

OPERATING AND MAINTENANCE

INSTRUCTIONS

FOR A

FIG 380D

SERIAL Nos:-

2 2 5 1 2

BASE

PISTON / CYLINDER

491 C

UNIT

Budenberg Gauge Co. Limited
Broadheath near Manchester

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PACKING LIST

- 1) For All Models
- The Tester Carton Contains :-
- a) 1 base
 - b) 2 - 500ml bottle of oil (not with Fig. 380CW or Fig. 380MW)
 - c) 4 Handwheel spokes
 - d) 1 Tool Roll Containing :-
 - 1 - Hexagon Wrench Key 3mm A/F
 - 2 - 30mm a/f Spanners
 - 1 - Spirit Level
 - 4 - Level Plates
 - 1 - Bag of Seals
 - 1 - 1/2 in. B.S.P. Angle Connection
 - 1 - Pointer Punch
 - 1 - Pointer Remove

SET OF CONNECTIONS AS ORDERED

<u>B.S.P.</u>		<u>A.P.I.</u>	<u>METRIC</u>
1 - 1/8 in.	1 - 1/8 in.	1 - M12 x 1.5	
1 - 1/4 in.	1 - 1/4 in.	2 - M20 x 1.5	
1 - 3/8 in.	1 - 3/8 in.		
1 - 1/2 in.	2 - 1/2 in.		

For Fig.380C or Fig.380CW ONLY

2 - Gauge Stands

FOR ALL OTHER MODELS

- 1 - Gauge Stand
- 1 - Piston/Cylinder Unit (See pge 2)
- 1 - Set of weights as listed on page 2 - supplied in separate carton.
- 1 - Set of fine increment weights (if ordered)
- 1 - Fig.27 two gauge stand (if ordered)
- 1 - Fig.25 oil seal (if ordered)

JUNE 1990

PACKING

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OPERATING DATAOil Specification (Not for Fig. 380CW)

A hydraulic mineral oil viscosity 10 to 37 cSt at 40°C (Viscosity Grade VG10 to VG37 to ISO3448 (BS4231) should be used. The more viscous oils give lower leak rates at higher pressures (say above 100 bar) and the less viscous oils give greater sensitivity at lower pressures.

See Specification Sheet 3/39 in Appendix.

For the convenience of users 2 x 500ml bottles of oil viscosity grade VG15 are supplied with each tester. Most users will be able to obtain a suitable oil locally.

Do not use other liquids. Castor based oils, Skydrol, solvents or similar fluids will attack the seals fitted in the standard tester.

Send queries to Budenberg Gauge Co. Ltd.

Fig.380CW and Fig.380MW only

Use Distilled or De Mineralised Water

Pressure Rangesa) Comparator

Fig.380C – Maximum Pressure on Low Pressure System 140 bar or 2000 lb/in²
and on High Pressure System 1200 bar or 17000 lb/in².

Fig.380CW – Maximum Pressure on Low Pressure System 140 bar or 2000lb/in² and
on High Pressure System 700bar or 10000lb/in².

OPERATING & MAINTENANCE INSTRUCTIONS

FIG. 380

b) DEAD-WEIGHT TESTERS

Weights Supplied

1) Fig. 380L
Area = 1/16 in²
Range 1-120 bar (or kg/cm²)
or 10-1600 lb/in²

bar (or kg/cm ²)	4 x 20	1 x 18	1 x 10	2 x 4	1 x 2	2 x 1	1 x 0.5
lb/in ²	6 x 200	1 x 180	1 x 100	2 x 40	1 x 20	2 x 10	1 x 5

2) Fig. 380M and Fig. 380MW.
Area = 1/40 in²
Range 2-300 bar (or kg/cm²)
or 30-4000 lb/in²

bar (or kg/cm ²)	4 x 50	1 x 45	1 x 25	2 x 10	1 x 5	1 x 2.5	1 x 3
lb/in ²	6 x 500	1 x 450	1 x 250	2 x 100	1 x 50	1 x 25	1 x 20

Make up to 2

3) Fig. 380D
(Dual Range)
Area = 1/8 & 1/80 in²
Range 1-600 bar (or kg/cm²)
or 10-8000 lb/in²

bar (or kg/cm ²)	4 x 10/100	1 x 9/90	1 x 5/50	2 x 2/20	1 x 1/10	1 x 0.5/5
lb/in ²	6 x 100/1000	1 x 90/900	1 x 50/500	2 x 20/200	1 x 10/100	1 x 5/50

Make up to 1/10

4) Fig. 380HX
(Dual Range)
Area = 1/8 & 1/160 in²
Range 1-1200 bar (or kg/cm²)
or 10-16000 lb/in²

bar (or kg/cm ²)	4 x 10/200	1 x 9/180	1 x 5/100	2 x 2/40	1 x 1/20	1 x 0.5/10
lb/in ²	6 x 100/2000	1 x 90/1800	1 x 50/1000	2 x 20/400	1 x 10/200	1 x 5/100

Make up to 1/20

INSTALLATION - GENERAL

Assembly

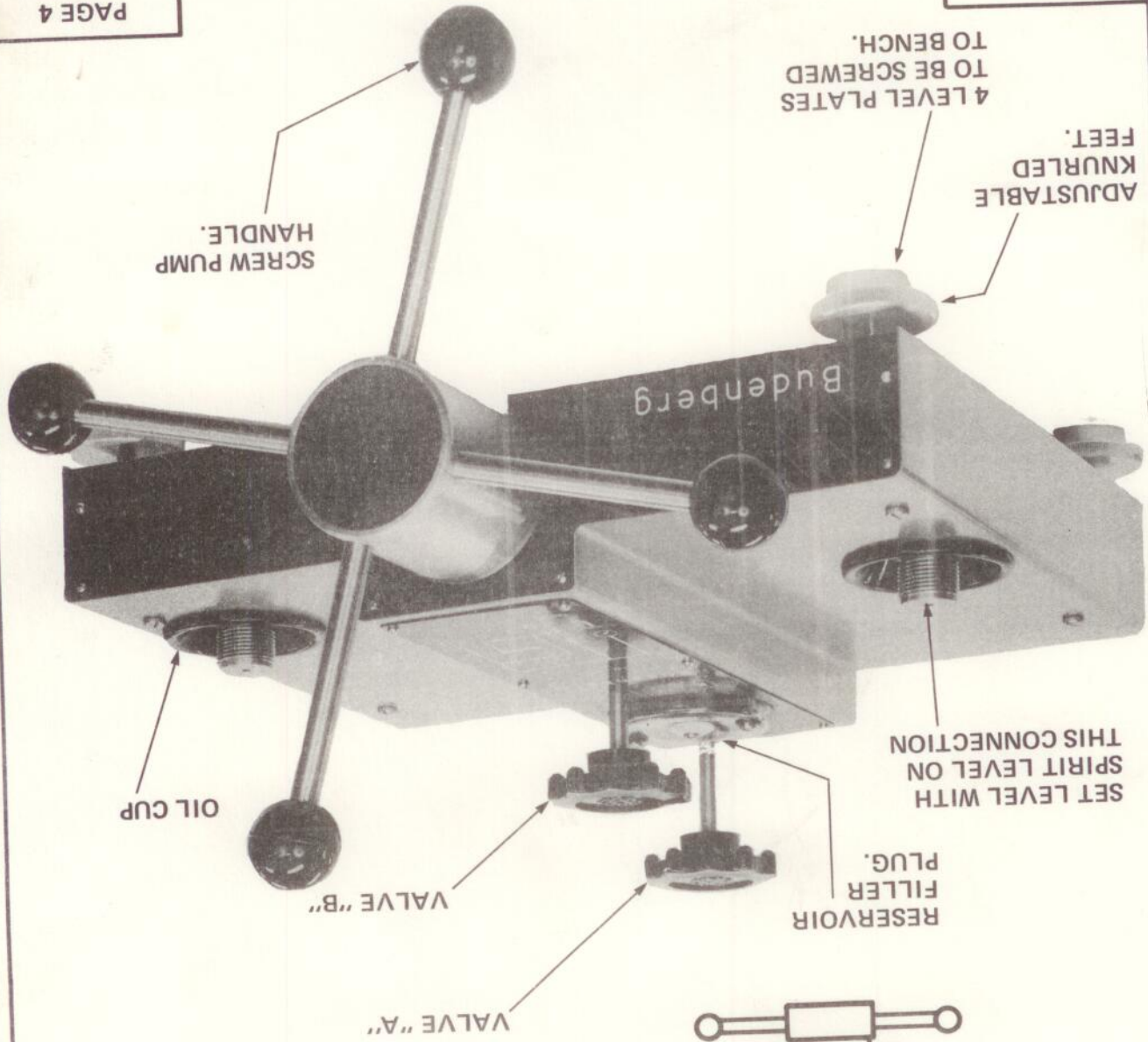
The base should be mounted on a firm bench about 0.9m high. For all Models, except fig. 380C, space is required for storing the weights on the left hand side of the bench.

The four level plates should be positioned and screwed to the bench to ensure that the tester is rigid. The centre line of the front plates should be about 40mm from the front edge of the bench to allow adequate clearance for the handwheel. Screw in the four handwheel spokes into the hub.

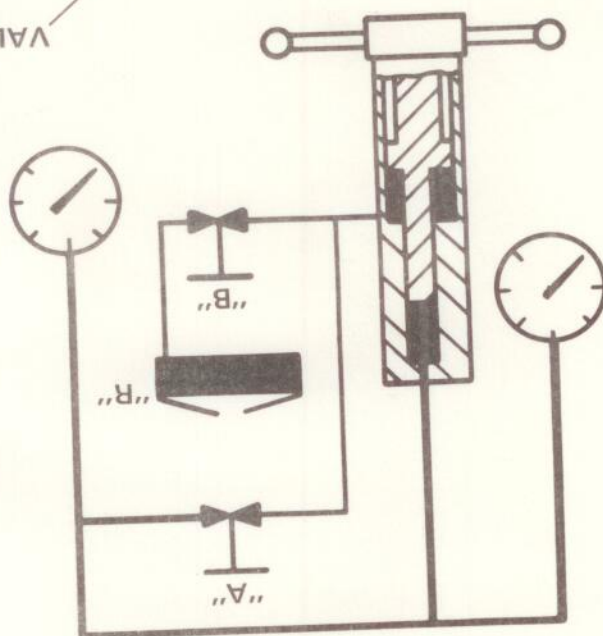
Set level by adjusting the four knurled feet and using the spirit level provided. See page 4.

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PAGE 4



CIRCUIT
DIAGRAM



OPERATING & MAINTENANCE INSTRUCTIONS

FIG 380

FIG. 380C & CW COMPARATOR

Assembly

- 1) Having set up the base as described on page 3. Screw in place the two gauge stands. Ensure that the mating faces are absolutely clean and the 12mm dia. 'O' ring seal is correctly located in its recess. Excess force is not required.

- 2) Fit the gauge under test using the appropriate adaptor to one gauge stand and the standard test gauge to the other. See page 7. For suitable Test Gauges see our catalogue section 1C and Super Test Gauge Leaflet. Joints should be made using the bonded seals provided or if preferred copper or leather washers. The loose nuts on the tester base enable gauges to be positioned as required, and for back connection gauges the adaptor is to be replaced by the angle connection.

Dirty or chemically contaminated gauges should not be fitted as they contaminate the comparator unless they are first cleaned - See Data Sheets 1/162A&B.

Operation

Filling

- 1) Remove Filler Plug from reservoir by slackening screw and prising rubber plug out. (This plug should be left out whilst in use).

- 2) Open valves A and B.
- 3) Wind screw pump handle fully clockwise.
- 4) Fill reservoir with appropriate liquid. See page 1.
- 5) Wind screw pump handle fully anti-clockwise.
- 6) Top up reservoir if necessary.

The comparator is now ready for use.

For pressures up to 140 bar

- 1) Close valve B (Valve A remaining open).
- 2) Wind screw pump handle clockwise.

This will generate pressure up to approximately 140 bar or 2000 lb/in².

For pressures above 140 bar

Close valve A and open valve B continue to wind screw pump handle clockwise.

To lower and release pressure

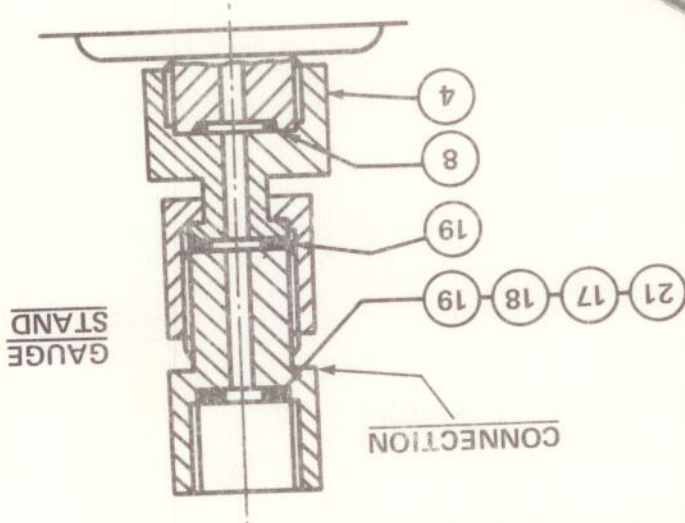
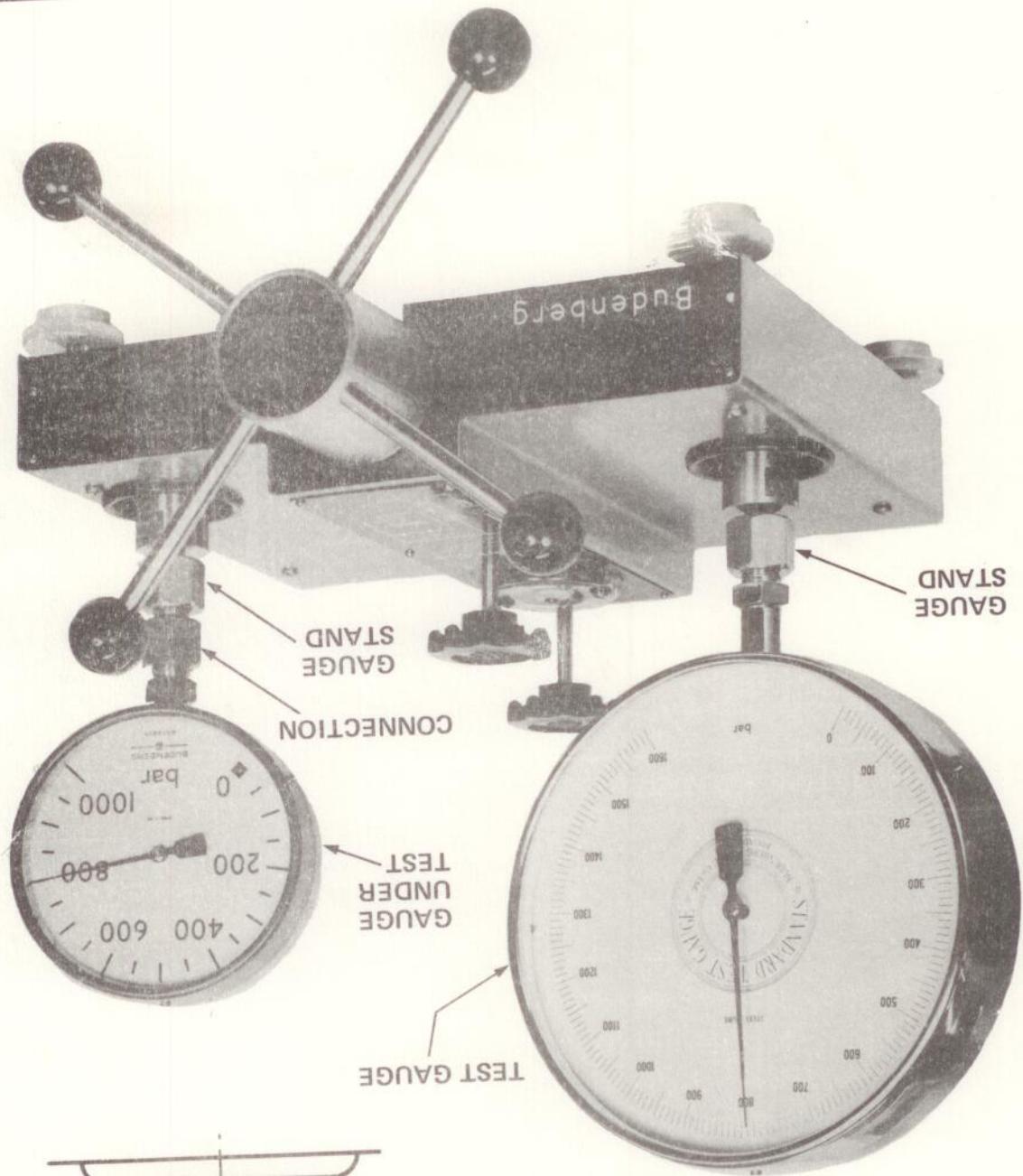
Wind screw pump handle fully anti-clockwise and then open valve A.

The comparator is now ready for another test and any residual pressure is relieved.

Notes

1) When testing equipment with a large volume, the capacity of the screw pump (65cc) may be insufficient to reach the pressure required. In this case the equipment should be filled as far as possible with the liquid before connecting it to the comparator, so that the displacement needed is reduced.

2) The Fig.380CW is supplied in the oil free condition for use on water. It should always be kept clean and free from contamination and instruments must always be cleaned as shown on Data Sheets 1/162A&B.



DEAD-WEIGHT TESTERS

Assembly

For general installation see page 3.

Fit the Piston unit to the L.H. connection and the gauge stand to the R.H. connection see page 10. Ensure that the mating faces are absolutely clean and the 12 mm dia. 'O' ring seals are correctly located. Excess force is not required.

Level the tester by using the levelling screws, with the spirit level on the Piston unit weight carrier.

Fit the appropriate connection to the gauge stand, using a bonded seal to make the joint and screw the gauge to be tested into position, also with a bonded seal. If preferred, a copper or leather washer can be substituted for the bonded seal at the gauge. The loose nut on the tester base enables the gauge to be positioned as required and for back connection gauges the loose connection is replaced by the angle connection.

The pressure datum of the tester is at the base of the piston and is marked on the Piston units (see page 9).

Dirty or chemically contaminated gauges should not be fitted as they contaminate the tester unless they are first cleaned. Severe damage may otherwise be caused to the piston/cylinder unit — See Data Sheets 1/162 A & B.

Operation

Fig.380 L, 380 M & 380 MW

1) Load the weight carrier with the weight equivalent to the desired pressure. Do not forget to take the weight of the carrier into account. Each weight is marked with the pressure equivalent and the piston area. The fig.380 L has a basic 10 lb/in² start, for other pressure units a make up weight is added to the weight carrier for conversion to 1 bar (or kg/cm²). The Fig.380 M and 380 MW uses a central screw weight which should be changed for the various pressure units to give basic starts of 30 lb/in² or 2 bar (or kg/cm²).

2) Fill and apply pressure as described on page 5 until the piston rises and the head is floating. The weights should be rotated by hand. The Fig.380 L piston is floating when the underside of the piston head has risen between 1 mm to 7 mm above the top face of the cylinder. The Fig.380 M and 380 MW piston is floating when the bottom edge of the auxiliary cylinder fitted to the piston head has risen to a position within the knurled portion on the stud fitted to this unit.

NOTE:

The Fig.380 MW is supplied in the oil-free condition for use on water (see Page 1). It should always be kept clean and free from contamination and instruments must always be cleaned as shown on Data Sheets 1/162 A & B.

When testing gauges on liquid it is occasionally necessary to take into account heads of liquid since a height difference of 10 mm corresponds to approximately 1 mbar. The datum levels of the Fig. 380 L, D and HX units are marked with a groove on the outer diameter of the piston unit adaptor. The datum of the Fig. 380 M and 380 MW is at the bottom of the knurled portion of the stud fitted to the unit.

It should be noted that when the tester is re-calibrated by a laboratory other than Budenberg, the datum level at which the tests have been carried out may differ from this standard and therefore allowance should be made for any variation.

Note on datum levels

contact Budenberg Gauge Co. Ltd.

If the volume required to be filled is very large requiring the use of an additional pump and reservoir to be connected to the tester it is ESSENTIAL to ensure that Valve B is kept open and Valve A closed at all times otherwise a high pressure can be built up on the low pressure ram of the screw press and damage caused. To ensure this does not happen we can supply the tester fitted with a relief valve which will release at a set pressure should the valve operation be incorrect. Alternatively we can supply a modified tester and hand pump for this operation. For further information on both items

Caution

After the test is finished stop the weights rotating, wind back the screw pump as far as possible, and open the valves. The tester is now ready for another test and any residual pressure is relieved. When testing equipment of a large volume the capacity of the screw pump may be insufficient to reach the pressure required. In this case the equipment should be filled as far as possible with oil before connecting it to the tester so that the displacement needed is reduced.

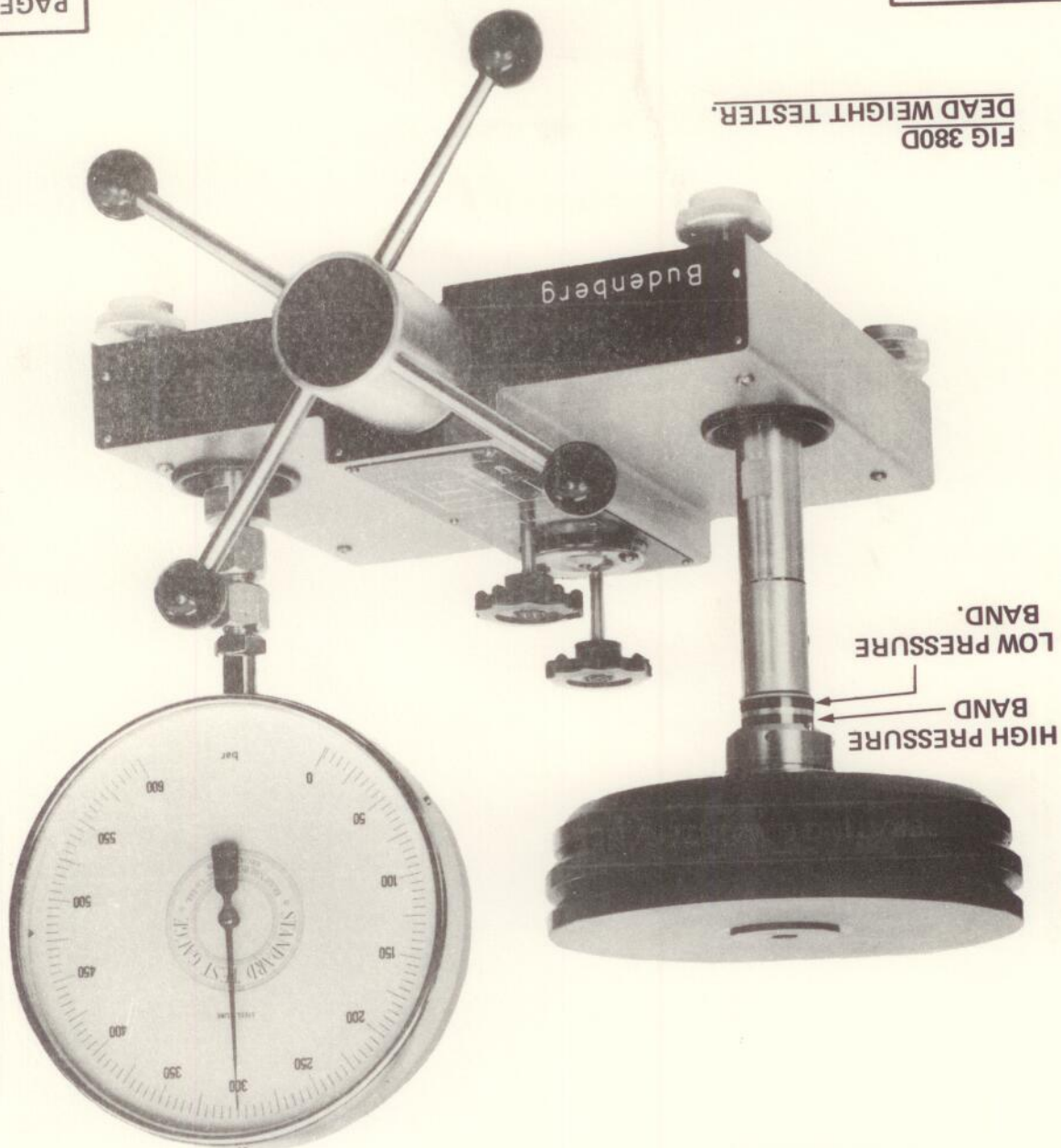
It is desirable that the weights should only be rotated when approximately the correct pressure is obtained. For any Dual Range Unit changing from one range to the other with the weights spinning does no harm. Weights should not be brought to rest by fully releasing the pressure and allowing the piston head to rotate against its stop under the full load of the weight pile. Stops come into action if the pressure is too high or too low and it is essential that the weights should be spinning freely whilst taking readings. At the lowest pressures the weights will not spin for more than a few seconds unless a very thin oil is used, see page 1, but provided the weight is rotated by hand immediately before taking a reading and is obviously 'floating' an accurate reading will be given. When the tester is correctly set up and there are no leaks the piston head should 'float' for many minutes without it being necessary to touch the screw pump handwheel. On the initial setting up, however, there may be some air trapped in the base of the piston/cylinder unit. As this leaks past the piston the weights may fall slightly but it will only be for a matter of a few minutes until the air has escaped. If the piston continues to fall check the connections for leaks. After the test is finished stop the weights rotating, wind back the screw pump as far as possible, and open the valves.

General

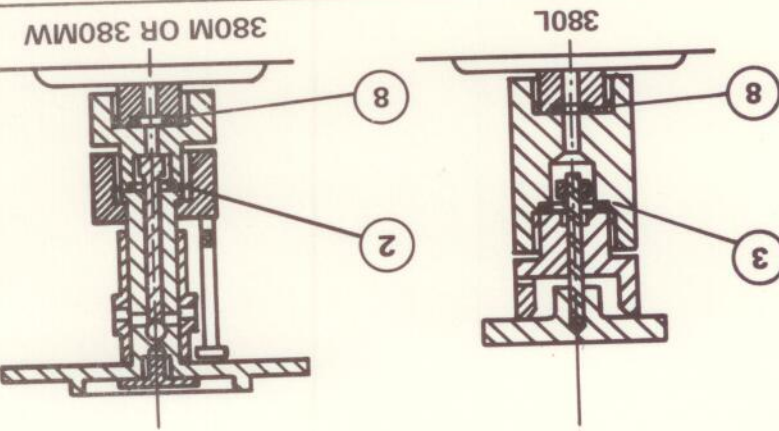
- 1) Load the weight carrier with the weights equivalent to the desired pressure. Each weight is marked with two pressures, one for the low pressure range and one for the high pressure range and the equivalent weight of the carrier must also be taken into account. The testers have a basic 10 lb/in² start, for other pressure units a make-up weight is added to the weight carrier for conversion to 1 bar (or kg/cm²).
- 2) Fill and apply pressure as described on page 5 until the piston rises and the piston head skirt floats within the blue band which corresponds to the low pressure range. The bands are easily visible from a seated position. The weights should be rotated by hand.
- 3) To engage the high range apply further pressure with the screw pump until the piston lifts higher and the piston head skirt floats within the red band.

Fig. 380D & HX

FIG 380D
DEAD WEIGHT TESTER.



HIGH PRESSURE
BAND
LOW PRESSURE
BAND.



TYPES OF PISTON/CYLINDER UNITS

FIG. 380

MAINTENANCE

General

1) Oil Operation

Keep the tester and weights clean and free from spilt oil, wipe out the oil cups under the gauge stands as necessary. A slight leakage through the vent hole of the piston/cylinder unit is normal, but this should not be excessive unless working frequently at high pressures with a thin viscosity oil.

If the oil in the tester becomes dirty, use the screw pump to flush through the clean oil with a drain screwed in the gauge stand. (The angle connection is suitable). The screw pump should be turned fully clockwise before starting. Remove the Piston/Cylinder unit complete and wipe away any dirt that has accumulated on the thread on the base. It is advisable not to dismantle this unit. See page 13. Do not use any cleansing solvents as they may damage the seals.

2) Oil Free Operation—Fig.380 CW and 380MW

Keep the comparator or tester clean and free from surplus water wipe out the cups under the gauge stands as necessary and keep weights free from spilt water. A leak through the vent hole of the piston/cylinder unit is normal.

If the water in the comparator or tester becomes contaminated then drain completely and fully dismantle ALL parts. Degrease ALL contact parts, re-assemble and fit new seals. If Fig.380 MW remove the piston/cylinder unit complete and wipe away any dirt that has accumulated on the thread on the base. It is advisable not to dismantle the unit. See Page 13.

With normal use no further maintenance should be necessary. If required, the tester or comparator can be returned to our works for re-conditioning but each unit is dealt with below in detail in case this course is not possible. Accuracy, overhaul and re-certification is explained in the leaflet in the appendix.

To Remove Cover

- 1) Drain as much oil as possible from tester by winding the screw press fully clockwise and using a drain screwed in the gauge stand see 1 above.

- 2) Unscrew the gauge stand(s) and/or Piston/Cylinder unit.

- 3) Remove the oil cups. Which must be carefully levered upwards.

- 4) Slacken the socket set screws using a 1/8 in. hexagon wrench key and remove both valve handwheels.

- 5) Remove the four cover retaining screws and lift off the cover.

Reservoir Seals

- 1) Unscrew two screws and remove the reservoir cover.

- 2) Remove the 'O' ring seal item 6 from the recess and the Seloc seal item 7 from the screws.

- 3) On replacement ensure all sealing faces are absolutely clean and do not overtighten screws.

Valve Seals

- 1) Unscrew the gland nut.
- 2) Unscrew the valve spindle and remove the bonded seal.
- 3) Slide gland nut off spindle.
- 4) Using a suitable hooked tool remove the 'O' ring seal item 8 from the bore of the gland nut. Renew 'O' ring and bonded seal item 9.
- 5) On replacement ensure that 'O' ring is correctly located in the groove and all sealing faces are clean. Remove all burrs from spindle.

Screw Pump

- 1) Using a 4mm hexagon wrench key unscrew the six socket head cap screws securing the hub locating plate. (These are positioned inside the recess in the back of the aluminium hub).
 - 2) By carefully pulling the hub the complete ram assembly can now be withdrawn from the barrel. (During this operation a container is required beneath the barrel to catch any liquid).
 - 3) Unscrew the ram from the hub assembly.
 - 4) The high pressure seal item 10 and low pressure seal item 11 can now be replaced. Note:— the H.P. Seal is retained by a screw and locating ring. Check that the ram is not scored on the locating diameters.
 - 5) At this point the hub assembly should be checked for excess play indicating wear in the bearings and for wear in the screwed spindle and nut. If any wear is found it will be necessary to dismantle the hub assembly (See next section).
 - 6) Check that the bore of the barrel item 12 is not badly scored or pitted. If the barrel is to be replaced or the seal item 13 is to be renewed the barrel is removed from the block by unscrewing the six socket head cap screws. The seal fits in a recess in the block and should be carefully prised out, taking care not to scratch the sealing face.
 - 7) Check that the bore of the block, item 20, is not badly scored or pitted. If a replacement is required this item is supplied complete with valves. The block is attached to the base by four socket head cap screws.
 - 8) Re-assembly is a straightforward reversal of the above procedures.
- NOTE:—
- a) On assembly care should be taken to align the ram to prevent bending, or damage to the seals. Excessive force should not be used.
 - b) The socket head cap screws are not spaced equally around the locating flanges so check hole alignment before inserting screws.

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Piston/Cylinder Unit

The Piston/Cylinder Unit Item 1 is made to extremely fine limits of accuracy and it is not advisable to dismantle it. If it is necessary to clean it the piston and cylinder bore must be oiled immediately, in order to protect the high grade finish. In the case of Fig. 380 MW only this should be cleaned and left dry.

Should the unit become damaged it should be returned complete for replacement or repair. Parts from different units are not inter-changeable as they have to be weighed and evaluated as a whole.

The serial Number of the piston/cylinder unit appears in the Certificate of Accuracy and is marked on the body of the unit. This number, as well as the tester serial number should always be quoted in correspondence concerning the piston/cylinder unit.

As the unit represents a high proportion of the total value of the tester it should always be handled with care and every effort made to keep it clean and the connection should be blanked if it is removed from the tester. If the unit is taken off for any reason it should be stored upside down resting on the weight carrier.

Lubricate the thread with molybdenum disulphide grease and screw into ram nut.

Clamp these items together to eliminate end play and re-assemble spring pin. If using new spindle drill through 6.2mm dia. to fit pin.

molybdenum disulphide grease.

6) Assemble the thrust bearing, locating plate and hub on to the spindle lubricating with

5) The nut and spindle can only be replaced as a matched pair, sub-assembly 14B. Unscrew the nut from the ram, gripping in a soft jaw vice and screw in the new nut.

The thrust bearing item 16 is renewed as a complete assembly.

If the flanged bush item 15 is to be renewed, it should be pressed out of the locating plate and a new one pressed in squarely.

4) The hub locating plate and thrust bearing can now be removed from the spindle.

3) Knock out the spring pin item 14A, found at the bottom of one of the tapped spoke holes in the hub, using a punch of 6mm dia. and pull off hub.

2) Unscrew the spokes from the hub.

1) Unscrew the ram from the spindle. Note:— Left Hand thread.

Hub Assembly

SPARES LIST

Unit	Item	Description	Part No.
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Piston/Cylinder Unit (Not for Fig.380CW)	1	Piston/Cylinder Assembly	QA/672
		Fig.380L	QA/474

		Fig.380M	QA/674
		Fig.380D	R/4290
		Fig.380HX	QA/2069

2 *	'O' Ring	200 015 4470
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3 *	'O' Ring	200 114 4490
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4	Gauge Stand	PA/4918 +
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5	Plug Assembly	PA/5158
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6 *	'O' Ring	200 149 4460
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7 *	Seloc Seal	435-004-1574-91
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8 *	'O' Ring (also used on stands)	200 611 4490
-----	--------------------------------	--------------

9 *	Bonded Seal	400-510-4490-41
-----	-------------	-----------------

10 *	H.P. Seal	S-55044-0127-42
------	-----------	-----------------

11 *	Distributor Seal	DE 125075
------	------------------	-----------

12	Barrel	PA/4657 +
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13 *	Bonded Seal	400-015-4490-41
------	-------------	-----------------

20	Block Assembly	QA/1001+
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14A	Spring Pin	PA/5237
-----	------------	---------

14B	Sub-assembly nut, pin & spindle	PA/5159
-----	---------------------------------	---------

15	Flanged Bush	PA/4188
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16	Needle Thrust Bearing	PA/3761
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17 *	Bonded Seal 1/8 in. BSP	400-003-4490-41
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21 *	Bonded Seal 1/4 in. BSP	400-306-4490-41
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18 *	Bonded Seal 3/8 in. BSP	400-007-4490-41
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19 *	Bonded Seal 1/2 in. BSP	400-008-4490-41
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Gauge Connections

Hub Assy.

Screw Pump

Valves

Reservoir

Gauge Stand

This list covers all the items subject to wear. Any enquiries should be addressed to Budenberg Gauge Co. Ltd.

Items marked thus * are contained in the bag of seals supplied with the tester which is also available as a spare.

Ordering Spares

When ordering spares or making enquiries always give :-

1) Tester Fig. No. (on front of this manual)

2) Tester Serial No. (on Nameplate)

3) Description of Part. See above.

4) Item No. See above. (Add suffix CW or MW to Part No's indicated +, when required for use on Fig.380 CW or 380 MW).

Whilst every effort is made to ensure that the correct parts are supplied, this cannot be guaranteed unless full information is given.

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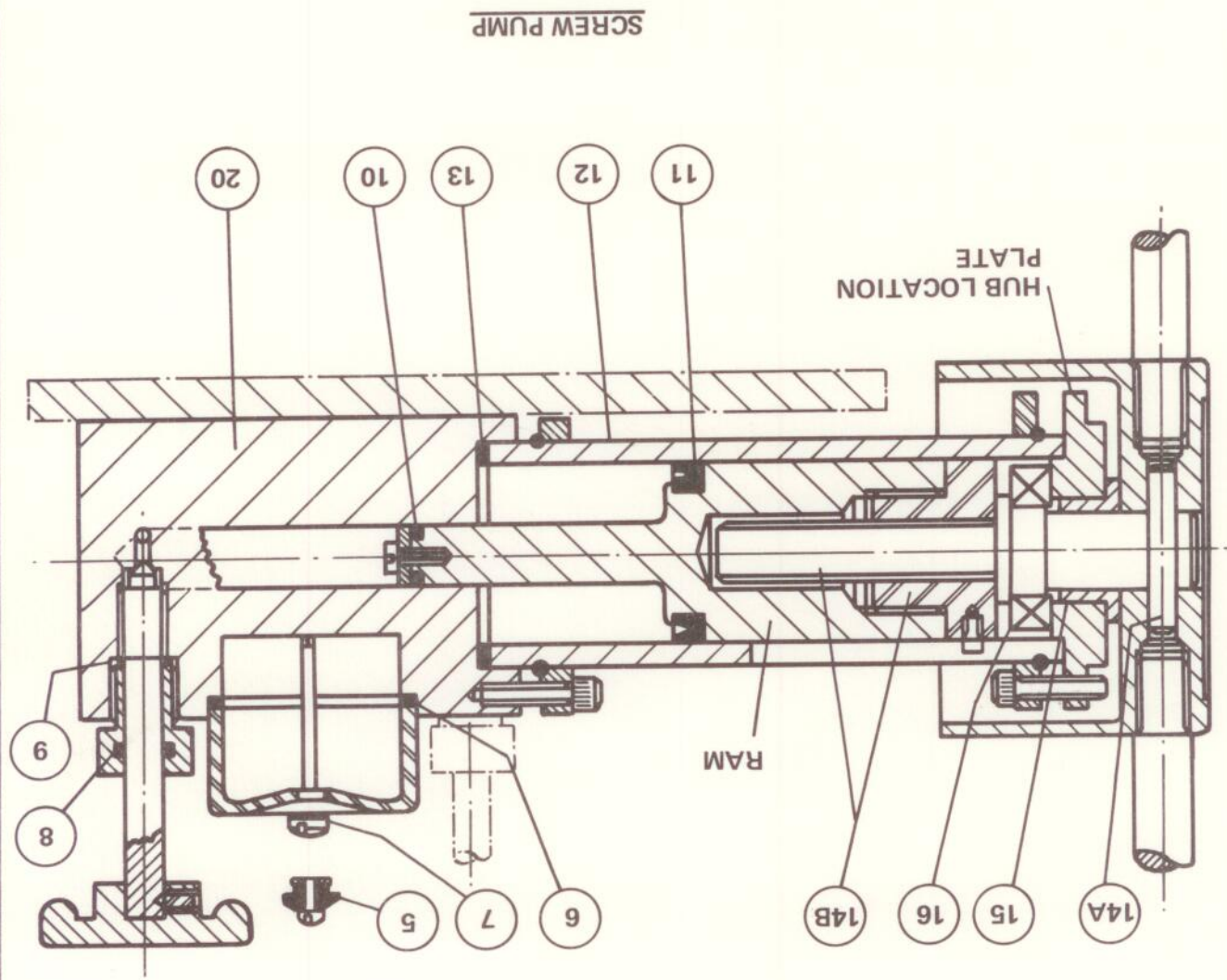


FIG.380

OPTIONAL EXTRAS

Fig. 29 Power Rotation Unit

This can be used with fig. 380D&H testers only.

It consists of a motor rotating the weights at a constant speed, and saves operator fatigue during prolonged testing.

Oil Free Testing

1) The fig.28 oil seal has a synthetic rubber sac which separated the oil in the tester from the fluid on which the gauge is to be tested. It can be used on any tester up to its maximum working pressure of 600 bar or 8500 lb/in².

2) The fig. 25 oil seal is similar to above but with a smaller displacement and for use up to 1200 bar or 17000 lb/in².

3) The Fig.380 CW is supplied in an oil free condition for use on water.

4) The Fig.380 MW is supplied in an oil free condition for use on water and covers the range 2 to 300 bar or 30 to 4000 lb/in².

Fine Increment Weights

Extra weight sets to give fine increments of pressure less than those listed on page 2 can be supplied for use with all Piston/Cylinder units. See catalogue Section 3 for full details.

Fig.27 - Two-Gauge Stand

This is available for the testing of two gauges simultaneously.

Note

- 1) Any fig.380C comparator can be converted to any dead-weight tester by the addition of the appropriate Piston/Cylinder unit and weights.
- 2) Any dead-weight tester can be converted to a fig.380C comparator with the addition of an extra gauge stand.

See Section 3 catalogue on above and other test equipment or contact Budenberg Gauge Co. Ltd.

Fluids for hydraulic dead-weight testers

Mineral oils

For hydraulic dead-weight testers Fig. numbers 279, 360, 370 and 380 we recommend a hydraulic mineral oil viscosity 10 to 37 cSt at 40°C. [Viscosity grade VG10 to VG37 as ISO 3448 (BS4231)]. The more viscous oils give lower fall rate at higher pressures, say above 100 bar, and the less viscous oils give greater sensitivity at lower pressures.

Most users will be able to obtain locally a suitable oil (see below) as used in hydraulic machinery. However for the convenience of users we do stock a 500ml bottle of oil, viscosity grade VG15.

Oils suitable for testers

ISO 3448 viscosity grade	Approx SAE viscosity classification	Shell	Esso	Mobil
VG10	5W	Tellus R10	Nuto H10	Velocite No. 6
VG15	-	Tellus T15 Tellus V15	Nuto H15	-
VG22	-	Tellus 22 Tellus R22	Nuto H22	DTE 22
VG32	10W	Tellus V32	Nuto H32	DTE Oil Light DTE 24
VG37	-	Tellus 37 Tellus R37 Tellus T37 Tellus V37	-	-

Skydrol 500B

Fig. 380 testers for use on Skydrol 500B (a Monsanto product) or other phosphate ester based fire resistant fluids should be ordered fitted with EP seals and tested on Skydrol. EP seals are not suitable for mineral oils.

Water

Fig. 380MW tester is made for use on water and has a tungsten carbide piston unit.

Brake fluids

Fig. 380 testers for use on non petroleum base brake fluids should be ordered fitted with EP seals and tested on the fluid. This fluid is known by the following names:
FMVSS No. 116 DOT 3 or DOT 4,
SAE J 1703,
BS AU 174; Part 2,
ISO 4925.

Other fluids

Fig. 279 and Fig. 380 testers can be used on silicone base fluids sebacate ethers such as Fluorolube, Fomblin, Halocarbon, which are of the viscosity mentioned above and are chemically inert, being suitable for contact with metals and with the nitrile seals which are standard on the tester. The tester can be supplied as standard tested on mineral oil for user to clean and fill, or alternatively the tester can be supplied cleaned and tested on any suitable fluid readily available in UK.

DATA SHEET

No.

1/162A

CLEANING GAUGES

Warning:

It is not advisable to degrease gauges with non-stainless steel Bourdon tubes since a very small amount of corrosion on the bore of a Bourdon tube can cause inaccuracies of reading and early failure of the tube.

This method of cleaning gauges is not suitable when gauges are to be used on oxygen, as complete removal of oil is not assured. Refer to Manufacture.

Equipment

This consists of a syringe and a special needle with the point bent through 90°.

Instructions for Use:

1. Fill syringe with solvent (Trichloroethylene, for example).
2. With gauge connection pointing upwards, put needle into connection and insert by feel the point into the hole leading to the tube. (See illustration).
3. Inject the solvent. Ideally the tube should be half full.
4. Shake gauge in various attitudes to agitate solvent.
5. Suck solvent back into syringe, holding gauge at an angle. (See illustration).
6. Check that solvent removed is clean. To be sure that all oil has been removed, repeat cleaning process until solvent removed from gauge is as clean as that put in.
7. Shake out solvent remaining in gauge.

Copy with each syringe
Copy to Warehouse

re-drawn 4-6-90 D.Be

CLEANING AND FILLING PRESSURE GAUGES USING A SYRINGE.

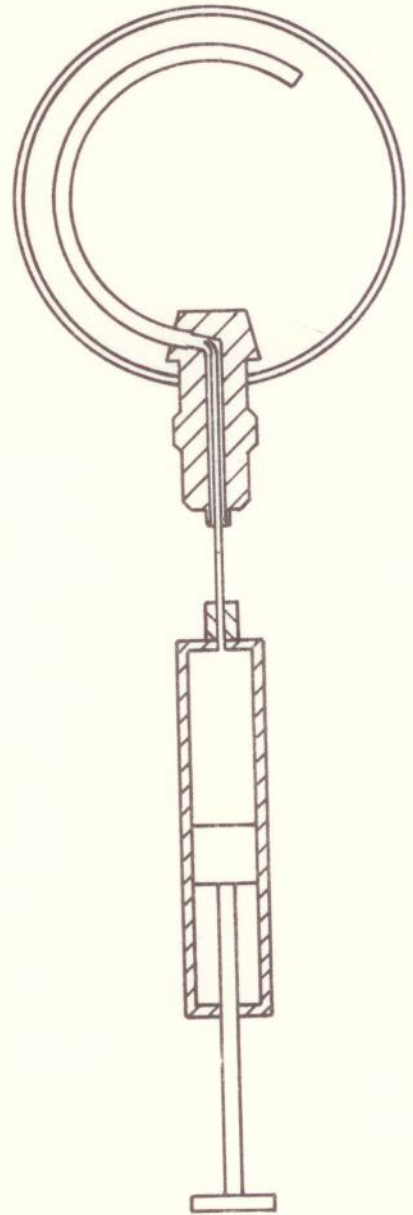
DR. D.Be.
TR. RCE
DATE 4-6-90

BUDENBERG GAUGE CO. LTD., BROADHEATH, N^o MANCHESTER.

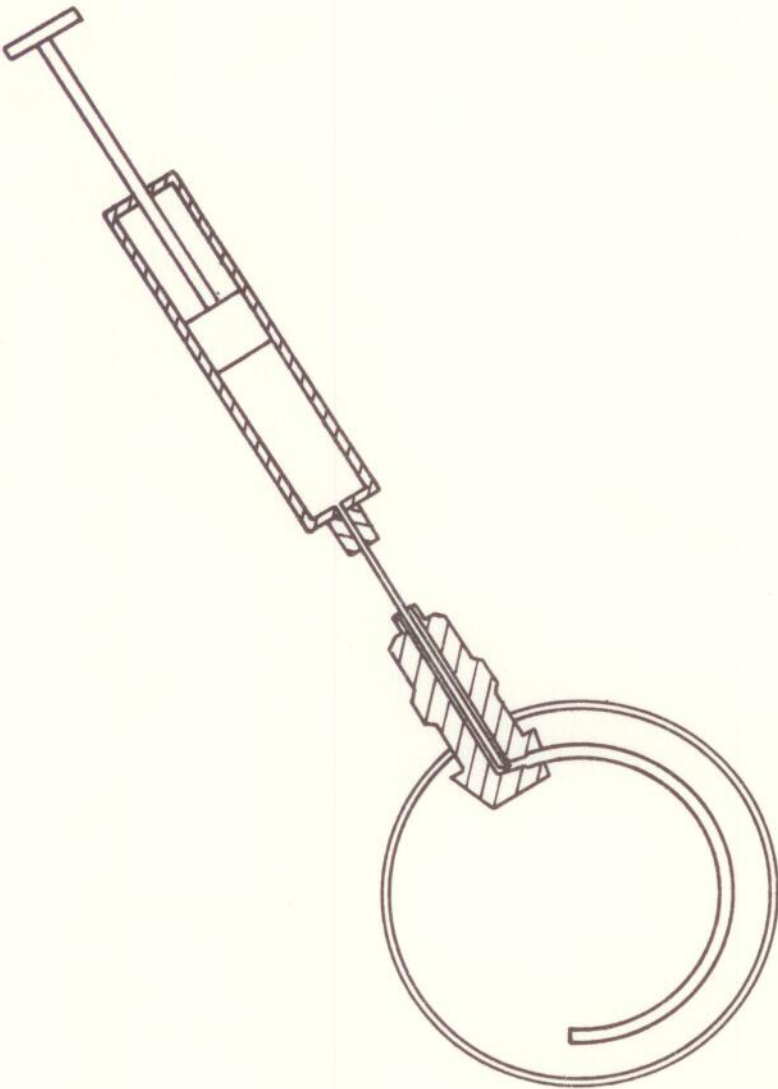
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No. 1/162B.

FILLING



EMPTYING



CLEANING AND FILLING PRESSURE GAUGES USING A SYRINGE.

BUDENBERG GAUGE CO. LTD., BROADHEATH, N^o MANCHESTER.

DR. M.R.L.
DATE 13.12.74

Overhaul and re-certification of dead-weight testers

Use of testers

An instruction manual is supplied with each tester; this describes the recommended oil (for hydraulic testers) and lists seals and spare parts likely to be needed. Use this manual.

Types of tester

These notes apply to hydraulic and air-operated dead-weight pressure gauge testers of our manufacture for pressures up to 4000 bar (60,000 lb/in²) and also to dead-weight gauges (Fig. 80, 80L and 82).

Maintenance of accuracy

The accuracy of a dead-weight tester depends primarily on the effective area of the piston unit and on the weights applied to the piston.

The effective area of the piston unit can be affected by wear of the unit. This is generally caused by contamination of the oil in the tester by foreign matter from instruments being calibrated, by water, or chemicals from instruments, or by rust or corrosion caused by contaminants.

Weights are made of type 416 martensitic stainless steel. These are entirely stable when used indoors, but if left exposed to water will tarnish slightly. This tarnishing is more severe if the weights are exposed to salt water. In the past we have supplied testers with specially treated cast iron weights which are suitable for indoor use, but which show signs of rust and instability if left wet.

Need for overhaul and re-certification

We recommend that the tester be returned to us for overhaul and re-certification at any time if when used in accordance with instructions:

- The piston does not spin freely.
- The rate of fall of the piston is appreciably greater than when new and makes use of the tester difficult.
- The weights are damaged or seriously corroded.
- The tester cannot be made to operate satisfactorily due to wear or damage to pump piping or valves which cannot be rectified by the user.

Many testers are used for calibration of instruments with an expected accuracy of 1, 0.5 or 0.25%. Such testers need not be sent back frequently for overhaul and re-certification and provided they are working well can be trusted for many years. Under these circumstances an interval of five years might be appropriate between overhauls.

When high accuracy is required of dead-weight testers the testers should be returned for overhaul and re-certification more frequently. The actual period will depend on how a tester is used. A tester kept in a laboratory and carefully used might need to be returned every 2/3 years. A tester carried around from site to site and used for calibrating high accuracy gauges or transducers from industrial process plant or for measuring pressures directly might well need to be returned at intervals of less than a year.

The actual period between overhaul and re-certification should be fixed by the user in the light of the above comments taking into account the requirements of any inspection authority which might be involved.

Identification of weights

Some users with two or more similar testers have difficulty in keeping separate the sets of weights. Such users might

Overhaul and re-certification

Testers should be returned to us complete with all weights. Tester bases will be stripped, all pipework cleaned, all seals replaced, worn components replaced where desirable, cover painted if necessary to restore it to a reasonable condition, and all re-assembled and tested.

The weights will all be checked and brought to within original limits if necessary. If one or two weights are missing or beyond economic repair they will be replaced. If instructions will be sought.

The piston unit will be checked for accuracy and sensitivity. If it is not satisfactory for any reason a quotation will be submitted for a replacement unit.

A new certificate of accuracy will be issued for each overhaul and re-certification. Unless otherwise instructed on order when there has been a slight change in area of the piston unit the certificate will reflect this; the accuracy will not be affected by more than 0.03%. For example the certificate of accuracy of an overhauled tester might show that the error does not exceed 0.06% when the original certificate shows that the error did not exceed 0.03%.



Ordering and pricing

We can issue NAMAS certificates for overhauled testers and also for testers in good condition whether or not of our manufacture. Details will be supplied on request.

An open order should be placed to avoid delays and correspondence. No tester will be overhauled if it is not economic to do so. By far the most expensive component likely to need replacement is the piston unit; this unit will not be replaced unless customers approval has been obtained.

When customers ordering procedure does not allow an open order to be placed we quote a basic price for the overhaul and re-certification of particular model of tester. This assumes that the tester and weights are in good condition and covers stripping, cleaning of pipework, replacement of seals, re-assembly and testing, checking of weights and of piston unit. The basic price covers our Certificate of Accuracy in the typical form shown in our catalogue. Customers requiring any more detailed certificate should state this on order.

Any additional work required will be carried out and will be charged on a time and material basis. These additional charges will be detailed on the invoice but the piston units will not be replaced without customers approval. Orders should therefore state basic quoted price "plus additional service and replacement parts as required".

Budenberg Gauge Co., Ltd.		Dr.: N/RCE/PAC	App: <i>[Signature]</i>	Date: 19.11.86	Page: 1 of 1
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TEMPERATURE MEASUREMENT OF PISTON UNITS

For many purposes such as calibrating most types of dial gauges and transducers accurate knowledge of the temperature of a piston unit is not necessary. However, in order to achieve the utmost accuracy from a Dead-weight Tester it is important to know the temperature of the piston unit as close as possible to the working part of the unit.

In laboratories where the room temperature is controlled it is most likely that the temperature of the working parts of the unit will not differ from the ambient temperature by more than 0.5°C. When working in uncontrolled temperatures, however, one would have to measure the temperature of the piston unit.

A possible way to do this is to use a disc shaped thermistor type probe sensing element taped to the outer surface of the piston unit. The sensing element should be insulated from the ambient temperature by covering the element with a thin strip of polystyrene, or other insulating material, then taping this to the piston unit. It is necessary to ensure that the tape is not wrapped all round the unit lest it acts as a lagging on the unit.

A suitable instrument for this purpose is the Edale electronic thermometer, Model C or K with its appropriate probes. This is available in the U.K. from:-

Edale Instruments (Cambridge) Ltd.,
 Wimpole Road,
 Gt. Eversden,
 Cambridge,
 CB3 7HR

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