	Charging impossible	Charging impossible	Charging impossible	Charging impossible
UC 12YD	40 °C	60 °C	Charging impossible	Charging impossible	Charging impossible	Charging impossible
UC 12YB	40 °C	60 °C	Charging impossible	Charging impossible	Charging impossible	Charging impossible
UC 12Y	40 °C	40 °C	Charging impossible	Charging impossible	Charging impossible	Charging impossible
UC 12YA	40 °C	40 °C	Charging impossible	Charging impossible	Charging impossible	Charging impossible

8. GENERAL PRECAUTIONS

8-1. Model UC 24YC

- (1) The outer frame consists of case (A) and case (B), and houses a printed circuit board (PCB).
- (2) The charging terminals, high-frequency power transformer, microcomputer controller ICs, etc., are mounted on the upper surface of the PCB.
- (3) As the PCB is permanently fixed to case (B) by a urethane resin to ensure waterproofing, it is not possible to remove the PCB alone.

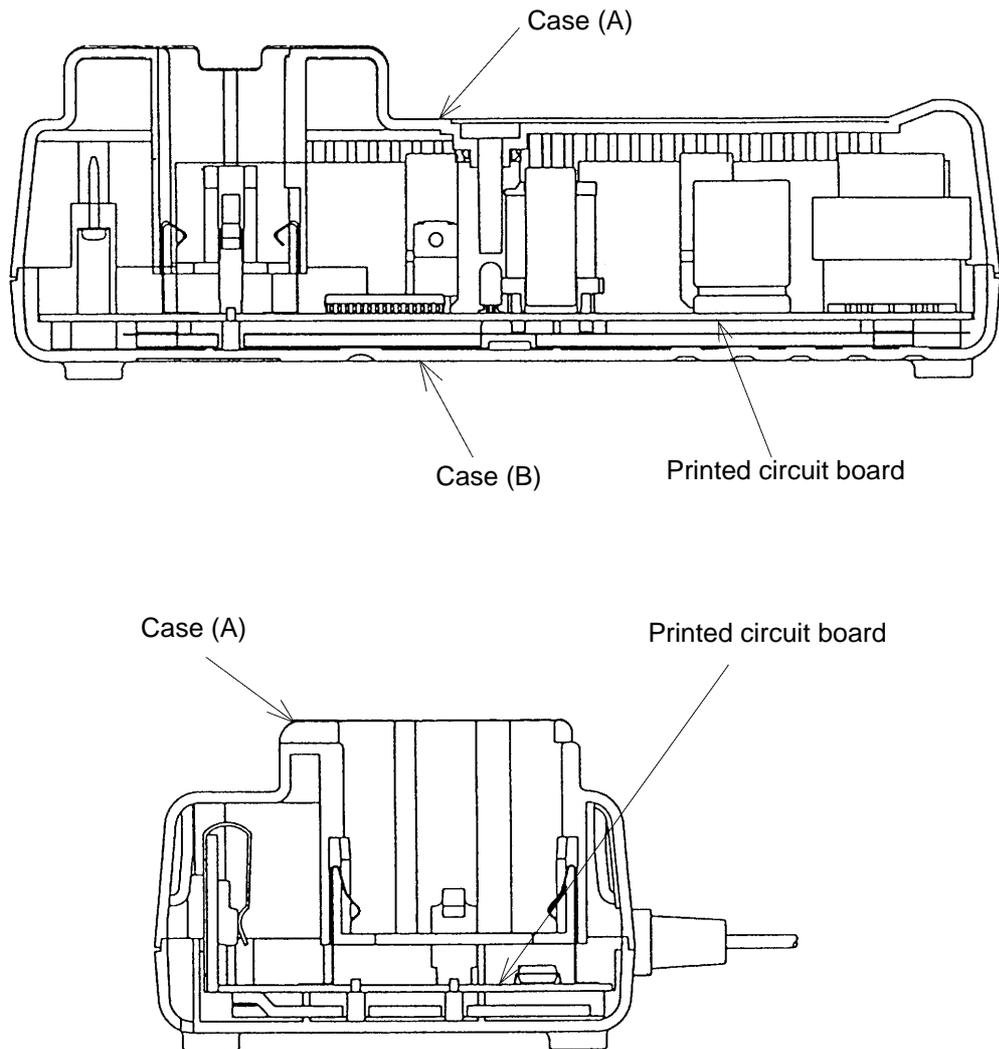


Fig. 8

9. PRECAUTIONS IN DISASSEMBLY AND REASSEMBLY

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

9-1. Disassembly

Remove the four Tapping Screws (W/Flange) D3 x 20 **[7]**, and separate Case (B) Ass'y **[6]** and Case (A) **[2]**.

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.

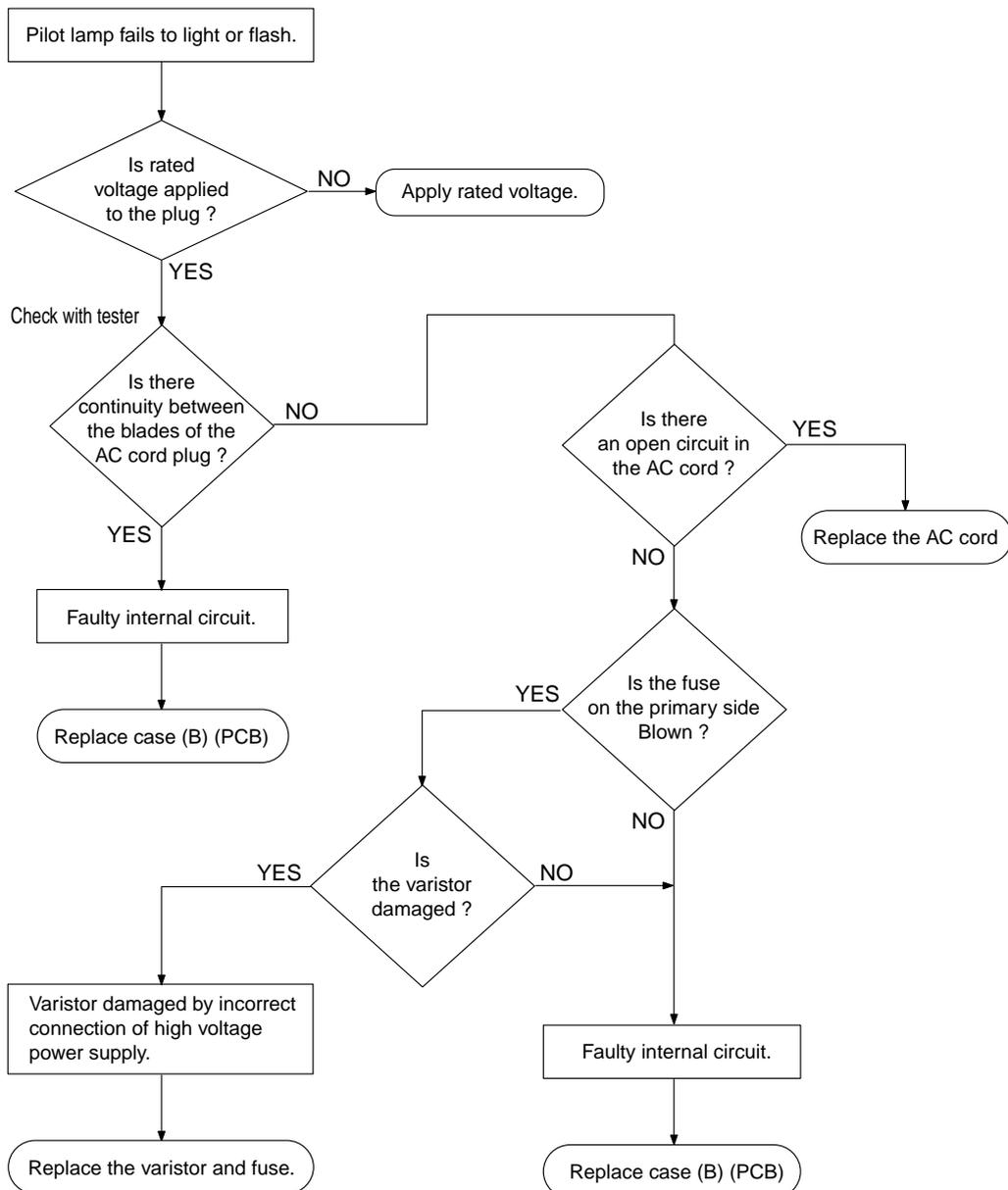
10. TROUBLESHOOTING GUIDE

10-1. Troubleshooting Based on Pilot Lamp Indications

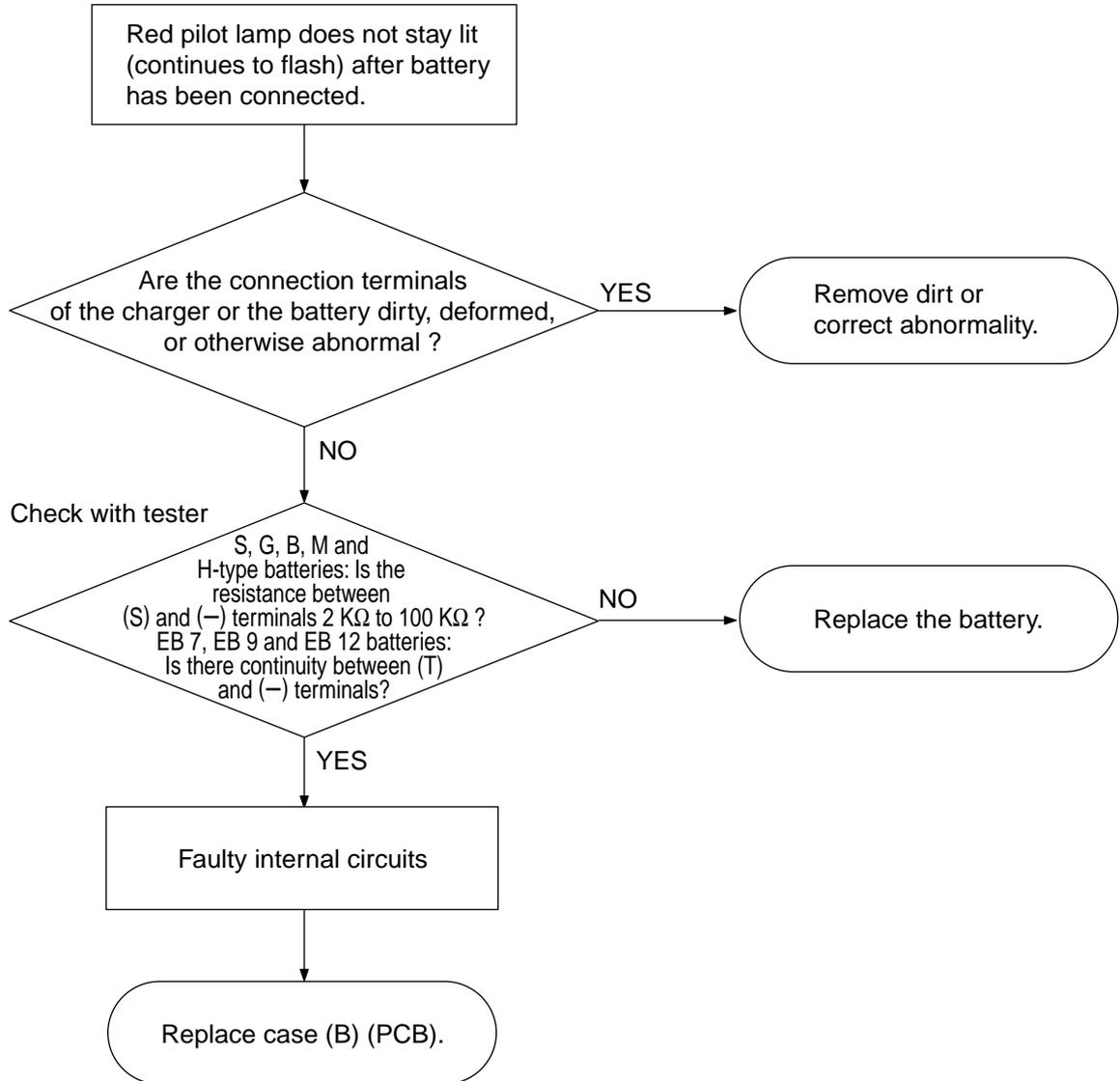
Phenomenon	Typical causes	Check procedures
Pilot lamp fails to light or flash.	(1) Faulty AC cord (2) Blown fuse (3.15 A) on primary side	Refer to trouble mode (A).
Red pilot lamp does not stay lit (continues to flicker) after battery has been connected.	(1) Poor connection of (T) or (S) terminal (2)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

10-2. Troubleshooting and Repair Procedures

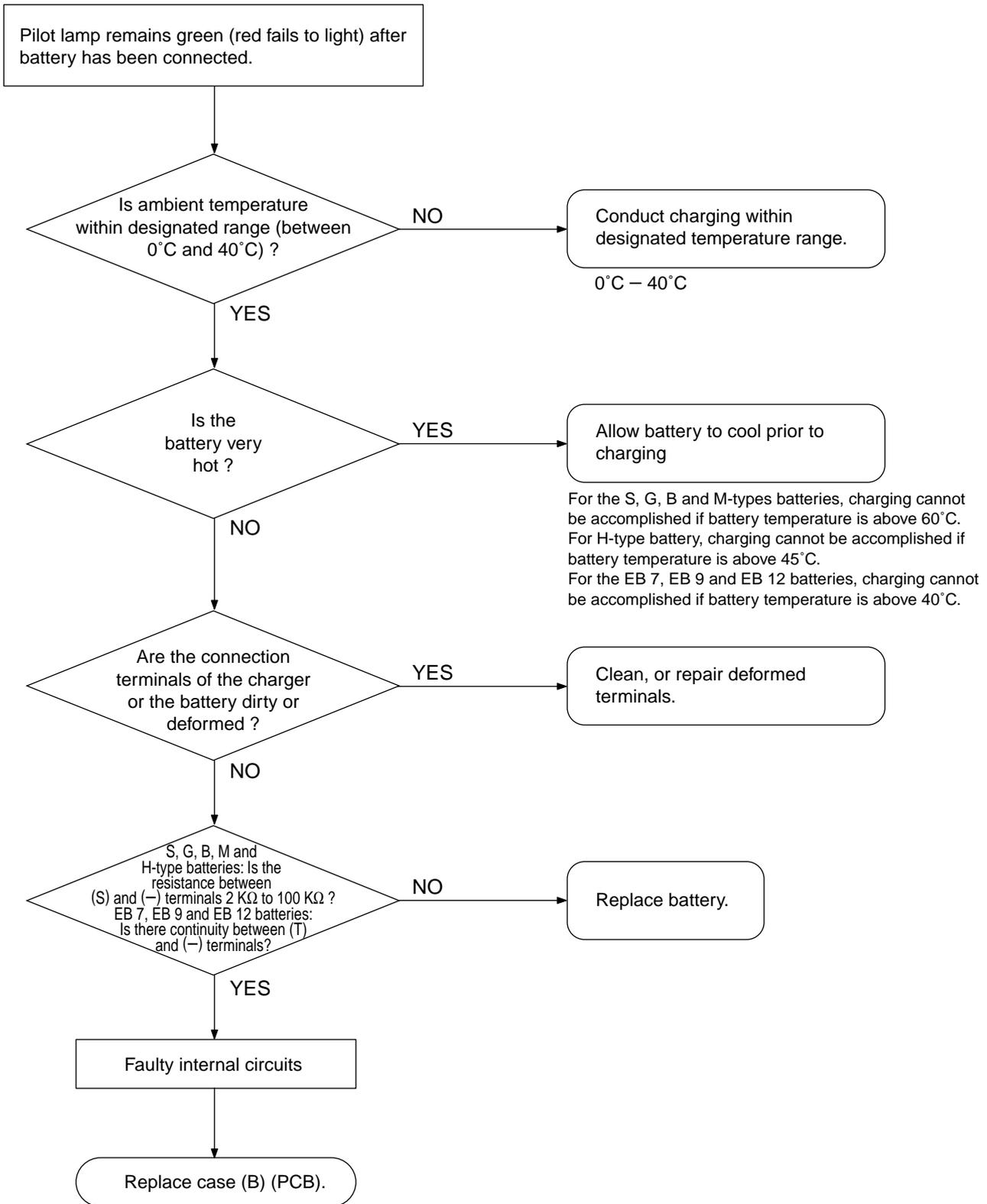
(1) Trouble mode (A)



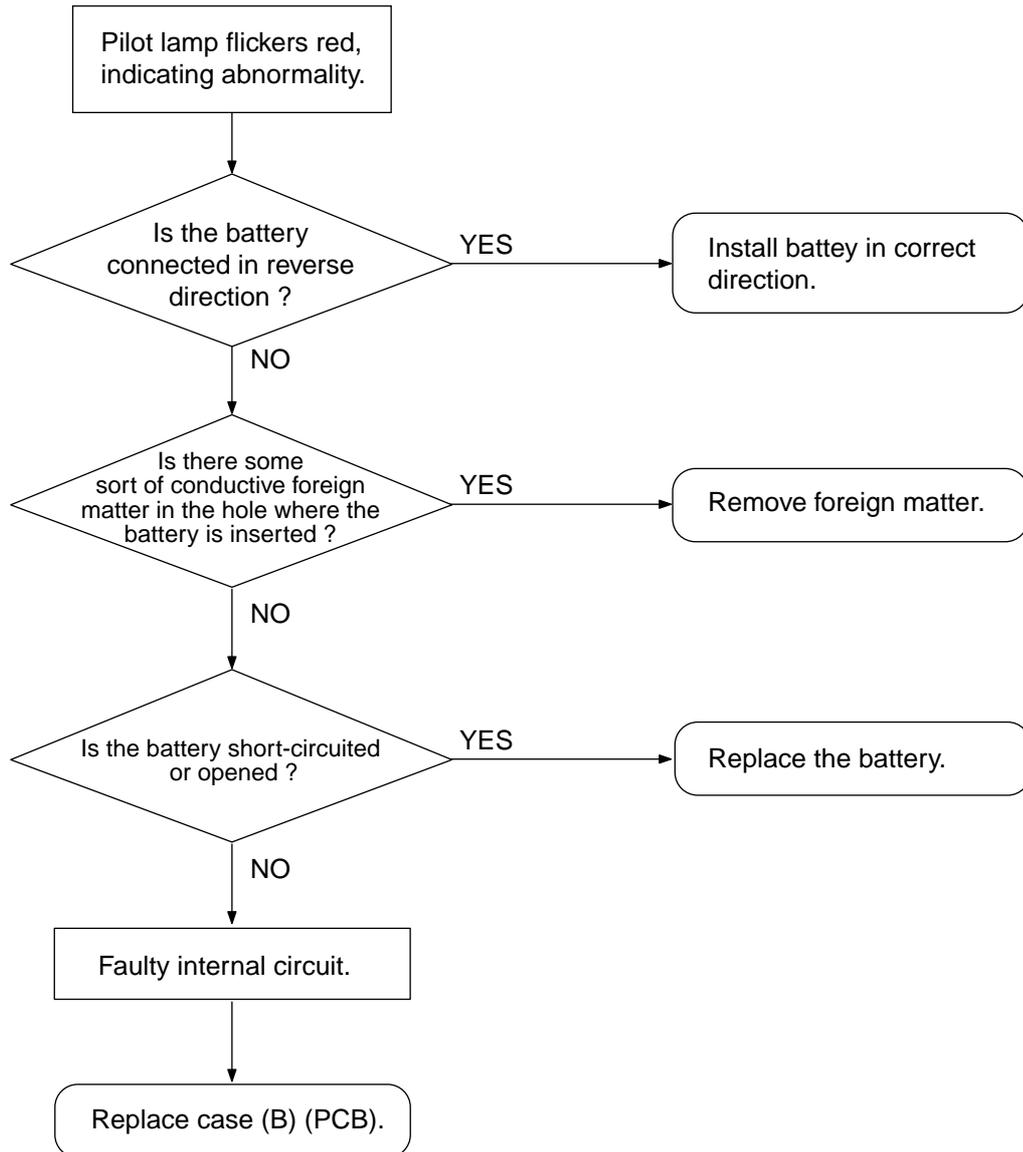
(2) Trouble mode (B)



(3) Trouble mode (C)



(4) Trouble mode (D)



11. STANDARD REPAIR TIME (UNIT) SCHEDULES

MODEL	Variable		10	20	30	40	50	60 min.
	Fixed							
UC 24YC	General Assembly	Work Flow						
		Case (A) Fuse (3.15 A) Prism	Case (B) Cord Varistor Terminal (A) Terminal (B)					

Assembly Diagram for UC 24YC

