Webtec Products Limited

Simplified Digital Hydraulic Testers

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DHT 401 - 751 - 751 HP

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Simplified Digital Hydraulic Testers Operating Manual

Introduction

DH Series Digital Portable Hydraulic Testers have been designed for easy connection to a hydraulic circuit so that flow, pressure and temperature can be readily checked. Engineering units are factory preset. Testers can take full back pressure up to 350/420 bar (depending on model) and the built-in loading (optional on DHC) valve enables many of the operating conditions to be simulated. The tester can be connected anywhere in the hydraulic system to test pumps motors, valves and cylinders in both flow directions.

BI-DIRECTIONAL FLOW TESTING

1. The loading valve (where fitted) gives smooth control of pressure in both flow directions and is protected in both flow directions by two replaceable safety discs which are designed to rupture at approximately 7 bar (100 psi) over the maximum working pressure. When these discs rupture the oil by-passes the loading valve at low pressure and continues to flow freely through the hydraulic system. A range of pressure safety discs are available to protect both the tester and other components in the hydraulic system.

2. Although the bi-directional tester can be used in both flow directions, the preferred direction is indicated by IN and OUT on the tester block. When the tester block is used for reverse flow tests, slightly lower accuracies may be obtained depending on the oil viscosity, density and compressibility.

3. The tester should be connected to the hydraulic circuit by means of flexible hoses 1 - 2 metres long. The use of quick-disconnect couplings can save time. Make sure the hoses are long enough so that the tester can be used conveniently on the machine. The hoses and fittings at the inlet to the tester must be of adequate size for the flow being tested. Elbows, rotary couplings etc., at the inlet and outlet ports of the tester should be avoided to ensure accurate readings.

5. The use of the flexible hoses will help to isolate the test unit from vibration which often exists.

6. After installing the Tester it is important to ensure that all connections are tightened and the oil can flow freely throughout the hydraulic system BEFORE running the machine at full speed. Check that the circuit is correctly connected and any shut-off valves are opened, also quick disconnect couplers MUST be open. IMPORTANT start the pump momentarily to ensure there is no obstruction which could cause pressure build up.

8. Testers have an automatic electronic system which shuts the power off after approximately 20 mins on the DHT and 1 hour on the DHC. To reactivate the tester, switch it “OFF” and the “ON” again.

9. If the display does not return, it may be necessary to replace the battery.

TROUBLE SHOOTING WITH THE HYDRAULIC TESTER

PRELIMINARY: Check oil level in tank, pump drive, valve linkage for damaged parts, external oil leaks etc

Problem	Possible Cause	Suggested Test, See Paragraph:
Excessive pump noise fluctuating pressure Low flow under no load	Pump cavitation caused by: a) Clogged suction filter b) Restricted suction line c) Air leak in pump suction line, fittings, shaft seals etc. d) Pump speed too high	 3.0; 4.1
Decreasing performance as pressure increases on all circuits On one circuit	Internal leakage in: a) Pump b) Main Relief Valve c) Directional Control Valve d) Cylinder or Hydraulic Motor	 3.0; 4.1 4.2; 4.3 4.2; 4.3; 4.4; 5.0 5.1; 5.2
Fails to hold load	Directional Control Valve Cross line Relief Valve Cylinder	4.2; 4.3; 4.4; 5.0 5.02 5.0; 5.2

Operation

MODELS: DHT and DHC

Temperature
The thermistor type temperature transducer is in contact with the oil flow and temperature is displayed on the left hand side of the digital display. The factory preset units are indicated by a cursor arrow.

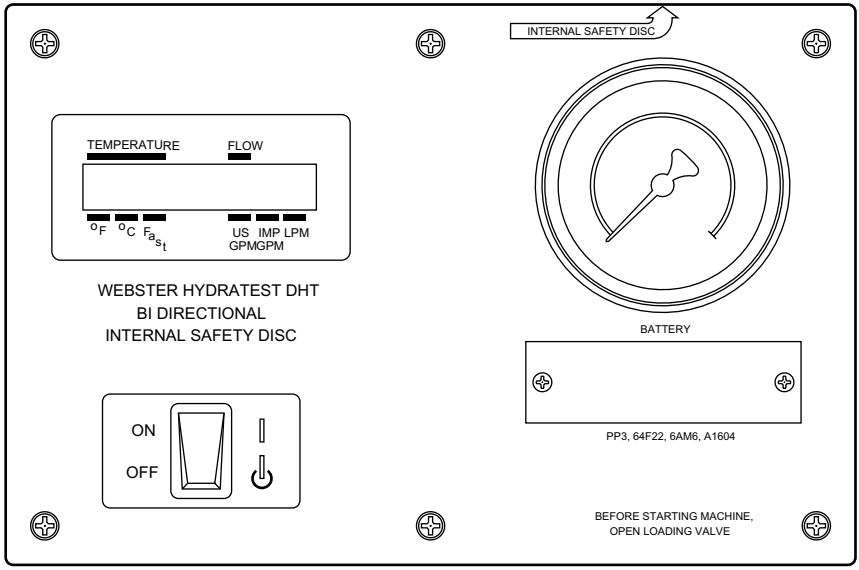
Flow

A) Flow Meter
The Flow Meter comprises an axial turbine mounted in an aluminium block. The oil flow rotates the turbine and its speed is proportional to the oil velocity. The revolutions of the turbine are measured by means of a magnetic sensing head which feeds a pulse every time a turbine blade goes by, to an electric circuit. The circuit amplifies the pulse, shapes it into square wave form and has a digital output which is directly proportional to the number of pulses per second. Flowrate is displayed in the right hand side of the digital display. The preset units are displayed in either USGPM, IGPM or LPM and the selection is indicated by a cursor arrow. When the flow rate falls below the minimum allowable “L” is indicated on the display. When flowrate exceeds the maximum “H” is indicated on the display.

Pressure Gauge
The pressure gauge has a spiral Bourdon tube and the gauge case is filled with glycerine to ensure good dampening on pulsating pressures. The gauge is connected to the turbine block by fine bore capillary tube. Testers with BUILT-IN load valve have a shuttle valve which automatically reads the highest pressure in both directions of flow.

Bi-Directional Loading Valve
The reverse flow valve gives positive shut-off and pressure control in both directions of flow. The loading valve has two easily replaceable safety discs located in the valve assembly which internally protect the tester and machine in both flow directions.

Accessories
Adaptors. Fitting kits are available for all testers. Consult Sales Office.


INTERNAL SAFETY DISC
TEMPERATURE
FLOW
°F °C Fast
US GPM IMP GPM LPM
WEBSTER HYDRATEST DHT
BI DIRECTIONAL
INTERNAL SAFETY DISC
BATTERY
PP3, 64F22, 6AM6, A1604
ON
OFF
BEFORE STARTING MACHINE,
OPEN LOADING VALVE

Instructions for using the portable hydraulic tester models - DHT & DHC

0.0 The Tester is designed to measure flow, pressure and temperature. It can take full system pressure up to 420 bar (depending on model) and measure flow in both directions for motor and cylinder testing.

0.1 Make all tests at operating temperatures because as the oil temperature increases it becomes thinner and any internal leakage becomes greater.

0.2 Testing will be easier and faster if quick disconnect couplers are used to attach the Test Unit.

0.3 There are two basic test 'set-ups' when using either the DHT or DHC or Testers:

A) The In Line test to check out pumps, entire systems and also monitoring operating conditions

B) The Tee Test to check out pumps, directional control valves and overall system condition.

0.4 A preliminary check of the hydraulic system's oil supply, pump rotation, filters, oil lines, cylinder rods as well as looking for external leaks should be made prior to installing the hydraulic tester.

1.0 INSTALLING THE TEST UNIT

1.1 Connect the Tester to the circuit, see page 22 for Port Sizes. The inlet and outlet ports are marked on the turbine block. Use hoses and fittings of sufficient diameter for the flow being tested. Avoid restrictions at inlet and outlet ports of the Tester. Also avoid sharp bends because at high pressure hoses will deflect and straighten under pressure.

1.2 When the pressure loading valve is used ensure it is fully opened by turning the knob counter clockwise.

1.3 When no flow is passing through the turbine, the display will read "L" for "LOW" flow.

1.4 Continue tests as specified for the hydraulic tester.

2.0 STANDARD TEST CONDITIONS

2.1 Position the Hydraulic Test Unit as described in paragraph 3.0 and 4.0

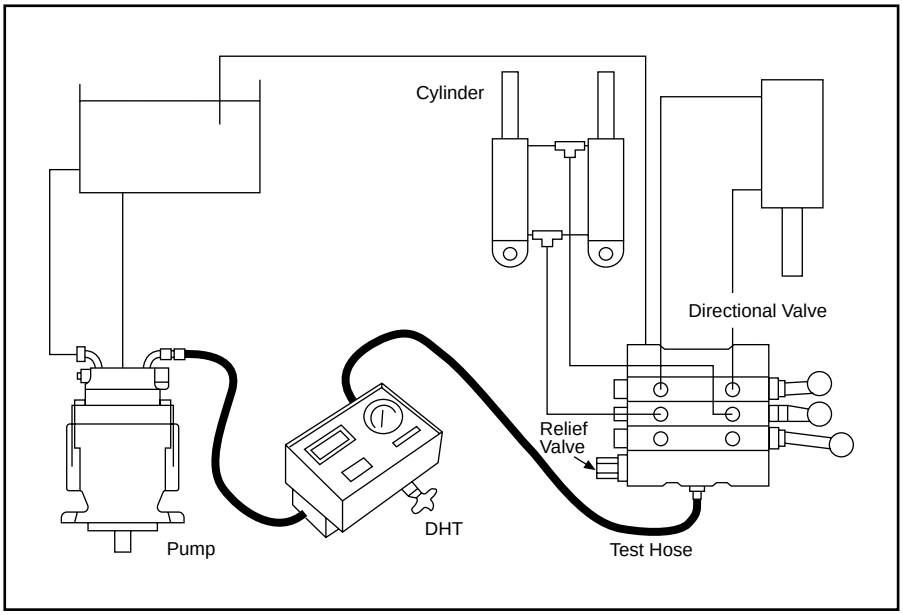
2.2 Open loading valve. (Rotate counter-clockwise) and select high flow range.

2.3 Start pump momentarily to ensure that oil flows freely through the hydraulic system, then run pump at normal maximum speed. Do not change pump speed while using the loading valve.

2.4 Slowly close Test Unit Loading Valve to develop desired pressure. Run the machine until normal operating temperature is reached.

2.5 Open the Testing Loading Valve and proceed with required test procedure (see Paragraph 3.0 or 4.0).

2.6 Keep a record of flow readings at various operating pressures for comparison of test results. The machine Manufacturer's service manual should be consulted.



Drawing A1

3.0 Test 1 - PUMP IN LINE TEST (See Test Diagram A1) using DHT or DHC

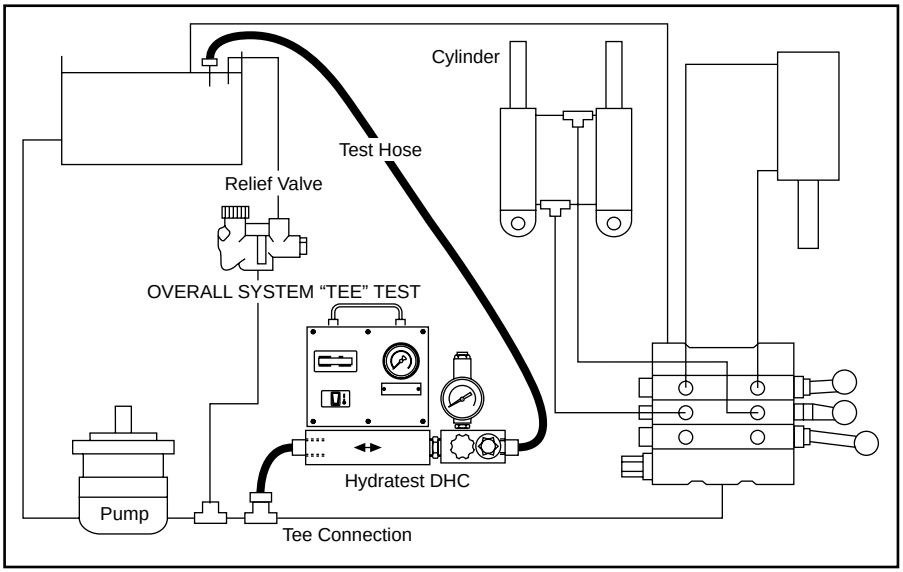
3.1 Install the Tester into the system between the pump outlet port and the inlet to the directional control valve.

3.2 Open Tester loading valve to read maximum pump flow at minimum pressure.

3.3 Close loading valve slowly to increase pressure and note reduction of flow as the pressure is increased to maximum pump pressure to determine pump condition.

3.4 Pump flow at rated pressure can now be checked against the pump manufacturer's specifications. The decrease in flow from the minimum pressure to maximum pressure determines the pump condition. Typically a worn or damaged pump will lose 20 - 30 percent. A pump that delivers low flow at both minimum and maximum pressure indicates suction problems. Blocked suction filters and pump cavitation problems can also be checked by recording the pump flow at various engine speeds.

3.5 The tester can be used at several points in the circuit and the machine can be used under its normal working conditions to evaluate the performance of the circuit elements, such as pump, control valve, cylinder and hydraulic motor.



Drawing A2

4.0 TEST B - 'TEE' TEST (See Drawing A2) using DHT or DHC

4.1 A 'Tee' must be installed at one point between the pump and control valve then connected to the "IN" port of the Tester. The "OUT" port of the tester is connected back to the tank. Make sure the loading valve is open.

4.12 Pump Test. Disconnect and plug connection to control valve and proceed as in paragraph 3.2; 3.3 and 3.4

4.2 Overall System and Relief Valve Test (See drawing A.2)
(For relief valve integral with directional control valves)

4.21 Connect control valve to 'Tee'. Operate control valve to extend the cylinder to end of stroke.

4.22 Close the Tester loading valve while watching pressure and flow meter reading. Pressure will increase until relief valve opens at which point flow reading will return to zero. Note or record pressure at this point. Adjust the relief valve if the pressure is below the recommended setting. It is not unusual for a relief valve to start cracking open below the maximum pressure setting causing considerable leakage and loss of machine performance. The cracking pressure can be checked by increasing the pressure slowly and noting the pressure at which the flow starts falling rapidly to zero. The maximum relief valve setting is when the flow is at zero.

4.3 Control Valve. Cylinder 'TEE' Test

4.31 Put control valve in power position. (On multiple spool valves, only one spool should be in a power position at any one time). The cylinder should be extended to the end of the stroke.

4.32 Close tester loading valve slowly while recording pressures and flow rate.

4.33 Repeat 4.32 for power position, for all spools of all control valves.

4.331 If all components are in good operating condition, pressure and flow measurements should be the same as in the pump test paragraph 3.0

4.332 If the decrease in the flow of any control valve position is noted, leakage is indicated in this control valve or cylinder. See paragraph 4.4 for test routine to determine which is at fault.

4.333 If the decrease in flow is the same for the control valve(s) in all positions, it indicates the relief valve is at fault. (**Note:** This can also indicate some other leak is present in the control valve such as defective casting - but always check the relief valve FIRST)

4.4 Additional test to locate fault in control valve or cylinder (see paragraph 4.332). Disconnect line to cylinder and plug valve port.

4.41 Place control valve handle in position where greatest decrease of flow was noted.

4.42 Close tester loading valve and record both pressure and flow.

4.43 If the **SAME** decrease in flow is noted as in test per paragraph 4.332 then the control valve is at fault. HOWEVER, if the flow readings are now higher and comparable to the other control valves, then a faulty cylinder is indicated.

5.0 DIRECTIONAL CONTROL VALVE 'IN-LINE' TEST (See drawing B.1) using DHT or DHC

5.01 To check the relief valve pressure setting where relief valves are integral with control valve, install flow meter in the cylinder line as shown in drawing B1,ensuring that loading valve is open (turn anti-clockwise). Start pump and operate the lever on the valve in which the tester is situated to raise load. Slowly close the loading valve (turn clockwise), reading pressure and flow, continue until loading valve is fully closed, pressure reading obtained is then relief valve pressure. Compare with manufacturer's recommendations. Adjust relief valve if necessary. Using **bi-directional flow testers**, the cylinder and valve may be tested in the opposite direction by operating the lever to retract the cylinder.

5.02 Control Valve Leakage

With flow meter installed as in 5.01, repeat test and compare flow readings obtained for comparable pump test 3.3. Differences in flow readings indicate leakage within control valve. Repeat test for all power ports to fully determine valve condition. Replace control valve block or valve segment where necessary.

5.1 Cylinder Test (See Drawing B.1)

5.11 If the cylinder is slow in operation or cylinder 'creeps' under load the following test should be carried out to check the cylinder seals.

Install the flow meter 'in line' as shown in Drawing B.1. Actuate cylinder to raise and lower the load. Note flow and pressure readings, also note the time taken by the cylinder to reach full stroke. Compare all readings with manufacturer's recommended figures. If flow is correct but time to extend cylinder is greater than expected leakage across the cylinder seals is indicated. If flow is lower than expected, investigate control valve function. See Test 5.0.

5.2 Motor Test

5.21 Motor performance is checked by measuring the flow and comparing it to the equivalent motor speed. Install the tester or remote flow block in the line upstream of the motor as indicated in the drawing B.1. Fully open the loading valve and operate the directional control valve ensuring the motor rotates in the correct direction. Allow motor to run under normal load. Note flow and pressure readings. If flow is below manufacturer's data sheet or lower than pump test (3.0) investigate control valve function. See Test (5.0).

NOTE: The motor may only be tested in reverse if it has an external drain. Do not pressurise the outlet port of the motor without first checking the allowable back pressure with the manufacturer.

Motor Leakage

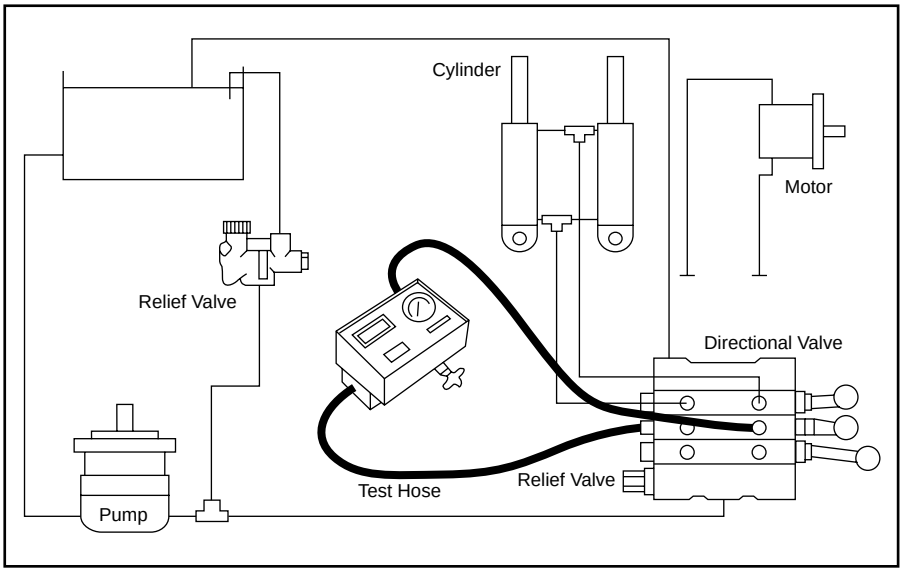
5.22 Measure hydraulic motor r.p.m. with tachometer when motor is working at normal pressure. If the motor speed is low and the inlet flow in 5.21 is found to be correct, internal leakage in the motor is indicated. Check the motor leakage by installing the remote flow block in the motor case drain. Note: most motors not fitted with high pressure shaft seals have a maximum case drain pressure of 1 bar (15 psi)

5.23 When the motor does not have an external drain or the motor cannot be back pressure loaded connect tester in the other line and repeat the test 5.21 and 5.22 for the other motor direction.

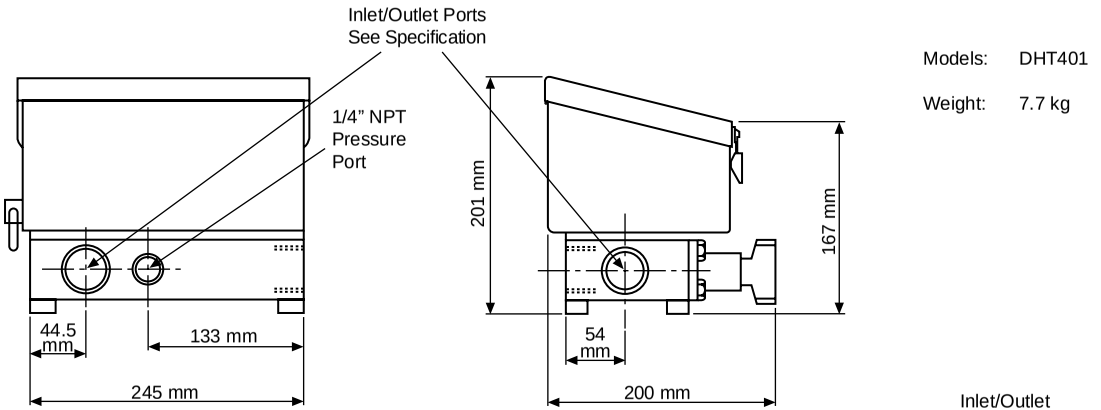
5.3 Alternative Cylinder and Motor Test

5.31 Both motors and cylinders may also be tested as shown in drawing B.2. Disconnect the two lines from the motor and connect the tester into these lines. Fully open the loading valve, start the pump and bias the directional valve to allow flow to the inlet port of the tester. Slowly close the loading valve by turning clockwise and note the flow and pressure. If the flow is below the manufacturer's data or lower than the pump flow test (3.0) investigate the control valve function. See Test (5.0). If the flow is correct and the speed is slow this indicates a defective motor or cylinder.

Operate the directional valve to reverse the flow through the tester and record the flow throughout the pressure range.

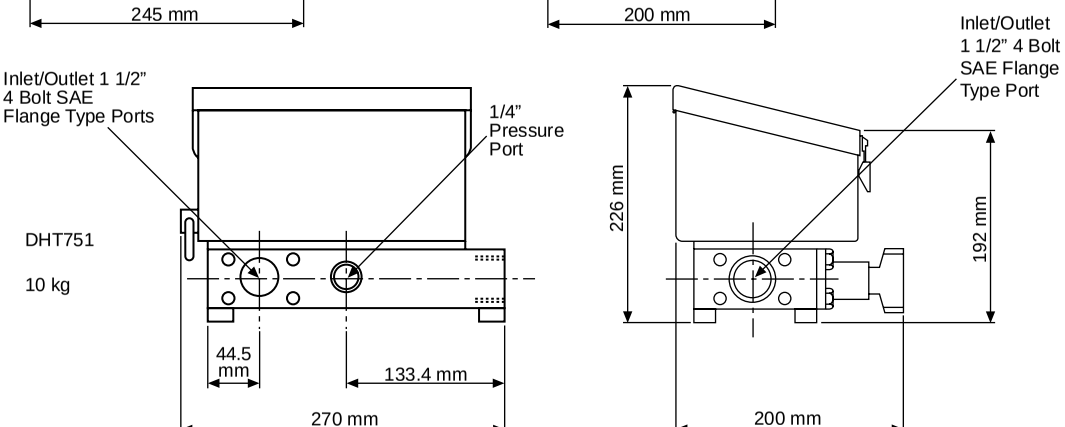

Cylinder
Motor
Relief Valve
Directional Valve
Test Hose
Relief Valve
Pump

Drawing B2



Models: DHT401

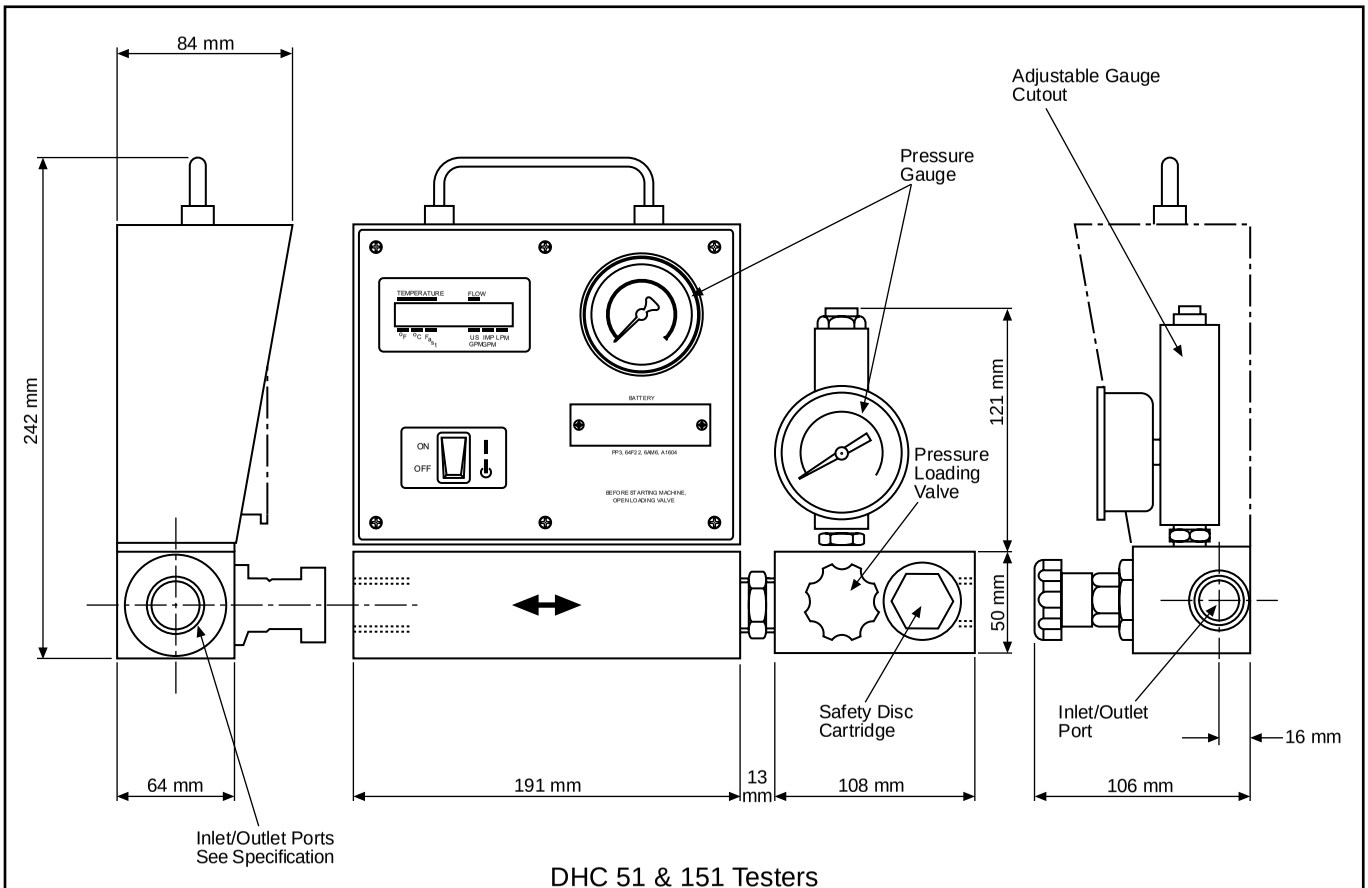
Weight: 7.7 kg



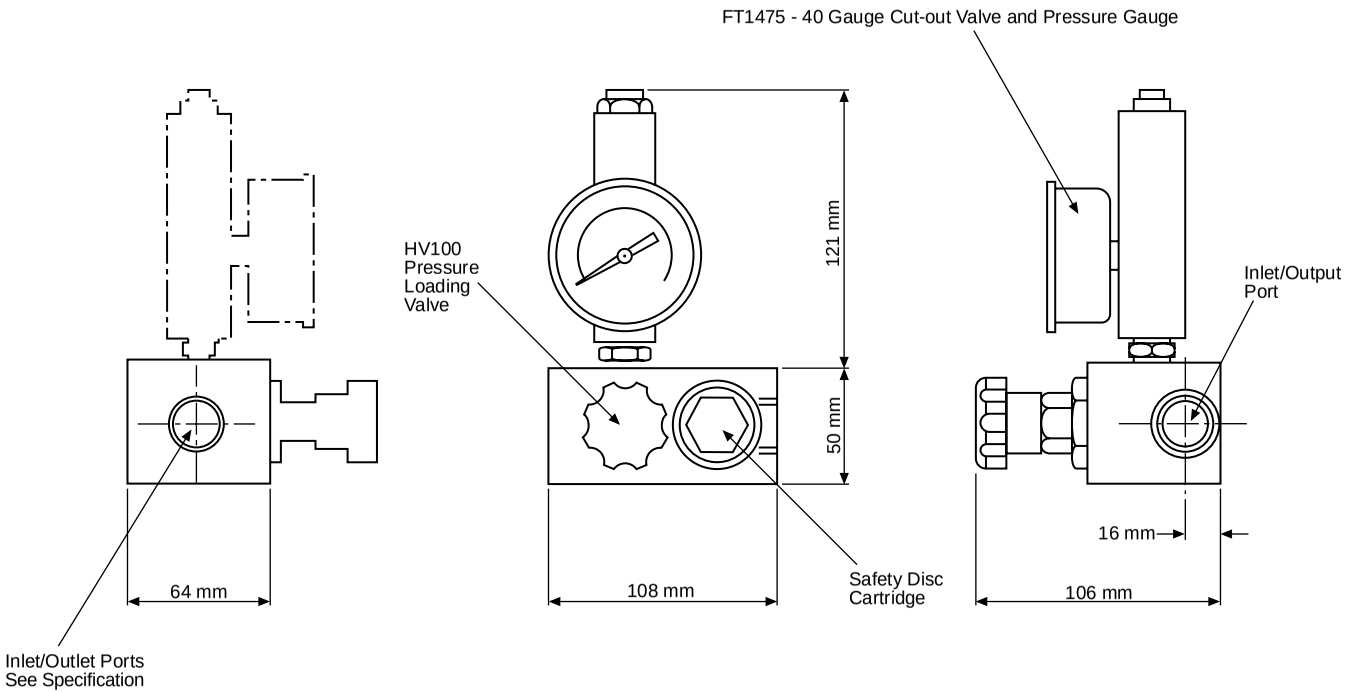
Models: DHT751

Weight: 10 kg

DHT 401 & 751 Testers



DHC 51 & 151 Testers



Loading Valve for DHC 51 & 151 Testers only

Service Instructions

If the tester does not indicate flow:

FLOWMETER

A) Turn the Tester “ON”. If the display is still faint or absent check the condition of the battery and battery connections located in the front panel of the DHT and in the side of the DHC case. Replace battery if necessary.

B) If the flowmeter displays a valid temperature but no flow it is likely that the turbine has become jammed by debris. This usually consists of pieces of ‘O’ ring, PTFE tape etc. Remove and clean turbine as in section C

C) **TURBINE**
To remove turbine assembly for cleaning, remove circlip from inlet port, Fig. 1 hold turbine flow straighteners with soft nose pliers and pull gently. Fig. 2 **DO NOT ROTATE**. Remove debris and wash in clean organic solvent. Turbine should revolve freely when blown along flow straightener.

Fig. 1

Fig. 2

D) Ensure the turbine block is also free of debris. Replace the turbine assembly ensuring the clipped corner of the flow straightener is returned to the 1 o’clock position.

E) The turbine can be driven with an air flow to check the flowmeter. For this test if a loading valve is fitted it should be opened completely. Direct the air flow through the inlet port of the turbine, switch on the tester to. The air should rotate the turbine and the digital display indicate the flow. If there is no reading check that the turbine is rotating. When using compressed air, do not overspeed the turbine or the meter will be overloaded.

WARNING: Care should be taken while removing the turbine assembly. Damage to the bearing will cause a loss of accuracy and the tester could malfunction.
For recalibration contact Webtec Products Ltd or your local sales office.

LOADING VALVE

DHC TESTERS WITH HV100 LOADING VALVE

If the handle becomes difficult to turn under pressure or will not close, remove the handle assembly with a 7/8“ AF spanner. Check for worn valve spindle and seat, damaged seals or contamination. Note: If the pressure does not increase progressively when the loading valve is operated, check if the safety discs have ruptured.

The loading valve (Fig. 3) is fitted with two safety discs which are designed to rupture internally at approximately 7 bar (100psi) over the maximum pressure. When these discs fail the loading valve becomes inoperative and the oil flows freely downstream. To replace the discs, remove the cartridge assembly by unscrewing the 1 3/8“ AF hexagon. Unscrew internal holder in cartridge, remove the two ruptured safety discs and fit new discs, as supplied, one each side of the spacing ring (Fig. 4). Tighten internal disc holder to 40 lb.ft. (54 Nm). Replace the cartridge in the valve body. Do not fit discs of unapproved design or material.

Fig. 3

REPLACEMENT SAFETY DISCS FOR ALL MODELS

Replacement safety discs available to the following specification: Blue 345 bar, (5000 psi), Red 420 bar (6000 psi). Consult Sales Office for lower pressure ratings. State the Tester model number when ordering replacements.

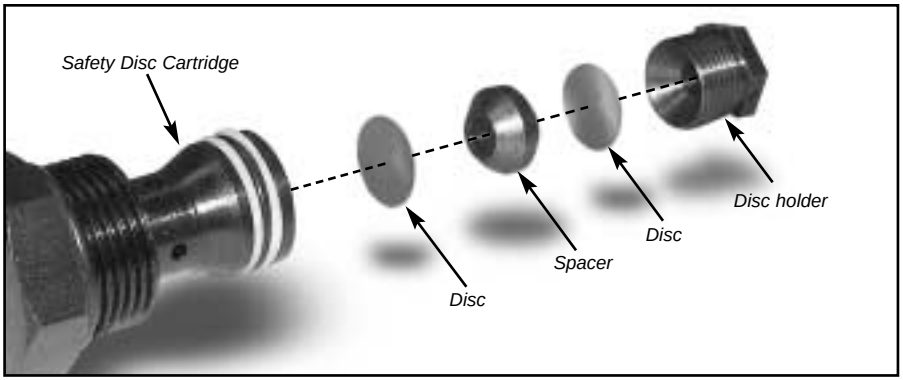


Fig. 4

LOADING VALVE
DHT401 TESTERS

If the loading valve becomes difficult to turn under pressure or will not close, remove the 4 socket screws. Check for worn valve seat, damaged or leaking seals and contamination. Note: If the pressure does not increase progressively when the loading valve is operated, check if the safety discs have been ruptured. Assemble the loading valve into the flow block ensuring that the guide pin is located in the slot on the poppet valve (Fig. 5).

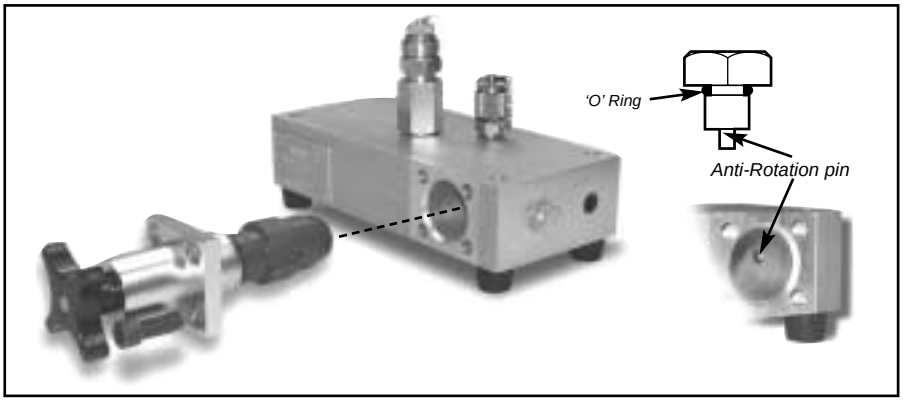


Fig. 5

SAFETY DISCS
DHT401

The loading valve is fitted with two safety discs which are designed to rupture internally at approximately 7 bar (100psi) over the maximum pressure. When the discs fail, the loading valve becomes inoperative and the oil flows freely downstream.

To replace the safety discs remove the loading valve assembly from the flow block. Unscrew the safety disc holder from the valve by carefully gripping the valve on the 30mm diameter. Remove the disc spacer and the ruptured discs from the valve and disc holder. Carefully preform the two discs by pressing them by hand between the disc holder and spacer then place one new disc inside the valve and replace the spacer. Place a second disc on top of the space and screw in the disc holder (Fig. 6). Tighten the holder to 40lb. ft. (54 Nm)

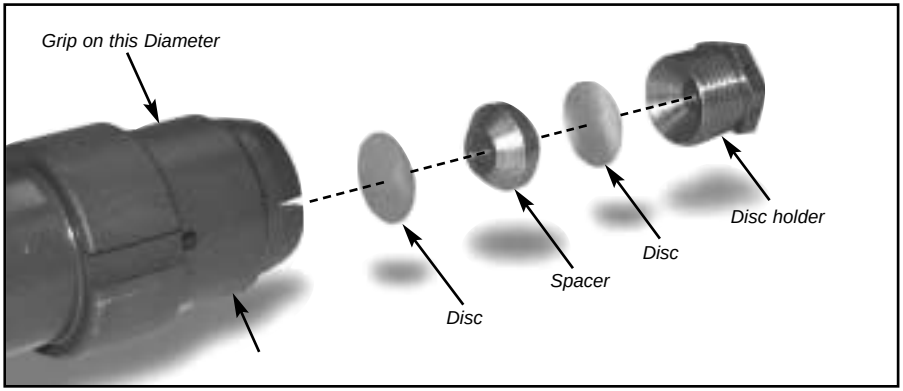


Fig 6

LOADING VALVE
DHT 751 & 751 HP TESTERS
If the loading valve becomes difficult to turn under pressure or will not close, remove the 4 bolts. Check for worn valve seat, damaged or leaking seals and contamination. Note: If the pressure does not increase progressively when the loading valve is operated, check if the safety discs have been ruptured. Assemble the loading valve into the flow block ensuring that the guide pin is located in the slot on the poppet valve (Fig. 7).

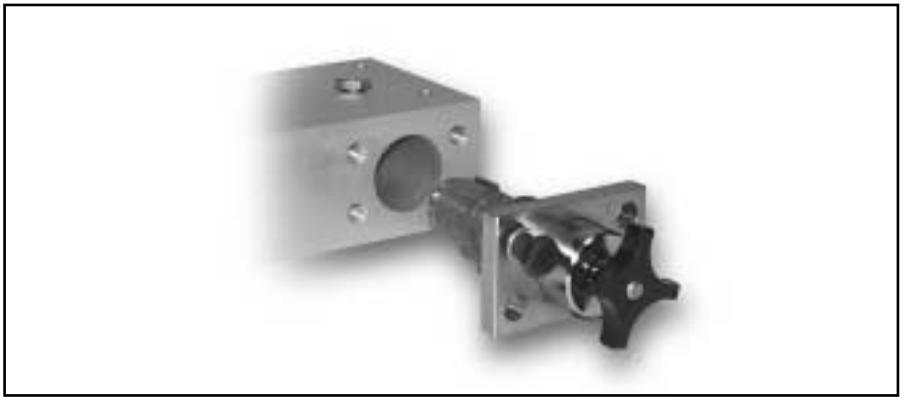


Fig 7

SAFETY DISCS
DHC 751 & DHC 751 HP
The loading valve is fitted with two safety discs which are designed to rupture internally at approximately 100 psi (7 bar) over the maximum pressure. When the discs fail, the loading valve becomes inoperative and the oil flows freely downstream.

To replace the safety discs remove the loading valve assembly from the flow block. Unscrew the safety disc holder from the valve by carefully gripping the valve on the 35mm diameter. Remove the disc spacer and the ruptured discs from the valve and disc holder. Carefully preform the two discs by pressing them by hand between the disc holder and spacer then place one new disc inside the valve and replace the spacer. Place a second disc on top of the space and screw in the disc holder (Fig. 8). Tighten the holder to 40lb. ft. (54 Nm)

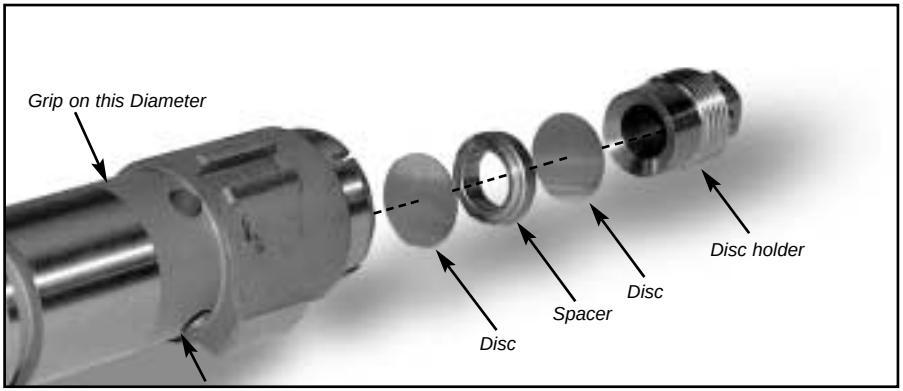


Fig 8

Specification

Pressure Gauge 0 - 420 bar 0 - 6000 psi

Models	Working Pressure (bar)	Normal Flow Range (lpm)	Maximum Flow Range (lpm)	Ports	
				English	American
DHC 51 DHC 151	0 - 420 0 - 420	10 - 60 10 - 125	2 - 60 4 - 160	Tester inlet/outlet 3/4”-14 BSPF Loading valve outlet 1/2”-BSPF	Tester inlet/outlet 1” 1/16-12 UNF SAE O-Ring Loading valve outlet 3/4”-8 UNF SAE “O”Ring
DHT 401	0 - 420	25 - 400	15 - 400	1”-12 BSPF PARALLEL	1”5/16-12 UNF SAE “O” Ring
DHT 751	0 - 350*	40 - 600	25 - 800	1” 1/2 SAE type four bolt flange Solid 350 bar/5000 psi, Split 200 bar/3000 psi	
DHT 751 HP	0 - 480	40 - 800	25 - 800	1” 7/8 UNF	

*Consult sales office for intermittent operation up to 420 bar, 6,000 psi.

TEMPERATURE 10 - 120 °C or 50 - 250 °F

GAUGE ¼” BSPF (English) ¼” NPT (American)

ACCURACY

Flow Over the normal flow range 1% full scale. Flowmeter calibrated with mineral oil, viscosity 21 centistokes.

Pressure Within 1.6% of full scale

Temperature ± 1 °C

BATTERIES

Tester 9 Volt battery, size 18 x 25 x 43mm. PP3 (UK), 64F22 (Europe), 6AM6 (Japan) A1604 (USA)