



for
Manual No. 68P81108C83-O
NTN4633C, NTN4634B, NTN49212B,
NTN4635B, NTN4636A, NTN4920A,
NTN4666B AND NTN4667A
SINGLE-UNIT BATTERY CHARGERS

This revision outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

<u>NO.</u>	<u>CHANGE AFFECTS</u>
1	Section I - NTN4666B AND NTN4667A Single-Unit Compact Battery Chargers, INTRODUCTION and DESCRIPTION
2	Section II - NTN4635B, NTN4636B AND NTN4920A Single-Unit Standard Charge Battery Chargers, INTRODUCTION, DESCRIPTION
3	Section III - NTN4633C, NTN4634C AND NTN4921A Single-Unit Rapid-Charge Battery Chargers, INTRODUCTION, DESCRIPTION and OPERATION

NO.

1. Section I - NTN4666B AND NTN4667A Single-Unit Compact Battery Chargers.

A. On the first page, under 1. **INTRODUCTION**, (end) just before 2. **SPECIFICATIONS**, add the following note:

NOTE

It is not recommended to charge nickel-metal hydride batteries in the NTN4666B and the NTN4667A chargers. Although nickel-metal hydride batteries are compatible with these chargers, long-term use of continuous slow or standard rate charging will reduce the useful life and capacity of the battery.

B. On the first page, under 3. **DESCRIPTION**, first paragraph, delete the last sentence.

2. Section II - NTN4635B, NTN4636B AND NTN4920A Single-Unit Standard Charge Battery Chargers.

A. On page 5, under 1. **INTRODUCTION**, (end) just before 2. **SPECIFICATIONS**, add the following note:

NOTE

It is not recommended to charge nickel-metal hydride batteries in the NTN4666B and the NTN4667A chargers. Although nickel-metal hydride batteries are compatible with these chargers, long-term use of continuous slow or standard rate charging will reduce the useful life and capacity of the battery.

B. On page 5, under 3. **DESCRIPTION**, first paragraph, delete the last sentence.

3. Section III - NTN4633C, NTN4634C and NTN4921A Single-Unit Rapid-Charge Battery Chargers

A. On page 9, under 1. **INTRODUCTION**, change the first sentence to read:

The NTN4633C (117Vac, UL approved), the NTN4634B (220Vac), and the NTN4921B (240Vac) Single-Unit Rapid-Charge Battery Chargers are accessory items for charging rechargeable nickel-cadmium and nickel-metal hydride batteries.

B. On page 9, under 1. **INTRODUCTION**, under **KIT NUMBER** add NTN7015A and NTN7016A to the end of the first box.

C. On page 9, under 1. **INTRODUCTION**, (end) just before 2. **SPECIFICATIONS**, add the following note:

NOTE

Nickel-metal hydride batteries (NI-MH) as offered by Motorola are lead, mercury, and cadmium free and are considered "environmentally friendly." Additionally, with proper care and use of these batteries, deliver increased capacity over nickel cadmium batteries of similar size.

TO ENSURE MAXIMUM BATTERY LIFE, and gain maximum usage (duty cycle and product life) **RAPID CHARGE ONLY!** with these higher capacity batteries.

Although compatible with existing product chargers, the use of continuous slow or



standard-rate charging will reduce the useful life and capacity of batteries. Battery life can be optimized if batteries are removed from the rapid charger after the charge cycle is completed. The charge cycle is completed when the red indicator light goes out and the green light comes on.

For optimal charge performance, nickel-metal hydride batteries should be at room temperature (20-30°C) prior to placement in the charger.

D. On page 9, under **4. OPERATION**, add the following additional note after c.

NOTE

The battery circuitry has been designed to regulate the rapid charge rates to provide for optimum performance and maximum cycle life. In some cases, new batteries, and batteries that have had periods of prolonged storage may require more than a 2-hour rapid-charge cycle to achieve rated capacity.

Section II

NTN4635B, NTN4636A, and NTN4920A

Single-Unit Standard-Charge Battery Chargers

HT600
HT800

1. INTRODUCTION

The NTN4635B (117Vac, UL approved) the NTN4636A (220Vac), and the NTN4920A (240Vac) Single-Unit Standard-Charge Battery Chargers are accessory items for charging rechargeable nickel-cadmium batteries. The chargers are approved for use with the following standard-charge and dual-charge batteries:

KIT NUMBER	CAPACITY	CHARGE TYPE
NTN4564, NTN4584, NTN4822, NTN4823, NTN4871, NTN5047, ZLN6408, NTN5160, NTN5161	Medium	Dual
NTN4585, NTN4586, NTN4824, NTN4825, NTN5049, NTN5414, NTN5415, NTN5447, NTN5448, ZLN6409	High	Dual
NTN4563, NTN4868, NTN5046	Medium	Standard
NTN4588, NTN4869, NTN5048, NTN5413, NTN5446	High	Standard

2. SPECIFICATIONS

INPUT POWER	117Vac, 220Vac, 50/60Hz
SIZE	7.60 x 5.02 x 3.05 in. (193 x 127.6 x 77.5mm)
WEIGHT	1.86 lbs. (842g)
CHARGE RATE	Approximately 16 hours (Radio Off)
OPERATING TEMPERATURE RANGE	0° C to 50° C.

3. DESCRIPTION

These single-unit standard chargers are current sensing, voltage sensing, current regulating devices which provide a 16-hour charge rate. The batteries can be left in the charger indefinitely without any resultant harm.

The NTN4635B charger operates from a 117Vac, 60Hz power source; the NTN4636A charger operates from a 220Vac, 50Hz power source, and the NTN4920A operates from a 240Vac, 50Hz power source. A red light-emitting diode (LED) indicates a charging condition when a battery is inserted into the charger.

4. OPERATION

Normal battery operation is eight hours of use followed by approximately 16 hours of charge. Place the charger in operation as follows:

a. Visually check the battery and charger charging contacts for dirt, grease or other material which may prevent good conduction, and clean if necessary.

b. Connect the charger's ac plug to the appropriate ac power source.

CAUTION

Turn radio off before inserting battery (with radio) into the charger.

c. Insert the battery, with or without radio, into the charger pocket. When the battery contacts mate with the charger's charging contacts, charging begins and the red LED indicator will light.

NOTE

To ensure proper charging, make certain that the battery is pushed fully into the charger pocket.

d. Allow sufficient time for the battery to fully charge (approximately 16 hours). After this time the battery will reach 100% full charge. The battery can be removed from the charger or remain in the charger indefinitely.

5. CIRCUIT DESCRIPTION

(Refer to the schematic diagram)

a. General

Operating voltage (B+) is developed from a step down transformer (T1), with a fused primary, driving a halfwave rectifier (CR6) in the NTN4635B (117Vac) charger, or a conventional full-wave bridge rectifier (CR6-CR9) in the NTN4636A (220Vac) and the NTN4920A (240Vac) chargers. The B+ voltage (approximately 30Vdc - no load, to 20Vdc - full load) is applied to transistor Q1 and resistor R1.

Initially, when the charger is plugged in (without a battery inserted), Q1 conducts and Q4 turns on, which provides a turn-on voltage for Q3. The conduction of Q3 effectively shorts out resistor R8, and a quiescent drive current is established for Q1, by components R1, VR1 and R9. Transistors Q3 and Q4 are components of the chargers short-circuit protection circuitry and are active during both the quiescent and charging states.

When a battery is placed in the charger pocket a current path is established through the battery. This allows current to flow through diode CR2 and the base-emitter junction of transistor Q5, which turns on Q5 and diode CR5 (the red LED). Charging current for the battery is provided by the current regulator circuitry consisting of transistors Q1 and Q2. Base current for Q1 is controlled by transistor Q2, resistors R2, R7, and R9, and the internal battery resistor RC. The value of RC determines the charge rate for a particular battery capacity. RC is electrically placed across the base-emitter junction of Q2. Its value, combined with the resistance of R7 and R9, determines the amount of conduction of Q2, which limits the amount of base drive for Q1, thus regulating the charge current. The following chart lists the two different capacity batteries and their respective RC and trickle charge currents.

BATTERY CAPACITY	RC	CHARGE CURRENT
Medium	5.6k	50mA
High	3.3k	80mA

b. Over-Voltage Protection

Battery over-voltage protection is achieved by Zener diode VR1 during the charging mode. If the voltage between the base of Q1 and the battery ground terminal approaches 16 volts, VR1 conducts. This conduction removes the base drive from Q1, thus maintaining a safe battery voltage of approximately 14.5 volts. Also, if Q1 should fail (e.g. collector to emitter short), the diode combination of CR3 and VR1 will hold the battery terminal voltage to a safe level.

c. Short-Circuit Protection

Transistor Q4 and resistors R3, R4, and R5, together with transistor Q3 and resistor R8 help to protect the charger if the charging contacts are

shorted. During normal operation, transistor Q4 is biased "on" to insure that transistor Q3 is always saturated, thus bypassing resistor R8. However, if B+ is shorted to ground (e.g. charging contacts are shorted together), Q4 is cut off, which removes the base drive of transistor Q3. Consequently, R8 (a high resistance component), is placed in the charging path, which limits the current to a value of less than 1mA.

6. MAINTENANCE

a. Fuse

The fuse (F1) in the primary circuit of transformer (T1) is the only user serviceable part in the charger. If necessary, replace this fuse with one the same size and rating as marked, or refer to the electrical parts list for the proper electrical specifications. After replacing the fuse, if the charger still fails to operate properly, contact a local Motorola Service Shop (MSS) for repairs.

b. Radio Contacts

If the red LED does not turn on when a battery is inserted into the pocket, check the contacts of the radio for dirt, grease, or other foreign material. Clean the contacts if necessary.

c. DC Voltage Measurement Charts

In the following charts,

- Measurements were taken at 25 degrees C with a Fluke 8010A digital multimeter
- All voltage readings are dc and referenced to charger ground
- The dc voltages are typical readings and will vary with conditions of the battery

DC VOLTAGE MEASUREMENTS CHART

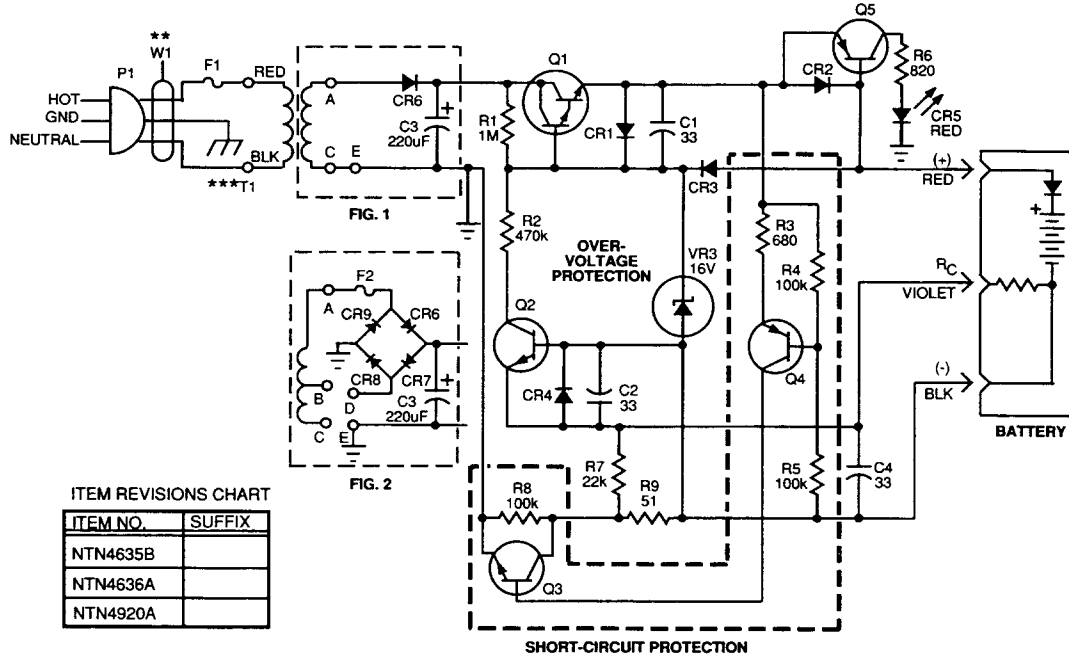
BATTERY TYPE (CAPACITY)	CHARGE CURRENT mA	Q1			Q2			Q3			Q4			Q5			CR5
		E	B	C	E	B	C	E	B	C	E	B	C	E	B	C	
NO BATTERY	0	15.1	16.2	29.1	.01	.02	15.4	0	0.79	.01	9.6	8.9	0.79	15.1	14.7	0	0
MEDIUM	50	15.5	16.6	25.0	2.2	2.7	12.9	0	0.84	.08	10.9	10.2	0.84	15.5	14.8	15.4	2.0
HIGH	80	16.7	17.7	23.6	3.6	4.1	15.3	0	0.86	0.12	12.1	11.4	0.86	16.7	15.9	16.6	2.03

***AC LINE CORD (W1) WIRING

CHARGER NO.	VAC	HOT	NEUTRAL	GROUND
NTN4635B	117	SMOOTH	RIBBED	GRN
NTN4636A	220	BRN	BLU	---
NTN4920A	240	BRN	BLU	GRN-YEL

*** TRANSFORMER (T1) WIRE COLORS

VAC	PRIMARY	SECONDARY	CONN. POINTS	FIG.
117	RED BLK	WHT ORG	C TO E	1
220	RED BLK	BRN ORG	C TO D	2
240	RED BLK	BRN WHT	B TO D	2

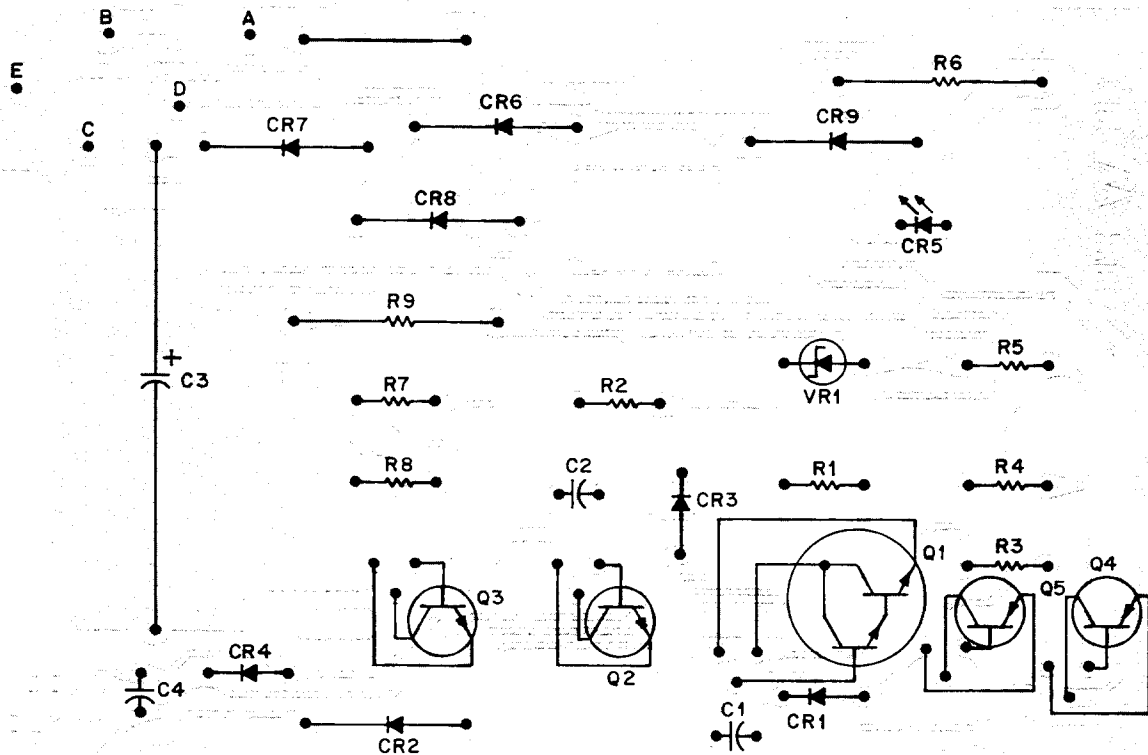


ITEM REVISIONS CHART

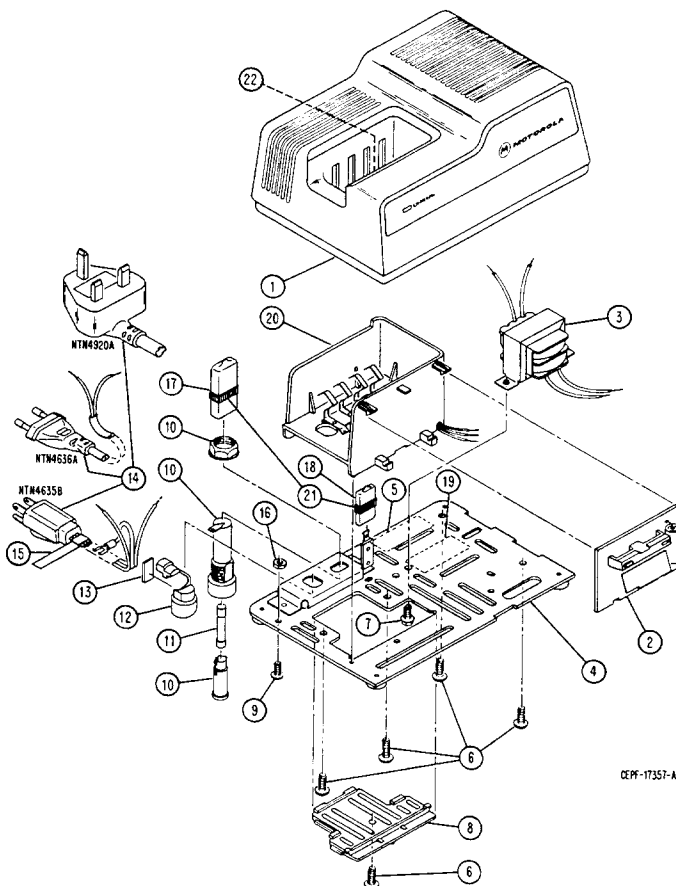
ITEM NO.	SUFFIX
NTN4635B	
NTN4636A	
NTN4920A	

63MA81107C83-B

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OL - BEPF-17548-A



TORQUE CHART

ITEM NO.	SCREW SIZE	TORQUE IN INCH POUNDS
6	8-32 X 3/8"	10
7	8-32 X 3/8"	30
9	6-32 X 3/8"	8

TEPF-20973-0

Electrical Parts List
NTN4635B (117Vac)
NTN4636A (220Vac)
NTN4920A (240Vac)

TPLF-3490-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2 C3 C4	2105499G01 2360561N01 2105499G01	CAPACITOR, Fixed: pF $\pm 5\%$; 50V unless stated 33; 63V 220 μ F; 50V 33; 63V
CR1 CR2 CR3, 4 CR5 CR6 CR7, 8, 9	4805746G13 4805746G10 4805746G13 4805729G08 4805746G10 4805746G10	DIODE: See Note Silicon Silicon Silicon LED, Red Silicon Silicon (NTN4636A, NTN4920A)
F1	6500480555 or 6505384M01	FUSE: 0.2 Amp.; 125V (NTN4635B) 1/8 Amp.; 250V (NTN4636A, NTN4920A)
P1	-----	PLUG, AC: Connector, Part of Cord Assembly W1
Q1 Q2, 3 Q4, 5	4805474G40 4805474G42 4805474G41	TRANSISTOR: See Note NPN, Darlington NPN PNP

Exploded View Parts List

NTN4635B (117Vac)
NTN4636A (220Vac)
NTN4920A (240Vac)

TPLF-3457-A

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0105957M11	ASSEMBLY, Top Housing; includes: Housing, Escutcheon, Thermal Partition, and Fastener Clip, CAUTION label.
2	0105950P75 or 0105957M09	ASSEMBLY, PC Board (NTN4635B) ASSEMBLY, PC Board (NTN4636A and NTN4920A)
3	See Note	TRANSFORMER (T1)
4	0102712J18 or 0105957M18 or 0105950P78	ASSEMBLY, Base Plate (NTN4635B); includes: Brackets, Single Lug Terminal Strip, Base Plate, and 4 Rubber Bumpers ASSEMBLY, Base Plate (NTN4636A); includes: Brackets, Single Lug Terminal Strip, Base Plate, and 4 Rubber Bumpers ASSEMBLY, Base Plate (NTN4920A); includes: Brackets, Single Lug Terminal Strip, Base Plate, and 4 Rubber Bumpers
5	5405228Q01	LABEL, WARNING
6	0300138574	SCREW, Phillips Hd.; 8-32 X 3/8" (5 req'd.)
7	0300131632	SCREW, Tapping; 8-32 X 3/8" (2 req'd.)
8	1305130Q01	GRILLE, Base
9	0300138035	SCREW, Phillips Hd.; 6-32 X 3/8" (NTN4635B and NTN4920A)
10	0905724C02 or 0905490R01	RECEPTACLE, Fuse Holder (NTN4635B) RECEPTACLE, Fuse Holder (NTN4636A and NTN4920A)
11	See Note	FUSE (F1)
12	4205723C01	RETAINER, Cable
13	4305233D01	SPACER
14	See Note	ASSEMBLY, Cable (P1, W1)
15	3305360N01	LABEL, Cable
16	0200007005	NUT, Hex; 6-32 X 1/4" 3/32" (NTN4635B and NTN4920A)
17	3805637M02	CAP GUARD, Fuse Holder
18	3805637M01	CAP GUARD, Terminal
19	3305334N23 or 5405230Q04 or 5405230Q06	LABEL, Info (NTN4635B) LABEL, Info (NTN4636A) LABEL, Info (NTN4920A)
20	0105957M10	ASSEMBLY, Partition; includes: Thermal Partition, Charging Contacts, and Fastener Clip
21	4210217A26	TIE WRAP
22	3305455U01	LABEL, pocket

NOTE: Refer to Electrical Parts List for part number and description.

R1 R2 R3 R4, 5 R6 R7 R8 R9	0660075B22 0660075B14 0660075A45 0660075A97 0660075L47 0660075M57 0660075A97 0660075L18	RESISTOR, Fixed: Ω $\pm 5\%$; 1/8W unless stated 1 Meg. 470k 680 100k 820; 3/4W 22k $\pm 2\%$ 100k 51; 3/4W
T1	2502489J01 or 2505491R02	TRANSFORMER, Power: for (NTN4635B) for (NTN4636A, NTN4920A)
VR1	4805249R14	ZENER DIODE, 16V
W1	0102712J12 or 3005526R01 or 0105950P79	CABLE ASSEMBLY: Includes AC Cord, Plug (P1), and Red Crimp Lug (NTN4635B) Includes AC Cord and Plug (P1) (NTN4636A) Includes AC Cord, Plug (P1), and Red Crimp Lug (NTN4920A)

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

HT600
P200

Section III

NTN4633C, NTN4634B, and NTN4921B Single-Unit Rapid-Charge Battery Chargers

1. INTRODUCTION

The NTN4633C (117Vac, UL approved), the NTN4634B (220Vac), and the NTN4921B (240Vac) Single-Unit Rapid-Charge Battery Chargers are accessory items for charging rechargeable nickel-cadmium batteries. The chargers are approved for use with the following standard-charge and dual-charge batteries:

KIT NUMBER	CAPACITY	CHARGE TYPE
NTN4564, NTN4584, NTN4822, NTN4823, NTN4871, NTN5047, ZLN6408	Medium	Dual
NTN4585, NTN4586, NTN4824, NTN4825, NTN5049, NTN5414, NTN5415, NTN5447, NTN5448, ZLN6409	High	Dual
NTN4563, NTN4868, NTN5046	Medium	Standard
NTN4588, NTN4869, NTN5048, NTN5413, NTN5446	High	Standard

2. SPECIFICATIONS

INPUT POWER	117Vac, 220Vac, 240Vac; 50/60Hz
SIZE	7.72 x 5.12 x 3.14 in. (193 x 128 x 78.5mm)
WEIGHT	3.54 lbs. (1.61kg)
CHARGE RATE	Approximately 1 hour
OPERATING TEMPERATURE RANGE	0° C to 50° C.
RAPID-CHARGE TEMPERATURE WINDOW	8°C. to 41°C.

3. DESCRIPTION

These single-unit rapid chargers are current sensing, voltage sensing, current regulating devices which provide two different charger rates; a one-hour rate and a 16-hour rate. A dual-charge nickel-cadmium battery is charged initially at a one-hour charge rate, after which the charging rate is automatically reduced to the 16-hour rate. A standard-charge nickel-cadmium battery is charged only at the 16-hour rate. Either of the batteries (dual or standard) can be left in the charger indefinitely without any resultant harm.

The NTN4633C charger operates from a 117Vac, 60Hz power source; the NTN4634B charger operates from a 220Vac, 50Hz power source, and the

NTN4921B operates from a 240Vac, 50Hz power source. Two light-emitting diode (LED) indicators display charging conditions and battery fault indications, such as open or shorted battery cells.

4. OPERATION

Normal battery operation is eight hours of use followed by approximately 1 hour of rapid charge. Place the charger in operation as follows:

a. Visually check the battery and charger charging contacts for dirt, grease or other material which may prevent good conduction, and clean if necessary.

b. Connect the charger's ac plug to the appropriate ac power source. Both LED's will light momentarily.

CAUTION

Turn radio off before inserting battery (with radio) into the charger.

c. Insert the battery, with or without radio, into the charger pocket. When the battery contacts mate with the charger's charging contacts, charging begins. If the battery is within the proper temperature range (+8 to +41 degrees C.), the red (CHARGING) LED will light to indicate that the battery is rapid-charging.

NOTE

To ensure proper charging, make certain that the battery is pushed fully into the charger pocket.

d. Allow sufficient time for the battery to fully charge (approximately 1 hour). When rapid-charging is complete, trickle-charging begins. The red (CHARGING) LED will turn off and the green (charge COMPLETE) LED will turn on.

At this time, the battery has reached approximately 90% full charge and can be used. If the battery is left in the charger, it will reach 100% full charge after approximately two hours of trickle-charging. The battery can be removed from the charger and used or remain in the charger indefinitely.

If a battery which is outside the +8 to +41 degree C. temperature range is inserted into the charger, it will be trickle-charged. The green LED will light if the battery temperature is above 41°C, or the red LED will light if the battery temperature is below 8°C. Once the battery moves inside the temperature window, the

charger automatically switches to the rapid-charge rate and charging continues as described in the steps above.

5. CIRCUIT DESCRIPTION

(Refer to the schematic diagram)

a. General

Operating voltage (B+) is developed from a step down transformer (T1), with a fused primary, driving a full-wave bridge rectifier (CR1-CR4). The B+ (approximately 30Vdc) output is applied to a number of transistor stages and to a precision 12-volt regulator circuit (U4). The regulated 12Vdc (A) is applied to various transistor stages and to most of the logic circuits. A reduced B+ voltage (approximately 27Vdc) is applied to the Vcc input at U1 pin 4.

Charging current for the battery is provided by a constant-current source. The charging current is controlled by a current regulator with negative feedback. The current regulator is comprised of transistor circuits (Q1-Q6), a differential amplifier (U1C), and a single-input amplifier (U1D). Under normal charging conditions, transistors Q2 and Q6 are turned on, R10 is effectively shorted (rapid charge condition). For a momentary increase in charging current, the voltage across R14 will increase. The input to U1C pin 10 increases, which produces an increased output at U1C pin 8. The higher potential at U1C pin 8 is fed through CR8, R21, and R22 to U1D pin 13. This higher input at pin 13 reduces the output at U1D pin 14, which is passed through R15, CR7, and VR2 to reduce the drive of Q3, then Q1. The reduced drive of Q1 results in a reduction of charging current, returning back to normal.

Diodes CR5, CR6, transistor Q4, and resistor R73 provide for a constant current input of transistor Q2, ensuring Q2 to be turned on, independent of battery terminal voltage and charge rate. Together with Q5, this constant current source can be switched off for trickle-charging, by switching off Q5, consequently Q4, and Q2. With Q2 turned off, resistor R10 is added in the charging path.

Rapid-charge charging current for a high-capacity rapid-charge battery is approximately 830mA. Trickle-charge current for the same battery is approximately 72mA. The following chart lists the two different capacity batteries and the battery's respective RC, rapid charging current, and trickle charging current.

BATTERY CAPACITY	RC	T1 CHARGE CURRENT	
		TRICKLE	RAPID
Medium	5.6k	50mA	550mA
High	3.3k	80mA	830mA

b. Maximum Current Limiter

The maximum current limiter is a protective circuit for the charger. If the charge rate exceeds a predetermined threshold, set by resistors R30 and R31, the output at U2A pin 1 goes high. This high turns on Q7, which turns off Q6. With Q6 turned off, the charging rate is no longer a function of RC, but a function of resistor R23. The charging current is limited to approximately 830mA.

c. Battery Sense Detect

With no battery in the charger, the voltage at U1B pin 6 is approximately 9.6V, which holds the output at U1B pin 7 low. When a battery is placed in the charger, via the conduction of transistor Q6, the voltage at U1B pin 6 drops to approximately 2.2V (during normal charging) or lower (if either the dynamic voltage clamp circuit or the open cell detect circuit is activated). The voltage drop at pin 6 of U1B, results in a high output at U1B pin 7, which turns on transistor Q8 and the red CHARGING LED, CR18.

d. Temperature Window and Bistable Multivibrator

Comparators U2C and U2D sense the RT line and set the cold and hot sides of the temperature window respectively. The cold side temperature is 8 degrees C. The hot side temperature is 41 degrees C. In a normal rapid-charge condition, a voltage level which represents the battery's temperature is felt at U2C pin 10 and U2D pin 9. As the battery charges and the battery's temperature rises, the voltage at U2D pin 9 decreases. At 41 degrees C., the low level input at U2D pin 9 reaches a point that triggers the output at U2D pin 14 to go low. The low output of U2D is applied through CR12, CR13, and R13 to the base of Q5 and the following sequence occurs. Transistor Q5 turns off, Q4 turns off, Q2 turns off, resistor R10 is placed in the charging circuit, and the battery trickle charges. The low output at U2D is also applied through coupling capacitor C15 to U3A pin 7, which triggers the output of U3A at pin 1 to switch from high to low. This low output at U3A pin 1 is applied to the LED display circuitry via Q8, turning off the red (CHARGING) LED, and via Q10/Q9, turning on the green (charge COMPLETE) LED. When the battery's temperature cools down below 41 degrees C., the outputs of U2D and U3A are latched low via feedback through diode CR14. This feedback latching prevents a fully charged battery from being rapid-charged again.

When a battery outside the cold temperature window is placed in the charger, the battery sense detect circuit, via U1B, turns on the red (CHARGING) LED. The temperature window circuit, via an increased voltage level at U2C pin 10, triggers a low from U2C pin 13 to initiate trickle charging. The output of U2C is

isolated from the output of U2D by diode CR13. Thus, the green LED remains off and the red LED remains on. When the battery's temperature rises and enters the temperature window, the output at U2C goes high, Q5, Q4, and Q2 turn on, and the battery begins rapid charging.

e. Oscillator

The oscillator circuit turns the green and red LEDs on and off (flashing) to indicate that a problem (shorted or open cells or shorted contacts) is detected with the battery or battery contacts. Whenever the potential at the cathode is lower than the anode of diode CR26 (a low from U2B pin 2 or a low from U3D pin 14), the oscillator becomes activated. The oscillator output at U3B pin 2 flips back and forth (high to low), and is sent to the LED display circuit. On the low cycle, both transistors (Q8 and Q9) are turned off and both LEDs are turned off. On the high cycle, both transistors are turned on and both LEDs are turned on. If a problem occurs during the charge complete cycle, only the green LED will flash.

f. Battery Open Circuit (O/C) Detect

During normal charging conditions (good battery) or when a battery is not in the charger, the voltage at the cathode of CR16 is somewhat higher than the anode voltage. The output of U2B at pin 2 is high. When an open-circuited battery is detected (RC present but no charging current), the low impedance path of RC (compared to R53) causes the voltage at the anode to drop to a very low level. This low-level input (2.2V to 1.2V) at U2B pin 5 flips the output (U2B pin 2) high to low. The U2B low is passed to the LED display circuit, turning on the green LED (CR21). The U2B low is also passed to the oscillator circuit, which triggers both LEDs to flash.

g. Shorted Cells and Short Circuit Detect

This circuit detects shorted battery cells and shorted contacts by monitoring the battery's terminal voltage (BATT B+). Low battery voltage at U3D pin 9 triggers the comparator (for rapid-charge battery or standard-charge battery) to produce a low output at U3D pin 14. A low from the comparator keys the oscillator to flash the LEDs and to trickle-charge the battery.

h. Dynamic Voltage Clamp

During normal charging conditions, a low voltage level at U1A pin 2 holds the output at U1A pin 1 high. As the battery voltage (BATT B+) increases, the input voltage level at U1A pin 2 increases. If the BATT B+ voltage increases to a predetermined threshold level (approximately 15.5 volts), the higher potential at U1A pin 2 triggers the output at U1A pin 1 low. This low output from U1A pin 1 overrides the output at U1D pin 14, and reduces the base drive current of transistor Q3, hence that of Q1. This negative feedback action to reduce the charging current results in maintaining a constant battery terminal voltage (15.5 volts). This circuit prevents overvoltage conditions that could damage the radio's electronics if the radio is attached to the battery when charging.

6. MAINTENANCE

a. Fuse

The fuse (F1) in the primary circuit of transformer (T1) is the only user serviceable part in the charger. If necessary, replace this fuse with one the same size and rating as marked, or refer to the electrical parts list for the proper electrical specifications. After replacing the fuse, if the charger still fails to operate properly, contact a local Motorola Service Shop (MSS) for repairs.

b. Radio Contacts

If the red LED does not turn on when a battery is inserted into the pocket, check the contacts of the radio for dirt, grease, or other foreign material. Clean the contacts if necessary.

c. DC Voltage Measurement Charts

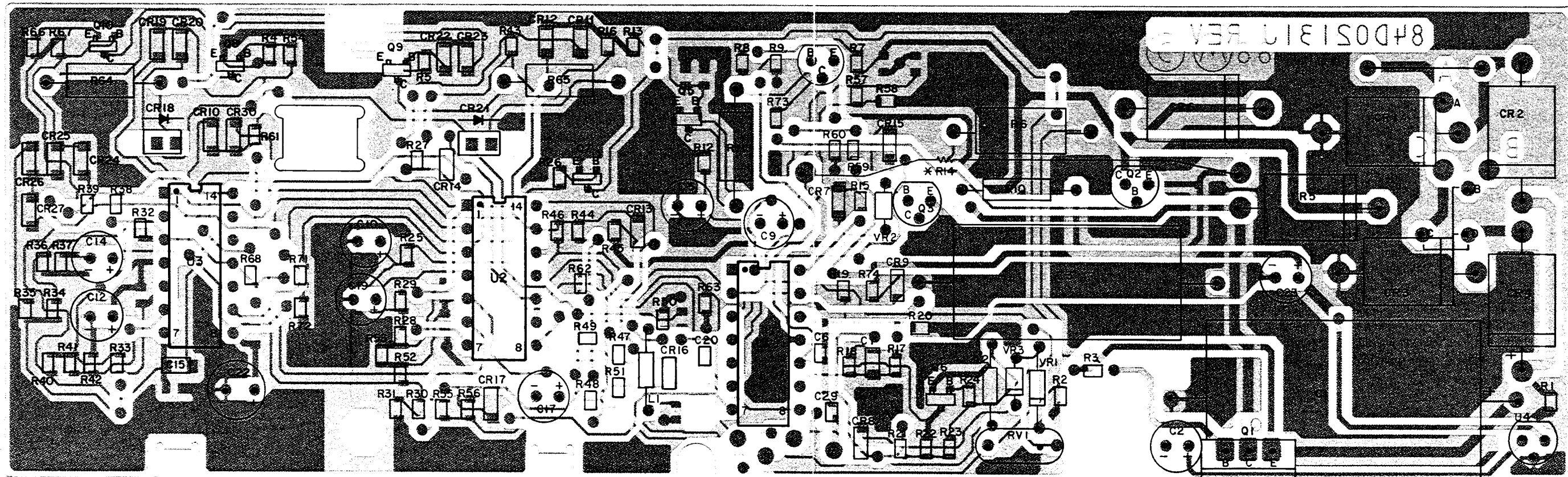
- In the following charts,
- Measurements were taken at 25 degrees C with a Fluke 8010A digital multimeter
 - All voltage readings are dc and referenced to charger ground
 - DC voltages designated with an "" will vary with the temperature of the battery

DC VOLTAGE MEASUREMENTS CHARTS

			Q1			Q2		Q3	Q4	Q5	Q6			Q7	Q8		Q9		Q10		VR1
BATTERY AND CONDITION	B+ BATT	CHRG. CUR. mA	E	B	C	B	E	B	B	B	B	C	E	B	C	B	C	B	B	C	
NO BATTERY	10.76	-	28.2	28.2	1.9	1.89	10.76	0.00	1.92	0.08	9.28	9.69	9.25	0.06	26.8	0.03	26.6	0.00	11.73	0.53	11.84
RAPID CHARGE (MEDIUM)	12.85	563.5	22.3	21.6	15.79	14.87	14.07	0.62	14.80	0.70	2.70	2.18	2.10	0.06	0.09	0.71	20.7	0.00	11.74	0.02	11.85
COMPLETE CHARGE (MEDIUM)	12.84	51.14	26.8	26.2	15.55	3.99	12.94	0.60	15.55	0.17	2.70	2.18	2.10	0.07	25.4	0.15	0.08	0.71	0.60	1.25	11.85
RAPID CHARGE (HIGH)	12.86	805.5	20.8	20.00	16.40	15.44	14.62	0.63	15.39	0.71	0.05	2.18	0.05	0.65	0.10	0.71	19.10	0.00	11.74	0.02	11.86
COMPLETE CHARGE (HIGH)	12.83	72.51	26.5	25.8	16.09	9.03	12.99	0.60	16.09	0.17	0.05	2.18	0.00	0.63	25.1	0.15	0.08	0.72	0.60	1.25	11.85

	U1														U2														U3									
BATTERY AND CONDITION	B+	1	2	3	5	6	7	8	9	10	12	13	14	1	2	4	5	6	7	8	9	10*	11	13	14	1	2	4	5	6	7	8	9	14				
NO BATTERY	26.8	25.5	5.66	7.61	6.97	9.64	0.61	0.00	10.60	9.23	2.17	9.68	0.00	0.06	11.52	2.14	3.93	6.88	0.00	2.91	11.83	11.83	7.32	0.08	11.83	11.83	11.73	9.61	11.49	1.11	11.80	1.10	5.66	11.77				
RAPID CHARGE (MEDIUM)	21.5	20.2	6.67	7.61	6.97	2.18	20.1	8.56	12.09	12.36	2.17	2.18	7.30	0.06	11.54	2.14	3.93	6.88	4.34	2.96	6.89	6.89	7.44	11.80	11.79	11.84	11.74	9.63	11.79	7.63	11.81	2.18	6.67	11.79				
COMPLETE CHARGE (MEDIUM)	25.9	24.6	6.65	7.61	6.98	2.18	24.5	8.69	12.07	12.23	2.17	2.18	6.88	0.07	11.48	2.14	3.93	6.89	4.41	2.92	0.62	0.62	7.33	0.75	0.11	0.06	11.74	9.63	11.79	7.64	2.23	2.18	6.65	11.79				
RAPID CHARGE (HIGH)	19.10	17.79	6.69	7.61	6.98	2.18	17.71	12.12	12.57	12.75	2.17	2.18	7.49	11.19	11.55	2.14	3.93	6.89	8.40	2.95	6.90	6.90	7.44	11.80	11.79	11.85	11.74	9.63	11.79	7.64	11.82	2.18	6.69	11.79				
COMPLETE CHARGE (HIGH)	24.8	23.6	6.65	7.61	6.98	2.18	23.5	12.13	12.51	12.67	2.17	2.18	7.01	11.19	11.48	2.14	3.93	6.89	8.40	2.92	0.62	0.62	7.33	0.75	0.11	0.06	11.74	9.63	11.79	7.63	2.23	2.18	6.65	11.79				

VIEWED FROM COMPONENT SIDE



* MOUNTED ON BACK OF BOARD

SS-CEPF-19808-C

OL-CEPF-19808-A

Electrical Parts List **TPLF-3807-B**
NTN4633C (117Vac) Single-Unit Charger (Rapid)
NTN4634B (220Vac) Single-Unit Charger (Rapid)
NTN4921B (240Vac) Single-Unit Charger (Rapid)

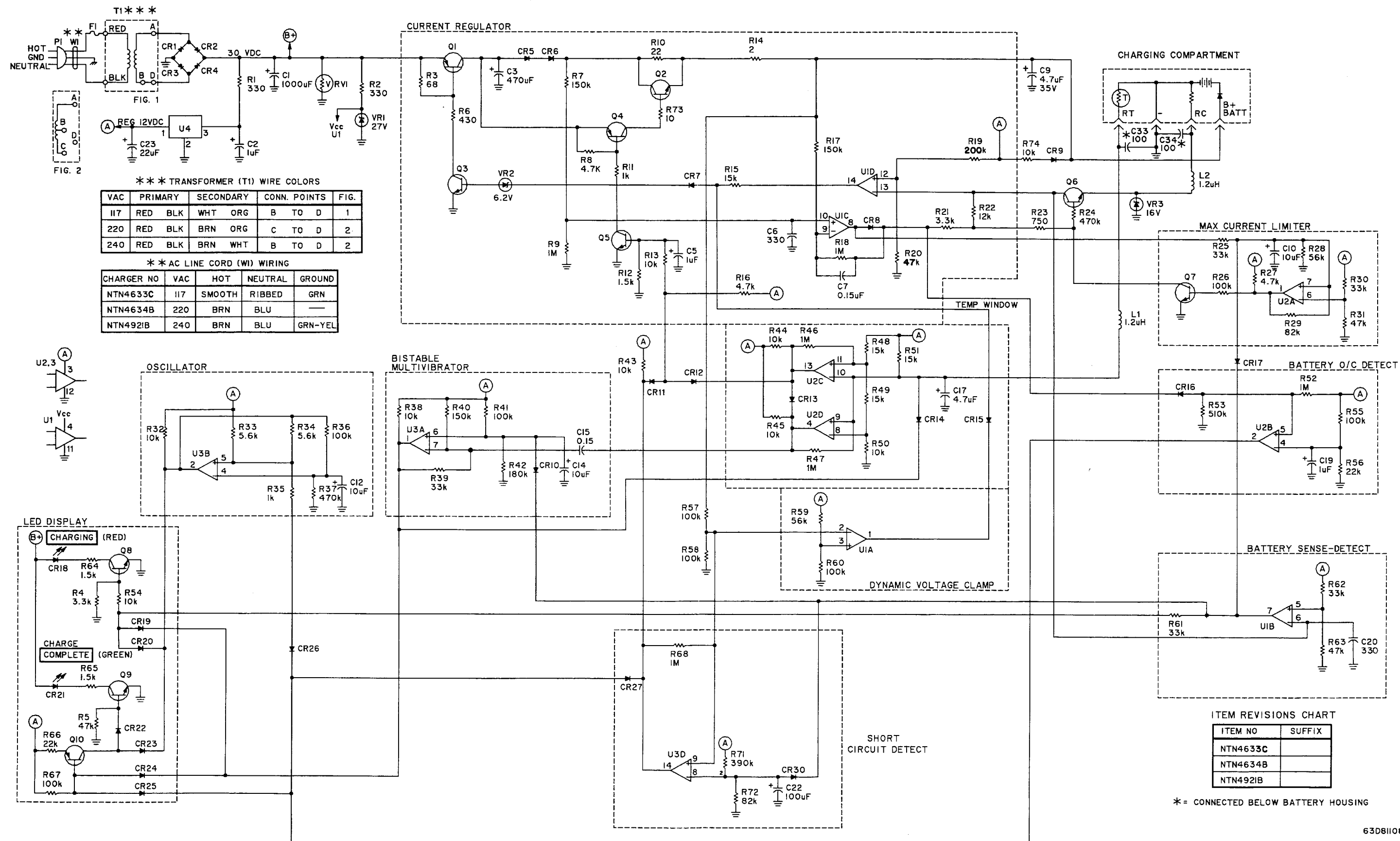
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	2360563A01	CAPACITOR, Fixed: pF±5%; 50V unless stated 1000µF
C2	2360561M09	
C3	2360561N02	
C5	2360561M09	
C6	2160520C13	
C7	2160521H39	
C9	2360561M15	
C10	2360561M19	
C12	2360561M19	
C14	2360561M19	
C15	2160521H39	
C17	2360561M15	
C19	2360561M09	
C20	2160520C13	
C22	2360561M44	
C23	2360561M23	
C33,34	2105455G12	
CR1 thru 6	4805746G16	DIODE: See Note Silicon
CR7 thru 17	4805494Q04	
CR18	4805729G08	
CR19, 20	4805494Q04	
CR21	4805729G09	
CR22 thru 27	4805494Q04	
		Silicon

CR30	4805494Q04	Silicon
F1	6500892099 or 6505384M02	FUSE: 3/4-Amp., 250V (NTN4633C) 1/4 Amp., 250V (NTN4634B, NTN4921B)
L1,2	2482723H01	CHOKE, RF: 1.2µH
P1	-----	PLUG, AC: Connector, part of W1
Q1	4805708G09	TRANSISTOR: See Note PNP
Q2	4805474G43	
Q3	4805474G42	
Q4	4805474G41	
Q5 thru 9	4805128M62	
Q10	4805128M67	PNP
R1,2	0660076A37	RESISTOR, Fixed: Ω±5%; 1/8W unless stated 330
R3	0660076A21	
R4	0660076A61	
R5	0660076A89	
R6	1760471A01	
R7	0660076F05	
R8	0660076A65	
R9	0660076F25	
R10	0660076N01	
R11	0660076L49	
R12	0660076A53	
R13	0660076A73	
R14	1805226Q01	
R15	0660076A77	
R16	0660076A65	

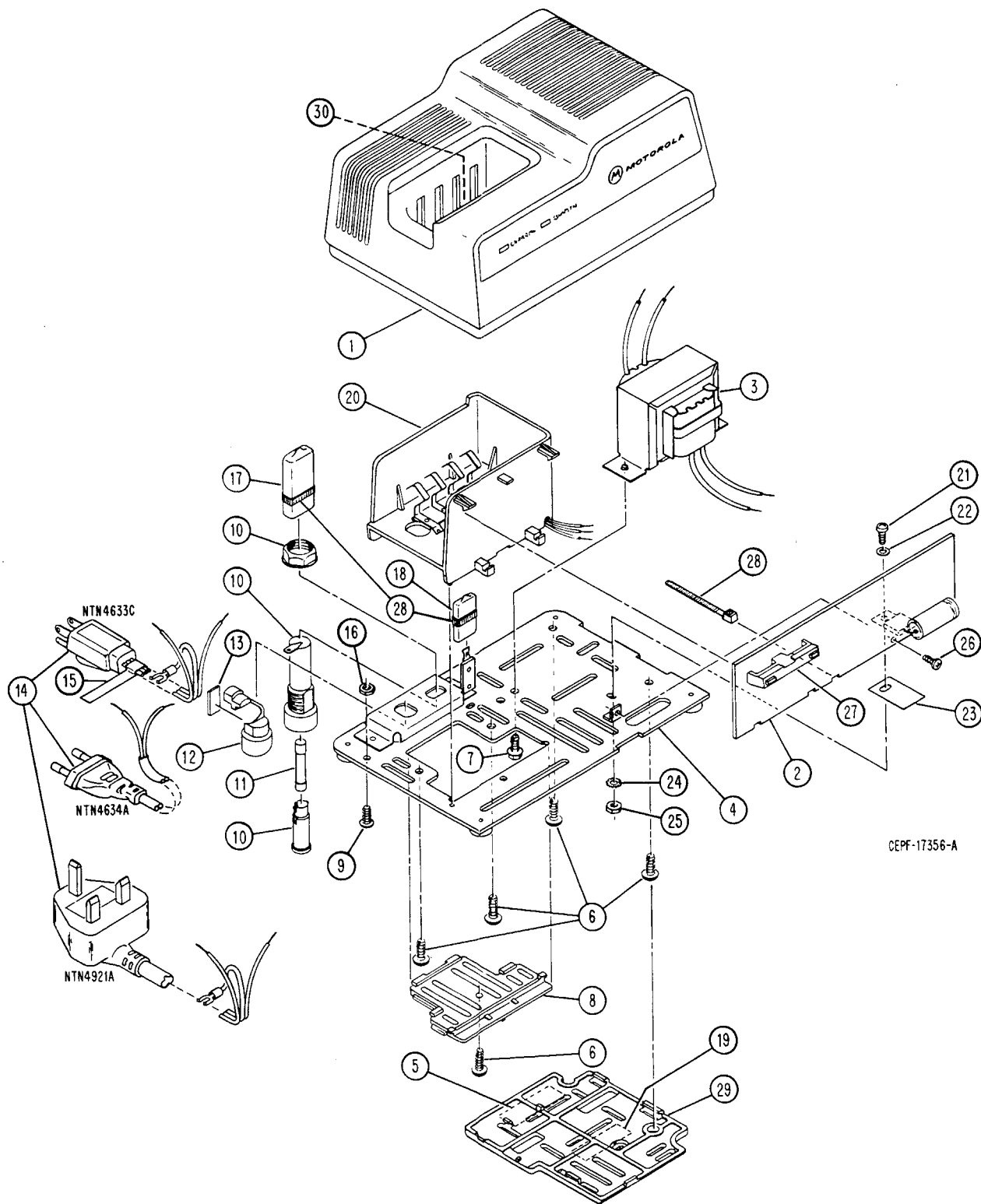
R17	0660076F05	150k ±1%
R18	0660076F25	1 Meg ±1%
R19	0660076F08	200k ±1%
R20	0660076E89	47k ±1%
R21	0660076E61	3.3k
R22	0660076E75	12k ±1%
R23	0660076E46	750 ±1%
R24	0660076B17	470k ±5%
R25	0660076A85	33k
R26	0660076B01	100k
R27	0660076A65	4.7k
R28	0660076A91	56k
R29	0660076A95	82k
R30	0660076A85	33k
R31	0660076A89	47k
R32	0660076A73	10k
R33, 34	0660076A67	5.6k
R35	0660076A49	1k
R36	0660076B01	100k
R37	0660076B17	470k ±5%
R38	0660076A73	10k
R39	0660076A85	33k
R40	0660076B05	150k
R41	0660076B01	100k
R42	0660076B07	180k
R43, 44, 45	0660076A73	10k
R46, 47	0660076B25	1Meg
R48, 49	0660076E77	15k ±1%
R50	0660076E73	10k
R51	0660076E77	15k ±1%
R52	0660076B25	1Meg
R53	0660076B18	510k
R54	0660076A73	10k
R55	0660076B01	100k
R56	0660076A81	22k
R57, 58	0660076F01	100k ±1%

R59	0660076E91	56k ±1%
R60	0660076F01	100k ±1%
R61, 62	0660076A85	33k
R63	0660076A89	47k
R64, 65	0660075L53	1.5k; 3/4W
R66	0660076A81	22k
R67	0660076B01	100k
R68	0660076B25	1 Meg
R71	0660076B15	390k
R72	0660076E95	82k ±1%
R73	0660076A01	10
R74	0660076A73	10k
RV1	0605220M01	VARIATOR, 35V
T1	2502419J01 or 2505491R01	TRANSFORMER, Power: for NTN4633C for NTN4634B and NTN4921B
U1	5184320A80	CIRCUIT MODULE: See Note Quad. Operational Amplifier Quad. Comparator Voltage Regulator, 12V
U2, 3	5184320A51	
U4	5105469E49	
VR1	4883461E12	DIODE, Zener: 27V 6.2V 16V
VR2	4805249R04	
VR3	4805249R14	
W1	0102712J12 or 3005526R01 or 0105950P79	CABLE ASSEMBLY: 3-conductor; includes AC cord, Plug P1, and red crimp lug (NTN4633C) 2-conductor; includes AC cord and Plug P1 (NTN4634B) 3-conductor; includes AC cord, Plug P1, and red crimp lug (NTN4921B)

**CIRCUIT BOARD DETAIL AND
ELECTRICAL PARTS LIST**



63D81108C48-A



TORQUE CHART

ITEM NO.	SCREW SIZE	TORQUE IN INCH POUNDS
6	8-32 x 3/8"	10
7	8-32 x 3/8"	30
9	6-32 x 3/8"	8
21	4-40 x 3/8"	5
26	4-40 x 3/16"	5

TEPF-20974-O

Exploded View Parts List, Rapid Charger TPLF-3454-B
 NTN4633C (117Vac)
 NTN4634B (220Vac)
 NTN4921B (240Vac)

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0105957M08	ASSEMBLY, Top Housing; includes: Housing, Escutcheon, and Fastener Clip
2	0102712J16	ASSEMBLY, Circuit Board with LED's
3	See Note	TRANSFORMER (T1)
4	0102712J13	ASSEMBLY, Base Plate; includes: Brackets, Single Lug Terminal Strip, Base Plate, and 4 Rubber Bumpers
5	5405228Q02	LABEL, Caution
6	0300138574	SCREW, Phillips Hd.; 8-32 x 3/8" (5 req'd)
7	0300131632	SCREW, Tapping; Slotted Hd.; 8-32 x 3/8" (2 req'd)
8	1305130Q01	GRILL, Base
9	0300138035	SCREW, Phillips Hd.; 6-32 x 3/8"
10	0905724C02	RECEPTACLE, Fuse Holder
11	See Note	FUSE (F1)
12	4205723C01	RETAINER, Cable
13	4305233D01	SPACER
14	See Note	ASSEMBLY, Cable (P1, W1)
15	3305360N01	LABEL, Cable
16	0200007005	NUT, Hex; 6-32 x 1/4" x 3/32"
17	3805637M02	CAP GUARD, Fuse Holder
18	3805637M01	CAP GUARD, Terminal
19	3305334N22	LABEL, Info
20	0105957M07	ASSEMBLY, Partition; includes: Thermal Partition, Charging Contacts, Fastener Clip, and Capacitors C33, C34
21	0300120938	SCREW, Phillips Hd.; 4-40 x 5/16"
22	4305552N01	BUSHING, Nylon
23	1405154N01	INSULATOR, Mica
24	0400007667	LOCKWASHER, #4 External Tooth
25	0200120486	NUT, Hex; 4-40 x 1/4" x 3/32"
26	0300120938	SCREW, Phillips Hd.; 4-40 x 5/16"
27	0705567P01	HOLDER, LED
28	4210217A26	TIE WRAP
29	1305412R01	GRILL, Thermal
30	3305455U01	LABEL, Pocket

NOTE: Refer to Electrical Parts List for part number and description.