Section 21
Chapter 1

POWERSHIFT TRANSMISSION SYSTEM

How It Works and Troubleshooting
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TRANSMISSION SYSTEM INTRODUCTION

- Engine Speed Sensor
- Seat Switch
- Transmission Speed Sensor
- R.H. Armrest Controller
- Gear Selection Buttons and Shuttle Shift Control Button
- Creep Switch
- Bottom of Clutch Switch
- Inching Pedal Potentiometer
- Transmission Controller
- Transmission Control Valve (Speed)
- Transmission Control Valve (Range)
- Transmission Control Valve (Odd / Even)
- Inching Valve
- Priority Regulator Valve
- Supply to Other Regulated Circuits
- System Pressure Signal from Transducer
- Programmable Display and Controller
- Standard Instrumentation
- Engine Controller
- Transmission Control Lever (FNR)
The full powershift transmission is controlled by the transmission controller. The transmission has 18 forward speeds and 4 reverse speeds. The optional creeper transmission is electro-hydraulically operated and provides 6 additional forward speeds and 2 additional reverse speeds.

It is not necessary to use the inching pedal when shifting between gears or in and out of neutral, with a full powershift transmission. It is necessary to shift to neutral when engaging and disengaging the optional creeper transmission. The transmission is also equipped with an electro-hydraulically operated park brake mechanism that is applied when power is removed.

The transmission controller either directly or through the Data Bus monitors the state/value of the following items:

- Transmission Control Lever
- Gear Selection Buttons
- Bottom of Clutch Switch
- Seat Switch
- Creep Switch
- Engine Speed Sensor
- Transmission Speed Sensor

The transmission controller will report any problems directly to the standard instrumentation controller. The standard instrumentation controller will display any system faults or fault code information through the programmable display.

When a fault occurs, a 3 second continuous audible alarm will sound. The audible alarm will stop after 3 seconds. Once the fault has been corrected, depress the “Reset” button on the programmable display to clear the fault.

**NOTE:** *The following warning is of a critical nature and the tractor engine should be shutdown immediately and the cause of the problem checked. If your tractor is equipped with the Performance Monitor, the tractor will automatically shutdown in 30 seconds after the warning is displayed. The warning below cannot be shut off by pushing the reset button.*

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANS</td>
<td>OIL TEMP</td>
<td>High transmission oil temperature</td>
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<tr>
<td></td>
<td></td>
<td>Shut the tractor engine OFF immediately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and check for cause.</td>
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</tbody>
</table>

The following faults will not cause immediate damage to the tractor or shut the tractor down, but may make other systems inoperative. Pushing the “Reset” button will clear the fault, however the fault will be displayed again after ten minutes if not corrected.

<table>
<thead>
<tr>
<th>Display</th>
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</thead>
<tbody>
<tr>
<td>TRANS</td>
<td>OFF LINE</td>
</tr>
<tr>
<td></td>
<td>Transmission Bus Off fault.</td>
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<tr>
<td>TRANS</td>
<td>OFF LINE</td>
</tr>
<tr>
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<td>Transmission diagnostic fault.</td>
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<tr>
<td>TRANS</td>
<td>CONF/CAL</td>
</tr>
<tr>
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<td>TRCU - Config/CAL required (bit in system status)</td>
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<tr>
<td>SIT</td>
<td>DOWN</td>
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<td></td>
<td>TRCU re-enable required.</td>
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TRANSMISSION SYSTEM CONTROLS

1. THROTTLE HAND LEVER
2. TRANSMISSION CONTROL LEVER
3. CREEPER CONTROL SWITCH (IF EQUIPPED)
4. MFD CONTROL SWITCH
5. DIFF LOCK SWITCH
6. GEAR SHIFT UP BUTTON
7. GEAR SHIFT DOWN BUTTON
8. PARK BUTTON (ACTIVATE IN NEUTRAL)
9. SHUTTLE SHIFT CONTROL BUTTON
1. POWERSHIFT VALVE ODD/EVEN
2. EVEN CLUTCH SOLENOID
3. ODD CLUTCH SOLENOID
4. CREEP CLUTCH SOLENOID
5. PARK BRAKE SOLENOID
6. PTO/DIFF LOCK VALVE
7. PRIORITY REGULATOR VALVE
8. REGULATED PRESSURE TO POWERSHIFT VALVES
9. POWERSHIFT VALVE RANGE
10. MFD SOLENOID
11. LOW CLUTCH SOLENOID
12. MID CLUTCH SOLENOID
13. HIGH CLUTCH SOLENOID
14. PTO SOLENOID
15. MASTER CLUTCH SOLENOID
16. INCHING VALVE
17. REGULATED PRESSURE INLET
18. MASTER CLUTCH LUBE INLET
19. MASTER CLUTCH TEST PORT
20. POWERSHIFT VALVE SPEED
21. C1 CLUTCH SOLENOID
22. C3 CLUTCH SOLENOID
23. C5 CLUTCH SOLENOID
24. REVERSE SOLENOID
25. SYSTEM PRESSURE TRANSDUCER
26. TO PARK BRAKE
27. PARK BRAKE PUMP
28. DIFF LOCK SOLENOID
TRANSMISSION LUBE AND DISTRIBUTION TUBES

1. SPEED POWERSHIFT VALVE MOUNTING PLATE
2. SPEED C1 CLUTCH DISTRIBUTION TUBE
3. SPEED C3 CLUTCH DISTRIBUTION TUBE
4. SPEED C5 CLUTCH DISTRIBUTION TUBE
5. SPEED REVERSE CLUTCH DISTRIBUTION TUBE
6. RANGE INPUT SHAFT BEARING CAGE
7. CREEPER CLUTCH SUPPLY
8. MASTER CLUTCH, SPEED OUT AND RANGE INPUT LUBE
9. HIGH CLUTCH DISTRIBUTION TUBE
10. MID CLUTCH DISTRIBUTION TUBE (BEHIND HIGH)
11. MASTER CLUTCH SUPPLY DISTRIBUTION TUBE
12. CREEPER LUBE SUPPLY

13. LOW CLUTCH DISTRIBUTION TUBE
14. SPEED LUBE DISTRIBUTION TUBE
15. ODD CLUTCH DISTRIBUTION TUBE
16. EVEN CLUTCH DISTRIBUTION TUBE
17. SPEED INPUT SHAFT BEARING CAGE
18. SPEED COUNTERSHAFT BEARING CAGE
19. MASTER CLUTCH SOLENOID
20. ODD / EVEN POWERSHIFT MOUNTING PLATE
21. INCHING VALVE MOUNTING PLATE
22. MASTER CLUTCH DIAGNOSTIC PORT

Rear View
TG SERIES POWERSHIFT TRANSMISSION CLUTCH LAYOUT

Neutral

NEUTRAL - In Neutral only C3 and C5 clutches are pressurized.
# POWERSHIFT VALVE CLUTCH ENGAGEMENTS

## CLUTCHES

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<th>5-6</th>
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<th>Mid</th>
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<th>Reverse</th>
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</table>
POWER FLOW (FORWARD SPEEDS)

FIRST GEAR - As the operator selects first speed, he simultaneously engages the odd speed clutch pack, the first speed clutch pack, and the low range clutch pack through the transmission controller. The power then flows through the input shaft, through the engaged odd-speed clutch pack gear, to the countershaft gear. Since the countershaft gears are in constant mesh with the output shaft gears, power flows from the countershaft gear, to the engaged first-speed clutch pack gear, along the speed output shaft, to the master clutch. With the master clutch engaged, power is transmitted across the range transmission input shaft to the low-range drive gear. Power then flows to the low-range clutch pack gear, across the range countershaft, to the constant mesh gear set. Power flow is delivered to the opinion shaft by this constant mesh gear set in all speeds.

SECOND GEAR - As the operator selects second speed with the gear selection switch, the odd-speed clutch is disengaged and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft, through the even-speed clutch gear, the countershaft, the first-speed clutch gear, along the speed output shaft, to the master clutch. Power flow through the range transmission is the same for speeds one through six.

The drive train consists of five separate housings:

- Speed Transmission Housing
- Range Transmission Housing
- Rear Frame Housing
- Two Final drive Housings
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 1

Gear No. 2

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts

RT98A017
RT98A022
POWER FLOW (FORWARD SPEEDS)

THIRD GEAR - As the operator selects third speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the first-speed clutch is disengaged, and the third-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd speed clutch, the countershaft, the third speed clutch, across the output shaft, to the master clutch. Power flow through the range transmission is the same for speeds one through six.

FOURTH GEAR - As the operator selects fourth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, the countershaft, the third-speed clutch, across the output shaft, to the master clutch. Power flow through the range transmission is the same for speeds one through six.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 3

Gear No. 4

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD SPEEDS)

FIFTH GEAR - As the operator selects fifth speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the third-speed clutch is disengaged, and the fifth-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the fifth speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds one through six.

SIX GEAR - As the operator selects sixth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows, from the speed transmission input shaft through the even-speed clutch, the countershaft, the fifth speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds one through six.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 5

Gear No. 6

Key:
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD SPEEDS)

SEVENTH GEAR - As the operator selects seventh speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the fifth-speed clutch and the low-range clutch are disengaged, the first speed clutch and medium range clutch are engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the first speed clutch, and across the output shaft to the master clutch. With the master clutch engaged, power is transmitted across the range transmission input shaft to the medium-range clutch. Power then flows to the range countershaft driven gear across the countershaft to the constant mesh gear set. Power flow is delivered to the pinion shaft by the constant mesh gear set in all speeds.

EIGHTH GEAR - As the operator selects eighth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows, from the speed transmission input shaft through the even-speed clutch, the countershaft, the first speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds seven through twelve.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 7

Gear No. 8

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts

RT98A030

RT98A064
POWER FLOW (FORWARD SPEEDS)

NINTH GEAR - As the operator selects ninth speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the first-speed clutch is disengaged, and the third-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the third speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds seven through twelve.

TENTH GEAR - As the operator selects tenth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, the countershaft, the third speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds seven through twelve.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 9

Gear No. 10

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts

RT98A032

RT98A033
POWER FLOW (FORWARD SPEEDS)

ELEVENTH GEAR - As the operator selects eleventh speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the third-speed clutch is disengaged, the fifth-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the fifth speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds seven through twelve.

TWELFTH GEAR - As the operator selects twelfth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, and the countershaft, the fifth speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds seven through twelve.
SECTION 21 - POWERSHIFT TRANSMISSION SYSTEM - CHAPTER 1

TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 11

Gear No. 12

KEY

- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD SPEEDS)

THIRTEENTH GEAR - As the operator selects thirteenth speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the fifth-speed clutch and the medium-range clutch are disengaged, the first-speed clutch and the high-range clutch are engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the first speed clutch, and across the output shaft to the master clutch. With the master clutch engaged, power is transmitted across the range transmission input shaft to the high-range clutch. Power then flows to the range countershaft driven gear across the countershaft to the constant mesh gear set. Power flow is delivered to the pinion shaft by the constant mesh gear set in all speeds.

FOURTEENTH GEAR - As the operator selects fourteenth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, the countershaft, the first speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds thirteen through eighteen.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 13

Gear No. 14

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD SPEEDS)

FIFTEENTH GEAR - As the operator selects fifteenth speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the first-speed clutch is disengaged, and the third-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the third speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds thirteen through twelve.

SIXTEENTH GEAR - As the operator selects sixteenth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, the countershaft, the third speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds thirteen through eighteen.
TG SERIES

Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 15

Gear No. 16

KEY

- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD SPEEDS)

SEVENTEENTH GEAR - As the operator selects seventeenth speed, the even-speed clutch is disengaged, and the odd-speed clutch is engaged. At the same time, the third-speed clutch is disengaged, the fifth-speed clutch is engaged. Power then flows from the speed transmission input shaft through the odd-speed clutch, the countershaft, the third speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds thirteen through eighteen.

EIGHTEENTH GEAR - As the operator selects eighteenth speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft through the even-speed clutch, the countershaft, the fifth-speed clutch, and across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds thirteen through eighteen.
TG SERIES

Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Gear No. 17

Gear No. 18
POWER FLOW (REVERSE SPEEDS)

FIRST REVERSE GEAR - As the operator selects first reverse speed, he simultaneously engages the odd-speed clutch pack, the reverse-speed clutch pack and the low-range clutch pack through the transmission controller. The power then flows through the input shaft, the engaged odd-speed clutch pack gear, to the countershaft gear. Since the countershaft gears are in constant mesh with the output shaft gears, power flows forward from the countershaft, through the even-speed driven gear to even-speed drive gear (idler gear), to the engaged reverse-speed clutch pack. Power is then directed across the output shaft to the master clutch. The addition of an idler gear for first-reverse and creeper-reverse 1 (creeper option) speeds causes the speed output shaft and everything rearward of the pinion shaft to reverse rotation compared to the forward gear rotation. With the master clutch engaged, power is transmitted across the range transmission input shaft to the low range drive gear. Power then flows to the low range clutch pack gear and across the range countershaft to the constant mesh gear set. Power flow is delivered to the pinion shaft by this constant mesh gear set in all speeds.

SECOND REVERSE GEAR - As the operator selects second reverse speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft, through the even-speed clutch, directly to the reverse-speed clutch. Since the countershaft is not used to transmit power in second reverse, the direction of rotation provided to the speed output shaft is opposite that which occurs in the forward speeds.

With the master clutch engaged, power is transmitted across the range transmission input shaft to the low range drive gear. Power then flows to the low range clutch pack gear and across the range countershaft to the constant mesh gear set, driving the pinion shaft.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Reverse No. 1

Reverse No. 2

[Diagram of TG SERIES Powershift Transmission Clutch Layout]

Inactive Clutches
Pressurized Clutches
Non-Torque Transmitting Parts
Torque Transmitting Parts

KEY
POWER FLOW (REVERSE SPEEDS)

THIRD REVERSE GEAR - As the operator selects third reverse speed, he simultaneously engages the odd-speed clutch, reverse-speed clutch pack and the medium-range clutch pack through the transmission controller. The power then flows through the input shaft, the engaged odd-speed clutch pack, to the countershaft gear. Since the countershaft gears are in constant mesh with the output shaft gears, power flows forward from the countershaft, to the even-speed drive gear (idler gear), to the engaged reverse-speed clutch pack. Power is then directed across the output shaft to the master clutch. The addition of an idler gear for third-reverse causes the speed output shaft, and everything rearward of the pinion shaft, to reverse rotation in contrast to the forward gear rotation. With the master clutch engaged, power is transmitted across the range transmission input shaft to the medium range clutch pack. Power then flows to the medium-range driven gear on the range countershaft, across to the constant mesh gear set driving the pinion shaft.

FOURTH REVERSE GEAR - As the operator selects fourth reverse speed, the odd-speed clutch is disengaged, and the even-speed clutch is engaged. Power then flows from the speed transmission input shaft, through the even speed clutch, directly to the reverse-speed clutch. Since the countershaft is not used to transmit power in fourth reverse, the direction of rotation provided to the speed output shaft is opposite that which occurs in the forward speeds. Power flows through the range transmission in the same manner as third reverse.

NOTE: HIGH RANGE CLUTCH PACK IS NOT USED FOR REVERSE SPEEDS.
TG SERIES

Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Reverse No. 3

Reverse No. 4

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts

RT98A031
RT98A052
POWER FLOW (FORWARD CREEPER DRIVE SPEEDS)

FIRST CREEP GEAR - As the operator selects first creep speed, he simultaneously disengages and locks out the odd-speed clutch pack and the even-speed clutch pack. He also engages the creep speed clutch pack, the first speed clutch pack and the low range clutch pack. This is accomplished through the transmission controller. Power then flows from the speed transmission input shaft creep speed drive gear through the creep-speed clutch, and across the countershaft to the first-speed clutch drive gear. Power is then directed through the first speed constant mesh gear set and the clutch pack, across the output shaft to the master clutch.

With the master clutch engaged, power is transmitted across the range transmission input shaft to the low-range drive gear. Power then flows to the low-range clutch pack gear and across the range countershaft to the constant mesh gear set. Power flow is delivered to the pinion shaft by this constant mesh gear set in all speeds.

SECOND CREEP GEAR - As the operator selects second creep speed, he simultaneously disengages the first speed clutch and engages the third speed clutch. Power then flows from the speed transmission input shaft through the creep-speed clutch on the countershaft, to the third-speed clutch on the output shaft then the master clutch. Power flow through the range transmission is the same for speeds first creep through third creep.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Creeper Gear No. 1

Creeper Gear No. 2

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD CREEPER DRIVE SPEEDS)

THIRD CREEP GEAR - As the operator selects third-creep speed, he simultaneously disengages the third-speed clutch and engages the fifth-speed clutch. Power then flows from the speed transmission input shaft through the creep-speed clutch on the countershaft, to the fifth-speed clutch, across the output shaft to the master clutch. Power flow through the range transmission is the same for speeds first creep through third creep.

FOURTH CREEP GEAR - As the operator selects fourth-creep speed, he simultaneously disengages the fifth-speed clutch and the low-range clutch, and engages the first speed clutch and the medium-range clutch. Power then flows from the speed transmission input shaft through the creep speed clutch on the countershaft, to the first speed clutch on the output shaft across the master clutch.

With the master clutch engaged, power is transmitted across the range transmission input shaft to the medium-range clutch. Power then flows to the range countershaft driven gear, across the countershaft, to the constant mesh gear set. Power flow is delivered to the pinion shaft by this constant mesh gear set in all speeds.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Creeper Gear No. 3

Creeper Gear No. 4

KEY

- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (FORWARD CREEPER DRIVE SPEEDS)

FIFTH CREEP GEAR - As the operator selects fifth creep speed, he simultaneously disengages the first-speed clutch and engages the third-speed clutch. Power then flows from the speed transmission input shaft, through the creep-speed clutch on the countershaft, to the third-speed clutch on the output shaft, across to the master clutch. Power flow through the range transmission is the same for speeds fourth creep through sixth creep.

SIXTH CREEP GEAR - As the operator selects sixth creep speed, he simultaneously disengages the third-speed clutch and engages the fifth-speed clutch. Power then flows from the speed transmission input shaft, through the creep-speed clutch on the countershaft, to the fifth-speed clutch on the output shaft, across to the master clutch. Power flow through the range transmission is the same for speeds fourth creep through sixth creep.

NOTE: High range clutch pack is not used for the creeper speeds.
**TG SERIES**

Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

**Creeper Gear No. 5**

**Creeper Gear No. 6**

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**KEY**
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
POWER FLOW (REVERSE CREEPER DRIVE SPEEDS)

CREEPER REVERSE FIRST GEAR (CR1) - As the operator selects creeper first-reverse speed, he simultaneously disengages and locks out the odd-speed clutch pack and the even-speed clutch pack. He also engages the creep-speed clutch pack, the reverse-speed clutch pack, and the low-range clutch pack. This is accomplished through the transmission controller. Power then flows from the speed transmission input shaft creeper speed drive gear, through the creeper speed clutch, to the countershaft. The countershaft drive gear transmits power through the even drive gear (idler gear), through the engaged reverse clutch, to the output shaft. The addition of an idler gear for reverse speed causes the speed output shaft, and everything rearward of the pinion shaft, to reverse rotation compared to the forward gear rotation. Power is transmitted across the output shaft and engaged master clutch, to the range input shaft. From the range input shaft, power is transmitted through the low-range drive gear, low-range driven gear, and clutch, to the constant mesh gear set and pinion shaft.

CREEPER REVERSE SECOND GEAR (CR2) - As the operator selects creeper second-reverse speed, he simultaneously disengages and locks out the odd/even speed clutch packs. He also engages the creep speed clutch pack, the reverse clutch pack and medium clutch pack. Power then flows from the speed input shaft creeper speed drive gear, through the creeper speed clutch, to the countershaft. The countershaft drive gear transmits power through the even-speed drive gear (idler gear), through the engaged reverse clutch, to the output shaft. The addition of the idler gear for reverse speed causes the speed output shaft and everything rearward of the pinion shaft to reverse rotation compared to the forward rotation. Power is transmitted across the output shaft and the engaged master clutch to the range transmission input shaft. From the range input shaft, power is transmitted through the medium-range clutch, the medium-range drive gear, to the medium-range driven gear on the countershaft. The power is then transmitted across the countershaft to the constant mesh gear set and the pinion shaft.
TG SERIES
Powershift Transmission Clutch Layout with Pump Drive, PTO, MFD, and Creeper Drive

Creeper Reverse Gear No. 1

Creeper Reverse Gear No. 2

KEY
- Inactive Clutches
- Pressurized Clutches
- Non-Torque Transmitting Parts
- Torque Transmitting Parts
INCHING VALVE OPERATION

1. PORTING TO MASTER CLUTCH
2. INCHING VALVE BODY
3. MODULATOR SPOOL
4. REGULATED PRESSURE SUPPLY
5. PROPORTIONAL CURRENT CONTROL SOLENOID
6. PRELOAD SPRING
7. INNER MODULATOR SPRING
8. PISTON CENTER PIN
9. MODULATOR PISTON ASSEMBLY
10. CHECK VALVE
The inching valve is shown with the engine running and the inching pedal fully depressed. The position of the inching pedal controls the current value supplied to the inching valve PCC solenoid. When the inching pedal is fully depressed there is no current supplied to the inching valve PCC solenoid.
As the inching pedal is let up, the transmission controller sends a current signal to the inching valve PCC solenoid. The current value is based on the inching pedal position. The solenoid spool shifts, metering oil through the center of the spool assembly down to the bottom of the modulator piston assembly.

As the pressure builds the modulator piston assembly begins to move up, against the force of both the inner modulator and preload springs. As the modulator piston assembly moves up, the center pin of the modulator piston assembly moves into the bore of the modulator spool. The modulator piston assembly does not directly shift the modulator spool. The inner modulator spring force begins to shift the modulator spool.

As the modulator spool shifts upward it simultaneously blocks the master clutch return and opens the master clutch supply to the inlet regulated supply. At the same time the inlet regulated supply is also ported through a cross drilled and end drilled holes to the top of the modulator spool. The balance between the increasing inner modulator spring force and pressure against the increasing clutch pressure at the top of the modulator spool causes the master clutch pressure to gradually build.
As the inching pedal is brought fully up the current supplied to the inching valve solenoid is at the maximum.

With the inching pedal fully up the modulator piston moves up and fully shifts the modulator spool. The modulator spool is no longer being moved by the inner spring, but through direct contact from the ramp area on the modulator piston assembly.

The modulator spool has now moved far enough to allow full regulated pressure from the valve inlet to be applied to the master clutch.
TRACTOR MONITOR - TRANSMISSION LEAKAGE CHECK

The regulated circuit pump is the front section of the tandem gear pump. The pump draws oil from the system reservoir through a 100 mesh suction screen. The pump flow passes through the regulated circuit filter housing and into the priority regulator valve. The priority regulator valve maintains the regulated pressure circuit at 23 to 24 bar (335 to 345 PSI). The regulated pump flow supplies the PTO/ Diff lock valve, transmission control valves and brake valve. Both the remote and hitch valves are also supplied with pilot pressure.

Once these circuits are satisfied the excess regulated pump flow is directed through the oil coolers and joins up with the charge pump flow at the downstream side of the main filter head.

The 27 GPM tandem gear pump is a fixed displacement pump, therefore the output flow will decrease as the engine speed is lowered. At low engine speeds leaks in the regulated and transmission circuits are more noticeable.

BACKGROUND INFORMATION:

The transmission controller monitors the pressure through the system pressure transducer. The manifold pressure can be read from the display through the Trans View Menu screen.

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

- 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.

- Press the DECR key until the display reads PRES TRNSCDR.

- Press the PROG key.

- The powershift system manifold pressure (in KPa) is now visible on the bottom of the display.

- Record pressure with the PTO and Diff Lock in the OFF position and the MFD switch in the ON position.

- Increase engine speed to 2000 RPM. Record the range powershift manifold pressure. Decrease engine speed.

  - **The Powershift System Manifold Pressure**______________kPa at 2000 RPM

    - A. If the pressure reading is less than 300 PSI (20.7 bar) go to the regulated pump flow test.

    - B. If the pressure reading is greater than 300 PSI (20.7 bar) go to the regulated system leakage test.

      (Complete the regulated system leakage test before adjusting the regulated pressure).

**NOTE:** Transducer Pressure Range: 2300 to 2400 kPa (335 to 345 PSI) at 2000 RPM and 120°F (49°C). *To convert kPa to bar move the decimal place over two places to left, 2300 kPa equals 23.0 bar.*

Fault codes will be generated if a problem is detected with the following components:

- System pressure transducer failure.
- Wire failed, or shorted between sensor and controller.
- Low regulated supply pressure to powershift valves.
- Low powershift manifold pressure due to leaking clutch.
- Wire failed, or shorted between powershift valve solenoid and controller.
STEP 1 - Record Clutch Pressures in each Gear with Tractor Monitor

NOTE: Clutch pack leaks can be identified through the tractor monitor pressure readings.

IMPORTANT: The tractor must be driven to perform this test. Perform this test in an open outdoor location free of obstacles and people.

- Move the transmission control lever into “P” Park position.

- Turn the MFD switch to the ON position.

- Turn the ignition switch to the OFF position. 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 PresS.

- Select 1st gear with the Gear selection switch.

Move the transmission control lever to forward. Release the inching pedal. Shift through the gears and record the “PresS” valve manifold pressures below.

NOTE: Valve manifold pressures will momentarily drop and quickly recover pressure as each shift is completed.

<table>
<thead>
<tr>
<th>GEAR 1</th>
<th>GEAR 7</th>
<th>GEAR 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEAR 2</td>
<td>GEAR 8</td>
<td>GEAR 14</td>
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<td>GEAR 3</td>
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<td>GEAR 4</td>
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<td>GEAR 11</td>
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<tr>
<td>GEAR 6</td>
<td>GEAR 12</td>
<td>GEAR 18</td>
</tr>
<tr>
<td>REVERSE 1</td>
<td>REVERSE 2</td>
<td>REVERSE 3</td>
</tr>
<tr>
<td>REVERSE 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Shift back to 1st gear and move the transmission control lever to reverse. Shift through the reverse speeds and record the pressures.

The “PresS” system pressure will be noticeably lower in the following gears if there is significant clutch leakage:

Low pressure for Speeds R1, R2, R3 and R4 ------------ Indicates Reverse Clutch Leakage.

Low pressure for Speeds 1, 2, 7, 8, 13 and 14 ------------ Indicates 1st Speed Clutch Leakage.
Low pressure for Speeds 3, 4, 9, 10, 15 and 16-----------------Indicates 3rd Speed Clutch Leakage.

Low pressure for Speeds 5, 6, 11, 12, 17 and 18 ---------------Indicates 5th Speed Clutch Leakage.

Low pressure for Speeds 1, 3, 5, 7, 9, 11, 13, 15, 17, R1 and R3 -----------------Indicates Odd Clutch Leakage.

Low pressure for Speeds 2, 4, 6, 8, 10, 12, 14, 16, 18, R2 and R4 -------------------Indicates Even Clutch Leakage.

Low pressure for Speeds 1, 2, 3, 4, 5, 6, R1 and R2 -------------------Indicates Low Range Clutch Leakage.

Low pressure for Speeds 7, 8, 9, 10, 11, 12, R3 and R4 ----------------Indicates Mid Range Clutch Leakage.

Low pressure for Speeds 13, 14, 15, 16, 17 and 18-------------------Indicates High Range Clutch Leakage.

Low pressure in all creep gears ----------------------------------------Indicates Creep Clutch Leakage.
The master clutch pressure diagnostic test port is located on the right hand side of the transmission below the pump drive gear housing.

Test Fitting and Tool Requirements:

- 400 PSI (28 bar) pressure gauge with extension hose long enough to reach into cab.

**IMPORTANT:** *The tractor must be driven to perform this test. Perform this test in an open outdoor location free of obstacles and people.*

- Connect the gauge/extension hose to the diagnostic port.
- Turn the Differential Lock OFF.
- Start and run the tractor at low idle.
- Using the gear selection switch select gear number 1.
- Press and hold the inching pedal to the floor.
- Place the transmission control lever in forward.
- As the inching pedal is slowly let up the gauge reading should gradually increase.

- Once the pedal is fully up and the tractor is moving forward the gauge reading should be 335 to 345 PSI (23.0 to 24.0 bar).

A. If the master clutch pressure reading is low go to section 8001 and perform the Regulated System Pressure Test.

If the regulated pressure is also low (matches master clutch) continue with the procedure in section 8000.

If the regulated pressure is within specification check for the following:

- Check for fault code in section 10003.
- Inspect the inching valve modulator spool and modulator piston. Both must move freely within the valve bore. See Inching Valve Operation in this section and section 6009 for disassembly.
- Master clutch is leaking see transmission section 6008.