## SECTION 25 – FRONT AXLE

Chapter 2 – Terraglide (Front Axle Suspension)

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23 000 – SPECIFICATIONS
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23 000 – TIGHTENING TORQUES
INTRODUCTION
Terraglide is an optional electronically controlled hydraulic suspension feature fitted to the front axle which allows the axle to raise and lower to absorb shock loads and maintain the tractor in a level plane when variations in weight are applied to the front wheels.

The Terraglide system reduces pitching, keeps the front wheels in contact with the ground and improves stability during fast road speeds when ground conditions could make the tractor unstable. This is especially important where the tractor is operating with minimal front axle loads while transporting heavy 3 point hitch implements.

Terraglide is automatically engaged each time the tractor is started however when the tractor is stationary or travelling at less than 1.5kmh the system is automatically “Locked Out” for safe mounting of implements or ballast.
At speeds between 1.5–12kmh the operator can turn the suspension off using the switch (1) on the cab pillar. This is ideal for instances where accurate depth control is required with implements mounted on the front linkage or for grading with a front loader. At speeds above 12kmh the system is automatically engaged.

The control valve assembly and accumulator(1) which supplies oil to the Terraglide suspension/damping system is located on the right hand side of the transmission.

The microprocessor which electronically controls the hydraulic control valve is located beneath the electronic draft control panel on the right hand side of the operator.

On tractors with Power Command transmissions the microprocessor controls only the Terraglide system, however on tractors with Range Command transmissions the microprocessor also contains the software which controls the Electronic Draft Control System.

To assist in diagnosing faults and achieving optimum performance the microprocessor has an inbuilt self diagnostic facility and electronic calibration procedure.

All information regarding error codes and calibration data is displayed on the electronic instrument cluster. Full details on error codes and calibration procedures are described in Chapter 55.
Front Axle Installation—Terraglide Suspension

1. Front Support  
2. Hydraulic Cylinder  
3. Axle  
4. Axle Pivot Point  
5. Potentiometer  
6. Pivot Arm (Panhard Rod)  
7. Fulcrum Point

The Terraglide suspension system connects the axle (3) to the tractor front support (1) through a pivot arm (4) referred to as a “Panhard Rod” and the single hydraulic cylinder (2).

Whenever the front axle is subjected to shock loads, vibration or front end weight changes the Panhard rod pivots about the fulcrum point (7) while at the same time the axle oscillates about the pivot point (4). This movement causes the front axle to move up or down in relation to the tractor front support.

The vertical movement of the axle in relation to the front support is measured by the potentiometer (5) which transmits a signal to the controlling microprocessor.

Dependant on the shock loading subjected to the system and the amount of vertical axle movement detected by the microprocessor the hydraulic system responds to absorb the shock loads and adjust the vertical position of the axle so that the tractor continues to operate on a level plane.
**Hydraulic Control System**

The hydraulic control system incorporates a Ride Control System and a Levelling System.

The “Ride Control System” controls the suspension damping and absorbs shock loads from the front axle when the tractor is being driven over rough surfaces.

The “Levelling System” controls the height of the front axle in order to maintain that the tractor operates on a level plane by compensating for:

- The addition or removal of weight from the tractor.
- Loss of cylinder oil to the reservoir through the system relief valve due to shock pressures above 210 bar in the system.
- Internal or external system leakage.

The potentiometer (5) Figure 6 measures the vertical position of the front axle in relation to the front support and is linked to the microprocessor. Whenever the microprocessor detects that the vertical height of the axle in relation to the front support is away from the operating parameters set within the software in the microprocessor, hydraulic oil is directed through the control valve to the hydraulic cylinder to adjust the height of the axle accordingly.

**NOTE:** Ride control and the levelling system only operate when the Terraglide suspension is switched on and the tractor is being driven at speeds above 1.5kph.

Operation of the Terraglide system for various working situations is described on the following pages.

The location of those specific components referenced in the circuit diagrams which are externally visible on the control valve are identified in Figure 7.
Hydraulic Control Valve Assembly

A. Load Sense Line
B. Return to Reservoir
C. Pump Pressure In

1. Accumulator
2. Raise Solenoid
3. Lower Solenoid
4. Manual Bleed Screw
5. Relief Valve
6. Lockout Valve (Rod Side)
7. Lockout Valve (Piston Side)
8. Rod Connection
9. Plug
10. Shut Off Plug
11. Piston Connection
**Terraglide Control System Switched OFF**

When the Terraglide system is ‘OFF’ (Speed under 1.5 Kmh), the raise valve (1) and lower valve (2) are de-energised as are the lockout valves (30 and 31). Oil is then trapped in the circuit by the load check valves (29 and 14).

If excessive pressure above 210 bar occurs in the system in this state the system relief valve (7) will open.

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**Diagram:**

System Switched Off

- **Pump Pressure**
- **Return To Tank**
- **Trapped Oil**
Operation Of Terraglide Ride Control
–Wheel Hits Small Bump
When the Terraglide system is ‘ON’ and tractor speed is above 1.5 km/h the lockout valves 30 and 31 are energised to allow oil flow through the valves.

Compression Stroke
When the tractor hits a small bump the cylinder is compressed forcing oil from the piston end.
As the piston moves in the cylinder some of the displaced oil passes through lockout valve (31) and check valve (11) to the rod end. The excess volume passes through lockout valve (30) into the accumulator through orifice (9).
Rebound Stroke
When the axle is returning to its mid position, oil from the accumulator flows back to the piston end via the check valve (8). Displaced oil from the cylinder rod side then goes through orifice (12) back to the piston end.
Operation Of Terraglide Ride Control  
–Wheel Hits Medium Size Bump
When the tractor hits a medium size bump lockout valves (30 and 31) are energised.

Compression Stroke
As the wheel goes over the bump the cylinder is compressed forcing oil from the piston end.
As the piston moves in the cylinder some of the displaced oil passes through lockout valve (31) and check valve (11) to the rod end. The excess volume passes through lockout valve (30) but cannot pass through the orifice (8), so pressure is generated which opens relief valve (10) to allow oil to the accumulator.
Rebound Stroke
When the axle is returning to its mid position oil from the accumulator flows back to the piston end via the check valve (8). Displaced oil from the cylinder rod side then goes through orifice(12) back to the piston end.
**Operation Of Terraglide Ride Control**  
**– Wheel Hits Large Size Bump**

When the tractor hits a large bump the lockout valves (30 and 31) are energised. As the wheel goes over the bump the cylinder is compressed forcing oil from the piston end.

As the piston moves in the cylinder some of the displaced oil passes through lockout valve (31) and check valve (11) to the rod end. The excess volume passes through lockout valve (30) but cannot pass through the orifice (8), so pressure is generated which opens relief valve (10) to allow oil to the accumulator.

The volume is now too great for the accumulator to cope with and so if the pressure exceeds 210bar the main relief valve (7) will open.
Rebound Stroke

When the axle is returning to its mid position oil from the accumulator flows back to the piston end via the check valve (8) as does the originally displaced oil from the rod end. As some of the oil was lost through the main relief valve the system will now need to "make up" the lost oil (Raising).
Raising Suspension

(Height adjustment after loss of Oil from the System or additional weight added to front of Tractor)

This type of situation can occur when the tractor is stopped to attach a front lift implement, pick up spoil using a front loader or Terraglide is manually switched on by the operator.

The Raise solenoid (1) is energised.

The raise solenoid (1) allows low standby pressure oil into the system and therefore provides a signal to the pump via the load sensing line to increase flow. Oil passes the check valve (29), the discpack valve(8)(9)(10), and the energised lockout valve (30) to the piston end of the suspension cylinder to extend the cylinder and raise the tractor. The speed of raising is controlled by orifice (16).

As oil is exhausted from the rod end of the cylinder it combines with the pump oil to the piston end of the cylinder via orifice (12), and the energised lockout valve (31). The piston can move down due to the volume differential in the cylinder between the rod and piston sides.
Lowering Suspension

(Height adjustment after removing weight from front of tractor)

The lowering solenoid (2) is energised and allows low standby pressure oil from the pump to open the unload valve (14), which in turn opens the system to return. As the cylinder retracts, oil from the piston side cannot pass the de-energised lock out valve (30), but can pass lockout (31) and allow the oil to return to sump. The speed of lowering is controlled by orifice (18).
NOTES
SUSPENDED FRONT AXLE CALIBRATION (H1)
Install the diagnostic tool, 295041 in to the black
diagnostic connector of the suspension/suspension,
EDC processor, located under the EDC panel.

Start the engine 1200rpm and enter the diagnostic
routine and depress the button on the diagnostic
switch until the display on the instrument cluster pan-
el changes to ‘H1’.

CAL will be displayed on EIC. Toggle the suspension
switch ON/OFF three times to enter suspension cal-
ibration mode,

ACP will be displayed.
The display will show an initial ramping up of the system (approx 290). The suspension will then fully lower and raise, (display indicating approx 640), and then lower (display showing approx. 290). The suspension will then raise to an approximate midpoint, and the display will change to show END.

All components of the suspension system are now calibrated. Turn OFF the key–start to store the calibration.
FRONT SUSPENSION DIAGNOSTICS

Introduction.
The TM Front Suspension has a built in diagnostic capability.
To gain access to the diagnostic HH Menu routine it is necessary to use the diagnostic test switch. Insert Tool 295041, into the tractor diagnostic black connector (C125) located behind the Electronic Draft Control panel.
All information relating to the HH Modes will be displayed at the bottom of the EIC centre display.

See Section 55, electrical systems for full details on diagnostics and fault code flow charts.
### Fault Code Listing

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<td>Lockout Valve Piston Side Solenoid Not Working</td>
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<tr>
<td>L02</td>
<td>Raising Solenoid Not Working</td>
</tr>
<tr>
<td>L03</td>
<td>Lowering Solenoid Not Working</td>
</tr>
<tr>
<td>L04</td>
<td>Front Axle Potentiometer Raise Value Is Higher Than Set Limit</td>
</tr>
<tr>
<td>L05</td>
<td>Front Axle Potentiometer Lower Value Is Lower Than Set Limit</td>
</tr>
<tr>
<td>L06</td>
<td>The Suspension Is Not Calibrated</td>
</tr>
<tr>
<td>L07</td>
<td>Front Axle Weight Has Been Reduced But The Suspension Is Unable To Reset Nominal Height</td>
</tr>
<tr>
<td>L08</td>
<td>Front Axle Weight Has Been Increased But The Suspension Is Unable To Reset Nominal Height</td>
</tr>
<tr>
<td>L09</td>
<td>Lockout Valve Rod Side Solenoid Not Working</td>
</tr>
<tr>
<td>U01</td>
<td>Front Axle Potentiometer Open Circuit</td>
</tr>
<tr>
<td>U02</td>
<td>Front Axle Potentiometer Raise Value Is Higher Than Set Limit</td>
</tr>
<tr>
<td>U03</td>
<td>Front Axle Potentiometer Short Circuit</td>
</tr>
<tr>
<td>U04</td>
<td>Front Axle Potentiometer Lowering Value Is Lower Than Set Limit</td>
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<tr>
<td>U05</td>
<td>Suspension Is Not Reaching Its Minimum/Maximum Position During Auto Calibration Procedure</td>
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<tr>
<td>U06</td>
<td>Not Used</td>
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<tr>
<td>U07</td>
<td>Suspension Is Stationary During The Raise Command In The Autocalibration Procedure</td>
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<tr>
<td>U08</td>
<td>Suspension Is Unable To Reach Maximum Height Within 20 Seconds</td>
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<tr>
<td>U09</td>
<td>Suspension Is Stationary During The Lowering Command In The Autocalibration Procedure</td>
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<td>U10</td>
<td>Suspension Unable To Reach Minimum Height Within 25 Seconds</td>
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<td>U11</td>
<td>Unable To Calibrate Suspension</td>
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<tr>
<td>U12</td>
<td>Auto Calibration Procedure Stopped Because Vehicle Not Stationary</td>
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SUSPENDED FRONT AXLE ASSEMBLY
Removal – Installation (Op.25.100.35)

⚠️ DANGER ⚠️
DO NOT remove any pipes from the suspension cylinder or valve block unless the system has been depressurised. The system remains under pressure even when the tractor engine is off.

Lift and handle all heavy components using lifting equipment of appropriate capacity. Ensure that units or parts are supported by suitable slings or hooks. Ensure that no one is in the vicinity of the load to be lifted.

1. Open and raise the engine hood.
2. Detach the negative cable (1) from the battery and insulate.

3. Depressurise the suspension system. Locate the screw of the load sense unload valve (1), and rotate clockwise, allow the tractor to lower completely onto the stops then rotate the screw anti–clockwise to return to normal operation.

NOTE: It is advisable to remove the hydraulic filter located above the suspension valve block to gain access to the depressurising screw.

4. If front ballast is fitted, thread a nylon cable (1) through the first row of ballast. Unscrew support plate (2) retaining screws and remove ballast using a hoist.

5. Unscrew retaining screws of the second row of ballast and slide them out, one at a time.
6. Disconnect the movement potentiometer linkage and electrical connector.

7. Disconnect the 2 steering tubes and the differential lock tube from the right hand side. **NOTE**: If front axle brakes are fitted, disconnect the common brake pipe to the axle.

8. If fitted, disconnect the steering angle sensor connector from behind the alternator and withdraw the cable from the engine.

9. Disconnect the FWD driveshaft at the sliding coupler joint.
10. Remove the brackets retaining the suspension ram hydraulic pipes to the tee-bar casting.

11. Raise the tractor using a suitable hoist and cable at the front support, sufficient to remove the front wheels, place stands under the axle for safety.

12. With the wheels removed, raise the tractor further to allow a bar to go between the sump and fwd shaft and support using stands either side of the engine. Allow enough space between the stands to withdraw the axle suspension arm from the front of the tractor.

13. Using a suitable lifting jack, raise the right hand side of the axle to gain access to the left hand pivot pin. Remove the pin retaining plate and using a drift knock the pin from the pivot from the front of the tractor.
14. With the axle supported centrally at the front and also under the suspension arm, raise or lower until access is gained to the right hand pin. Remove the right hand pin retaining plate and drift out the pin from the front of the tractor.

15. With the tee bar supported, remove the four bolts from the rear swivel assembly of the bar, slightly lower the tee–bar and prise the rear swivel assembly from the transmission dowels.

16. Ensuring that all pipes are disconnected and that the axle casting can clear the front support, carefully withdraw the axle, with the rear tee bar supported away from the tractor.

17. Place the axle assembly onto a suitable stand. Prise the yoke from its bearing surface, to gain access to the tee–bar securing bolts.
18. Using a suitable hoist/lifting crane, support the tee–bar. Remove the retaining bolts, noting the two thin headed bolts at the top and bottom.

19. Slightly withdraw the tee–bar casting and remove the universal joint bolts and remove the propshaft. Remove the suspension arm casting away from the axle.

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**WARNING**

Always use suitable tools to align holes. **DO NOT USE HANDS OR FINGERS.**

20. Re–install the front axle assembly observing the following:
   - Reassembly follows the disassembly procedure in reverse from step 18 back to 1.
   - If front axle brakes are fitted it will be necessary to bleed the front braking system.
   - If necessary ensure that the axle and hub oil levels are correct and that items requiring grease lubrication are sufficiently lubricated.
FRONT AXLE COMPONENTS

Suspension Arm and Pivot Assemblies

1. Suspension arm
2. Bolt
3. Pin
4. Seal
5. Bearing
6. Circlip
7. O–ring
8. Grease fitting
9. Circlip
10. O–ring
11. Retaining plate
12. Bolt
13. Washer
14. Grease fitting
15. Pin
16. Pivot Arm (Panhard rod)
17. Bearing
18. O–ring
19. Grease fitting
Potentiometer Components

1. Potentiometer Harness
2. Bracket
3. Potentiometer
4. Circlip
5. Nut
6. Washer
7. Operating arm
8. Link rod
9. Clip
10. Nut
11. Rod
12. Guard
13. Washer
14. Bolt
15. Nut
16. Harness retainer
Cylinder Installation

1. Cylinder
2. Circlip x2
3. Connector
4. O–ring
5. Seal
6. Connector
7. O–ring
8. Seal
9. Bearing
10. Lower pin
11. Grease fitting
12. Spacer
13. Upper pin
14. Washer
15. Bolt
16. Retaining plate
17. Washer
18. Bolt
SUSPENSION CYLINDER REMOVAL

DANGER

Exercise extreme caution when performing tasks on the front suspension system. ALWAYS ensure that the system is depressurised and that the axle is at rest on the support stops.

1. Disconnect the battery(1) to prevent accidental tractor start up.

2. Depressurise the suspension system. Locate the screw of the load sense unload valve, on the valve block and rotate clockwise, allow the tractor to lower completely onto the stops then rotate the screw anti-clockwise to return to normal operation.

   NOTE: It is advisable to remove the hydraulic filter located above the suspension valve block to gain access to the depressurising screw.

3. Place a suitable oil collecting container under the pipe connections and disconnect the pipes from the cylinder.

4. If necessary use a suitable hoist and cable around the front support and raise the tractor until access is gained to the lower pin. Remove the retaining plate and drift the pin out from the front of the tractor.
5. Remove the bolt from the top pin and using a suitable slide hammer with an M10 thread, remove the top pin and lower the cylinder assembly away from the tractor.

**Installation**
Installation is the reversal of removal, noting the following points:
- Ensure the O–rings are installed on the O–Ring Face Seal connectors of the cylinder.
- Lubricate the rod end bearings with the specified grease after installation.

**SUSPENSION CYLINDER OVERHAUL**
Fully stroke the piston several times to remove as much oil as possible and ensure that the cylinder is cleaned externally before overhaul.

1. Remove the outer circlip. Push the rod gland into the cylinder and remove the retaining ring from the cylinder bore.

2. Pull the rod assembly from the cylinder.

3. Using the flats on the rod end, secure the rod in a vice. Using a suitable bar, remove the rod end. **NOTE:** The rod end has a thread locking compound applied and will require considerable force to loosen.
4. Remove the gland assembly from the rod.

5. If necessary, the rod end bearing can be replaced. Remove the two circlips and using a suitable press, press the bearing from the rod end.

**Inspection**

Inspect the cylinder bore, if scored or damaged in any way replace the cylinder.
Inspect the rod for scoring and ensure that it is perfectly straight, replace if damaged.
It is recommended at this stage to obtain a seal kit and replace the seals prior to reassembly.

**Reassembly**

Reassembly is the reversal of the disassembly procedure, noting the following points:

- Coat all seals with clean hydraulic oil prior to assembly.
- Apply New Holland Thread Lock and Seal, Part No.82995773, to the rod end and tighten to 200Nm (147lbf.ft).
Front Suspension Cylinder Assembly

1. Cylinder
2. Rod and piston
3. Guide ring*
4. Slipper seal*
5. Guide ring*
6. Dual ring seal*
7. Step seal*
8. O–ring*
9. Seal*
10. Rod wiper*
11. Retaining ring
12. Bearing
13. Rod end
14. Retaining ring
15. Circlip
16. Gland retaining ring
17. Gland

NOTE: Items Marked with an ( * ) are supplied in a service seal kit.
SUSPENSION VALVE BLOCK REMOVAL

DANGER

Exercise extreme caution when performing tasks on the front suspension system. ALWAYS ensure that the system is depressurised and that the axle is at rest on the support stops.

1. Disconnect the battery to prevent accidental tractor start up.

2. Depressurise the suspension system. Locate the screw of the load sense unload valve, on the valve block and rotate clockwise, allow the tractor to lower completely onto the stops then rotate the screw anti-clockwise to return to normal operation.

**NOTE:** It is advisable to remove the hydraulic filter located above the suspension valve block to gain access to the depressurising screw.

3. Disconnect the wiring to the solenoids. Tag the connectors for reassembly.

4. Place a suitable oil collecting container under the pipe connections and disconnect the pipes to the valve. Make a note of each connection for reassembly.
5. Place a trolley jack under the valve assembly. Undo the bolts from the bracket and carefully remove the valve and bracket assembly away from the tractor.

**SUSPENSION VALVE BLOCK OVERHAUL**

It should be noted that due to the complexity of the valve block that only the following major external items are serviced:

- **Valve block section complete with bracket**
  1. Ensure the valve block is clean.
  2. Remove the four cap head screws from the end of the ride control valve block section. Carefully pull the sections apart. On replacement of a section install new O–ring seals between the valve sections. Tighten the screws to 9.5Nm (7lbf.ft).

- **Electrical solenoids**
  1. Ensure the area around the solenoids is clean.
  2. Remove the outer nut and withdraw the solenoid coil, then Unscrew and remove the solenoid valve.
  3. Installation is the reversal, install the solenoid valve ensuring that the O–ring is located under the nut followed by the solenoid coil.

- **Hydraulic accumulator**
  1. Ensure the area around the accumulator is clean.
  2. Unscrew the accumulator counter clockwise to remove and clockwise to install.