Acez Sensing
Beyond Sensing

THERMOCOUPLE & RESISTANCE THERMOMETER SENSORS & PROBES

Acez Sensing Pte Ltd
Blk 28E Penjuru Close #01-04 Singapore 609133
Tel: (65) 6265 1588 Fax: (65) 6264 3992
Email: sales@acezsensing.com
Website: www.acezsensing.com
Ecommerce: www.acezonline.com

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CERTIFICATION INTERNATIONAL ISO 9001:2008 Cert No: CU10952

UKAS MANAGEMENT SYSTEMS 063

When you have a technical problem or question about thermocouples, RTDs, or temperature measurement, give us a call. You'll speak with an experienced technician with a wide knowledge of the field. In addition to a complete line of temperature sensors, we build more "specials" and service a greater variety of industries than any of the thermocouple manufacturer. In fact, chances are excellent as we have already solved a problem similar to yours. We'll be happy to tell you about our experience and discuss possible solutions without any obligations.

Many larger thermocouple manufacturers would rather not be bothered with "specials". They want large volume orders. So 'specials" go to the bottom of the pile and delivery and communication with the customer are usually very poor.

Of course, we like large orders as much as the next company. But what sets us apart is our enthusiasm about solving problems for our customers, big and small. You can depend on our temperature sensors to provide the temperature measurement and control solutions you need.

Acez Sensing thermocouples and thermocouple wire meet accuracy standards as defined by the many technical societies and manufacturers.

Selected grade thermocouple wire can be supplied in instances where special or standard grade material does not provide the accuracy needed at specific temperatures. The availability of this grade depends on your specific requirements and stock levels.

Calibration of thermocouples or thermocouple wire is a laboratory test performed on a specific product or lot to determine its departure from a defined temperature - E.M.F. relationship. ASTM E 230 (ITS 90) describes the relationship for the various thermocouple types, portions of which can be found in Acez Sensing's Technical Reference Information booklet, available on request. Calibrations are conducted following the general guidelines of ASTM E 220. Test results are reported in certificate form indicating test temperatures, ˚F or ˚C corrections and standards traceable data.

Each product tested can be tagged with a test number, date and correction data. Pricing for calibration and testing is based on tests selected, quantity to be tested, and number of test temperatues. Test temperatures within the range of 0˚C (32˚F) to 1371˚C (2500˚F) are available at competitive pricing. Sub-zero checking and high temperature (above 1371˚C) are available on special quotation only.

Acez sensing is using mineral Insulated thermocouple. It is a departure from the traditional assembly of tubes, wires and insulators. It has a mineral Insulation with thermal response, greater flexibility, size for size, and is longer lasting than no replacement parts and has improved traditional types.

THERMOCOUPLE

Thermocouples essentially comprise a thermoelement (a junction of two specified dissimilar metals) and an appropriate two wire extension lead. A thermocouple operates on the basis of the junction located in the process producing a small voltage which increases with temperature. It does so on a reasonably stable and repeatable basis.

Measuring Junction Typical Response Time

Sheath OD	Measuring Junction	Response Time*
Ø 063 (1/16")	Grounded	.09
	Ungrounded	.28
Ø .125 (1/8")	Grounded	.34
	Ungrounded	1.6
Ø .188 (3/16")	Grounded	.7
	Ungrounded	2.6
Ø .250 (1/4")	Grounded	1.7
	Ungrounded	4.5
	Exposed loop	.09

*Sensors not in thermowell or protection tubes

DIFFERENT THERMOCOUPLE TYPES

Calibration Selection Guide

Calibration Type	Conductors Positive	Conductors Negative	Temperature Range °C	Limits of Error Standard	Limits of Error Special	Extension Wire Jacket Color	Color Coding (ANSI STD)
J	Iron (Magnetic)	Constantan (Non-magnetic)	0°C to 750°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%	Black	White+ Red-
K	Chromel (Non-magnetic)	Alumel (Magnetic)	-200°C to 0°C 0°C to 1250°C	±2.2°C or ±2% ±2.2°C or ±0.75%	- ±1.1°C or ±0.4%	Yellow	Yellow+ Red-
T	Copper (Non-Magnetic)	Constantan (Non-magnetic)	-200°C to 0°C 0°C to 350°C	±1°C or ±.1.5% ±1°C or ±0.75%	- ±0.5°C or ±0.4%	Blue	Blue+ Red-
E	Chromel (Non-magnetic)	Constantan (Non-magnetic)	-200°C to 0°C 0°C to 900°C	±1.7°C or ±1% ±1.7°C or ±0.5%	- ±1°C or ±0.4%	Purple	Purple+ Red-
N	Nicrosil (Non-magnetic)	Nisil (Non-magnetic)	0°C to 1260°C	±3/4%	±3/8%	Orange	Orange+ Red-
R	Platinum 13% Rhodium (Non-magnetic)	Pure Platinum (Non-magnetic)	0°C to 1450°C	±1.5°C or ±0.25%	N/A N/A	Green	Black+ Red-
S	Platinum 10% Rhodium (Non-magnetic)	Pure Platinum (Non-magnetic)	0°C to 1450°C	±1.5°C or ±0.25%	N/A N/A	Green	Black+ Red-
B	Platinum 30% Rhodium (Non-magnetic)	Platinum 6% Rhodium (Non-magnetic)	870°C to 1700°C	±0.5%	N/A N/A	Gray	Gray+ Red-

Calibration Notes

J- Iron Constantan - Reducing atmosphere recommended. Iron oxidizes rapidly at elevated temperatures. A larger gauge size will extend the life of the iron wire.
T- Copper Constantan - Can be used in oxidizing or reducing atmospheres. Rust and corrosion resistant. Best for sub-zero temperatures.
K- Chromel Alumel - Oxidizing atmosphere recommended. Most commonly used base metal thermocouple. Cycling at high temperatures can cause calibration drift. Not recommended in sulfur environments.
E- Chromel Constantan - Oxidizing atmosphere recommended. Highest EMF output of thermocouples commonly used. Good corrosion resistance
S, R- Use in oxidizing or inert atmospheres. Not recommended for reducing atmospheres. Granular precipitation from metal protection tubes can cause failure or calibration drift.
N- Use in oxidizing, reducing and inert atmospheres. Not recommended in sulfur environments. Improved resistance to drift and better stability over K and E at elevated temperatures.

Thermocouple Type	Sensivity
Type J	55μV / °C
Type K	41μV / °C
Type T	42μV / °C
Type E	68μV / °C
Type N	39μV / °C
Type R	6 -14μV / °C
Type S	6 -12μV / °C
Type B	6 -14μV / °C

THERMOCOUPLE CONSTRUCTION

Many alternative configurations exist for thermocouple assemblies; basically two general types of construction describe most industrial thermocouples – fabricated and mineral insulated.

Fabricated Thermocouples are assembled using insulated thermocouples wires, sheathing (usually stainless steel) and some form of termination (extension lead, connecting head or connector for example).

Fig 10: Fabricated Thermocouple

Insulated, Twisted Pair Thermocouple inside Stainless Steel Sheath.

Measuring junction earthed in this example.

Mineral Insulated Thermocouples consist of thermocouple wire embedded in a densely packed refractory oxide powder insulant all enclosed in a seamless, drawn metal sheath (usually stainless steel).

Fig 11: Mineral Insulated Thermocouple

Thermocouple wire insulated by compressed mineral oxide powder.

Insulated measuring junction shown in this example.

Effectively, the thermoelement, insulation and sheath are combined as a flexible cable which is available in different diameters, usually from 0.5mm to 8mm.

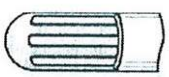
At one end, the cores and sheath are welded to form a "hot" junction. At the other end, the thermocouple is connected to a "transition" of extension wires, connecting head or connector.

Advantages of Mineral Insulated Thermocouples are:

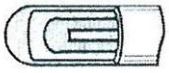
a) Small overall dimension and high flexibility which enable temperature measurement in locations with poor accessibility.
b) Good mechanical strength.
c) Protection of the thermoelement wires against oxidation, corrosion and contamination.
d) Fast thermal response.

The mineral oxides used for insulation are highly hygroscopic and open ended cable must be effectively sealed (usually with epoxy resins) to prevent moisture take-up. A carefully prepared mineral insulated thermocouple will normally have a high value of insulation resistance (many hundreds of MOhms).

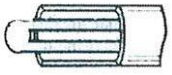
MEASURING JUNCTION



Grounded Junction - The sheath and the thermocouple wires are welded together, forming a completely closed measuring junction. Recommended in the presence of liquids, moisture, gas or high pressure. The thermocouple is protected from the environment. Response time approaches that of an exposed juntion.



Ungrounded Junction - The thermocouple junction is insulated from the welded measuring junction closure. Recommended for applications where stray EMFs could affect the instrument reading and for frequent/rapid temperature cycling. Response time is slower than a grounded junction.



Exposed Junction - The thermocouple junction is not protected by a welded closure. Insulation is sealed against liquid or gas penetration. Provides fastest response time. Not recommended for applications that are corrosive.

Thermocouple Construction Materials

The most basic thermocouple construction is the wire type consisting of two dissimilar metals homogeneously joined at one end to form the measuring junction. All wire-type thermocouples have an exposed junction. While wire-type thermocouples offer good response time, ruggedness, and high temperature use, they are susceptible to environmental conditions and therefore must be protected.

Mineral insulated thermocouples overcome the disadvantages of wire type construction by imbedding the thermocouple wires in ceramic insulation and protecting them with a metallic sheath. The mineral insulated cable (MI cable) design is based on small mass and high thermal conductivity which in turn promotes rapid heat transfer from the heat source to the measuring junction.

The sheaths are impervious to most liquids and gases and withstand high external pressures. The seamless design protects against moisture or other contaminants attacking the thermocouple elements. Since the only materials used to make the MI cable are the thermocouple conductors, the mineral oxide insulation and the metallic sheath, the cables are inherently fireproof thus providing the safest temperature measuring system.

Mineral Insulated Cable

M.I. cable is designed to meet the following specifications:

Sheath OD & Wall Thickness: Per ASTME-585
Accuracy: Per ASTME-230 (1993) & IEC 584-2 : 1982

Insulation Resistance @ Room Temperature: Per ASTME-585
Formability : Per ASTME-585 (Can be formed around a mandrel equal to twice the outside diameter without sheath rupture or loss of IR.)
Fabrication: The cable can be welded, brazed or soldered without changing IR. (Care should be taken with smaller diameter sheaths)

Sheath Material

The table below shows just some of the many different materials which can be used to protect the mineral insulated thermocouple. Sheath materials used vary from standard stainless alloys like 304, 310, 316, 321, 347, 446 to the slightly more exotic alloy 600 or Hasteloy®.

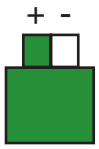
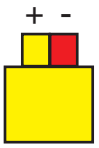
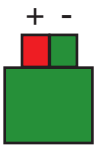
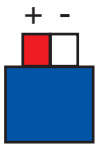
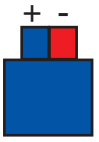
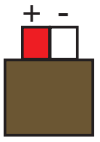
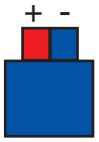
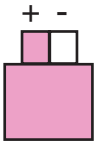
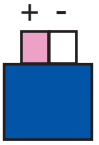
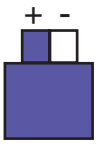
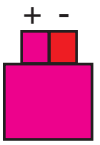
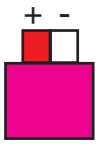
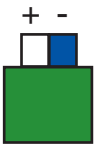
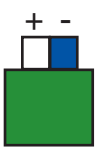
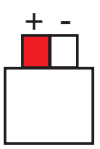
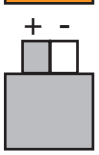
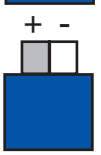
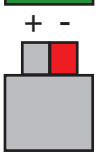
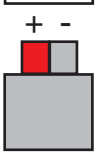
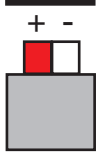
These sheaths are selected based on the rigors of the application with corrosion and temperature being the leading factors in sheath selection. The atmospheric environmental parameters are oxidizing, reducing, neutral, and vacuum. For example, 304 Stainless Steel can be used in each type of atmosphere with a maximum operating temperature of 1650°F.

Sheath Material

Material	Melting Point °F	Max. Temp. in Air	Recommended OPR ATM *	Recommended Continuous Max. Temp. °F
304SS	2560	1920	ORNV	1650
310SS	2560	1960	ORNV	2100
316SS	2280	1760	ORNV	1650
321 SS	2580	1500	ORNV	1600
347SS	2600	1680	ORNV	1600
Inconel Alloy 600	2550	2000	ONV(c)	2100
Copper	1980	600	ORNV (b)	600
Aluminum	1220	800	ORNV	700
Platinum	3216	3000	ON(c)	3050
Molybdenum	4750	1000	VNR	4000
Tantalum	5440	750	V	4500
Titanium	3300	600	VN	2000

Key: O — Oxidizing
R — Reducing
N — Neutral
V — Vacuum
(b) — Scales readily in oxidizing atmosphere
(c) — Sensitive to sulphur corrosion

Thermocouple Extension and Compensating Cables

Thermocouple Conductor Combination Type	International Color Code To IEC 584.3:1989 BS 4937 Part 30: 1993 (soon to be replaced by BS EN 60584.3)	International Color Code To IEC 584.3.1989 BS 4937 Part 30: 1993 (soon to be replaced by BS EN 60584.3) For intrinsically safe circuits	Redundant national colour coding for insulation of thermocouple extension and compensating cable			
			British To BS 1843	American To ANSI/MC96.1	German To DIN 43714	Japanese To JIS C 1610-1981
K						
T						
J						
N						
E						
R						
S						
B						

Extension Cables- Extension cables are manufactured from conductors having the same nominal compositions as those of the corresponding thermocouple. They are designated by a letter X following the designation of the thermocouple, for example "JX" Compensating Cables- Compensating cables are manufactured from conductors having a composition different from the corresponding thermocouple. They are designated by a letter "C" following the designation of the thermocouple, for example "KC" Different alloys maybe used for the same thermocouple type and are distinguished by additional letters, for example, "KCA" and "KCB"

RESISTANCE TEMPERATURE DETECTOR

The temperature scale which is accepted world-wide is called the International Temperature Scale of 1990 (ITS-90) and is the best attempt to reconcile the laws of thermodynamics with the practical world of temperature measurement.

Over the temperature range -200 °C to +850 °C the internationally accepted working standard is the Platinum Resistance Thermometer (PRT).

A consideration of the electric conduction in pure metals, alloys and semiconductors shows that the conduction mechanism is very complex. The basis of our present knowledge is the idea that the free electrons travel through the metal as plane waves modified by a function having the periodicity of the lattice. This disposition is too brief to explain fully the mechanisms, however, the theory suggests that a wire wound platinum resistance thermometer will follow a quadratic of the type RT = Ro (1+At+Bt2) for a wide range of temperature above ambient.

Usefully, A = Alpha (1 + Delpha/100 °C)

B = 10-4 Alpha Delta °C2

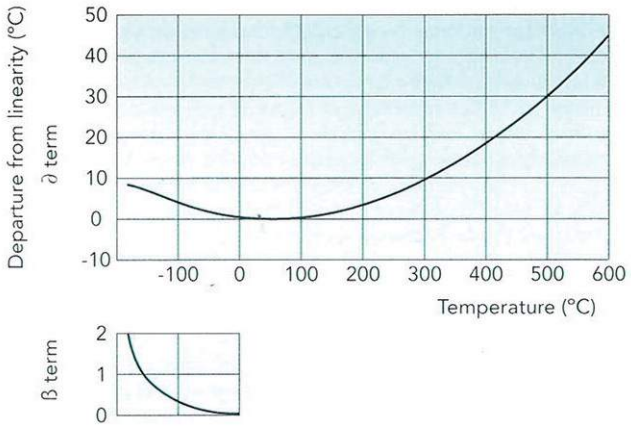
Alpha and Delta are characteristic of each thermometer showing respectively the mean slope of the resistance/ temperature curve between 0 °C and 100 °C, and the departure from linearity in the same range.

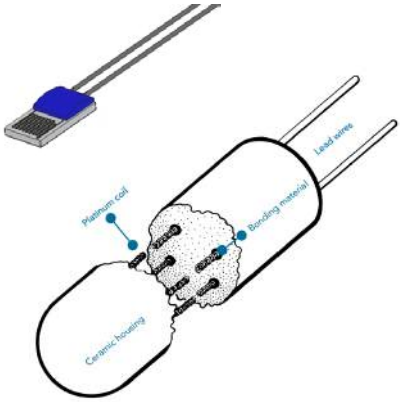
Alpha is a good indication of purity, and the state of anneal of the thermometer.

Delta depends upon the thermal expansion and the density of states curve near the fermi energy.

Both these quantities depend upon the purity of the wire, and indicate that Delta and Alpha are related. For temperatures below 0 °C, departure from linearity becomes too great for a quadratic equation and so a further term 13 was added in 1925, which was updated in 1968 to a 29-term polynomial.

The table below shows that departure from linearity of a platinum thermometer over temperature range -200 °C to +600 °C.





Industrial PRT are constructed with an alloy comprising of pure platinum alloyed with other platinum group metals to reduce the alpha value to the IEC Publication of 751, 1995 value of 0.003850 or of pure platinum having a alpha value of 0.003916 and above.

Wire wound PRT manufacture use ceramic materials of a very high purity. The processing of the wire into its high purity alumina ceramic is achieved without contamination of the platinum. Special annealing and and tailor design of the vibration/stability properties of the PRT now ensures accuracies and stabilities verging on those achieved by standard PRT's.

THICK FILM, the spreading of a glass/platinum paste through a silk screen onto a substance.

THIN FILM, the evaporation of metal or alloy via a vacuum onto a substrate, usually alumina.

TOLERANCES

Tolerance values of resistance thermometers are classified as follows:

Tolerance class	Tolerance (O°C)	Tolerance (t°C)
A	± 0.15	0.15 + 0.002 (t)
B	± 0.30	0.3 + 0.005 (t)
1/3 DIN	± 0.10	1/3 [0.3 + 0.005 (t)]
1/5 DIN	± 0.06	1/5 [0.3 + 0.005 (t)]
1/10 DIN	± 0.03	1/10 [0.3 + 0.005 (t)]

*(t) = modules of temperature in degrees Celcius without regard to sign.

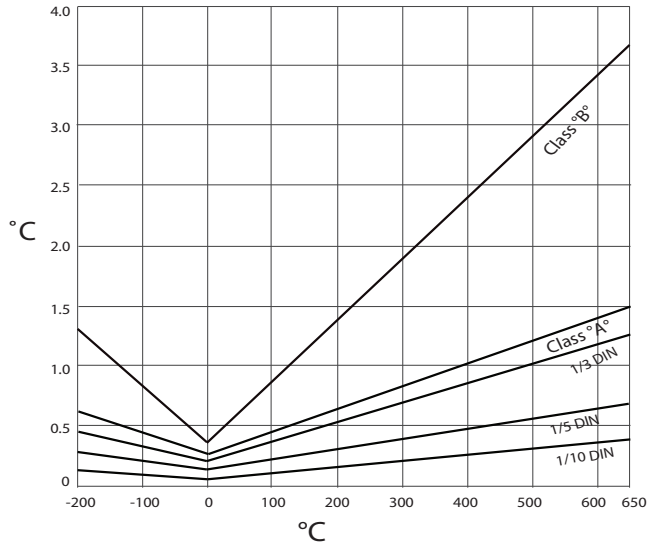
Thermometers of 100 Ω nominal resistance value shall be classified according to degree of conformity with the values of table 1. Class A tolerances shall not be applied to 100 Ω resistance thermometers at temperatures above 650°C.

Tolerances for Platinum Resistance Detectors to BS EN 60751:1996 / DIN 43760

Temp °C	Tolerance									
	CLASS B		CLASS A		1/3 DIN*		1/5 DIN*		1/10 DIN*	
	± °C	± OHMS	± °C	± OHMS	± °C	± OHMS	± °C	± OHMS	± °C	± OHMS
-200	1.3	0.56	0.55	0.24	0.44	0.19	0.26	0.11	0.13	0.06
-100	0.8	0.32	0.35	0.14	0.27	0.11	0.16	0.06	0.08	0.03
0	0.3	0.12	0.15	0.06	0.1	0.04	0.06	0.02	0.03	0.01
100	0.8	0.3	0.35	0.13	0.27	0.1	0.16	0.05	0.08	0.03
200	1.3	0.48	0.55	0.2	0.44	0.16	0.26	0.1	0.13	0.05
300	1.8	0.64	0.75	0.27	0.6	0.21	0.36	0.13		
400	2.3	0.79	0.95	0.33	0.77	0.26				
500	2.8	0.93	1.15	0.38						
600	3.3	1.06	1.35	0.43						
650	3.6	1.13	1.45	0.46						
700	3.8	1.17								
800	4.3	1.28								
850	4.6	1.34								

NOTE
Tolerances are calculated to 2 decimal points and are taken as a fraction of Class B.
* The tabulated values for close tolerance detectors 1/3rd, 1/5th and 1/10th DIN are interpolated and are for guidance only.

Tolerance values as a function of temperature for 100 Ω thermometers



VIBRATION

When correctly supported, units will withstand a minimum vibration level of 30g over the frequency range 10hz to 1Khz. Units from normal production have been subjected to many varied ranges of vibration, and we have in-house ability to test to a Customer's needs should they have any special requirement.

STABILITY

Detectors typically conform to BSEN Stability figures. Drfit of less than ±0.05% of its initial value after ten thermal cycles from 0 °C to 600 °C and from -200 °C to 0 °C. Stability is a compromise between vibration performance and there are various options available.

SELF HEATING

Less than 0.3 °C with 10mW dissipation when tested in a stirred ice bath.

THERMAL RESPONSE TIME

BS EN 60751: 1996 & IEC 751 : 1995

Require that the response time for a 50% change (~0.5) in resistance to a step temperature change be recorded. The normal 63.2% value is not recommended. However it is the accepted figure. Hence the table below gives the 63.2% figure. The 50% figure may be obtained by reduing the times given by approximately 10%. 90% response times can be obtained by multiplying the times given by a factor of 3. To obtain the time constants at other flow rates and for other liquids and gases, the times may be multiplied by the inverse of the ratio masses of fluids per second passing the element.

Ceramic diameter (mm)	4.5	3.2	2.8	2.4	2.0	1.6	1.5	1.2	0.9
Typical time (secs)	0.7	0.4	0.4	0.3	0.25	0.15	0.1	0.08	0.03

to 63% of final value,

50% step, water flowing at 1m/s.

HERMETICALLY SEALED UNITS

For optimum stability, air should be allowed to circulate around the platinum coil. For this reason our detectors are not Hermetically sealed. Care must therefore be taken to pervent the ingress of moisture or gases from contaminating the detector by enclosing it in a suitable sheath. However applications have arisen where detectors have to be totally immersed; or to operate in conditions of high humidity. For special cases units can be hermetically sealed. These units are made to order only.

PT100 Temperature Conversion Table

°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms
-50	80.31	+37	114.38	+124	147.58	+211	179.90	+298	211.34	+385	241.91	+482	274.96	+565	302.38
-49	80.70	+38	114.77	+125	147.95	+212	180.26	+299	211.69	+386	242.25	+483	275.29	+566	302.71
-48	81.10	+39	115.15	+126	148.33	+213	180.63	+300	212.05	+397	242.60	+484	275.63	+567	303.03
-47	81.50	+40	115.54	+127	148.71	+214	180.99	+301	212.40	+398	242.95	+485	275.96	+568	303.36
-46	81.89	+41	115.93	+128	149.08	+215	181.36	+302	212.76	+399	243.29	+486	276.31	+569	303.68
-45	82.29	+42	116.31	+129	149.46	+216	181.73	+303	213.12	+400	243.64	+487	276.64	+570	304.01
-44	82.69	+43	116.70	+130	149.83	+217	182.09	+304	213.47	+401	247.43	+488	276.97	+571	304.33
-43	83.08	+44	117.08	+131	150.21	+218	182.46	+305	213.83	+402	247.78	+489	277.31	+572	304.66
-42	83.48	+45	117.47	+132	150.58	+219	182.82	+306	214.19	+403	248.12	+490	277.64	+573	304.98
-41	83.88	+46	117.85	+133	150.96	+220	183.19	+307	214.55	+404	248.46	+491	277.98	+574	305.30
-40	84.27	+47	118.24	+134	151.34	+221	183.55	+308	214.90	+405	248.81	+492	278.31	+575	305.63
-39	84.67	+48	118.62	+135	151.71	+222	183.92	+309	215.26	+406	249.15	+493	278.64	+576	305.95
-38	85.06	+49	119.01	+136	152.09	+223	184.28	+310	215.61	+407	249.50	+494	278.98	+577	306.28
-37	85.46	+50	119.40	+137	152.46	+224	184.65	+311	215.97	+408	249.84	+495	279.31	+578	306.60
-36	85.85	+51	119.78	+138	152.84	+225	185.01	+312	216.32	+409	250.18	+496	279.64	+579	306.92
-35	86.25	+52	120.16	+139	153.21	+226	185.38	+313	216.68	+410	250.53	+497	279.98	+580	307.25
-34	86.64	+53	120.55	+140	153.58	+227	185.74	+314	217.03	+411	250.89	+498	280.31	+581	307.57
-33	87.04	+54	120.93	+141	153.95	+228	186.11	+315	217.39	+412	251.21	+499	280.64	+582	307.89
-32	87.43	+55	121.32	+142	154.32	+229	186.47	+316	217.73	+413	251.55	+500	280.98	+583	308.22
-31	87.83	+56	121.70	+143	154.71	+230	186.84	+317	218.08	+414	251.90	+501	281.31	+584	308.54
-30	88.22	+57	122.09	+144	155.08	+231	187.20	+318	218.44	+415	252.24	+502	281.64	+585	308.86
-29	88.62	+58	122.47	+145	155.46	+232	187.56	+319	218.79	+416	252.59	+503	281.97	+586	309.19
-28	89.01	+59	122.86	+146	155.83	+233	187.93	+320	219.15	+417	252.94	+504	282.31	+587	309.51
-27	89.40	+60	123.24	+147	156.21	+234	188.29	+321	219.50	+418	253.28	+505	282.64	+588	309.83
-26	89.80	+61	123.62	+148	156.58	+235	188.65	+322	219.85	+419	253.62	+506	282.97	+589	310.15
-25	90.19	+62	124.01	+149	156.96	+236	189.02	+323	220.21	+420	253.96	+507	283.30	+590	310.48
-24	90.59	+63	124.39	+150	157.33	+237	189.38	+324	220.56	+421	254.30	+508	283.63	+591	310.80
-23	90.98	+64	124.77	+151	157.71	+238	189.74	+325	220.91	+422	254.65	+509	283.97	+592	311.12
-22	91.37	+65	125.17	+152	158.08	+239	190.11	+326	221.27	+423	254.99	+510	284.30	+593	311.45
-21	91.77	+66	125.55	+153	158.45	+240	190.47	+327	221.62	+424	255.33	+511	284.63	+594	311.78
-20	92.16	+67	125.93	+154	158.83	+241	190.83	+328	221.97	+425	255.67	+512	284.96	+595	312.10
-19	92.55	+68	126.32	+155	159.20	+242	191.20	+329	222.32	+426	256.01	+513	285.29	+596	312.43
-18	92.95	+69	126.70	+156	159.56	+243	191.56	+330	222.68	+427	256.35	+514	285.62	+597	312.75
-17	93.34	+70	127.08	+157	159.94	+244	191.92	+331	223.03	+428	256.70	+515	285.95	+598	313.07
-16	93.73	+71	127.46	+158	160.31	+245	192.28	+332	223.38	+429	257.04	+516	286.30	+599	313.39
-15	94.12	+72	127.85	+159	160.68	+246	192.66	+333	223.73	+430	257.38	+517	286.63	+600	313.71
-14	94.52	+73	128.23	+160	161.05	+247	193.02	+334	224.09	+431	257.72	+518	286.96	+601	314.04
-13	94.91	+74	128.61	+161	161.43	+248	193.38	+335	224.45	+432	258.06	+519	287.29	+602	314.36
-12	95.30	+75	128.99	+162	161.80	+249	193.74	+336	224.80	+433	258.40	+520	287.62	+603	314.68
-11	95.69	+76	129.38	+163	162.17	+250	194.10	+337	225.15	+434	258.74	+521	287.95	+604	315.00
-10	96.09	+77	129.76	+164	162.54	+251	194.47	+338	225.50	+435	259.08	+522	288.28	+605	315.32
-9	96.48	+78	130.14	+165	162.91	+252	194.83	+339	225.85	+436	259.42	+523	288.61	+606	315.64
-8	96.87	+79	130.52	+166	163.28	+253	195.19	+340	226.21	+437	259.76	+524	288.94	+607	315.96
-7	97.26	+80	130.90	+167	163.66	+254	195.55	+341	226.56	+438	260.10	+525	289.27	+608	316.28
-6	97.65	+81	131.28	+168	164.03	+255	195.90	+342	226.91	+439	260.44	+526	289.60	+609	316.60
-5	98.04	+82	131.67	+169	164.40	+256	196.26	+343	227.26	+440	260.78	+527	289.93	+610	316.92
-4	98.44	+83	132.05	+170	164.77	+257	196.62	+344	227.61	+441	261.12	+528	290.26	+611	317.24
-3	98.83	+84	132.43	+171	165.14	+258	196.98	+345	227.96	+442	261.46	+529	290.59	+612	317.56
-2	99.22	+85	132.81	+172	165.51	+259	197.35	+346	228.31	+443	261.80	+530	290.92	+613	317.88
-1	99.61	+86	133.19	+173	165.88	+260	197.71	+347	228.66	+444	262.14	+531	291.25	+614	318.20
±0	100.00	+87	133.57	+174	166.25	+261	198.07	+348	229.01	+445	262.48	+532	291.58	+615	318.52
+1	100.39	+88	133.95	+175	166.62	+262	198.43	+349	229.36	+446	262.83	+533	291.90	+616	318.85
+2	100.78	+89	134.33	+176	167.00	+263	198.79	+350	229.72	+447	263.17	+534	292.23	+617	319.17
+3	101.17	+90	134.71	+177	167.37	+264	199.15	+351	230.07	+448	263.50	+535	292.56	+618	319.49
+4	101.56	+91	135.09	+178	167.74	+265	199.51	+352	230.42	+449	263.84	+536	292.90	+619	319.81
+5	101.95	+92	135.47	+179	168.11	+266	199.87	+353	230.77	+450	264.18	+537	293.23	+620	320.12
+6	102.34	+93	135.85	+180	168.48	+267	200.23	+354	231.12	+451	264.52	+538	293.56	+621	320.44
+7	102.73	+94	136.23	+181	168.85	+268	200.59	+355	231.47	+452	264.86	+539	293.89	+622	320.76
+8	103.12	+95	136.61	+182	169.22	+269	200.95	+356	231.81	+453	265.20	+540	294.21	+623	321.08
+9	103.51	+96	136.99	+183	169.59	+270	201.31	+357	232.16	+454	265.54	+541	294.54	+624	321.40
+10	103.90	+97	137.37	+184	169.96	+271	201.67	+358	232.51	+455	265.87	+542	294.87	+625	321.72
+11	104.29	+98	137.75	+185	170.33	+272	202.03	+359	232.86	+456	266.21	+539	293.89	+626	322.03
+12	104.68	+99	138.13	+186	170.69	+273	202.38	+360	233.21	+457	266.55	+540	294.21	+627	322.34
+13	105.07	+100	138.51	+187	171.06	+274	202.74	+361	233.56	+458	266.89	+541	294.54	+628	322.66
+14	105.46	+101	138.89	+188	171.43	+275	203.10	+362	233.91	+459	267.22	+542	294.87	+629	322.98
+15	105.85	+102	139.27	+189	171.80	+276	203.46	+363	234.26	+460	267.56	+543	295.20	+630	323.30
+16	106.24	+103	139.65	+190	172.17	+277	203.82	+364	234.60	+461	267.90	+544	295.53	+631	323.61
+17	106.63	+104	140.03	+191	172.54	+278	204.18	+365	234.95	+462	268.24	+545	295.85	+632	323.93
+18	107.02	+105	140.39	+192	172.91	+279	204.54	+366	235.30	+463	268.57	+546	296.18	+633	324.25
+19	107.40	+106	140.77	+193	173.27	+280	204.90	+367	235.65	+464	268.91	+547	296.51	+634	324.57
+20	107.79	+107	141.15	+194	173.64	+281	205.25	+368	236.00	+465	269.25	+548	296.84	+635	324.88
+21	108.18	+108	141.53	+195	174.01	+282	205.61	+369	236.35	+466	269.58	+549	297.16	+636	325.21
+22	108.57	+109	141.91	+196	174.39	+283	205.97	+370	236.70	+467	269.92	+550	297.49	+637	325.53
+23	108.96	+110	142.29	+197	174.75	+284	206.33	+371	237.05	+468	270.26	+551	297.82	+638	325.85
+24	109.35	+111	142.66	+198	175.12	+285	206.70	+372	237.40	+469	270.59	+552	298.14	+639	326.16
+25	109.73	+112	143.04	+199	175.49	+286	207.05	+373	237.75	+470	270.93	+553	298.47	+640	326.48
+26	110.12	+113	143.42	+200	175.86	+287	207.41	+374	238.09	+471	271.27	+554	298.80	+641	326.79
+27	110.51	+114	143.80	+201	176.23	+288	207.77	+375	238.44	+472	271.60	+555	299.12	+642	327.11
+28	110.90	+115	144.18	+202	176.59	+289	208.13	+376	238.79	+473	271.94	+556	299.45	+643	327.43
+29	111.28	+116	144.56	+203	176.96	+290	208.48	+377	239.14	+474	272.27	+557	299.78	+644	327.74
+30	111.67	+117	144.94	+204	177.33	+291	208.84	+378	239.48	+475	272.61	+558	300.10	+645	328.06
+31	112.06	+118	145.32	+205	177.70	+292	209.20	+379	239.83	+476	272.95	+559	300.43	+646	328.38
+32	112.45	+119	145.69	+206	178.06	+293	209.55	+380	240.18	+477	273.28	+560	300.75	+647	328.69
+33	112.83	+120	146.07	+207	178.43	+294	209.91	+381	240.52	+478	273.62	+561	301.08	+648	329.01
+34	113.22	+121	146.45	+208	178.80	+295	210.27	+382	240.87	+479	273.95	+562	301.41	+649	329.32
+35	113.61	+122	146.82	+209	179.16	+296	210.62	+383	241.22	+480	274.29	+563	301.73	+650	329.64
+36	113.99	+123	147.20	+210	179.53	+297	210.98	+384	241.56	+481	274.62	+564	302.06		

General Purpose Sensor (TE 11)

Sensor Type

K	Type K Thermocouple	Standard Temperature Range: -200 to 1250 ℃
J	Type J Thermocouple	Standard Temperature Range: -200 to 750 ℃
T	Type T Thermocouple	Standard Temperature Range: -200 to 350 ℃
E	Type E Thermocouple	Standard Temperature Range: -200 to 900 ℃
R	RTD (Resistance Temperature Detector)	Standard Temperature Range: -200 to 850 ℃
Y 1	Special version , to be specified	

Tolerance Type

A	Class A , IEC 751 , Thin Film(RTD) (Note : the data for reference only , it may varies based on sensor type)

Sensor Sheath

M 1	MI-RTD-Ø 6 mm-Single-3 Wires-SS 316 (Note : the data for reference only , it may varies based on sensor type)

Wire junction

U	Ungrounded (Std for RTD)
G	Grounded
E	Exposed

Sheath length

XXXX	To be specified (e.g 0125 for 125 mm long)

Sensor Connection Style

Z	None	8	RTD, Std male connector/plug
1	Epoxy holder & protection spring*	9	RTD,Std female connector/plug
2	Epoxy holder only*	10	RTD, Miniature male connector/plug
3	Plastic handheld holder, protection spring	11	RTD, Miniature female connector/plug
4	Thermocouple , Std male connector/plug	12	Base plate
5	Thermocouple ,Std female connector/plug	13	Base plate with terminal block
6	Thermocouple , Miniature male connector/plug	14	Bare end*
7	Thermocouple , Miniature female connector/plug	Y 2	Special version, to be specified

Wire Insulation , Size : AWG 24

L	Thermocouple - TE/TE	Y 3	Special version, to be specified
M	Thermocouple - TE/TE/SSOB	L	RTD - TE/TE
N	Thermocouple - FG/FG	M	RTD - TE/TE/SSOB
O	Thermocouple - PVC/PVC	N	RTD - FG/FG
P	Thermocouple - SiR/SiR	O	RTD - PVC/PVC
C	Thermocouple -PVC Coiled cable	P	RTD - SiR/SiR
Z	None		

Extension wire length

XXXX	To be specified (e.g 0125 for 125 mm long)

Wire termination style

Z	None	8	RTD, Std male connector/plug
1	Epoxy holder & protection spring*	9	RTD,Std female connector/plug
2	Epoxy holder only*	10	RTD, Miniature male connector/plug
3	Plastic handheld holder, protection spring	11	RTD, Miniature female connector/plug
4	Thermocouple , Std male connector/plug	12	Base plate
5	Thermocouple ,Std female connector/plug	13	Base plate with terminal block
6	Thermocouple , Miniature male connector/plug	14	Bare end*
7	Thermocouple , Miniature female connector/plug	Y 5	Special version, to be specified

Additional Options

Z	None
X 1	Bayonet cap
X 2	Compression fitting
X 3	Flexible Amour Cable
Y 6	Special version, to be specified
U	More than one option

Documents (optional)

In-house Calibration Certificate {RTD,PT100 (@ Class A , Class B, 1/3 DIN, 1/5 DIN) , Type K , J , T , E}

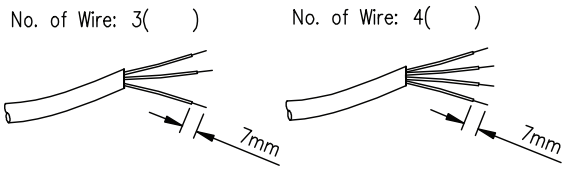
1	One Point (-25 to 500℃)
2	Two Points (-25 to 500℃)
3	Three Points (-25 to 500℃)
-	_

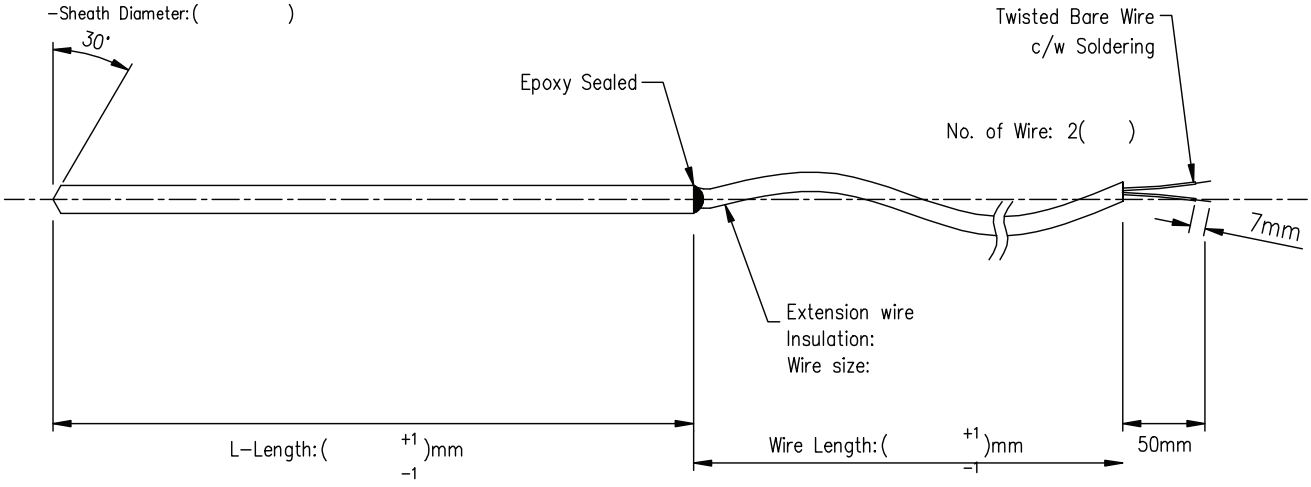
(Note : Non-Singlas / Singlas Calibration report is avaliable upon request)

TE 11											← Order Code
	1	2	3	4	5	6	7	8	9	10	

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )

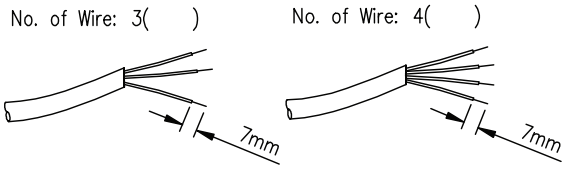


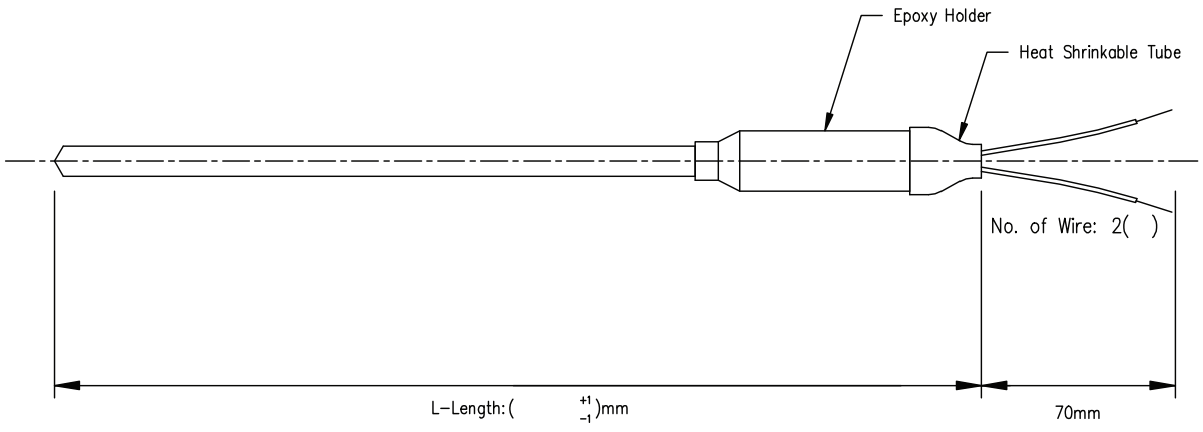


Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )

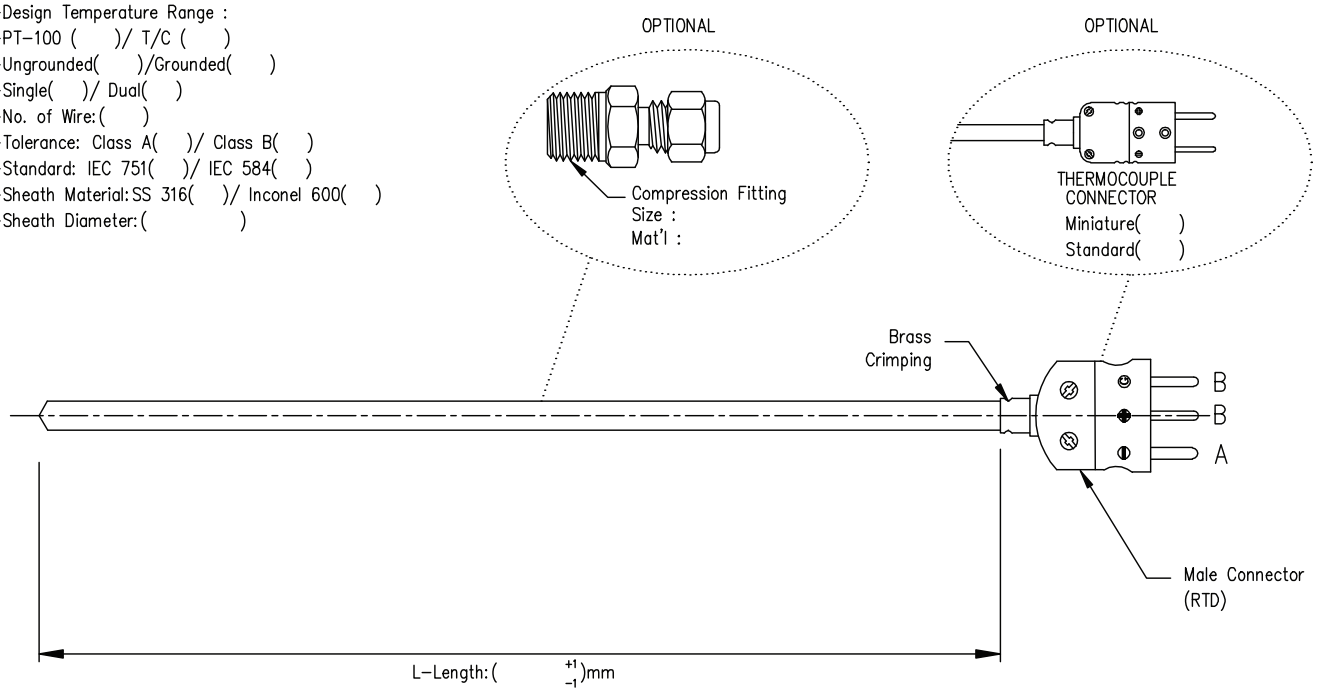




Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

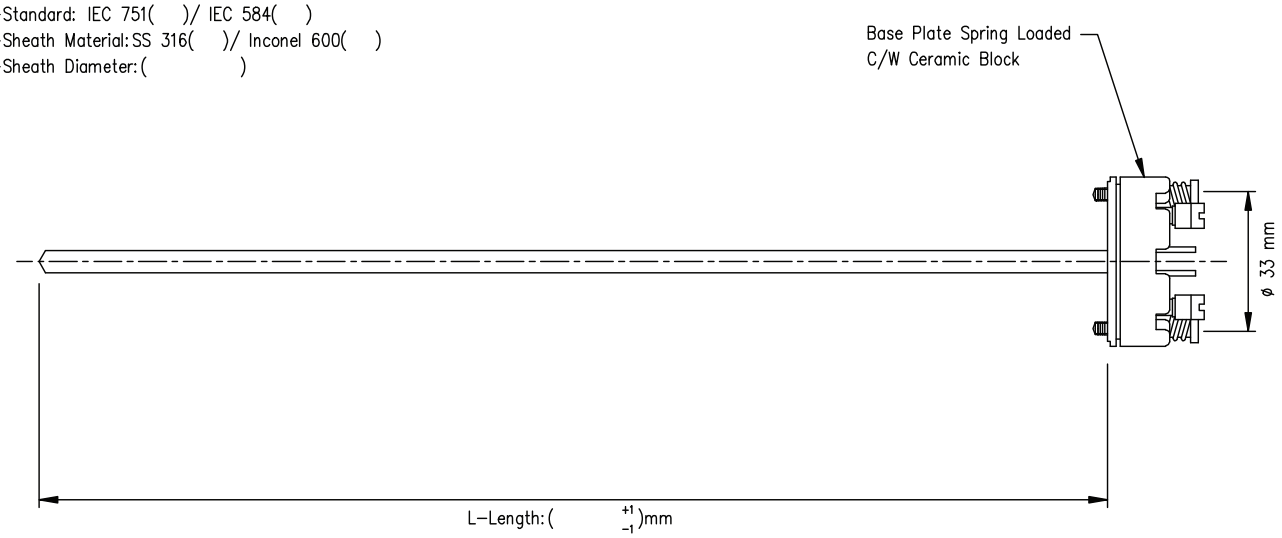
Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

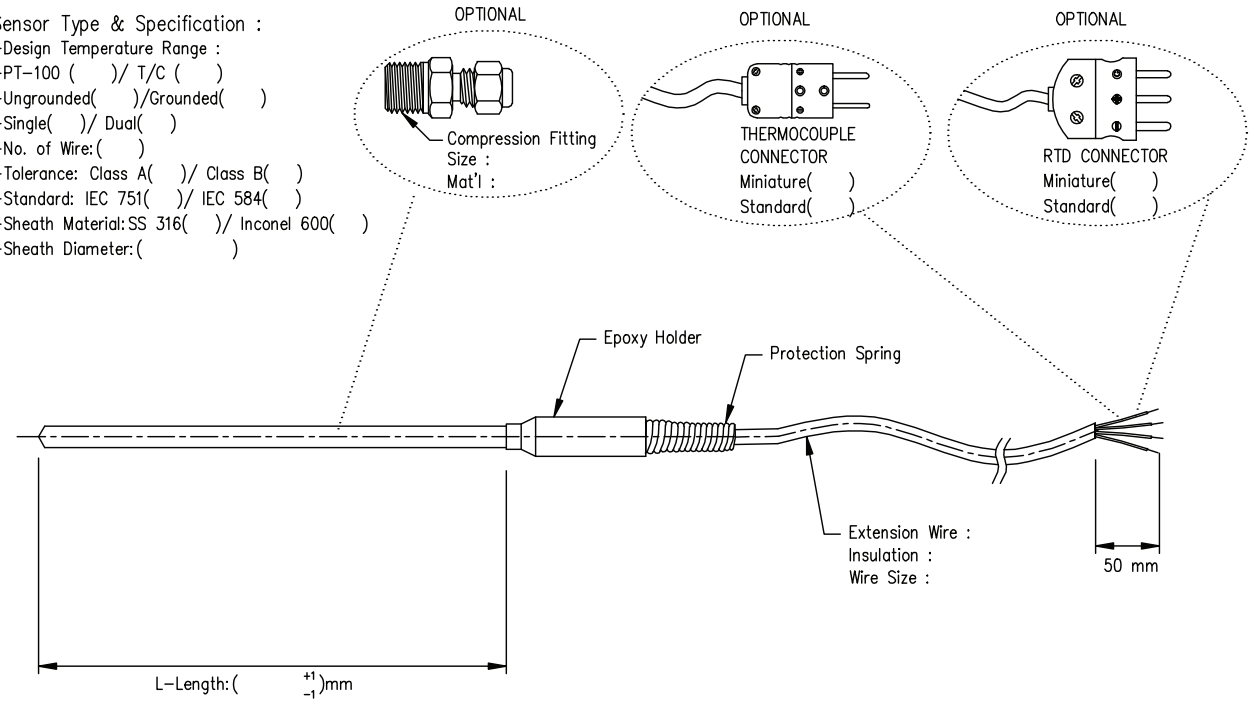
Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

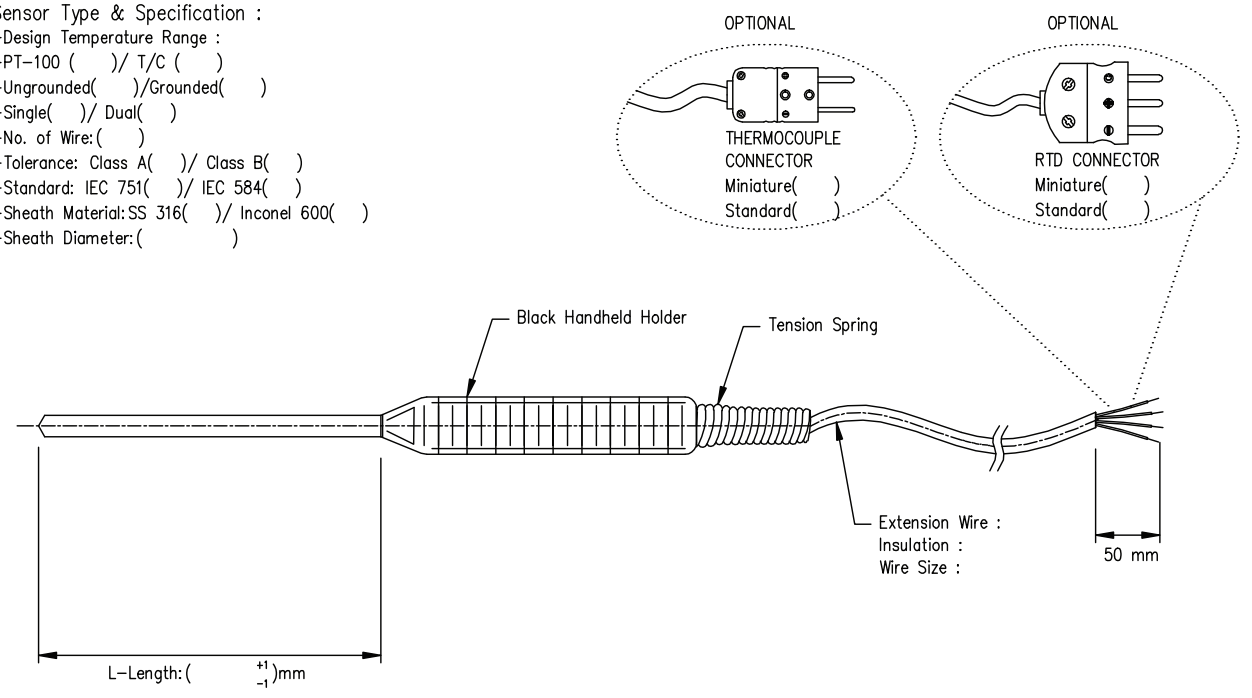
Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

TE11 GENERAL PURPOSE TEMPERATURE SENSOR

Sensor Type & Specification :
-Design Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE11 | – | – | – | – | – | – | – | – | – | – | – | – | –

Temperature Sensor Assembly
TE 20 Fixed Type (No Spring Movement)
TE 21 Base Plate Spring Loaded Type
TE 22 Hexagonal Spring Loaded Type

Sensor Type

K	Type K Thermocouple	Standard Temperature Range:	-200	to	1250	℃
J	Type J Thermocouple	Standard Temperature Range:	-200	to	750	℃
T	Type T Thermocouple	Standard Temperature Range:	-200	to	350	℃
E	Type E Thermocouple	Standard Temperature Range:	-200	to	900	℃
R	RTD (Resistance Temperature Detector)	Standard Temperature Range:	-200	to	850	℃
Y 1	Special version , to be specified					

Tolerance Type

A	Class A , IEC 751 , Thin Film(RTD) (Note : the data for reference only , it may varies based on sensor type)

Sensor Sheath

M 1	MI-RTD-Ø 6 mm-Single-3 Wires-SS (Note : the data for reference only , it may varies based on sensor type)

Wire junction

U	Ungrounded (Std for RTD)
G	Grounded
E	Exposed

Sheath length

XXXX	To be specified (e.g 0125 for 125 mm long)

Housing / Enclosure

KN 1	Weather Proof (KNE) , Die Cast Aluminum , Blue
KN 2	Weather Proof (KNE) , SS 316 , SS Colour
KS	Weather Proof (KS) , Die Cast Aluminum , Blue
KD	Weather Proof (KD) , Die Cast Aluminum , Silver
A 1	ATEX Explosion proof , Die Cast Aluminum , Blue
A 2	ATEX Explosion proof , SS 316, SS Colour
C 1	CSA Explosion proof , Die Cast Aluminum , Blue
C 2	CSA Explosion proof , SS 316 , SS Colour
T	Transmitters (Note : Mounting thread to be specified by customer)
Z	None
Y 4	Special Version to be specified

Mounting Thread (if it do not require the enclosure head)

P	1/2" NPT c/w 6" teflon lead wire (TE/TE, AWG 24)
Q	M20 x 1.5 P c/w 6" teflon lead wire (TE/TE, AWG 24)
R	1/2" BSP c/w 6" teflon lead wire (TE/TE, AWG 24)
Y 5	Special Version to be specified

Extension nipple type

1	30mm, SS 316, 1/2" NPT Hexagonal Nipple
2	75mm, SS 316, 1/2" NPT Plain Nipple
3	150mm, SS 316, 1/2"NPT Plain Nipple and Union
Z	None
Y 6	Special version, to be specified

Additional Options

Z	None
X 1	Compression fitting
Y 7	Special version, to be specified

Documents (Optio]nal)
In-house Calibration Certificate {RTD,PT100 (@ Class A , Class B, 1/3 DIN, 1/5 DIN) , Type K , J , T , E}

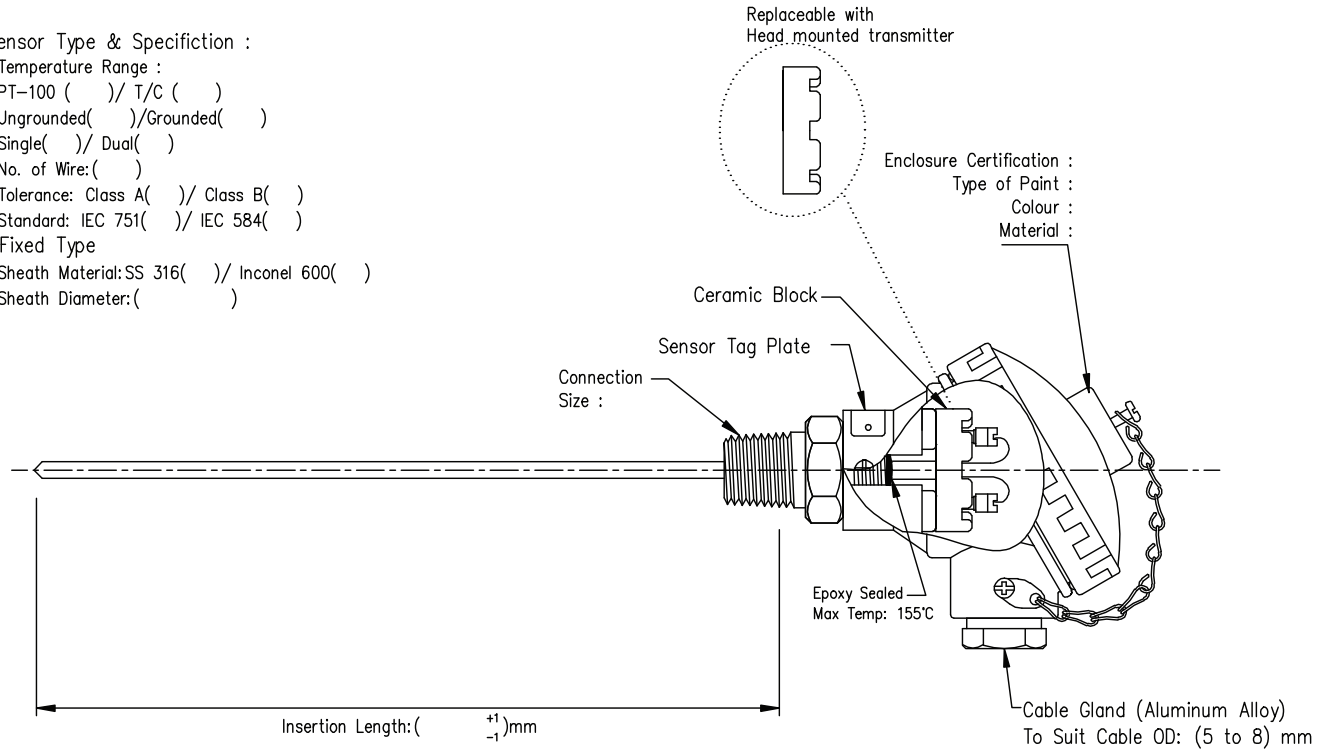
1	One Point (-25 to 500℃)
2	Two Points (-25 to 500℃)
3	Three Points (-25 to 500℃)
-	_

(Note : Non-Singlas / Singlas Calibration report is avaliable upon request)

TE XX											← Order Code
	1	2	3	4	5	6	7	8	9	10	

TE20 FIXED TYPE(NO SPRING MOVEMENT) TEMPERATURE SENSOR ASSEMBLY

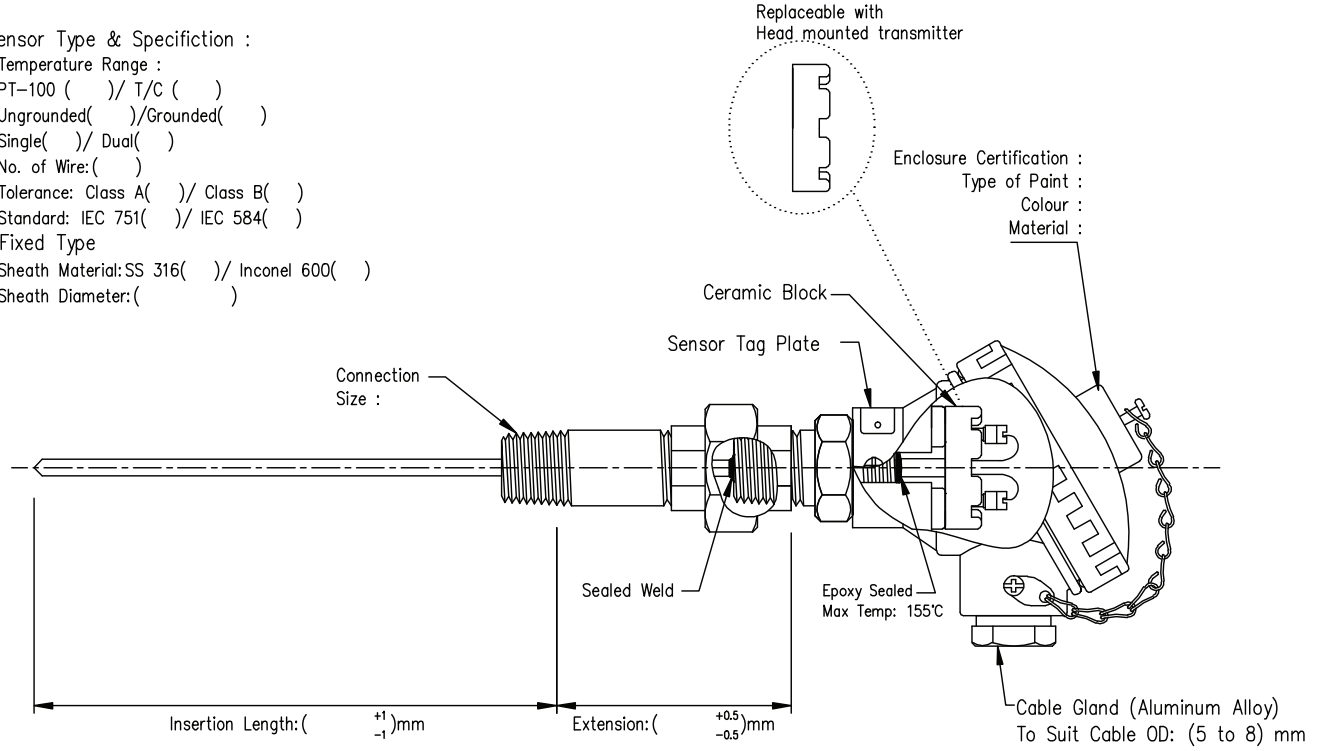
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Fixed Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE20 | – | – | – | – | – | – | – | – | – | – | – | –

TE20 FIXED TYPE(NO SPRING MOVEMENT) TEMPERATURE SENSOR ASSEMBLY

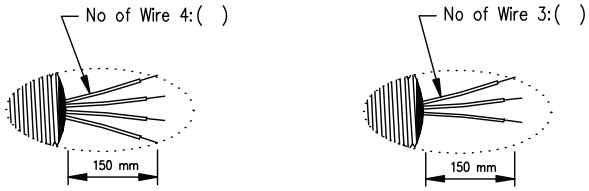
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Fixed Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )

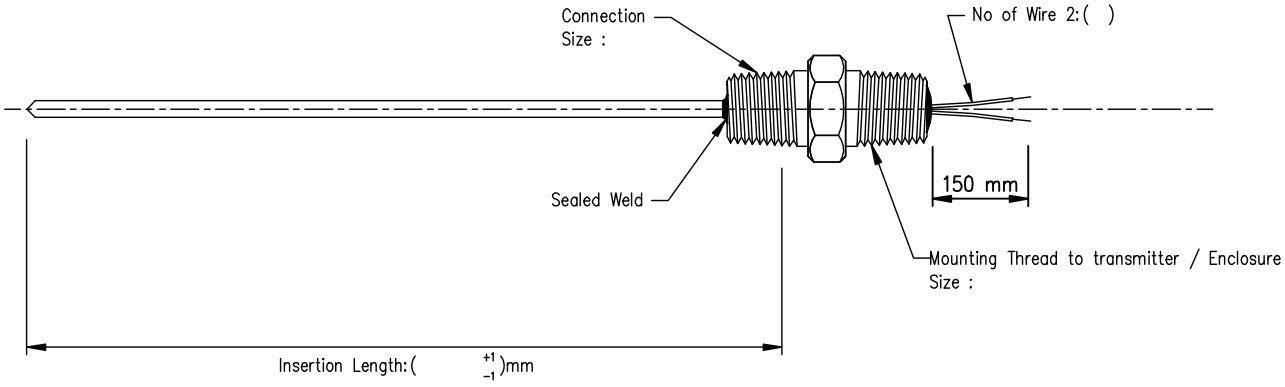


Model No | TE20 | – | – | – | – | – | – | – | – | – | – | – | –

TE20 FIXED TYPE(NO SPRING MOVEMENT) TEMPERATURE SENSOR ASSEMBLY

Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Fixed Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )

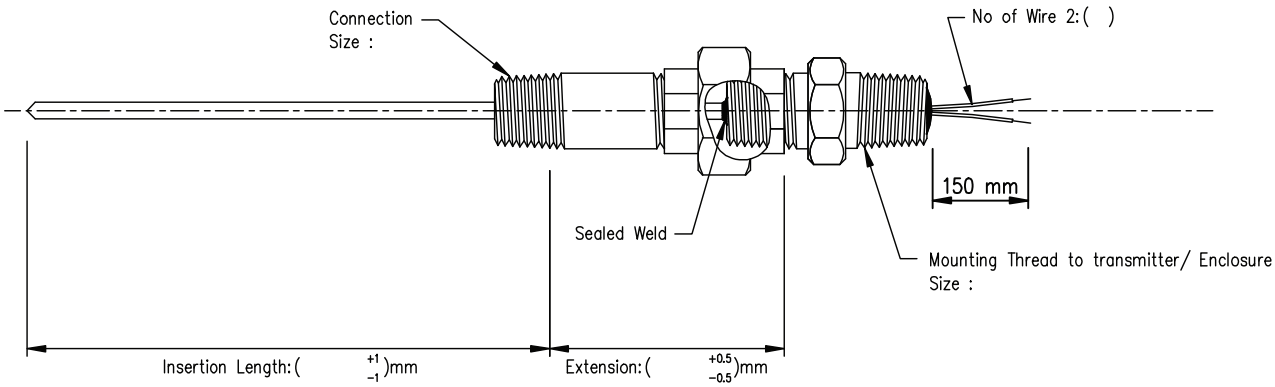




Model No | TE20 | – | – | – | – | – | – | – | – | – | – | – | –

TE20 FIXED TYPE(NO SPRING MOVEMENT) TEMPERATURE SENSOR ASSEMBLY

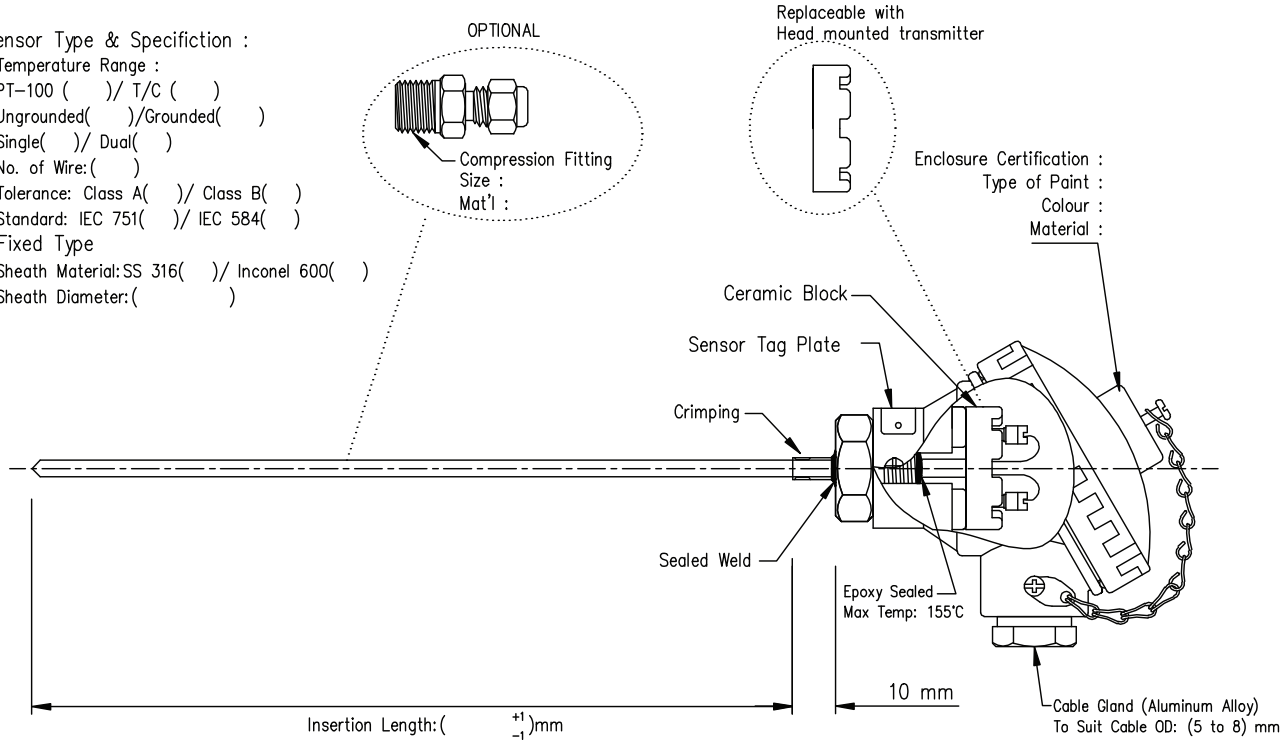
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Fixed Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE20 | – | – | – | – | – | – | – | – | – | – | – | –

TE20 FIXED TYPE(NO SPRING MOVEMENT) TEMPERATURE SENSOR ASSEMBLY

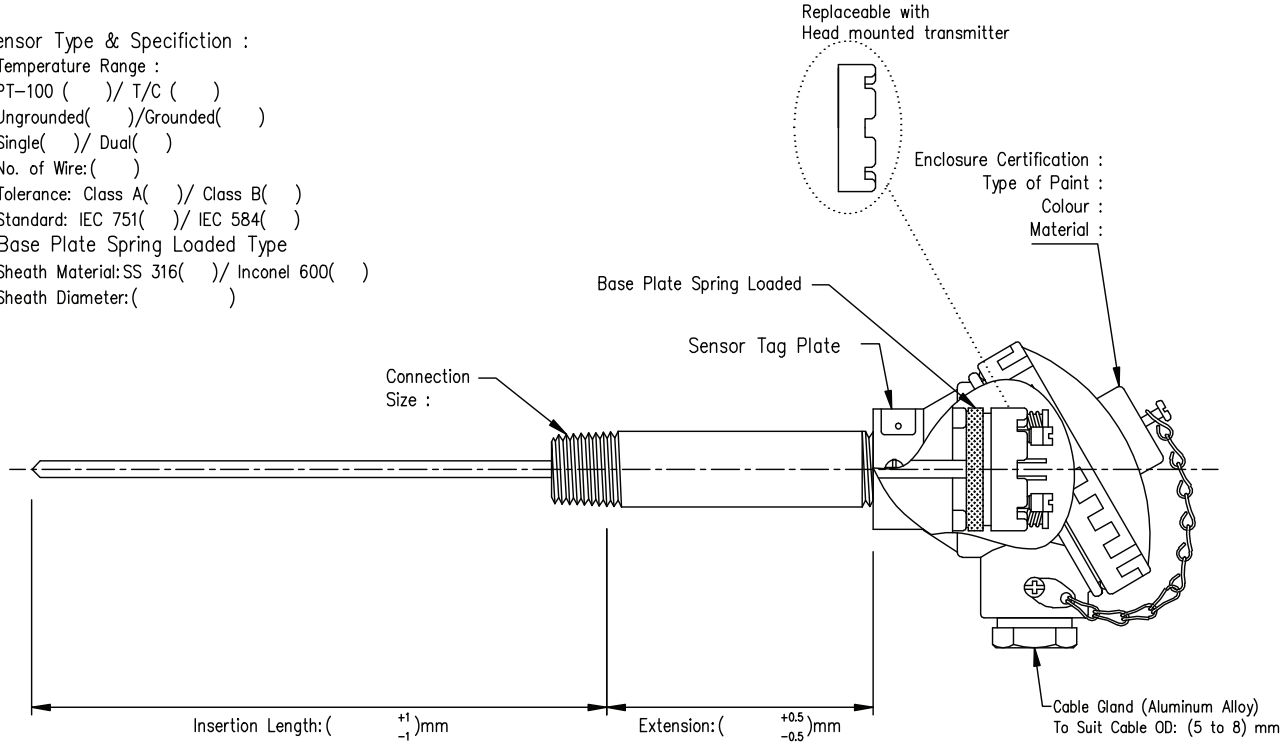
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Fixed Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE20 | – | – | – | – | – | – | – | – | – | – | – | –

TE21 BASE PLATE SPRING LOADED TYPE TEMPERATURE SENSOR ASSEMBLY

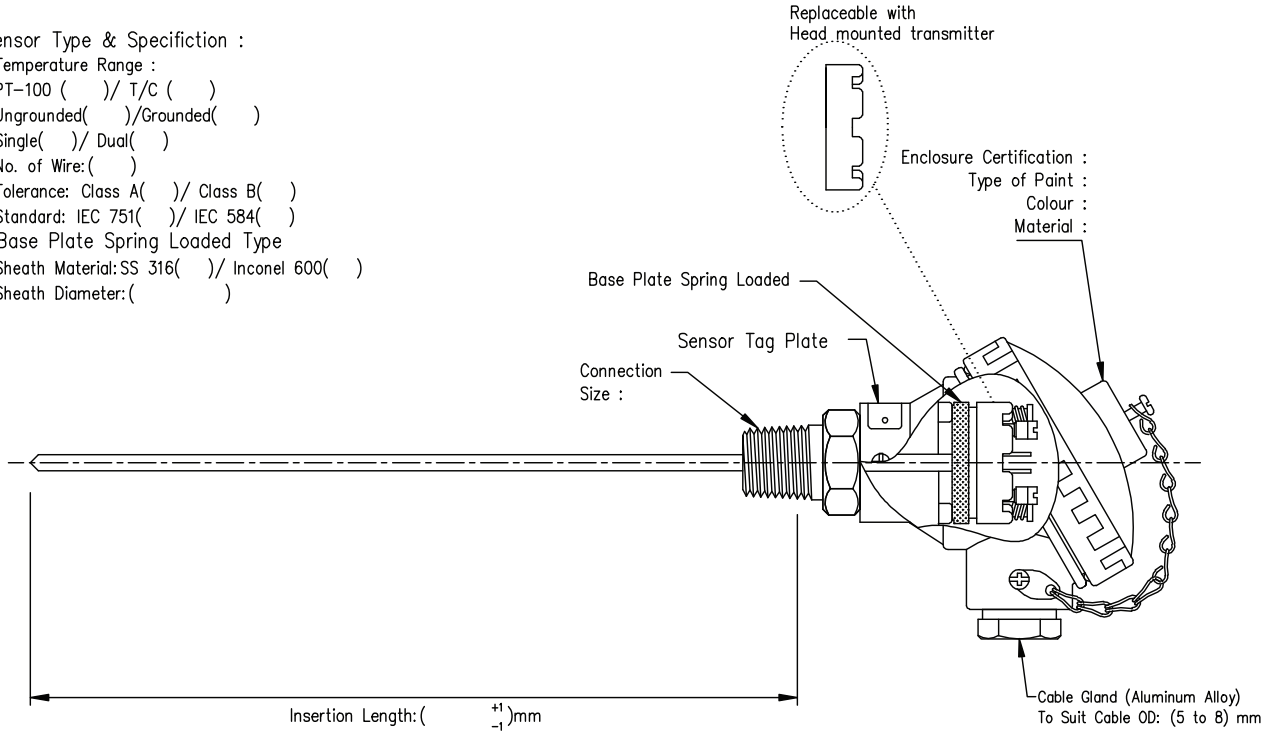
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Base Plate Spring Loaded Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE21 | – | – | – | – | – | – | – | – | – | – | – | –

TE21 BASE PLATE SPRING LOADED TYPE TEMPERATURE SENSOR ASSEMBLY

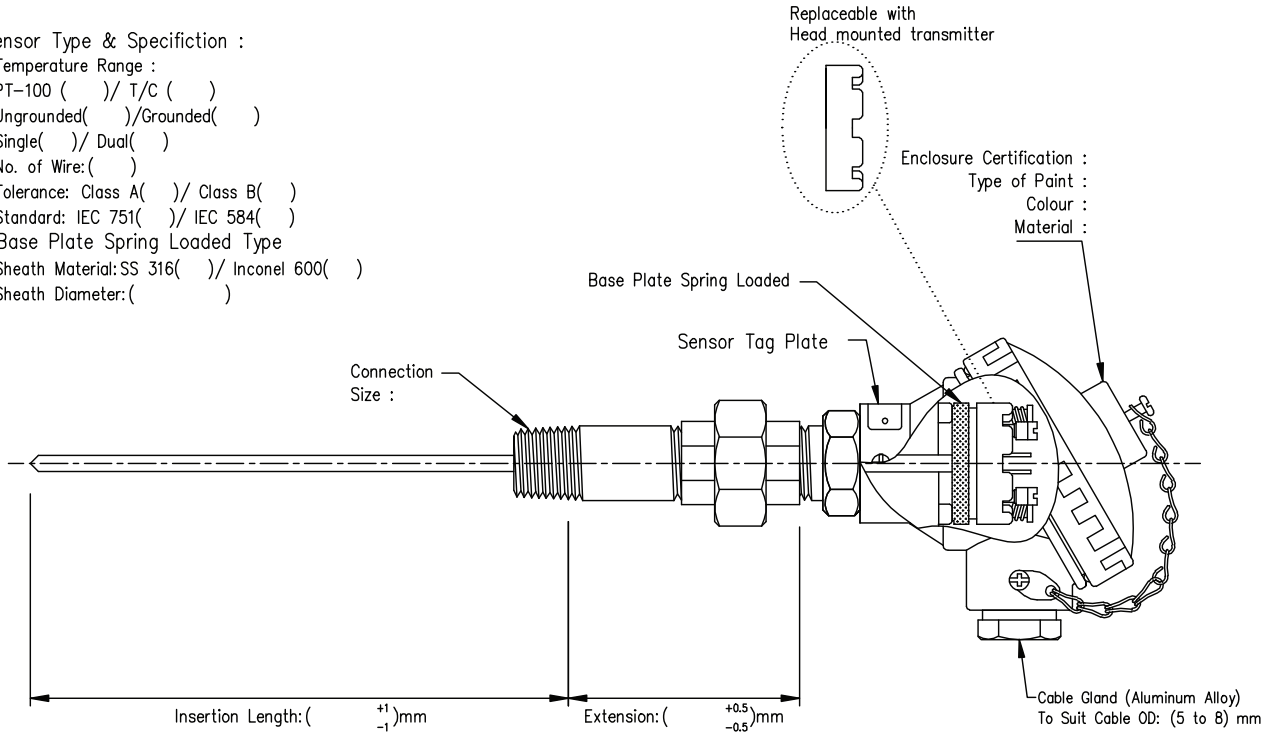
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Base Plate Spring Loaded Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE21 | – | – | – | – | – | – | – | – | – | – | – | – |

TE21 BASE PLATE SPRING LOADED TYPE TEMPERATURE SENSOR ASSEMBLY

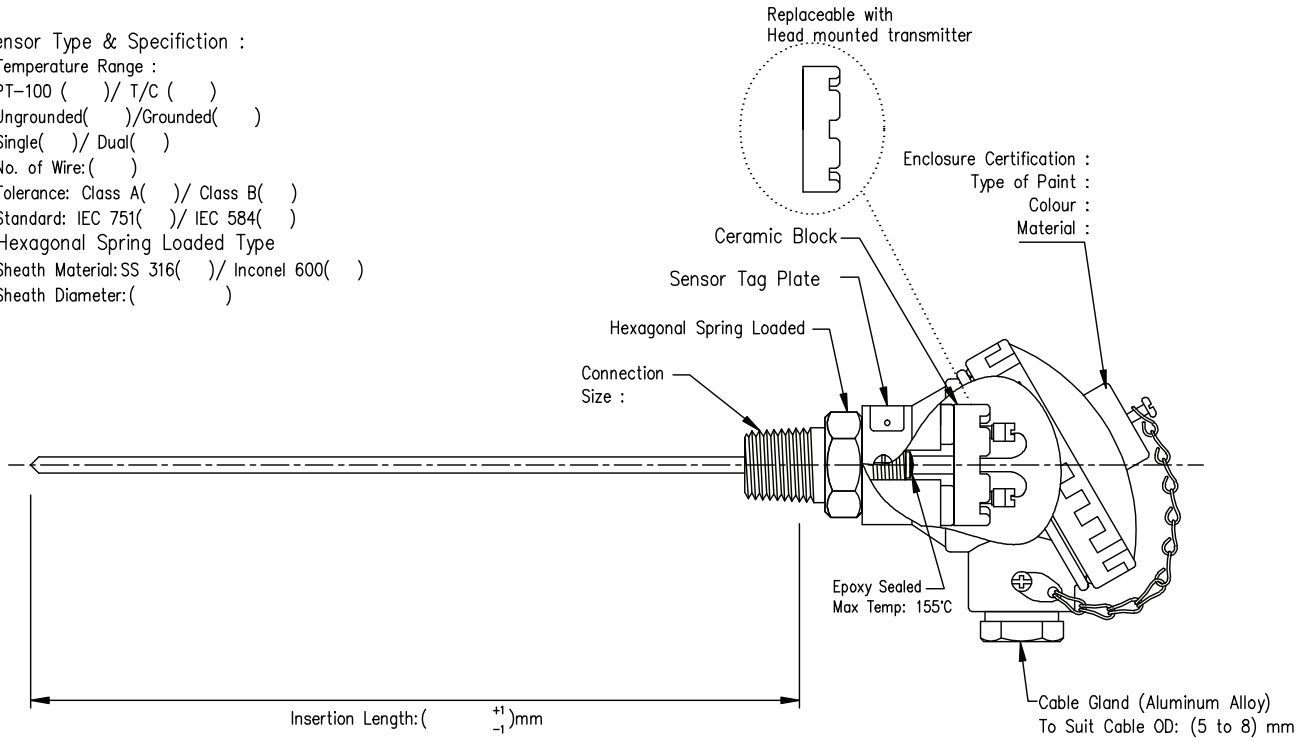
Sensor Type & Specifiction :
-Temperature Range :
-PT-100 ( )/ T/C ( )
-Ungrounded( )/Grounded( )
-Single( )/ Dual( )
-No. of Wire:( )
-Tolerance: Class A( )/ Class B( )
-Standard: IEC 751( )/ IEC 584( )
-Base Plate Spring Loaded Type
-Sheath Material:SS 316( )/ Inconel 600( )
-Sheath Diameter:( )



Model No | TE21 | – | – | – | – | – | – | – | – | – | – | – | – |

TE22 HEXAGONAL SPRING LOADED TYPE TEMPERATURE SENSOR ASSEMBLY

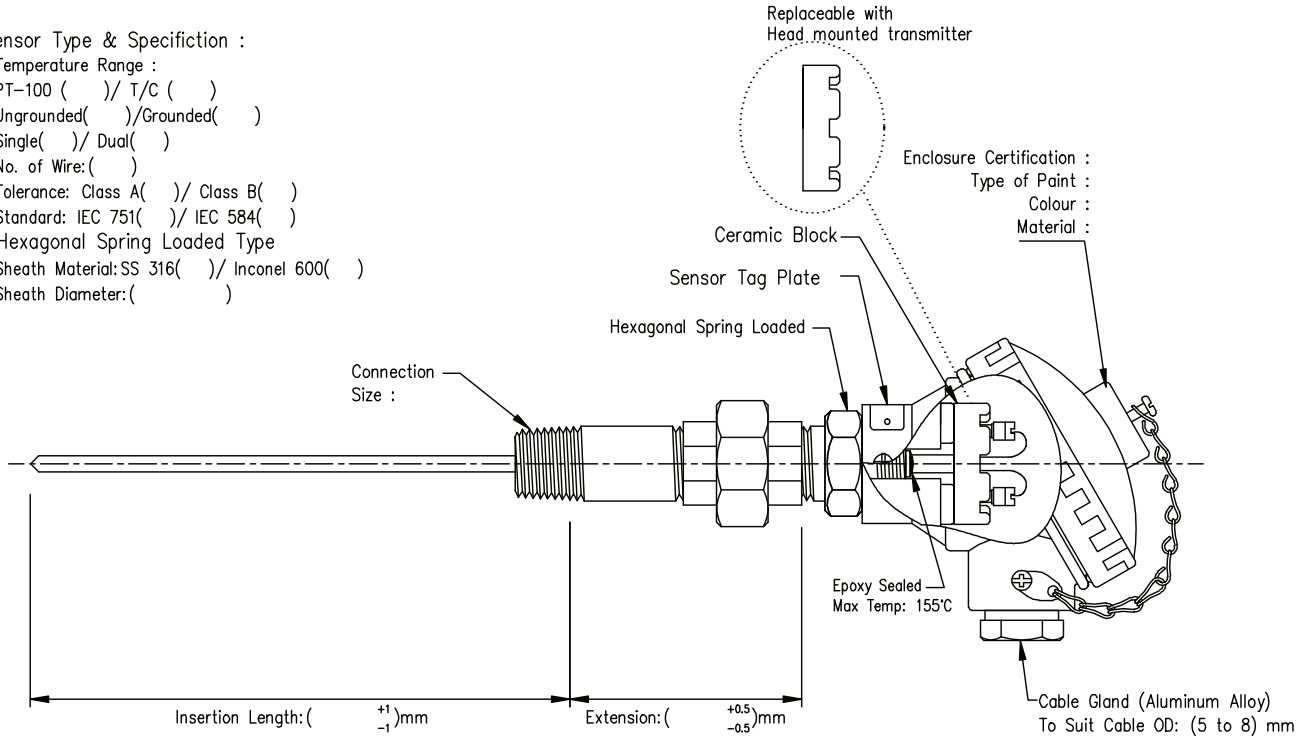
Sensor Type & Specifiction :
- Temperature Range :
- PT-100 ( )/ T/C ( )
- Ungrounded( )/Grounded( )
- Single( )/ Dual( )
- No. of Wire:( )
- Tolerance: Class A( )/ Class B( )
- Standard: IEC 751( )/ IEC 584( )
- Hexagonal Spring Loaded Type
- Sheath Material: SS 316( )/ Inconel 600( )
- Sheath Diameter:( )



Model No | TE22 | – | – | – | – | – | – | – | – | – | – | – |

TE22 HEXAGONAL SPRING LOADED TYPE TEMPERATURE SENSOR ASSEMBLY

Sensor Type & Specifiction :
- Temperature Range :
- PT-100 ( )/ T/C ( )
- Ungrounded( )/Grounded( )
- Single( )/ Dual( )
- No. of Wire:( )
- Tolerance: Class A( )/ Class B( )
- Standard: IEC 751( )/ IEC 584( )
- Hexagonal Spring Loaded Type
- Sheath Material: SS 316( )/ Inconel 600( )
- Sheath Diameter:( )



Model No | TE22 | – | – | – | – | – | – | – | – | – | – | – |

Ex designation

Temperature Class:
Gases are divided into temperature classes based on their different ignition temperatures. The electrical equipment in Group II is divided in parallel to this according to the maximum surface temperatures at which the Ex-atmosphere can be reached.

T6

Maximum permitted housing or component temperature of the operating devices					
T1	T2	T3	T4	T5	T6
450°C	300°C	200°C	135°C	100°C	85°C

IIC

Explosion groups:
The equipment group, amongst other items, appears again in this Designation Section. Group 1 comprises operating devices for coal mining where coal dust and methane atmospheres prevail. Group II applies to the "aboveground" areas such as chemistry, petrochemistry, mills (dusts) etc. Due to the different minimum ignition energies of the various gases, there is a further division into the categories IIA to IIC for the ignition protection classes "personal safety", "pressure resistant casing" and "sand casing"

CENELEC marking	Type of Gas	ignition energy/µJ
I	methane	280
IIA	propane	› 180
IIB	ethylene	60 … 180
IIC	hydrogen	‹ 60

de

Type of protection:
In areas where the occurrence of an explosive mixture of flammable materials and air cannot be prevented by applying primary explosion protection, special measures for the prevention of ignition sources are to be taken. For example: separation (o, q, m), exclusion (p), special mech. construction (d, e), limitation of energy (ia, ib) or other methods (s).

Ex

Explosion protection

II 2 G

Use in hazardous areas:
Equipment which are certified according to Directive 94/9/EC (ATEX 95) regulations carries a special marking. The device group appears first, then the device category and finally the atmosphere reference (G) as and (D) ust.

For category II, the following classification applies:
Category 1 very high degree of safety / Safety is provided by 2 protective measures – even in cases of rarely occurring machine errors or 2 independent machine errors.
Application in zones 0, 1, 2 or 20, 21, 22, atmosphere G/D / Category 2 high degree of safety sufficient safety in cases of frequent machine errors/ in cases of 1 error
Application in zones 1, 2 or 21, 22, atmosphere G/D / Category 3 normal degree of safety sufficient safety in cases of failure-free operation
Application in zone 2/22, atmosphere G/D* (*non-conductive dusts)

Mark identifying explosion prevention
(required in accordance with Directive 94/9/EC)

ATEX (Atmosphere Explosive)

94/9/EC Directive
Harmonises legal provisions of member states for devices and protection systems for designated use in potentially explosive areas.
New: ATEX 9 5 (Old: ATEX 100a)

1999/92/CE Directive
Minimum requirements for improving the health and safety protection of the worker at risk from explosive atmospheres.
New: ATEX 1 37 (Old: ATEX 118a)

Designation examples:

Use in gaseous atmospheres:	Use in dusty atmospheres:	Use for mining applications:
II 2 G EEx d e IIC T6	II 2 D T90°C IP64	I M2 EEx ia I

Temperature classes:
In the event of a malfunction, the maximum temperature of a surface that may be exposed to gas (in normal use with "n" type of protection). (Should not be used for dust ex-designations.)
T1 = 450°C
T2 = 300°C
T3 = 200°C
T4 = 135°C
T5 = 100°C
T6 = 85°C

IP Code
(Data only for devices used in areas rendered potentially explosive by dust)
Figure 1 Contact and foreign body protection:
5 = Protection against dust deposits
6 = protection against dust penetration
Figure 2 Water protection
Protection against:
0 = (no protection)
1 = vertically falling drip water
2 = drip water on operating device inclined to 5°
3 = spray water
4 = spray water
5 = jet water
6 = strong jet water
7 = temporary immersion
8 = continuous immersion

Explosion group
(Data only for devices used in areas rendered potentially explosive by gas)
I = Methane (mining)
IIA = such as Propane
IIB = such as Ethylene
IIC = most dangerous group (e.g. hydrogen)

Ex	II 2 G	Ex	de	IIC	T6	
Ex	II 2 D	Ex	td	A21	T90°	IP64

Device group
I = Mining
II = all other explosive areas

Category
1 = can be used in Zones 0 or 20
2 = can be used in Zones 1 or 21
3 = can be used in Zones 2 or 22
M1 = Mining
(In case of firedamp, continuation of operation is possible)
M2 = Mining
(Must be switched off in case of firedamp)

Atmosphere
G = Gas
D = Dust
(Mining – no details)

Types of protection:
o = oil immersion
p = high-pressure encapsulation
q = sand encapsulation
d = pressure-resistant encapsulation
e = increased safety
ia = intrinsic safety (permitted for Zone 0*)
*depending on the device category
ib = intrinsic safety (sufficient for Zone 1 (+ 2))
ma = cast encapsulation (for Zone 0*)
mb = (sufficient for Zone 1 (+ 2))
s = special protection
n = normal operation In normal conditions (only for Zone 2)
nA = non-sparking
nC = enclosed break
nR = vapour-proof housing
nL = energy limited
nZ = high-pressure encapsulation
op = optical radiation (is, pr, sh)
tD = protected by housing (dust)
pD = high-pressure encapsulation (dust)
iaD = Instrinsic safety dust (use for Zone 20*)
ibD = Instrinsic safety dust (sufficient for Zone 21 (and 22))
mD = cast encapsulation (dust)

Max. surface temperature
(Data for devices used in areas rendered potentially explosive by dust - rarely also used in gas ex marking.)
- Maximum temperature of a surface during a machine error (normal operation in the case of category 3 devices) that can be reached by the ex atmosphere.
Evaluation by the user:
a.) Limit temperature 1=2/3 of min. ignition temperature of dust present
b.) Limit temperature 2=min. glow temperature of dust present minus 75k (applies for layer thicknesses of up to 5mm)
The smaller value for the limit temperature must be above the indicated max. surface temperature of the device.

Zone
Procedure for determining the housing's leak tightness (A or B)

Ex-Proof (IECEx / ATEX) Temperature Sensor Assembly

AS-SLT-2010 : Hexagonal Spring Loaded Type
AS-WT-2010 : Welded / Fixed Type

Sensor Type

K	Type K Thermocouple	Standard Temperature Range: -200 to 1250 ℃
J	Type J Thermocouple	Standard Temperature Range: -200 to 750 ℃
T	Type T Thermocouple	Standard Temperature Range: -200 to 350 ℃
E	Type E Thermocouple	Standard Temperature Range: -200 to 900 ℃
R	RTD (Resistance Temperature Detector)	Standard Temperature Range: -200 to 850 ℃
Y 1	Special version , to be specified	

Tolerance Type

A	Class A , IEC 751 , Thin Filn (RTD)	(Note : the data for reference only , it may varies based on sensor type)

Sensor Sheath

M 1	MI-RTD-Ø 6 mm-Single-3 Wires-SS 316	(Note : the data for reference only , it may varies based on sensor type)

Wire junction

U	Ungrounded (Std for RTD)
G	Grounded
E	Exposed

Sheath length

XXXX	To be specified (e.g 0125 for 125 mm long)

Housing / Enclosure

LMT 1	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T6 Gb Ta -30℃ to +65℃), Die cast Aluminum , Blue colour
LMT 2	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T6 Gb Ta -30℃ to +65℃), SS316 , SS colour
LMT 3	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T5 Gb Ta -30℃ to +80℃), Die cast Aluminum , Blue colour
LMT 4	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T5 Gb Ta -30℃ to +80℃), SS316 , SS colour
-	-
IME 1	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T6 Gb Ta -30℃ to +65℃), Die cast Aluminum , Blue colour
IME 2	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T6 Gb Ta -30℃ to +65℃), SS316 , SS colour
IME 3	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T5 Gb Ta -30℃ to +80℃), Die cast Aluminum , Blue colour
IME 4	Explosion Proof (Bassefa11ATEX0024, Ex d e IIC T5 Gb Ta -30℃ to +80℃), SS316 , SS colour
T	Transmitter, Mounting Thread to be specified (Supplied by customer)
Z	None

Mounting Thread (If it do not require the enclosure head)

P	1/2" NPT c/w 150 mm long teflon lead wire (TE/TE, AWG 24)
Q	M20 x 1.5 P c/w 150 mm long teflon lead wire (TE/TE, AWG 24)
R	3/4" NPT c/w 150 mm long teflon lead wire (TE/TE, AWG 24)
Y 5	Special Version to be specified

(Area Classification: Ex d e IIC T6 Gb Ta ,-30°C to +70°C)

(Area Classification: Ex d e IIC T5 Gb Ta ,-30°C to +85°C)

Extension nipple type

1	150mm, SS 316, 1/2"NPT Plain Nipple and Union
2	150mm, SS 316, 3/4"NPT Plain Nipple and Union
3	200mm, SS 316, 1/2"NPT Plain Nipple and Union
4	200mm, SS 316, 3/4"NPT Plain Nipple and Union
Z	None
Y 6	Special version, to be specified

Documents (Optional)
In-house Calibration Certificate {RTD,PT100 (@ Class A , Class B, 1/3 DIN, 1/5 DIN) , Type K , J , T , E}

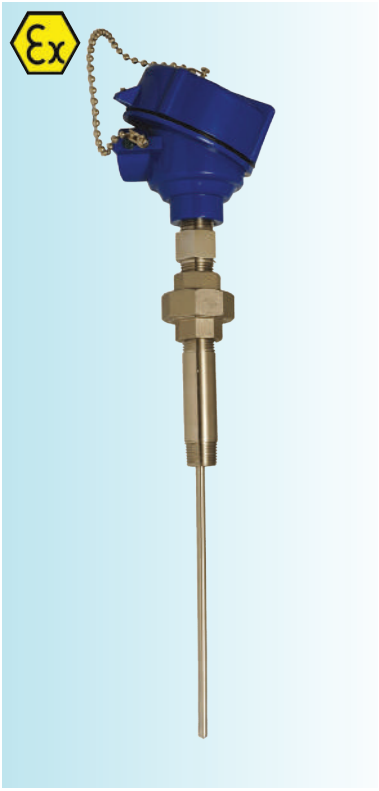
1	One Point (-25 to 500℃)
2	Two Points (-25 to 500℃)
3	Three Points (-25 to 500℃)
-	_

(Note : Non-Singlas / Singlas Calibration report is avaliable upon request)

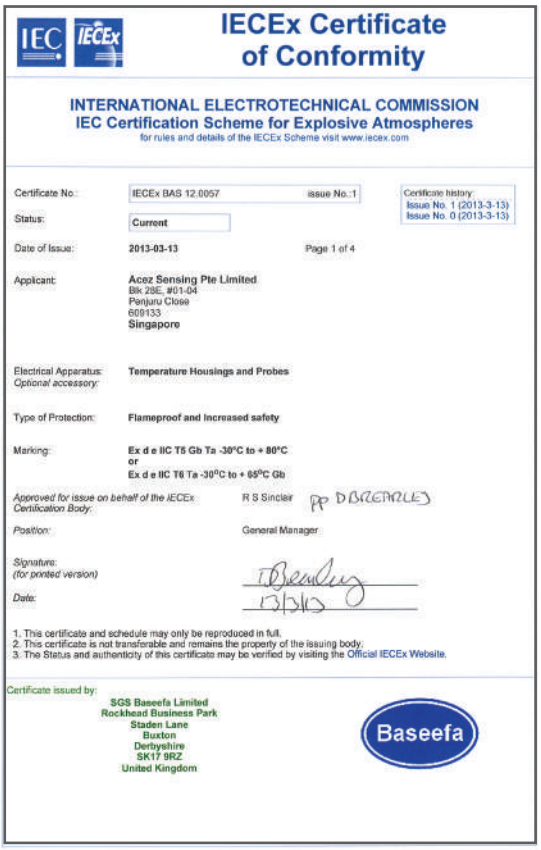
AS - XX										Order Code
	1	2	3	4	5	6	7	8	9	

Ex-Proof Temperature Sensor Assembly (AS-SLT-2010) & (AS-WT-2010)

- IECEx/ATEX approved temperature sensor assembly suitable for use in hazardous environment such as Oil & Gas and Petrochemical industries.
- Wide range of thermowells with different materials and process connections to suit your requirements for different ranges of temperature
- Customised fabrication according to customer specifications



Area Classification for temperature housing and probes (T5)	Ex II 2 G Ex d e IIC T5 Gb Ta -30°C to +80°C
Area Classification for temperature housing and probes (T6)	Ex II 2 G Ex d e IIC T6 Gb Ta -30°C to +65°C



IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx BAS 12.0057 Issue No.:1
Certificate history: Issue No. 1 (2013-3-13) Issue No. 0 (2013-3-13)
Status: Current
Date of Issue: 2013-03-13 Page 1 of 4
Applicant: Acez Sensing Pte Limited, Blk 28E, #01-04, Penjuru Close, 609133, Singapore
Electrical Apparatus: Temperature Housings and Probes
Optional accessory:
Type of Protection: Flameproof and Increased safety
Marking: Ex d e IIC T5 Gb Ta -30°C to + 80°C or Ex d e IIC T6 Ta -30°C to + 65°C Gb
Approved for issue on behalf of the IECEx Certification Body: R S Sinclair pp D BREARLEY
Position: General Manager
Signature: (for printed version)
Date: 13/3/13

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2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:
SGS Baseefa Limited
Rockhead Business Park
Staden Lane
Buxton
Derbyshire
SK17 9RZ
United Kingdom

Baseefa

Certificate Number Baseefa11ATEX0024
Baseefa
Issued 17 January 2013
Page 1 of 2

EC - TYPE EXAMINATION CERTIFICATE

Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 EC - Type Examination Certificate Number: Baseefa11ATEX0024
4 Equipment or Protective System: Temperature Housing and Probe
5 Manufacturer: Acez Sensing Pte Limited
6 Address: Blk 28E, #01-04, Penjuru Close, Singapore. 609133
7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
8 Baseefa, Notified Body number 1180, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in confidential Report No. GB/BAS/ExTR12.0071/00.
9 Compliance with the Essential Health and Safety Requirements has been assured by compliance with: EN 60079-0: 2012 EN 60079-1: 2007 EN 60079-7: 2007
except in respect of those requirements listed at item 18 of the Schedule.
10 If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.
11 This EC - TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.
12 The marking of the equipment or protective system shall include the following:
Ex II 2G Ex d e IIC T5 Gb Ta –30°C to + 80°C
This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa Customer Reference No. 6462 Project File No. 10/0121

This certificate is granted subject to the general terms and conditions of Baseefa. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

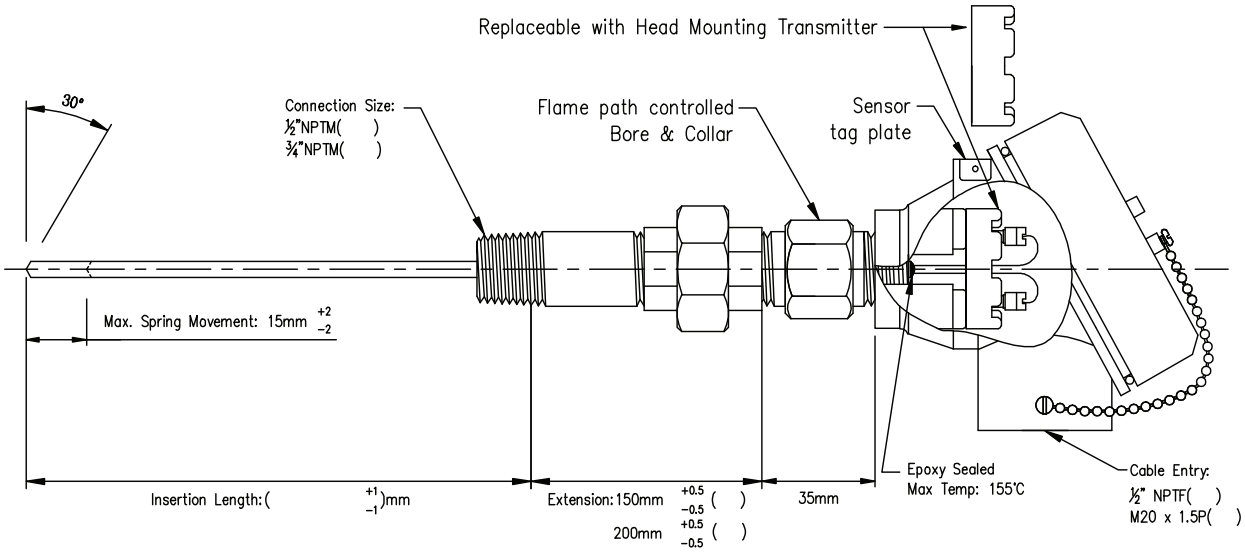
Baseefa
Rockhead Business Park, Staden Lane, Buxton, Derbyshire SK17 9RZ
Telephone +44 (0) 1298 766600 Fax +44 (0) 1298 766601
e-mail info@baseefa.com web site www.baseefa.com
Baseefa is a trading name of Baseefa Ltd
Registered in England No. 4365078. Registered address as above.

R S SINCLAIR
DIRECTOR
On behalf of Baseefa

AS-SLT-2010: Ex-proof Sensor Assembly c/w Hexagonal Spring Loaded Type

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Probe & Housing	ATEX Explosion Proof Baseefa11ATEX0024 Ex d e IIC T5 Gb Ta-30°C to +80°C (or) Ex d e IIC T6 Gb Ta-30°C to +65°C	
IP Rating	IP68	
Housing Material	Die Cast Al( )	SS316( )
Housing Colour & Paint	Blue (RAL-5010)	NIL/SST Finish

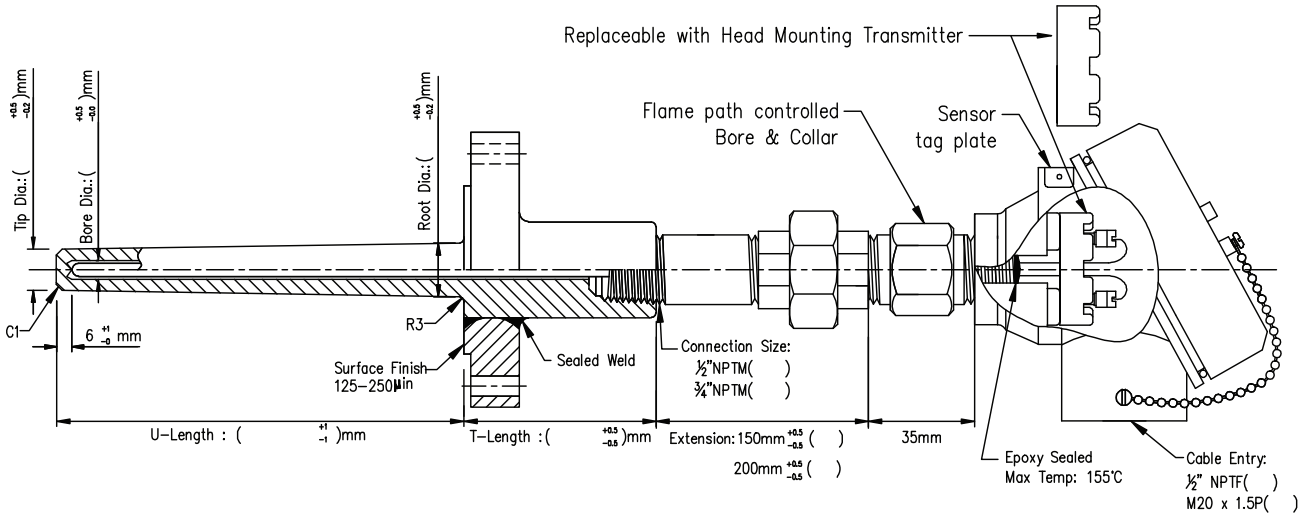


Model No | AS-SLT-2010 | - | - | - | - | - | - | - | - | -

Hexagonal Spring Loader, Terminal Block with Housing

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Probe & Housing	ATEX Explosion Proof Baseefa11ATEX0024 Ex d e IIC T5 Gb Ta-30°C to +80°C (or) Ex d e IIC T6 Gb Ta-30°C to +65°C	
IP Rating	IP68	
Housing Material	Die Cast Al( )	SS316( )
Housing Colour & Paint	Blue (RAL-5010)	NIL/SST Finish



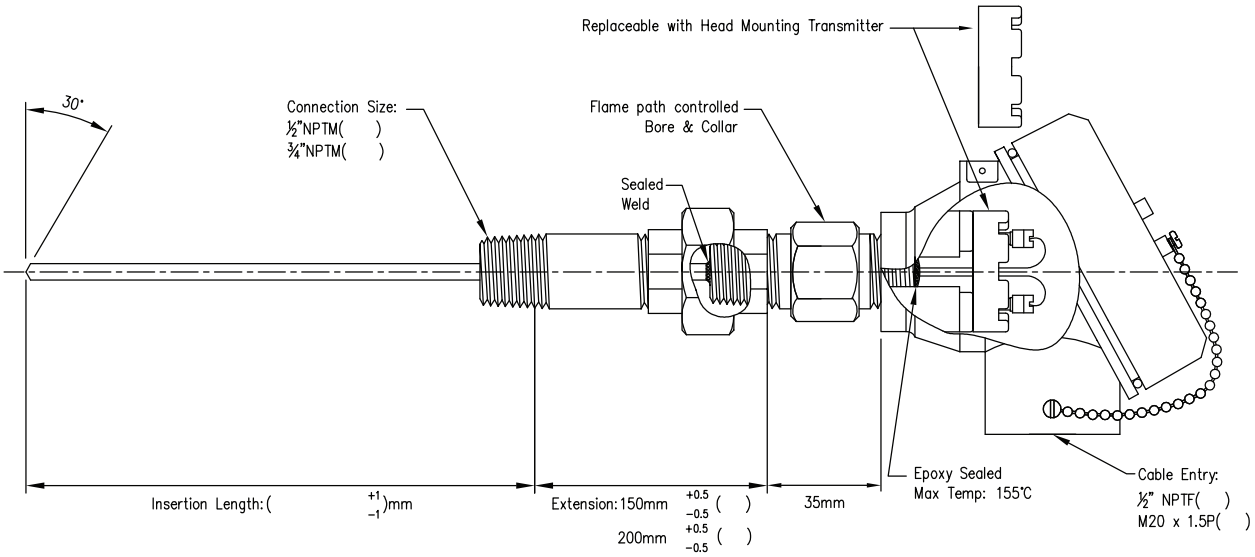
Model No | AS-SLT-2010 | - | - | - | - | - | - | - | - | -

Hexagonal Spring Loader, Sensor Assembly (with flange thermowell)

AS-WT-2010: Ex-proof Sensor Assembly c/w Welded Type

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Probe & Housing	ATEX Explosion Proof Baseefa11ATEX0024 Ex d e IIC T5 Gb Ta-30°C to +80°C (or) Ex d e IIC T6 Gb Ta-30°C to +65°C	
IP Rating	IP68	
Housing Material	Die Cast Al( )	SS316( )
Housing Colour & Paint	Blue (RAL-5010)	NIL/SST Finish

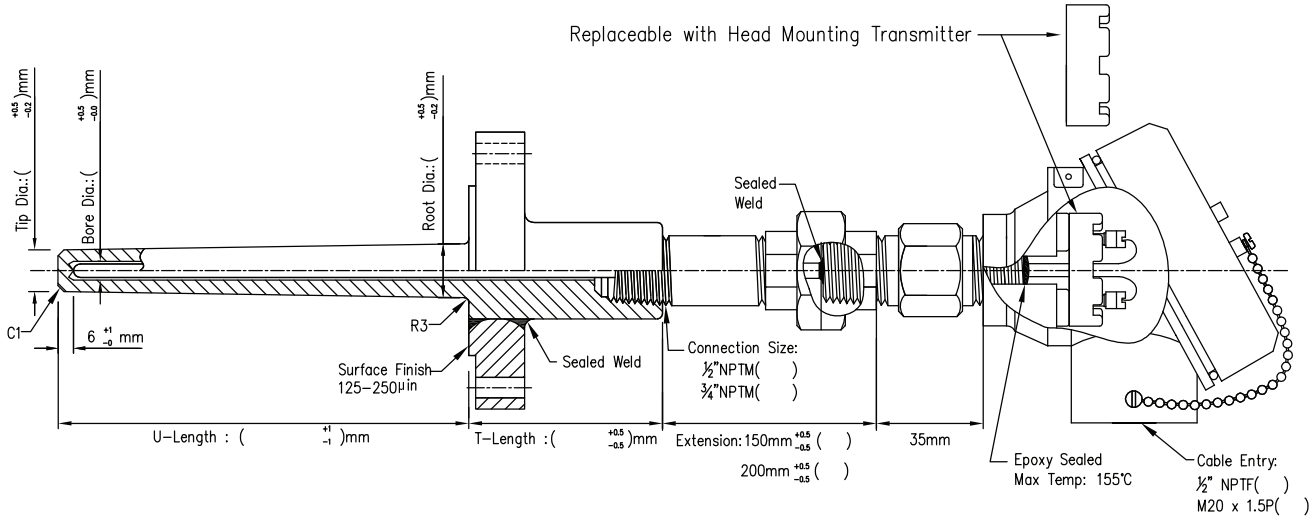


Model No | AS-WT-2010 | - | - | - | - | - | - | - | - | -

Hexagonal Welded Fitting, Terminal Block with Housing

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Probe & Housing	ATEX Explosion Proof Baseefa11ATEX0024 Ex d e IIC T5 Gb Ta-30°C to +80°C (or) Ex d e IIC T6 Gb Ta-30°C to +65°C	
IP Rating	IP68	
Housing Material	Die Cast Al( )	SS316( )
Housing Colour & Paint	Blue (RAL-5010)	NIL/SST Finish



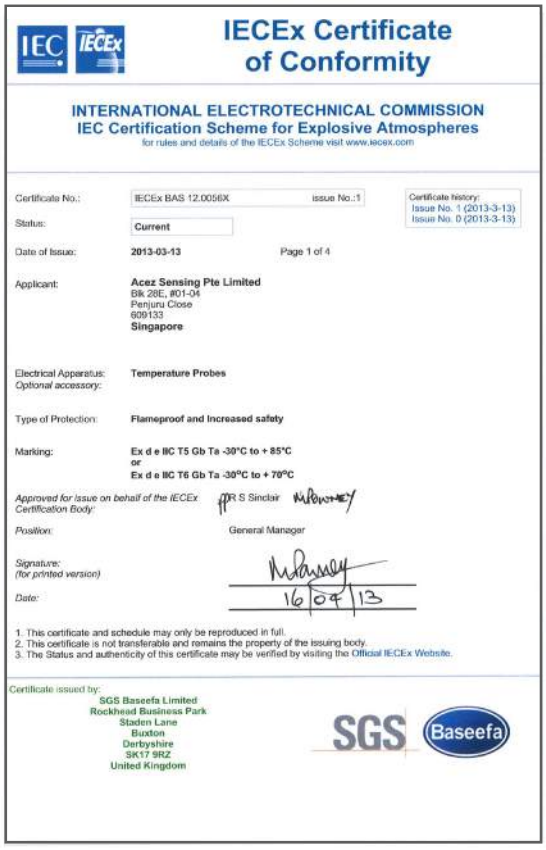
Model No | AS-WT-2010 | - | - | - | - | - | - | - | - | -

Hexagonal Welded Fitting, Sensor Assembly (with flange thermowell)

Ex-Proof Temperature Sensor Probes (AS-SLT-2010) & (AS-WT-2010)

- IECEx/ATEX approved temperature sensor probes suitable for use in hazardous environment such as Oil & Gas and Petrochemical industries.
- Wide range of thermowells with different materials and process connections to suit your requirements for different ranges of temperature
- Customised fabrication according to customer specifications

Area Classification for temperature probes (T5)	Ex II 2 G Ex d e IIC T5 Gb Ta -30°C to +85°C
Area Classification for temperature probes (T6)	Ex II 2 G Ex d e IIC T6 Gb Ta -30°C to +70°C



IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
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Certificate No.: IECEx BAS 12.0056X Issue No.:1
Certificate history: Issue No. 1 (2013-3-13) Issue No. 0 (2013-3-13)
Status: Current
Date of Issue: 2013-03-13 Page 1 of 4
Applicant: Acez Sensing Pte Limited, Blk 28E, #01-04, Penjuru Close, 609133, Singapore
Electrical Apparatus: Temperature Probes
Optional accessory:
Type of Protection: Flameproof and Increased safety
Marking: Ex d e IIC T5 Gb Ta -30°C to + 85°C or Ex d e IIC T6 Gb Ta -30°C to + 70°C
Approved for issue on behalf of the IECEx Certification Body: R S Sinclair
Position: General Manager
Signature: (for printed version)
Date: 16/04/13

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Certificate issued by:
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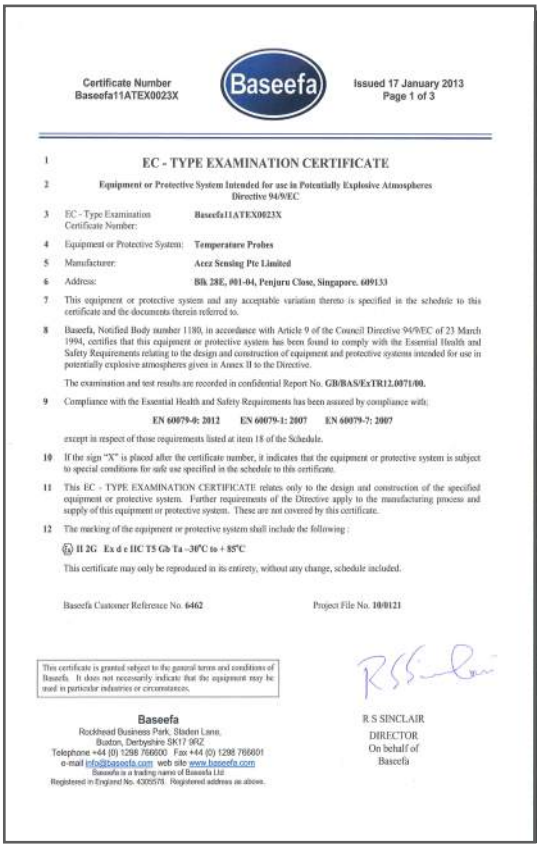
United Kingdom



Certificate Number Baseefa11ATEX0023X
Issued 17 January 2013
Page 1 of 3

EC - TYPE EXAMINATION CERTIFICATE

Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 EC - Type Examination Certificate Number: Baseefa11ATEX0023X
4 Equipment or Protective System: Temperature Probes
5 Manufacturer: Acez Sensing Pte Limited
6 Address: Blk 28E, #01-04, Penjuru Close, Singapore. 609133
7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
8 Baseefa, Notified Body number 1180, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
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Ex II 2G Ex d e IIC T5 Gb Ta -30°C to + 85°C
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Baseefa Customer Reference No. 6462 Project File No. 10/0121

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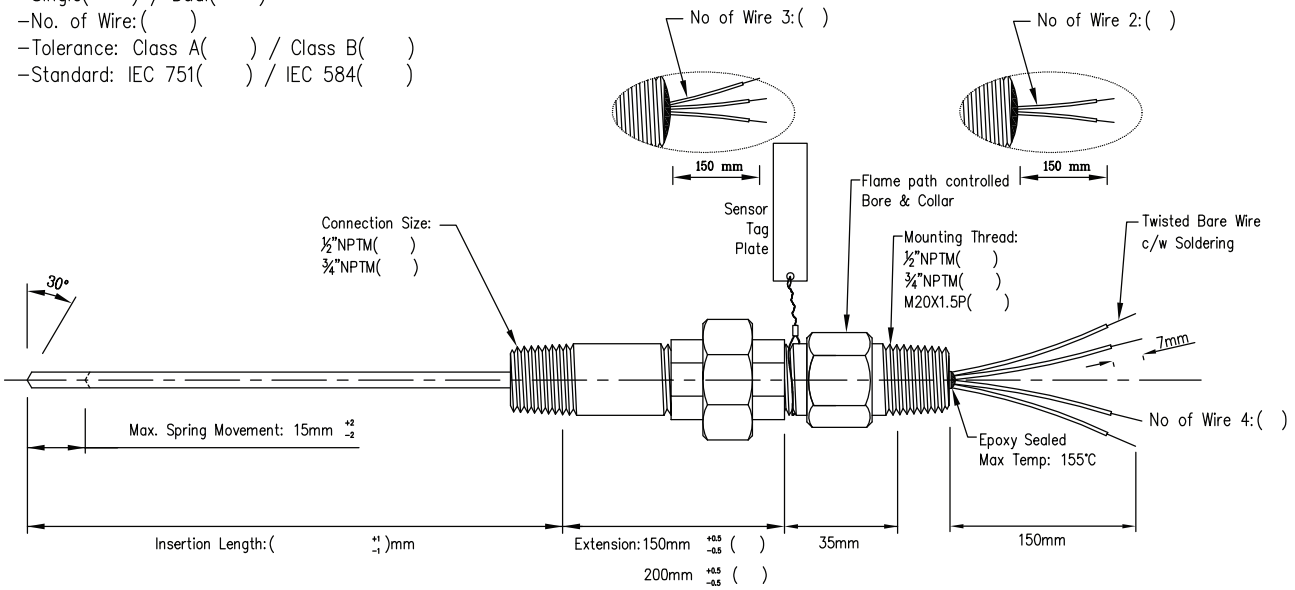
Baseefa
Rockhead Business Park, Staden Lane, Buxton, Derbyshire SK17 9RZ
Telephone +44 (0) 1298 766600 Fax +44 (0) 1298 766601
e-mail info@baseefa.com web site www.baseefa.com
Baseefa is a trading name of Baseefa Ltd
Registered in England No. 4305578. Registered address as above.

R S SINCLAIR
DIRECTOR
On behalf of
Baseefa

AS-SLT-2010: Ex-proof Sensor Assembly c/w Hexagonal Spring Loaded Type

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Assembly	ATEX Explosion Proof Baseefa11ATEX0023X Ex d e IIC T5 Gb Ta-30°C to +85°C (or) Ex d e IIC T6 Gb Ta-30°C to +70°C

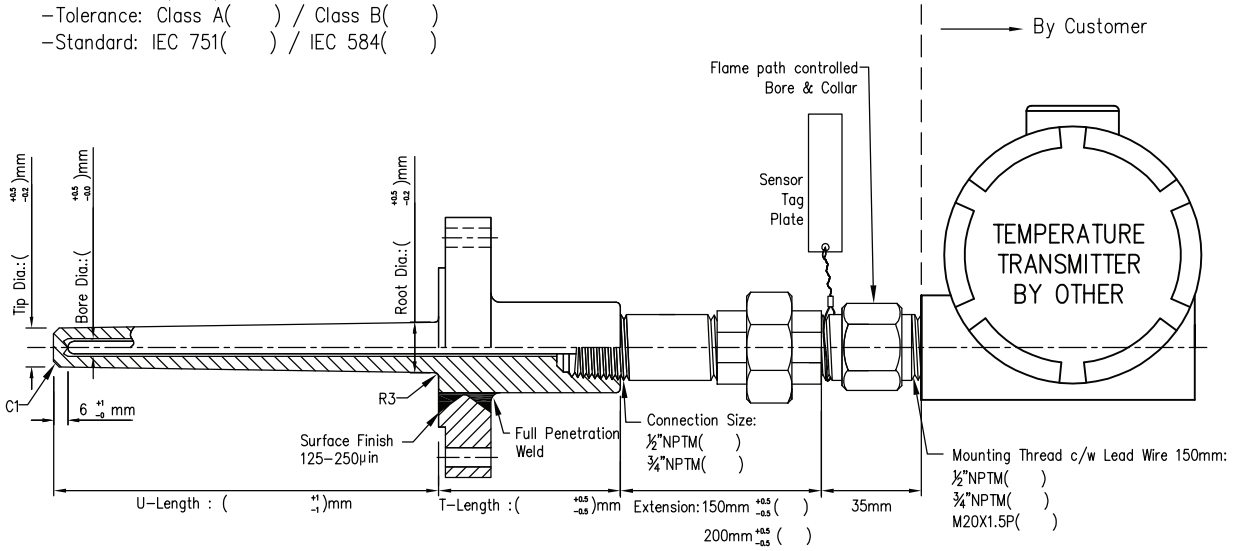


Model No | AS-SLT-2010 | – | – | – | – | – | – | – | – | –

Hexagonal Spring Loader, without Housing

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Assembly	ATEX Explosion Proof Baseefa11ATEX0023X Ex d e IIC T5 Gb Ta-30°C to +85°C (or) Ex d e IIC T6 Gb Ta-30°C to +70°C



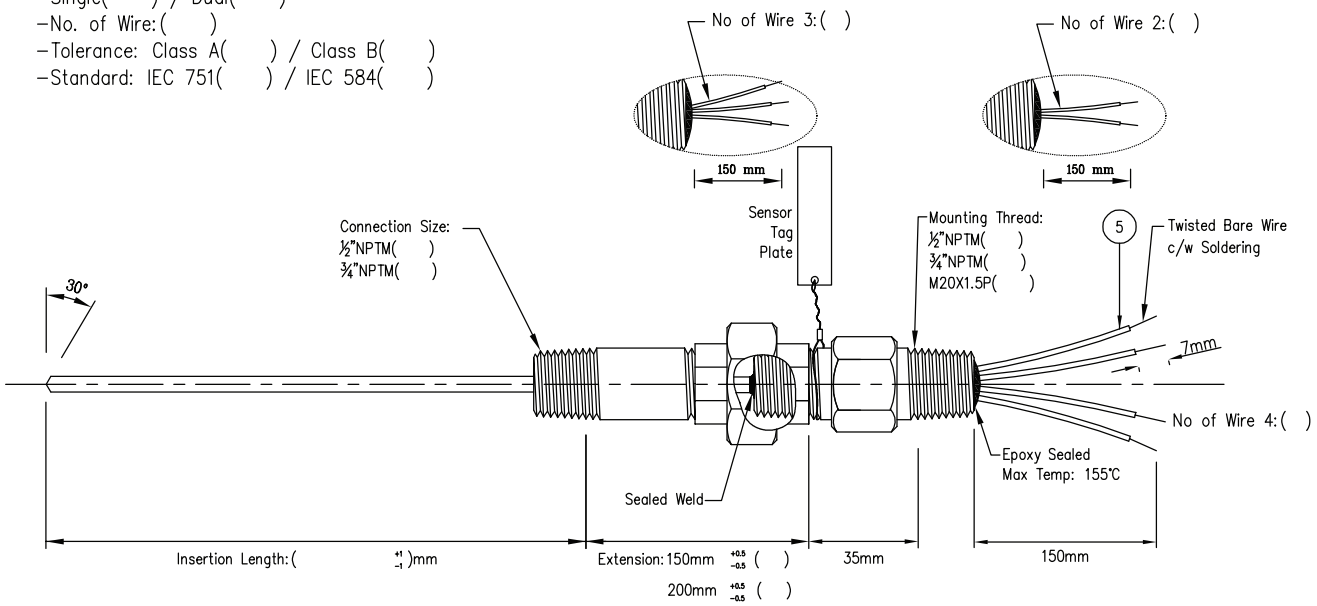
Model No | AS-SLT-2010 | – | – | – | – | – | – | – | – | –

Hexagonal Spring Loader, Sensor Assembly (with flange thermowell)

AS-WT-2010: Ex-proof Sensor Assembly c/w Welded Type

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Assembly	ATEX Explosion Proof Baseefa11ATEX0023X Ex d e IIC T5 Gb Ta=-30°C to +85°C (or) Ex d e IIC T6 Gb Ta=-30°C to +70°C

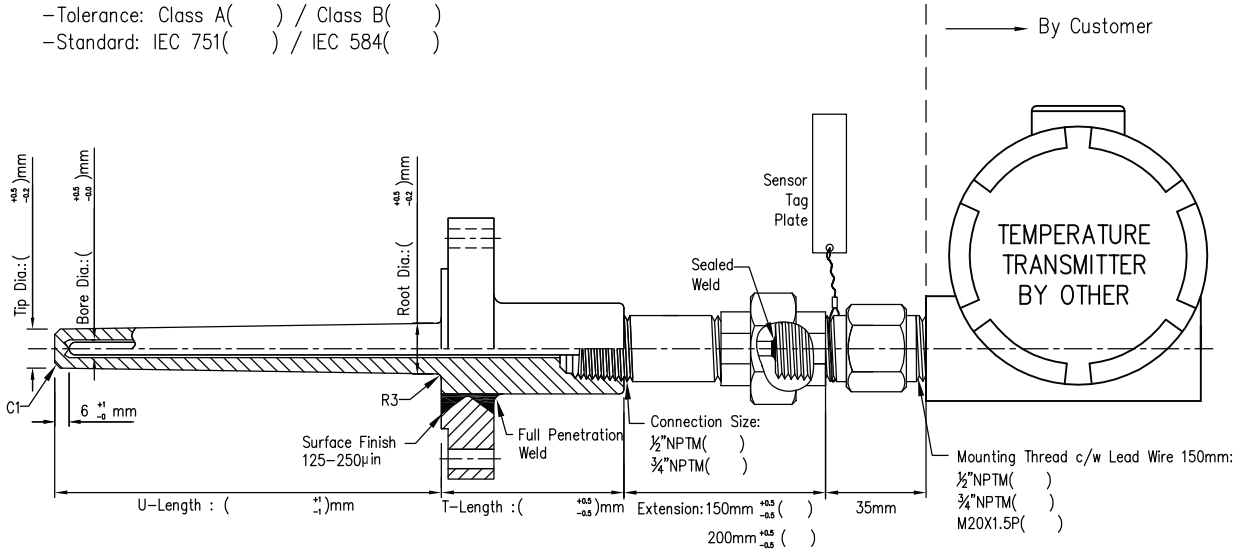


Model No | AS-WT-2010 | – | – | – | – | – | – | – | – | –

Hexagonal Welded Loader, without Housing

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / T/C( )
-Ungrounded( ) / Grounded( )
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance: Class A( ) / Class B( )
-Standard: IEC 751( ) / IEC 584( )

Area classification For Sensor Assembly	ATEX Explosion Proof Baseefa11ATEX0023X Ex d e IIC T5 Gb Ta=-30°C to +85°C (or) Ex d e IIC T6 Gb Ta=-30°C to +70°C



Model No | AS-WT-2010 | – | – | – | – | – | – | – | – | –

Hexagonal Welded Fitting, Sensor Assembly (with flange thermowell)

High Accuracy Sensor Assembly c/w Opened-end Thermowell (TE.25)

Resistance thermometer for temperature measurement in chilled pipe

Sensor Type

R	RTD , PT 100 , 1/10 DIN , ±0.03℃ at 0℃
T 1	Thermistor 10 K , ±0.10℃ at (0 to 50°C)
T 2	Thermistor 10 K , ±0.05℃ at (0 to 50°C)

Tolerance Type

1	± 0.03℃ at 0 ℃ (For 1/10 DIN)	(Maximun Temperature range : +150ºC)
2	± 0.05℃ at (0 to 50°C) , For Thermistor 10 K	(Maximun Temperature range : +88ºC)
3	± 0.10℃ at (0 to 50°C), For Thermistor 10 K	(Maximun Temperature range : +150ºC)

Sensor Sheath

T U 1	Tubing-RTD-Ø 3.0 mm -Single-4 Wires-SS 316 (Note : the data for reference only , it may varies based on sensor type)

Wire Junction

U	Ungrounded (Std for this design)

Complete Design

W	With Open-end Thread thermowell
W O	Thermowell is not required
B	Base plate and terminal block
L 1	Epoxy holder and lead wire (TE/TE, AWG 24) , 70 mm (STD)
	(Note : 100 mm , 150 mm , 200 mm , 250 mm and 300 mm are avaliable as option)

Process Connection (PC)

P C 1	1/2" NPT M
P C 2	1/2" BSP M
-	Not Applicable
Y 2	Special version to be specified

Thermowell Stem Dimensions

T W 1	Root Dia : Ø16 mm , Tip Dia : Ø12 mm , Bore Dia : Ø6.6 mm
T W 2	Root Dia : Ø16 mm , Tip Dia : Ø16 mm , Bore Dia : Ø6.6 mm
-	Not Applicable
Y 3	Special version, to be specified

Thermowell insertion length/sensor length if thermowell is not require

XXXX	To be specified (e.g 0125 mm for 125 mm long)

Lagging length "T"

T	45 mm (STD)
Y 4	Special version to be specified

Accessories

P	Test Plug Size : 1/4 " NPT M , Material : Brass
B	Ball valve Size : 1/4" NPT F , Material : SS 316
P B	Test plug (P) and ball valve (B) , size : 1/4" NPT
-	Not Applicable
Y 5	Special version, to be specified

Housing / Enclosure

W 1	Weather Proof , IP65, Die Cast Aluminum , Blue colour
W 2	Weather Proof ,IP 65, Die Cast Aluminum , Silver colour
W 3	KNH(S) Head , IP 65, Die Cast Aluminum , Silver colour
-	Connection head is not required
Y 6	Special version to be specified

Accessories (from customer to assembly with)

T X	Head mounted transmitter (suplied by customer)
-	Not Applicable

Documents (optional)

In-house Calibration Certificate {RTD,PT100 ,1/10 DIN}

1	One Point (0 to 50℃)
2	Two Points (0 to 50℃)
3	Three Points (0 to 50℃)
-	–
	(Note : Non-Singlas / Singlas Calibration report is avaliable upon request)

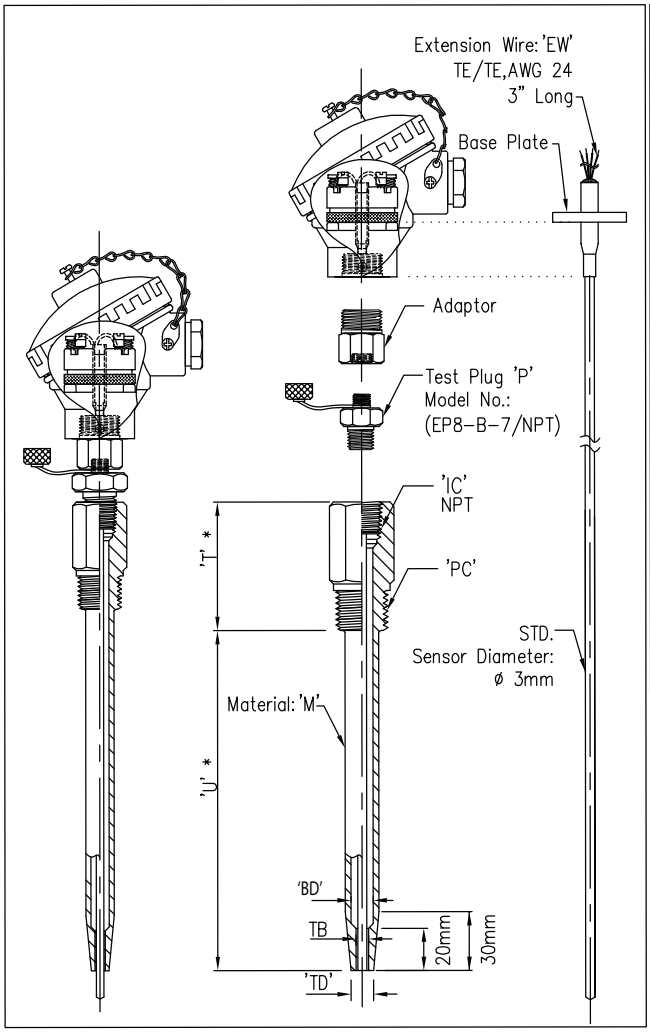
TE 25														← Order Code
	1	2	3	4	5	6	7	8	9	10	11	12	13	

High Accuracy Sensor Assembly c/w Opened-end Thermowell (TE.25)

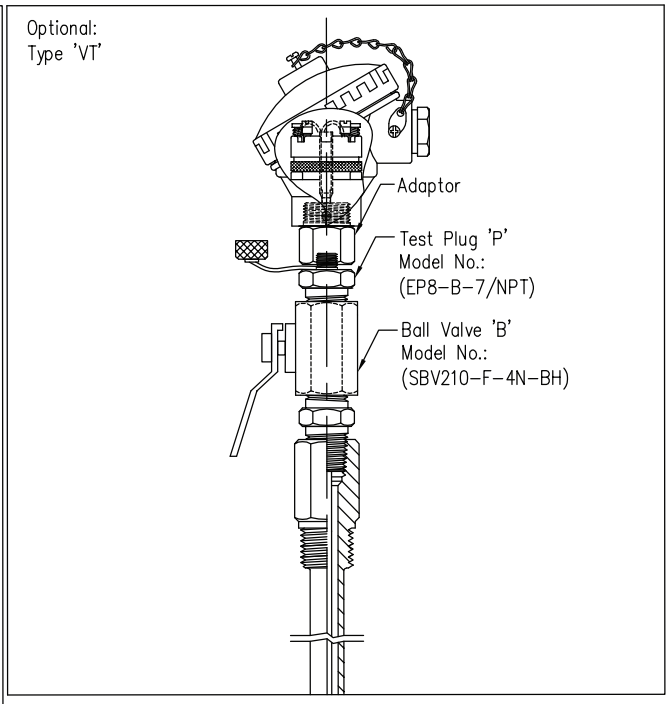
Resistance thermometer for temperature measurement in chille pipe

Sensor & Opened-end thread thermowell with housing
Optional :
1) Test plug
2) Ball Valve

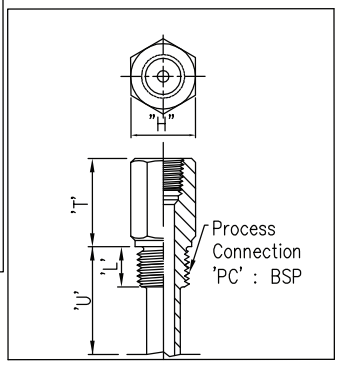
Assembly drawing for sensor & opened–end thread thermowell



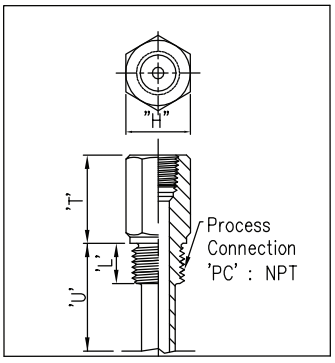
Sensor & opened–end thread thermowell assembly with ball valve and test plug



*For process connection type 'BSP'



*For process connection type 'NPT'



U = Insertion length
T = Lagging length
BD = Bore diameter
TB = Tip bore diameter
M = Material
PC = Process connection
IC = Instrument connection
B = Ball valve
PC = Test plg
L = Thread length
EW = Extension wire

BSP : British Standard Pipe Thread

NPT : National Pipe Thread

Process Connection	Hex F/F Size: 'H'	Thread Length: 'L'
½" BSP	28.5 mm	14 mm
¾" BSP	31.75 mm	16 mm

Process Connection	Hex F/F Size: 'H'	Thread Length: 'L'
½" NPT	28.5 mm	19 mm
¾" NPT	28.5 mm	19 mm

Process Connection,
NPT or BSP, measurement system of insertion length 'U' and lagging length 'T' will reflect upon the selected connection type.

High Accuracy Sensor Assembly c/w Opened-end Thermowell (TE.25)

Resistance thermometer for temperature measurement in chille pipe

General Construction:

Resistance thermometers, also called resistance temperature detectors (RTDs), are sensors used to measure temperature by correlating the resistance of the RTD element with temperature.Convectronics' standard RTD assemblies are constructed using wire wound platinum elements with a reference resistance of 100 ohm(called as PT 100) at 0°C.

Thermistors are temperature sensors that are made from a variety of metal–oxide semiconductor materials. The semiconductor material used determines the temperature range, sensitivity and resistance ranges involved in its application.
Resistance @ +25°C=10,000 ohm(10 KΩ) Nominal

Sensor Leadwire:

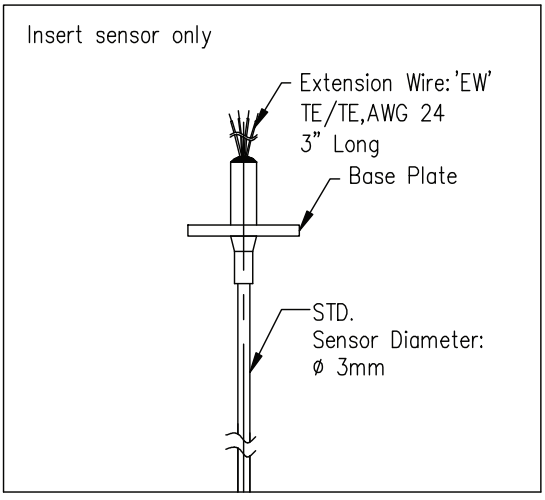
All standard RTD sensor or thermistor lead wire is stranded as Teflon insulation.Teflon insulated leads are rated at 200°C maximum.

Circuit type

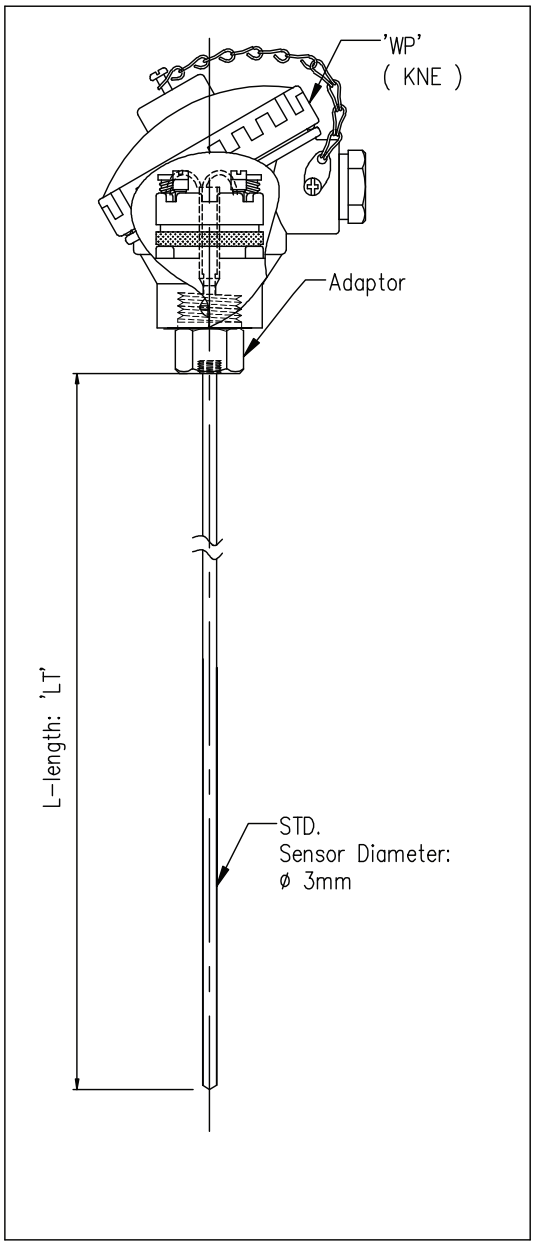
2 wires circuit for Thermistor 10 K ("+"ve , "–"ve)
4 wires circuit for RTD,PT 100, 1/10 DIN (A,A ; B,B)

Connection Head Type,

Type KNE or KNH, Weather proof
Colours are available as
silver or blue upon selection.



Assembly drawing for sensor only



EW = Extension wire
LT = Sensor insertion length

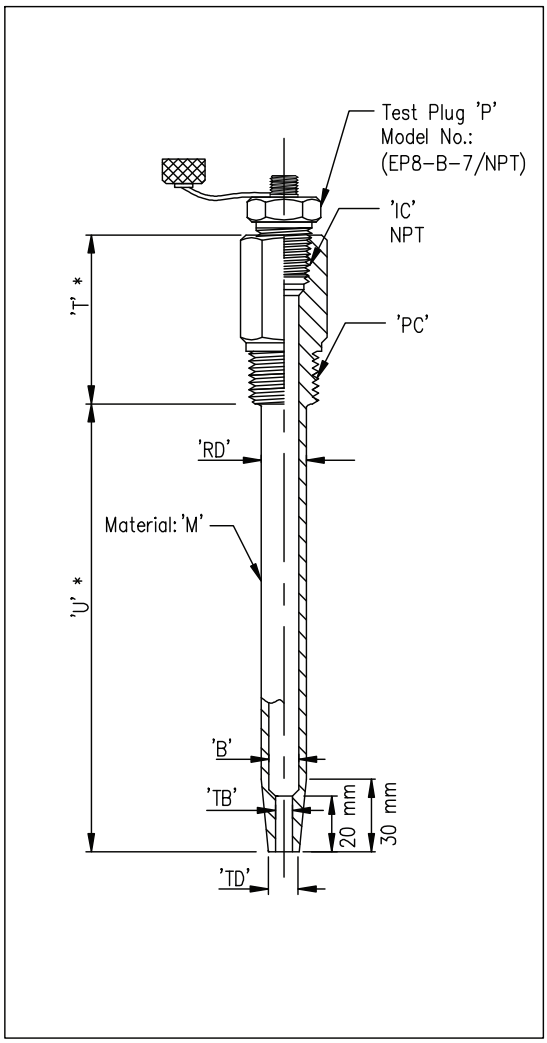
High Accuracy Sensor Assembly c/w Opened-end Thermowell (TE.25)

Resistance thermometer for temperature measurement in chille pipe

Opened–end thread thermowell

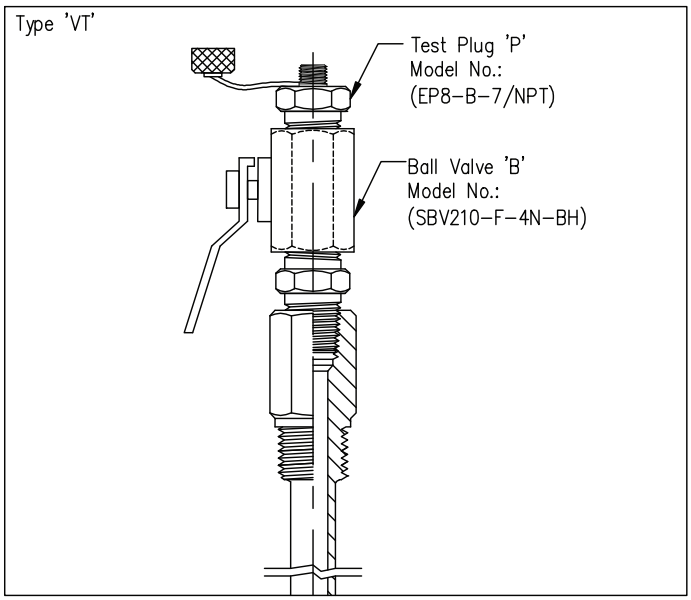
Optional:
(1) Ball Valve
(2) Test Plug

Assembly drawing for opened–end thread thermowell

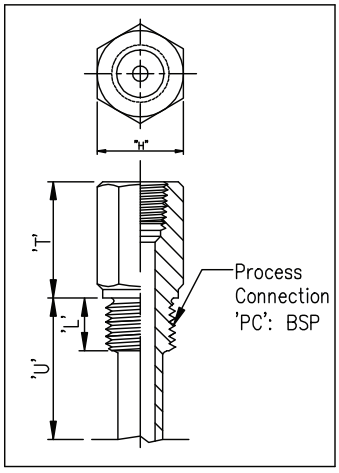


U = Insertion length
T = Lagging length
B = Bore diameter
TB = Tip bore diameter
TD = Tip diameter
RD = Root diameter
M = Material
PC = Process connection
IC = Instrument connection
T1 = Test plug
L = Thread length

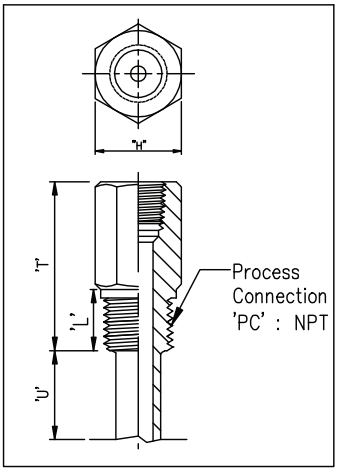
Opened–end thread thermowell assembly with ball valve and test plug



*For process connection type 'BSP'



*For process connection type 'NPT'



BSP : British Standard Pipe Thread

Process Connection	Hex F/F Size: 'H'	Thread Length: 'L'
½" BSP	28.5 mm	14 mm
¾" BSP	31.75 mm	16 mm

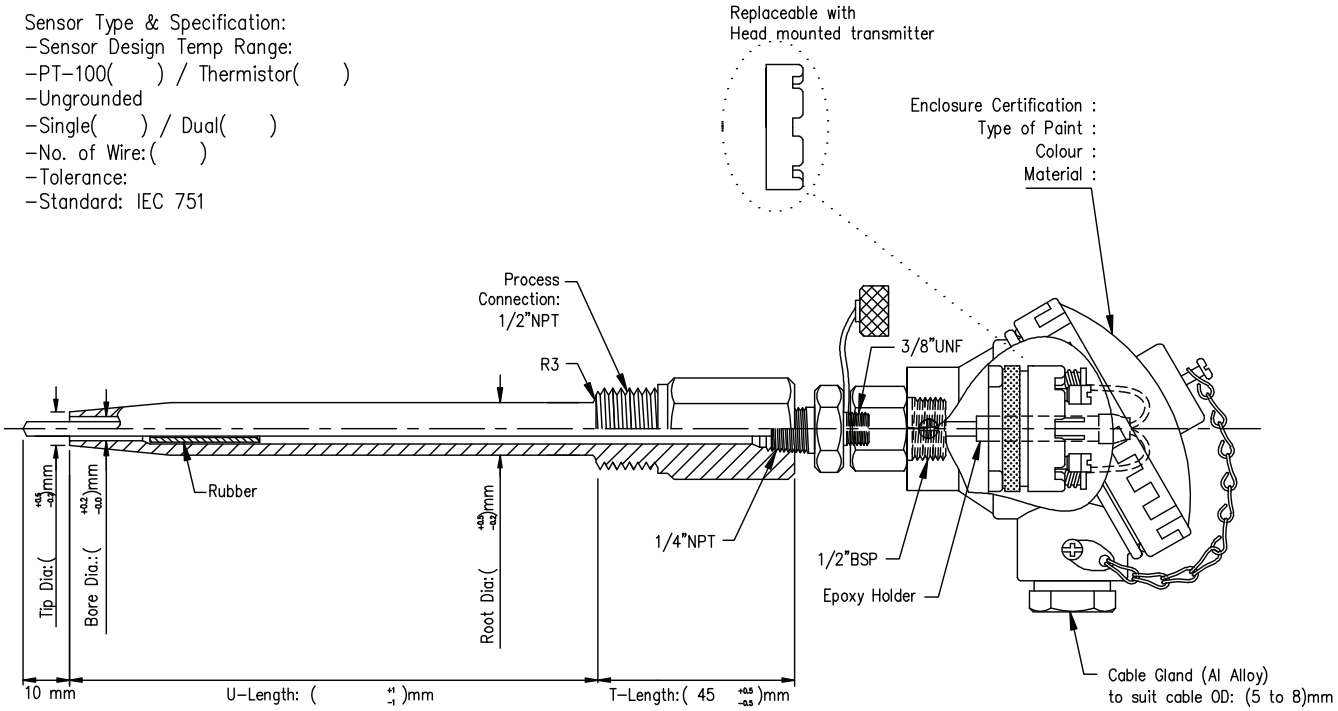
NPT : National Pipe Thread

Process Connection	Hex F/F Size: 'H'	Thread Length: 'L'
½" NPT	28.5 mm	19 mm
¾" NPT	28.5 mm	19 mm

Process Connection,
NPT or BSP, measurement system of insertion length 'U' and lagging length 'T' will reflect upon the selected connection type.

TE25 High Accuracy Sensor Assembly c/w opened-end thread thermowell

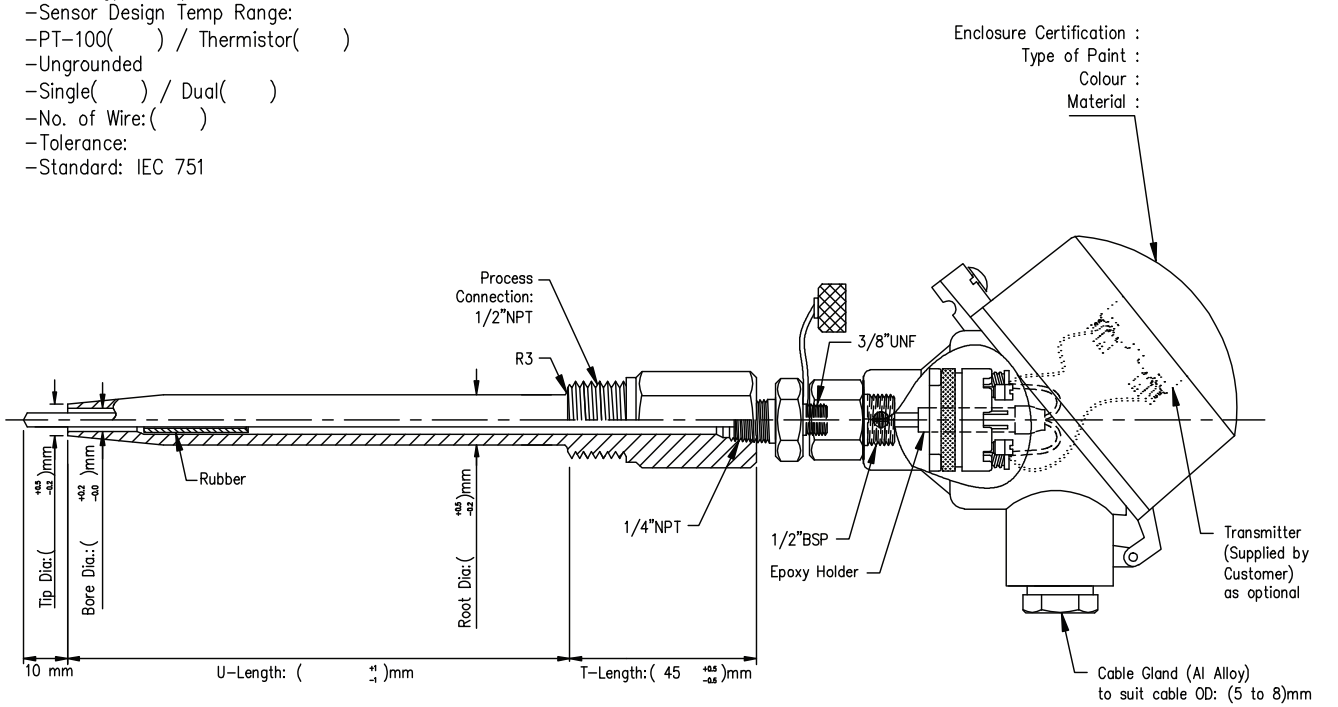
Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / Thermistor( )
-Ungrounded
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance:
-Standard: IEC 751



Model No | TE25 | – | – | – | – | – | – | – | – | – | – | – | –

TE25 High Accuracy Sensor Assembly c/w opened-end thread thermowell

Sensor Type & Specification:
-Sensor Design Temp Range:
-PT-100( ) / Thermistor( )
-Ungrounded
-Single( ) / Dual( )
-No. of Wire:( )
-Tolerance:
-Standard: IEC 751



Model No | TE25 | – | – | – | – | – | – | – | – | – | – | – | –

SELECTION OF THERMOWELLS

Material

Thermowell material chosen for an installation is governed by corrosive conditions. Occasionally, the material consideration is one of strength rather than a corrosive condition. Consult the pressure-temperature ratings given for each well type for proper selection.

Insertion Length "U"

The distance from the end of the well to the underside of the thread, or other connection means, designated as "U" is the insertion length. For best accuracy, this length should be long enough to permit the entire temperature sensitive part of the thermocouple to project into the temperature medium being measured.

Bore Size

The bore size of wells shown in this catalog cover the most commonly used temperature sensing elements as follows:

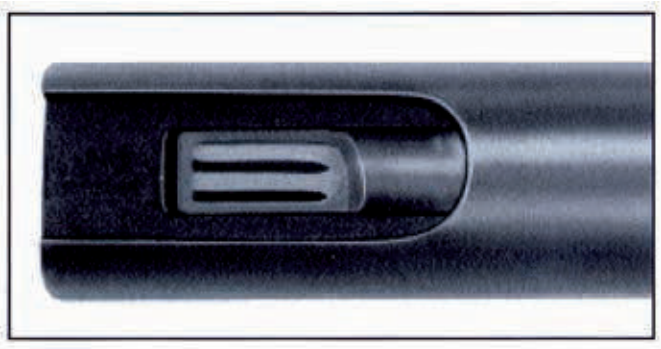
Bore Diameter	Recommended Element Diameter
Ø 6.6	Ø 6.0
Ø 6.6 or Ø 7	Ø 6.35
Ø 8.5	Ø 8.0
Ø 10	Ø 9.5

Tapered or Straight Shank

Tapered shank wells provide greater stiffness for the same sensitivity. The hight strength-to-weight ratio gives these wells higher natural frequency than equivalent length straight shank wells, thus permitting operation at higher fluid velocity.

Velocity Ratings of Wells

Wells failures in most cases are not due to the effect of pressure and temperature. The calculations necessary to provide adequate strength under given conditions are familiar enough to permit proper choice of wall thickness and material.



Less familiar, and more dangerous, are the vibrational effects to which wells are subjected. Fluid flowing by the well forms a turbulent wake (called the Von Karman Trail) which has definite frequency based on the diameter of the well and the velocity of the fluid. It is important that the well have sufficient stiffness so that the wake frequency will never equal the natural frequency of the well itself. If the natural frequency of the well were to coincide with the wake frequency, the well would vibrate to destruction and break off in the piping.

A recommended maximum velocity rating for typical well lengths and materials is listed in the accompanying tables. To reduce the complexity of presenting this information, the ratings given are based on operating temperatures of 1000˚F for wells made of Carbon Steel (C - 1018), A.I.S.I 304 & A.I.S.I. 316. Values for brass wells are based on 350˚F (177˚C) operation. Limits for Monel wells are based on 900˚F (482˚C) service. Slightly higher velocity is possible at lower temperatures.

Where single values appear in the velocity tables, they maybe considered safe for water, steam, air or gas. In the shorter insertion lenghts, consideration is given to the velocity pressure effect of water flowing at high velocities. The values in parenthesis, therefore, represent safe values for water flow while the unbracketed value may be used for steam, air, gas and similar density fluids. The values given are conservative and intended as a guide. Wells are also safe if the resonant frequency is well below the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. Nevertheless, if the installation is not hampered by the use of a sufficiently stiff well, the values given should not be exceeded.

Maximum Allowable Working Pressure

Weld-In Thermowells										
MATERIAL		ORDER CODE	0.260" BORE		0.385" BORE		TEMPERATURE RANGE			
			Wall = 0.158"/"V" = 5/8"		Wall = 0.165"/"V" = 49/64"		C		F	
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A479 Gr. 304/304L	304/304L	09	7361 psi	3400 psi	6007 psi	2800 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 316/316L	316/316L	08	7234 psi	5200 psi	5900 psi	4200 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 347	347	36	7234 psi	5200 psi	5900 psi	4200 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	8175 psi	5062 psi	6753 psi	4259 psi	-28 C	482 C	-20 F	900 F
B164 Gr. N04400	Alloy 400	27	6178 psi	4970 psi	5103 psi	4105 psi	-28 C	482 C	-20 F	900 F
B574 Gr. N10276	Alloy C-276	29	9336 psi	5713 psi	7712 psi	4700 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. F11	F11	60	8175 psi	5156 psi	6753 psi	4259 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F22	F22	59	10266 psi	5156 psi	8374 psi	4259 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F91	F91	91	13670 psi	5156 psi	11142 psi	4259 psi	-28 C	482 C	-20 F	900 F
B473 Gr. N08020	Alloy 20	38	8361 psi	6038 psi	6907 psi	4988 psi	-28 C	425 C	-20 F	800 F
B166 Gr. N06600	Alloy 600	03	6410 psi	1511 psi	5295 psi	1258 psi	-28 C	650 C	-20 F	1200 F
B408 Gr. N08800	Alloy 800	37	7153 psi	4923 psi	5909 psi	4067 psi	-28 C	593 C	-20 F	1100 F

Threaded Thermowells												
MATERIAL		ORDER CODE	STRAIGHT				STEPPED		TEMPERATURE RANGE			
			0.260" BORE		0.385" BORE		0.260" BORE					
			Wall = 0.158"/"Q" = 5/8"		Wall = 0.165"/"V" = 49/64"		Wall = 0.101"/"V" = 1/2"		C		F	
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A479 Gr. 304/304L	304/304L	09	7361 psi	3400 psi	6007 psi	2800 psi	5489 psi	2600 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 316/316L	316/316L	08	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 347	347	36	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	8175 psi	5062 psi	6753 psi	4259 psi	6238 psi	3934 psi	-28 C	482 C	-20 F	900 F
B164 Gr. N04400	Alloy 400	27	6178 psi	4970 psi	5103 psi	4105 psi	4713 psi	3792 psi	-28 C	482 C	-20 F	900 F
B574 Gr. N10276	Alloy C-276	29	9336 psi	5713 psi	7712 psi	4700 psi	7124 psi	4309 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. F11	F11	60	8175 psi	5156 psi	6753 psi	4259 psi	6238 psi	3934 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F22	F22	59	10266 psi	5156 psi	8374 psi	4259 psi	7671 psi	3934 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F91	F91	91	13670 psi	5156 psi	11142 psi	4259 psi	10200 psi	3934 psi	-28 C	482 C	-20 F	900 F
B473 Gr. N08020	Alloy 20	38	8361 psi	6038 psi	6907 psi	4988 psi	6379 psi	4607 psi	-28 C	425 C	-20 F	800 F
B166 Gr. N06600	Alloy 600	03	6410 psi	1511 psi	5295 psi	1258 psi	4891 psi	1162 psi	-28 C	650 C	-20 F	1200 F
B408 Gr. N08800	Alloy 800	37	7153 psi	4923 psi	5909 psi	4067 psi	5458 psi	3757 psi	-28 C	593 C	-20 F	1100 F
MATERIAL		ORDER CODE	TAPERED				LIMITED SPACE		TEMPERATURE RANGE			
			Wall = 0.158"/"V" = 5/8"		Wall = 0.165"/"V" = 49/64"		Wall = 0.101"/"Q" = 1/2"		C		F	
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A479 Gr. 304/304L	304/304L	09	7361 psi	3400 psi	6007 psi	2800 psi	5489 psi	2600 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 316/316L	316/316L	08	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 347	347	36	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	8175 psi	5062 psi	6753 psi	4259 psi	6238 psi	3934 psi	-28 C	482 C	-20 F	900 F
B164 Gr. N04400	Alloy 400	27	6178 psi	4970 psi	5103 psi	4105 psi	4713 psi	3792 psi	-28 C	482 C	-20 F	900 F
B574 Gr. N10276	Alloy C-276	29	9336 psi	5713 psi	7712 psi	4700 psi	7124 psi	4309 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. F11	F11	60	8175 psi	5156 psi	6753 psi	4259 psi	6238 psi	3934 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F22	F22	59	10266 psi	5156 psi	8374 psi	4259 psi	7671 psi	3934 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F91	F91	91	13670 psi	5156 psi	11142 psi	4259 psi	10200 psi	3934 psi	-28 C	482 C	-20 F	900 F
B473 Gr. N08020	Alloy 20	38	8361 psi	6038 psi	6907 psi	4988 psi	6379 psi	4607 psi	-28 C	425 C	-20 F	800 F
B166 Gr. N06600	Alloy 600	03	6410 psi	1511 psi	5295 psi	1258 psi	4891 psi	1162 psi	-28 C	650 C	-20 F	1200 F
B408 Gr. N08800	Alloy 800	37	7153 psi	4923 psi	5909 psi	4067 psi	5458 psi	3757 psi	-28 C	593 C	-20 F	1100 F

These tables are for reference only. Other design factors should be taken into consideration in addition to temperature and pressure, such as vibration, corrosion, and installation method.

Maximum Allowable Working Pressure

Socket-Weld Thermowells

MATERIAL		ORDER CODE	STRAIGHT				STEPPED		TAPERED				TEMPERATURE RANGE			
			0.260" BORE		0.385" BORE		0.260" BORE		0.260" BORE		0.385" BORE		C		F	
			Wall = 0.158"/"Q" = 5/8"		Wall = 0.165"/"Q" = 49/64"		Wall = 0.101"/"V" = 1/2"		Wall = 0.158"/"V" = 5/8"		Wall = 0.165"/"V" = 49/64"					
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A479 Gr. 304/304L	304/304L	09	7361 psi	3400 psi	6007 psi	2800 psi	5489 psi	2600 psi	7361 psi	3400 psi	6007 psi	2800 psi	-28 C	538C	-20 F	1000 F
A479 Gr. 316/316L	316/316L	08	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	7234 psi	5200 psi	5900 psi	4200 psi	-28 C	538 C	-20 F	1000 F
A479 Gr. 347	347	36	7234 psi	5200 psi	5900 psi	4200 psi	5404 psi	3800 psi	7234 psi	5200 psi	5900 psi	4200 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	8175 psi	5062 psi	6753 psi	4259 psi	6238 psi	3934 psi	8175 psi	5062 psi	6753 psi	4259 psi	-28 C	482 C	-20 F	900 F
B164 Gr. N04400	Alloy 400	27	6178 psi	4970 psi	5103 psi	4105 psi	4713 psi	3792 psi	6178 psi	4970 psi	5103 psi	4105 psi	-28 C	485 C	-20 F	900 F
B574 Gr. N10276	Alloy C-276	29	9336 psi	5713 psi	7712 psi	4700 psi	7124 psi	4309 psi	9336 psi	5713 psi	7712 psi	4700 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. F11	F11	60	8175 psi	5156 psi	6753 psi	4259 psi	6238 psi	3934 psi	8175 psi	5156 psi	6753 psi	4259 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F22	F22	59	10266 psi	5156 psi	8374 psi	4259 psi	7671 psi	3934 psi	10266 psi	5156 psi	8374 psi	4259 psi	-28 C	482 C	-20 F	900 F
A182 Gr. F91	F91	91	13670 psi	5156 psi	11142 psi	4259 psi	10200 psi	3934 psi	13670 psi	5156 psi	11142 psi	4259 psi	-28 C	482 C	-20 F	900 F
B473 Gr. N08020	Alloy 20	38	8361 psi	6038 psi	6907 psi	4988 psi	6379 psi	4607 psi	8361 psi	6038 psi	6907 psi	4988 psi	-28 C	425 C	-20 F	800 F
B166 Gr. N06600	Alloy 600	03	6410 psi	1511 psi	5295 psi	1258 psi	4891 psi	1162 psi	6410 psi	1511 psi	5295 psi	1258 psi	-28 C	650 C	-20 F	1200 F
B408 Gr. N08800	Alloy 800	37	7153 psi	4923 psi	5909 psi	4067 psi	5458 psi	3757 psi	7153 psi	4923 psi	5909 psi	4067 psi	-28 C	593 C	-20 F	1100 F

Flanged Thermowells

MATERIAL		ORDER CODE	CLASS 150		CLASS 300		CLASS 600		TEMPERATURE RANGE			
									C		F	
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A182 Gr. 304/304L	304/304L	09	275 psi	20 psi	720 psi	355 psi	1440 psi	710 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. 316/316L	316/316L	08	275 psi	20 psi	720 psi	365 psi	1440 psi	725 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. 347	347	36	275 psi	20 psi	720 psi	365 psi	1440 psi	725 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	285 psi	50 psi	740 psi	230 psi	1480 psi	460 psi	-28 C	482 C	-20 F	900 F
B564 Gr. N04400	Alloy 400	27	230 psi	50 psi	600 psi	275 psi	1200 psi	550 psi	-28 C	482 C	-20 F	900 F
B462 Gr. N10276	Alloy C-276	29	290 psi	20 psi	750 psi	365 psi	1500 psi	725 psi	-28 C	538 C	-20 F	1000 F
B462 Gr. N08020	Alloy 20	38	290 psi	80 psi	750 psi	510 psi	1500 psi	1015 psi	-28 C	425 C	-20 F	800 F
B564 Gr. N06600	Alloy 600	03	290 psi	20 psi[1]	750 psi	70 psi	1500 psi	135 psi	-28 C	650 C	-20 F	1200 F
B564 Gr. N08800	Alloy 800	37	275 psi	20 psi[1]	720 psi	325 psi	1440 psi	645 psi	-28 C	593 C	-20 F	1100 F
MATERIAL		ORDER CODE	CLASS 900[2]		CLASS 1500		CLASS 2500		TEMPERATURE RANGE			
									C		F	
ASTM SPECIFICATION	TYPE		MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN TEMP	MAX TEMP	MIN	MAX	MIN	MAX
A182 Gr. 304/304L	304/304L	09	2160 psi	1065 psi	3600 psi	1770 psi	6000 psi	2950 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. 316/316L	316/316L	08	2160 psi	1090 psi	3600 psi	1820 psi	6000 psi	3030 psi	-28 C	538 C	-20 F	1000 F
A182 Gr. 347	347	36	2160 psi	1090 psi	3600 psi	1820 psi	6000 psi	3030 psi	-28 C	538 C	-20 F	1000 F
A105	A105	61	2220 psi	690 psi	3705 psi	1150 psi	6170 psi	1915 psi	-28 C	482 C	-20 F	900 F
B564 Gr. N04400	Alloy 400	27	1800 psi	825 psi	3000 psi	1370 psi	5000 psi	2285 psi	-28 C	482 C	-20 F	900 F
B462 Gr. N10276	Alloy C-276	29	2250 psi	1090 psi	3750 psi	1820 psi	6250 psi	3030 psi	-28 C	538 C	-20 F	1000 F
B462 Gr. N08020	Alloy 20	38	2250 psi	1525 psi	3750 psi	2540 psi	6250 psi	4230 psi	-28 C	425 C	-20 F	800 F
B564 Gr. N06600	Alloy 600	03	2250 psi	205 psi	3750 psi	345 psi	6250 psi	570 psi	-28 C	650 C	-20 F	1200 F
B564 Gr. N08800	Alloy 800	37	2160 psi	965 psi	3600 psi	1610 psi	6000 psi	2685 psi	-28 C	593 C	-20 F	1100 F

[1] Class 150 flanges are only rated to 538 °C [1,000 °F].
[2] For NPS less than 3" a Class 1500 flange will be provided. The Class 900 flange and Class 1500 flange are dimensionally the same for this size range. For NPS 3" and 4" Class 900 or Class 1500 must be specified.

These tables are for reference only. Other design factors should be taken into consideration in addition to temperature and pressure, such as vibration, corrosion, and installation method.

Corrosive Service Guide

CORROSIVE SERVICE GUIDE TO MATERIALS FOR SHEATHS and THERMOWELLS
Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels
(Teflon® coated thermowells and/or Teflon® sheaths may be substituted for all corrosive agents listed)

CORROSIVE AGENT	TEMP °C	TEMP °F	CONC %	RECOM. MATERIAL	CORROSIVE AGENT	TEMP °C	TEMP °F	CONC %	RECOM. MATERIAL
Acetic Acid (Glacial)	199	[390]	ALL	316 SS	Chlorine (Gas)	93	[200]	ALL	Monel®
Acetic Acid	143	[290]	80%	Hast. C®		199	[390]	ALL	316 SS[1]
	199	[390]	50%	316 SS	Chlorine (Gas - Moist)	66	[150]	ALL	Hast C®
	143	[290]	80%	Carp. 20®[1]	Chloroacetic Acid	182	[360]	ALL	Hast. B®
Acetic Anhydride	132	[270]	ALL	Hast. C®	Chloroform	93	[200]	ALL	Nickel
	199	[390]	ALL	316 SS[1]		93	[200]	ALL	Carp. 20®[1]
Acetone	199	[390]	ALL	316 SS	Chromic Acid	93	[200]	50%	Titanium
Acetylene	199	[390]	ALL	304 SS		93	[200]	50%	Hast. C®[1]
Alcohol, Ethyl	93	[200]	ALL	Hast. C®	Citric Acid	127	[260]	ALL	Hast. C®
	199	[390]	ALL	316 SS[1]		93	[200]	ALL	Carp. 20®[1]
Aluminum Chloride (Aqueous)	143	[290]	ALL	Hast. B®	Copper Chloride	88	[190]	ALL	Titanium
	143	[290]	ALL	Nickel[1]		88	[190]	ALL	Hast. C®[1]
Aluminum Nitrate (Saturated)	93	[200]	ALL	446 SS	Copper Nitrate	149	[300]	ALL	304 SS
	88	[190]	ALL	316 SS[1]	Copper Sulfate	93	[200]	ALL	Hast. C®
Aluminum Sulfate (Saturated)	93	[200]	ALL	Titanium		199	[390]	ALL	316 SS[1]
	93	[200]	ALL	316 SS[1]	Corn Oil	238	[460]	ALL	TFE
Ammonia (Anhydrous)	293	[560]	ALL	316 SS		193	[380]	ALL	FEP
Ammonia (Gas)	93	[200]	ALL	304 SS		171	[340]	ALL	316 SS[1]
Ammonium Chloride	88	[190]	ALL	Titanium	Crude Oil	93	[200]	ALL	304 SS
	293	[560]	ALL	Nickel[1]	Cyanogen Gas	238	[460]	ALL	TFE
	71	[160]	50%	Nickel		193	[380]	ALL	FEP
Ammonium Hydroxide	27	[80]	ALL	Steel		171	[340]	ALL	316 SS[1]
	82	[180]	ALL	Steel[1]	Ether	88	[190]	ALL	304 SS
Ammonium Nitrate	93	[200]	ALL	Carp. 20®	Ethyl Acetate	93	[200]	ALL	Titanium
Ammonium Sulfate	93	[200]	SAT.	Hast. B®		199	[390]	ALL	316 SS[1]
	143	[290]	SAT.	304 SS[1]	Ethyl Chloride (Dry)	293	[560]	ALL	316 SS
	93	[200]	10 - 40%	Titanium	Ethylene Glycol	93	[200]	ALL	Carp. 20®
	199	[390]	10 - 40%	316 SS[1]		93	[200]	ALL	304 SS[1]
Amyl Acetate	143	[290]	ALL	304 SS	Ethylene Oxide	21	[70]	ALL	Hast. C®
Aniline	254	[490]	ALL	304 SS		199	[390]	ALL	316 SS[1]
Barium Chloride (Saturated)	93	[200]	ALL	Hast. C®	Fatty Acids	199	[390]	ALL	316 SS
	293	[560]	ALL	Inconel®[1]	Ferric Chloride	143	[290]	ALL	Titanium
Barium Hydroxide (Saturated)	104	[220]	50%	Carp. 20®		27	[80]	ALL	Hast. C®[1]
	199	[390]	ALL	316 SS[1]	Ferric Sulfate	49	[120]	ALL	Carp. 20®
Beer	88	[190]		304 SS		88	[190]	10%	316 SS
Benzene (Benzol)	104	[220]	ALL	Carp. 20®	Ferrous Sulfate	27	[80]		Titanium
	104	[220]	ALL	304 SS[1]		93	[200]	ALL	304 SS[1]
Benzoic Acid	199	[390]	ALL	Titanium	Formaldehyde	49	[120]	ALL	304 SS
	199	[390]	ALL	304 SS[1]		49-293	[120-560]	50%	304 SS[1]
Black Liquor	238	[460]	ALL	TFE	Formic Acid (Anhydrous)	93	[200]	50%	Carp. 20®
	193	[380]	ALL	FEP	Freon (F-11)	204	[400]	ALL	Monel®
	93	[200]	ALL	Carp. 20®[1]		204	[400]	ALL	316 SS[1]
Bleach (Active Chlorine)	60	[140]	12.5%	Hast. C®	Furfural	199	[390]	ALL	Nickel
Borax	199	[390]	ALL	316 SS		199	[390]	ALL	304 SS[1]
Boric Acid	293	[560]	ALL	Hast. C®	Gallic Acid	238	[460]	ALL	TFE
	93	[200]	ALL	Nickel[1]		193	[380]	ALL	FEP
Brine Acid	60	[140]	ALL	Hast. C®		199	[390]	ALL	316 SS[1]
	27	[80]	ALL	Brass[1]	Gasoline (Unleaded)	154	[310]	ALL	Hast. C®
Bromine (Liquid)	293	[560]	ALL	Tantalum		16	[60]		446 SS
	93	[200]	ALL	Aluminum[1]		171	[340]		Steel[1]
Butane	171	[340]	ALL	Steel		238	[460]		TFE
Butyl Acetate	93	[200]	ALL	Titanium	Gasoline (Refined)	193	[380]		FEP
	188	[370]	ALL	316 SS[1]		88	[190]		Steel[1]
Butyl Alcohol	199	[390]	ALL	316 SS		27	[80]	ALL	Nickel
Butyric Acid	143	[290]	ALL	Carp. 20®	Glucose	193	[380]	ALL	316 SS[1]
	199	[390]	ALL	316 SS[1]		27	[80]	ALL	Hast. B®
Calcium Bisulfite	93	[200]	ALL	TFE	Glue	60	[140]	ALL	Steel[1]
	193	[380]	ALL	FEP		127	[260]	ALL	304 SS
	171	[340]	ALL	316 SS[1]	Glycerine	88	[190]	50%	Titanium
Calcium Chlorate	238	[460]	ALL	TFE	Hydrobromic Acid	121	[250]	50%	Hast. B®[1]
	193	[380]	ALL	FEP		60	[140]	38%	Hast. B®
	93	[200]	ALL	316 SS[1]	Hydrochloric Acid	238	[460]	ALL	TFE
Calcium Chloride (Saturated)	171	[340]	ALL	Hast. C®	Hydrocyanic Acid	193	[380]	ALL	FEP
	93	[200]	ALL	Carp. 20®[1]		171	[340]	ALL	316 SS[1]
Calcium Hydroxide	93	[200]	50%	Hast. C®		238	[460]	ALL	TFE
	88	[190]	SAT.	304 SS[1]	Hydroflouric Acid	193	[380]	ALL	FEP
Carbonic Acid	293	[560]	ALL	Carp. 20®		93	[200]	ALL	Hast. C®[1]
	171	[340]	ALL	316 SS[1]		293	[560]	ALL	Carp. 20®
Carbon Dioxide (Dry)	427	[800]	ALL	Brass	Hydrogen Chloride (Gas, Dry)	38	[100]	ALL	304 SS
Carbonated Beverages	100	[212]	ALL	304 SS	Hydrogen Flouride (Dry)	199	[390]	ALL	304 SS[1]
Carbon Disulfide	93	[200]	ALL	Titanium		88	[190]	90%	Hast. C®
	199	[390]	ALL	316 SS[1]	Hydrogen Peroxide	71	[160]	ALL	316 SS
Carbon Tetrachloride	93	[200]	ALL	304 SS	Hydrogen Sulfide (Dry)	293	[560]	ALL	316 SS

All materials listed are rated < 2 Mils penetration/year except as noted: [1] = < 20 Mils penetration/year

Corrosive Service Guide

CORROSIVE SERVICE GUIDE TO MATERIALS FOR SHEATHS and THERMOWELLS
Refer to A.S.M.E. Boiler Code, Section VIII for allowable stress levels
(coated thermowells and/or Teflon® sheaths may be substituted for all corrosive agents listed)

CORROSIVE AGENT	TEMP °C	TEMP °F	CONC %	RECOM. MATERIAL
	83	[190]	ALL	Hast. C
	21	[70]	ALL	Nickel
	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	171	[340]		Steel [1]
	32	[90]	ALL	Hast. C
Lactic Acid	127	[260]	ALL	316 SS [1]
	154	[310]	ALL	Titanium
Lime (Sulfur)	116	[240]	ALL	Hast. B [1]
	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
Linseed Oil	154	[310]	ALL	316 SS [1]
	60	[140]	ALL	Carp. 20
Magnesium Chloride	27	[80]	ALL	Steel [1]
	143	[290]	ALL	Nickel
Magnesium Hydroxide	88	[190]	50%	Carp. 20 [1]
Magnesium Sulfate	93	[200]	ALL	304 SS
	93	[200]	60%	Nickel
Mercuric Chloride	171	[340]	ALL	316 SS [1]
	143	[290]	ALL	Tantalum
	77	[170]	10%	Hast. C [1]
Methyl Chloride (Dry)	293	[560]	ALL	304 SS
Methylene Chloride	171	[340]	ALL	316 SS
	93	[200]	ALL	Carp. 20
	93	[200]		304 SS
	16	[60]	ALL	446 SS
Natural Gas	116	[240]	ALL	304 SS [1]
	238	[460]		TFE
	193	[380]		FEP
Nickel Chloride	43	[110]		Steel [1]
Nickel Sulfate	93	[200]	80%	Hast. C
	82	[180]	10%	Tantalum
	93	[200]	ALL	304 SS [1]
	21	[70]	ALL	304 SS
Nitrobenzene	93	[200]	40%	304 SS
	143	[290]	ALL	Carp. 20
	171	[340]	ALL	316 SS [1]
	138	[280]	ALL	316 SS
	49	[120]	40%	Hast. C
Oxalic Acid	116	[240]	ALL	316 SS [1]
	93	[200]	ALL	Tantalum
	93	[200]	ALL	Carp. 20 [1]
	271	[520]	ALL	Tantalum
	16	[60]	ALL	446 SS
Palmitic Acid	171	[340]	ALL	316 SS [1]
	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
Phenol (Carbolic Acid)	199	[390]	ALL	304 SS [1]
Phosphoric Acid	293	[560]	ALL	316 SS
Phosphoric	93	[200]	50-85%	Hast. C
	43	[110]	50-85%	Carp. 20
Phosphoric Solutions	171	[340]	ALL	316 SS
	27	[80]	ALL	Titanium
	21	[70]	ALL	Aluminum
Potassium Bromide	199	[390]	ALL	316 SS [1]
	93	[200]	30%	Titanium
Potassium Carbonate	93	[200]	30%	446 SS
Potassium Chlorate	93	[200]	50%	304 SS
Potassium Hydroxide	171	[340]	30%	316 SS
Potassium Nitrate	93	[200]	50%	Nickel
	171	[340]	80%	Aluminum
Potassium Permanganate	277	[530]	80%	446 SS [1]
	21	[70]	20%	Hast C.
Potassium Sulfate	171	[340]	20%	316 SS [1]
	171	[340]	10%	316 SS
	60	[140]	ALL	446 SS
Pyrogallic Acid	27	[80]	ALL	Brass
	27	[80]	ALL	Copper
Salicylic Acid	171	[340]	ALL	316 SS [1]
	116	[240]	ALL	Hast. C
Sea Water (Stagnant)	171	[340]	ALL	316 SS [1] Monel®
Sea Water (Cavitation)				316 SS
Soap Solutions	16	[60]	ALL	446 SS
	54	[130]	ALL	Nickel [1]
Sodium Bicarbonate	171	[340]	20%	316 SS
Sodium Bisulfite	71	[160]	10%	316 SS
	93	[200]	10 - 40%	Carp. 20
Sodium Carbonate	93	[200]	30%	Carp. 20
	293	[560]	10-100%	Hast. B [1]
Sodium Chloride	27	[80]	30%	Nickel
Sodium Flouride	71	[160]	ALL	Monel®
	77	[170]	ALL	Carp. 20 [1]
Sodium Hydroxide	104	[220]	ALL	Monel®
	71	[160]	ALL	316 SS [1]
Sodium Nitrate	171	[340]	60%	316 SS
Sodium Nitrite	93	[200]	Saturated	Titanium
	93	[200]	40%	304 SS [1]
Sodium Peroxide	16	[60]	10%	446 SS
	171	[340]	10%	316 SS [1]
Sodium Phosphate Acid	93	[200]	ALL	Titanium
	93	[200]	ALL	304 SS [1]
Sodium Silicate	27	[80]	ALL	446 SS [1]
	166	[330]	ALL	316 SS [1]
Sodium Sulfate	199	[390]	ALL	316 SS
Sodium Sulfide	238	[460]	50%	TFE
	193	[380]	50%	FEP
	93	[200]	50%	316 SS [1]
Sodium Sulfite	93	[200]	10%	304 SS
Sodium Thiosulfate	16	[60]	25%	446 SS
	116	[240]	ALL	316 SS [1]
Steam (Low Pressure)				Inconel
				304 SS [1]
(Medium Pressure)				Nickel
				304 SS [1]
(High Pressure)				316 SS [1]
Sulfur	293	[560]	ALL	304 SS
	871	[1600]	ALL	Alloy 556
Sulfur Chloride (Dry)	32	[90]	ALL	Tantalum
	293	[560]	ALL	Nickel [1]
Sulfur Dioxide (Dry)	49	[120]	ALL	Steel
	293	[560]	ALL	316 SS [1]
Sulfur Trioxide (Dry)	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	293	[560]	ALL	304 SS [1]
Sulfuric Acid	38	[100]	100%	Carp. 20
	121	[250]	60%	Hast. B
Sulfurous Acid	71	[160]	ALL	Titanium
	177	[350]	ALL	Carp. 20 [1]
Tannic Acid	93	[200]	10 - 20%	Titanium
	93	[200]	ALL	304 SS [1]
Tartaric Acid	199	[390]	ALL	304 SS
Titanium Tetrachloride	27	[80]	ALL	Carp. 20
	138	[280]	ALL	Titanium
Toluene (Toluol)	171	[340]	ALL	Steel
	93	[200]	ALL	304 SS
Trichloroacetic Acid	238	[460]	ALL	TFE
	193	[380]	ALL	FEP
	93	[200]	ALL	Hast. C [1]
Trichloroethylene	71	[160]	ALL	Inconel®
Turpentine	88	[190]	ALL	304 SS
Whiskey and Wine			ALL	304 SS
Xylene (Xylol)	88	[190]	ALL	446 SS
Zinc Chloride	82	[180]	to 70%	Titanium
	293	[560]	ALL	Hast. B [1]
Zinc Sulfate	93	[200]	SAT.	316 SS

All materials listed are rated < 2 Mils penetration/year except as noted: [1] = < 20 Mils penetration/year

Thermowell options and specifications

The following options are avaliable on thermowells. Please contact our sales department for more info and current pricing.

Documentation/Testing	
Material Certificate	EN 10204-3.1 B
Certificate Of Conformance	Avaliable upon request
Certificate Of Compliance	Avaliable upon request
Certificate Of Origin	Avaliable upon request
Warranty Certificate	Avaliable upon request
Hydrostatic Test Report (Internal)	ASME B 16.5
Dye Penetration Test Report	ASTM E 165
Wake Frequency Calculation	ASME PTC 19.3 (2010)
NACE Hardness test	NACE MR 01-03
Post Weld Heat Treatment (PWHT)	Avaliable upon request
Positive material Identification (PMI)	ASME Section II (2010)
Magnetic Praticle Inspection Report (MPI)	ASME B 31.3 -2008 ED
Radiographic Test Report	ASME B 31.3 -2008 ED
Ultrasonic Test Report	ASME B 31.3 -2008 ED
Service	
Expedited Delivery	Avaliable upon request
Full Penetration Weld	Performed by welders certified to ASME Section IX (2010) Ed
Coatings	
Teflon Coating	Avaliable upon request
Satellite Coating (No.6)	Avaliable upon request
Painting	Avaliable upon request
Industry Specifications	
Flange thermowell	ASME B 16.5 , JIS B2220
Heat treating	NACE certificate avaliable for applicable materials . Stress relief , annealing , and custom heat treating avaliable upon request
Material	ASTM Complaince and other applicable National Standards
Pipe Threads	ANSI/ASME B1.20.1
Manufacturing Tolerances	
Marking	Standard marking includes raw material grade , length , manufacture serial number ,customer tag no (if avaliable) and raw material heat code.
Insertion length	$\pm$ 1 mm ($\leq$ 1000 mm) ,± 2 mm ($>$ 1000 mm and < 2000 mm)
Stem Outside Diameter	+ 0.5 mm , - 0.2 mm
Bore Diameter	+ 0.2 mm , - 0.0 mm
Lagging Length	$\pm$ 0.5 mm
Tip Thickness	+ 1 mm , - 0.0 mm

Wake Frequency Calculation In accordance with ASME PTC-19.3-TW-2010 Version 3.0.4

Please complete the following information when requesting a wake frequency calculation

Company Name

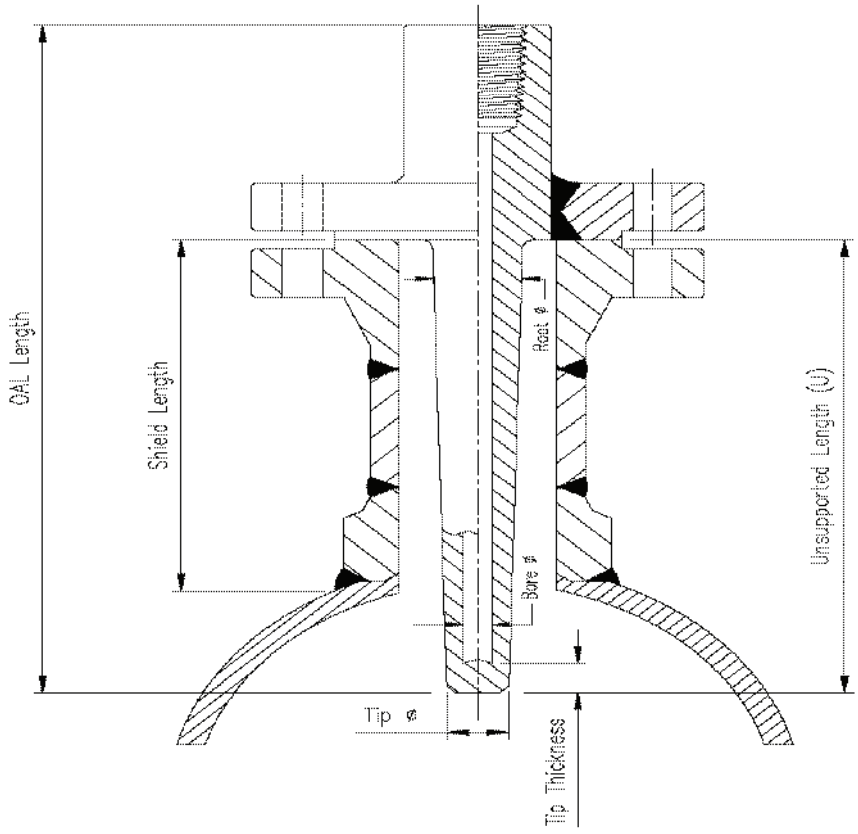
Company Name :	Contact Name :
Phone Number :	Fax Number :
E-Mail Address :	
Request Date (MM/DD/YY) :	Calculation Required By Date :

Thermowell Configuration

Unsupported Length (in),(mm)	Root Diameter (in),(mm)
Overall Length (in),(mm)	Tip Diameter (in),(mm)
Shielded Length (in),(mm)	Bore Diameter (in),(mm)
Process Connection :	Tip Thickness (in),(mm)
Flange Size/Rating :	Root Fillet (in),(mm)
Flange Facing	Material :
	Stem Style :

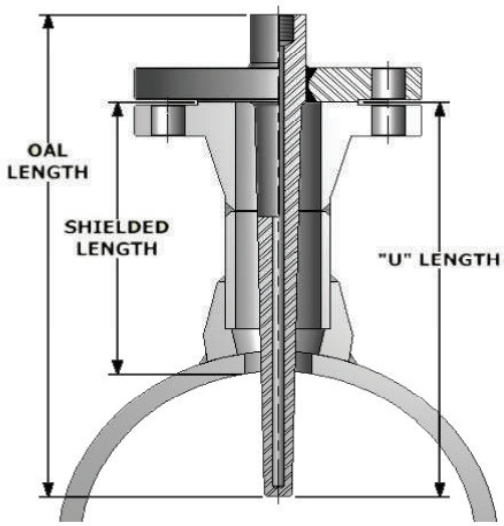
Process Operating Conditions

Process Fluids/Gas (water,steam,natural gas,crude oil, etc.) :
Maximum Temperature (° F),(°C) :
Maximum Pressure (psi),(kPa)
Velocity (ft/s),(m/s)
Density (lb/in³),(kg/m³)
Viscosity (cP)



Report Information

Customers:	Date :
Tag Numbers:	Reference # :



Process Operation Conditions

Process Fluids
Max Temperature (T)
Max Pressure (P)
Fluid Velocity (v)
Fluid Density
Fluid Viscosity

Thermowell Material Properties

Density (Pm):
Elastic Modulus, E(T):
Allowable Stress(S)/Fatigue Limit (Sf):

Stress (Support Plane)

In-Line Reson. Velocity(VIR):	Von Mises Stress(Root):
Bending Stress at VIR (So.max)	
Dynamic Stress at V(So.max)	

Thermowell Configuration

Porces Connection:
Stem Style:
Thermowell Material:
Flange Size I Rating:
Flange Facing
Flange Material:
Bore Size:
Overall Length(L):
Unsupported Length(U):
Shielded Length(L0):
Lag Extension:
Root Diameter(Q):
Tip Diameter(B)
Tip Thickness(t):
Fillet(Root):

Frequency

Frequency Limit:	Reynolds #(Re):
Frequency must be below:	Strouhal #(Ns):
Installed Natural Freq(fnc):	Scruton #(Nsc):
Strouhal Frequency (fs):	Freq Ration(fs/fnc)

Pressure

Allowable Stem Pressure(Pc):
Allowable Tip Pressure(Pt):

Thermowell Rating

	Status	Valve
Oscillating Stress (psi)		
Steady-State Stress (psi)		
Pressure (psi)		
Frequency (Hz)		

The wake frequency calculation is passed

"These well design calculations are based on the ASME PTC 19.3 TW-2010 formulas. The results of these calculations should only be used as a guide for thermowell design. The company does not guarantee the performance of a specific well design obtained from the use of these calculations".

Printed using the V-MAC Wake Calc System

Heavy Duty Flange Thermowell -Solid Drilled Bar Stock (TW 511)

Flange size & pressure rating : (Avaliable as "RF" and "RTJ")

1A	1"150 # RF
	(Note : the data for reference only , it may varies upon request)
1.5K	1-1/2" 1500# RTJ
	(Note : the data for reference only , it may varies upon request)

Welding structure

W 1	Full Penetration Weld
W 2	Sealed Weld

Flange material

S	SS 316
I6	Inconel 600
M	Monel 400
H	Hastelloy C 276
D	Duplex F51
A	A 350 LF2
I8	Inconel 800H/HT
Y 2	Special version to be specified

Thermowell material

S	SS 316
I6	Inconel 600
M	Monel 400
H	Hastelloy C 276
D	Duplex F51
A	A 350 LF2
I8	Inconel 800H/HT
Y 3	Special version to be specified

Thermowell insertion "U" length

XXXX	To be specified (e.g 0125 for 125 mm long)

Lagging "T" length

T 1	60 mm (STD)
T 2	80 mm
Y 4	Special version to be specified

Tip thickness "E"

E	6 mm (Std)
Y 5	Special version to be specified

Stem dimensions "Ø R , ØT"

R T 1	Root: Ø 26.5 mm , Tip: Ø 18 mm
R T 2	Root: Ø 19 mm , Tip: Ø 13 mm
R T 3	Root: Ø 22 mm , Tip: Ø 13 mm
T 4	Tip: Ø 19 mm
T 5	Tip: Ø 21.5 mm
Y 6	Special version to be specified

Bore diameter "Ø R"

B 1	6.6 mm (STD)
B 2	7 mm
B 3	8 mm
Y 7	Special version to be specified

Instrument connection

N	1/2" NPT F (STD)
Y 8	Special version to be specified

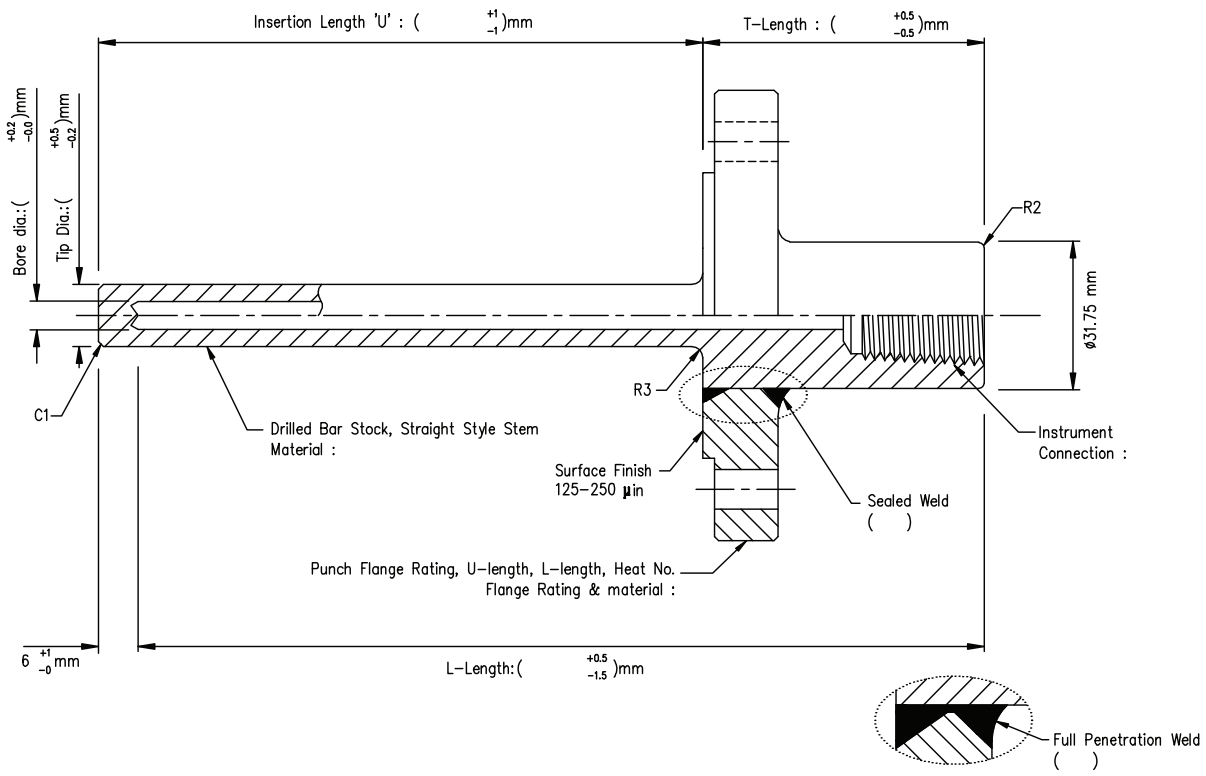
Documents (optional)

		(Standard Specifications)
1	Material Certificate	EN 10204-3.1B
2	Hydrostatics Test Report	ASME B 16.5
3	Dye Penetration Report	ASTM E 165
4	Wake Frequency Calculation	ASME PTC 19.3 (2010)
5	Certificate Of Conformance	-
6	Certificate Of Compliance	-
7	Certificate Of Origin	-
8	Warranty Certificate	Only for manufacturing defect
9	None	-

(Note : Please refer to "Page 41" for more details for test report and certificate)

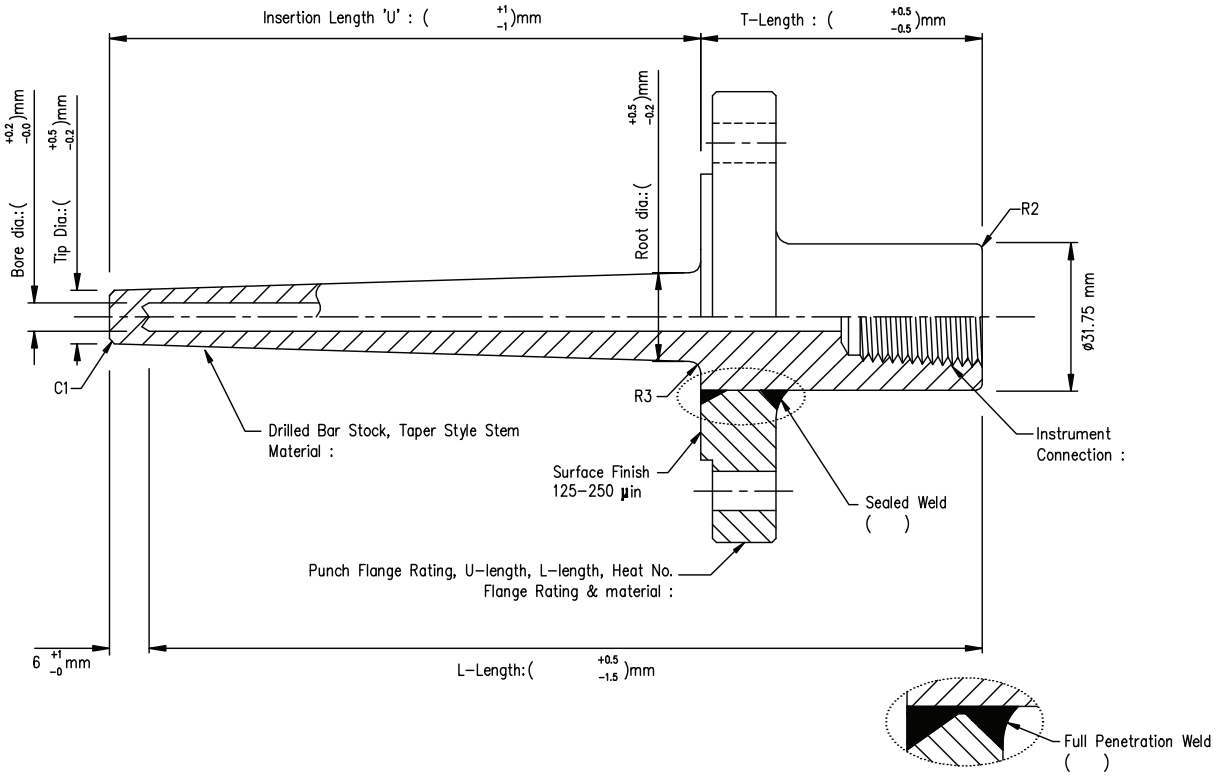
TW 511											← Order Code
	1	2	3	4	5	6	7	8	9	10	

TW511 HEAVY DUTY FLANGE THERMOWELL SOLID DRILLED BAR STOCK (STRAIGHT STYLE STEM)



Model No TW511 – – – – – – – – – – –

TW511 HEAVY DUTY FLANGE THERMOWELL SOLID DRILLED BAR STOCK (TAPER STYLE STEM)



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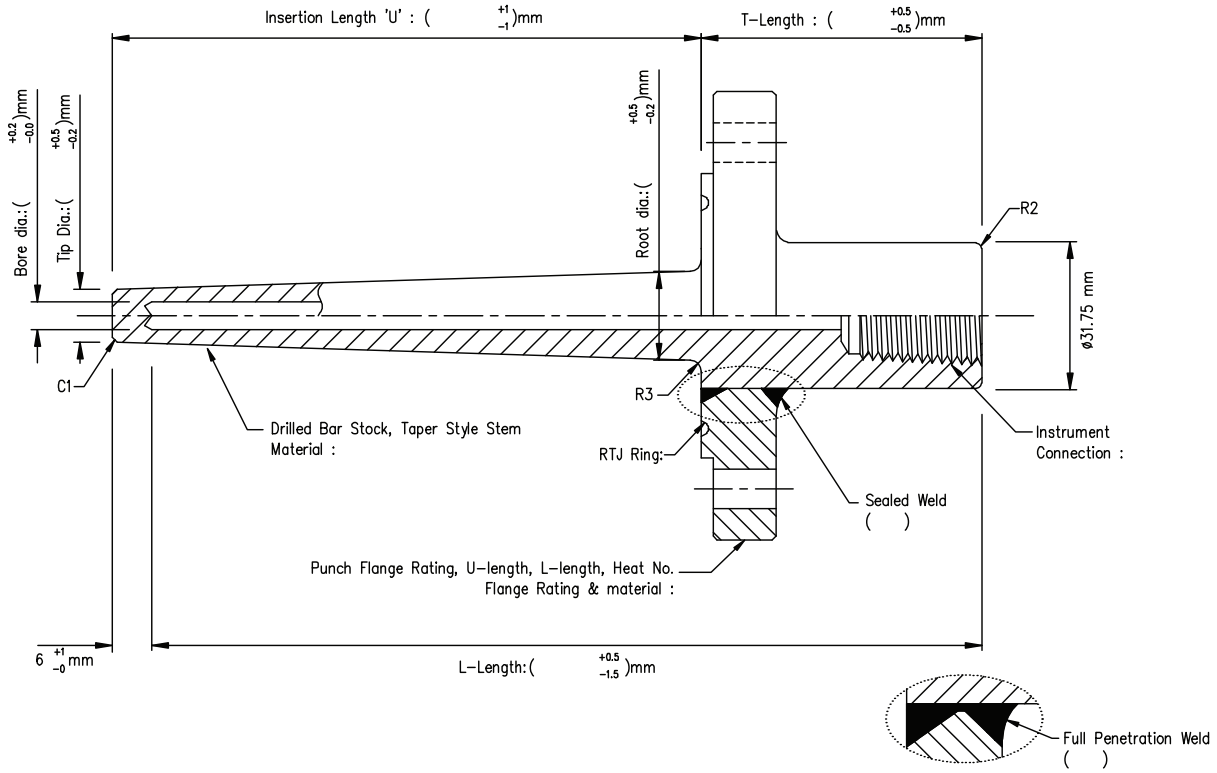
TW511 HEAVY DUTY FLANGE THERMOWELL SOLID DRILLED BAR STOCK (TAPER STYLE STEM)



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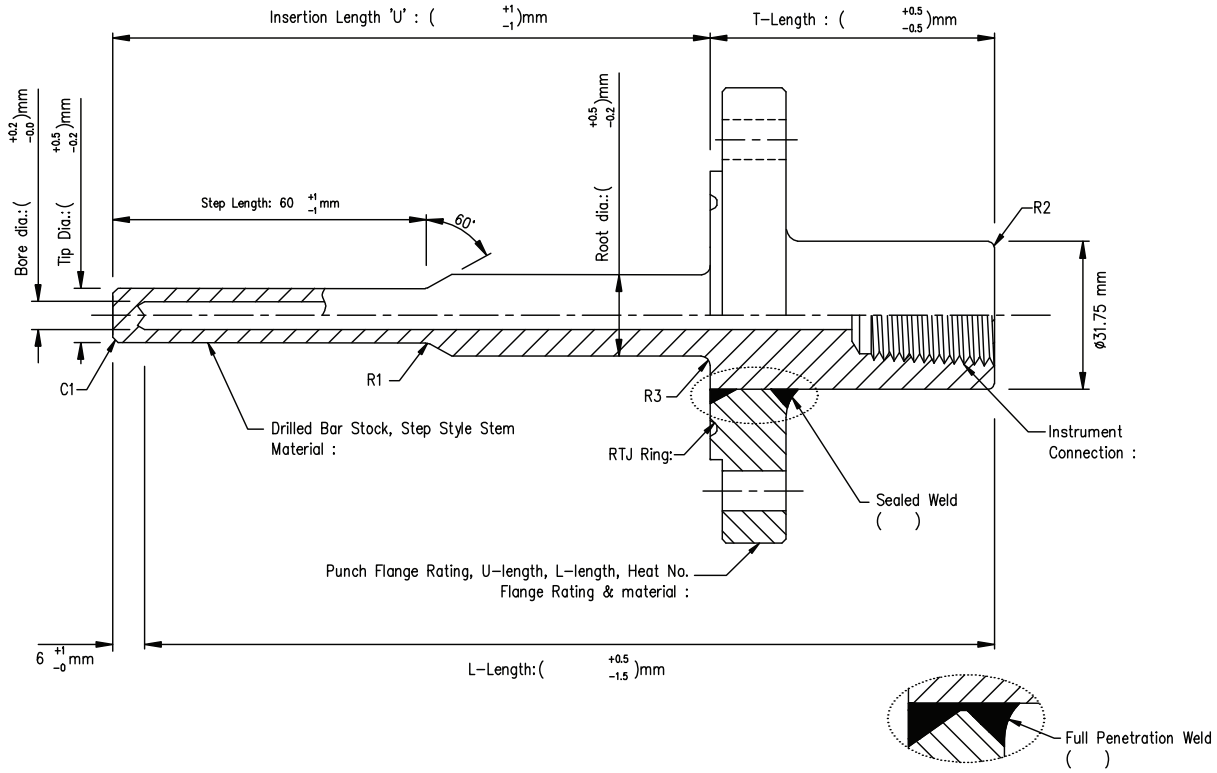
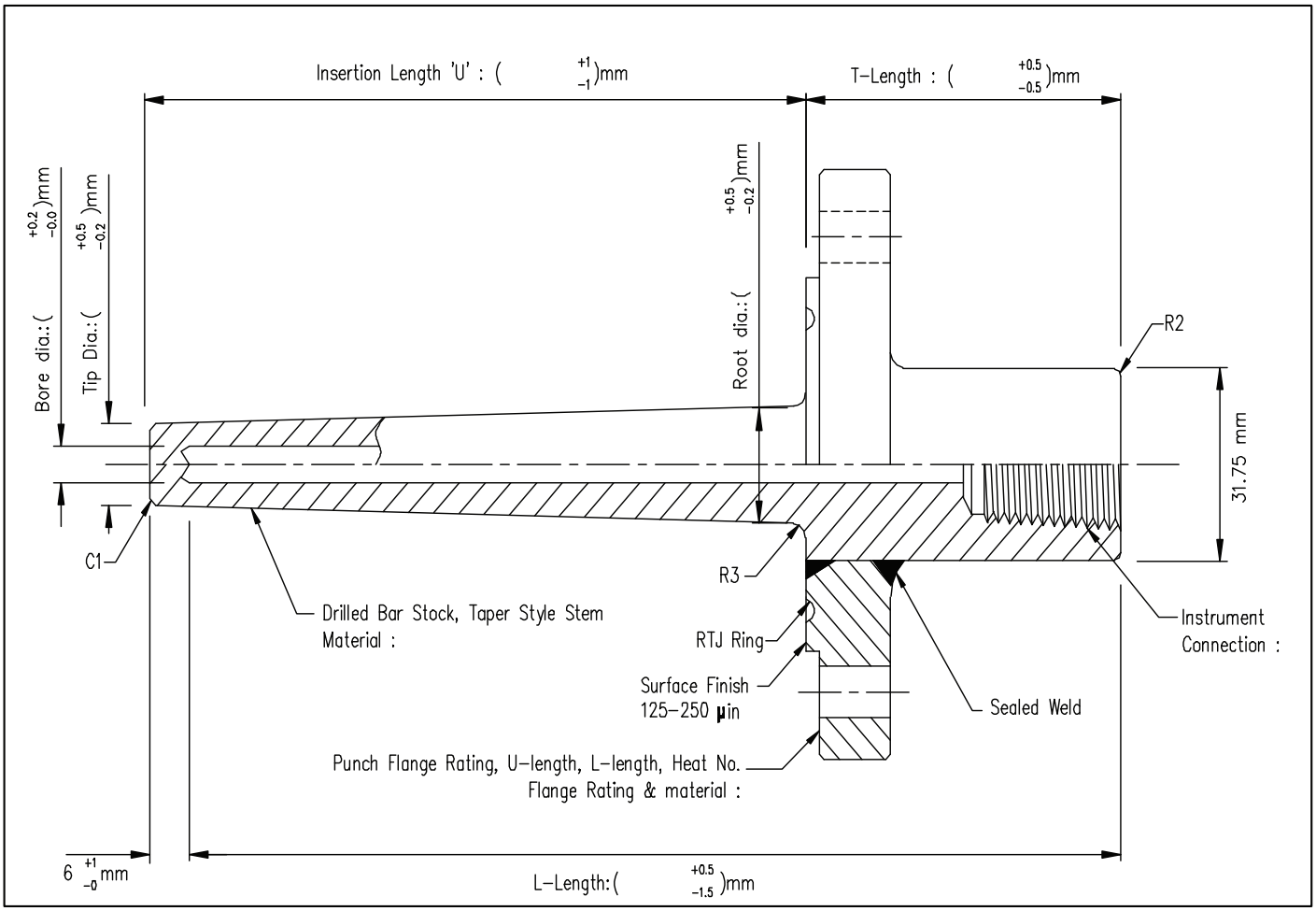
TW511 HEAVY DUTY FLANGE THERMOWELL SOLID DRILLED BAR STOCK (STEP STYLE STEM)



Model No TW511 – – – – – – – – – – –



Tapered range & ring size (For RTJ)

RTJ Flange Size	Root Diameter	Tip Diameter	T-Length	Ring Number
Class 150#				
1"	19 mm	13 mm	60 mm	R15
1-1/2"	26.5 mm	18 mm	60 mm	R19
2"	26.5 mm	18 mm	60 mm	R22
3"	26.5 mm	18 mm	60 mm	R29
Class 300#				
1"	19 mm	13 mm	60 mm	R16
1-1/2"	26.5 mm	18 mm	60 mm	R20
2"	26.5 mm	18 mm	60 mm	R23
Class 600#				
1"	19 mm	13 mm	80 mm	R16
1-1/2"	26.5 mm	18 mm	80 mm	R20
2"	26.5 mm	18 mm	80 mm	R23
Class 900# & 1500#				
1-1/2"	26.5 mm	18 mm	80 mm	R20
2"	26.5 mm	18 mm	80 mm	R24
Class 2500#				
1-1/2"	26.5 mm	18 mm	80 mm	R23
2"	26.5 mm	18 mm	80 mm	R26

Tapered range (For RF)

Flange Size	Root Diameter	Tip Diameter	T-Length
Class 150#			
1"	19 mm	13 mm	60 mm
1-1/2"	26.5 mm	18 mm	60 mm
2"	26.5 mm	18 mm	60 mm
3"	26.5 mm	18 mm	60 mm
Class 300#			
1"	19 mm	13 mm	60 mm
1-1/2"	26.5 mm	18 mm	60 mm
2"	26.5 mm	18 mm	60 mm
Class 600#			
1"	19 mm	13 mm	60 mm
1-1/2"	26.5 mm	18 mm	60 mm
2"	26.5 mm	18 mm	60 mm
Class 900# & 1500#			
1-1/2"	26.5 mm	18 mm	80 mm
2"	26.5 mm	18 mm	80 mm
Class 2500#			
1-1/2"	26.5 mm	18 mm	80 mm
2"	26.5 mm	18 mm	80 mm

Shell Standard Thermowell

Thermowell Standard

S38-113-0	Shell Standard S 38-113
	(Note : the data for reference only , it may varies upon request)
S38-114-0	Shell Standard S 38-114
	(Note : the data for reference only , it may varies upon request)

Connection flange size

4LF1	DN40 (1-1/2") , 150 # LJF (RF)
4LF2	DN40 (1-1/2") , 300 # LJF (RF)
4LF3	DN40 (1-1/2") , 600 # LJF (RF)
4LF4	DN40 (1-1/2") , 900 #/1500# LJF (RF)
4LF5	DN40 (1-1/2") , 2500 # LJF (RF)

(Note : the data for reference only , it may varies upon request)

L-length (mm)

L1	230 mm
L2	255 mm
L3	305 mm
L4	355 mm
L5	405 mm
L6	455 mm
-	

(Note : the data for reference only , it may varies upon request)

Thermowell material

S	SS 316
D	Duplex F51
M	Monel 400
-	

Connection flange material

S	SS 316
D	Duplex F51
M	Monel 400
-	

Stem dimensions "Ø R ,Ø T"

S3	Root:Ø 30 mm , Tip: Ø14 mm , Step Bore: Ø8mm ~ Ø6.5mm	(For S38-113-0)
S4	Root:Ø 30 mm , Tip: Ø16 mm , Step Bore: Ø8mm ~ Ø6.5mm	(For S38-114-0)
-	-	

Well disc dimensions

D3	Outside Diameter:Ø 73 mm , Thickness : 15 mm	(For S38-113-0)
D5	Outside Diameter:Ø 92 mm , Thickness : 20 mm	(For S38-114-0)
-	-	

Bore diameter "ØB"

B1	Step Bore from 8 mm to 6.5 mm
-	-

Instrument Connection

N	1/2" NPT F (STD)
-	-

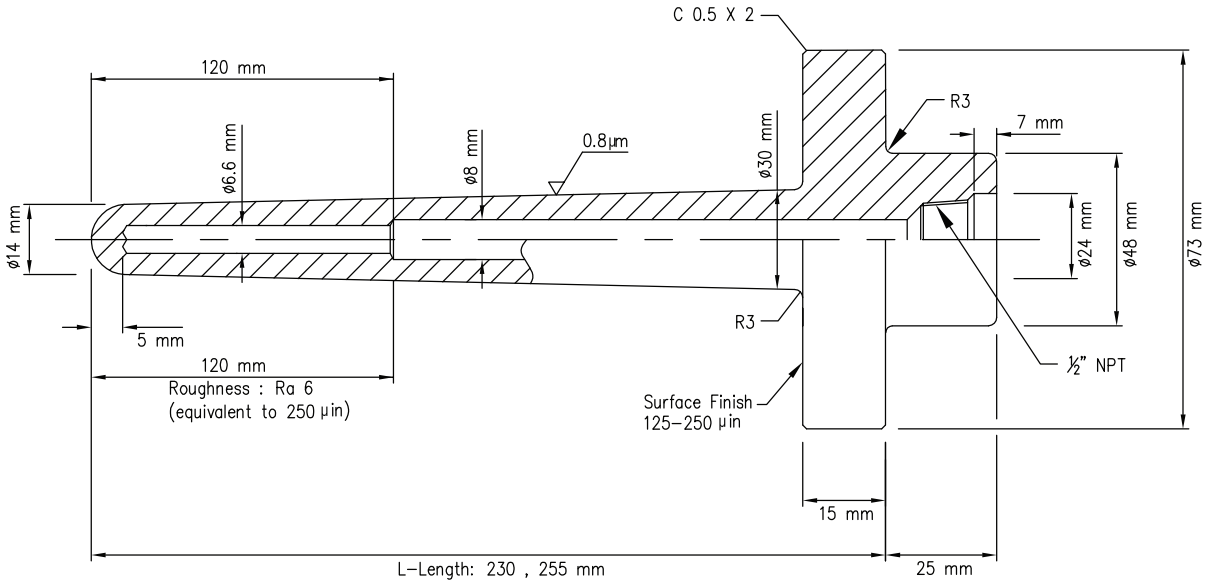
Documents (Optional)

		(Standard Specifications)
1	Material Certificate	EN 10204-3.1B
2	Hydrostatics Test Report	ASME B 16.5
3	Dye Penetration Report	ASTM E 165
4	Wake Frequency Calculation	ASME PTC 19.3 (2010)
5	Certificate Of Conformance	-
6	Certificate Of Compliance	-
7	Certificate Of Origin	-
8	Warranty Certificate	Only for manufacturing defect
9	None	-

(Note : Please refer to "Page 39" for more details for test report and certificate)

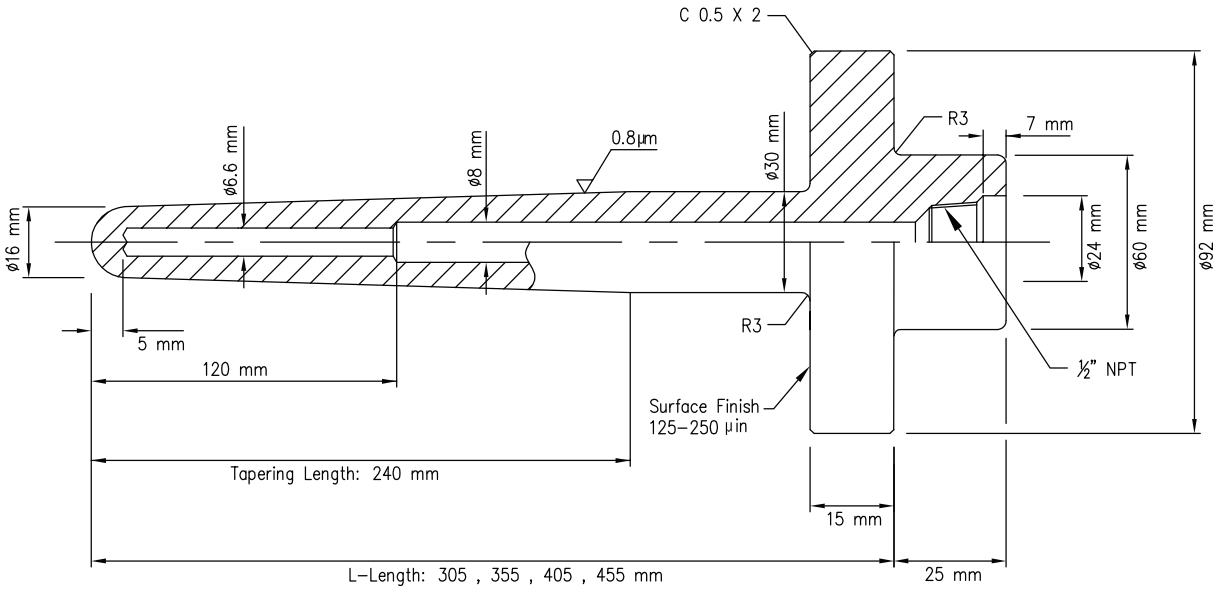
S38-XXX-X										← Order Code
	1	2	3	4	5	6	7	8	9	

Shell Standard Thermowell



Model No | S38–113–0 | – | – | – | – | – | – | – | – | –

Shell Standard Thermowell



Model No | S38–114–0 | – | – | – | – | – | – | – | – | –

Heavy Duty Thread Thermowell -Solid Drilled Bar Stock (TW 512T)
Heavy Duty Weld in Thermowell -Solid Drilled Bar Stock (TW 512W)

	Process connection
T 1	1/2" NPT M
T 2	1/2" BSP M
T 3	3/4" NPT M
T 4	3/4" BSP M
T 5	1" NPT M
T 6	1" BSP M
-	-
W 1	Ø 27 mm (For 3/4" Pipe)
W 2	Ø 34 mm (For 1" Pipe)
W 3	Ø 48 mm (For 1-1/2" Pipe)
Y 1	Special version to be specified

	Thermowell material
S	SS 316
I6	Inconel 600
M	Monel 400
H	Hastelloy C 276
D	Duplex F51
A	A 350 LF2
I8	Inconel 800H/HT
Y 2	Special version to be specified

	Thermowell insertion "U" length
XXXX	To be specified (e.g 0125 for 125 mm long)

	Lagging "T" length
T 1	60 mm (STD)
T 2	80 mm
Y 3	Special version to be specified

	Tip thickness "E"
E	6 mm (Std)
Y 4	Special version to be specified

	Stem dimensions "ØR , ØT"
R T 1	Root: Ø 26.5 mm , Tip: Ø 18 mm
R T 2	Root: Ø 19 mm , Tip: Ø 12.5 mm
R T 3	Root: Ø 17 mm , Tip: Ø 12.5 mm
-	-
R T 4	Root & tip Diameter : Ø 19 mm
R T 5	Root & tip Diameter : Ø 17 mm
R T 6	Root & tip Diameter : Ø 12.5 mm
-	-
R T 7	Root: Ø 26.5 mm , Tip: Ø 12.5 mm
R T 8	Root: Ø 19 mm , Tip: Ø 12.5 mm
R T 9	Root: Ø 17 mm , Tip: Ø 12.5 mm
Y 5	Special version to be specified

	Bore diameter "ØB"
B 1	6.6 mm (STD)
B 2	7 mm
B 3	8 mm
Y 6	Special version to be specified

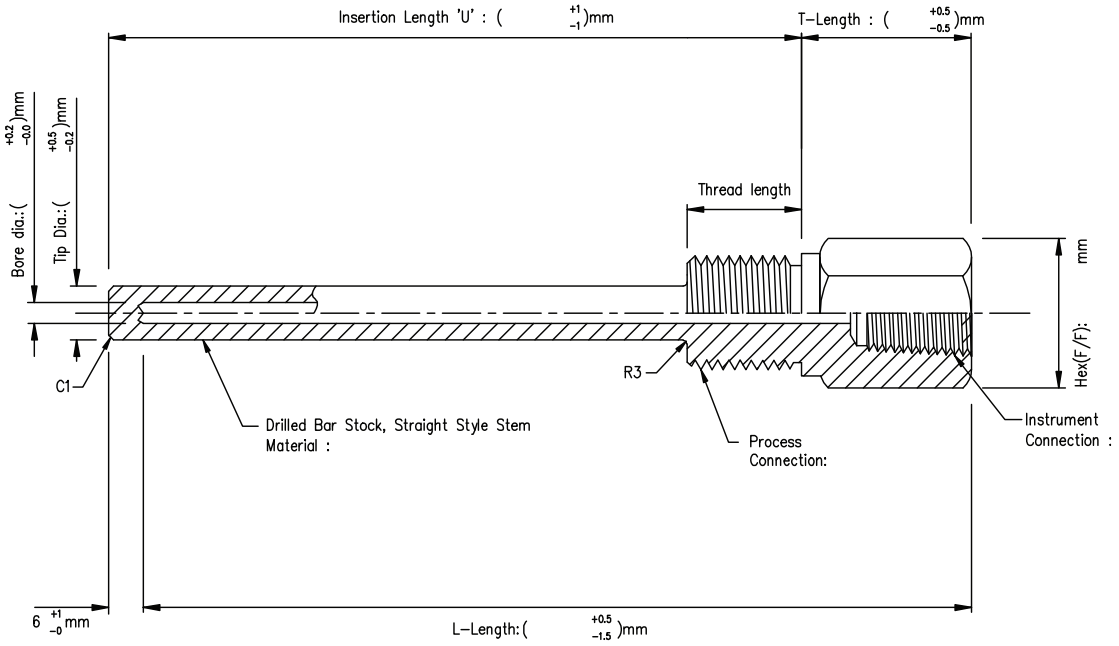
	Instrument connection
N	1/2" NPT F (STD)
Y 7	Special version to be specified

	Documents (optional)	(Standard Specifications)
1	Material Certificate	EN 10204-3.1B
2	Hydrostatics Test Report	ASME B 16.5
3	Dye Penetration Report	ASTM E 165
4	Wake Frequency Calculation	ASME PTC 19.3 (2010)
5	Certificate Of Conformance	-
6	Certificate Of Compliance	-
7	Certificate Of Origin	-
8	Warranty Certificate	Only for manufacturing defect
9	None	-

(Note : Please refer to "Page 39" for more details for test report and certificate)

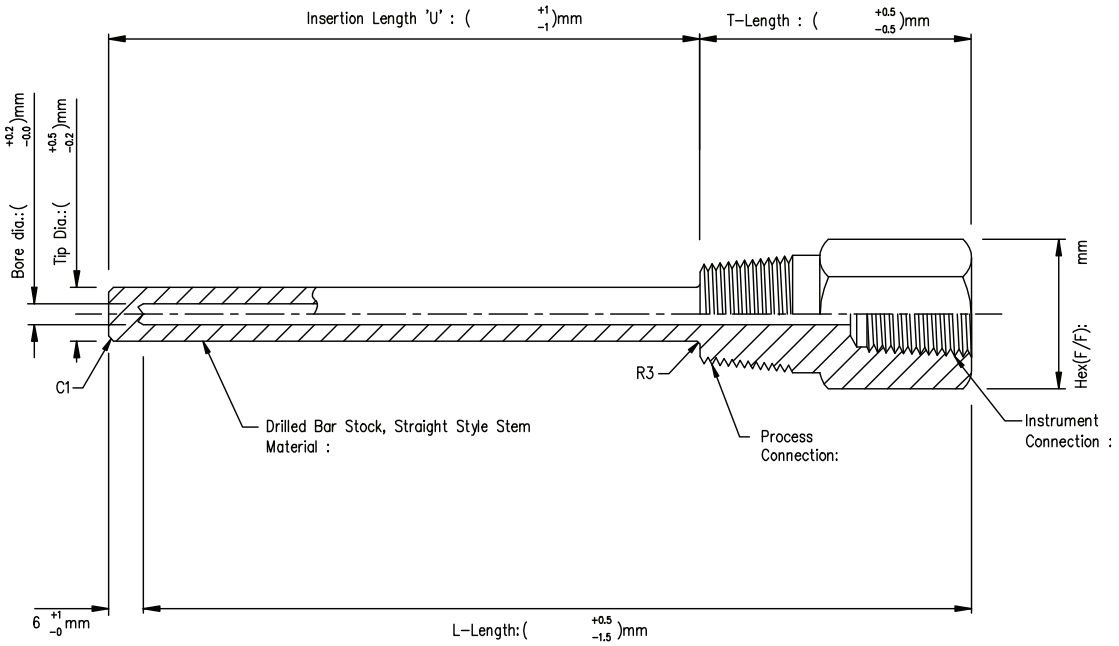
T W XXXX										← Order Code
	1	2	3	4	5	6	7	8	9	

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (BSP)



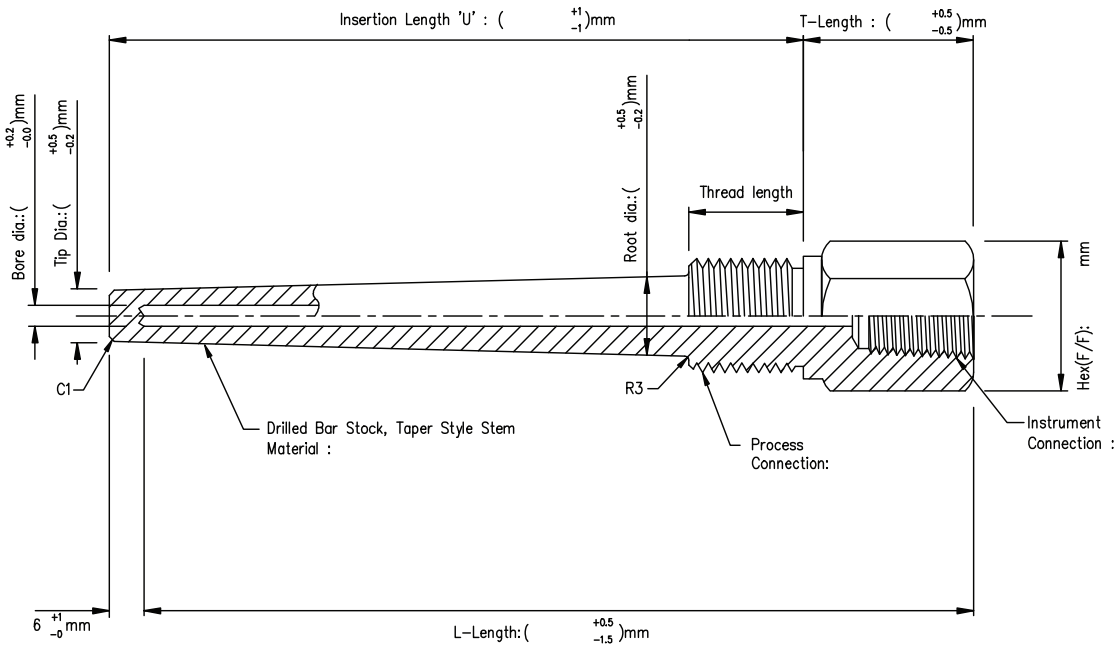
Model No | TW512T | – | – | – | – | – | – | – | – | – | –

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (NPT)



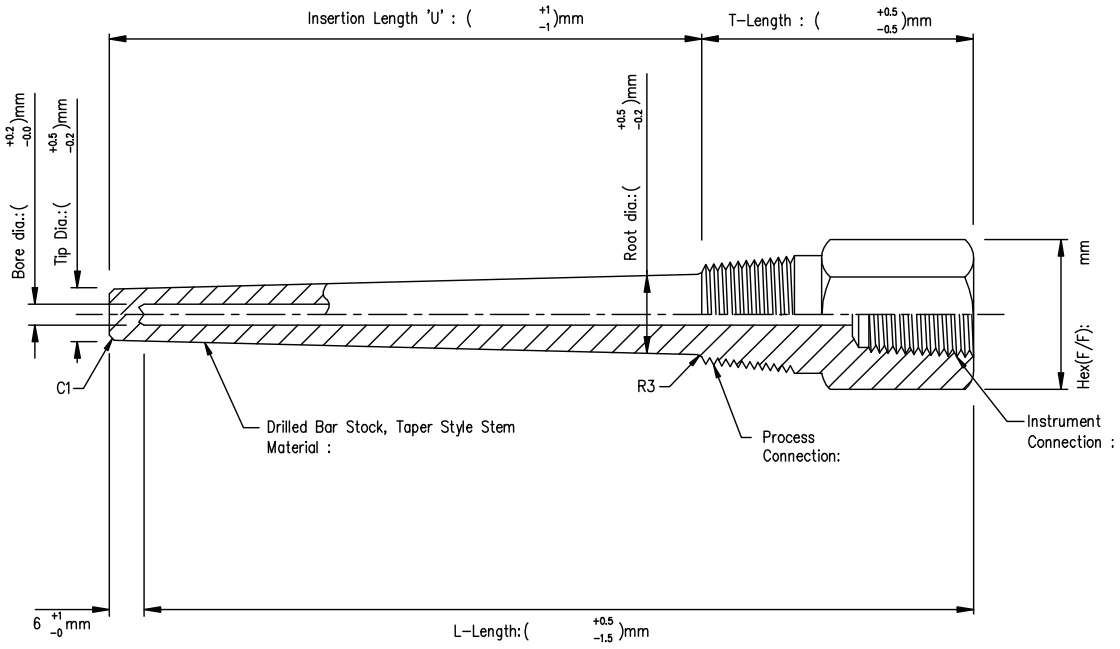
Model No | TW512T | – | – | – | – | – | – | – | – | – | –

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (BSP)



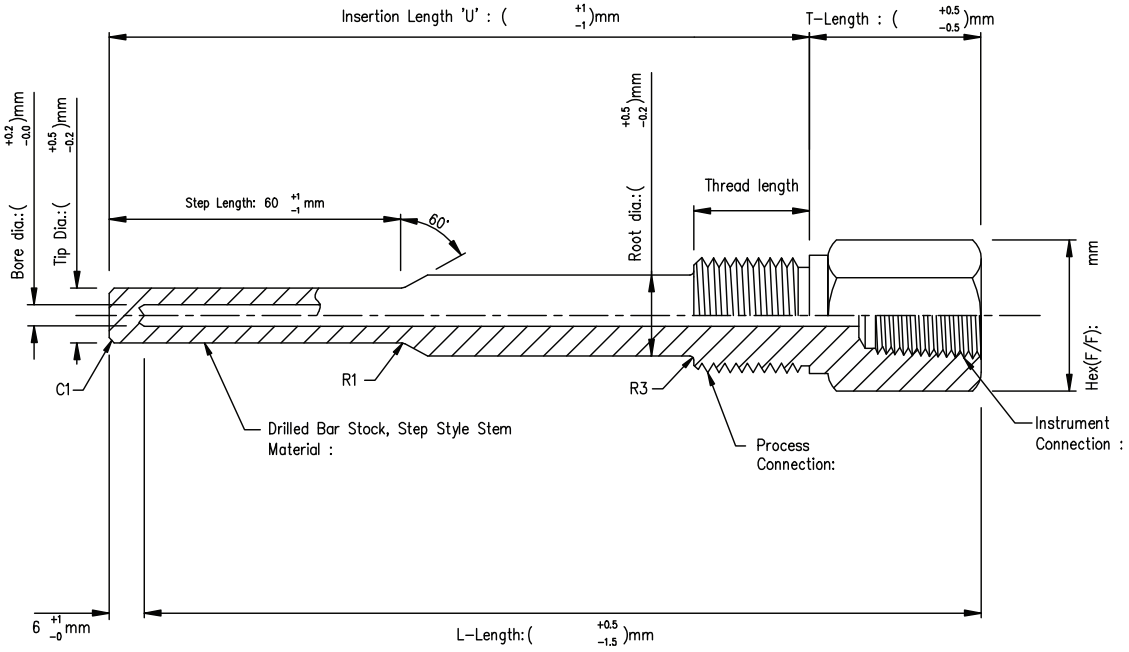
Model No TW512T – – – – – – – – – –

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (NPT)



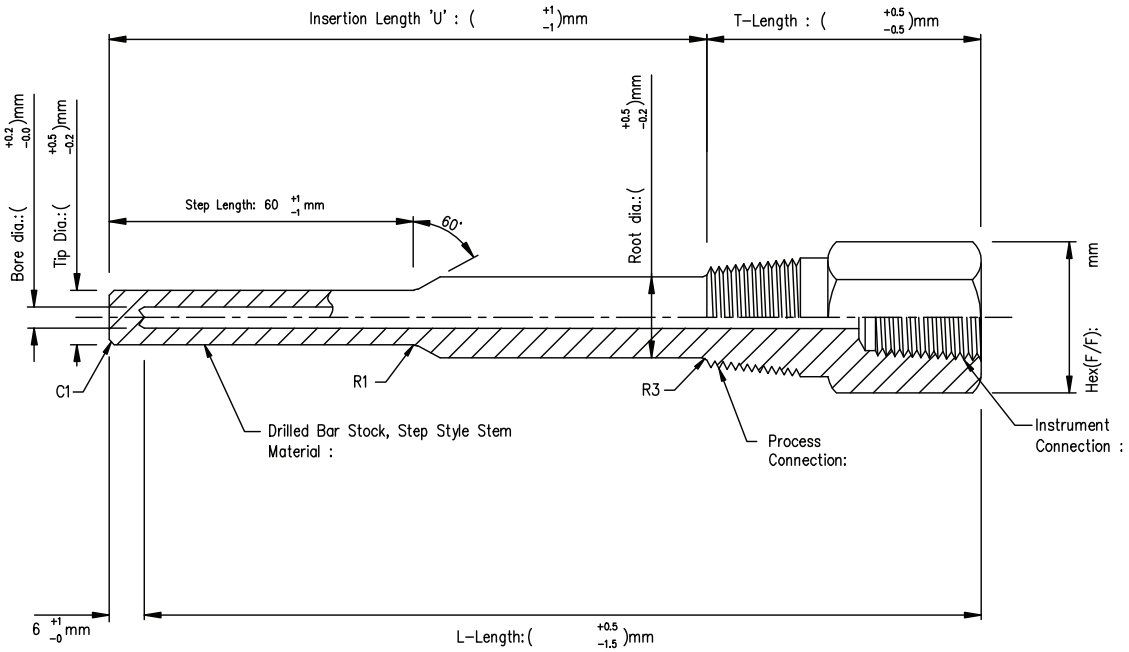
Model No TW512T – – – – – – – – – –

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (BSP)



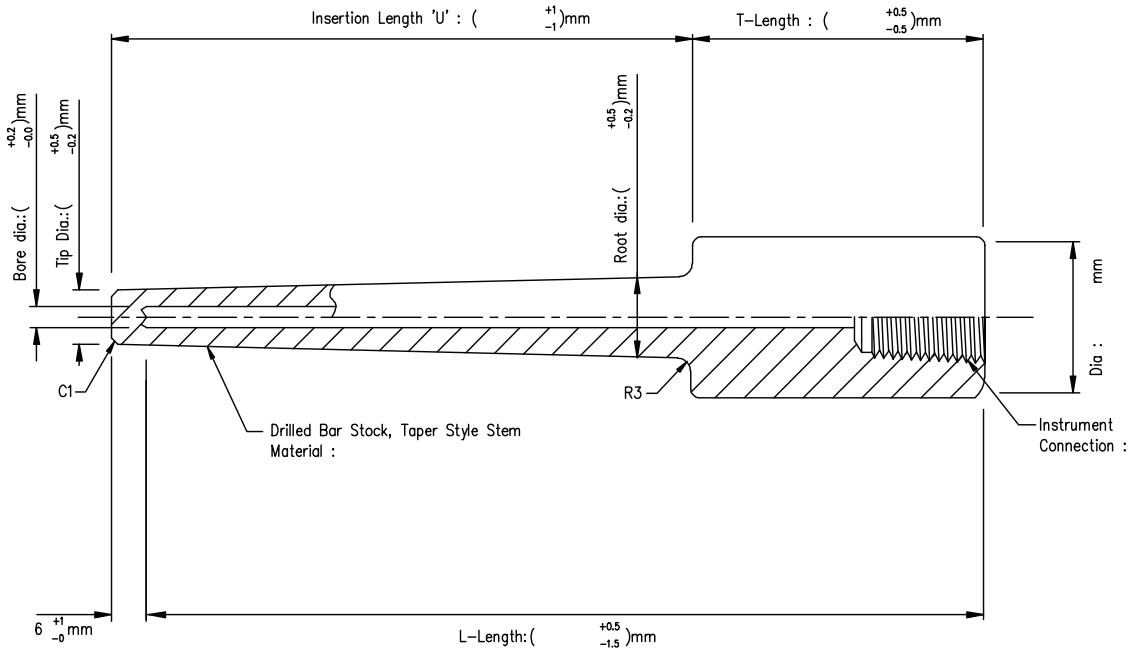
Model No | TW512T | – | – | – | – | – | – | – | – | – | –

TW512T HEAVY DUTY THREAD THERMOWELL SOLID DRILLED BAR STOCK (NPT)



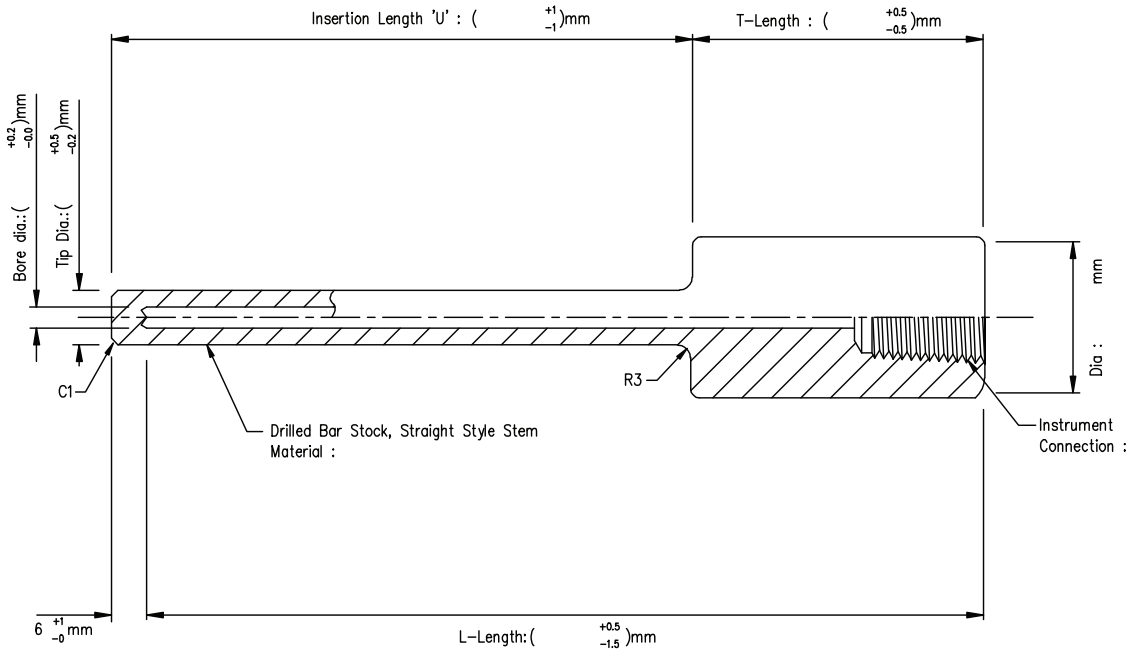
Model No | TW512T | – | – | – | – | – | – | – | – | – | –

TW512W HEAVY DUTY WELDED THERMOWELL SOLID DRILLED BAR STOCK (TAPER STYLE STEM)



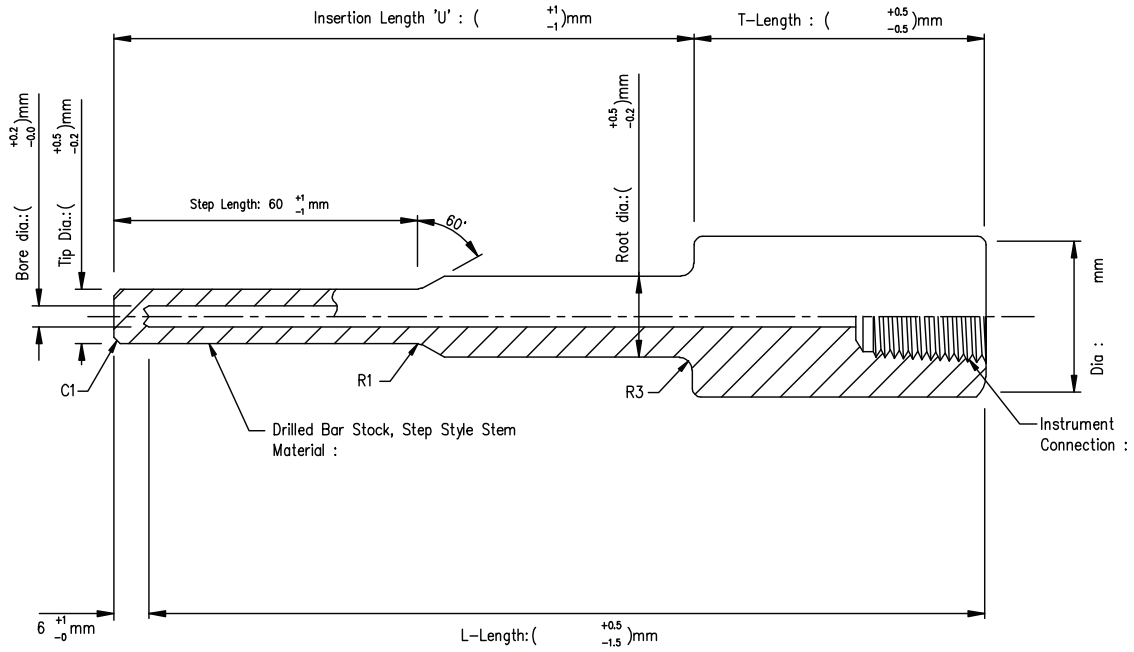
Model No TW512W – – – – – – – – – –

TW512W HEAVY DUTY WELDED THERMOWELL SOLID DRILLED BAR STOCK (STRAIGHT STYLE STEM)



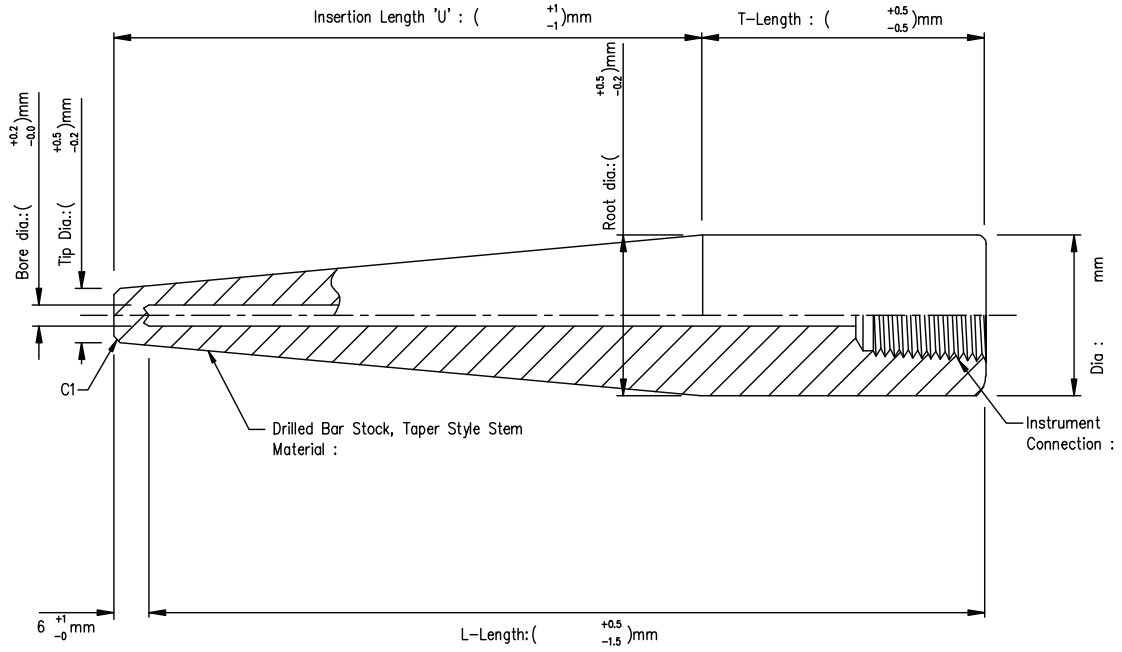
Model No TW512W – – – – – – – – – –

TW512W HEAVY DUTY WELDED THERMOWELL SOLID DRILLED BAR STOCK (STEP STYLE STEM)



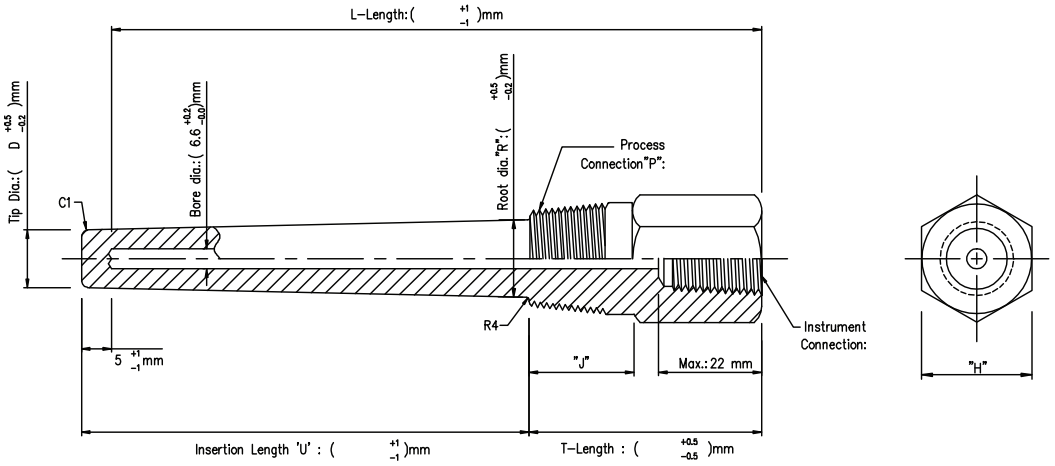
Model No TW512W – – – – – – – – – –

TW512W HEAVY DUTY WELDED THERMOWELL SOLID DRILLED BAR STOCK (LURGI STYLE)



Model No TW512W – – – – – – – – – –

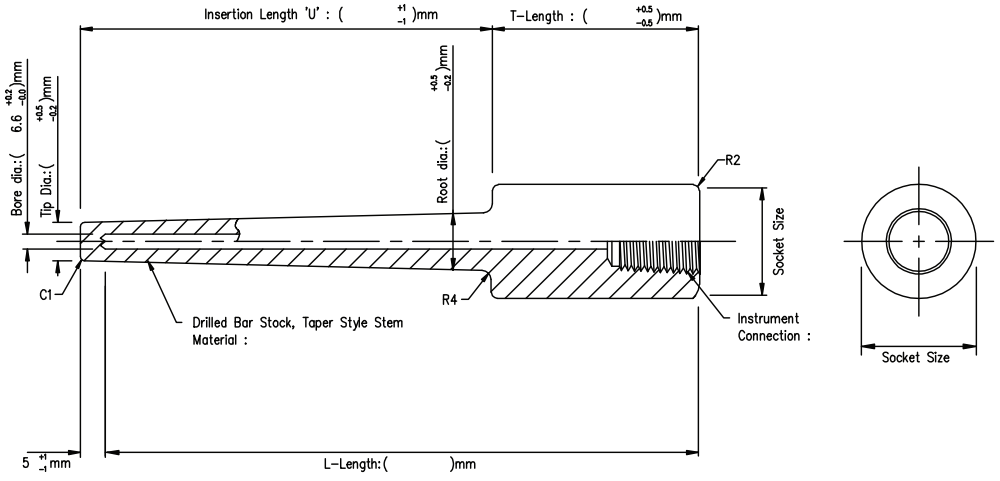
THREAD THERMOWELLS (TAPER THREAD)



Tapered range (For thread thermowell , TW 512T)

HEX Size (H)	Thread (Process Connection) (P)	Thread (J)	Root Diameter (R)	Tip Diameter (Tapered Stem) (D)
28.5 mm	1/2" NPT	19 mm	17 mm	13 mm
28.5 mm	3/4" NPT	19 mm	19 mm	13 mm
35 mm	1" NPT	25 mm	26.5 mm	18 mm
28.5 mm	1/2" BSPT	19 mm	17 mm	13 mm
31.75 mm	3/4" BSPT	19 mm	19 mm	13 mm
35 mm	1" BSPT	25 mm	26.5 mm	18 mm

WELDED THERMOWELLS



Tapered range (For weld-in thermowell , TW 512 W)

Pipe Size	Socket Size	Root Diameter	Tip Diameter
3/4"	26.7 mm	19 mm	13 mm
1"	33.4 mm	19 mm	13 mm
1-1/4"	42.2 mm	19 mm	13 mm
1-1/2"	48.3 mm	19 mm	13 mm

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SINGAPORE OFFICES

Acez Sensing Pte Ltd
Blk 28E Penjuru Close #01-04 Singapore 609133
Tel (65) 6265 1588
Fax (65) 6264 3992
Email sales@acezsensing.com
Website www.acezsensing.com

Acez Instruments Pte Ltd
Blk 28D Penjuru Close #01-07 Singapore 609132
Tel (65) 6268 0100
Fax (65) 6268 7286
Email sales@acez.com.sg
Website www.acez.com.sg

Showroom/Retail Outlet
No. 10 Jalan Besar #B1-38
Sim Lim Tower Singapore 208787
Tel (65) 6296 3037
Fax (65) 6296 4982

Jurong Island
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Tel (65) 6867 7600
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WHOLLY-OWNED SUBSIDIARIES

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Tel (65) 6266 6155
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Website www.isolab.com.sg

OVERSEAS OFFICES

PT Acez Instruments Indonesia
Jl. Mangga Besar Raya, No. 33B Mangga Besar
Taman Sari, Jakarta Barat, Jakarta 11180 Indonesia
Tel (+62) 21 6232 0237 / (+62) 21 6232 0238
Fax (+62) 21 6232 0236
Email sales@acez.co.id
Websie www.acez.co.id

Acez Instruments (Shenzhen) Co.,Ltd
2105B Seg Plaza Huaqiang Road
Futian Qu Shenzhen CHINA
Tel (86) 0755 6136 2527/28
Fax (86) 0755 06136 2529
Email sales@acez.com.cn
Website www.acez.com.cn

Acez Instruments Philippines Corporation
Unit 301-303, DMG Center Libertad cor. Calbayog St.
Mandaluyong City PHILIPPINES 1553
Tel (+63) 2 470 8068/69/71/72
Fax (+63) 2 470 8043
Email sales@acez.com.ph
Website www.acez.com. ph

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