



Offshore Design Section  
Engineering Services  
ISO – 9001:2008

**FUNCTIONAL  
SPECIFICATION FOR  
“DIFFERENTIAL PRESSURE  
GAUGE”**

Spec. No. 3400

Rev. No. 7

Discipline Instt

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FOR  
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## **1.0 SCOPE OF THIS DOCUMENT:**

- 1.1 This functional specification describes the essential design considerations for the selection of Differential Pressure Gauge for the intended service.

## **2.0 CODES & STANDARDS:**

### **2.1 Standards :**

- a) ASME B 40 .100 – latest edition : Pressure gauges and gauge attachments
- b) EN - 837 - (Part 2 & 3 )- latest edition: Pressure gauges Dimensions, metrology, requirements and testing

### **2.2 Reference Documents :**

- a) Instrumentation Design Criteria
- b) Basic Bid Work
- c) Project P & IDs
- d) Process Design Criteria / Instrument Process Data Sheets

## **3.0 SCOPE OF SUPPLY:**

- 3.1 The quantity to be supplied and installed shall be as per the requirements indicated in above reference documents.
- 3.2 The vendor shall be responsible for the selection of the Differential Pressure gauge suitable for its intended application, its procurement, tagging, packing, testing & calibration, preparation for shipment, along with accessories, spares, and assistance where required for its installation & commissioning at site.

## **4.0 DIFFERENTIAL PRESSURE GAUGE:**

### **4.1 General:**

- 4.1.1 Differential Pressure gauges shall be used for local indication. Differential Pressure Gauge may be Field mounted or Panel mounted based on the requirements.
- 4.1.2 Dial size of Field mounted gauges shall not be less than 6” (150 mm). Process connection for these gauges shall be ½ ” NPTM , generally with bottom entry .
- 4.1.3 Dial size of Panel mounted differential pressure gauges shall be of preferably 6”or 4” . Process connections for these gauges shall be ½ ” NPTM with back entry .
- 4.1.4 For packaged items. In case of space constraints, 4” Dial size Gauge may be accepted
- 4.1.5 Differential Pressure gauges shall in general be heavy duty, weatherproof , white coloured dial with black numerals & markings and with black pointer.
- 4.1.6 Position of blowout disc shall be preferably rear mounted where ever not possible, top mounted can be considered.





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
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- 4.1.7 Gauges shall have external or internal zero micrometer adjustment .Gauge pointers shall be adjustable without removal from shaft. 
- 4.1.8 Differential Pressure gauge measuring element shall generally be Bellows / Diaphragm type. Diaphragm seals shall be used for measurement of slurries, viscous and chemicals (effluent/ injection services etc.). Diaphragm seals with capillary shall in general be 1 ½” flanged.
- 4.1.9 Additionally, where damping is required for gauges, differential pressure gauge shall be liquid filled or any other proven (with PTR) advanced damping technology can be used (without liquid filled damping) to arrest the process fluctuations and vibrations due to installation. Glycerin / Silicone oil shall generally be used for liquid filling. Liquid filled gauges (considering both process and ambient temperature limits) shall have a small vapor space for thermal expansion of liquid fill.
- 4.1.10 Differential Pressure gauge enclosure shall be weather proof to NEMA 4 / IP 65 or better. Over range protection of 130 % of maximum static pressure shall be provided without affecting its calibration / accuracy.
- 4.1.11 Gauges located on lines subjected to pulsating pressures (such as all pumps, compressors discharge service etc.) shall be provided with Snubber type pulsation dampeners.
- 4.1.12 Gauge savers shall be provided wherever specified to prevent the gauge when maximum working pressure exceeds 130% of maximum static pressure. Gauges in vacuum service shall have over range protection to full vacuum. A visible Stop Pin shall be used to restrict the upper limit of the pointer travel.
- 4.1.13 DPG shall be installed in such way that length of impulse lines is kept minimum.
- 4.1.14 Mandatory spare instruments shall be provided as 10% minimum or 1 (one), whichever is more of each type and range. 

**4.2 Material:**

- 4.2.1 Material requirements for pressure gauges shall in general be according to Annexure –II : Material selection chart and clause 3.6.4.5 of Instrumentation Design Criteria. 
- 4.2.2 Process connections and ‘Material of construction’ of all wetted parts shall be compatible with the process fluid however it shall be SS 316 minimum. 
- 4.2.3 Material for Pointer shall be SS 316 or Aluminium.
- 4.2.4 Material for movement shall be SS 316. However for liquid filled gauges SS 304 can be accepted.
- 4.2.5 Case material for all Differential Pressure gauges shall be SS 316 with a screwed bezel / bayonet bezel retaining ring and weatherproof design.



4.2.6 Window material shall be of Shatter-proof glass or ‘fully transparent’ acrylic plastic.

4.2.7 Gauge saver, snubber (whenever used) and manifold shall be of the same material as that of the pressure element.



**4.3 Range :**

4.3.1 Range shall be selected such that at zero differential pressure, pointer will be at starting point of the scale. However only for Vacuum applications, Pointer position will be at the centre of the scale.

**4.4 Accuracy :**

4.4.1 Accuracy shall be +/- 1 % of the span or better. However for Low Static pressure applications ( i.e 0 to 1 kg/cm<sup>2</sup> ) accuracy can be +/- 1.6 % of FSD or better.

4.4.2 Change in process conditions shall not affect the accuracy of gauge.

**4.5 Testing & Inspection as per ASME B 40 .100 :**



4.5.1 Test Requirement of Pressure Gauges according to EN 837-3: 1996:-

1. Leak Test
2. Accuracy and Hysteresis
3. Influence of Mounting Position
4. Temperature Effects
5. Temperature in Service
6. Storage Temperature
7. Degree of Protection
8. Endurance – Steady Pressure, over-pressure & cyclic pressure
9. Effects of Mechanical Vibration
10. Effects of Mechanical shock
11. For safety pattern Gauges: Blowout test & Energy release test

4.5.2 Inspection /Acceptance Test at Factory / Manufacturer Premises for pressure Gauge:-

1. Visual Inspection
2. Dimensional Verification
3. Accuracy
4. Leak Test
5. Degree of Protection

4.5.3 Tests indicated in (4.5.1) but not covered in Inspection/Acceptance Test (4.5.2) for Pressure Gauge are to be covered in Type Test. However, Accuracy & Hysteresis test shall be included in Type Tests. The type test requirement will be for each model and range. The type tests are to be witnessed by DNV/LLOYDS/BV/TUV/NABL/Govt. Laboratory etc. Valid type test certificate shall be provided along-with the supply.

4.5.4 Each type test certificate should indicate its validity period (Normally 5 years). The same has to be seen at the time of delivery/supply.



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4.5.5 Inspection/Acceptance Test shall be as per company provided IRT 

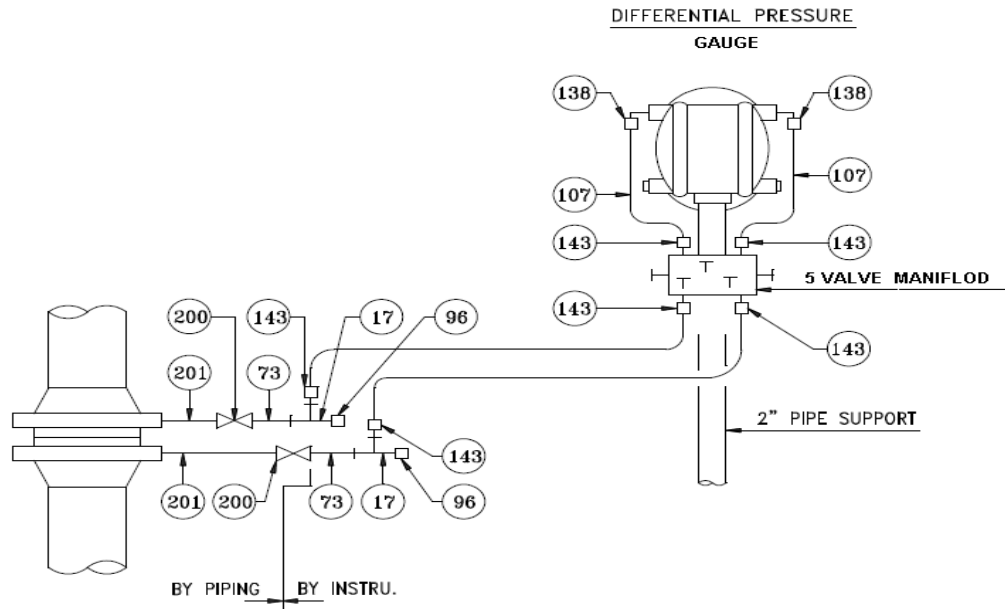
**4.6 Reading Scales:**

4.6.1 Indicating scale shall be direct reading type . It shall have scale as ‘mm H<sub>2</sub>O’/  
‘mm H<sub>g</sub>’ / ‘PSI’ as per process requirements.



**ANNEXURE – I**

*(Hook Up Drawing)*



ITEM	QTY	SIZE	DESCRIPTION
17	2	½" NPTF	TEE , THKxTHKxTHK,
73	2	½" NPTM	NIPPLE , 3" LONG , PL x THK x THK x THK,
96	2	½" NPTM	PLUG , SCRD
107	A/R	½"OD x 0.065 THK	TUBING
138	2	½" THK x ½" OD NPTM	MALE CONNECTOR ,
143	6	½" THK x ½" OD NPTM	MALE CONNECTOR ,
			5 VALVE MANIFOLD
200	-	-	VALVE - BY PIPING
201	-	-	NIPPLE - BY PIPING



**ANNEXURE – II**



**Material Selection Chart for Diff Pressure Gauges**

Sr. No	Piping Class	Element Material
1.	A1, B1, D1, E1, F1, XF1, F1, PA1, PB1, PD1, PE1, PXF1, PF1, A2, B2, D2, E2, XG1, A1H, A3, B3, A8 (EXCEPT WAT. INJ. SERVICE)	SS316
2.	Raw seawater and treated water service	Monel
3.	A4, A6, A9, B9, D9, E9	SS316
4.	A5	Monel
5.	A7	SS316
6.	A1N, B1N, D1N, E1N, F1N, XF1N, PA1N, PB1N, PD1N, PF1N, XG1N	SS316L
7.	A10, B10, D10, E10, F10	SS316L
8.	A11, B11, D11, E11, F11, PA11, PB11, PD11, PE11, PF11	Hastalloy C
9.	A23, B23, D23, E23, F23, PA23, PB23, PD23, PE23, PF23	Hastalloy C

For Sour service applications, MOC shall be compliant to NACE MR-01 75 requirements.





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**ANNEXURE – III**

**TYPICAL DATA SHEET – DIFFERENTIAL PRESSURE GAUGE**

**DIFFERENTIAL PRESSURE GAUGES**

UNITS :- Flow Liquid – M3/HR Gas – NM3/HR Pressure – kg/cm2 Temperature – deg C Level/length -M

1	Type		15	Diaphragm Seal (wherever required)	
2	Mounting		a)	Type	
3	Dial Size/Colour		b)	Wetted Parts	
4	Case Material		c)	Other Material	
5	Bezel Ring		d)	Process Connection	
6	Window Material		e)	Facing & Finish	
7	Enclosure Class		f)	Capillary Material	
8	Pressure Element		g)	Armour type	
9	Element Material		h)	Armour Material	
10	Socket Material		i)	Capillary Length	
11	Accuracy		j)	Flushing Filling Conn.	
12	Zero Adjustment		16	Over range protection	
13	Connection & Location		17	Blow out protection	
14	Movement		18	Options	
15	Diff Pressure Range & Scale		a)	Snubber	
			b)	Siphon	
			c)	Gauge saver	
			d)	Liquid filled casing	
			e)	Vacuum protection	
			f)	Space ring	
			g)	Solid front	

TAG No.	RANGE	OPER. PRESSURE	MAX. SERVICE TEMP.	OPER. TEMP	MAX. SERVICE TEMP.	FLUID	SERVICE	OPTIONS

NOTE:-

VENDOR SEAL AND SIGNATURE