NORTH AMERICAN ADVANCED TECHNOLOGIES, INC.

RTD, TC & Integral Temperature Transmitter

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Preface

The Resistive Temperature Detector (RTD)， Thermocouple (TC) and their thermowells, joints and connection heads (also called terminal box compartment) are all made of stainless steel. Our designers emphasize the design, features, workmanship and appearance of our products making the quality, appearance and the technology top notch.

Our quality inspectors are very strict in every chain of manufacturing. Our products have been used widely in various industries. In the past many years, we researched the advantages and disadvantages of various products in the world. We received the advices from many of our users and continuously improved and innovated all of our products. See the following styles of our high quality products:

- Armored RTDs and TCs of various dimensions and specifications
- Integral temperature transmitters assembled with RTDs or TCs of various specifications
- Stainless steel connectors and connection head, stainless steel or special alloy sheath
- Various connecting forms and pressure ratings
- Thermowell from deep hole drilling method
  (Machined from Stainless steel or special alloy solid bar)
- Various water-proof and/or explosion-proof products
- Corrosion-proof thermowell of various specifications
- Wear-proof thermowell of various specifications

Features of Construction and Applications

Armored

Armored temperature sensors are constructed of thermocouple conductors or RTD elements, and protected with stainless steel (1Cr18Ni8Ti) or special alloy sheath, insulated with pure MgO. It has advantages of a small diameter ranging from 3mm to 8mm, flexible, hi-pressure rating, quick response to temperature variations (short time constant), strong and durable.

Under the condition of normal flow rate and little vibration, armored RTD or TC can be insert into pipes or equipment directly, which is being used more and more in industry applications. The different forms of mounting are screw with ferrule, flange with ferrule, fixed screw, fixed flange and unfixed flange.

Stainless steel thermowell will be supplied with armored sensor for continuous process to avoid the down time of production in order to replace the sensor, special alloy is available upon request. When dismounting and changing the temperature sensor, the thermowell stays in pipes or equipment. The outside diameters (OD) are typically 12mm and 16mm.

Integral Temperature Transmitter for RTD and TC

When temperature transmitter is assembled directly with RTD or TC, it is called integral temperature transmitter for RTD or TC. Our integral products are assembled with high quality transmitters and RTD or TC. Because the wirings between RTD (or TC) and transmitter are inside the thermometer, there are only two 4-20 mA outgoing wires from the transmitter. The output of two wires, 4~20mA, increases the capability of anti-interference (EMC) for long distance signal transmission, and also save the cost for very expensive thermocouple compensation wires for cold junction compensation.

Different spans of temperature transmitter required by user will be calibrated in factory before they are shipped out.

Stainless Steel Thermometer

Protecting thermowell, flange and compartment of thermometer or integral temperature transmitter are all stainless steel. The stainless steel gives the thermometer a high quality appearance

and also gives the ability of anti-corrosion for fluid and harsh environment conditions. 1Cr18Ni8Ti is generally used as the housing material for normal service. Special alloys are used for erosion and corrosion environment.

Connecting Style & Pressure Rating

There are many forms for connecting to pipes and equipment for armored, stainless steel RTD or TC. The style of connection and the pressure rating in normal service are shown in Table 1 below. We will supply RTD or TC according to the pressure rating in Table 1 if the pressure rating is not identified by user. Users can request the custom connecting style and the different pressure rating.

Table 1. Connecting Style and Pressure Rating

Style of Connection	Commonly used Connectors	Pressure Rating
No Mounting Fittings	N/A	N/A
Fixed Ferrule within Screw	M12X1.5 (ϕ3, ϕ4) M16X15 (ϕ5, ϕ6, ϕ8)	2.5MPa
Fixed Ferrule within Flange	See Dimension Drawing of Ferrule within Flange In Diagrams of Model Selection	2.5MPa
Unfixed Ferrule within Flange	Dimensions Same as Fixed Ferrule with Flange	Atm. Pressure
Unfixed Ferrule within Screw	Dimensions Same as Fixed Ferrule with Flange	Atm. Pressure
Fixed Screw	M27X2	Determined by Specifications
Fixed Screw (For Straight Thermowell)	M27X2	10 MPa
Fixed Screw (For Tapered Thermowell)	M33X2	30 MPa
Unfixed Flange	See Dimension Drawing of Unfixed Flange in Diagrams of Model Selection	Atm. Pressure
Fixed Flange	Codes of Standards, DN and PN identified by User	Determined by Specification

Other Style Flanges and Model Numbers and Specifications:

We can supply our products according to the following standards to satisfy the various requirements for fixed flanges in various applications. (Please note the code of standard, DN, PN and the material for the flange.)

Table 2 Flange Standards

American Standards	ASME/ANSI B16.5	DN: 1/2" ~ 4"	PN: 150 ~ 1500 lbs
German Standards	DIN	DN: 10 ~ 100	PN: 0.25 ~ 25.0 MPa
Japanese Standards	JIS10 ~ 16K	DN: 10 ~ 100	PN: 0.25 ~ 25.0 MPa
Chinese Standards	GB, HG, SH, JB	DN: 10 ~ 100	PN: 0.25 ~ 25.0 MPa

Protecting Thermowell Machined from Solid Bar

The stainless steel thermowell for the thermometer is manufactured by deep hole drilling method, when its length is less than 600 mm. There is no welding seam at the bottom of the thermowell. Although the machining of thermowell is very difficult but it highly improves the pressure rating, reduce leakage, enhance anti-corrosion, etc. Thermowells longer than 600 mm will be handled under the discussion with users after its model number and specification have been determined. Detailed specifications are shown in Table 3, 4 and 5.

Table 3. Enclosure Rating

Style	Enclosure Rating	Classified Explosion-proof
Water-proof	IP65	
Explosion-proof	IP65	dIIBT4
	IP65	dIIBT6
	IP65	dIICT4
Intrinsic Safe	IP65	Ia, Ib

Table 4. Corrosion-proof for Protecting Thermowell

Material	Max. Operating Temp.
F (Teflon)	0 ~ 190 ^{o}C
T (Titanium)	< 350 ^{o}C

Table 5. Wear-proof for Protecting Thermowell

Material	Max. Operating Temp.	Rigidity
Ni60	-200 ~ 600 ^{o}C	HRC60

Type, Temperature Range and Accuracy of Thermometer

All thermometers meet the international standards; See the table 5 for the temperature range and accuracy. (‘‘t’’ refers to absolute value which is measured. Normal, accuracy for Platinum RTD is rate B.)

Table 6 Sensor Types, Temperature Range and Accuracy

Sensor	Type	Symbol	Temp. Range	Accuracy
Thermocouples	B	WRB	0~1600	+/- 1.5 ^{o}C or +/- 0.25% t
	S	WRS	0~1300	+/- 1.5 ^{o}C or +/- 0.25% t
	K	WRK	0~1100	+/- 2.5 ^{o}C or +/- 0.75% t
	E	WRE	0~600	+/- 2.5 ^{o}C or +/- 0.75%t
	T	WRT	-40~350	+/- 1 ^{o}C or +/- 0.75%t
	J	WRJ	-40~750	+/- 2.5 ^{o}C or +/- 0.75%t
RTD	Pt100	WZP	-200~500	Class A: +/- (0.15 + 0.002 | t |) Class B: +/- (0.30 + 0.005 | t |)
	Cu50	WZC	-50~100	+/- (0.30 + 0.006 | t |)

Main Specification of Integral Temperature Transmitter

Main specifications of Integral temperature transmitter are shown in Table 7.

Table 7 Specification of Transmitter

Specifications	Mated with RTD	Mated with TC: K, T, E, J
Accuracy	± 0.2 C ± 0.2% of reading	± 1 % of full scale, including cold junction temp.
Cold Junction Temp.	N/A	0 ~ 70 °C Compensate automatically
Indication for Broken Circuit	N/A	Lower limit
Range	- 30 ~ 500 °C - 200 - 850 °C (Smart)	0 ~ 800 °C - 200 ~ 1760 °C (Smart)
Output Signal	4 ~ 20mA DC Linear with the input.	4 ~ 20mA DC Linear with the input.
Power Supply	10 ~ 30V DC Protected by reverse connecting (24VDC for rated load voltage)	10 ~ 30V DC Protected by reverse connecting (24VDC for rated load voltage)
Load	0 ~ 700 Ohm at 24V 250 Ohm For rated	0 ~ 700 Ohm at 24V 250 Ohm For rated
Ambient Temp.	0 ~70 °C - 40 ~ 70 °C (Smart)	0 ~70 °C - 40 ~ 70 °C (Smart)
Relative Humidity	5% ~ 95%, No condensation	5% ~ 95%, No condensation
EMC	EN55011 Electromagnetic Leak IEC801-2 Static Discharge IEC801-3 EMI Inhibition IEC801 - 4 Transient Pulse (Under the condition of 24V DC Input and 250 Ohm load)	EN55011 Electromagnetic Leak IEC801-2 Static Discharge IEC801-3 EMI Inhibition IEC801 - 4 Transient Pulse (Under the condition of 24V DC Input and 250 Ohm load)
Mechanical Vibration	Amplitude < 0.15mm f < 55 Hz	Amplitude < 0.15mm f < 55 Hz
Programming or communicator	Smart, Rcpw Smart, HART communication	Smart, Rcpw Smart, HART communication

Immersion Length and Connecting Style of Thermowell

Immersion length and connecting style of thermowell are show in Table 8.

Note: There is another connecting structure, L Stem with unfixed flange, for armored thermometer with thermowell. And there are two specifications in normal service, 1500 mm long in total length with 750mm of immersion length, and 1000mm long in total length with 500 mm of immersion length. Custom lengths are available.

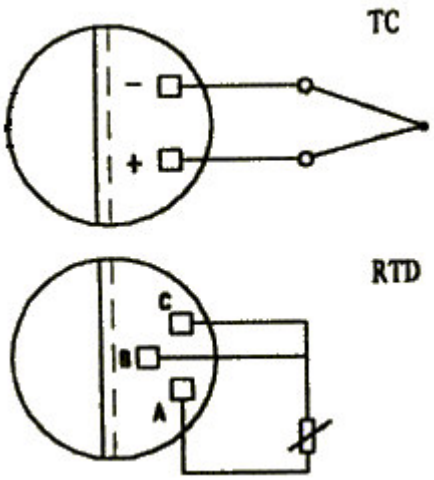
Table 8 Immersion Length & Connecting Forms

Total length L	**225**	**250**	**300**	**350**	**400**	**450**	**550**	**650**	**900**	**1150**	**1150**	**1650**	**2150**	**Option**
Immersion length L	**75**	**100**	**150**	**200**	**250**	**300**	**400**	**500**	**750**	**1000**	**1000**	**1500**	**2000**	**Option**
Armored without Thermowell														
Fixed Screw	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Ferrule with Screw	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Ferrule with Flange	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Armored with Thermowell														
Fixed Screw for Straight Thermowell	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
Fixed Screw for Tapered Thermowell	✔	✔	✔	✔	✔									
Unfixed Flange	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
Fixed Flange	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
No Mounting Fittings	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
Non-metallic Thermowell														
OD of Thermowell 16			✔	✔	✔	✔	✔	✔	✔	✔				
OD of Thermowell 20					✔	✔	✔	✔	✔	✔	✔	✔	✔	
OD of Thermowell 25							✔	✔	✔	✔	✔	✔	✔	

Wiring

Thermocouple has two terminals, “+” and “-“. RTD has 3 terminals for RTD lead resistance compensation. The output of integrated transmitter has 2 terminals for output of 4 to 20 mA, and is in the same head compartment with RTD or TC. Detailed wirings are shown in Fig. 1 wiring.

Wiring for RTD & TC



Wiring for Integral Transmitter of RTD & TC

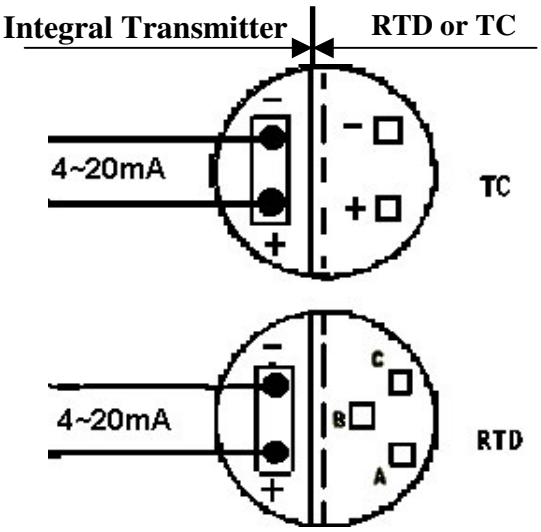


Fig. 1 Wiring

Appearance and Connecting Dimension for the Stainless Steel Head Compartment

See Fig. 2.

Note:
M20 x 1.5 (IP65) is water-proof;
M22xl.5 is water-proof and explosion-proof (dIIBT4/T6, IP65 or dIICT_6, IP65).

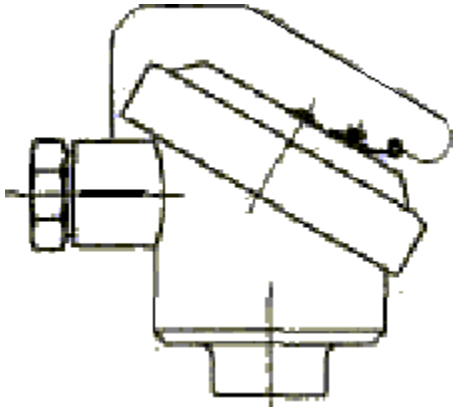


Fig. 2 Stainless Steel Compartment

Attention Needed When Mounting

1. RTD, TC and Integral temperature transmitter should avoid being mounted in the place where there is strong vibration, for example, at the outlet of a pump.
2. Accessories supplied should be kept until the end of installation.
3. Temperature of storage: -20 ^{o}C ~ +60 ^{o}C.
4. Minimum immersion length for RTD or TC is recommended as the following:
   150 mm or 200 mm for normal process pipes,
   400 mm for normal process equipment.

Model Selection Chart

Armored Thermometer of Stainless Steel / Integral Temperature Transmitter
Example: WREK14706-0750P/T1: Theermocouple-Type E-Single element- Fixed Ferrule with Flange-Intrinsic safe-No special requirement-OD 6 mm-Imersion length 750 mm-0~100 ^{o}C –Stainless steel compartment.

W [1] [2] **K** [3] [4] [5] [6] [7] **-** [8] **P / T** [9] (P - Stainless steel compartment)

		Sensor Category
1	R	TC
	Z	RTD

		Type
	K	**K** Thermocouple 0~800 °C (0~1000 °C)
2	E	**E** Thermocouple 0~600 °C
	T	**T** Thermocouple -40~350 °C
	J	**J** Thermocouple -40~750 °C
	P	Pt100 RTD -200~500 °C
	C	Cu50 RTD -50~100 °C

		Single or Dual Element
3	1	Single-Element
	2	Dual-Element

		Mounting
	0	M27X2 Fixed Screw
	1	No mounting fitting
4	2	Fixed Ferrule with Screw (See the following drawings)
	3	Unfixed Ferrule with Screw (See the following drawings)
	4	Fixed Ferrule with Flange (See the following drawings)
	5	Unfixed Ferrule with Flange (See the following drawings)
	9	Custom Form

		Connection Head Style
	3	Water-proof, IP65
5	4	Explosion-proof, dllBT4, IP65
	5	Explosion-proof, dllBT6, IP65
	6	Explosion-proof, dllCT6, IP65
	7	Intrinsic Safe, ia. ib, IP65

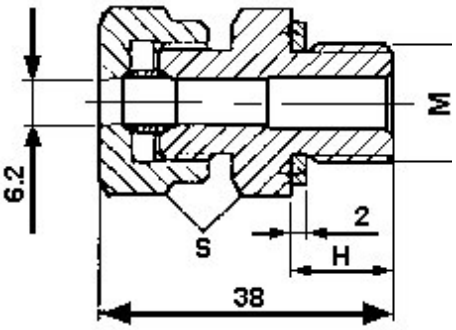
		Special Requirement
6	0	No special requirement
	9	for Special requirement

		OD for Armored Sheath
	3	ϕ 3 mm (0.12")
	4	ϕ 4 mm (0.16")
7	5	ϕ 5 mm (0.20")
	6	ϕ 6 mm (0.24")
	8	ϕ 8 mm (0.32")

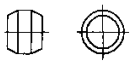
		Immersion Length
	0050	50 mm (1.97")
	0075	75 mm (2.95")
	0100	100 mm (3.94")
	0150	150 mm (5.91")
	0200	200 mm (7.87")
8	0250	250 mm (9.84")
	0300	300 mm (11.81")
	0400	400 mm (15.75")
	0500	500 mm (19.69")
	0750	750 mm (29.53")
	1000	1000 mm (39.37")
	XXXX	Special requirement

		Span of transmitter
	0	-50 °C ~ 50 °C
	1	0~100 °C
	2	0~200 °C
	3	0~300 °C
9	4	0~400 °C
	5	0~500 °C
	6	0~1000 °C
	9	Special requirement
	S_1	-200~1760 °C Smart
	S_2	-200~1760 °C Smart, HART communicator

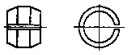
Screw with Ferrule



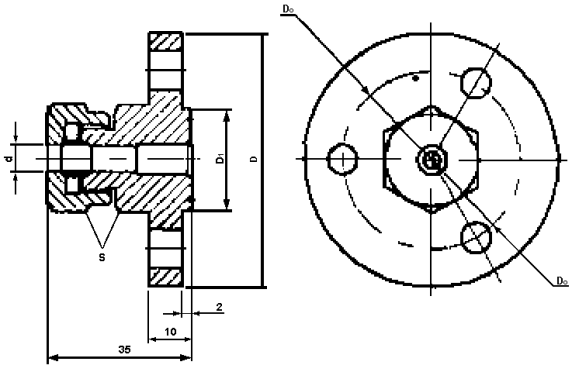
Fixed Ferrule



Unfixed Ferrule



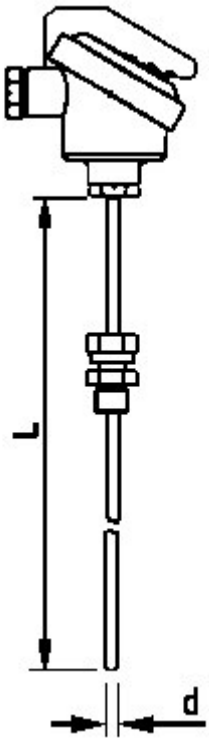
Flange with Ferrule



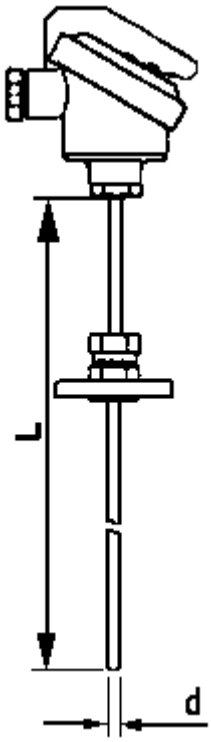
	ϕ 8	ϕ 6	ϕ 5	ϕ 4	ϕ 3
M	M16 x 1.5			M16 x 1.5	
H	15			15	
S	19			22	

	ϕ 8	ϕ 6	ϕ 5	ϕ 4	ϕ 3
D	**ϕ 60**			**ϕ 50**	
Do	**ϕ 42**			**ϕ 36**	
D_1	**ϕ 24**			**ϕ 20**	
d_0	**ϕ 9**			**ϕ 7**	
S	**22**			**19**	

Without Mounting Fittings



Screw with
Fixed/Unfixed Ferrule



Flange with
Fixed/Unfixed Ferrule

Armored Thermometer with SS Thermowell / Integral Temperature Transmitter

W | **1** | **2** | **3** | **-** | **4** | **5** | **6** | **7** | **-** | **8** | **P / T** | **9** (P - Stainless steel connection head)

		Sensor Category
1	R	TC
	Z	RTD

		Type
	K	**K** Thermocouple 0~800 °C (0~1000 °C)
2	E	**E** Thermocouple 0~600 °C
	T	**T** Thermocouple -40~350 °C
	J	**J** Thermocouple -40~750 °C
	P	Pt100 RTD -200~500 °C
	C	Cu50 RTD -50~100 °C (Dis-armored)

		Single or Dual-elements
3	1	Single-Element
	2	Dual-Elements

		Mounting
	1	No mounting fitting
	2	M27X2 Fixed Screw (For Straight Thermowell)
4	3	Unfixed Flange
	4	Fixed Flange (Noted with Codes of Standards, DN or PN determined by User)
	5	L Stem with Unfixed Flange
	6	M33x2 Fixed Screw (For Tapered Thermowell)
	9	Special

		Connection Head Style
	3	Water-proof, IP65
5	4	Explosion-proof, dllBT4, IP65
	5	Explosion-proof, dllBT6, IP65
	6	Explosion-proof, dllCT6, IP65
	7	Intrinsic Safe, ia. ib, IP65

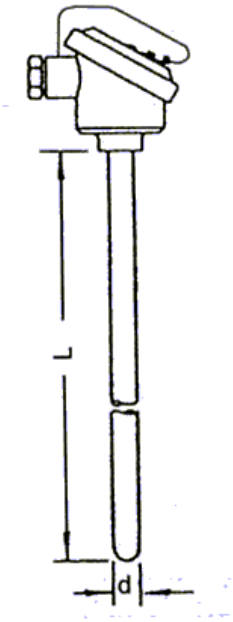
		Special Requirement
	0	No special requirement
6	F	Corrosion-proof Style
	N	Wear-proof Style
	9	For Special requirement

		OD for Thermowell
	0	ϕ 16 mm (0.63")
	1	ϕ 12 mm (0.47")
7	2	ϕ 20 mm (0.79") (For Tapered Thermowell)
	9	Special Size

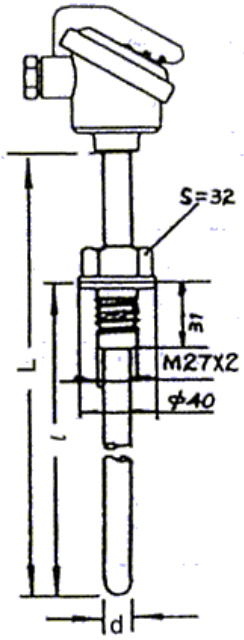
		Immersion Length
	0075	75 mm (2.95")
	0100	100 mm (3.94")
	0150	150 mm (5.91")
	0200	200 mm (7.87")
8	0250	250 mm (9.84")
	0300	300 mm (11.81")
	0400	400 mm (15.75")
	0500	500 mm (19.69")
	0750	750 mm (29.53")
	1000	1000 mm (39.37")
	XXX	Special requirement

		Span of transmitter
	0	-50 °C ~ 50 °C
	1	0~100 °C
	2	0~200 °C
	3	0~300 °C
9 _	4	0~400 °C
	5	0~500 °C
	6	0~1000 °C
	9	Special requirement
	S_1	-200~1760 °C Smart HART Communicator
	S_2	-200~1760 °C Smart, HART communicator

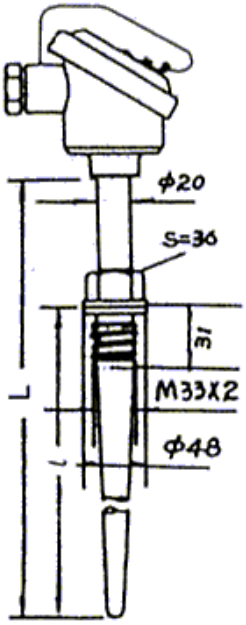
Without Mounting Fittings



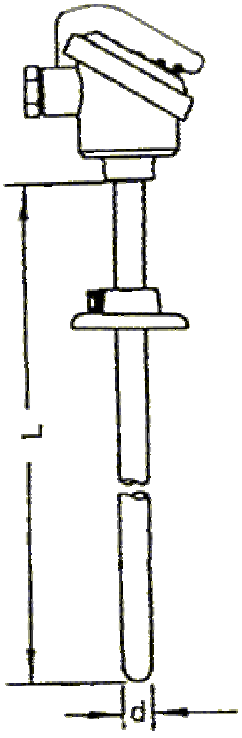
Fixed Screw
(For Straight Thermowell)



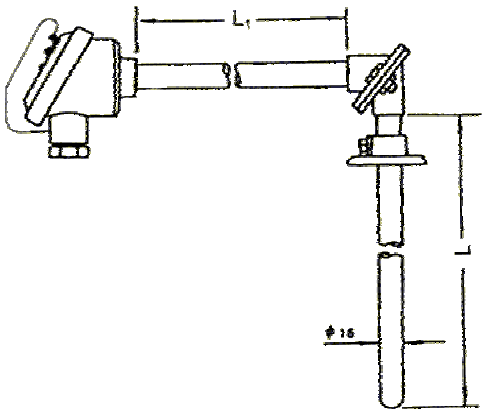
Unfixed Flange
(For Tapered Thermowell)



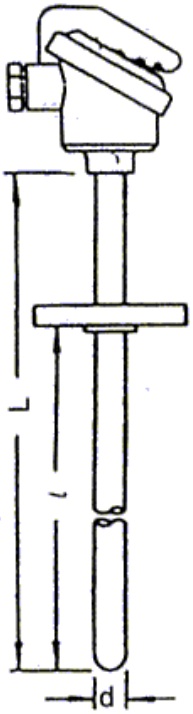
Unfixed Flange



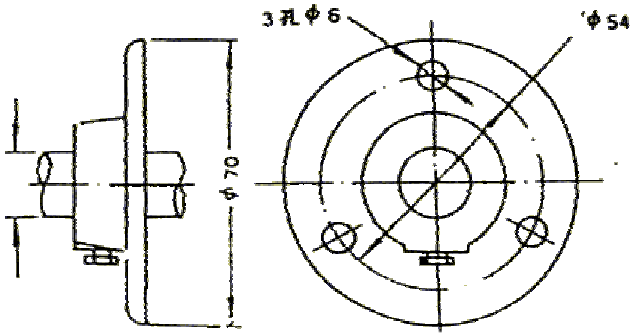
L Stem with Unfixed Flange



Fixed Flange



Unfixed Flange



Thermocouple for High Temperature (With Non-metallic Thermowell)

WR 1 2 - 3 4 5 - 6 **HP** HP (H - High Temperature; P - Stainless steel connection head)

		Type
1	B	B 0 ~ 1600 °C
	S	S 0 ~1300 °C
	K	K Single-element: 0 ~ 1200 °C, Dual-element: 0 ~ 1100 °C

		Single or Dual-element
2	1	Single-Element
	2	Dual-Element

		Mounting
3	1	No Mounting Fitting
	9	Special Form

		Connection head Style
	3	Water-proof, IP65
	4	Explosion-proof, dllBT4, IP65
4	5	Explosion-proof, dllBT6, IP65
	6	Explosion-proof, dllCT6, IP65
	7	Intrinsic Safe, ia, ib, IP65

		OD for Non-metallic Thermowell
	1	ϕ 25 (Thermowell of Double Layer for Style B & S.)
5	2	ϕ 16 (Thermowell of Monolayer for Style B & S.)
	3	ϕ 20 (Thermowell of Monolayer for Style K.)

***Material of the Non-metallic Thermowells:**
Corundum for Style B
Hi-alumina Clay for Style K & S

	Immersion Length (mm)
0150	150
0200	200
0250	250
0300	300
6 0400	400
0500	500
0750	750
1000	1000
1250	1250
1500	1500
2000	2000

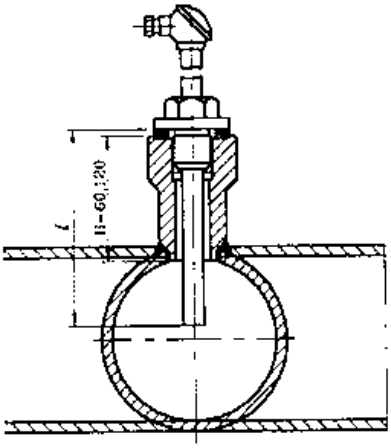
Example: WRB1-132-0750 HP: Thermocouple-Type R-Single element-No mounting fitting-Water-proof IP65-OD=16 mm-Immersion length 750 mm-stainless steel connection head.

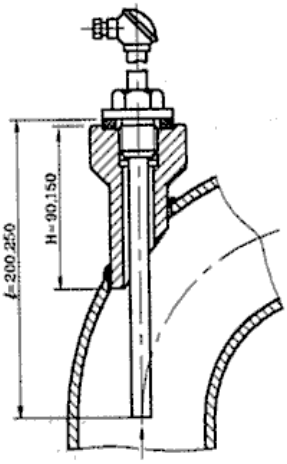
* **Attention needed when ordering**

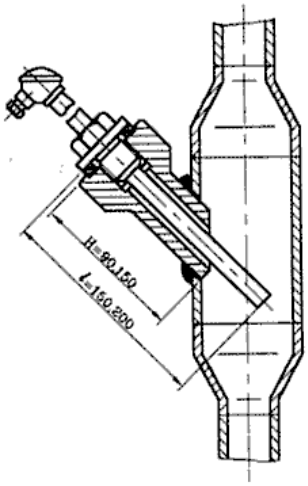
1. Write product name, model number, specifications (type, OD of Thermowell, immersion length, etc.) quantity, and delivery date.
2. Special requirements, for example, material, pressure rating, connecting style, special applications, etc., can be discussed through by telephone or e-mail.
3. Write your company name, mailing address, post code, telephone number, fax number, e-mail address, ship to address, and contact person for the company or department.
4. Payment method or credit references.

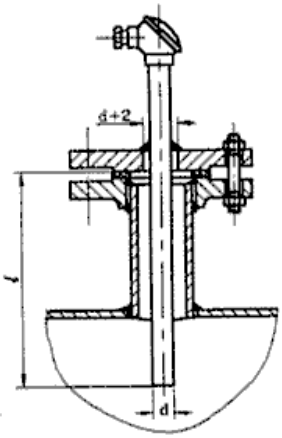
Mounting Graphics

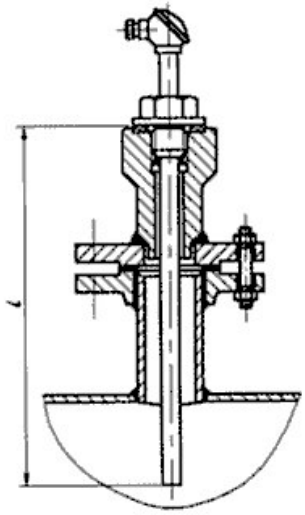
RTD
TC

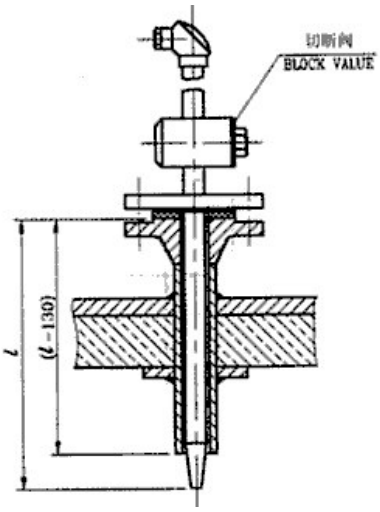


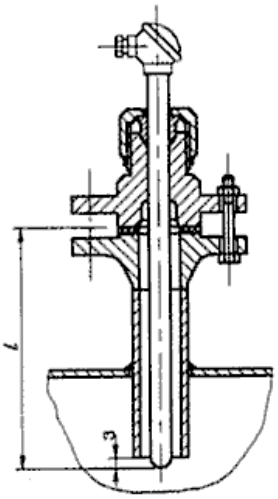


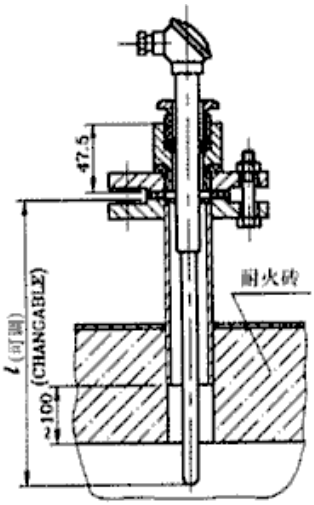




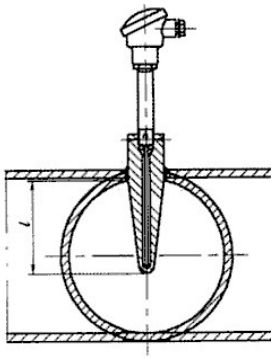


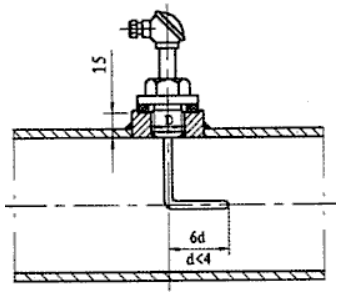


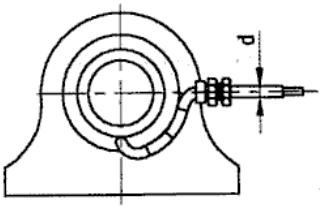


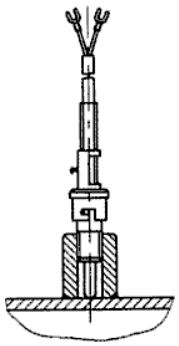


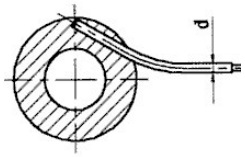
Armored RTD
Armored TC

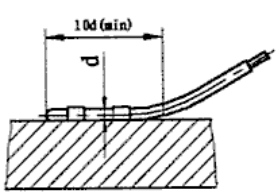


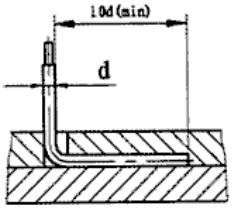


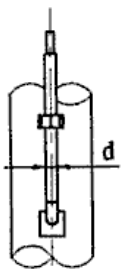












Thermowell

We supply thermowells of various styles and dimensions suitable for various applications. Users can specify the types of stainless steel or alloy for the specific deep hole drilling thermowell.

Style of thermowell:

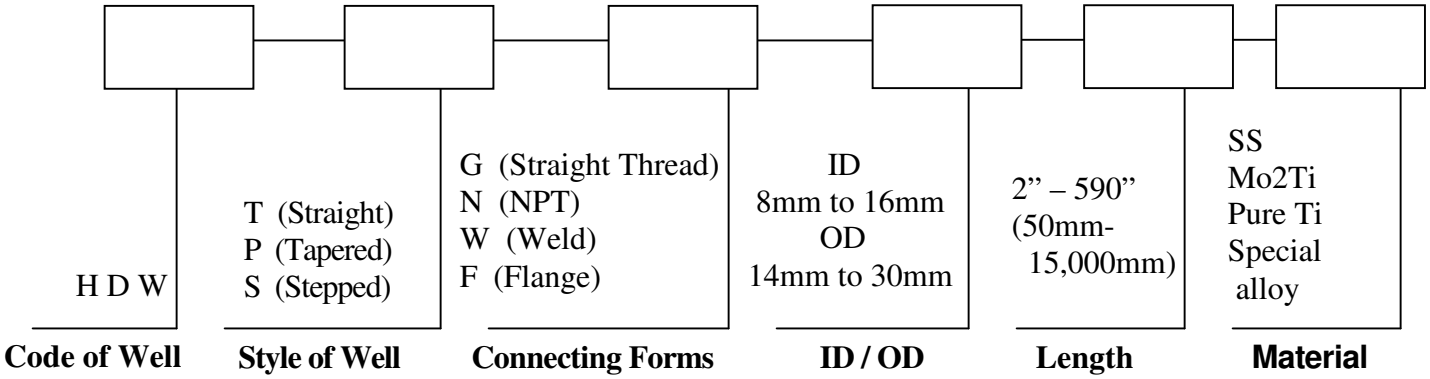
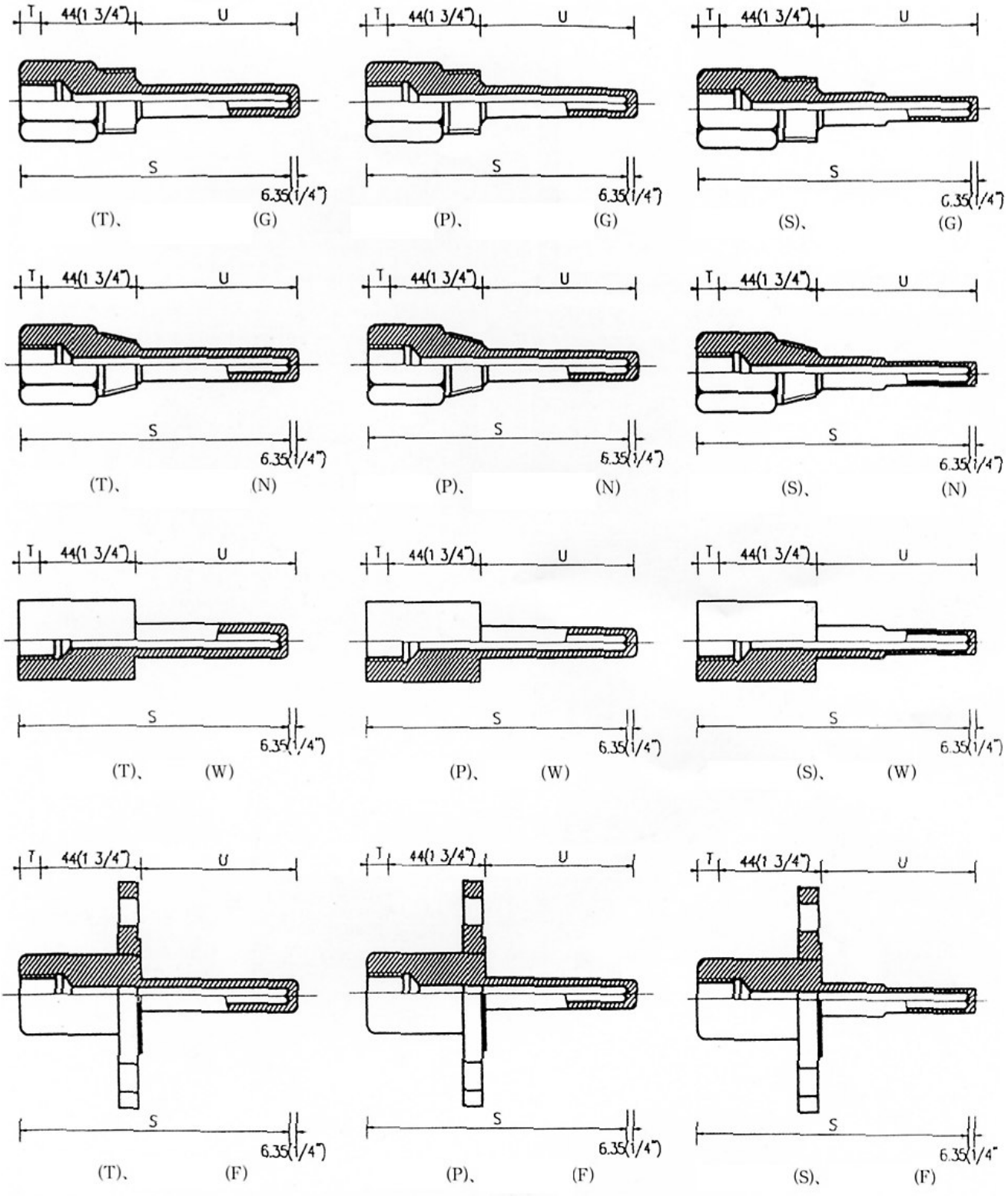


Table 9 Specifications of Thermowell

Pipe Style	ID (mm)	OD (mm)	Length (mm)	Material
Machined from Solid Metal Rod	8 to 16 .	14 to 30	< = 1000	SS
				Mo2Ti
				Pure Ti
				Special Alloy
Seamless Pipe	8 to 16	14 to 30	150 to 2000 Special Length Available	SS
				Mo2Ti
				Pure Ti
				Special Alloy

Styles of Thermowell



U: Immersion Length into Process
T: Lagging Length
S (L): Thermowell Length