MOTOROLA

SINGLE-UNIT RAPID BATTERY CHARGERS

("OMNI" RADIOS)

MT500/HT210/HT220

MODEL TABLE

MODEL	INPUT VOLTAGE	COLOR
NLN4569B	117 VAC	Shadow Bronze
NLN4571B	234 VAC	Shadow Bronze
NLN5594A	117 VAC	Shadow Black
NLN5595A	234 VAC	Shadow Black
NLN6897B	117 VAC	Stellar Blue
NLN6999B	234 VAC	Stellar Blue

APPLICATION TABLE

BATTERY MODEL	TYPE
NLN4463	MT500 Rapid Charge
NLN6761	HT210/HT220 Slow Charge
NLN6900	HT210/HT220 Rapid Charge
NLN8232	HT220 Rapid Charge, Intrinsically Safe

SPECIFICATIONS

CHARGING TIME (nominal) Rapid: (about 500-650 mA) Trickle: (about 45 mA)	 One hour Ten hours
INPUT VOLTAGE	117 VAC, 50-60 Hz (NLN4569B, NLN5594A, NLN6897B) 234 VAC, 50-60 Hz (NLN4571B, NLN5595A, NLN6999B)
CAPACITY	One nickel-cadmium powered radio or one nickel-cadmium battery
OPERATING TEMPERATURE RANGE	+40°F to +95°F (+5°C to +35°C)
DIMENSIONS (H x W x D)	5 in. x 5 in. x 6 in. (12.7 cm x 12.7 cm x 15.3 cm)
WEIGHT	2 lbs. 11 oz. (1.22 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

THIS MANUAL HAS BEEN **DISCONTINUED**

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1. OPERATION

The battery can be charged with or without the radio. The battery will be rapid charged until fully charged (red charging lamp is off), after which the battery is trickel charged. The battery can be left in the charger indefinitely without any resultant harm.

a. Check the ac input voltage to the charger and connect the transformer primary as indicated on the table on the schematic diagram.

NOTE

For 234-volt ac battery chargers, the plug is not supplied because of the many different plug configurations available. Therefore, determine the type plug needed and connect it to the charger line cord.

b. A nickel-cadmium battery can be charged either in or out of the radio housing. If the battery is in the radio during charging, turn the radio off; rotate the volume control counterclockwise until a click is heard and the mechanical stop is reached.

c. Insert the battery, with or without the radio, into the charger pocket. If properly inserted, the red CHARGING indicator lamp will glow to indicate that the battery is being charged.

IMPORTANT

To insure proper charging, make certain that the battery is pushed fully into the charger pocket and that the battery is retained by the two tabs on the face of the charger pocket.

NOTE

Only batteries in radios with four-contact front covers will charge at the rapid rate while in the radio housing. Batteries in radios equipped with three-contact front covers will be charged at the slow rate only. In any case, the battery can be charged at the rapid rate when removed from the radio.

After the battery is fully charged, the red CHARGING indicator lamp stops glowing and the green COMPLETE indicator lamp begins to glow. At this time, the charger is trickel charged.

d. The battery may now be removed or it can be left in the battery charger.

2. CIRCUIT DESCRIPTION

The rapid battery chargers are all solid-state, automatic operating units for recharging nickel-cadmium batteries used in the MT500, HT210, or HT220 Series radios. Refer to the schematic diagram for the following circuit description.

When a battery is inserted into one of the charger pockets, a current path is established through circuitry within the battery and transistor Q3. Initially, the battery circuitry has relatively low resistance (positive temperature coefficient) resulting in sufficient current flow through R10 to cause transistor Q4 to saturate. Transistors Q4 and Q5 form a Schmitt-Trigger configuration, resulting in the collector of Q5 going "high" (more positive logic level). This "high is routed through R8 to Q2, turning it on with the resultant firing of SCR3 through resistor R29. Resistor R29 and SCR3 provide the rapid charge mode of charger operation. In addition, charging lamp DS1 is energized through SCR1 and one side of the transformer secondary circuit whenever a battery is inserted for recharge.

As the battery approaches full charge, its temperature rises and the resistance of the battery internal circuitry also rises. This increase in resistance causes the voltage across R10 to drop, resulting in transistor Q4 turning off and Q5 turning on. The negative-going pulse from Q5 drives Q6 to the off condition which fires SCR4. As SCR4 fires, a "high" is coupled to the base of transistor Q1 as well as to the gate of SCR2 through resistors R24 and R25. This causes SCR2 to conduct which lights rapid charge complete lamp DS2. Conduction of Q1 turns off SCR3 when its anode potential drops to zero (between dc line pulses). This disables the rapid charge operational mode. When rapid charge complete lamp DS2 glows, battery charging lamp DS1 stops glowing since SCR1 is turned off between dc pulses due to the "low" (less positive) voltage level at the SCR2 anode (in conduction) being coupled through CR5 to the gate of SCR1. This overall condition occurs when the battery is in a fully charged state and is being switched to the reduced 10-hour charge rate. This is accomplished by charging the battery through resistor R28 with all rapid charge circuitry in the off state.

In the event a "hot" (high temperature) battery is inserted into the charger for recharge, operation will be as follows:

The battery internal circuitry will have a higher than normal resistance value resulting in low current flow through transistor Q3 and resistor R10. This low current prevents the Schmitt-Trigger (Q4 and Q5) from operating and transistor

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Q2 and SCR3 are held at cutoff, resulting in a low-charge rate operation. In this way a "hot" battery is protected from a rapid charge rate that could otherwise cause possible damage.

As the battery cools in the charger, Q3 starts to conduct more through R10 due to the battery internal circuit resistance decreasing. This turns on Q4 and drives Q5 into cutoff. As the collector potential of Q5 goes "high," transistor Q2 saturates and fires SCR3 to initiate the rapid charge cycle of operation as previously explained.

3. MAINTENANCE

a. Fuse

If the charger does not operate, check the fuse and replace if necessary. If the replaced fuse "blows," check for short circuits in the transformer and charger circuitry. A short circuit existing across the contact pins of the charger pocket will not cause the fuse to "blow."

b. Contact Pins

If the red charging indicator lamp does not glow when the radio or battery is inserted, check the contact pins of the radio and charger for dirt, grease, or other foreign matter. Clean the contacts, check the charging rates, and check the rate switch-over every 30 days.

c. Rapid Charger Test Fixture

A rapid charger test fixture can be built easily using an old HT220 radio, an empty frame housing, and a front cover assembly. If the parts are not available, the following should be ordered from the Parts Depot:

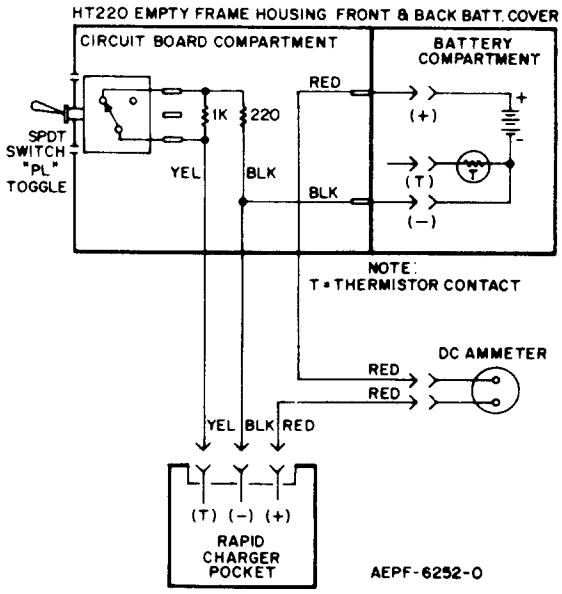
(1) 1V80701C32 Front Cover Assembly
(2) 0705622A01 Frame Housing
(3) NLN6749A Extension Sleeve
(4) NLN6752A Battery Cover
(5) 4082085J03 PL toggle switch
(6) 0283570H01 Nut, special
(7) 0600127802 Resistor (1 k ±10%; 1/4 W)
(8) 0600127800 Resistor (220 Ω ±10%; 1/4 W)

d. Rapid Charger Pocket Test Procedure

Connect a battery (450 mA, NLN6900) in series with a dc ammeter to the charger contacts. Connect a 1 k and 220-ohm resistor in series between the negative and thermistor contacts of the rapid charger pocket. Short the 1 k resistor out by wiring it across any two-position switch, such as the PL on-off toggle switch. Connect the charger to its power source and measure the rapid charge current (500-650 mA) observing that the red light is on. (Power supply primary tap set at 115 V or 220 V.) Remove the short from the 1 k resistor noting that the green light is on and the charging current is reduced to 45 mA.

NOTE

EIA standards have recently raised the standard test voltage from 117 V to 121 V ac. If the line voltage in your area is consistently at 117 to 122 V, the primary power tap of power supply transformer T1 should be changed to the 125 V position. If the line voltage varies more than ±10% from the nominal value, the power supply tap should be set to the next highest tap above the nominal voltage. This will ensure that the batteries are charging at the proper rate.



Test Fixture Detail

TEST POINT	VOLTAGE DURING CHARGE (RT = 150 ∩)	VOLTAGE DURING CHARGE COMPLETE	
		THERMISTOR HOT (RT = 1 k ∩)	THERMISTOR COOL (RT = 150 ∩)
1	2.7	0.76	0.76
2	9.1	0	0
3	2.6	0.65	2.2
4	0.4	1.6	0.5
5	17.7	0.8	21.6
6	0	2.6	2.6
7	17.0	21.8	21.8

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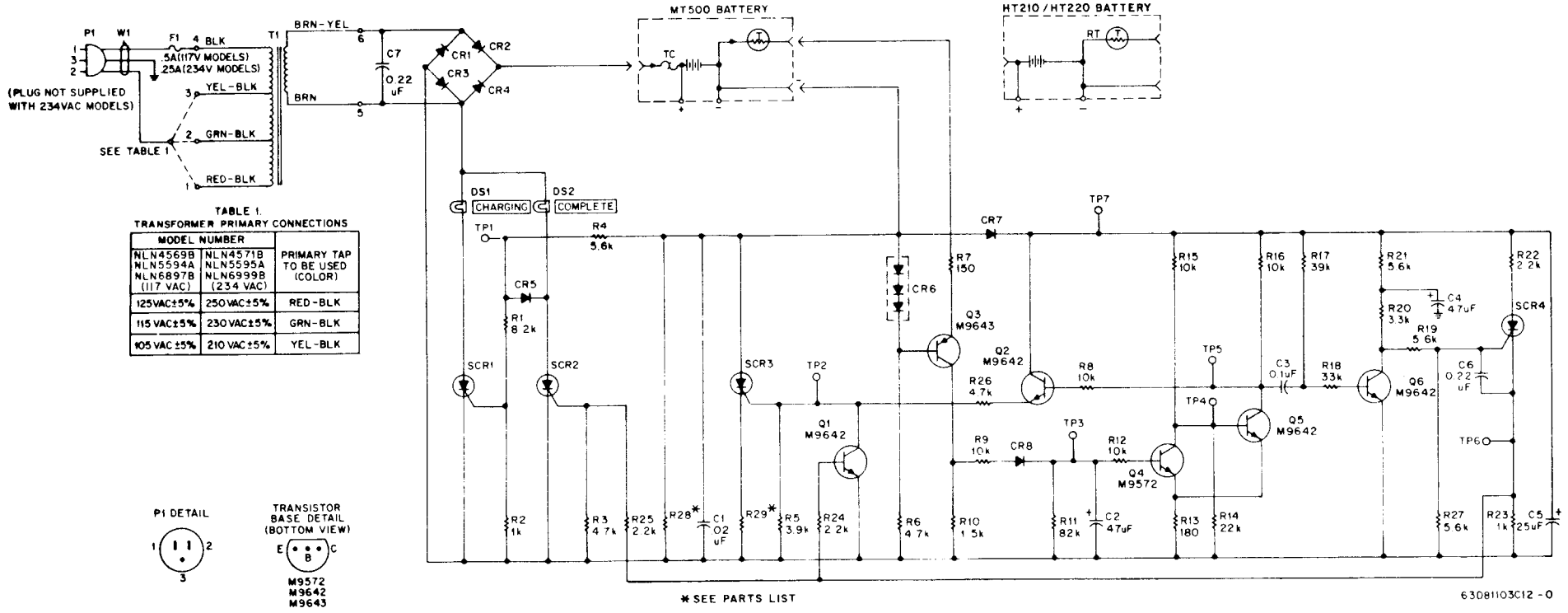
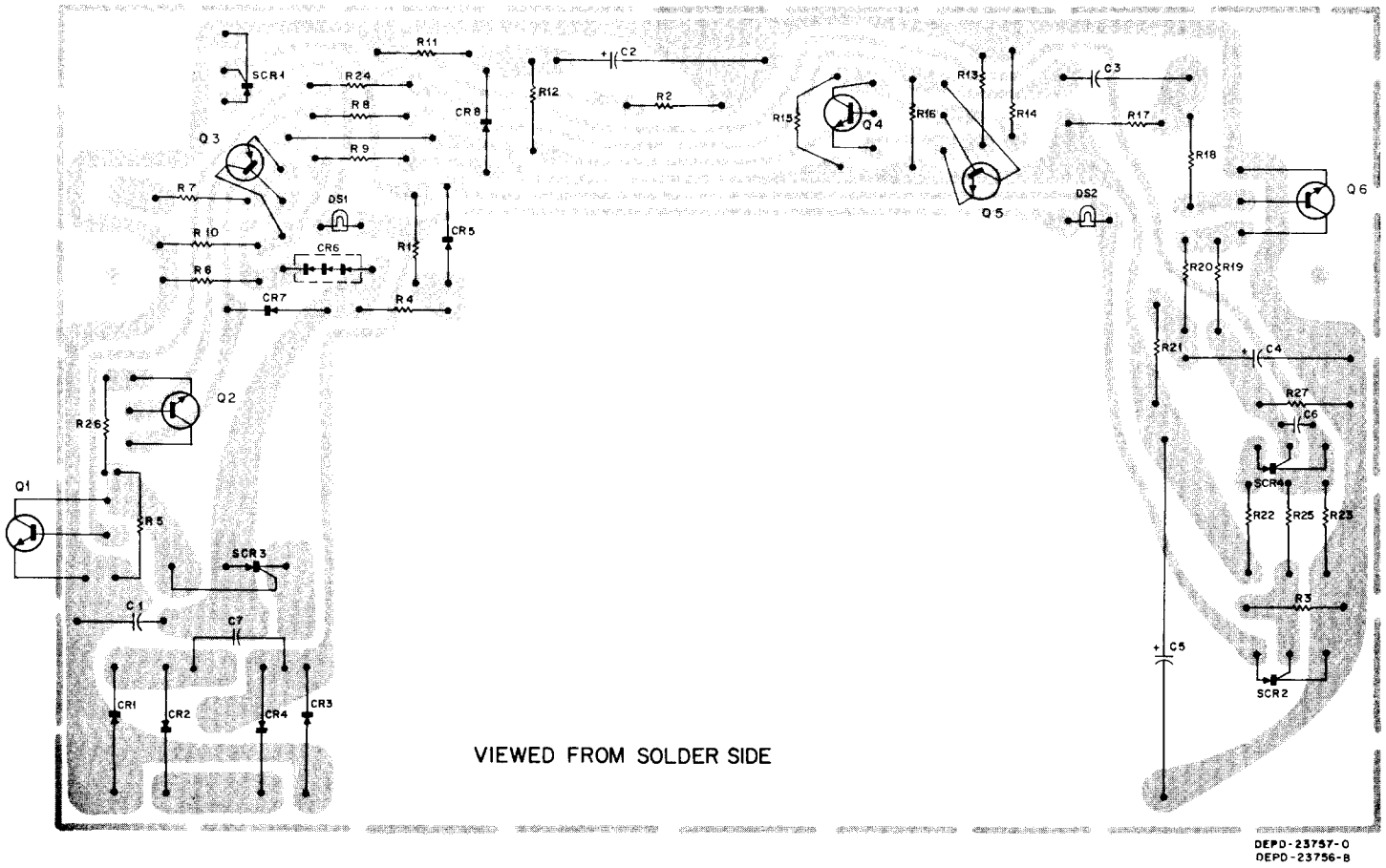


TABLE 1.
TRANSFORMER PRIMARY CONNECTIONS

MODEL NUMBER		PRIMARY TAP TO BE USED (COLOR)
NLN4569B NLN5594A NLN6897B (117 VAC)	NLN4571B NLN5595A NLN6999B (234 VAC)	
125VAC±5%	250VAC±5%	RED-BLK
115 VAC±5%	230VAC±5%	GRN-BLK
105 VAC ±5%	210 VAC±5%	YEL-BLK



NOTE: R28 and R29 are mounted on the base plate.

PARTS LIST

PLF-1539-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF unless stated
C1	2182428B26	.02 +80-20%; 200 V
C2	2384762H02	47 ±10%; 6 V
C3	0882905G07	0.1 ±10%; 50 V
C4	2384762H01	4.7 ±10%; 35 V
C5	2382601A08	25 +150-10%; 60 V
C6	2100861478	0.22 +100-0%; 3 V
C7	0882905G11	0.22 ±10%; 50 V
		DIODE: See Note
CR1 thru 4	4882466H13	Silicon
CR5	4882392B03	Silicon
CR6	4883329G04	Silicon
CR7,8	4882392B03	Silicon
		LAMP, Incandescent:
DS1,2	6584686H01	14 V (See NOTE below)
		FUSE, Cartridge:
F1	6500475395	1/2-amp; 125 V (NLN4565A, NLN4569A)
	or 6500020987	1/4-amp; 250 V (NLN4567A, NLN4571A)
		TRANSISTOR: See Note
Q1,2	4800869642	NPN; type M9642
Q3	4800869643	PNP; type M9643
Q4	4800869572	NPN; type M9572
Q5,6	4800869642	NPN; type M9642
		RESISTOR, Fixed: Ω ±10%; 1/4 W unless stated
R1	0600124C71	8.2 k
R2	0600124C49	1 k
R3	0600124C65	4.7 k
R4	0600124C67	5.6 k
R5	0600124C63	3.9 k
R6	0600124C65	4.7 k
R7	0600124C29	150
R8	0600124C73	10 k
R9	0600124A73	10 k ±5%
R10	0600124A53	1.5 k ±5%
R11	0600124A95	82 k ±5%
R12	0600124C73	10 k
R13	0600124A31	180 ±5%
R14	0600124C81	22 k
R15,16	0600124C73	10 k
R17	0600124C87	39 k
R18	0600124C85	33 k
R19	0600124C67	5.6 k
R20	0600124C61	3.3 k
R21	0600124C67	5.6 k
R22	0600124C57	2.2 k
R23	0600124C49	1 k
R24,25	0600124C57	2.2 k
R26	0600124C65	4.7 k
R27	0600124C67	5.6 k
R28	0600125C49	1 k; 1/2 W (NLN4565A, NLN4567 NLN4567A)
	or 0600126C37	330; 1 W (NLN4569A, NLN4571A)
R29	1782381A20	45; 20 W (NLN4565A, NLN4567A)
	or 1782381A19	15; 20 W (NLN4569A, NLN4571A)
		DIODE: See Note
SCR1,2	4884755H01	Silicon; type 2N5061
SCR3	4883875D05	Silicon; type MCR106-2
SCR4	4884755H01	Silicon; type 2N5061
		TRANSFORMER:
T1	2584658H01	(For 117 VAC Models) Pri: #1 RED-BLK; 125 V ac #2 GRN-BLK; 115 V ac #3 YEL-BLK; 105 V ac #4 BLK; common 22.5 Ω between term. 1 and 4 Sec: #5 BRN #6 BRN-YEL 1.5 Ω between term. 5 and 6
	or 2582101J01	(For 234 VAC Models) Pri: #1 RED-BLK; 260 V ac #2 GRN-BLK; 240 V ac #3 YEL-BLK; 220 V ac #4 BLK; common 100 Ω between term. 1 and 4 Sec: #5 BRN #6 BRN-YEL 1.5 Ω between term. 5 and 6
W1	3082494J03	CABLE: 3-conductor; includes 3 contact male plug (P1)
NONREFERENCED ITEMS		
	0105952E83	ASSEMBLY, Charger Pocket (for NLN4569B, NLN4571B); Shadow Bronze, includes: Pocket Housing, charging contacts, Hold-Down Spring, and washers
	or 0105952E85	ASSEMBLY, Charger Pocket (for NLN6897B, NLN6999B); Stellar Blue, includes: Pocket Housing, charging contacts, Hold-Down Spring, and washers
	or 0105954E53	ASSEMBLY, Charger Pocket (for NLN5594A, NLN5595A); Shadow Black, includes: Pocket Housing, charging contacts, Hold-Down Spring, and washers
	0905774B01	SOCKET, Spring
	0982083C02	RECEPTACLE, Fuseholder
	1305564G01	ESCUTCHEON
	1582224E03	BASE, Charger (Stellar Blue)
	or 1582224E04	BASE, Charger (Shadow Bronze)
	or 1582224E05	BASE, Charger (Shadow Black)
	3100118964	STRIP, Terminal; 4 ins. #3 gnd
	3100124665	STRIP, Terminal; 2 ins. #2 mounting
	4200850861	RETAINER, Cable
	4282018H10	RETAINER, Cable
	4384659H03	SPACER
	5405181B01	LABEL, Patent
	5482500J01	LABEL, Warning
	6484657H01	PLATE, Base
	8484754H01	CIRCUIT BOARD

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

NOTE: Both lamps are #7387, which are 28V and 0.04 amps.

END OF DOCUMENT