

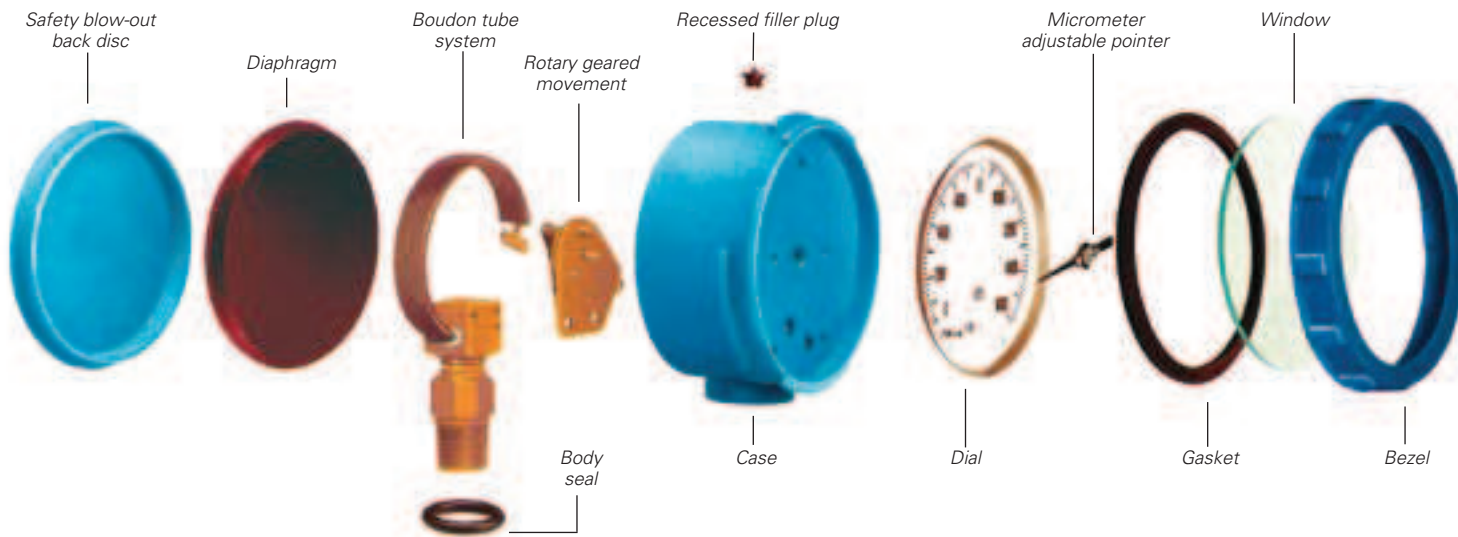


PRODUCT OF
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RHOMBERG
I N S T R U M E N T S

*Designer & Manufacturer of Pressure & Temperature Instruments
Chemical Seals & Accessories*





Key Factors for Gauge Selection

Many factors should be evaluated including temperature, vibration, process conditions, pulsation and corrosion, but by carefully considering the 7 key factors outlined below, the chances of correct selection will increase significantly.

Process Medium

The process medium to which the gauge will be exposed is especially important when using a thin walled Bourdon tube because, if the wrong materials are selected, corrosion may occur which could lead to catastrophic failure. Materials which display the essential combination of properties (good spring memory, easy to form, easy to join, reasonably priced) are phosphor bronze, 316 stainless steel and Monel.

Where these materials can't satisfy the application, a diaphragm seal (gauge isolator) can be added to prevent the process media from contacting the Bourdon tube. This protects the gauge from corrosion attack, and also prevents viscous or dirty media from clogging the small bore Bourdon tube. The only limitation in using a diaphragm seal is that it typically degrades the accuracy of the pressure gauge by an additional 0,5 % of the full scale deviation.

Pressure Gauge Range

It is important to select a pressure range which accommodates all anticipated pressure swings, and which prevents excessive needle movement. It is recommended to confine normal operating pressure to 25 % - 75 % of scale. With fluctuating pressures (e.g. pulsation caused by a pump or compressor), the maximum operating pressure should be lower (50 % of the full range).

Gauges in severe service should be liquid filled and throttled to reduce Bourdon tube stresses. To minimise sensing element stress and to extend the life of the gauge use internal throttle screws, pulsation dampeners, pressure snubbers, gauge savers or diaphragm seals.

The Environment

Temperature changes affect the elastic modulus of the Bourdon tube to indicate higher pressure than actual as temperature increases, (lower as temperature decreases), except if made with expensive constant modulus materials.

In a liquid filled gauge with an uncompensating case, a temperature increase of as little as 10° C results in internal case pressure build up which causes a downscale pointer shift. An upscale pointer shift can result from a temperature drop of 10° C or more. This potential error most often occurs in pressure ranges of 600 kPa or less. In gauges with true case compensation, temperature error from internal case pressure build-up is negligible.

Where ambient conditions are corrosive or contain a large number of particles, specify hermetically sealed and / or liquid filled pressure gauges to prevent foreign elements from entering the case.

Vibration can cause wear to the gears of the rotary movement and can make it difficult to accurately read pressure off an oscillating pointer. Filling a gauge with dampening fluid, such as glycerine, helps prevent these problems.

Accuracy

Accuracy is the conformity of a pressure gauge reading to an accepted standard (e.g. deadweight tester). Inaccuracy is the difference (error) between the true value and the indication, expressed as a percent of the span. It includes the combined errors of method, observer, apparatus and environment. Total accuracy error includes hysteresis and repeatability errors. Accuracy is not a percentage of the gauge reading - for mechanical pressure gauges, accuracy is a percentage of the full range, full scale or span of the gauge. Accurate to within the stated accuracy at 20 DC. Add or deduct 0,3 % for every 10 DC above or below the stated accuracy

Guidelines are:

Test Gauges (0,25 % up to 25 MPa, above 25 MPa up to 100 MPa. 0,3 %);
Critical Processes (0,50 %); General Industry Processes (1,0 %);
Less Critical Commercial Uses (2,0 %).

Dial Size

Sizes range from 40 mm to 250 mm diameters, with the 63 mm, 100 mm and 150 mm being the most popular. The dial size is generally determined by the readability requirements (larger for remote reading and smaller where the gauge is close to the operator). More accurate pressure gauges generally have larger dials as more dial graduations are needed to read the higher degree of accuracy.

Connections

Factors to consider include gauge pressures, size and weight, space limitations, leak integrity and past experience. 150 mm and 100 mm process gauges usually have 1/2" NPT/BSP connections, especially when direct stem mounted and liquid filled. Smaller dial sizes generally have 1/4" or 1/8" connections.

Mountings

Pressure gauges may be:

Direct stem mount bottom connection;
Remote wall - surface mount bottom connection;
Panel surface mount back connection;
Panel hole U clamp (yoke) flush mount back connection;
Panel hole front flange flush mount back connection.

Rhomberg Process Gauges

Liquid Fillable Process Gauges with Brass, Stainless Steel or Monel Wetted Parts

- PBB** - stainless steel case and bezel
- PBZ** - colour coded case and bezel
- PBX** - colour coded, solid front safety pattern case
- PBT** - turret case gauge
- PCB** - stainless steel case capsule gauge
- PBR** - aluminium case gauge
- CBC** - aluminium case simplex & duplex gauge
- BBR** - aluminium case butterfly gauge
- MBB** - stainless steel case master gauge
- HGZ** - stainless steel case homogeniser gauge
- DPG** - digital pressure gauge



Features common to all Rhomberg Process Gauges

Window

Acrylic as standard (safety glass optional)

Seal

Nitrile (natural rubber for silicon fills)

Dampening Fluid

Glycerine, silicon or halocarbon (for oxidising services)

Socket and Bourdon Tube

Code:	SS	BB	MM
Socket:	316L/Ti	brass	Monel 400
Bourdon tube:	316Ti	bronze	K-Monel

Movement

Code:	SS/MM	BB
	300 series stainless steel high impact movement	brass/nickel silver high impact movement

Dial

Aluminium, black lettering on white background

Pointer

Black aluminium, micrometer adjustable

Connections

1/4" + 3/8" + 1/2" (NPT - BSP)
Other connections available on request

Maximum Range

Vacuum through 100 MPa
Higher ranges available on request

Snubbing

Snubbing / throttle screws available in brass and stainless steel

Accuracy

100 mm & 150 mm	1.0 % FSD (SABS 1062)
63 mm	1.6 % FSD

Temperature Range

Ambient temperature -25° C to 60° C
Note: minimum temperature should not be less or equal to the freezing point of the process fluid.
Higher temperatures can be accommodated with heat reducing devices.

Approvals

SABS 1062 (1985) for 100 mm and 150 mm

Feature Highlights

- Adjustable micrometer pointer as standard
- Field liquid fillable
- Limited one year warranty on materials and workmanship
- Threaded for retro-fit snubber / throttle screw
- Fully repairable
- Retro-fit electrical contacts
- SABS 1062 (1985) for 100 mm and 150 mm

PBG - Robust Liquid Filled - Equipment and Industrial Gauges

For heavy duty service where vibration or pulsation of medium would cause excessive wear on a dry gauge or where corrosive ambient conditions prevail. Specific application examples are hydraulic equipment, mining equipment and irrigation equipment.

Case

Case: 304 stainless steel
 Bezel: 304 stainless steel
 Window: extruded acrylic sheet
 Seal: neoprene
 Dampening fluid: glycerine, silicone (options available)

Configurations

A B D E F U V mm 52 63 100
 (52 mm available only D conf.) Imp 2" 2½" 4"

Internals

Socket: brass or stainless steel
 Bourdon tube: bronze or stainless steel
 Movement: brass or stainless steel
 Dial: aluminium, white with black numerals
 Pointer: aluminium, black anodised

Connections

1/8" + 1/4" (BSP - NPT - BSPT) Options 3/8" + 1/2"
 (bottom and centre-back)

Maximum Range

60 MPa (brass) 100 Mpa (SS)

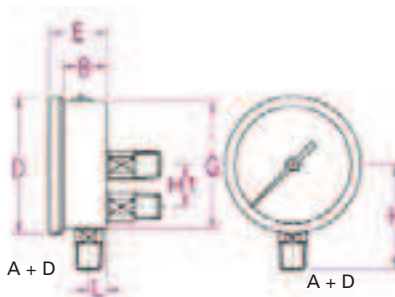
Accuracy

1,6 % FSD

Temperature Range

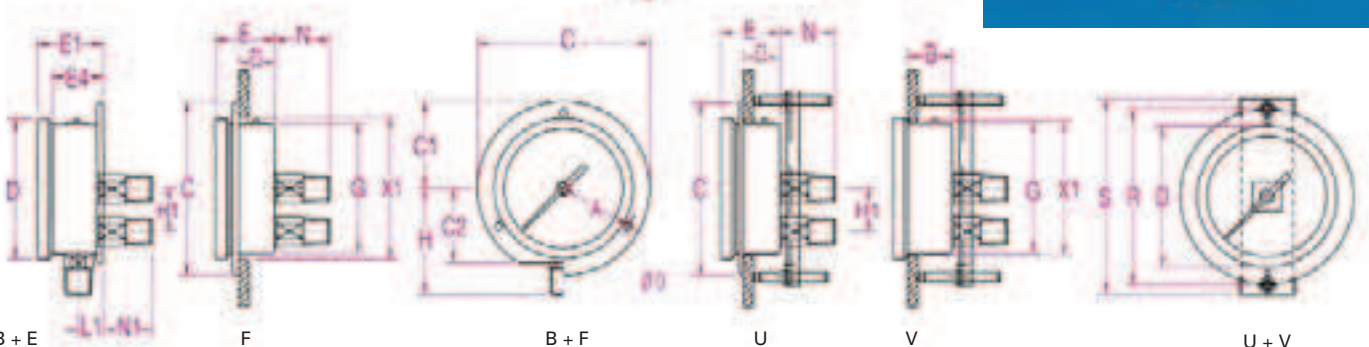
Ambient temperature -25° C to +60° C

Note: minimum temperature should not be less or equal to the freezing point of the filling fluid.



Conf. A + D

A + D



Conf. B + E

F

B + F

U

V

U + V

Nominal size

Dimensions (X is panel cut-out diameter)

Metric	A	B	C	C1	C2	D	E	E1	E3	E4	G	H	H1	L	L1	N	N1	O	R	S	X1
Imperial																					
63 mm	37,00	22,00	85,00	42,50	36,50	69,00	29,00	33,00	22,00	25,50	62,00	60,00	16,50	9,00	13,00	27,00	23,00	3,50	68,00	77,00	63,50
2½"	1,48	0,87	3,35	1,67	1,44	2,72	1,14	1,30	0,87	1,01	2,44	2,36	0,65	0,35	0,51	1,06	0,91	0,14	2,68	3,03	2,50
100 mm	58,00	22,00	133,00	66,50	56,00	108,50	29,00	34,00	22,00	24,00	99,50	77,50		9,00	13,00	23,50	23,50	5,00	110,00	122,00	101,00
4"	2,28	0,87	5,24	2,62	2,20	4,27	1,14	1,34	0,87	0,95	3,92	3,05		0,35	0,51	0,93	0,91	0,20	4,33	4,80	3,98

Accessories and Optional Features

Red Set Pointer ①

To indicate a specific pressure limit
External key or knob to reset hand

Maximum Drag Pointer

Available for gauges 63 mm, 100 mm and 150 mm
Indicates maximum pressure attained
External key or knob to reset hand

Maximum Stop

To protect movement against overpressure

Minimum Stop

To protect low range gauges against vacuum

Special Dial

Ranges different from standards, or custom artwork,
available on application

Windows

4 mm instrument glass or laminated safety glass

Cooling Element ②

To protect the gauge from high temperatures of $\pm 400^{\circ}\text{C}$
encountered on liquid based applications

Isolation Valves and Gauge Cocks ③

To isolate pressure from gauge. Equipped with a facility
to vent the gauge. Suitable for use with gases, liquids and
vapour.

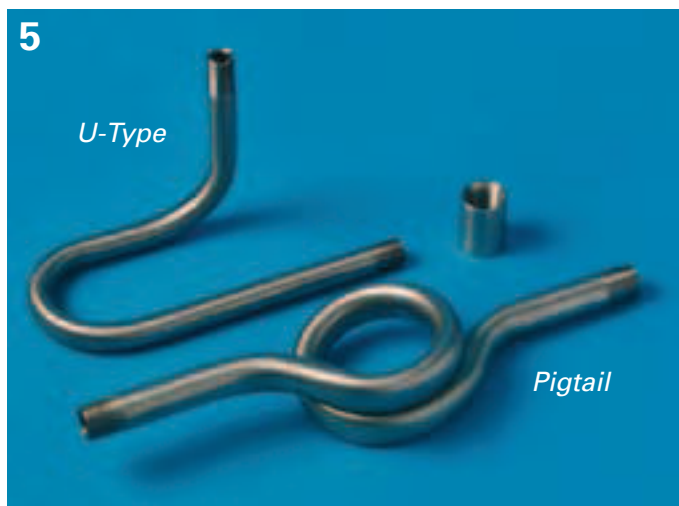
Electric Warning Contacts ④

The contact assembly is available for 100 mm & 150 mm
PBB pressure gauges and for 100 mm PBZ.
Indicating accuracy of process gauges, above 250 kPa, with
electric contact:

- pointer not carrying contact - 0,5 %
- pointer carrying contact - 1,5 %

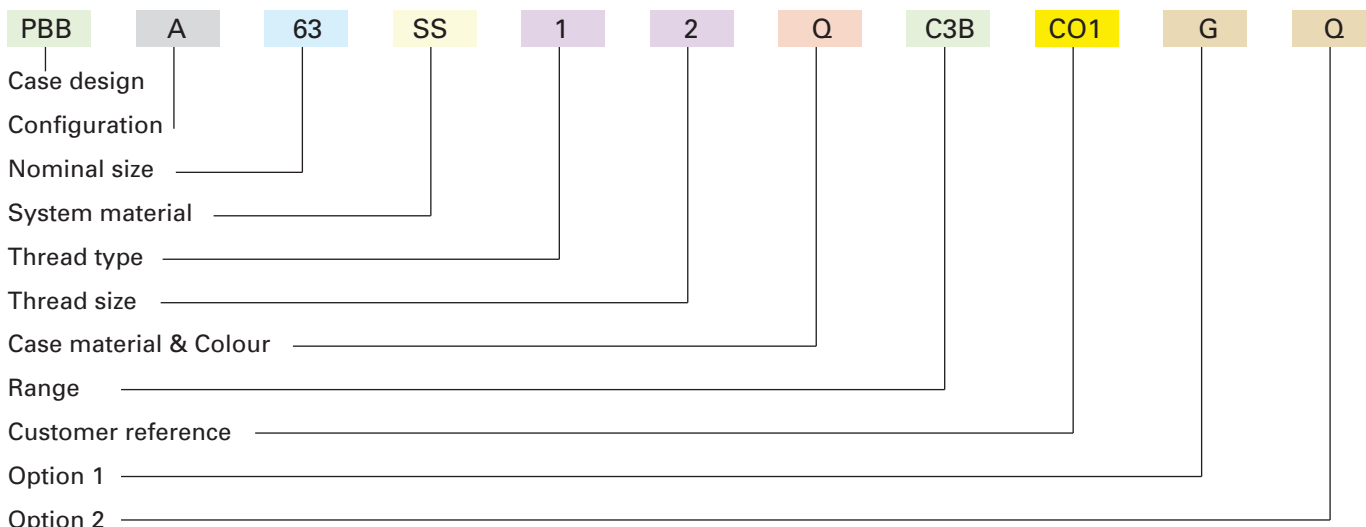
Siphons ⑤

Siphons should be installed on all live steam applications to
protect the gauge from the high temperatures encountered.
Available in either "pigtail" or "U-type" configurations for
installation on horizontal or vertical line respectively.



Gauges Ordering Code

Example of how to make up the ordering product code:



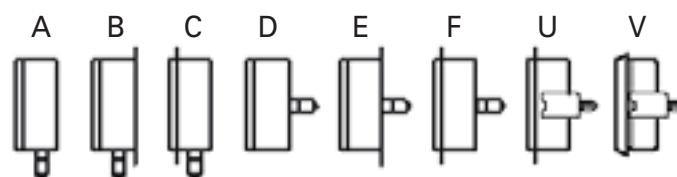
For the complete part number for Diaphragm Pressure Gauges, please consult with your sales representative when placing an order.

Case Type and Size

Case	Case & Bezel Material (Std)	Size Code	Nom. size mm (inch)	Available Configuration
PBB	polished 304 stainless steel	63 10 15	63 (2 1/2) 100 (4) 150 (6)	ABC* DEFUV *100 mm only
PBZ	colour coded (grey) PBT	10 15	100 (4) 150 (6)	AB
PBX	colour coded (black) PBT	10	100 (4)	A
PCB	polished 304 stainless steel	63 10 15	63 (2 1/2) 100 (4) 150 (6)	ABC* DFUV *100 mm only
PCZ	colour coded (grey) PBT	10 15	100 (4) 150 (6)	AB
PCK	(black) mild steel	68	68 (2 1/2)	ADV
PDB	polished 304 stainless steel	10 15	100 (4) 150 (6)	H
PDZ	colour coded (grey) PBT	10 15	100 (4) 150 (6)	H
DPG	colour coded (blue) PBT	10	100 (4)	A
MBB	polished 304 stainless steel	10 15	100 (4) 150 (6)	ABC* DEFUV *100 mm only
HGZ	polished 304 stainless steel	10 15	100 (4) 150 (6)	A
PBG	304 stainless steel	52 63 10	52 (2) 63 (2 1/2) 100 (4)	ABD* EFUV *52 mm back entry only
PBJ	(black) injection moulded, 304 stainless steel bezel	63 80	63 (2 1/2) 80 (3)	A

Case	Case & Bezel Material (Std)	Size Code	Nom. size mm (inch)	Available Configuration
PBN	(black) injection moulded case polycarbonate clip-in lens	42 54 68	42 (1 1/2) 54 (2) 68 (2 1/2)	AD
PBM	(black) mild steel polycarbonate clip-in lens	42 54 68	42 (1 1/2) 54 (2) 68 (2 1/2)	ADV
PBK	(black) mild steel threaded polycarbonate window	42 54 68 96	42 (1 1/2) 54 (2) 68 (2 1/2) 96 (4)	ADV* * only option for safety pattern ** 54 mm & 68 mm only
PBU	(black) mild steel flat acrylic window	42 54 63 10 12	42 (1 1/2) 54 (2) 63 (2 1/2) 100 (4) 125 (5)	AB**DE**F*U* * 54 mm & 68 mm only ** on application 100 mm, 125 mm
PBV	(black) mild steel with nickel plated bezel, flat acrylic window	52	52 (2)	DV

Configurations



- A bottom connection, stem mounting
- B bottom connection, back flange, surface mounting
- C bottom connection, front flange, surface mounting
- D back connection, stem mounting
- E back connection, back flange, surface mounting
- F back connection, wide front flange, (drilled) panel mounting
- U back connection, wide front flange, (undrilled) panel mounting (yoke)
- V back connection, narrow front-ring, panel mounting (yoke)

Bourdon Tube Selection

System code	Socket material	Bourdon tube material (kPa)	Tube type	Range selection
BB	brass	bronze tube brass tip	C-tube	60 / 6 000
BB	brass brass tip	bronze tube -tube	Spiral	10 000 ... / 60 000
SS	316 L stainless steel	316 Ti tube and tip	C-tube	60 / 6 000
SS	316 L stainless steel	316 Ti tube and tip	spiral	10 000 ... / 250 000
MM	Monel 400	K-Monel	C-tube	60 / 6 000
MM	Monel 400	K-Monel	Spiral	10 000 ... / 60 000

Utility gauges-ranges above 20 MPa on request

Capsule Systems Materials Selection

System code	Socket material	Capsule material (kPa)	Tube type	Range selection
SS	316 L	stainless	capsule	2,5 to 100 kPa -10 to -25 kPa (Vac)
BB	brass	copper	capsule	2,5 to 100 kPa -6 to -25 kPa (Vac)

Thread Type and Size

Thread type	Thread size (size code = number 1/8" 's)
O = NPT	1 = 1/8"
1 = BSP	2 = 1/4"
2 = BSPT	3 = 3/8"
	4 = 1/2"

Customer Reference

Codes allocated to customers describing their specific requirements
Standard CI gauge code is C01
Where applicable consult with our sales representative for your specific code

Case Material and Case Colour

Q = standard (see Case type & size)
C = nickel plated
P = brass plated
S = stainless steel case (where not standard)

H = white
E = yellow
A = purple
O = orange
X = non standard (describe under special instructions)

R = red
L = blue
N = green
B = black

Standard Metric Ranges (kPa)

Range kPa (kilopascal)	range code	Dial graduation	
		figure interval	minor graduation
0/10 Pa	C1A	1	0,1
0/16 Pa	C1B	1	0,2
0/25 Pa	C1C	5	0,2
0/40 Pa	C1D	5	0,5
0/60 Pa	C1E	10	0,5
0/100 Pa	C1F	10	1
0/160 Pa	C1G	10	2
0/250 Pa	C1H	50	5
0/400 Pa	C1J	50	5
0/600 Pa	C1K	100	10
0/1 000 Pa	C1L	100	10
0/1 600 Pa	C1M	100	20
0/2 500 Pa	C2A	500	50
0/4 000 Pa	C2B	500	50
0/6 000 Pa	C2C	1 000	100
0/1	C2D	0,1	0,01
0/1,6	C2E	0,1	0,02
0/2,5	C2F	0,5	0,5
0/4	C2G	0,5	0,5
0/6	C2H	1	0,1
0/10	C2J	1	0,1
0/16	C2K	1	0,2
0/25	C2L	5	0,2
0/40	C2M	5	0,5
0/60	C3A	10	0,5
0/100	C3B	10	1
0/160	C3C	10	2
0/250	C3D	50	5
0/400	C3E	50	5
0/600	C3F	100	10
0/1 000	C3G	100	10
0/1 600	C3H	100	20
0/2 500	C3J	500	50
0/4 000	C3K	500	50
0/6 000	C3L	1 000	100
0/1 MPa	C3M	0,1	0,01
0/1,6 MPa	C4A	0,1	0,02
0/2,5 MPa	C4B	0,5	0,5
0/4 MPa	C4C	0,5	0,5
0/6 MPa	C4D	1	0,1
0/10 MPa	C4E	1	0,1
0/16 MPa	C4F	1	0,2
0/25 MPa	C4G	5	0,2
0/40 MPa	C4H	5	0,5
0/60 MPa	C4J	10	0,5
0/100 MPa	C4K	10	1
0/160 MPa	C4L	10	2
0/250 MPa	C4M	50	5
vacuum			
-100/0	A5B	10	1
compound			
-100/0/150	B5A	50	5
-100/0/300	B5B	50	5
-100/0/500	B5C	100	10
-100/0/900	B5D	100	10
-100/01 500	B5E	100	20
-100/0/2 400	B5F	500	50

Gauges may be ordered with non-standard metric dials (kPa, bar or kg/cm²). Range in accordance with SABS 1062. Dual scale dials will be supplied with a standard metric inner scale and equivalent psi outer scale. psi dominant dual scales are also available. Please be specific when ordering.

Other Standard Metric Ranges (kg/cm² & Bar)

Range		Dial graduation	
kg/cm ² (kilograms per sq.cm ²)	bar	figure interval	minor graduation
<i>pressure</i>			
0/1	0/1	0,1	0,01
0/1,6	0/1,6	0,2	0,02
0/2,5	0/2,5	0,5	0,05
0/4	0/4	0,5	0,05
0/6	0/6	0,5	0,1
0/10	0/10	1	0,1
0/16	0/16	1	0,2
0/25	0/25	5	0,5
0/40	0/40	5	0,5
0/60	0/60	5	0,5
0/100	0/100	10	1
0/160	0/160	10	2
0/250	0/250	50	5
0/400	0/400	50	5
0/600	0/600	50	10
0/1 000	0/1 000	100	10
<i>vacuum</i>			
-10/0	-1/0	0,1	0,01
<i>compound</i>			
-10/0/1,5	-1/0/1,5	0,5	0,05
-1/0/3	-1/0/3	0,5	0,05
-1/0/5	-1/0/5	1	0,1
-1/0/9	-1/0/9	1	0,1
-1/0/15	-1/0/15	2	0,2
-1/0/24	-1/0/24	5	0,5

Note: Where required range has no code indicated, that range should be clearly specified on ordering.

Options

Both option digits to be filled in:
No options = QQ; One option = selected digit then Q;
Two options = list from below alpha-numerically

- Q = no options
- X = special instruction
- A = drag pointer
- B = blow-out back with baffle (safety)
- C = red set pointer
- D = micro switch movement single
- E = micro switch movement double
- F = vibration free movement (VFM)
- G = safety glass
- H = bar secondary scale
- I = kPa secondary scale
- J = zero adjuster
- K = oil free, oxygen clean logo; gauge bagged in plastic
- L = psi secondary scale

Standard Imperial Ranges (psi)

Range		Dial graduation	
psi	range code	figure interval	minor graduation
0/15	G2D	1	0,2
0/30	G2F	5	0,5
0/60	G2G	10	1
0/100	G3A	10	1
0/160	G3E	10	2
0/200	G3C	50	2
0/300	G3D	50	5
0/400	G3E	50	5
0/600	G3G	100	10
0/800	G3H	100	10
0/1 000	G3J	100	10
0/1 500	G3K	500	20
0/2 000	G3L	500	20
0/3 000	G4A	500	50
0/4 000	G4B	500	50
0/5 000	G4C	1 000	100
0/6 000	G4D	1 000	100
0/10 000	G4E	1 000	100
0/15 000	G4F	5 000	500
<i>vacuum</i>			
30-0 inches mercury	E1A	5 inches	0,5
<i>compound</i>		<i>'Hg psi</i>	<i>'Hg psi</i>
30" Hg Vac/0/15psi	F1A	5 3	1 0,5
30" Hg Vac/0/30psi	F1B	10 5	1 1
30" Hg Vac/0/60psi	F1C	10 10	2 1
30" Hg Vac/0/100psi	F1D	10 10	2 1
30" Hg Vac/0/150psi	F1E	10 25	5 5
30" Hg Vac/0/300psi	F2B	30 25	5 5

- M = refrigeration scale
- N = retarded scale
- P = overload stop internal
- R = studs and bracket
- S = nickel plated block
- T = snubbers
- U = adaptor fitted
- V = silicon oil filled
- W = block welded to case
- Y = glycerine filled
- Z = opanol oil filled
- 2 = other filling medium (Siltherm 800, Fluorolube, Krytox GPL 100, etc.)
- 3 = female thread
- 4 = stainless steel movement in brass system
- 5 = no aluminium parts
- 9 = centre back option

Pressure Cross Reference Chart

psi	atms.	Ft.Hd. H ₂ O at 20° C	in H ₂ O	kg/cm ²	meters H ₂ O	in.Hg. at 20° C	mm.Hg.	cm.Hg.	bar	Milibar (mbar)	kPa
1	0,0680	2,310	27,720	0,0700	0,704	2,043	51,884	5,188	0,0690	68,947	6,895
14,696	1	33,659	407,513	1,0330	10,351	30,019	762,480	76,248	1,0130	1013,0	101,325
0,433	0,0290	1	12,000	0,0300	0,305	0,884	22,452	2,245	0,0300	29,837	2,984
0,036	0,0025	0,833	1	0,0025	0,025	0,074	1,871	0,187	0,0025	2,486	0,249
14,233	0,9680	32,867	394,408	1	10,018	29,054	737,959	73,796	0,9810	980,662	98,066
1,422	0,0970	3,287	39,370	0,0990	1	2,905	73,796	7,379	0,0980	98,066	9,807
0,489	0,0330	1,131	13,575	0,0340	0,345	1	25,400	2,540	0,0340	33,753	3,375
0,019	0,0013	0,045	0,534	0,0014	0,0136	0,039	1	0,100	0,0010	1,329	0,133
0,193	0,0131	0,445	5,340	0,0140	0,1360	0,393	10,000	1	0,0133	13,290	1,328
14,503	0,9870	33,514	402,164	1,0200	10,2110	29,625	752,470	75,247	1	1000,0	100,00
0,014	0,0009	0,033	0,402	0,0010	0,0102	0,029	0,752	0,075	0,001	1	0,100
0,145	0,0098	0,335	4,021	0,0100	0,1020	0,296	7,525	0,752	0,010	10,000	1

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I N S T R U M E N T S



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I N S T R U M E N T S

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