General
AN ISO 9001:2000 COMPANY

PRESSURE

TEMPERATURE

FLOW

LEVEL

Comprehensive Product Catalogue

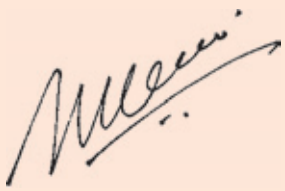
From the chairman's desk

For over forty years **GENERAL** has been designing & manufacturing primary process control instruments for measuring Pressure, Temperature, Flow & Level. Since inception in 1966, we have earned a reputation for providing solutions to process related problems & has been a single point source for reliable precision instruments.

Today, **GENERAL** is the largest manufacturer of Primary Process Control Instruments in India having seven manufacturing plants & over 400 people working in the group. All manufacturing plants are ISO 9001:2000 certified. National & international approvals are the foundations of our reputation in the industry.

With offices in all major metros in India, representation in various countries in South East Asia, Africa, Middle East and Australia, Europe & USA, we are in a unique position to have total system capability to solve customers' problems. With the help of latest technology to test & monitor each production process & uncompromising commitment to quality, customer gets the product, which meets the highest standards. By catering to growing number of applications in a cross section of industries, **GENERAL** is able to enjoy a substantial share of the market. Qualified members of our team are engaged in customsing newer solutions to solve problems, striving for improvement. 'Export Excellence Award' from the Ministry of Commerce - Govt of India, has added another feather in our cap.

We value ethics, commitment & integrity the most, which has been our philosophy for achieving total customer satisfaction. I reaffirm the same.



Capt. M. M. Kulkarni
Group Chairman

Corporate Information

Board of Directors	Capt. M. M. Kulkarni Y. M. Kulkarni M. T. Kulkarni Manavendra Kulkarni Amarendra Kulkarni Raghavendra Kulkarni
Auditors	VDM & Associates V P Deshpande & Associates
Bankers	Bank of India Shamrao Vithal Co-operative Bank Ltd. Saraswat Co-operative Bank Central Bank of India Punjab National Bank
Registered Office	Parwati Kunj, 2nd Floor, Bhagat Gally, Mahim, Mumbai-400 016.
Domestic Network	
Mumbai	194/195, Gopi Tank Road, Mahim, Mumbai 400016.
Baroda	715, Yashkamal Building, Tilak Road, Sayaji Ganj, Baroda 390005
Chennai	7, Block AD, II Avenue, Anna Nagar, Chennai 600040
New Delhi	511, Eros Apts., 56, Nehru Place, New Delhi 110019
Bangalore	Unit 1005, B Wing, Mittal Tower, M. G. Road, Bangalore 560001.
Goa	D-2/5, Mapusa Industrial Estate, Mapusa, Goa 403525
Kolkata	Room No. 4, Poddar Court, 18 Rabindra Sarani, Kolkata 700001.
Overseas Network	Abu Dhabi, Australia, Bangladesh, Dubai, Egypt, France, Indonesia, Iran, Iraq, Italy, Kuwait, Malaysia, Nepal, Oman, Qatar, Saudi Arabia, Singapore, Sri Lanka, Thailand, U.A.E., U.K., U.S.A.

Business Lines

Manufacturing Plants

New Mumbai Works
Plot No. 4, 5, 6, Jawahar Co-op. Indl.Estate, Kamothe,
Panvel - 410209, Raigad, INDIA

Products Manufactured : Pressure Gauges, Differential Pressure Gauges, Pressure Switches, Level Instruments, Manifold Valves & Instrument Fittings
(Under technical collaboration with Gauges Bourdon Ltd., UK)

Goa Works

A) D-2/5, Mapusa Industrial Estate Mapusa,
Goa – 403525, INDIA
Products Manufactured : Temperature Gauges, Temperature Switches, Temperature Elements & Thermowells

B) D-2/35, Tivim Indl.Estate, Karaswada, Tivim,
Goa – 403526, INDIA
Products Manufactured : Orifice Assemblies, Venturi Tubes, Flow Nozzles, Averaging Pitot Tubes

Sawantwadi Works

A) Survey No.250 A/B, At & Post Mangaon Taluka : Kudal,
Sawantwadi Dist. Sindhudurg - 416519 INDIA
Products Manufactured : Mineral Insulated RTD/ Thermocouple Cables, Temperature Elements & Thermowells, Skin RTD/ Multipoint Thermocouple / RTD Assemblies
(Technology adopted from M/s. BICC Pyrotenax, UK)

B) Plot No.10, Udyam Nagar, At & Post Mazgaon
Taluka : Sawantwadi, Dist. Sindhudurg - 416510 INDIA
Products Manufactured : Pressure Gauges & Temperature Gauges.

Daman Works
33, Somnath Co-op. Indl. Society Ltd., Somnath Road,
Dabhel, Daman - 396240 (UT), INDIA
Products Manufactured : Signal/Control & Thermocouple Extension/Compensating Cables

International Product Approval/Certification

CE, UL, CSA, CRN No. (Canada)

Our Experience in various Industrial Sectors

Chemicals, Fertilisers, Steel & Non Ferrous metal, Power Generation, Refineries & Petrochemicals, Pulp & Paper, Oil Exploration, Pharmaceutical, Synthetic Fibre and Cement.

General

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PRESSURE

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General

PRESSURE

Bourdon Sensing Pressure Gauges

Features

- Designed to fulfill most industrial requirements
- Compliance to latest EN-837 standard
- Range : (-) 1 to 1600 kg/cm^2
- Bourdon in SS316 Ti as standard providing better mechanical properties guaranteeing repeatability and accuracy
- Accuracy ± 0.5% / ± 1% FSD
- Unit of measurement - kg/cm^2, bar, PSIG, KPa, mbar
- Micrometer pointer
- IP-67 Protection
- 22 mm A/F Socket

Specifications

Ref. Standard : EN-837
Dial : 40 mm / 50 mm / 63 mm / 100 mm / 150 mm / 250 mm in Aluminium, white background, black markings
Case : Diecast aluminium with screwed bezel, epoxy painted black
SS304 with bayonet bezel (SS316 on request)
Phenol with screwed bezel
Protection : IP-67 (IS :13947 Part I)
Bourdon : 63mm dia as standard, 110 mm dia optional in phosphor bronze, SS316 Ti / SS316L, Monel
Socket : 22mm A/ F in brass, SS316, SS316 Ti / SS316L, Monel
Movement : Brass, SS304, SS316
Range : As EN 837 (refer table 1) minimum span 0.4 kg/cm^2, maximum 1600 kg/cm^2
Connection : 1/2" NPT (M) as standard (other optional)
Accuracy : ±0.5% / ± 1% FSD (± 2% FSD for dial size 40 mm / 50 mm / 63 mm)
Overrange : 130% FSD
Suitability : (-) 20^{0}C to 60^{0}C for ferrous system (service temperature)
(-) 20^{0}C to 60^{0}C for non-ferrous system (service temperature)
Zero adjustment : Micrometer pointer (internal)
Blow out disc : Provided (on top)
Optional : Glycerine filled case (in Al, SS304, SS316 case)
IBR certification
Maxima pointer
NACE compliance
External zero setting (especially for glycerine filled gauges)
Integral snubber
Swievel connection to facilitate rotation and in turn positioning of pressure gauge
Note : Non ferrous system is recommended up to 40 kg/cm^{2}g

Bourdon Sensing Pressure Gauges

Table 1

Gauge	System	Bar, kg/cm²	Least count
vacuum	PB, SS	(-)1 to 0	0.02
Compound	PB, SS	(-)1 to 0.6	0.05
	PB, SS	(-)1 to 1.5	0.05
	PB, SS	(-)1 to 3	0.10
	PB, SS	(-) 1 to 5	0.10
	PB, SS	(-)1 to 9	0.20
	PB, SS	(-)1 to 15	0.50
	PB, SS	(-)1 to 24	0.50
	PB, SS	(-)1 to 39	1.0
Pressure Gauge ('C' shaped Bourdon)	PB, SS	0 to 0.4	0.01
	PB, SS	0 to 0.6	0.01
	PB, SS	0 to 1	0.02
	PB, SS	0 to 1.6	0.05
	PB, SS	0 to 2.5	0.05
	PB, SS	0 to 4	0.10
	PB, SS	0 to 6	0.10
	PB, SS	0 to 10	0.20
	PB, SS	0 to 16	0.50
	PB,SS	0 to 25	0.50
	PB,SS	0 to 40	1.0
	SS	0 to 60	1.0
	SS	0 to 100	2.0
Pressure Gauge Coil type Bourdon	SS	0 to 160	5.0
	SS	0 to 250	5.0
	SS	0 to 400	10.0
	SS	0 to 600	10.0
	SS	0 to 800	20.0
	SS	0 to 1000	20.0
	SS	0 to 1600	50.0

PB : Non ferrous (Phosphor Bronze) bourdon.

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Bourdon Sensing Pressure Gauges

How to Order

TYPE : BSPG

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Flush Panel Mounting

DIAL
10 - 100 mm
15 - 150 mm
25 - 250 mm

CASE
PH - Phenol*
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

BOURDON/SOCKET
P - Phosphor Bronze / Brass
S - SS316 / SS316
L - SS316L / SS316L
M - Monel / Monel
T - SS316Ti/SS316Ti

MOVEMENT
2 - Brass
4 - SS304
6 - SS316

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

OPTION
A - +/- 0.5% Accuracy
C - Colour band
D - Dual Scale
E - External zero reset (for Al, S4 and S6 case)
F - Flanged process connection **
G - Glycerine Filled Case #
I - IBR
L - Nil
M - Maxima Pointer
N - NACE-MR-01-75
O - O_2 Cleaning
R - 150% over range
S - Silicon Oil Filled Case
X - Accessory +
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

UNIT
A - kg/cm^2 (g)
B - Bar (g)
C - Psig
D - KPa
E - mmHg
F- Pl. specify

RANGE
Refer Table 1

****F-FLANGED PROCESS CONNECTION**

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

* Not available in 250 mm dial size

Not available in phenol case

** For Flanged Process Connection refer the above table (mentioned separately)

+ For accessory, specify material & connecion in the bracket e.g. SYI (CS, 1/2" NPT(F) x PL)

Chemical Seal Pressure Gauges

Chemical seal pressure gauges are used essentially to isolate the pressure sensing device from the process fluid. Applications are found in various industries such as Chemical, Petrochemical, Oil Exploration, etc.

Where isolation is essential

A) Corrosive process fluid.

B) Process fluid having sediments or is viscous.

C) Process fluid has a tendency to solidify, freeze or crystallise at lower temperatures which may block the sensing element.

D) Process fluid is hazardous.

The diaphragm seal transmits process pressure to the instrument through a diaphragm. The instrument side of the diaphragm is filled with appropriate fluid. As liquids are incompressible, pressure is hydraulically transmitted to the pressure sensing element.

Proper selection of diaphragm seal is important after reviewing the application.

Specifications

Ref. standard	: EN-837
Range	: 0 -1 kg/cm^{2}g and above
Filled fluid	: Silicone oil as a standard (Fluorolube, DC-704, etc. also can be offered)
Top flange	: CS/SS304/SS316
Diaphragm	: SS316, SS316 + PTFE, PTFE
Bottom flange	: SS 304/SS316/SS316L/SS 316 + PTFE
Connection	: Screwed / Flanged
Optional	: a) Flushing connection on bottom flange. b) 'I' section type chemical seal unit c) Capillary for remote sensing gauge d) Welded diaphragm construction **All other specification as Bourdon Sensing Pressure Gauges**

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Chemical Seal Pressure Gauges

How to Order

TYPE : PGCSU

MOUNTING
V - Bottom Entry, Local Mounting
S - Bottom Entry, Surface Mounting

DIAL
10 - 100 mm
15 - 150 mm
25 - 250 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

TOP CHAMBER
C - CS
S4 - SS304
S6 - SS316

DIAPHRAGM

S6 - SS316	M4 - Monel 400
SL - SS316L	HB - Hastelloy B
ST - SS316Ti	HC - Hastelloy C
SP - SS316+PTFE	TI - Titanium
S1 - SS321	NI - Nickel
I6 - Inconel 600	TA - Tantalum
I5 - Inconel 625	CA - Carpenter 20 (Alloy 20)
I8 - Incoloy 800	

BOTTOM CHAMBER

S6 - SS316	I8 - Incoloy 800
SL - SS316L	M4 - Monel 400
ST - SS316Ti	HB - Hastelloy B
SP - SS316+PTFE	HC - Hastelloy C
S1 - SS321	TI - Titanium
I6 - Inconel 600	NI - Nickel
I5 - Inconel 625	S3 - SS310

CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

OPTION
C - Colour band
D - Dual Scale
E - Flushing Connection #
F - Flanged process connection **
G - Glycerine Filled Case
L - Nil
M - Maxima Pointer
N - NACE-MR-01-75
O - O_2 Cleaning
P - Capillary for mounting "S" *
S - Silicon Oil Filled Case
T - Filling Fluid - Silicon Oil DC 704
U - Filling Fluid - Flouro Lube Oil
V - Filling Fluid - Vegetable Oil
W - Welded Diaphragm
X - Accessory +
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

UNIT

A - kg/cm² (g)	D - KPa
B - Bar (g)	E - mmHg
C - Psig	F - Pl. specify

RANGE
Refer Table 1 under
Bourdon Sensing Pressure Gauges
(minimum span of 1 kg/cm²g)

F - FLANGED PROCESS CONNECTION **

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

* Length of capillary to be specified in bracket e.g. P (3) i.e. 3 mtr. capillary
** For Flanged Process Connection refer the above table (mentioned separately)
# Flushing connection not possible with PTFE lined bottom flange / PTFE block
+ Specify size & material in the bracket eg. GS (Monel, 1/2" NPT(F) x 1/2" NPT(M))

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Diaphragm Sensing Pressure Gauges

Diaphragm sensing pressure gauges are generally used for low pressures where bourdon is insensitive. The sensing element is diaphragm which is connected to movement assembly through a 'ball & socket' arrangement. Pressure is transmitted through the diaphragm to transmission shaft. Irrecoverable accuracy loss is due to too many mechanical linkages thereby leading to an accuracy of ±2% FSD (±1.6% FSD can however be offered on request). Coincidently constructioin isolates the process as well. Screwed or flanged process connection can be offered. Lowest span of 250mm WC is possible.

Specifications

Dial : 100/150mm, aluminium , black marking on white background
Case : Diecast aluminium with screwed bezel / SS304, SS316 with bayonet bezel
Protection : IP-67 (IS : 13947 part I)
Top Flange : CS/SS304/SS316
Diaphragm : SS316, PTFE lined SS316 (other material optionally)
Bottom flange : SS304/SS316, SS316 + PTFE Block, PTFE lined SS316 (other material optionally)
Connection : 1/2" NPT (M) or flanged (specify size & rating)
Range : Refer table - 2
Accuracy : ±2% FSD (1.6% FSD on request)
Overrange : 130% FSD
Zero adjustment : Micrometer pointer
Blow out disc : Provided
Optional : 1) Flushing connection on the bottom flange to facilitate cleaning
2) Glycerine filled SS304 or SS316 case
3) Solid front SS304 or SS316 case
Note : 1) PTFE block construction possible in flange connection alone.
2) Flushing connection on PTFE lined (or SS316 + PTFE block) bottom flange not possible.

Table 2

0-400 mm WC	(-) 400 to 0 mm WC
0-600 mm WC	(-) 600 to 0 mm WC
0-1000 mm WC	(-) 1000 to 0 mm WC
0-1600 mm WC	(-) 1600 to 0 mm WC
0-2500 mm WC	(-) 2500 to 0 mm WC
0-4000 mm WC	(-) 4000 to 0 mm WC
0-6000 mm WC	(-) 6000 to 0 mm WC
0-1.0 Bar or 0-10000 mm WC	0 - 250 mm WC

Special : Combination for compound ranges available.

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Diaphragm Sensing Pressure Gauges

How to Order

TYPE : DSPG

MOUNTING
V - Bottom Entry, Local Mounting
S - Bottom Entry, Bracket Mounting
V/SF - Bottom Entry, Local Mounting with solid front case
S/SF - Bottom Entry, Bracket Mounting with solid front case

DIAL
10 - 100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

TOP CHAMBER
C - CS
S4 - SS304
S6 - SS316

DIAPHRAGM
S6 - SS316
SL - SS316L
ST - SS316Ti
SP - SS316+PTFE
S2 - SS321
I6 - Inconel 600
I5 - Inconel 625
I8 - Incoloy 800
M4 - Monel 400
HB - Hastelloy B
HC - Hastelloy C
TI - Titanium
NI - Nickel
TA - Tantalum

BOTTOM CHAMBER
S6 - SS316
SL - SS316L
ST - SS316Ti
SP - SS316+PTFE
S2 - SS321
I6 - Inconel 600
I5 - Inconel 625
I8 - Incoloy 800
M4 - Monel 400
HB - Hastelloy B
HC - Hastelloy C
TI - Titanium
NI - Nickel

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

OPTION
C - Colour band
D - Dual Scale
E - Flushing connection # (1/4" NPT(F) / 1/2" NPT(F))
F - Flanged process ** connection
G - Glycerine Filled Case
L - Nil
M - Maxima Pointer
N - NACE-MR-01-75
O - O_2 Cleaning
S - Silicon Oil Filled Case
X - Accessory +
SN - Snubber
SY - Syphon
SYI - IBR Certified Syphon
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

UNIT
A - mm WC
B - Specify

RANGE
Refer Table 2

F - FLANGED PROCESS CONNECTION **

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

** For Flanged Process Connection refer the above table (mentioned separately)
# Flushing connectioin not possible with PTFE block or PTFE lined bottom flange
+ Specify material & size in the bracket e.g. 3V (SS316, 1/2" NPT)

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Capsule Sensing Pressure Gauges

Industrial capsule pressure gauges are well suited for low pressure measurement on clean and non corrosive fluids in the range (-) 60 mm WC to 600 mbar. The sensing element - Capsule - is made up of two SS316L laser welded diaphragms. Capsule sensing pressure gauges are used where diaphragm sensing pressure gauge can't be used due to its insensitivity to low pressure and where accuracy is of prime importance. Offered capsule gauges are unique in its compactness.

Features

- Lowest span with high accuracy
- All SS internals
- Vital components - capsule and special movement are procured from collaborator.
- Accuracy ±1% FSD
- Compact design avoids use of bulky manometers
- Ingress protection class IP-67

Specifications

Dial	: 100 mm, 150 mm (refer table for details) white background, black figures
Case	: Diecast aluminium with screwed bezel SS304, SS316 with bayonet bezel
Pointer	: Light weight, balanced, aluminium
Protection	: IP-67 (IS : 13947 Part I)
Capsule	: SS316L (made of two SS 316L diaphragms laser-welded)
Socket	: SS316 / SS316L
Movement	: SS
Connection	: 1/2"NPT (M) as standard (other optional)
Range	: Refer table- 3
Accuracy	: ±1% FSD
Overraange	: 110% FSD
Zero reset	: Provided
Blow out disc	: Provided

Table 3

	Dial Size	
Range in mm WC	**100 mm**	**150 mm**
0-60	■	■
0-100	■	■
0-150	■	■
0-250	■	■
0-400	■	■
0-500	■	■
0-600	■	■
0-750	■	■
0-1000	■	■
0-1600	■	■
0-2000	■	■
0-2500	■	■
0-4000	■	■
0-6000	■	■
(-)25 to (+)25	■	■
(-)40 to (+)60	■	■
(-)200 to 200	■	■

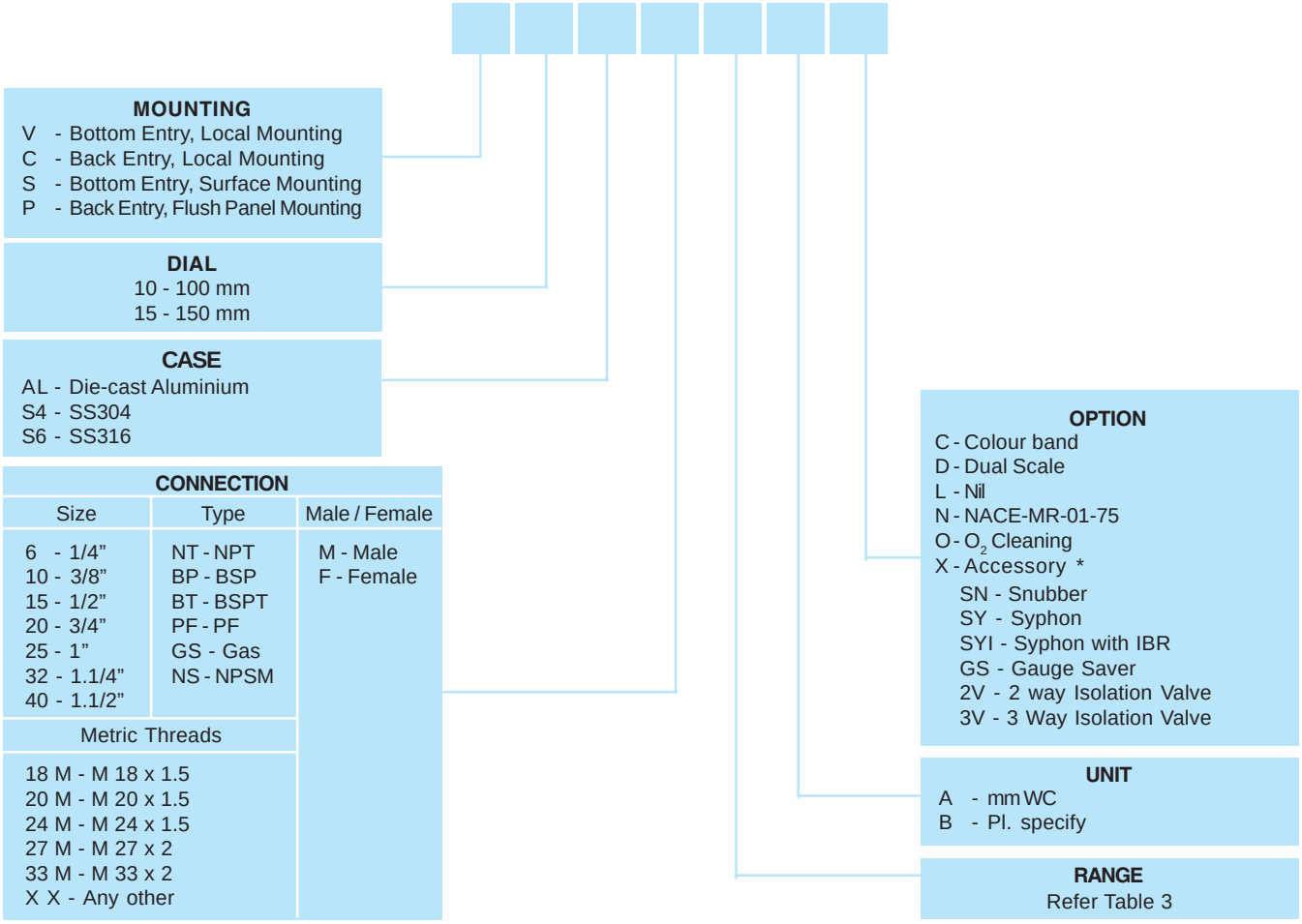
■ Available ■ Not Available

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Capsule Sensing Pressure Gauges

How to Order

TYPE : CSPG



MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Flush Panel Mounting

DIAL
10 - 100 mm
15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

OPTION
C - Colour band
D - Dual Scale
L - Nil
N - NACE-MR-01-75
O - O_2 Cleaning
X - Accessory *
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

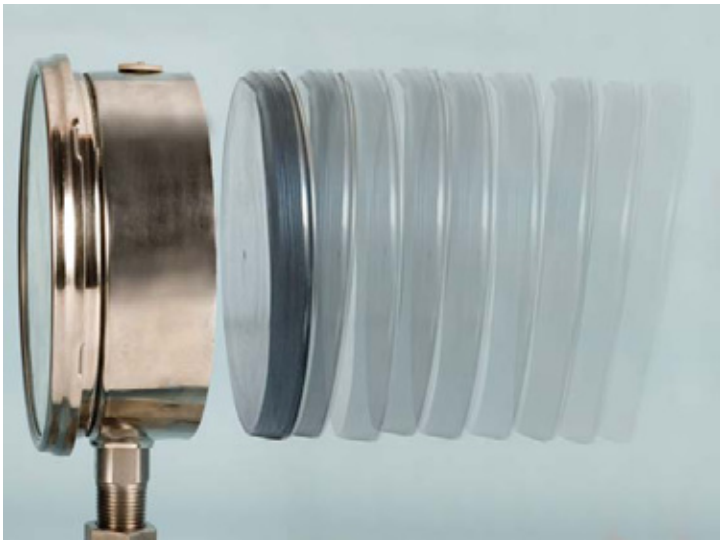
UNIT
A - mm WC
B - Pl. specify

RANGE
Refer Table 3

* Specify material & size in the bracket e.g. 2V (SS316, 1/2" NPT(F) x 1/2" NPT(M))

Solid Front (Safety Pattern) Pressure Gauges

Solid Front gauges have been designed to fulfill the requirement of the process industry with safety considerations. They are designed with a solid front and a full blow out back which will be relieved in case of accidental bourdon rupture, due to excess pressure developed in the case, hence the name 'Safety Pattern'. The integral metal baffle acts as a partition between the bourdon and the dial.



Features

- Safety pattern
- All SS construction
- Micrometer Pointer
- Glycerine filled case possible
- IP-67 Protection

Specifications

Dial	: 100/150/250 mm, aluminium, white background, black markings
Case	: SS304, SS316 with bayonet bezel
Protection	: Weatherproof to IP-67 (IS : 13947 part I)
Ref. standard	: EN 837
Bourdon	: 63 mm dia as standard, optional 110 mm dia in SS316 Ti, SS316L, Monel
Socket	: 22 mm A/F in SS 316, SS316L, SS316 Ti, Monel
Movement	: SS304, SS316
Range	: As EN 837 (refer table-1 under Bourdon sensing pressure gauge) minimum span 0.4 kg/cm^2, maximum 1600 kg/cm^{2}g
Accuracy	: ±1% FSD
Overrange	: 130% FSD
Suitability	: (-) 20^{0}C to 60^{0}C for ferrous system (service temperature) (-) 20^{0}C to 60^{0}C for non-ferrous system (service temperature) : Ambient (-) 20^{0}C to 60^{0}C
Zero adjustment	: Micrometer pointer
Optional	: NACE compliance Glycerine filled case

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Solid Front (Safety Pattern) Pressure Gauges

How to Order

TYPE : SFBSPG

MOUNTING
V - Bottom Entry, Local Mounting,
C - Back Entry, Local Mounting

DIAL
10 - 100 mm
15 - 150 mm
25 - 250 mm

CASE
S4 - SS304
S6 - SS316

BOURDON/SOCKET
S - SS316 / SS316
L - SS316L / SS316L
M - Monel / Monel
T - SS316Ti / SS316Ti

MOVEMENT
2 - Brass
4 - SS304
6 - SS316

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

OPTION
A - +/- 0.5% Accuracy
C - Colour band
D - Dual Scale
F - Flanged process connection **
G - Glycerine Filled Case
I - IBR
L - Nil
M - Maxima Pointer
N - NACE-MR-01-75
O - O_2 Cleaning
R - 150% over range
S - Silicon Oil Filled Case
X - Accessory*
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

UNIT
A - kg/cm² (g)
B - Bar (g)
C - Psig
D - KPa
E - mmHg
F- Specify

RANGE
Specify from Table 1 under BSPG minimum 0 - 0.4 kg/cm²g

F - FLANGED PROCESS CONNECTION **

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

** For Flanged Process Connection refer the above table (mentioned separately)

* Specify material & size in the bracket

Special Pressure Gauges

Receiver Gauges : Offered in 100 mm, 150 mm dial sizes, aluminium, phenol, SS304 or SS316 case with local, surface or panel mounting having bottom or back entry. Suitable for receiving Pneumatic signals of level and flow transmitters of 0.2 to 1 bar (3 to 15 psig). Dial marking in square root, linear scale are offered as required.

Vacuum / Compound Gauges : Offered in 100 mm, 150mm and 250 mm dial size, aluminium, phenol, SS304 or SS316 case. Lowest range of (-) 1 kg /cm^2g to 0 or 0 - 760 mm Hg Vac. available or (-) 5000 mm WC to (+) 5000 mm WC. (consult our design department for other ranges)

Oxygen / Acetylene Gauges : Bourdon sensing pressure gauges in 100 mm or 150 mm dial size are offered for oxygen, acetylene. Special cleaning procedure is employed after calibration

Ammonia Gauges : Special bourdon sensing pressure gauges for ammonia application with equivalent ^{0}C marking are offered.

Hygiene Gauges

Special pressure gauges designed for pressure measurement in sanitary application in accordance with International Dairy Federation (IDF) requirements in pharmaceutical, dairy, biotechnology, food & beverages industries. Use of triclover clamp allows quick removal or mounting of the gauge.

Specifications

Sensing : SS 316L (or any other suitable) diaphragm, welded
Movement : Precision geared SS
Dial : 100 mm, 150 mm white aluminium, black marking
Case : SS304, SS316 with bayonet bezel
Protection : Weatherproof to IP-67 (IS 13947 Part I)
Entry : Bottom with local mounting
Window : 4mm thick shatterproof glass
Range : 0 - 6 kg/cm^2g (min) upto 0- 40 kg/cm^2g
Filling Fluid : Silicone oil
Accuracy : ±1% FSD
Overrange : 130% FSD
Optional : Glycerine filled case, triclover clamp.
: NACE compliance
Note : SMS fittings are also available.

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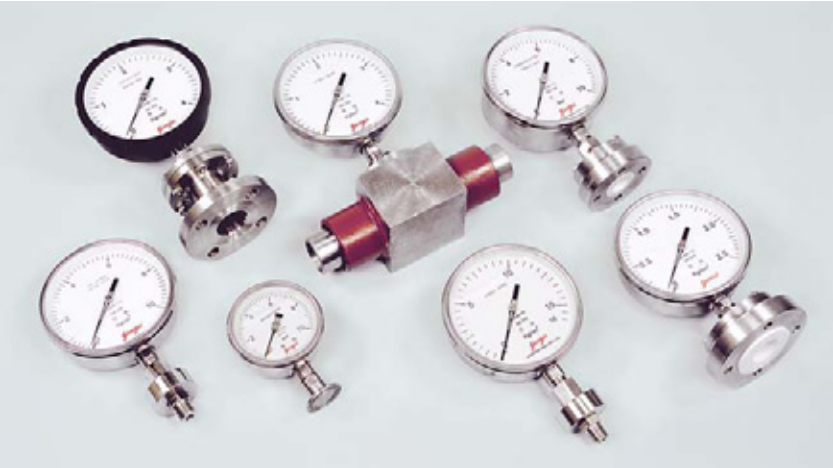
Diaphragm Seals for Pressure Gauges & Transmitters

A diaphragm seal is a protecting device used to isolate a pressure sensing instrument from the process fluid being monitored. When the fluid is dirty, solids laden or viscous, diaphragm seal with a welded diaphragm is used. The seal protects pressure gauges, switches or transmitters.



Construction

Diaphragm seals consist of upper housing having screwed connection for the pressure sensing instrument and lower housing with a screwed or flanged connection for the process. The diaphragm is housed between upper and lower chambers. The upper portion of the diaphragm is filled with fluid. The material is chosen considering the process fluid compatibility. Typically, applications (which involve corrosive liquid containing undissolved particles, liquids which tend to solidify or viscous fluid) are found in industries such as Refineries, Waste Water, Pulp & Paper, Synthetic Fibre, etc.

The generally offered MOC is as follows :

Upper housing : CS, SS304. SS316

Diaphragm : SS316L, PTFE, PTFE coated, Ti, Hastelloy B, C, Ni, Monel, Tantalum

Lower housing : CS, SS304, SS316, SS304L, SS316L, Ti, Ni, PTFE coated / lined, PTFE block, Hastelloy B, C.

Filling Fluid :

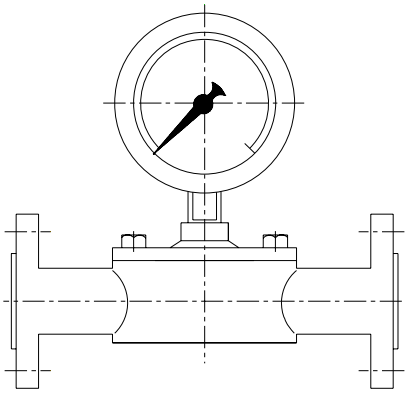
Name	**Application range**
Silicone oil	(-) 50^{0}C to 200^{0}C
Fluorolube	(-) 50^{0}C to 150^{0}C
Glycerine	0 to 80^{0}C
Paraffine	0 to 85^{0}C
DC-704	0 to 339^{0}C
Halocarbon	(-) 25^{0}C to 225^{0}C

Note : 1) Purchaser must confirm the suitability of the MOC suggested.
2) Capillary for remote seal can be offered.

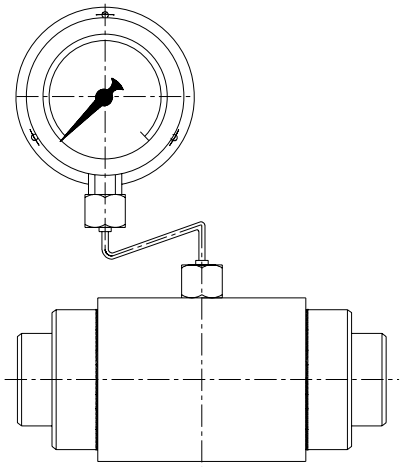
Different types of diaphragm seal offered:

1) Inline flow through type with flanged connection.
2) Inline flow through type (jacketed)
3) Inline flow through type (weld in)
4) Extended diaphragm seal
5) Pan cake type diaphragm seal

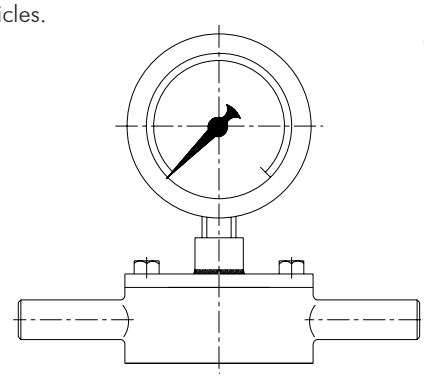
Diaphragm Seals
Typical Constructions



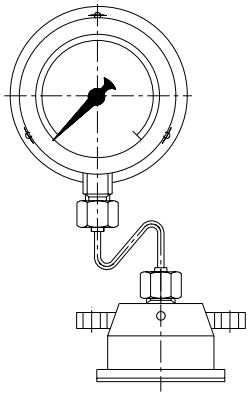
1) In-line flow through type
(End connection flanged)
For appreciation in Waste Water, Pulp & Paper, Synhetic Fibre, where fluid is viscous and will contain solid undissolved particles.



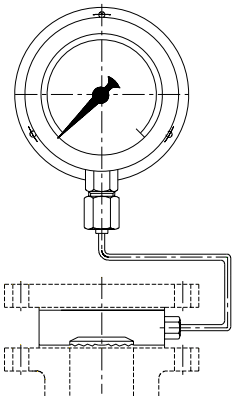
2) In-line flow through type
(Jacketed)
For applications where process fluid is likely to solidify as temperature reduces. Jacketing provided for steam or thermic fluid.
(End connection - weld in shown above)



3) In-line Flow through type
(Weld in)
End pipe suitable for butt welding to the process pipe. For applicatioin in Waste Water, Synthetic Fibre, Pulp & paper, etc.



4) Extended diaphragm seal
Diaphragm flushed to the process. Extension depends upon nozzle standout. Allows mounting in insulated vessels or pipelines.



5) Pan Cake type diaphragm seal
Sandwiched between loose flange (back-up flange) and nozzle flange. For fluids which are corrosive, contaminated, etc.

Indicating Pressure Switches

Indicating pressure switches combine indication with switching. Electrical contacts or microswitch are offered as option. It makes or breaks allied electrical circuit thus controlling the process.

Features

- Combination of indication and switch
- Choice of electrical contacts and microswitch
- One or two contacts possible
- Switch setting throughout the range externally
- High repeatability and low hysteresis
- Weatherproof or Flameproof housing
- Mil connector provided optionally.

Specifications

Dial	: 100 mm or 150 mm, aluminium, white background, black markings
Case	: Diecast aluminium with screwed bezel SS304, SS316 with bayonet bezel
Protection	: Weatherproof to IP - 67 (IS 13947 part I) Flameproof to IIA IIB (equivalent to NEC C1. I, Div. 2, Gr. C & D)
Bourdon	: SS316 Ti, Monel, phosphor Bronze, SS316L
Socket	: SS316, Monel, brass, SS316, SS316 Ti
Movement	: SS304, brass (with SPDT microswitch)
Connection	: 1/2" NPT (M) as standard
Range	: (-)1 to 1600 kg /cm^2 minimum span of 4 kg/cm^2 (only standard ranges as mentioned under table 1 of Bourdon sensing pressure gauge possible)
Accuracy	: ± 1% FSD for indication ± 2% FSD for switching
Overrange	: 130% FSD
Blow out disc	: Provided
Zero reset	: Provided with contact assembly
Contacts	: 1SPST, single, normally open, closing on rise in pressure or vice versa, rated 30VA @ 230V AC
	: 2 SPST, two contacts , independently adjustable, one normally open ,other normally closed or both normally open or both normally closed, rated 30VA @ 230V AC
	: 1SPDT, single microswitch, adjustable over entire range, rated 5 amp @ 230V AC (3A @ 28 VDC)
	: 2SPDT, double microswitch, adjustable over entire range, rated 5 amp @ 230V AC (3A @ 28 VDC)
Accessory	: Relay for the contact assembly to suit 5 amp @ 230V AC, separately mounted.

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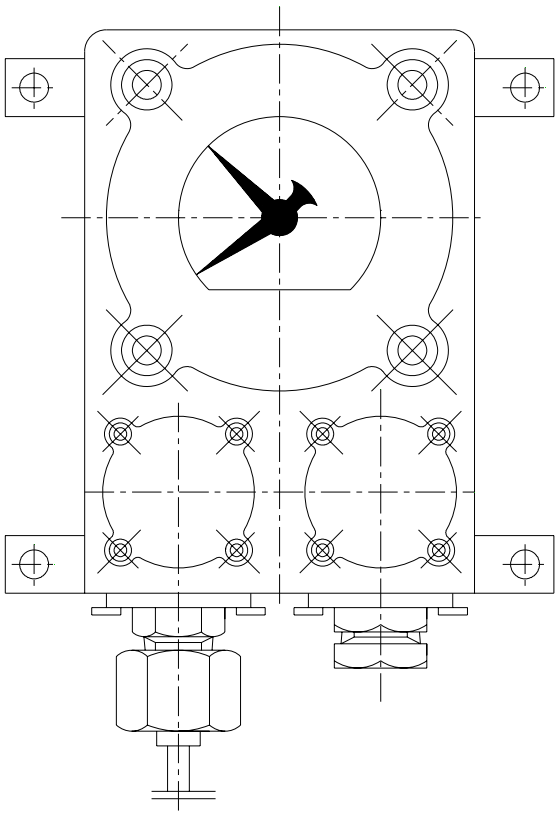
Indicating Pressure Switches

Notes:
1) Electrical contact assembly is not offered in flameproof version.
2) Contact assembly is offered only in diecast aluminium case.
3) Flameproof version available only in diecast aluminium case & with microswitch with 100 mm dial size only.
4) Non- ferrous system is recommended up to 40 kg/cm^2
5) Pressure switch can also be offered with chemical seal pressure gauges in weatherproof and flameproof cases.
6) Surface mounted flameproof housing with chemical seal pressure gauge is available with capillary.

Benefits of Microswitch type over contact assembly

- Microswitch is rated 5 amp @ 230 VAC (3A @ 28 VDC). Hence use of relay is not required
- Microswitch offered as a combination of movement and switch is procured from Internationally reputed vendor.
- Microswitch assembly provides better switching accuracy and repeatability
- Compact design.



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Indicating Pressure Switches

How to Order

TYPE : IPS

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Flush Panel Mounting

DIAL
10 - 100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

BOURDON/SOCKET
P - Phosphor Bronze / Brass
S - SS316 / SS316
L - SS316L / SS316L
M - Monel / Monel
T - SS316Ti / SS316Ti

MOVEMENT
2 - Brass
4 - SS304
6 - SS316

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

OPTION
A - 1 SPDT
B - 2 SPDT
C - Colour band
D - Dual Scale
F - Flanged Process connection **
H - Flameproof housing
I - 1 SPST
J - 2 SPST
L - Nil
N - NACE-MR-01-75
R - Relay
U - Chemical Seal Unit
X - Accessory*
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

UNIT
A - kg/cm^2 (g)
B - Bar (g)
C - Psig
D - KPa
E - mmHg
F- Specify

RANGE
Refer Table 1 of Bourdon Sensing Pressure Gauge.
Minimum span 4 kg/cm^{2}g

F - FLANGED PROCESS CONNECTION **

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

** For Flanged Process Connection refer the above table (mentioned separately)

* Specify material & size in the bracket e.g. SY [CS, 1/2" NPT(F) x 1/2" NPT(M)]

Note : Liquid filled case not available with this construction / model

Blind Pressure & Differential Pressure Switches

GENERAL has been designing & manufacturing reliable, high quality diaphragm type blind pressure switches to suit to most of the industrial applications for accurate control of the process equipments. Rigorous and continuous tests are conducted for design and quality conformance.

BLIND PRESSURE SWITCH

Application Area
Safety, Alarming & Tripping of following systems

- Compressors, Pumps
- Turbines, Generators
- Boilers, etc…

BLIND DIFFERENTIAL PRESSURE SWITCH

Application Area
Loss of pressure due to choking, blockage

- Across Filters
- Across Blowers
- Across Orifice Plates, Nozzle & Venturi
- Across water steam interface in boilers etc…

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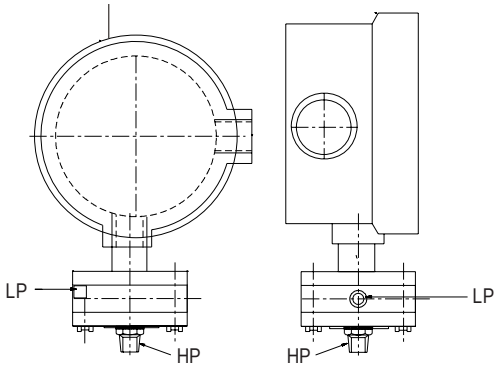
Blind Pressure & Differential Pressure Switches

Die-cast Al, Flameproof to Gr. IIA, IIB, IIC & Weather proof to IP66



Blind Differential Pressure Switch (Flameproof)

General Specifications

Standard	: BS-6134:1981
Repeat Accuracy	: +/- 0.5% FSR
Scale Accuracy	: +/- 3% FSR
Switching Differential	: Fixed or adjustable
Ambient Temp	: (-)20°C to 70°C
Process Temp	: (-)20°C to 70°C for Brass Wetted Parts with nitrile seal (-)20°C to 170°C for SS wetted parts with Teflon Seal
Set Point	: Adjustable through out the range (adjustable from 20 to 90% of span)
High Voltage Strength	: Withstands 0.5 KV between open contact for 1 Sec & 2 KV between terminals and earth for one minute.
Insulation Resistance	: >10 M Ohms at 500VDC
Intrinsic Safety	: Switches are classified as Simple Electrical Apparatus as per BS-5345 & suitable to be used in intrinsically safe equipments/systems without certification.
Mounting	: Surface mounting /Pipe/Field.

Notes :

1. Gr.IIA & IIB (equivalent to NEC CL.1,Gr.C & D.)
2. Gr.IIC (equivalent to NEC CL.1, DIV.1, Gr.A & B.)
3. Weatherproof enclosure is effective only if all entries and joint faces are properly sealed. Flameproof enclosure is weatherproof only if cover 'O' ring is retained in position and proper flameproof cable gland is used. It is recommended to procure cable glands along with flameproof instruments to avoid neglect of it while installation.
4. Accuracy & repeatability are one and the same for all blind differential pressure switches. A shift of ±2% may be observed in set point when pressure falls from full static pressure. Settings will also shift with varying temperature.
5. The instrument is calibrated in the mounting position depicted in the drawing. Hence mounting in any other direction will cause a minor range shift, especially in low and compound ranges.
6. A pressure switch is a switching device and not a measuring instrument — even though it has a scale to assist setting. For this reason, Test Certificates will not contain individual ON-OFF switching values at different scale readings. Maximum differential obtained alone will be declared, besides other specifications.
7. Switching differentials furnished are nominal values under test conditions at mid-scale and will vary with range settings and operating conditions.
8. On & off setting should not exceed the upper or lower range of the span.

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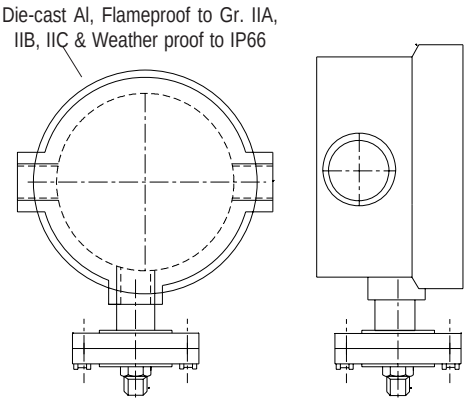
Blind Pressure & Differential Pressure Switches

9. Ambient temperature range: All models are suitable for operating within a range of ambient temperature from (–) 10°C to (+) 60°C provided the process fluid does not freeze within this range. Below 0°C, precautions should be taken in humid atmospheres to prevent frost formation inside the instrument from jamming the mechanism. Occasional excursions beyond this range are possible but accuracy might be impaired. The microswitch is the limiting factor which should never exceed the limits (–) 25°C to (+) 80°C.
10. Fluid Temperature: A pressure switch connected to the main pipe is not subjected to the flow and therefore is not fully exposed to the fluid temperature. Use of adequate length of impulse piping will greatly reduce excessive heating of the sensing element. For e.g., connection of 7.5 cm of 12 mm dia impulse piping will reduce water temperature of 100°C to 65°C at an ambient temperature of 50°C.
11. Ensure that impulse pipe work applies no stress on sensing element housing and use spanners to hold pressure port / housing when connections are made.
12. Select the range of the instrument such that the set value lies between 35 to 65% of the FSR.
13. Scale Markings are for guidance only. Set the correct set value against precision master gauge.



Blind Pressure Switch (Flameproof)

ORDERING CODE

ORDERING code will be e.g.....

GF	SS	010	W	103	FGE	SB	80B	IK	P

GF	BPS with fixed switching differential (select from Table I)
SS	BPS with metal diaphragm (select from Table II)
010	1-10 kg/cm^2 (select from Table III)
W	Weather proof (select from Table IV)
103	1 SPDT 5A 230VAC general purpose snap acting switch. (select from Table V)
FGE	1/2" NPT Brass nickel plated DCCG. (select from Table VI)
SB	SS316L Diaphragm with Brass wetted parts & nitrile seal. (select from Table VII)
80B	1/2" NPT(M) Brass process connections. (select from Table VIII)
IK	Calibration for increasing pressure in kg/cm^2 (select from Table IX)
P	2" Pipe mounting Bracket. (select from Table X)

NOTE : Specifications are subject to change without prior notice due to continuous product development.

Blind Pressure & Differential Pressure Switches

Model Selection Guide

Please select one code from each of the following tables to complete the model selection

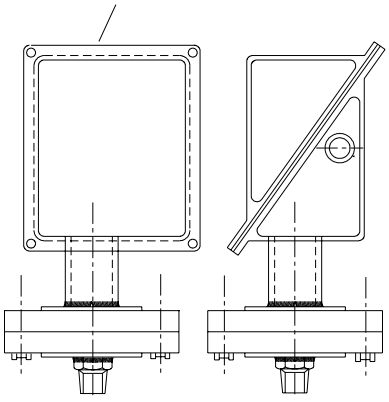
Table I : Model

DESCRIPTION	CODE
Blind pressure switch with fixed switching differential	GF
Blind pressure switch with adjustable switching differential	GA
Blind differential pressure switch with fixed switching differential	GD
Blind differential pressure switch with adjustable switching differential	DA

Table II : Series

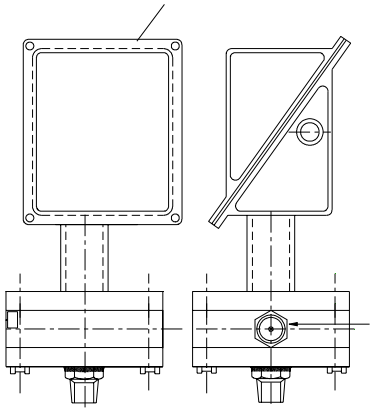
DESCRIPTION	CODE
Pressure switch Metal diaphragm	SS
Differential pressure switch Metal diaphragm	DS
Pressure switch Rubber diaphragm	SR
Differential pressure switch Rubber diaphragm	DR

Die-cast Aluminium, Weatherproof to IP-66 (IS:13947)



Blind Pressure Switch (Weatherproof)

Die-cast Aluminium, Weatherproof to IP-66 (IS:13947)



Blind Differential Pressure Switch (Weatherproof)

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Blind Pressure & Differential Pressure Switches

Table III : Ranges

RANGE	Availability	CODE	Dimensional Details of Sensor System	
			BPS L X D	BDPS L X D
-0.9 TO 0 kg/cm^2	In SS series	**VP9**	60X 60	90X60
-0.9 TO 1.5 kg/cm^2	In SS series	**C15**	60X 60	90X60
-0.5 TO 0.5 kg/cm^2	In SS series	**CP5**	60X 60	90X60
-200 TO +200 mm WC	In all series	**C02**	105X50	110X65
-400 TO +400 mmWC	In all series	**C04**	105X50	110X65
-800 TO 0 mmWC	In all series	**C08**	105X50	110X65
20 TO 200 mmWC	In all series	**W02**	105X40	110X55
40 TO 400 mmWC	In all series	**W04**	105X40	110X55
50 TO 500 mmWC	In all series	**W05**	105X40	110X55
100 TO 1000 mmWC	In all series	**W10**	90X40	110X55
0.05 TO 0.16 kg/cm^2	In all series	**P16**	90X40	110X55
0.08 TO 0.4 kg/cm^2	In all series	**0P4**	65X40	110X55
60 TO 600 mBar	In all series	**W06**	65X40	110X55
0.2 TO 1 kg/cm^2	In all series	**001**	60X40	80X55
0.2 TO 2 kg/cm^2	In all series	**002**	60X40	80X55
0.4 TO 4 kg/cm^2	In all series	**004**	60X40	80X55
0.6 TO 6 kg/cm^2	In all series	**006**	60X40	80X55
1.0 TO 10 kg/cm^2	In SS series	**010**	60X40	80X55
1.5 TO 15 kg/cm^2	In SS series	**015**	60X40	-
2.0 TO 20 kg/cm^2	In SS series	**020**	45X40	-
2.0 TO 25 kg/cm^2	In SS series	**025**	45X40	-
4.0 TO 40 kg/cm^2	In SS series	**040**	45X40	-
6.0 TO 60 kg/cm^2	In SS series	**060**	35X40	-
10 TO 100 kg/cm^2	In SS series	**100**	35X40	-
10 TO 160 kg/cm^2	In SS series	**160**	35X40	-
20 TO 200 kg/cm^2	In SS series	**200**	35X40	-
25 TO 250 kg/cm^2	In SS series	**250**	35X40	-

Table IV : Type of Enclosure

DESCRIPTION	CODE
Weather proof with die-cast Aluminium with epoxy powder coated conforming to IP-66 protection in accordance with IS:13947 Part I	**W**
Flame proof & weather proof with die cast Aluminium with epoxy powder coating conforming to IP-66 protection –suitable to gas group I, IIA, IIB (NEC Cl. 1, Div 1, Gr C & D)	**F**
Flame proof & weather proof with die cast Aluminium with epoxy powder coating conforming to IP-66 protection –suitable to gas group IIC (NEC Cl. 1, Div 1, Gr B, C & D)	**C**

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Blind Pressure & Differential Pressure Switches

Table V : Type of Micro Switch

DESCRIPTION	CODE	AVAILABILITY IN MODELS	A.C.RATING	D.C.RATING		
				Volt ——-	Current Resistive	Inductive
1-SPDT general purpose	**100**	GF/GD	5A-250VAC	220 110 24	0.25A 0.50A 5.0A	0.03A 0.07A 3.00A
1-SPDT-low switching differential	**101**	GF/GD/GA/DA	15A-250 VAC	220 110 24	0.2A 0.4A 2.0A	0.03A 0.03A 1.00A
2-SPDT-low switching differential	**201**	GF/GD/GA/DA	15A-250VAC	220 110 24	0.2A 0.4A 2.0A	0.03A 0.03A 1.00A
1-SPDT-General Purpose	**102**	GF/GD/GA/DA	5A-250VAC		—N/A—	
2-SPDT-General Purpose	**202**	GF/GD/GA/DA	5A-250VAC		—N/A—	
SPDT-General Purpose	**103**	GF/GD/GA/DA	15A-250VAC		—N/A—	
2-SPDT-General Purpose	**203**	GF/GD/GA/DA	15A-250VAC		—N/A—	
1-SPDT- Very low switching differential	**104**	GF/GD	10A-250 VAC	220 110 24	0.2A 0.4A 2.0A	0.03A 0.03A 1.00A
2-SPDT- Very low switching differential	**204**	GF/GD	10A-250 VAC	220 110 24	0.2A 0.4A 2.0A	0.03A 0.03A 1.00A
SPDT-Gold Contact	**105**	GF/GD/GA/DA	1A-250VAC		—N/A—	
2-SPDT-Gold Contact	**205**	GF/GD/GA/DA	1A-250VAC		—N/A—	
SPDT-General Purpose	**106**	GF/GD/GA/DA	10A-250VAC	6A-30VDC		
2-SPDT-General Purpose	**206**	GF/GD/GA/DA	10A-250VAC	6A-30VDC		
1-DPDT.	**107**	GF/GD/GA/DA	10A-250 VAC	250 125 24	0.2A 0.3A 6.0A	0.01A 0.02A 1.00A
1-SPDT environmentally sealed	**108**	GF/GD	5A-250VAC		—N/A—	
Any special requirement	**XXX**	—N/A—	—N/A—		—N/A—	

Note:

1) For 2nos SPDT version +/-2% FSR variation can be observed between two micro switch change overs.

2) Switching differential for 2SPDT & flameproof is 1.5 times that of 1SPDT

Blind Pressure & Differential Pressure Switches

Table VI : Type of Electrical Entry

Please specify entry/gland as per the code given below.
SCCG : Single compression cable gland **DCCG** : Double compression cable gland.

DESCRIPTION	W/P	CODE FLP(IIA/IIB)	FLP(IIC)
SCCG	WSS	——	——
3/8"BSPF	W1S	F11	C11
¾" ET	W11	F1S	C1S
½" BSPF	W12	F12	C12
½" NPTF	W13	F13	C13
¾" BSPF	W14	F14	C14
¾" NTPF	W15	F15	C15
¾"ET DCCG Brass	WGA	FGA	CGA
¾"ET DCCG SS	WGB	FGB	CGB
½"BSP DCCG Brass	WGC	FGC	CGC
½"BSP DCCG SS	WGD	FGD	CGD
½"NPT DCCG Brass	WGE	FGE	CGE
½"NPT DCCG SS	WGF	FGF	CGF
¾"NPT DCCG Brass	WGG	FGG	CGG
¾"NPT DCCG SS	WGH	FGH	CGH
¾"BSP DCCG Brass	WGI	FGI	CGI
¾"BSP DCCG SS	WGJ	FGJ	CGJ
4 Pin Connector*	4PC	-	-
7 Pin connector*	7PC	-	-

a) On request SCCG-shall be provided for weather proof housing : use CODE as "WSS"

b) For "double entry" please insert number "2" in middle position of the code. (e.g- CODE X2X)

c) For double entry" but one entry plugged insert letter "P" in middle position (e.g-CODE XPX).

d) For flameproof enclosure entry is directly provided on the housing.

e) Specify "99X" for any special requirement.

f) * For 4 & 7 pin connector option please replace P by R for 47 Kohms resistor.

g) * For 4 & 7 pin connector option replace C by G for gold contacts.

Blind Pressure & Differential Pressure Switches

Table VII : Sensor System (Diaphragm & Wetted Parts)

DESCRIPTION	CODE
SS316L diaphragm with BRASS wetted parts & nitrile seal	SB
SS316L diaphragm with SS304 wetted parts & teflon seal	SS
SS316L diaphragm with SS316 wetted parts & teflon seal	SX
Neoprene diaphragm and Aluminium wetted parts with nitrile seal	NA
Silicone diaphragm and Aluminium wetted parts with teflon seal	SA
EPDM diaphragm and Aluminium wetted parts with teflon seal	EA
Viton diaphragm and Aluminium wetted parts with teflon seal	VA
Monel diaphragm with Monel wetted parts& teflon seal.	MM
Hastelloy diaphragm with Hastelloy wetted parts & teflon seal.	HH
Wetted part conforming to sour gas to NACE MR-01-75.	SN
Any other special construction (Please specify complete details separately)	XX

Table VIII : Type of Process Connection Required

XOB-BRASS X4S-SS304 X6S-SS316

SIZE	BSP(F)	BSP(M)	NPT(F)	NPT(M)
1/4"	10B 14S 16S	20B 24S 26S	30B 34S 36S	40B 44S 46S
1/2"	50B 54S 56S	60B 64S 66S	70B 74S 76S	80B 84S 86S

Special Mention 99X for selection other than the above

¼" BSP (F) is standard. Any other connections will be provided with suitable adaptors.

Blind Pressure & Differential Pressure Switches

Table IX : Calibration / Units

DESCRIPTION	CODE
Calibration in increasing pressure in kg/cm^2	IK
Calibration in decreasing pressure in kg/cm^2	DK
Calibration in increasing pressure in bar	IB
Calibration in decreasing pressure in bar	DB

For any other pressure units please specify IX - for increasing & DX - for decreasing

Table X : Accessories

TYPE	CODE
Snubber	S
Syphon	Y
Manifold	M
Chemical seal	C
SS Tag plate	T
Mounting bracket	B
Pipe mounting bracket	P
Any other	X
No accessory	O

Blind Pressure & Differential Pressure Switches

Switching Differential Chart : Direct Pressure Switch, Fixed Differential

RANGE	AVAILABILITY IN SERIES	Micro Switch CODE						
		100	101	102	103	104	105	106
-0.9 TO 0 kg/cm^2	SS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-0.9 TO 1.5 kg/cm^2	SS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-0.5 TO 0.5 kg/cm^2	SS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-200 TO +200 mmWC	SS, SR	90	100	-	-	100	-	-
-400 TO +400 mmWC	SS, SR	150	100	-	-	100	-	-
-800 TO 0 mmWC	SS, SR	200	150	-	-	100	-	-
20 TO 200 mmWC	SS, SR	100	60	-	-	50	-	-
40 TO 400 mmWC	SS, SR	100	100	-	-	50	-	-
50 TO 500 mmWC	SS, SR	100	100	-	-	50	-	-
100 TO 1000 mmWC	SS, SR	120	100	-	-	80	-	-
0.05 TO 0.16 kg/cm^2	SS, SR	0.015	0.015	0.06	0.06	0.012	0.06	0.06
0.08 TO 0.4 kg/cm^2	SS, SR	0.045	0.025	0.06	0.06	0.010	0.06	0.06
60 TO 600 mBar	SS, SR	50	30	70	70	15	70	70
0.2 TO 1 kg/cm^2	SS, SR	0.15	0.080	0.30	0.30	0.05	0.30	0.30
0.2 TO 2 kg/cm^2	SS	0.20	0.10	0.40	0.40	0.05	0.40	0.40
0.4 TO 4 kg/cm^2	SS	0.40	0.30	0.50	0.50	0.10	0.50	0.50
0.6 TO 6 kg/cm^2	SS	0.50	0.40	0.60	0.60	0.20	0.60	0.60
1.0 TO 10 kg/cm^2	SS	0.70	0.60	0.80	0.80	0.40	0.80	0.80
1.5 TO 15 kg/cm^2	SS	1.00	0.80	2.00	2.00	0.60	2.00	2.00
2.0 TO 20 kg/cm^2	SS	2.00	1.20	3.00	3.00	1.00	3.00	3.00
2.0 TO 25 kg/cm^2	SS	3.00	1.50	4.00	4.00	1.50	4.00	4.00
4.0 TO 40 kg/cm^2	SS	3.00	1.50	4.00	4.00	1.50	4.00	4.00
6.0 TO 60 kg/cm^2	SS	5.00	3.00	7.00	7.00	2.00	7.00	7.00
10 TO 100 kg/cm^2	SS	7.00	4.00	8.00	8.00	3.00	8.00	8.00
10 TO 160 kg/cm^2	SS	8.00	5.00	9.00	9.00	4.00	9.00	9.00
20 TO 200 kg/cm^2	SS	9.00	6.00	11.00	11.00	5.00	11.00	11.00
25 TO 250 kg/cm^2	SS	10.0	7.00	12.00	12.00	6.00	12.00	12.00

Switching differentials are nominal max. values at mid-point and change along the set points.

Blind Pressure & Differential Pressure Switches

Switching Differential Chart : Direct Pressure Switch, Adjustable Differential

RANGE	AVAILABILITY IN SERIES	Micro Switch CODE 101	102	103	106
-0.9 TO 0 kg/cm^2	SS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-0.9 TO 1.5 kg/cm^2	SS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-0.5 TO 0.5 kg/cm^2	SS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-200 TO +200 mmWC	SS, SR	100-200	-	-	-
-400 TO +400 mmWC	SS, SR	100-300	-	-	-
-800 TO 0 mmWC	SS, SR	200-500	-	-	-
20 TO 200 mmWC	SS, SR	60-100	-	-	-
40 TO 400 mmWC	SS, SR	100-300	-	-	-
50 TO 500 mmWC	SS, SR	100-300	-	-	-
100 TO 1000 mmWC	SS, SR	100-500	-	-	-
0.05 TO 0.16 kg/cm^2	SS, SR	0.02-0.06	-	-	-
0.08 TO 0.4 kg/cm^2	SS, SR	0.05-0.06	0.08-0.2	0.08-0.2	0.08-0.2
60 TO 600 mBar	SS, SR	30-60	90-300	90-300	90-300
0.2 TO 1 kg/cm^2	SS, SR	0.08-0.30	0.3-0.6	0.3-0.6	0.3-0.6
0.2 TO 2 kg/cm^2	SS	0.1-0.3	0.4-1	0.4-1	0.4-1
0.4 TO 4 kg/cm^2	SS	0.3-1	0.5-2	0.5-2	0.5-2
0.6 TO 6 kg/cm^2	SS	0.4-2	0.6-3	0.6-3	0.6-3
1.0 TO 10 kg/cm^2	SS	0.6-2	1-5	1-5	1-5
1.5 TO 15 kg/cm^2	SS	0.8-3	2-8	2-8	2-8
2.0 TO 20 kg/cm^2	SS	1.2-5	3-12	3-12	3-12
2.0 TO 25 kg/cm^2	SS	1.5-6	4-12	4-12	4-12
4.0 TO 40 kg/cm^2	SS	1.5-6	5-25	5-25	5-25
6.0 TO 60 kg/cm^2	SS	3-6	7-30	7-30	7-30
10 TO 100 kg/cm^2	SS	4-8	8-50	8-50	8-50
10 TO 160 kg/cm^2	SS	5-8	10-80	10-80	10-80
20 TO 200 kg/cm^2	SS	6-10	12-100	12-100	12-100
25 TO 250 kg/cm^2	SS	7-10	50-150	50-150	50-150

Blind Pressure & Differential Pressure Switches

Switching Differential Chart : Differential Pressure Switch, Fixed Differential

RANGE	AVAILABILITY IN SERIES	Micro Switch CODE						
		100	101	102	103	104	105	106
-0.9 TO 0 kg/cm^2	DS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-0.9 TO 1.5 kg/cm^2	DS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-0.5 TO 0.5 kg/cm^2	DS	0.20	0.10	0.40	0.40	0.06	0.40	0.40
-200 TO +200 mmWC	DS, DR	90	100	-	-	100	-	-
-400 TO +400 mmWC	DS, DR	150	100	-	-	100	-	-
-800 TO 0 mmWC	DS, DR	200	150	-	-	100	-	-
20 TO 200 mmWC	DS, DR	100	60	-	-	50	-	-
40 TO 400 mmWC	DS, DR	100	100	-	-	50	-	-
50 TO 500 mmWC	DS, DR	100	100	-	-	50	-	-
100 TO 1000 mmWC	DS, DR	120	100	-	-	80	-	-
0.05 TO 0.16 kg/cm^2	DS, DR	0.015	0.015	0.06	0.06	0.012	0.06	0.06
0.08 TO 0.4 kg/cm^2	DS, DR	0.045	0.025	0.06	0.06	0.010	0.06	0.06
60 TO 600 mBar	DS, DR	50	30	70	70	15	70	70
0.2 TO 1 kg/cm^2	DS, DR	0.15	0.080	0.30	0.30	0.05	0.30	0.30
0.2 TO 2 kg/cm^2	DS	0.20	0.10	0.40	0.40	0.05	0.40	0.40
0.4 TO 4 kg/cm^2	DS	0.40	0.30	0.50	0.50	0.10	0.50	0.50
0.6 TO 6 kg/cm^2	DS	0.50	0.40	0.60	0.60	0.20	0.60	0.60
1.0 TO 10 kg/cm^2	DS	0.70	0.60	0.80	0.80	0.40	0.80	0.80

Switching Differential Chart : Differential Pressure Switch, Adjustable Differential

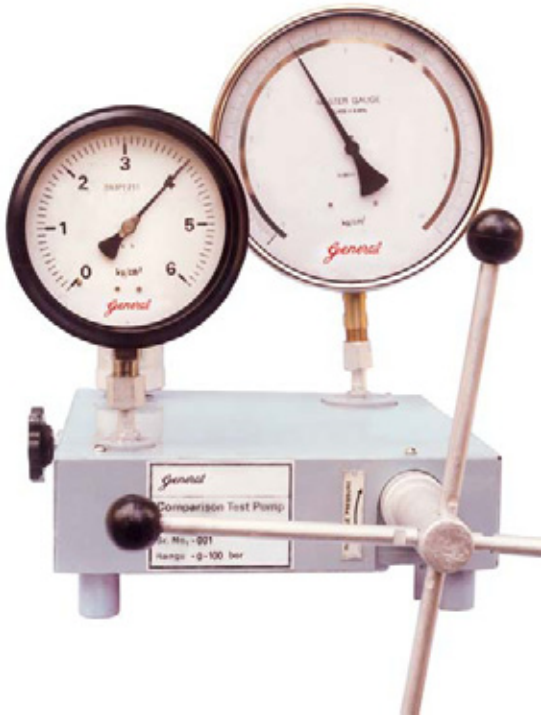
RANGE	AVAILABILITY IN SERIES	Micro Switch CODE			
		101	102	103	106
-0.9 TO 0 kg/cm^2	DS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-0.9 TO 1.5 kg/cm^2	DS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-0.5 TO 0.5 kg/cm^2	DS	0.1-0.4	0.4-0.8	0.4-0.8	0.4-0.8
-200 TO +200 mmWC	DS, DR	100-200	-	-	-
-400 TO +400 mmWC	DS, DR	100-300	-	-	-
-800 TO 0 mmWC	DS, DR	200-500	-	-	-
20 TO 200 mmWC	DS, DR	60-100	-	-	-
40 TO 400 mmWC	DS, DR	100-300	-	-	-
50 TO 500 mmWC	DS, DR	100-300	-	-	-
100 TO 1000 mmWC	DS, DR	100-500	-	-	-
0.05 TO 0.16 kg/cm^2	DS, DR	0.02-0.06	-	-	-
0.08 TO 0.4 kg/cm^2	DS, DR	0.05-0.06	0.08-0.2	0.08-0.2	0.08-0.2
60 TO 600 mBar	DS, DR	30-60	90-300	90-300	90-300
0.2 TO 1 kg/cm^2	DS, DR	0.08-0.30	0.3-0.6	0.3-0.6	0.3-0.6
0.2 TO 2 kg/cm^2	DS	0.1-0.3	0.4-1	0.4-1	0.4-1
0.4 TO 4 kg/cm^2	DS	0.3-1	0.5-2	0.5-2	0.5-2
0.6 TO 6 kg/cm^2	DS	0.4-2	0.6-3	0.6-3	0.6-3
1.0 TO 10 kg/cm^2	DS	0.6-2	1-5	1-5	1-5

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Master Pressure Gauges

GENERAL precision master gauges are manufactured to the highest standards and are used to calibrate industrial gauges in laboratories meeting the requirements of ISO-9000. The pressure proportional elastic deformation of bourdon tube (measuring element) is transmitted through low friction, jeweled bearings to balanced knife edge pointer. A mirror dial is provided for anti parallax readings.

Application : Precision monitoring in process plants, laboratories, control and adjustment of pressure gauges, switch, test equipment.



Features

- Accuracy class ± 0.25%
- Rugged construction
- 1.2 fold overrange capability
- Traceability to national/international standard / laboratory

Specifications

Ref. Standard	: EN 837
Normal size	: 150 mm or 250 mm
Case	: Diecast aluminium / SS304
Bezel	: Aluminium / SS304 for 150 mm or chromium plated brass for 250 mm.
Dial	: Anti parallax mirror type, white, with black markings.
Window	: Instrument glass
Pointer	: Balanced knife edge
Measuring element	: Copper alloy bourdon tube for < 40 bar SS316 Ti for > 60 bar
Movement	: Precision brass, jewel bearings
Connection	: 1/2" NPT (M), bottom or back eccentric in brass or SS316
Range	: 760 mm Hg Vac upto 600 bar g (Refer table -1 of Bourdon Sensing Pressure Gauge)
Scale	: Bar (g), kg/cm^{2}g, Psig
Accuracy	: ± 0.25%
Overrange	: 1.2 times maximum rating for short duration
Suitability	: Media up to 50^{0}C ambient (-) 25^{0}C to 60^{0}C
Weight	: 1.5 kg / 2.5 kg (approx.)
Option	: Pressure comparator bench (as shown in above picture) can be supplied. Pressure comparator bench consists of pressure raising by screw press, reservoir for filling the system. The pressure is released to atmosphere by opening valve between reservoir and the system after screw press has been reversed to lower pressure. It has maintenance free operation.

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

How to Order

TYPE : MPG

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Flush Panel Mounting

CASE
AL - Die-cast Aluminium
S4 - SS304

DIAL
15 - 150 mm
25 - 250 mm

CONNECTION

Size	Type	Male / Female
6 - 1/4” 10 - 3/8” 15 - 1/2” 20 - 3/4” 25 - 1” 32 - 1.1/4” 40 - 1.1/2”	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

RANGE
Refer Table 1 of
Bourdon Sensing Pressure Gauge

UNIT
A - kg/cm^2 (g)
B - Bar (g)
C - Psig
D - Kpa
E - mmHg
F - Specify

Differential Pressure Gauges

Differential pressure gauges are used for measuring differential pressure across filters, strainers, columns, reactors, ID / FD fans, blowers and for flow measurement. A set of two stainless steel bellows or two diaphragms enables direct reading of the actual differential pressure. Each port can withstand the full static pressure without any damage.

Features

- Bellow /Diaphragm (double diaphragm design) type construction
- Static pressure upto 300 kg/cm^2 (higher static pressure on request)
- All SS internals
- Screwed / Flanged connection
- Chemical seal unit (optional) for process suitability
- Accuracy ± 1% FSD (bellow) / ± 2% FSD (diaphragm) (1.6% FSD on request)
- Glycerine filled case as an option
- Microswitch type contacts as required

Specifications

Dial	: 6" Nominal / 4" (Only for diaphragm type)
Case & Bezel	: Diecast aluminium / SS304 / SS316, weatherproof to IP-67 (IS:13947 Part 1)
Window	: Toughened Glass with rubber ring
Pointer	: Light weight, micrometer adjustable
Sensing	: Bellow / diaphragm in SS316 / SS316L / Monel
Other wetted parts	: SS316 / SS316 L / Monel
Movement	: SS304
Connection	: ½" NPT (M) or flanged
Range	: As customer requires (Minimum 0 to 160 mm WC)
Static Pressure	: Upto 300 kg/cm^{2}g max. (Higher static pressure on request)
Accuracy	: ± 1% FSD for bellow type and ± 2% FSD for diaphragm type (1.6 % FSD on request)
Blow out disc	: Provided (top of the case)
Temperature suitability	: (-) 20^{0}C to 60^{0}C ambient, (-) 20^{0}C to 60^{0}C Process
Optional	: Chemical seal unit Glycerine filled case Microswitch type contacts

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Differential Pressure Gauges
Bellow type

How to Order

TYPE : DPG-B

MOUNTING
S - Bottom Entry, Surface Mounting
P - Back Entry, Panel Mounting
Y - Yoke Mounting (2" pipe mounting)

DIAL
15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

BELLOW
S6- SS316 M - Monel 400

MOVEMENT
A - SS304

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

Range
Please Specify

UNIT
A - kg/cm² (g) D - Kpa
B - Bar (g) E - mmHg
C - Psig

OPTION
G - Glycerin Filled Case
S - Silicon Oil Filled Case
N - NACE-MR-01-75
I - IBR
O - O_2 Cleaning
M - Maxima Pointer
D - Dual Scale
C - Chemical Seal Unit Refer PGCSU
L - NIL
X - Accessory*
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Guage Saver
2V - 2 way Isolation Valve
3V - 3 Way Isolation Valve

Static Pressure
Please Specify

* Specify material & size in the bracket e.g. SN [SS316, 1/2" NPT(F) x 1/2" NPT(M)]

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Differential Pressure Gauges
Diaphragm Type

How to Order

TYPE : DPG-D

MOUNTING
S - Bottom Entry, Surface Mounting
P - Back Entry, Panel Mounting
Y - Yoke Mounting (2" pipe mounting)

DIAL
10-100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

DIAPHRAGM
S6 - SS316
HC - Hastelloy C - 276
HB - Hastelloy B
M - Monel 400

MOVEMENT
A-SS304

CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

Range

0 - 6 kg/cm^{2}g	0 - 0.4 kg/cm^{2}g
0 - 4 kg/cm^{2}g	0 - 0.25 kg/cm^{2}g
0 - 2.5 kg/cm^{2}g	0 - 0.16 kg/cm^{2}g
0 - 1.6 kg/cm^{2}g	0 - 0.1 kg/cm^{2}g
0 - 1 kg/cm^{2}g	0 - 0. 06 kg/cm^{2}g
(-) 1 to 0 kg/cm^{2}g	0 - 0. 04 kg/cm^{2}g
(-) 1 to 1.5 kg/cm^{2}g	0 - 0. 025 kg/cm^{2}g
0 - 0.6 kg/cm^{2}g	

OPTION
G - Glycerine Filled Case
S - Silicon Oil Filled Case
N - NACE-MR-01-75
I - IBR
O - O_2 Cleaning
M - Maxima Pointer
D - Dual Scale
C - Chemical Seal Unit
L - NIL
X - Accessory*
SN - Snubber
SY - Syphon
SYI - Syphon with IBR
GS - Gauge Saver
2V - 2 Way Isolation Valve
3V - 3 Way Isolation Valve

UNIT

A - kg/cm^2 (g)	D - KPa
B - Bar (g)	E - mm Hg
C - Psi	

* Specify material & size in the bracket e.g. SN [SS316, 1/2" NPT(F) x 1/2" NPT(M)]

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Indicating Differential Pressure Switch

GENERAL has been designing and manufacturing high quality Diaphragm & Bellow Type Differential pressure indicating switches to suit most of the industrial application for accurate control of the process equipments. Rigorous and continuous tests are conducted for design and quality conformance.

Application Areas

Pumps, Compressors, Lubrication Systems, Turbines, Generators, Boilers, Furnances etc. in industries such as Chemical, Fertiliser, Ferrous & Non-ferrous metal, Pulp & Paper, Power, Waste Water Treatment, Refinery & Petrochemical, Synthetic Fibre, etc.

Specifications

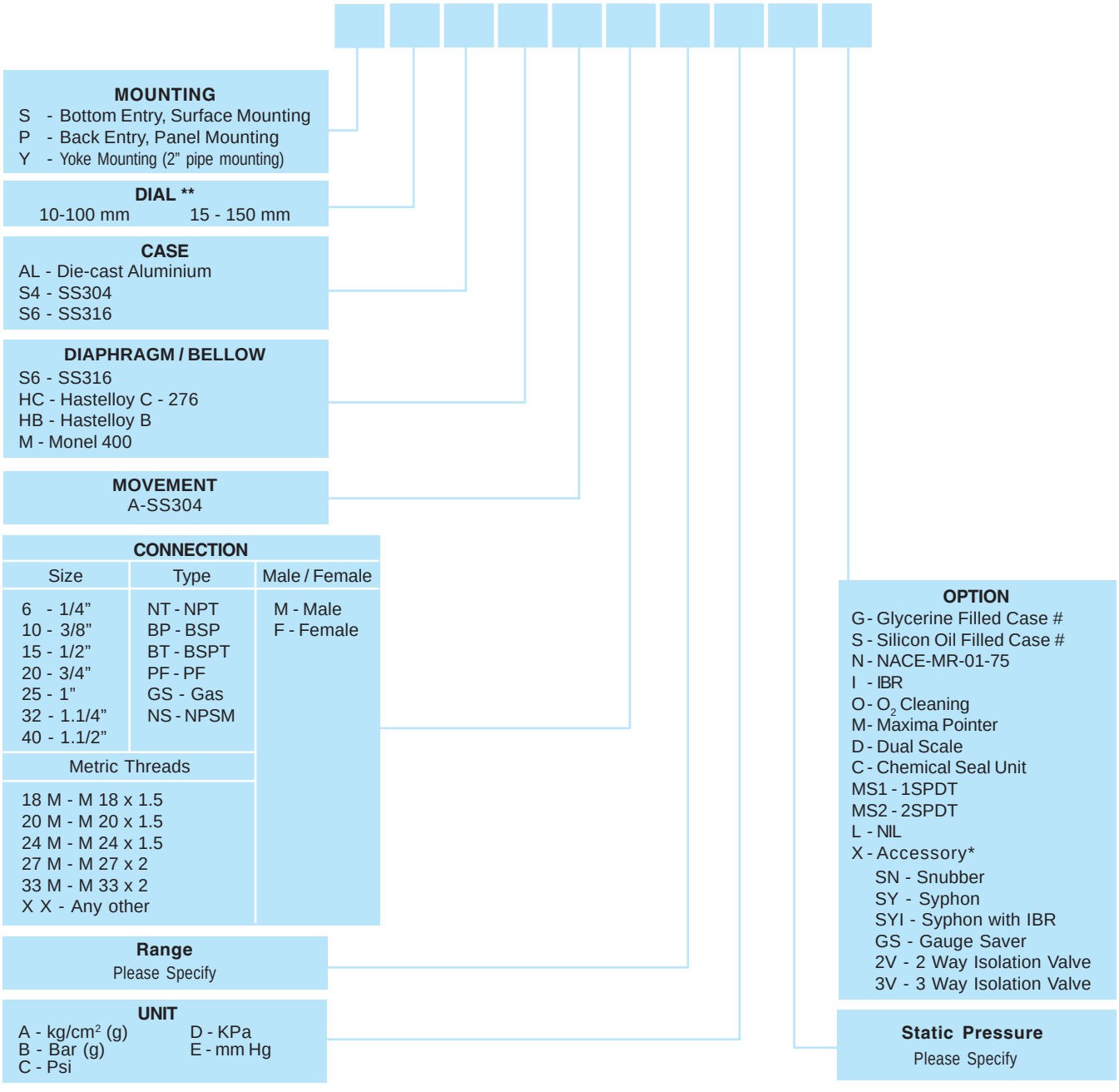
Sensing Element	: SS316L diaphragm or bellow
Case	: Diecast aluminium, epoxy painted, weatherproof to IP-67 (IS:13947 Part I) or SS316 optionally
Cable Entry	: 1/2" ET (F)
Switch	: I SPDT / 2 SPDT. Snap acting micro-switch (DPDT on request) Rated 5A @ 230 VAC (3A @ 28 VDC) or 15A @ 230VAC
Movement	: Brass
Set Point	: Adjustable throughout the range
Mounting	: Surface Mounting / Pipe, also available with Remote Seal
Process Connection	: 1/2" NPT (M) as standard. Other connections optionally
Range	: As customer requires (minimum 0 to 160 mm WC)
Indication Accuracy	: ±1% FSD with Bellow & ± 2% FSD with Diaphragm sensing
Switching Accuracy	: ±1.5 - 2% FSD
Repeatability	: 1% FSD
Process Temperature	: (-)20°C to 60°C for SS wetted parts
Calibration	: All switches are individually calibrated

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Indicating Differential Pressure Switch

How to Order

TYPE : IDPS-D/B



* Specify material & size in the bracket e.g. SN [SS316, 1/2" NPT(F) x 1/2" NPT(M)]

** Bellow type DP switch only in 150 mm dial size

Liquid filled case not available with this construction / model

Accessories

Snubber

Pulsation dampener for pulsating services, or where vibration exists, on pump descharge lines, for dampening erratic pressures. Available in materials such as CS, SS304, SS316, Monel (other material on request) standard connection 1/2" NPT(F) x 1/2" NPT(M) (please specify other connection)

Syphon

For lowering the service temperature so that gauge is exposed to lower temperature (i.e. $<60^0$C). Generally offered in 1/2" sch, 40 or 80 size (other sizes also can be offered on request). Two types - U type and pig tail type are mainly offered, as customer desires. Available in material like CS (A106), SS304 SS316, P11 etc. IBR Certification - Wherever applicable is offered. Standard connection 1/2" NPT(F) x 1/2" NPT(M). Butt welded (plain) connection also can be offered.

Two way isolation valve

Simple needle type isolation valve used for isolating (separating) process from the gauge. Available in CS, SS304, SS316. Standard connection is 1/2" NPT(F) x 1/2" NPT(M). Request for other requirements.

Gauge saver

Used where maximum pressure (or design pressure) exceeds the overrange pressure of the gauge. Minimum setting, generally offered is 1 kg/cm^{2}g. Request for lower settings. Normally offered in SS316 & Monel. Other material on request. Standard connection offered is 1/2" NPT.

Three way isolation valve

Isolates the gauge from the process and has drain facility. Available normally in SS316 (other material on request). Standard connection of 1/2" NPT(F) x 1/2" NPT(F) x 1/2" NPT(M). (Please specify other requirement like 1/2" BSP or M20 x 1.5 etc.)

Swievelling adaptor or gauge union

Facilitates positioning of the gauge while installation. Generally offered in the same material as that of socket i.e. SS304, SS316, Monel. Other material can be offered on request.

In-House testing facilities for Pressure Gauges

Pressure Gauges, Differential Pressure Gauges and Pressure Switches are manufactured in technical collaboration with M/s Gauges Bourdon, U.K. The same are manufactured and tested in accordance with EN : 837 standard. According to the said international standard, following tests are carried out to ensure the quality of Pressure Gauges. We can carry out following tests-In-House-at our manufacturing plant.

1. Visual Inspection
2. Dimensional Verification
3. Accuracy Test
4. Hysteresis Test
5. Leak Test
6. Influence of Mounting Position
7. Degree of Protection
8. Effects of Mechanical Vibration
9. Effects of Mechanical Shock
10. Endurance test with Steady Pressure
11. Endurance test with Over Pressure
12. Endurance test with Cyclic Pressure
13. Safety Blow-out Test
14. Thermal stability test at rated temperature
15. Temperature effect test
16. Energy release test

Under Technical Collaboration with M/s. Gauges Bourdon, U.K.

Pressure units cross reference (Conversion chart)

To convert pressure from one unit to another:

1. Start at column heading with units to convert **from**.
2. Move down the same column to number **"1"**.
3. Move across this **row** to the column with units heading you are converting **to**.
4. Multiply the number in this table cell times the amount you are converting from to get the new value in converted **units**.

psi	atms.	"WC	mm WC	cm WC	oz/in²	Kg/cm²	"Hg	mm Hg	cm Hg	mbar	bar	Pa (N/m²)	KPa	MPa
1	0.0681	27.71	703.08	70.308	16	0.0704	2.036	51.715	5.17	68.95	0.0689	6,895	6.895	0.0069
14.7	**1**	407.2	10,343	1,034.30	235.1	1.033	29.92	760	76	1013	1.013	101,325	101.3	0.1013
0.0361	0.00246	**1**	25.4	2.54	0.5775	0.00254	0.0735	1.866	0.187	2.488	0.00249	248.8	0.249	0.00025
0.001421	0.000097	0.0394	**1**	0.1	0.0227	0.0001	0.00289	0.0735	0.00735	0.098	0.000098	9.8	0.0098	0.00001
0.01421	0.000967	0.3937	10	**1**	0.227	0.001	0.0289	0.735	0.0735	0.98	0.00098	98	0.098	0.0001
0.0625	0.00425	1.732	43.986	4.4	**1**	0.0044	0.1273	3.232	0.3232	4.31	0.00431	431	0.431	0.00043
14.22	0.968	394.1	10010	1,001	227.6	**1**	28.96	735.6	73.56	980.7	0.981	98,067	98.07	0.0981
0.4912	0.03342	13.61	345.7	34.57	7.858	0.0345	**1**	25.4	2.54	33.86	0.0339	3,386	3.386	0.00339
0.01934	0.001316	0.536	13.61	1.361	0.31	0.00136	0.0394	**1**	0.1	1.333	0.001333	133.3	0.1333	0.000133
0.1934	0.01316	5.358	136.1	13.61	3.1	0.0136	0.394	10	**1**	13.33	0.01333	1,333	1.333	0.00133
0.0145	0.000987	0.4012	10.21	1.021	0.2321	0.00102	0.0295	0.75	0.075	**1**	0.001	100	0.1	0.0001
14.504	0.987	401.9	10,210	1021	232.1	1.02	29.53	750	75	1,000	**1**	100,000	100	0.1
0.000145	0.00001	0.00402	0.102	0.0102	0.00232	0.00001	0.000295	0.0075	0.00075	0.01	0.00001	**1**	0.001	0.000001
0.14504	0.00987	4.019	102.07	10.207	2.321	0.0102	0.295	7.5	0.75	10	0.01	1,000	**1**	0.001
145.04	9.869	4019	102,074	10,207	2321	10.2	295.3	7500	750	10,000	10	1,000,000	1,000	**1**

General

MANIFOLD VALVES & INSTRUMENT FITTINGS

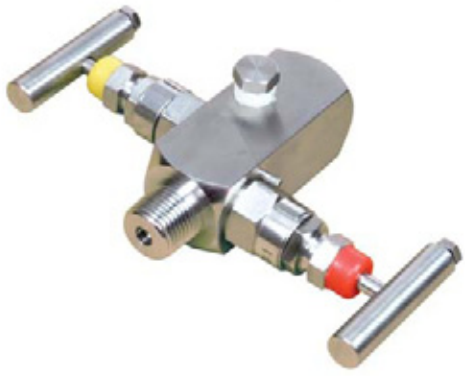
Needle Valves

Screwed Bonnet Design

Designed for use in applications for throttling & straight shut off of liquids, gas or vapour service.
These needle valves are available with a variety of end connections with female ends & male-female ends.

Standard MOC : CS to A105, SS304, SS316 other material optionally

Standard connection : 1/4", 3/8", 1/2", 1"



Double Block & Bleed Valves

Designed for use with gauges, switches or pressure transmitters. These gauge valves incorporate two valves with single outlet that combine isolation, calibration and venting. Available in standard material of construction of CS to A105, SS304 & SS316. Other materials available optionally. Connection options available are M x F, F x F, M x M or F x M

Valve Manifold

Two Valve Manifold

Two valve manifold is designed in a single block with female screwed inlet & outlet port combining isolation valve and calibration/vent valve. Generally used on static pressure transmitters, switches or gauges. Standard connection available is 1/2" NPT(F) x 1/2" NPT(F) and drain connection of 1/4" NPT(F) or 1/2" NPT(F). Available in CS to A105, SS304, SS316. Other material will be offered optionally.

Three Valve Manifold Separately Mounted

Designed for applications to facilitate remote mounting of differential pressure instruments. Useful for installations in remote fields eleminating conventional method of piping. Standard dimensions are 54mm or 2.1/8" between instrument connections.

For requirement of other dimensions, please consult us.

Standard connection : 1/2" NPT(F) x 1/2" NPT(F) x 1/4" NPTF)

Three Valve Manifold Direct Mounting - T Type

Designed for direct or remote mounting. Two oval flanges are used for connecting process pipe to manifold block. The manifold block incorporates two main valves for process isolation and one valve for equalising. Standard dimensions of centre distance of instrument connections are 54mm or 2.1/8". Other dimensions can be offered optionally. Standard material of construction is CS to A105, SS304, SS316 (other material can be offered optionally). Mounting bracket with U bolts for 2" pipe mounting or nuts/bolts for wall mounting are offered separately as an option.

Valve Manifold

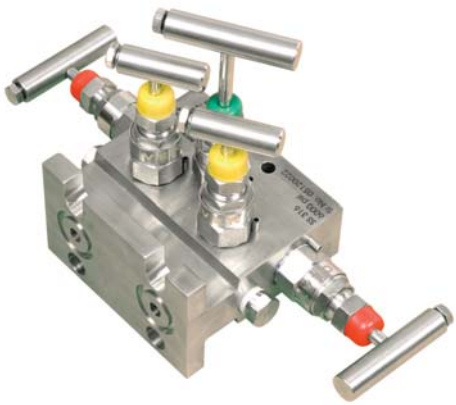
Five Valve Manifold Remote Mounting

Five valve manifold incorporates two process isolation valves, one equaliser valve and two drain/vent valves with a common drain connection in a compact manifold block. The manifold is designed for remote mounting, away from differential pressure instrument and joined by tube or pipe impulse lines. Normally has threaded connections. Standard dimensions of instrument connections centre are 54mm or 2.1/8". Manifolds with other dimensions are offered optionally. Available normally in CS to A105, SS304, SS316. Other non-standard materials are offered optionally.

Five Valve Manifold Direct Mounting - H Type

H type five valve manifiold is designed for direct mounting of differential pressure transmitter. For remote mounting, two oval flanges are used for connecting process pipe to manifold block. This manifold block incorporates five valves - two main valves for process isolation, valve for vent and two valves for equalising. Standard instrument connection centre dimensions are 54mm or 2.1/8". Other dimensions are also available on request.

Five Valve Manifold Direct Mounting - T Type



As in H type, T type five valve manifold is designed for direct mounting on differential pressre instruments. The manifold incorporates two process isolation valves, one equaliser valve and two drain/vent valves in a compact block. The process connection is threaded for connecting by tube or pipe fittings. Instrument and process connection centre distances of 54mm or 2.1/8" are standard.

Standard MOC is CS to A105, SS304, SS316.
Other materials available optionally.

Detailed catalogue of Valves & Valve Manifolds available on request

Instrument Fittings

Instrument fittings are vital for reliablility under varying service conditions. Employing good quality material ensures that it is suitable for use in chemical plants and refinery piping besides other industries. The hardness of the wetted part material is minimum RB 60 (For NACE requirement it is ensured to be RB 90).

We offer entire range of Instrument Fittings in various materials viz. SS, Brass, Monel 400, Hastelloy C etc. The different types of tube fittings offered are :

Male/female connector (compression fitting - single or double ferrule)

Union

Equal tee

Adaptor

Reducer

Air Header

Elbow

Nuts/Caps

Condensate pot

Close tolerences are maintained while manufacturing to avoid energy losses (and avoiding hazard in certain cases). The fittings are subjected to random sampling tests as mentioned below:

Visual Check

Dimensional Check

Chemical Composition

Hardness Test

Air Leak Test

Detailed catalogue of Instrument Fittings available on request

TEMPERATURE

General

TEMPERATURE GAUGES

Bimetal Dial Thermometer

The Bimetal thermometer employs a bimetal strip in the form of helix (it works on the principle of thermal expansion - two metals having different coefficient of expansions are joined to form a bimetal. The resultant expansion of bimetal is proportional to temperature). Bimetal dial thermometers are simple in construction, yet rugged. They are used for measurement of temperature in most of the industrial applications. They are offered in the range of (-) 50^{0}C to 600^{0}C. With rigid stem having bottom or back entry. It can also be offered in every angle rotatable construction.

Features

- Rugged construction
- Bottom/Back entry, every angle construction
- Fast response
- Protection class IP-67
- Accuracy ± 1% FSD
- High repeatability, low hysteresis
- Hermetically sealed case

Specifications

Reference standard	: ASME B 40.3, EN 13190
Dial	: 63 mm, 100 mm or 150 mm in aluminium white background, black markings
Case	: Die cast aluminium with screwed bezel SS304 with bayonet bezel
Protection	: Weatherproof to IP - 67 (IS : 13947)
Window	: Shatterproof glass
Pointer	: Aluminium, black
Stem	: SS304 or SS316 in 6 mm, 8 mm,9.5 mm, 10 mm, 12 mm, 12.7 mm, 14 mm, 16 mm dia and length from 100 mm to 1000 mm as standard
Connection	: ½" NPT (M) as standard in SS304 or SS316 adjustable three piece compression fitting
Range	: (-) 50^{0}C to 600^{0}C with a minimum span of 80^{0}C
Accuracy	: ±1% FSD (±2% FSD for 63 mm dial size) (In accordance with EN 13190)
Overrange	: 125% FSD (130% on request upto 500^{0}C)
Reset	: External
Contact	: Single SPST, normally open, closed on rise in temperature (specify action required) adjustable over the entire range, rating 30 VA @ 230 V AC (100 mm dial back entry model in SS case only)

Note : 1) For minimum insertion length essential for proper sensing, contact our design department.
2) Three point calibration certificate accompanies each thermometer.

Bimetal Dial Thermometer

How to Order

TYPE : BDT

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
E - Every Angle, Local Mounting

DIAL
63 - 63 mm
10 - 100 mm
15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

STEM-OD

A - 6 mm	E - 12 mm
B - 8 mm	F - 12.7 mm
C - 9.5 mm	G - 14 mm
D - 10 mm	H - 16 mm

STEM LENGTH
Specify in mm

STEM MATERIAL
S4-SS304
S6-SS316

CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

OPTION
A - Thermowell
S - Liquid Filled Case *
C - Colour Band
D - Dual Scale
E - 1 SPST # Electrical contact

UNIT
C - Deg C
F - Deg F

RANGE

(-) 50 to (+) 30	0 to 200
(-) 30 to (+) 50	0 to 250
(-) 20 to (+) 60	0 to 300
0 to 80	0 to 350
0 to 100	0 to 400
0 to 120	0 to 500
0 to 160	0 to 600

* Suitable upto maximum temperature 339°C.

In 100 mm dial size, back entry, SS case.

Mercury in Steel Dial Thermometer

Mercury filled system based on mercury expansion principle is used for measuring temperature ranging from (-) 40°C to 600°C. It has faster response and the same is available in rigid stem as well as capillary type for remote sensing. Every angle type can be offered in all SS construction. Manufactured in accordance with BS:5235. System is case compensated as standard (SAMA CI VB). Fully compensated (capillary compensation) system is offered wherever essential.

Features

- Rugged construction
- Rigid stem or capillary type
- Fast response
- Protection class IP- 67
- Accuracy ± 1% FSD (0.5% FSD on request)
- High repeatability, low hysteresis
- Case compensated system
- Micrometer Pointer

Specifications

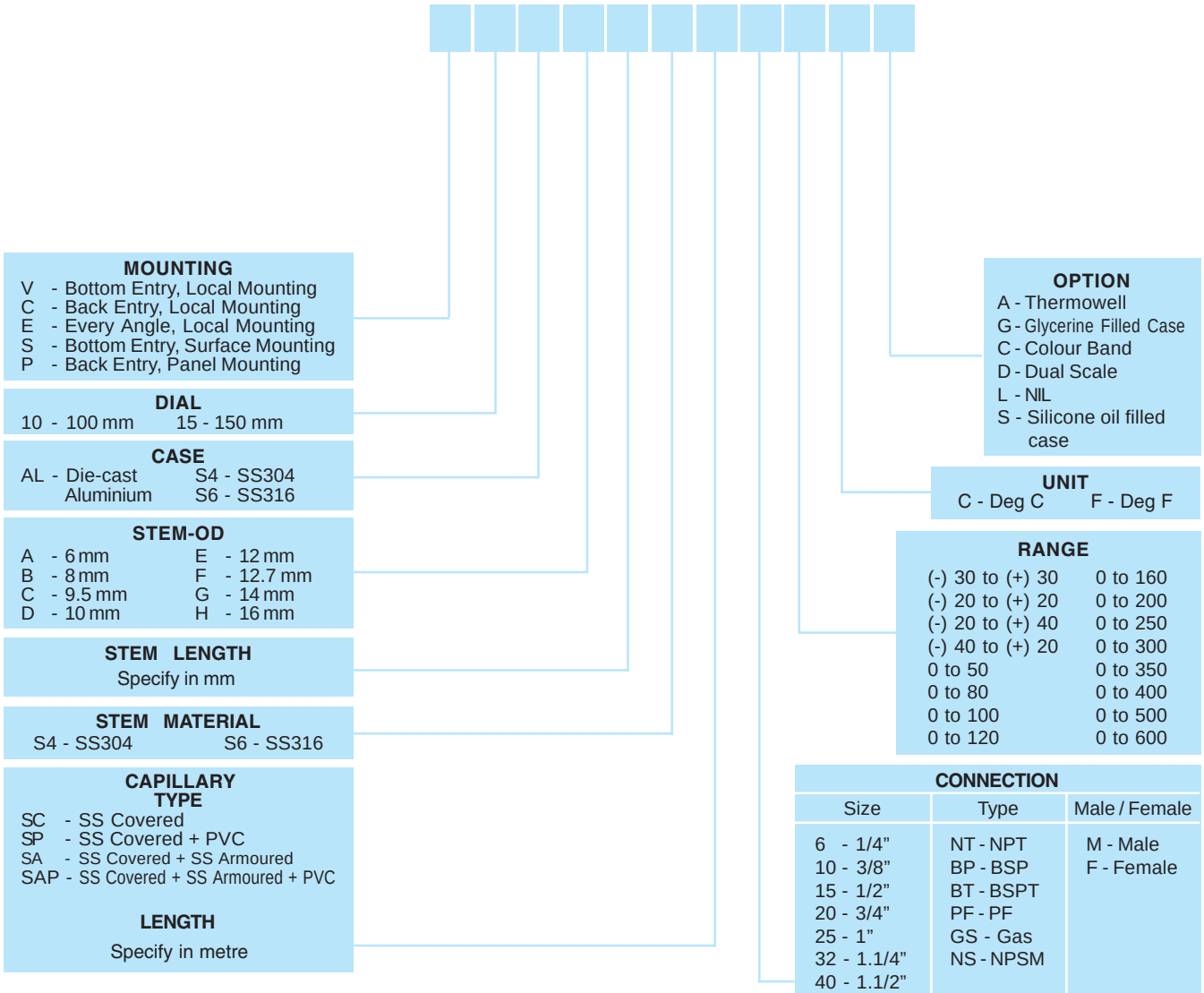
Ref Standard	: BS 5235
System	: Mercury filled, case compensated in accordance with SAMA CI. V B
Dial	: 100 mm or 150 mm in aluminium, white background, black markings
Case	: Die cast aluminum with screwed bezel, SS304 / SS316 with bayonet bezel
Protection	: Weather proof to IP - 67 (IS : 13947 Part I)
Window	: Shatterproof glass
Pointer	: Aluminium, black
Stem	: SS304 or SS316 in 6 mm, 8 mm, 9.5 mm, 10 mm, 12 mm, 12.7 mm, 14 mm, 16 mm dia and length from 100 mm to 1000 mm (longer lengths available on request)
Capillary	: SS covered / SS covered + PVC / SS armoured (up to 15 M).
Connection	: ½" NPT (M) as standard in SS304 or SS316 three piece adjustable compression fitting.
Range	: (-) 40°C to 600°C with a minimum span of 50°C
Accuracy	: ± 1% FSD / ± 0.5% FSD
Overrange	: 130% FSD as standard
Zero reset	: Micrometer Pointer
Optional	: 1) Glycerine filled SS304 / SS316 case 2) Fully compensated double bourdon system in accordance with SAMA CI. V A 3) SS solid drawn capillary for better performance

Note : 1) For minimum immersion length essential for proper sensing, contact our design department.
2) Three point calibration certificate accompanies each thermometer.

Mercury in Steel Dial Thermometer

How to Order

TYPE
MIS-R - Rigid Stem
MIS-C - Capillary Type



MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
E - Every Angle, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Panel Mounting

DIAL
10 - 100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

STEM-OD
A - 6 mm E - 12 mm
B - 8 mm F - 12.7 mm
C - 9.5 mm G - 14 mm
D - 10 mm H - 16 mm

STEM LENGTH
Specify in mm

STEM MATERIAL
S4 - SS304 S6 - SS316

CAPILLARY TYPE
SC - SS Covered
SP - SS Covered + PVC
SA - SS Covered + SS Armoured
SAP - SS Covered + SS Armoured + PVC

LENGTH
Specify in metre

OPTION
A - Thermowell
G - Glycerine Filled Case
C - Colour Band
D - Dual Scale
L - NIL
S - Silicone oil filled case

UNIT
C - Deg C F - Deg F

RANGE

(-) 30 to (+) 30	0 to 160
(-) 20 to (+) 20	0 to 200
(-) 20 to (+) 40	0 to 250
(-) 40 to (+) 20	0 to 300
0 to 50	0 to 350
0 to 80	0 to 400
0 to 100	0 to 500
0 to 120	0 to 600

CONNECTION

Size	Type	Male / Female
6 - 1/4” 10 - 3/8” 15 - 1/2” 20 - 3/4” 25 - 1” 32 - 1.1/4” 40 - 1.1/2”	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

Liquid Filled Dial Thermometer

Liquid filled system based on liquid (other than mercury) expansion principle is used for measuring temperature ranging from (-) 30^{0}C to 250^{0}C.

It has faster response and the same is available in rigid stem as well as capillary type for remote sensing. Every angle type can be offered in all SS construction. Generally used where mercury type thermometer is not used in industries such as Food, Pharmaceutical, etc. The main advantage is its minimum immersion length required for sensing (as low as 30mm suffices for proper sensing thereby making it ideal for installing in lower line sizes)

Features

- Rugged construction
- Rigid stem or capillary type
- Suitable for pharmaceutical, food, biotechnology industry.
- Protection class IP-67
- Accuracy ± 1% FSD
- Minimum immersion length (as low as 30 mm suitable for lower line sizes) possible.
- Case compensated system (SAMA Cl. IB)

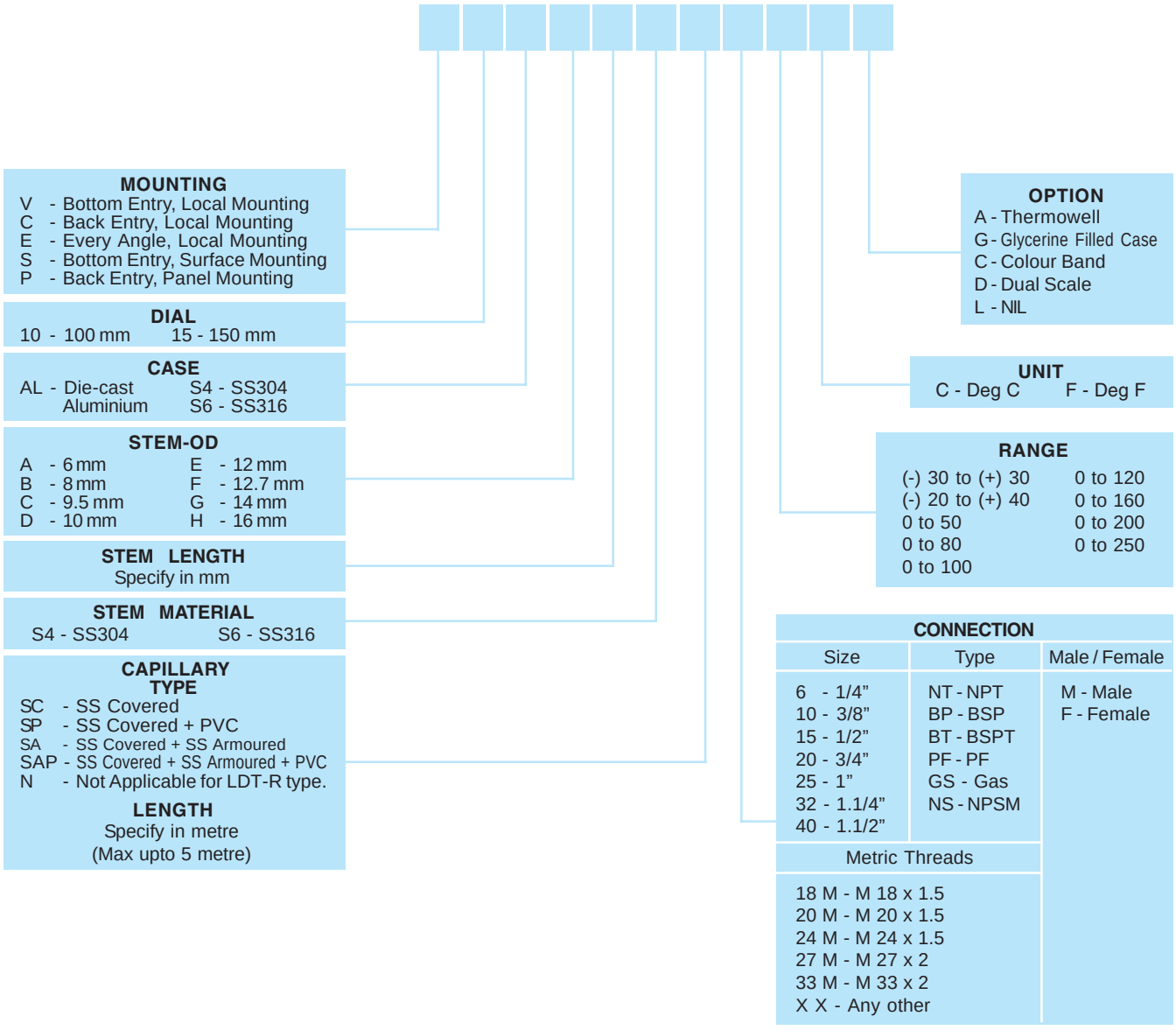
Specifications

System	: Liquid filled, case compensated in accordance with SAMA Cl. I B
Dial	: 100 mm or 150 mm in aluminium, white background, black markings
Case	: Die cast aluminum with screwed bezel, SS304 / SS316 with bayonet bezel
Protection	: Weather proof to IP - 67 (IS : 13947 Part I)
Window	: Shatterproof glass
Pointer	: Aluminium, black
Stem	: SS304 or SS316 in 6 mm, 8 mm, 9.5 mm,10 mm, 12 mm, 12.7 mm, 14 mm, 16 mm dia (immersion length as small as 30 mm possible).
Capillary	: SS covered / SS covered + PVC / SS armoured (up to 5 Mtr.).
Connection	: ½" NPT (M) as standard in SS304 or SS316 three piece adjustable compression fitting.
Range	: (-) 30^{0}C to 250^{0}C with a minimum span of 50^{0}C
Accuracy	: ± 1% FSD
Overrange	: 125% FSD as standard
Zero reset	: Micrometer Pointer
Optional	: Glycerine filled SS304 case

Liquid Filled
Dial Thermometer

How to Order

TYPE
LDT-R - Rigid Stem
LDT-C - Capillary Type



Gas Filled Dial Thermometer

Gas filled temperature gauge overcomes most of the limitations of other members of family. It is offered in a very wide temperature range i.e. (-)200 to 800^{0}C. Practically any stem length can be offered and capillary length as long as 25 mtr, without any loss of accuracy. Inert, non hazardous, non toxic nature of the filled system makes it virtually ideal choice of cross section of industries.

Features

- Use of inert gas - N_2
- Suitable for sanitary application
- All SS construction
- Rigid stem or capillary type
- Fast response
- Non-polluting, environment friendly
- Non-hazardous for the service
- High reliability
- IP-67 protection
- Accuracy ± 1% FSD

Specifications

System	: Gas (N2) filled, case compensated in accordance with SAMA Cl. III B
Dial	: 100 mm or 150 mm in aluminium, white background, black marking
Case	: SS304 / SS316 with bayonet bezel
Protection	: Weatherproof to IP-67 (IS:13947 Part I)
Window	: Shatterproof glass
Pointer	: Aluminium, black with micrometer adjustment
Stem	: SS316 in 8 mm, 10 mm, 12 mm dia as standard
Capillary	: SS solid drawn or SS armoured or SS + PVC covered up to 25 M
Connection	: 1/2"NPT (M) adjustable three piece compression fitting in SS304 or SS316
Range	: (-) 200^{0}C to 800^{0}C with minimum span of 80^{0}C
Accuracy	: ± 1% FSD in accordance with EN 13190
Overrange	: 130% FSD
Zero Reset	: Micrometer pointer

Note :For minimum immersion length (excluding thread length) for proper sensing, contact our design department.

Gas Filled
Dial Thermometer

How to Order

TYPE
GDT-R - Rigid Stem
GDT-C - Capillary Type

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
E - Every Angle, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Panel Mounting

DIAL
10 - 100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

STEM-OD
A - 6 mm
B - 8 mm
C - 9.5 mm
D - 10 mm
E - 12 mm
F - 12.7 mm
G - 14 mm
H - 16 mm

STEM LENGTH
Specify in mm

STEM MATERIAL
S4 - SS304 S6 - SS316

CAPILLARY TYPE
SC - SS Covered
SP - SS Covered + PVC
SA - SS Covered + SS Armoured
SAP - SS Covered + SS Armoured + PVC
N - Not Applicable for GDT-R type.

CAPILLARY LENGTH
Specify in metre

OPTION
A - Thermowell
C - Colour Band
D - Dual Scale
G - Liquid filled case
L - Nil

UNIT
C - Deg C F - Deg F

RANGE

(-) 30 to (+) 50	0 to 350
(-) 20 to (+) 80	0 to 400
(-) 50 to (+) 30	0 to 500
0 to 80	0 to 600
0 to 100	(-) 50 to (+) 50
0 to 120	(-) 80 to (+) 120
0 to 160	(-) 100 to (+) 150
0 to 200	(-) 200 to (+) 50
0 to 250	(-) 200 to (+) 100
0 to 300	0 to 800

CONNECTION

Size	Type	Male / Female
6 - 1/4” 10 - 3/8” 15 - 1/2” 20 - 3/4” 25 - 1” 32 - 1.1/4” 40 - 1.1/2”	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

Indicating Temperature Switch

Indicating temperature switch combines indication with switching (in order to make or break the associated electrical circuit). Can be offered with contact assembly as well as microswitch (as a combination of switch and movement)

Features

- Combination of indication and switch
- Fast response
- Choice of contact assembly or microswitch
- Switching accuracy ± 2% FSD
- High repeatability and low hysteresis
- Flameproof version available
- Case compensated system

Specifications

System : Mercury filled, Gas (N_2) filled case compensated in accordance with SAMA C1. V B/IIIB

Dial : 100 mm or 150 mm, white anodised, black markings

Case : SS304 / SS316 with bayonet bezel (Flameproof case in Al only)

Protection : Weatherproof to IP-67 (IS : 13947)
Flameproof to IIA IIB (Equivalent to NEC C1. I Div 2 Gr. C&D)

Stem : SS304 or SS316, 6 mm, 8 mm, 10 mm, 12 mm

Connection : 1/2" NPT (M) adjustable three piece compression fitting as standard

Capillary : SS covered or SS armoured or SS covered with PVC up to 15 M.

Range : (-) 40°C to 600°C with a minimum span 50°C for mercury filled temperature switch / (-) 100 to 600°C for gas filled temperature switch (minimum span 80°C)

Accuracy : ± 1% FSD for indication, ± 2% FSD for switching

Overrange : 125% FSD as standard (130% FSD on request upto 500°C)

Contacts :
1) 1 SPST, single, normally open, closed on rise in temperature or vice versa, rated 30 VA @ 230V AC
2) 2 SPST, two contacts, independently adjustable, one normally open other normally closed or both normally open or both normally closed, rated 30VA @ 230 V AC
3) ISPDT, single microswitch, adjustable over entire range, rated 5amp @ 230 V AC (3A @ 28 VDC)
4) 2 SPDT, double microswitch, adjustable over entire range, rated 5 amp @ 230 V AC (3A @ 28 VDC)

Accessory : Relay for the contact assembly to suit 5 amp @ 230 V AC, separately mounted.

Note :
1) SPDT microswitch is offered in flameproof housing, 100mm dial and diecast Al case.
2) Surface mounted flameproof housing is available with capillary.
3) Flameproof (conforming to IIC) version also available with microswitch.
4) 2 SPDT only in 150 mm dial size.

Advantages of Microswitch Type Models : Microswitch is rated 5 amp @ 230 V AC (3A @ 28 VDC). No relay is required. Microswitch is imported from reputed international supplier as combination of movement and switch. Microswitch assembly gives better switching accuracy. Compact design.

Note : For minimum immersion length essential for proper sensing, contact our design department.

Indicating Temperature Switch

How to Order

TYPE

MIS-SW-R - Rigid Stem (Mercury Filled)
MIS-SW-C - Capillary Type (Mercury Filled)
GDT-SW-R - Rigid Stem (Gas Filled)
GDT-SW-C - Capillary Type (Gas Filled)

MOUNTING
V - Bottom Entry, Local Mounting
C - Back Entry, Local Mounting
E - Every Angle, Local Mounting
S - Bottom Entry, Surface Mounting
P - Back Entry, Panel Mounting

DIAL
10 - 100 mm 15 - 150 mm

CASE
AL - Die-cast Aluminium
S4 - SS304
S6 - SS316

STEM-OD
A - 6 mm E - 12 mm
B - 8 mm F - 12.7 mm
C - 9.5 mm G - 14 mm
D - 10 mm H - 16 mm

STEM LENGTH
Specify in mm

STEM MATERIAL
S4 - SS304 S6 - SS316

CAPILLARY TYPE
SC - SS Covered
SP - SS Covered + PVC
SA - SS Covered+SS Armoured
SAP - SS Covered+SS Armoured+PVC
N - Not Applicable for MIS-SW-R, GDT- SW - R type.

LENGTH
Specify in metre

OPTION
A - Thermowell
B - 1 SPDT
C - 2 SPDT
D - 1 SPST
E - 2 SPST
L - NIL
R - Relay
FA-Flame proof Case (IIA, IIB)
FC-Flame proof Case (IIC)

UNIT
C - Deg C
F - Deg F

RANGE

(-) 30 to (+) 30	0 to 250
(-) 20 to (+) 40	0 to 300
0 to 50	0 to 350
0 to 80	0 to 400
0 to 100	0 to 500
0 to 120	0 to 600
0 to 160	14 - Any other (Specify)
0 to 200	

CONNECTION

Size	Type	Male / Female
6 - 1/4” 10 - 3/8” 15 - 1/2” 20 - 3/4” 25 - 1” 32 - 1.1/4” 40 - 1.1/2”	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

In-House Testing facilities for Temperature Gauges

For the manufacturing & testing of temperature gauges, we strictly follow EN : 13190-2001 and DIN 16203, 16204, 16205 and 16206 standard. Following tests are carried out to ensure the quality of temperature gauges. We have facilities to carry out following tests in-house at our manufacturing plant.

1. Accuracy test
2. Overrange test
3. Hysteresis test
4. Response time test
5. Repeatability test
6. Vibration test (rattling test)
7. Load test
8. Mounting position test
9. Ambient temperature compensation test (Case compensation test)
10. Capillary compensation test
11. Hermetical sealing test (for Bimetal temperature gauges)
12. Thermal stability test
13. End nipple test (for Bimetal temperature gauges)
14. Hose down test (water spray test)
15. Switching accuracy test (for contact assembly & microswitch type models)
16. High voltage test (for contact assembly & microswitch type models)
17. Insulation test
18. Contact resistance test
19. Altitude test
20. Dial printing stability test
21. Life test for SPDT movement
22. Cyclic test
23. Friction test

General

THERMOCOUPLES & RTDs

Mineral Insulated Cables

GENERAL has more than a quarter of a century's experience in manufacturing high precision instruments for temperature and pressure measurements for a wide spectrum of processing industries. Continuous research and development programme coupled with a regular study of customer needs in the light of technological evolution has helped to design and manufacture a range of self - armoured mineral insulated cables. Their unique characteristics and performance capabilities were tested in hostile operating environments, including nuclear reactors over many years, which has helped to establish a leadership.

Mineral insulated thermocouple and RTD Cable (basic raw material for manufacturing thermocouples and RTDs) manufacturing is a very specialised process which **GENERAL** has perfected over the years in technical collaboration with M/s. BICC, UK. The process involves cold drawing followed by annealing in hydrogen atmosphere (to avoid surface defects as well as partial oxidation of conductor) at specified temperature (which depends upon conductor and sheath material). This process is repeated till required diameter is achieved. Original virgin conductor is used for this purpose alongwith over 99% pure magnesium oxide (mineral insulation) in order to have desired results.

GENERAL has been manufacturing the following mineral insulated cables for over three decades :

a) **M I Thermocouple cables and Probes**

b) **M I Transducer Lead out cable**

c) **M I Extension / Compensating cable**

Mineral Insulated Cables

MI Thermocouple Cables and Probes

- Manufactured in a variety of sizes and conductor combinations.
- Thermo-element protection from oxidation and corrosion
- Highly compacted mineral insulant, metal sheath and hermetically sealed termination ensure extra long life for a wide range of temperature sensing applications
- The metal sheath provides self-armouring and enables the small mass thermocouple to be installed in difficult situations
- The small mass high thermal conductivity of the insulant ensure rapid response to temperature change.
- The stable EMF characteristics are achieved through controlled production and testing

Sheath materials, conductor combination and maximum operating temperature

Sheath Material	T/C Code	Maximum Temperature
Inconel 600	K	1150^{0}C
	J	700^{0}C
	R	1150^{0}C
	S	1150^{0}C
	B	1150^{0}C
AISI 310	K	1150^{0}C
AISI 316	K	800^{0}C
	E	800^{0}C
	J	700^{0}C
	T	300^{0}C
AISI 321	K	800^{0}C
	E	800^{0}C
	J	700^{0}C
	T	300^{0}C
AISI 446	K	1000^{0}C

Conductor Diameters

2 Core		4 Core	
OD (mm)	Conductor dia Nominal (mm)	OD (mm)	Conductor dia Nominal (mm)
3	0.6	3	0.45
4.5	0.9	4.5	0.68
6	1.2	6	0.91
8	1.6	8	1.21

Thermocouple Probes

Manufactured using MI cable with the cold and hot junctions formed.

Cold ends of three types available - a) Pot seal
b) Plug and jack
c) Ceramic terminal block

Grounded, ungrounded or exposed hot junctions are offered.

Ungrounded junction - Hot junction insulated from sheath.

Grounded junction - Conductor and sheath welded together for improving response time.

Exposed junction - Junction is formed outside the sheath.

Mineral Insulated Cables

MI Transducer Cables

Generally used as a lead out cable for RTD assemblies.

Sheath material for this type of cable is AISI 321 as a standard.

Type	Conductor	OD	Conductor dia
4 Core	Copper	2.8mm 5mm 6mm 8mm	0.3mm 0.6mm 0.7mm 0.95mm
6 core	Copper	2.8mm 5mm 6mm 8mm	2.25mm 0.55mm 0.65mm 0.85mm

Other conductor material available as required.

Tests On M I Cable

a) Insulation resistance test at ambient and at elevated temperature

b) Sheath ductility test

c) Calibration (for thermocouple cable)

d) Conductor ductility test

e) Water immersion test

f) Loop resistance test

g) Nitrogen leakage test for MI probes

h) Dimensional test

Mineral Insulated Thermocouples

GENERAL Mineral Insulated Thermocouple Assemblies consist of two, four or six thermocouple wires embedded in compact MgO - mineral insulation, enclosed in a metallic tube. The assembly is compact, flexible enough to route, has a high insulation resistance and high thermal conductivity. Mineral insulated thermocouple assemblies are robust in construction and offer good mechanical strength.

Besides the standard construction, complex, custom built designs are available. Our expert design team can assist you solve your temperature related problems to satisfaction.

T/C Type	Temp range	Sheath OD	Sheath Material*	Std limits of error
J Iron Constantan	0-700^{0}C	2 mm, 3 mm 4.5 mm, 6 mm 8 mm	SS316, SS321 Inconel 600	±2.2^{0}C or ±0.75%
K Chromel Alumel	(-) 200^{0}C to 1150^{0}C	1 mm, 1.5 mm 2 mm, 3 mm 4.5 mm, 6 mm 8 mm	SS316, SS321 Inconel 600, SS310, SS446	±2.2^{0}C or ±0.75%
E Chromel Constantan	(-) 200^{0}C to 800^{0}C	2 mm, 3 mm 4.5 mm, 6 mm 8 mm	SS316, SS321	±1.7^{0}C or ±0.75%
T Copper Constantan	(-) 200^{0}C to 300^{0}C	2 mm, 3 mm 4.5 mm, 6 mm 8 mm	SS316, SS321	±1.0^{0}C or ±0.75%
N Nicrosil Nisil	0 to 1280^{0}C	2 mm, 3 mm 4.5 mm, 6 mm 8 mm	Inconel 600, nicrobel/pyrosil	±2.2^{0}C or ±0.75%
R Pt PtRh 13%	0 to 1400^{0}C	3 mm, 4.5 mm 6 mm	Inconel or ceramic	±1.5^{0}C or ±0.25%
S Pt PtRh 10%	0 to 1400^{0}C	3 mm, 4.5 mm 6 mm	Inconel or ceramic	±1.5^{0}C or ±0.25%
B PtRh 6% PtRh 30%	800^{0}C to 1700^{0}C	3 mm, 4.5 mm 6 mm	Inconel or ceramic	±0.5%

Note : Inconel 600 sheath is available for R, S and B type of thermocouple up to 1150^{0}C only.
Wherever essential, other sheath materials such as incoloy 800 and hastelloy C etc. also can be offered.
T/C having special limits of error offered on request.

For our detailed catalogue on MI Thermocouple Assembly, contact our Marketing Department.

*These are standard sheath materials. Other materials on requrest.
**SS sheath upto 800^{0}C and Inconel 600 beyond 800^{0}C upto 1150^{0}C.

Mineral Insulated Thermocouples

Specifications

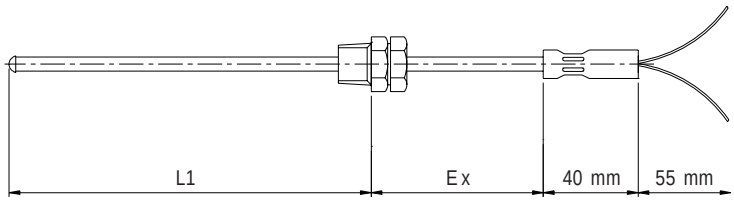
Element : J, K, E, T, N, R, S, B type thermocouple, single, duplex (triplex on request)
Sheath OD : 1 mm, 2 mm, 3 mm, 4.5 mm, 6 mm, 8 mm, 10 mm
Sheath material : SS316, SS321, Inconel 600 as standard
Insulation : Mineral, Compact MgO (over 99% purity)
Calibration : In accordance with ANSI MC 96.1/ IEC 584 (class B) (class A as option)
Junction : Grounded, ungrounded, exposed
Cold end : a) Pot seal with PVC or PTFE insulated flexible tails
b) Quick connect / disconnect plug and Jack
c) Ceramic spring loaded terminal block with silver plated brass terminals
Head : Diecast aluminium / SS304 / SS316, single or double entry with ¾" ET (F) or ½" NPT (F) cable entry as standard, ½" NPT (F) for well or nipple
Protection : Weatherproof to IP-67 (IS :13947 Part I)
: Flameproof to Gr.I, IIA IIB (Equivalent to NEC. C1, I, Div 2 Gr. C & D)
: Flameproof to IIC (Equivalent to NEC. C1, I, Div 2 Gr. B, C & D)
: Increased safety
: ATEX certified
Extension : Provided in the form of nipple or nipple - union - nipple in Cd plated CS or SS.
Optional : a) Thermowell (refer section on Thermowell)
b) Head mounted temperature transmitter
c) Adjustable compression fitting or flange.
Note : Beaded thermocouples also can be offered if customer so desires.
(Specify conductor diameter in such case)

Tests*:
a) Calibration
b) Nitrogen leak test
c) Dimensional check
d) Insulation resistance
(>100M Ohm @ 500 VDC at 25°C)
e) Hot IR test

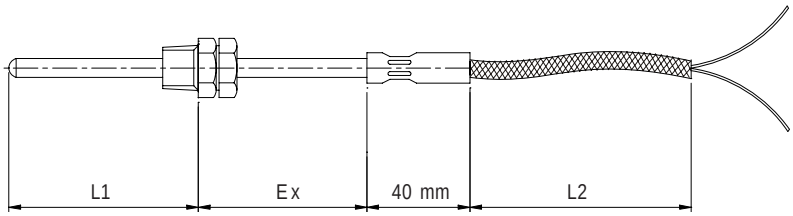
* Refer seperate sheet which mentions complete list of tests carried out.

Mineral Insulated Thermocouples

How to Order



TYPE : TC IA



TYPE : TC IB

ELEMENT
1K, 2K, 1J, 2J, 1E, 2E, 1T, 2T, 1N, 2N

SHEATH OD
2, 3, 3.2, 4.5, 6, 8mm

SHEATH MATERIAL

S6 : SS316	S3 : SS310
S2 : SS321	HC : Hastelloy C
I6 : Inconel 600	SH : SS446
I8 : Incoloy 800	

L1
Specify in mm

Ex
Specify in mm

EXTENSION CABLE TYPE
1. PTFE insulated tails-55mm long
2. PTFE insulated, PTFE overall cable
3. PTFE insulated, overall PTFE & SS braided cable
4. FG insulated, overall FG cable
5. FG insulated, overall FG, SS braided cable

OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Spring loaded bayonet fitting
3. Lugs for tails
4. Special limits of error
5. Grounded junction
6. Calibration standard (specify other than IEC-584)
7. Triplex element
8. Bulk head connector
9. Thermowell
10. Any other requirement
0. None

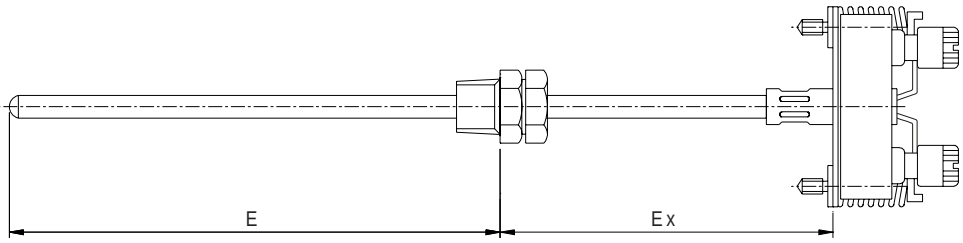
EXTENSION CABLE LENGTH
L_2 metre

Standard Features: a - Reference standard IEC 584 Class B
b - Ungrounded junction
c - Mineral (compact MgO) insulation

Typical Model No : TC-I-A-2J-3-S6-200-50-1-0-0

Mineral Insulated Thermocouples

How to Order



TYPE : TC-I-TB

ELEMENT
1K, 2K, 1J, 2J, 1E, 2E, 1T, 2T, 1N, 2N

ELEMENT OD
2, 3, 4.5, 6, 8, 10, 12.5 mm

SHEATH MATERIAL

S6 : SS316	S3 : SS310
S2 : SS321	HC : Hastelloy C
I6 : Inconel 600	SH : SS446
I8 : Incoloy 800	

E
Specify in mm

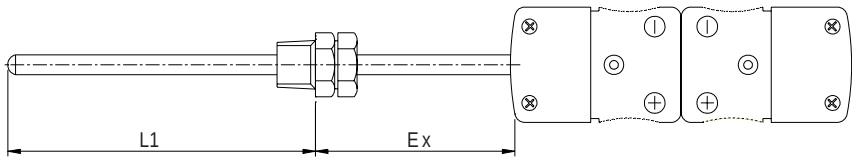
Ex
Specify in mm

OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Special limits of error
3. Grounded junction
4. Calibration standard (specify other than IEC-584)
5. Triplex element
6. Thermowell
7. Any other requirement (terminal block in fibre glass etc.)
0. None

Standard Features : a - Ungrounded junction
b - Reference standard IEC 584 Class B
c - Mineral insulated (compact MgO) construction

Mineral Insulated Thermocouples

How to Order



TYPE : TC-I-PJ

ELEMENT
1K, 2K, 1J, 2J, 1E, 2E, 1T, 2T, 1N, 2N

ELEMENT OD
3, 3.2, 4.5, 6, 8mm

SHEATH MATERIAL

S6 : SS316	S0 : SS310
S1 : SS321	HC : Hastelloy C
I6 : Inconel 600	S4 : SS446
I8 : Incoloy 800	

L1
Specify in mm

Ex
Specify in mm

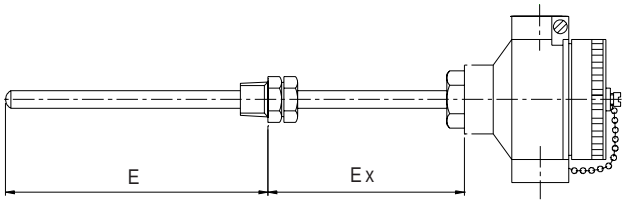
OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Special limits of error
3. Grounded junction
4. Calibration standard (specify other than IEC-584)
5. Thermowell
6. Any other requirement (specify)
0. None

Standard Features: a - Ungrounded junction
b - Reference standard IEC 584 Class B
c - Mineral insulated (compact MgO) construction

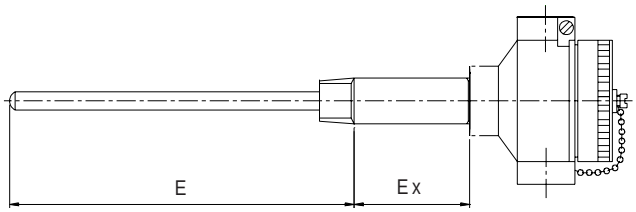
Typical Model No : TC-I-PJ-IK-3-S6-200-50-0

Mineral Insulated Thermocouples

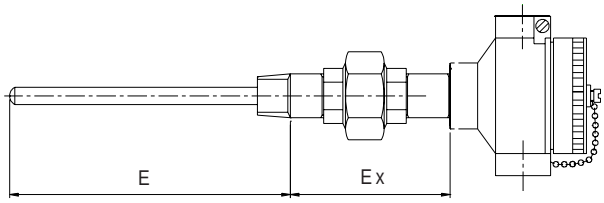
How to Order



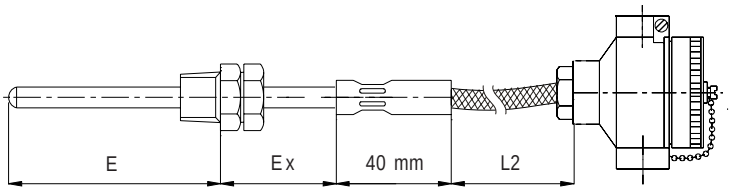
TYPE : TC-H-A



TYPE : TC-H-B



TYPE : TC-H-C



TYPE : TC-H-D

ELEMENT
1K, 2K, 1J, 2J, 1E, 2E, 1T, 2T, 1N, 2N

ELEMENT OD
4.5, 6, 8, 10, 12, 12.7mm

SHEATH MATERIAL

S6 : SS316	I6 : Inconel 600
S2 : SS321	I8 : Incoloy 800
S3 : SS310	SH : SS446
	HC : Hastelloy C

HEAD
WAL : Aluminium, weatherproof (IP-66)
WS4 : SS304, weatherproof (IP-66)
WS6 : SS316, weatherproof (IP-66)
FLAL : Aluminium, Flameproof (IIA, IIB)
FLS4 : SS304, Flameproof (IIA, IIB)
FLS6 : SS316, Flameproof (IIA, IIB)
FCAL : Aluminium, Flameproof (IIC)
FCS4 : SS304, Flameproof (IIC)
FCS6 : SS316, Flameproof (IIC)
FCCAL: Aluminium, Flameproof (IIC + CCOE)
ATAL : Aluminium, ATEX certified
FMAL : Aluminium, FM/UL certified

CABLE ENTRY
15N : ½" NPT(F)
20E : ¾" ET(F)
15M : M20 x 1.5(F)
15B : ½" BSP(F)

E
Specify in mm

OPTION / SPECIAL
1. Cable gland (specify material)
2. Two cable entries
3. Head mounted transmitter
4. Plug for cable entry (specify material)
5. Connection(other than specified)
6. FG/FG, SS braided cable
   (specify length e.g. 6(3) i.e. 3 Mtr cable)
7. Grounded junction
8. Thermowell
9. Special limits of error
0. None

Ex
Specify in mm

CONNECTION MATERIAL
C - Cd plated CS
S4 - SS304
S6 - SS316

Standard Features : a - Ungrounded junction
b - Reference standard IEC 584 Cl. B
c - Mineral (compact MgO) insulation
d - 1/2" NPT(M) connection

MI Thickwall Thermocouple

The conventional thermocouple is used with an outer protecting tube or thermowell to protect it from aggressive and corrosive process condition. This improves longevity of the thermocouple. However, response time is poor. To overcome above problem, **GENERAL** has designed MI Thickwall Thermocouple having thicker wall with relatively larger conductor diameters. This construction enables the user to insert the thermocouple directly in the process without a protecting tube or thermowell, improving response time considerably.

Type of thermocouple offered under Thickwall:
J (Iron constantan)
K (Chromel alumel)
E (Chromel constantan)

Normal applications:
Furnaces, rotary kilns, recuperators,
skin temperature measurement of heater tubes.

Advantages
a) Faster response.
b) Longer lengths can be offered.
c) Pliable and easily routed.
d) Available in SS316, SS310, Inconel 600, Incoloy 800, SS446 sheath materials

SHEATH DIA	WALL THICKNESS	CONDUCTOR DIA (Nominal) Single	CONDUCTOR DIA (Nominal) Duplex
8 mm	1.65 mm	1.12 mm	0.65 mm
10 mm	2.10 mm	1.40 mm	0.85 mm
12.7 mm	3.00 mm	1.80 mm	1.10 mm
15 mm	3.60 mm	2.00 mm	1.65 mm
17 mm	4.00 mm	2.20 mm	1.85 mm
19 mm	4.50 mm	2.45 mm	2.00 mm

Mineral Insulated Tube Skin Thermocouple Assembly

GENERAL indegenised the Skin Thermocouple assemblies first time in India. Tube Skin Thermocouples manufactured by us are reliable for measurement and control of tube surface temperature in fire heaters. Accurate temperature measurement is important for prolonging heater tube life, for ensuring safe and efficient operation. We have been supplying tube skin thermocouple assemblies in quantities to majority of the projects in India as well as exporting to various countries.

The basic thermocouple is normally of 12.7 mm OD with relatively higher sheath wall thickness, mineral insulated (compacted MgO) and in variety of sheath materials such as SS310, SS446, inconel 600, incoloy 800 etc. The Junction is generally grounded. However ungrounded junction also is offered, as customer requires. Mineral Insulated (MI) thermocouple is manufactured by Cold drawing & annealing (heat treatment) process in controlled atmosphere. The heat treatment (which is controlled within +/-2 Deg C) is carried out in hydrogen atmosphere to avoid surface defects & partial oxidation of conductor.

Major user industries

Refineries & Petrochemical
Oil & Gas
Chemical
Fertiliser
Metal (ferrous/non ferrous)

Different types available

a. Knife edge wedge type
b. Washer type
c. Retractable type
d. Assemblies with single or multiple expansion loop

Mineral Insulated Tube Skin Thermocouple Assembly

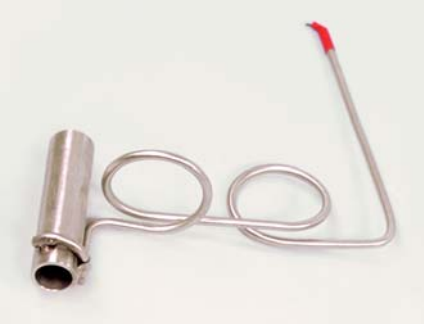
Technical Notes on Tube Skin Type Assembly

1. **GENERAL** was the first company to actually indigenise the product. Earlier the product was fully imported. The product was started in Technical Collaboration with M/s BICC - Pyrotenax of Hebburn UK. **GENERAL** has also supplied this assembly in very big quantities to several countries such as UK, Germany, Italy & Middle East. **GENERAL** has approval for this product from most consultants in India & abroad.
2. **Raw Materials** : There are basically three raw materials that go in to manufacturing of Tube Skin, Thermocouple, they are -

   Basic Mother Tube : This is mostly SS310, SS446, Inconel 600, Incoloy 800 etc. This tube is required in seamless form and as it goes under several reduction, quality of input tube has to be very good. In view of this, tubes are procured only from established mills.

   Insulators : MgO is used as mineral insulation. The material is imported from a German company - Who are pioneers in this field worldwide. The purity is very important for long life of thermocouple. We use over 99% pure MgO.

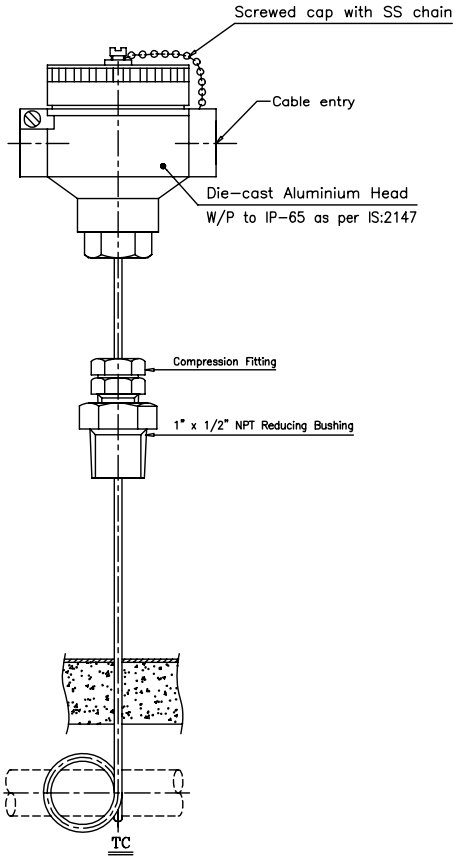
   Conductor : Type K in most cases, conductors are of virgin quality. The initial conductor calibration as well as final calibration falls within half tolerance as a standard.
3. **Manufacturing Process of Mineral Insulated Thermocouple Thick-wall Cable (MITTC)** : The manufacturing process involves cold drawing and heat treatment. The three raw materials are assembled as per requirement and are cold drawn on draw benches. The heat treatment process, in this case strand annealing, is the key area of concern as it decides the final quality of product. **GENERAL** has capability of drawing and annealing in very controlled conditions. The annealing is controlled within +/- 2 Deg C. The heat treatment is requirement to be carried out in hydrogen atmosphere to avoid surface defects as well as partial oxidation of conductor material.
4. Final product conforms to specification as given.
5. Bending Process & Welding : After the thick-wall cable is bent on automatic bending machines to get even circular diameters. The bends (D & 2D) are the expansion loops of the thermocouple.

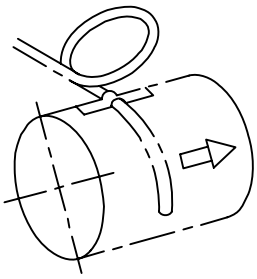


Mineral Insulated Tube Skin Thermocouple Assembly

Specifications

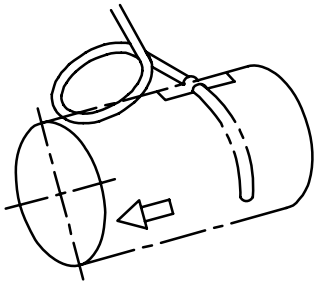
Sheath Materials Offered	: SS446, Inconel 600/601, SS310 (Other materials on request)
Sheath Diameter	: 12.7 mm (½") Higher diameter on request
Thermocouple Types	: ANSI Type K, J, E, N
Conductor Diameter	: 1.8 mm (nominal)
Sheath Thickness	: 3.20 mm (nominal)
Insulation Material	: Compact mass of MgO (99% min Purity)
Insulation Resistance	: > 100 M Ohm @ 500VDC (Before grounding)
Calibration	: ANSI MC 96.1 / IEC 584 (Special Tolerance)
Response Time	: 10 seconds (after grounding)
Heat Shield	: Provided on request
Junction Type	: Grounded, Knife Edge Wedge Type
Expansion Loop	: Provided ex-factory (In accordance with customer requirement)





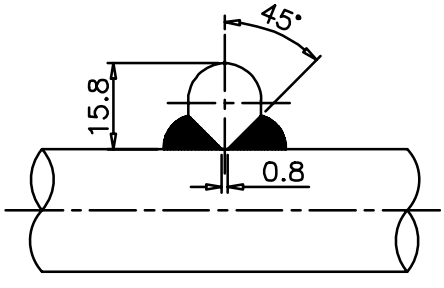
Arrow indicates direction of tube movement due to expansion

Left Loop (Typical)



Arrow indicates direction of tube movement due to expansion

Right Loop (Typical)



Weld details (Typical)

Mineral Insulated Tube Skin Thermocouple Assembly

Welding Procedure

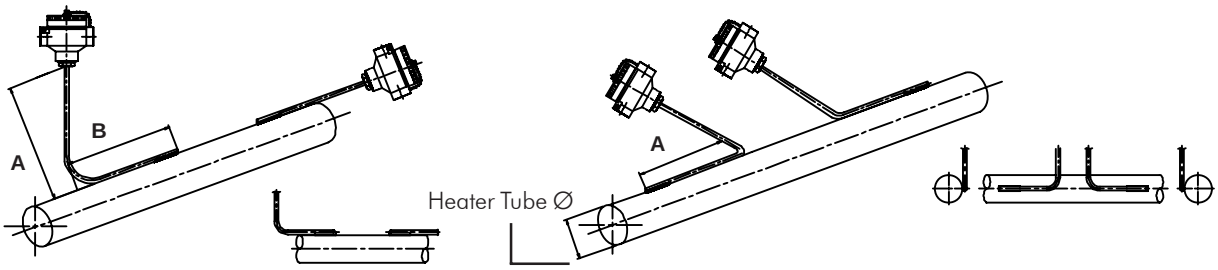
1. Grind the surface of heater tube in the area of thermocouple junction location for removing scale & rust. Clean the area.
2. Clamp the thermocouple in the desired location.
3. Centre of the wedge type pad must be ensured to be in contact with the heater tube.
4. Perform root weld pass on both sides of the pad using 1.57 mm dia filler rod. Welds must overlap each other & run full length of the pad.
5. Perform secondary weld pass on both sides of the pad using 2.36 mm dia filler rod. Welds to run full length of the pad.
6. Perform final weld pass on both sides of the pads using 2.36 mm dia filler rod. Welds must extend 9.5mm minimum above tube surface & run full length of the pad.
7. For transverse mounted thermocouple, locate the retaining clip at the tangent point of the thermocouple and tube & weld at both ends using 2.36 mm dia filler rod.
8. For Axial mounted thermocouple, locate the retaining clip as desired & weld as mentioned under point no. 7 above.

Recommended weld filler rod material for SS446 sheathed thermocouple

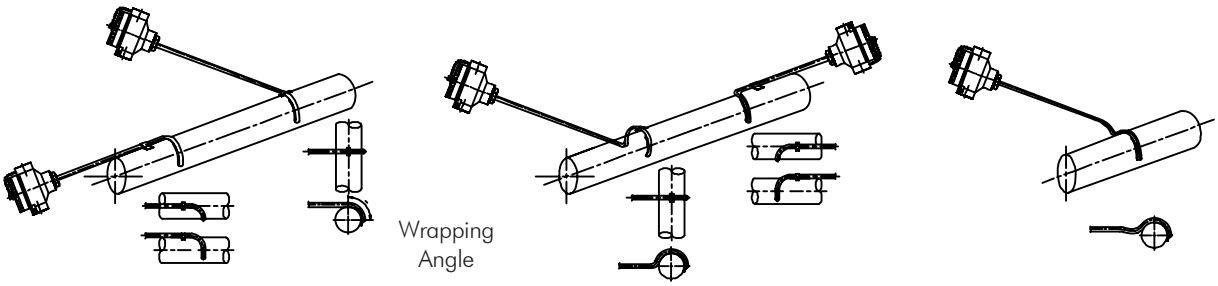
HEATER TUBE MATERIAL	FILLER ROD MATERIAL
ASTM A312 TP 304, TP 309, TP 310	SS309-AWS A5.9, Class ER 309
ASTM A321 (Ti Stabilised)	SS309-AWS A5.9, Class ER309
ASTM A3347 (Cb Stabilised)	SS309-AWS A5.9, Class ER309
ASTM A335 P11, P22, P5, P9, ASTM A106	Inconel 82-AWS A5.14, Class ER Ni Cr 3
Incoloy 800	Inconel 82-AWS A5.14, Class ER Ni Cr 3

Note : Filler rods & welding procedures for other sheath materials, types of thermocouples will be furnished on request.

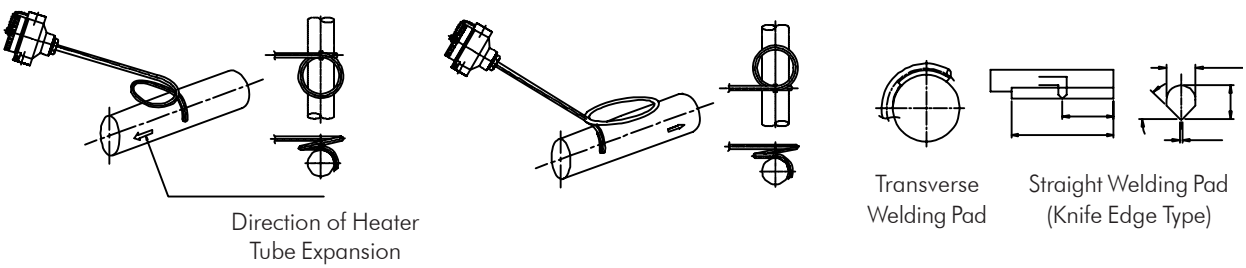
Typical Installations of Tube Skin Thermocouple



A) Right angle / Straight Mounting



B) Wrap up angular mounting



C) Mounting with expansion loop

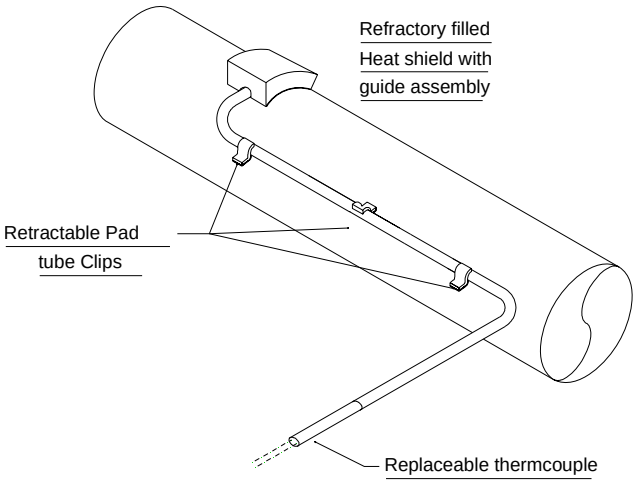
Retractable Type Tube Skin Thermocouples

Conventional Tube Skin Thermocouples are to be welded to the heater tube. As this is hot working on heater tube, it poses several problems in terms of maintenance and longer shut down time. Each and every time a conventional tube skin thermocouple is installed, the heater tubes are required to be pressure tested as it has undergone welding.

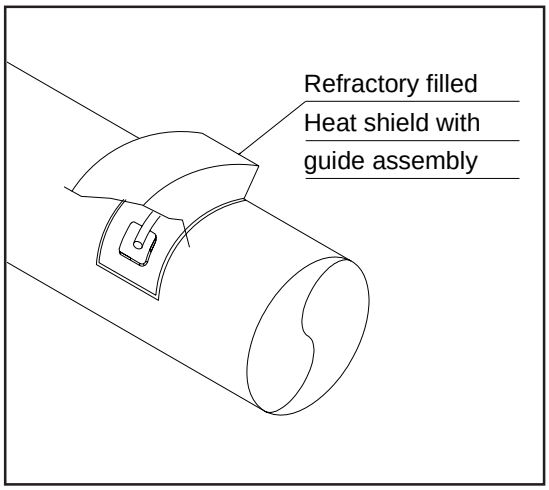
General's retractable type thermocouples make replacement of thermocouple possible without any welding or any hot work on the tube. This results in significant amount of saving in terms of time as well as shut down costs.

The major differences between conventional knife edge type thermocouple and retractable type are :

KNIFE EDGE TYPE	RETRACTABLE TYPE
■ Weld pad welded to thermocouple	■ Weld pad fabricated has guide assembly.
■ Weld Clips hold thermocouple in place can be used only once	■ Weld Clips can be reused.
■ Thermocouple cannot be removed without hot work on tube.	■ Thermocouples are replaceable without performing hot work on heater tube.



Typical installation



Heat shield & weld pad assembly

Multipoint Thermocouple Assemblies

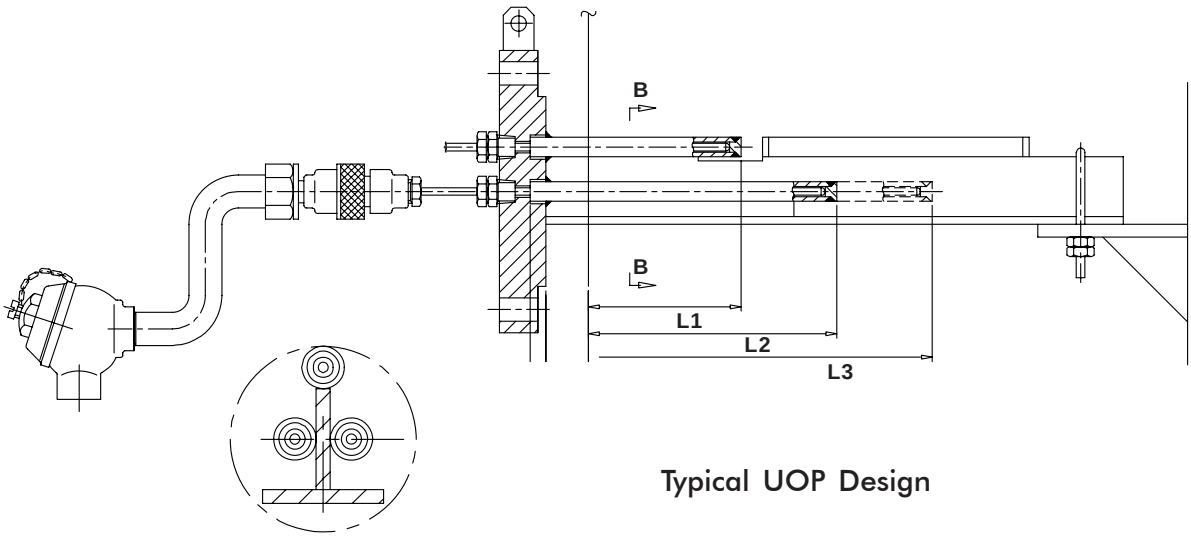
Features

- Ideal for measuring temperature at various elevations
- Fully tailormade
- Proven track record in cross section of industries
- Can be offered with practically any length
- Cost effective & overcomes space limitation
- Different thermocouples with varied MOC possible.
- Construction enables user to remove thermocouple for maintenance

Where space limitations and cost consideration are of prime importance, multi-point thermocouple assemblies come into picture which are used for measuring and controlling temperature in a reactor having different temperature zones. Any thermocouple assembly with measuring junctions located at more than a one-immersion depth is commonly referred to as a multi-point. As the number of variations possible in multi-point assemblies is virtually limitless they are generally designed and manufactured to meet the requirements of individual applications. As different multi-point designs vary tremendously, careful consideration should be given to such variables as the positive location of measuring junctions and the ease/cost of replacement.

GENERAL with its vast experience has designed and developed several types of multipoint assemblies, which are performing satisfactorily at hundreds of installations in several parts of world. Some designs allow for replacement of individual elements while others require replacement of the entire assembly. In either case, complete shut down of the process line may not be required depending upon important design considerations. Testing of multipoint is another specialised area. Our manufacturing set-up is equipped with all latest testing equipments to perform all stringent tests.

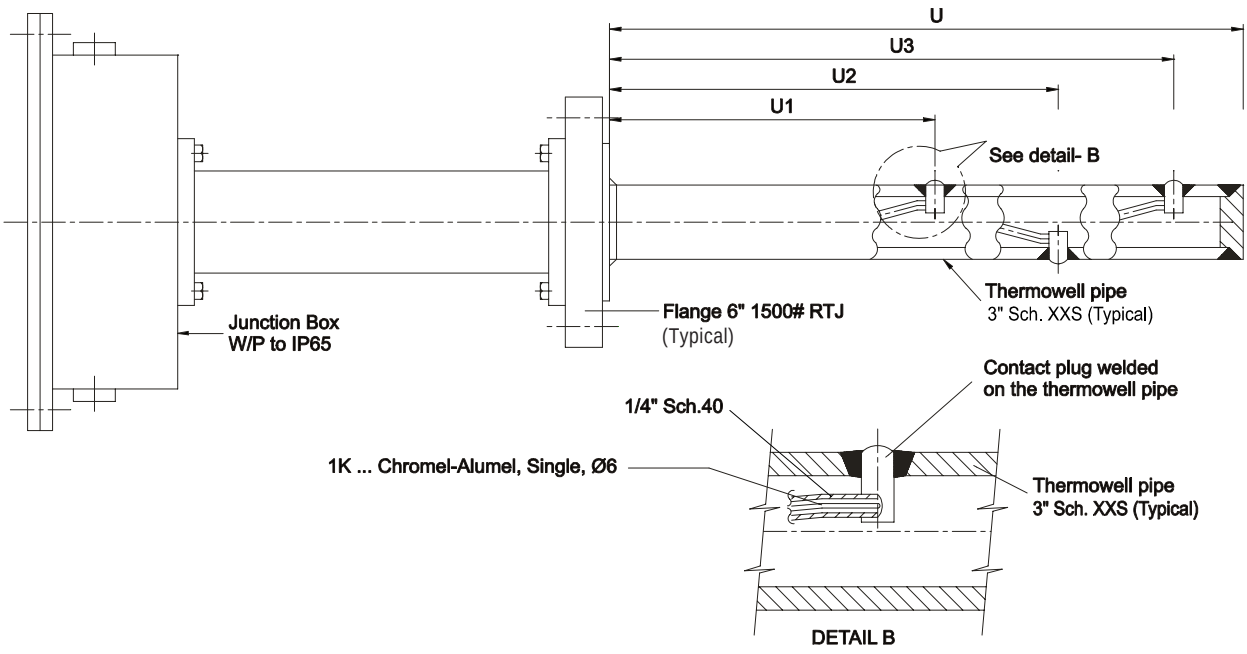
Major user industries : Refineries & Petrochemical, Oil & Gas, Chemical & Fertiliser



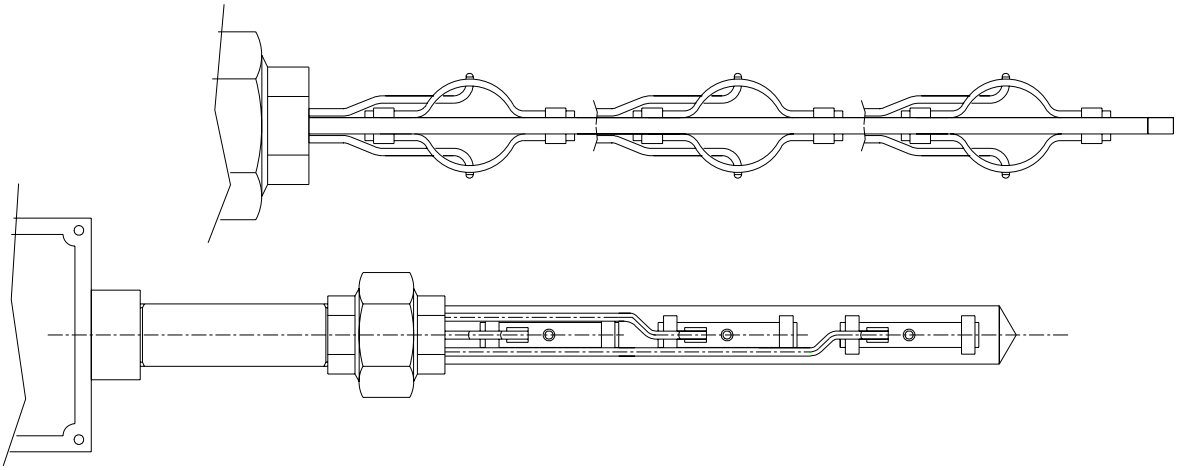
Typical UOP Design

Multipoint Thermocouple Assemblies

Typical Constructions



Thermocouples at various levels inserted in individual guiding tubes which in turn are welded to outer protecting tube as shown.



Spring loaded (with the help of 'S' spring or leaf spring) thermocouples located at various points mounted on a plate enclosed in a protecting tube as shown above. The springs ensure proper contact with the protecting tube. As many as 33 points assembly was supplied as import substitution for a reputed fertiliser plant.

In-House tests carried out for thermocouple assemblies

1. Calibration - Thermocouple calibration in accordance with IEC 584 / ANSI MC 96.1 Class 1 & 2 Typically test is conducted at two points viz. 100^{0}C & 600^{0}C for J, K, E & at 100^{0}C & 900^{0}C or 1100^{0}C for R, S & B type. Optionally for 3 points or more on request.

2. Insulation Resistance Test at ambient at 500 VDC (M.I. type).

   - Should be more than 100 M ohms for sheath OD greater than 3 mm

   - Should be more than 100 M ohms at 75 V DC in case of sheath OD 1 to 3 mm

3. Insulation Resistance Test at 540^{0}C at 500 VDC - IR should be more than 2 M ohms as standard. IR > 20 M ohms can also be offered on request.

4. N2 leakage test - For thermocouple tip sensor after cap welding the same test is conducted & no leakage should be observed at 40 kg/cm^2 as per IEC 1515.

5. Response time test/Thermal cycling/Thermal Inertia - As per IS7358 - ASTM E-839 (63.2% step change from ambient to 80^0 C)

6. Flame test : This test is applicable for multipoint thermocouple assembly to find out exact location of thermocouple in protecting tube & to ensure touching of thermocouple tip to tube.

7. Continuity Test : By using continuity tester / multimeter - To confirm the element is proper & no open junction is observed.

8. Grounding & ungrounding junction - By using continuity tester / multimeter.

9. Ductility - (Bending test) - (For MI thermocouple & MI RTD cable) - Minimum bending radius should be 5 times sheath OD.

10. Sheath Integrity Test - Water Immersion test - To check sheath integrity of mineral insulated (MI) thermocouple / RTD cable.

11. Dye Penetration Test - For skin type Dye Penetration test for weld joints of weld pad & tip of sensor.

Mineral Insulated RTDs

Accurate temperature monitoring and control begins with a properly designed sensor. RTD - Resistance Temperature Detector used for temperature measurement (-) 200^{0}C to 500^{0}C (upto 800^{0}C on request), must have the physical configuration necessary for optimum thermal response to the process fluid it is sensing and the resistive element compatible with instrumentation.

The system accuracy begins with proper primary sensor selection. The integrity of any temperature measuring device depends upon proper traceability.

Our fully equipped measurement and testing laboratory maintains primary reference standard calibrated and duly certified to national standards. These are used for the calibration of all RTDs we manufacture.

Various considerations apply to the design of RTD assemblies. The element should be protected from shock and vibration, yet free of expansion stresses that may shift the reading. The element assembly needs to be isolated without obstructing heat flow. The outer sheath has to withstand pressure, erosion and vibration, yet it should be small enough for easy installation and rapid response to temperature changes.

Features

- High integrity construction.
- High accuracy, repeatability.
- High insulation resistance (>100 M ohm @ 500 VDC at 25^{0}C)
- Wide operating range i.e. (-) 200^{0}C to 800^{0}C
- Fast response
- Mineral insulated construction enables the sheath to be bent / routed to suit installation without affecting performance.
- Available in variety of sheath diameters.
- Two , three and four wire configuration
- Calibration in accordance with IEC 751
- Class A type or 1/3rd DIN with special limits of error optional#.
- Suitable for head mounted transmitters.

Refer our precision RTD section.

Mineral Insulated RTDs

Specifications

Element : 1Pt 100 or 2 Pt 100 - single or duplex (triplex on request)

Element OD : 3.2 mm , 6 mm, 8 mm, for the element portion of 60 mm, with leadout MI cable of 2.8 mm, 5 mm respectively
Straight construction with continuous OD of 6 mm , 8 mm also available.

Sheath material : SS316

Insulation : Mineral, compact MgO (over 99% purity)

Calibration : In accordance with IEC-751 / DIN 43760 (class B or A)

Conductor : Copper (Nickel on request*)

Configuration : Two wire, three wire or four wire

Open end : Pot seal or quick connect-disconnect plug and jack or terminal block with PTFE insulated copper conductor flexible tails . (Terminal block- ceramic spring loaded 41mm OD, 33 PCD with two M4 screws, silver plated brass terminals).

Head : Diecast aluminium / SS304 / SS316, single or double entry with ¾" ET (F) cable entry as standard, ½" NPT (F) for well or nipple.

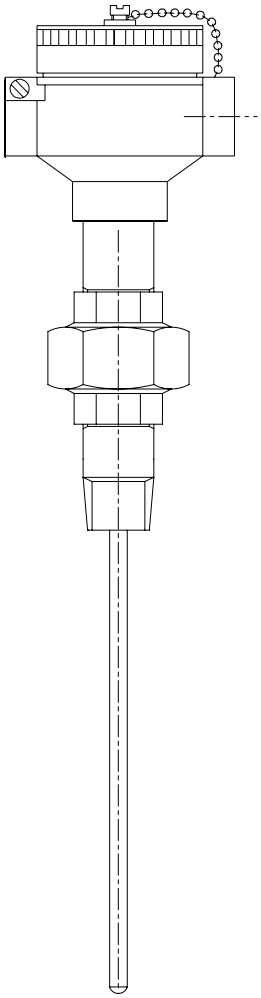
Protection : Weatherproof to IP -67 (IS :13947 Part I)
: Flameproof to Gr. I, IIA IIB (equivalent to NEC class I Div II Gr. C & D)
: Flameproof to IIC (equivalent to NEC class I Div II Gr. B, C & D)
: Increased safety
: ATEX certified

Extension : Nipple or nipple - union - nipple standard 150mm long, 1/2" sch. 40 /80 in A106 Gr. B, Cd plated or SS304 or SS316 or adjustable compression fitting.

Optional : a) Thermowell (refer - section on Thermowell)
b) Head mounted temperature transmitter

Routine tests : a) Calibration
b) Nitrogen leak test
c) Dimensional check
d) Insulation resistance (>100 M ohm @ 500VDC at 25^{0}C)
e) Continuity

Type tests : a) Vibration test
b) Drop / Shock test
c) Self heating error test
d) Response time test (In situ-water flown @ 20 ltr. per second)
e) Autoclave test



* Refer detailed note on this, mentioned seperately.

Nickel Wire
Mineral Insulated RTD

In continuation of its endeavour to provide better & better products to clients, **GENERAL** has developed RTD with Nickel conductor in Mineral Insulated Construction first time in India.

The basic difference between the conventional & Nickel conductor is material of conductor. In conventional, it is copper as against Nickel in newly developed MI.

Advantages of Nickel conductor MI RTD

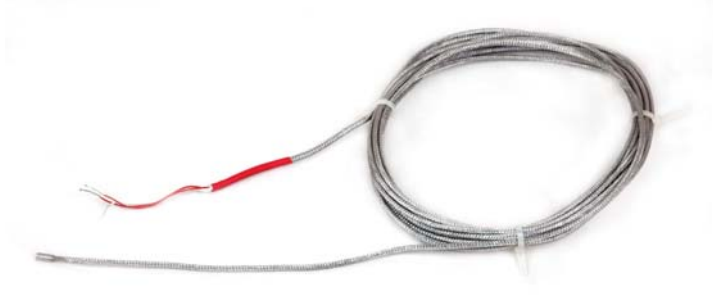
1. Most important advantage is that the RTD element is welded on to conductors and not brazed. As such same RTD can be used for much higher temperature of up to 600^{0}C. In conventional RTD with copper conductor, brazing does not allow use of RTD above 450^{0}C, after which brazing starts softening and RTD loses its contact with cable conductors. In Nickel conductors, as Nickel can be welded, contact is much more stronger even at higher temperature.
2. Nickel conductor cables are annealed at higher temperature than that of Copper. The cable therefore is much more softer. Hence RTDs made with nickel conductor are more pliable and easier to use.
3. Nickel has much more strength than copper. Hence, they can be directly terminated in the terminal block avoiding another connection of flexible leads. RTDs with Nickel conductors give steady readings and chances of loose connection of flexible leads to copper wires is avoided.
4. As Nickel conductors are welded to RTD element, it is a much more stable design than brazed RTD. This advantage is very important in applications where vibrations are present.
5. Copper can get easily oxidised causing fluctuations in readings. Nickel being much more inert chemically, is not so prone to oxidation and hence gives stable readings over a longer period of time.

Property	Copper	Nickel
Resistivity at room temp	1.694 x 10^{-8} Ohm - m	6.9 x 10^{-8} Ohm - m
Melting point	1085^{o}C	1455^{o}C
Density @ 20^{o}C	8.96 gm / cc	8.9 gm / cc
Young's Modulus	129.8 GPa	199.5 GPa
Poisson's Ratio	0.343	0.312

Mineral Insulated RTDs

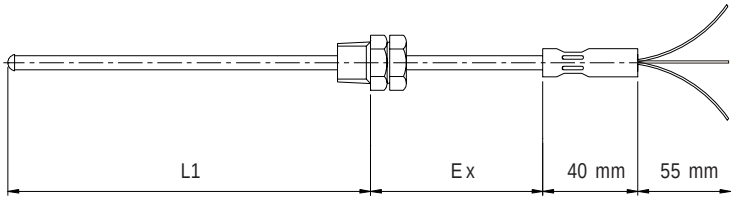
Special Assemblies

- **Skin temperature RTDs** : Combines a precision element with low cost, easily installable accessories and flexible thermal cable with an ability to produce the ultimate in fast response surface sensing.
- **Bearing temperature measurement RTDs** : Miniature detector for embedment in thrust pads-spring loaded holder with fluid seal easily adjustable for a proper loading at any hole depth. These are installed in babbit layer of large bearing for immediate warning of possible failure.
- **Room temperature measuring RTDs** : RTD assemblies with a suitable protecting tube and surface mounted junction box are available for temperature measurement in cold storages installations, textile factories, air conditioned environment.
- **RTD with local indication** : Refer our detailed section
- **Multipoint RTD assembly** : Multi elements are located at different heights in a reactor or storage tanks (e.g. Ammonia storage). Fully tailor-made designs are available to suit the specific requirement.
- **Retractable telescopic assembly** : Special assembly design has been developed for polymer manufacturing units as import substitution. The system comprise of a RTD assembly, actuator, solenoid valve and another hardware. (contact our design department for details).

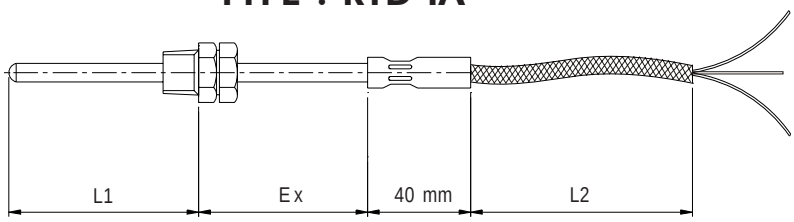


Mineral Insulated RTD

How to Order



TYPE : RTD IA



TYPE : RTD IB

ELEMENT
1Pt100, 2Pt100, 1Pt46, 2Pt46, 1Cu53, 2Cu53, 1Pt1000, 2Pt1000

SHEATH OD
3, 3.2, 4.5, 6, 8mm

SHEATH MATERIAL
S6 : SS316, S2 : SS321

L1
Specify in mm

Ex
Specify in mm

EXTENSION CABLE TYPE
1. PTFE insulated tails-55mm long
2. PTFE insulated, PTFE overall cable
3. PTFE insulated, overall PTFE & SS braided cable

EXTENSION CABLE LENGTH
(L2) Specify in mtr

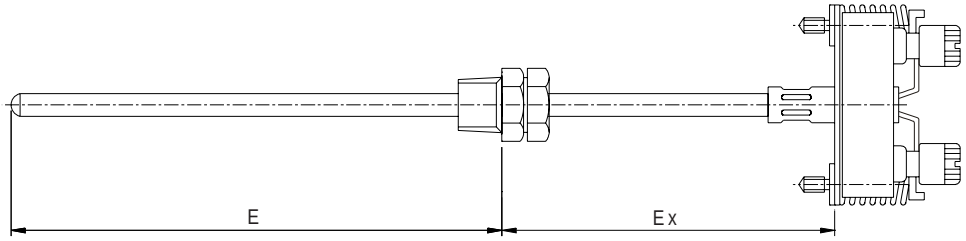
OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Spring loaded bayonet fitting
3. Lugs for tails
4. Special limits of error
5. Calibration standard (specify other than IEC-751)
6. Triplex element
7. Bulk Head Connector
8. Thermowell
0. None

Standard Features : a - Mineral insulated (compact MgO) construction
b - 3 Wire System
c - Reference standard IEC 751 Class B

Typical Model No : RTD - I - B - 1Pt100 - 4.5 - S6 - 200 - 0 - 3 - 3 -1/2" BSP(M)

Mineral Insulated RTD

How to Order



TYPE : RTD-I-TB

ELEMENT
1Pt100, 2Pt100, 1Cu53, 2Cu53,1Pt46, 2Pt46, 1Pt1000, 2Pt1000

SHEATH OD
3, 4.5, 6, 8mm

SHEATH MATERIAL
S6 : SS316, S2 : SS321

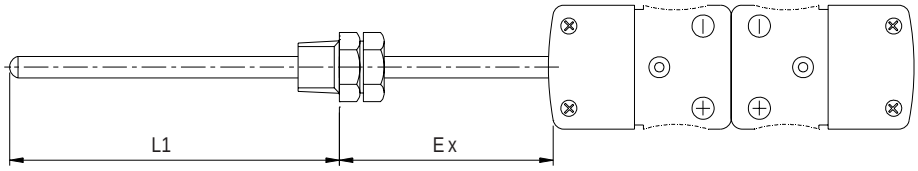
E
Specify in mm

Ex
Specify in mm

OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Special limits of error
3. Calibration standard (specify other than IEC-751)
4. Triplex element
5. Thermowell
6. Any other requirement (specify)
0. None

Standard Feature : a - Reference standard IEC 751 Class B
b - Mineral insulated (compact MgO) construction
c - 3 Wire System

How to Order



TYPE : RTD-I-PJ

ELEMENT
1Pt100

SHEATH OD
3, 3.2, 4.5, 6, 8mm

SHEATH MATERIAL
S6 : SS316, S2 : SS321

L1
Specify in mm

Ex
Specify in mm

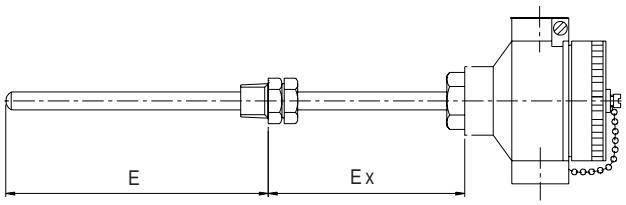
OPTION / SPECIAL
1. Adjustable compression fitting in SS316 (specify the size)
2. Special limits of error
3. Calibration standard (specify other than IEC-751)
4. Any other requirement (specify)
0. None

Standard Feature : a - Reference standard IEC 751 Class B
b - Mineral insulated (compact MgO) construction
c - 3 Wire System

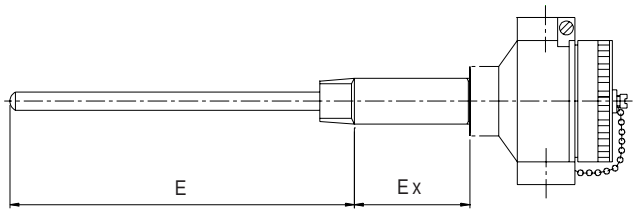
Typical Model No : RTD - I - PJ - 1Pt100 - 3 - S2 - 300 - 100 -1/2" NPT(M)

Mineral Insulated RTD

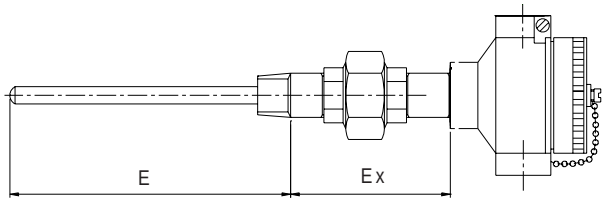
How to Order



TYPE : RTD H - A



TYPE : RTD H - B



TYPE : RTD H - C

ELEMENT
1Pt100, 2Pt100, 1Cu53, 2Cu53,1Pt46, 2Pt46, 1Pt1000, 2Pt1000

SHEATH OD
4.5, 6, 8mm

SHEATH MATERIAL
S6 : SS316, S2 : SS321

HEAD
WAL : Aluminium, weatherproof (IP-66)
WS4 : SS304, weatherproof (IP-66)
WS6 : SS316, weatherproof (IP-66)
FLAL : Aluminium, Flameproof (IIA, IIB)
FLS4 : SS304, Flameproof (IIA, IIB)
FLS6 : SS316, Flameproof (IIA, IIB)
FCAL : Aluminium, Flameproof (IIC)
FCS4 : SS304, Flameproof (IIC)
FCS6 : SS316, Flameproof (IIC)
FCCAL: Aluminium, Flameproof (IIC + CCOE)
ATAL : Aluminium, ATEX certified
FMAL : Aluminium, FM/UL certified

CABLE ENTRY
15N : ½" NPT(F)
20E : ¾" ET(F)
15M : M20 x 1.5(F)
15B : ½" BSP(F)

E
Specify in mm

OPTION / SPECIAL
1. Cable gland (specify material)
2. Two cable entries
3. Head mounted transmitter
4. Plug for cable entry (specify material)
5. Connection(other than specified)
6. FG/FG, SS braided cable
   (specify length e.g. 6(3) i.e. 3 Mtr cable)
7. Special limits of error
8. Thermowell
0. None

Ex
Specify in mm

CONNECTION MATERIAL
C - Cd plated CS
S4 - SS304
S6 - SS316

Standard Feature

a - Reference standard IEC 751 Class B

b - Mineral insulated (compact MgO) construction

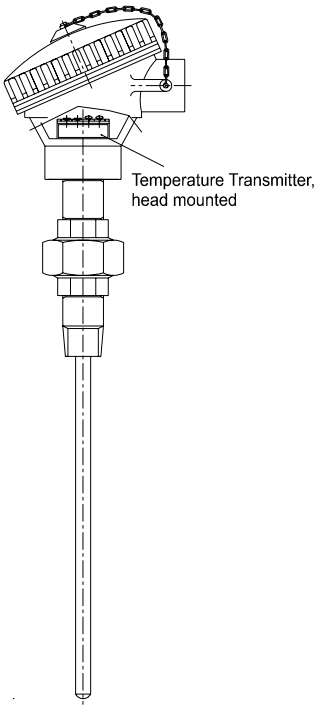
c - 1/2" NPT(M) connection

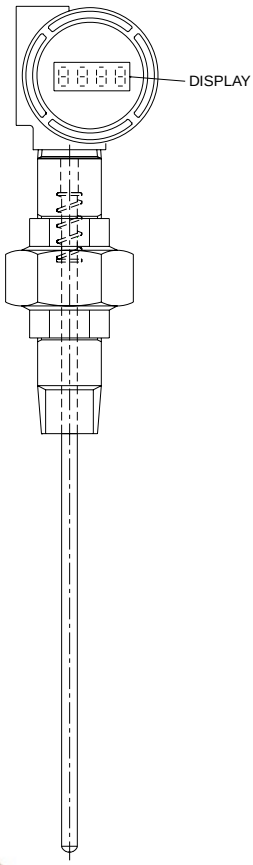
d - 3 Wire System

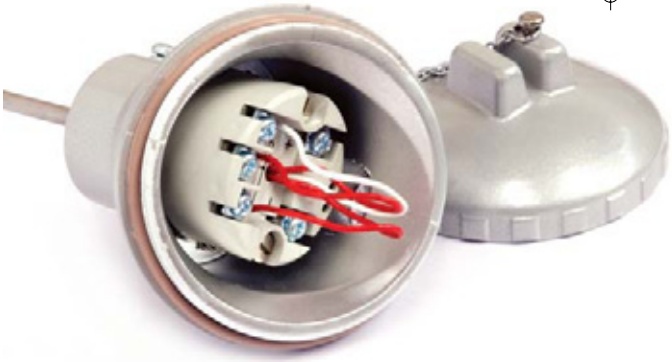
Temperature Element Assemblies Suitable for Temperature Transmitter

GENERAL has the capability of supplying temperature Element (T/c as well as RTD) assemblies suitable for temperature transmitters. The transmitter either can be mounted in the enclosure (Head) or connected to the extension (in the form of Nipple-union-nipple) that comes with built in enclosure. (with or without indication) The assemblies are offered complete with element, head & thermowell. In either case, the spring loading is provided ensures proper contact of the element to the bottom of thermowell. Moreover the assembly (if the transmitter is in our scope) will be duly calibrated.

The assemblies are generally suitable for various models of reputed make. We have been supplying these to major transmitter manufacturers such as ABB, Emerson, Yokogawa, E & H etc.







Thermocouple / RTD with Local Indication

Features

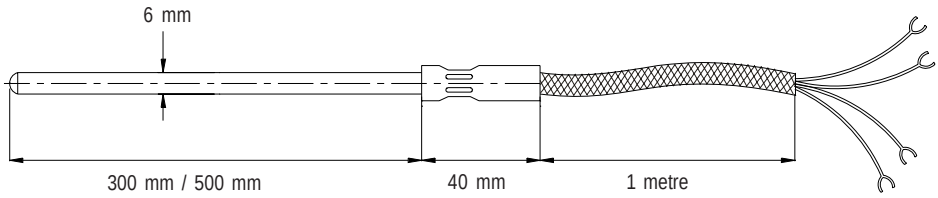
- Battery or mains operated.
- Special magnetic key for battery operated model to save battery consumption.
- Combination of local indication with provision for parallel remote indication.
- Weatherproof or flameproof case.
- Longer length of sensor available.
- Accuracy better than 1% full scale.

Specifications

Sensor	: RTD or thermocouple, single or duplex
Enclosure	: a) SS304 for battery operated b) Diecast aluminium for mains operated
Protection	: a) Weatherproof to IP - 67 (IS - 13947 Part I) b) Flameproof to Gr.I, IIA, IIB CMRI Dhanbad approved (equivalent to NEC Cl.1 Div.2, Gr.C & D) only in diecast aluminium case.
Display	: 3.1/2 digit, 12 mm LCD
Resolution	: 1^0C / 0.1^0C
Range	: (-) 25^0C to 500^0C for RTD, 0 to 1000^0C for thermocouple (other ranges available on request)
Accuracy	: Better than 1% of full scale /+ 1 digit
Power supply	: a) 9 V battery b) Mains - 230 V AC / 110 V AC c) Loop powered - 24 V DC
Special feature	: a) Power on / off provided be magnetic key for all battery operated models. b) Duplex element with local indication and provision for remote indication and 4-20 mA Signal
Process connecting	: 1/2" NPT (M) as standard (or as specified)
Mounting	: Local or surface
Accessory	: Thermowell (refer section on Thermowell)

Precision Industrial RTDs

Any industrial installation has several electrical thermometers such as Thermocouples & RTDs. At a regular interval, these instruments are required to be checked against a 'Standard Industrial RTD', which has accuracy to the level of 1/10th DIN. 'General' with its vast experience in design and manufacturing of precision instruments has developed 'Standard PT100 Industrial RTD' which caters to such requirements of client. These RTDs are traceable to National Physical Laboratory (NPL) and are either provided with Original Calibration Certificate from NPL with very low level of uncertainty or Internal Certificate traceable to National laboratory. These Standard RTDs are manufactured with 4 wire design to deliver highest performance.



Specifications

Resistance : Nominal 100 ohms at 0°C (PT100)
Four Wire System.
Temperature Coefficient :0.00385 ohms/ohm/°C nominal
Temperature Range : (–)200°C to 500°C (transition and cable temperature 150°C maximum)
Resistance Stability : ±0.20 °C at 0°C after 1000 hours at 400°C
Sheath Material : Inconel 600
Leads : Teflon™-insulated, silver-plated stranded copper, 22 AWG. Colour Coded as 2 White / 2 Red
Termination : Four gold-plated spade lugs are standard. Other options available.
Hysteresis : 0.04% maximum between (–)200°C and 500°C
Time Constant : Four seconds maximum for 63.2% response to step change in water flowing at 1 mps.
Conductor : Pure Silver
Calibration : Includes National Physical Laboratory Certificate in Original.
(Calibration points (-)25°C, 0°C, 100°C, 200°C, 300°C, 400°C & 500°C)
Any other points optional.
Probe Accuracy : Includes calibration uncertainty and short-term stability
(-)25°C ±0.070°C, 0°C ±0.030°C, 200°C ±0.10°C, 300°C ±0.15°C
Immersion Effects : Reading will not vary more than 0.02°C when the probe immersion is varied between 50 mm and 150mm in an ice bath.
Size : **PIR01**-300: 300 mm L C 6.0 mm Dia.
PIR01-500: 500 mm L C 6.0 mm Dia.

Temperature	Class B (Full Tolerance)		Class A (Half Tolerance)		1/4th Tolerance		1/10th Tolerance	
0°C	± 0.12 Ω	± 0.3°C	± 0.06 Ω	± 0.15°C	± 0.03 Ω	± 0.075°C	± 0.012 Ω	± 0.03°C
100°C	± 0.32 Ω	± 0.8°C	± 0.13 Ω	± 0.35°C	± 0.065 Ω	± 0.175°C	± 0.032 Ω	± 0.08°C
300°C	± 0.64 Ω	± 1.8°C	± 0.27 Ω	± 0.75°C	± 0.135 Ω	± 0.375°C	± 0.064 Ω	± 0.18°C
500°C	± 0.93 Ω	± 2.8°C	± 0.38 Ω	± 1.15°C	± 0.19 Ω	± 0.575°C	± 0.093 Ω	± 0.28°C

In-House tests carried out for RTD assemblies

1. Calibration : RTD calibration can be done as per IEC 751 / DIN 43760 Class A & B. Normally test is conducted for two points (i.e. 0^0C & 100^0C) 3 point calibration or more on request.

2. Insulation Resistance Test at ambient (room temp.) at 500 VDC - should be more than 100 M ohms.

3. Insulation Resistance Test at 320^0 C at 100 V DC - IR should be more than 2 M ohms. More than 20 M ohms also can be offered.

4. N2 leakage test - For RTD sensor, after cap welding the N2 leakage test should be carried out, no leakage should observed at 40 kg/cm^2.

5. Response time test - Response time test as per IEC 751 - (63.2% step change from ambient to 80^0C) For RTD without transmitter - 6 to 9 sec up to 6 mm OD of sheath. For RTD with thermowell the response time will be 35 to 45 sec.

6. Special test - Autoclave test - RTD kept in steam @ 125^0C & at 1.2 kg/cm^2 for about 1 hour. IR should be more than 5 M Ohms.

7. Continuity Test - By using continuity tester/multimeter - This test is used to confirm the element is connected properly to the RTD transducer cable.

8. Sheath Integrity Test - Water Immersion test - To check sheath integrity of thermocouple / MI RTD cable.

9. Response time test for RTD with RTD connected to pipe on its outside surface through which water is flowing @ 20 ltrs. per second & @ 80^0C. Acceptance norm is less than 20 seconds.

10. Self heating error test in accordance with IEC 751

Instrumentation Cables

- **Thermocouple Extension, Compensating cables**
- **Signal cables**
- **Control cables**
- **Instrumentation Power cables**

Instrumentation Cables

Specifications

S. No.	Part	Type	Range
1.	Conductor	Solid Conductor	Standard sizes : 0.81mm dia (0.5mm^2), 20 AWG 1.13mm dia (1.0mm^2) 1.29mm dia (1.31 mm^2), 16AWG 1.38mm dia. (1.5mm^2) 1.79mm dia (2.0mm^2)
		Stranded Conductor	Standard sizes : 7 x 0.31mm dia. (0.5mm^2), 20 AWG 7 x 0.43mm dia. (1.0mm^2) 7 x 0.49mm dia (1.3mm^2) 7 x 0.53mm dia (1.5mm^2) 7 x 0.67mm dia. (2.5mm^2)
2.	Core Insulation	PVC 70^{0}C PVC 85^{0}C PVC 105^{0}C LDPE	Standard thickness : 0.6mm
3.	Units	Core Pair Triad Quad	Length of Twist ; 0.5mm^2 conductor 55 mm/18 twists per meter 0.1mm^2 conductor 60 mm/17 twists per meter 16AWG conductor 60 mm/17 twists per meter 1.5mm^2 conductor 70 mm/14 twists per meter 2.5mm^2 conductor 80 mm/12 twists per meter
4.	Unit screen	1 layer of polyester tape. 1 tinned copper drain wire. 1 layer of aluminium mylar tape with 25% overlap For 100% coverage. 1 layer of Polyester tape.	Polyester tape 25 micron thick 7 x 0.31mm dia. (0.5mm^2) Aluminium - mylar Tape 65 micron thick. Polyester tape 25 micron thick.
5.	Number of units	Single unit Multi unit	

Specifications

S. No.	Part	Type	Range
6.	Communication pair	7 x 0.31 mm dai. (0.5 mm^2) insulated, twisted pair	Provided for cables with 6 pairs, 6 traids, 6 quads and above.
7.	Overall Screen	Same as for Unit Screen (4.)	
8.	Inner Sheath	PVC 70°C PVC 85°C PVC 105°C FRLS Grade PVC	Standard thickness : 1.0 mm min.
9.	Armour	Galvanised round steel wires Galvanised flat Steel wires	Standard size 1.0 mm dia. for cable OD up to 1.3 mm and 1.4 mm dia. above 13 mm 4 x 0.81 mm (Optional)
10.	Outer Sheath	PVC 70°C PVC 85°C PVC 105°C FRLS Grade PVC	Standard thickness : 1.2 mm for Cable OD up to 13 mm and 1.50 mm above 13 mm

Instrumentation Cables

Testing

STANDARD		TESTS
IS :8130	:	Annealing test for conductors, Wrapping test for conductors Persulphate test for tinned copper conductors, Conductor resistance test for copper conductors
ANSI MC 96.1	:	Thermo-emf performance test for thermocouple cables, Loop resistance test for thermocouple cables
IS : 5831	:	Insulation and sheath thickness test, Tensile strength of insulation and sheath, Elongation test for insulation and sheath, Shrinkage test for insulation and sheath, Loss of mass test for insulation and sheath, loss of mass test for insulation and sheath, Ageing test for insulation and sheath, heat shock test for insulation and sheath Bleaching and blooming test for insulation and sheath, Insulation resistance test for insulation and sheath, flammability test for cable
IS : 3975	:	Tensile strength of armour material, Elongation test for armour material, Zinc coating test on GI armour wire
IS :1554	:	Tensile strength for insulation and sheath, Elongation strength for insulation and sheath, High voltage test for insulation and sheath
IS :694	:	Spark test for insulation and sheath, HV test for insulation and sheath **IEEE :383** Flame resistance test
ASTM-D-2863	:	Limiting Oxygen Index test, Temperature Index Test **ASTM -D -2843** Smoke density test.
IEC -332- 1 and 3	:	Flammability test
IEC -754-1	:	HCl gas emmission test
SS-424-14-75 (F-3)	:	Flame retardancy test (Swedish chimney test) Noise rejection ratio test Rodent & termite resistance chemical test

General

THERMOWELLS

Thermowells

Thermowells are provided to protect the basic sensor from mechanical damage and corrosion. An extremely sturdy design may increase the life of the sensor but may lead to a poor response. Similarly, a delicate design will have poor life but will improve the response time. Therefore, a proper balance needs to be struck.

For given process parameters, **GENERAL** can arrive at an optimum Thermowell design considering aspects such as temperature, pressure, fluid velocity and corrosion. Such designs will conform to ASTM PTC 19.3.

The Thermowell material can be brass, SS304, SS316, SS316L, SS310, Inconel 600, Incoloy 800, Monel, Hastelloy depending upon the process parameters and type of fluid. For proper selection of Thermowell material, expert advice is available from our design department.

Thermowells

Various Types of Thermowells

A) BAR STOCK THREADED (BT)
(Process threads NPT, BSP or Metric)

B) BAR STOCK FLANGED (BF)
(Flanges as per ANSI, BS or DIN)

C) BAR STOCK WELD IN (BW)

D) FABRICATED THREADED (FT)

E) FABRICATED FLANGED (FF)

F) FABRICATED WELD IN (FW)

Barstock Thermowell is normally offered up to an insertion length of 600 mm. Fabricated Thermowells are recommended above 600 mm. If required, insertion length can be determined by performing wake frequency calculations, in accordance with PTC 19.3.

Welding (tig welding process) of the Thermowell is performed by professional and approved welders following practice laid down in the ASME code and weld joints can be tested up to 600 kg/ cm^2.

Bore concentricity within 10% of wall thickness can be checked by radiography or ultrasonic method. Special material tests such as ultrasonic test for flaw detection are also available. For steam/ feed water service, an IBR certificate in form IIIC can be issued.

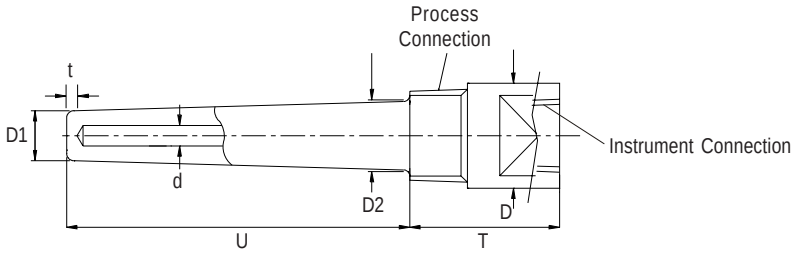
Routine tests :

Chemical analysis
Dimensional
Hydro test
Dye penetration
Bore concentricity
Physical
Microstructure

Type tests :

NACE compliance
Radiography
Ultrasonic
Physical testing
Post weld heat treatment

Bar stock threaded thermowell



TYPE : TW-BT

WELL MATERIAL*

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

DIA OF BARSTOCK In mm (D)

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

BORE in mm (d)

COLD END DIAMETER IN mm (D_2)

HOT END DIAMETER IN mm (D_1)

INSERTION LENGTH IN mm (U)

SPECIAL REQUIREMENT

U - Ultrasonic Test
X1 - X Ray for Bore Concentricity
X2 - X Ray for weld joints
FP - Full penetration weld
D - Dye Penetration Test
I - IBR
W - PWHT
H - H_2 Service
N - NACE to MR- 01-75
R - RF portion in material same as thermowell
C1 - Companion flange in CS to A105
C2 - Companion flange in same material as that of thermowell flange
F - Studs / Nuts & Gasket
Z1 - Nozzle / Stub in CS to A1O6 or A105
Z2 - Nozzle / Stub in same material as that of flange
ST - 1 mm Ti sleeve
SN - 1 mm Ni sleeve
SH - 1 mm HaC sleeve
STa -0.4 mm Ta sleeve
QP - 1 mm PTFE coating
QZ - 1 mm zirconium oxide coating
QT05 - 0.5 mm Tungsten carbide coating
QT10 - 1 mm Tungsten carbide coating
QS - 1 mm stellite coating
EN - Extension Nipple
specify length x size, material
eg. 100mm, 1/2" NPT(M) x M20x1.5(F), Cd plated CS.

Tip thickness in mm (t)

EXTENSION LENGTH IN mm (T)

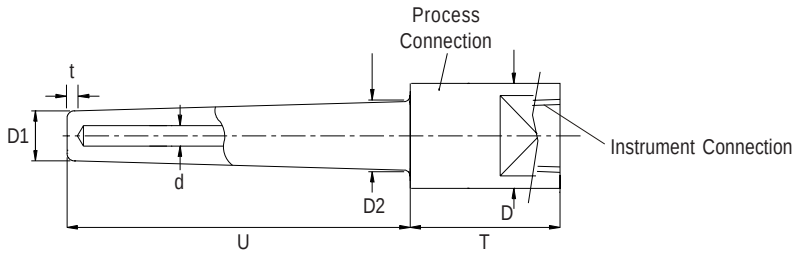
*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.

Note :

1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Thermowells

Bar stock
weld in thermowell



TYPE : TW-BW

WELL MATERIAL*

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

Dia of barstock in mm (D)

INSTRUMENT CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

Weld in diameter in mm

BORE in mm (d)

SPECIAL REQUIREMENT

U	Ultrasonic Test
X1	X Ray for Bore Concentricity
X2	X Ray for weld joints
FP	Full penetration weld
D	Dye Penetration Test
I	IBR
W	PWHT
H	H_2 Service
N	NACE to MR- 01-75
R	RF portion in material same as thermowell
C1	Companion flange in CS to A105
C2	Companion flange in same material as that of thermowell flange
F	Studs / Nuts & Gasket
Z1	Nozzle / Stub in CS to A1O5 or A106
Z2	Nozzle / Stub in same material as that of flange
ST	1 mm Ti sleeve
SN	1 mm Ni sleeve
SH	1 mm HaC sleeve
STa	0.4 mm Ta sleeve
QP	1 mm PTFE coating
QZ	1 mm zirconium oxide coating
QT05	0.5 mm Tungsten carbide coating
QT10	1 mm Tungsten carbide coating
QS	1 mm stellite coating

(t) Tip thickness in mm (t)

(T) Extension length in mm (T)

(U) Insertion length in mm

HOT END DIAMETER IN mm (D_1)

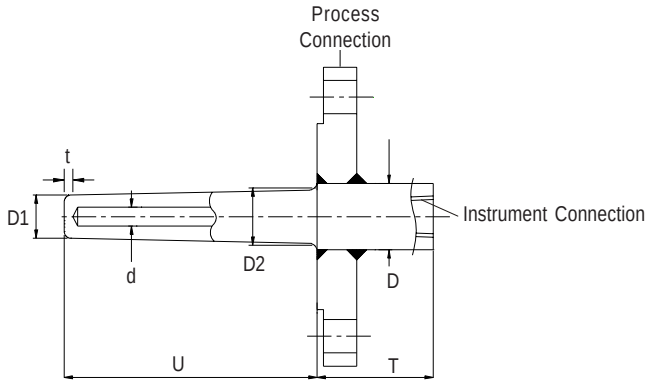
COLD END DIAMETER IN mm (D_2)

*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.

Note :

1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Bar stock flanged thermowell



TYPE : TW-BF

WELL MATERIAL*

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

Dia of barstock in mm

INSTRUMENT CONNECTION

Size	Type	Male / Female
6 - 1/4”	NT - NPT	M - Male
10 - 3/8”	BP - BSP	F - Female
15 - 1/2”	BT - BSPT	
20 - 3/4”	PF - PF	
25 - 1”	GS - Gas	
32 - 1.1/4”	NS - NPSM	
40 - 1.1/2”		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

PROCESS CONNECTION

Size	Code	Rating	Code	Facing	Code
½”	15	150#	A	RF	RF
¾”	20	300#	B	FF	FF
1”	25	600#	C	RTJ	RTJ
1½”	40	900#	D	LT	LT
2”	50	1500#	E	LG	LG
3”	80	2500#	F		

SPECIAL REQUIREMENT

U - Ultrasonic Test
X1 - X Ray for Bore Concentricity
X2 - X Ray for weld joints
FP - Full penetration weld
D - Dye Penetration Test
I - IBR
W - PWHT
H - H_2 Service
N - NACE to MR- 01-75
R - RF portion in material same as thermowell
B - Tail portion in bar stock**
C1 - Companion flange in CS to A105
C2 - Companion flange in same material as that of thermowell flange
F - Studs / Nuts & Gasket
Z1 - Nozzle / Stub in CS to A105 or A106
Z2 - Nozzle / Stub in same material as that of flange
ST - 1 mm Ti sleeve
SN - 1 mm Ni sleeve
SH - 1 mm HaC sleeve
STa -0.4 mm Ta sleeve
QP - 1 mm PTFE coating
QZ - 1 mm zirconium oxide coating
QT05 - 0.5 mm Tungsten carbide coating
QT10 - 1 mm Tungsten carbide coating
QS - 1 mm stellite coating
TP150 - Tapered for tail portion of 150 mm

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

Hot end diameter in mm

Cold end diameter in mm

Bore in mm

*****Flange Material**

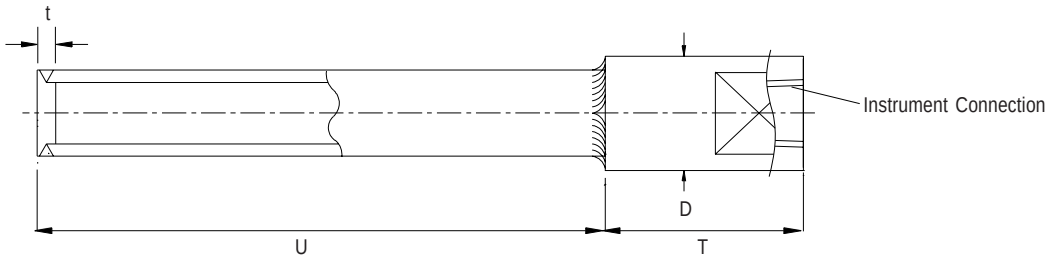
*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.

***For flange material refer the same code as that of well material. If the flange is with ‘HUB’ specify the same in the bracket e.g. 20 BRF (HUB).

Note : 1. Wherever coating/lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Thermowells

Fabricated weld in thermowell



TYPE : TW-FW

WELL MATERIAL

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT CONNECTION

Size	Type	Male / Female
6 - 1/4" 10 - 3/8" 15 - 1/2" 20 - 3/4" 25 - 1" 32 - 1.1/4" 40 - 1.1/2"	NT - NPT BP - BSP BT - BSPT PF - PF GS - Gas NS - NPSM	M - Male F - Female
Metric Threads		
18 M - M 18 x 1.5 20 M - M 20 x 1.5 24 M - M 24 x 1.5 27 M - M 27 x 2 33 M - M 33 x 2 X X - Any other		

Weld in diameter in mm

(U) Insertion length in mm

SPECIAL REQUIREMENT

U	- Ultrasonic Test
X1	- X Ray for Bore Concentricity
X2	- X Ray for weld joints
FP	- Full penetration weld
D	- Dye Penetration Test
I	- IBR
W	- PWHT
H	- H_2 Service
N	- NACE to MR- 01-75
R	- RF portion in material same as thermowell
B	- Tail portion in bar stock**
C1	- Companion flange in CS to A105
C2	- Companion flange in same material as that of thermowell flange
F	- Studs / Nuts & Gasket
Z1	- Nozzle / Stub in CS to A1O5 or A106
Z2	- Nozzle / Stub in same material as that of flange
ST	- 1 mm Ti sleeve
SN	- 1 mm Ni sleeve
SH	- 1 mm HaC sleeve
STa	- 0.4 mm Ta sleeve
QP	- 1 mm PTFE coating
QZ	- 1 mm zirconium oxide coating
QT05	- 0.5 mm Tungsten carbide coating
QT10	- 1 mm Tungsten carbide coating
QS	- 1 mm stellite coating

(t) Tip thickness in mm

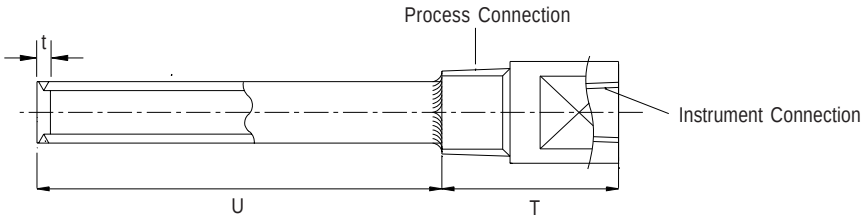
(t) Tip thickness in mm

(T) Extension length in mm

Note : 1. Wherever coating/lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)

2. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Fabricated threaded thermowell



TYPE : TW-FT

WELL MATERIAL

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

(U) Insertion length in mm

SPECIAL REQUIREMENT

U	- Ultrasonic Test
X1	- X Ray for Bore Concentricity
X2	- X Ray for weld joints
FP	- Full penetration weld
D	- Dye Penetration Test
I	- IBR
W	- PWHT
H	- H_2 Service
N	- NACE to MR- 01-75
R	- RF portion in material same as thermowell
B	- Tail portion in bar stock**
C1	- Companion flange in CS to A105
C2	- Companion flange in same material as that of thermowell flange
F	- Studs / Nuts & Gasket
Z1	- Nozzle / Stub in CS to A1O5 or A106
Z2	- Nozzle / Stub in same material as that of flange
ST	- 1 mm Ti sleeve
SN	- 1 mm Ni sleeve
SH	- 1 mm HaC sleeve
STa	- 0.4 mm Ta sleeve
QP	- 1 mm PTFE coating
QZ	- 1 mm zirconium oxide coating
QT05	- 0.5 mm Tungsten carbide coating
QT10	- 1 mm Tungsten carbide coating
QS	- 1 mm stellite coating

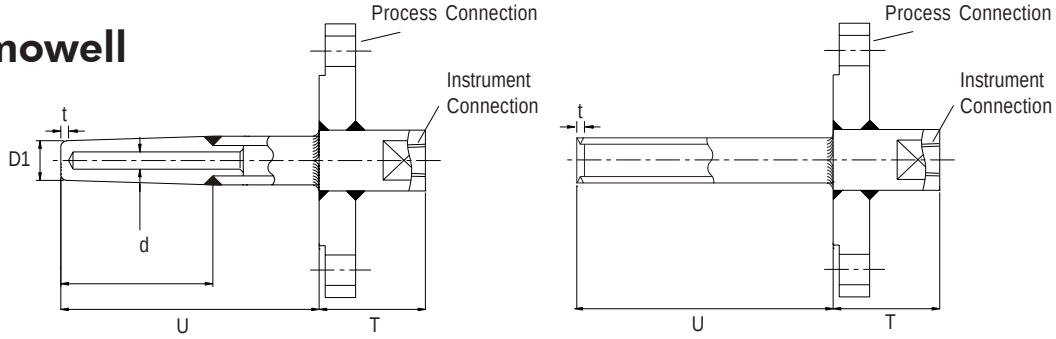
(t) Tip thickness in mm

(T) Extension length in mm

Note : 1. Wherever coating/lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2mm).
2. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Thermowells

Fabricated flanged thermowell



TYPE : TW-FF

WELL MATERIAL

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SS - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

SPECIAL REQUIREMENT

U	- Ultrasonic Test
X1	- X Ray for Bore Concentricity
X2	- X Ray for weld joints
FP	- Full penetration weld
D	- Dye Penetration Test
I	- IBR
W	- PWHT
H	- H_2 Service
N	- NACE to MR- 01-75
R	- RF portion in material same as thermowell
B	- Tail portion in bar stock**
C1	- Companion flange in CS to A105
C2	- Companion flange in same material as that of thermowell flange
F	- Studs / Nuts & Gasket
Z1	- Nozzle / Stub in CS to A105 or A106
Z2	- Nozzle / Stub in same material as that of flange
ST	- 1 mm Ti sleeve
SN	- 1 mm Ni sleeve
SH	- 1 mm HaC sleeve
STa	- 0.4 mm Ta sleeve
QP	- 1 mm PTFE coating
QZ	- 1 mm zirconium oxide coating
QT05	- 0.5 mm Tungsten carbide coating
QT10	- 1 mm Tungsten carbide coating
QS	- 1 mm stellite coating

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

*****Flange Material**

PROCESS CONNECTION

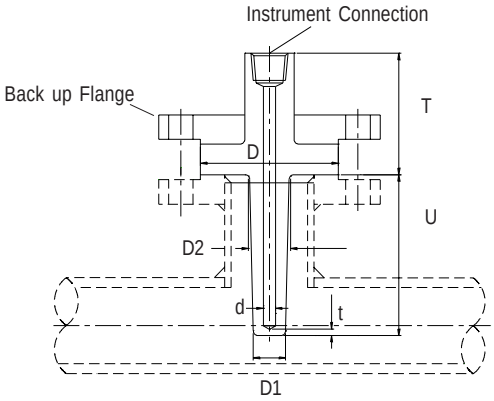
Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

***For flange material refer the same code as that of well material. If the flange is with 'HUB' specify the same in the bracket e.g. 20 BRF (HUB).

Note : 1. Wherever coating/lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm).
2. Wherever sleeve is required, thermowell shall be straight & not tapered.
3. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Van stone type thermowell

For high pressure applications and where welding is to be avoided, Van Stone design thermowells are used. These are machined from a single barstock, sandwiched between the nozzle flange and cover (companion) flange. The OD of the machined portion corresponding the raised face portion of the flange. Wake frequency calculations (in accordance with PTC 19.3) are performed where ever data is made available and are essential in order to suggest appropriate dimensions of thermowell.



TYPE : TW-V

WELL MATERIAL*

S4 - SS304	I825- Incoloy 825
S6 - SS316	I6 - Inconel 600
S3 - SS310	I8 - Incoloy 800
SH - SS446	S2 - SS321
4L - SS304L	K - Kanthal
6L - SS316L	HC - Hastelloy C-276
C - CS to A105	HB - Hastelloy B
S1 - SS410	M - Monel 400
S7 - SS317	T - Ti-II
7L - SS317L	N - Nickel 200

(D) Dia of barstock portion to be sandwitched in mm

INSTRUMENT CONNECTION

Size	Type	Male / Female
6 - 1/4"	NT - NPT	M - Male
10 - 3/8"	BP - BSP	F - Female
15 - 1/2"	BT - BSPT	
20 - 3/4"	PF - PF	
25 - 1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

Back-up flange size, rating & facing

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500#	F		

SPECIAL REQUIREMENT

U	Ultrasonic Test
X1	X Ray for Bore Concentricity
X2	X Ray for weld joints
FP	Full penetration weld
D	Dye Penetration Test
I	IBR
W	PWHT
H	H_2 Service
N	NACE to MR- 01-75
R	RF portion in material same as thermowell
B	Tail portion in bar stock**
C1	Companion flange in CS to A105
C2	Companion flange in same material as that of thermowell flange
F	Studs / Nuts & Gasket
Z1	Nozzle / Stub in CS to A105 or A106
Z2	Nozzle / Stub in same material as that of flange
ST	1 mm Ti sleeve
SN	1 mm Ni sleeve
SH	1 mm HaC sleeve
STa	0.4 mm Ta sleeve
QP	1 mm PTFE coating
QZ	1 mm zirconium oxide coating
QT05	0.5 mm Tungsten carbide coating
QT10	1 mm Tungsten carbide coating
QS	1 mm stellite coating

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

(D1) HOT END DIAMETER IN mm

(D2) COLD END DIAMETER IN mm

(d) BORE in mm

*****Back-up Flange Material**

*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.
***For flange material refer the same code as that of well material. If the flange is with 'HUB' specify the same in the bracket e.g. 20 BRF (HUB).

Special Thermowells

One of the most difficult problems in temperature measurement of process parameters has been the rapid wearing out of Thermowells made out of conventional stainless steel. Various factors could cause the failure of the thermowells, the most difficult, have been the erosion due to severe particle impingement.
The corrosion due to chemically agressive fluids; the combination of high temperature, high velocity fluids & the thermal shock faced by the sensor protective sheaths in the glass & metallurgical industries.

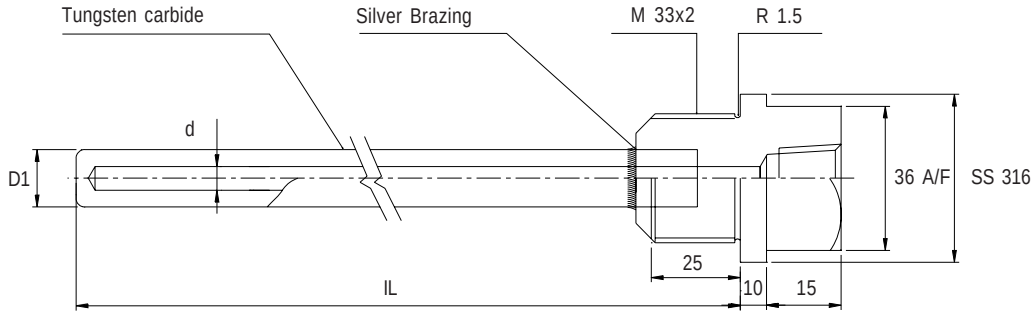
With an experience of over three decades, **GENERAL** is in a position to offer some solutions to most of these problems. Some of the standard designs are described & illustrated in this literature.

Solid sintered tungsten carbide thermowell

These thermowells are ideally suited for use in very abrasive environment such as in air preheaters & coal mills of coal based power plants (mill classifier or pulveriser outlet) or steam generation units, for temperature measurement of coal and air mixture.

TYPICAL SPECIFICATIONS

Type : Built-up threaded
Material : Solid Sintered Tungsten Carbide brazed to 316 SS threaded bushing.
Process connection : M33 x 2 or as required
Bore : 7 mm, 10.5 mm
Outer diameter : 16 mm, 20 mm as standard or else to be specified
Immersion length : IL - 160, 200, 250, 320, 400
Extension length : EL - 100, 160 in the form of ½" schedule 80 nipple generally
Note : When the length are longer, it is recommended to use tungsten carbide only for the tail portion of say 200 to 250 mm.



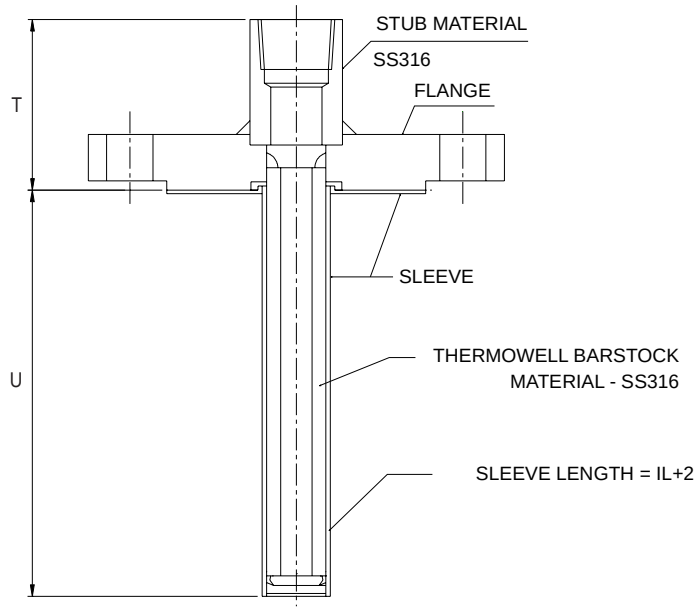
Sensor & Bulb dia (mm)	d	D1	IL
MI TC 6 mm dia	6.5	16	160, 200, 250, 320, 350
MI RTD 6 mm dia	6.5	16	160, 200, 250, 320, 350
Temp Gauge or Switch 10 mm dia	10.5	20	160, 200, 250, 320, 350

Lined (Sleeved) Thermowell

One of the most economical solutions to protect the thermowells from chemically agressive fluids is to provide a bar-stock flanged thermowell made out of conventional stainless steel with loose lining in the form of a sleeve on the entire wetted portion. This will provide strength from stainless steel & corrosion resistance from the lining.

TYPICAL SPECIFICATIONS

Type : Bar-stock flanged
Well Material : SS316
Lining Material : Hastelloy-C, Nickel, Titanium, Tantalum, Silver
Lining thickness : 0.4 mm for Tantalum & Silver, 1 to 1.5 mm for other materials as standard. Other thicknesses can be provided on request.
Process Connection : Flanged 1" (DN25) to 3" (DN80) as per ANSI or DIN as standard. Other on request.
Insertion length : To be specified.
Note : Sometimes even the conventional stainless stell flanged thermowells can be provided with carbon steel flange corresponding to ASTMA105, with a lining of 3 mm thick stianless steel plate on the RF portion of the flange. This construction offers a very economical solution without having to surrender corrosion resistant charateristics of stainless steels for wetted parts.



d : Bore of thermowell
D : Outer dia of thermowell without sleeve
D1 : Outer dia with sleeve

Basic Well	Lining	d	D	D1	Insertion Length (U)
316 SS	Hastelloy 'C' Ni, Ti	6.25	13.8	16	200, 250, 300, 400, 500
316 SS	Tantalum, Silver	6.25	14.1	15	200, 250, 300, 400, 500

Special Thermowells

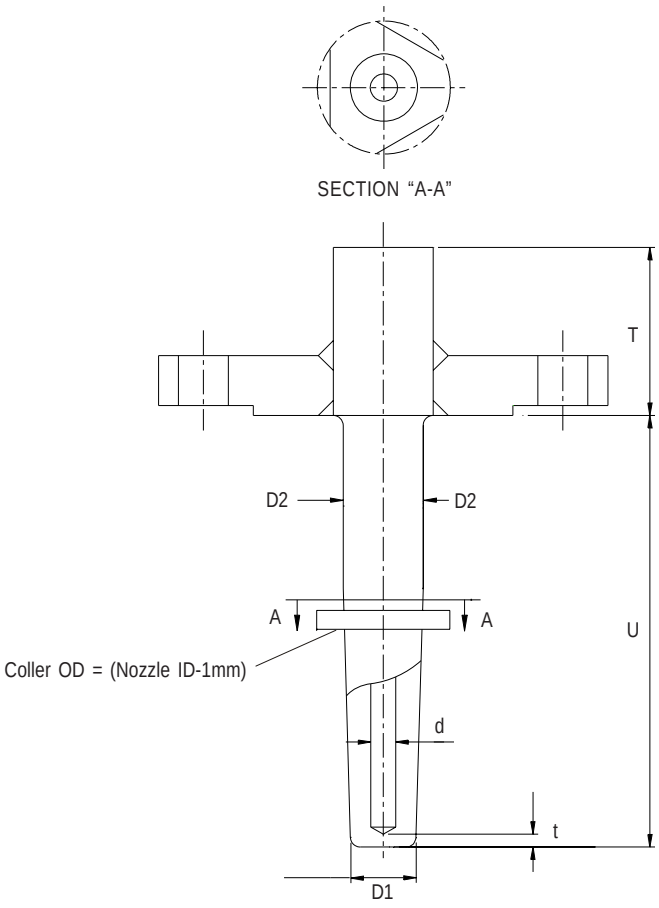
Thermowells for use in high temperature applications

For use in Chemical Plants for installing on Flue Gas areas of Boilers, Furnaces, Kilns, Heat Recovery Units, Incinerators, Reformers & Gasifiers, Material of Construction is recommended based on the working Temperature, Pressure & Other process parameters. The general guide line for selection of materials for Protecting tubes can be regarded as given in the table below.

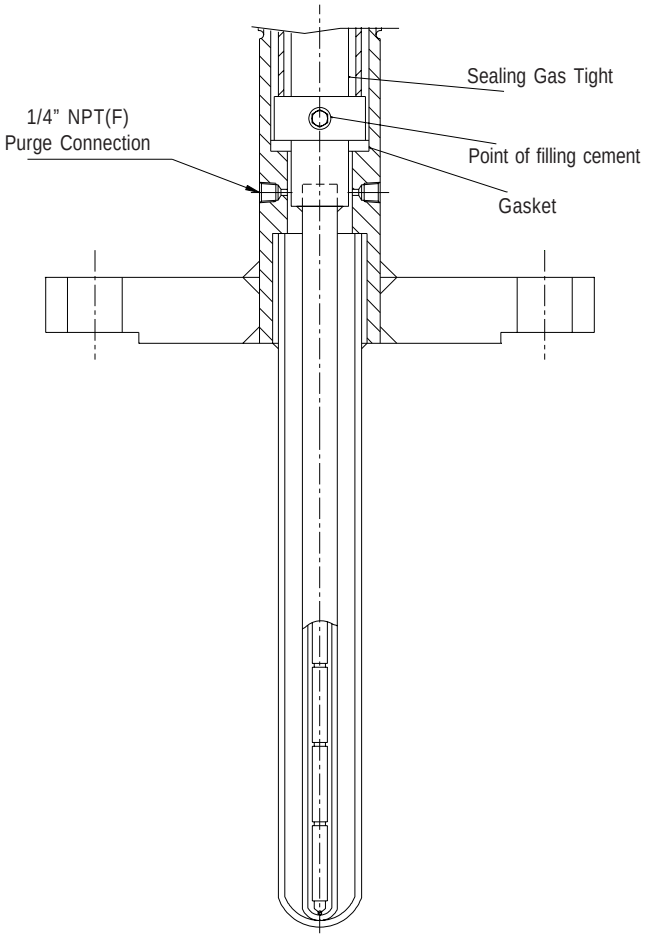
Working Temperature	Material of Construction
Upto 800 DegC	Conventional Stainless Steels 321 SS, 316 SS
800 DegC to 1100 DegC	Heat resistant Stainless Steels, 310 SS, 446 SS & high alloy steels such as Incoloy 800 & Inconel 600
1100 DegC to 1500 DegC	Ceramic Material grade 610 & 710

The length, diameter & the thickness will depend on the process parameters. However, as a general guide line we would recommend a minimum thickness of 3.5 mm for metalic tubes.

The wake frequency calculations can be performed in accordance with PTC 19.3, in order to ascertain exact insertion length and outer dimension like OD to save it from breakage due to high velocity service.



Thermowells for use in high temperature applications



For high temperature appications, generally, **Ceramic protecting tubes** are used in different industries such as Iron & Steel, glass, cement etc. It has high resistance to thermal shocks. It is inert to most chemicals & has a high dielectric strength. These are primariliy used to protect noble metal thermocouples (like R, S & B type) They are available in variety of sizes. Normally it is cemented (by high temperature withstanding cement) to metal tubes (which are termed as holding tubes) The process connection slides or is welded to this metallic portion of the tube. For double protection, inner ceramic tube is also used. Mainly two grades of ceramic are used. Ceramic 610 (also termed as Mullite) & Ceramic 710 (recrystallised Alumina- 99.5% purity) Can withstand upto 1500 DegC & 1800 DegC respectively. It should be remembered that it has poor mechanical shock resistance. It is impervious to gases at high temperatures.

Silicon Carbide protecting tubes are also used generally as a secondary protection for applications such as Kilns, Furnaces, Stove Dome etc. Recrystallised silicon carbide has a very high abrasion resistance. Also used for flue gas application or incinerators in waste management system. It can withstand 1600 DegC & direct flame impingement. It is extremely hard & chemically inert. It resists most of the acids, molten salts. Generally used in conjunction with ceramic tube.

Cermet (LT-1) which is metal ceramic composite (combination of chromium & aluminium oxide) is stable in oxidising atomospheres upto 1300 DegC. Cermet tubes are stronger & more resistant to thermal & mechanical shocks than ceramic protecting tubes. Main area of usage is in molten copper, open hearth furnace, blast furnace. Ceramic primary tube is recommended when Cermet is used.

Thermowells

Thermowell material selection guide

APPLICATION	MATERIAL
IRON AND STEEL	
Blast furnaces	
Stove dome	Silicon Carbide
Hot blast main	Inconel 600
Open Hearth	
Flues and Stack	Inconel 600, SS 446
Waste heat Boiler	Inconel 600, SS 446
CEMENT	
Exit Flue Gas	Inconel 600, SS 446
Kilns, Heating Zone	Inconel 600
CERAMIC	
Kilns	Ceramic and silicon carbide
Dryers	Silicon carbide
POWER	
Coal-air mixtures	Solid sintered tungsten carbide
Flue Gas	SS 446
Preheater	SS 446
Boiler Tube	SS 304, SS 316, SS 310
INCINERATOR	
Up to 1050^{0}C	Inconel 600, SS 446
Over 1050^{0}C	Ceramic 610/710 (Primary), Silicon Carbide (Secondary)
CHEMICAL	
Acetic Acid	
10 to 50% 20^{0}C	SS 304, Hastelloy C, Monel 400
50 % 100^{0}C	SS 316, Hastelloy C, Monel 400
99% 21 to 100^{0}C	Hastelloy C, Monel
Alcohol, ethyl, methyl	
20 to 100^{0}C	SS 304
Ammonia	
All concentrations 20^{0}C	SS 304, SS 316
Ammonium Chloride	
All Concentration 100^{0}C	SS 316, Monel

Thermowell material selection guide

APPLICATION	MATERIAL
Brine	Monel 400
Bromine	Tantalum, Monel 400
Butyl Acetate	Monel 400
Calcium Hydroxide	SS 304
Upto 50% 100°C	SS 304, Hastelloy C
Chlorine Gas	
Dry, 20°C	SS 316, Monel 400
Moist, - 7 to 100°C	Hastelloy C, Tantalum
Chromic Acid, 10 to 50% 100°C	SS 316, Hastelloy C (all concentrations)
Ethyl Acetate	SS 304, Monel 400
Ethyl Chloride 20°C	SS 304, low carbon steel
Ethyl Sulphate 20°C	Monel 400
Ferric Chloride 5% 20°C to boiling	Tantalum, Hastelloy C
Formaldehyde	SS 304, SS 316
Formic Acid, 5% 20 to 66°C	SS 316
Hydrochloric Acid	
Upto 5% 20°C	Hastelloy C
Upto 25% 100°C	Hastelloy B
Hydrofluoric Acid, 60% 100°C	Hastelloy C, Monel
Hydrogen peroxide	SS 304, SS 316
Hydrogen Sulphide, wet and dry	SS 316
Phosphoric Acid	
Upto 10% 20°C	SS 316
10% 100°C	Hastelloy C
30% to 85% 100°C	Hastelloy B
Sodium Hydroxide	Nickel 200
Sulphuric Acid	
Upto 90% 20°C	Hastelloy B

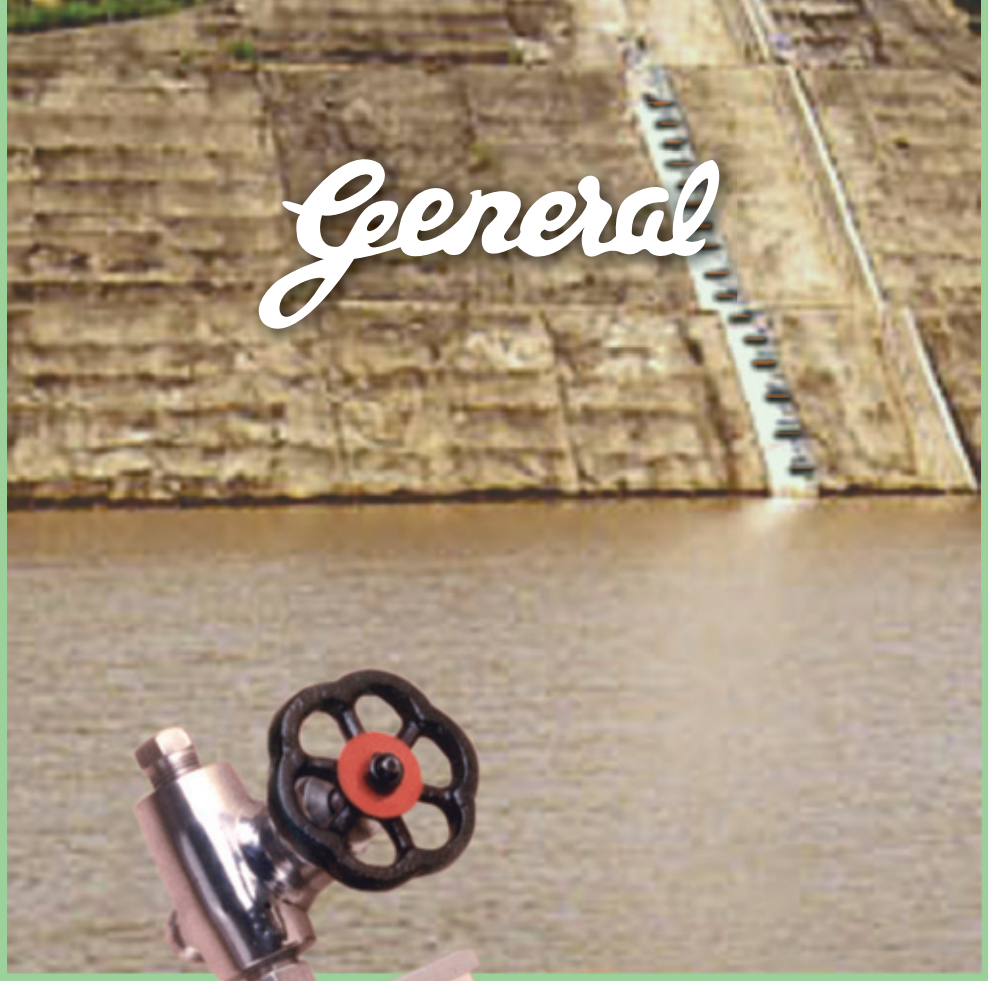
Thermowells

In-House Testing facilities for Thermowells

1. **Dimensional** : As per approved drawing & data sheet.
2. **Hydro test** : For barstock threaded 100 Kg/Cm^2 (internal as standard) & more as per customer requirement.
   : External if applicable
   : Flanged Thermowells - Internal / external - 1.5 times the operating pressure
   : Internal - 100 kg/cm^2 for ratings below 600# & 200 kg/cm^2 above 600# rating
   : External - In accordance with flange rating.
3. **Bore concentricity** : By using "D" meter (Ultrasonic thickness tester) - Wall thickness measurement - Sample 5% at two different points & each at 180^0 angle to each other.
   : Radiography test by external lab (X-Ray) for immersion length portion. (optional)
4. **Dye Penetration test**: For weld joints of thermowell / protecting tube
5. **Threading Check** : Process thread & instrument thread - Check by thread gauge.

Optional Tests

1. Hardness Test
2. PWHT - Post weld heat treatment
3. Intra Granular Corrosion Test
4. Corrosion test as per A293 Method C
5. Ferrite No. Test
6. Impact test
7. Radiography for bore concentricity & weld joint as applicable
8. Physical, Chemical & Micro Analysis as applicable
9. PMI test (Positive Material Identification)



LEVEL

Magnetic Level Indicator

Magnetic Level Indicators provide clear and high clarity indication of liquid level. A float containing the magnet rises and falls with liquid level. As the float moves, the information is transferred to the indication rail mounted on the outside of the tube. Bicolour Flappers / Rotoballs or Capsule represent level of liquid. Magnetic Level Indicator can be mounted in various orientation typically onto the side of the vessels. However it may be mounted on top as per requirement.

Each of the colour flaps, balls contain a small magnet which rotates through 180^0 when passed by the bar magnet within the float. The indicator rail magnetic field is interlocked by the individual magnets in each of the flaps/balls which ensures a suitable indication.

TYPES : ❑ Rotoball / Flapper / Roller ❑ Capsule

Rotoball Type Level Indicator

Red and White magnetic rollers or balls equipped with small magnets rotate one after another as the level changes.

High & Low switching with microswitch can be offered in weatherproof or flameproof housing.

Operating Temperature : 10^0C to 80^0C for side mounted
10^0C to 120^0C for top mounted

Operating Pressure : 25 Kg/cm^2

Higher pressure rating and different material of construction suitable for service conditions are available on request.

Capsule Type Level Indicator

Capsule is used to indicate the liquid level.
The capsule is actuated with the help of magnetic float which will indicate the level of liquid.

Specifications for Magnetic Level Indicator

Type	: Rotoball / Capsule/ Roller / Flapper
Main Chamber	: CS / SS 304 /SS 316
Mounting	: Side / Top
Gaskets	: CAF / PTFE / Graffoil
Vent / Drain	: ½" NPT(plugged) or with Needle Valve
Connection	: Screwed or flanged, side or end
Accessory	: Scale
C.C. Distance	: User to inform

Level Gauges

Direct reading level gauges are used wherever positive, accurate measurement of fluids levels and/or observation of the fluids in vessels is necessary. These are available in variety of material and special design to suit service requirements. All gauges have auto shut-off ball check valves with offset or straight construction.

TYPES : ❑ Reflex ❑ Transparent ❑ Tubular

Reflex Level Gauges

This instrument consists of a metal body, machined to have an internal chamber and one or more front windows (only on one side of the gauge). On each window a special high resistance plate reflex glass is fitted with sealing joint and metal cover plates held by bolts and nuts. The chamber is connected to vessel with cross fittings and flanged, threaded or welded ends. Usually, between the instrument and its connecting ends, valves are fitted to connect shut-off piping and to disassemble the level gauge without need to empty the vessel. Drain valves can also be fitted to cross fittings device. To avoid leakage in case of glass breakage, safety ball-check device can be provided. Reflex level gauges' working principle is based on the light refraction and reflection laws and mainly recommended for colorless liquids. When in operation, the chamber is filled with liquid in the lower zone and gases or vapors in the upper zone; the liquid level is distinguished by different brightness of the glass in the liquid and in the gas/vapor zone. The reflex level gauges do not need a specific illumination: the day environmental light is enough. Only during the night an artificial light must be provided.

Transparent Level Gauges

This instrument consists of a steel body having trapezoid cross section and machined to have a longitudinal chamber and front holes uniformly distributed on the two not parallel faces. On each hole a transparent cylindrical glass is tightly pressed between a metallic cover and the body by means of bolts and nuts. A mica shield, frost shield can be offered for higher & lower temperature applications. Illuminator (weatherproof or flameproof) can be provided for specific applications. The chamber is connected to vessel with cross fittings and flanged, threaded or welded ends. Illuminator can be provided for specific applications. Transparent level gauges are mainly recommended for coloured liquid, steam-water and interface level measurement.

Level Gauges

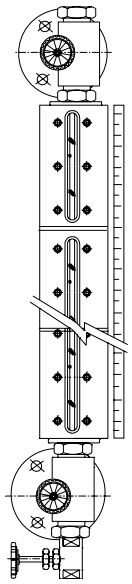
Tubular Level Gauges

Tubular Level gauge is the simplest form of level indication in process industry. It is simple and reliable device for direct reading in atmospheric or pressurised tank applications. It is mounted on the side of tank. As the process level fluctuates, the level in the transparent glass tube changes accordingly and gives local liquid indication.

Float & Board Level Gauges

This instrument is used in measurement of liquids in large overground storage tanks at low pressure. This instrument consists of float, pulley mechanism, pointer and scales.

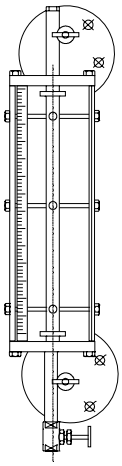
Specifications for Reflex & Transparent Type Level Gauges



Type	: Reflex / Transparent
Main Chamber	: CS / SS 304 /SS 316
Glass	: Borosilicate
Cover Plate	: CS Forged
Studs & Nuts	: ASTM A 193 Gr. B7 / A 194 Cl. 2H
Gaskets	: CAF / PTFE / Graffoil
Ball Check Valves	: Auto shut off type having offset or straight construction
Valve Body	: CS / SS 304 /SS 316
Trim	: SS 304 /SS 316
Vent / Drain	: ½" NPT (plugged) or with Needle Valve
Connection	: Screwed or flanged, side or end
Accessory	: Scale, Frost shield, mica shield, illuminator (for Transparent Level Gauge)
Op. Temperature	: 300^{0}C
Op. Pressure	: 40 Kg/cm^2 for Reflex & 30 Kg/cm^2 for Transparent
C.C. Distance	: User to inform

Higher pressure ratings and other material of construction available on request.

Specifications for Tubular Type Level Gauges



Glass	: Borosilicate
Protection	: MS guard rods or 'C' channel
Packing	: PTFE or Graphite
Ball Check Valve	: Auto Shut off Ball Check Valves having Offset construction
Valve Body	: CS / SS 304 /SS 316
Trim	: SS 304 /SS 316
Connection	: Flanged or Screwed
C.C. Distance	: User to inform

Float Operated Level Switch

A Float operated level switch is the simplest way to control one or multi levels by using side or top mounted switches. A microswitch or reed switch is offered as an option. Various materials of constructions are available depending upon service conditions.

Side Mounted Level Switch

Specifications

Float	: SS316 or PTFE coated or PP/PVC (other on request)
Flange	: 2" 150#RF as standard. Other as required in CS or SS304 or SS316 or SS lined CS, etc.
Switch	: ISPDT or 2SPDT microswitch, rated 5 amp @ 230 V AC or 15 amp @ 230V AC
Switch Housing	: Die cast aluminium, weatherproof to IP-65 (IS:13947 Part I) Flameproof to IIA, IIB Flameproof to IIC (on request)
Electrical Connection	: ¾" ET (F) or ½" NPT (F)
Switching Differential	: ± 15 mm
Optional	: Cooling fins for high temperature (above 250^{0}C)

Top Mounted Level Switch

Specifications

All specifications identical as side mounted level switch except,

Switch	: SPDT reed, rated 0.5 amp @ 230V AC or 1amp @ 115V DC SPDT micro, rated 5 amp @ 230V AC
Operating Pressure	: 25 kg/cm^2
Operating Temperature	: 250^{0}C

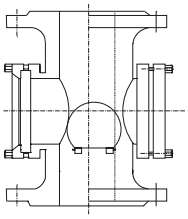
External cage type is available with side mounted as well as top mounted switch. However specify C/C distance if external cage model is required.

Displacer Type Level Switch is also offered for specific application.

Sight Flow Indicators

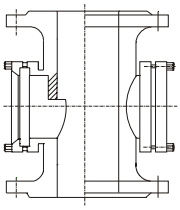
Specifications

Body : CS to A216 Gr. WCB, SS304 to A351 Gr. CF8, SS316 to A351 Gr. CF8M. Other material suitable for process fluid on request.
Connection : Flanged/Screwed
Glass : Toughened/Borosilicate/Polycarbonate
Gasket : PTFE/CAF
Studs/Nuts : ASTM A193 Gr. B7/A194 C1.2H



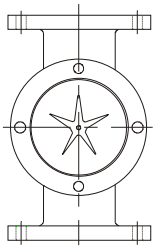
Flapper Type

Recommended for vertical upward as well as horizontal flow. Suited for colourless, transparent fluids. (Bidirectional flapper type can be offered for specific application.)



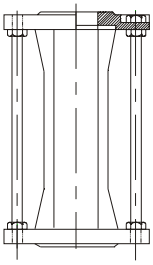
Drip Tube Type

Particularly suitable for vertical downward lines having intermittent flow like in distillation column.



Rotary Type

Best suited for lines carrying dark solution where rotary movement can be easily detected.



Full View Type

Means of viewing the process to assure that the flow is continuous or to note the process turbidity, colour etc.

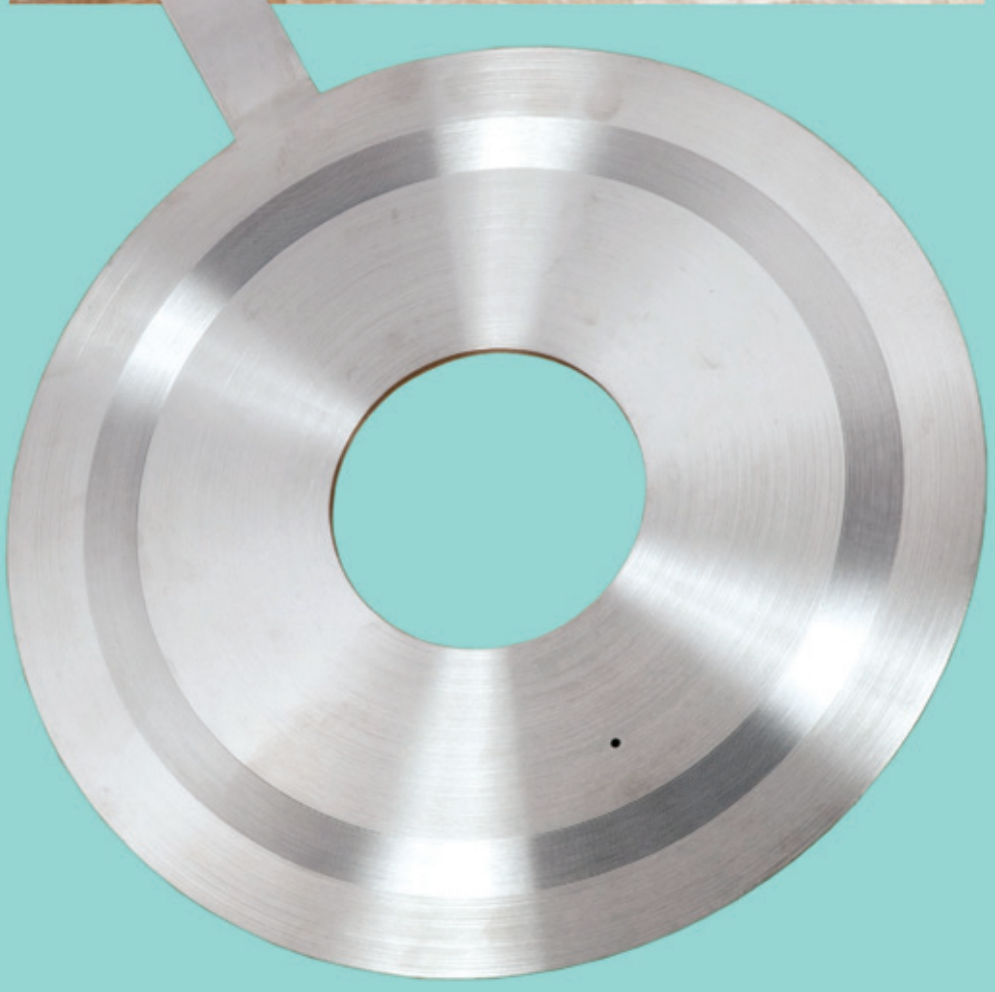
(Pith ball type suitable for colourless gases can be offered)

Flow Switch

Specifications

Type	: In line/top mounted
Body	: CS/SS304/SS316 (other material on request)
Flapper	: SS304/SS316 (other material on request)
Bellow	: Phosphor bronze/SS
Switch	: SPDT micro
Switch Rating	: 5 Amp @230V AC
Switch Housing	: Die cast aluminium, weaterproof to IP-65 as per IS:13947 Part I Die cast aluminium, flameproof to IIA, IIB (equivalent to NEC Cl I Div 2 gr C & D) Die cast aluminium, flameproof to IIC (equivalent to NEC Cl I Div 2 gr B, C & D)
Cable Entry	: ½" NPT (F) / ¾" ET (F)
Connection	: Flanged/Screwed (1.¼" BSPT (M) Standard for top mounted)
Callibration	: At third party laboratory like VJTI
Repetability	: ± 2%
Temperature	: 80^{0}C Max.
Op. Pressure	: 10 kg/cm^2 Max.

Line Size	Flow (LPM) Min.	Max.
½"	4	20
¾"	8	40
1"	15	19
1½"	30	215
2"	40	360



FLOW

Orifice Plates & Assemblies

Orifice plates are most commonly used primary elements for flow measurement in pipelines based on the principle of measurement of 'differential pressure' created when an obstruction is placed in the fluid flow, due to increase in fluid velocity.

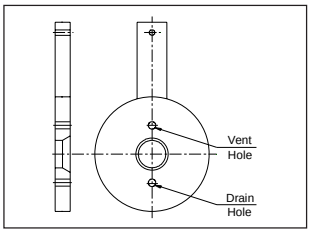
Orifice Plates cover a wide range of applications of fluid and operating conditions. They give an acceptable level of uncertainities at lowest cost and long life without regular maintenance.

We manufacture orifice plates, restriction orifice plates, with or without carrier ring, meter run assemblies, integral orifice plates to suit customer's requirements.

We have fully equipped integrated designing, manufacturing and testing facilities which are among the best in country. Over the years we have manufactured and supplied orifice plate assemblies to many prestigious projects in the domestic as well as international market.

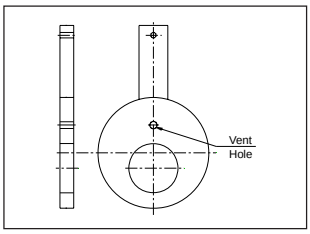
Orifice Plates

Types of orifice plates



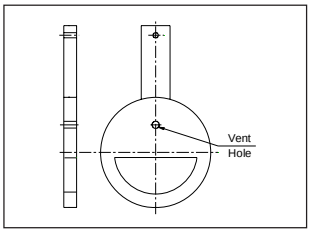
SQUARE EDGED CONCENTRIC

SQUARE EDGED CONCENTRIC : These are most commonly used for flow measurement . This has special features such as simple structure, high accuracy, and ease of installation & replacement. The orifice plates are correctly finished to the dimensions, surface roughness, and flatness to the applicable standard. These plates are recommended for clean liquids, gases & steam flow, when the Reynold number range from 10000 to 10^7.



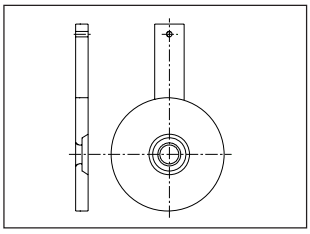
ECCENTRIC

ECCENTRIC : For liquids containing solid particles that are likely to sediment or for vapors likely to deposit water condensate, this orifice plate is used with its eccentric bore bottom flush with the bottom of the piping inside surface so that the sedimentation of such inclusions are avoided. Likewise, for gases or vapors, it may be installed with its eccentric bore top flush with the ID of the piping to avoid stay of gas or vapor in its vicinity.



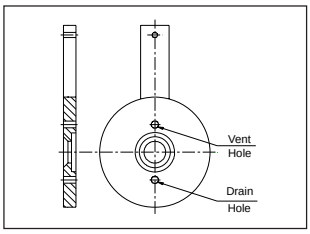
SEGMENTAL

SEGMENTAL : The bore of this orifice plate is a semicircle. These are used for measurements where solids are entrained in a gas or liquid flow stream.



QUADRANT EDGE

QUADRANT EDGE : The inlet edge of the bore of this orifice plate is rounded to a quarter circle. This orifice plate is principally used for measuring flow rates of low Reynolds number i.e. between 2000 to 10000



CONICAL ENTRANCE

CONICAL ENTRANCE : This orifice plate is suitable for viscous fluids Reynolds number is very low i.e. between 80 to 2000.

Orifice Plates & Assemblies

Specifications

Design : Conforms to ISA RP 3.2 , DIN 1952 , BS 1042, ISO-5167

Types : Square edge concentric, Quadrant edged, Conical entrance, Eccentric, Segmental

Plate material : SS304 , SS316 , SS316L as standard. Hastelloy-C , Monel , PP , PVC , PTFE coated , etc. can be given on request.

Orifice Bore : In accordance with ISO-5167, BS-1042, ASME MFC 3M, R.W.Miller, L.K.Spink, AGA-3

Tab Plate : In the same material as plate & is welded to orifice plate. Tab plate integral to the Orifice plate (i.e. without welding) can also be offered as a special case.

Vent / Drain : Vent or Drain holes are provided as per customer's requirement. Not drilled for orifice bores smaller than 25.4 mm

Flange Union : Weld neck, Slip on, Threaded, Socket welded with RF or RTJ facing Orifice flanges are in accordance with ANSI B16.36 with minimum flange rating of 300# for sizes up to 8" or male - female flanges in accordance with ANSI B16.5.

Pressure Tappings : Corner tappings are recommended for sizes upto 1 ½"; Flange taps from 2" to 16" ; D – D/2 taps for higher sizes.

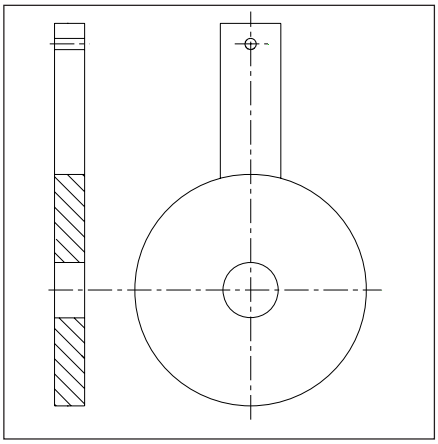
Gasket : CAF as per IS: 2712 Gr 0/1 , SS spiral wound + CAF , SS spiral wound + Grafoil, SS spiral wound + PTFE are normally supplied as per process requirement. Other materials available on request.

For RTJ flanges , the plate is fixed on the plate holder. The plate holder is in Soft Iron material & acts as a gasket .

Studs / Nuts : ASTM A193 Gr.B7/A-194 Gr.2H as standard, Other material on request.

Jack Screw : Carbon Steel (C1038 heat treated)

Restriction Orifice



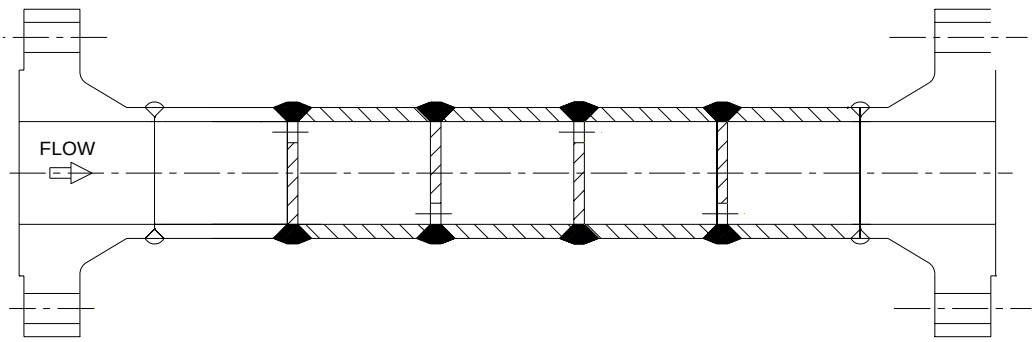
The restriction orifices are used for reducing fluid pressure and are designed somewhat different from the orifice plates that are used for measuring flow rates. They are designed to slip between the piping flanges.

While single restriction orifices are often sufficient to meet the requirements, there are situations where limitations arise due to process conditions making the single restriction orifices unacceptable. In such situations, use of multiple restriction in series is a better solution.

The foremost consideration for the case of multiple restriction is the pressure drop. This applies whether or not the fluid is liquid or vapor/gas. Higher pressure drop implies higher velocities resulting in vibration and noise problems.

The other consideration is not just about maximum permitted pressure drop & this is particularly for gas flow. If the process condition indicates that critical flow will occur with the use of single restriction plate, care should be exercised to avoid operating well beyond the critical pressure drop. Critical implies a pressure drop across the device exceeding 50 percent of the absolute upstream pressure at which point sonic velocity is reached.

Construction of Multistage Orifice Assembly comprises of multiple restriction orifice plates separated by a distance of one pipe diameter and welded with the pipes in between them. End connection is either suitable for butt welding or with end flanges.



Multiple Restriction Orifice Assembly

Orifice Plate Assemblies with RTJ Holder

Description

The Plate Holder Assembly is a combination of plate holder and an orifice plate designed for **ring tongue joint (RTJ)** flanges. The plate holder has a function of holding the orifice plate and also a function as a gasket to prevent leakage of the process fluid. The plate holder has a oval or octagonal ring for mounting between ring type joint flanges.This metallic sealing system is applicable to a fluid of high temperature and high pressure. The pressure tapping system normally is of the flange tap type.

Orifice plate is screwed to the plate holder. Generally the plate holder is of soft iron material. The Orifice plate is available in standard material such as SS316, SS304, SS316L , Monel, Hastelloy-C, etc. Other materials are available on request. The plate holder along with the orifice plate can be also machined from one piece.

CROSS SECTIONAL VIEW

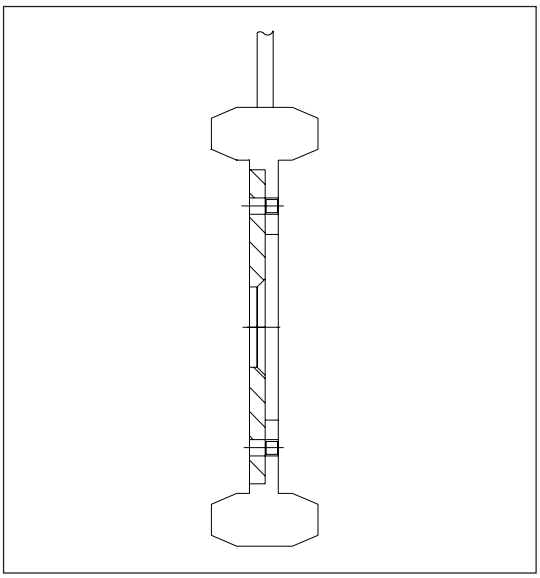


PLATE WITH PLATE HOLDER

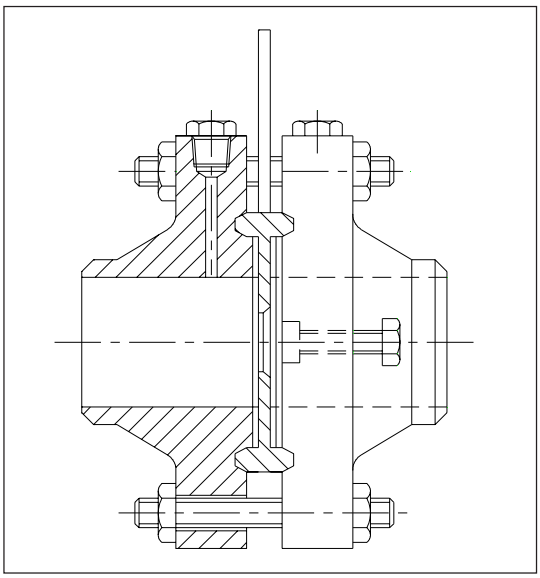
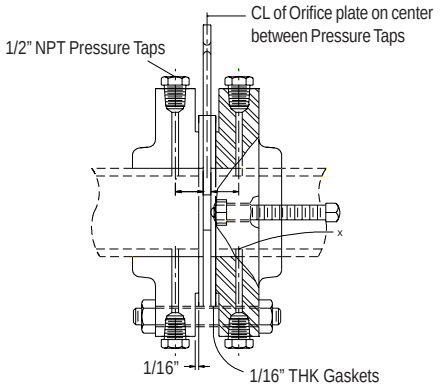


PLATE WITH PLATE HOLDER
MOUNTED IN BETWEEN RTJ FLANGES

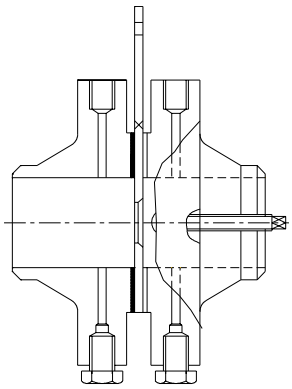
Orifice Plates & Assemblies

Typical assemblies



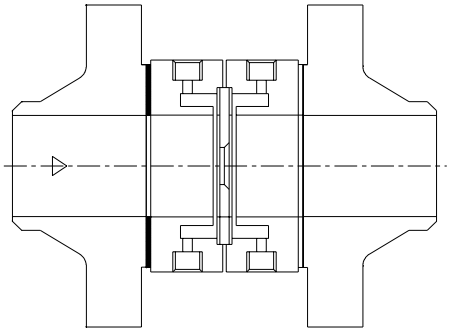
ORIFICE PLATE WITH SLIP ON FLANGE UNION

The slip on flange has a low hub because the pipe slips into the flange prior to welding. It is welded both from inside and out to provide sufficient strength and prevent leakage. The slip on flanges are bored slightly larger than the OD of the matching pipe



ORIFICE PLATE WITH WELD NECK FLANGE UNION

The weld neck flange is normally referred to as " high Hub" flange. It is designed to transfer stresses to the pipe, thereby reducing high stress concentrations at the base of the flange. The pressure tappings are provided through the flangewhich arte at a distance of 1" from the face of the plate (shown in the drawing attached).



ORIFICE PLATE WITH MALE-FEMALE CARRIER RING AND WELD NECK FLANGED UNION

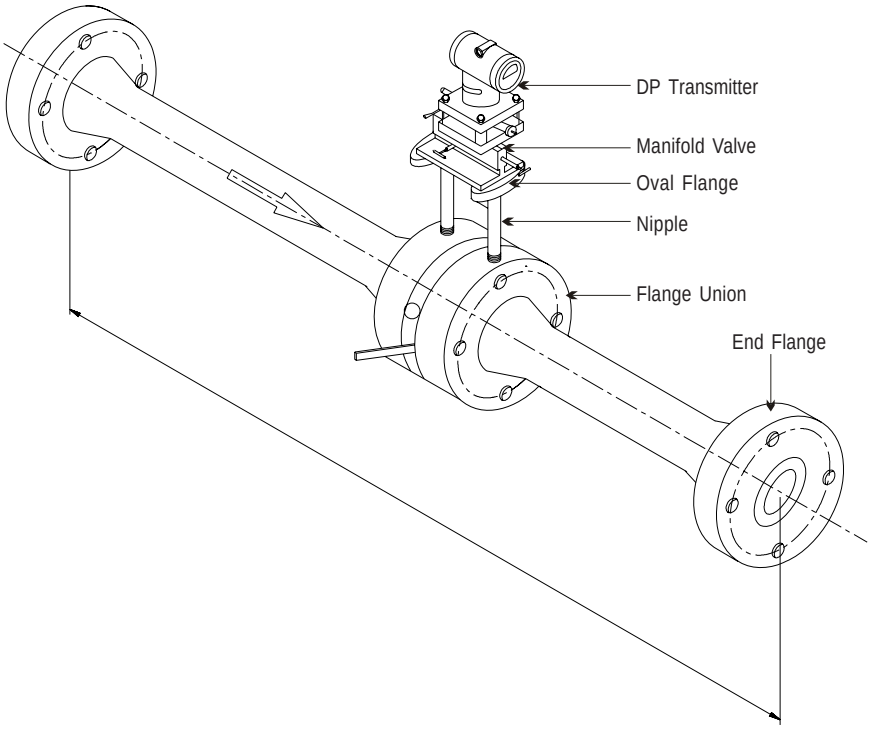
The construction is similar to the above except male-female carrier ring is provided to facilitate pressure tapping through it (corner tapping). This construction is generally used for lower line sizes (normally less than 2"). Carrier ring machined from single block is also offered in place of male-female carrier. For better accuracy, honed meter run assemblies are recommended which employ upstream and downstream straight lengths. The end connection in such case can be plain (suitable for welding) or flanged.

Integral Flow Orifice Assembly

Integral Flow Orifice Assembly is used when Differential Pressure Transmitter has to be directly mounted on the orifice assembly. This eliminates cost of installation of Differential Pressure Transmitter with impulse piping up to the orifice assembly. The transmitter is mounted on the orifice assembly through a 3-Valve H-type manifold. Available with line sizes of 2" & below. However due to process temperature limits of the transmitter , this assembly cannot be used for process temperatures above 120 Degrees Centigrade.

The assembly consists of a orifice plate between two integral blocks having corner taps. Generally meter run pipe is recommended with upstream length of 750mm and downstream length of 250mm.

The pipes are welded to the blocks with end flanges.



Integral Orifice Assembly with flange union, manifold valve, DP transmitter & end flanges

Flow Nozzles

Salient features & benefits

- Widely used for high pressure & high temperature steam flow
- Useful for flow measurement at high velocities
- Rounded inlet not subject to wear or damage, extending product life
- Better sweep-through effect for debris and liquids, eliminate damming effect
- Lower susceptibility to erosion
- Extended product life with no moving parts

GENERAL Flow Nozzle is used typically for high-velocity , non-viscous , erosive flow. They are suitable for determining the flow rates of fluids at high temperature and high pressure. **GENERAL** Flow Nozzles are erosion-resistant, consistently accurate and virtually maintenance-free. They perform a wide variety of applications that include air, water, steam, gas, chemical substances and high temperature applications. The rounded design provides a more effective sweep-through of particles in the flow stream, which extends product life by reducing wear and potential damage. Flow Nozzles are manufactured in strict accordance with ASME MFC-3M , BS-1042 and ISO-5167 standards. For critical measurement applications, wet calibration at reputed flow laboratories can be offered.

Flow Nozzles have a smooth elliptical inlet leading to a throat section with a sharp outlet. Restriction in the fluid flow causes a pressure drop , which relates to the flow rate by applying Bernoulli's equation. The smooth inlet of the flow nozzle results in a higher coefficient of discharge than most other differential meters. This higher efficiency means greater flow capacity when compared to most other differential meters of the same size.

There are three types of Flow Nozzles

- ISA 1932, with corner taps
- ASME long radius, low beta ratio ($0.20 \leq \beta \leq 0.5$), with radius taps (D & D/2)
- ASME long radius, high beta ratio ($0.45 \leq \beta \leq 0.8$), with radius taps (D & D/2)

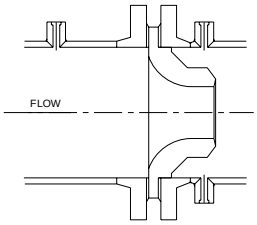
ASME long radius , low beta ratio Nozzle with throat taps is used in steam turbine performance test as per ASME PTC-6 code.

ISA-1932 nozzle can be mounted with carrier ring or in between flanges with corner taps.

Long radius nozzle are normally with weld-in branch pipe with radius taps.
Can be also mounted in between flanges.

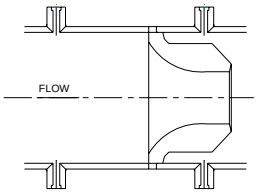
To avoid welding of dissimilar metals , nozzles are also installed in the pipe with holding ring.

Flow Nozzles



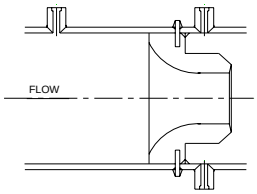
FLANGED TYPE FLOW NOZZLE

This type flow nozzle are the type most commonly used for insertion between pipe flanges. This type of nozzle is designed for pipe wall taps whose locations are determined by Beta ratio and pipe.



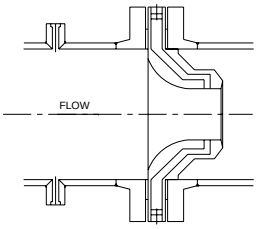
WELD-IN TYPE FLOW NOZZLE

This type of nozzle has a machined tongue around its greatest diameter designed to fit between beveled ends of both inlet and outlet pipe section. The pipe sections, with the nozzle in place are firmly clamped and welded. The weld-in flow nozzle is used where flanges are not applicable such as high temperature and pressure applications in power plant installations, feed water,etc.



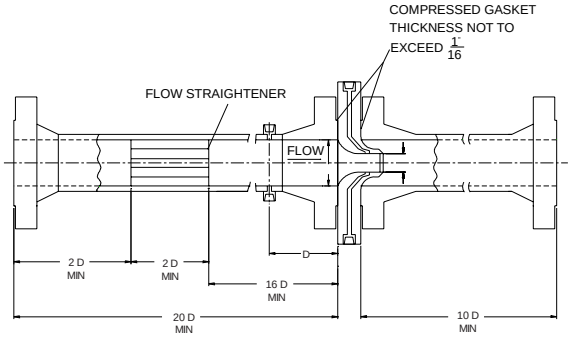
HOLDING RING TYPE FLOW NOZZLE

This type of nozzle is designed for installation in a pipe without flanges. The flow nozzle is installed with the help of holding ring and locating pins which are made of same material as that of pipe thereby eliminating welding of dissimilar materials.



FLANGED TYPE THROAT-TAP FLOW NOZZLE

Flange type throat-tap flow nozzle is used when extreme accuracy and repeatability required. In most cases this type of nozzle is purchased with a complete flow section and laboratory flow calibrated. This type of nozzles are manufactured in strict accordance with ASME performance test code PTC-6.



FLOW NOZZLE ASSEMBLY IN ACCORDANCE WITH ASME PTC-6

Venturi Tubes

Salient features & benefits

- Can be used for slurries and dirty fluids
- Short upstream piping required
- Low installation costs
- Lower susceptibility to erosion
- High pressure recovery
- Low permanent pressure loss
- Extended product life with no moving parts
- Vertical or horizontal installation

GENERAL Venturi Tubes serve users with accurate measurement of non-viscous fluids in clean & dirty streams. Venturi Tubes are virtually maintenance-free and erosion-resistant. Venturi tubes are manufactured in strict accordance with ASME MFC-3M , BS-1042 and ISO-5167 standards. These measurement standards provide users with +/-1.0% uncertainty of discharge coefficient. For critical measurement applications, wet calibration at reputed flow laboratories can be offered.

Venturi Tube is a low pressure drop metering device . It offers constant accuracy, low susceptibility to erosion, high-pressure recovery, and installation at any angle from horizontal to vertical. Erosion-resistant and virtually maintenance-free, this measurement product performs in a wide variety of applications that include air, water, vapor, steam, gas, chemical substances, sludge and slurry applications.

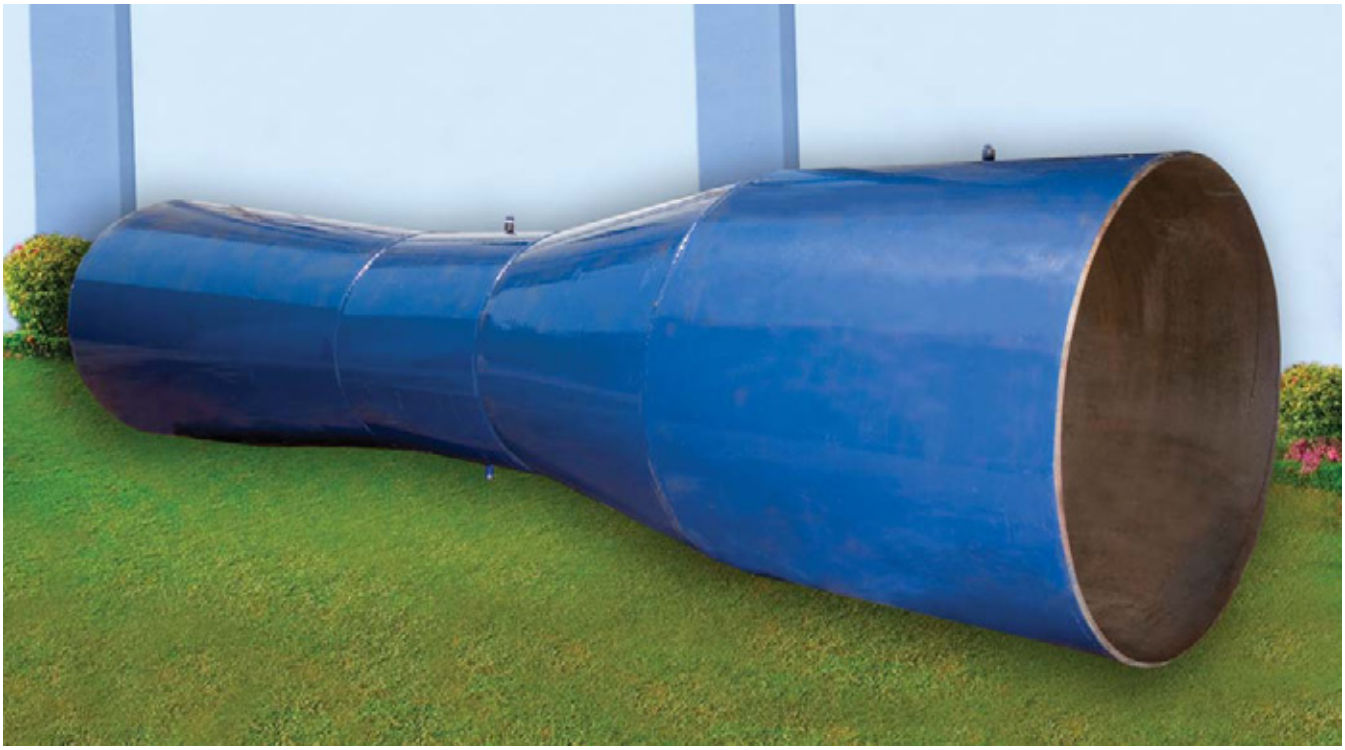
The classical Venturi Tube is made up of a entrance cylinder of the same diameter as the pipe connected to a conical convergent section , a cylindrical throat , and a conical divergent section. The convergent angle is 21 degrees and the divergent angle is between 7 and 15 degrees. The high pressure taps are located on the inlet convergent section and the low pressure taps are located at the middle of the throat section.
A piezometer ring is sometimes used for differential pressure measurement. This consists of several holes in the plane of the tap locations. Each set of holes is connected together in an annular ring to give an average pressure.

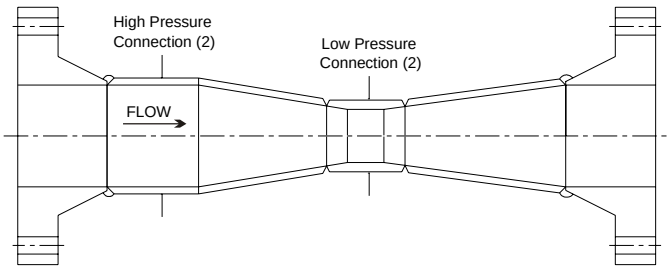
Up to 8 inches , the entire venturi is machined from a single solid bar-stock . Above 8 inches the venturi is fabricated from sheet. Rectangular type venturi used in ductwork is also fabricated from sheet.

Many times the piping geometry does not allow full length of the Venturi Tube. In such case, 'Truncated' classical Venturi Tube can be offered wherein the divergent section can be truncated down by about 35% of its length without greatly modifying the pressure loss in the device. The outer diameter of the divergent section is less than the inside diameter D of the pipe.

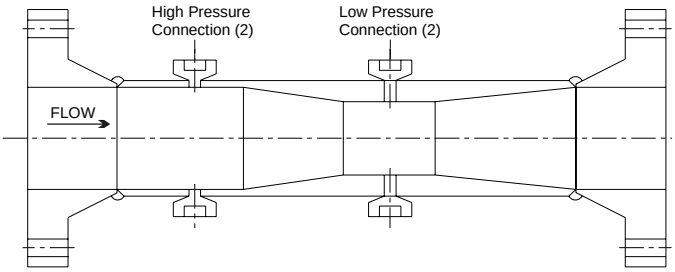
The throat restricts the fluid flow resulting in a pressure drop. This differential pressure relates to the flow rate by applying Bernoulli's equation. The angled inlet and outlet cones help control the pressure recovery, making the Venturi the most efficient of all the differential meters available. This results in lower permanent pressure loss and greater capacity than other differential meters of the same size. Permanent pressure loss is generally 5% to 20% of the differential pressure, depending on the bore size selected.

Venturi Tubes

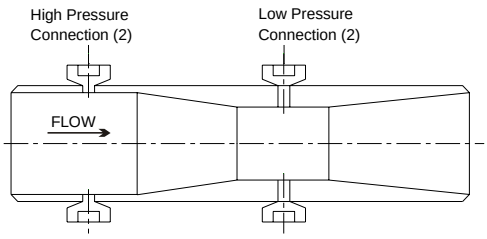




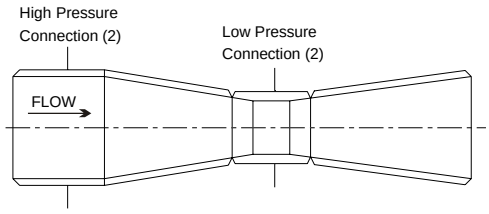
Fabricated with Flanged ends



Machined with Flanged ends



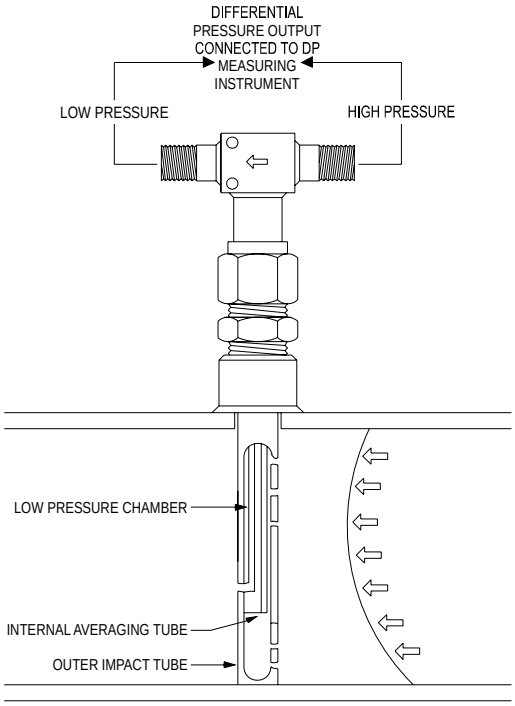
Machined with Weld ends



Fabricated with Weld ends

Averaging Pitot Tube

Averaging Pitot tube is a multiport self averaging flow meter. It is a primary element for flow measurement of gas, liquid, vapour in pipelines and ducts based on the principle of measurement of 'differential pressure'.



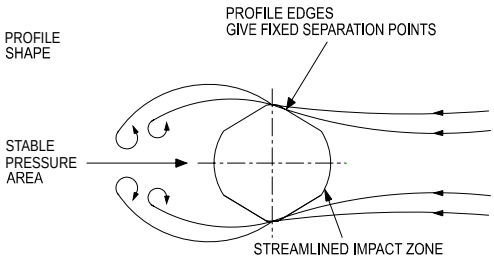
Features :

- Unique profile shape enables high flow rate turn down
- Dual averaging for better accuracy
- Suitable for Liquid ,gas and steam flow measurement
- Repeatability of measurement ± 0.1 %
- Short upstream and downstream straight pipe lengths
- Long term accuracy unaffected by wear.

Averaging pitot tubes are generally used for large line sizes or ducts where other primary devices become relatively expensive.

Averaging Pitot tube comprises of following components:

- **Outer impact tube -** one piece construction
- **Internal averaging tube**
- **Low pressure chamber**
- **Head**



The outer impact tube has a number of pressure sensing holes facing upstream which are positioned at equal annular points in accordance with a loglinear distribution.

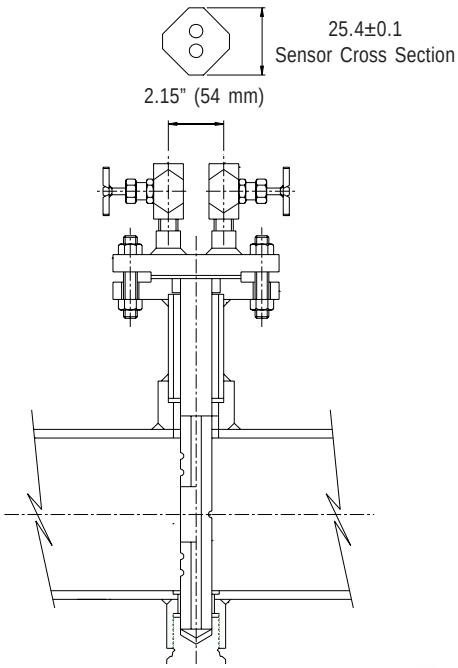
The 'total pressures' developed at each upstream hole by the impact of the flowing medium are firstly averaged within the outer impact tube and then to a second order (and more accurately) averaged within the internal averaging tube.

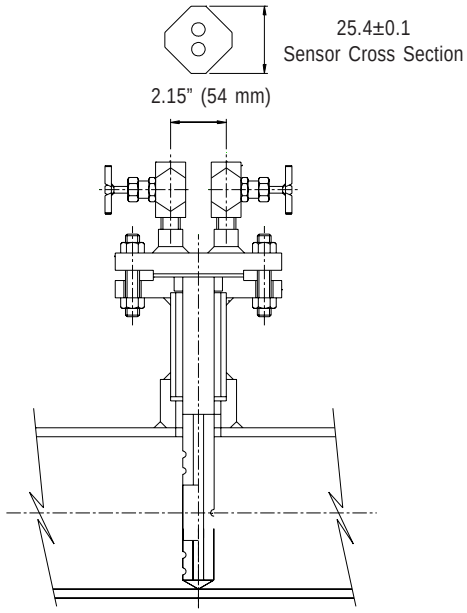
This pressure is represented at the head as the high pressure component of the DP output. The low pressure component is generated from a single sensing hole located on the downstream side of the outer impact tube.

Stable flow coefficient which is the result of typical diamond shape, makes it a reliable flow measuring primary flow element.

Simple and inexpensive, long term accuracy within acceptable limits over wide range of flow, low permanent pressure loss & minimum operating cost makes it ideal choice of any design engineer.

Averaging Pitot Tube





Flow Element Assemblies

Bore Calculation Input Data

Name of the fluid & State	:	
Operating temperature / Ambient temperature	:	
Operating Pressure (abs)	:	
Viscosity (Cp)	:	
Maximum flow / Normal flow	:	
Differential range	:	
Base sp. gravity / density	:	
(only for gas)		
Operating sp. gravity / density	:	
(for gas & liquid)		
Specific heat ratio (Cp/Cv)	:	
Pipe size & schedule	:	
Pipe material	:	
Tap type	:	
Plate material	:	
Vent / Drain	:	Yes / No

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Consultants

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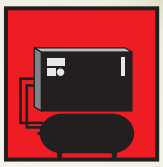
S N C Lavalin Engineering India Pvt. Ltd.
Tata Consulting Engineers
Technimont ICB Ltd.
Toyo Engineering (I) Ltd.
Triuene Project
Uhde India Ltd.

Instrument Manufacturers

ABB Ltd.
Emerson India Ltd.
Endress + Hauser
Forbes Marshall
Honeywell Automation Ltd.
Invensys
Siemens Ltd.
Yokogawa India Ltd.

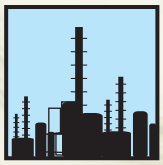


Original Equipment Manufacturers

Alfa-Laval (India) Ltd.
Bharat Heavy Electricals Ltd.
Bharat Heavy Plates & Vessels Ltd.
Daelim Engineering
Greensol Power Systems Private Limited.
Hindustan Dorr-Oliver Ltd.
Hyundai Heavy Engineering
Ion Exchange (India) Ltd.
Kirloskar Pneumatic Co. Ltd.
Larsen & Toubro Ltd.
Mazgaon Dock Ltd.
Neela Group of Companies
Nishotech Engineers Pvt. Ltd.
Pall Pharmalab
Praj Industries Ltd.
T. D. Power Systems Private Limited.
Thermax Ltd.
Thermax Babcock & Wilcox Ltd.
Triveni Engineering

Pharmaceutical

Cadila Healthcare Ltd.
Ciba Specialty Chemicals (India) Ltd.
Core Parental
Johnson & Johnson Ltd.
Max - GB Ltd.
Orchid Chemicals & Pharmaceuticals Ltd.
Pfizer Ltd.
Ranbaxy Laboratories Ltd.
Sandoz (India) Ltd.
Torrent Pharmaceuticals Ltd.
Unichem Laboratories
Wockhardt Ltd.



Oil Exploration / Refineries / Petrochemicals

Bharat Petroleum Corporation Ltd.
Bongaigaon Refinery & Petrochemicals Ltd.
Chennai Petroleum Corporation Ltd.
Cochin Refineries Ltd.
Deepak Fertilisers & Petrochemicals Corpn. Ltd.
Gas Authority of India Ltd.
Hindustan Petroleum Corporation Ltd.
Indian Oil Corporation Ltd.
Indian Petrochemicals Corporation Ltd.
Manali Petrochemical Ltd.
Mysore Petrochemicals Ltd.
Numaligarh Refinery
Oil India Ltd.
Oil & Natural Gas Corporation India Ltd.
SPIC - SMO
Reliance Industries Ltd.
The Andhra Petrochemicals Limited

Chemical

Alkyl Amines Chemicals Ltd.
DCW Ltd.
Gharda Chemicals Ltd.
Hindustan Lever Ltd.
Hindustan Organic Chemicals Ltd.
India Glycols Ltd.
Lubrizol India Ltd.
Maharashtra Aldehydes & Chemicals Ltd.
National Organic Chemicals Inds. Ltd.
National Peroxide Ltd.
Punjab Alkalies & Chemicals Ltd.
United Phosphorus Ltd.

Some of our valued customers

Pulp & Paper

Andhra Pradesh Paper Mills Ltd.
Ballarpur Industries Ltd.
ITC Bhadrachalam Paperboards Ltd.
Mysore Paper Mills Ltd.
Orient Paper Mills.
Tamilnadu Newsprint and Papers Ltd.

Power Generation

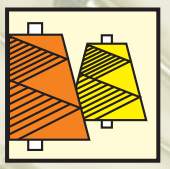
Ahmedabad Electricity Co. Ltd.
A. P. State Electricity Board
Asea Brown Boveri
Damodar Valley Corporation
Gujarat Industries Power Co. Ltd.
Haryana State Electricity Board
Madhya Pradesh Electricity Board
Maharashtra State Electricity Board
National Thermal Power Corpn. Ltd.
Punjab State Electricity Board
Reliance Energy Ltd.
Siemens Ltd.
T. N. Electricity Board
U. P. State Electricity Board

Metallurgy

Bharat Aluminium Co. Ltd.
Bhushan steel
Birla Copper
Essar Steel
Godavari Power & Ispat Ltd.
Hindalco Ltd.
Hindustan Copper Ltd.
Hindustan Zinc Ltd.
Ispat Industries Ltd.
Jindal Vijayanagar Steel Ltd.
Kerala Minerals & Metals Ltd.
Kudremukh Iron Ore Co. Ltd.
NALCO
Neo Metalliks Ltd.
Neyveli Lignite Corpn. Ltd.
Orissa Sponge Iron Ltd.
Steel Authority of India Ltd.
Sunflag Iron & Steel Ltd.
Tata Iron & Steel Co. Ltd.
Tata Metaliks Limited.
Sesa Goa Limited.

Cement

Associated Cement Companies Ltd.
Grasim Cement
Gujarat Ambuja Cement Ltd.
Manikgarh Cement
Rajashree Cement



Synthetic Fibre

Apollo Fibers
Bombay Dyeing & Manufacturing Co. Ltd.
Century Enka Ltd.
Central India Polyesters Ltd.
Garden Silk Mills Ltd.
Indo-Rama Synthetics India Ltd.
JCT Ltd.
J.K. Synthetics Ltd.
Parasrampuria Synthetics Ltd.
Raymond Synthetics Ltd.
SRF Ltd.

Fertiliser

Chambal Fertilisers & Chemicals Ltd.
Coromondal Fertilisers Ltd.
Deepak Fertilisers & Petrochemicals Corpn. Ltd.
Godavari Fertilisers & Chemicals Ltd.
Gujarat Narmada Valley Fertiliser Co. Ltd.
Indian Farmers Fertilisers Co-op. Ltd.
Indo-Gulf Fertilisers & Chemicals Corpn. Ltd.
Krishak Bharati Co-op Ltd.
Madras Fertilizers Ltd.
National Fertilizers Ltd.
Oswal Chemicals & Fertilizers Ltd.
Rashtriya Chemicals & Fertilizers Ltd.
Tata Chemicals Ltd.
The Fertilisers & Chemicals Travancore Ltd.
Zuari Agro Chemicals Ltd.

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General **INSTRUMENTS CONSORTIUM**
Head Office: 194/195, Gopi Tank Road, Mahim, Mumbai - 400016, India.
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