Section 25
Chapter 2

DIFFERENTIAL LOCK CONTROL SYSTEM

How It Works
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DIFFERENTIAL LOCK

General Description

The Differential Lock consists of the differential lock piston, differential lock control valve, differential lock control switch, brake pedal switches, true ground speed circuit, hitch position circuit, transmission speed circuit, and electronic control modules (through the Data Bus). Because the differential lock is electronically controlled automatic operation is possible.

The PTO/Differential Lock valve is mounted externally on top of the rear frame transmission housing. The control valve is supplied with regulated circuit pressure from the priority/regulator valve. This pressurized supply is directed to the differential lock piston for engagement. If the differential lock is activated, pressurized oil from the regulated supply circuit is ported to the differential lock piston in the differential carrier housing. As the piston extends friction discs and separator plates are locked together. The separator plates are pinned to the differential carrier, while the friction plates are splined to the left differential side gear. When the differential lock is applied, the clutch pack locks causing the left side gear to rotate with the differential carrier. This eliminates all differential action, causing power to be transmitted equally through both rear axles.

The PTO controller supplies current to the differential lock valve to activate the clutch based on commands from the operator (Differential Lock switch) and signals supplied to it from the brake pedal switches, true ground speed circuit, hitch position control system, and transmission speed signal circuit.

Diagnosing control system faults is accomplished by reading appropriate faults codes through the instrument cluster display or the service tool. Refer to PTO system fault code section of this manual for a complete list of fault codes related to the PTO, MFD, and Differential Lock system.
1. PTO/DIFF LOCK VALVE
2. DIFF LOCK CLUTCH SOLENOID
ELECTRONIC DIFFERENTIAL LOCK CONTROL

General Description
The Differential Lock consists of the differential lock clutch, differential lock control valve, differential lock control switch, brake pedal switches, true ground speed circuit, hitch position circuit, transmission speed circuit, and electronic control modules (through the Data Bus). Because the differential lock is electronically controlled, automatic operation is possible.

All differential lock operator commands are sent to the Arm Rest Control Module then relayed to the PTO controller via the Data Bus. Transmission speed and true ground speed signals are sent to the Instrument Cluster Unit (ICU) then relayed to the PTO controller. Diagnostic and programming information are communicated between the PTO controller and the Instrument Control Unit (ICU) by way of the Data Bus.

Operational Modes
The differential lock system operates in one of two (2) modes based on operator commands and the signals received from the other tractor systems.

OFF (see NOTE below)
ON (Differential Symbol)
Automatic Differential Lock Control (A)

NOTE: It is not possible to disengage the differential lock with the switch control. Pushing either brake pedal will deactivate the differential lock.
1. DIFFERENTIAL LOCK SWITCH
DIFFERENTIAL LOCK CONTROL MODES

ON (Differential Symbol) – When the differential lock switch is placed in the ON position the differential lock will be activated. A differential symbol will be illuminated on the tractor monitor. The differential lock will disengage when either brake pedal is pushed.

NOTE: It is not possible to disengage the differential lock with the switch control. Pushing either brake pedal will deactivate the differential lock.

The differential lock switch has three (3) positions. The mid switch position is OFF when the differential lock is deactivated. The same switch position is ON when the differential lock is activated manually.

Automatic Differential Lock Control – When the differential lock switch is placed in the Automatic position (A symbol) the differential lock will be activated (differential symbol will be illuminated on the tractor monitor) unless the following conditions are applicable.

1. Operating with the hitch position control lever down and the hitch is raised with the UP/DOWN switch (End of Row Feature deactivates differential lock).
2. One of the brake pedals is depressed and slip is below 15%.
3. Ground speed is in excess of 10 MPH and slip is below 15%.

NOTE: If the differential lock automatically disengages when ground speed exceeds 10 MPH. The differential lock will not automatically engage when ground speed decreases. To reactivate the differential lock after speed decreases (below 8 MPH), place the switch in the AUTO position and return the switch to the middle position.
Differential Lock Control

- Engine
- Transmission
- PTO Control Module
- Microcontroller
- CAN Transceiver
- LH Brake Pedal Switch
- RH Brake Pedal Switch
- Armrest Control Module
- Key Switch (Off/On, Off/On, Off/On)
- INST. Control Module
- Transmission Speed Sensor
- INST. Speed Sensor
- Data Bus
- MFD/Diff Lock Control
- Clean Ground
- Implement Brake Lights
- Tractor Brake Lights
- Range Transmission Housing
- MFD Valve
- MFD Clutch
- Diff Lock Valve
- Diff Lock Clutch
- Front Frame Housing
- Rear Frame Housing
- TRUE GROUND SPEED SENSOR
- TRANSMISSION SPEED SENSOR
### DIFFERENTIAL LOCK FUNCTIONAL TESTS

**IMPORTANT:** Hitch position and wheel slip will influence differential lock operation when tractor is in motion.

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Engaged/Disengaged</th>
<th>Operational Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON</strong></td>
<td>Engaged</td>
<td>The differential Lock icon will illuminate. If one (or both) brake pedals is pushed the differential lock light will go out and the differential lock will be deactivated.</td>
</tr>
</tbody>
</table>
| **AUTO**        | Disengaged         | As hitch raises and reaches upper 30% of travel (lever down/switch).  
**NOTE:** If slippage is above 15% the differential lock will engage (or stay engaged). |
|                 | Disengaged         | As travel speed exceeds 10 MPH.  
**NOTE:** If slippage is above 15% the differential lock will engage (or stay engaged). |
|                 | Disengaged         | As one or both brakes is applied. Differential lock will re-engage if both brake pedals are released. |
|                 | Engaged            | As hitch lowers below upper 30% of travel. (lever down/switch down) |
|                 | Engaged            | Brakes not applied. |

**IMPORTANT:** Hitch position and wheel slip will influence differential lock operation when tractor is in motion.
Differential Lock Valve

The differential lock valve is a closed center valve and is contained as a part of the PTO valve. Oil is supplied to the differential lock cartridge valve from the regulated pressure circuit. The differential lock clutch supply flow is distributed internally (no external tubing) to the clutch. The valve is mounted on the top of the rear frame transmission housing. The following components of the PTO valve are involved in the differential lock system.

Solenoid Cartridge Valve

The solenoid is controlled by an armrest mounted rocker switch. The armrest controller communicates (via the Data Bus) with the PTO controller. The PTO controller supplies current to the differential lock valve to activate the differential lock clutch based on commands from the operator (differential lock switch) and signals supplied to it from the brake pedal switches, true ground speed circuit, hitch position control system, and transmission speed signal circuit. The differential lock is a hydraulically applied clutch.
Differential Lock Clutch Disengaged

When the switch is in the disengaged position (middle) and a brake pedal is pushed, the solenoid will be de-energized. Regulated pressure will be at the valve cartridge. The piston of the differential lock clutch is mechanically returned to the neutral position. As the piston retracts, oil will be ported to the transmission housing and the differential lock clutch will disengage.

NOTE: It is not possible to disengage the differential lock with the switch control. Pushing either brake pedal will deactivate the differential lock.

The differential lock switch has three (3) positions. The mid switch position is OFF when the differential lock is deactivated. The same switch position is ON when the differential lock is activated manually.

1. PTO SOLENOID
2. REGULATED SUPPLY PASSAGE (THROUGH TOP OF VALVE BODY)
3. TO DIFF LOCK CLUTCH (PORTED THROUGH BACK OF VALVE)
4. DIFF LOCK SOLENOID
TROUBLESHOOTING

Problem – Differential lock will not engage

1. Check for PTO System fault codes.
   A. If fault codes are found, follow procedures outlined in PTO system fault code troubleshooting in this section.

2. Push either brake pedal switch to deactivate the differential lock. Check the tractor monitor for the differential lock icon in the instrumentation display.
   A. If the differential lock icon is not displayed, this is an indication the electrical control circuit is functioning correctly. Go to step 4.
   B. If the differential lock icon is displayed, this in an indication the electrical control circuit is not functioning correctly. Check fault codes, controller, and data bus function.

3. Activate the differential lock with the manual switch position. Check for 12 VDC at differential lock valve coil.
   A. If 12 VDC is available to the coil, the differential lock electrical circuit is functioning properly.
   B. If 12 VDC is not found, troubleshoot the differential lock electrical circuit.
      1. Check wires 530A (R) and 175E (BK) ground.
      2. Check all connections for excessive resistance.

   Apply the brakes, this will deactivate the differential lock. Check for 12 VDC at differential lock valve coil.
   C. If 12 VDC is available to the coil, the differential lock electrical circuit is not functioning properly.
      1. Check left and right brake switches.
   D. If 12 VDC is not found the differential lock electrical circuit is functioning properly.

4. Turn the ignition switch to the OFF position. Be prepared to press and hold the PROG key on the Tractor Monitor within the first 10 seconds after restarting the engine.
   - Start and run the engine at low idle. Press and hold the PROG key
   - The tractor monitor will emit a short beep and display INST SET MENU. Press the DECR key until the display reads TRANS SET MENU.
   - Next press the PROG key until the display reads TRANS VIEW. Continue to press the PROG key until the display reads “Press3”.
   - The powershift system manifold pressure (in KPa) is now visible on the bottom of the display.

   NOTE: Start the engine and heat the transmission oil to 120°F (49°C).

5. While viewing the display, activate the Differential Lock. The display pressure should dip, then recover to normal regulated pressure. If the pressure dips, but does not recover there is a leak in the Differential Lock circuit. Repeat this check several times.

6. A. Inspect the differential lock valve cartridge for leaking seals.
   B. Inspect the differential lock slip ring teflon seals.
   C. Inspect the differential lock piston o-ring.

7. Check and repair the differential lock clutch as needed.
Differential Lock Engaged

When the switch is in the engaged position (differential symbol) the solenoid will be activated. Oil pressure, available to the valve cartridge, will be ported (internally) to the rear frame transmission housing of the tractor. The clutch will be engaged, as the piston extends, locking the friction and separator plates together. The clutch pack locks causing the left side gear to rotate with the differential carrier, eliminating differential action.
TROUBLESHOOTING

Problem – Differential lock will not disengage

1. Check for PTO fault codes.
   A. If fault codes are found, follow procedures outlined in PTO system fault code troubleshooting in this section.

2. Place the differential lock switch in the ON position. Check the tractor monitor for the differential lock icon in the instrumentation display.
   A. If the differential lock icon is displayed, this is an indication the electrical control circuit is functioning correctly. Go to step 4.
   B. If the differential lock icon is not displayed, this is an indication the electrical control circuit is not functioning correctly. Check fault codes, controller, and data bus function.

3. Place the differential lock switch in the ON position. Check for 12 VDC at differential lock valve coil.
   A. If 12 VDC is available to the coil, the differential lock electrical circuit is functioning properly.
   B. If 12 VDC is not found, troubleshoot the differential lock electrical circuit.
      1. Check wires 530A (R) and 175E (BK) ground.
      2. Check all connections for excessive resistance.

Apply the brakes, this will deactivate the differential lock. Check for 12 VDC at differential lock valve coil.
C. If 12 VDC is available to the coil, the differential lock electrical circuit is not functioning properly.
   1. Check left and right brake switches.

D. If 12 VDC is not found the differential lock electrical circuit is functioning properly.

4. Check and repair the differential lock clutch as needed.
PTO/DIFFERENTIAL LOCK VALVE CIRCUIT

NOTE: Refer to Differential Lock electrical schematic diagram.
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