

STALL TORQUE SPEED**Test****5D – 01 – 11**

The stall torque test should only be carried out on a fully run-in engine (after 100 hours) as a low reading may be obtained from a new or newly rebuilt engine.

1. Check oil level then run machine until transmission oil is at normal operating temperature.
2. Check maximum no-load engine speed which should be 2140 rpm.
3. **Firmly apply the hand brake and select 4th gear.**
4. With the engine at low idle speed select FORWARD drive and then using the foot throttle, accelerate the engine to maximum speed. The engine speed should be 1875-1975 rpm or 1225-1325 rpm if the loader hydraulics are stalled in addition to the torque converter.
5. Repeat operation in reverse drive. There should be no difference at all in the stall speeds. If there is, it indicates that one of the clutches may be slipping. Further testing is then required.
6. Leave the engine idling for a few minutes to cool the transmission oil.

TRANSMISSION OUTPUT CHECK**Basic Test****5D – 02 – 11**

As a rough check of transmission output power the following procedure is useful to determine whether further investigation is required. **For this test 2-wheel drive must be selected on 4-wheel drive machines.**

1. Work the machine until engine and transmission oil are at normal operating temperature.
 2. Drive the front bucket against a stockpile, bank or other solid face.
 3. Engage 1st gear, select FORWARD and run engine at maximum speed. The rear drive wheels should spin irrespective of ground conditions, i.e. tarmac, concrete, etc.
- For machines with low ratio, 20 kph transmissions this test can be carried out in 1st or 2nd gears.

PUMP FLOW CHECK**Basic Test****5D – 03 – 11**

As the pump serves both steering and transmission systems the following check will quickly indicate whether further investigation is necessary.

1. Work machine until engine and transmission are at normal operating temperature.
2. Check that the machine is on a flat surface and that the brakes are not dragging.
3. Reduce engine speed to 750 rpm and engage 1st gear.
4. Turn steering wheel almost to full lock, so that the relief valve does not relieve, select FORWARD, and the machine should move, if not increase engine speed very slightly until the machine begins to creep forward.
5. Turn steering wheel on full lock to make the relief valve operate. The machine should continue to creep forward, if it stops or fails to restart when FORWARD is selected it indicates low pump output and transmission pressure test operation 5D – 04 should be completed.

POWERSHUTTLE TRANSMISSION

TRANSMISSION CLUTCH PRESSURE

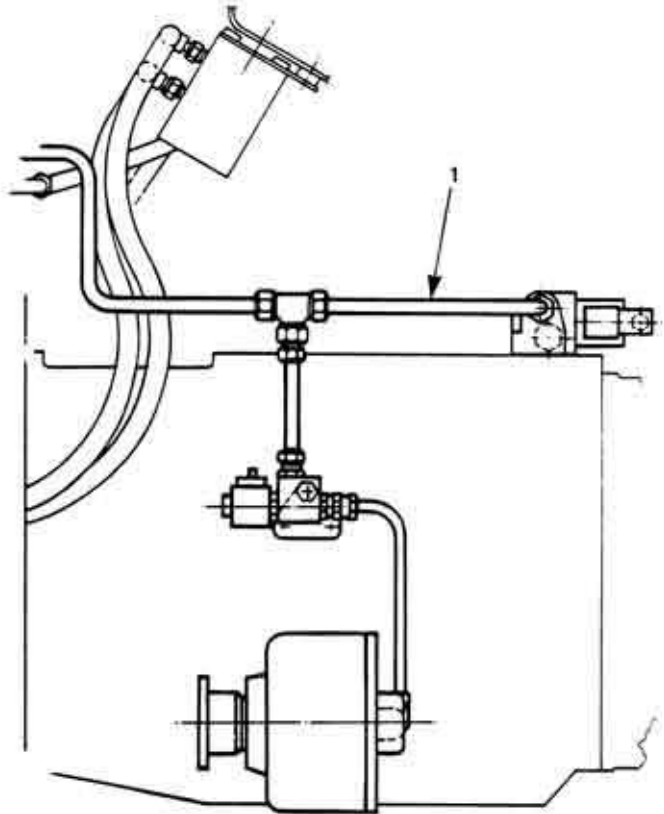
Test 5D - 04 - 12

Special Tools:

Pressure gauge 0-40 bar (0-600 lbf/in²)

3/4" JIC tee.

1. With engine and transmission oil at working temperature install pressure gauge in the pipe between oil cooler and the pressure maintaining valve.
2. Select NEUTRAL with gear lever and FORWARD/ REVERSE switch.
3. Start engine and run at low idle speed, pressure reading should not be less than **18.6 bar (270 lbf/in²)**.
With engine at full speed the pressure should be **25.5 bar (370 lbf/in²)** maximum.
Selection of FORWARD, REVERSE or 4 WD will cause a small reduction of pressure due to the internal leakage within the clutch system.
4. Turn the steering wheel to full lock and hold so that the relief valve operates continuously and repeat the check in instruction 3.
Minimum pressure should be **18.6 bar (270 lbf/in²)**.
If the pressure falls below **18.6 bar (270 lbf/in²)** it indicates the pump is worn and unable to deliver its rated output at 110 bar (steering relief valve pressure).



TORQUE CONVERTER PRESSURE

Test 5D - 05 - 12

Special Tools:

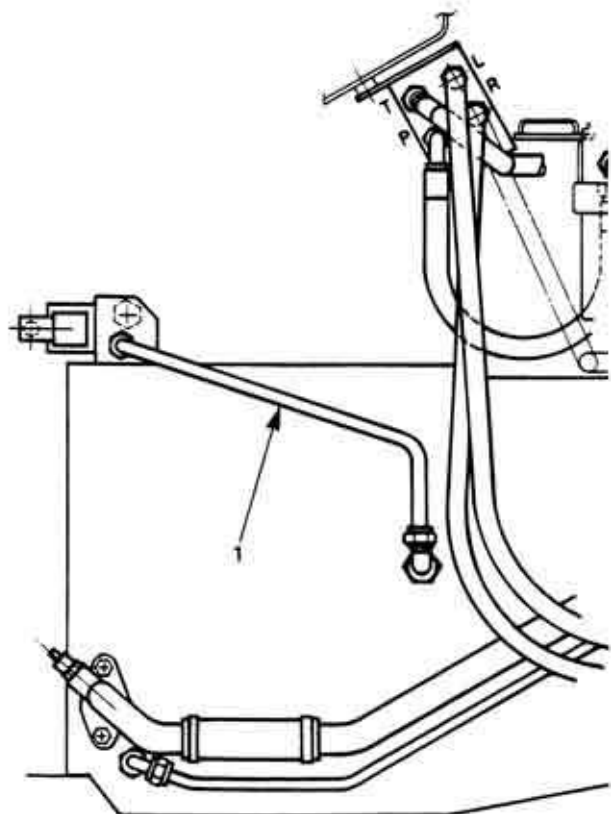
Pressure gauge 0-20 bar (0-300 lbf/in²).

3/4 inch JIC swivel tee.

Slave hose.

This test will determine the working pressure in the torque converter. The reading gained will include resistance created by the oil passages leading into the torque converter so it is important to record at least the minimum pressure given below.

1. With engine and transmission at working temperature, stop the engine and remove the steel pipe connecting the valve block to torque converter inlet. Install pressure gauge using the slave hose and tee piece; in place of the steel pipe.
2. Start engine and run at **750 rpm**; pressure gauge reading should be **2.1 bar (30 lbf/in²)** minimum. Increase engine speed and recheck at maximum engine speed when pressure can be substantially higher **4.1-4.8 bar (60-70 lbf/in²)**.
Any gauge reading below 2.1 bar (30 lbf/in²) indicates a faulty pressure maintaining valve. The transmission must be removed to service this item.



POWERSHUTTLE TRANSMISSION

TORQUE CONVERTER SAFETY VALVE

Test

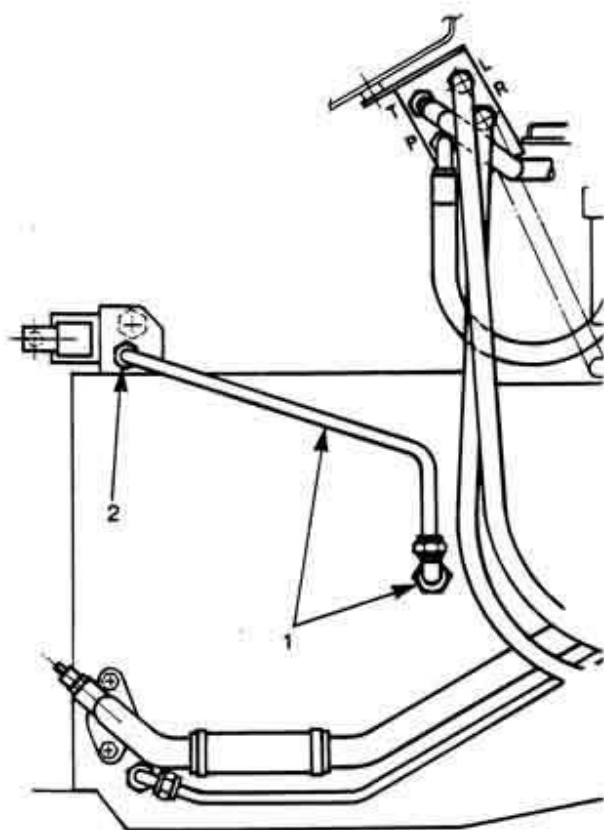
5D - 06 - 13

Special Tools:

Pressure gauge 0-20 bar (0-300 lbf/in²).

Adaptor, 3/4 inch JIC to pressure gauge.

This test is to check the pressure setting of the safety valve which protects the torque converter against damage in the event of the pressure maintaining valve malfunctioning.



1. With engine and transmission at working temperature, stop engine and remove the steel pipe from between the valve block and torque converter and plug the torque converter inlet union.
2. Install pressure gauge directly into the port on the right hand side of the valve block, in place of the steel pipe removed.
3. Shift gear lever to neutral and select N (neutral) with forward/reverse switch. Start engine.
Warning: Do not select FORWARD or REVERSE or attempt to stall the torque converter during this test.
4. At all engine speeds pressure should be between 6-6-8-3 bar (95-120 lbf/in²).

FORWARD/REVERSE CLUTCH LEAKAGE

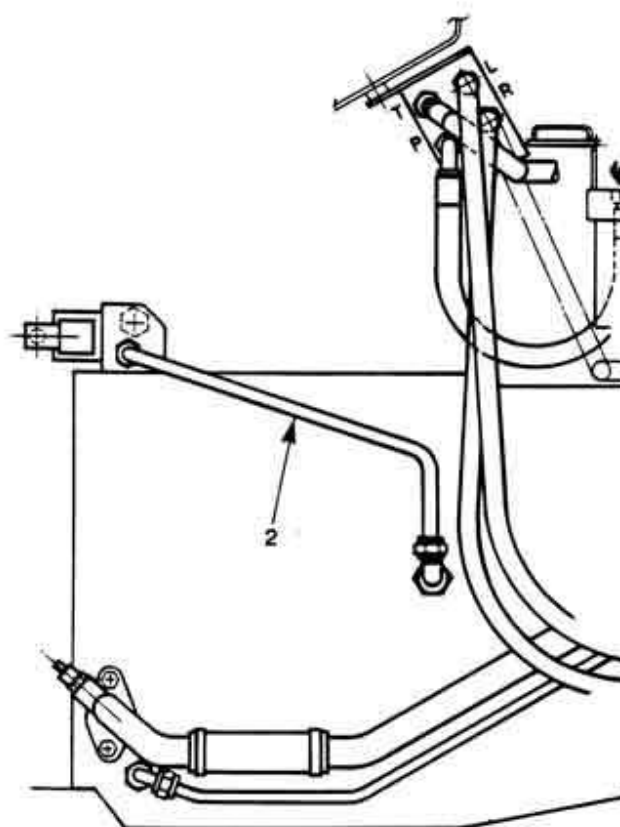
Test

5D - 07 - 13

Special Tools:

Flow meter 40 litre/min (10 US gals/min) capacity.

This test will show the leakage rate of each clutch. Both clutches should have similar leakage rates, a large difference in flow between FORWARD and REVERSE clutches indicates a problem in the clutch with the largest measured flow drop.



1. With engine and transmission oil at normal operating temperatures, stop the engine and disconnect the steel pipe from between the valve block and torque converter inlet union.
2. Connect flow meter in place of steel pipe removed.
3. Shift gear lever and FORWARD/REVERSE switch to neutral, and start engine.
4. Residual pressure should be below 5-5 bar (80 lbf/in²), note the flow reading with the FORWARD/REVERSE switch in neutral. Select FORWARD and the flow will drop. Note the new reading.
Subtract the second flow reading from the first to obtain the leakage through the FORWARD clutch pack. Leakage flow must not exceed 10 litres/min (2-64 US gals/min).
Repeat test with REVERSE clutch.
Leakage rates through both clutches should be similar, if not recheck the clutch with the greatest leakage rate and investigate further.

POWERSHUTTLE TRANSMISSION

VENTING VALVE

Test

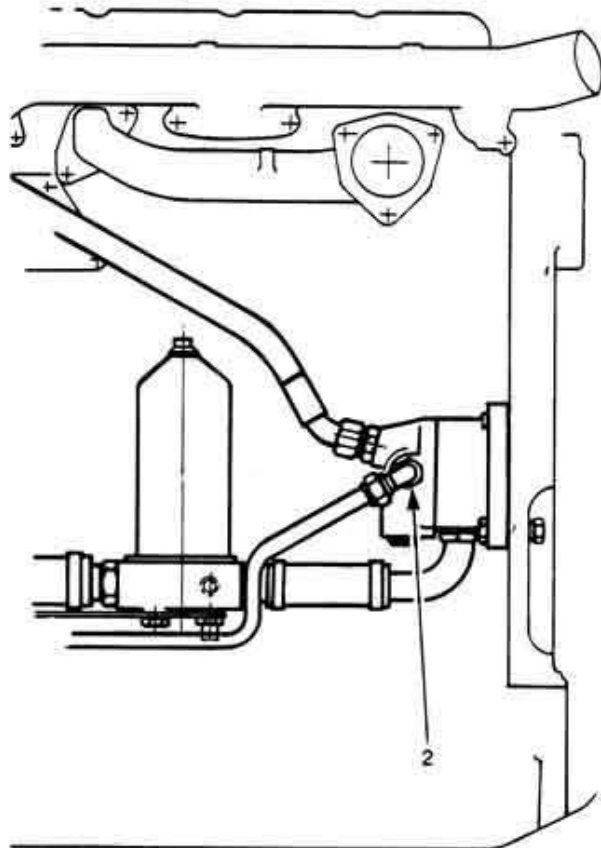
5D - 08 - 14

Special Tools:

Small measuring jar.

This test will check that the venting valve closes properly.

1. Warm transmission oil to correct operating temperature. Shift gear lever and FORWARD/ REVERSE switch to neutral. Apply handbrake securely and lower digger and loader buckets to ground.
2. With engine speed at **700 rpm** remove drain hose from side of pump and use measuring jar to measure leakage over one minute.
3. Leakage oil from pump drain port should not exceed **10 millilitres (0.625 in³)** per minute.



4-WHEEL DRIVE CLUTCH LEAKAGE

Test

5D - 09 - 14

Special Tools:

Flow meter 40 litre (10 US gals/min) capacity.

This test will check the general condition of the 4-wheel drive clutch system but not necessarily provide any indication of clutch plate wear.

1. Warm the transmission oil to 60-80°C (140-175°F). Stop the engine, and remove the steel pipe between the 4-wheel drive tee piece and transmission control valve block.
2. Install flow meter in place of steel pipe and start engine.
3. With gear lever, direction control switch and 4-wheel drive switch in neutral note flow meter reading. Select 4-wheel drive but with direction switch still in neutral, then note the flow meter reading again. Subtract the second reading from the first to obtain leakage through 4-wheel drive clutch.
4. Leakage should be **1.5-3 litres (3.15-6.3 US pints)** per minute.

