

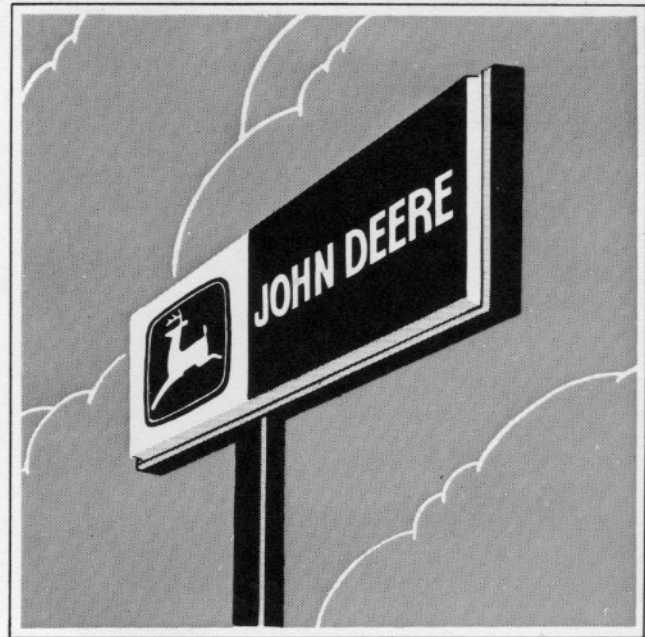


John Deere
Electric 90
Mower

Service Textbook
STB-150M
1972



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

GENERAL

Specifications	3
Identification	4
Controls	5
Battery Service	8

ELECTRICAL SYSTEM

Charger	13
Wiring Diagrams	14
Diagnosing Malfunctions	19
Testing Electrical Components	26

POWER TRAIN

Transaxle	33
Clutch	38
Brake	38
Mower Blades	39

SPECIFICATIONS



DIMENSIONS AND WEIGHT

Wheelbase	40 in.
Tread	
Front	22 in.
Rear	25 in.
Height	37 in.
Length	52.6 in.
Width (incl. mower)	43 in.
Weight (approx. curb weight)	475 lb.
Tires (pneumatic)	
Front	11x4.00
Rear	16x6.50

TIRE PRESSURES

Front	8 psi
Rear	6 psi

TRACTION MOTOR (36 DC VOLTS) 2400 rpm

Permanent Magnet—2 Pole

MOWER MOTORS (2) (36 DC VOLTS) ... 3200 rpm

Permanent Magnet—2 Pole

TRACTION MOTOR PROTECTION Thermal overload

MOWER MOTOR PROTECTION .. Circuit breakers

CHARGER PROTECTION Thermal overload

ELECTRICAL PROTECTION, 100 AMP .. Metal fuse

BATTERIES* (3) John Deere 55 amp-hr.,
12 volt (AM33995)

CHARGING TIME 100%—6 to 12 Hours

TRANSAXLE LUBRICANT SAE 90
AM30200 Lubricant

TRANSAXLE CAPACITY 24 oz.

TRANSAXLE 3 forward speeds;
1 reverse

MAXIMUM GROUND SPEEDS ... 1st gear, 1.8 mph
2nd gear, 3.4 mph
3rd gear, 5.0 mph
Reverse, 2.5 mph

CLUTCH ... V-belt from traction motor to transaxle

BRAKE Band type on transaxle,
pedal operated

BRAKE, PARKING Hand Lever Lock

STEERING

Type Gear reduction

Ratio 4:1

MOWER

Width of cut 34 in.

Lift ... Pedestal-mounted lever-spring assisted

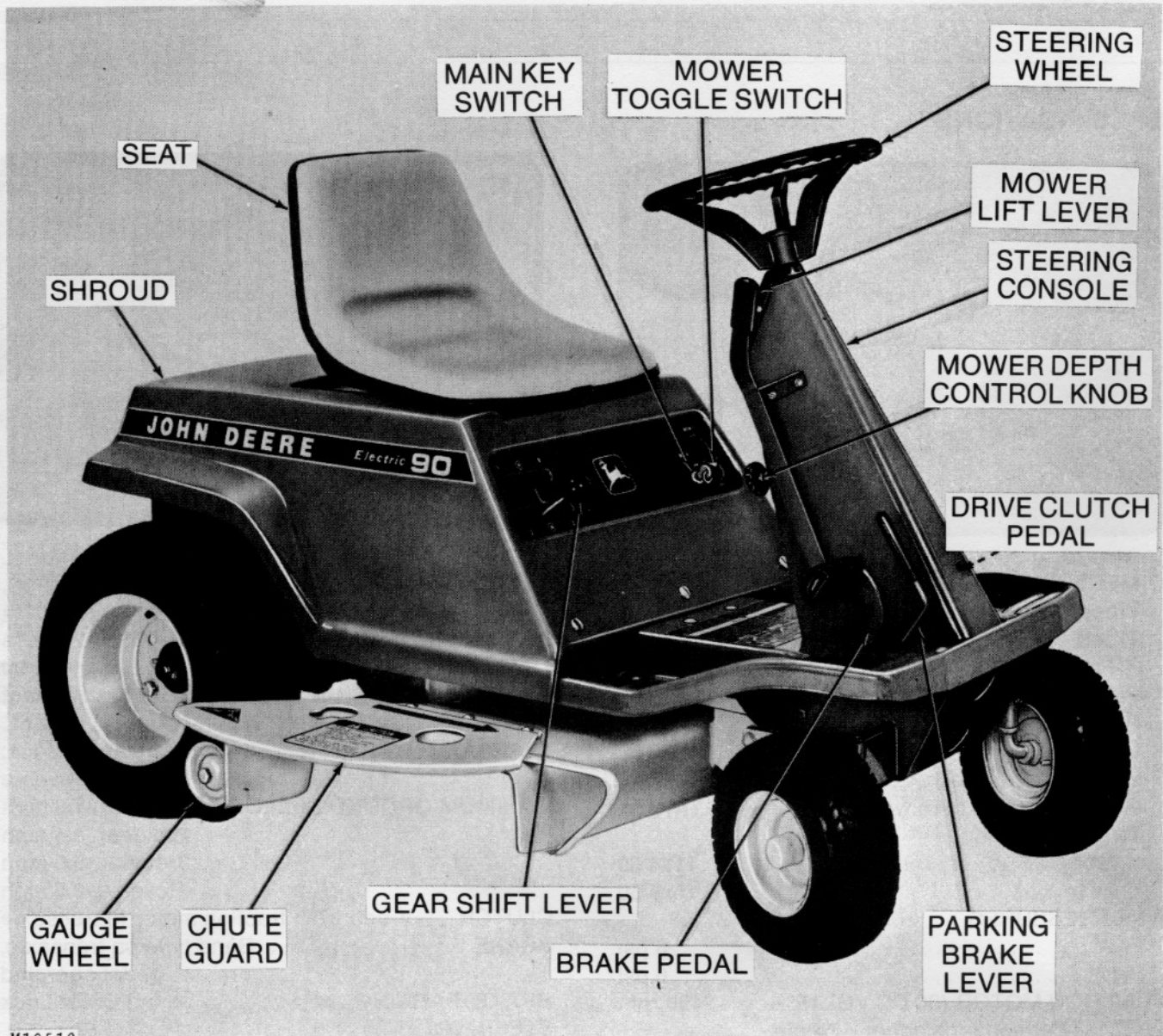
Height of cut 1 to 4 in.

Blades 2 (direct-driven)

*The batteries are specially designed and constructed for motive power and are not suitable for engine starting service. Likewise, starter service batteries are not suitable for motive power service.

(Specifications and design subject to change without notice.)

MOWER IDENTIFICATION



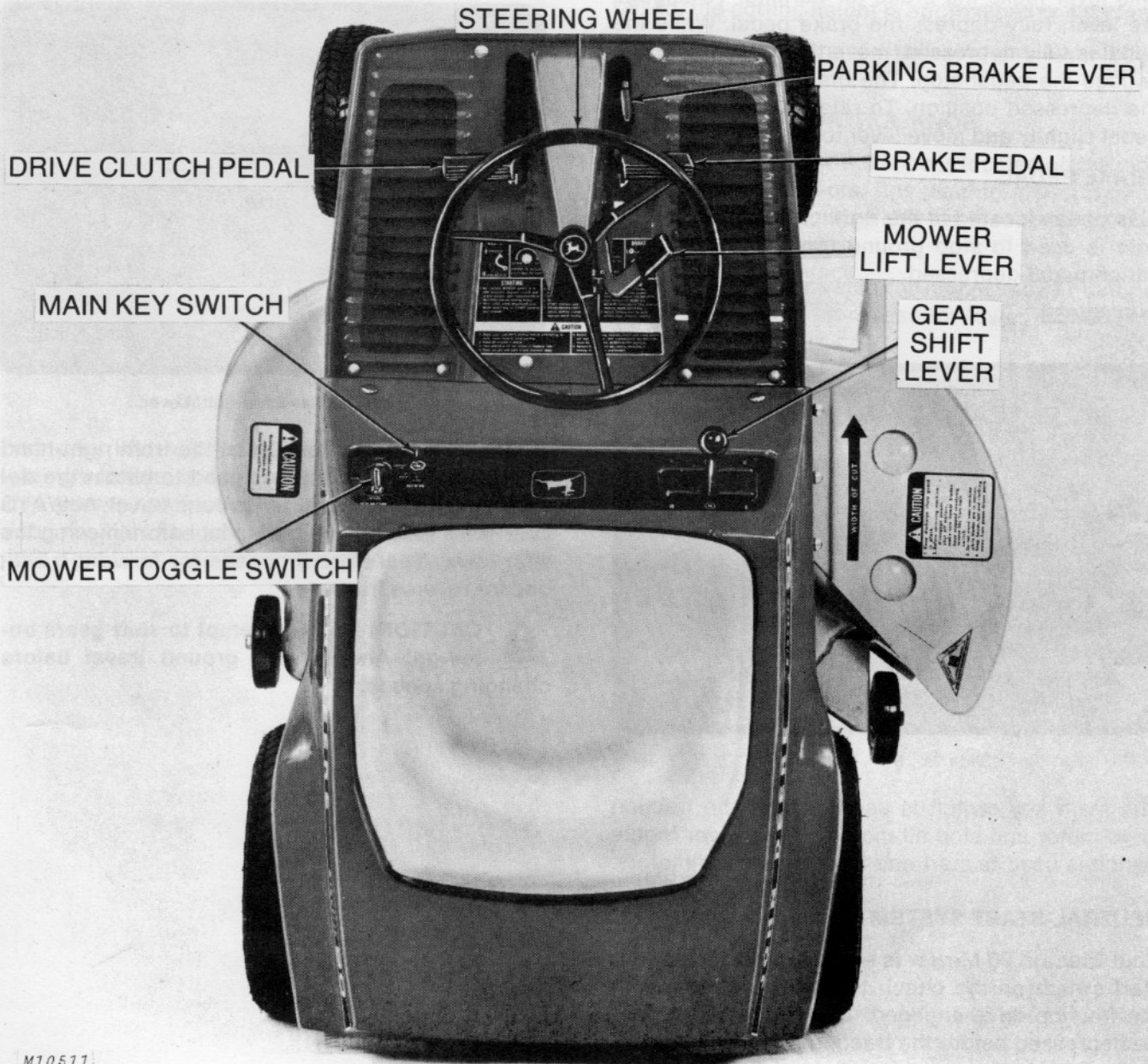
M10510

Slide No. 3 — John Deere Electric 90 Mower

The **Electric 90 Mower** is designed and manufactured to the traditionally high standards of John Deere. It has many quality features to bring you new mowing efficiency and convenience, as well as greater ease of operation and maintenance. If given proper care, your mower will give you long, efficient service.

The Electric 90 Mower has an electric traction drive motor to power the 3-speed transaxle. The mower is driven by two individual motors, one on each blade. Cutting width is 34 inches.

CONTROLS



M10511

Slide No. 4 — Controls

DRIVE CLUTCH PEDAL

This pedal, located at the left of the steering console, is used to engage or disengage the transaxle drive for ground travel. When depressed, the drive is disengaged. The drive clutch pedal must be de-

pressed when starting the traction motor used to drive the transaxle. Depressing the drive clutch pedal does not stop machine. The brake pedal must be depressed to stop ground travel.

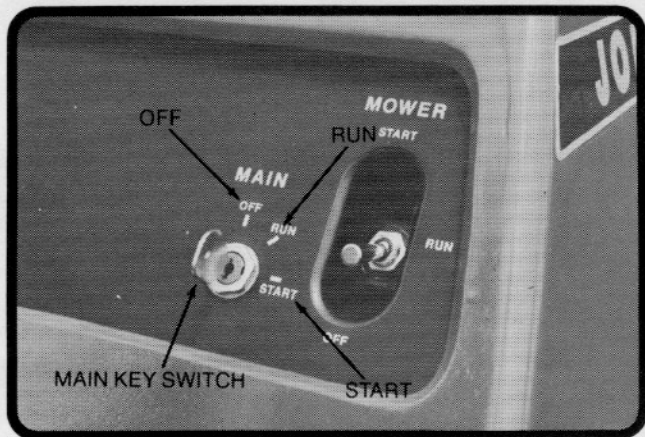
PARKING BRAKE LEVER

This lever locks the brake for parking. To engage the lever, fully depress the brake pedal. While the pedal is fully depressed, move the lever forward to engage the pedal stop. The brake pedal is held in the depressed position. To release, depress brake pedal slightly and move lever to the rear.

BRAKE PEDAL

This pedal, located at the right of the steering console is used to stop ground travel with the drive clutch pedal depressed.

SWITCHES



Slide No. 5 — Switches

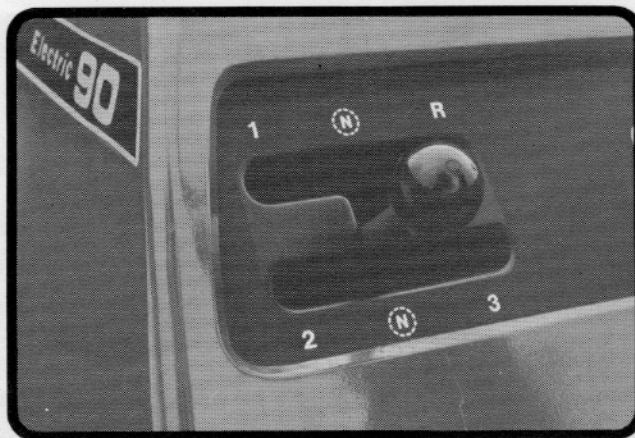
The main key switch is used to start the traction drive motor and stop all motors. The mower toggle switch is used to start and stop the mower motors.

NEUTRAL-START SYSTEM

Your Electric 90 Mower is equipped with a neutral-start switch on the clutch to prevent starting with the traction drive engaged. The clutch pedal must be depressed before the traction motor will start.

A safety interlock between the traction circuit and the mower circuit prevents the mower motors from running unless the traction motor is running.

GEAR SHIFT LEVER

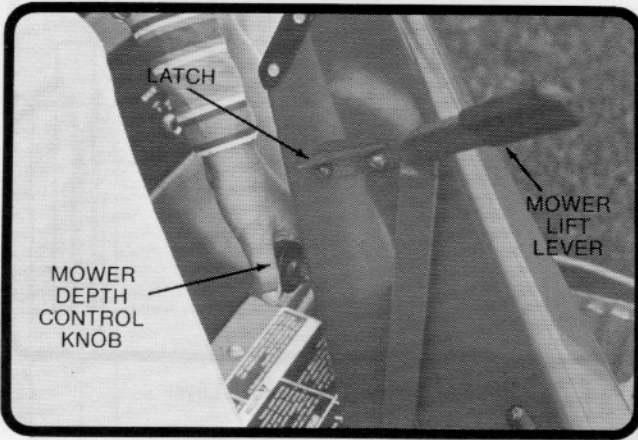


Slide No. 6 — Gear Shift Lever

The gear shift lever, located at the front right-hand side of the seat pedestal, is used to obtain the desired speed and direction of ground travel. ALWAYS DEPRESS the drive clutch pedal before moving the shift lever. There are 3 speeds for forward travel; one for reverse travel.

CAUTION: Do not attempt to shift gears on-the-go. Always stop ground travel before changing speeds.

MOWER LIFT LEVER



Slide No. 7 — Mower Lift Lever

The mower lift lever, located on the right side of the steering console, is used to lower the mower to the same preset height and to lock the mower in the raised position. To lower mower, pull lever back and to the right to release lever from the latch.

With the mower completely lowered, the cutting height is approximately 1 inch. With the mower fully raised, the cutting height is approximately 4 inches.

To lock mower in raised position, pull lever back and hook behind latch.

MOWER DEPTH CONTROL KNOB

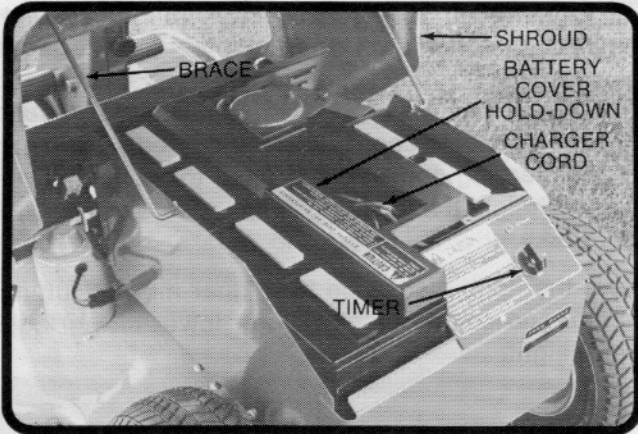
The mower depth control knob is located on the rear of the steering console. It is used to preset mower cutting height by limiting how far the mower can be lowered.

Turn the knob clockwise for higher mower cutting height and counterclockwise for lower mower cutting height.

CAUTION: Highly combustible hydrogen gas is vented from the batteries during the charging cycle. Keep the hood raised while charging batteries until timer returns to "OFF". Charge batteries in ventilated area. Keep flames away from and do not smoke around batteries.

BATTERY SERVICE

ACTIVATING BATTERIES



Slide No. 8 — Batteries

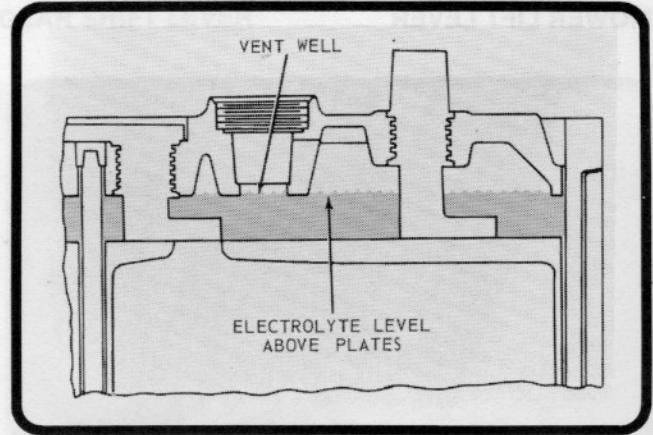
Remove shroud by pivoting forward, then lift upward and remove from slotted deck opening.

Remove charger cord from storage compartment.

Depress battery cover hold-down and turn ¼-turn right or left to unhook hold-down from base. Lift cover off.

Disconnect cables and charger wires from battery terminals. Remove batteries from compartment.

IMPORTANT: Be sure to remove batteries before filling with electrolyte. This will prevent accidental damage in case of acid spill.



Slide No. 9 — Electrolyte Level

Fill with electrolyte to bottom of filler tubes.

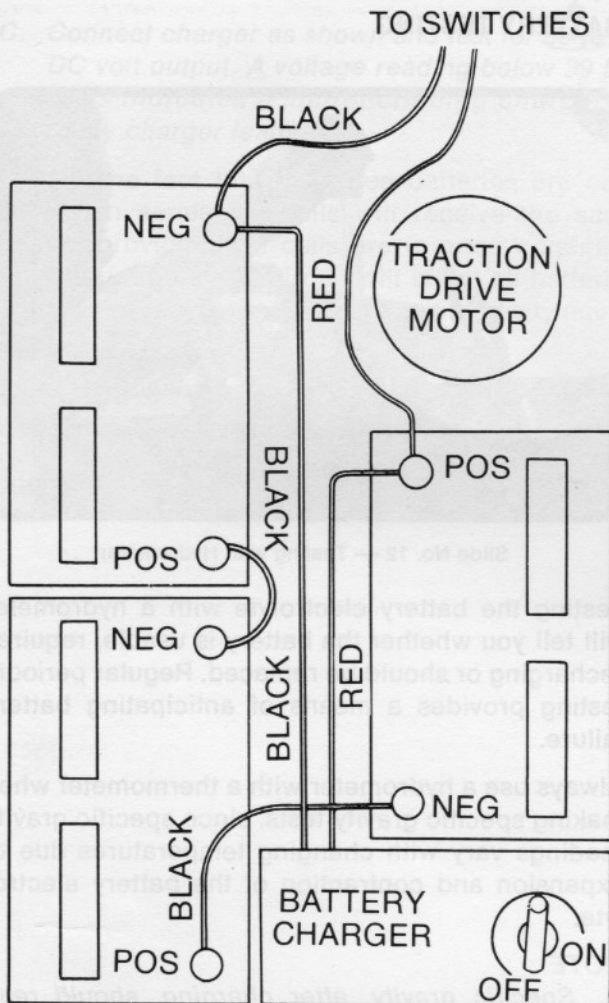
CAUTION: Battery electrolyte is poisonous and can be injurious to eyes and clothing. Handle it carefully. If spilled, clean with a solution of one part baking soda to four parts water.

Electrolyte is not furnished with the Electric 90 Mower. It is available from your Parts Depot in the following quantities:

Part No.	Description
4098522	5 gallons
4098532	6 quarts
409240	Hose for 5 gallon package

Use only battery grade sulfuric acid electrolyte with 1.265 specific gravity plus or minus 0.005 corrected to 80 degrees Fahrenheit.

Clean and dry batteries and install in battery compartment.



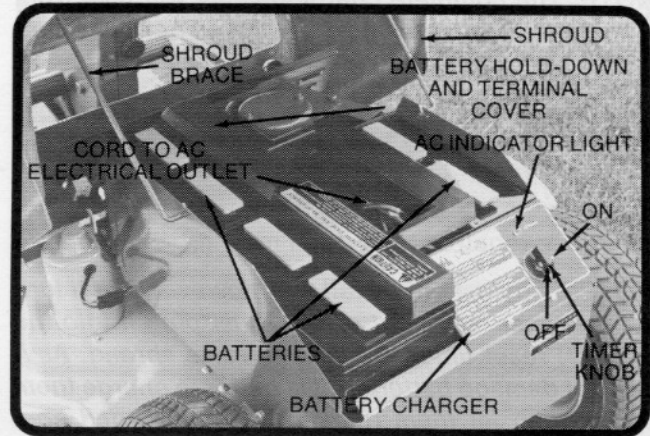
Slide No. 10 — Battery Wiring Diagram

Connect cables and charger wires to terminals (See diagram). Replace battery cover.

When replacing shroud, be sure notches on shroud hinges engage pivot brace at sides of frame.

NOTE: Keep rags and clutter out of cavity in battery terminal cover as this is air vent for cooling charger.

CHARGING THE BATTERIES



Slide No. 11 — Charging the Batteries

After you have finished the pre-delivery preparation, raise the shroud and pivot the brace forward to hold the shroud in the raised position.

Remove the charge cord from the storage compartment between the batteries and plug it into a grounded alternating current (AC) outlet supplying at least 105 to 130 volts.

When the red indicator light glows, electrical current is being supplied to the charger. If the light does not glow, check supply circuit for blown fuses, a tripped circuit breaker, or to see that a controlling wall switch is not in the "OFF" position.

Turn the timer knob clockwise to the "ON" position to start the charging cycle. The timer will not be activated until batteries reach approximately 80 percent of full charge. The timer will then operate for an additional six hours to fully charge the batteries.

CAUTION: Highly combustible hydrogen gas is vented from the batteries during the charging cycle. Keep the shroud raised while charging batteries until timer returns to "OFF." Charge batteries in ventilated area. Keep flames away from and do not smoke around batteries.

CHARGING THE BATTERIES — Continued

NOTE: The complete charging cycle will take from 6 to 12 hours, depending upon condition of batteries.

The charger also contains an automatic timer that turns the charger on once every 24 hours to permit a 12- to 15-minute boost charge. This keeps the batteries at full charge at all times. Only one full charge is required after each mowing.

NOTE: Should memory fail you, however, (Did I turn on the timer last night or did I just plug it into the outlet?) reset timer. Be sure to raise shroud. As it will not damage batteries, it is better to charge them twice, than let them remain in a discharged condition.

IMPORTANT: Keep the charger connected to a live electrical outlet whenever the machine is not in use . . . even during winter storage. Batteries can be severely damaged if stored for prolonged periods in a discharged condition.

As long as the charger is plugged into the electrical outlet, the indicator light will glow. Movement of the timer knob is not noticeable due to the length of the charging cycle.

It is normal for the charger to become warm while in operation. A thermostat within the charger, prevents machine damage in the event the charger becomes too warm. The thermostat works much in the same manner as a circuit breaker. Keeping the shroud raised and the air passage in the battery cover open helps in cooling the charger.

The shroud does not have to be in the raised position after the timer has returned to the "OFF" position. The shroud can be lowered during the daily automatic charging cycles.

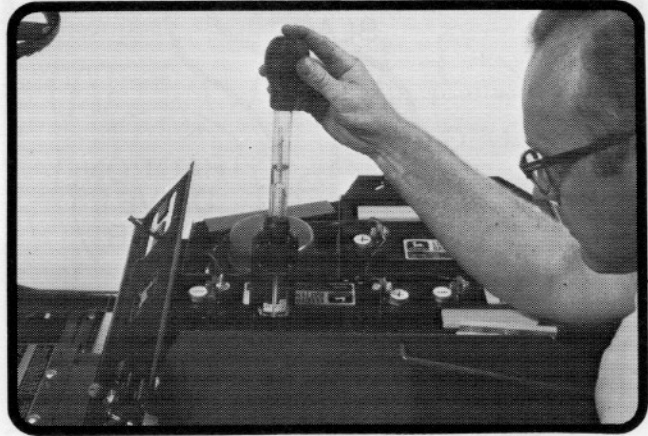


CAUTION: Do not charge batteries with any other charger. Do not use the mower batteries to start other vehicles. Battery damage will result.

CHECKING BATTERIES

Check electrolyte level periodically (at least once each month). If necessary, add distilled water to bring level to top of circular split ledge in filler tube. Check more frequently if mower is operated and recharged more than once each week.

BATTERY TESTING



Slide No. 12 — Testing with Hydrometer

Testing the battery electrolyte with a hydrometer will tell you whether the battery is usable, requires recharging or should be replaced. Regular periodic testing provides a means of anticipating battery failure.

Always use a hydrometer with a thermometer when making specific gravity tests, since specific gravity readings vary with changing temperatures due to expansion and contraction of the battery electrolyte.

NOTE:

- A. Specific gravity, after charging, should read from 1.215 to 1.270 (corrected for 80° F electrolyte temperatures).
- B. The variation in readings between cells should be no more than 0.050.

If the readings are not within the specified range, do the following:

- A. Inspect and clean battery and cable terminal connections.
- B. Visual inspection of battery condition, presence of moisture on battery top and cracks.

2VOLT + or -

- C. Connect charger as shown and test for ~~39 to 40~~ DC volt output. A voltage reading below 39 DC volts indicates a malfunctioning charger or faulty charger leads.

Due to the fact that the three batteries are connected in series, all cells will receive the same charge providing the cells are in good condition. An interruption in the circuit will effect all batteries equally, thereby lowering the specific gravity equally.

Using the specific gravity test information will help you determine if one battery is beginning to fail or if the whole battery pack is simply in a discharged state.



Slide No. 13 — Connecting Tester to Charger

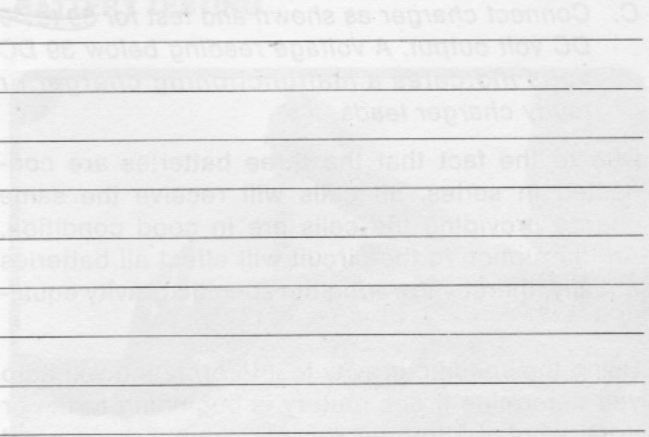
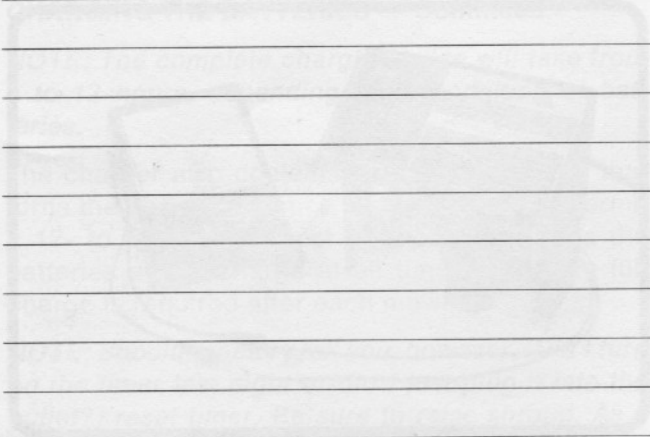
CHARGER



Slide No. 14 — Charger

The Electric 30 is the first commercial application of the new "Reactance Limited" charger, which differs from past model Ferro Resonant types in the following manner:

A—Ferro Resonant chargers produce and hold a



IMPORTANT: Keep the charger connected to a battery even during winter storage. Batteries can be damaged if they are not recharged in a timely manner.

As long as the charger is plugged into the electrical outlet, the indicator light will glow. Movement of the float valve will indicate the state of charge of the battery.

It is normal for the charger to become warm while in operation. A thermometer will indicate the temperature of the charger. The thermometer will show the temperature of the charger. The thermometer will show the temperature of the charger.

The charger will not operate if the battery is not fully charged. The charger will not operate if the battery is not fully charged. The charger will not operate if the battery is not fully charged.

CAUTION: Do not charge batteries with any other fluids. Do not charge batteries with any other fluids. Do not charge batteries with any other fluids.

Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly.

Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly. Recharge batteries regularly.

Always use a hydrometer to test the electrolyte. Always use a hydrometer to test the electrolyte. Always use a hydrometer to test the electrolyte.

NOTE: A. Specific gravity of electrolyte should be between 1.215 and 1.270 at 80°F (27°C). B. The voltage of a fully charged battery should be 12.6V or more.

If the readings are outside the following range, the battery may be faulty. If the readings are outside the following range, the battery may be faulty. If the readings are outside the following range, the battery may be faulty.

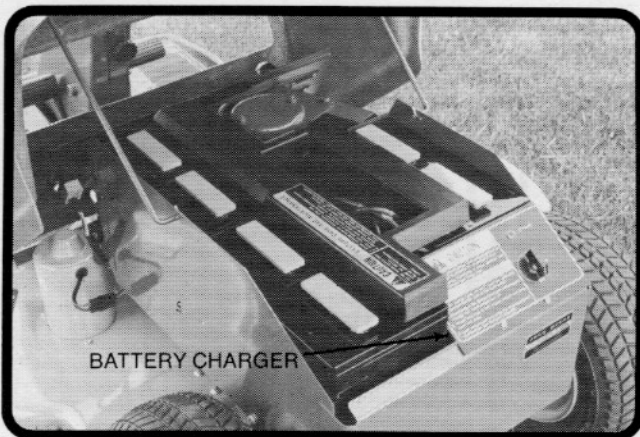
A. Visual inspection of battery for cracks, leaks, or other damage. A. Visual inspection of battery for cracks, leaks, or other damage. A. Visual inspection of battery for cracks, leaks, or other damage.

The **electrical system** of the Electric 90 Mower consists of the following components:

- A. *Battery pack consisting of (3) 12 volt deep cycle lead-acid batteries connected in series.*
- B. *Control panel consisting of a master solenoid, mower motor solenoid, mower motor stop resistor and system fuse.*
- C. *Switch panel containing the master key switch and mower control switch.*
- D. *A traction motor and two mower motors for power supply.*
- E. *Safety-start switch to insure "declutched" starting.*

To better understand each components function and to aid in locating a malfunction, use the wiring schematics and trouble shooting charts on the following pages.

CHARGER



Slide No. 14 — Charger

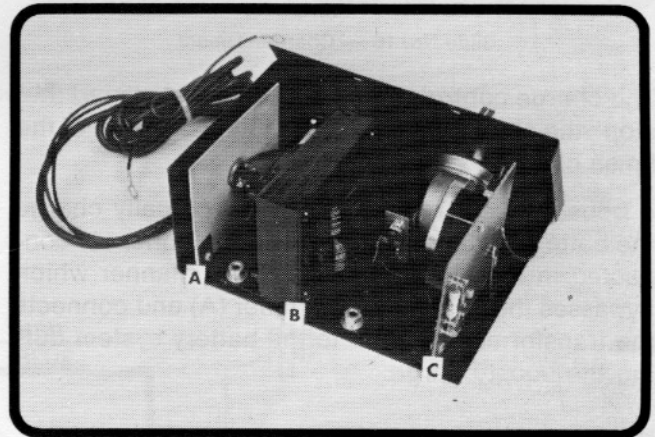
The Electric 90 is the first commercial application of the new "Reactance Limited" charger, which differs from past model Ferro Resonant types in the following manner:

- A. **Ferro Resonant** chargers produce and hold a

constant voltage while amperage tapers downward while the batteries charge.

- B. **Reactance Limited** chargers maintain a *constant amperage* finish charge rate and the *voltage increases* as necessary to complete final charge. This means a fully charged battery in less time and maintains a healthier battery over months and years of constant usage.

CHARGER COMPONENTS

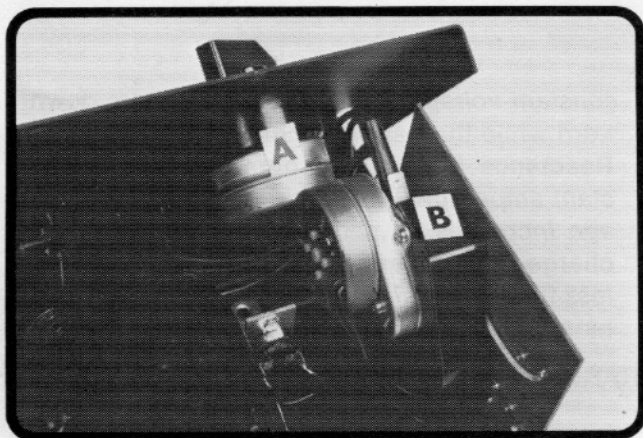


Slide No. 15 — Charger Components

The "**Reactance Limited**" charger utilizes the following components:

- A. AC to DC rectifier, which converts AC current to usable DC charging current.
- B. Transformer provides recharge current at correct voltage level.
- C. Voltage sensor panel to test battery voltage and start 6-hour timer after batteries reach 80% of full charge.

CHARGE CONTROL TIMERS



Slide No. 16 — Charger Timers

The charge control timer (A) is utilized to “start and stop” the charger and to control time duration of the finish charge.

A boost timer (B) is utilized to periodically charge the batteries automatically. This component is connected in the charging system in a manner which bypasses the charge control timer (A) and connects the transformer/rectifier to the battery system during the boost charge.

WIRING DIAGRAMS

Study the wiring diagrams on page 15 carefully. The diagrams, each with a system explanation, provide a general outline of how the electrical system functions.

The circuits activated are identified with a heavy dark line.

TRACTION MOTOR START

Starting at the positive terminal of the battery, follow the path of the current as it progresses through each component.

Thirty-six volts must be present at any given point of the test.

The absence of 36 volts indicates an open circuit from either a poor connection or open thermostatic breaker, fuse or switches.

In the event of failure, use the diagnosing malfunction test procedure chart to locate the trouble.

TRACTION MOTOR RUN

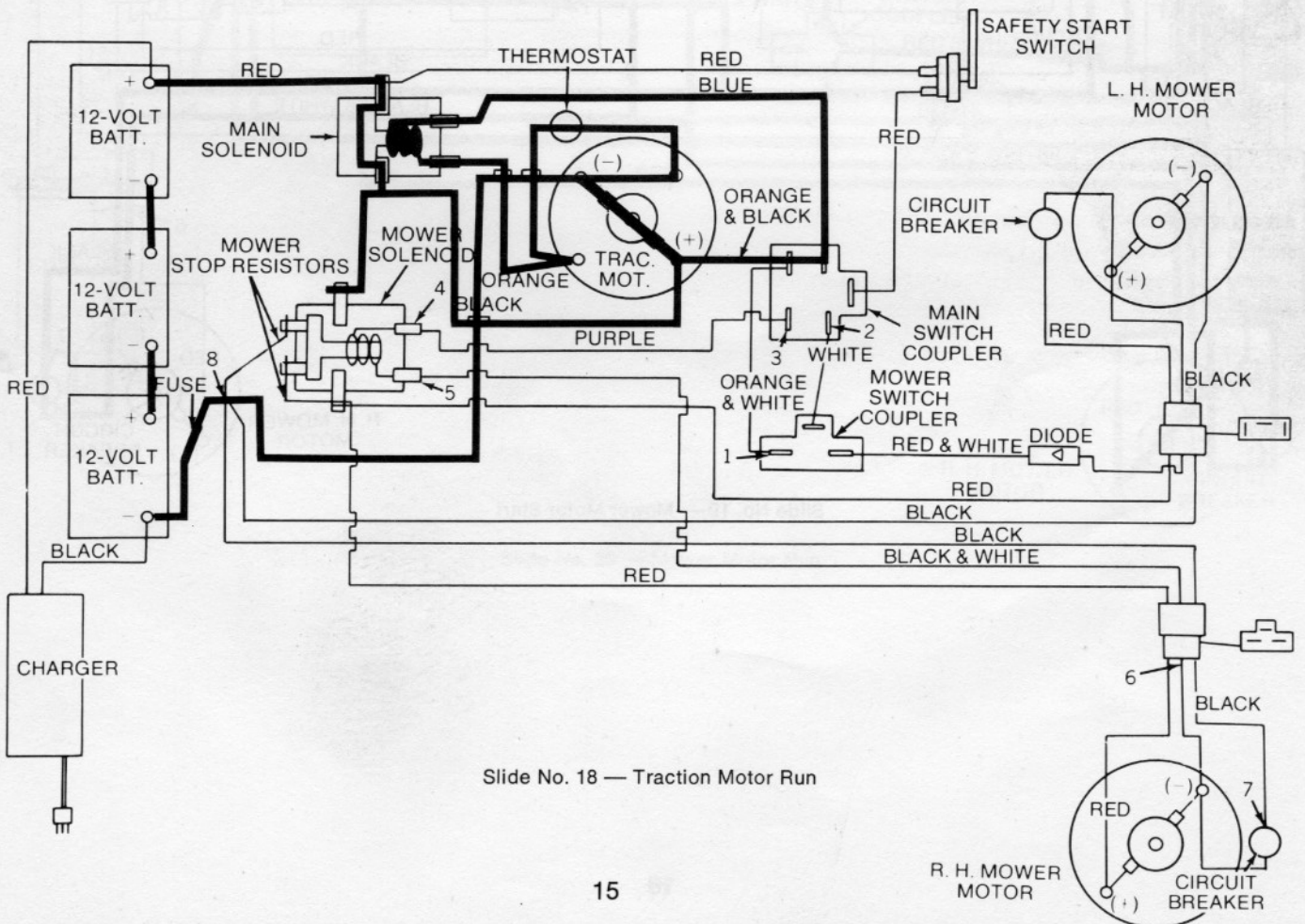
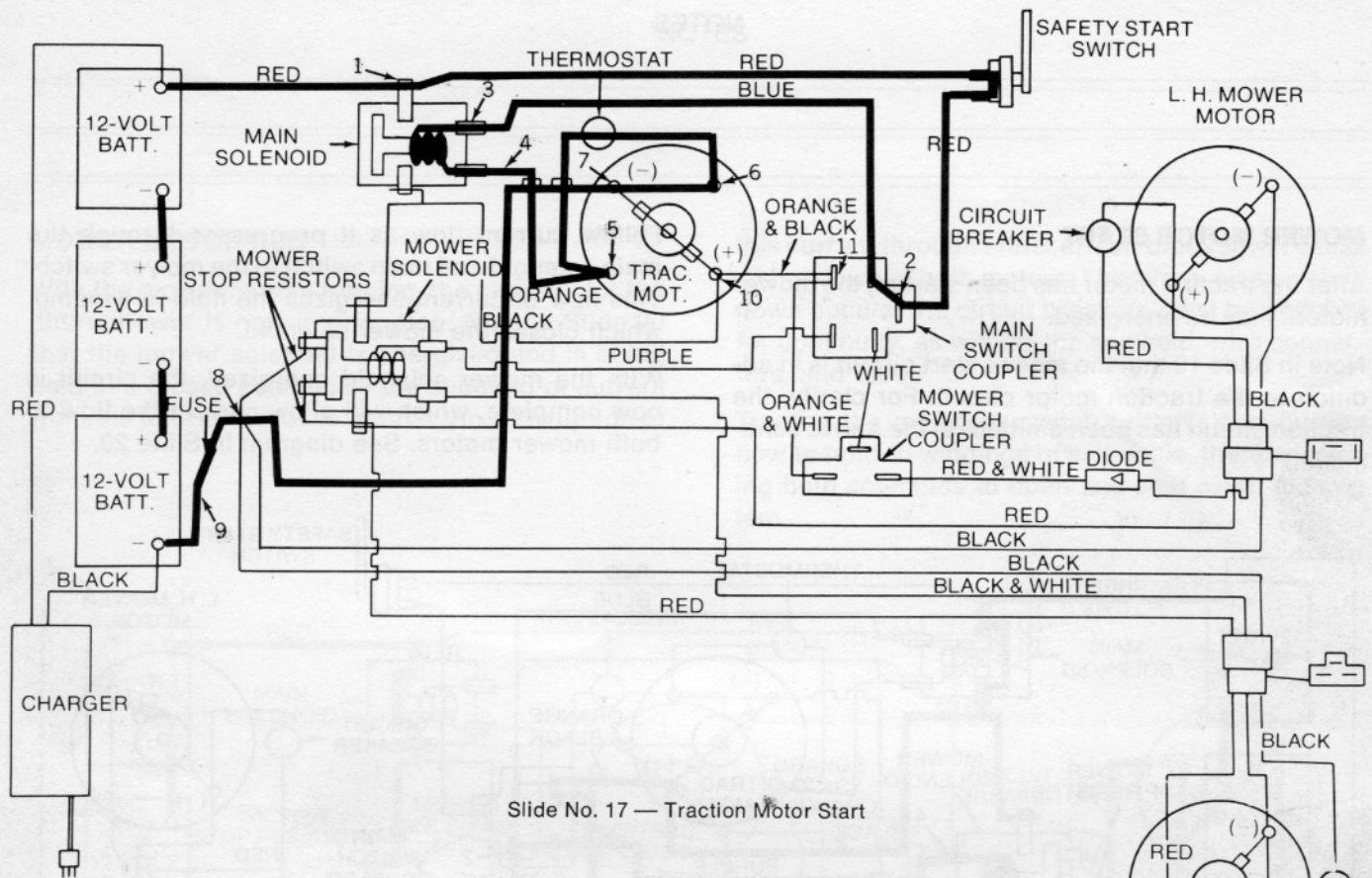
Note change in electrical circuit between traction motor start and run.

The safety start switch drops out of the circuit and the main solenoid closes, completing a path for current flow through the traction motor.

Again 36 volts must be present at all points of electrical circuit when testing.

The absence of 36 volts indicates the possibility of an open circuit from either a poor wire connection, an open thermostatic breaker, a solenoid, or a faulty main switch.

Test each terminal point to isolate the offending component.



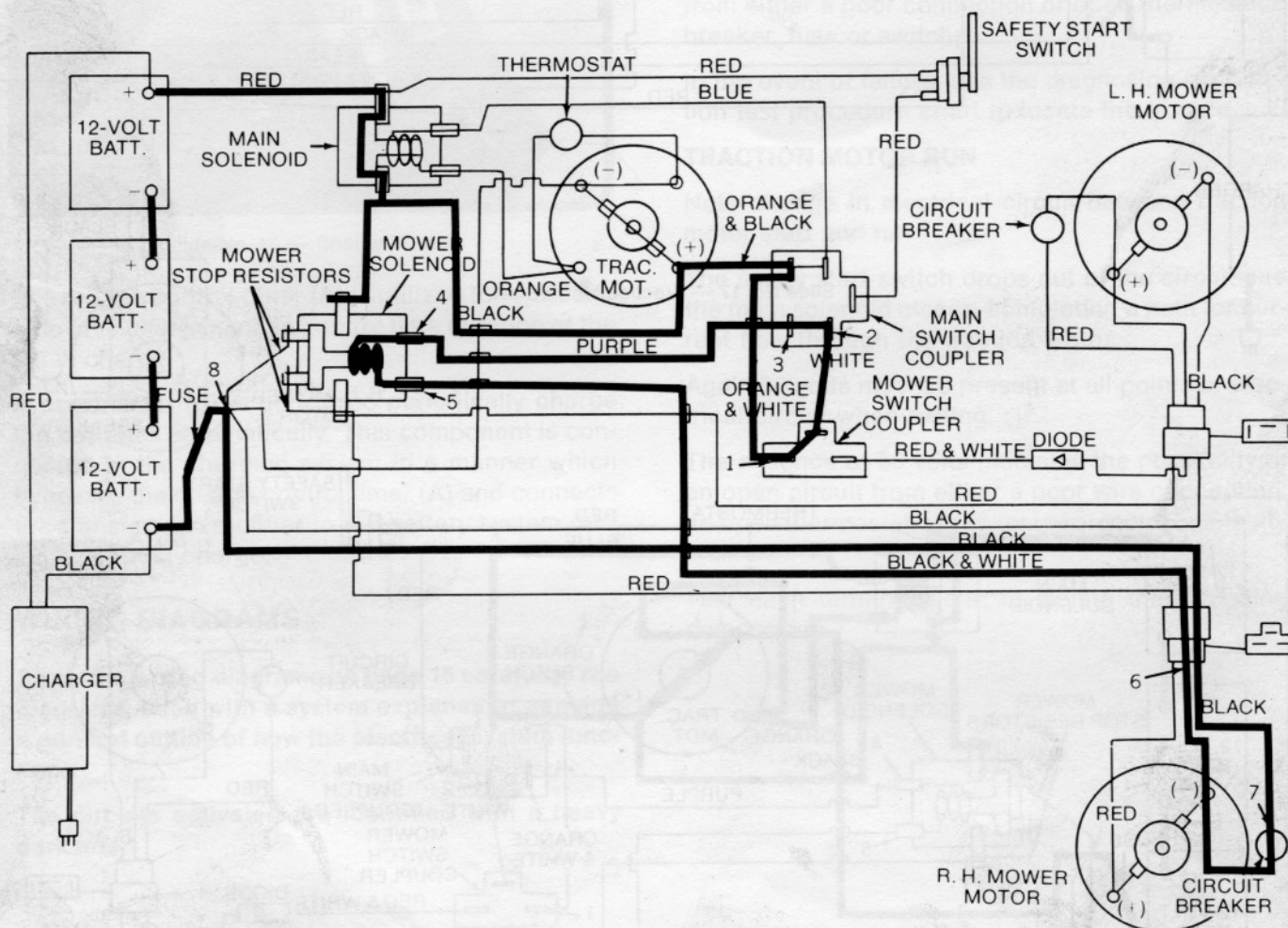
MOWER MOTOR START

After the traction motor has been started, the mower motors may be energized.

Note in Slide 19 that the mower start circuit is in addition to the traction motor circuit. For clarity, the traction circuit has been omitted on the above schematic.

Follow current flow as it progresses through the main solenoid and main switch to the mower switch. This flow of current energizes the hold-in winding, which closes the mower solenoid.

With the mower solenoid energized, the circuit is now complete, which will allow current the flow to both mower motors. See diagram in Slide 20.



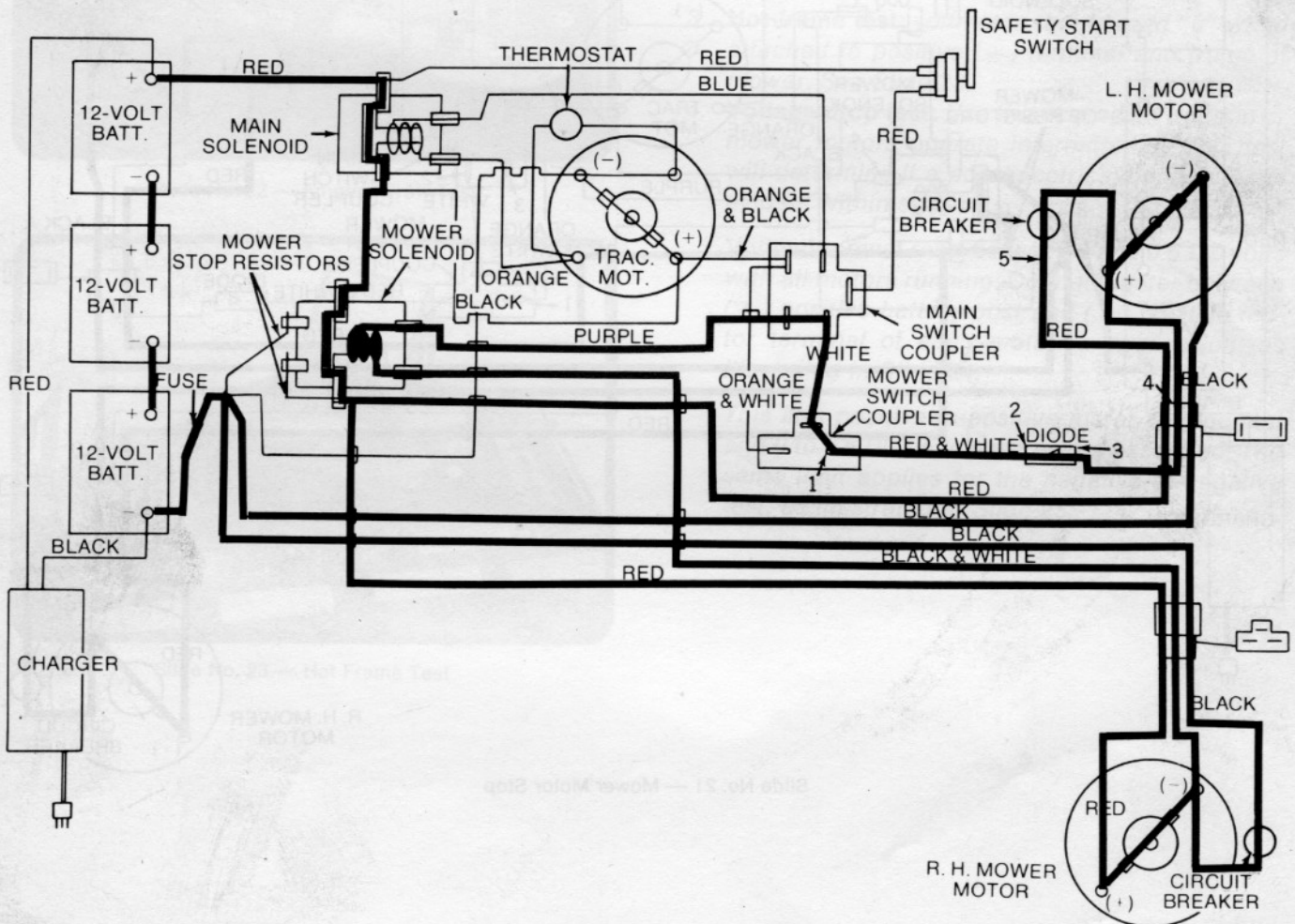
Slide No. 19 — Mower Motor Start

MOWER MOTOR RUN

With the mower motors running, the circuitry for the entire mower is now in operation. Note in Slide 20 that the mower solenoid is energized and is being held in a closed position by the shunting of current from the left-hand mower motors. An interruption of

this current through either circuit breaker will cause a shut down of both motors. Therefore, when a shut-down occurs, the circuit breakers must be checked for continuity, as well as the solenoid, wire connectors, and diode.

Turning the main key switch to "off" cuts current flow to hold-in windings of solenoids, thereby causing both solenoids to open and shut down the system.

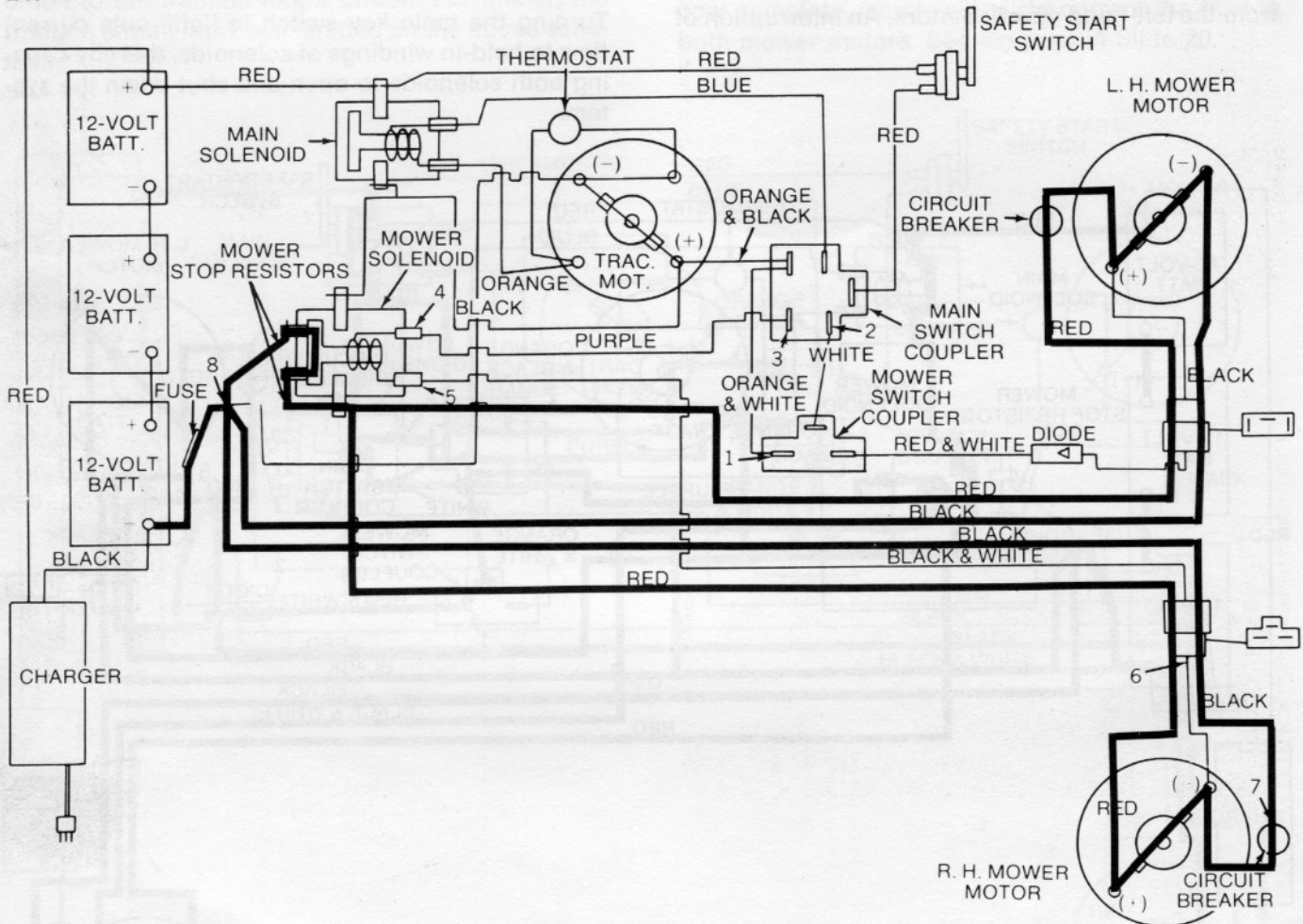


Slide No. 20 — Mower Motor Run

MOWER MOTOR STOP

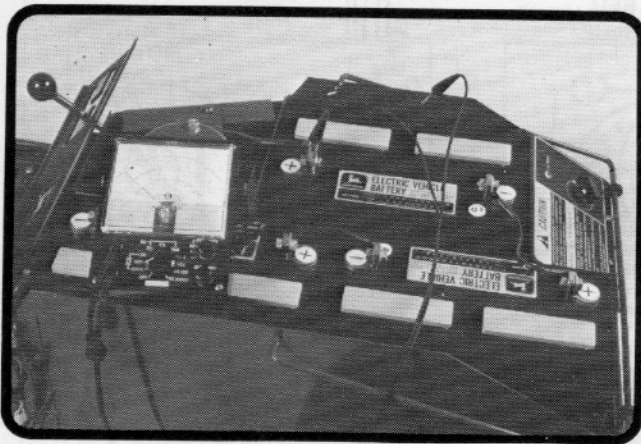
To provide for fast stopping of mower blade rotation, the mower solenoid is designed to route electrical energy through two stop resistors. See Slide 21.

This arrangement reverses the current flow through the mower motor armatures, thereby applying magnetic braking action to the mower motor armatures and blades.



Slide No. 21 — Mower Motor Stop

DIAGNOSING MALFUNCTIONS



Slide No. 22 — Ampere Draw Test



Slide No. 23 — Hot Frame Test

PRELIMINARY TESTS

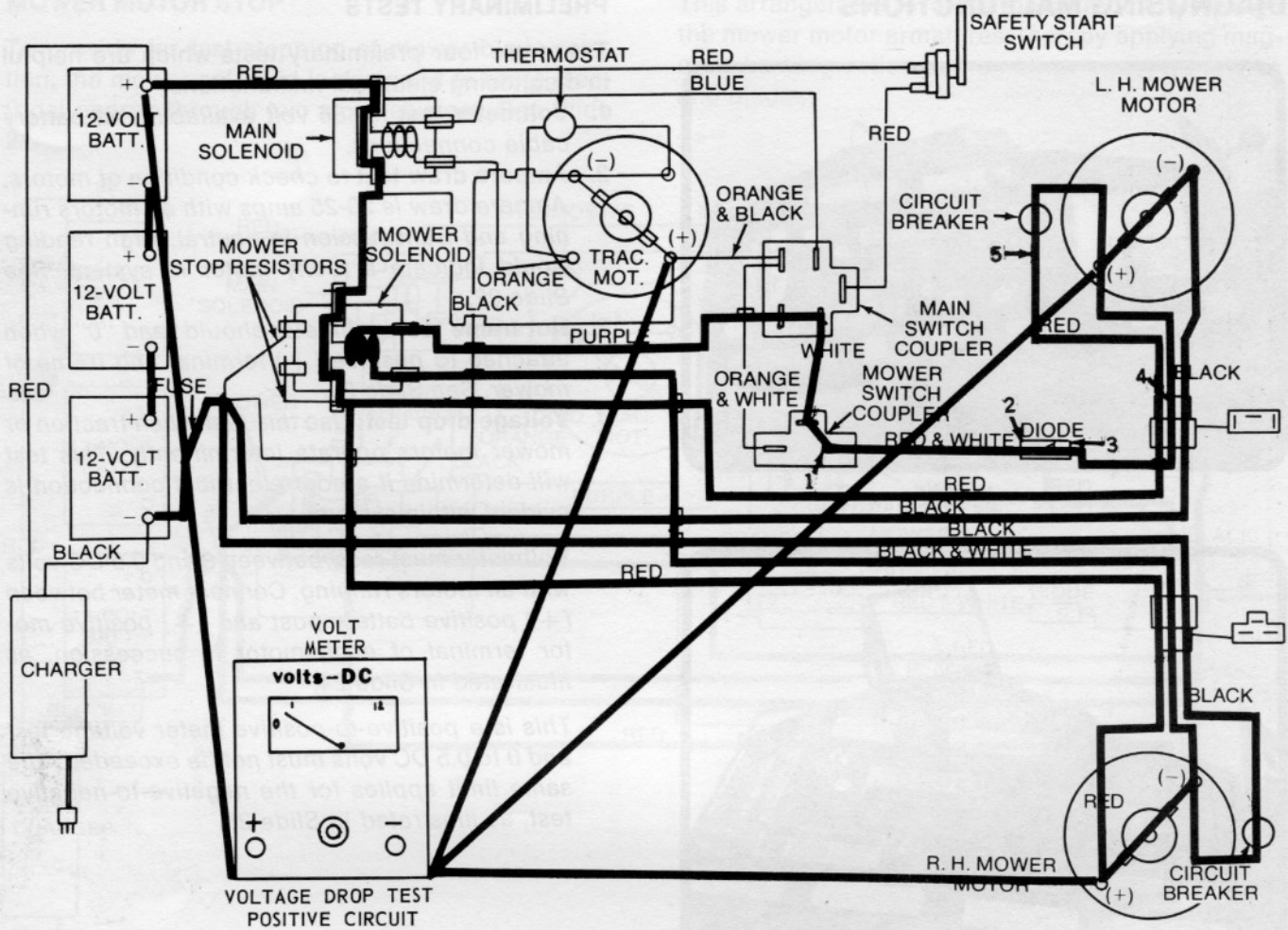
There are four preliminary tests which are helpful in diagnosing electrical malfunctions.

1. **Voltmeter test** for 36 volt availability at battery cable connections.
2. **Ampere draw test** to check condition of motors. Ampere draw is 20-25 amps with all motors running and transmission in neutral. High reading would indicate a faulty motor in system. See Slide 22.
3. **Hot frame test:** voltmeter should read "0" when attached to positive (+) terminal and frame of mower. See Slide 23.
4. **Voltage drop test:** Use this test when traction or mower motors operate intermittently. This test will determine if a poor electrical connection is evident within system.

Voltmeter must read between 0 and 0.5 DC volts with all motors running. Connect meter between (+) positive battery post and (+) positive motor terminal of each motor in succession, as illustrated in Slide 24.

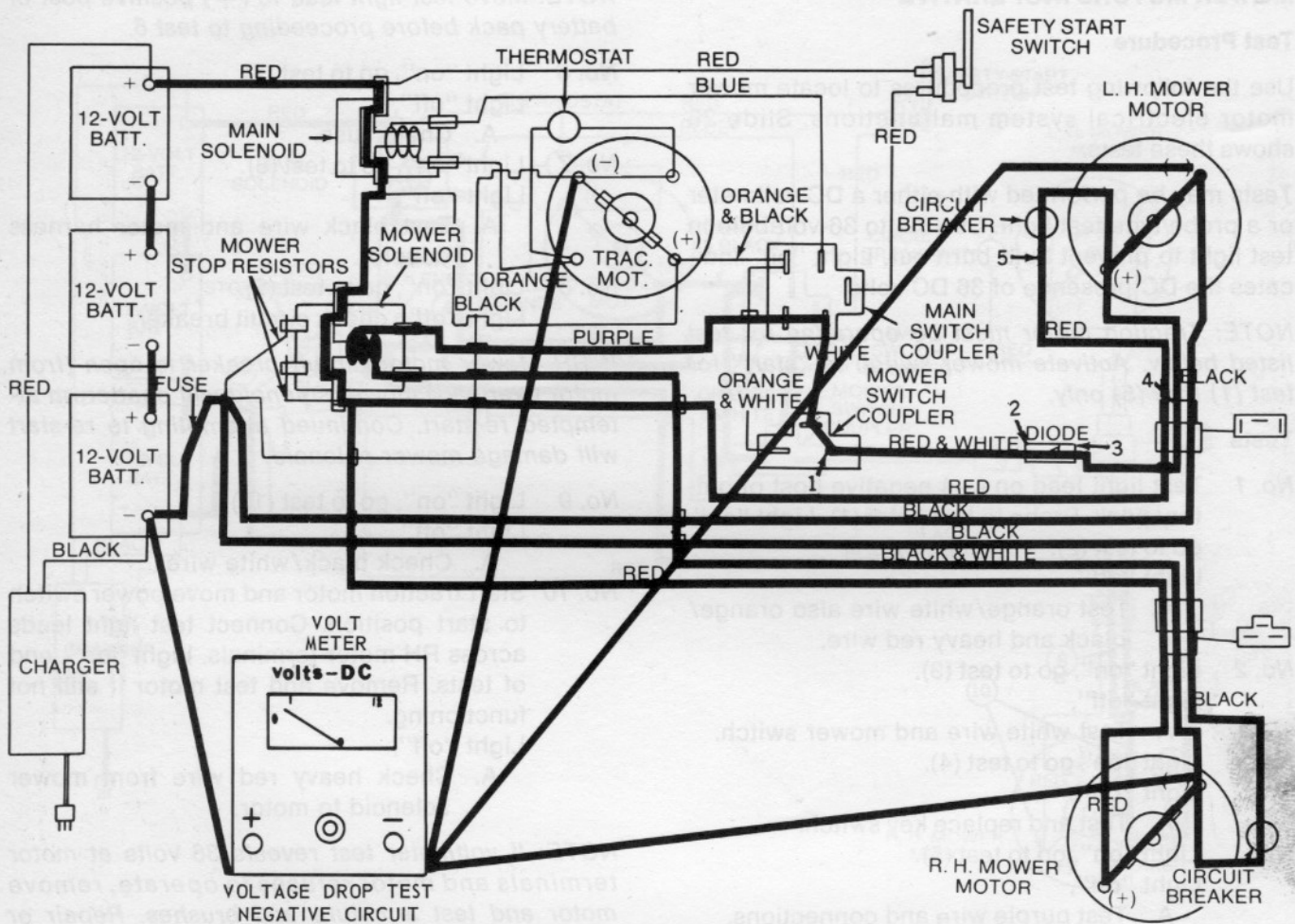
This is a positive-to-positive meter voltage test and 0 to 0.5 DC volts must not be exceeded. The same limit applies for the negative-to-negative test, as illustrated in Slide 25.

NOTES



Slide No. 24 — Voltage Drop Test — Part 1

NOTES



Slide No. 25 — Voltage Drop Test — Part 2

MOWER MOTORS INOPERATIVE

Test Procedure

Use the following test procedures to locate mower motor electrical system malfunctions. Slide 26 shows these tests.

Tests may be performed with either a DC voltmeter or a probe type test light. Use 32- to 36-volt bulb in test light to prevent bulb burn out. Light "on" indicates the DC presence of 36 DC volts.

NOTE: Traction motor must be operating for test listed below. Activate mower switch to "start" for test (1) thru (5) only.

Tests

- No. 1 Test light lead on (—) negative post of battery pack. Probe to test point (1). Light "on", go to test (2).
Light "off",
A. Test orange/white wire also orange/black and heavy red wire.
- No. 2 Light "on", go to test (3).
Light "off",
A. Test white wire and mower switch.
- No. 3 Light "on" go to test (4).
Light "off",
A. Test and replace key switch.
- No. 4 Light "on", go to test (5).
Light "off",
A. Test purple wire and connections.
- No. 5 Remove black/white wire from solenoid terminal. Probe to solenoid terminal.
Light "on", go to test (6).
Light "off",
A. Listen for audible pull in of solenoid.
If it does not click, remove and test solenoid.

NOTE: Move test light lead to (+) positive post of battery pack before proceeding to test 6.

- No. 6 Light "on", go to test (7).
Light "off",
A. Check fuse.
- No. 7 Light "on", go to test (8).
Light "off",
A. Test black wire and motor harness coupler.
- No. 8 Light "on", go to test (9).
Light "off", check circuit breaker.

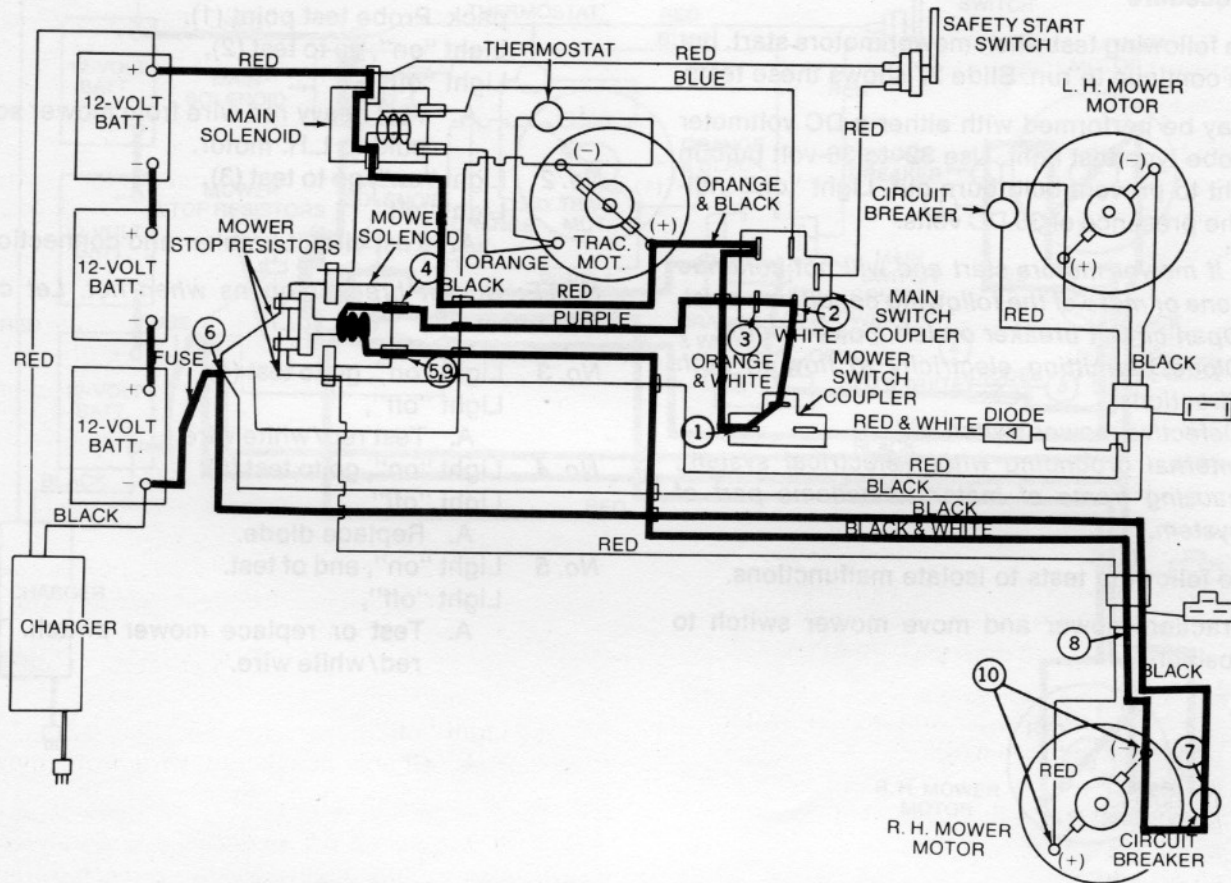
If RH Mower motor circuit breaker is open (from motor overload) mower solenoid will chatter on attempted re-start. Continued attempting to re-start will damage mower solenoid.

- No. 9 Light "on", go to test (10).
Light "off",
A. Check black/white wire.
- No. 10 Start traction motor and move power switch to start position. Connect test light leads across RH motor terminals. Light "on", end of tests. Remove and test motor if still not functioning.
Light "off",
A. Check heavy red wire from mower solenoid to motor.

NOTE: If voltmeter test reveals 36 volts at motor terminals and motor refuses to operate, remove motor and test armature and brushes. Repair or replace components as necessary.

NOTE: Repeat tests for left-hand motor.

NOTES



Slide No. 26 — Tests for Inoperative Mower Motors

MOWER MOTORS START, THEN STOP

Test Procedure

Use the following test when mower motors start, but will not continue to run. Slide 27 shows these tests.

Test may be performed with either a DC voltmeter or a probe type test light. Use 32- to 36-volt bulb in test light to prevent bulb burn out. Light "on" indicates the presence of 36 DC volts.

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

1. Open circuit breaker on left mower motor.
2. Diode permitting electricity to flow in both directions.
3. Defective mower switch.
4. Internal grounding within electrical system, causing frame of motor to become part of system.

Use the following tests to isolate malfunctions.

Start traction mower and move mower switch to start position.

Tests

No. 1 Test lead on negative (—) post of battery pack. Probe test point (1).
Light "on", go to test (2).
Light "off",

- A. Test heavy red wire from mower solenoid to L.H. motor.

No. 2 Light "on", go to test (3).
Light "off",

- A. Test circuit breaker and connections.

NOTE: Circuit breaker opens when hot. Let cool and retest.

No. 3 Light "on", go to test (4).
Light "off",

- A. Test red/white wire.

No. 4 Light "on", go to test (5).
Light "off",

- A. Replace diode.

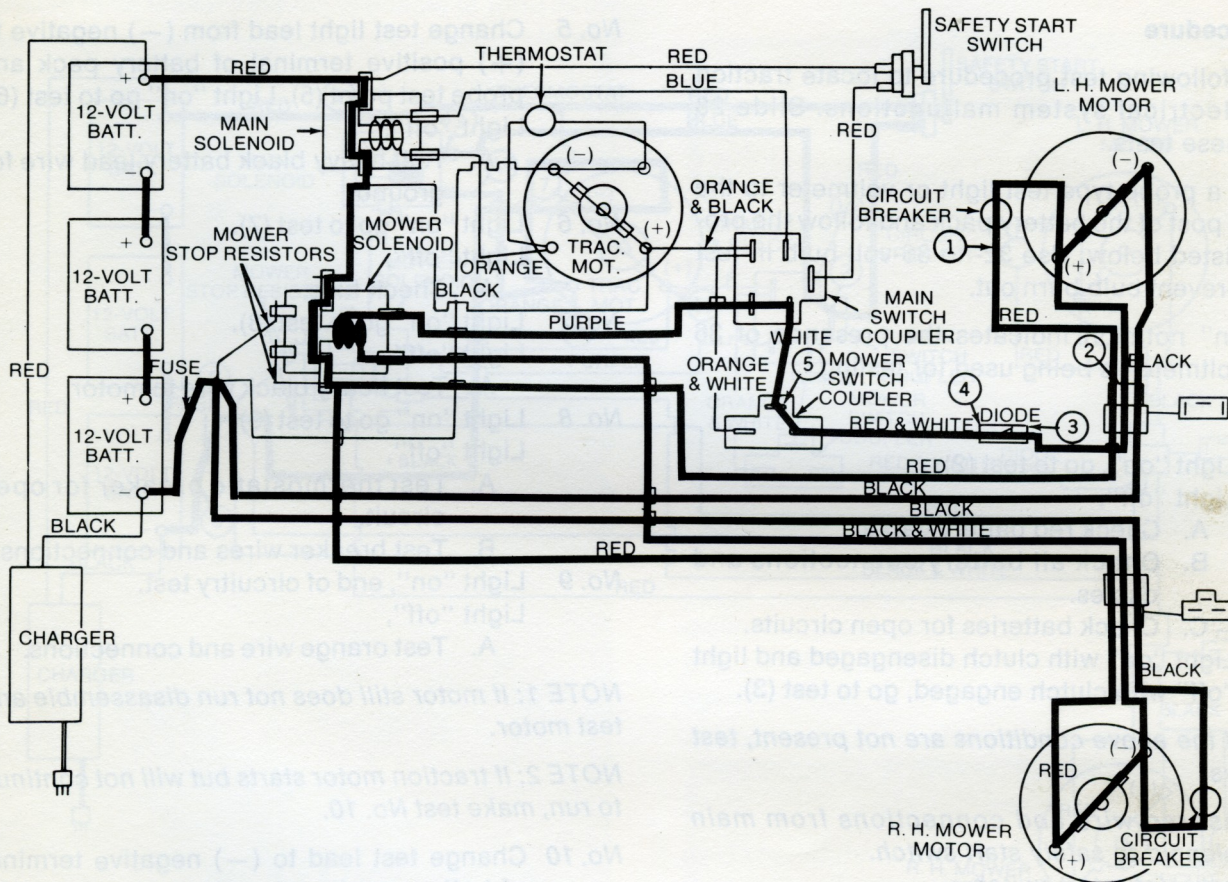
No. 5 Light "on", end of test.
Light "off",

- A. Test or replace mower switch. Test red/white wire.

NOTE: If voltmeter test reveals 36 volts at motor terminals and motor refuses to operate, remove motor and test armature and brushes. Repair or replace as necessary.

NOTE: Repeat tests for left-hand motor.

NOTES



Slide No. 27 — Tests for Mower Motors, Starting, then Stopping

TRACTION MOTOR INOPERATIVE**Test Procedure**

Use the following test procedure to locate traction motor electrical system malfunctions. Slide 28 shows these tests.

Connect a probe type test light or voltmeter to the **negative** post of the battery pack and follow the procedure listed below. Use 32- to 36-volt bulb in test light to prevent bulb burn out.

Light "on" notation indicates the presence of 36 volts if voltmeter is being used for testing.

Tests

- No. 1 Light "on", go to test (2).
Light "off",
A. Check red battery cable.
B. Check all battery connections and cables.
C. Check batteries for open circuits.
- No. 2 Light "on" with clutch disengaged and light "off" with clutch engaged, 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 safety start switch.
B. Test safety start switch.
C. Test red wire from safety start switch to key switch.
- No. 3 Light "on" with clutch disengaged 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.
- No. 4 Disconnect orange wire from main solenoid, probe test point (4) on solenoid terminal with key switch in start position, and clutch disengaged, Light "on", go to test (5).
Light "off",
A. Test solenoid.

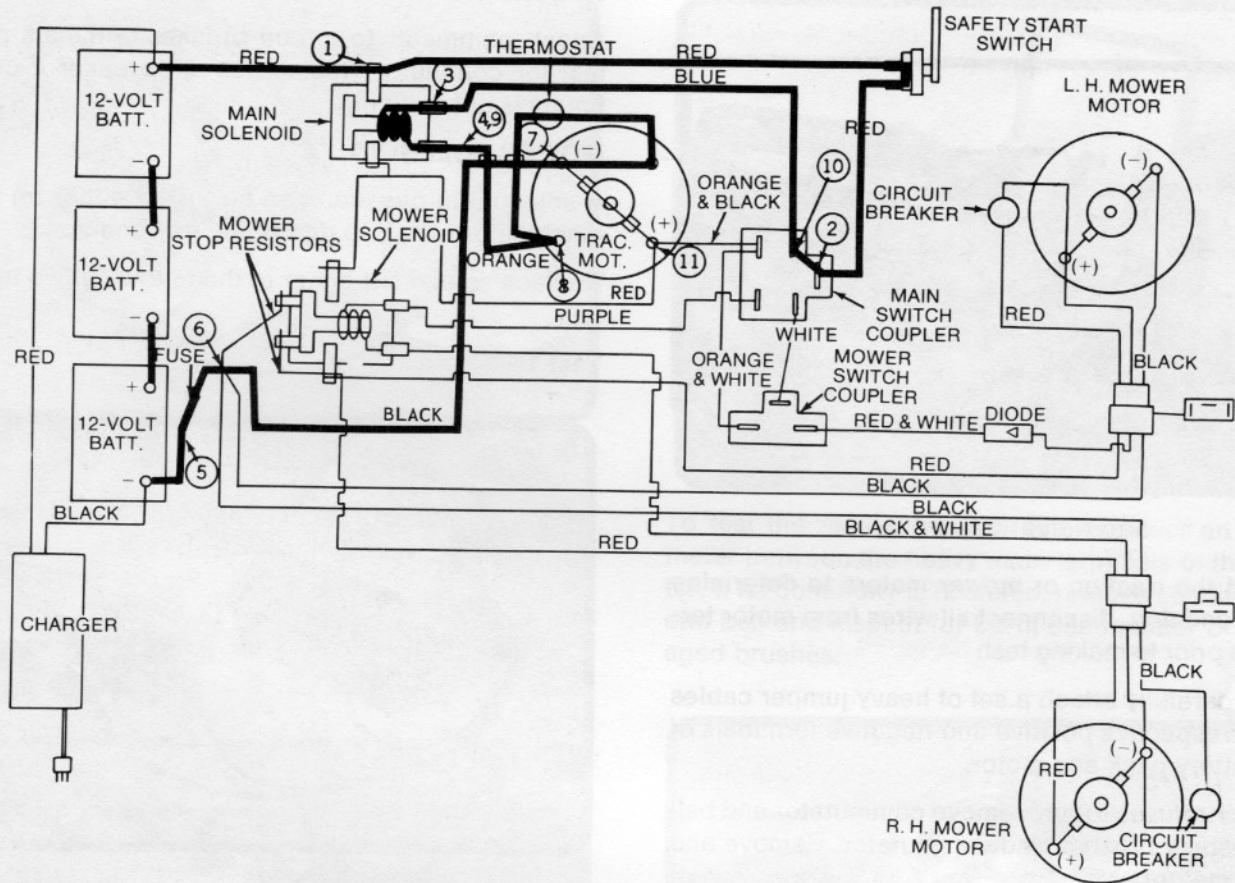
Test 5 thru 9—Clutch engaged and key switch "off".

- No. 5 Change test light lead from (—) negative to (+) positive terminal of battery pack and probe test point (5). Light "on" go to test (6).
Light "off",
A. Test heavy black battery lead wire for ground.
- No. 6 Light "on" go to test (7).
Light "off",
A. Check fuse.
- No. 7 Light "on" go to test (8).
Light "off",
A. Test heavy black wire to motor.
- No. 8 Light "on" go to test (9).
Light "off",
A. Test thermostatic breaker for open circuit.
B. Test breaker wires and connections.
- No. 9 Light "on", end of circuitry test.
Light "off",
A. Test orange wire and connections.

NOTE 1: If motor still does not run disassemble and test motor.

NOTE 2: If traction motor starts but will not continue to run, make test No. 10.

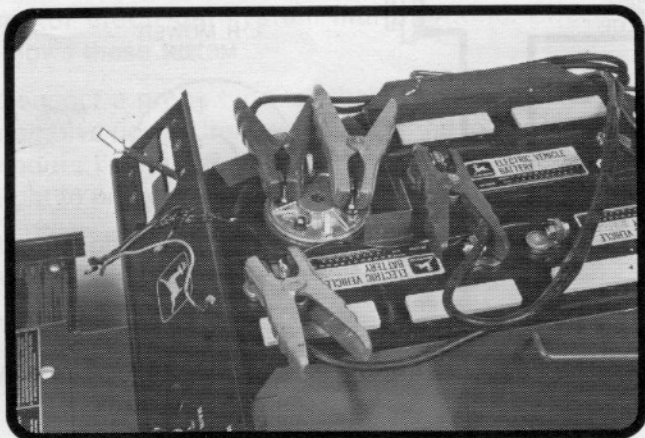
- No. 10 Change test lead to (—) negative terminal of battery pack and probe test points (10), with clutch disengaged and key switch in "start" position, Light "on" go to test (11).
Light "off",
A. Test key switch for continuity between orange/white and blue wire terminals.
B. Test orange/black wire.



Slide No. 28 — Test for Inoperative Traction Motor

TESTING ELECTRICAL COMPONENTS

TRACTION AND MOWER MOTORS



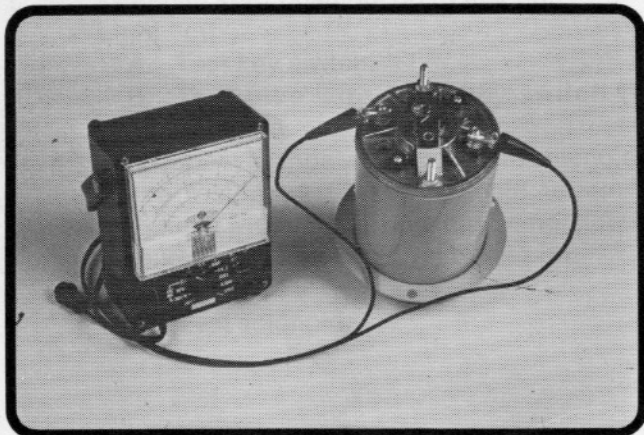
Slide No. 29 — Testing Motors

To test the traction or mower motors to determine their condition, disconnect all wires from motor terminals prior to making test.

Then, carefully attach a set of heavy jumper cables to the respective positive and negative terminals of the battery pack and motor.

If motor refuses to run, remove commutator end bell and inspect brushes and commutator. Remove and test armature also.

CIRCUIT BREAKERS AND THERMOSTATS



Slide No. 30 — Testing Circuit Breakers

Motor circuit breakers must show continuity to be usable. A circuit breaker can fail to reset and, therefore, testing is a must, when diagnosing electrical

system malfunctions. Disconnect circuit breaker wires prior to testing to isolate breaker from balance of system.

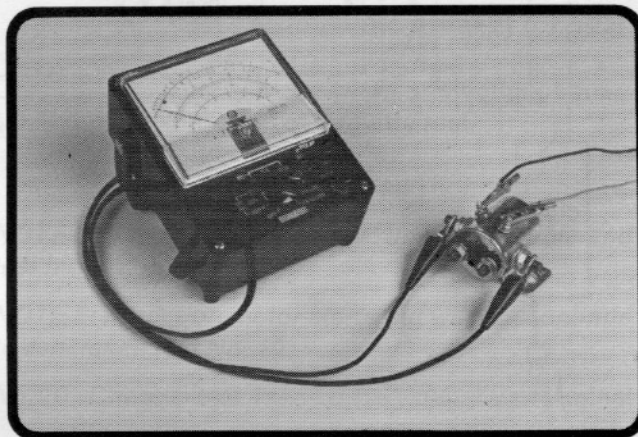
Attach ohmmeter to circuit breaker terminals and test for continuity. Replace circuit breaker if continuity is not evident.

MOWER SOLENOID

A solenoid in question can be tested either on the machine or bench to determine its condition.

Replace solenoid if either of the following two tests fail.

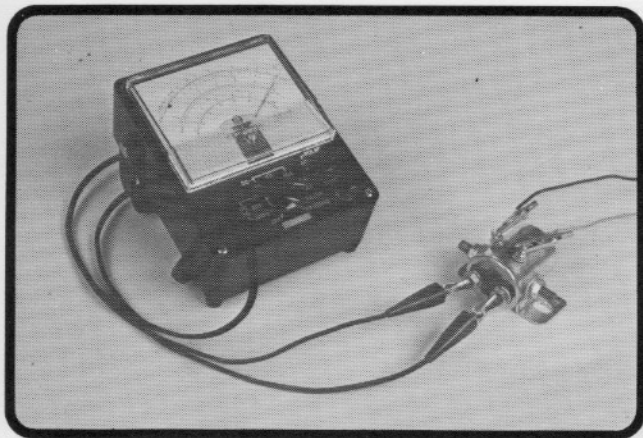
Test 1



Slide No. 31 — Test 1 for Mower or Main Solenoids

Test 1 uses an ohmmeter connected at the two side terminals. With the meter connected, touch the two small solenoid terminals with a 36-volt power supply. Solenoid should click sharply and show continuity. Conversely, when the 36-volt supply is removed, meter must show an open circuit.

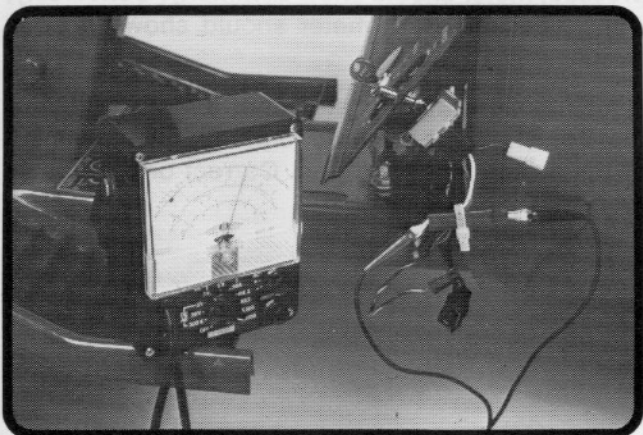
Test 2



Slide No. 32 — Test 2 for Mower Solenoid

For test 2, move ohmmeter leads to bottom terminals of mower solenoid. Continuity must be evident at this point of the test. Next, apply 36 volts to small solenoid terminals. Ohmmeter must now reveal an open circuit.

DIODE



Slide No. 33 — Testing Diode

A blown diode allows the mower motors to start, but refuse to continue to run.

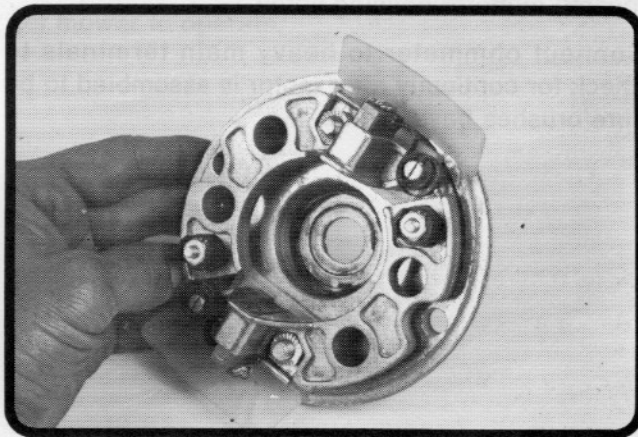
Using an ohmmeter, check diode for continuity in one direction **only**. If continuity is shown in both directions, replace diode, or diode can fail open. Replace diode in either case.

MOTOR BRUSHES



Slide No. 34 — Testing Motor Brush Circuit

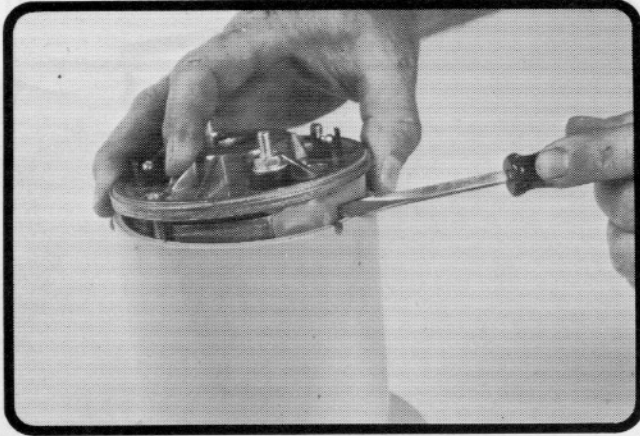
To test the motor brush circuit, connect an ohmmeter between the heavy main terminals of the motor. If no continuity is revealed, remove commutator end bell and inspect for burnt commutator or damaged brushes.



Slide No. 35 — Loading Brushes

After brushes have been checked or replaced, load brushes into end bell and hold in place by positioning brush spring against side of brush. This will hold brush in a retracted position until bell is in position over armature.

MOTOR BRUSHES — Continued

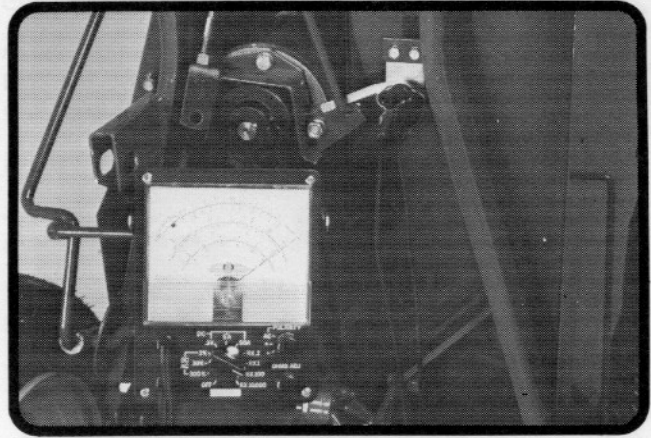


Slide No. 36 — Installing End Bell

Place commutator end bell carefully over armature, use a small amount of grease to hold wave washer in place over bearing. Slide end bell onto armature end bearing gently until in position as shown. At this point, press the brushes into place and complete assembly of the motor. Be sure end bell lug is located in motor housing notch.

Connect ohmmeter to heavy main terminals to check for continuity after motor is assembled to be sure brushes have seated.

SAFETY START SWITCH

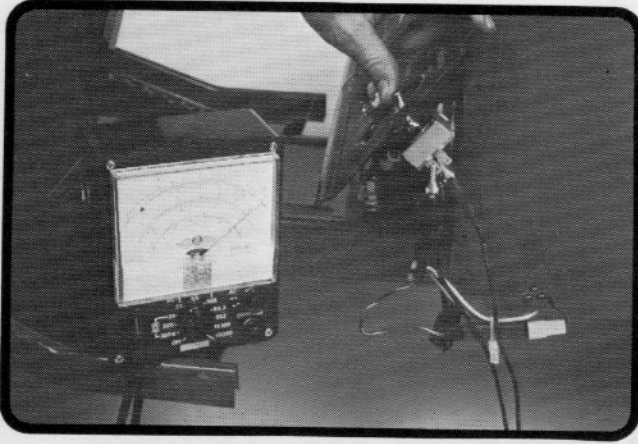


Slide No. 37 — Testing Safety Start Switch

To test the safety switch located under the mower frame, remove both red wires on switch and attach ohmmeter to switch terminals or attach a test light lead to negative battery terminal and probe to red wire behind main key switch.

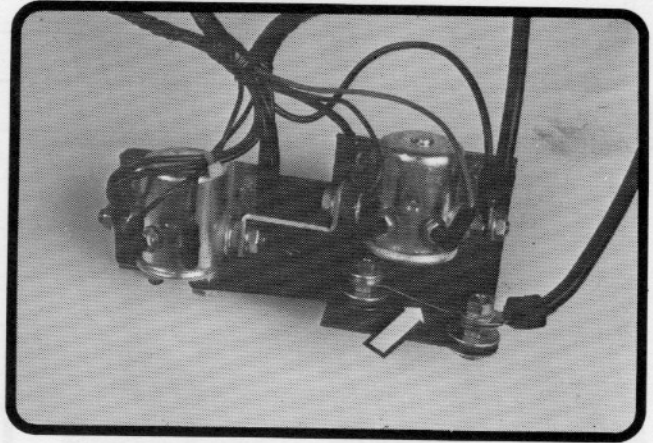
Using either method, with the clutch pedal depressed, meter should show continuity. Conversely, with pedal released, meter should show an open circuit.

A malfunction will indicate either a faulty switch or that adjustment is required to permit full movement of the switch actuating arm. Correct or replace as required.

MOWER SWITCHES

Slide No. 38 — Testing Mower Switches

Using either a volt/ohmmeter or test light, test mower switches for proper function using the wiring diagrams shown on pages 15, 16, 17, and 18.

SYSTEM FUSE

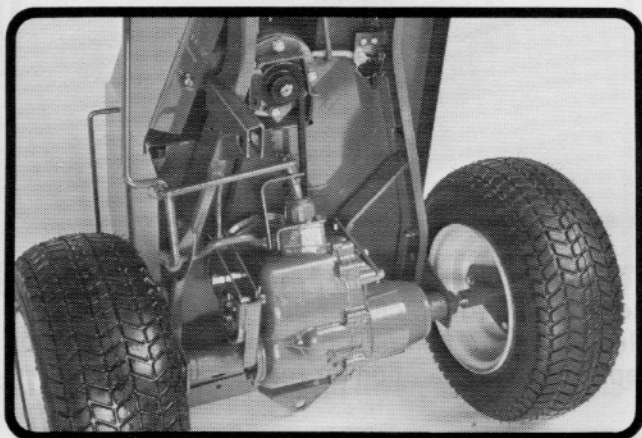
Slide No. 39 — Testing System Fuse

The electrical system is protected with a 100 ampere metal strip fuse in case of a massive short circuit.

A blown fuse will completely shut down the electrical system except for the battery charger. Be sure to inspect for a blown fuse when you are unable to get mower to operate.

NOTES

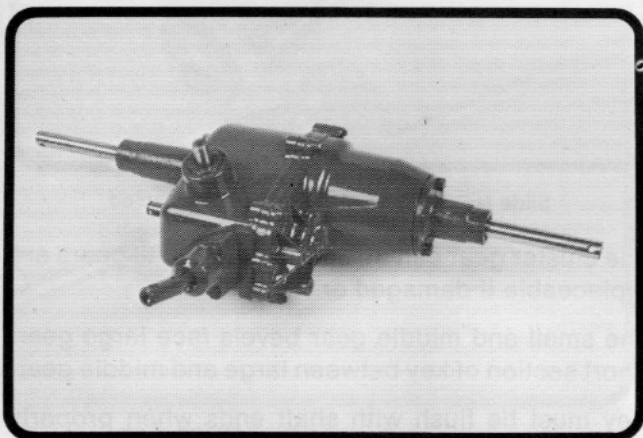
TRANSAXLE



Slide No. 40 — Transaxle in Mower

A 3-speed, aluminum case **transaxle** is the heart of the Electric 90 Mower drive train.

This transaxle performs three specific functions: *speed selection, rear axle support and braking.*

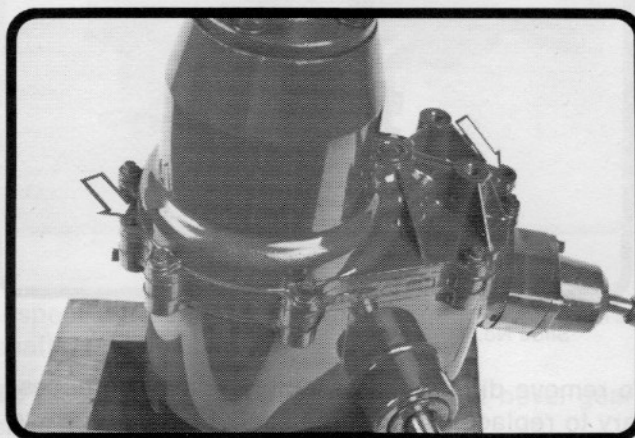


Slide No. 41 — Transaxle Removed from Mower

To service this model transaxle, remove assembly from mower frame and place in suitable holding fixture.

Remove shift tower and tip transaxle to drain lubricant from housing.

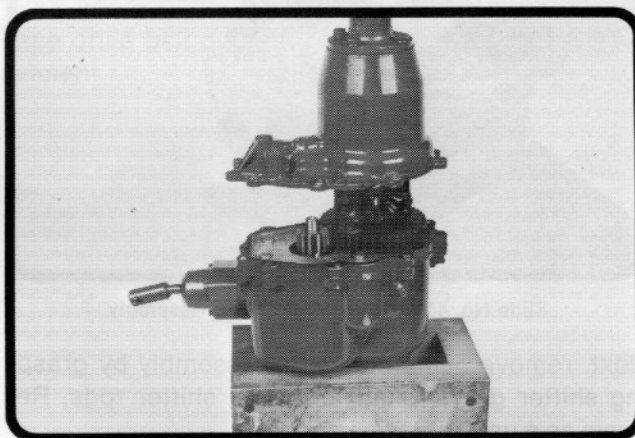
NOTE: Exploded view of transaxle is shown in Slide 51.



Slide No. 42 — Socket Head Cap Screws

After removing axle wheel flanges, position transaxle so that the socket head cap screws are facing up.

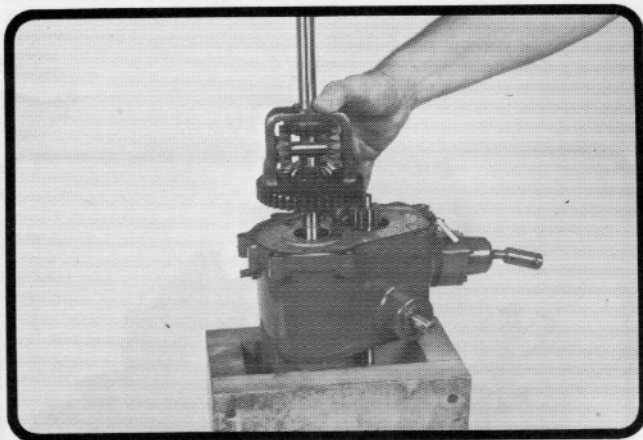
Remove the socket-head cap screws and drive out dowel pins used for alignment of housings.



Slide No. 43 — Removing Cover Assembly

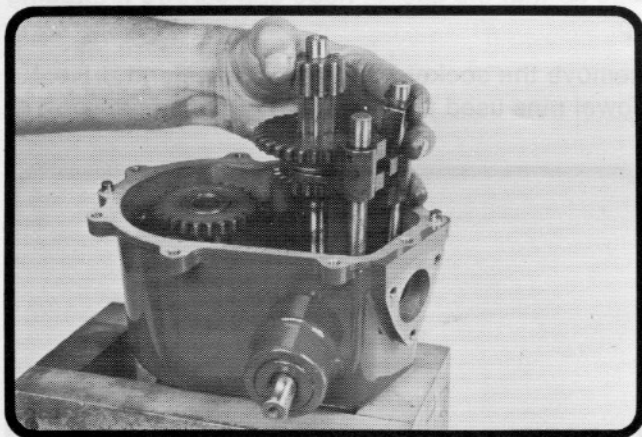
Install a seal protection over end of axle shaft and remove cover assembly.

TRANSAXLE — Continued



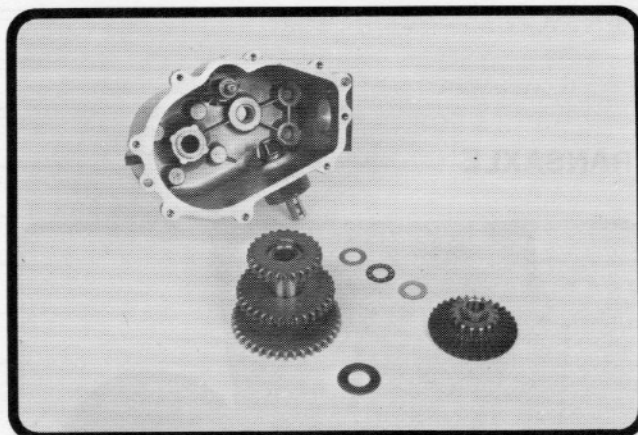
Slide No. 44 — Removing Differential Assembly

To remove differential assembly, it may be necessary to replace two or three socket head screws to hold center plate in place. Pull assembly straight up. If tight, tap on lower axle shaft with soft mallet. Remove temporary retaining screws and center plate.



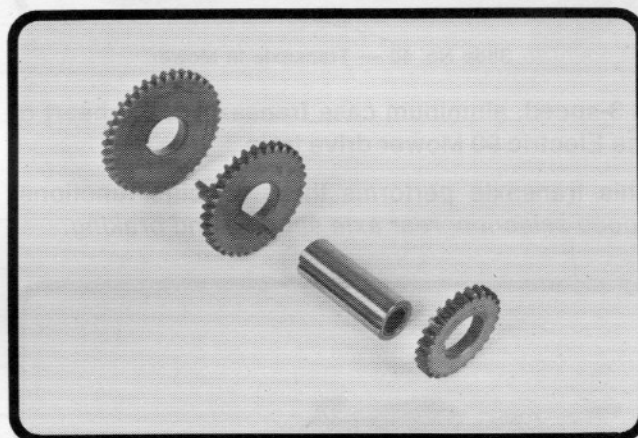
Slide No. 45 — Removing Shifter Assembly

Next, remove complete shifter assembly by grasping shifter gears, shaft and both shifter rods. Remove as a unit.



Slide No. 46 — Gears Removed

Reverse idler gear, cluster gear assembly and beveled idler gear can now be removed, inspected or replaced in preparation for reassembly.



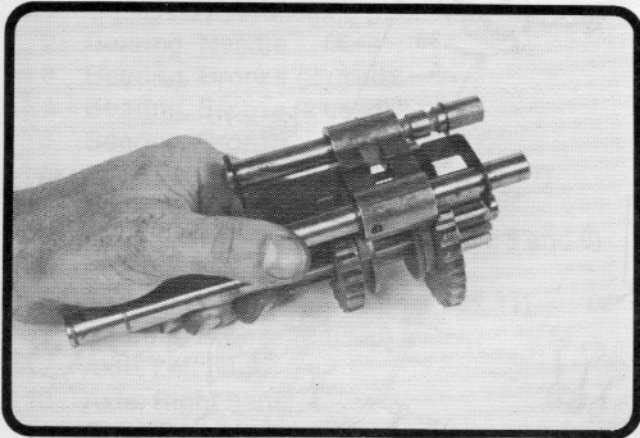
Slide No. 47 — Cluster Gear Disassembled

The cluster gear can be disassembled. All gears are replaceable if damaged or worn.

The small and middle gear bevels face large gear. Short section of key between large and middle gear.

Key must be flush with shaft ends when properly assembled.

TRANSAXLE — Continued

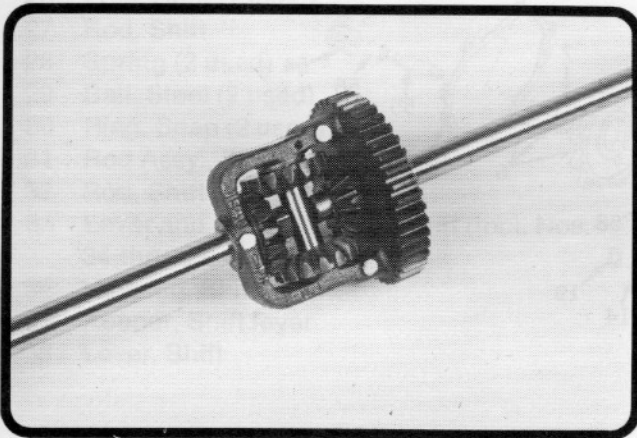


Slide No. 48 — Aligning Shifter Assembly

Reassemble gears to case in reverse manner of disassembly.

Align shifter assembly as shown, grasp firmly, and insert into case.

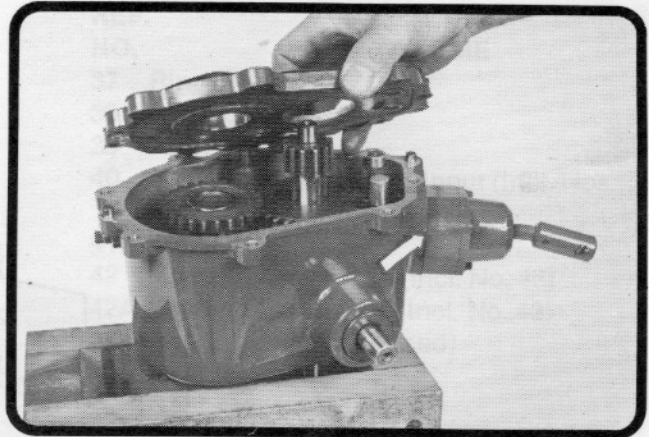
Use the reverse idler shaft as a guide if necessary when inserting shifter through bevel idler gear and thrust washers.



Slide No. 49 — Installing Center Plate

Install reverse idler gear, make sure beveled gear edge is up. Position spacer on top of gear.

Tap dowel pins into place and install new case gasket. Install center plate being sure shifter shafts are properly located.



Slide No. 50 — Differential Assembled

Inspect differential for wear or damage. All gears, shafts, and housing are serviceable.

To disassemble, drive out roll pin and bevel gear shaft.

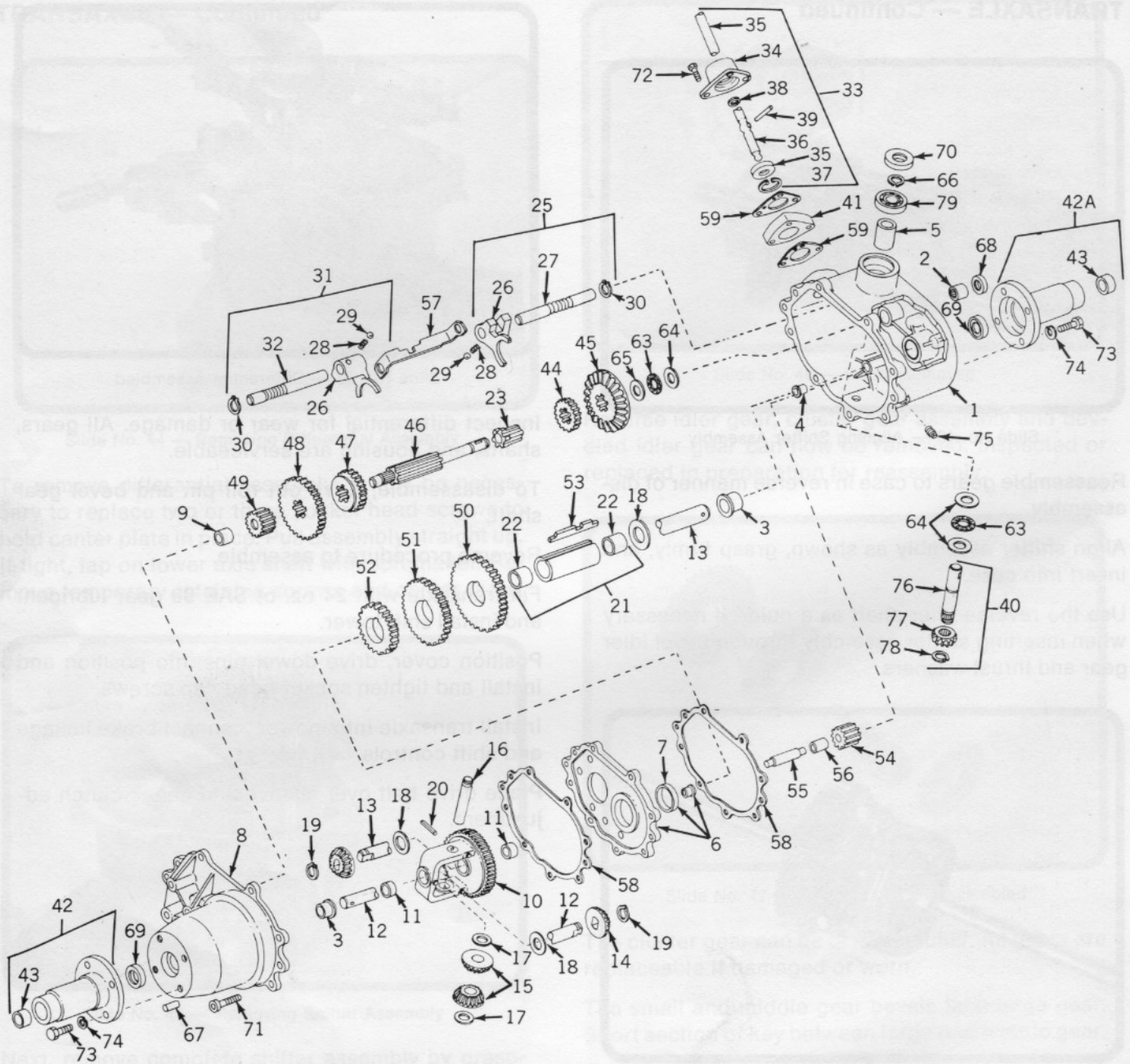
Reverse procedure to assemble.

Fill transaxle with 24 oz. of SAE 90 gear lubricant and install shift tower.

Position cover, drive dowel pins into position and install and tighten socket-head cap screws.

Install transaxle into mower, connect brake linkage and shift controls.

Place drive belt over sheave and check clutch adjustment.



Slide No. 51 — Exploded View of Transaxle

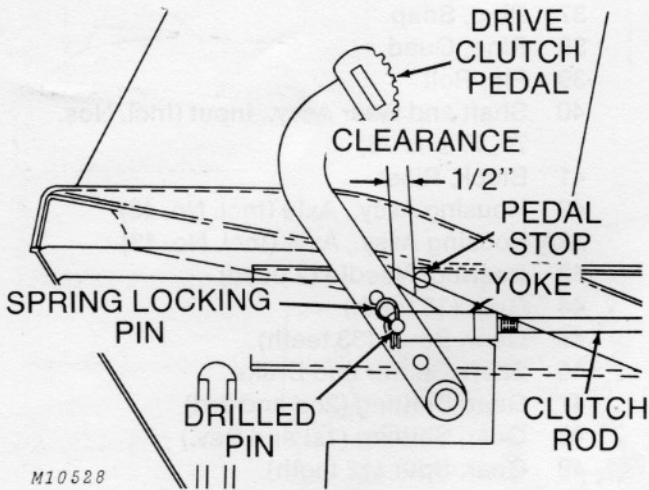
NOTES

REF. NO.	PART NAME
1	Case Assy., Transaxle (Incl. Nos. 2 thru 5)
2	Bearing, Needle
3	Bearing, Bronze (2 used)
4	Bearing, Bronze (2 used)
5	Bearing, Bronze
6	Plate Assy., Center (Incl. Nos. 4 and 7)
7	Bearing, Bronze
8	Cover Assy., Transaxle (Incl. Nos. 3 and 9)
9	Bearing, Needle
10	Gear Assy., Differential (Incl. No. 11)
11	Bearing, Bronze (2 used)
12	Axle, Left hand
13	Axle, Right hand
14	Gear, Bevel (2 used)
15	Pinion, Bevel (2 used)
16	Pin, Drive
17	Washer, Thrust (2 used)
18	Washer, Thrust (3 used)
19	Ring, Snap (2 used)
20	Pin, Roll
21	Sleeve Assy., Countershaft (Incl. No. 22)
22	Bearing, Bronze (2 used)
23	Shaft, Idler
25	Rod Assy., Shift (1st and Rev.)
26	Fork, Shift (2 used)
27	Rod, Shift
28	Spring (2 used)
29	Ball, Steel (2 used)
30	Ring, Snap (2 used)
31	Rod Assy., Shift (2nd and 3rd)
32	Rod, Shift
33	Lever and Housing Assy., Shift (Incl. Nos. 34 thru 39)
34	Housing, Shift lever
35	Keeper, Shift lever
36	Lever, Shift

REF. NO.	PART NAME
37	Ring, Snap
38	Ring, Quad
39	Pin, Roll
40	Shaft and Gear Assy., Input (Incl. Nos. 76, 77 and 78)
41	Block, Riser
42	Housing Assy., Axle (Incl. No. 43)
42A	Housing Assy., Axle (Incl. No. 43)
43	Bearing, Needle (2 used)
44	Gear (16 teeth)
45	Gear, Bevel (33 teeth)
46	Shaft, Shifter and Brake
47	Gear, Shifting (2nd and 3rd)
48	Gear, Shifting (1st and Rev.)
49	Gear, Spur (12 teeth)
50	Gear, Countershaft drive (39 teeth)
51	Gear, Countershaft (34 teeth)
52	Gear, Countershaft (25 teeth)
53	Key, Countershaft
54	Idler, Reverse
55	Shaft, Reverse idler
56	Spacer, Reverse idler
57	Stop, Shifter
58	Gasket, Case and Cover (2 used)
59	Gasket, Shift lever housing (2 used)
63	Bearing, Thrust (2 used)
64	Washer, Thrust (3 used)
65	Washer, Thrust
66	Ring, Snap
67	Pin, Dowel (2 used)
68	Seal, Oil
69	Seal, Oil (2 used)
70	Seal, Oil
71	Screw, Socket hd. cap, 1/4-20x1 1/4 (8 used)
72	Screw, Socket hd. cap, 1/4-20x1 3/4 (3 used)
73	Screw, Hex hd., 5/16-18x1 (8 used)
74	Lockwasher, 5/16" (8 used)
75	Plug, Pipe, 1/8" (2 used)
76	Shaft, Input
77	Pinion, Input
78	Ring, Retaining
79	Bearing, Ball

Reference for Parts shown in Slide 51

CLUTCH



Slide No. 52 — Clutch Adjustment

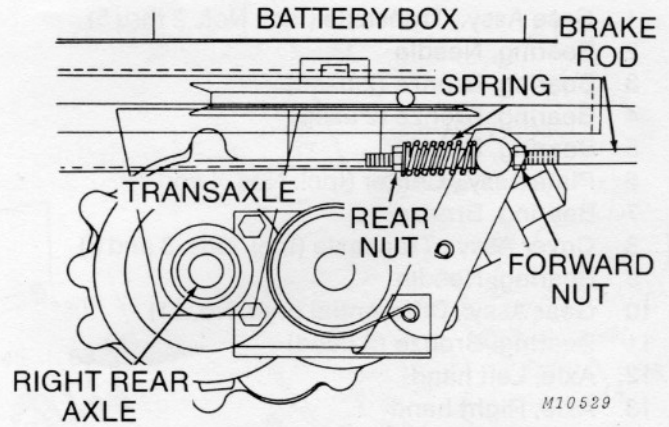
The drive clutch pedal should be adjusted to have approximately 1/2-inch of clearance between the back edge of pedal and the pedal stop when in the "Engaged" position.

To adjust, remove the spring-locking pin securing the drilled pin; remove the drilled pin.

Turn the yoke off the clutch rod to increase clearance, and onto the clutch rod to decrease clearance.

Install the drilled pin in the center hole of clutch pedal and secure the spring-locking pin.

BRAKE



Slide No. 53 — Brake Adjustment

If parking brake is not effective, adjust brake as follows:

Set brake and lock with parking brake lever.

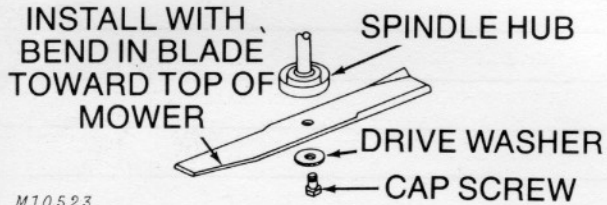
Back off forward nut approximately 1/2-inch.

Tighten rear nut until spring is completely compressed; then, back off four to five turns.

Tighten forward nut.

NOTE: If excessive pedal pressure is required to set parking brake lever, rear nut may be backed off additional turns.

MOWER BLADES

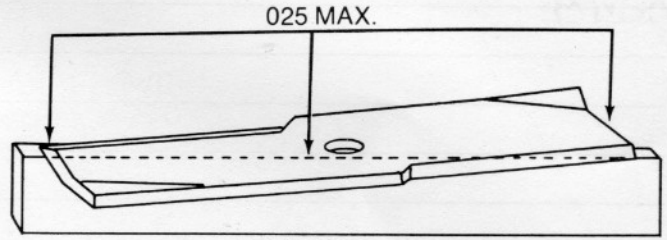


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Slide No. 54 — Blade Installation

Sharpen blades leaving a 1/64-inch dull tip on the cutting edge. A razor-sharp cutting edge will roll over and dull more quickly. Maintain original bevel. Remove an equal amount of material from each end of the blade to maintain proper balance.

Replace blade if extensively damaged or out of balance.



STRAIGHT EDGE

Slide No. 55 — Blade Flatness

In the event of objectionable vibration, inspect mower blades for trueness and balance.

Blades must not exceed .025-inch run out of flatness as indicated above.

Static balance must be as accurate as possible, using quality balancing equipment.

Blade mounting hub trueness must not exceed .007-inch run-out at mounting face.

NOTES

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~~BM 15720~~

AM 34247

AM 34259 TILLAGE Drive of 34254

BM 15718 PTO Drive Mt

