



4278
100 GPM Hydraulic Flow Meter
User Manual



Introduction

The OTC 4278 Hydraulic Flow Meter has been designed for easy connection to a hydraulic circuit so that flow, pressure and temperature can be readily checked. The Flow Meter can take full back pressure up to 6000 psi (420 bar), and the built-in loading valve enables many of the operating conditions to be simulated. The unit can be connected anywhere in the hydraulic system to test pumps, motors, valves and cylinders in both flow directions.

Safety Precautions



CAUTION: To prevent injury and / or property damage,



- Study, understand, and follow all safety precautions and operating instructions before using this equipment. If the operator cannot read instructions, operating instructions and safety precautions must be read and discussed in the operator's native language.

- No alteration shall be made to this product.

- Inspect the condition of the equipment before each use; do not use if damaged, altered, or in poor condition.

- Ensure load valve is fully open prior to testing.



- Wear eye protection that meets the standards of ANSI Z87.1 and OSHA.

Basic operation

Flow measurement

The unit measures flow using an axial turbine mounted in the aluminum base 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 electronic circuit. The electronic circuit has a built-in micro processor; the signal is amplified and linearised to maximise accuracy.

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 a fine bore capillary tube. The unit gauge has a shuttle valve which automatically reads the highest pressure in both directions of flow. A gauge port is provided on the block for the addition of a low pressure gauge.

Temperature

The thermistor temperature transducer is in contact with the oil flow and readout is on the meter scale calibrated 32 - 250°F or 0 - 120°C.

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 burst discs located in the valve assembly which internally protect the unit and machine in both flow directions.

Installation guidance

- All hydraulic connections should be made by suitably qualified personnel.
- Avoid sharp bends because high pressure hoses will deflect and straighten under pressure.
- 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 unit.
- Although the unit can be used in both flow directions, the preferred direction is indicated by the larger arrow on the panel. When used for reverse flow tests, slightly lower accuracies may be obtained depending on the oil viscosity, density and compressibility.
- The unit should be connected to the hydraulic circuit by means of flexible hoses 3 - 6 ft (1 - 2 metres) metres long.
- The use of quick-disconnect couplings can save time. Make sure the hoses are long enough so that the unit can be used safely on the machine.
- The hoses and fittings at the inlet must be of adequate size for the flow being tested. Elbows, rotary couplings etc., at the inlet and outlet ports should be avoided to ensure accurate readings.
- The use of the flexible hoses will help to isolate the unit from vibration which often exists.
- The internal burst discs are to protect the unit not the hydraulic installation. Always ensure the appropriate relief devices are fitted to protect the installation.

General Operation

All tests should be performed by suitably qualified personnel.

1. Connect the unit to the circuit (see previous page for installation guidance).
2. Ensure the pressure loading valve is fully opened by turning the knob counterclockwise.
3. Switch the unit on. If the display flashes, then the battery needs replacing.
4. Select the desired test using the front panel controls where applicable.
5. **IMPORTANT:** Ensure 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. Quick disconnect couplers **MUST** be open.
6. Start the pump momentarily to ensure there is no obstruction which could cause pressure build up.
7. Check for leaks and free flow of oil.
8. The unit is now ready for use - run the machine and adjust the loading valve as needed.
9. When the test is completed fully open loading valve.

Notes

When low pressure testing is required, connect the optional low pressure gauge with automatic cut-out valve to the flow block.

The unit has an automatic electronic system which shuts the power off after approximately 20 minutes should you forget. To reactivate, switch the unit off then switch on again.

Specification

Model Number	Flow Range	Pressure Range	Inlet/Outlet Ports
4278	2.5 - 100 gpm (10 - 400 lpm)	0 - 6000 psi (0 - 420 bar)	1-5/16" -12UN #16 SAE ORB

* per J518 SAE Code 61 standard

Ambient temperature:	41 - 104°F (5 to 40°C)
Fluid type:	Hydraulic oil
Fluid temperature:	32 - 250°F (0 to 120°C)
Flow Accuracy:	± 1% of full scale.
Pressure Accuracy:	± 1.6% of full scale.
Temperature Accuracy:	± 2°F, 1°C.

Construction materials

Case:	Painted mild steel
Flow block:	High tensile aluminum
Seals:	FKM

Battery Details

PP3 9 volt Alkaline (IEC6LR61, ANSI/NEDA 1604A)

Dimensions and Weight

Model	Height	Width	Depth	Weight
4278	9.45" (240 mm)	7.87" (200 mm)	7.87" (200 mm)	14.33 lbs (6.5 kg)

Fluid viscosity

The performance of a turbine flow meter can be affected by the viscosity of the fluid measured. Our turbine flow meters are calibrated at between 18 and 26 cSt as standard (a mean viscosity of 21 cSt), which is the typical kinematic viscosity for a hydraulic fluid operating at 50 °C. The kinematic viscosity of all hydraulic fluids is related to the fluid temperature and the table below shows the affect of temperature on the kinematic viscosity of a range of typical grades of hydraulic oil.

The shaded area of the table shows the range of viscosities that can be measured by a flow meter with standard calibration with minimal effect on the accuracy (less that ± 1% FS).

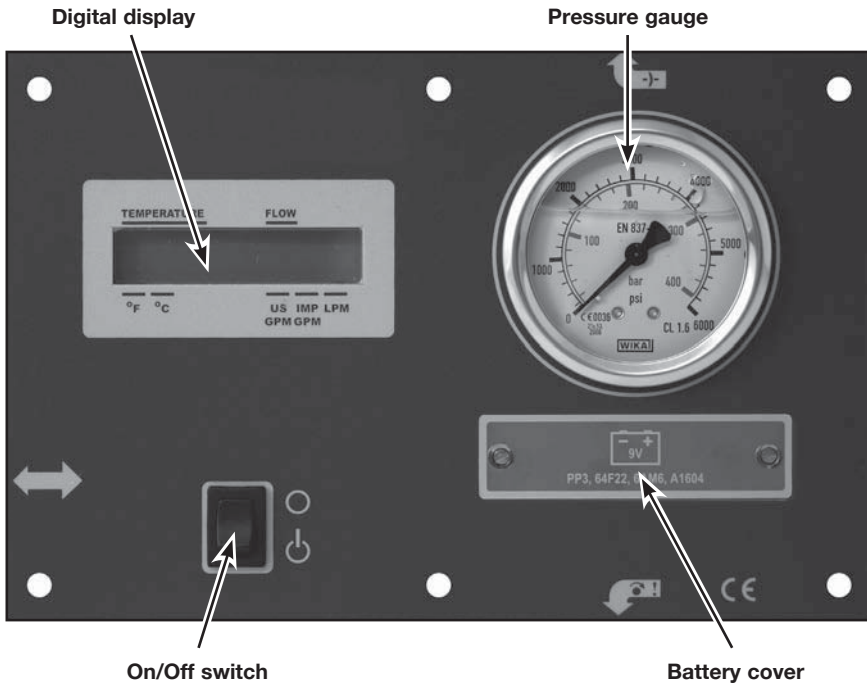
Flow meters can be specially calibrated at a different viscosity to the standard or we can advise on the expected error when the flow meter is used at other viscosities, please contact sales for further information.

Table showing kinematic viscosity (cSt) of different mineral oils at specific temperatures

Temp °C	Fluid type					
	ISO15	ISO22	ISO32	ISO37	ISO46	ISO68
0	85.9	165.6	309.3	449.9	527.6	894.3
10	49.0	87.0	150.8	204.7	244.9	393.3
20	30.4	50.5	82.2	105.5	127.9	196.1
30	20.1	31.6	48.8	59.8	73.1	107.7
40	14.0	21.0	31.0	36.6	44.9	63.9
50	10.2	14.7	20.8	23.9	29.4	40.5
60	7.7	10.7	14.7	16.5	20.2	27.2
70	6.0	8.1	10.9	12.0	14.6	19.2
80	4.8	6.4	8.4	9.1	11.1	14.3
90	4.0	5.2	6.6	7.2	8.7	11.1
100	3.3	4.3	5.5	6.0	7.1	8.9

ISO 15, 22, 32, 46 and 68 based on typical figures for the Esso Nuto range of HM oils. ISO 37 based on Shell Tellus HM oil.

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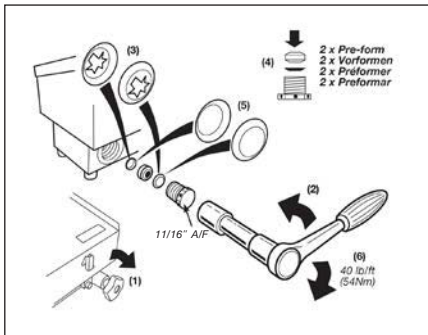


Maintenance and service

Battery replacement

- Turn the unit off.
- Loosen the two screws on either end of the battery cover.
Note: They are captive screws.
- Carefully remove battery and disconnect.
- Connect new battery (See page 4 for details), place in unit and replace battery cover.
Note: Only replace with similar size and type of battery.

Replacement of burst discs (No. 573736)



- Disconnect the unit from the hydraulic circuit
- Locate the new discs - the unit is shipped with spare discs located in the block
- Screw the load valve fully shut - (clockwise)
- Unscrew the disc holder from the valve
- Remove the disc spacer and ruptured discs from the valve and disc holder
- Carefully shape the two new discs by pressing them by hand between the disc holder and spacer
- Place the first disc inside the valve
- Replace the spacer
- Place the second disc on top of the spacer
- Screw in the disc holder, tighten to 40 lb.ft (54 Nm)
- Unscrew the load valve fully
- Re-connect the unit if required

Calibration

Flow measurement equipment, such as flow meters and flow blocks, should be calibrated annually or after every 2,000 hours of use. Calibrate the equipment more frequently if it is used or stored in environments where the equipment is exposed to dust or vibrations.

Accessories

Only use approved parts and accessories, using other parts could cause permanent damage or compromise safety.