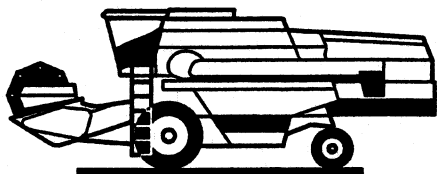


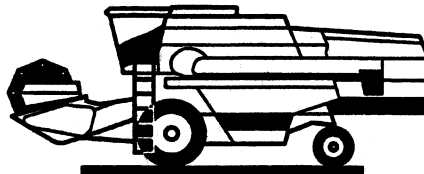
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**COMBINE
REPAIR**

**TR®96, TR®97,
TR®98**

**Vol. 1
40009630**



**COMBINE
REPAIR**

**TR®96, TR®97,
TR®98**

**Vol. 2
40009630**



TR96, TR97, TR98 COMBINE REPAIR MANUAL CONTENTS

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SECTION 1 - ELECTRICAL SYSTEM
SECTION 2- HYDRAULIC SYSTEM
SECTION 3- MONITOR SYSTEM
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TR[®]96, TR[®]97, TR[®]98 COMBINE REPAIR MANUAL

INTRODUCTION

This repair manual provides you with the technical information needed to properly service the TR96, TR97, and TR98 combines. By using this repair manual in addition to the operator's manual supplied with the combine, you should be able to correctly service and maintain the combine.

On New Holland equipment, left and right are determined by standing behind the unit, looking in the direction of travel.

This manual describes the procedures of removal, disassembly, reassembly, etc., that have been found to be the easiest and least time-consuming. There may be several other ways of completing the same job, but it has been established that the described methods are best. Modifications to these procedures are your own decision.

Certain hardware on the combine must be tightened to particular torque specifications. If there are no specific torque specifications for the hardware, tighten to the torque listed in the torque charts in this section of the manual.



CAUTION!

CAUTION: PICTURES IN THIS MANUAL MAY SHOW PROTECTIVE SHIELDING OPEN OR REMOVED TO BETTER ILLUSTRATE A PARTICULAR FEATURE OR ADJUSTMENT.

BE CERTAIN, HOWEVER, TO CLOSE OR REPLACE ALL SHIELDING BEFORE OPERATING THE MACHINE.

IMPROVEMENTS

New Holland North America, Inc. is continually striving to improve its products. We reserve the right to make improvements or changes when it becomes practical and possible to do so, without incurring any obligation to make changes or additions to the equipment sold previously.

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

PRECAUTIONARY STATEMENTS

PERSONAL SAFETY

Throughout this manual and on machine decals, you will find precautionary statements ("CAUTION", "WARNING", and "DANGER") followed by specific instructions. These precautions are intended for the personal safety of you and those working with you. Please take the time to read them.



CAUTION: THE WORD "CAUTION" IS USED WHERE A SAFE BEHAVIORAL PRACTICE ACCORDING TO OPERATING AND MAINTENANCE INSTRUCTIONS AND COMMON SAFETY PRACTICES WILL PROTECT THE OPERATOR AND OTHERS FROM ACCIDENT INVOLVEMENT.



WARNING: THE WORD "WARNING" DENOTES A POTENTIAL OR HIDDEN HAZARD WHICH HAS A POTENTIAL FOR SERIOUS INJURY. IT IS USED TO WARN OPERATORS AND OTHERS TO EXERCISE EVERY APPROPRIATE MEANS TO AVOID A SURPRISE INVOLVEMENT WITH MACHINERY.



DANGER: THE WORD "DANGER" DENOTES A FORBIDDEN PRACTICE IN CONNECTION WITH A SERIOUS HAZARD.

FAILURE TO FOLLOW THE "CAUTION", "WARNING", AND "DANGER" INSTRUCTIONS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.

MACHINE SAFETY

Additional precautionary statements ("ATTENTION" and "IMPORTANT") are followed by specific instructions. These statements are intended for machine safety.

ATTENTION: The word "ATTENTION" is used to warn the operator of potential machine damage if a certain procedure is not followed.

IMPORTANT: The word "IMPORTANT" is used to inform the reader of something he needs to know to prevent minor machine damage if a certain procedure is not followed.



SAFETY PRECAUTIONS

- 1. DO NOT ATTEMPT TO LUBRICATE OR MAKE ANY ADJUSTMENTS ON THE COMBINE WHILE IT IS IN MOTION OR WHILE THE ENGINE IS RUNNING.**
- 2. ALLOW ONLY THE OPERATOR ON THE COMBINE. DO NOT PERMIT ANYONE TO RIDE ON THE COMBINE.**
- 3. USE THE HANDRAIL WHEN GETTING ON OR OFF THE COMBINE.**
- 4. BE ESPECIALLY CAREFUL WHEN OPERATING ON HILLSIDES, AS THE COMBINE COULD TIP SIDWAYS IF IT STRIKES A HOLE, DITCH OR OTHER IRREGULARITY. KEEP THE COMBINE IN GEAR WHEN GOING DOWNHILL.**
- 5. KEEP ALL SHIELDS IN PLACE WHILE THE COMBINE IS IN OPERATION.**
- 6. HAVE A FIRE EXTINGUISHER HANDY. IT IS A GOOD IDEA TO MOUNT ONE ON THE OPERATOR'S PLATFORM.**
- 7. KEEP THE ENGINE AREA CLEAN OF DUST, CHAFF AND STRAW TO PREVENT THE POSSIBILITY OF FIRES.**
- 8. DO NOT WORK UNDER THE HEAD WHEN IT IS IN THE RAISED POSITION UNLESS IT IS PROPERLY BLOCKED OR THE CYLINDER STOP, A, FIGURE 0-1, IS DOWN AND LOCKED.**

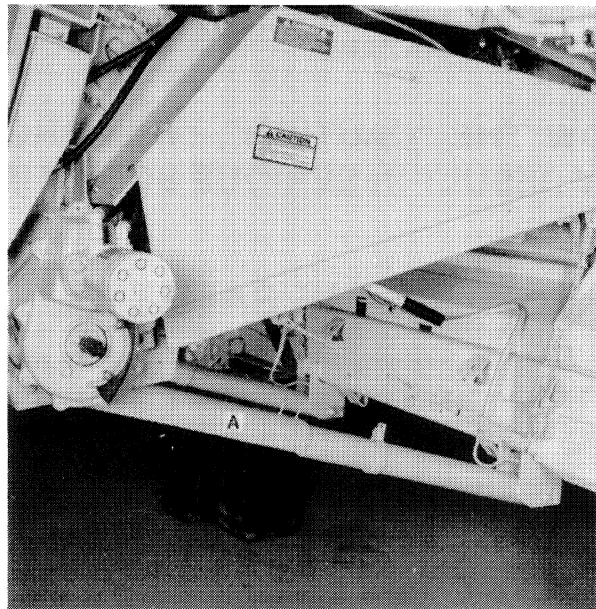


FIGURE 0-1

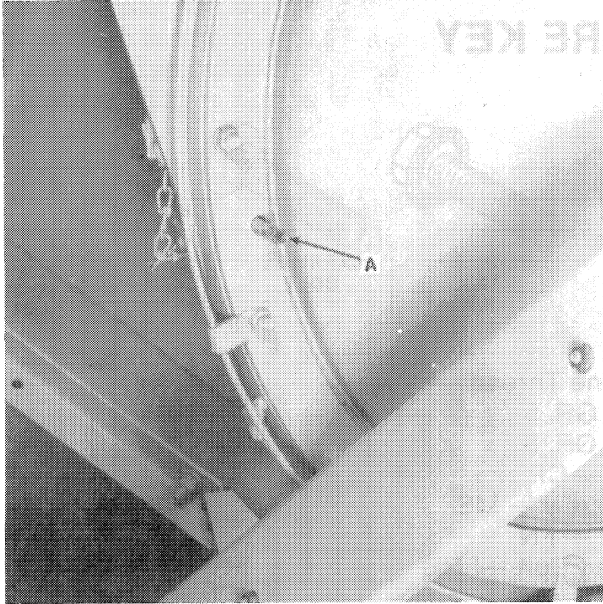


FIGURE 0-2

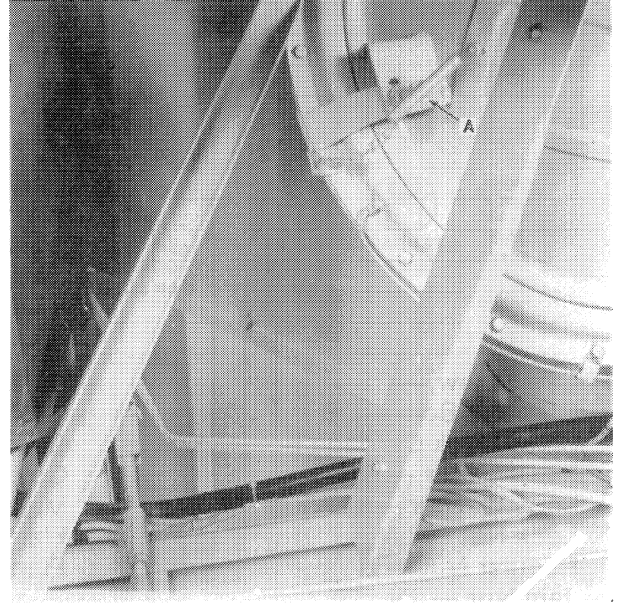


FIGURE 0-3

9. BE SURE THE PARKING BRAKE IS ENGAGED BEFORE LEAVING THE OPERATOR CONTROL AREA.
10. BE SURE THE HYDROSTATIC SPEED CONTROL LEVER IS IN NEUTRAL BEFORE STARTING THE ENGINE.
11. REPLACE BADLY FRAYED BELTS BEFORE THEY BREAK.
12. WHEN DRIVING THE COMBINE ON A ROAD OR HIGHWAY, USE ACCESSORY LIGHTS OR DEVICES PROVIDED FOR ADEQUATE WARNING TO THE OPERATORS OF OTHER VEHICLES. CHECK YOUR LOCAL GOVERNMENT REGULATIONS CONCERNING THE USE OF WARNING DEVICES.
13. KEEP CHILDREN AWAY FROM AND OFF THE COMBINE AT ALL TIMES.
14. THE COMBINE SHOULD ALWAYS BE EQUIPPED WITH SUFFICIENT REAR AXLE WEIGHT FOR SAFE OPERATION. UNDER SOME FIELD CONDITIONS, MORE WEIGHT MAY BE REQUIRED AT THE REAR AXLE FOR SAFE STABILITY. REFER TO THE GRAIN HEAD AND/OR CORN HEAD MANUAL FOR ADDITIONAL INFORMATION.
15. FOLD THE UNLOADING AUGER BACK AGAINST THE SIDE OF THE COMBINE AFTER UNLOADING THE GRAIN TANK OR WHEN TRANSPORTING THE COMBINE.
16. WHEN THE UNLOADING AUGER IS IN ITS OPERATING POSITION, INSTALL THE CYLINDER STOP, A, FIGURE 0-2, OR A, FIGURE 0-3, BEFORE WORKING ON OR SERVICING THE COMBINE.
17. REFUEL THE COMBINE ONLY WHEN THE ENGINE HAS BEEN SHUT OFF. DO NOT SMOKE OR HAVE ANY OPEN FLAME WHEN REFUELING.

SECTION 1

ELECTRICAL SYSTEM

CONTENTS

TR96 and TR97

GENERAL ELECTRICAL	1A-1
AIR CONDITIONING ELECTRICAL SYSTEM	1B-1
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VARIABLE SPEED CONTROL ELECTRICAL SYSTEM	1D-1
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SECTION 1A

ELECTRICAL SYSTEM

GENERAL ELECTRICAL

INTRODUCTION

The electrical system has been divided into the following sections:

- 1A GENERAL ELECTRICAL
- 1B AIR-CONDITIONING ELECTRICAL SYSTEM
- 1C LIGHT ELECTRICAL SYSTEMS
- 1D VARIABLE SPEED CONTROL ELECTRICAL SYSTEMS
- 1E ENGINE ELECTRICAL SYSTEMS
- 1F ELECTRONIC STONE TRAP ELECTRICAL SYSTEM
- 1G ELECTRO-HYDRAULIC ELECTRICAL SYSTEMS
- 1H WIRING DIAGRAMS

Each section has a description of the electrical circuit, a schematic of the circuit, and diagnostic test procedures based on the symptom(s) that a system demonstrates.

Read all the introductory information before starting any test procedure. Next, look through the test procedures and locate the correct symptom. Use that test procedure to locate and correct the problem. Follow the steps as instructed. Do not skip steps unless instructed to do so in the test procedures.

Prepare the machine for the test by following the pretest instructions. Perform the test and observe the results. Perform the indicated corrective action. Continue through the test procedure until the problem is corrected, then return the system to an operational condition (replace shields, etc.).

DEFINITION OF TERMS

ALTERNATING CURRENT (A.C.) -- A flow of electrons which reverses its direction of flow at regular intervals in a conductor.

AMMETER -- Measures the flow of electrical current in amperes. Ammeters are connected in series with the circuit to be tested.

AMPERE -- A unit of measure for the flow of current in a circuit. The ampere is used to measure electricity such as "gallons per minute" is used to measure liquid flow.

CIRCUIT -- A continuous, unbroken path along a conductor through which electrical current can flow from a source, through various units, and back to the source.

CIRCUIT BREAKER -- A device to protect an electrical circuit from overloads.

COLD RATING -- The cranking load capacity of a battery at low temperatures.

CONTINUITY -- Unbroken path along a conductor through which electrical current can flow.

CURRENT -- Movement of electricity along a conductor. Current is measured in amperes.

DIODE -- An electrical device that will allow current to pass through itself in one direction only.

DIRECT CURRENT (D.C.) -- A flow of electrons moving in the same direction along a conductor from a point of high potential to one of lower potential.

OHM -- The standard unit for measuring resistance to flow of an electrical current.

OHMMETER -- An instrument for measuring the resistance in ohms of an electrical circuit.

OPEN CIRCUIT -- An open circuit occurs when a circuit is broken interrupting the flow of current through the circuit.

RELAY -- An electrical switch which opens and closes a circuit automatically when activated.

RESISTANCE -- The opposing force offered by a circuit. Resistance is measured in ohms.

SHORT CIRCUIT -- A part of a circuit comes in contact with part of the same circuit or unintentionally touches a metallic object.

SOLENOID -- A circular coil used for producing a magnetic field.

VOLT -- A unit of electrical pressure which caused current to flow in a circuit.

VOLTAGE -- The force which is generated to cause current to flow in an electrical circuit. Voltage is measured in volts.

VOLTMETER -- An instrument for measuring the force in volts of electrical current. Voltmeters are connected in parallel to the points where voltage is to be measured.

ELECTRICAL SYSTEM COMPONENTS

** IMPORTANT! ROCKER SWITCH AND*

PADDLE SWITCH OPERATION:

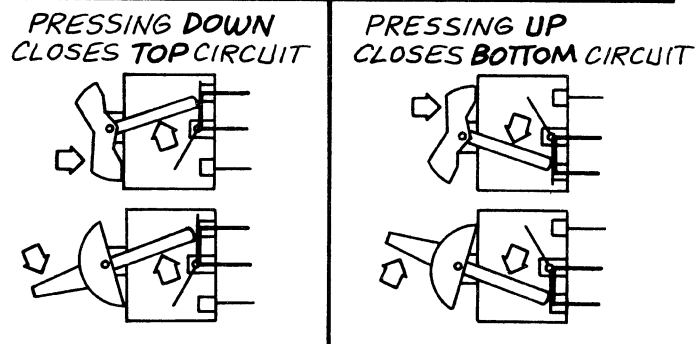


FIGURE 1A-1

MOMENTARY SWITCHES

Figure 1A-1

Momentary switches are used to direct power to circuits. These switches will return to the neutral position when released. Power flow through the switch is shown in the schematic.

CIRCUIT BREAKERS

Circuit breakers are used to protect wires and electrical parts from overload caused by short circuits or circuit overload.

FUSES

Fuses protect electrical parts from overload. Use the correct size fuse, as specified, for the circuits. Use of higher rated or slow-blow fuses could cause damage to components.

DIODES

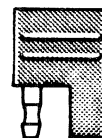
Diodes permit electrical current to flow in one direction but not the other. Diodes are used in the electro-hydraulic system so that one wire can be used with more than one circuit to control a relay or solenoid. Diodes also prevent arcing at the contact points of the relays and momentary switches.

Two size diodes are used in the electrical system. One amp diodes are used to operate relays and six amp diodes are used to operate solenoids.

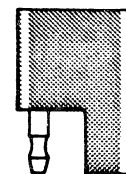
A six amp diode may be substituted for a one amp diode, but a one amp should not be used in place of a six amp diode.

One amp diodes are smaller in size than six amp diodes as shown in Figure 1A-2. One amp diodes also have two parallel lines on each side of the diodes while six amp diodes have plain sides.

Diodes can fail in either an open condition, in which no power passes in either direction, or a closed condition in which power flows in both directions. Failures usually occur due to overload or by short circuits. **DO NOT SHORT WIRES TO GROUND TO DETERMINE IF POWER IS AVAILABLE (SPARK TEST). THIS WILL CAUSE DIODES TO FAIL.**



1 AMP



6 AMP

FIGURE 1A-2

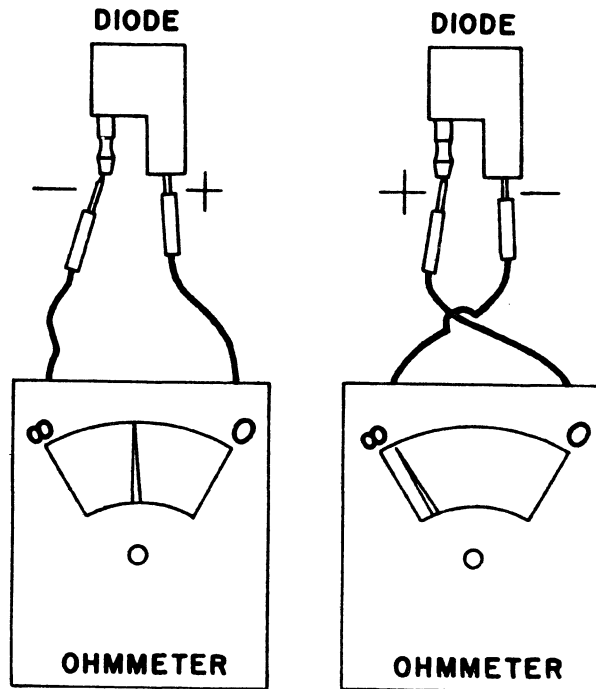


FIGURE 1A-3

DIODE TEST PROCEDURE

Figure 1A-3

To test a diode, use an ohmmeter set to the R X 1 or to the R X 10 scale. Remove the diode and connect the ohmmeter test leads to the ends of the diode. Measure the resistance, then reverse the test leads. In one direction the ohmmeter should show an open circuit (no needle deflection). When the test leads are reversed the ohmmeter should show about half scale deflection. If the two readings are the same, the diode is defective and should be replaced. A known good diode or one from a working circuit can be substituted for a suspected defective diode if an ohmmeter is not available.

DIODE CHART

The chart shows which functions will be affected by a diode that fails open or closed.

The symptoms that the operator will observe are listed first (1). The electrical symptoms that will be observed at the coils of the stack valve(s) are listed second (2).

A circuit may indicate a model and/or serial number range for which it applies. If a circuit does not indicate a model or serial number range, the circuit description applies to all Models TR96 and TR97 combines.

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Reel raise/ lower (TR96 below S/N 529779)	D1	(1) Reel will not raise when the reel raise circuit is activated. (2) Power to the master solenoid, no power to reel solenoid when the reel raise circuit is activated.	(1) Reel will raise when the reel lower button is depressed. (2) Power to the master and reel solenoids when the reel lower circuit is activated.
(TR96 above S/N 529778 and TR97)	D1	NOT USED	
Reel raise (TR96 below S/N 529779)	D2	(1) Reel will lower when the reel raise circuit is activated. (2) Power to reel solenoid, no power at master solenoid when the reel raise circuit is activated.	(1) Reel will raise when head is raised or head tilt circuits are activated. (2) Power to reel solenoid when listed systems are activated.
Reel raise (TR96 above S/N 529778 and TR97)	D2	(1) Reel will not raise when the reel raise circuit is activated. (2) Power to reel raise solenoid, no power at master solenoid when the reel raise circuit is activated.	(1) Reel will raise when head is raised or head tilt circuits are activated. (2) Power to reel raise solenoid when listed systems are activated.

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Head raise and automatic head height	D3	(1) The head will not raise, and the head raise light does not light, when the manual head raise switch is activated. The head will raise and the head raise light will light when the automatic head height raise switch is activated on the head. (2) No power to the head raise or master solenoids when the manual head raise switch is activated.	(1) The head will not raise, and the head height power on light goes out when the automatic head height control raise switch is activated on the head. The head raises normally when the manual head raise switch is activated. (2) Power at the P/O wire connection at the head height latch off relay base when the relay is removed and the automatic head height control raise switch on the head is activated.
Head raise	D4	(1) Head will not raise, but the head raise indicator light lights when the head raise circuit is activated. (2) Power to the head raise solenoid, no power to the master solenoid when the head raise circuit is activated.	(1) Head will raise when the head raise, reel raise, or head tilt circuits are activated. (2) Power at the head raise solenoid when the listed functions are activated.
Head lower	D5	(1) System works properly until the automatic head height system is activated. Then, the automatic head height control system will not work and the automatic head height control system on light will not light. (2) There is power to the head lower solenoid but no power to the automatic head height and head tilt switches when the head lower switch is depressed.	(1) System works properly until the automatic head height control is activated. Then, the head will continually lower and the head lower light will stay on. When the automatic head raise switch is activated, the head will raise very slowly. Both the head raise and head lower lights will light. (2) There is continual power to the head lower solenoid when the automatic head height system is activated with connector K disconnected.

SECTION 1 - ELECTRICAL SYSTEM (General Electrical)

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Head tilt clockwise	D6	(1) Head will not tilt clockwise but the clockwise indicator light will light. (2) Power to clockwise tilt solenoid, but no power to the master solenoid when the clockwise tilt system is activated.	(1) Head tilts clockwise when reel lift and head lift circuits are activated. Head will not tilt when counterclockwise tilt circuit is activated. The clockwise tilt indicator light will light when any of the listed functions are activated. (2) Power to clockwise head tilt solenoid when listed functions are activated.
Head tilt counterclockwise	D7	(1) Head will not tilt counterclockwise but the counterclockwise indicator light will light. (2) Power at counterclockwise tilt solenoid, no power at master solenoid when the counterclockwise tilt system is activated.	(1) Head will tilt counterclockwise when reel lift or head lift circuits are activated. Head will not tilt when clockwise tilt circuit is activated. The counterclockwise tilt indicator light will light when any of the listed functions are activated. (2) Power to counterclockwise head tilt solenoid when listed functions are activated.
	D8	NOT USED	
	D9	NOT USED	
Unloading auger swing out	D10	(1) Unloading auger will not swing out. (2) Power at the swing out solenoid, no power at the master solenoid when the system is activated.	(1) Unloading auger will swing out when the reel raise, head raise, head tilt CW or CCW, feeder reverser, or reel fore-aft systems are activated. The auger will not move when the swing in system is activated. (2) Power to the swing out solenoid when any of the listed functions are activated.

SECTION 1 - ELECTRICAL SYSTEM (General Electrical)

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Unloading auger swing in	D11	(1) Unloading auger will not swing in. (2) Power at the swing in solenoid, no power at the master solenoid when the system is activated.	(1) Unloading auger will swing in when the reel raise, head raise, head tilt CW or CCW, feeder reverser, or reel fore-aft systems are activated. The auger will not move when the swing out system is activated. (2) Power to the swing in solenoid when any of the listed functions are activated.
Feeder reverser reverse direction	D12	(1) Reverser will not work in the reverse direction. (2) Power at the reverse solenoid, no power at the master solenoid when the system is activated.	(1) Reverser will operate in the reverse direction when the reel raise, head raise, head tilt CW or CCW, unloading auger swing in or out, or reel fore-aft systems are activated. The reverser will not move when the forward direction system is activated. (2) Power to the reverse solenoid when any of the listed functions are activated.
Feeder reverser forward direction	D13	(1) Reverser will not work in the forward direction. (2) Power at the forward solenoid, no power at the master solenoid when the system is activated.	(1) Reverser will operate in the forward direction when the reel raise, head raise, head tilt CW or CCW, unloading auger swing in or out, or reel fore-aft systems are activated. The reverser will not move when the reverse direction system is activated. (2) Power to the forward solenoid when any of the listed functions are activated.

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Automatic head tilt counterclockwise lower switch (located on the head)	D14	(1) Head will not tilt CCW when the automatic CCW lower switch is activated. CCW indicator light does not light. (2) No power at the CCW tilt solenoid or the master solenoid when the automatic CCW lower switch is activated.	(1) Head will not tilt CCW when the automatic CCW raise switch is activated. Both CW and CCW indicator lights light. (2) Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CCW raise switch is activated.
Automatic head tilt clockwise raise switch (located on the head)	D15	(1) Head will not tilt CW when the automatic CW raise switch is activated. CW indicator light does not light. (2) No power at the CW tilt solenoid or the master solenoid when the automatic CW raise switch is activated.	(1) Head will not tilt CW when the automatic CW lower switch is activated. Both CW and CCW indicator lights light. (2) Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CW lower switch is activated.
Automatic head tilt counterclockwise raise switch (located on the head)	D16	(1) Head will not tilt CCW when the automatic CCW raise switch is activated. CCW indicator light does not light. (2) No power at the CCW tilt solenoid or the master solenoid when the automatic CCW raise switch is activated.	(1) Head will not tilt CCW when the automatic CCW lower switch is activated. Both CW and CCW indicator lights light. (2) Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CCW lower switch is activated.
Automatic head tilt clockwise lower switch (located on the head)	D17	(1) Head will not tilt CW when the automatic CW lower switch is activated. CW indicator light does not light. (2) No power at the CW tilt solenoid or the master solenoid when the automatic CW lower switch is activated.	(1) Head will not tilt CW when the automatic CW raise switch is activated. Both CW and CCW indicator lights light. (2) Power to CW and CCW head tilt solenoids and the master solenoid when the automatic CW lower switch is activated.

SECTION 1 - ELECTRICAL SYSTEM (General Electrical)

CIRCUIT (applicable model)	DIODE	SYMPTOMS IF DIODE FAILS OPEN	SYMPTOMS IF DIODE FAILS CLOSED
Rotor speed decrease (TR96, TR97 below S/N 557404)	D18	(1) Rotor speed will not decrease when the rotor speed decrease circuit is activated. (2) Power to rotor speed decrease solenoid on the stack valve but no power to the solenoid on the rotor speed isolation valve when the rotor speed decrease switch is activated.	(1) Rotor speed will not increase or increases very slowly. (2) Power to the master solenoid, rotor speed increase solenoid, rotor speed decrease solenoid on the stack valve and power to the solenoid on the rotor speed isolation valve when the rotor speed increase switch is activated.
(TR97 above S/N 557403)	D18	NOT USED	
Rotor speed increase (TR96, TR97 below S/N 557404)	D19	(1) Rotor speed will not increase when the rotor speed increase circuit is activated. (2) Power to master solenoid and rotor speed increase solenoid on the stack valve but no power to the solenoid on the rotor speed isolation valve when the rotor speed increase switch is activated.	(1) Rotor speed will not increase or increases very slowly. (2) Power to the master solenoid, rotor speed increase solenoid, rotor speed decrease solenoid on the stack valve and power to the solenoid on the rotor speed isolation valve when the rotor decrease switch is activated.
(TR97 above S/N 557403)	D19	NOT USED	
Reel forward (TR97 above S/N 557403)	D20	(1) Reel will not move forward when the reel fore circuit is activated. (2) Power at the reel fore solenoid, no power at the master solenoid when then reel fore circuit is activated.	(1) Reel will move forward when the reel raise, head raise, head tilt CW/CCW, feeder reverser, or unloading auger swing in/out systems are activated. (2) Power to the reel forward solenoid when any of the listed functions are activated.
Reel aft (TR97 above S/N 557403)	D21	(1) Reel will not move aft when the reel aft circuit is activated. (2) Power at the reel aft solenoid, no power at the master solenoid when then reel fore circuit is activated.	(1) Reel will move aft when the reel raise, head raise, head tilt CW/CCW, feeder reverser, or unloading auger swing in/out systems are activated. (2) Power to the reel aft solenoid when any of the listed functions are activated.

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SOLENOID COILS

Introduction

Three different styles of coils are used to activate the various solenoids used on the combine.

One style coil is used on the electro-hydraulic stack valve solenoids. This style coil is an intermittent duty coil and is energized only when a stack valve function is activated. This coil has an internal spark suppression diode to prolong the life of the momentary switches. These coils are identified by a dot of red and yellow paint.

All the coils used on the stack valve are the same and can be interchanged.

A second style coil is used on the reel speed control valve. This coil is a continual duty coil and is energized when the reel speed is activated.

A third style coil is used on the powered rear axle control valve. This is a continual duty coil and is energized when the powered rear axle is engaged.

Operation

Power enters the coil through the stud and passes through the coil windings and grounds through the metal ring at the end of the coil. When the coil is energized, an electro-magnetic field is created around the solenoid. The electro-magnetic field causes the armature inside the solenoid to move. The armature moves a poppet which controls oil flow through the electro-hydraulic valve.