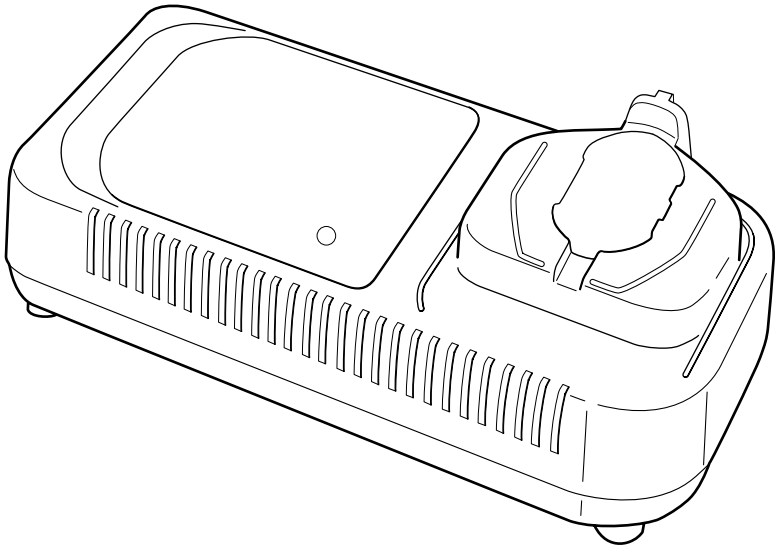
MODEL

UC 14YFA

Hitachi
Power Tools

CHARGER
UC 14YFA

TECHNICAL DATA
AND
SERVICE MANUAL



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LIST No. F888

Aug. 2003

SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

CONTENTS

1. PRODUCT NAME

Hitachi Charger, Model UC 14YFA

2. MARKETING OBJECTIVE

As the cordless tool market expands strongly, customers have come to expect low-price chargers. The new Model UC 14YFA is based on the current Model UC 24YFA and low-price by limiting the rechargeable batteries to Hitachi major batteries. This is capable of recharging both nickel cadmium (Ni-Cd) and nickel metal hydride (Ni-MH) batteries from 7.2 V to 14.4 V rapidly.

3. APPLICATIONS

Recharging of Hitachi batteries

Applicable batteries:

Ni-Cd batteries*	EB 712S	[7.2 V,	1.2 Ah]
	EB 912S	[9.6 V,	1.2 Ah]
	EB 1212S	[12 V,	1.2 Ah]
	EB 1412S	[14.4 V,	1.2 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 914	[9.6 V,	1.4 Ah]
	EB 1214	[12 V,	1.4 Ah]
	EB 1414	[14.4 V,	1.4 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 1220BL	[12 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 1222HL	[12 V,	2.2 Ah]
	EB 930H	[9.6 V,	3.0 Ah]
	EB 1230H	[12 V,	3.0 Ah]
	EB 1230HL	[12 V,	3.0 Ah]
	EB 1430H	[14.4 V,	3.0 Ah]

* The Model UC 14YFA can also recharge the B-2 and B-3 batteries by means of the adaptor for the Model UC 14YF2.

4. SELLING POINTS

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

(2) Rapidly charges all Hitachi EB-series batteries

Charging time:

1.2 to 1.4 Ah ····· 30 minutes	2.2 Ah ····· 55 minutes	3.0 Ah ····· 70 minutes
2.0 Ah ····· 50 minutes	2.4 Ah ····· 60 minutes	

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

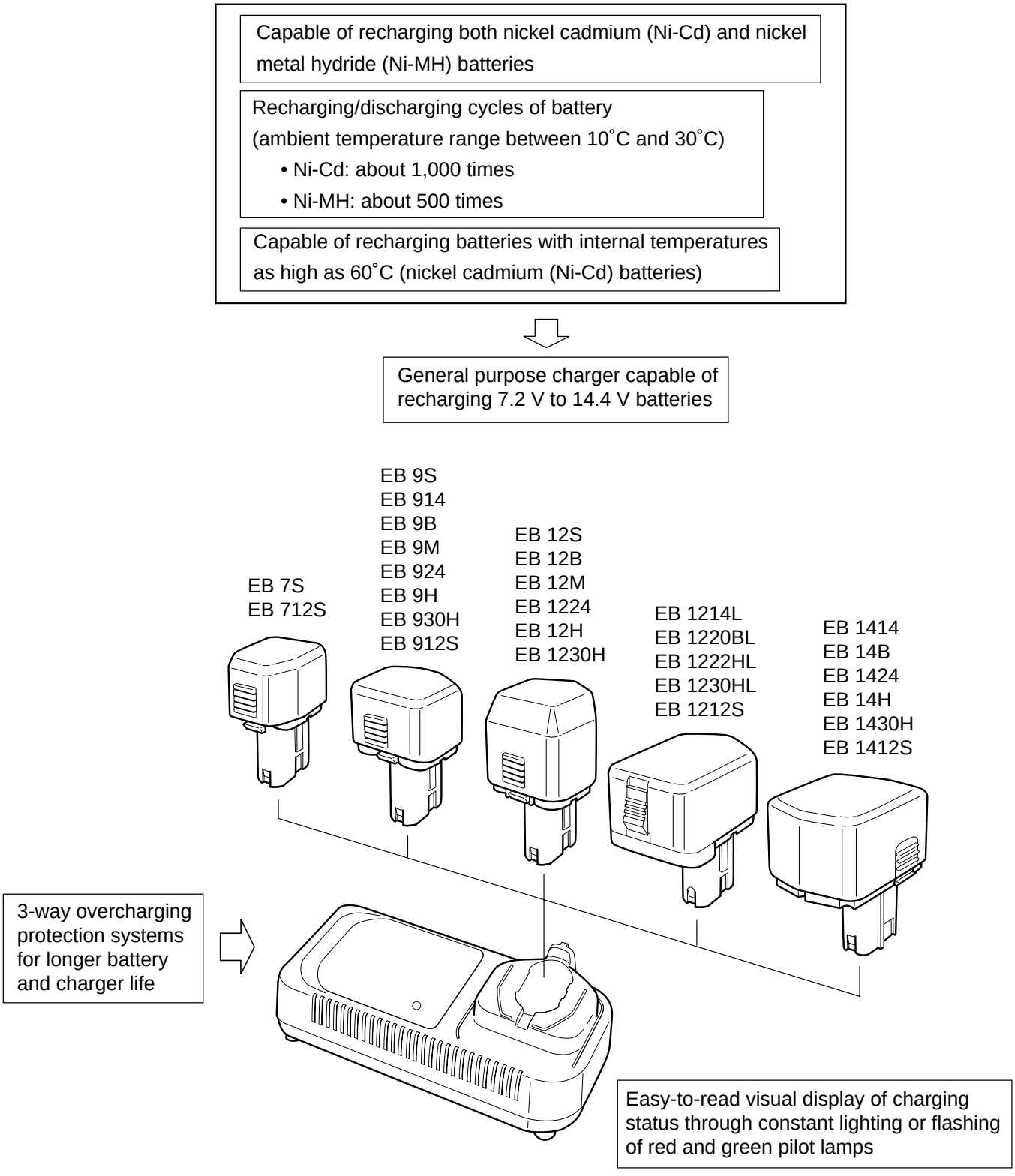


Fig. 1

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 14YFA is capable of handling both Ni-Cd and Ni-MH batteries.

4-1-2. 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

Recharging/discharging cycles of batteries can be dramatically increased by stopping recharging just before the overcharging range by means of the $\triangle^2V$ system or the dT/dt system. (Refer to 4-1-4 for details.)

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

Each nickel cadmium (Ni-Cd) battery shown in Figs. 2 and 3 incorporates a thermistor. The Model UC 14YFA can continue recharging these batteries until the battery temperature reaches 60 ˚C.

(Note 1)
- Wiring diagrams for batteries are shown below.
- The thermistor is an element to detect the battery temperature.
- The 95 ˚C thermal protector incorporated in each 14.4 V battery interrupts the recharging circuit when the battery temperature reaches 95 ˚C.
- The discriminating resistor is incorporated in each nickel metal hydride (Ni-MH) battery to distinguish them from the nickel cadmium (Ni-Cd) batteries.
- Because the nickel metal hydride (Ni-MH) batteries are heated to high temperatures during recharging, this charger operates within a range of 10˚C temperature difference between the maximum battery temperature when starting recharging (45 ˚C) and the temperature when stopping recharging (55 ˚C).

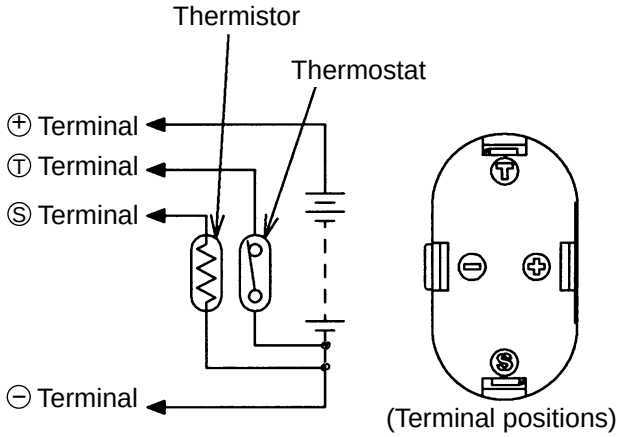


Fig. 2 Ni-Cd batteries (7.2 to 12 V)

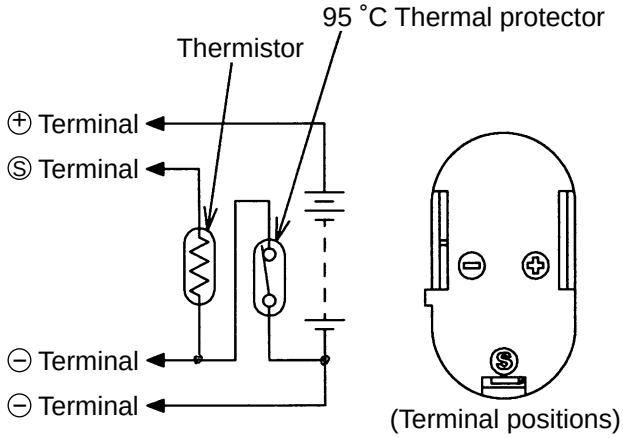


Fig. 3 Ni-Cd batteries (14.4 V)

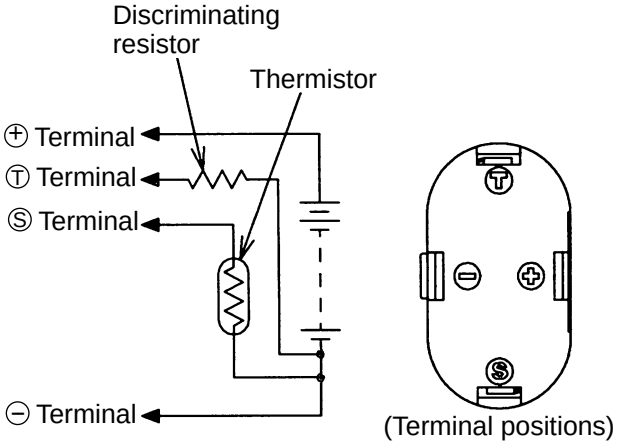


Fig. 4 Ni-MH batteries (9.6 to 12 V)

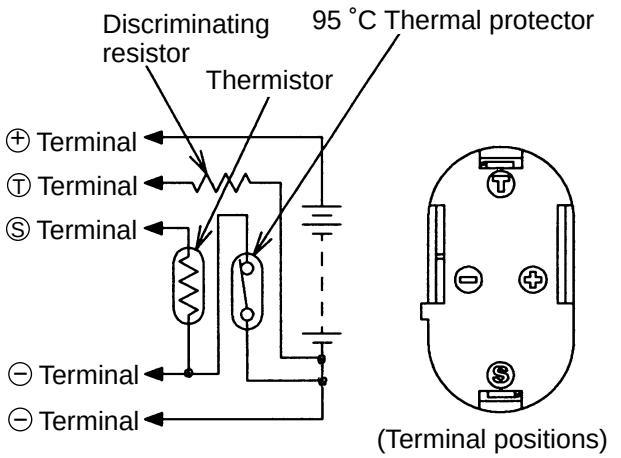


Fig. 5 Ni-MH batteries (14.4 V)

4-1-4. 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 sensor (thermistor) and (C) a timer.

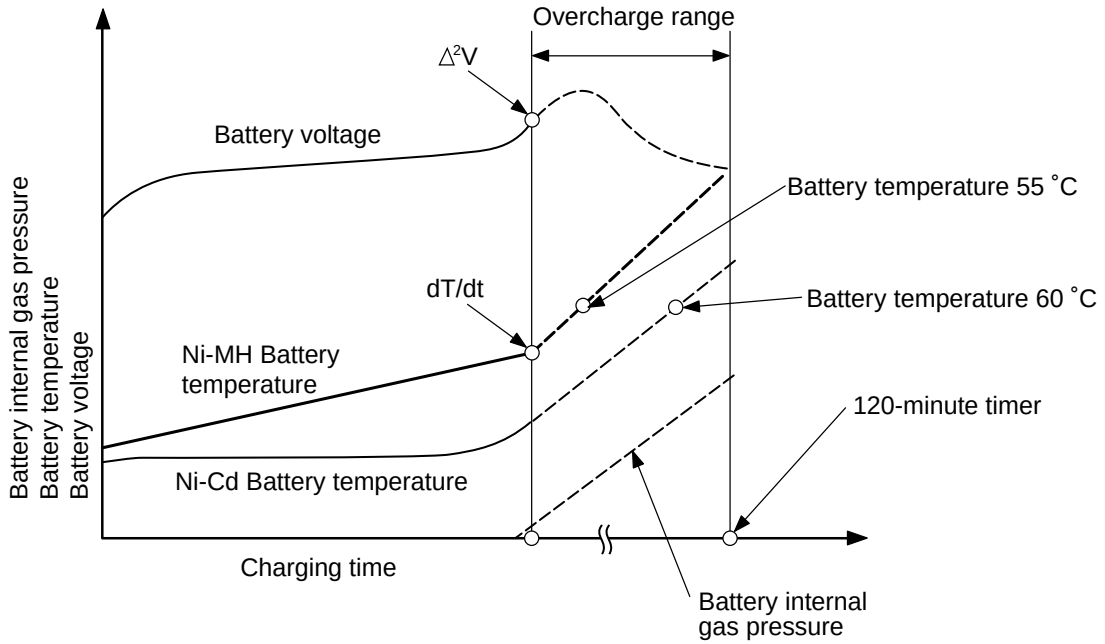


Fig. 6 Relationships of time, voltage, temperature and gas pressure while charging

(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 sensor : In the event both the $\triangle^2V$ system and the dT/dt system fail to detect completion of recharging, recharging is automatically stopped when the battery temperature reaches 60 ˚C in the case of the nickel cadmium (Ni-Cd) batteries or 55 ˚C in the case of the nickel metal hydride (Ni-MH) batteries.

(C) • Timer : Should both the $\triangle^2V$ system, dT/dt system and the temperature sensor 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.

4-1-5. 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
Nickel cadmium (Ni-Cd) batteries	–5 ˚C to 60 ˚C	Green pilot lamp lights. When battery temperature is reduced to 55 ˚C, green pilot lamp goes OFF and charging begins.
Nickel metal hydride (Ni-MH) batteries	0 ˚C to 55 ˚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	56 W
Charging system	Constant current charge with feedback control
Overcharging protection system	(1) Battery voltage detection ($\triangle^2V$ system) Battery temperature detection (dT/dt system) for Ni-MH battery (2) Battery surface temperature detection (thermistor) (3) 120-minute timer
Charging voltage	7.2 V to 14.4 V
Charging current	2.6 A
Charging time	Approx. 50 minutes (for 2.0 Ah)
Product weight	0.6 kg
Operating ambient temperature range	0 ˚C to 40 ˚C

5-2. Comparisons with Similar Products

		HITACHI	
		UC 14YFA	UC 14YF2
Charging time	min.	50 (2.0 Ah)	60 (2.0 Ah)
Charging voltage	V	7.2 to 14.4	7.2 to 14.4
Charging current	A	2.6	1.9
Power input	W	56	44
Operating ambient temperature range	˚C	0 to 40	0 to 40
Chargeable battery temperature range	˚C	(*1) - 5 to 55 (*2) 0 to 45	(*1) - 5 to 60 (*2) 0 to 45
Overcharge protection system	–	$\triangle^2V$ system, dT/dt system, battery surface temperature detection, timer	$\triangle^2V$ system, battery surface temperature detection, timer
External dimensions (length x width x height)	mm	226 x 110 x 75	175 x 86 x 80
Weight	kg	0.6 (1.3 lbs.)	1.3 (2.9 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 14YFA 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 to 40 ˚C.
If charging is attempted when the ambient temperature is below 0 ˚C, charging is not possible or overcharging occurs because the recharging control circuit does not function properly. If charging is attempted when the ambient temperature is above 40 ˚C, charging is stopped before the battery is fully charged due to temperature rise during charging because the difference between the upper limit of the rechargeable battery temperature (Ni-Cd batteries: 60 ˚C, Ni-MH batteries: 55 ˚C) and the ambient temperature is small.

(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 5 minutes before commencing next charging. Particular care is necessary in summer or tropical countries when the power source voltage is low.

(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 but also decrease the service life of the battery and cause damage to the charger. Customers should be advised to correctly insert the battery into the charger.

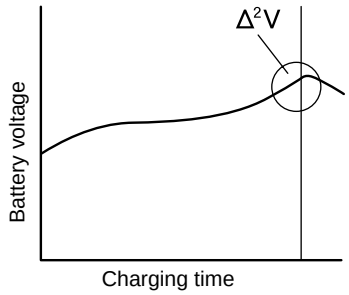
7. QUESTIONS AND ANSWERS ON MODEL UC 14YFA

Q1 What are typical charging methods?

A1 The most recent electronic charging methods are outlined below.

Method A

UC 14YFA
UC 24YFA
UC 24YFB
UC 24YC
UC 14YF2

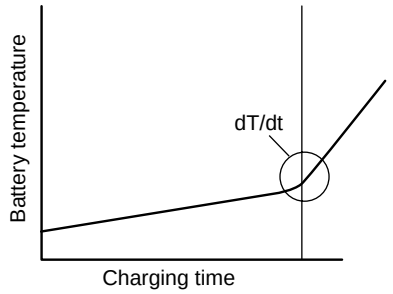


Voltage variation factor immediately before battery becomes fully charged is detected, and charging is automatically suspended.

△²V Charging method

Method B

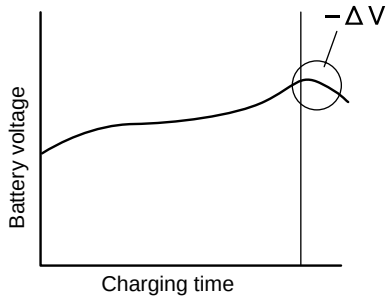
UC 14YFA
UC 24YFA
UC 24YFB
UC 24YC



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

dT/dt Charging method

Method C



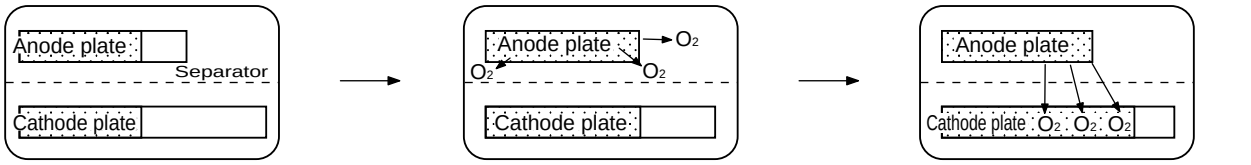
The descending voltage (− ΔV) of the battery in the final stage of charging is detected, and charging is automatically suspended.

− ΔV Charging method

Q2 Why was the $\triangle^2V$ microcomputer control system adopted for the Model UC 14YFA?

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.

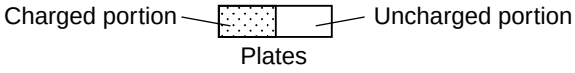
The $\triangle^2V$ microcomputer control system was adopted for the Model UC 14YFA charger in order to stop charging immediately before the battery is fully charged, thereby avoiding the generation of oxygen gas. This charging method applies no stress to the batteries.



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 If charging is attempted when the ambient temperature is below 0 ˚C, charging is not possible or overcharging occurs because the recharging control circuit does not function properly. If charging is attempted when the ambient temperature is above 40 ˚C, charging is stopped before the battery is fully charged due to temperature rise during charging because the difference between the upper limit of the rechargeable battery temperature (Ni-Cd batteries: 60 ˚C, Ni-MH batteries: 55 ˚C) and the ambient temperature is small.

Q6 What is the relationship between the chargeable temperature range of the battery when starting charging and the upper limit of the chargeable temperature of the battery?

A6 The relationship is indicated in the following table.

Charger	Chargeable temperature range of the battery when starting charging		*Upper limit of the chargeable temperature of the battery	
	Ni-Cd battery	Ni-MH battery	Ni-Cd battery	Ni-MH battery
UC 14YFA	- 5 ˚C to 55 ˚C	0 ˚C to 45 ˚C	60 ˚C	55 ˚C
UC 24YFA	- 5 ˚C to 55 ˚C	0 ˚C to 45 ˚C	60 ˚C	55 ˚C
UC 24YC	- 5 ˚C to 55 ˚C	0 ˚C to 45 ˚C	60 ˚C	55 ˚C
UC 14YF2	- 5 ˚C to 60 ˚C	0 ˚C to 45 ˚C	65 ˚C	55 ˚C

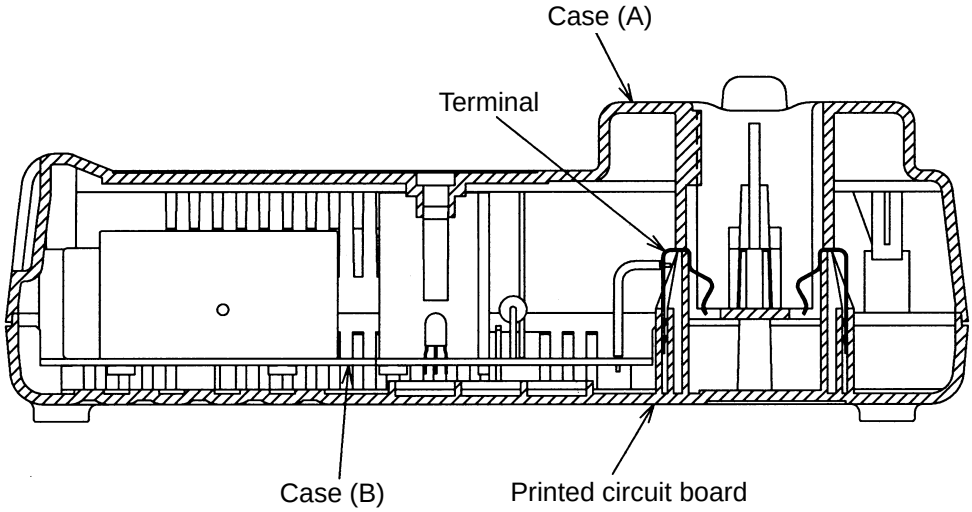
* Charging is automatically stopped when the $\triangle^2V$ system or the dT/dt system detects completion of recharging even if the battery temperature does not reach the above limit.

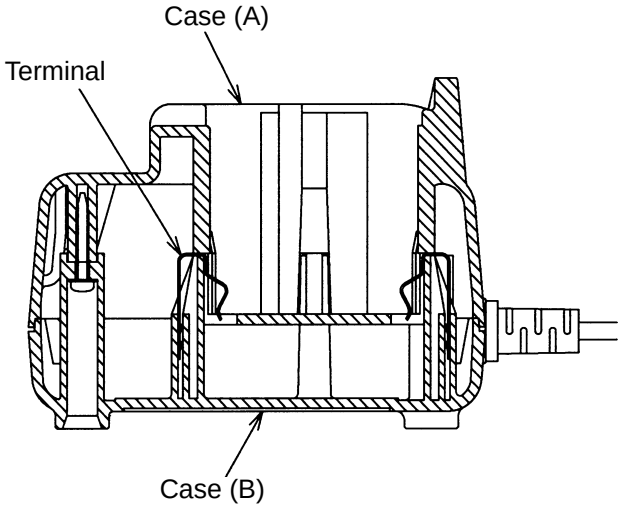
8. GENERAL PRECAUTIONS

8-1. Model UC 14YFA

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

(2) The printed 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

Refer to 4-1-5.

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 14YFA .

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 Print Circuit Board Ass'y **[4]** and the Cord **[9]**, melt the soldered portions with a soldering iron.
(NOTE) Ideally, the soldered portions should be freed 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 after reassembly. The red pilot lamp on the charger lights up when charging is started.
- When charging an EB 14B battery, confirm that the red pilot lamp flashes at 1 second intervals approx. 50 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)
220 V to 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.

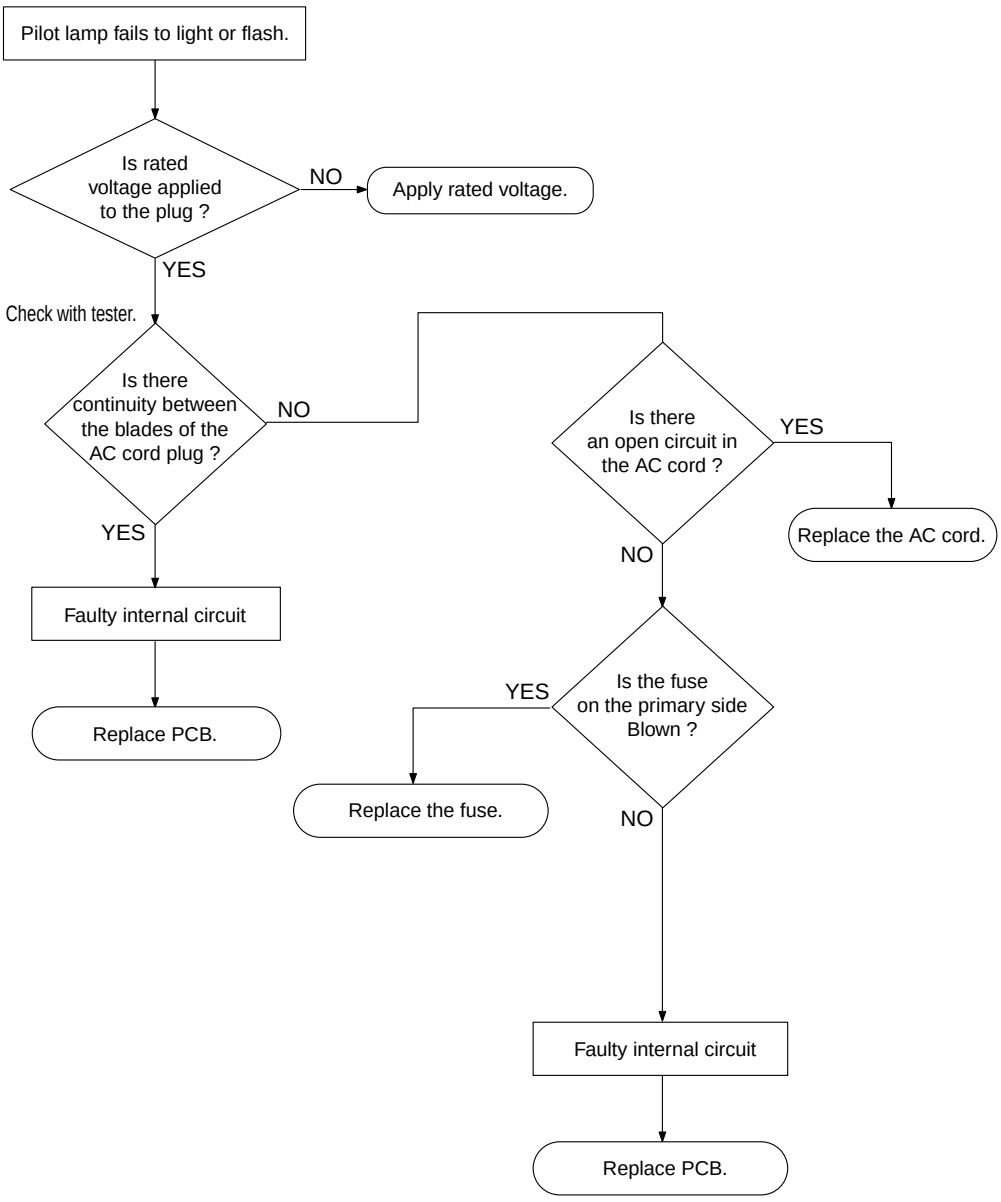
10. TROUBLESHOOTING GUIDE

10-1. Troubleshooting Based on Pilot Lamp Indications

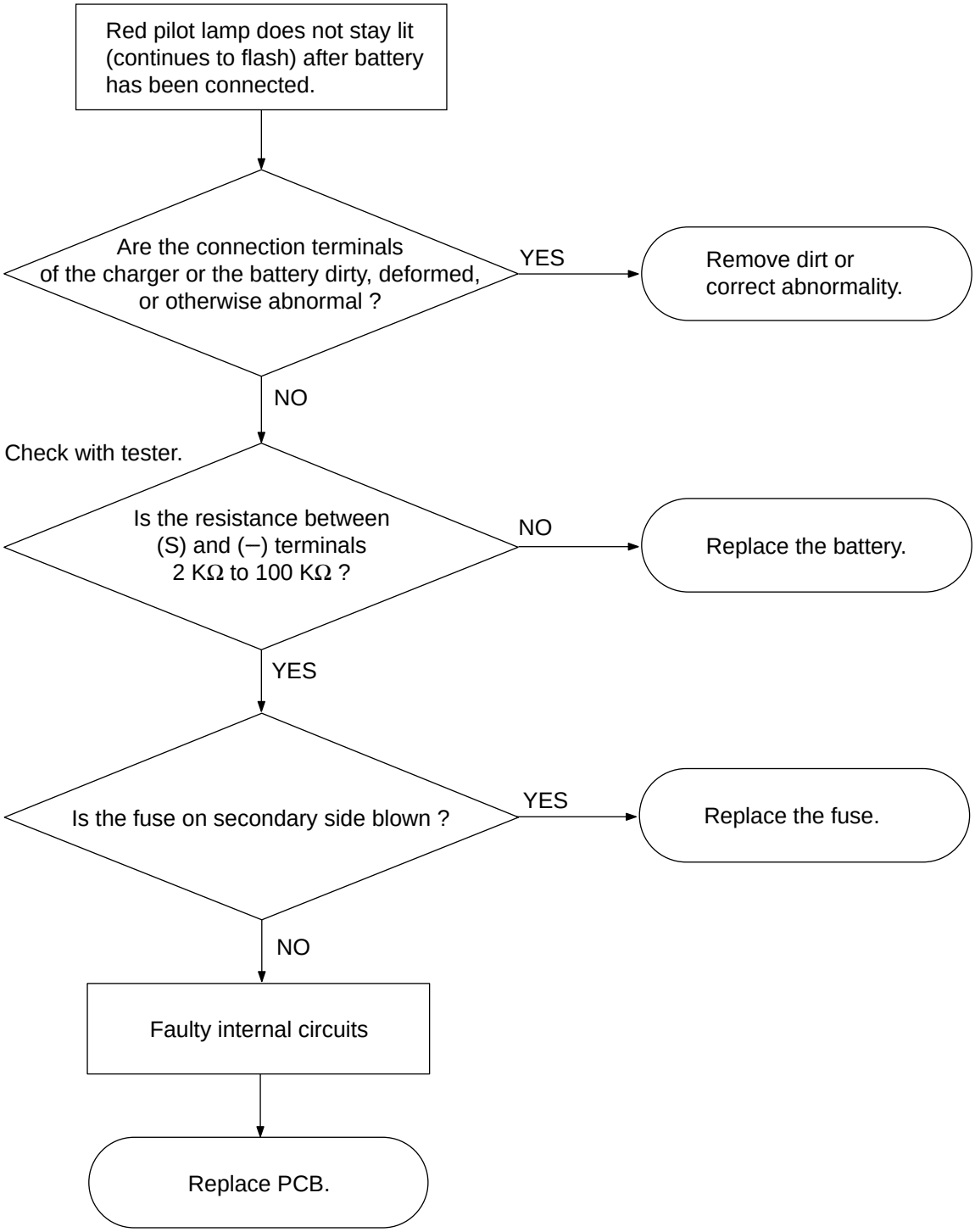
Phenomenon	Typical causes	Check procedures
Pilot lamp fails to light or flash.	(1) Faulty AC cord (2) Blown fuse (3.15 A) on primary side	Refer to trouble mode (A).
Red pilot lamp does not stay lit (continues to flicker) after battery has been connected.	(1) Poor connection of (T) or (S) terminal (2) Faulty battery (open circuit) (3) Blown fuse (5 A) on secondary side (4) 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) Battery connected in reverse direction (2) Faulty battery (short-circuit, or open circuit) (3) Faulty PCB	Refer to trouble mode (D).

10-2. Troubleshooting and Repair Procedures

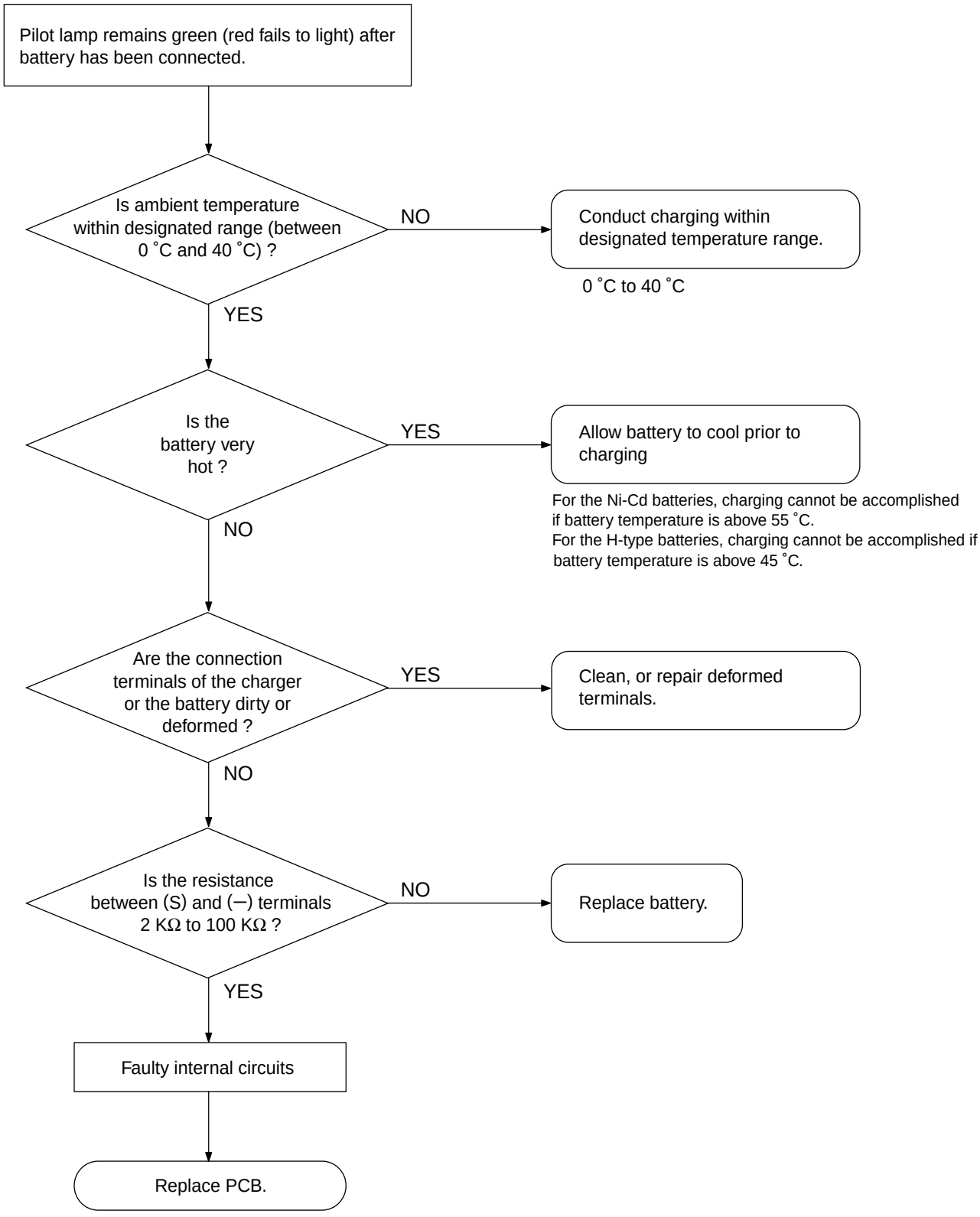
(1) Trouble mode (A)



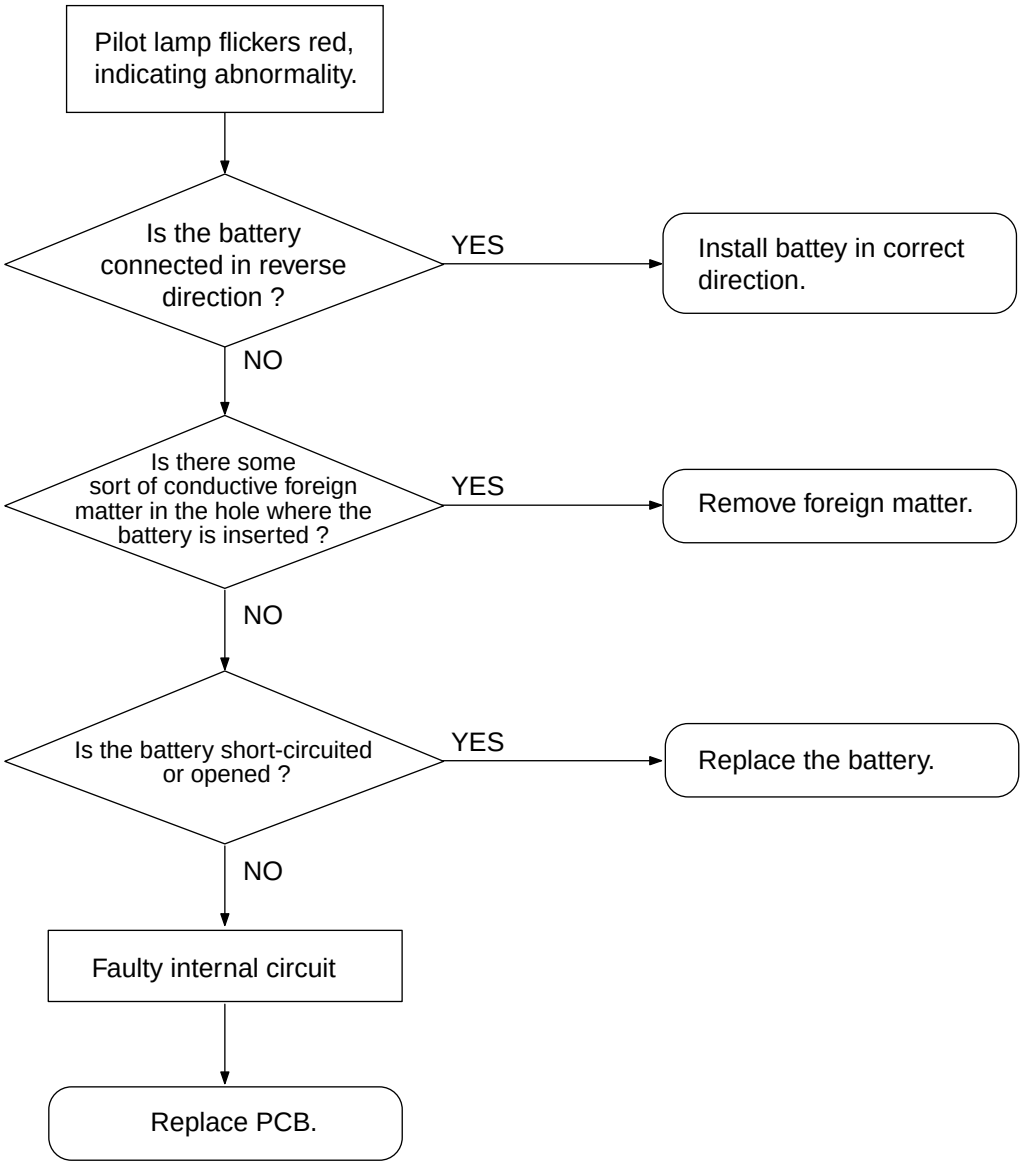
(2) Trouble mode (B)



(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 14YFA	General Assembly →	Case (A) Fuse (3.15 A) Fuse (5 A) Light Bar	Case (B) Printed Circuit Board Ass'y Cord				

Hitachi Power Tools

LIST NO. F888

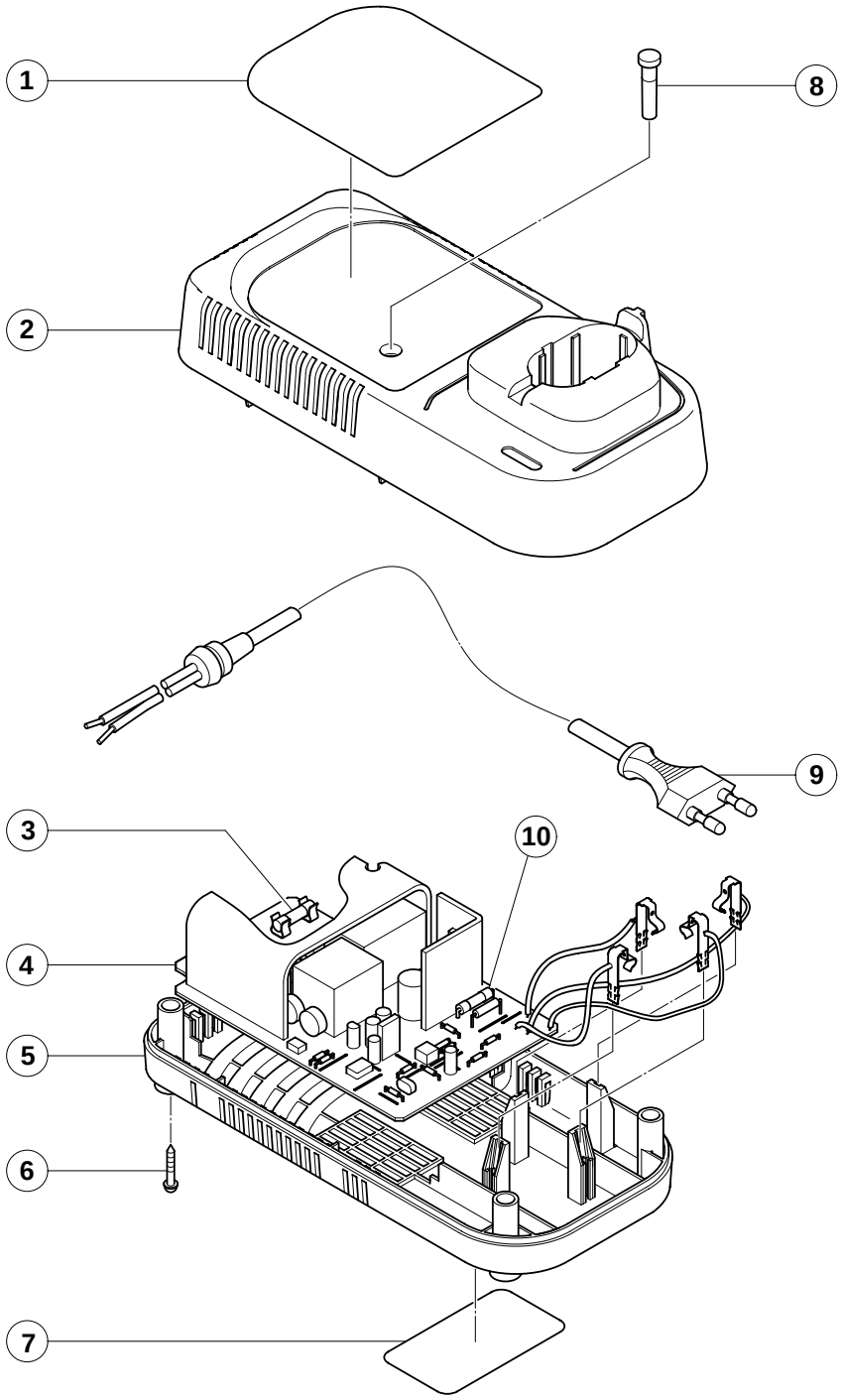
ELECTRIC TOOL PARTS LIST

■ CHARGER

2003・8・20

Model UC 14YFA

(E1)



PARTS

	ITEM NO.	CODE NO.	DESCRIPTION	NO. USED	REMARKS	
	1		HITACHI LABEL	1		
	2	322-190	CASE (A)	1		
*	3	319-781	FUSE (125V-3.15A)	1	FOR 120V	
*	3	319-780	FUSE (250V-3.15A)	1	FOR 220V-240V	
*	4	322-191	PRINTED CIRCUIT BOARD ASS'Y 120V	1	INCLUD. 3, 10	
*	4	322-192	PRINTED CIRCUIT BOARD ASS'Y 220V-230V	1	INCLUD. 3, 10	
*	4	322-264	PRINTED CIRCUIT BOARD ASS'Y 240V	1	INCLUD. 3, 10	
	5	319-777	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, CAN	
*	9	318-260	CORD	1	FOR NZL, AUS	
*	9	318-261	CORD	1	FOR GBR	
*	9	319-327	CORD	1	FOR CHN	
	10	322-263	FUSE (250V-5A)	1		

* ALTERNATIVE PARTS

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Hitachi Koki Co., Ltd.

Tokyo Japan