ELECTRICAL SYSTEMS

Class Objective

Understand the electrical systems, component location, and testing and trouble-shooting techniques necessry to provide field service.

- o Basic Electrical
- o Automatic Reel Speed to Ground Speed Control
- o Automatic Header Control
- o Automatic Feeder Cutoff
- o Shaft Speed Monitoring System
- o Grain Loss Monitor

ELECTRICAL

BATTERIES

The combine utilizes two maintenance free batteries wired in a parallel circuit for an electrical power source. Latest production will utilize a Prestolite battery P/N B2472, which is the Case IH brand. However, you may see some Delco batteries in production until they are used up. The following batteries have been used in recent years:

121 787 C1	Delco (production)
IHMF 24 PH	Prestolite (service parts)
IHMF 245	Prestolite - IH brand (production and parts)
B-2472	Prestolite - Case IH brand (production and parts)

These batteries all range from 520-540 cold cranking amps. Cold cranking amps is the number of amps the battery can deliver for 30 seconds at 0 degrees fahrenheit before a battery drops below 7.2 volts. Rule of thumb for battery size is CID x 2 = CCA necessary. So we have ample power for cold cranking capabilities and battery life.

BATTERY TESTING AND CHARGING

Since the introduction of maintenance free batteries, the age old method of testing and charging batteries is no longer appropriate. With the top of the battery sealed, it is impossible to check specific gravity of the electrolyte. Also, because maintenance free batteries contain more electrolyte than batteries that require maintenance, the charging technique is different. Unless the battery charger will provide 16 volts, it will take an extremely long time for the battery to take any noticeable charge. Therefore, it is assumed the battery has failed, when in actuality, it may be a good battery.

A common example: A tractor sits in storage for several months during the off season. The batteries have a certain amount of parasitic draw, which over a period of time will drain the batteries. These parasitic draws can be from radios, digital tachs, and alternators. When the tractor is put back into service, it has to be jump started. Then the customer will drive the tractor all day assuming that the alternator will charge the batteries. The next day, the tractor has to be jump started again. The customer assumes the batteries have failed and reacts accordingly. However, the reason why the batteries did not charge on the tractor is the 14.3 volts maximum output of the alternator. Since the alternator limit is 14.3 volts, it will take several days of constant use (with no drain) to recharge a badly discharged battery in the tractor.

Refer to Service Bulletin **S-4423** for testing and charging recommendations.

AGRICULTURAL EQUIPMENT GROUP

North American Operations

DEALER CIRCULATION	
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SERVICE MGR	
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SERVICE BULLETIN

DEALER CONTRACT

J-122 U.S. Dealers

J-100 Canadian Dealers

DATE: July 16, 1982

FILE: Book 4-8 Electrical

NO. S-4423

TESTING AND CHARGING MAINTENANCE-FREE BATTERIES

All of the previously released publications listed below discussed important servicing information related to maintenance-free batteries.

NUMBER	DATE	BOOK NO.	SUBJECT
S-3573	11-11-77	4-1	Test Procedures
S-3863	6-14-79	4-8	Charging Information
S-3864	6-12-79	4-8	Packaging
S-3913	10-12-79	4-8	Test Procedures
S-3958	1-16-80	4-8	Charging And Testing
GSS-5124	5-79	- -	Battery Test Card

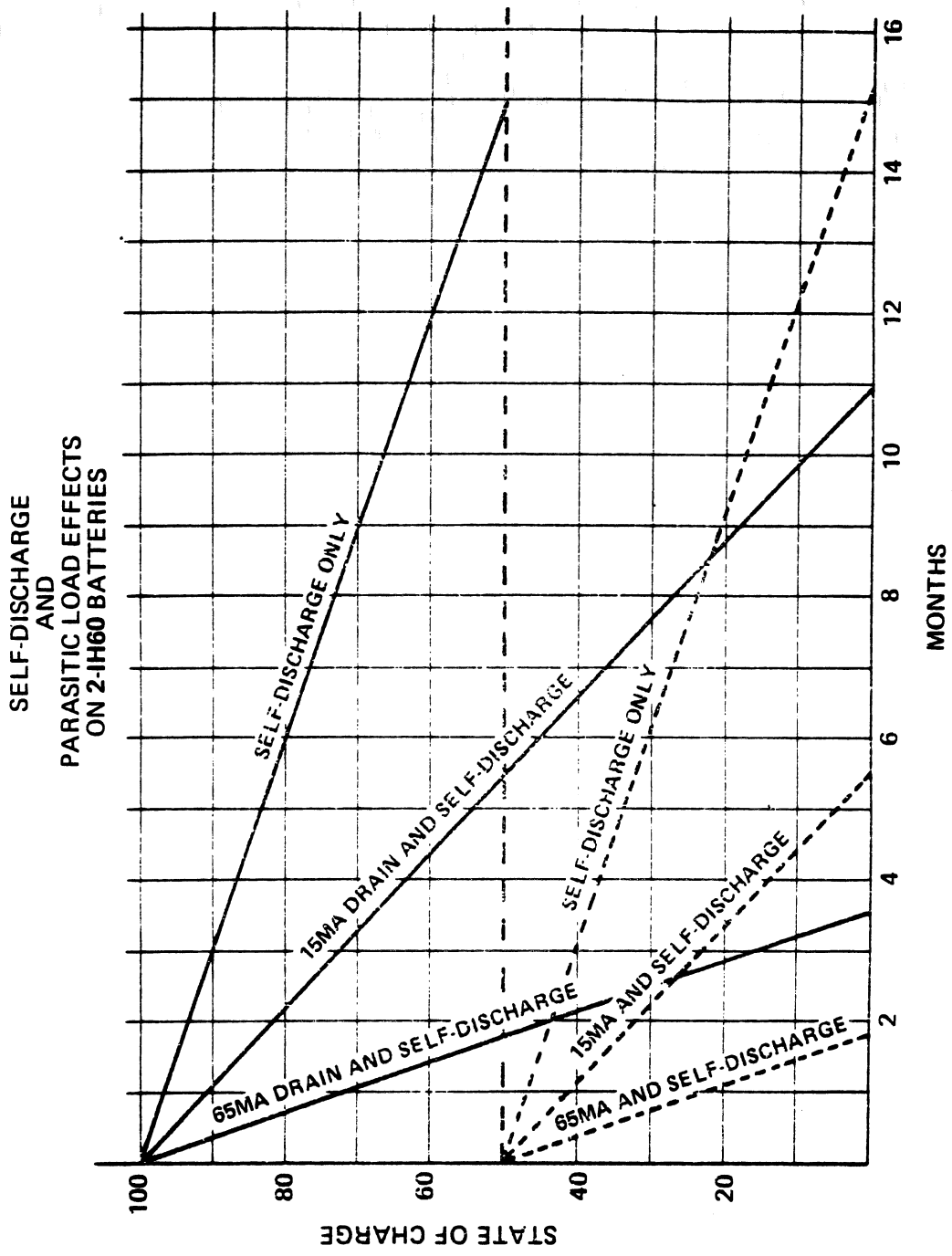
This bulletin is released to update and supplement this previously released information.

SULFATED BATTERIES

To find a badly sulfated maintenance-free battery in an agricultural tractor or implement is not uncommon today. Today's equipment is larger, gets the job done faster and spends more time in storage.

Battery plate sulfation refers to the normal building up of lead sulfate on the plates during extended machine/battery storage periods (one to eighteen months). During this storage time a battery is exposed to normal self-discharge, as well as any parasitic loads (milli amp drain) created by such things as the alternator, radio or cabin instrumentation.

The chart on page 5-4 illustrates various maintenance-free battery storage discharge rates. Note the effect of various milli amp drains and how quickly a battery can discharge if put in storage at only 50% state of charge.


SELF-DISCHARGE AND PARASITIC LOAD EFFECTS ON 2-IH60 BATTERIES
SELF-DISCHARGE ONLY
15MA DRAIN AND SELF-DISCHARGE
65MA DRAIN AND SELF-DISCHARGE
SELF-DISCHARGE ONLY
15MA AND SELF-DISCHARGE
65MA AND SELF-DISCHARGE
MONTHS
2
4
6
8
10
12
14
16
STATE OF CHARGE
100
80
60
40
20

STORAGE PRACTICES

As illustrated by the chart on page 2, one of the most important things that can be done to prevent a dead, sulfated battery at the end of a storage period is to put it in storage at a full state of charge.

Recharging a maintenance-free battery every 30 to 45 days during the storage period will prevent the battery from going dead due to self-discharge and parasitic drain.

If recharging is not convenient, the battery cables can be disconnected to remove parasitic drain from the battery during storage.

CHARGING

Typically when a sulfated battery is hooked to a charger, the charger ammeter will read zero or near zero charge. Too often an immediate assumption is made that the battery has failed when, in most cases, it has not.

What is happening is that the battery is taking a very small charge, perhaps less than one amp, not measurable on the charger ammeter. The battery is, in fact, resisting current flow from the charger because the plates are covered with lead sulfate.

To speed up the conversion of the lead sulfate on the plates to lead on the negative plates and lead dioxide on the positive plates, the battery charger must be able to provide 16 volts.

If the charger being used will not provide 16 volts, it will take longer to obtain a 25 amp charging level.

THE IH 80 AMP CHARGER 1131 855 R1 WILL PROVIDE THE 16 VOLTS REQUIRED TO EFFECTIVELY CHARGE A MAINTENANCE-FREE BATTERY.

The charts on pages 4 & 5 graphically illustrate charge times required at 16 volts until a sulfated maintenance-free battery will accept a 25 amp charge.

Chart "A" illustrates the typical charge response to be expected from a battery that was discharged over a 30 day period.

Note that after one hour of charge the charger ammeter may still indicate zero, as the charge rate is only at .3 amps. Also note that after two hours of charge the ammeter would read about 3 amps; after three hours about 12 amps; after four hours 25 amps.

Chart "B" illustrates the typical charge response to be expected from a battery that was discharged over a 90 day period.

Note that the period of time until the battery first begins to take a measurable charge is greatly extended because the battery is more sulfated than the battery illustrated in Chart "A".

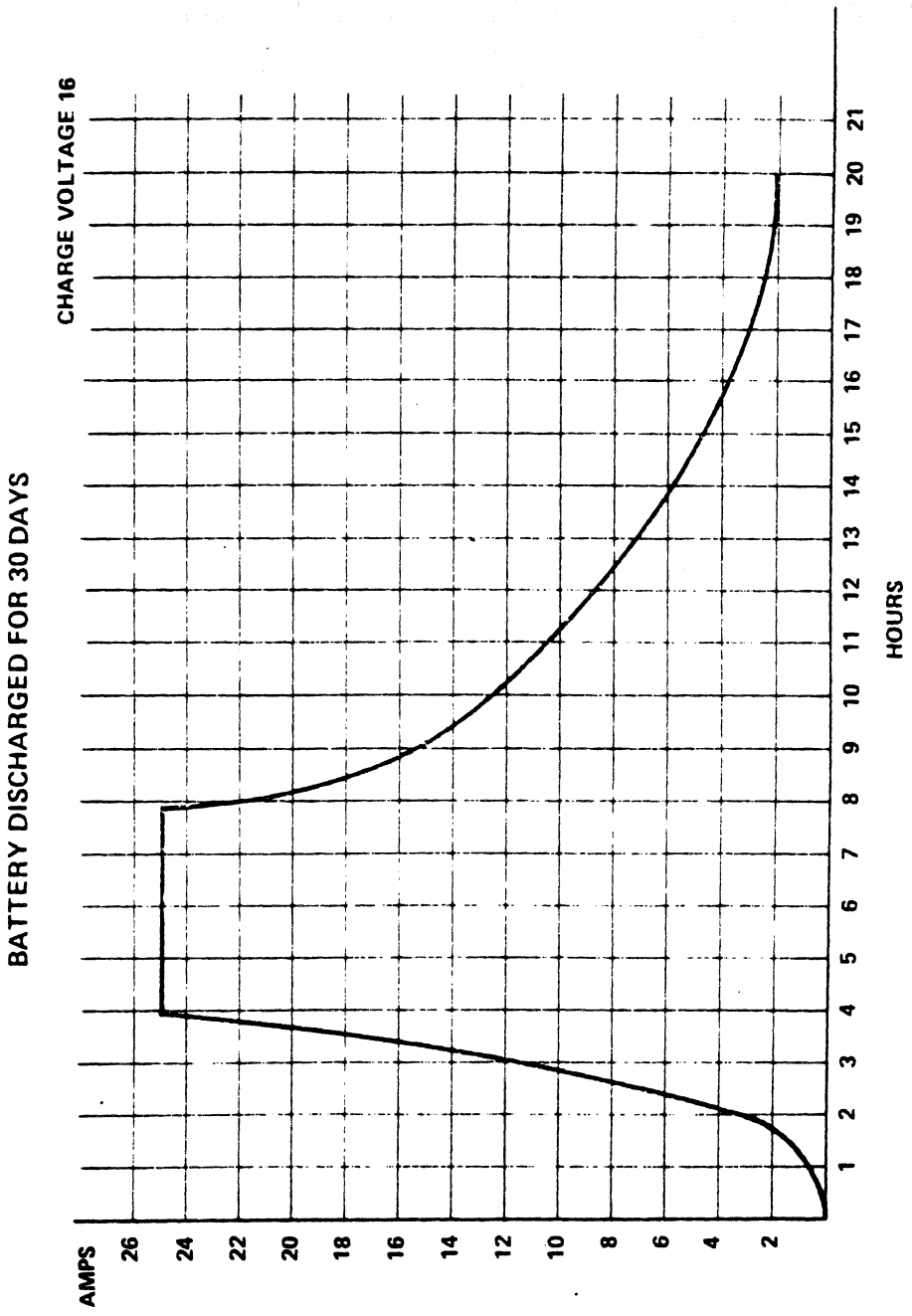

BATTERY DISCHARGED FOR 30 DAYS
CHARGE VOLTAGE 16
AMPS
26
24
22
20
18
16
14
12
10
8
6
4
2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
HOURS

CHART A

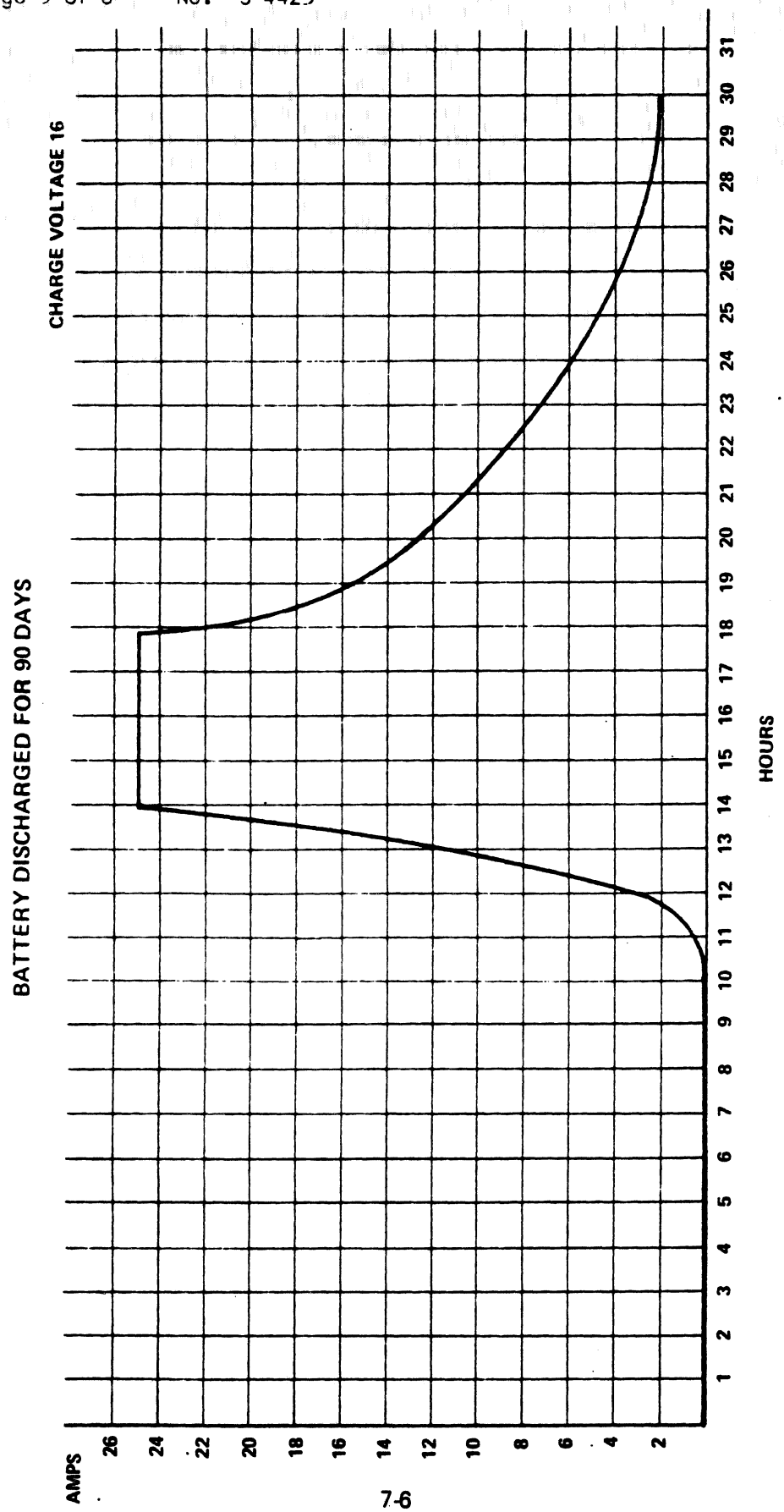

BATTERY DISCHARGED FOR 90 DAYS
CHARGE VOLTAGE 16
AMPS
26
24
22
20
18
16
14
12
10
8
6
4
2
HOURS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

CHART B

The table below is provided as an acceptable charging guide for maintenance-free batteries. Tables one and two provided in Service Bulletin S-3863 are also acceptable charge rates.

IMPORTANT

Additional charge time may be required for batteries that are badly sulfated. The chart below is applicable once that battery begins to take a measurable charge on the charger ammeter.

BATTERY CHARGING GUIDE

12 Volt Maintenance-Free Batteries

16 VOLTS REQUIRED

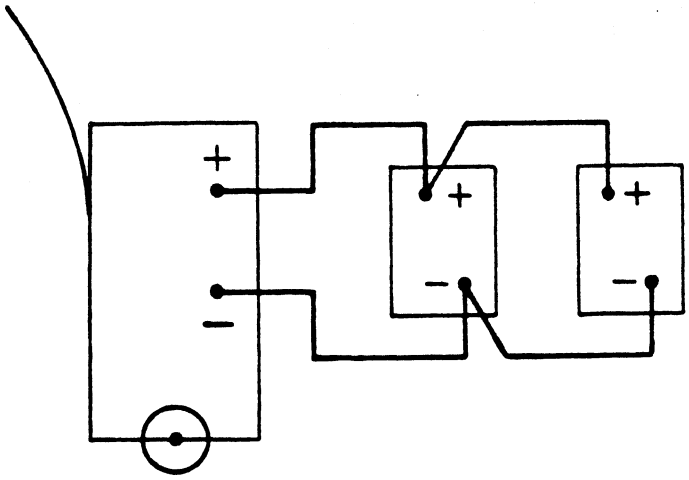
Recommended Rate* and Time For Fully Discharged Condition

Rated CCA @-17.8°C (0°F) Cold Cranking Amps	Slow Charge	Fast Charge
400 Amps Or Less	15 Hours @ 5 Amperes 7 Hours @ 10 Amperes	5 Hours @ 15 Amperes 4 Hours @ 20 Amperes
Above 400 to 500 Amps	22 Hours @ 5 Amperes 11 Hours @ 10 Amperes	8 Hours @ 15 Amperes
Above 500 Amps	27 Hours @ 5 Amperes 14 Hours @ 10 Amperes	9 Hours @ 15 Amperes

* Initial rate for standard taper charger.

IMPORTANT

Some chargers are equipped with a "reverse polarity protection" relay. These chargers require at least six volts or they will not "turn on". To insure that the charger will "turn on", charge with at least one good battery in parallel. Follow the illustration below to provide this parallel hook-up.



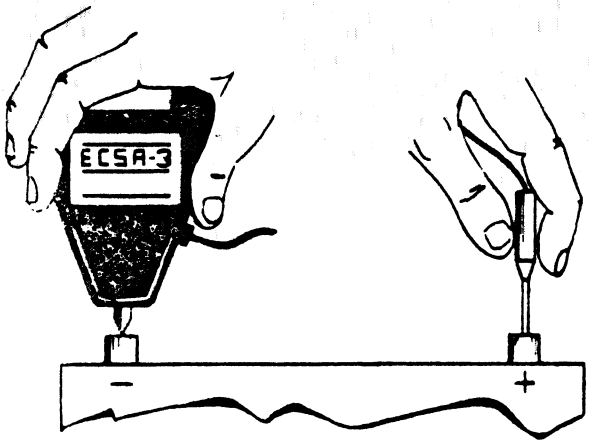
TESTING

Two publications have been distributed in the past which discuss the proper testing of maintenance-free batteries. They are GSS-5124, Battery Test Card (available from Westmont), and Service Bulletin S-3958. Both of these publications are acceptable guides when testing maintenance-free batteries.

In February of 1978 the Product Support Center introduced an electronic battery tester number 15-550. This tester has proven itself accurate when testing conventional (non maintenance-free) batteries, however, recent evaluations of this tool indicates that it does not provide the required accuracy when testing maintenance-free batteries.

The Equipment Group recently released a digital display voltmeter which will accurately test maintenance-free batteries. It is available through the IH Parts Distribution System under part number 739 834 C1, at a current dealer net price of $29.00. All dealers are urged to order and use this voltmeter to test maintenance-free batteries.

An illustration of this tool and its specifications are provided on page 8. This tool is provided complete with operating instructions and a limited one-year warranty.



SPECIFICATIONS

1. Instant solid state with L.E.D. display
2. Resolution: 0.01 Volt
3. Accuracy ± 0.1% minimum
4. Volt range 5.75 to 19.99
5. Reverse polarity indicator and protection (L.E.D. display will indicate a - minus)
6. Shock and oil resistant
7. Positive cable is red and 15 inches long.

NOTE: The information contained in this and previously released Service Bulletins will soon be released as an additional section to Service Manual GSS-1052.

EQUIPMENT GROUP
PRODUCT SUPPORT CENTER

AGO/dp

ELECTRICAL

FUEL GAUGE & PUMP

1. When the key is turned to the on position, the cab (front) solenoid will provide battery voltage to the fuse panel through wire 49 (lt. green/red).

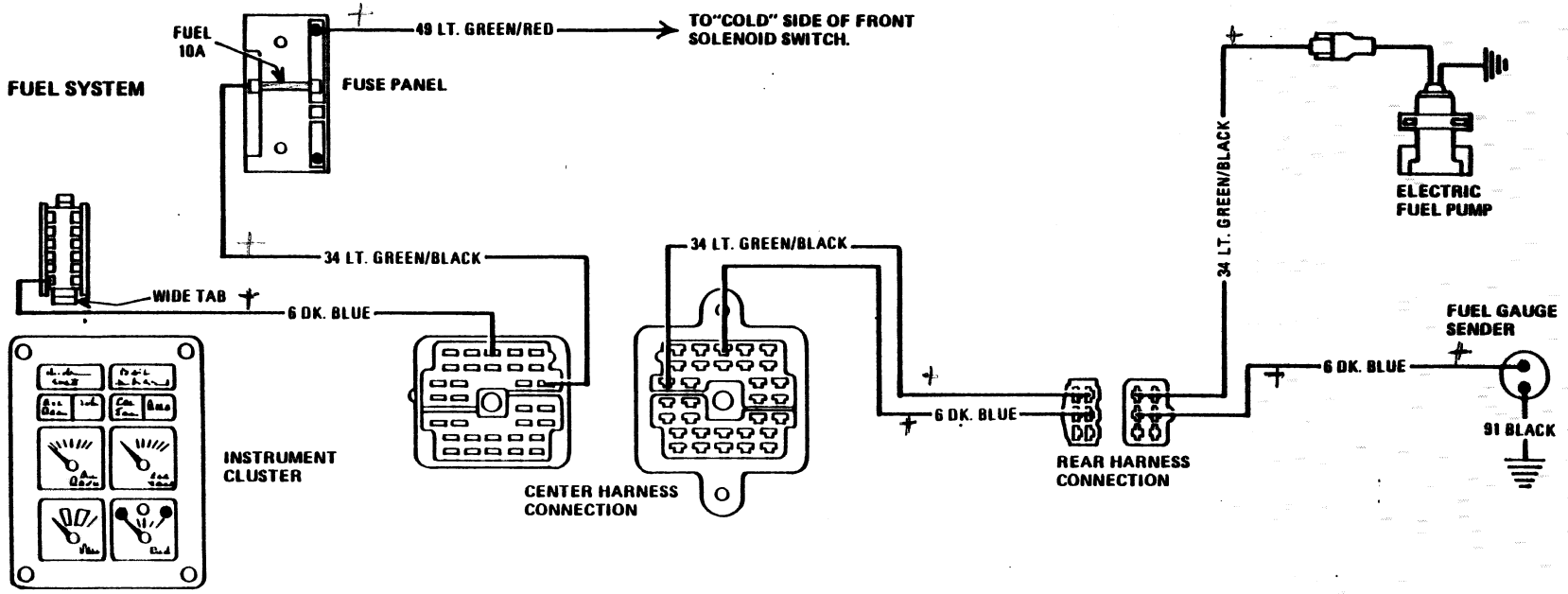
2. The 10 AMP fuse for the fuel pump will provide current flow (positive) through wire 34 (lt. green/black) to the electric fuel pump, the fuel pump is grounded to the frame.

3. Wire 6 (dk. blue) is the signal wire from the fuel tank sender to the fuel gauge. This wire has current all the time the key is on through wires 2 (black) and 4 (red w/white) which are the negative and positive leads to the guage cluster. The fuel gauge sender is a variable resistor which changes voltage to the fuel gauge as the fuel level changes. The fuel gauge being a voltmeter will react accordingly to voltage changes.

TESTING

1. Turn system on.
2. Fuel gauge should read maximum (full) at this time. If it does, the sending unit is suspect (proceed to 3) if not, proceed to step 5.
3. When tank is full, you should read 29 to 33.5 ohms. When empty, you should read 240 to 260 OHMS.
5. Replace fuel gauge.

1. Turn key on.
2. Disconnect the positive lead at the sending unit and touch to ground.
3. Hook an ohmmeter across the positive lead of the sending unit to ground.
4. Replace sending unit if necessary
5. Check for low voltage at harness connections on #6 (dk. blue wire).


FUEL SYSTEM
FUEL 10A
FUSE PANEL
49 LT. GREEN/RED
TO "COLD" SIDE OF FRONT SOLENOID SWITCH.
34 LT. GREEN/BLACK
WIDE TAB
6 DK. BLUE
INSTRUMENT CLUSTER
CENTER HARNESS CONNECTION
34 LT. GREEN/BLACK
6 DK. BLUE
REAR HARNESS CONNECTION
34 LT. GREEN/BLACK
ELECTRIC FUEL PUMP
6 DK. BLUE
FUEL GAUGE SENDER
91 BLACK

ELECTRICAL

SEPARATOR AND FEEDER CLUTCH

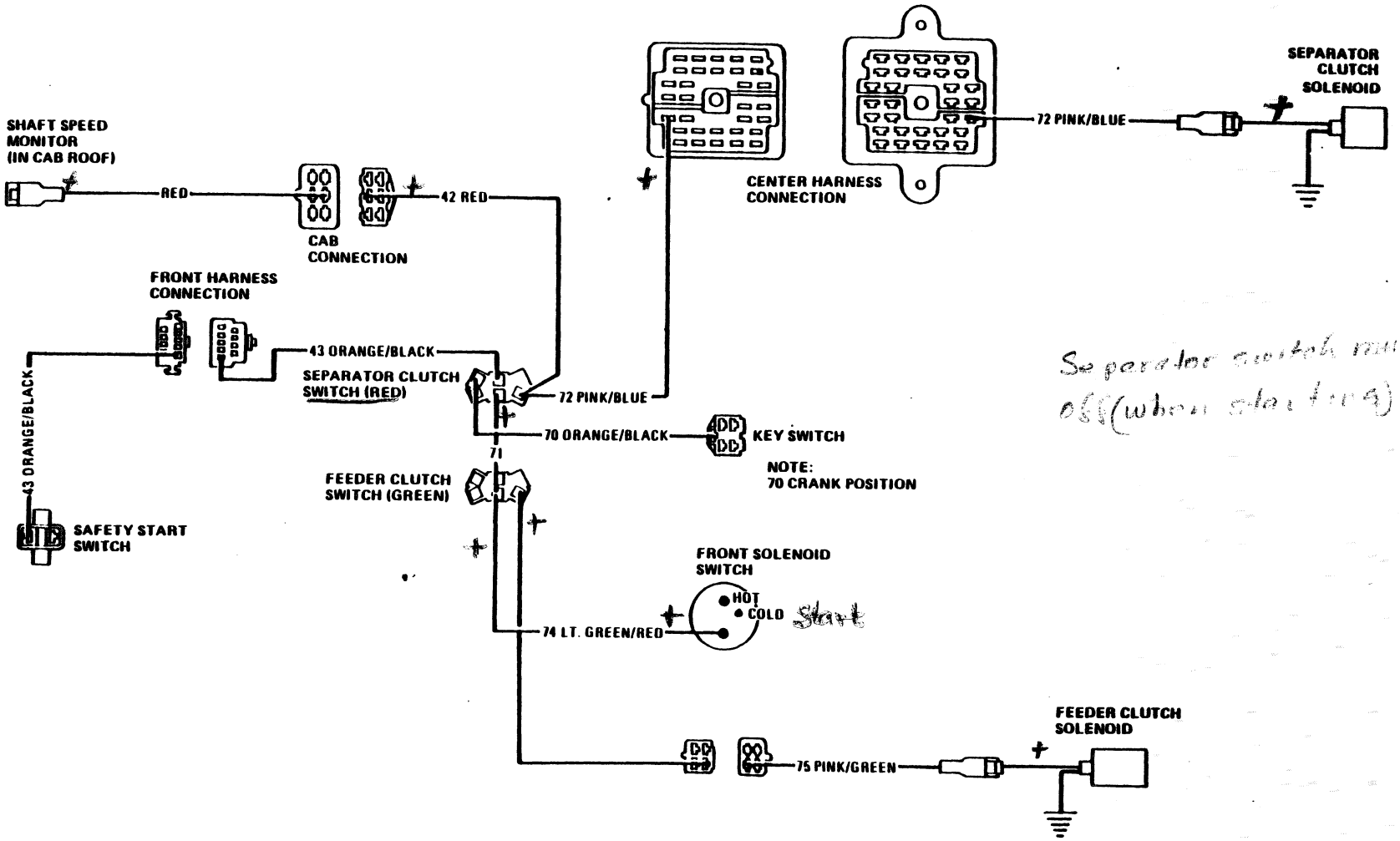
1. When the key is turned on, battery voltage will be present at wire 74 (lt. green/red) this will provide current to the feeder clutch switch (green).

2. From the feeder clutch switch wire 71 will provide current to the separator switch (red), when the separator switch is turned on current will flow from wire 71 to wire 72 (pink/blue) through the center harness connection and on to the separator clutch solenoid.

3. When the feeder clutch switch (green) is turned on, current will flow from wire 71 to wire 75 (pink/green) to the feeder clutch solenoid.

NOTE: The separator clutch switch also provides current to supply the shaft speed monitor wire - 42 (red).

SEPARATOR and FEEDER CLUTCH



Separator switch must be off (when starting) to run.

FESM–11027A

ELECTRICAL

AUDIBLE ALERT

1. The source to power the audible alert is through wire 38 (red), to the key switch, through wire 60 (dk. green/white), to fuse panel, through 5 AMP fuse to wire 13 (red/white) to the audible alert.

NOTE: Wire 4 (red/white) is power to gauge cluster.
Wire 14 (lt. green) is power to tachometer.

2. The audible alert will sound when any tellite illuminates. This ground comes from the diode module wire 55 (red/black) through safety start switch, to wire 22 (red/white), through front harness connection to audible alert.

NOTE: The tellite alert can be disabled by depressing the foot-n-inch pedal.

3. The tachometer also can sound the audible alert whenever engine R.P.M. is below 2450. The positive feed is wire 14 (lt. green) and the negative is wire 76 (red/black). The trigger or connector is inside the tachometer.

NOTE: The tachometer sound alert cannot be disabled by depressing the foot-n-inch pedal.

AMP LIGHT

1. Wire 46 (tan) is the positive lead coming from the "R" terminal of the alternator to the relay, wire 47 (black) is the ground for the relay.

NOTE: Wire 2 (black) is also in this connector. It provides a ground to the gauge cluster.

2. Wire 19 (lt. green/red) is the positive feed through the diode module to the AMP light in the gauge cluster.

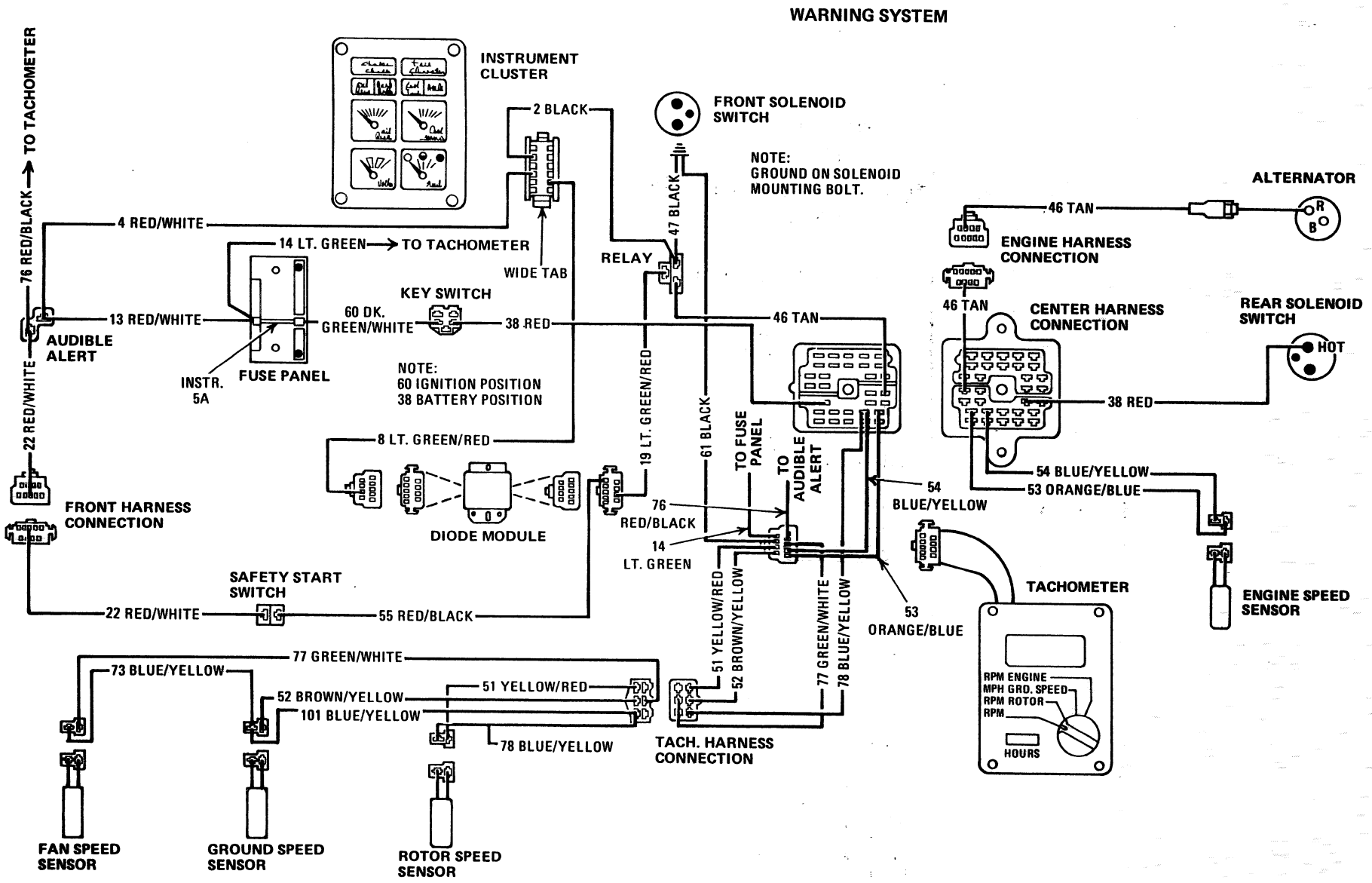
3. Under normal conditions (alternator charging) the current flow through the relay will hold the contact points inside the relay open. The AMP light wire 19 (lt. green/red) will have no ground, and the light will not be on.

4. However, if the current flow from wire 46 (tan) stops, the relay will close, thus connecting wire 19 (lt. green/red) with wire 47 (black) and the AMP light will illuminate.

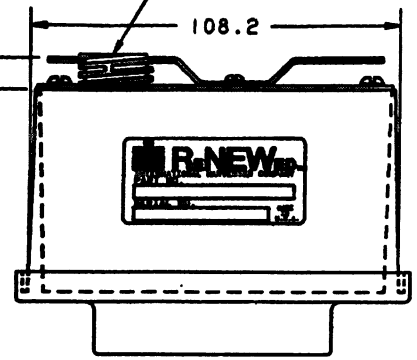
[illegible]

Post-it® Fax Note 7671	Date	# of pages ▶ 2
To Doug	From Case	
Co./Dept.	Co. TJG	
Phone #	Phone # Chris	
Fax # 701-483-8742	Fax #	

NHE SB 041 94

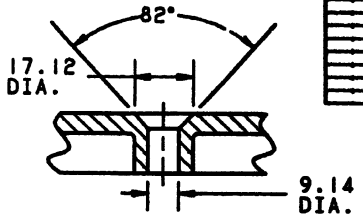


FESM—11034

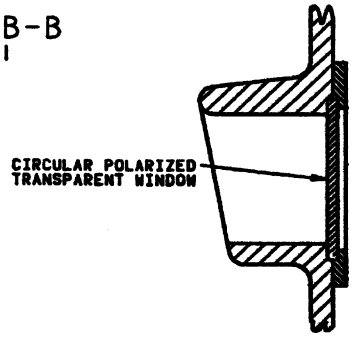


AMP TERM.	FUNCTION
1	12 VDC
3	GND.
6	ROTOR SIGNAL
5	GND. SPEED SIGNAL
4	ENGINE SIGNAL
2	SIGNAL COMMON
7	FAN SIGNAL
9	SOUND ALERT OUTPUT
8	OPEN

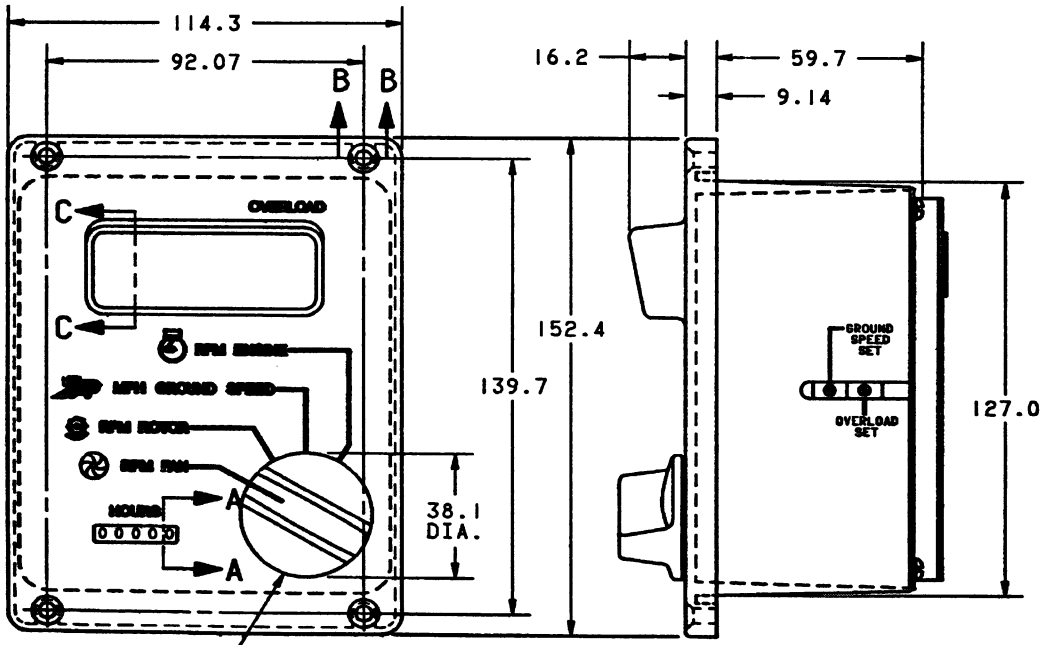
RESET SPEED
OVERLOAD 2450±10 RPM
OVERLOAD CUTOFF 2000±10 RPM
GND. SPEED 8.6±.1MPH (BASED ON 290 HZ INPUT)



SECTION B-B
SCALE 2:1



SECTION C-C
SCALE 2:1



BLACK PLASTIC KNOB WITH WHITE INDICATOR LINE.
1/4" SHAFT HOLE WITH TAPPED HOLE FOR 8-32 SET SCREW
PART NO. 1520

SOURCE: DAVIES MOLDING COMPANY
4920 W. BLOOMINGDALE AVE.
CHICAGO, IL. 60639

NOTES:

1. SYMBOLS AND LETTERING RAISED .75 HOT STAMP "GLOSS STAINLESS" THERMARK SUPER URGENT 1963.
2. TYPE FACE-14 PT. UNIVERS DEMIBOLD CONDENSED NO.67.
3. FINISH-RAWAL ENGRAVERS MT.1129. 621 E. WILDWOOD. VILLA PARK, IL. 60181
4. COLOR - NO.001 BLACK PANEL WITH TRANSPARENT WINDOW.
5. RENEWED UNIT OF PRODUCTION 187512C91.

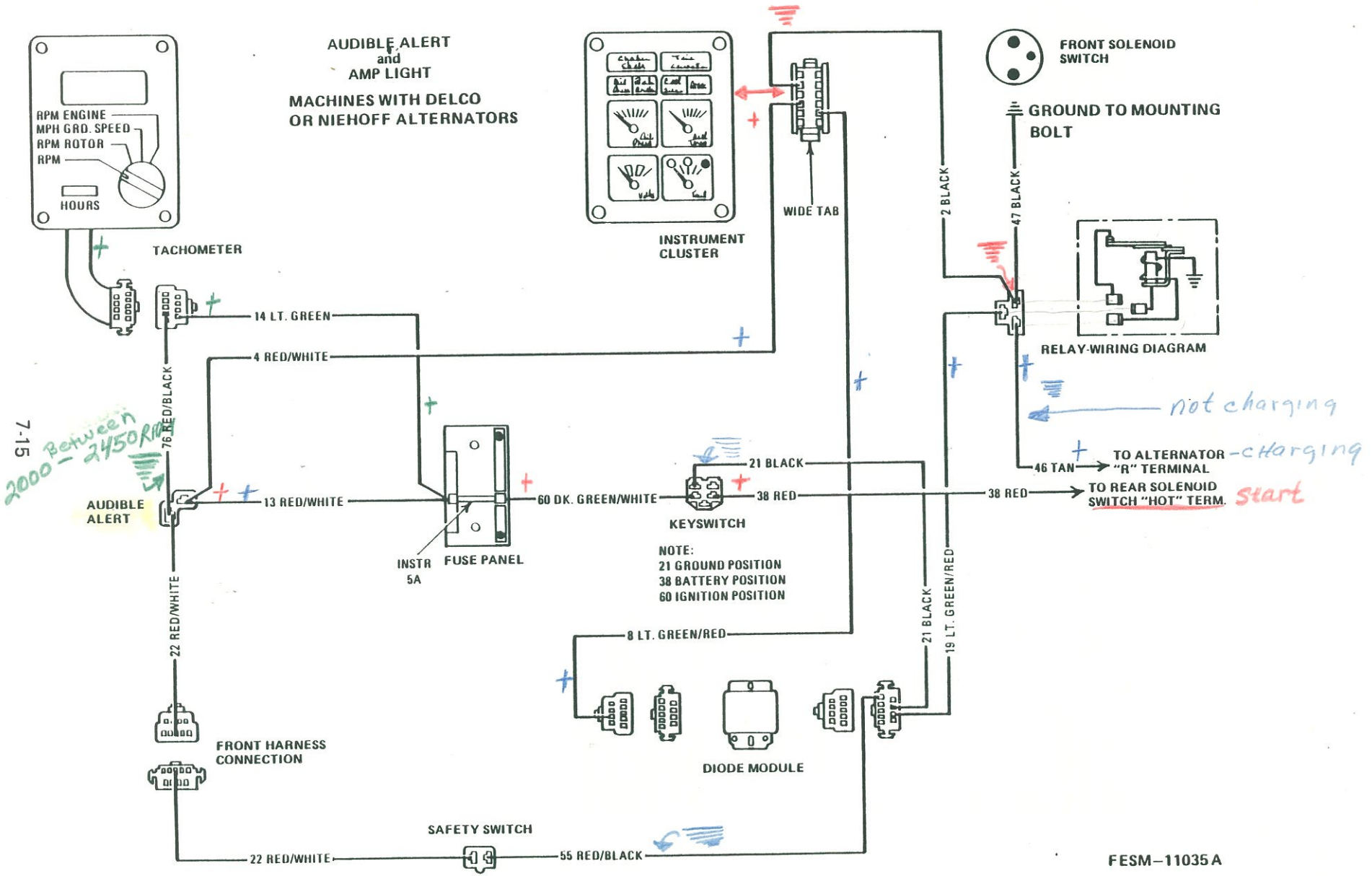
INTERNATIONAL HARVESTER
AGRICULTURAL EQUIPMENT GROUP
HINSDALE ENGINEERING

TACHOMETER, COMBINE INSTRUMENTATION

FULL

245256C91

3


AUDIBLE ALERT
and
AMP LIGHT
MACHINES WITH DELCO
OR NIEHOFF ALTERNATORS
RPM ENGINE
MPH GRD. SPEED
RPM ROTOR
RPM
HOURS
TACHOMETER
INSTRUMENT CLUSTER
WIDE TAB
FRONT SOLENOID SWITCH
GROUND TO MOUNTING BOLT
2 BLACK
47 BLACK
RELAY-WIRING DIAGRAM
14 LT. GREEN
4 RED/WHITE
76 RED/BLACK
2000 Between 2450 RPM
not charging
AUDIBLE ALERT
13 RED/WHITE
INSTR 5A
FUSE PANEL
60 DK. GREEN/WHITE
21 BLACK
38 RED
KEYSWITCH
NOTE:
21 GROUND POSITION
38 BATTERY POSITION
60 IGNITION POSITION
46 TAN
TO ALTERNATOR "R" TERMINAL
-charging
38 RED
TO REAR SOLENOID SWITCH "HOT" TERM.
start
22 RED/WHITE
8 LT. GREEN/RED
21 BLACK
19 LT. GREEN/RED
FRONT HARNESS CONNECTION
DIODE MODULE
SAFETY SWITCH
22 RED/WHITE
55 RED/BLACK
FESM–11035 A

ELECTRICAL

ENGINE COOLANT AND OIL PRESSURE LIGHTS

Warning lights are provided to alert the operator of possible problems which could if continued to operate, cause severe engine damage. The engine and oil pressur lights are located in the instrument cluster. These lights have a positive lead searching for a ground. When the key is turned to the start position, wire 21 (black) provides this ground to all the lights. This enables the operator to check for failed bulbs. When the key is returned to the on position, wire 21 (black) is no longer negative so the lights go out.

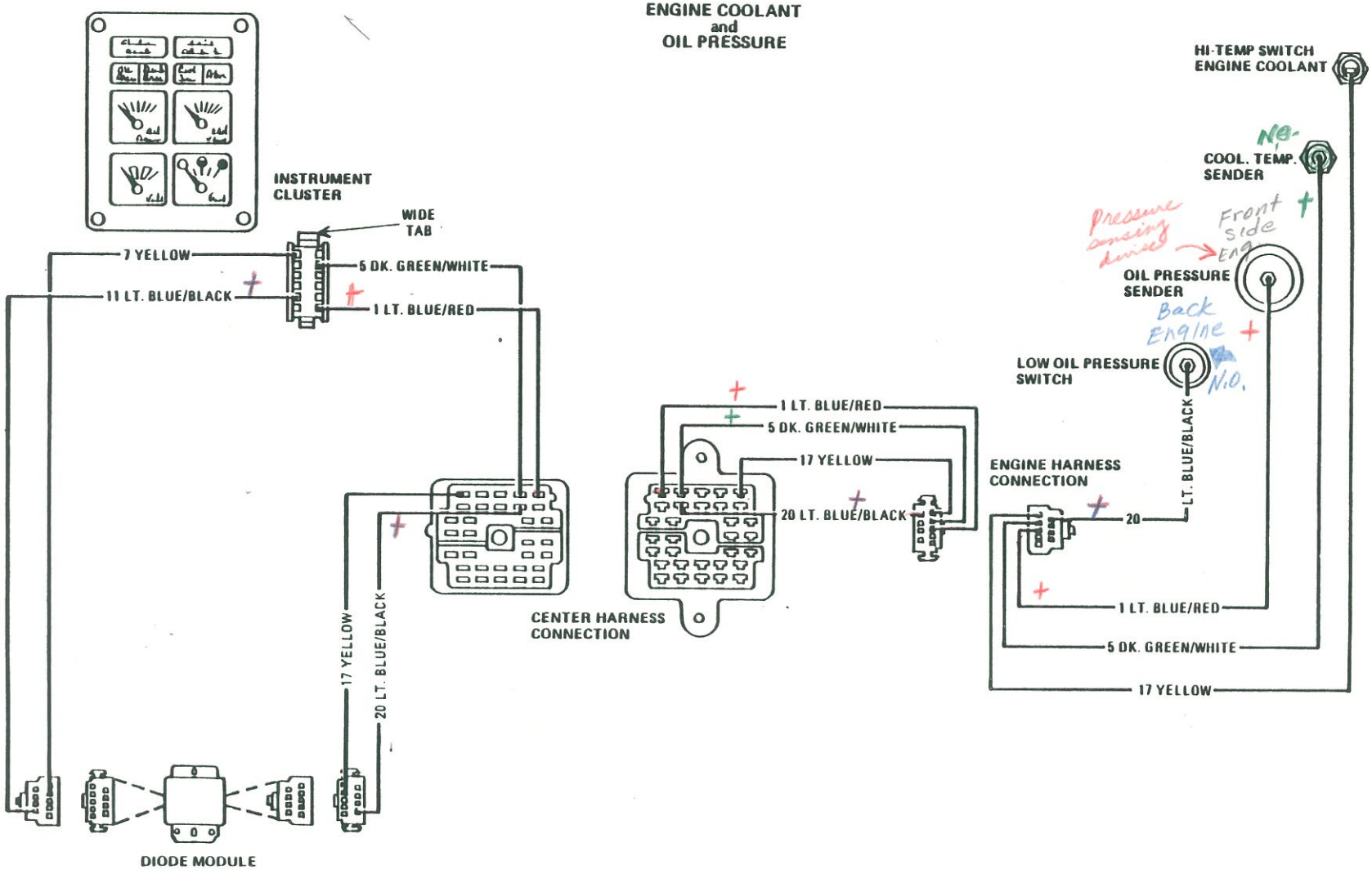
1. During normal operation the senders are open, the circuit is positive (hot) back to the sender, the light is off.

2. If excessive coolant temperature _____ or low oil pressure _____ exists, the sender will close its contacts and provide a ground. The light will illuminate.

ENGINE COOLANT AND OIL PRESSURE GAUGES

Gauges are provided to allow the operator to monitor engine coolant temperature and engine oil pressure. Each gauge has three wires to it. The positive and negative are supplied by the gauge cluster source wire 4 (red/white) and wire 2 (black). The sending unit is the signal to the gauge. As changes occur in coolant temperature and oil pressure, the sender varies the voltage felt by the gauge and the gauge reacts accordingly.

ENGINE COOLANT and OIL PRESSURE



FESM–11029

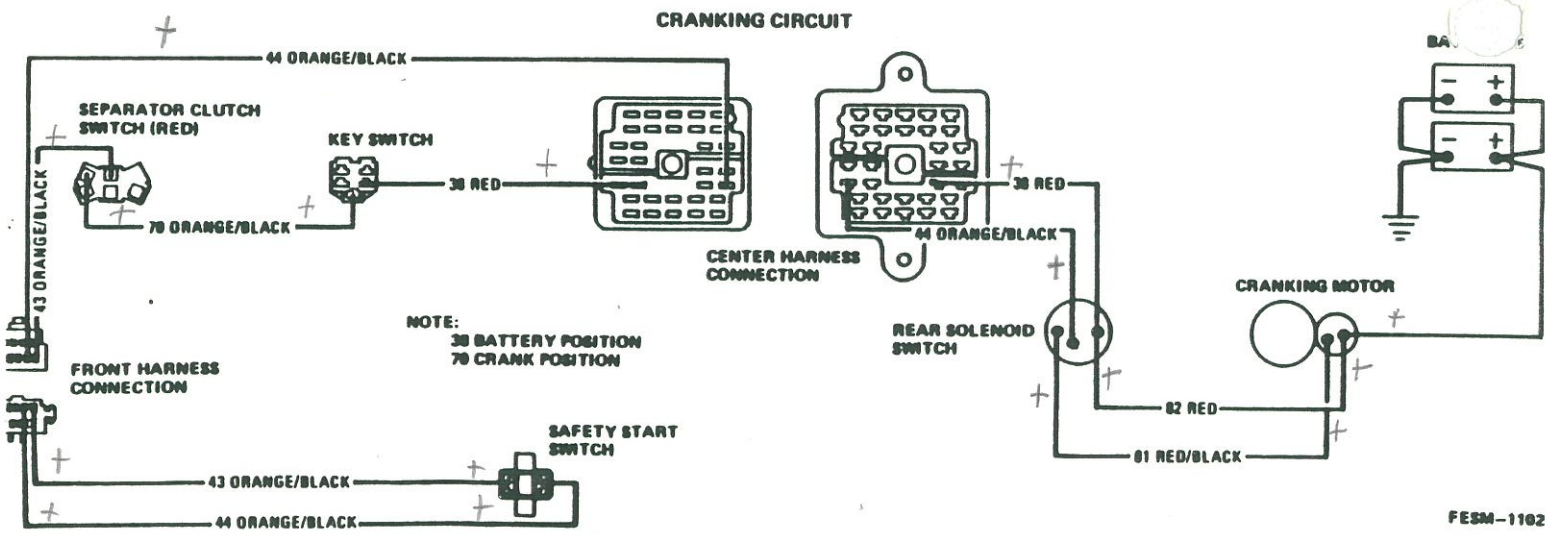
ELECTRICAL

CRANKING CIRCUIT

1. Wire 82 (red) and 38 (red) are positive coding directly from the batteries, wire 38 being attached to the key switch.

2. When key is turned to crank position, the circuit is completed through key switch to the separator switch (red). The switch must be in the off position to connect wire 70 (orange/black) to wire 43 (orange/black). The foot and inch value pedal must be depressed to provide current path across the safety start switch.

3. The current flow will now be directed by wire 44 (orange/black) to the rear solenoid switch "S" terminal. The solenoid will activate which will connect wire 82 (red) with wire 81 (red/black). This will complete the circuit to the cranking motor solenoid.



ELECTRICAL

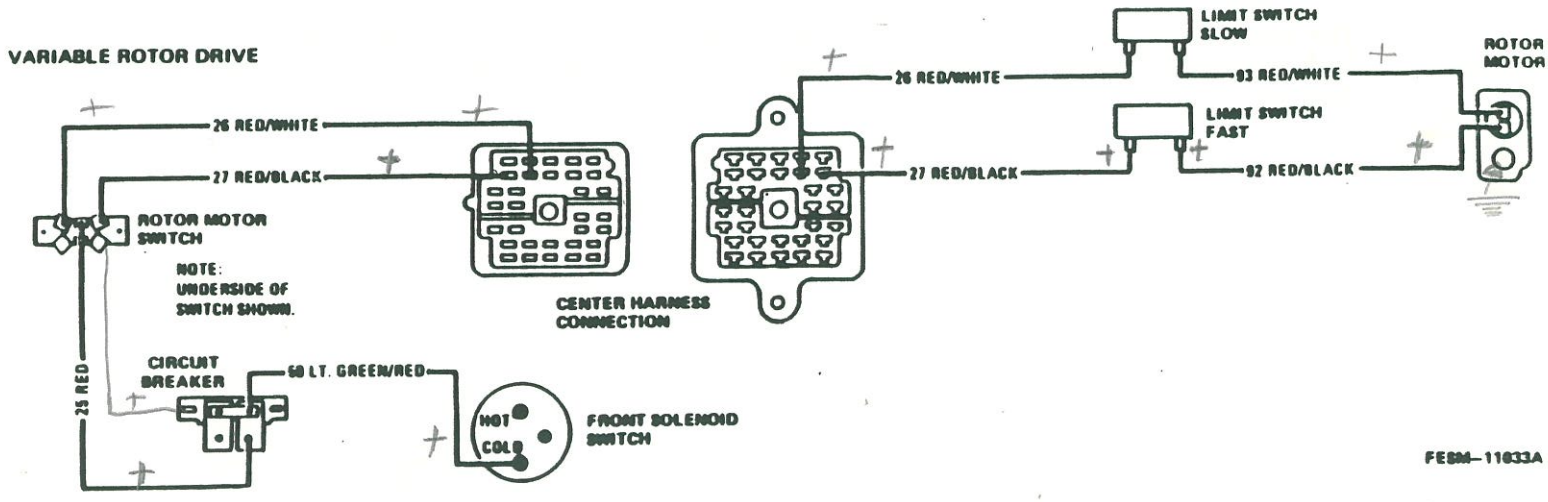
VARIABLE ROTOR DRIVE

1. When the key switch is on, battery voltage will be present at the lower part of the cab solenoid switch.

2. A current path is thus created from wire 50 (lt. green/red) through a circuit breaker to the rotor motor switch via wire 25 (red).

3. To increase rotor speed, depress the rocker switch forward. Wire 27 (red/black) is connected through the center harness connector and fast limit switch to the rotor motor. The motor will rotate and cause the rotor to increase speed (as long as the rocker switch is depressed) until the sprocket makes contact with the limit switch. The limit switch (normally closed) will open when contacted and cause the rotor motor to stop.

4. To decrease rotor speed, depress the rocker switch rearward. Wire 26 (red/white) is connected through the center harness connector and slow limit switch to the rotor motor. The motor will rotate and cause the rotor to decrease speed (as long as the rocker switch is depressed) until the sprocket makes contact with the limit switch. The limit switch (normally closed) will open when contacted and cause the rotor motor to stop.



ELECTRICAL

GAUGE CLUSTER AND DIODE MODULE

The gauge cluster houses the following:

- o Fuel gauge
- o Voltmeter
- o Oil pressure gauge
- o Collant temperature gauge
- o Sound alert
- o High temperature light
- o Low oil pressure light
- o AMP light
- o Park brake light
- o Shaker shaft light
- o Tailings elevator light

1. The wire 4 (red/white) provides all the current for the gauge cluster.

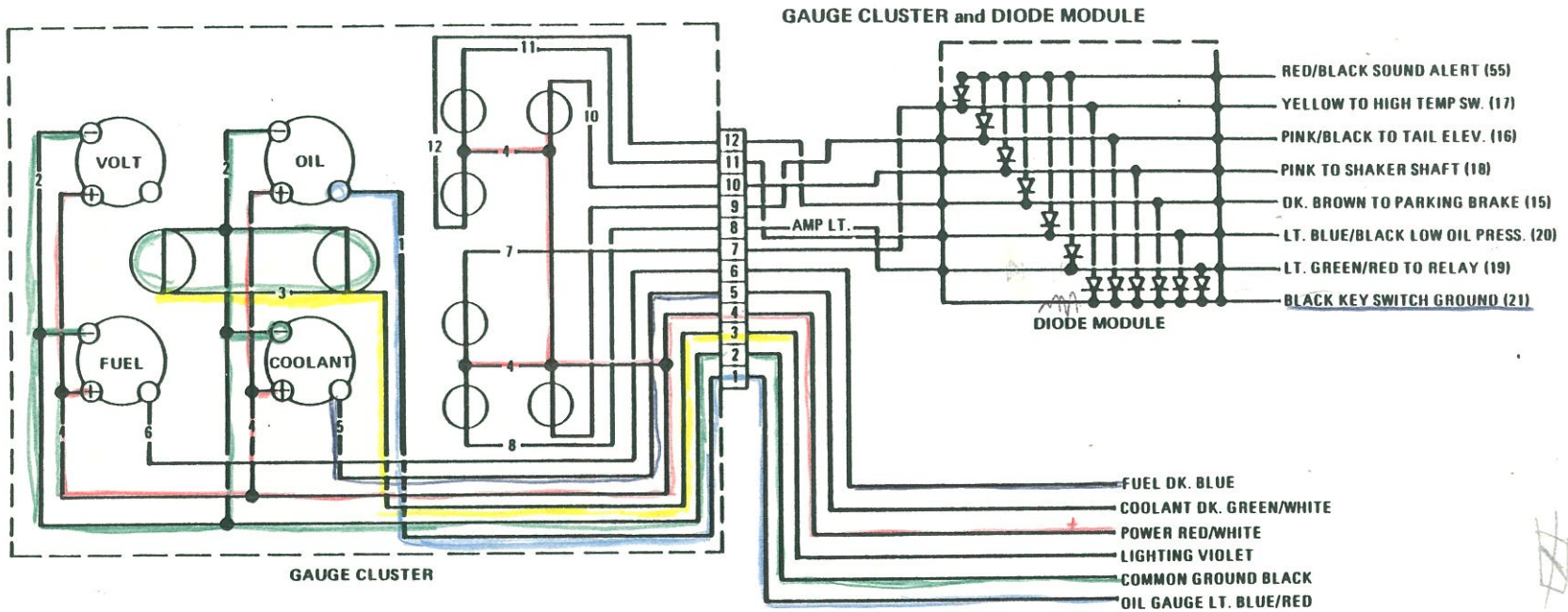
2. The wire 2 (black) provides a ground for all the gauges.

3. The wire 21 (black) provides a ground for all other functions when key is in the start position. This checks the function of all the light bulbs, as well as the audible alert.

4. When a failure occurs, the sender will ground thus illuminating the light (which ever function failed). The sender will also provide a ground to wire 55 (red/black) which will activate the sound alert.

DIODE MODULE

The function of the diode module is to allow the operator to test the light bulbs when (key is to start position) as well as to keep current from backfeeding from one light to another.



7-21

Post-it® Fax Note 7671	Date 6/26	# of pages ▶ 2
To Mike	From	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # 519-235-2791	Fax #	

DIODE MODULE CHECK

1. Disconnect diode module on both sides.

2. Using a continuity light, check for continuity on the terminal at the outer extremes of the diode module on the following wires:

   a. Yellow wire (17) - high temperature.

   b. Pink w/black (16) - tail elevator.

   c. Pink (18) - shaker shaft.

   d. Dark brown (15) - parking brake.

   e. Light blue w/black (20) - low oil pressure.

   f. Light green w/red (19) - amp relay.

3. Check the direction of the batteries inside your continuity light. The positive end of the batteries should be connected to the point of the continuity light. The point is, therefore, positive and the alligator clip is negative.

4. Look at the two plastic connectors on each end of the diode module. You will check the larger connector with the 2 extra wires: a red w/black wire (55 - sound alert) and a black wire 921 - key switch ground).

5. Hook the negative alligator clip to the black wire. You should see continuity when you touch the following terminals with the positive point:

   a. Red w/black (55) - sound alert.

   b. Yellow (17).

   c. Pink w/black (16).

   d. Pink (18)

   e. Dark brown (15).

   f. Light blue w/black (20).

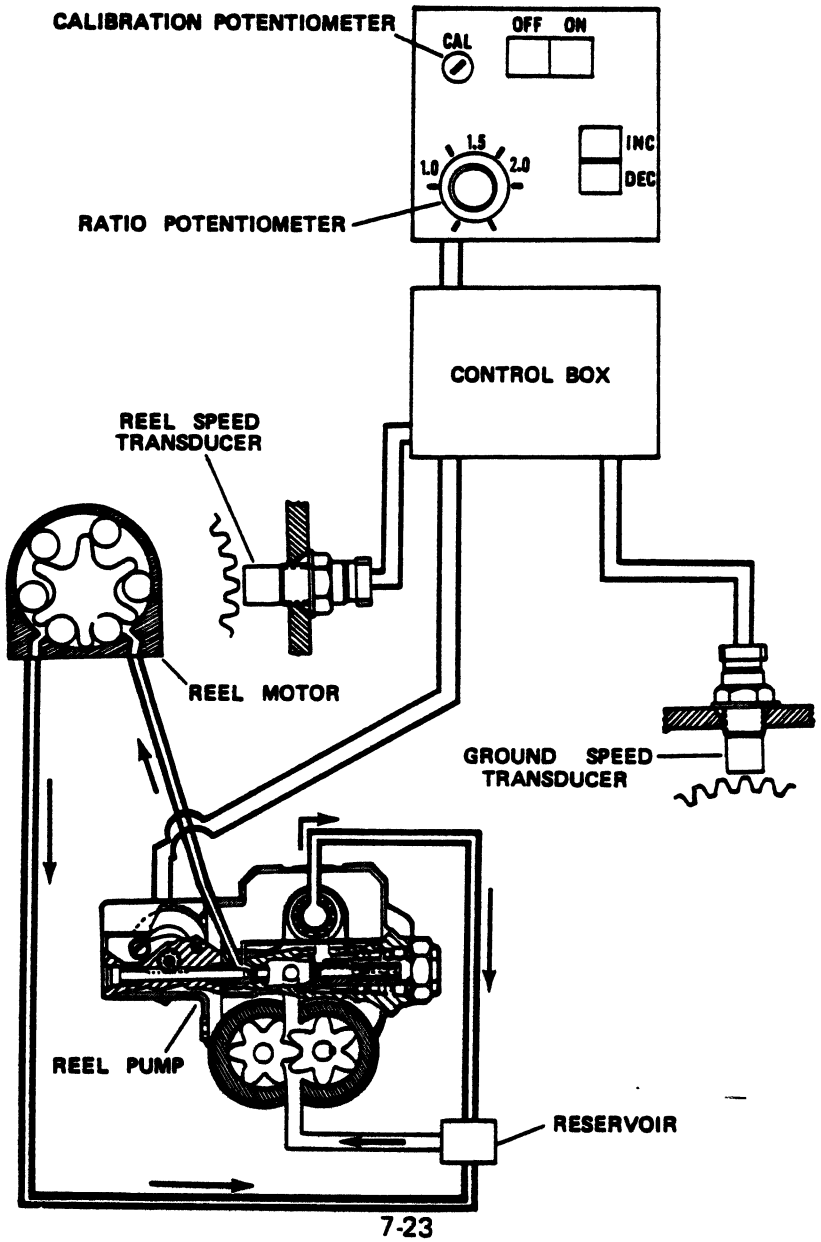
   g. Light green w/red (19).

6. Reverse the continuity light connections. Connect the positive point to the black wire. You should not see continuity when you touch the above terminals with the negative alligator clip.

REEL DRIVE SYSTEM - Automatic Reel Speed To Ground Speed Control

A new feature to automatically synchronize reel speed to ground speed is available as a factory code for 1982. This allows the operator to concentrate his efforts on driving the combine without having to think about reel speed.

REEL SPEED TO GROUND SPEED AUTOMATIC CONTROL 1400 SERIES COMBINE



Components

The electrical system (illustrated on the preceding and following pages) is composed of a control module, wiring harness, two potentiometers, two transducers and an "ON/OFF" switch. The control module is located behind the access panel on the right side of the control center. The two potentiometers and the "ON/OFF" switch are located on the right instrument console extension to the left of the automatic height controls. One transducer is located near the reel drive motor sprocket and uses the sprocket as its reluctance interrupter. The other transducer is the ground speed transducer located on the top cover of the transmission. It sends signals to the digital tachometer as well as the control module.

The hydraulic system is the same as a combine without this option and is explained on the previous pages.

Automatic Operation

To maintain a constant ratio between the reel speed and ground speed, the operator selects a ratio between 1 to 1 and 2 to 1 on the ratio potentiometer.

After the feeder switch is engaged and the "ON/OFF" switch is turned on, the reel will rotate at a minimum RPM even though the combine is static.

The rotation is to remind you for safety reasons that you are in the automatic mode and also the reel is able to reach its optimum speed quicker if the crop is at close proximity.

With forward movement of the combine, the transmission transducer sends its RPM signal to the control box and compares the speed of the reel in light of the operator's ratio selection. If the reel speed is too slow for the rate of travel or ratio selected, electrical current is sent to the control motor on the reel drive pump. This causes the motor to open the pintle to allow more fluid to flow to the reel hydraulic motor and speed the reel up until the signals match the selected ratio.

If the speed ratio lever is pulled back to a slower ground sped, the transmission transducer will signal the control module of the change. At the same time, the reel speed transducer's signal and the operator's ratio preference is compared with the ground speed.

Because the reel RPM will be too fast for the ground speed, the reel drive pump control motor is signaled from the control module to decrease the fluid flowing and the reel speed decreases in proportion to the ground speed.

Calibration - Automatic System

The reel speed control must be calibrated for the combine tire and header type. Once the control has been calibrated, no additional calibration is necesary unless the tire

size or header type is changed. The calibration control is accessible to the operator by removing the plug located in the right front console.

To calibrate the control, perform the following steps in sequence:

1. Start the engine.
2. Set the ratio control at 1:1.
3. Turn automatic reel speed on.
4. Engage the separator and feeder switches.
5. Drive the combine forward at approximately 2 MPH.
6. Using a small screwdriver, adjust the calibration potentiometer until the lower reel bat appears to remain stationary with the ground.

Manual Operation

The reel speed can be controlled manually by turning the automatic reel speed switch off. The manual reel speed switch will then control the increase or decrease in speed.

Components In The System

1. Feeder Switch (Green Toggle)
2. Automtic Reel Speed Switch (On/Off)
3. Reel Speed Switch (Manual)
4. Reel Speed Sensor
5. Ratio Potentiometer
6. Calibration Potentiometer
7. Ground Speed Sensor
8. Reel Speed Motor and Hydraulic Pump
9. Right Hand Console Harness
10. Deck Harness
11. Feeder Harness
12. Header Harness
13. Control Assy.

Location Of Components

1. **Feeder Switch -**

   A green toggle switch located just behind the S/R lever. This switch is the source of voltage to the automatic reel speed on/off switch.

2. **Automatic Reel Speed Switch (On/Off) -**

   Located in the forward section of the R.H. console adjacent to the S/R lever. This switch is the selector for manual or automatic mode.

3. **Reel Speed Switch (Manual) -**

   Located in the forward section of the R.H. console. This switch is used for manual mode only.

Location Of Components (cont'd)

4. **Reel Speed Sensor -**

   Located on R.H. end of header. The sensor is located next to the reel drive sprocket.

5. **Ratio Potentiometer -**

   Located in forward section of the R.H. console. The ratio potentiometer is adjustable from 1:1 to 2:1.

6. **Calibration Potentiometer -**

   Located in the forward section of R.H. console. This potentiometer is used to calibrate tire size and header to the combine when reel to ground speed is used.

7. **Ground Speed Sensor -**

   Located in the transmission. This is the same sensor as the MPH sensor for the tachometer.

8. **Reel Speed Motor and Hydraulic Pump -**

   Hydraulic components for the reel.

9. **Right Hand Console Harness -**

   1301 290 C1 - harness is used in conjuction with reel to ground speed only.

10. **Deck Harness -**

    1301 499 C1 - routed from R.H. console along underside of cab floor to a location just above the reel drive motor. This is a common harness with the automatic header control and automatic feeder cutoff options.

11. **Feeder Harness -**

    1301 500 C1 - routed along L.H. side of feeder and connects to 1 301 499 C1 deck harness. This is a common harness with the automatic header control and automatic feeder cutoff.

12. **Header Harness -**

    1301 584 C1 - routed along header upper beam to the reel speed sensor. This harness connects to 1301 500 C1 feeder harness.

TROUBLESHOOTING GUIDE
AUTOMATIC REEL TO GROUND SPEED CONTROL

The following is a troubleshooting guide which should assist you in determining problems with the automatic reel to ground speed control presently being used on 1400 Series Combines.

Test 1 - Operational Test - Manual Mode

A. Start engine.

B. Engage separator and feeder switches.

C. Position the auto-reel speed switch in the **OFF** position.

D. Attempt to increase and decrease the reel speed by use of the manual reel speed control switch.

If reel speed increases and decreases, go to Test 2.

If unable to control the reel with the manual switch, continue with this test to isolate the source of the problem.

E. Turn off separator and feeder switches. Turn off engine.

F. Check for blown fuse. Replace if necessary.
The fuse panel is located in the R.H. console.

G. Turn key switch to the **ON** position, do not start engine. Engage feeder switch. Check for battery voltage (greater than 9 volts) at reel speed motor connector with manual switch in the increase or decrease position either pin can be positive. If voltage exists at this connector, the problem is internal to the reel speed motor.

H. If battery voltage was not present at reel speed motor connector, the outside R.H. console access panel will have to be removed. Check the harness connectors, feeder switch, auto/manual switch, and manual increase/decrease switch utilizing the attached wiring schematic.

NOTE:

The manual mode must be operational before testing automatic reel speed mode.

Test 2 - Automatic Reel Speed Mode

A. Start engine.

B. Engage feeder and separator switches.

C. Position the auto-reel speed switch in the **ON** position.

Test 2 - Automatic Reel Speed Mode - continued

D. Reel should rotate at minimum speed of approximately 12 rpm.

If reel does not rotate, go to Test 3.

If reel speed is at maximum while combine is static, go to Test 4.

If reel operates but will not stay synchronized with ground speed, go to Test 5.

Test 3 - Reel Does Not Rotate

NOTE:

Continuation of steps performed in test 2.

A. Disengage separator and feeder switches.

B. Turn off engine.

C. Remove outside R.H. console access panel.

D. Remove 14 pin connector from auto reel speed control (Harness 1301 290 C2).

E. Turn key switch to ON position (do not start engine). Engage feeder switch.

F. Check for battery voltage (9.0 volts or more) between pins 13 and 14 of the reel speed harness connector. If battery voltage is not present, the problem is in 1301 290 C2 harness or auto/manual switch 183 896 C1.

G. If problem is not corrected in step F, measure the resistance between pins 11 and 12 of the reel speed harness connector. The reading should be between 15 and 35 ohms. If the resistance is high, check the resistance of reel speed motor at the motor connector. If the resistance is above 35 ohms. the problem is in the motor. If resistance is between 15 and 35 ohms, the problem is in the harness or connectors.

If items F & G are ok, the problem is in the module which should be replaced.

Test 4 - Reel Speed At Maximum While Combine Is Static

NOTE:

Engine running, separator and feed switches are ON, auto/manual switch is in the ON position.

A. Position the auto-reel switch to OFF, lower speed of reel using manual control re-position the reel speed switch to ON.

If reel speed goes back to maximum, go to step B.

Test 4 - Reel Speed At Maximum While Combine Is Static - continued

If reel speed does not change when the auto-reel switch is placed in the ON position, perform steps C through G as outlined in Test 3 before replacing the control module.

B. Turn off engine, separator and feeder switches.

C. Check harness connectors and air gap between sensor and reel drive sprocket. Start engine and recheck system. If problem is not corrected, proceed with step D.

D. Remove RH console outside access panel. Remove reel speed connector from control module. Check ohm resistance at terminals 3 and 4 of the 1301 290 C2 harness connector.

If the reading is between 2000 and 4000 ohms, the control module should be replaced.

If reading is outside the 2000 to 4000 ohm range, the reel speed transducer, harness and connections will have to be checked.

Test 5 - Reel Operates But Will Not Stay Synchronized With Changes In Ground Speed

A. If reel speed does not increase and decrease porportionally with ground spee check mph indicator on the tachometer to see if it is functioning properly.

If it is functioning properly, go to step B.

If it is not functioning properly go to step D.

B. Remove outside R.H. console access panel. Remove reel speed connector from control module. Check ohm resistance at terminals 1 and 2. Results should be 2000 to 4000 ohms. If not in this range, check the ground speed two pin connector between 1301 530 C3 harness and 1301 290 C2 harness.

If terminals 1 and 2 do have between 2000 to 4000 ohms the problem is in the control module which should be replaced.

C. Some machines have a ground wire leading from the 1301 290 C harness to a bolt securing the front solenoid switch. Check to make sure there is a good ground at this location.

D. If the tachometer does not indicate the mph while the combine is in motion, the resistance of the sensor at the transmission should be checked. Results should be 2000 to 4000 ohms.

If not within this range, remove and replace sensor.

If transducer is within this range, reset the air gap by bottoming ou transducer and then backing out ¼ turn.

Test 5 - Reel Operates But Will Not Stay Synchronized With Changes In Ground Speed - continued

Remove R.H. console outside access cover.

Check connectors between harnesses 1301 533 C1, 1301 530 C3 and 1301 290 C2 utilizing wiring schematic.

Results: should have 2000 to 4000 ohms at terminal 1 and 2 of the reel speed control module connector.

If reading is between 2000 to 4000 ohms the problem is in the module which should be replaced.

NOTE:

Test 6 should be used only if unable to calibrate reel to ground speed as outlined in Operators Manual.

Test 6 - Test For Calibration Pot

To verify if the calibration pot is transmitting its signal to the control module, the following steps should be followed.

A. Remove RH console outside access panel.

B. Remove reel to ground speed harness (1301 290 C2) from the control module.

C. Check continuity between pins 8 and 10.

D. Results should be between 80,000 and 120,000 ohms.

If within this range continue with step E.

If not within this range the calibration potentiometer should be replaced.

E. Check continuity between pins 8 and 9 while rotating pot stem slowly.

Results: The ohm meter should indicate a steady movement of the indicator needle.

F. Perform the same procedure as step E between pins 9 and 10. If needle is jerky the calibration pot should be replaced.

NOTE:

Test 7 performed when unable to change the ratio between reel and ground speed.

Test 7 - Test For Ratio Pot

To verify if the ratio pot is transmitting its signal to the control module, the following steps should be followed.

A. Remove RH console outside access panel.

B. Remove reel to ground speed harness (1 301 290 C2) from the control module.

C. Check continuity between pins 5 and 7.

D. **Results:** There should be between 900 and 1100 ohms.

If within this range, continue with step E.

If not within this range the ratio potentiometer should be replaced.

E. Check continuity between pins 5 and 6 while rotating ratio knob slowly.

Results: The ohmmeter should indicate a steady movement of the indicator needle. If needle is jerky the calibration pot should be replaced.

F. Perform the same procedure as step E between pins 6 and 7.

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MA-19944A

TROUBLESHOOTING ELECTRO-HYDRAULIC AUTOMATIC HEADER CONTROL

Overview

The Automatic Header Control is designed to maintain a preselected cutting height when operating cutting knife close to the ground. This is accomplished by linkage from the height sensor to a potentiometer that sends electrical signals through a control box to the header control valve raising and lowering the header.

Components In The System

1. Automatic Header Control (AHC) On/Off Switch
2. Height Control Potentiometer
3. Sensitivity Potentiometer
4. Header Potentiometer
5. AHC Control Module
6. Harness

Location Of Components

The components involved in the system are:

1. Automatic Header On/Off Switch located in R.H. Console.

   Off Position - The header is raised and lowered by a switch in the S/R lever.

   On Position - When the switch is in the ON position, the header can be raised and lowered. When the lower switch is activated, the header will lower to a predetermined height.

2. Height Control Potentiometer located in the R.H. console.

   Positioning of the header for the desired cutting height when AHC is in use is accomplished by rotating "height" knob in R.H. console.

3. Sensitivity Potentiometer is located in the R.H. console.

   Hydraulic sensing response can be increased or decreased to match ground conditions and speed by rotating the sensitivity knob located in the R.H. console. Turn knob to the right for increased sensitivity. Turn knob to left for decreased sensitivity.

4. Header Potentiometer

   Located at the top L.H. corner of the 820 headers and at the upper left hand corner of the feeder house opening on the 810 headers.

   The header potentiometer transmits the mechanical linkage sensing into electrical signals.

Location Of Components (cont'd)

5. AHC Control Module located inside R.H. console.
   This is the "brain box" that coordinates signals from the height control, sensitivity and header potentiometers and forwards the electrical signal to the header valve to raise, lower or remain at a present height.

6. Harness.

Service Bulletin S-4568 has been developed to electrically troubleshoot the automatic header control system. The test is performed with the use of an ohm meter.

TROUBLESHOOTING GUIDE
AUTOMATIC HEADER CONTROL

1400 SERIES COMBINES - ELECTRO HYDRAULICS

The following is a troubleshooting guide which should assist you in determining problems with the automatic header control system (AHC) presently being used on 1400 Series Combines. Instructions should be followed in sequence in order to receive valid test results.

TEST 1 - OPERATIONAL TEST

Operate machine and determine if the header will respond manually by use of the raise/lower switch on the SR lever. If manual operation is okay, but AHC does not function correctly, continue on with Test 2.

TEST 2 - HEADER CHECK

A. Rotate header sensitivity and header height potentiometers fully counterclockwise (Illustration 2, right console pictorial, Pot. C and Pot. D).

B. Lower header, turn off engine, then disconnect auto-header potentiometer at upper rear left corner on 820 Headers or on rear of header back sheet next to feeder housing on 810 Headers. Install a known good potentiometer (obtain through service parts) in the header control harness.

NOTE: Tests with header potentiometer are viewed from stem side.

C. Turn the auto-header potentiometer stem manually fully clockwise. This will keep the header lowered.

D. Start engine and operate at high idle.

E. Turn AHC switch on. Press the lower button on SR lever which will activate AHC system.

F. Slowly turn the auto-header potentiometer stem counterclockwise, then clockwise, to see if the header will respond both up and down. The header lower cycle may be slower than the raise cycle because of knob settings performed in Step A. The auto-header potentiometer stem will have to be turned back slightly from extreme clockwise and counterclockwise positions before header will respond.

CAUTION: The header may raise and lower suddenly. Stand clear of header while performing this check:

G. If header raises and lowers, the problem is in the auto-header potentiometer and/or the mechanical adjustment of the header. If the header does not raise and lower, then continue on with Test 3.

TEST 3 - AHC POWER SUPPLY TEST

A. Turn engine off and remove key.

B. Remove the right hand side sheet of the control center. Disconnect the AHC control box harness female connector (Illustration 1, Reference 1). Routed through the floor compartment there are two 9 pin connectors. Disconnect 9 pin connector (Illustration 1, Ref. 5) which retains female lead on this harness. Leave disconnected throughout test.

NOTE: The following checks are made on the 0-1000 scale of an ohm meter. Calibrate ohm meter at this setting.

C. Connect between pin #1 of the AHC control box harness female connector (Illustration 1, Reference 1) and the red wire with green tracer (Illustration 2, Wire #20) in the 32 pin center harness connector (Illustration 1, Ref. 2). Results -- Closed circuit with less than 1 ohm resistance.

If results are other than given, the problem is in the harness. Repair or replace as necessary.

TEST 4 - AHC GROUND SUPPLY TEST

A. Connect between pin #16 of the AHC control box harness (Illustration 1, Reference 1) to cab frame. Results -- Closed to ground. Less than 1 ohm resistance.

B. If results are other than given, test direct on the ground wire (black with white tracer) located at the front magnetic switch mounting bolt (Illustration 1, Reference 3) and to pin #16 of the AHC control box harness. Results -- Closed circuit. Less than 1 ohm resistance.

If Test B is less than 1 ohm, the cab does not have a good ground. Establish good ground to the cab and retest. If more than 1 ohm, problem is in harness and it will need to be repaired or replaced.

TEST 5 - HARNESS CHECK TO GROUND

Connect between ground and pins 1 thru 15 of the AHC control box harness female connector (Illustration 1, Reference 1). The test should indicate an open circuit for all pins. If resistance is indicated, the harness is to be repaired or replaced for that circuit. Refer to Illustration 2 to follow circuit. NOTE: Pin numbers 10 and 12 not used. Results -- Open.

POTENTIOMETER SPECIFICATIONS

In the following potentiometer tests (sensitivity, header height and header) the potentiometer can be determined as being within specification by the following: A good unit is determined if reading is 0-900 ohms minimum or 0-1100 ohms maximum. Any potentiometer with a reading between 900 and 1100 ohms is good. A potentiometer with a reading of 0-850 ohms or 0-1150 ohms would be defective and should be replaced.

TEST 6 - SENSITIVITY POTENTIOMETER & HARNESS CHECK

Connect between pin #2 and pin #3 on the AHC control box harness female connector (Illustration 1, Reference 1). Rotate the sensitivity potentiometer slowly and observe readings (Illustration 2, Rt. Console Pictorial, Pot. C). The ohm meter should illustrate a steady movement of the indicator needle. See potentiometer specifications. If needle is jerky, sensitivity switch should be replaced. Retest after replacement to verify problem is not in harness.

TEST 7 - HEADER HEIGHT POTENTIOMETER & HARNESS CHECK

A. Connect between pin #4 and pin #5 of the AHC control box harness female connector (Ill. 1, Reference 1). Rotate the header height potentiometer slowly and observe the readings (Ill. 2, Rt. Console Pictorial, Pot. D). The ohm meter should illustrate a steady movement of the indicator needle. See potentiometer specifications. If needle is jerky, header height switch should be replaced. Retest after replacement to verify problem is not in harness.

B. Perform the same as above between pin #5 and pin #6. If needle is jerky, header height switch should be replaced. Retest after replacement to verify problem is not in harness.

TEST 8 - HEADER POTENTIOMETER & HARNESS CHECK

The following test will require two people or removal of harness securing clips so that harness and potentiometer can be moved to a location on right hand side of combine to perform Tests A and B.

NOTE: A known good potentiometer used in Test 2 can be used for the harness check.

A. Connect between pin #7 and pin #8 of the AHC control box female connector. Rotate the header potentiometer slowly and observe the readings (Illustration 2, auto-header potentiometer). See potentiometer specifications.

B. Perform the same as above between pin #8 and pin #9. See potentiometer specifications.

For Tests A and B, the ohm meter should illustrate a steady movement of the indicator needle. Ohm range should be the same in both Tests A and B. If readings are not the same, the harness connectors should be checked for (1) paint and/or corrosion on the terminals; (2) Wire pushed out of connector.

C. If harness test is okay, then header potentiometer should be checked using Steps A and B. Use Illustration 2 for wire color and pin number clarification.

TEST 9 - AHC AUTO/MANUAL SWITCH & HARNESS CHECK

Connect between pin #11 and #13 on the AHC control box female connector.

A. AHC switch in the auto position (ON). Results -- Less than 1 ohm.
B. AHC switch in the manual position (OFF). Results -- Open.

If results are other than shown for Tests A and B, the switch will have to be replaced.

TEST 10 - AHC RAISE/LOWER HARNESS CHECK

A. Connect between pin #14 of the AHC control box harness connector and pin #B of the male 9 pin connector. This connector was disconnected in Step B of Test 3. Results -- Closed circuit, less than 1 ohm resistance.

B. Connect between pin #15 of the AHC control box harness connector and pin #A of the male 9 pin connector. (Same connector as used in Test A above.) Results -- Closed circuit, less than 1 ohm resistance.

If resistance is over 1 ohm for Tests A or B, the harness and in-line connector between AHC control box connector (Illustration 1, Ref. 1) and 9 pin connector (Illustration 1, Ref. 5) will have to be checked. Refer to Illustration 2, Reference 1 and 5.

This concludes tests for harness and potentiometers. If a problem still exists, the AHC control box (Illustration 1, Reference 6) will have to be replaced.

OVERSIZE PAGE
CONNECTIONS

AUTOMATIC FEEDER CUTOFF

Overview

The Automatic Feeder Cutoff Module is designed to monitor the speed of the feeder pivot shaft. When the header switch is engaged, the feeder clutch solenoid and the reel speed-to-ground speed control relay is energized immediately. The Automatic Feeder Cutoff has a 5-second delay built in to allow the feeder to get up to speed before the feeder speed is monitored. After the 5-second delay, any time the feeder pivot shaft speed drops below 100 RPM, the Automatic Feeder Cutoff module will de-energize the feeder clutch and control relay. Also, the "Feeder Stop" light and a sound alert will be energized. The feeder will remain shut off until the header switch is disengaged and re-enaged.

Components In The System

1. Feeder Switch (Green Toggle)
2. RH Console Harness
3. Feeder Solenoid
4. Indicator Light
5. Audible Alert
6. Safety Start Switch
7. Control Assy. (Module)
8. Deck Harness
9. Feeder Harness
10. Harness
11. Feeder Pivot Shaft RPM Sensor
12. RPM Sensor Disc.

Location Of Components

1. **Feeder Switch -**

   A green toggle switch located just behind the S/R lever.

2. **RH Console Harness -**

   1301 530 C1 harness is located in the RH console.

3. **Feeder Solenoid -**

   187 505 C91 located outside of cab at lower LH rear corner.

4. **Indicator Light -**

   Located just behind feeder switch in RH console.

Location Of Components (cont'd)

5. **Audible Alert -**

   Located on front side of RH console.

6. **Safety Start Switch -**

   Located at underside of cab. Foot-n-inch peddle contacts this switch.

7. **Control Assy. (Module) -**

   1310 805 C1 located in RH console. Harness 1301 530 C1 connects to this module.

8. **Deck Harness -**

   1301 499 C1 - routed from RH console along underside of cab floor to a location just above the reel drive motor. This is a common harness with the automatic header control and automatic reel to ground speed options.

9. **Feeder Harness -**

   1301 500 C1 routed along LH side of feeder and connects to 1301 499 C1 deck harness. This is a common harness with the automatic header control and automatic reel to ground speed options.

10. **Harness -**

    1301 419 C1 routed through a rectangle tube at the feeder pivot from LH side. This harness connects to 1301 500 C1 feeder harness.

11. **Feeder Pivot Shaft RPM Sensor -**

    Located inside feeder at pivot shaft location.

12. **RPM Sensor Disc -**

    A disc with holes in it to provide an impulse (interruption) for the RPM sensor.

AUTOMATIC FEEDER CUTOFF

Operational Test

Start engine and engage separator and feeder switches. The feeder should engage and continue running. The red light behind feed switch should remain off.

TROUBLESHOOTING
AUTOMATIC FEEDER CUTOFF

I. **The Feeder Does Not Run At All**

A. Check fuse located in R.H. console - third from top marked "head". Replace if necessary.

B. Remove R.H. outside cab panel.

C. Check to see if harness is connected to control module.

D. If steps A and C are ok, bypass system by hooking together the jumper wires. The jumper can be found by tracing the lead which hooks onto the AFC control module back to where it "y's" out of main harness 1301 530 C4. At this location there will be leads that will be disconnected with two wires each. Connect these leads.

- Start engine engage feeder and separator switches.
- If feeder does not run, turn off engine, remove harness connector from AFC control box and turn on key switch. There should be 9.0 volts or more at harness terminals 1 and 8 as well as 7 and 8 (w/jumper connected).
- If 9.0 volts or more are present at these terminals, check voltage at feeder clutch valve. If voltage is present, inspect feeder clutch solenoid and valve for correct operation. If no voltage is available at the feeder clutch valve, the harness will have to be repaired or replaced.
- If no voltage is available at terminals 1 and 8 as well as 7 and 8, check for good ground at front solenoid mounting bolt by checking continuity between mounting bolt and terminal 8 of the connector.

  If no continuity, check for paint at mounting bolt surface.

  If there is continuity, the feeder clutch switch should be checked for flow of voltage through the switch.

I. The Feeder Does Not Run At All (continued)

E. Disconnect jumper wire with key switch on, there should 9.0 volts or more between terminals 1 and 8 of the AFC control module connector. If this voltage is not available, recheck system as outlined in step D.

If voltage is available, the control module is defective and should be replaced.

II. Feeder Runs For 5 Seconds And Shuts Off

Start engine, engage separator and feeder switches. If feeder runs for 5 seconds and then disengages, proceed as follows.

A. The red light located behind feeder switch should come on and the audible alert should sound. If the light does not come on, check to see if the bulb is burned out. Replace if necessary. A burned out bulb will not cause the system to malfunction.

B. Located on the feeder pivot shaft is a signal disc and sensor for the AFC. Check the sensor and wiring for physical damage and if necessary adjust sensor to proper air gap of .010 to .060 in.

C. If the feeder still will not operate, remove the R.H. outside cab panel.

D. Remove harness from AFC control module.

E. Check ohm resistance on terminals 2 and 3 of control module harness. Resistance should be 2000 to 4000 ohms. If resistance is within this range, the harness and all harness connections to the sensor are ok. The control module will have to be changed.

F. If resistance is not between 2000 and 4000 ohms, the harness and harness connections will have to be inspected.

- Harness 1301 499 C1 contains 7 wires with three connectors. Of the seven wires, the connector which houses the "tan" and "black w/white tracer" wires are used for the AFC. Approximately 10" of this harness w/the three connectors is exposed through the cab floor into the R.H. console area. The remainder of the harness is routed along the underside of the cab floor to a location just above the reel drive motor. At this location 1301 499 C1 connects to 1301 500 C1 harness assembly via a 7 pin amp connector. Pin locations 6 (tan) and 7 (black w/white tracer) are used for the AFC. 1301 500 C1 harness is routed along feeder housing to the header. Approximately 12" from the 7 pin connector a "pig tail" approximately 4" long is exposed. Harness 1301 419 C1 connects to this pigtail and is routed through a rectangle tube near the feeder pivot shaft to the sensor. All connections are to be free of paint and corrosion. All harnesses (less the sensor) should have a resistance of 1 ohm or less and should be repaired or replaced as necessary.

- Resistance for the sensor should be between 2000 to 4000 ohms. If not within this range, the sensor is to be replaced.

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MA-19945B

SHAFT SPEED MONITORING SYSTEM

General Information

The monitoring system consists of three basic parts: a console which mounts within easy view of the operator; the sensors which are mounted near the various shafts and other positions to be monitored; and the wiring harness, which connects the various sensors to the console.

The console is the heart of the system. It receives information from each of the sensors and then translates this information for the operator to let him know whether or not all monitored positions are functioning properly. The entire system is powered by the combine battery(s).

Principles Of Operation

Sensors, which are mounted at six different locations on the combine, continuously monitor the operation of the combine. Any time a monitored shaft slows down or stops rotating or when an oscillating shaft or lever slows down, an audible alarm will sound to alert the operator. The alarm is located on the left front of the console panel. The digital display will indicate numerically which position and function is at fault. If more than one position is at fault, a "0" will be displayed. As long as all positions are operating properly, the digital display will be dark.

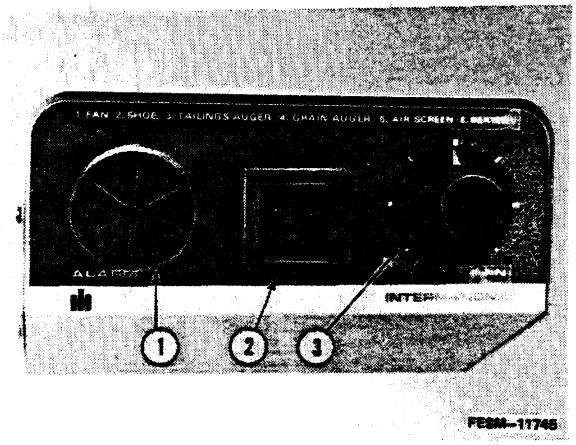
Each sensor consists of a switch assembly and a magnet assembly. The switch assembly is mounted adjacent to the shaft or lever to be monitored, while the magnet is mounted on the rotating shaft or on the lever. All of the sensors are connected to the console by means of a wiring harness.

Rotation or a back and forth movement of the magnet causes the switch contacts to open and close, each time the magnet passes by the switch, thus providing information to the console in the form of electrical signals. The electronics within the console are factory pre-tuned to match the speed range for each monitored position. One of the monitored positions (cleaning fan) may be tuned by the operator by means of a control knob on the console.

Console

Serial Number 1500 and Below

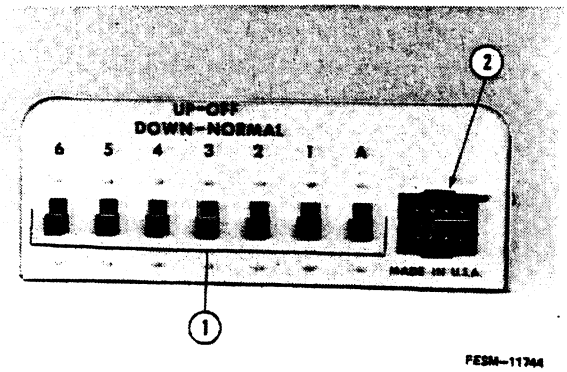
There is only one operating control, labled FAN. This control is used to alter the characteristic of the fan sensor response to match the speed as selected by the combine fan speed control. A centrally located digital display indicates, numerically, which sensor has detected a malfunction. Just below this display is a table listing the monitored positions and their relationship to the digital display.



1. Alarm
2. Digital display
3. Cleaning fan control knob

There is no on-off switch on the console, since this function is performed by the combine ignition switch. The alarm is turned on or off automatically. When the combine engine is slowed down with separator engaged, the alarm on the console will sound. After all sensed positions fall below approximately 70% of their operational speed, the alarm will shut itself off. When the engine speed is again brought up to normal operating speed with separator engaged, the alarm will sound. As soon as all sensed positions resume operating speed, the alarm will become silent.

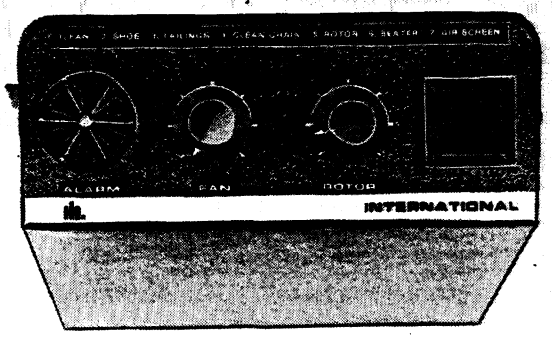
The rear panel of the console contains seven switches and a connector jack. These switches are labeled A and 1 through 6. When all switches are in the DOWN-NORMAL position, the alarm and the six sensors operate normally. The UP-OFF position is used to disable a sensor position that is not being used so that the rest of the monitoring system can be used.



1. Switches
2. Connector jack

The switch labeled A may be used to disable the alarm, if so desired. The panel connector is used to connect the console to the wiring harness. These switches are also used in conjunction with a IH Combine Monitor Test Unit.

Console

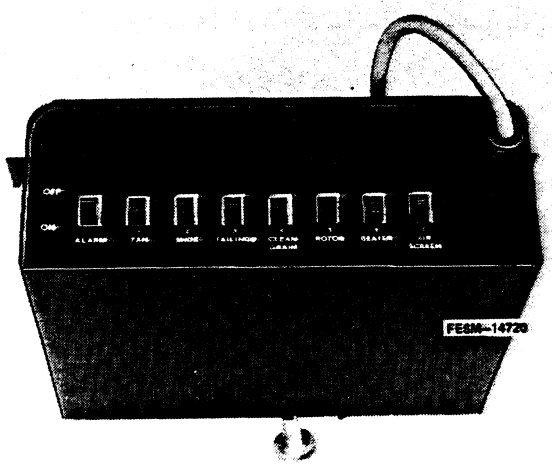


FESM-14719

Serial Number 1501 and Above

There are only two operating controls, labeled FAN and ROTOR. These controls are used to alter the characteristic of the fan and rotor sensor response to match the speed as selected by the combine fan and rotor speed control. Just above this display is a table, listing the monitored positions and their relationship to the digital display.

There is no on-off switch on the console, since this function is performed by the combine ignition switch.



FESM-14720

The rear panel of the console contains eight switches and a connector jack. These switches are labeled A and 1 through 7. When all switches are in the DOWN-NORMAL position, the alarm and the seven sensors operate normally. The UP-OFF position is used to disable a sensor position that is not being used or is malfunctioning so that the rest of the monitoring system can be used.

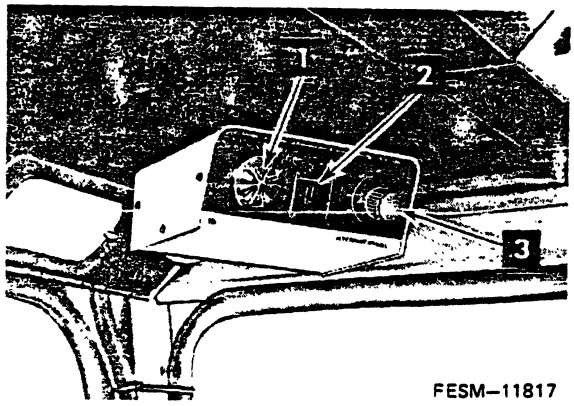
The switch labeled A may be used to disable the alarm, if so desired. The panel connector is used to connect the console to the wiring harness.

NOTE: At least two channel disable switches must remain in the on position in order for the shaft monitor to function properly.

Operating Instructions

This monitoring system will indicate, by means of a numerical display and an audible alarm, whenever the cleaning fan, shoe, tailings elevator, clean grain elevator, rotary air screen, the discharge beater or straw chopper are operating at less than 70% of their designed speed.

The monitoring system is functioning properly if the following conditions exist during start-up and during operation of the combine:



FESM–11817

1. Alarm
2. Digital display
3. Cleaning fan control knob

1. Ignition switch turned on: A zero appears on the console display. The audible alarm sound. After a short time the alarm is silent.

2. Separator engaged and engine running at operational speed: As engine is brought up to speed, the alarm will sound. The zero will be replaced by a 1 (FAN control knob fully clockwise). As the FAN control knob is turned slowly counterclockwise, the display will blank out and the alarm will become silent.

NOTE: Some shaft monitor console units do not allow turning of the fan channel control knob up to the maximum possible operating speed. These units will not display as 1 if the fan is operated above approximately 650 rpm. However, these units will provide the same measure of protection on the fan channel as on the remaining channels.

When operating the fan above 650 rpm the fan control knob should be in the fully clockwise position. To check the fan channel for operation, idle the engine down until the fan speed is below 650 rpm. At this time a 1 should appear and be made to go out by adjusting the knob counterclockwise. It will probably be necessary to disable the other channels to perform this check depending upon how much the engine has to be idled down.

Field Operation

Start the combine engine, engage the separator lever, then run the engine at operating speed.

NOTE: Each time the cleaning fan speed is changed, the fan position (1) of the monitor must be returned by turning the console FAN control fully clockwise. After the 1 appears on the display and the alarm sounds, turn the FAN control knob slowly counterclockwise until the alarm is silenced and the display darkens.

Precautions

THIS IS A 12 VOLT (BATTERY) SYSTEM

Keep all connectors clean. This should be a part of routine maintenance.

Do not tape sensor connectors together.

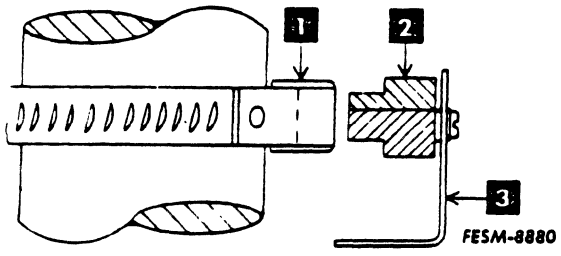
Be sure all magnet assemblies are secure on their shafts or levers before starting your combine operations.

To detach sensor lead from combine harness, twist and pull connectors apart simultaneously. DO NOT PULL ON THE WIRES.

Troubleshooting

The trouble shooting procedures listed are for the monitoring system, and should not be confused with locating trouble on the combine when one of the sensors detects a malfunction. When one of the sensors consistently indicates a fault and the combine is not at fault, or if the monitor appears to be completely "dead" then use the following procedures.

Isolate the cause to the sensor, sensor lead, wiring harness, or the console, in that order. Make necessary repairs only after the trouble is located.



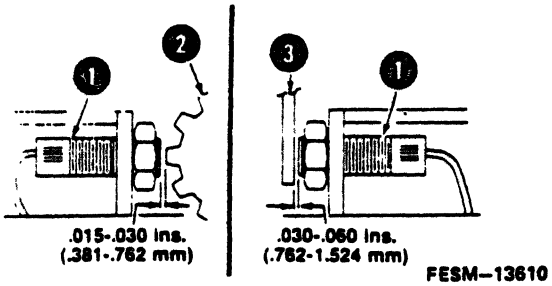
1. Magnet
2. Switch housing
3. Mounting bracket

Sensors

1. Look for any physical damage to sensor parts or the sensor leads.

2. Check clearance between the magnet and the switch assembly. There should be 1/8 inch clearance between the flat of the magnet and the switch assembly when the shaft is rotated or when a magnet on an arm or lever is nearest the switch assembly. Loosen the bracket mounting bolt if necessary and make the adjustment.

3. Be sure the magnet assembly and the switch assembly are securely fastened.

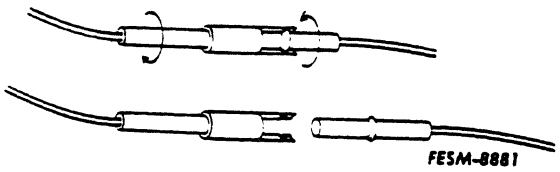


Reluctance sensor.

The rotor cleaning fan and feeder reluctance pick-up should be set as shown in the illustration.

Check the control actuators for physical damage or adjustment. Check power availability at the actuator with a continuity check or when the control switch is activated.

1. Reluctance transducer
2. Fan and rotor signal wheel
3. Feeder pivot shaft



Sensor connectors.

4. Disconnect sensor connectors by twisting and pulling apart simultaneously. DO NOT PULL ON THE WIRES. Look for signs of corrosion and if necessary, clean the connector contacts.

5. If sensor leads are damaged carefully cut away the gray covering at the damaged area. Repair damaged wire or wires by soldering wires together, being sure to match wire colors, then tape each repaired lead. Finally, tape over cut portion of the cable cover. If necessary, move the cable so that the same type of damage will not occur again.

Harness

1. Carefully examine the monitor harness for damage. If the harness is cut or pinched, carefully cut away the grey cable covering. Repair cut or damaged wire or wires by soldering wires together, being sure to match wire colors. Tape each repaired lead, then tape over the cut cable covering. If necessary, move the cable so that the same type of damage will not occur again.

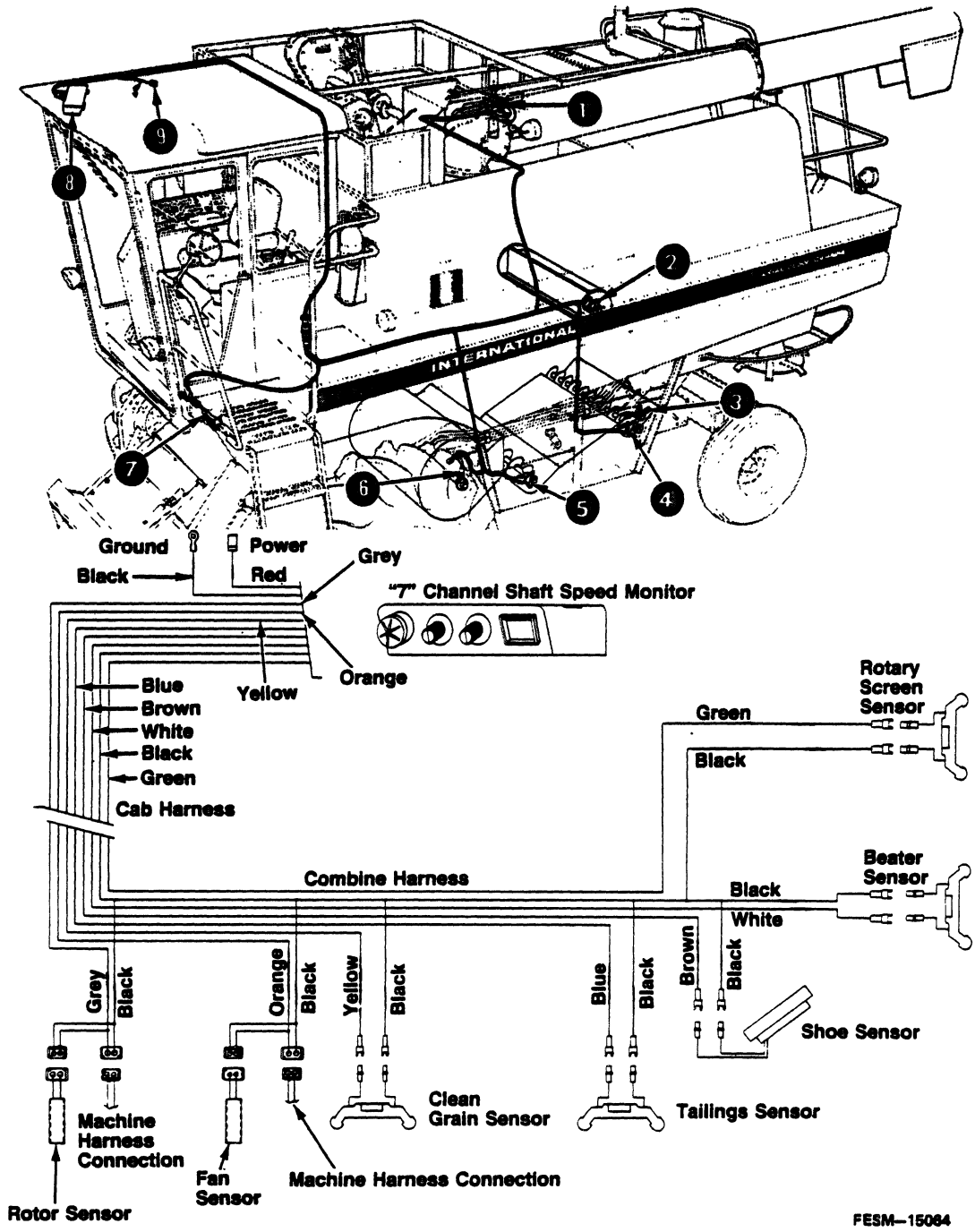
Console

1. Be sure the harness connector is plugged into the console connector.

2. Check for blown fuse in the combine fuse panel.

3. Check battery(s) for low output voltage. Recharge or replace if necessary.

NOTE: Combining may be continued, before making repairs if a defective sensor is found. Disable the defective sensor by placing its related switch in the UP-OFF position. The remaining sensors will function normally.



Shaft Speed Monitor

1. Rotary screen sensor
2. Beater sensor
3. Shoe sensor
4. Tailings sensor
5. Clean grain sensor
6. Fan speed sensor
7. Rotor sensor
8. Monitor
9. Power supply

STRAIGHT TALK

May 3, 1983

To All AE Dealers (U.S.)
Mr. Ken Benson – National Marketing Office, Canada

COMBINES – IH GRAIN LOSS MONITOR (1983 U.S.)

IH is pleased to introduce a new grain loss monitor for 1983. These units are built by the DICKEY-john Corporation of Auburn, Illinois, and will be made available to U.S. dealers only for 1983. Canadian dealers will remain with the SED unit used by both U.S. and Canada during 1982.

The IH grain loss monitor is a solid state electronic unit consisting of:

1. Control console
2. Four grain sensors
3. Ground speed sensor
4. Various inter-connecting cables

How Does It Work?

The IH Grain Loss Monitor has the capability of operating in two modes, either the Distance Mode or the Time Mode. In the Distance Mode the ground speed signal from the Ground Speed Sensor is utilized and the monitor will indicate relative grain loss per unit of area. In the Time Mode the ground speed signal is ignored and the monitor will indicate relative grain loss per unit of time.

In the Distance Mode, which is the recommended mode of operation, the monitor console processes the information from the grain sensors and the ground speed sensor and indicates the relative grain loss per unit of area on the front panel meter indicator. When the monitor controls are set for an acceptable grain loss condition, which is determined by the operator, any changes in the separator loss will be seen on the meter. The monitor will enable the operator to save grain by indicating to the operator when changes in field conditions are affecting the combine separating efficiency and by indicating the results of any corrective action taken.

In the Time Mode the monitor console processes the information from the grain sensors and indicates the relative grain loss per unit of time on the meter indicator. As material flow and associated loss is increased or decreased the indicated grain loss should follow the same pattern since the monitor is indicating the grain loss per unit of time.

In either mode the Grain Loss Monitor is used for assisting the operator in determining the best rate of ground speed during harvesting.

Area Base (Distance) versus Time Base?

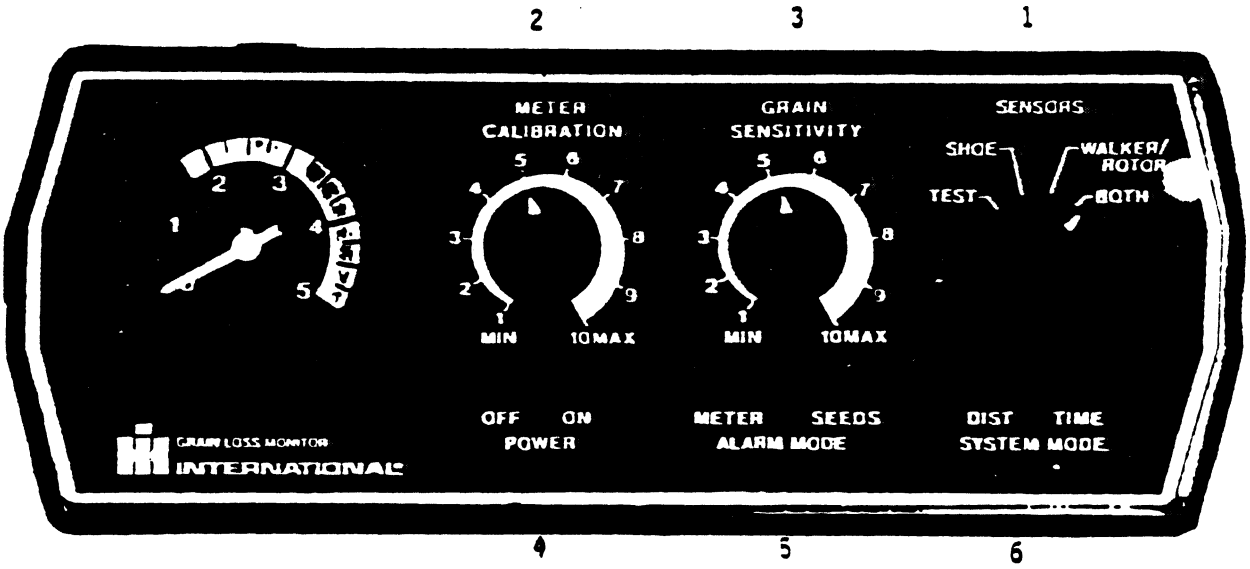
Some grain loss monitors measure grain loss relative to time – seeds per second. The IH Grain Loss Monitor measures grain loss relative to the area being harvested – the way you really need to monitor it.

Time based monitors don't take harvesting speed into consideration – so their results can be misleading. In fact, if you slow down to decrease loss per second, you may actually increase loss per acre.

Area-based monitors, on the other hand, give you an indication of any change in loss per acre – at a glance.

The IH Grain Loss Monitor does, however, enable the operator to utilize the Time Base Mode. The primary use for this mode is for a system check of the monitor console and grain sensors. This mode can also be used when crop conditions are such that the ground speed falls below the drop-out level of the ground speed sensor signal (normally 1/2 MPH) or in the event of a malfunction of the ground speed sensor. An "insurance" policy to keep you running.

The Console



1. Sensors – This switch is a four position rotary switch with the positions labelled "Test – Shoe – Walker/Rotor – Both".

   The "Test" position is an internal speed signal which is generated enabling the operator to test the operation of the console and ground speed sensor.

   The "Shoe" position – System monitors only the chaffer sensors and displays the relative grain loss on the meter.

   "Walker/Rotor" position – System monitors only the rotor sensors and displays the relative grain loss on the meter.

   "Both" position – System monitors both the rotor and shoe sensors and displays the total relative grain loss on the meter.

2. **Meter Calibration** – This control sets the amount of meter deflection and is used to position the meter indicator to a point (normally one) on the scale so that an increase or decrease in relative grain loss can be observed.

3. **Grain Sensitivity** – This control sets the system sensitivity to the grain striking the grain sensors. Usually small soft grain such as barley or rice require a more sensitive setting, "Max", and large hard grain such as corn which requires a less sensitive setting, "Minimum".

4. **Power Switch** – This switch is a two position slide switch with the positions labelled "Off" and "On". In the "On" position power is applied to the monitor system. In the "Off" position, power is removed from the monitor system.

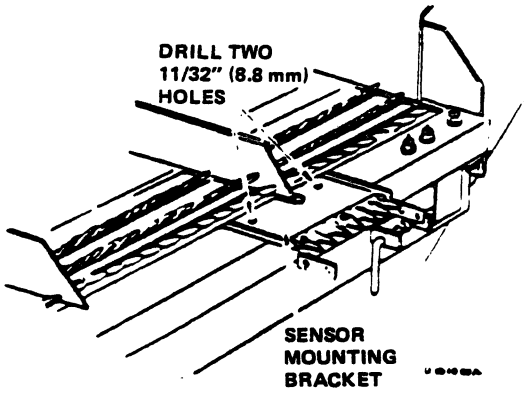
5. **Alarm Mode Switch** – This switch is a two position slide switch with the positions labelled "Meter" and "Seeds". In the "Meter" position the alarm periodically sounds for one second when the meter indicator moves into the red zone and remains for over 10 seconds. In the "Seeds" position the alarm sounds "chirps" when grain strikes the grain sensors or when tapping on the grain sensors with sharp objectives, "test purposes".

6. **System Mode** – This switch is a two position slide switch with the positions labelled "Dist" (Distance) and "Time".

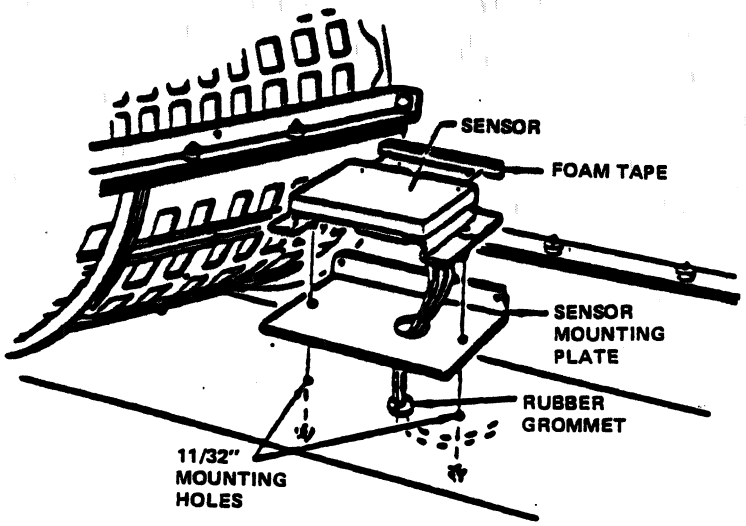
Meter Indicator – Visual display indicating grain loss (See item 2).

The Sensors

The two chaffer sensors are installed as close as possible to the outer edges of the chaffer sieve.



The two rotor sensors are installed in the rotor chamber, on the partition between the chaffer and the rotor. They are located below the rear or discharge end of the rotor cage.



The sensors are sensitive enough to distinguish seeds from chaff. As seeds strike the sensors they generate impulses which are transmitted to the console.

The Distance Sensor

The key to area based monitoring. The sensor measures the distance travelled by the combine and transmits this information to the console. The console monitors the area being harvested and compares area with grain being lost relative to that area. The meter reflects any changes in the amount of grain being lost.

The ground speed sensor mounts on the driving axle, near the left front wheel.

Operation (Distance Mode)

- Set the POWER switch to ON.
- Set the ALARM MODE switch to METER.
- Set the SYSTEM MODE switch to DIST. (distance).
- Set the SENSORS switch to BOTH.
- Set the METER CALIBRATION control to MAX. (fully clockwise).
- Set the GRAIN SENSITIVITY control to MIN. (fully counter-clockwise).
- Begin operating the combine in a normal manner while harvesting a test strip. **NOTE:** Make sure that the crop being harvested and the combine loading and adjustments will be representative of normal operating conditions.

- After the combine is fully loaded and operating at the ground speed expected for normal or satisfactory conditions, advance the GRAIN SENSITIVITY control slowly clockwise until the meter indicates a full scale reading of 5, then advance the control one or two more divisions clockwise. **NOTE:** Usually small, soft grains such as barley or rice require a more sensitive (MAX.) setting than larger, harder grain such as corn which requires a less sensitive (MIN.) setting. Typically the settings are: corn and beans 6-7, wheat 7-8, barley, rice or rapeseed 8-9.

- Rotate the METER CALIBRATION control counter-clockwise until the meter indicates a green zone setting of 1. This sets the loss reference position of the indicator.

- After the desired setting has been obtained, stop the combine and check the ground behind the combine for grain loss. If the separator losses are acceptable, continue combining. The monitor will now indicate whether the separator losses are increasing or decreasing as compared to the loss found during the test run. Greater grain loss will be indicated by an upscale deflection into the red zone by the meter pointer. The operator can then make the necessary separator adjustments or make a change in the ground speed in order to reduce the grain loss.

- The WALKER/ROTOR and SHOE positions of the console SENSORS switch enable the operator to make comparative checks of the separator loss at either the rotor or the shoe, by switching to the desired position. To do this, switch to the WALKER/ROTOR and SHOE positions while the combine is operating satisfactorily. Note the pointer deflection for each position.

- Generally, if the WALKER/ROTOR position indicates an increase in grain loss, the cause may be improper threshing. If the SHOE position indicates an increase in grain loss, the air flow or the sieves are not set properly. In addition, variations in ground and crop conditions can affect losses in both the rotor and the shoe. If plugging of the shoe sensor brackets occurs during operation, remove the sensor seed combs.

- When normal operating conditions are obtained, the meter pointer will remain in the green zone but may produce some momentary excursions into the yellow or red zone. Such momentary deflections should be ignored unless they occur frequently. In such cases, the operator should inspect the ground behind the combine, the combine and the monitoring system for potential problems.

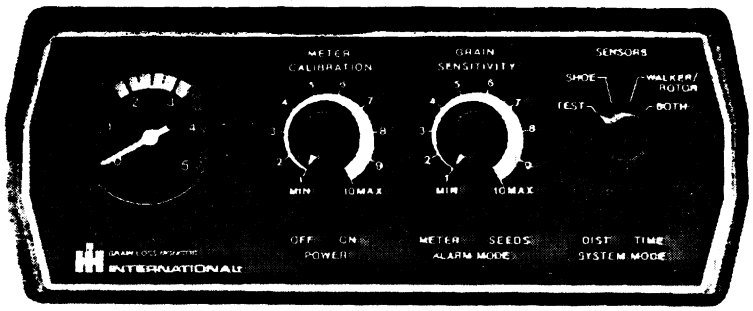
- If the result of the first test strip was not satisfactory, adjust combine and repeat the test, using the procedure described above.

Comments

Procedures for testing, operation in the time mode, troubleshooting, and installation are all outlined in the setting up instructions which come with each unit. Warranty on these monitors will take the same as the new combine it's sold on and will be further outlined in future correspondence forwarded by the Product Support Center.

TROUBLESHOOTING

-DICKEY-JOHN GRAIN LOSS MONITOR SYSTEM-



EG-128422

This unit has a built in test mode which can help isolate problems. When a problem is suspected, the operation of the monitor system should be checked using the following procedures.

A. Control Console

With the combine stationary and the engine OFF, set the POWER switch to ON, ALARM MODE switch to SEEDS, SYSTEM MODE switch to TIME, SENSORS switch to TEST, GRAIN SENSITIVITY control to MAX. (fully clockwise), and METER CALIBRATION control to MIN. (fully counterclockwise).

The alarm should be sounding at a rapid chirp. Advance the METER CALIBRATION control in a clockwise direction and note that the meter pointer deflects to full scale.

If the alarm sounds at a rapid chirp and the meter pointer deflects to full scale the console is operational in the TIME MODE. If not, the console is defective and needs to be repaired or replaced.

B. Ground Speed Sensor

To check the ground speed sensor the combine must be driven at a speed above one MPH. DO NOT ENGAGE SEPARATOR.

Set the POWER switch to ON, ALARM MODE switch to METER, SYSTEM MODE switch to DIST., SENSORS switch to TEST, GRAIN SENSITIVITY control to MAX., and METER CALIBRATION control to MIN.

Drive the combine at a constant speed above one MPH.

Advance the METER CALIBRATION control clockwise until a meter reading of 2.5 is obtained.

Increase combine speed and note that the meter reading decreases. Decrease combine speed and note that the meter reading increases.

If the meter pointer deflects as described above, the ground speed sensor is operational in the DIST. MODE. If not, the ground speed sensor or harness is defective and needs to be repaired or replaced.

C. Grain Sensors

CAUTION: BEFORE CHECKING SENSORS MAKE CERTAIN THE COMBINE IS STOPPED AND THE ENGINE IS OFF.

Set the POWER switch to ON, ALARM MODE to SEEDS, SYSTEM MODE to TIME, GRAIN SENSITIVITY control to MAX., and the SENSORS switch to BOTH positions.

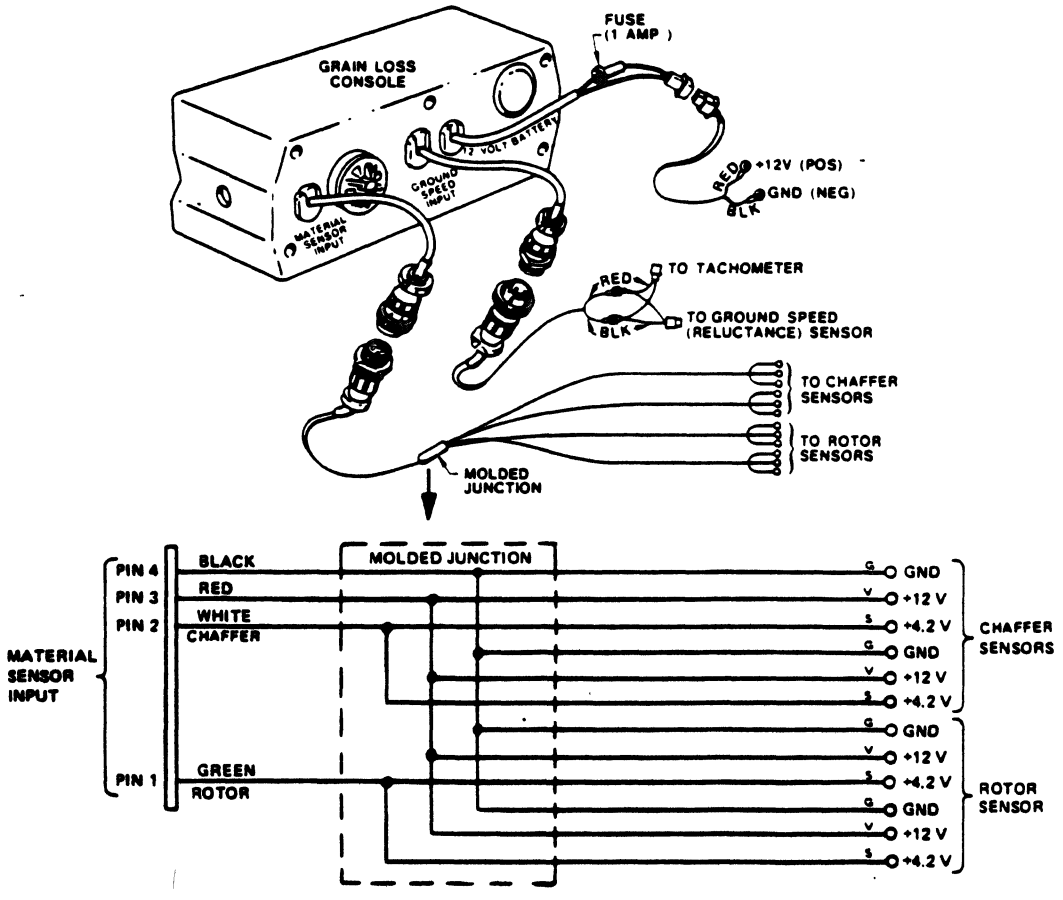
Tap on each grain sensor sounding board with a sharp object (pencil or screwdriver) or drop seeds from a minimum distance of six inches. The alarm on the console should sound (chirp) for each impact on the grain sensor sounding boards. If the alarm does not sound, repeat the test and if it still does not sound the grain sensor or sensor wiring harness is defective and needs to be repaired or replaced.

D.

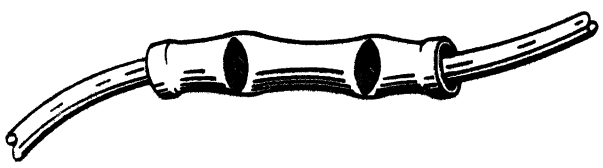
SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
Monitor is completely dead.	Poor power connections at 12-volt bus.	Check power connections. Connections must be clean and tight.
	Blown fuse.	Check fuse. The monitor contains a fuse in the negative (black) power lead. If blown, replace with a 1-amp fuse.
	Cut or broken battery lead.	Check for cut or broken wires from battery. If cut or broken, splice the wires being sure to match wire colors. Solder the splices and tape each wire individually. USE ONLY ROSIN CORE SOLDER.
Monitor operates erratically. Light behind gage indicator flickers off and on.	Poor power connections at 12-volt bus.	Check power connections. Connections must be clean and tight.
Monitor indicator needle remains at zero in the Distance Mode and in ground speed sensor Test. Monitor operates satisfactorily in the Time Mode.	Ground Speed Sensor lead cut or broken.	Check for cut or broken wires from Ground Speed Sensor. If damage is found, carefully cut away the cable covering. Repair damaged wire or wires by soldering wires together. (USE ONLY ROSIN CORE SOLDER) being sure to match wire colors, then tape over each repaired lead using vinyl tape. Tape over cut portion of cable cover. Relocate path of cable so that the same type of damage will not occur again.
	Ground Speed Sensor defective.	Inspect the sensor for any signs of physical damage. If physical damage is found, replace ground speed sensor.
		Check all sensor connectors for signs of corrosion. Make sure connectors are clean and making good contact.

SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
Monitor operates normally when the SENSOR select switch is in the SHOE (CHAFFER) position but has no indicator movement or alarm when the switch is in the WALKER/ROTOR position. (NOTE: This symptom may be reversed when the walker/rotor is normal and the shoe(chaffer) is malfunctioning.)	Shorted rotor sensor lead.	Check rotor wiring harness (including sensor connections) and repair short.
	Defective rotor sensor (shorted).	Replace defective rotor sensor.
Monitor inoperative.	Shorted voltage lead on grain sensor.	Check wiring harness from all grain sensors to monitor. Repair damaged wiring. (Refer to the following Grain Sensor Cable Repair.)
	Grain sensor shorted internally.	Replace defective grain sensor.
	Monitor console defective.	Replace defective monitor console.
With ALARM MODE to SEEDS, SYSTEM MODE to TIME and SENSORS switch to BOTH. Alarm will not sound (chirp) when tapping on one of the sensors.	Broken lead to sensor.	Inspect wiring harness and repair. (Refer to the following Grain Sensor Cable Repair.)
	Defective grain sensor.	Replace grain sensor.
Fuse in negative (black) power cable lead blown.	Monitor console defective.	Replace defective monitor console.
	Power cable leads reversed and monitor console grounding stud connected to chassis ground.	Make certain the Red lead of the power cable is connected to the +12 volt DC power bus.

SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
Combine stationary with engine running, separator engaged and no seeds striking grain sensors. System in TIME mode with METER CALIBRATION and GRAIN SENSITIVITY controls to 8 and SENSORS switch to BOTH.	Electrical interference	Install a grounding strap between the grounding stud on the rear of the console and the combine chassis. Install a grounding strap at each sensor between the sensor ground connection (G) and the sensors mounting bracket.
Meter deflects when engine is revved up. Meter may deflect more when blower and/or flashers are turned on.		Reroute the sensor cable.



EG-127961



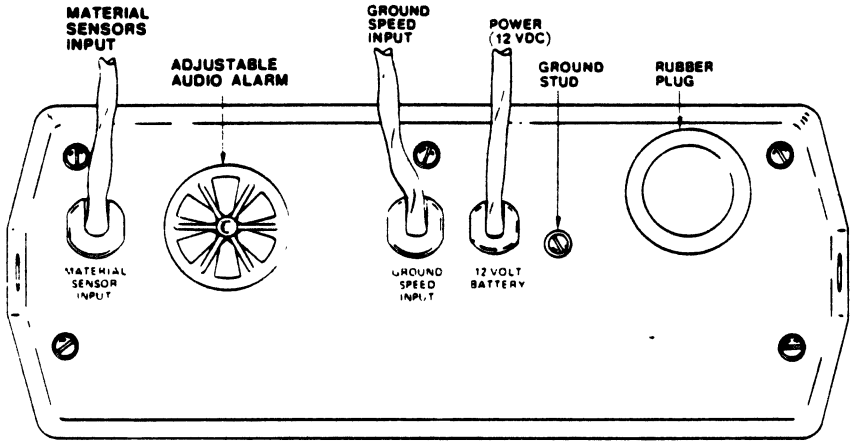
EG-127959

E. Grain Sensor Cable Repair

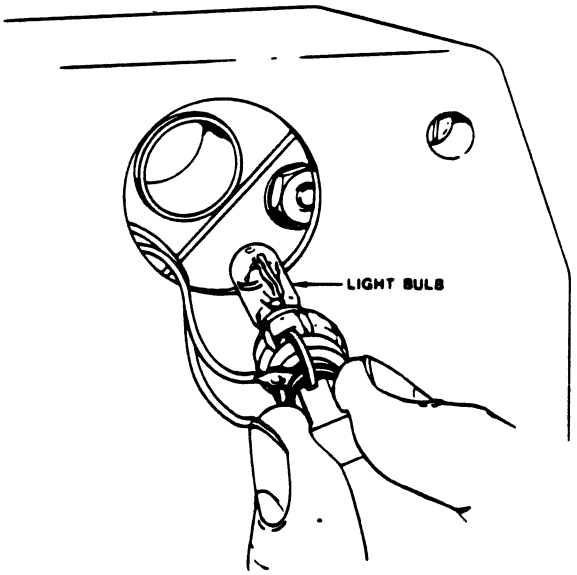
Strip off approximately 3/8 inch of insulation from each end of the broken lead.

Insert each bare wire into an in-line crimp-on connector and crimp with a crimping tool as shown. NOTE: If a crimping tool is not available, use combination pliers and crimp each lead in place with the wire cutting part of the pliers.

Wrap vinyl tape over the leads and the crimp-on connector to make the connection weather-proof.



EG-127960



F. Bulb Replacement

Remove the rubber plug located behind the meter on the back of the console.

Remove the bulb and replace as shown.