VC
260

STB

Service Textbook

Electric 96 Mower

STB-223M
1975

SERVICE SUPERIORITY

To those service technicians dedicated to superior service . . .

This book contains the latest in factory service information. The material has been written and illustrated through the efforts of the Factory Service Training Department and various Engineering personnel.

The total value of this book will be determined by the amount of knowledge you gain from it and how you use it as a reference in the future. No matter how great the book or who the author is, if the book is not read, the contents will be of absolutely no value. Because you are interested in learning, there is no doubt that this book will be of great value to you.

This book is designed as a study book, reference book, and notebook. Use it for all three purposes. Take it home and, in your leisure hours, read it again. Refer to it time and again.

You are a vital part of a technical group representing John Deere service throughout the country. The modern, complex equipment of our time requires professional attention which only you can render. The role you play that provides **superior service** to the customer is serving many purposes.

Consider how you affect prospective customers who buy new machines — Consider how you affect repeat purchases by the old, reliable, satisfied customer — Consider how you can be the direct cause of a customer going elsewhere to purchase competitive machines — Consider the fact that few people have the keen technical ability to perform service tasks which you are qualified to do — Consider the role you play on-the-scene to develop your country and a major part of the rest of the world.

This is your book, intended to provide you with a little more knowledge to meet your job challenge with greater ease. *Remember — you are a professional person rendering not just service but* **superior service** *— John Deere Service!!!*

THIS BOOK BELONGS TO:

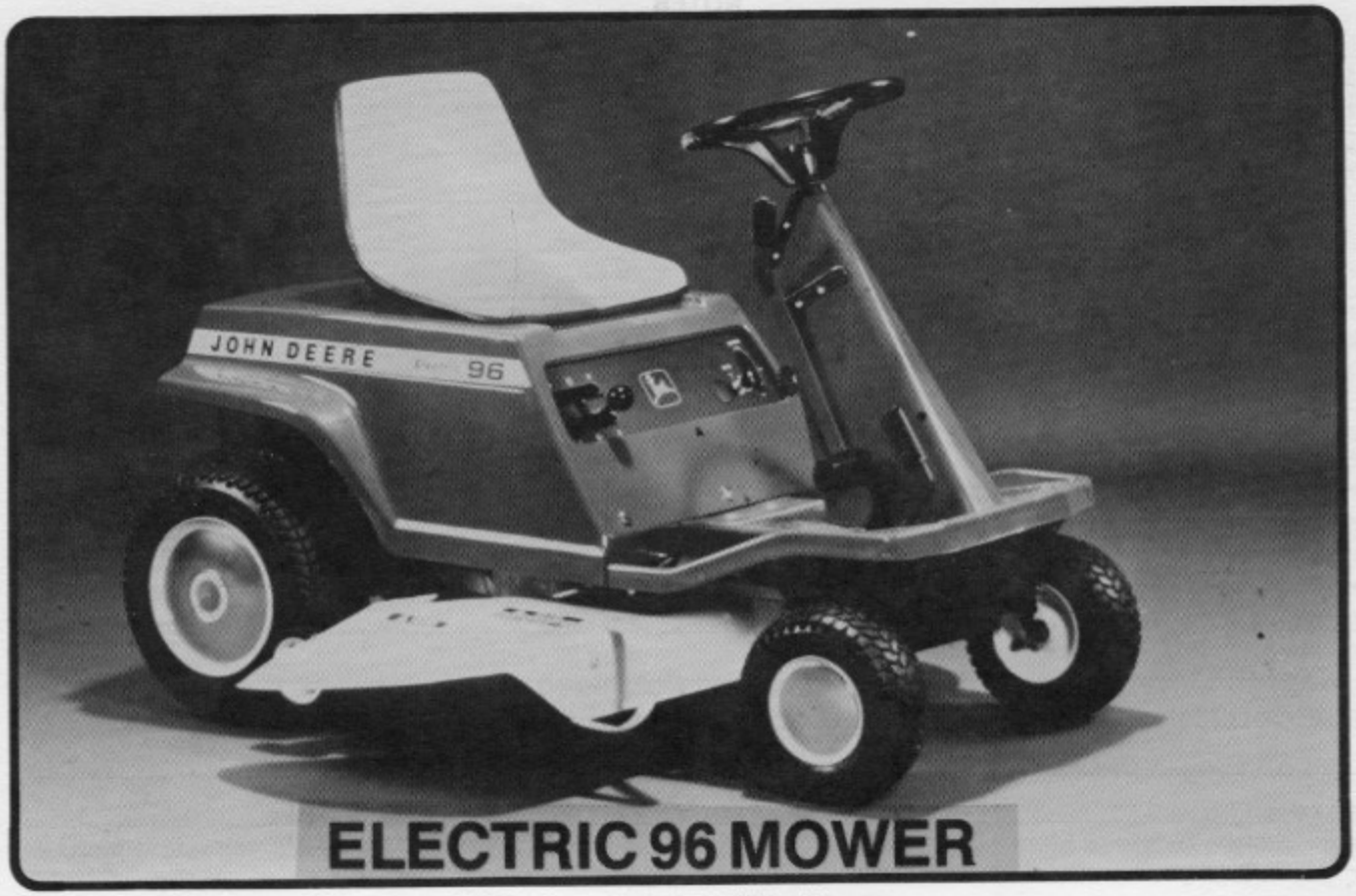
Name _____

Address _____

_____

CONTENTS

This text covers the adjustments and testing for the Model 96 Mower. In addition, use earlier text STB-150M on the 90 Mower as a supplement to cover the basic systems which are common to both electric mowers.



SLIDE NO. 1 — Electric 96 Riding Mower

INTRODUCTION

The **Electric 96 Mower** is new to the John Deere Grounds Care line for 1975. The cutting width is 34 inches.

SERIAL NUMBERS

Model	Shipping Bundle	Ordering Code	Beginning Serial No.
96 (Complete)	BM15861	2151M	A096D030001M
96 (less Mower)	BM15862	2152M	A096D030001M

NOTES

DIMENSIONS AND WEIGHT

Wheelbase ..... 40 in.
Tread
  Front ..... 22 in.
  Rear ..... 25 in.
Height ..... 37 in.
Length ..... 52½ in.
Width (incl. mower) ..... 43 in.
Weight (approx. curb weight) ..... 475 lbs.
Tires (pneumatic)
  Front ..... 11 x 4.00
  Rear ..... 16 x 16.50
  Tire Pressure
    Front — 11 x 4.00 - 5 ..... 8 psi
    Rear — 16 x 6.50 - 8 ..... 6 psi

BATTERIES

Number used 3
Weight (each, dry) ..... 34½ lbs.
Voltage ..... 12 volts
Type ..... John Deere 55 ampere-hour AM35175 motive-type, lead-acid batteries specifically designed to give long cycle life and withstand deep charging.
Electrical protection ..... 100 AMP metal fuse

CHARGER (Ferro Resonant)

Charge capacity ..... 100% replacement, 6 to 12 hours; 80% replacement, 5 hours
Line voltage ... 100/125 volt AC household current
Temperature range recharge capability ..... 0 to 100° F.
Charger protection ..... AC and DC fuses

TRACTION MOWER

Type ..... Permanent-magnet, 2-pole
Voltage ..... 36 volts
Speed ..... 3600 rpm
Continuous horsepower ..... 1.25 H.P.
Peak horsepower ..... 3.40 H.P.
Protection ..... thermostat
Amperage draw ..... 7.5 amps. max.
(Neutral — clutch engaged)

MOWER MOTORS

Number 2
Type ..... Permanent-magnet, 2-pole
Voltage ..... 36 volts DC
Speed ..... 3200 rpm
Continuous horsepower ..... 1.05 H.P.
Peak horsepower ..... 2.80 H.P.
Protection ..... thermostats
Amperage draw ..... 15 amps. max.
(no load — with mower blades)

TRANSAXLE

Capabilities ..... 3 forward speeds, 1 reverse speed
Maximum ground speeds ..... 1st gear — 1.4 mph
2nd gear — 2.8 mph
3rd gear — 4.2 mph
Reverse — 2.1 mph
Transaxle lubricant ..... SAE 90 (AM30200) (or equivalent)
Transaxle capacity ..... 24 oz.
Clutch ..... V-belt from traction motor to transaxle

BRAKES

Type ..... disk on transaxle
Lock ..... hand operated parking lock

STEERING

Type ..... gear reduction
Ratio 4:1

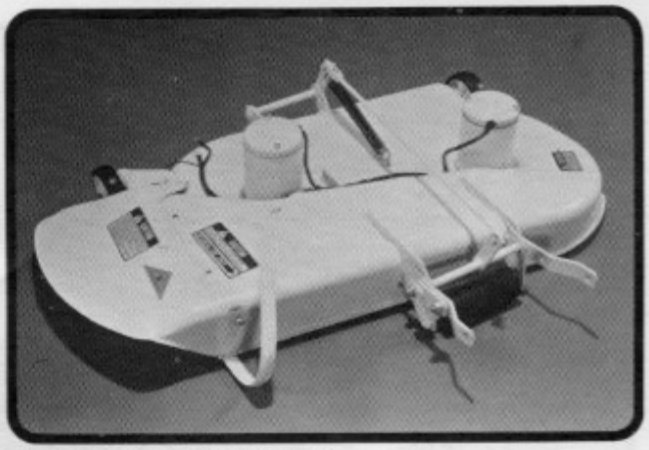
MOWER

Width of cut ..... 34 in.
Lift ..... pedestal-mounted, lever-spring assisted
Height of cut ..... 1 to 4 in. above ground
Blades ..... 2, direct-motor driven

NOTES

34" MOWER WITH MOTORS (BM15715)

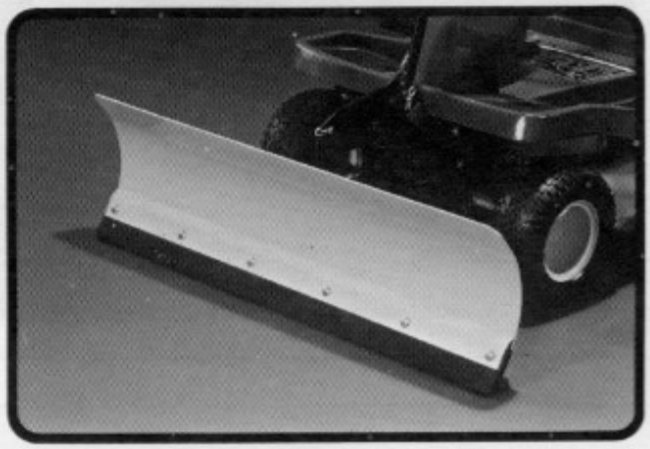
Available for Electric 96 shipped without mower.



SLIDE NO. 2 — 34" Mower Deck

38 SNOW BLADE (BM15759)

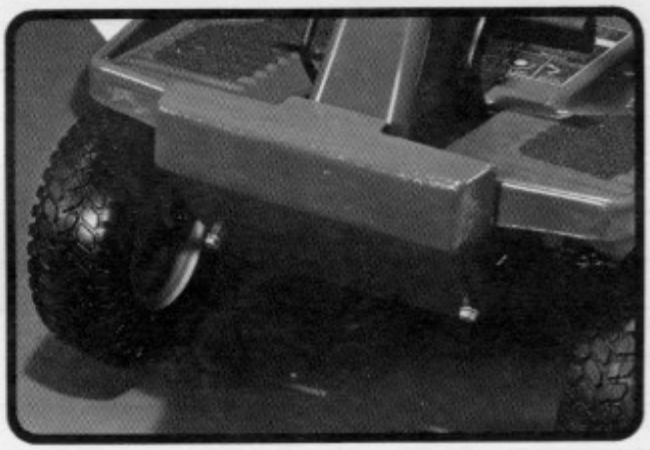
The 38 blade is available for light snow removal.



SLIDE NO. 3 — 38" Snow Blade

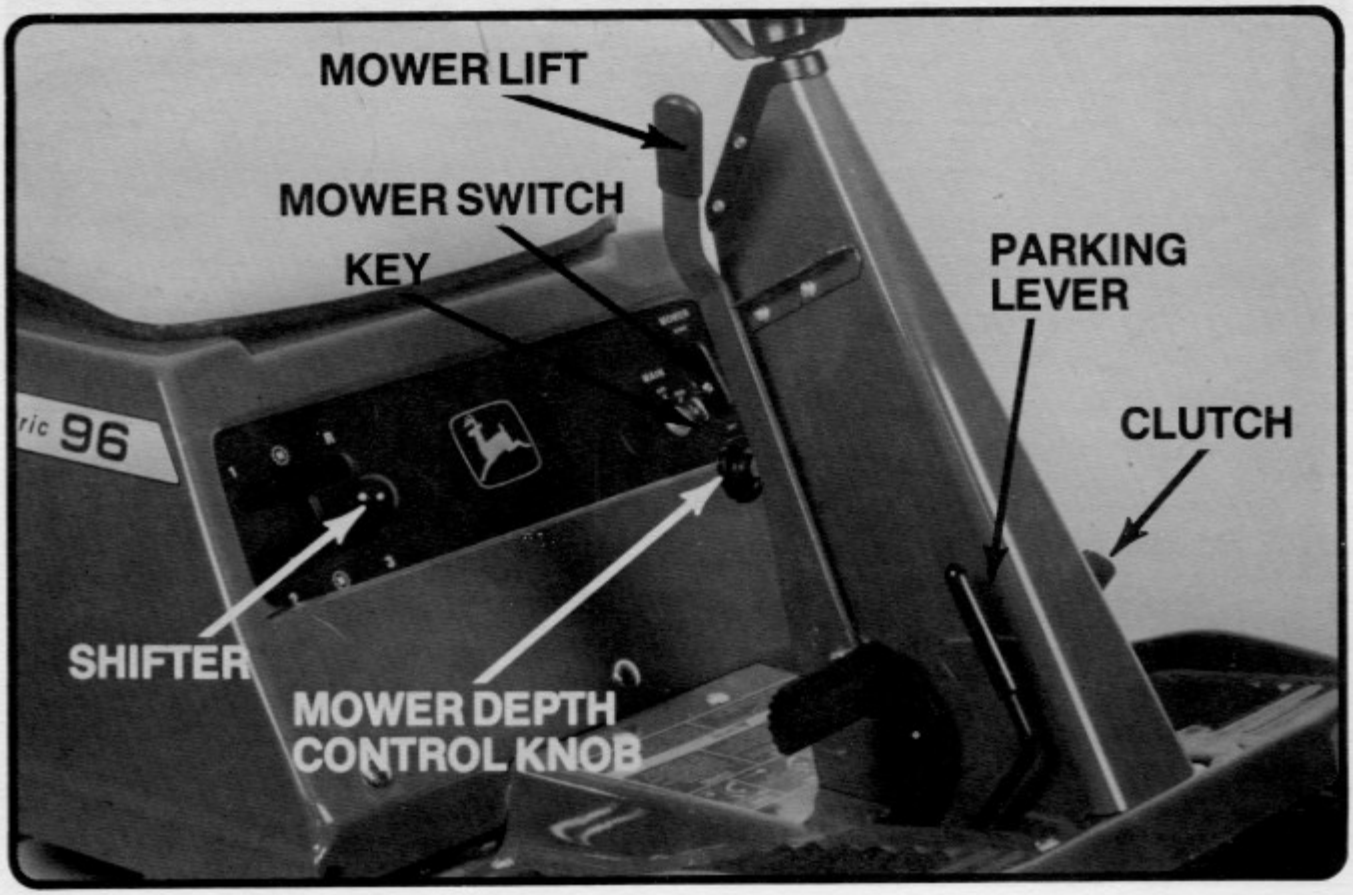
FRONT-END WEIGHT KIT (AM36030)

If needed, a 45 pound front-end weight is available.



SLIDE NO. 4 — Front-end Weight

NOTES



SLIDE NO. 5 — Rider Controls

SHIFT LEVER

The shift quadrant has a horizontal "H" pattern with 3 forward speeds and 1 reverse.

MOWER LIFT LEVER

The mower height can be pre-set at height desired. The height is regulated by the mower depth control knob.

PARKING BRAKE

The parking brake is engaged by depressing the brake pedal and moving the parking lever forward.

OPERATION

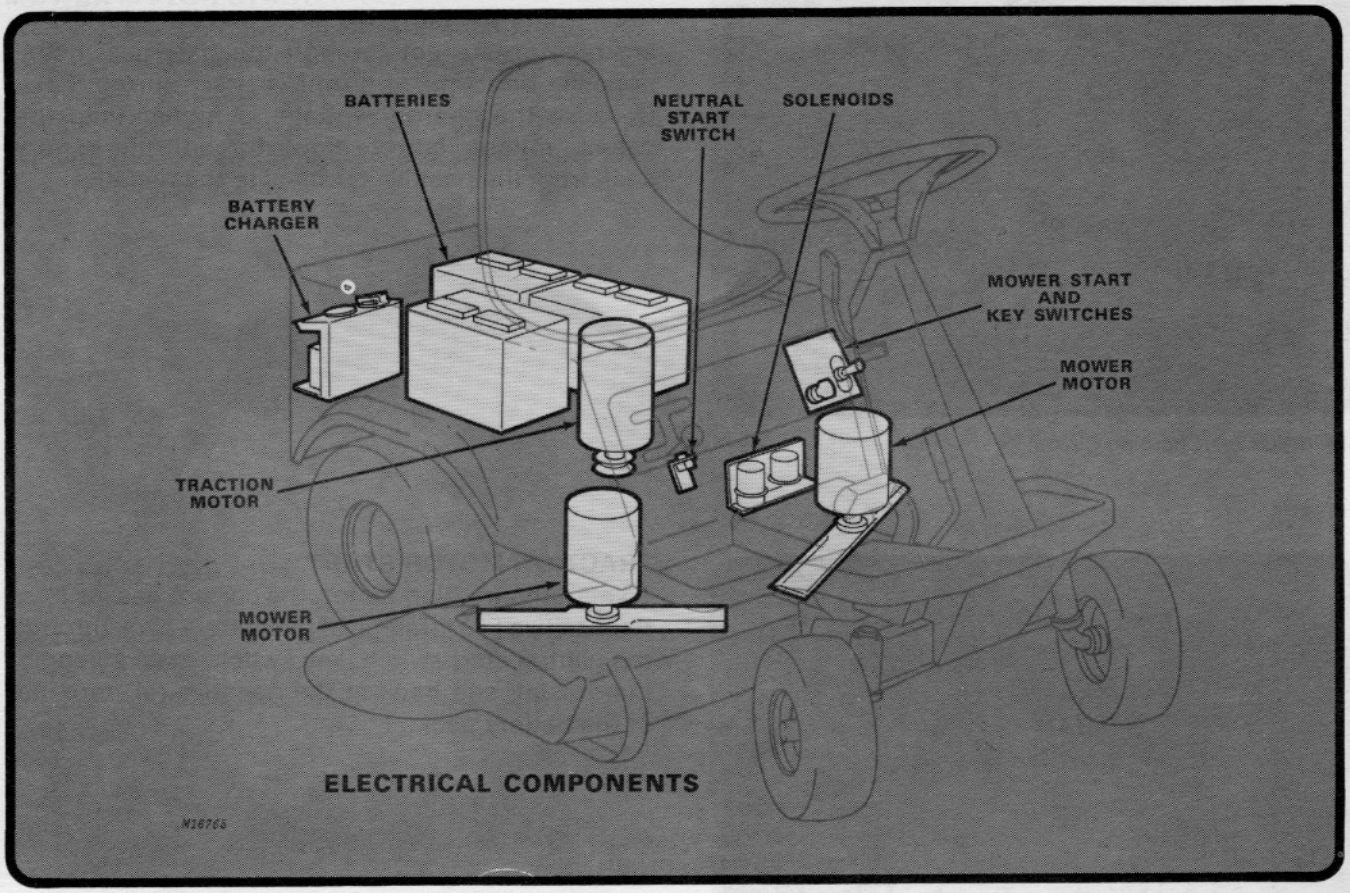
STARTING TRACTION MOTOR

To start traction motor, shift the transaxle to neutral and press down on the shift lever to activate the neutral start switch. Turn the main key switch.

STARTING MOWER MOTOR

Mower motor can only be engaged while the traction motor is running. To start, raise mower toggle to "start" position. Release switch after mower motors are running.

NOTES



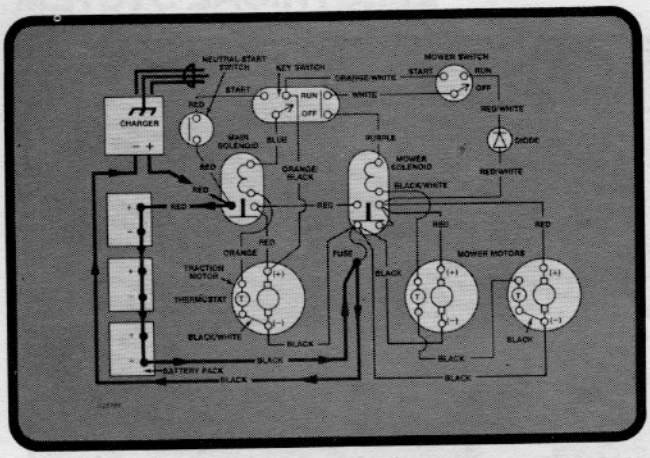
SLIDE NO. 6 — Electrical Components

GENERAL INFORMATION

The electrical system of the Electric 96 Mower uses two 36-volt DC motors for mower blades and a 36-volt DC traction motor. Permanent magnet motors are combined with magnetic solenoid switches to provide maximum power output with minimum current usage. All motors are protected by thermostats.

Power for the motors is supplied by three 12-volt, deep-cycle, motive-type lead acid batteries connected in series. These batteries are designed to provide an acceptable reserve of electrical power during the operational time period.

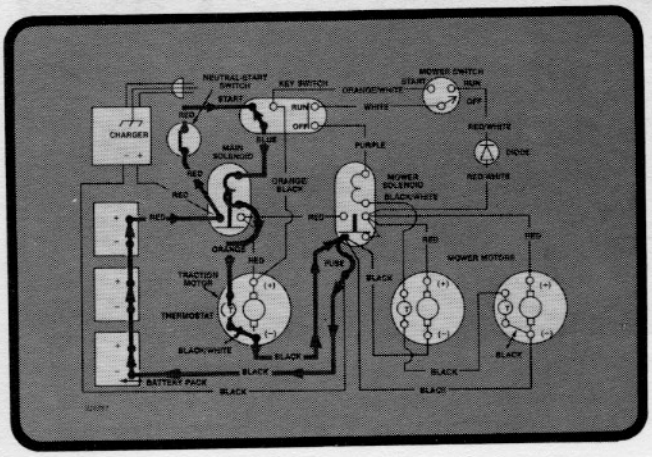
A ferro resonant battery charger is used for controlled recharging of the battery pack. Battery charging is automatic and self-controlled after initial setting of the timer control knob.



SLIDE NO. 7 — Charging Circuit

CHARGING CIRCUIT

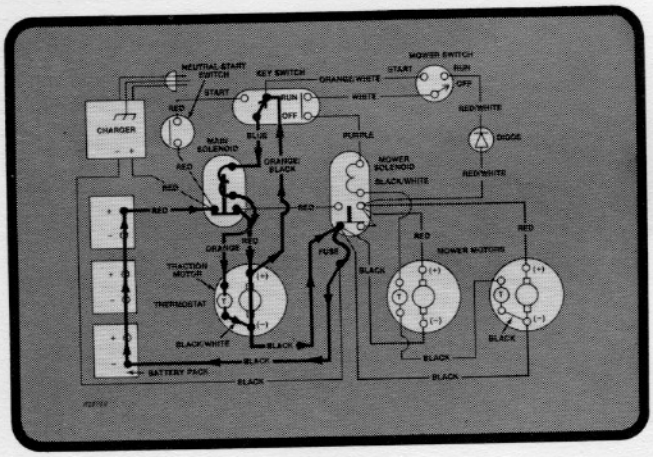
Recharging the batteries is accomplished by forcing electric current through the batteries in the opposite direction of normal battery current flow. Because the charger voltage is higher than the battery voltage, current flows through the battery pack from the positive terminal to the negative.



SLIDE NO. 8 — Traction Motor Start

TRACTION MOTOR START

To start the traction motor, the current passes from the positive (+) terminal of the battery pack through the neutral start switch, key switch, main solenoid, thermostat, and back to the negative (−) terminal of the battery pack.



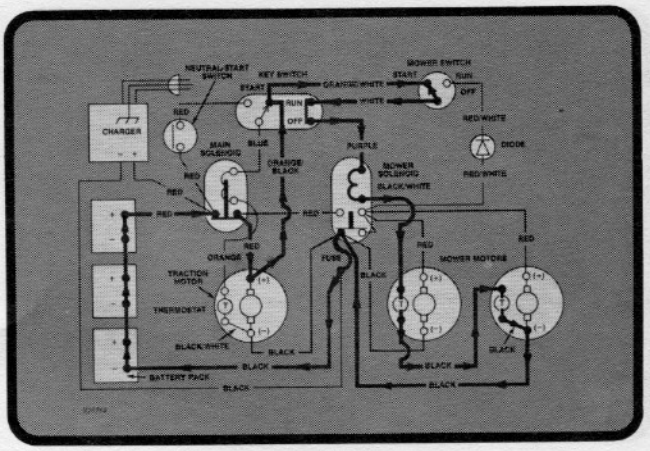
SLIDE NO. 9 — Traction Motor Run

TRACTION MOTOR RUN

Once the main solenoid is engaged, current will flow from the battery pack through the traction motor. The neutral start circuit is also dropped once the solenoid engages.

MOWER MOTOR START

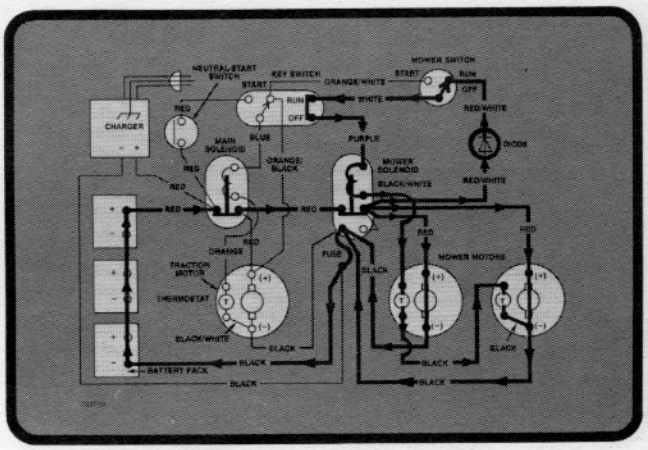
After the traction motor has been started, the mower motors may be energized. For clarity, the traction motor circuit has been omitted from mower start circuit. Current flows from the main solenoid through the key switch and mower switch to energize the mower solenoid.



SLIDE NO. 10 — Mower Motor Start

MOWER MOTOR RUN

The mower solenoid completes the circuit from the main solenoid through the mower motors back to the batteries. The solenoid is held in the closed position by current shunted from the mower solenoid itself.



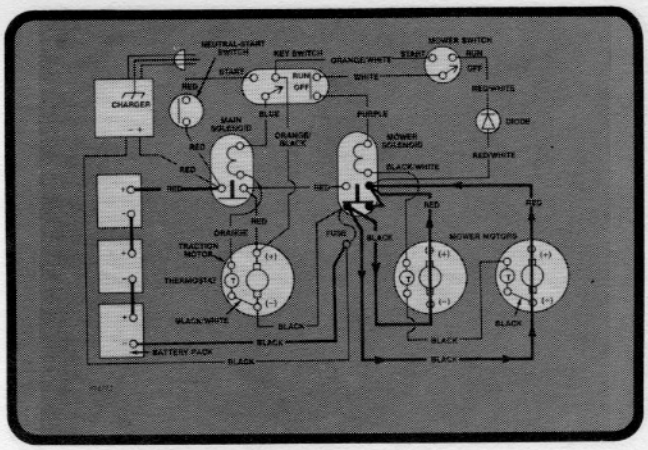
SLIDE NO. 11 — Mower Motor Run

MOWER MOTOR STOP

Turning the key to the "off" position cuts current flow to the hold-in windings of the main and mower solenoids. This causes both solenoids to open and shut down the system.

To stop the mower blades quickly, the mower solenoid is designed to route electrical energy through a stop resistor.

This reverses the current flow through the mower motor armatures, thereby applying a magnetic breaking action to the armature and blades.



SLIDE NO. 12 — Mower Motor Stop

DIAGNOSING AND TESTING

BATTERY PACK VOLTAGE

Connect a voltmeter to the positive (+) and negative (−) posts of the battery pack. Meter should show a nominal 36 volts DC.

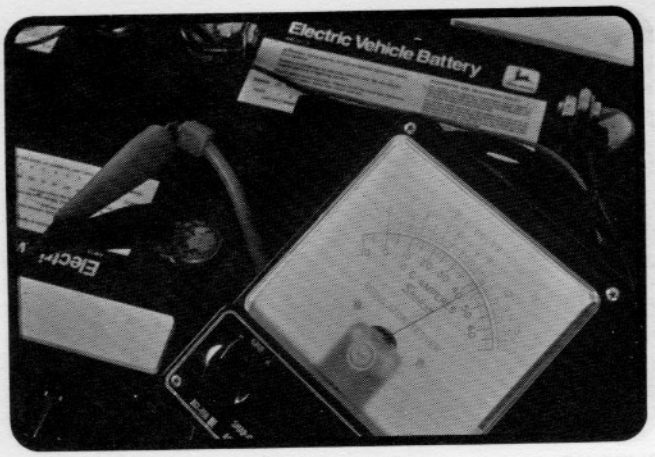
SLIDE NO. 13 — Battery Package Voltage

AMPERAGE DRAW TESTS

Connect an ammeter between the positive cable and the battery pack. Check the traction motor with the transmission in neutral, clutch engaged.

Maximum draw is 7.5 amps.

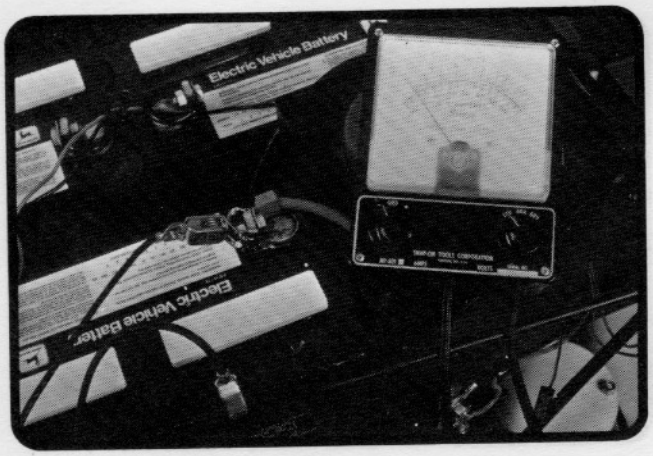
Check the mower motors on a concrete surface. Blades should be installed. Maximum current draw is 15 amps.



SLIDE NO. 14 — Amperage Draw Test

HOT FRAME TEST

Connect voltmeter to the positive terminal and the mower frame. Voltage should read "0". If a reading is obtained, look for a short or ground in the system. Note electrolyte spillage can also cause a reading. Be sure compartment and batteries are clean.



SLIDE NO. 15 — Hot Frame Test

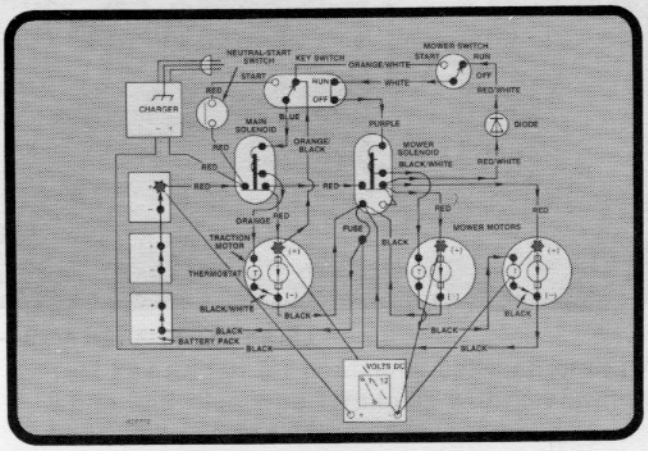
VOLTAGE DROP TESTS

The purpose of this check is to isolate excess resistance (voltage drop) in the system. If excess voltage is found, check all terminals back to the battery with the meter to isolate the resistance.

NOTE: Keep feet and hands clear of the mower blades when conducting these tests.

POSITIVE VOLTAGE DROP TEST

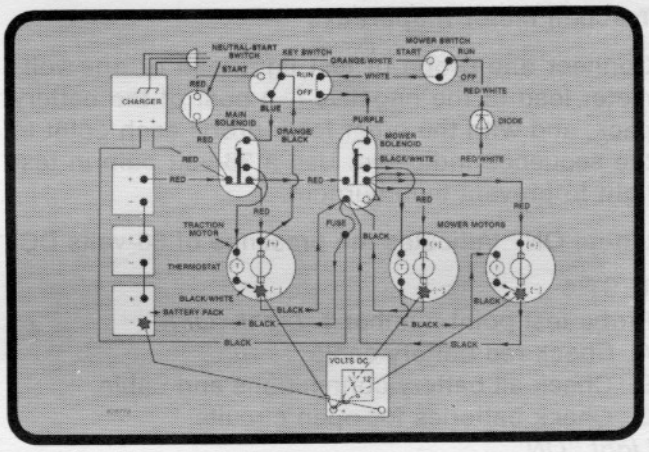
Connect positive lead from voltmeter to positive post of battery pack. Connect negative lead to positive terminal of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.



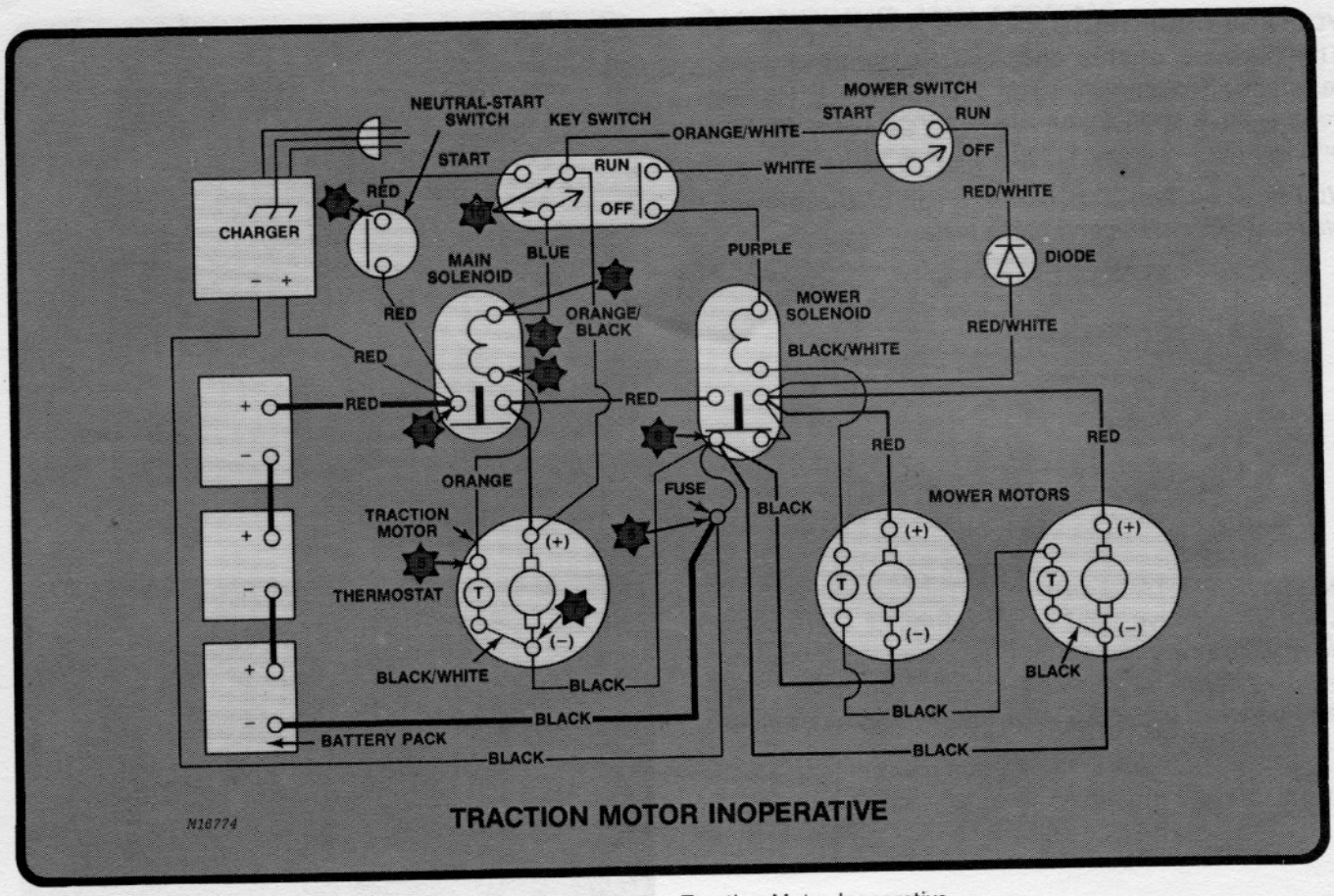
SLIDE NO. 16 — Positive Voltage Drop

NEGATIVE VOLTAGE DROP TEST

Connect negative lead from voltmeter to negative post of battery pack, and positive lead to the negative terminal of each motor. Voltmeter must read between 0 and 0.5 volts with all motors running.



SLIDE NO. 17 — Negative Voltage Drop



SLIDE NO. 18 — Test Points — Traction Motor Inoperative

CIRCUIT TESTS

Traction Motor Inoperative

Connect one probe of test light lead or one voltmeter lead to the negative (−) post of the battery pack, and with the other lead, probe each point in the sequence indicated. Use a 36-volt bulb in test light to prevent bulb burnout.

Light "ON" indicates the presence of 36-volts DC.

TEST 1
Probe test point number 1. *Light "OFF"*
A. Check red battery cable.
B. Check all battery connections and cable.
C. Check batteries for open circuits.
Light "ON"
A. Go to test 2.

TEST 2
Probe test point number 2. Light should come "ON" with shift lever held down in neutral. Light should go "OFF" with shift lever up in neutral. Go to test 3.

NOTE: If the above conditions are not present, test as follows:

A. Test red wire and connections from main solenoid to neutral-start switch.
B. Test neutral-start switch.
C. Test red wire from neutral-start switch to key switch.

TEST 3
Probe test point number 3. Light should come "ON" with shift lever held down in neutral and key switch in "START" position. Go to test 4.
Light "OFF"
A. Test key switch.
B. Test blue wire from key switch to solenoid.

TEST 4

Disconnect orange wire from main solenoid terminal. Probe solenoid terminal (4) with key switch in "START" position and shift lever held down in neutral.

A. Light "ON" verifies solenoid coil continuity. If light is "OFF," replace solenoid.
B. Light "ON". Proceed as follows: Reconnect orange wire to solenoid, hold shift lever down in neutral and activate key switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary.
C. If click is heard, go to test 5.

IMPORTANT: For tests 5 through 9, key switch must be "OFF". Change test light lead from negative (−) to positive (+) terminal of battery pack.

TEST 5

Probe test point number 5.

Light "OFF"

A. Test heavy black battery lead wire for ground.

Light "ON"

A. Go to test 6.

TEST 6

Probe test point number 6.

Light "OFF"

A. Check fuse.

Light "ON"

A. Go to test 7.

TEST 7

Probe test point number 7.

Light "OFF"

A. Test heavy black wire to motor.

Light "ON"

A. Go to test 8.

TEST 8

Probe test point number 8.

Light "OFF"

A. Test thermostat for open circuit.
B. Test thermostat wires and connections.

Light "ON"

A. Go to test 9.

TEST 9

Probe test point number 9.

Light "OFF"

A. Test orange wire and connections.

Light "ON"

A. End of circuitry test.

NOTE: If traction motor starts but will not continue to run, make test 10.

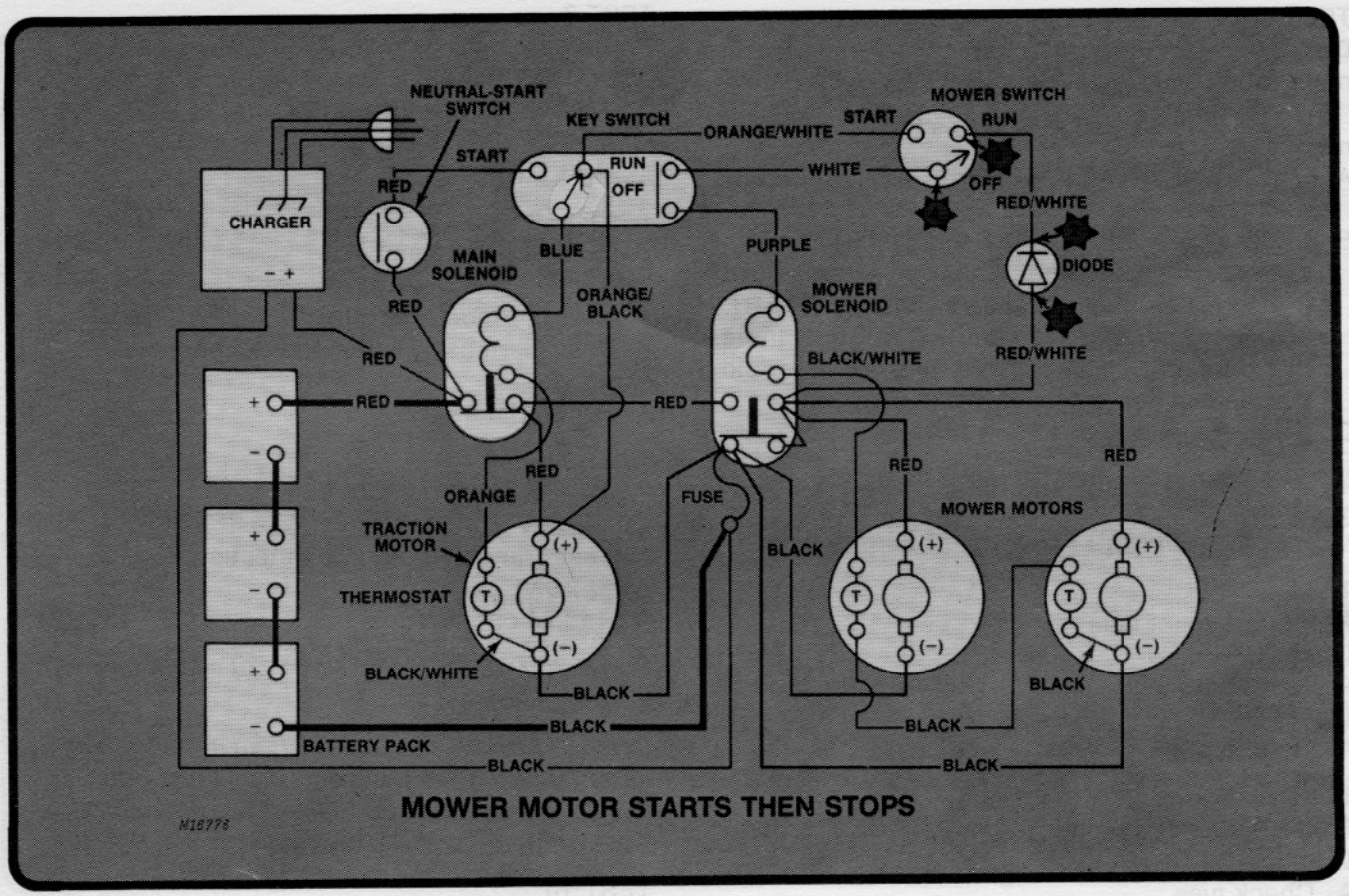
IMPORTANT: Change test lead to negative (−) terminal of battery pack and probe test point number 10 with shift lever held down in neutral and key switch in "START" position.

TEST 10

Light "OFF"

A. Test key switch for continuity between orange/white and blue wire terminals with key switch in "RUN" position.
B. Test orange/black wire.

NOTE: If motor still does not run, disassemble and test motor.



SLIDE NO. 19 — Test Points — Mower Motor Inoperative

MOWER MOTORS INOPERATIVE

Connect one probe of test light lead or one voltmeter lead to the negative (−) post on the battery pack, and with the other lead, probe each point in the sequence indicated.

NOTE: Traction motor must be operating for testing mower motors. Activate mower switch to "START" for test 1 through 5 only.

TEST 1
Probe test point number 1.
Light "OFF"
A. Test orange/white wire, orange/black wire, and heavy red wire.
Light "ON"
A. Go to test 2.

TEST 2
Probe test point number 2.
Light "OFF"
A. Test white wire and mower switch.
Light "ON"
A. Go to test 3.

TEST 3
Probe test point number 3.
Light "OFF"
A. Test key switch and replace if necessary.
Light "ON"
A. Go to test 4.

TEST 4
Probe test point number 4.
Light "OFF"
A. Test purple wire and connections.
Light "ON"
A. Go to test 5.

TEST 5
Disconnect black/white wire from mower solenoid terminal. Probe solenoid terminal 5.

A. Light "ON," verifies solenoid coil continuity. If light is "OFF", replace solenoid.
B. Light "ON". Proceed as follows: Reconnect black/white wire to solenoid and activate mower switch to "START" position. Listen for audible pull-in of solenoid. If it does not click, remove and test solenoid. Replace as necessary.
C. If click is heard, go to test 6.

NOTE: Change test light lead from negative (−) to positive (+) post of battery pack before proceeding with test 6. Stop traction motor.

TEST 6
Probe test point number 6.
Light "OFF"
A. Test black wire and motor harness coupler.
Light "ON"
A. Go to test 7.

TEST 7
Probe test point number 7.
Light "OFF"
A. Check thermostat in left-hand mower motor.
Light "ON"
A. Go to test 8.

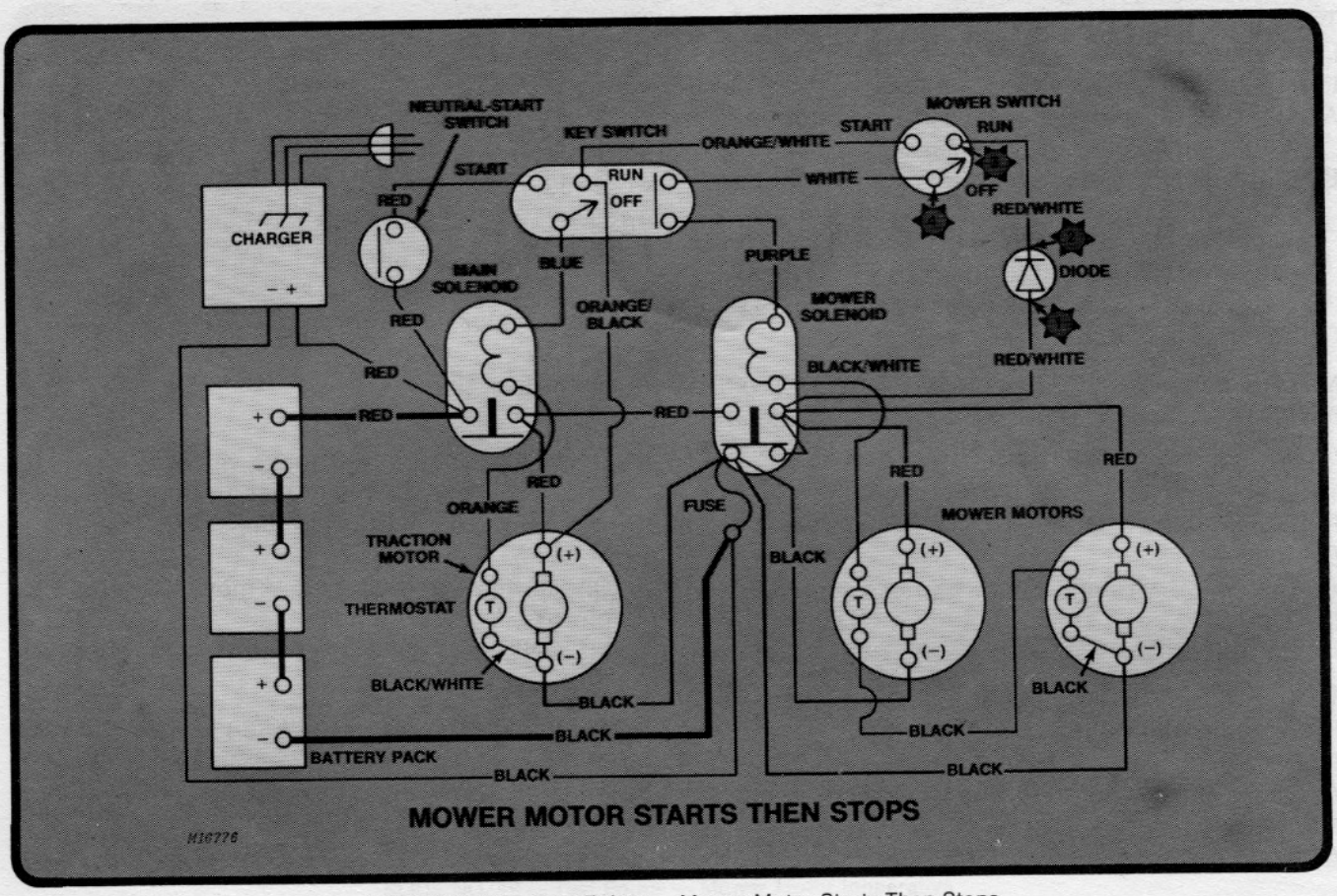
TEST 8
Probe test point number 8.
Light "OFF"
A. Check thermostat in right-hand mower motor.
Light "ON"
A. Go to test 9.

TEST 9
Probe test point number 9.
Light "OFF"
A. Check black/white wire.
Light "ON"
A. Go to test 10.

TEST 10
Start traction motor and move mower switch to "START" position. Connect test light leads across right-hand mower motor terminals 10.
Light "OFF"
A. Check heavy red wire from mower solenoid to motor.
Light "ON"
A. End of tests.

NOTE: If voltmeter test reveals 36-volts DC at motor terminals and motor will not operate, remove motor and test armature and brushes. Repair or replace components as necessary.

Repeat test No. 10 for the left-hand mower motor.



SLIDE NO. 20 — Test Points — Mower Motor Starts Then Stops

MOWER MOTOR STARTS, THEN STOPS

These tests may be performed with either a DC voltmeter or a probe test light.

NOTE: If mower motors start and will not continue to run, one of the following conditions exist:

1. *Diode is open*
2. *Mower switch is defective.*

NOTE: Start traction motor and move mower switch to "START" position. Connect test lead to negative (–) post of battery pack.

TEST 1
Probe test point number 1.
Light "OFF"
A. Test red/white wire from mower solenoid to diode.
Light "ON"
A. Go to test 2.

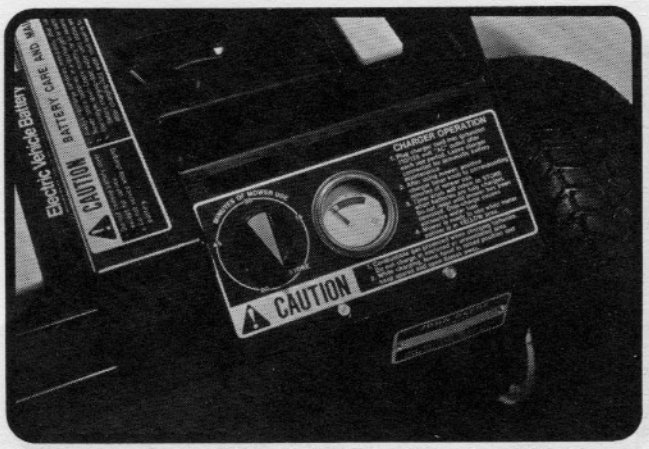
TEST 2
Probe test point number 2.
Light "OFF"
A. Replace diode.
Light "ON"
A. Go to test 3.

TEST 3
Probe test point number 3.
Light "OFF"
A. Test red/white wire from diode to mower switch.
Light "ON"
A. Go to test 4.

TEST 4
Probe test point number 4.
Light "OFF"
A. Test mower switch.
Light "ON"
A. End of test.

BATTERY CHARGER

The new ferro resonant battery charger is superior to the old reactance-limited unit because it will maintain a more constant voltage to the batteries when the power supply voltage varies. The charger has two charging rates. When the charger is plugged in, the storage circuit is supplying approximately .05 amps to maintain the batteries. A charging rate of 1.5-8 amps is used to charge the batteries.

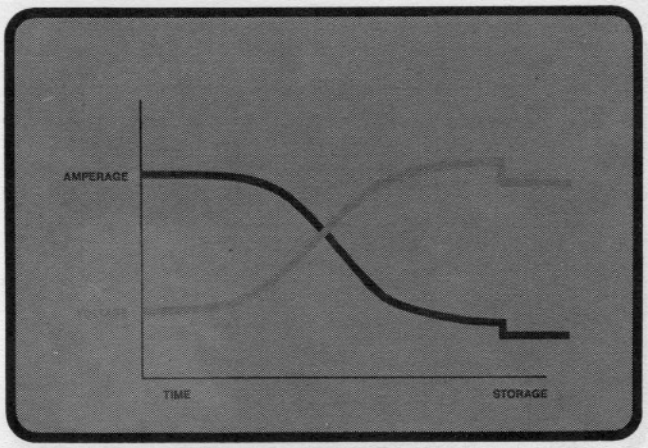


SLIDE NO. 21 — Battery Charger

PERFORMANCE CURVE

At the beginning of the battery charge, resistance is low. Low battery resistance causes high amperage and low voltage.

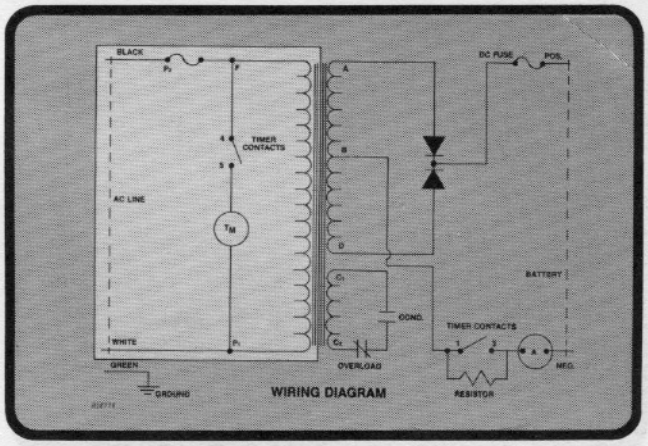
As the battery charges, resistance and voltage increase and amperage tapers off. Voltage will continue to rise and amperage drop until the charger switches to the "storage" position. The added resistance in the charger causes *both* voltage and amperage to drop. This constant charge maintains the batteries at peak charge.



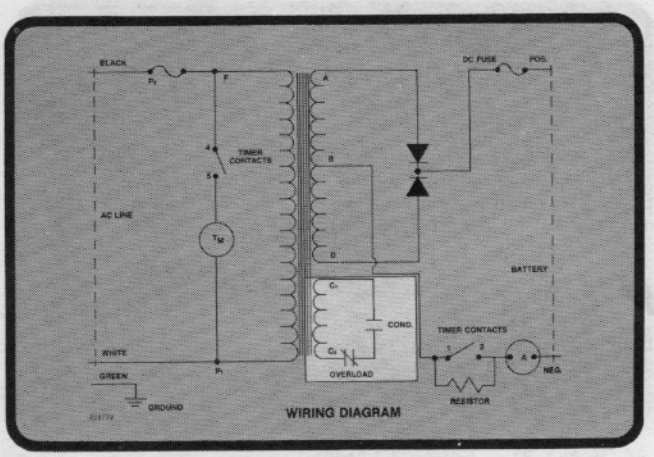
SLIDE NO. 22 — Performance Curve

AC COIL

When the charger is connected to a power source, alternating current flows through the fuse and coil windings. An alternating magnetic field is induced into the coil core. The timing motor operates when contacts 4 and 5 are closed.



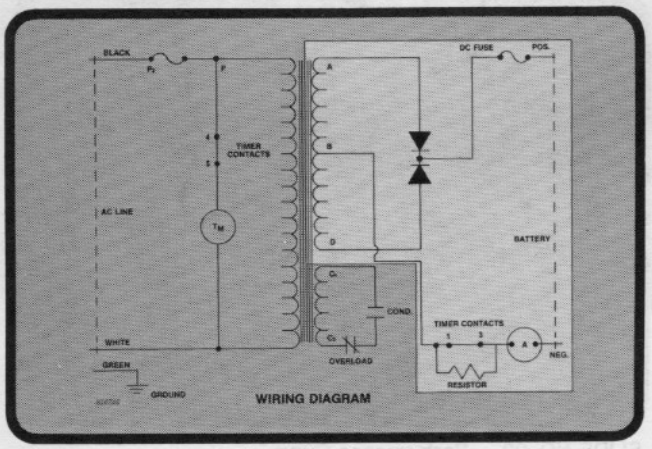
SLIDE NO. 23 — AC Coil



SLIDE NO. 24 — Resonant Circuit

FERRO RESONANT CIRCUIT

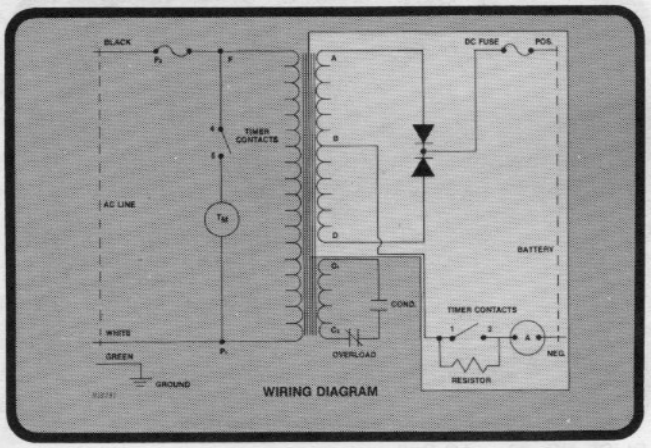
The ferro resonant circuit tunes the magnetic impulses in the coil core. This regulates the DC output under various power supply voltages.



SLIDE NO. 25 — Secondary Circuit — Charge

SECONDARY CIRCUIT-CHARGE

Two secondary coils convert the magnetic energy into an alternating voltage. This AC voltage is rectified by the diodes. When timer contacts 1 and 3 are closed, full charger output is directed to the batteries.



SLIDE NO. 26 — Secondary Circuit — Storage

SECONDARY CIRCUIT-STORAGE

With the timer in storage position, contacts 1 and 3 are open. All charger ouput must pass through the line resistor. The increased resistance reduces charger output to approximately .05 amps.

TROUBLE SHOOTING OF CHARGER

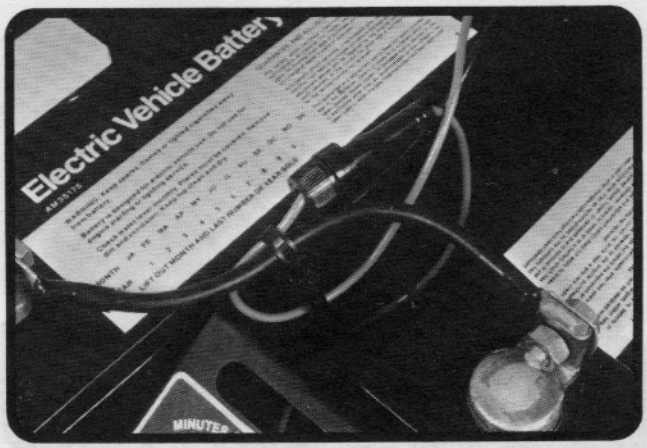
If charger fails to charge, check the following:
1. AC power source.
2. Physical charger damage.
3. Both the AC and DC fuses.
4. Timer terminals 1 and 3 for continuity.
5. All connections for cleanliness and tightness.
6. Ammeter continuity.
7. DC polarity — red lead is positive.

If charger fails to produce full charging current (approximately 8 amps), check the following:
1. All connections for cleanliness and tightness.
2. Transformer damage.
3. Defective capacitor.
4. Defective diodes.
5. Timer terminals 1 and 3 for continuity.

NOTE: Batteries that are close to fully charged will cause low charger output.

If timer fails to return to storage position, check the following:
1. AC power source.
2. AC fuse.
3. All charger terminals.

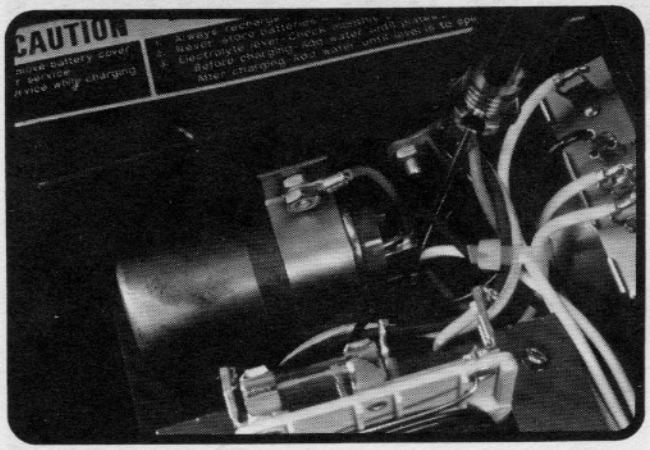
If battery fails to fully charge batteries overnight, check the following:
1. AC power source.
2. AC and DC fuses.
3. Batteries for defective cells.



SLIDE NO. 27 — DC Fuse

CHARGER COMPONENT CHECK-OUT

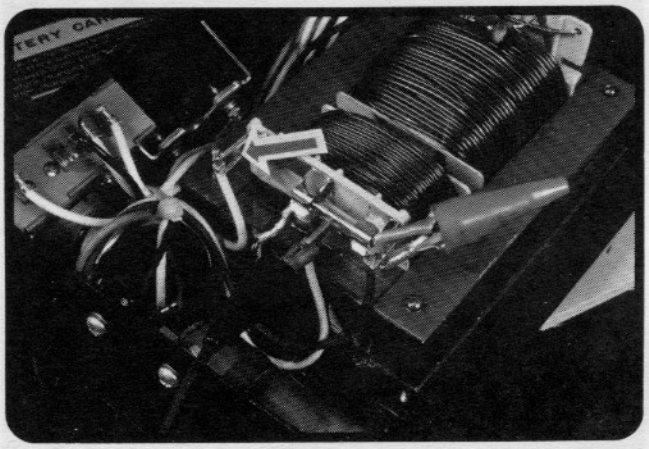
A volt ohmmeter is necessary to check charger components. Always disconnect both AC and DC power sources before using ohmmeter. Always disconnect AC power source and short capacitor before handling capacitor terminals. Check points are lettered or numbered for ease of service.



SLIDE NO. 28 — Short Capacitor

CHECKING TRANSFORMER

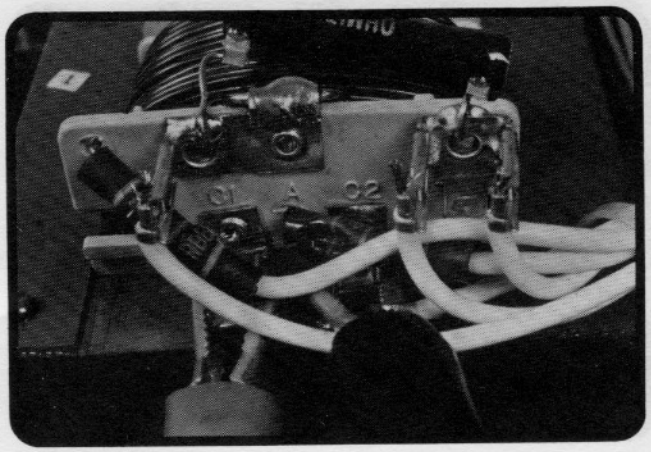
Disconnect AC power supply. Short capacitor terminals with an insulated screwdriver and disconnect one of the capacitor leads. Reconnect power supply. Turn timer to the "on" position.



SLIDE NO. 29 — Test Points, AC Fuse

Points P_1 to P_2 and P_1 to F should both indicate the AC power supply voltage. This shows the AC fuse is good.

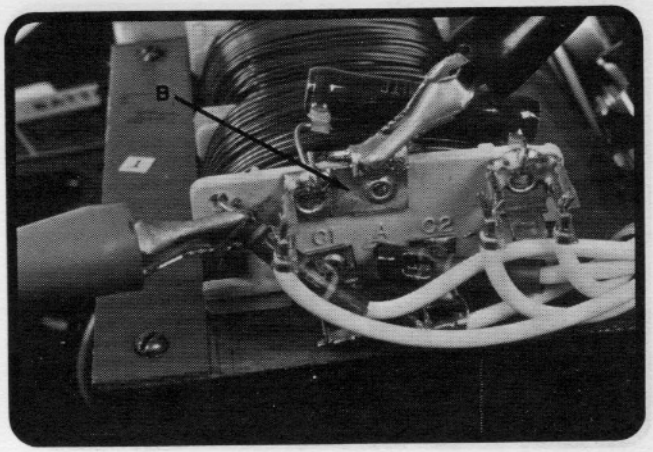
The resonant winding is checked from C_1 to C_2. The reading should be approximately 300 volts AC.



SLIDE NO. 30 — Test Points, Resonant Winding

The secondary windings are checked at points A to B and B to D. Both readings should be approximately 34 volts AC. Voltage from A to D should be approximately 68 volts AC.

A defective transformer will not give the proper voltage readings.

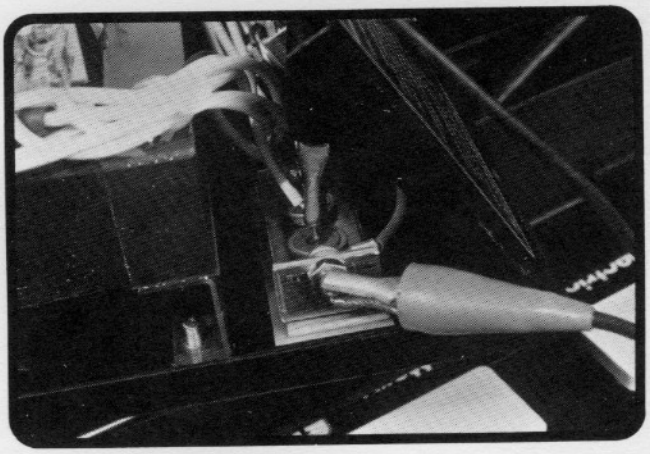


SLIDE NO. 31 — Test Points, Secondary Windings

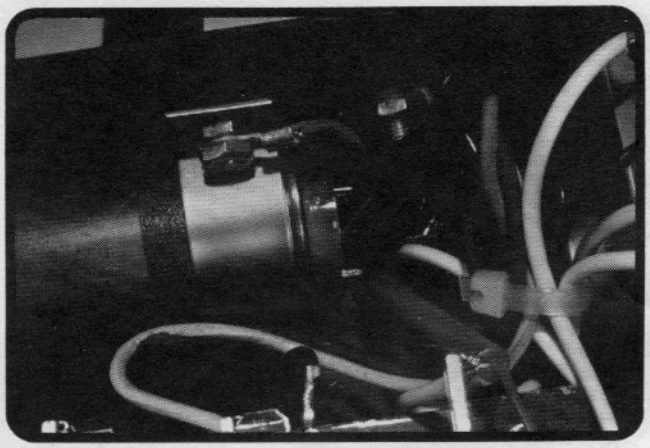
CHECKING DIODES

The diodes rectify the AC voltage by allowing current to flow in one direction only. Check with the AC power supply disconnected.

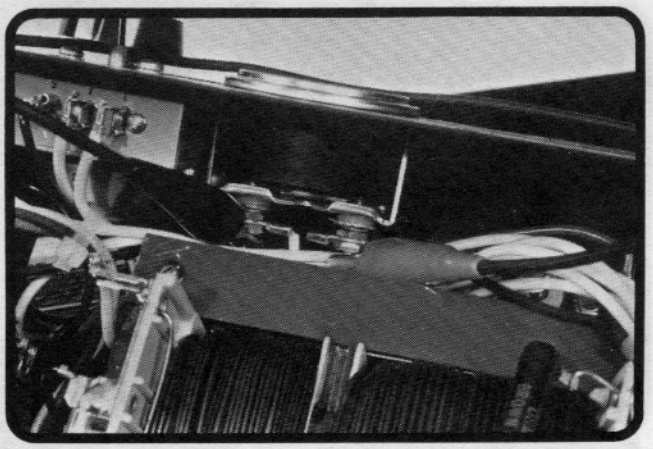
Place ohmmeter probes across the diode. Reverse probes. Meter should show continuity in one direction but not the other. Check remaining diode. Replace if defective.



SLIDE NO. 32 — Test Points, Diodes



SLIDE NO. 33 — Capacitor Test



SLIDE NO. 34 — Ammeter Continuity

CHECKING CAPACITOR

With the power disconnected, short the capacitor terminals. Use an ohmmeter to check the capacitor as follows:

1. Disconnect a capacitor lead.
2. With the meter set on the RX 10,000 scale, touch probes to the capacitor terminals. Meter should deflect and return to the original position. It may be necessary to reverse meter leads to obtain deflection.
3. If meter deflects but does not return, the capacitor is shorted and should be replaced.
4. If meter does not deflect in either position, the capacitor is open and should be replaced.

CHECKING AMMETER

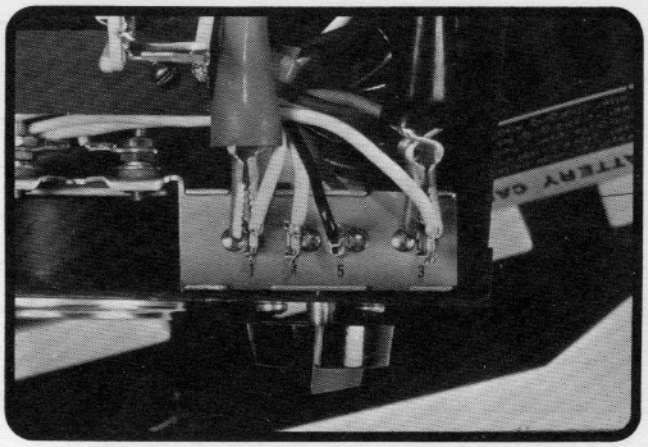
With the AC power supply disconnected, the ammeter should show continuity when checked with an ohmmeter.

CHECKING TIMER

The timer is checked by connecting the power source and turning charger on. After a one hour period, check timer. If timer has failed to move, it is defective.

SLIDE NO. 35 — Timer Check

Use an ohmmeter to check continuity through terminals 1 and 3 when the timer is in the "on" position. Disconnect power supply for this test.



SLIDE NO. 36 — Test Points Timer Continuity

NOTES

STB-223M (Mar. 75) Litho in U.S.A.