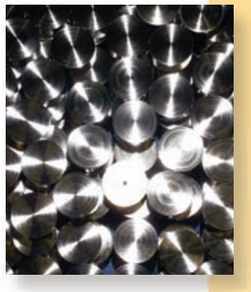
Bailey & Mackey Ltd

DIAPHRAGM & DIFFERENTIAL PRESSURE GAUGES

Keeping pressure under control

AN ISO 9000 COMPANY

Diaphragm & Differential Pressure Gauges



Bailey & Mackey have been manufacturing high quality pressure instruments for over 75 years. The product range has been extended over this period and we now manufacture Pressure Gauges, Temperature Gauges, Pressure Switches and Pressure Transducers.

Our products satisfy most pressure and temperature sensing applications in many industrial markets including, **Aerospace**, **Automotive**, **Chemical**, **Marine**, **Medical**, **Water**, **Waste**, **Fire**, **Food**, **Heating and Ventilating**, and **General Industries**. In fact we have products which cover almost every pressure sensing application.

Expertise in pressure sensing technology enables us to manufacture to the highest standard of quality and reliability.

Our quality management system, which is approved by B. S. I. Quality assurance to **BS EN 9001**, ensures that all products have been correctly assembled and tested prior to despatch to our customers.

Bailey & Mackey aims to lead its chosen sectors of the **Pressure Gauge**, **Temperature Gauge**, **Pressure Switch** and **Pressure Transducer** Industry through excellence in customer service and product quality.

Bailey & Mackey – Pressure control experience and innovation for over 75 years

BSI REGISTERED
UKAS QUALITY MANAGEMENT 003
Cert No. FM 59294

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Diaphragm & Differential Pressure Gauges **Contents**

Bailey & Mackey Pressure Gauges measure pressures relative to atmospheric pressure and are divided into three groups, each group being based on a different measuring principle.

Bourdon Tube Gauges consist of a formed tube with one end fixed and the other end free to deflect under pressure. This type of gauge is only available for applications where the material of the tube (e.g. Beryllium Copper or Stainless Steel) is compatible with the fluid in the system. The maximum pressure that we manufacture these gauges to is 700 bar (10000 psi). Illustrated in our Bourdon Tube Pressure Gauges catalogue.

Diaphragm Gauges consist of a metal diaphragm which deflects under pressure. This type of gauge is extremely versatile as materials and coatings can be used which will resist corrosion and consequently can be adapted for use with the majority of fluids. The maximum pressure that we manufacture these gauges to is 70 bar (1000 psi). Illustrated in this Catalogue.

Differential Gauges consist of a metal diaphragm which deflects under pressure such that the difference of two pressures is registered on an analogue gauge face. The maximum pressure difference is 25 bar and the maximum static (line) pressure is 34 bar. Illustrated in this Catalogue.

Bellows Gauges consist of a metal bellows which expand/contract when pressure/vacuum is applied. This type of gauge is used for low pressures up to 500 mbar (200 in.H_20). Illustrated in our Diaphragm Catalogue.

All **Bailey & Mackey Pressure Gauges** can be supplied for measuring vacuum although absolute pressure gauges are not included in our range.

Temperature Gauges utilise both the bourdon tube and vapour pressure principle. A temperature sensing element is connected to the bourdon tube via a length of capillary or rigid stem. Liquid contained in the element, when subject to heat, converts to a gas pressure which deflects the tube. Illustrated in our Bourdon Tube Pressure Gauges Catalogue.

Bailey & Mackey Pressure and Temperature Gauges can be modified to suit almost any requirement. Please contact our Sales Office for technical assistance.

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Bailey & Mackey's range of Diaphragm and Differential Pressure Gauges are built to the highest standards of workmanship required for such precision instruments. Each individual Pressure Gauge is subject to a series of the most stringent pressure and calibration tests before despatch.

Diaphragm Pressure Gauges

Applications

A diaphragm is a more mechanically stable element than a bourdon tube and can stand mechanical shock with less damage. Diaphragm Pressure Gauges can be used to indicate pressures below those practical for bourdon tube pressure gauges.

The diaphragm can be protected against aggressive liquids and gasses by fitting a thin flexible disc of resistant material as a barrier between it and the corrosive media. The pressure chamber or base can be made from a suitable material (see page 12). A Diaphragm Gauge is technically preferable to using a Bourdon Tube Pressure Gauge fitted to a chemical seal.

They can be used on viscous liquids, powders, and slurries, with the connection having a large entry passage or the diaphragm can be fitted directly onto pipe flanges or hygienic fittings.

Diaphragm Gauges can be adapted to meet stringent operating conditions for example, they can be fitted with overload protection, they can have pulsation dampers fitted above the working diaphragm (see pages 13 and 14).

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Differential Pressure Gauges

Applications

Differential Pressure Gauges are used to measure the difference in pressure between two points in a pressurised system.

They can be connected across filters to indicate the condition of the filter, or across a boiler to play an important part in energy management. They can be used to measure the content of a pressurised tank. They can be calibrated with square root scales to measure the flow through orifice plates, pitot tubes, venturies or pumps.

Design

Using a diaphragm with pressure applied to either side allows for higher static (line) pressures than a double bourdon tube differential pressure gauge when measuring low pressure differences. The diaphragm chambers are machined to restrict movement of the diaphragm under out-of-balance pressures greater than the maximum calibration of the gauge. With balanced pressure chamber the accuracy does not vary with changes in static pressure.

It is recommended that a bypass valve is connected between the high and low pressure chambers, this valve is opened when the system is started and closed when the system is running at full system pressure.

Temperature

Both Diaphragm and Differential Pressure Gauges should not be exposed to excessive heat or cold since this causes them to indicate incorrectly and if the measured fluid is allowed to freeze damage can occur to the diaphragm.

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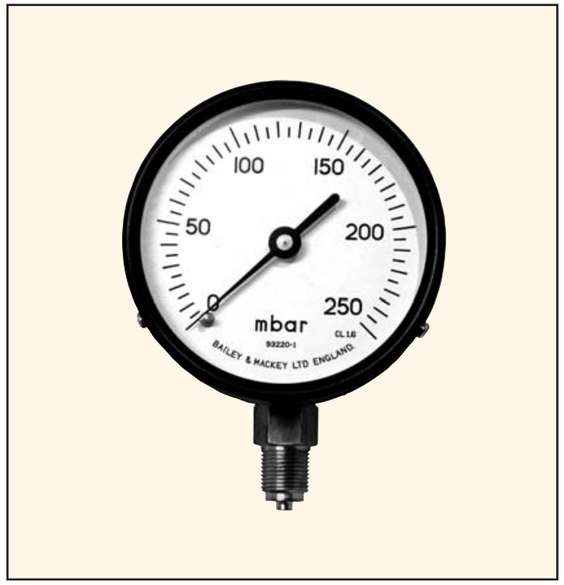
- 100 and 160 mm Diameter
- Maximum Pressure 400 mbar
- Maximum Vacuum 400 mbar
- Combined Pressure & Vacuum
- All Metal Construction

- Type 65 is Direct Mounting Bottom Connection
- Type 66 is Panel Mounting Centre Back Connection 3 Hole Fixing
- Type 67 is Panel Mounting Centre Back Connection Clamp Fixing
- Type 68 is Wall Mounting Centre Back Connection



Standard Calibrations

0 to 30 mbar	or	0 to 12” H2O
0 to 50 mbar	or	0 to 20” H2O
0 to 100 mbar	or	0 to 40” H2O
0 to 160 mbar	or	0 to 60” H2O
0 to 250 mbar	or	0 to 100” H2O
0 to 400 mbar	or	0 to 160” H2O

For Higher Pressures see page 8.

Special Dial Markings

Dials calibrated in other pressure units such as kN/m2, MN/m2, kPa, Kg/cm2, cm water, meters of water, cm Hg, inches Hg etc single scale, dual scale or with square root markings can be supplied if required. An extra charge is made for special dial marking, dependent on the costs involved.

Combined Pressure and Vacuum

Gauges with dials marked positive and negative relative to atmospheric pressure to indicate pressure and vacuum on the same instrument can be supplied.

NOTE: Absolute Pressure Gauges are not available from Bailey & Mackey.

Accuracy .....± 1.5% of Maximum Scale Value

Temperature Coefficient.....0.07% of range per 0°C from 20°C

For alternative connections see page 11.

For alternative wetted parts see page 12.

For variants see page 13, 14 & 15.

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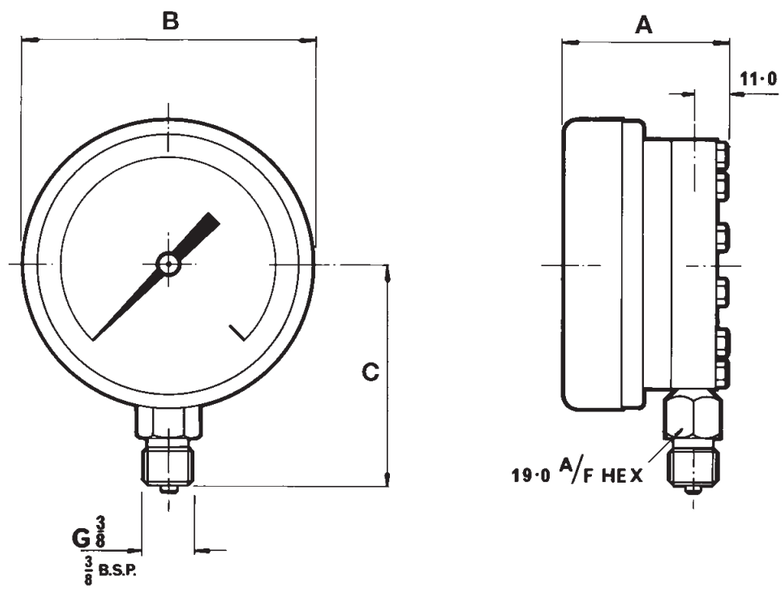
Type 65 Low Pressure Gauge Direct Mounting Bottom Connection



Nominal Size	A	B	C	Weight
100mm	66.8mm	103mm	79.5mm	1.1kg
160mm	71.8mm	151mm	103.5mm	1.4kg

For Stainless Steel add 9mm to all dimensions for the 160mm diameter gauge.

Materials of Construction

Case .....Mild Steel case with brass bezel black enamelled

Alternatively.....304 Stainless Steel case and Bezel

Pressure Chamber.....Brass with Beryllium Copper Diaphragm

Alternatively.....17/7 P.H. Stainless Steel Diaphragm with A.S.A. 321 Stainless Steel Pressure Chamber

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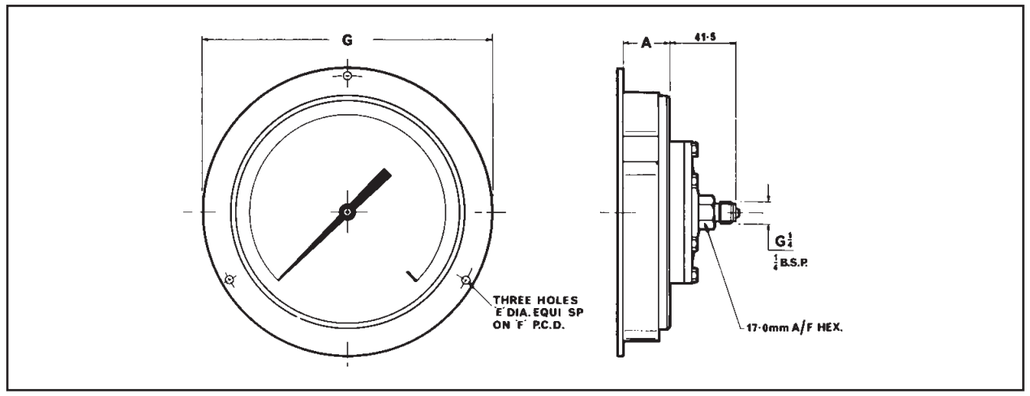
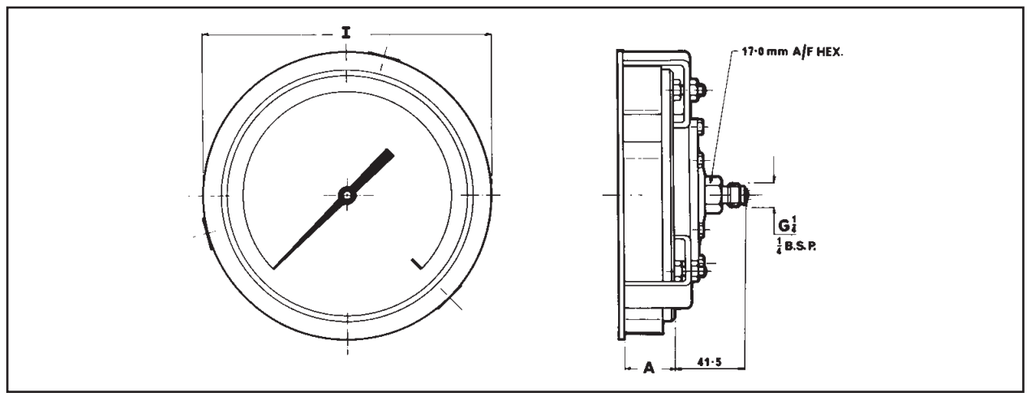
Low Pressure Gauge Front Flange Mounted Centre Back Connection

Type 66 3 Hole Fixing



Type 67 Clamp Fixing



Nominal Size	A	E	F	G	I	No of Clamps	Panel Cut-out	Weight
100mm	32.4mm	5mm	120.7mm	134mm	120mm	2	112mm	0.9kg
160mm	42.2mm	5mm	175mm	184mm	169mm	3	165.1mm	1.1kg

Materials of Construction

Case ..... 100mm Gauge Mild Steel case with brass bezel black enamelled
160mm Gauge Aluminium case with A.B.S bezel black enamelled

Pressure Chamber..... Brass Base with Beryllium Copper Diaphragm

Alternatively..... A.S.A. 321 Stainless Steel Pressure Chamber
with 17/7 P.H. Stainless Steel Diaphragm

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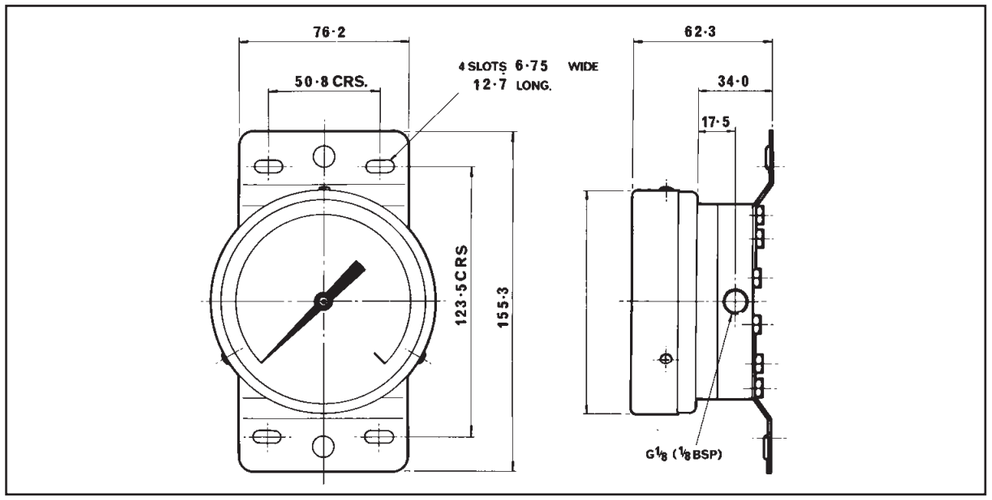
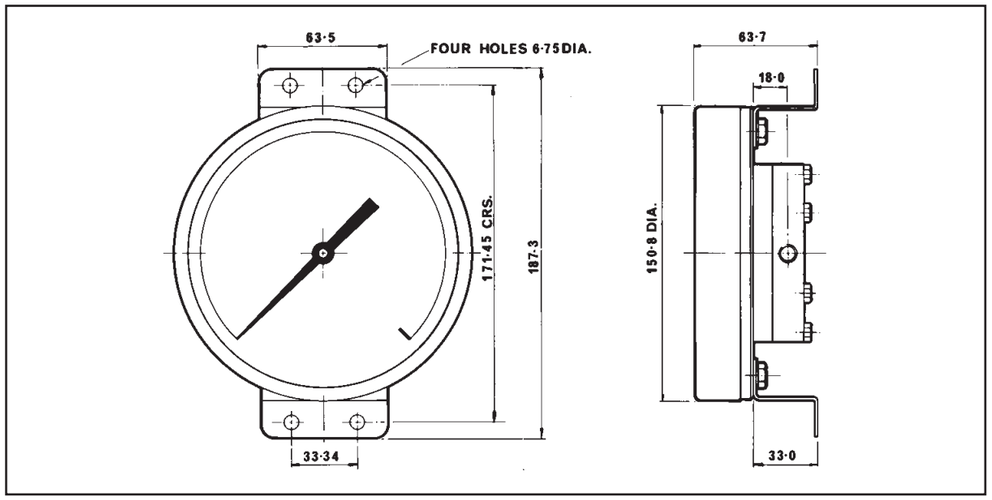
Type 68 Low Pressure Gauge with Wall Mounting Brackets

Nominal Size 100mm



Nominal Size 160mm



Materials of Construction

Case ..... 100mm Gauge Mild Steel Case with Brass Bezel Black Enamelled
160mm Gauge Aluminium Case with Brass Bezel Black Enamelled

Pressure Chamber..... Brass Base with Beryllium Copper Diaphragm

Alternatively..... A.S.A. 321 Stainless Steel Pressure Chamber
with 17/7 P.H. Stainless Steel Diaphragm

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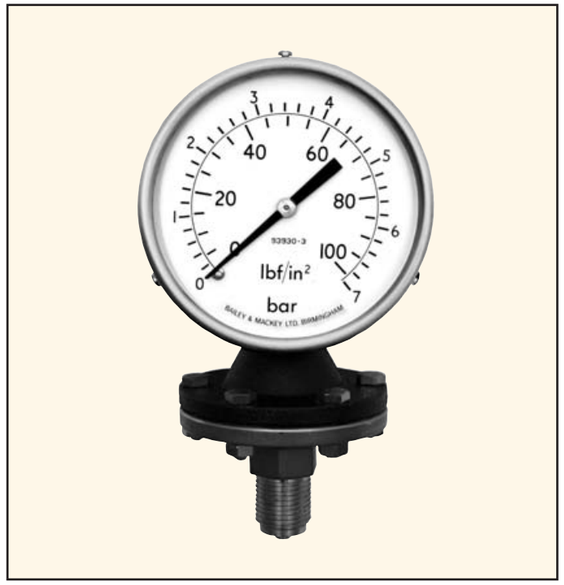
- 100 and 160 mm Diameter
- Maximum Pressure 40 bar
- Maximum Vacuum 1 bar
- Combined Pressure & Vacuum
- All Metal Construction

- Type 70 is Direct Mounting Bottom Connection
- Type 70A is Panel Mounting Centre Back Connection 3 Hole Fixing
- Type 70B is Panel Mounting Centre Back Connection Clamp Fixing
- For Stainless Steel Add a Suffix S to the above part numbers
- For Glycerine Filled Gauges Add a Suffix G to the above part numbers



Standard Calibrations

0 to -1 bar	or	0 to 30 inches water
0 to 1 bar	or	0 to 15 lbf/in2
0 to 1.6 bar	or	0 to 30 lbf/in2
0 to 2.5 bar	or	0 to 60 lbf/in2
0 to 4 bar	or	0 to 100 lbf/in2
0 to 6 bar	or	0 to 160 lbf/in2
0 to 10 bar	or	0 to 200 lbf/in2
0 to 16 bar	or	0 to 300 lbf/in2
0 to 25 bar	or	0 to 400 lbf/in2
0 to 40 bar	or	0 to 600 lbf/in2

For Lower Pressures see page 4.

Special Dial Markings

Dials calibrated in other pressure units such as kN/m2, MN/m2, kPa, Kg/cm2, cm water, meters of water, cm Hg, inches Hg etc single scale, dual scale or with square root markings can be supplied if required. An extra charge is made for special dial marking, dependent on the costs involved.

Combined Pressure and Vacuum

Gauges with dials marked positive and negative relative to atmospheric pressure to indicate pressure and vacuum on the same instrument can be supplied.

NOTE: Absolute Pressure Gauges are not available from Bailey & Mackey.

Accuracy .....± 1.5% of Maximum Scale Value

Temperature Coefficient.....0.07% of range per 0°C from 20°C

For Alternative Connections See Page 11.

For alternative Wetted Parts see Page 12.

For Variants see Page 13, 14 and 15.

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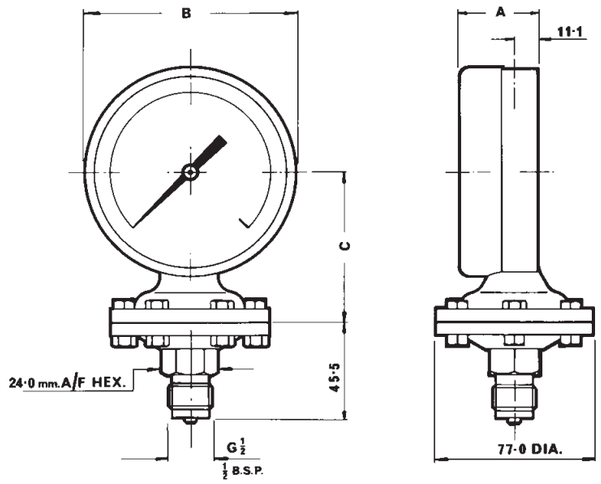
Type 70 Pressure Gauge Direct Mounting Bottom Connection



Nominal Size	A	B	C	Weight
100mm	38mm	103mm	74.6mm	1.0kg
160mm	43mm	151mm	99mm	1.1kg

Standard Materials of Construction

Case ..... 100mm Gauge Mild Steel Case with Brass Bezel Black Enamelled
160mm Gauge Aluminium Case with Brass Bezel Black Enamelled

Pressure Chamber..... Brass Base with Beryllium Copper Diaphragm

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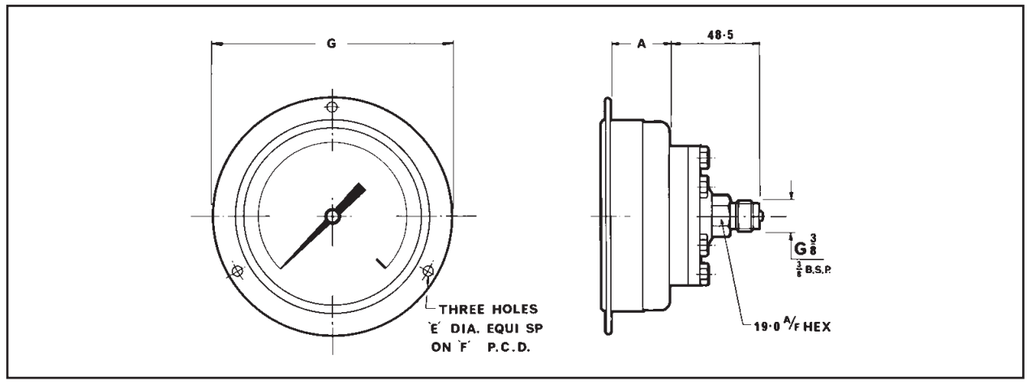
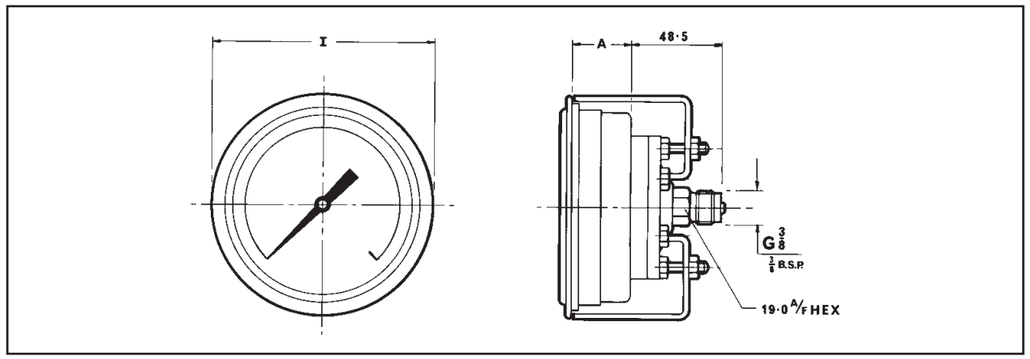
Pressure Gauge Panel Mounting

Type 70A 3 Hole Fixing



Type 70B Clamp Fixing



Nominal Size	A	E	F	G	I	No of Clamps	Panel Cut-out	Weight
80mm	27.7mm	4.8mm	94mm	102mm	95mm	2	86.8mm	0.56kg
100mm	41.7mm	5.2mm	121mm	134mm	120mm	2	112mm	1.0kg
160mm	49.5mm	5.2mm	175mm	184mm	169mm	3	165mm	1.7mm

Materials of Construction

Case ..... 100mm Gauge Zinc Diecast Case and Brass Bezel Black Enamelled
160mm Gauge Aluminium Case and Bezel Black Enamelled

Alternatively ..... 304 Stainless Steel Case & Bezel (Not Available in Type 70A)

Pressure Chamber ..... Brass Pressure Chamber with Beryllium Copper Diaphragm

Alternatively ..... A.S.A. 321 Stainless Steel Pressure Chamber
with 17/7 P.H. Stainless Steel Diaphragm

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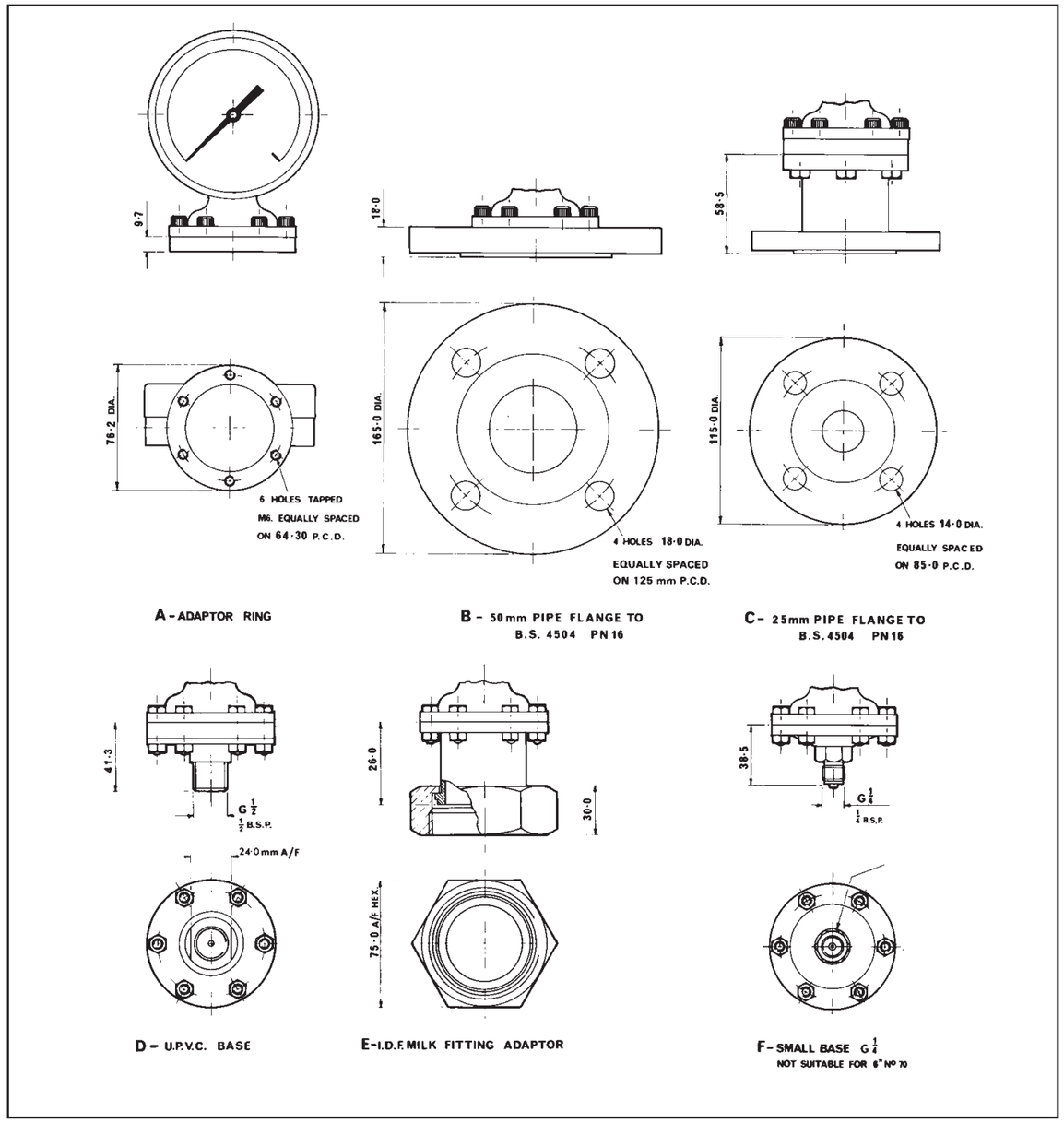
Alternative Base Fittings

Items A, B and C show flange fittings which can be supplied in either Mild Steel or 316 Stainless Steel. These are particularly useful on plant pumping viscous liquids or powders or where the gauge has to be removed for cleaning.

Flanges to ASA standards are also available. This is not an exhaustive illustration – Please enquire for the alternative that you need.



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Pressure Conditions

Standard materials for wetted parts are brass pressure chamber and beryllium copper diaphragm. This can be changed to make the wetted parts suitable for most other fluid applications. The diaphragm can be protected against corrosion, by a thin sheet of suitable material and the pressure chamber can be electro-plated or machined from a suitable material either metal or plastic.

Examples of suggested materials for use with a range of chemicals are given in the tables below ; these are only suggestions and it is the users responsibility to ensure that the material used is compatible with the chemicals used and the application conditions of concentration and temperature.

Vacuum Conditions

Diaphragm protection under vacuum conditions must be integral with the diaphragm.

On vacuum applications or where suction can occur a 17/7 precipitation hardened stainless steel can be used as an alternative to beryllium copper. 17 / 7ph is less corrosion resistant than 316 stainless steel but it can be hardened and tempered to give reasonable spring properties.

If this is not sufficiently resistant for the application the beryllium copper diaphragm can be electroplated or coated with a suitable plastic material.

Malleable Iron Base, 316 S.Steel Disc

Acetylene
Alkyl Chlorides
Ammonia (Max 60°C)
Aniline
Calcium Chloride (Max 60°C)
Caustic Soda (Max 60°C)
Chlorides of Na, K, Mg
Hydrocyanic Acid
Pyridine

Silver Plated Base, Fine Silver Disc

Brines
Bromine
Chlorine (wet or dry)
chlorates of Na, K, Ba
Chlorides of Na, K, Mg
Flourine
Mercuric Chloride
Ozone

UPVC Base 1/2” BSP, PTFE Disc

Max Temperature 40°C
Max Pressure 200 lbf/in2
Anhydrous Ammonia
Aluminium Chloride
Caustic Soda
Hydrobromic Acid (50%)
Hydrochloric Acid (36%)
Hydrogen Sulphide
Lead Acetate
Methanol
Oxalic Acid
Phosphoric Acid (50%)
Potassium Salts
Sodium Hypochlorite
Sodium Salts
Sulphuric Acid (70%)
Waste Gases

316 Stainless Base and Disc

Acetic Acid
Ammonium Hydroxide
Carbon Disulphide
Carbon Tetrachloride
Caustic Soda
Caustic Potash
Citric Acid
Formic Acid
Fruit Juices
Food Machinery
Hexamine
Hydrogen Peroxide
Oil-Phosphate Ester Based
Silver Nitrate
Water De-ionised

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- **Diaphragm Gauge Transmitter**
- **100mm and 160mm Diameter**
- **For Viscous Liquids**
- **Maximum Temperature 300°C**
- **Will accept overload up to 25 bar**
- **Used where a Syphon Tube cannot be fitted**
- **For Bitumen Road Spraying Bars, Boilers and other high temperature applications**

Special Features

1. Pressure passage through the brass G1/2 (1/2” BSP) pressure connection is 3/8” dia. (9.5mm) instead of the normal 3mm (1/8”) dia. This reduces the possibility of blockage when the liquid becomes cold and very viscous. If this is considered to be too small other designs of pressure connections are available, and also alternative materials as described on pages 11 and 12.
2. The 450mm of coiled small bore tube which connects the transmitter diaphragm to the working diaphragm, has the effect of damping out pressure pulsations as well as providing a temperature gradient.
3. Transmitter liquid is normally Shell Calibrating Fluid; for special applications the following alternatives have been used – paraffin, distilled water, glycerine, vinegar, or silicone only where temperatures above 140°C are involved.
4. An overload stop is fitted above the working diaphragm so that gauges will not be damaged by high pressures which may be generated starting from cold or changing from off-load recirculate to on-load spray.

NOTE: The flange-clamping bolts must not be slackened as this will break the pressure seal and render the gauge inoperative.

Method of Operating

Pressure is applied to a flexible thin stainless steel transmitter diaphragm clamped between the lower flanges. Deflection of this lower diaphragm transmits the pressure up the liquid filled coiled tube to the “working” diaphragm clamped between the upper flanges. Movement of the working diaphragm is indicated by the gauge pointer via a mechanism in the normal way.

The working diaphragm and gauge mechanism are situated far enough away from the hot fluid for the reading not to be affected by fluid temperatures up to 300°C.

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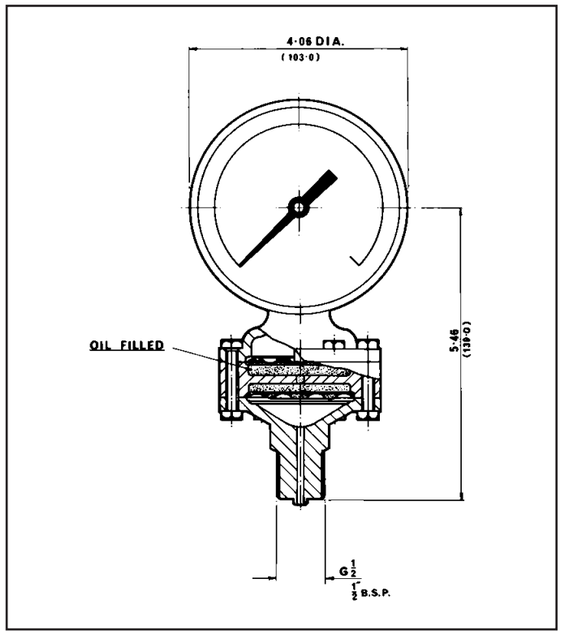
Throttled Transmitter

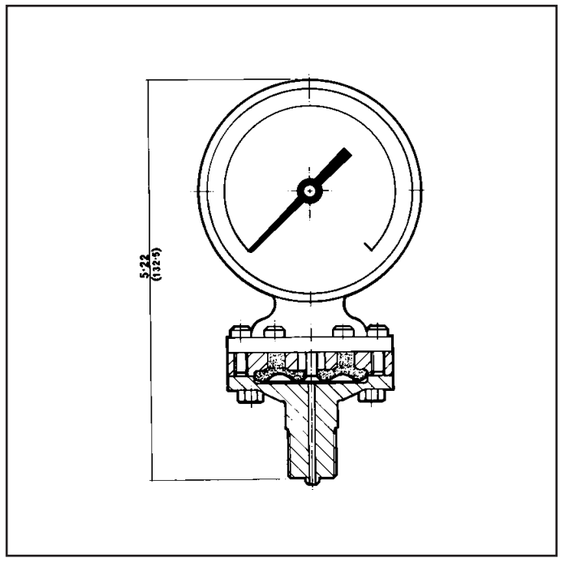


In many applications where diaphragm gauges are used it is not possible to protect the mechanism against the effect of pulsating pressures by means of a snubber involving a small orifice in the line to the gauge. This particularly applies where the application is on suspended solids or there is a hygiene requirement. The Bailey & Mackey solution to the problem is integral hydraulic throttling.

The drawing shows how this is achieved. The diaphragm pressure gauge is assembled with a plate which has 2 oil filled chambers which connect through a scintered filter. Pressure in the system is transmitted via the lower stainless steel diaphragm to the working diaphragm on the gauge and pressure pulsations slowed down at the scintered filter with no danger of blockage.

Please note: the 2 hexagon head screws at the side of the plate are used for filling the two chambers with oil. These should never be slackened because loss of oil will cause the gauge to read incorrectly and, in extreme cases, could rupture the transmitter diaphragm.

Overload Protection



It is recommended that the working pressure of gauges should be 2/3 of the range for fluctuating pressures or 3/4 for steady pressures. Overload will strain the diaphragm causing distortion which will put the gauge out of calibration.

Normally the pressure range should be chosen to cover the highest pressure likely to develop in the system, but gauges can be built with a moulded resin diaphragm support which prevents excessive deflection under over-pressure.

The drawing shows how this is achieved by adding a support plate above the diaphragm to hold the resin.

Maximum overload pressure is 1000 lbf/in2.

Temperatures above 60°C are not recommended.

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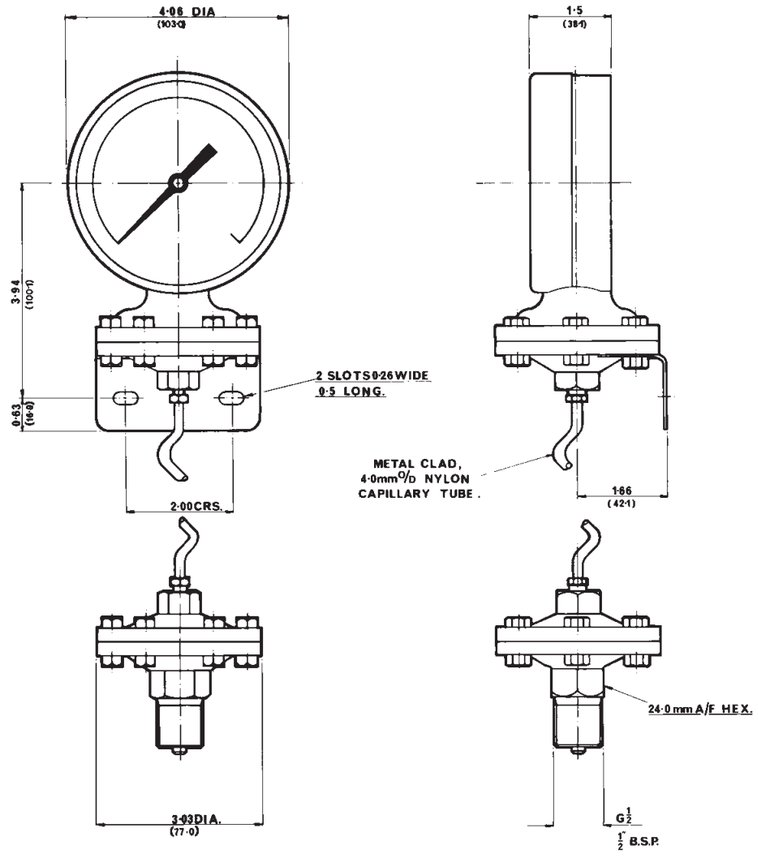
Distant Reading Transmitter



Bailey & Mackey diaphragm pressure gauges in ranges 0-1 bar and above can be fitted with transmitters for distant reading. In this way indication can be provided at a panel some distance away from the tapping point or, where severe vibration is present, the gauge can be mounted on a wall away from the vibration.

The standard material for pressure chamber is brass; stainless steel, UPVC or other corrosion resistant materials can be used if required. The stainless steel transmitter diaphragm is connected to the pressure gauge by a length of oil-filled capillary.

The illustration shows a bottom connection gauge with bracket for wall mounting. Transmitters can also be fitted to the front flange mounted gauges No. 70A and No. 70B shown on page 10. The recommended maximum length of capillary is 6 metres (20ft.) Accuracy of diaphragm pressure gauges with Distant Reading Transmitters is +2% of full scale deflection. It is important that great care is taken when fitting Distant Reading Transmitter Gauges because damage to the capillary tube or end connections can lead to oil leaking out of the sealed system and inaccurate gauge reading.

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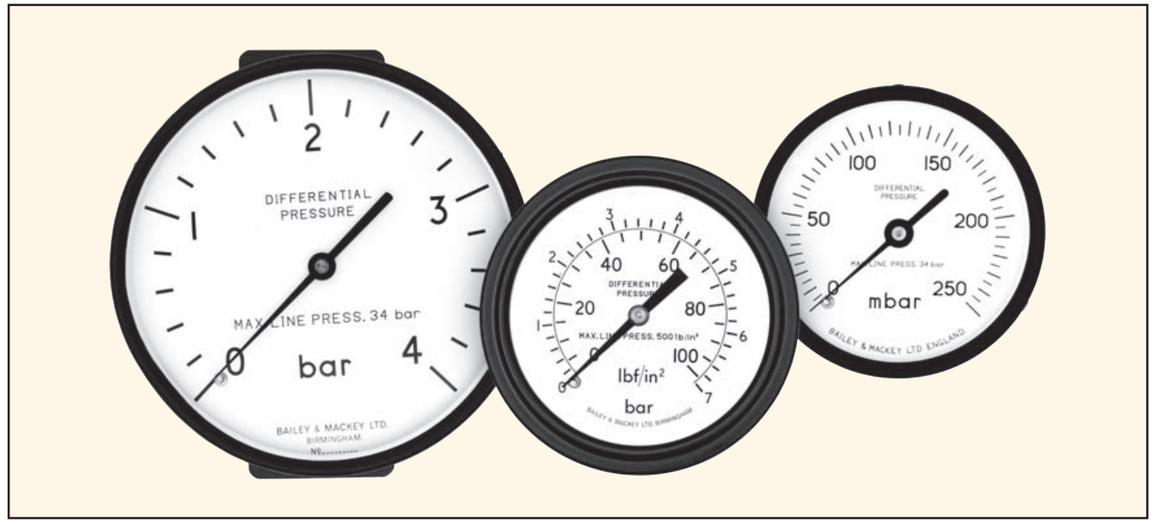
Type 91, 92, 93, 95, 96 & 97 Differential Pressure Gauges



- **Balanced Pressure Chambers**
- **Safe Against Pressure Surges**
- **Unbalanced Pressure Protection**
- **Accuracy Unaffected by Static Pressure Changes**
- **Calibrated to Read Both Rising and Falling Pressures**
- **Can be Calibrated to have a Center Zero Indicating Pointer**

Applications

Differential Pressure Gauges are used to monitor the difference in pressure between two points. They can be used to monitor the condition of filters as when filters become contaminated the flow through the filter hence the pressure across the filter becomes less. They can be used to monitor the condition of boilers and pumps as the less efficient they become the pressure drop across them increases. They can even be used to measure flow through pipes, orifice plates etc.

The instrument can be fitted with a ‘maximum finger’ mounted on the window . This red ‘slave pointer’ is driven round the dial by the indicating pointer and remains to indicate the maximum differential pressure reached if the indicating pointer drops back with reducing differential.

Specification

The two pressures are applied to either side of a spring diaphragm. The accuracy of these gauges does not vary with changes in line pressure because the two pressures act on opposite sides of the one element that has equal areas.

The diaphragm chamber is machined to restrict movement of the diaphragm under out-of-balance pressures greater than the maximum calibration of the gauge.

Chemical Protection

For aggressive chemicals both sides of the differential pressure gauges can be fitted with diaphragm seals which protect the gauges from chemical attack. (see page 12 for chemical compatibility charts)

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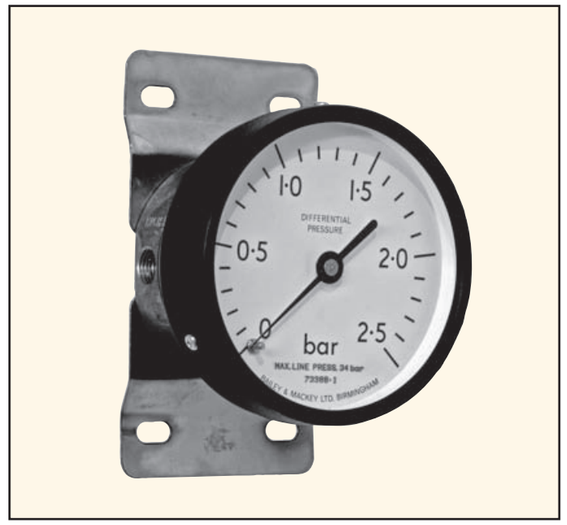
Differential Pressure Gauges Type 91, 92 & 93

- **80, 100 mm and 160 mm Diameter**
- **Maximum Pressure 6 bar**
- **Out of balance Pressure 4x range**
- **Accuracy 2% Full Scale Deflection**
- **All Metal Construction**



Standard Calibrations

0 to 0.6 bar or 0 to 10 p.s.i.
0 to 1 bar or 0 to 15 p.s.i.
0 to 1.6 bar or 0 to 20 p.s.i.
0 to 2 bar or 0 to 30 p.s.i.
0 to 2.5 bar or to 40 p.s.i.
0 to 4 bar or 0 to 60 p.s.i.
0 to 6 bar or 0 to 100 p.s.i.

Maximum Line Pressure 34 bar (500 p.s.i.)

All ranges can be calibrated to have a center zero for reading in both directions

For Lower Pressure ranges see page 19

Special Dial Markings

Dials calibrated in other pressure units such as kN/m2, MN/m2, kPa, Kg/cm2, cm water, meters of water, cm Hg, inches Hg etc single scale, dual scale or with square root markings can be supplied if required. An extra charge is made for special dial marking, dependent on the costs involved.

Overload

Dimensions of the diaphragm housing are such that the movement of the diaphragm is stopped when the pressure difference exceeds the full scale deflection. The gauge will accept the accidental application of up to 4 times the range without damage except for a small calibration error. Under working conditions the pressure difference should not exceed the full scale value of the gauge. This overload should not preclude the installation of a balancing valve in all applications where differential pressure gauges are used (see page 23).

- **Type 91 is Panel Mounting 3 Hole Fixing.**
- **Type 92 is Panel Mounting Clamp Fixing.**
- **Type 93 is Direct Mounting**
- **For Stainless Steel Add a Suffix S to the above Part Numbers (Type 92 & 93 only)**
- **For Glycerine Filled Gauges Add a Suffix G to the above part Numbers (Type 92 & 93 only)**

Materials of Construction

Wetted Parts..... Brass with Beryllium Copper Diaphragm
Seals..... Nitrile Rubber
Case 80 & 100mm dia .. Mild Steel Black Enamelled
Case 160mm dia ..... Aluminium Black Enamelled
Bezel 80 & 100mm dia . Mild Steel Black Enamelled
Bezel 160mm dia..... Black ABS Plastic

Alternatives Available

Wetted Parts..... Stainless Steel
Seals..... Viton
Case & Bezel ..... Stainless Steel

Accuracy ..... ± 1.5% full scale deflection

Temperature..... 80°C Maximum
(a temperature coeficient of 2% over 30°C can be expected)

Applications

When these low pressure gauges are used on liquids both connections and the tapping points should be in one horizontal plane. If not, allowance should be made for differences in the height of liquid in the connecting pipes. Bleed ports can be provided at the highest point of the pressure chambers if required

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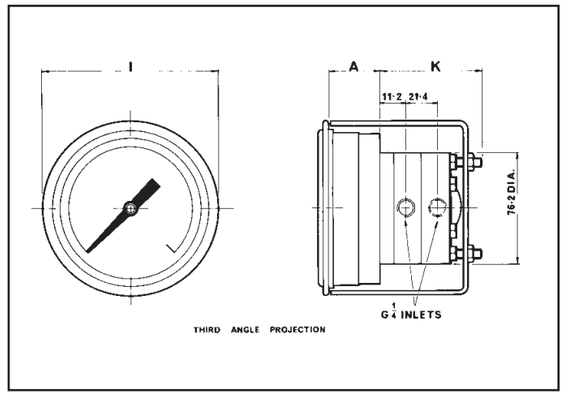
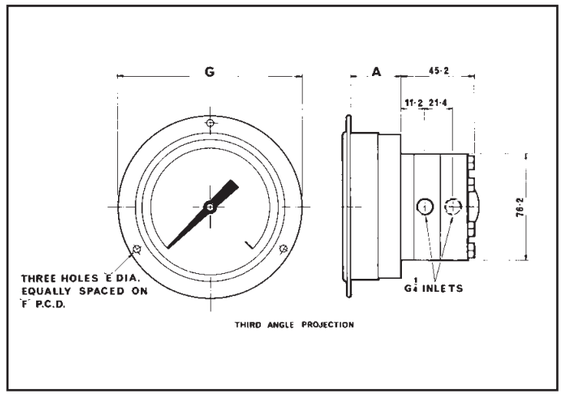
Type 91 Panel Mounting 3 Hole Fixing



Type 92 Panel Mounting Clamp Fixing



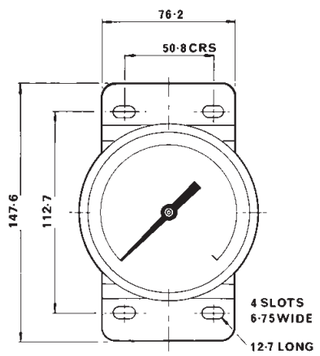
Nominal Size	A	E	F	G	I	K	No of Clamps	Panel Cut-out	Weight
80mm	21mm	4.8mm	94mm	102mm	95mm	70mm	1	86mm	1.1kg
100mm	27mm	5.2mm	121mm	134mm	118.4mm	70mm	1	112mm	1.8kg
160mm	36.5mm	5.2mm	175mm	184.2mm	169.1mm	45.2mm	3	165mm	1.8mm

Pressure Connections are at 3 o'clock and 9 0'clock when viewed from the front of the gauge the high pressure port is on the left side of the gauge and the low pressure port is on the right side of the gauge

Type 93 Direct Mounting with optional wall fixing brackets attached

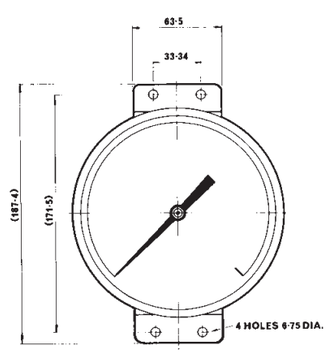
Nominal size
100mm diameter

Weight 1.75kg



Nominal size
160mm diameter

Weight 1.75kg



For Type 93 all other dimensions are as for Type 91 above except that the panel mounting bezel is replaced by a plain bezel.

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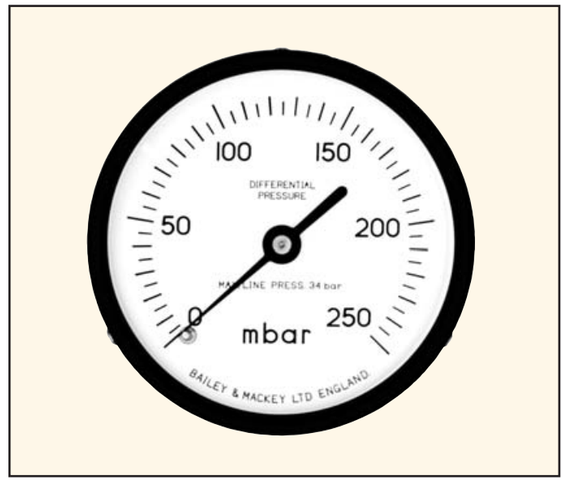
- **100 mm and 160 mm Diameter**
- **Maximum Pressure 400 mbar**
- **Out of balance Pressure 7 bar Max**
- **Accuracy 2% Full Scale Deflection**
- **All Metal Construction**



Standard Calibrations

0 to 80 mbar or 0 to 30"H20

0 to 100 mbar or 0 to 160"H20

Maximum Line Pressure
7 bar (100 p.s.i.)

0 to 250 mbar or 0 to 100"H20

0 to 400 mbar or 0 to 160"H20

Maximum Line Pressure
34 bar (500 p.s.i.)

All ranges can be calibrated to have a center zero for reading in both directions.

For Higher Pressure ranges see page 17.

Special Dial Markings

Dials calibrated in other pressure units such as kN/m2, MN/m2, kPa, Kg/cm2, cm water, meters of water, cm Hg, inches Hg etc single scale, dual scale or with square root markings can be supplied if required. An extra charge is made for special dial marking, dependent on the costs involved.

Overload

Dimensions of the diaphragm housing are such that the movement of the diaphragm is stopped when the pressure difference exceeds the full scale deflection. The gauge will accept the accidental application of up to 7 bar (100 p.s.i.) without damage except for a small calibration error. Under working conditions the pressure difference should not exceed the full scale value of the gauge. This overload should not preclude the installation of a balancing valve in all applications where differential pressure gauges are used (see page 23).

- **Type 95 is Panel Mounting 3 Hole Fixing**
- **Type 96 is Panel Mounting Clamp Fixing**
- **Type 97 is Direct Mounting**
- **For Stainless Steel add a suffix S to the above part numbers (Type 96 & 97 only)**

Materials of Construction

Wetted Parts.....Brass with Beryllium Copper Diaphragm
Seals.....Nitrile Rubber
Case 100mm dia ...Mild Steel Black Enamelled
Case 160mm dia ...Aluminium Black Enamelled
Bezel 100mm dia...Mild Steel Black Enamelled
Bezel 160mm dia...Black ABS Plastic

Alternatives Available

(above 250 mbar (100"H20))
Wetted Parts.....Stainless Steel
Seals.....Viton
Case & Bezel .....Stainless Steel

Accuracy .....± 2% full scale deflection

Temperature.....80°C Maximum
(a temperature coeficient of 2% over 30°C can be expected)

Applications

When these low pressure gauges are used on liquids both connections and the tapping points should be in one horizontal plane. If not, allowance should be made for differences in the height of liquid in the connecting pipes. Bleed ports can be provided at the highest point of the pressure chambers if required

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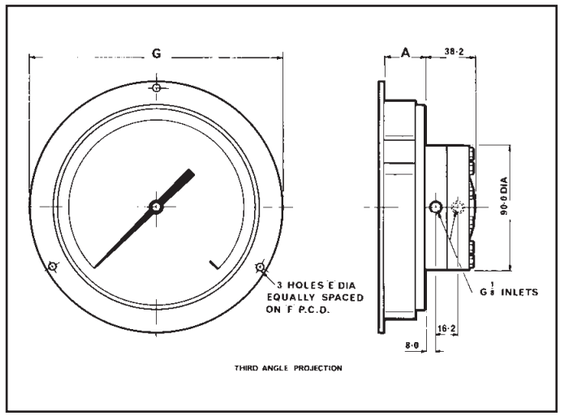
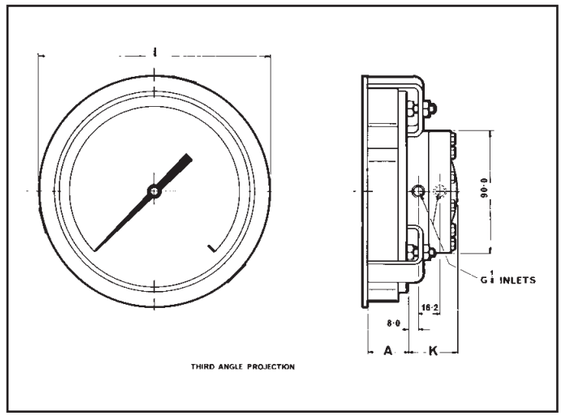
Type 95, 96 & 97 Low Pressure Differential Pressure Gauges

Type 95 Panel Mounting 3 Hole Fixing



Type 96 Panel Mounting Clamp Fixing



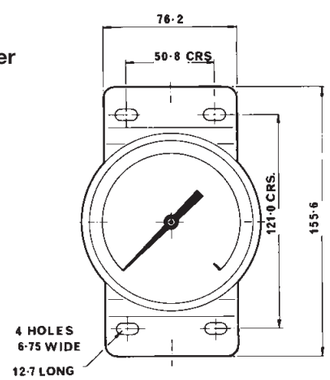
Nominal Size	A	E	F	G	I	K	No of Clamps	Panel Cut-out	Weight
100mm	32.5mm	5.2mm	121mm	134mm	118.5mm	38.2mm	1	112mm	1.65kg
160mm	42.2mm	5.2mm	175mm	184mm	169mm	38.2mm	3	165mm	1.85kg

Pressure Connections are at 3 o'clock and 9 0'clock when viewed from the front of the gauge the high pressure port is on the left side of the gauge and the low pressure port is on the right side of the gauge

Type 97 Direct Mounting with optional wall fixing brackets attached

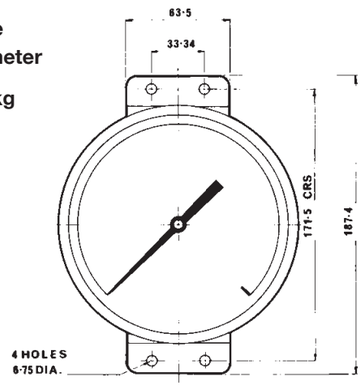
Nominal size
100mm diameter

Weight 1.75kg



Nominal size
160mm diameter

Weight 1.75kg



For Type 97 all other dimensions are as for Type 95 above except that the panel mounting bezel is replaced by a plain bezel.

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Differential Pressure Gauge with Differential Pressure Switch

Applications

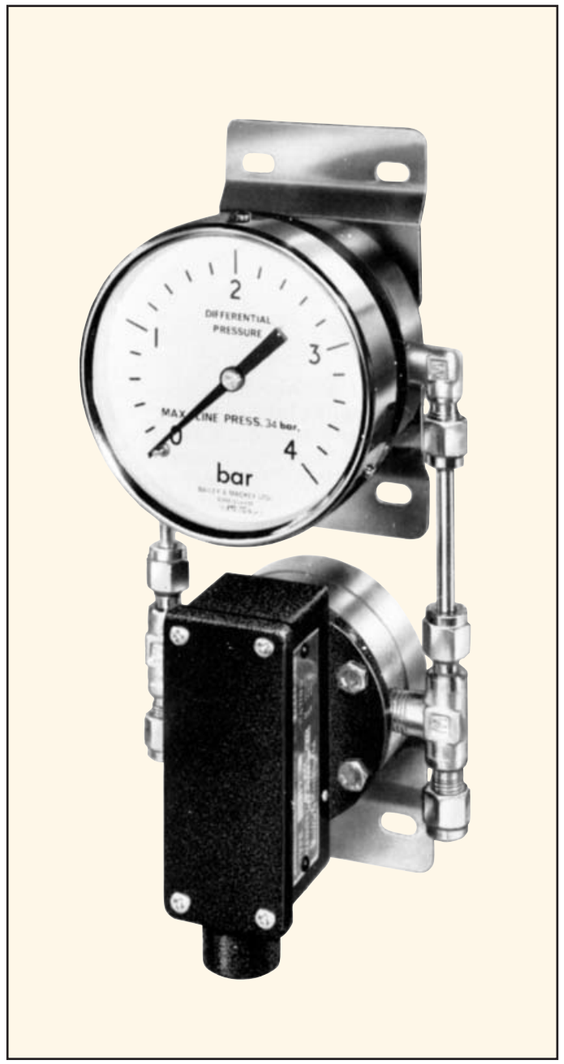
Changes in differential pressure indicated by a differential pressure gauge are only apparent if an operator is available to look at the instrument.

An automatic warning signal on high or low conditions can be provided by a Bailey & Mackey differential pressure switch.

The photograph and drawing show a 100mm (4") dia Type 93 differential pressure gauge and Type 1382 differential pressure switch piped up together as a convenient means of providing both indication and alarm or control. This unit comes complete with brackets for wall mounting.

A flush panel mounted version is available in the 160mm (6") dia size only; a drawing showing this arrangement is available if required.

The Type 1382 differential pressure switch has an electric rating of 10A at 250V AC and can be wired directly to a warning light of buzzer.



Lower Pressure Ranges

Both the wall mounted and 160mm flush mount versions are available with a range of 250mbar; use of a differential pressure switch on this low pressure provides a much more stable electric switching operation than that obtained from contacts operated by a gauge pointer.

The general arrangement of low pressure Type 97 differential pressure gauge and Type 1482 differential pressure switch assembly is similar to that shown here except that pressure connections are further apart, conduit connection is at one side and the vertical distance between mounting slots is greater. A drawing showing dimensions is available it required.

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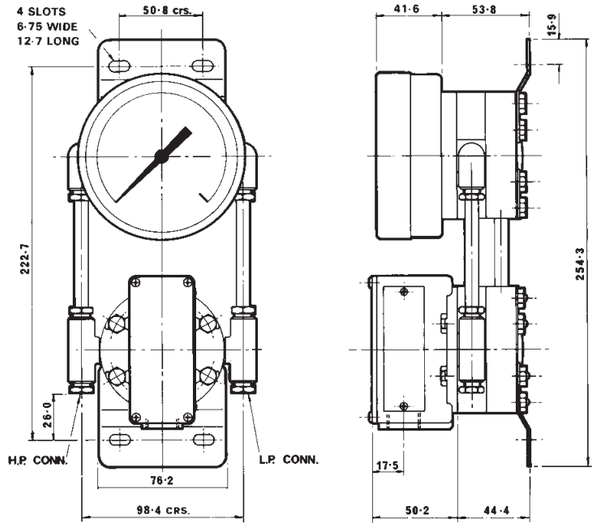
Differential Pressure Gauge with Differential Pressure Switch



Standard Calibrations

250 mbar or 100"H_2O
400 mbar or 160"H_2O
1 bar or 15 p.s.i.
2.5 bar or 40 p.s.i.
4 bar or 60 p.s.i.
6 bar or 100 p.s.i.

Maximum Line Pressure ...34 bar (500 lbf/in^2)
Accuracy .....±1.5% Full Scale Deflection

Materials of Construction

Wetted parts.....Brass
Diaphragm.....Beryllium Copper
Seals.....Nitrile
Connecting pipes .....Copper
Fittings.....Brass

Alternatives Available

Stainless steel wetted parts.
Viton seals.

Electric Rating

The differential pressure switch has a SPDT microswitch rated at 10 amps at 250 volts AC single phase.

Standard conduit fitting is 20mm.

Wiring Instructions

Remove lid and terminal cover.

Use terminals 1 and 2 (or C and NC) for closed circuit below operating pressure.

Use terminals 1 and 3 (or C and NO) for closed circuit above operating pressure.

Adjustment

One quarter turn of the adjusting nut in a clockwise direction will lower the set point by approximately 10% of the maximum range of the switch and vice versa.

Additional Features

A mechanism for increasing the pressure difference between operation and reset can be fitted for control applications.

Differential pressure switches can be built with two microswitches to give two circuits with independently adjustable set points.

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Differential Pressure Gauges

Installation

Ensure that the differential pressure gauge range, maximum line pressure and materials are correct for the application.

As the gauge is a delicate instrument it should not be mounted in a position where it is vunerable to damage.

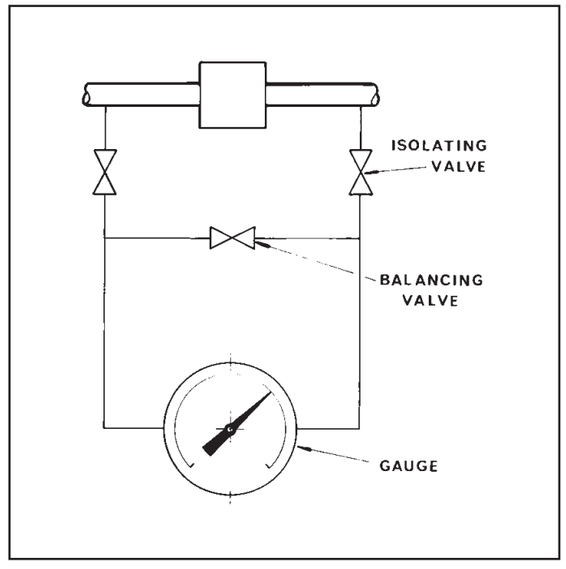
Connect the high pressure and low pressure connections to the appropriate tapping points. In applications involving flow where differences in line pressure between the two connections are always within the range of the gauge there is no need to fit valves.

In cases where there may be a sudden pressure surge on start-up, such as may come from a pump, it is necessary to fit isolating valves on each leg and link the pipes between each valve and the differential pressure gauge by a line with a third valve used for balancing.

Start-up routine with valves:-

1. Run system with all three valves closed until equilibrium is reached.
2. Open the balancing valve between the high and low pressure connections.
3. Open both isolating valves.
4. Close the balancing valve.
5. The differential pressure gauge will then indicate the pressure differential between the two tapping points.

Note: The balancing valve should always be opened before closing the isolating valves when the system is running.



Maintenance

No maintenance is required on those differential pressure gauges.

Temperature

Suitable for use over the range 0-80°C. When used with hot water or steam the connections should be made via a 500mm length of copper tube with a coil in it to cool the fluid before it reaches the gauge.

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Installation and Use — Pressure Gauges

A Pressure Gauge correctly installed and to the correct specification gives indication of pressure in the system which helps to ensure the safe working of process plant machinery.

a) Before fitting the gauge to a pressure source check that the maximum scale value of the gauge is higher than the pressure to be applied. The applied pressure should be 75% of maximum scale value for steady pressures or 65% of maximum scale value for fluctuating pressures.

b) Before fitting the gauge to a pressure source check that the wetted parts are compatible with the fluid being used, and that the pressure connection correctly matches that of the pipework.

c) When fitting the gauge to the pipework, use correct sealing methods. Do not use the gauge case to tighten the gauge to the pipework, use a correct size spanner on the neck hexagon.

d) Do not use gauge for oxygen or acetylene unless approved by our Technical Department. Gauges must have “Oxygen” or “Acetylene” marked on dial if used on these gases.

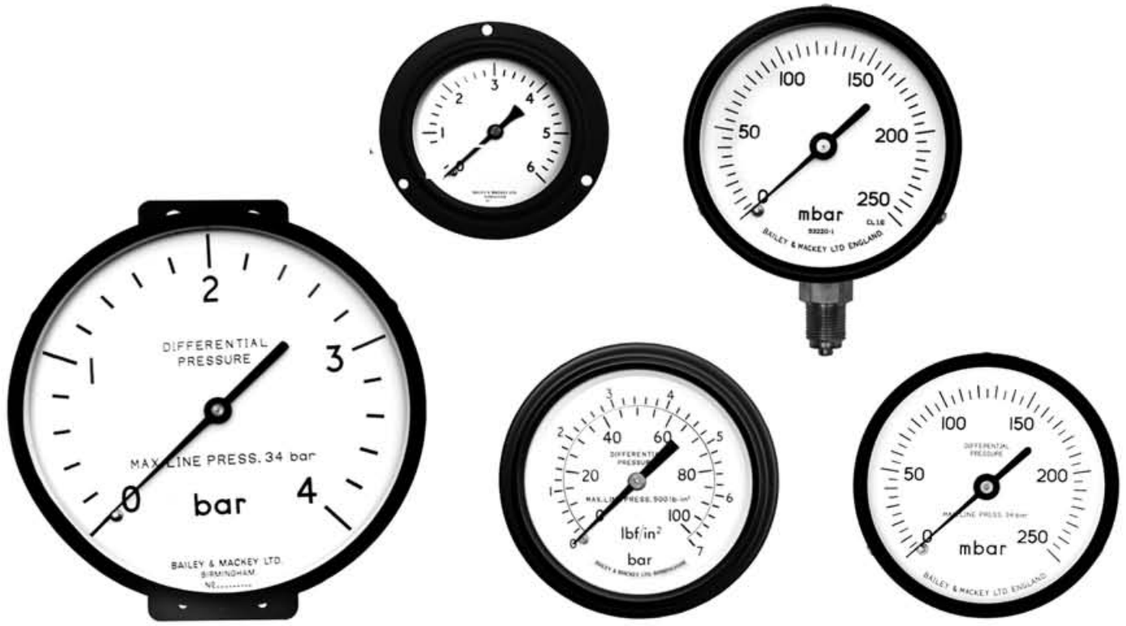
e) Do not use glycerine filled gauges for any fluid which has strong oxydizing agents for example chlorine, hydrogen peroxide, nitric acid, etc.

f) If the pressure gauge is to be subject to vibration, pressure surges, pressure pulses or over pressure, consult our Technical Department for approval before use.

g) The ambient and process temperature acting on the gauge should be within -20°C and + 80°C and protected from higher fluid temperature by means of a syphon tube filled with condensate before use. The fluid in the pressure chamber should not be allowed to freeze or crystallise as this will lead to rupture of the sensing element.

h) Should the pointer of any pressure gauge not return to zero, when the pressure is removed, it is an indication that damage to the gauge has occurred and the gauge should be replaced immediately.

If in doubt concerning the application of any pressure gauge please contact our Technical Department who will be only to pleased to give you advice.



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Pressure Gauge — Conversion Factors

Multiply units in left hand column by factor to obtain units at top. i.e. bar x 14.504 = lb./in²

	bar	lbf/in²	kg/cm	atm (std)	MH_2O	inH_20	mmHg	inHg	N/M²	Pa
bar	1	14.504	1.0197	0.9869	10.197	401.46	750.06	29.53	100000	100000 ‘
lbf/in²	0.0689	1	0.0703	0.068	0.7031	27.68	51.715	2.036	6894.8	6894.8
kg/cm²	0.9807	14.223	1	0.9678	10	393.7	735.56	28.959	98066	98066
atm (std)	1.0133	14.696	1.0332	1	10.332	406.78	760	29.921	101325	101325
MH_2O	0.0981	1.4223	0.1	0.0968	1	39.37	73.556	2.8959	9806.6	9806.6
inH_2O	0,0025	0.0361	0.0025	0.0025	0.0254	1	1.8683	0.0736	249.09	249.09
mmHg	0.0013	0.0193	0.0014	0.0013	0.0136	0.5352	1	0.0394	133.32	133.32
inHg	0.0339	0.4912	0.0345	0.0334	0.3453	13.595	25.4	1	3386.4	3386.4
N/M²	0.00001	0.00015	0.00001	0.00001	0.0001	0.004	0.0075	0.0003	1	1
Pa	0.00001	0.00015	0.00001	0.00001	0.0001	0.004	0.0075	0.0003	1	1

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