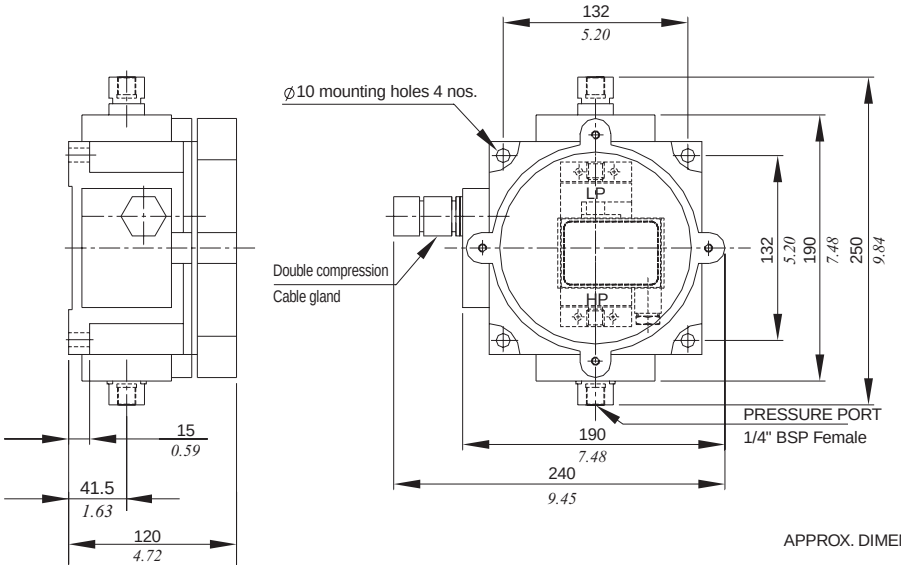
ACCESSORIES

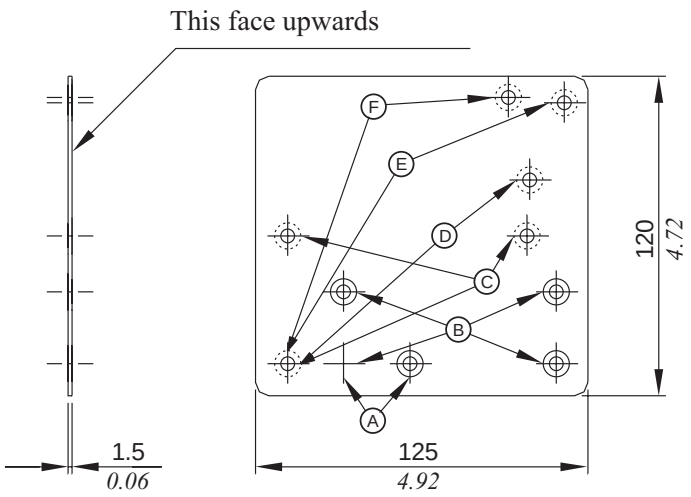
FLAMEPROOF ENCLOSURE FOR DP SERIES PRESSURE SWITCHES

INSTALLATION DRAWING



APPROX. DIMENSIONS IN mm / *inches*

MOUNTING PLATE



A. Mounting holes for MN / MA/MB models
B. Mounting holes for MG / ME / MF models
C. Three no.s holes on 90 X 48 (mm)
D. Two no.s holes on 91 X 69 (mm)
E. Two no.s holes on 104 X 98 (mm)
F. Two no.s holes on 83 X 100 (mm)

Note : Mounting screws, washers and spacers will be provided with this plate

APPROX. DIMENSIONS IN mm / *inches*

ACCESSORIES

CHEMICAL SEALS (DIAPHRAGM SEALS) :

General description :

Diaphragm seals are partitions used with pressure switches which prevent the measured medium from entering the pressure capsule of the pressure switch. Diaphragm seals solve many problems encountered in sensing, which are otherwise impossible to solve with only pressure switches. Some of the examples are :

- protection of pressure switch from aggressive, highly viscous solidifying or crystallizing measured media
- protection from high measured medium temperatures or fluctuations in temperature
- protection from vibrations by coupling via capillaries
- dead zone free sensing arrangements for particular hygienic applications
- use of special materials or surface coatings of the wetted parts for special applications.

CAUTION : Pressure switch and diaphragm seal are always a closed system and should not be separated by unauthorised persons.

When the pressure switch is to be kept away from undesirable temperatures or vibrations, a capillary can be used to connect the pressure switch and the diaphragm seal. Capillaries also have a throttling effect which is often desirable in pulsating process pressures. During setpoint adjustment, the weight of the liquid column between the diaphragm seal and the pressure switch needs to be taken into consideration, if they are mounted at different elevations.

Depending on the application, a variety of media with different properties are used as transmission liquids. For most of the general applications, silicon oil can be used. For food industries, a transmission liquid compatible with the process needs to be used.

A variety of chemical seals can be supplied with pressure switches and only the most commonly used arrangements / assemblies are shown here.

In most of the cases, the common wetted parts and diaphragms are of SS316. Alternate wetted materials that can be provided are :

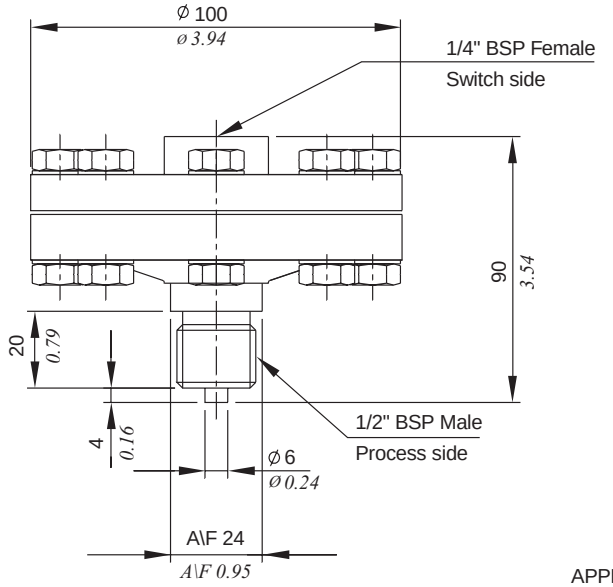
- HASTELLOY B2
- HASTELLOY C4
- HASTELLOY C22
- HASTELLOY C276
- INCONEL ALLOY 600
- MONEL ALLOY 400
- MONEL ALLOY K500
- NICKEL
- PLATINUM
- TANTALUM
- TITANIUM
- ZIRCONIUM
- SILVER
- PTFE

The on - off differentials of pressure switches fitted with chemical seals are likely to be higher than those mentioned in the catalogue. There is also a possibility of time lag (for sensing) being introduced, depending on the length of the tubing between the pressure switch and the seal.

While ordering, customer's are requested to specify all the process parameters including ambient conditions, operating conditions, the process to be sensed and response times allowable, temperature of the seal under sensing conditions and temperature outside the measuring / sensing sequences (e.g as in rinsing sequences) so that a proper sealing system can be suggested.

ACCESSORIES

STANDARD CHEMICAL SEAL SUITABLE FOR THREADED CONNECTION : (Type A)

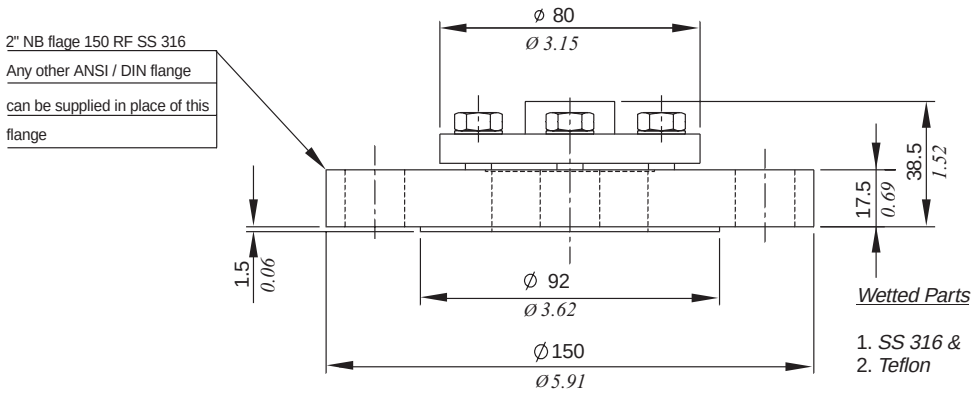


Wetted Parts

1. *SS 316 &*
2. *Teflon*

APPROX. DIMENSIONS IN mm / *inches*

CHEMICAL SEAL SUITABLE FOR VARIABLE FLANGED CONNECTION : (Type B)



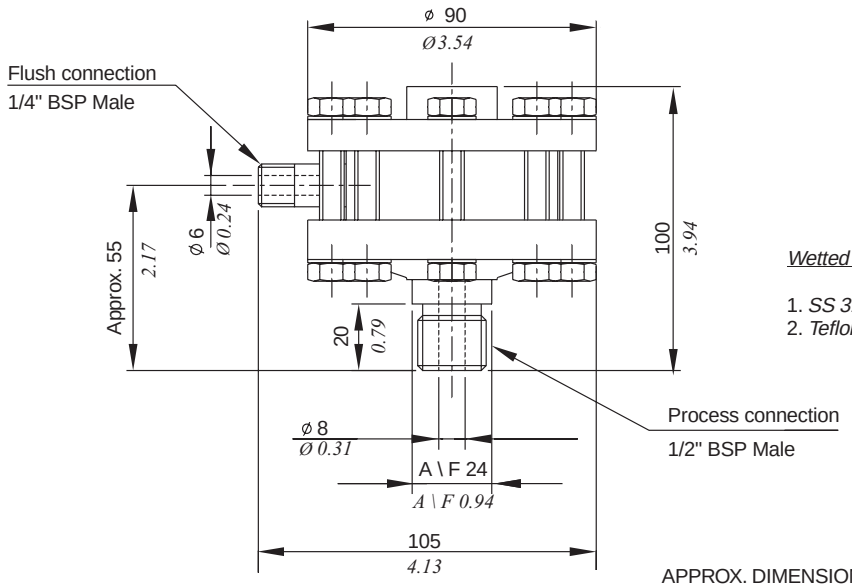
Wetted Parts

1. *SS 316 &*
2. *Teflon*

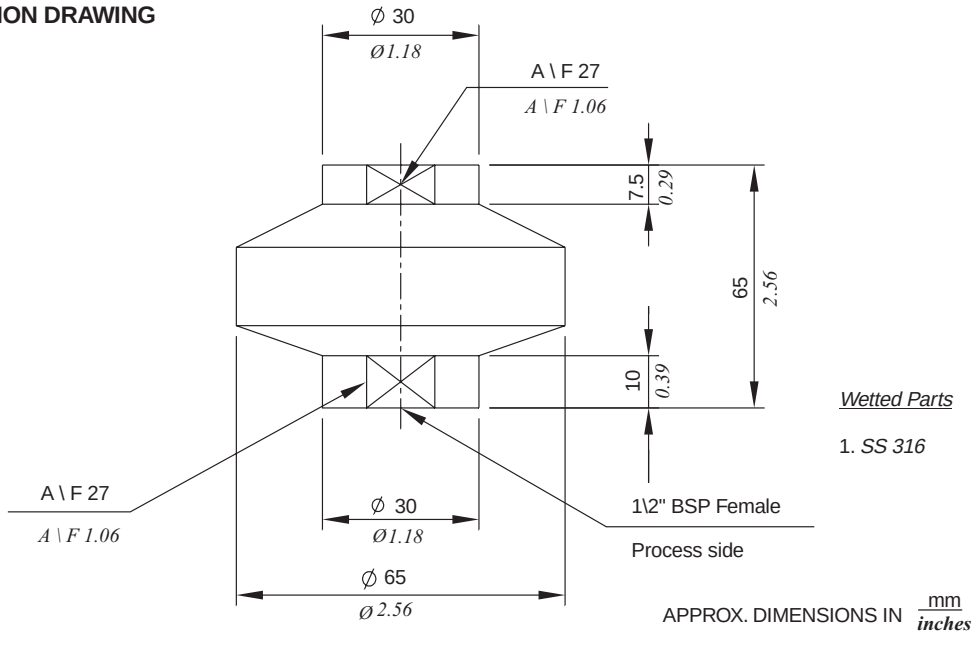
APPROX. DIMENSIONS IN mm / *inches*

ACCESSORIES

FLUSH TYPE CHEMICAL SEAL (Type C)



FULL WELDED CHEMICAL SEAL (Type D)



GENERAL SPECIFICATIONS AND APPLICATION NOTES

1. All the pressure switches contained in this catalogue are gauge pressure switches.

2. Pressure switches are switching instruments and not measuring ones. As such, the word "calibration" is used for the markings made on the scale to indicate the approximate setpoint of the pressure switch. No "calibration certificate" for this indication can be given in the proper sense of the word. However, the pressure switches can be supplied preset at user specified setpoints, provided the setpoints are indicated during the ordering stage itself.

3. Process temperature : can be 80 deg. C maximum. A pressure switch being a dead end, is not subjected to continuous process temperature(as in case of flow). As such, a proper length of impulse tubing of proper material (or chemical seals with adequate tubing) will substantially bring down the temperature, well within the specified limits. Normal pressure switches (without any modifications) have been used with working media having a temperature of upto 350 deg. C, only by employing an additional impulse tube.

4. Ambient temperature : can be from -10 deg. C to 60 deg. C for most of the standard pressure switches. Care should be taken that no icing occurs inside the enclosure where the atmospheres are humid, when pressure switches are used in subzero ambient temperature areas. Pressure switches for use in wider ambient temperatures can be developed should your application fall in such areas. If the process is likely to freeze / crystallize / solidify within this ambient range, chemical seals should be used alongwith the pressure switches.

5. All the pressure switches are tested on kerosene / air prior to despatch. For applications involving food grade material / oxygen service or processes not compatible with kerosene, such a note should be specifically made while ordering, so that pressure switches are tested accordingly.

6. All data published is under standard test conditions. Following conditions generally apply for Laboratory Evaluation tests :

Temperature	:	Ambient room temperature (21 ^{0}C)
Humidity	:	Ambient (50 %)
Proof pressure	:	1.5 times maximum working pressure
Cycling rate	:	30 cycles / minute
Pressure rise	:	compatible with above cycling rate (maximum)
Life in no. of cycles	:	100,000 minimum

The life and characteristics of pressure switches can be affected by temperature, humidity, airborne contamination, vibration and frequency of operation of the pressure switches. For specific switch selection, customers are requested to evaluate switch performance under actual application conditions or by simulating all the extreme application conditions and requirements. Laboratory Evaluation test data can never substitute customer's own product evaluation.

The life of the pressure switches can be increased by incorporating changes in design or by substituting certain components. Customers are requested to contact our sales office for any such specific requirements.

DEFINITIONS & TERMINOLOGY FOR PRESSURE ACTUATED SWITCHES

Pressure Switch :- A pressure switch is an instrument that automatically senses a change in pressure and opens or closes an electrical switching element when a pre-determined pressure point is reached.

Pressure sensing element :- A pressure sensing element is the portion of the pressure switch that transmits motion due to change in pressure.

Electrical switching element :- The electrical switching element in a pressure switch opens or closes an electrical circuit in response to the actuating force it receives from the pressure sensing element. Orion pressure switches are fitted with single pole double throw (SPDT) snap action switch(es) as electrical switching element (s) for maximum reliability.

Normally open switching element :- No current can flow through the switching element until the switch is actuated.

Normally closed switching element :- Current flows through the switching element until the switch is actuated.

Set Point :-

The set point is expressed in terms of exact pressure at which the snap-action switch is actuated to either open or close the electrical circuit (depending on how the switch is wired).

Differential (Dead band, Hysterisis) :- Differential is the difference between the actuation point and the deactuation point. e.g. if a pressure switch is set to operate at 5 bar on increasing pressure, the switch will close when the pressure rises to that point. As the pressure drops to, say, 4.8 bar the switch may open (this is the deactuation point). The differential of this switch is then 0.2 bar, the difference between the set point of 5 bar and deactuation point of 4.8 bar. Differential is sometimes referred to as "deadband" or "hysterisis".

Set Point in relation to increasing pressure & decreasing pressure :- A pressure switch may be set to actuate at any desired point on rising pressure or falling pressure. The former is described as "set to actuate on increasing (or rising) pressure" & the latter as "set to actuate on decreasing (or falling) pressure". The preferred actuation must be specified clearly on orders for pressure switches that are to be factory set.

Range :- The span within which the set point of a pressure-actuated switch may be adjusted.

Proof Pressure :- Proof pressure is the highest pressure to which a switch may be subjected without permanent damage.

Maximum working pressure (MWP) :- The nominal pressure level that a system will operate at, including workload.

Differential pressure :-The difference between a reference pressure and a variable pressure.

Wetted parts :- The parts which come in contact with the working medium.

HOW TO SELECT A PRESSURE SWITCH FOR YOUR APPLICATION

Following are the general guidelines which should help you arrive at a proper selection of a pressure switch for your application.

Step 1.

Service life of the switch. Expected service life is the first consideration to be made in selecting a pressure switch, regardless of sensitivity or pressure desired. A second consideration in choosing a pressure switch is the speed of cycling, regardless of the service life. A sensing element made of metal sheets is likely to fatigue at cycling speeds above 20 cycles per minute and is not recommended for service life of more than 1 million cycles. Orion and Parus pressure switches use nylon reinforced rubber or piston as a sensing element and have been tested at a cycling frequency of 30 cycles / minute for more than a million cycles. The working medium to be controlled must be considered and to simplify selection, wetted parts are indicated on the catalogue pages.

Step 2.

Proof pressure - Choice of type of pressure switch must also be governed by the highest pressure to which it will ever be subjected. The highest pressure in the system including surges, should not be more than the proof pressure of the switch. It must be remembered that, though there are surges in the system, a pressure gauge may register a constant reading, the surges being dampened out by the orifice in the gauge.

Step 3.

Function of the switch. Three types of Orion pressure switches, based on function, are described below. a) Single setting pressure switches : They sense a single pressure source and open or close a single electrical circuit by means of a snap action electrical switch. b) Pressure difference switches : They sense a change in relationship between two pressures and open or close a single electrical circuit by means of a snap action electrical switch. c) Adjustable differential pressure switches: They sense two pressure limits, within a desired adjustable range, from a single pressure source and open or close a single electrical circuit by means of a snap action electrical switch.

Step 4.

Selection of adjustable range. The range should be selected such that the setpoint lies as close as possible to the middle of the total adjustable range. This will ensure the most favourable combination of accuracy and life.

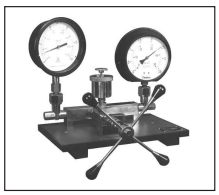
Step 5.

Working medium. The working medium should be compatible with the wetted parts. For easier selection, the wetted parts are given in the catalogue pages. The maximum temperature of the working medium is also important. A pressure switch, being a dead end, is not subjected to continuous temperature. If the temperature of the working medium exceeds 80 deg. C, an impulse tubing of appropriate length should be used between the process connection and pressure port of the switch. Where the working medium is likely to freeze at the sensing element, a diaphragm seal (chemical seal) with appropriate wetted parts should be used. In case of excessive temperature or mounting the pressure switch remotely, pressure switches can also be supplied with remote seals. The filling medium has to be compatible with the working medium, and needs to be specified while ordering. (Specially in case of food related industries / processes)

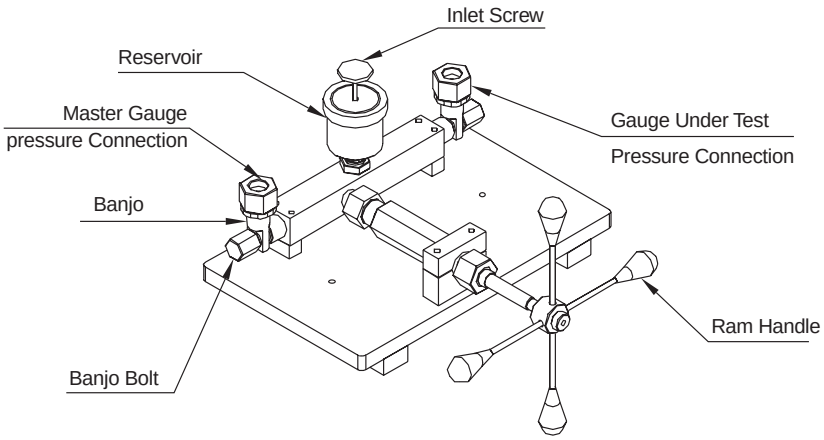
Step 6.

Environment. The environment in which the pressure switch will operate is very important. Orion pressure switches can be supplied in weatherproof enclosures for outdoor service. For use of pressure switches in hazardous areas Orion pressure switches can be supplied in flameproof enclosures.

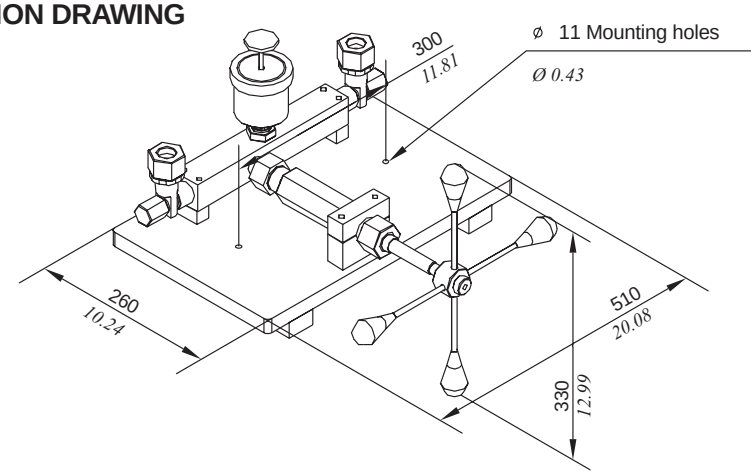
TR COMPARISON TEST PUMP



USER END DETAILS



INSTALLATION DRAWING



APPROX. DIMENSIONS IN mm / *inches*

COMPARISON TEST PUMP TR

General information :
A comparison test pump is a device by which pressure gauges can be calibrated in comparison with master pressure gauges. These can also be used for comparison of master gauges with normal use pressure gauges after periodic intervals to detect a drift in calibration. The unit is portable and comes in handy during pressure gauge calibration verification in ISO 9000 companies. Standard process connection provided is 3/8" BSP female. Adaptors to suit individual pressure gauges can be provided as accessories.

Features :
- Portable
- Light weight
- suitable for both bottom and back connection pressure gauges

Range Selection Table

Range Code	Range bar *(psi)*
TR 400 MD	0 - 400 *(0 - 5714.29)*
TR 700 MD	200 - 700 *(2857.14 - 10000)*

Testing procedure for comparing pressure gauges

Mount the master pressure gauge on the left hand side adaptor and gauge under test on right hand side adaptor. Fill the reservoir with kerosene.

To fill the system with kerosene proceed as follows :

1 Unscrew the inlet screw of reservoir
2 Take the ram out by rotating the ram handle anticlockwise to the extreme end. This will fill the system with kerosene.
3 To remove any air trapped inside the system, turn the ram handle clockwise to the extreme end. The presence of air is established if bubbles appear in the reservoir.

Repeat steps 2 and 3 till no bubbles appear in the reservoir.

Take the ram handle fully out and tighten the inlet screw. When the ram handle is rotated clockwise, the pressure in the system starts increasing and the two pressure gauges can be compared with each other.

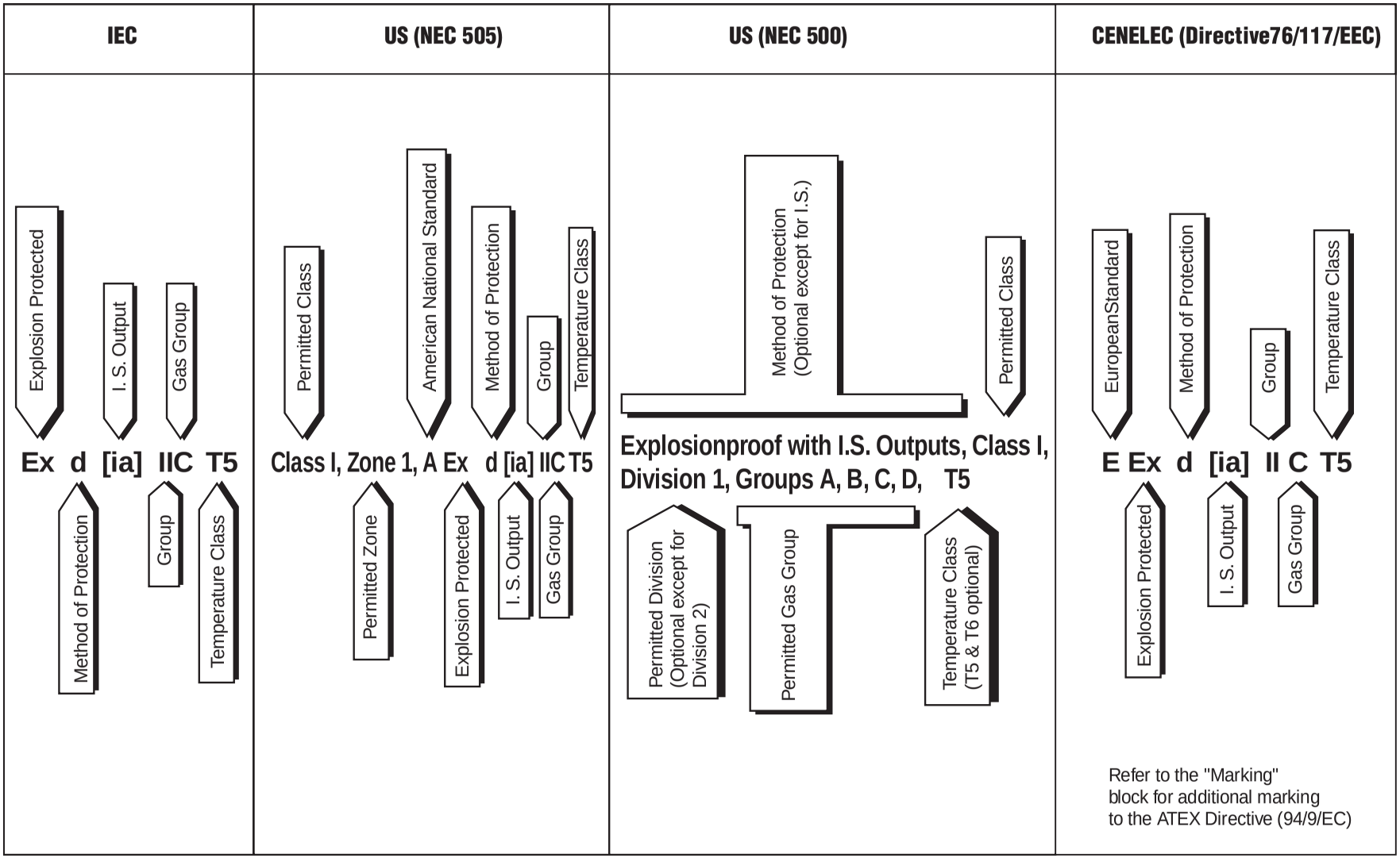
The gauges can be tilted to a convenient angle by loosening the bolt and rotating the banjos as per requirement, before the system is pressurized. The banjo bolt has to be tightened after attaining the desired angle. This facility is particularly useful in pressure gauges with back connection.

The pressurizing fluid used should be kerosene (not supplied with the equipment). The *wetted parts* are *mild steel, nitrile, and teflon*. As such, only pressure gauges used on process fluids compatible with kerosene and the wetted parts can be / should be checked / compared using the comparison test pump.

Please Note *:*
A comparison test pump is only a device to generate pressure. As such, it has no accuracy and no such certificate of accuracy can be provided for these devices.

How to order Parus comparison test pumps.
Specify the model by choosing the item code in the range selection table. Give the details of accessories needed, if any, in text.

Ex MARKING GUIDE



Bulletin No. KA000504

PROTECTION CONCEPTS

Method Of Protection	Code	Permitted Use	Standard	Protection Principle
Increased Safety	AEx e	Class I, Zone 1,2	FM 3600* (ISA S12.16.01)	No arcs, sparks or hot surfaces
	EEx e	Zone 1, 2	EN 50 019	
	Ex e	Zone 1, 2	IEC 60079-7	
Non-incendive	(NI)	Class I, Div 2	FM 3611	
Non-sparking	Ex nA	Zone 2	IEC 60079-15	
Explosionproof	(XP)	Class I, Division 1,2	FM 3615	Contain the explosion and quench the flame
Flameproof	AEx d	Class I, Zone 1, 2	FM 3600* (ISA S 12.22.01)	
	EEx d	Zone 1, 2	EN 50 018	
	Ex d	Zone 1, 2	IEC 60079-1	
Powder Filled	A Ex q	Class I, Zone 1, 2	FM 3600* (ISA S12.25.01)	
	EEx d	Zone 1, 2	EN 50 017	
	Ex q	Zone 1, 2	IEC 60079 - 5	
Enclosed Break	Ex nC	Zone 2	IEC 60079 - 15	
Intrinsic Safety	(IS)	Class I, Div 1, 2	FM 3610 †	Limit energy of sparks and surface temperature
	AEx ia	Class I, Zone 0, 1, 2	FM 3610 †	
	AEx ib	Class I, Zone 1, 2	FM 3610 †	
	EEx ia	Zone 0, 1, 2	EN 50 020/39	
	EEx ib	Zone 1, 2	EN 50 020/39	
	Ex ia	Zone 0, 1, 2	IEC 60079-11	
	Ex ib	Zone 1, 2	IEC 60079-11	
Limited Energy	Ex nA	Zone 2	IEC 60079-15	
Pressurized	Type X	Class I, Div 1	FM 3620	Keep Flammable gas out.
	Type Y	Class I, Div 1	FM 3620	
	Type Z	Class I, Div 2	FM 3620	
	EEx p	Zone 1	EN 50 016	
	Ex p	Zone 1	IEC 60079-2	
Restricted Breaching	Ex nR	Zone 2	IEC 60079-15	
Encapsulation	AEx m	Class I, Zone 1, 2	FM 3600* (ISA S12.23.01)	
	EEx m	Zone 1, 2	EN 50 028	
	Ex m	Zone 1, 2	IEC 60079 - 18	
Oil Immersion	AEx o	Class I, Zone 1, 2	FM 3600* (ISA S 12.26.01)	
	EEx o	Zone 1, 2	EN 50 015	
	Ex o	Zone 1, 2	IEC 60079-6	

*Also shall comply with ISA S12.0.01 †Based on ISA S12.2.01

Source : Factory Mutual Research

AREA CLASSIFICATION

	Flammable Material Present		
	Continuously	Intermittently	Abnormally
IEC/ CENELEC	Zone 0 (Zone 20 - dust)	Zone 1 (Zone 21 - dust)	Zone 2 (Zone 22 - dust)
US NEC 505	Zone 0	Zone 1	Zone 2
US NEC 500	Division1		Division 2

IEC Classification per IEC 60079-10.
CENELEC classification per EN 60079-10
US classification per ANSI/NFPA 70 National Eletric Code (NEC) Article 500 or Article 505

APPARATUS GROUPING

Typical Gas/dust/fibre	**US (NEC 505) IEC CENELEC**	**US (NEC 500)**
Acetylene	Group IIC	Class I/Group A
Hydrogen	(Group IIB + H_2)	Class I/Group B
Ethylene	Group IIB	Class I/Group C
Propane	Group IIA	Class I/Group D
Methane	Group I*	Mining*
Metal Dust	None	Class II/Group E
Coal Dust	None	Class II/Group F
Grain Dust	None	Class II/Group G
Fibers	None	Class III

*Not within scope of NEC. Under jurisdiction of MSHA.
MSHA - Mine Safety & Health Administration

TCODES

Maximum Surface Temperature	**US (NEC 505) IEC CENELEC**	**US (NEC 500)**
450°C	T1	T1
300°C	T2	T2
280°C	-	T2A
260°C	-	T2B
230°C	-	T2C
215°C	-	T2D
200°C	T3	T3
180°C	-	T3A
165°C	-	T3B
160°C	-	T3C
135°C	T4	T4
120°C	-	T4A
100°C	T5	T5
85°C	T6	T6

Notes :

INGRESS PROTECTION (IP) CODES

First Number	Second Number
Protection against solid bodies	**Protection against liquid**
0. No protection	0. No protection
1. Object greater than 50mm	1. Vertically dripping water
2. Object greater than 12mm	2. 75^0 to 90^0 dripping water
3. Object greater than 2.5mm	3. Sprayed water
4. Object greater than 1mm	4. Splashed water
5. Dust-protected	5. Water jets
6. Dust-tight	6. Heavy seas
7. -	7. Effects of immersion
8. -	8. Indefinite immersion

Approximate US Enclosure Type Equivalent to IPXX

Type →	IP	Type →	IP	Type →	IP
1	10	3S	54	6 & 6P	67
2	11	4 & 4X	55	12 & 12K	52
3	54	5	52	13	54
3R	14				

Source : Factory Mutual Research

Pressure Conversion Table

	Kg/cm^2	mmHg	Bar	mbar	mmWC	psi (lb/in^2).	KPa
Kg/cm^2	1	735.56	0.9807	980.7	10000	14.2233	98.066
mmHg	0.001359	1	0.00133	1.3332	13.5951	0.01934	0.13332
Bar	1.01972	750.062	1	1000	10197.16	14.5038	10^2
mbar	1.01972×10^{-3}	0.7501	0.001	1	10.197	0.0145	0.1
mmWc	0.0001	0.07355	0.000098	0.098	1	0.00142	9.8067×10^{-3}
psi (lb/in^2)	0.07031	51.715	0.06895	68.950	703.07	1	6.8947
KPa	0.0101972	7.50062	10^{-2}	10	101.9716	0.145038	1

While every effort has been made to ensure the accuracy of this catalogue at the time of publication, we reserve the right to supply equipment in line with current design specifications. So, we recommend that critical parameters be checked at the order stage.