

INDUMART PRESSURE GAUGES

This section of our catalogue is designed to categorize all Indumart pressure gauges to make it easier for our customers to order exactly the type of pressure gauge they need. For a careful selection of your required pressure gauge, the following specifications must be stated:

- Pressure Range
- Pressure Element
- Movement
- Accuracy
- Case & Bezel
- Mounting & Connection Position
- Pressure Connection
- Environmental Elements
- Process Temperature
- Over Pressure
- Shocks and Pulsations
- Dials
- Window

Pressure Range

Range of the selected pressure gauge should be about twice the normal operating pressure of the process. The maximum operating pressure should not exceed 75% of the full scale range. Failure to select a gauge within these criteria may ultimately result in fatigue failure of the Bourdon Tube.

Indumart standard pressure ranges are in psi and bar scales. Other pressure units such as kPa, MPa, in.H₂O, mH₂O, in.Hg, kg/cm² and mbar are also available. Following tables show the standard pressure ranges for "C" shaped Bourdon tube and helical Bourdon tube systems. For other pressure systems, check their data sheets.

Table 1- Standard Pressure Ranges in bar

0 ... 0.6	0 ... 6	0 ... 60	0 ... 600
0 ... 1	0 ... 10	0 ... 100	0 ... 1000
0 ... 1.6	0 ... 16	0 ... 160	0 ... 1600
0 ... 2.5	0 ... 25	0 ... 250	
0 ... 4	0 ... 40	0 ... 400	

Table 2 - Standard Pressure Ranges in Psi

0 ... 10	0 ... 160	0 ... 1000	0 ... 10000
0 ... 15	0 ... 200	0 ... 1600	0 ... 16000
0 ... 30	0 ... 300	0 ... 3000	0 ... 20000
0 ... 60	0 ... 400	0 ... 5000	
0 ... 100	0 ... 600	0 ... 6000	

Vacuum Ranges in bar

-0.6 ... 0	-1 ... 0
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Vacuum Ranges in psi

-10 ... 0	-15 ... 0	-30" Hg ... 0 psi
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Compound Ranges in bar

-1 ... 0.6	-1 ... 3	-1 ... 9	-1 ... 24
-1 ... 1.5	-1 ... 5	-1 ... 15	

Compound Ranges in psi

-30" Hg ... 10	-30" Hg ... 30	-30" Hg ... 100	-30" Hg ... 200
-30" Hg ... 15	-30" Hg ... 60	-30" Hg ... 160	-30" Hg ... 350

Table 3 - Pressure Conversion Table

psi	bar	kPa	mH ₂ O	in.H ₂ O	mmHg	in.Hg	kg/cm ²	atm
1	0.06894	6.8948	0.70307	27.735	51.924	2.0442	0.07031	0.06805
14.504	1	100	10.1972	401.47	750.06	29.530	1.0197	0.98692
0.14504	0.01	1	0.10197	4.0147	7.5006	0.29530	0.01019	0.009869
1.42233	0.09807	9.8066	1	39.37	73.556	2.8959	0.1	0.09678
0.03606	0.00249	0.24908	0.0254	1	1.8721	0.07368	0.00254	0.00245
0.01926	0.001333	0.13332	0.0136	0.53418	1	0.03937	0.00135	0.00131
0.4892	0.03386	3.3864	0.34532	13.568	25.401	1	0.03439	0.03329
14.223	0.98068	98.068	10	394.57	738.51	29.075	1	0.96784
14.696	1.01325	101.325	10.332	407.69	763.07	30.042	1.0332	1

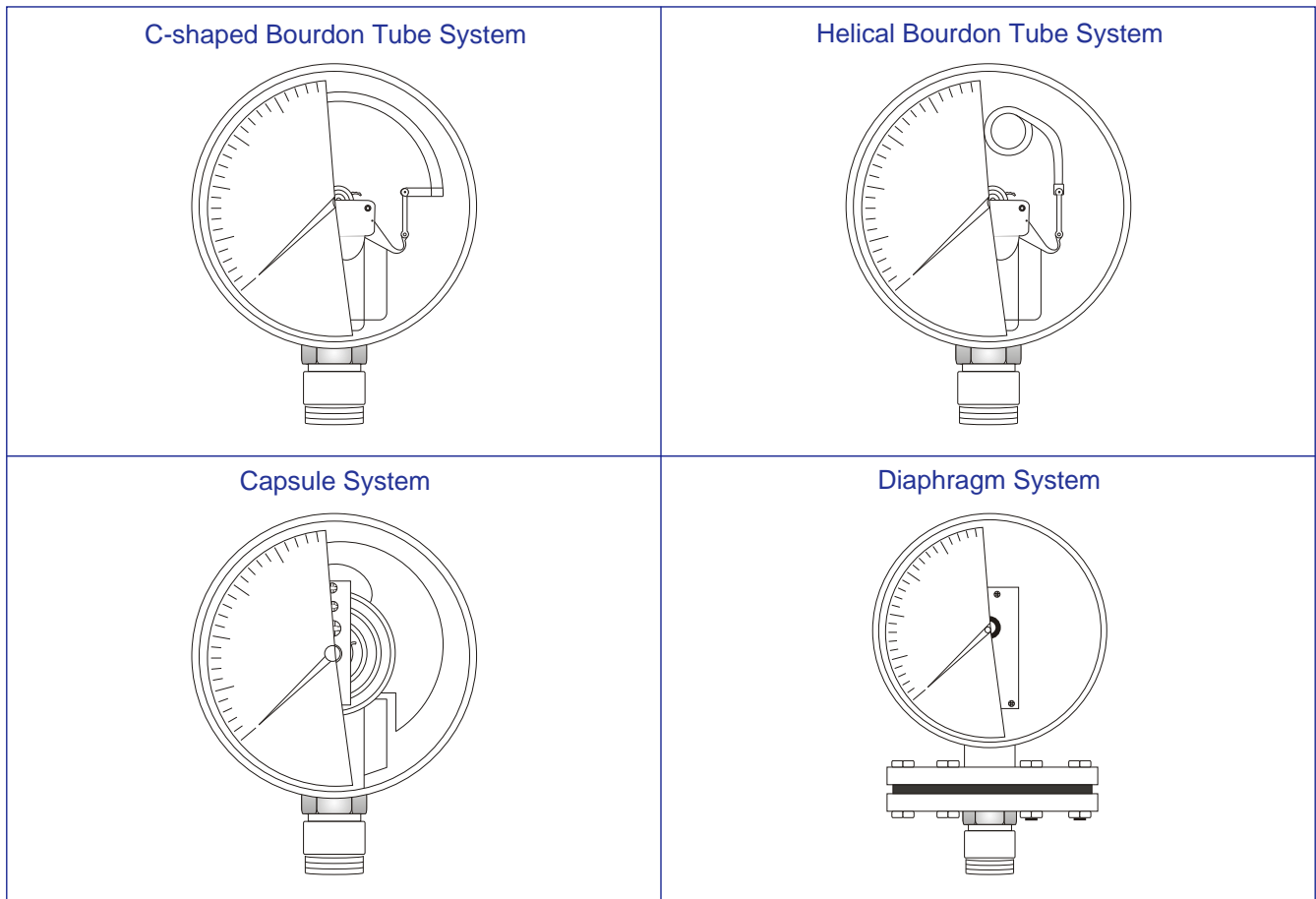
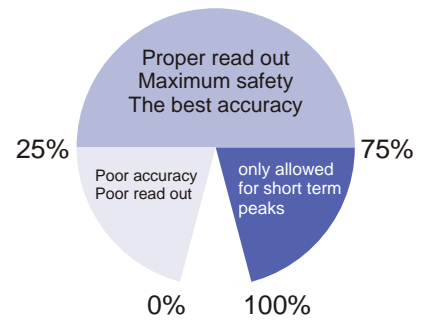
Pressure Element

Indumart offers pressure elements in a wide variety of materials, such as brass, phosphor bronze, 316L stainless steel and Kmonel®. Since the pressure element is in direct contact with the process fluid, chemical compatibility of the fluid with the pressure element must be checked. If the correct material is not available, the use of a diaphragm seal may be necessary to protect the system from the process fluid.

Additionally, the pressure range should also be considered for selection of the pressure element. Table 4 shows various types of pressure elements and their range limitations. Definite advantages of Indumart pressure gauges over other brands are bigger and thicker Bourdon tubes.

Table 4 - Range Limitations of Pressure Elements Supplied by Indumart
For other measurement units, please use the conversion factors.

Pressure Element	Range (bar)	Min. Range (bar)
"C" shaped Bourdon tube system	-1/0 ... 0/40	0...0.6
Helical Bourdon tube system	0/60 ... 0/1,600	0...60
Capsule system	-0.6/0 ... 0/0.6	0...0.025
Low pressure diaphragm system	-0.4/0 ... 0/0.4	0...0.01
High pressure diaphragm system	-1/0 ... 0/25	0...0.6
Differential capsule system	0...0.4	0...0.004
Differential diaphragm system	0...25	0...0.1
Differential tube system	0...25	0...0.6
Differential piston system	0...10	0...0.25



Movement

Movements are used to transfer the displacement of the pressure element to the pointer. Reducing the friction to its minimum, and extending the wear life are the two important factors when designing the movement parts. The movement systems of Indumart pressure gauges are very sturdy comparing to those of the others and most models are equipped with various adjustment screws on the movement to acquire the best pressure measurements.

Accuracy

Accuracy class is the maximum permissible error of indication at the reference temperature, expressed as a percentage of the span. The various accuracy classes and their availabilities are shown in Table 5.

The total of indication errors including hysteresis error and temperature error at reference temperature of 20°C shall not exceed the value given as accuracy class. For special accuracy classes, certain materials and procedures will be used.

If usage of liquid filling is required in the pressure gauges, the accuracy will drop at least one class compared to the accuracy of the same dry gauges.

Table 5 - Nominal Dial Sizes and Accuracy Classes

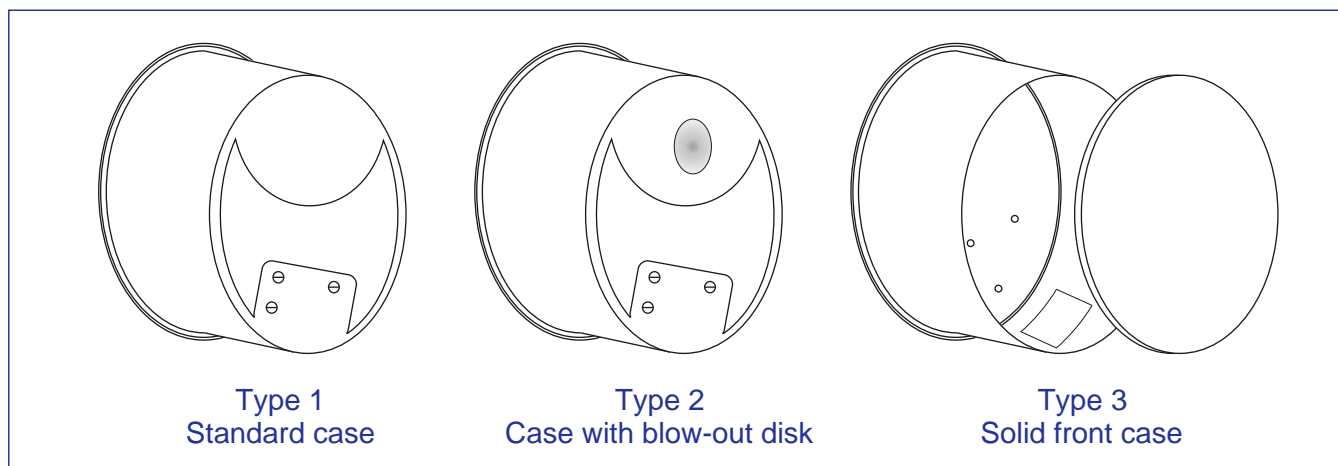
Dial (mm)	Accuracy Class					
	0.1	0.25	0.5	0.6	1.0	1.6
40						x
50						x
63						x
100			x	x	x	x
160		x	x	x	x	x
250	x				x	x

Case and Bezel

Case and bezel selection of a pressure gauge should be in accordance with the gauge environment. They vary in size, the material of construction and style.

Pressure gauge cases and bezels are available in ABS plastic, painted steel, chrome-plated steel, brass, stainless steel, aluminum and phenolic turret.

Indumart offers three types of cases: (1) standard case without blow-out device, (2) case with blow-out disk, and (3) solid front case with a solid wall between the bourdon tube and the window.

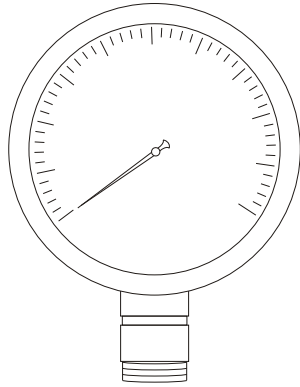


The bezel is to retain the window. Depending on the application and case type, five types of bezels are used: (1) bayonet, (2) crimped, (3) threaded, (4) snap-on, and (5) ring with screws.

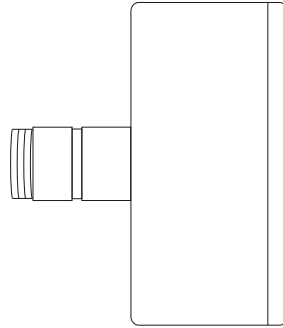
Mounting and Connection Position

Indumart pressure gauges are offered for five different kinds of mounting:

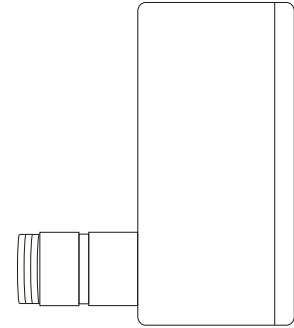
- * Direct mounting with bottom connection
- * Direct mounting with back connection (2 types)
- * Panel mounting by means of U-clamp
- * Wall mounting by means of back flange
- * Panel mounting by means of front flange with 3 fixing holes



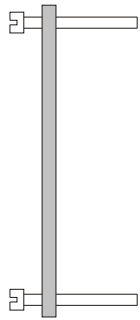
Bottom connection



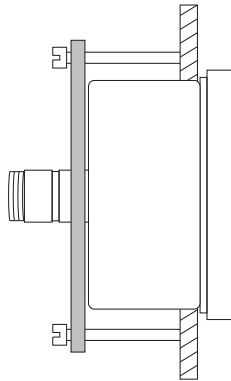
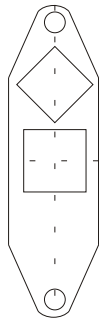
Centre back connection



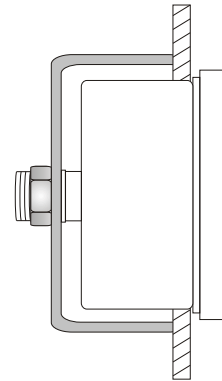
Eccentric back connection



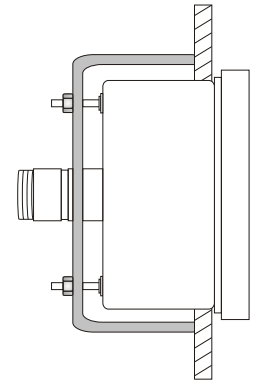
U-clamp for centre back and eccentric back connections



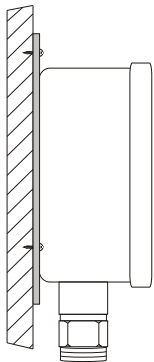
Panel mounting by means of U-clamp



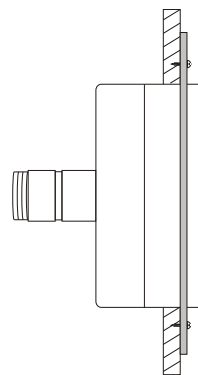
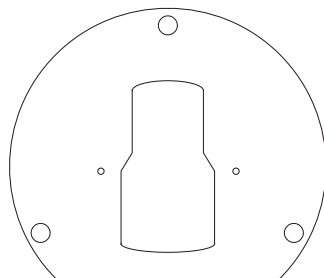
U-clamp and a nut on the back connection



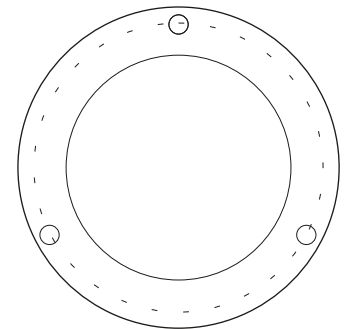
U-clamp with 2 welded bolts on the casing



Wall mounting by means of a back flange



Panel mounting by means of a front flange with 3 fixing holes



Pressure Connection

The position of the process connection and thread size for all pressure gauges are specified in the technical sheets. Standard threads are taper pipe threads according to ANSI/ASME B1.20.1 with NPT symbol, and parallel thread with G or BSP symbol. Other threads like SAE flair, specific to certain industries, are also available as special order.

Environmental Elements

Adequate safety results from intelligent planning, careful selection and proper installation of gauges into the system. The user should inform the supplier of all conditions pertinent to the application and the environment, so the supplier be able to recommend the most suitable pressure gauge.

The Ingress Protection (IP) rating of the selected pressure gauge must be such that to protect the gauge from dust and water penetrations. The IP code always consists of the letters IP followed by a two digit number. The first digit represents protection against penetration of solid foreign objects, while the second digit indicates resistance against liquid penetration.

1st Digit		2nd Digit	
Protection Against Solid Foreign Bodies		Protection Against Liquids	
0	No protection	0	No protection
1	Objects greater than 50 mm diameter	1	Vertically dripping water
2	Objects greater than 12 mm diameter	2	Angled (15°) dripping water
3	Objects greater than 2.5 mm diameter	3	Raining; maximum 60° angle
4	Objects greater than 1.0 mm diameter	4	Splashing from any direction
5	Dust protected	5	Water jets from any direction
6	Dust-tight	6	Heavy sea waves
		7	Immersed in water
		8	Immersed in water (specified pressure)

For safe installation, pressure restrictors, relief valves, pressure regulators, chemical seals, pulsation dampeners or snubbers, syphons, manifolds and other similar items are available.

Process Temperature

An important piece of information for selecting the correct pressure gauge is the profile of the process temperature. For proper operation of the selected pressure gauges, it is essential that the gauge stand the maximum temperature of the process.

Another benefit of knowing the process temperature is estimation of the accuracy of the pressure measurement. Accuracies of pressure gauges are usually expressed at the reference temperature of 20°C. Variations of process temperature alters the accuracies of Indumart pressure gauges as follows:

Where:

t_1 is the ambient temperature in °C,
 t_2 is the reference temperature in °C.

for Bourdon tube gauges $\pm 0.04 \times (t_2 - t_1)\%$ of the span

for capsule gauges $\pm 0.06 \times (t_2 - t_1)\%$ of the span

for diaphragm gauges $\pm 0.08 \times (t_2 - t_1)\%$ of the span

Over-pressure

Any over-pressure creates stress in the pressure sensing element and consequently reduces the life and accuracy of the pressure gauge. It is therefore always preferable to use a pressure gauge with a maximum scale value greater than the maximum working pressure to absorb over-pressure and surges more easily. Surges can be handled in the same way as pressure pulses.

Specifying over-pressure for a pressure gauge means that the sensing element will only withstand that for a short period of time. Use of an over-range protection unit is highly recommended for solving the over-pressure problem.

scale in psi	scale in bar	over-pressure at 20°C
up to 1500	up to 100	1.25 x full scale value
>1500 to 10000	>100 to 600	1.15 x full scale value
>10000 to 20000	>600 to 1600	1.10 x full scale value

Over pressure protector



Shocks and Pulsation

Where pressure shocks and pulsations cause the pointer of the pressure gauge to vibrate, use of a liquid-filled pressure gauge is recommended. Liquid filled pressure gauges are specifically designed for severe service applications. When immersed in glycerin, all moving parts of the pressure gauge are lubricated and dampened from the harmful effects of vibration and pulsation.

Liquid filled pressure gauges are widely used for agricultural equipments, hydraulic equipments, pressure washers, oil field equipments, pumps, compressors and other systems which may experience pressure shocks and vibrations.

Not all pressure gauges should be filled with a liquid (glycerin). For example, in case of capsule element pressure gauges, external dampeners must be used instead of liquid filling of the case.

IMPORTANT - All pressure gauges sealed for the purpose of liquid-filling have a device to assure atmospheric compensation. A sticker on the case shows how to cut off or pierce a hole into the rubber placed at the top of the gauge after installation. If the rubber device is not opened, in addition to false pressure reading, severe personal damage may be resulted.

Dials

The scale normally covers 270° of arc, but that may be longer for accuracy classes of 0.5% to 0.1%. Dials with an accuracy of 1.6 % have a stopping and a shortened first block. With an accuracy of 1% or better, there is no stopping and no shortened first block on the dial.

Window

Indumart pressure gauges are offered with (1) flat instrument glass, (2) laminated safety glass, (3) acrylic / plexiglas.