

APPENDIX A RELATED SERVICE MANUALS

A-1. GENERAL

A-1.1 Appendix A lists service manuals for engines used in the Series 2000 tractors covered in this manual. Refer to Table A-1.

Table A-1. Related Service Manuals

Item	Service Manual No.
Kohler Command 11, 12.5, 14 HP Horizontal Engines	KH-TP-2402
Onan E125H, E140H Elite Series Engines	965-0758
Briggs & Stratton Vanguard V-Twin OHV Engines	BS-272144-9
Kohler Command 18, 20, 22, 25 HP Horizontal Engines	KH-TP-2428

APPENDIX B BULK SERVICE ITEMS

B-1. GENERAL.

B-1.1 This appendix lists bulk service items available for the maintenance of the equipment covered in this manual. Refer to Table B-1.

Table B-1. Bulk Service Items

Bulk Item	Part Number
ENGINE OIL	
-Low Ash SAE 30W (gasoline)	737-3029 (1 qt.)
-Low Ash SAE 30W (gasoline)	737-3061 (1 gal.)
-Low Ash SAE 10W30 (gasoline)	737-3030A (1 qt.)
-Low Ash SAE 5W30 (gasoline)	737-3049 (1 qt.)
TRANSMISSION OIL	
-Cub Cadet Drive System Oil	737-3055 (1 qt.)
-Cub Cadet Drive System Oil	737-3054 (1 gal.)
MULTI-PURPOSE GREASE	
-251H EP Lithium	737-3034 (14.5 oz. cartridge)
	737-3020 (4 oz. can)
	737-3019 (4 oz. can w/extension)
	737-3018 (8 oz. can w/extension)
PENETRATING OIL	
	737-3037 (11.75 oz. can)
ULTRA GREY SEALANT	
	737-3746 (2 oz. tube)
PAINTS	
-Cadet Yellow (powder coat)	759-3588 (12 oz. aerosol)
	759-3589 (quart)
	759-3692 (.6 oz. bottle w/brush)
-Cadet Beige (powder coat)	759-3735 (12 oz. aerosol)
	759-3736 (quart)
	759-3674 (.6 oz. bottle w/brush)
-Gloss Black	759-3262 (12 oz. aerosol)
-Hi -Temp Black	759-3261 (12 oz. aerosol)

APPENDIX C

INSPECTING AND TESTING ELECTRICAL COMPONENTS

C-1. GENERAL.

C-1.1 This appendix contains general testing and inspection information pertaining to selected electrical components. Refer to ELECTRICAL SCHEMATICS in APPENDIX D and to TROUBLE SHOOTING AND TESTING in SECTION 4 when attempting to diagnose electrical system problems.

C-2. REPLACEMENT OF STARTER SOLENOID - Models 2160 and 2165. Models 2130, 2135, 2140, 2145 and 2185 are equipped with a solenoid shift type starter. Refer to the appropriate Engine Service Manual for information regarding the solenoid on these models.

C-2.1 **General.** In many instances the solenoid is replaced unnecessarily when a starting problem is experienced. Simple testing can determine whether replacement is necessary.

C-2.2 **Solenoid Problems.** The following are solenoid problems that require replacement of the solenoid.

1. Solenoid is stuck; the starter remains engaged regardless of the ignition switch key position.
2. The coil wiring (inside solenoid) is bad; the solenoid will not function.
3. Bad leaf contactor (inside solenoid); solenoid clicks but starter motor does not turn.

C-2.3 Other Problems Which Can Appear To Be A Defective Solenoid.

1. Faulty ground
2. Defective safety switch
3. Discharged battery
4. Defective starter motor
5. Blown fuse
6. Defective ignition switch
7. Defective wire harness

C-2.4 **Testing The Starter Solenoid.** Refer to Section 4, Table 4-2, for electrical system testing procedures which will help to determine if the solenoid should be tested.

1. Remove the solenoid from the tractor.

2. Using an ohmmeter, test for continuity across the two large terminals. There should be **no** continuity.
3. Test for continuity between small coil terminal and the mounting plate. There should be continuity.
4. Using jumper leads, ground the mounting plate to the negative terminal of the battery and connect the small coil terminal to the battery's positive terminal. Re-test for continuity across the large terminals of the solenoid. Continuity should now be present.
5. The solenoid is functioning properly if these results are obtained.

C-3. REPLACEMENT OF THE PTO SWITCH AND REVERSE RELAY - All Models.

C-3.1 **General.** Unnecessary replacement of the PTO switch and/or the reverse relay should not be the first action taken to correct an electric PTO problem. Simple continuity tests can be conducted to determine their condition and whether replacement is necessary.

C-3.2 **Testing the PTO switch.** Refer to Figure C-1. Using an ohmmeter, check the terminals for proper continuity.

1. With the switch knob fully **depressed**, continuity should be present only between terminals 1 & 2 and terminals 5 & 7. **No** continuity should be present between terminals 3 & 4 and 6 & 7.

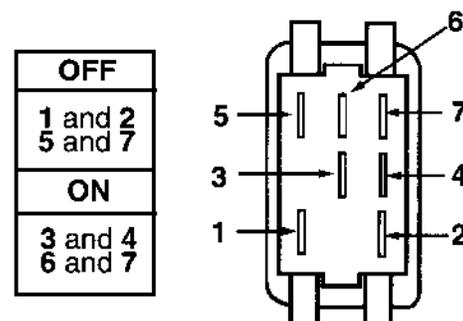


Figure C-1. PTO Switch Terminals.

2. Pull the switch knob to the fully **extended** position. Continuity should now be present between terminals 3 & 4 and terminals 6 & 7. There should be no continuity between terminals 1 & 2 and 5 & 7.
3. If these results are obtained, the switch is operating correctly and the problem is elsewhere in the system.

C-3.3 Testing the Reverse Relay. Refer to Figure C-2. The relay consists of two separate circuits: the activation coil circuit and the contact point circuit. Remove the relay and test as follows:

1. Test for continuity across the coil circuit (terminals 1 and 2). If there is no continuity, replace the relay. Proceed to step 2 if continuity is present.
2. Using jumper leads, apply battery voltage to one terminal of the relay coil and ground the other terminal (you may hear the contact points close).
3. Test for continuity across the contact point terminals (terminals 3 and 5). No continuity indicates the contact points are not closing and the relay should be replaced. If continuity is present, proceed to step 4.

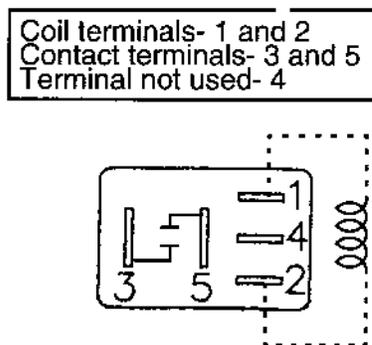


Figure C-2. Reverse Relay Terminals.

4. Remove either jumper lead from its coil terminal (1 or 2). Continuity should be broken across the contact points. If the circuit remains closed, the contact points are sticking and the relay should be replaced. If the circuit is broken, the relay is operating correctly and the problem is elsewhere in the PTO circuit.

C-4. REPLACEMENT OF THE BRAKE PEDAL INTERLOCK SWITCH - All Models.

C-4.1 General. The interlock switch consists of two separate switch circuits, one normally open and the other normally closed. Testing the continuity of the circuits can determine if the switch is functioning properly.

C-4.2 Testing the Interlock Switch. Refer to figures C-3 and C-4. Using an ohmmeter, check the switch terminals for proper continuity.

1. Touch the tester probes to the switch terminals in Position A as shown in Figure C-3.
 - a. With the switch button extended (out) there should be no continuity between the terminals.
 - b. Depress the button. The tester should now indicate continuity between the terminals.

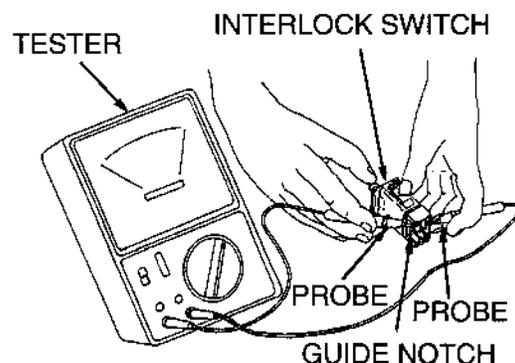


Figure C-3. Interlock Switch Terminals - Position A.

2. Touch the tester probes to the switch terminals in Position B as shown in Figure C-4.
 - a. With the switch button extended (out), the tester should indicate continuity between the terminals.
 - b. Depress the button. The tester should now indicate no continuity between the terminals.

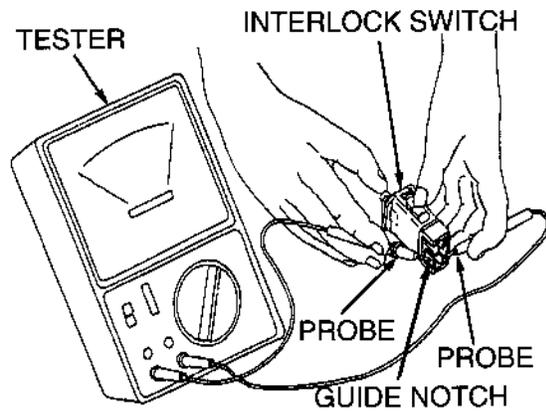


Figure C-4. Interlock Switch Terminals - Position B.

C-5. BATTERY INSPECTION AND TESTS.

C-5.1 A visual inspection cannot be expected to effectively substitute for an instrument check when diagnosing a battery problem or evaluating its condition. An inspection may, however, uncover tell-tale clues which can direct the service technician toward the selection of instrumentation which will most efficiently test a battery under a given set of conditions.

C-5.2 Where there is an indication that there is a need for further service, it is advisable that the technician check the installation date. (Length of service could be a factor — it would certainly be an aid in determining whether trouble is premature or the result of normal degeneration.)

C-5.3 Common Causes of Battery Failure.

1. Overcharging. Charging a battery greatly in excess of what is required is harmful in the following ways:
 - a. Severely corrodes the positive plate grids, causing mechanical weakening and loss of electrical conduction.
 - b. Evaporates the water of the electrolyte into hydrogen and oxygen gas, creating gas bubbles which tend to wash active material from the plates and carry moisture from the cells as a fine mist.

- c. Evaporation of water leaves the acid more concentrated. This concentrated acid is harmful to cell components.
- d. Causes high internal heat, which accelerates the above mentioned corrosion of the positive plates and damages the separators and negative plates.
- e. Causes liquid expansion, forcing electrolyte from the cells and causing corrosion and damage to external parts.

2. Undercharging. Operating with an insufficient charge can cause sulfating of the plates, which may result in buckling of the plates. Especially if subjected to a prolonged overcharging.
3. Lack of water. The plates cannot take full part in the battery action unless they are completely covered by the electrolyte.

C-5.4 **Visual Inspection.** The following are items which may be checked visually for symptoms of trouble in-the-making:



WARNING

Battery cables must be disconnected in proper order to avoid arcing. When disconnecting the cables from the battery, ALWAYS remove the negative cable first, and then remove the positive cable.



WARNING

Battery electrolyte is diluted sulfuric acid. Use extreme care to avoid spilling and to avoid contact with the skin and eyes. Acid can destroy clothing and burn your skin.

1. Battery date coding.
2. The condition of the battery case and its individual cell covers.
3. The top surface of the cover for acid accumulation.
4. The color and odor of the electrolyte in the battery.

5. A gassing condition when the charging circuit is operating.
6. The condition and size of the cables.
7. Corrosive deposits.
8. All surfaces of the battery for any indications of abuse.
9. Missing vent plugs.
10. The level of the battery's electrolyte.

C-5.5 Condition of the Case and Cover. Check for cracks or buckling which could result from one of the following:

1. Hold-down attachment too loose, causing vibration damage.
2. Excessive temperatures in the engine compartment, or internally, due to a high charging rate.
3. Freezing of the electrolyte, due to undercharging of the battery (a battery with a 3/4 state of charge is in no danger of freezing).
4. Prolonged overcharging which could cause severe buckling and warping of the battery plates, especially after operating in an undercharged condition over a long period of time.

C-5.6 Evidence of Acid on the Cover. If acid deposits are noted on the cover, it is quite possible that leakage, spillover, or gassing due to a high charging rate is a contributing cause. (A voltmeter check will determine whether leakage is taking place.) If these conditions are not serviced, they can result in an increase in the rate of self-discharge.

C-5.7 Color and Odor of the Electrolyte. Separately or in combination, discoloration of the normally clear electrolyte and/or the presence of an odor similar to that of rotten eggs suggests one or more of the following:

1. The existence of an excessively high charging rate.
2. The adverse affects of deep cycling.
3. The presence of impurities in the electrolyte solution.
4. An aged battery which is approaching the end of its useful life.

C-5.8 Electrolyte Level. Battery capacity is reduced in direct proportion to the amount of active material that is exposed to the air.



WARNING

NEVER use **ACID** to refill the battery.

1. If inspection reveals a low supply, pure water should be added to bring the electrolyte to the proper level. Most batteries will have an electrolyte level indicator near the base of the filler opening. For batteries which do not have a level indicator, add water to restore the level to 1/4 to 1/2 inch above the top of the plates. Never add acid to restore the electrolyte level. This would disrupt the predetermined sulfuric acid to water ratio and cause destruction of the plate separators.
2. The need to add excessive amounts of water suggests the need to check and possibly replace the voltage regulator.

C-5.9 Signs of Abuse. Surface indications of abuse to the battery are a clue to the cause of some troubles. Check the battery posts for damage which may be the result of the following:

1. Hammering.
2. Striking tools or wires across the terminals.
3. Stretching short cables on applications where longer lengths are required.
4. Improper removal of the cables.
5. Improper connection of booster or charging equipment.

C-5.10 Testing the Battery With a Hydrometer.

1. Raise the hood.
2. Remove the battery cell caps.
3. Make sure the electrolyte level in each cell is high enough to withdraw the proper amount of liquid into the hydrometer barrel
 - a. Do not take readings immediately after adding water.

- b. In the event the electrolyte level is too low to test with the hydrometer, add water and charge before testing.
 - c. A correct specific gravity reading can be measured only when the electrolyte temperature is 80°F. If the electrolyte varies from this temperature, compensation must be made in the reading by adding four gravity points (.004) for each 10° above or subtracting .004 for each 10° below 80°F.
4. With the bulb squeezed tightly by thumb pressure, insert the hydrometer pick-up tube into the cell.
 5. Slowly release the thumb pressure until the bulb is fully expanded and the float is suspended freely in the barrel.
 - a. Always hold the barrel vertically to prevent the float from binding or sticking to the sides
 - b. The float assembly should not touch the top or bottom stoppers of the barrel.
- c. Periodically wash the barrel and float assembly with soap and water and inspect the float for leaks.
6. Holding the hydrometer with the liquid at eye level, read the float scale and record the specific gravity reading.
 7. Repeat this procedure (steps 4 through 6) for each cell in the battery.
 8. When all cells are tested, if the specific gravity between the highest and lowest cell varies 50 points (.050) or more the battery is no longer serviceable.
 9. If there is less than a 50 point variation, but the reading of one or more cells is below 1.250, recharge the battery.
 10. If unable to bring the specific gravity of any one cell up to 1.250 after charging, the battery is no longer serviceable.

APPENDIX D

ELECTRICAL SCHEMATICS AND CIRCUIT DESCRIPTIONS

D-1. GENERAL.

D-1.1 This appendix contains electrical schematics for all tractors covered in this manual, along with a general description of each working circuit within the schematic.

D-1.2 All switches shown in the electrical schematics are depicted (normally open/normally closed) in their non-engaged position.

D-1.3 The information provided is schematically correct; however, some wire connections may not be located as shown. In many cases the connection is made at the terminal connector (resulting in multiple wires at the connectors).

D-1.4 The following applies to all tractors covered in this manual and will be considered as understood when describing the circuit functions: Battery voltage should always be present at one large terminal of the solenoid via the positive battery cable; and at terminal B of the key switch, through a circuit consisting of a red wire connecting the large solenoid terminal (or positive battery terminal) to the fuse and a black wire connecting the fuse to the B terminal of the key switch. Because the circuit is incomplete, there should be no current flow (amperage) with the key switch in the off position.

D-2. CIRCUIT DESCRIPTION AND SCHEMATICS (All Models).

D-2.1 **General.** The Engine Crank and Engine Run circuits of Models 2160, 2165 and 2185 differ slightly from those of Models 2130, 2135, 2140 and 2145. Therefore, separate schematics and descriptions are included for the Models 2160, 2165 and 2185.

D-2.2 **Function: Engine Cranking - Models 2130, 2135, 2140 and 2145 (Refer to Figure D-1).** Observe the following to start the engine.



WARNING

Operator must be in the seat when starting the engine.

1. The brake pedal must be depressed.
2. The PTO switch must be in the off position.
3. The key switch must be turned to the start position.
 - a. Current flows through the key switch from terminal B to terminal S. From terminal S, current flows through an orange wire to terminal 2 of the PTO switch. With the PTO switch in the off position, current passes through the closed contacts to terminal 1 and on to the interlock switch through the orange wire.
 - b. With the brake pedal depressed, the normally open contacts of the interlock switch are closed. Current passes across the now closed contacts and through the orange wire to the starter solenoid. The solenoid is engaged and the contacts are closed, allowing current to flow from the battery to the starter which cranks the engine over.

D-2.3 **Function: Engine Cranking - Models 2160 and 2165 (Refer to Figure D-2).** Observe the following to start the engine.



WARNING

Operator must be in the seat when starting the engine.

1. The brake pedal must be depressed.
2. The PTO switch must be in the off position.
3. The key switch must be turned to the start position.
 - a. Current flows through the key switch from terminal B to terminal S. From terminal S, current flows through an orange wire to terminal 2 of the PTO switch. With the PTO switch in the off position, current passes through the closed contacts to terminal 1 and on to the interlock switch through the orange wire.

- b. With the brake pedal depressed, the normally open contacts of the interlock switch are closed. Current passes across the now closed contacts and through the orange wire to the starter solenoid. The solenoid is activated, allowing current to flow from the battery to the starter which cranks the engine over.
- c. With the starter solenoid activated, battery current at the starter is also picked up by a red wire connected to the starter cable terminal. Current flows through a diode assembly and a red wire to the carburetor fuel solenoid, activating the fuel solenoid. This allows fuel flow in the carburetor when the key switch is in the start position.

D-2.4 Function: Engine Cranking - Model 2185 (Refer to Figure D-3). Observe the following to start the engine.



WARNING

Operator must be in the seat when starting the engine.

- 1. The brake pedal must be depressed.
- 2. The PTO switch must be in the off position.
- 3. The key switch must be turned to the start position.
 - a. Current flows through the key switch from terminal B to terminal S. From terminal S, current flows through an orange wire to terminal 2 of the PTO switch. With the PTO switch in the off position, current passes through the closed contacts to terminal 1 and on to the interlock switch through the orange wire.
 - b. With the brake pedal depressed, the normally open contacts of the interlock switch are closed. Current passes across the now closed contacts and through the orange wire to the starter solenoid. The solenoid is engaged and the contacts are closed, allowing current to flow from the battery to the starter which cranks the engine over.

- c. Battery current from the orange wire also flows through a wire (normally red) and diode in the engine wire harness to the carburetor fuel solenoid. This circuit supplies power to the fuel solenoid, allowing fuel flow in the carburetor when the key switch is in the start position.

D-2.5 Function: Engine Run and Charging - Models 2130, 2135, 2140 and 2145 (Refer to Figure D-4). Observe the following.

- 1. The operator must be in the seat or the brake pedal must be depressed.
- 2. The operator must be in the seat if the PTO switch is in the on position.
- 3. The key switch must be in the run position.
 - a. Battery current passes from terminal B to terminal R of the key switch. From terminal R, current passes through a red wire to the regulator/rectifier of the engine, activating the regulator. With the engine running, alternating current (AC) is produced by the engine alternator and converted to direct current (DC) by the rectifier. This DC current flows in the reverse direction through this same circuit (red wire) to the positive terminal of the battery and maintains the battery charge.
 - b. With the PTO switch in the off position and the tractor in neutral or forward drive, current flows from the R terminal to the reverse switch through a red wire. Current passes across the closed reverse switch and on to the coil of the reverse relay through a white wire, through the relay coil, and on to terminal 7 of the PTO switch through a brown wire. With the PTO off, the contacts of terminals 7 and 5 are closed and the circuit is completed to ground. This energizes the relay, closing the relay points and providing this circuit with a second source to ground.
 - c. Battery current also flows from the R terminal through a red wire to the hourmeter, activating the hourmeter.
 - d. Battery *voltage* from terminal R is supplied through red wires to the PTO clutch, dash lights, and voltage sensor. No current flow (amperage) is present until conditions are met that will complete each circuit to ground.

D-2.6 Function: Engine Run and Charging - Models 2160 and 2165 (Refer to Figure D-5). Observe the following.

1. The operator must be in the seat or the brake pedal must be depressed.
2. The operator must be in the seat if the PTO switch is in the on position.
3. The key switch must be in the run position.
 - a. Battery current passes from terminal B to terminal R of the key switch. From terminal R, current passes through a red wire to the regulator/rectifier of the engine, activating the regulator. With the engine running, alternating current (AC) is produced by the engine alternator and converted to direct current (DC) by the rectifier. This DC current flows in the reverse direction through this same circuit (red wire) to the positive terminal of the battery and maintains the battery charge. Battery current and/or charge current is also supplied to the carburetor fuel solenoid through a red wire, keeping the solenoid activated.
 - b. With the PTO switch in the off position and the tractor in neutral or forward drive, current flows from the R terminal to the reverse switch through a red wire. Current passes across the closed reverse switch and on to the coil of the reverse relay through a white wire, through the relay coil, and on to terminal 7 of the PTO switch through a brown wire. With the PTO off, the contacts of terminals 7 and 5 are closed and the circuit is completed to ground. This energizes the relay, closing the relay points and providing this circuit with another source to ground.
 - c. Battery current also flows from the R terminal through a red wire to the hourmeter, activating the hourmeter.
 - d. Battery *voltage* from terminal R is supplied through red wires to the PTO clutch, dash lights, and voltage sensor. No current flow (amperage) is present until conditions are met that will complete each circuit to ground.

D-2.7 Function: Engine Run and Charging - Model 2185 (Refer to Figure D-6). Observe the following.

1. The operator must be in the seat or the brake pedal must be depressed.
2. The operator must be in the seat if the PTO switch is in the on position.
3. The key switch must be in the run position.
 - a. Battery current passes from terminal B to terminal R of the key switch. From terminal R, current passes through a red wire to the regulator/rectifier of the engine, activating the regulator. With the engine running, alternating current (AC) is produced by the engine alternator and converted to direct current (DC) by the rectifier. This DC current flows in the reverse direction through this same circuit (red wire) to the positive terminal of the battery and maintains the battery charge. Battery current and/or charge current is also supplied to the carburetor fuel solenoid through a wire (normally red) and diode in the engine wire harness, keeping the solenoid activated.
 - b. With the PTO switch in the off position and the tractor in neutral or forward drive, current flows from the R terminal to the reverse switch through a red wire. Current passes across the closed reverse switch and on to the coil of the reverse relay through a white wire, through the relay coil, and on to terminal 7 of the PTO switch through a brown wire. With the PTO off, the contacts of terminals 7 and 5 are closed and the circuit is completed to ground. This energizes the relay, closing the relay points and providing this circuit with a second source to ground.
 - c. Battery current also flows from the R terminal through a red wire to the hourmeter, activating the hourmeter.
 - d. Battery *voltage* from terminal R is supplied through red wires to the PTO clutch, dash lights, and voltage sensor. No current flow (amperage) is present until conditions are met that will complete each circuit to ground.

D-2.8 Function: Normal and Safety Engine Shutdown - All Models (Refer to Figure D-7).

1. *Normal Engine Shutdown.* A yellow wire runs from the engine wire harness to the M terminal of the key switch. The corresponding wire of the engine harness connects to the grounding terminal of the ignition module(s). When the key switch is turned to the off position, contact is closed between terminals M and G. The ignition module is grounded and engine shutdown occurs.
2. *Safety Engine Shutdown.* A second yellow wire runs to the normally closed seat switch. If the operator is **not** in the seat, the circuit continues through a yellow wire to the normally closed interlock switch and also to terminal 3 of the PTO switch. If the brake pedal is not depressed, the circuit is completed to ground and the engine is shut down. The operator cannot leave the seat without locking down the brake pedal. If the PTO switch is in the on position, contact between terminals 3 and 4 is closed, completing the circuit to ground and shutting down the engine. The operator cannot leave the seat when the PTO switch is on.

D-2.9 Function: PTO Start and Run - All Models (Refer to Figure D-8).



WARNING

The operator must be in the seat when operating the PTO.

1. Battery voltage from terminal R of the key switch is available at the PTO clutch through a red wire, and also at terminal 6 of the PTO switch through the clutch field coil and a blue wire. Because the circuit is incomplete, no current flows and the PTO clutch is not engaged.
2. As noted previously in the **Engine Run** descriptions, when the PTO switch is in the off position and the tractor in neutral or forward drive, current flows from the R terminal of the key switch to the reverse switch through a red wire. Current passes across the closed reverse switch and through a white wire to the coil of the reverse relay, through the relay coil, and on to terminal 7 of the PTO switch through a brown wire. With the PTO off, the contacts of terminals 7 and 5 are closed and the circuit is completed to ground. This closes the relay points and provides this circuit with a second source to ground.
3. When the PTO switch is moved to the on position, continuity between terminals 5 and 7 is broken and terminals 6 and 7 are closed. The opening of terminals 5 and 7 eliminates one source to ground and the relay coil must now ground through the relay points to remain energized. The closing of terminals 6 and 7 provides the blue wire from the PTO clutch a source to ground through a brown wire and the relay points, thus completing the PTO circuit and engaging the PTO clutch.
4. When the reverse drive pedal is depressed, the reverse switch is actuated and the switch contacts are opened. This breaks the circuit energizing the relay coil, causing the relay points to open. The opening of the relay eliminates the source of ground for the PTO clutch circuit and the clutch disengages.
5. When the reverse drive pedal is released, the reverse switch closes and battery *voltage* is again available to the relay coil. However, because the PTO switch is in the on position and the relay points are open, the circuit cannot be completed. The PTO switch must be moved to the off position, closing terminals 5 and 7, to complete the circuit and re-activate the relay.

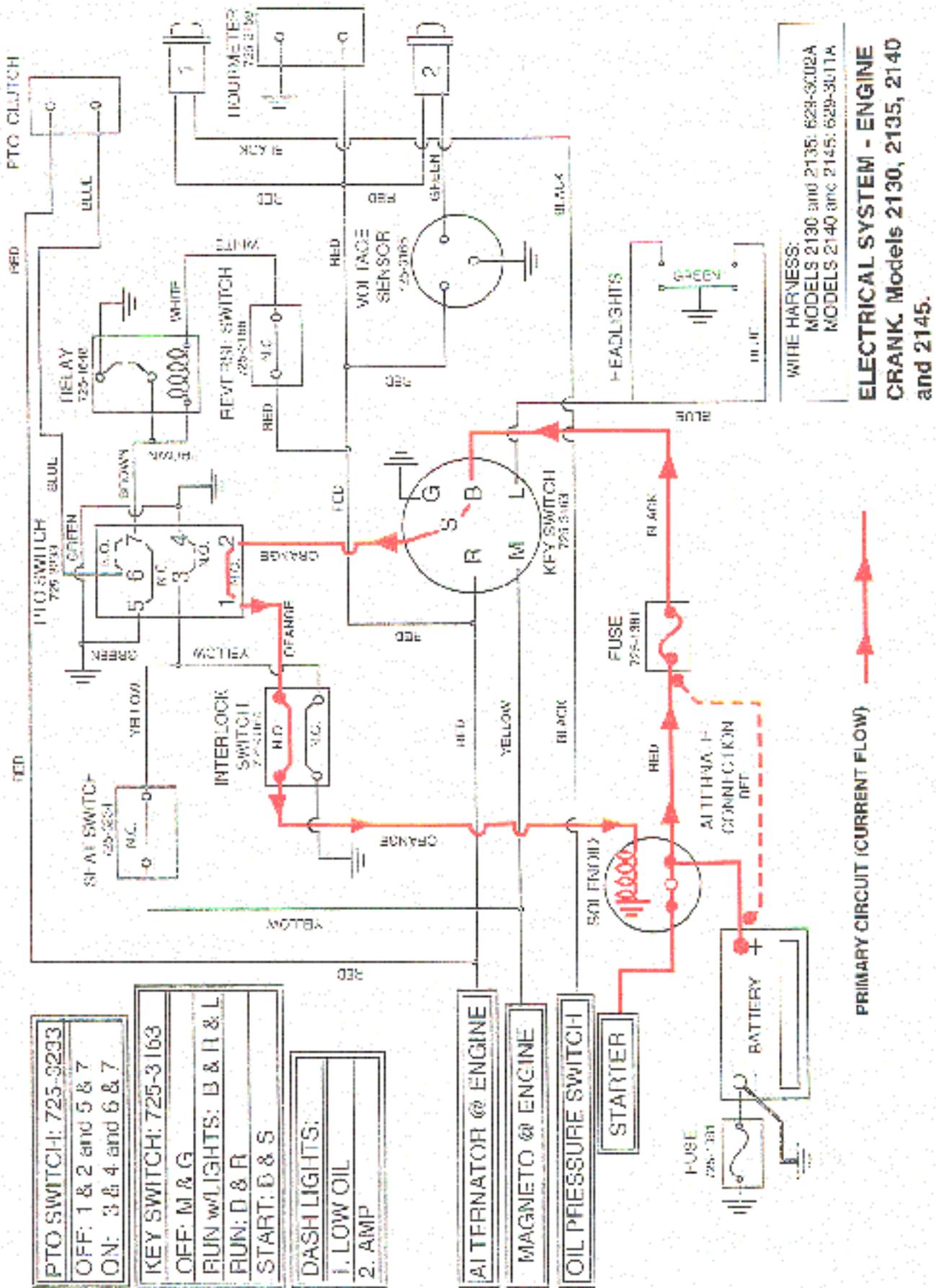


Figure D-1. Engine Crank, Models 2130, 2135, 2140 and 2145

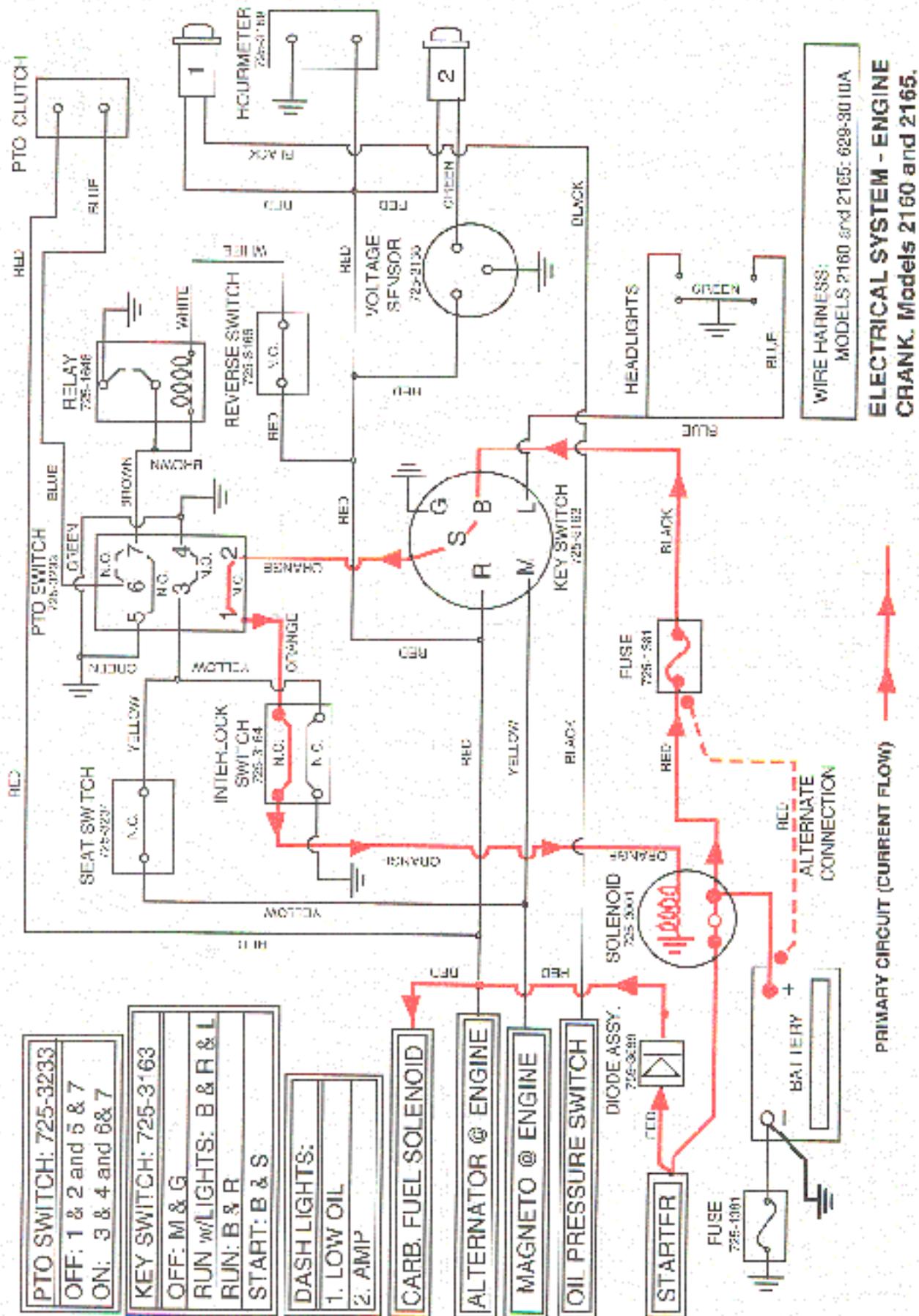


Figure D-2. Engine Crank, Models 2160 and 2165.

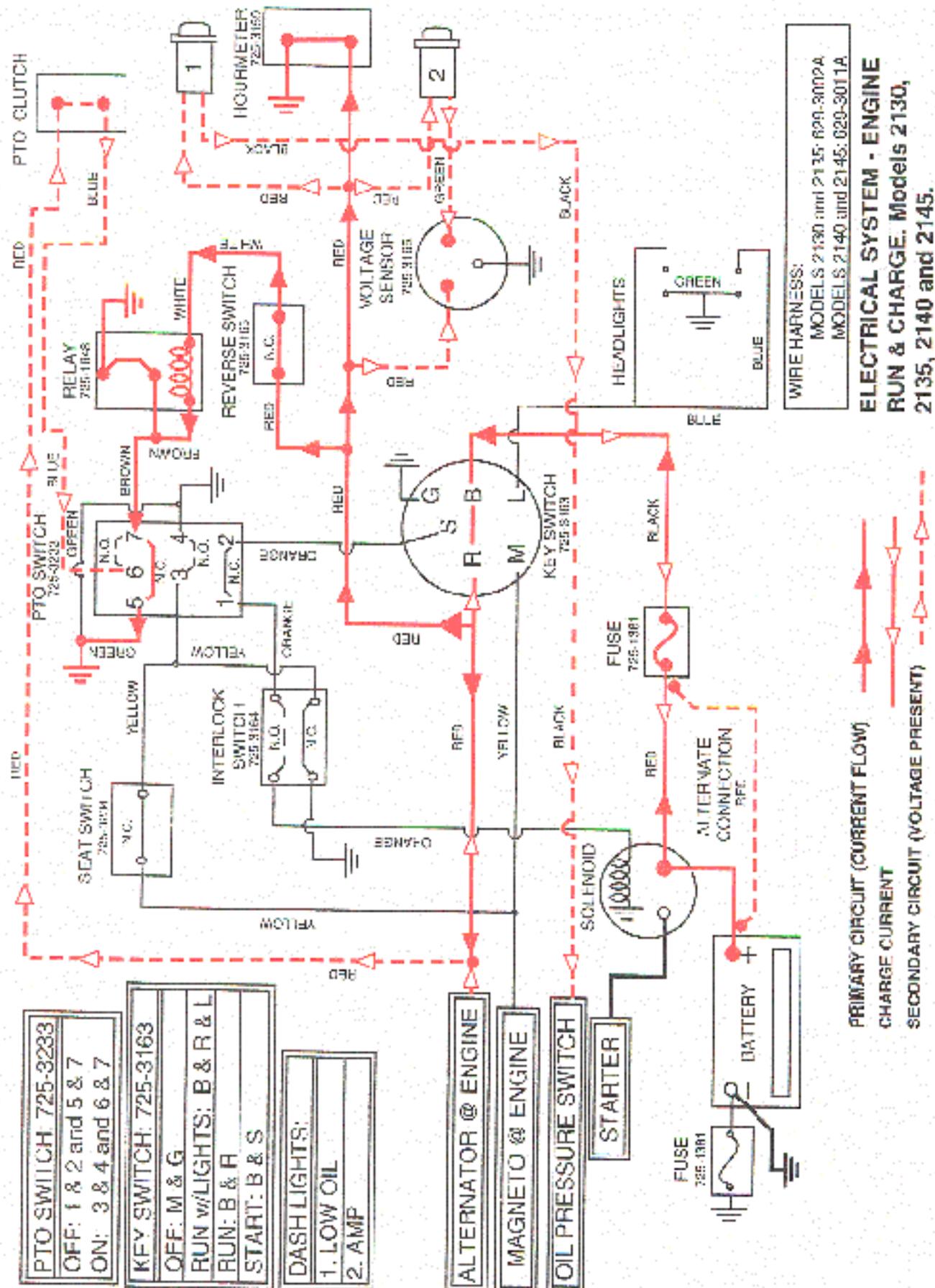


Figure D-4. Engine Run and Charging Circuit, Models 2130, 2135, 2140 and 2145.
 D-8

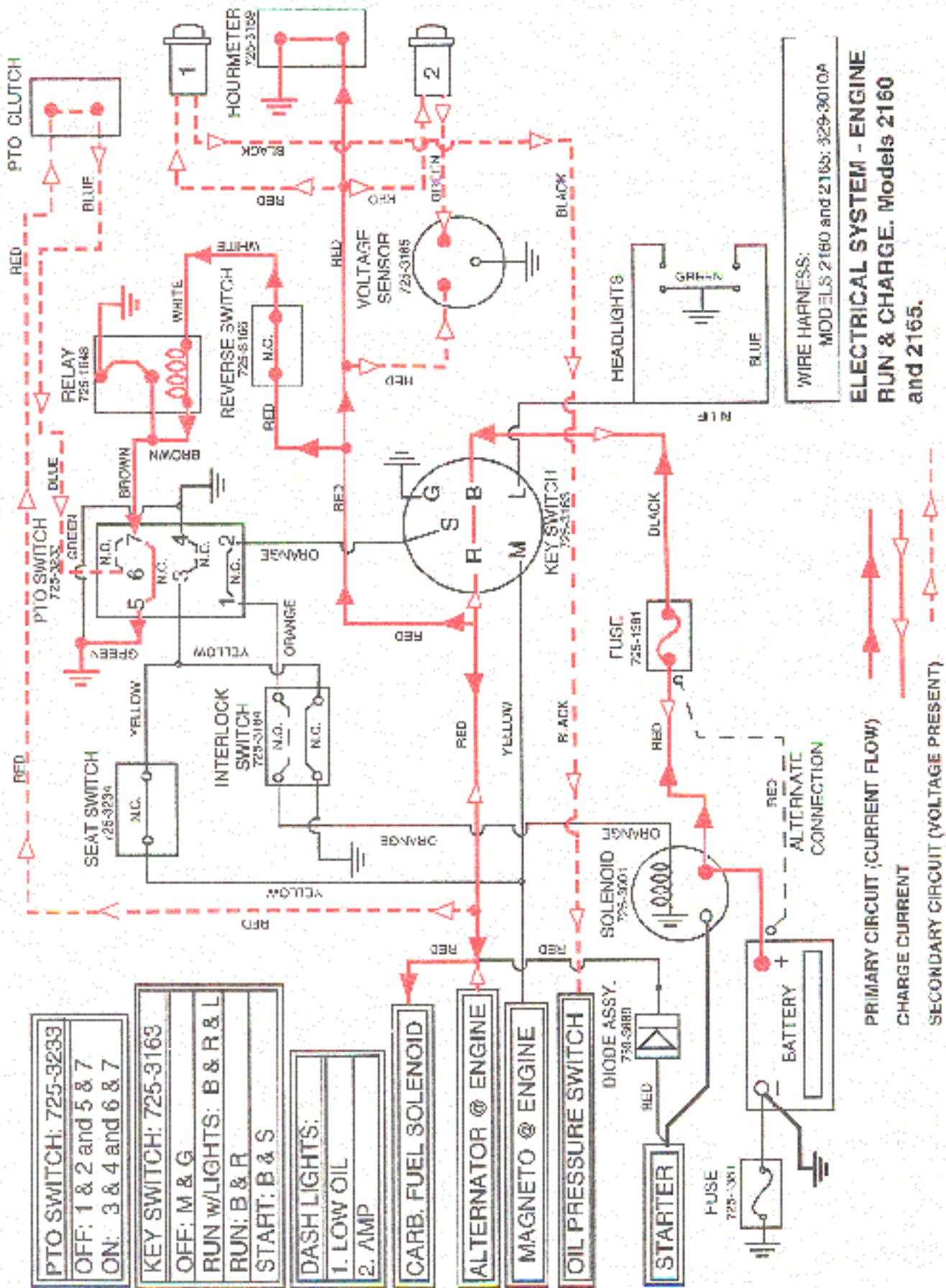


Figure D-5. Engine Run and Charging Circuit, Models 2160 and 2165.
 D-9

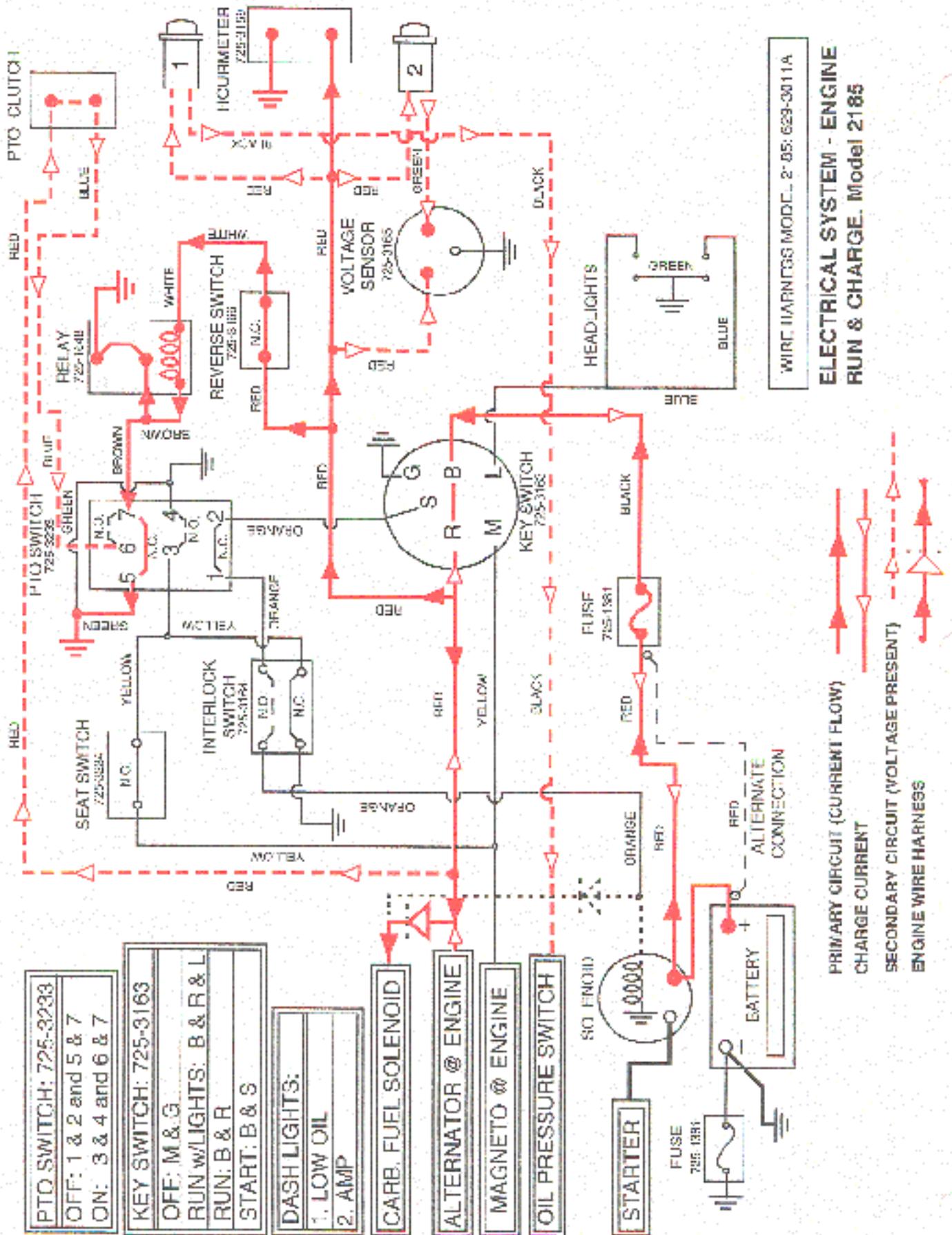


Figure D-6. Engine Run and Charging Circuit, Model 2185.
 D-10

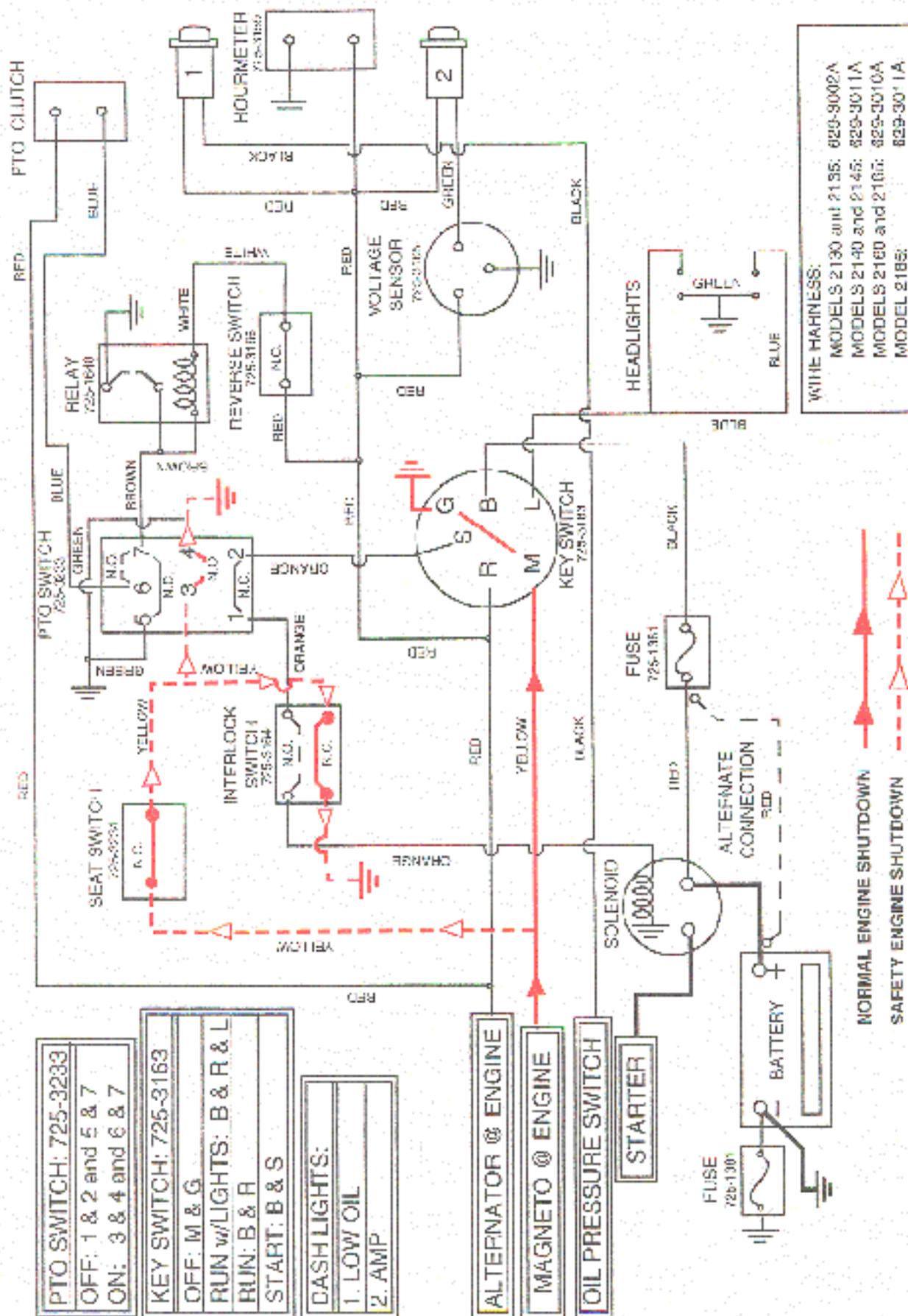


Figure D-7. Normal/Safety Engine Shutdown, ALL MODELS.

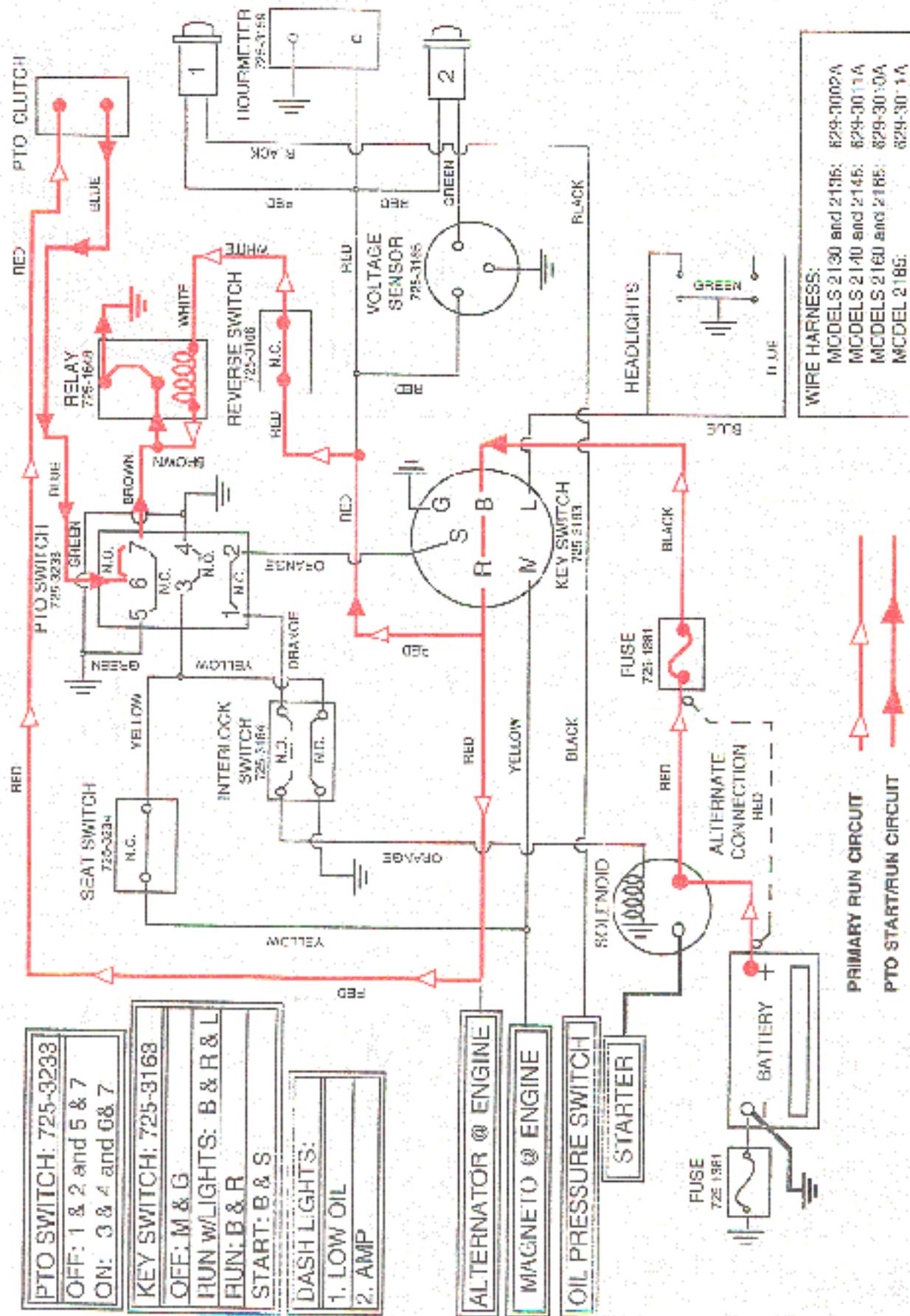


Figure D-8. PTO Start/Run, ALL MODELS.
D-12

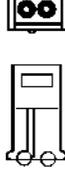
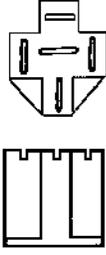
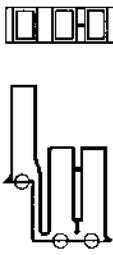
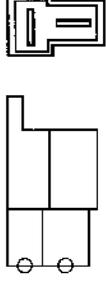
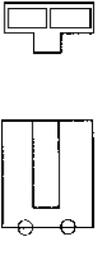
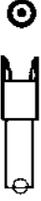
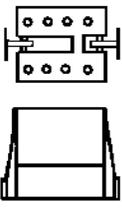
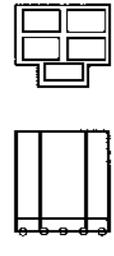
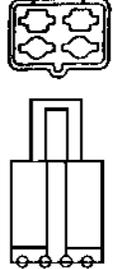
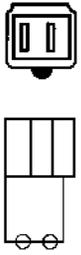
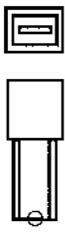
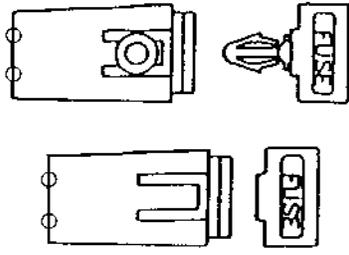
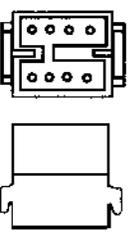
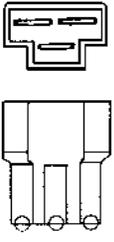
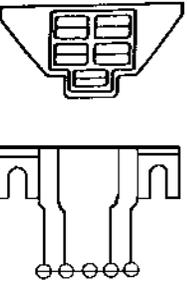
ELECTRICAL SYSTEM - PTO START & RUN. All Models.

APPENDIX E ELECTRICAL CONNECTION INSULATORS

E-1. GENERAL.

E-1.1 This appendix shows the general configuration and part numbers of electrical connection insulators available through Cub Cadet Service Parts.

Table E-1. Electrical Connection Insulators

<p><u>729-0166</u></p> 	<p><u>729-0132</u></p> 	<p><u>729-0141</u></p> 	<p><u>729-0205</u></p> 	<p><u>725-0768</u></p> 	<p><u>729-0145</u></p> 	<p><u>729-0140</u></p> 	
<p><u>729-0139</u></p> 	<p><u>729-0171</u></p> 	<p><u>729-0170</u></p> 		<p><u>729-0125</u></p> 	<p><u>729-0213</u></p> 	<p><u>729-0147</u></p> 	
<p><u>729-0142</u></p> 	<p><u>729-0152</u></p> 	<p><u>725-3168</u></p> 			<p><u>729-0207</u></p> 		
<p><u>729-0169</u></p> 	<p><u>729-0177</u></p> 	<p><u>729-0131</u></p> 	<p><u>729-0206</u></p> 				

APPENDIX F MOWER DECK BELT INFORMATION

F-1 GENERAL.

F-1.1 This Appendix contains information related to the possible causes of belt problems which are occasionally encountered with belt-driven mower decks.

1. V-belt failures are not normally caused by a bad belt. Such failures are usually the result of the failure of another part.
2. Belts which are frayed or worn on the inside surfaces indicate defective or damaged pulley(s).
 - a. A V-belt should not bottom out in the pulley sheave. If the belt bottoms out, the pulley is too wide or the sheave has spread apart. Refer to Figure I-1.

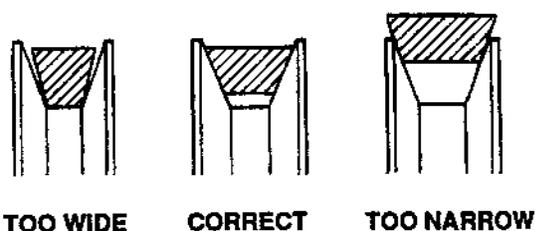


Figure F-1. Belt Position in Pulley Sheaves.

- b. If the sheave is too narrow, the belt will not have full contact with the V-surface of the pulley sheaves. As a general rule, a belt should not ride out of the pulley more than 1/16 inch. A belt riding too far out of the pulley will also appear to be too short.
 - c. Check to determine if the double pulley has been mounted upside down, causing a mismatch between the pulley and belt sizes.
 - d. Inspect the pulley sheaves for dents or nicks caused by thrown objects, prying the belt on or off with a screw driver (or similar device), or striking the pulley to remove it from its blade spindle or shaft.
3. Heavy wear on only one side of the PTO belt indicates misaligned pulleys.
 - a. Figure I-2 shows the optimal alignment of the drive belt running over idler pulleys to the input pulley of the mower. Some misalignment of the mower pulley is normal, due to deck

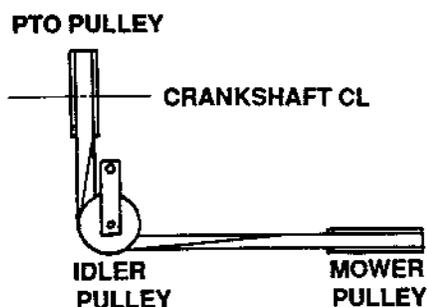


Figure F-2. Properly Aligned Drive Belt.

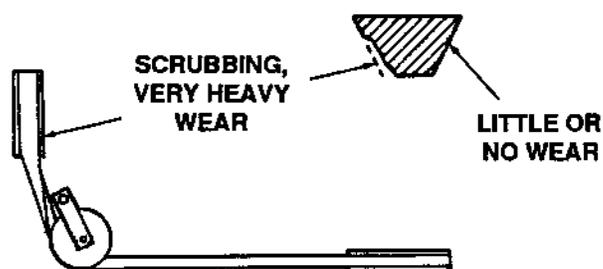


Figure F-3. Excessively Misaligned Drive Belt.

height adjustment. The degree of misalignment will depend on the height selected.

- b. Figure I-3 shows excessive misalignment (particularly over a short length run of the drive belt) causing one side of the belt to scrub heavily against the PTO pulley.
4. A misaligned pulley may also cause the belt to roll over on the pulley. A belt which has rolled over will have cracks throughout the length of the belt (see Figure I-4). Once a belt has rolled over in the pulleys, it must be replaced.
5. As long as a belt is not slipping, it can be assumed the it has proper tension. An over tightened belt will stress components and reduce the service life of the belt.



Figure F-4. Cracked Drive Belt.

APPENDIX G BASICS OF MOWER DECK OPERATION

G-1 GENERAL.

G-1.1 Appendix G contains information on the basic principles of mower deck operation. Knowledge of these principles can be helpful when attempting to determine the cause of poor mowing deck performance.

G-2 BASIC CUTTING BLADE OPERATION.

Figure G-1 below depicts the normal cutting blade of a rotary mower deck as it moves through the grass.

The leading edge (relative to the direction of rotation) at each end of the blade will have a sharpened cutting edge.

The trailing edges of the blade will have *lift wings*, curving upward from the top surface of the blade. The height and pitch (angle) of these lift wings control the amount of vacuum created by the blade. This *vacuum action* serves the following functions:

- Stands the grass up for a quality cut.
- Provides the air movement needed to discharge the grass clippings.

The designed form of the deck housing directs this air movement, creating the *air flow* which carries the grass clippings out the discharge tunnel of the housing.

Any condition that will spoil this *air flow*, such as a damaged deck housing, grass build-up from previous

mowings, or mowing an excessive volume of grass, will adversely affect the mower deck performance.

As the cutting blade moves forward, it takes *bites* of grass. First one tip then the other, A,B,A,B,A,B, etc.

The size of these *bites* is determined by two things, the *ground speed* of the tractor and the *tip speed* of the cutting blade. Generally it is desirable to keep the bite size very small for a quality cut. The smaller bites allow efficient discharge of the grass clippings, which will lessen problems with clogging. The smaller bites also require less engine horsepower.

The *tip speed* of the cutting blade is limited by regulations to 19,000 feet per minute. The mower deck *must be designed to operate within this regulated tip speed* when the tractor engine is running at top (no load) speed. Consequently, mowing at a slower engine speed will **not** produce the preferred blade tip speed.

The bite size of the of the cutting blade is under the control of the operator through ground speed and engine speed. Because of the *regulated tip speed*, it is

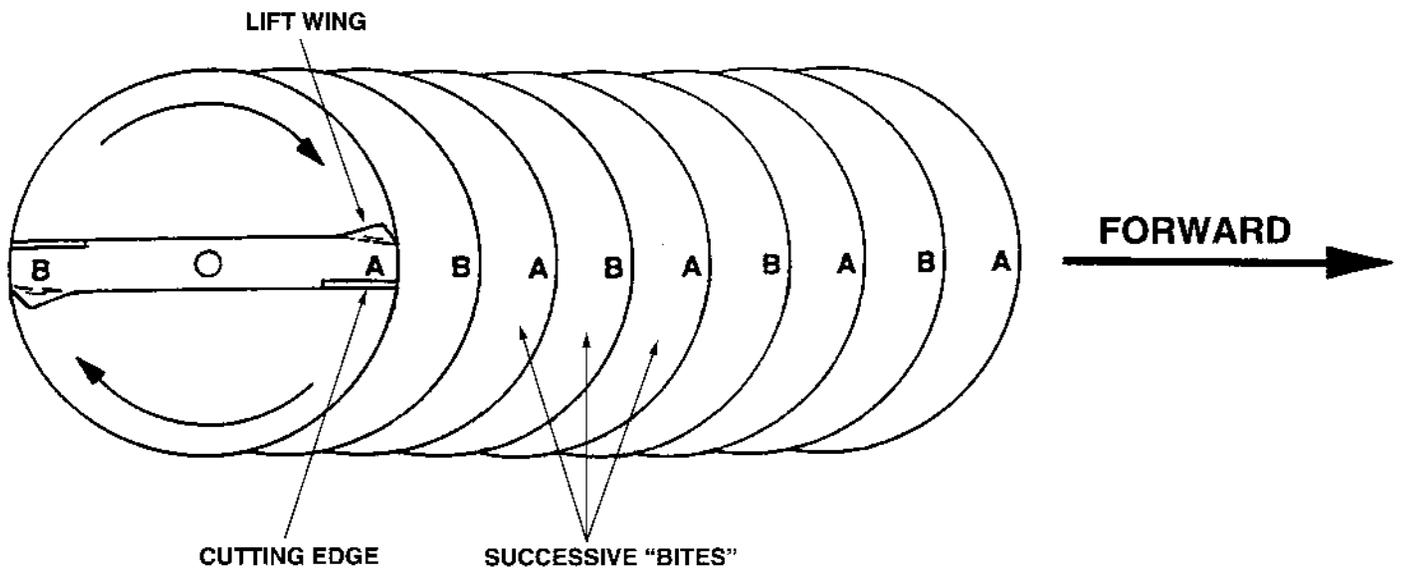


Figure G-1. Basic Cutting Blade Operation.

normally recommended that the tractor engine be operated at full throttle when cutting grass. The operator must decide what *bite size* is right for the particular lawn being mowed, and adjust the ground speed to control the bite size. The right bite for the same lawn may differ from one cutting to the next, or one area to another. The ground speed may have to be adjusted to compensate for changes in *grass length*, *desired cutting height*, *moisture content*, and possible *horsepower* or *terrain* changes. In all cases, the right bite size is determined by the conditions.

G-3 MOWING WITH A CORRECTLY LEVELED MOWER DECK.

NOTE

The forward tilt of the cutting blade shown in Figure G-2 is exaggerated for informational purposes.

Figure G-2 depicts the cutting blade of a properly leveled mowing deck as it moves through the grass.

Line 1 shows the plane of the cutting blade with the tractor stationary on the lawn. At this point, the mower deck is *engaged* and the blade starts spinning.

Note (line 1) when the mower deck is initially engaged, the cutting blade is in *full contact* with the grass. The entire length of the blade is attempting to cut grass, even the unsharpened areas of the blade. This results in ragged cut at the spot of engagement.

The succeeding lines (2 through 7) show the plane of the blade as it moves forward through the grass. Note that **only** the leading edge of the blade is in contact with the grass, due to the *forward tilt* of the mower deck. Each blade of grass is cut to the proper height with just one cut. **This is the condition desired when performing deck leveling procedures.**

G-4 MOWING WITH AN INCORRECTLY LEVELED MOWER DECK.

NOTE

The rearward tilt of the cutting blade shown in Figure G-3 is exaggerated for informational purposes.

Figure G-3 depicts the cutting blade of an improperly leveled mowing deck as it moves through the grass.

Line 1 shows the plane of the cutting blade with the tractor stationary on the lawn. At this point, the mower deck is *engaged* and the blade starts spinning.

Note (line 1) when the mower deck is initially engaged, the cutting blade is in *full contact* with the grass. The entire length of the blade is attempting to cut grass, even the unsharpened areas of the blade.

The succeeding lines (2 through 7) show the plane of the blade as it moves forward through the grass. Note that the condition does not improve. The entire length of the blade remains in *full contact* with the grass as a result of the rearward tilt of the mower deck.

As the blade moves forward, the leading edge of the blade makes a major cut of the grass; while the *remainder of the blade length* attempts to make many more *minor cuts*, with the trailing edge making the final cut.

These many *minor cuts* of each blade of grass can result in damaged or frayed grass tips, and, especially in lush grass, can cause a *milking* of the tips. This *milking*, combined with the bits of grass from the many minor cuts, can form a paste-like substance which can stick the underside of the deck housing. As this condition continues, the deck *air flow* is disrupted and eventually the deck becomes plugged.

This multiple cutting of the grass requires more engine horsepower. Also, because of the increased load, may cause premature PTO clutch and/or belt wear.

G-5 CORRECT MOWER DECK LEVELING.

NOTE

Refer to the appropriate tractor or deck Owner's Manual for the specific deck leveling procedure.

Before attempting to level the mower deck, ensure all deck hangers are properly connected and all tires are inflated properly.

Place the tractor on a hard, flat and level surface.

All measurements requested in the leveling procedure should be measured from the sharpened edge



The rearward tilt of the cutting blade shown in this figure is exaggerated for informational purposes. However, even a minor rearward tilt will result in the condition shown.

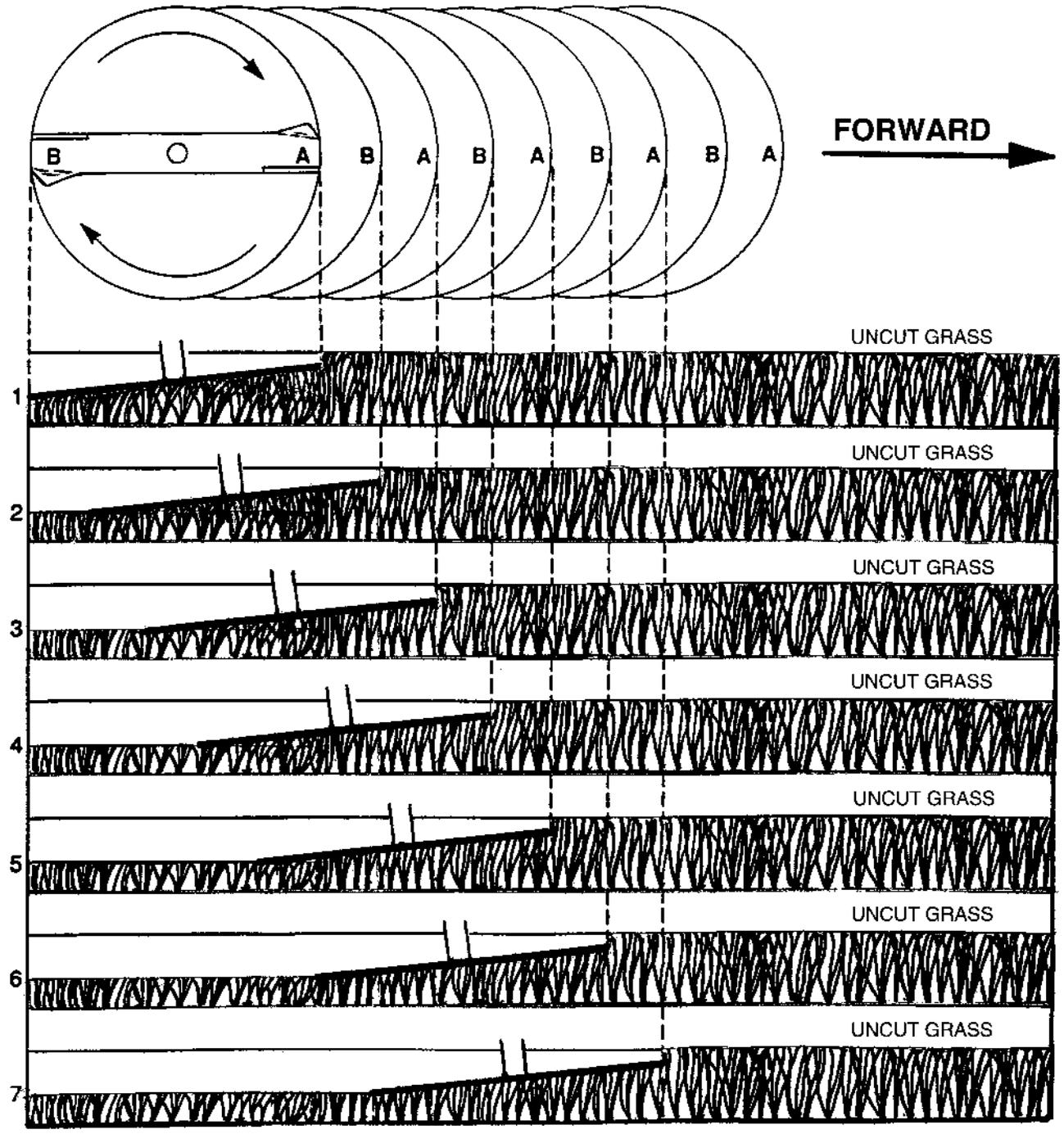


Figure G-3. Cutting Grass With an Incorrectly Leveled Mower Deck.

of the blade tip to the flat level surface. DO NOT take measurements from the deck housing.

Level the mower deck in the following sequence:

- Position the two outer blades so they are pointing left to right (perpendicular to tractor frame).
- Measure the height of the outside blade tips from the flat level surface. The measurements should be within 1/16 inch of each other.
- If necessary, refer to the Owner's Manual to adjust the side to side leveling.
- Rotate the blades 180 degrees and measure again at the same points. The measurements should be the same. A difference in measurements could indicate a bent — blade, blade spindle, or spindle mounting surface.
- Position the outer blades fore and aft (parallel to tractor frame).
- Measure the height of the *forward* blade tips; then measure the *rearward* blade tips. The *forward* measurement should be 1/8 to 1/4 inch **LESS** than the rear measurement.
- If necessary, refer to the Owner's Manual and perform the adjustments needed to achieve the above specified *forward tilt*.

G-6 MOWING WITH A MULTI-BLADE MOWER DECK.



The conditions depicted in Figures G-4.2 and G-4.3 are exaggerated for instructional purposes.

There are two basic types of multi-blade mowing decks.

The less popular type is designed with “timed” cutting blades. This design allows the blades to be placed in line with each other, with the blade tips actually overlapping. The problems with this design are:

- The need for costly *toothed* timing belts and pulleys.
- The frequency of belts “jumping time.” This can allow the blades to contact each other, which could result in extensive damage.

The more practical type is the design shown in Figure G-4. With this design, the blades are positioned off-set behind one another and cannot come in contact with each other.

Figure G-4.1 depicts this design on a two-bladed mower deck moving in the straight forward direction. Note the *staggered* arrangement of the blades create the *blade overlap* that is necessary to avoid leaving strips of uncut grass.

Characteristics of this style mowing deck can, however, affect the mowing procedure and resulting quality of cut. Particularly when turning the tractor while mowing.

Figure G-4.2 depicts the same two-bladed mower deck in a tight left turn. Note that as the tractor turns, the right blade trails behind the left blade; momentarily increasing the the *blade overlap* while decreasing the cutting width.

Figure G-4.3 shows the two-bladed mower in a tight right turn. As the tractor turns, the space between the blades momentarily aligns with the direction of travel. This allows a thin strip of uncut grass to pass between the blades, resulting in a poor quality cut.

On a three-bladed deck, both of the conditions described above (Fig. G-4.2 and G-4.3) apply when turning the tractor in either direction.

- When turning to the left, the space between the left and center blades aligns with the direction of travel, leaving uncut grass. The right blade trails the center blade; increasing the overlap while decreasing the cutting width.
- When turning to the right, although the conditions and results are reversed, the same poor quality cut is obtained.

When mowing the lawn with a multi-blade mower deck, the following procedures are recommended for the best cut quality and appearance:

- When making turns, reduce the tractor ground speed.
- Cut in a “*clover-leaf pattern*,” with the turns being made over the previously cut grass.
- Remove areas where the initial cut was made while turning the tractor.
- Discharge grass clippings toward the previously mowed areas.

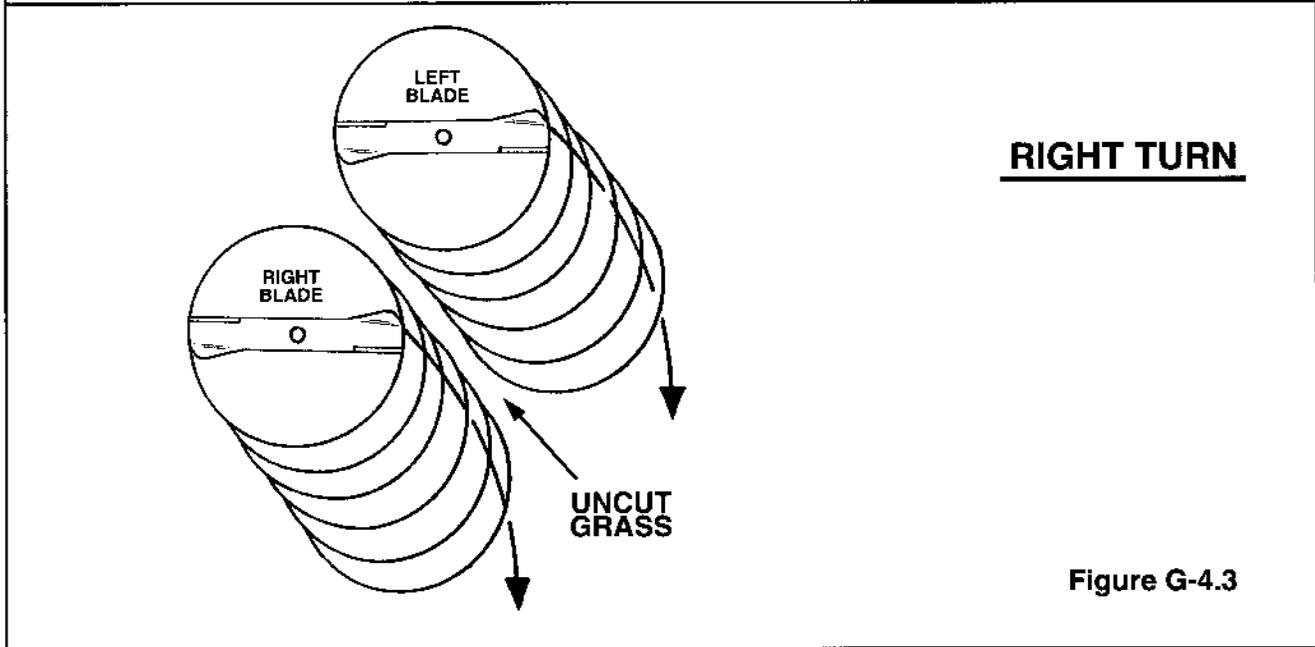
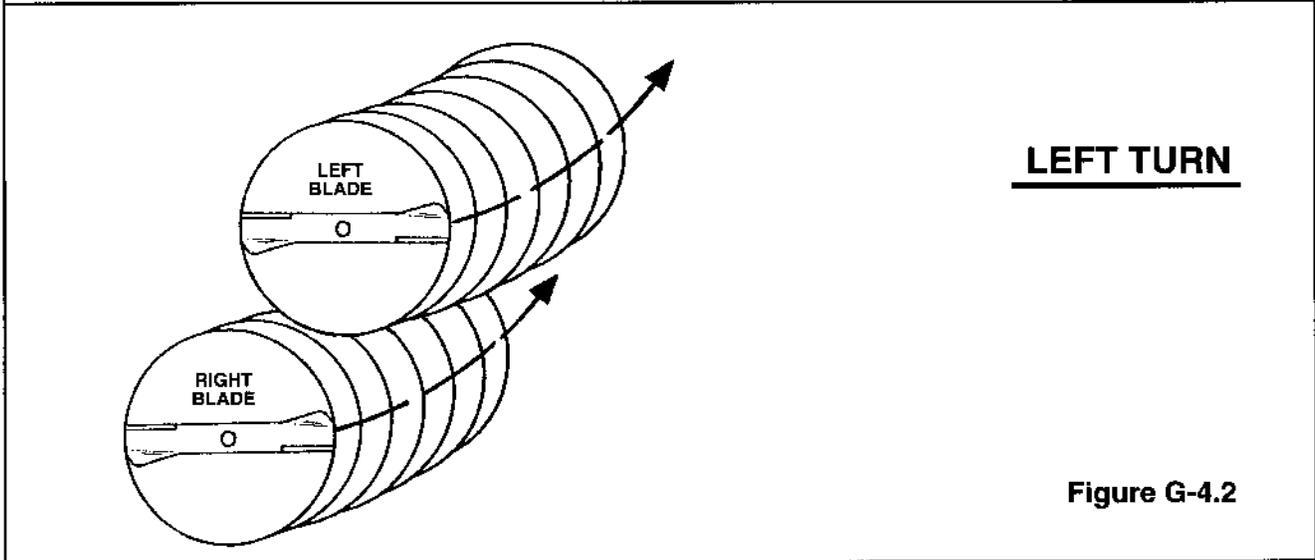
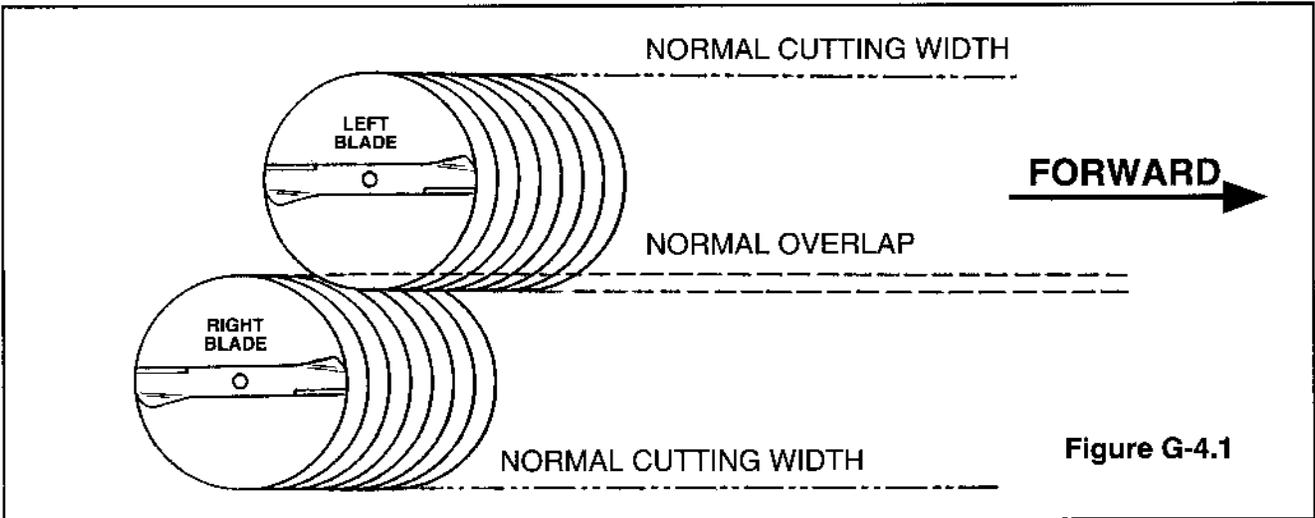


Figure G-4. Mowing with Multi-Blade Mowing Decks.

Table G-1. Basic Mower Deck Troubleshooting.

MOWER DECK TROUBLESHOOTING		POSSIBLE CAUSES																
		SYMPTOMS																
OPERATOR CONTROLLED	GROUND SPEED TOO HIGH	•	•	•	•				•	•	•	•						
	ENGINE RPM TOO SLOW	•	•	•	•			•		•	•	•	•					
ENVIRONMENT RELATED	CUTTING TOO LOW							•		•	•	•						
	CUTTING TOO HIGH	•	•	•														
	TURNING SPEED TOO FAST	•	•	•	•			•										
	ROUGH OR UNEVEN TERRAIN	•	•	•	•			•				•						
	GRASS VERY DRY	•	•	•								•						
MAINTENANCE PROBLEMS	GRASS VERY WET	•	•	•	•			•		•	•	•	•					
	GRASS TOO HIGH	•	•	•	•			•		•	•	•	•					
	SANDY TERRAIN															•		•
	DECK INCORRECTLY ADJUSTED	•	•	•	•			•	•	•	•	•	•	•	•			
	DEBRIS UNDER DECK	•	•	•					•	•	•	•	•	•	•	•		
	'V' BELTS DAMAGED/STRETCHED	•	•	•					•	•		•	•	•	•			
	OIL OR GREASE ON BELTS	•	•	•						•		•	•	•	•			
	PTO CLUTCH SLIPPING	•	•	•					•			•	•	•	•			
	DULL OR WORN BLADES (CUTTING EDGE OR LIFT WINGS)	•	•	•	•							•	•	•	•			
	BLADES BENT/OUT OF BALANCE	•	•	•	•				•			•	•	•	•			
MECHANICAL PROBLEMS	BLADES INSTALLED UPSIDE DOWN	•	•	•	•			•	•	•	•	•	•	•				
	INCORRECT BLADES	•		•					•	•	•	•	•	•				
	TIRES OVER/UNDER INFLATED	•	•					•	•									
MECHANICAL PROBLEMS	DAMAGED OR SEIZED SPINDLES OR BEARINGS	•	•	•					•	•	•	•	•			•		•
	PTO CLUTCH WORN OR IMPROPERLY ADJUSTED	•	•	•					•			•	•					
	DECK WORN OR DAMAGED											•	•	•				

APPENDIX H TORQUE DATA

H-1. GENERAL.

H-1.1 This appendix provides the general torque information listed below. Except where a specific torque value is contained in the text, these torque values should be used to tighten fasteners removed when performing the repair procedures covered in this manual.

Table H-1 — Standard Torque Data for Inch Nuts and Bolts - Given In Foot Pounds.

Table H-2 — Standard Torque Data for Inch Nuts and Bolts - Given In Newton Meters.

Table H-3 — Conversion Table - Inches to Millimeters.

Table H-4 — Conversion Table - Millimeters to Inches.

Table H-1. Standard Torque Data for Inch Nuts and Bolts - Foot Pounds

Recommended torque for all standard unplated nuts and bolts, provided:

- A. Surface finish is oxide coated, oil quenched or bright.
- B. All threaded surfaces are clean and lubricated with SAE-30 engine oil or equivalent (see NOTE).
- C. Joints are rigid, that is, no gaskets or compressible materials are used.
- D. When reusing nuts or bolts, use minimum torque values.

NOTE: Multiply the standard torque by:

- .65 when finished jam nuts are used.
- .70 when Molykote, white lead or similar mixtures are used as lubricants.
- .75 when phosphate coated and oiled bolts or nuts are used.
- .85 when cadmium or zinc dichromate bolts or nuts are used.
- .90 when hardened surfaces are used under the nut or bolt head.
(this applies to standard unplated hardware only)

1 Foot Pound = 1.355 Newton Meters

Bolt or Stud Diameter	Type 2 Studs Only		Type 2 Bolts 6" Length or Less		Type 2 Bolts Longer Than 6"		Type 5 All Lengths		Type 8 - All Lengths			
									† Only When Used In Cast (gray) Iron		All Other Applications	
Inches	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	5	6	6	7	4	4	9	10	11	13	13	14
5/16	12	13	11	13	7	8	18	20	22	25	25	28
3/8	21	24	21	24	13	14	33	37	41	46	45	50
7/16	35	38	35	38	20	23	53	60	65	74	75	85
1/2	52	58	52	59	31	35	80	90	100	112	115	130
9/16	70	80	75	85	45	51	115	130	145	160	165	185
5/8	98	110	104	117	62	70	160	180	200	225	225	255
3/4	174	195	185	205	180	200	285	320	355	400	400	450
7/8	280	315	265	300	265	300	460	575	570	640	645	725
1	420	470	380	425	380	425	685	720	855	960	970	1090
1-1/8	595	670	535	600	535	600	850	950	1210	1360	1375	1545
1-1/4	840	945	700	785	700	785	1200	1350	1705	1920	1940	2180
1-3/8	1100	1240	925	1045	925	1045	1570	1760	2235	2515	2540	2860

† When bolt penetration is 1-1/2 times the diameter of the bolt.

Bolt Type Identification Chart

SAE Grade	Description	Bolt Head Marking *
2	WILL BE BLANK IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	WILL HAVE 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	WILL HAVE 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

* The center marking identifies the bolt manufacturer.

Table H-2. Standard Torque Data for Inch Nuts and Bolts - Newton Meters

Recommended torque for all standard unplated nuts and bolts, provided:

- A. Surface finish is oxide coated, oil quenched or bright.
- B. All threaded surfaces are clean and lubricated with SAE-30 engine oil or equivalent (see NOTE).
- C. Joints are rigid, that is, no gaskets or compressible materials are used.
- D. When reusing nuts or bolts, use minimum torque values.

NOTE: Multiply the standard torque by:

- .65 when finished jam nuts are used.
- .70 when Molykote, white lead or similar mixtures are used as lubricants.
- .75 when phosphate coated and oiled bolts or nuts are used.
- .85 when cadmium or zinc dichromate bolts or nuts are used.
- .90 when hardened surfaces are used under the nut or bolt head.
(this applies to standard unplated hardware only)

1 Newton Meter = 0.738 Foot Pound

Bolt or Stud Diameter	Type 2 Studs Only		Type 2 Bolts 6" Length or Less		Type 2 Bolts Longer Than 6"		Type 5 All Lengths		Type 8 - All Lengths			
									† Only When Used In Cast (gray) Iron		All Other Applications	
Inches	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	7	8	8	9	5	5	12	14	15	18	18	19
5/16	16	18	15	18	9	11	24	27	30	34	34	38
3/8	28	33	28	33	18	19	45	50	56	62	61	68
7/16	47	52	47	52	27	31	72	81	88	100	102	115
1/2	71	79	71	80	42	47	109	122	136	152	156	176
9/16	95	109	102	115	61	69	156	176	197	217	224	251
5/8	133	149	141	159	84	95	217	244	271	305	305	346
3/4	236	265	251	278	244	271	387	434	482	543	543	611
7/8	380	427	360	407	360	407	624	780	773	868	875	984
1	570	638	516	577	516	577	929	977	1160	1303	1316	1479
1-1/8	807	909	726	814	726	814	1153	1289	1642	1845	1866	2096
1-1/4	1140	1282	950	1065	950	1065	1628	1832	2313	2605	2632	2958
1-3/8	1492	1682	1255	1418	1255	1418	2130	2388	3033	3412	3446	3881

† When bolt penetration is 1-1/2 times the diameter of the bolt.

Bolt Type Identification Chart

SAE Grade	Description	Bolt Head Marking *
2	WILL BE BLANK IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	WILL HAVE 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	WILL HAVE 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

* The center marking identifies the bolt manufacturer.

Table H-3. Conversion Table - Inches to Millimeters

Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
1	25.4	26	660.4	51	1295.4	76	1930.4
2	50.8	27	685.8	52	1320.8	77	1955.8
3	76.2	28	711.2	53	1346.2	78	1981.2
4	101.6	29	736.6	54	1371.6	79	2006.6
5	127.0	30	762.0	55	1397.0	80	2032.0
6	152.4	31	787.4	56	1422.4	81	2057.4
7	177.8	32	812.8	57	1447.8	82	2082.8
8	203.2	33	838.2	58	1473.2	83	2108.2
9	228.6	34	863.6	59	1498.6	84	2133.6
10	254.0	35	889.0	60	1524.0	85	2159.0
11	279.4	36	914.4	61	1549.4	86	2184.4
12	304.8	37	939.8	62	1574.8	87	2209.8
13	330.2	38	965.2	63	1600.2	88	2235.2
14	355.6	39	990.6	64	1625.6	89	2260.6
15	381.0	40	1016.0	65	1651.0	90	2286.0
16	406.4	41	1041.4	66	1676.4	91	2311.4
17	431.8	42	1066.8	67	1701.8	92	2336.8
18	457.2	43	1092.2	68	1727.2	93	2362.2
19	482.6	44	1117.6	69	1752.6	94	2387.6
20	508.0	45	1143.0	70	1778.0	95	2413.0
21	533.4	46	1168.4	71	1803.4	96	2438.4
22	558.8	47	1193.8	72	1828.8	97	2463.8
23	584.2	48	1219.2	73	1854.2	98	2489.2
24	609.6	49	1244.6	74	1879.6	99	2514.6
25	635.0	50	1270.0	75	1905.0	100	2540.0

1 Inch = 25.4 Millimeters

To convert inches to millimeters, the inch value to be converted should be written down, carried to as many decimal places as the desired accuracy requires. It should then be split into groups of not more than two figures each. The equivalent of each group should then be taken from the table, proper regard being given to the position of the decimal point in each case, and the equivalent values of the groups added together. This sum will be the millimeter equivalent of the inch value given.

For example, to convert 2.4635 inches to millimeters:

2.0000 inches = 50.80000 millimeters
 .4600 inches = 11.684000
 .0035 inches = .08890
 2.4635 inches = 62.57290 millimeters
 Correct to 3 decimal places.
 2.4635 inches = 62.573 millimeters

Table H-4. Conversion Table - Millimeters to Inches

Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches
1	.0393701	26	1.0236220	51	2.0078740	76	2.9921260
2	.0787402	27	1.0629921	52	2.0472441	77	3.0314961
3	.1181102	28	1.1023622	53	2.0866142	78	3.0708661
4	.1574803	29	1.1417323	54	2.1259842	79	3.1102362
5	.1968504	30	1.1811024	55	2.1653543	80	3.1496063
6	.2362205	31	1.2204724	56	2.2047244	81	3.1889764
7	.2755906	32	1.2598425	57	2.2440945	82	3.2283465
8	.3149606	33	1.2992126	58	2.2834646	83	3.2677165
9	.3543307	34	1.3385827	59	2.3228346	84	3.3070866
10	.3937008	35	1.3779528	60	2.3622047	85	3.3464567
11	.4330709	36	1.4173228	61	2.4015748	86	3.3858268
12	.4724409	37	1.4566929	62	2.4409449	87	3.4251968
13	.5118110	38	1.4960630	63	2.4803150	88	3.4645669
14	.5511811	39	1.5354331	64	2.5196850	89	3.5039370
15	.5905512	40	1.5748031	65	2.5590551	90	3.5433071
16	.6299213	41	1.6141732	66	2.5984252	91	3.5826772
17	.6692913	42	1.6535433	67	2.6377953	92	3.6220472
18	.7086614	43	1.6929134	68	2.6771654	93	3.6614173
19	.7480315	44	1.7322835	69	2.7165354	94	3.7007874
20	.7874016	45	1.7716535	70	2.7559055	95	3.7401575
21	.8267717	46	1.8110236	71	2.7952756	96	3.7795276
22	.8661417	47	1.8503937	72	2.8346457	97	3.8188976
23	.9055118	48	1.8897638	73	2.8740157	98	3.8582677
24	.9448819	49	1.9291339	74	2.9133858	99	3.8976378
25	.9842520	50	1.9685039	75	2.9527559	100	3.9370080

1 Millimeter = .03937008 Inch

To convert millimeters to inches, the millimeter value to be converted should be written down, carried to as many decimal places as the desired accuracy requires. It should then be split into groups of not more than two figures each. The equivalent of each group should then be taken from the table, proper regard being given to the position of the decimal point in each case, and the equivalent values of the groups added together. This sum will be the inch equivalent of the millimeter value given.

For example, to convert 75.384 millimeters to inches:

75.000	millimeters =	2.9527559	inches
.380	millimeters =	.0149606	
<u>.004</u>	millimeters =	<u>.0001574</u>	
75.384	millimeters =	2.9678739	inches
	Correct to 5 decimal places.		
75.384	millimeters =	2.96787	inches