ThermoPLUS

Temperature Sensor

Model ATT90

OVERVIEW

The model ATT90 temperature sensor , which is designed to be used in conjunction with the Smart Temperature Transmitter model ATT61/71, is comprised of various sheathed thermocouple and a sheathed resistance temperature detector (RTD) combinations.
Both sheathed thermocouple and resistance temperature detector (RTD) are constructed with thin, stainless steel or heat resistant steel sheaths, which encase either thermocouple or resistance temperature detector elements and are packed with non-organic insulation (magnesium oxide). They have a number of superior features over the thermocouples or RTDs used in conventional protecting wells.

Combination of ATT71 temperature transmitter (sold separately) and ATT90 temperature sensor (sold separately) *1

Combination of ATT71 temperature transmitter (sold separately) and ATT90 temperature sensor and ATT91 protecting well (sold separately) *1

Combination of ATT71 temperature transmitter, ATT90 temperature sensor (sold separately) with ATT95 sensor protecting well (sold separately) *1

FEATURES

1. Broad measuring range
   Using a small diameter protecting well, the thermocouple and resistor can measure the temperature of small objects.
   Thermocouple covers a range of -200~+1050°C, whereas RTD covers -200~+500°C.
2. Quick response
   A small diameter sheath has a low heat capacity. The sensing element quickly responds to any change in temperature.
3. Easy to install
   The minimum-bending radius is twice the external diameter of the sheath. It can be installed at any location at the plant site.
4. Long life
   Both thermocouple and RTD are insulated by air tight and chemically stable magnesium oxide. This ensures longer product life.
5. Superior mechanical strength and environmental resistance
   Proper selection of sheath material will ensure safe operation in any high vibration, corrosive, high-temperature or low-temperature location.
6. Various sheath diameters and lengths available
   [External diameter] Ø3.2/ Ø4.8/ Ø3.2/ Ø6.4/ Ø8
   [Length] 50 ~ up to1500 mm
   (Custom designed product /1501~3000mm)

Note)*1 External appearance may differ from those shown in the photographs in this Specification Sheet depending on the types of sensors to be integrated.

SPECIFICATIONS

Sheathed thermocouple

Table 1 Materials of thermocouple elements JIS C-1605-1995

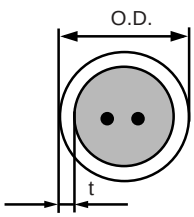
Symbol	+leg	-leg
SN (N)	Alloy (mainly consisting of nickel, chrome and silicone)	Alloy (mainly consisting of nickel and silicone)
SK (K)	Alloy (mainly consisting of nickel and chrome)	Alloy (mainly consisting of nickel)
SE (E)	Alloy (mainly consisting of nickel and chrome)	Alloy (mainly consisting of copper and nickel)
SJ (J)	Iron	Alloy (mainly consisting of copper and nickel)
ST (T)	Copper	Alloy (mainly consisting of copper and nickel)

Table 2 Temperature ranges (Limits of temperature rise in atmosphere) Unit: °C

Sheath external diameter (mm)	SN	SK		SE	SJ	ST
Ø3.2	750 *1	750		**750**	**650**	**350**
Ø4.8	800*1	800		800	750	350
Ø6.4	**1000***1	1000*1	**900***2	800	750	350
Ø8.0	1050*1	1050*1	1000*2	800	750	350

Note) Specifications that are underlined are most commonly used.
**1 Sheath material is NCF600 (Equivalent to Inconnel 600)*
**2 Sheath material is SUS310S*
without mark: Sheath material is SUS316

Table 3 Standard specifications of sheathed thermocouple

Construction	External diameter (mm)	Wall thickness (mm)	Diameter of element (mm)	Type of thermocouple and sheath material				
				SN	SK	SE	SJ	ST
Single element 	**Ø3.2**	**0.47**	**Ø0.51**	NCF600*3 Hoskins2300	SUS316 NCF600*3 Hoskins2300	**SUS316**	**SUS316**	**SUS316**
	Ø4.8	0.72	Ø0.76	NCF600*3 Hoskins2300	SUS316 NCF600*3 Hoskins2300	SUS316	SUS316	SUS316
	Ø6.4	**0.93**	**Ø1.0**	**NCF600***3 Hoskins2300	**SUS310S** NCF600	SUS316	SUS316	SUS316
No. of elements: 2	Ø8.0	1.16	Ø1.3	NCF600*3	SUS310S NCF600*3	SUS316	SUS316	SUS316

Note) Specifications that are underlined are most commonly used. All Hoskins2300 items are custom designed.
**3 NCF600 is equivalent to Inconnel 600*

Table 4 Available lengths for sheathed thermocouple and approximate weight

Sheath external dia. (mm)	Ø3.2	Ø4.8	Ø6.4	Ø8.0
Available length	50 ~ 3000 (Over 1501, custom order)			
Approx. weight (g/m)	4.5	100	180	280

Table 5 Construction of thermal joint

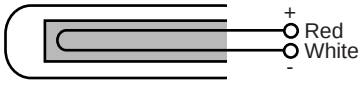
Type	Tip construction	Features
Non-grounding		1.Not limited by measuring objects. Most commonly used. 2.Element is covered by non-organic insulation material, therefore, ensuring long life.

Table 6 Tolerances of thermocouples and applicable national standards

	JIS C1605-1995				IEC 584-2-1982			ASTM E230-1996		
	Temp. range (°C)	Class	Tolerance (°C)*4, *5		Temp. range	Class	Tolerance (°C)*4	Temp. range	Class	Tolerance (°C)*4
SN & SK	-40~+375	1	±1.5	N & K	-40~+375	1	±1.5	0~+1260	STD	±2.2 (°C) or ±0.75%
	+375~+1000		±0.004|t|		+375~+1000		±0.004|t|			
	-40~+333	**2**	±2.5		-40~+333	2	±2.5		SP.	±1.1(°C) or ±0.4%
	+333~1200		±0.0075|t|		+333~1200		±0.0075|t|			
	-167~+40	3	±2.5		-167~+40	3	±2.5	-200~0	STD	±2.2 (°C) or ±2%
	-200~167		±0.015|t|		-200~167		±0.015 |t|			
SE	-40~+375	1	±1.5	E	-40~+375	1	±1.5	0~+870	STD	±1.7 (°C) or ±0.5%
	+375~+800		±0.004 |t|		+375~+1000		±0.004 |t|			
	-40~+333	**2**	±2.5		-40~+333	2	±2.5		SP	±1 (°C) or ±0.4%
	+333~+900		±0.0075 |t|		+333~+1200		±0.0075 |t|			
	-167~+40	3	±2.5		-167~+40	3	±2.5	-200~0	STD	±1.7 (°C) or ±2%
	-200~-167		±0.015 |t|		-200~-167		±0.015 |t|			
SJ	-40~+375	1	±1.5	J	-40~+375	1	±1.5	0~+760	STD	±2.2 (°C)or ±0.75%
	+375~+750		±0.004 |t|		+375~+750		±0.004 |t|			
	-40~+333	**2**	±2.5		-40~+333	2	±2.5		SP	±1.1°C)or ±0.4%
	+333~+750		±0.0075 |t|		+333~+7570		±0.0075 |t|			
ST	-40~+125	1	±0.5	E	-40~+125	1	±0.5	0~+370	STD	±1 (°C) or ±0.75%
	+125~+350		±0.004 |t|		+125~+350		±0.004 |t|			
	-40~+133	**2**	±1.0		-40~+133	2	±1.0		SP	±0.5 (°C) or ±0.4%
	+133~+350		±0.0075 |t|		+133~+350		±0.0075 |t|			
	-67~+40	3	±1.0		-67~+40	3	±2.5	-200~0	STD	±1.0 (°C) or ±1.5%
	-200~-67		±0.015 |t|		-200~-67		±0.015 |t|			

Note) Underlined items are most commonly used.
**4 Tolerance refer to the difference between temperature as converted from the emf-temperature table minus the measuring point temperature.*
**5 |t| is measured temperature regardless of the + or - symbol.*

Inspection specifications of sheathed thermocouple

Table 7 Dimension check

Sheath external diameter (mm)		Ø3.2, Ø4.8	±0.05
		Ø6.0, Ø8.0	±0.10
Length *6 (mm)	Welded	Under 150	±2.0
		Over 150	±1.5%
	With spring	±3.0	
Nipple length		±3.0	

*Note) *6 Maximum length is up to 1 meter. Consult with a Yamatake representative if the length is to be over 1 meter.*

Table 8 Thermoelectric motive force test

Type	Test temperature	Test condition
ST	100°C	Boiling point of water
SN, SK, SE, SJ	300°C	Niter bath

Note) Additionally, testing at 0°C, -400°C is possible. Also, 10~70°C, 70~280°C, 280~560°C, 100~1100°C, -50~10°C, -80~-60°C tests, and -183°C (LOx), 196°C (LN2), -269°C (LHe), metallic fixed point (Sn), metallic fixed point (Zn), metallic fixed point (Sb) tests are available. These tests will require additional test fees. (Custom order)

Table 9 Insulation resistance test

Sheath external diameter (mm)	Ø 3.2	Ø 4.8	Ø 6.4	Ø 8.0
Test condition	100MΩ / 500V DC			

Testing table

The test certificate available from this option is for the sheathed thermocouple only, not for the integrated test with model ATT61/71 temperature transmitter .

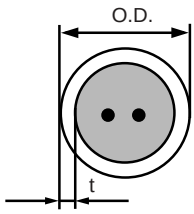
Sheathed resistance temperature detector

Table 10 Type of resistance temperature detector

Nominal resistance at 0°C	Class	Rated current	R100/R0 *7
Pt100(JPt100) *8	A	Under 2mA	1.3851(-1.3916)
	B		

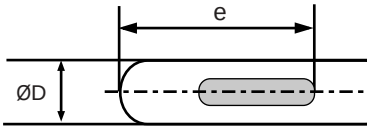
Note) The item underlined is the most commonly used specification.
**7 The resistance value of the R100 element at 100°C is given here. The resistance value of the R0 element at 0°C is given in parenthesis.*

Table 11 Standard specifications of sheathed resistance temperature detector

Construction	Sheath			Lead wire		
	External dia. (mm)	Wall thickness (mm)	Material	Wire dia. (mm)	Resistance per wire (Ω/m)	Material
Single element  No. of elements: 3	**Ø3.2**	**0.47**	**SUS316**	**Ø0.51**	**0.50 Max.**	**Ni**
	Ø4.8	**0.72**		**Ø0.76**	**0.28 Max.**	
	Ø6.4	0.93		Ø1.00	0.16 Max.	
	Ø8.0	1.16		Ø1.3	0.13 Max.	

Note) The items underlined are the most commonly used.

Table 12 Tip construction of resistance temperature detector, external diameter and available length

Construction	Sheath external dia. (mm)	Approx. weight (g/m)	Position of platinum element e (mm)	Available length for manufacture L (mm)
	**Ø3.2**	**45**	**32**	50~3000 (Custom order if over 1501)
	Ø4.8	**100**	**43**	
	Ø6.4	180	45	
	Ø8.0	280	46	

Note) Underlined items are most commonly used.

Table 13 Wiring connection of resistance temperature detector

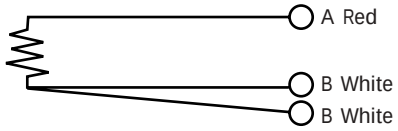
Wiring connection	Connection schematic	Feature
3-lead type		Most commonly used wiring connection

Table 14 Tolerance of resistance temperature detector and applicable national standards

	JIS C 1604-1997		IEC Pub.751-1983	
	Class	Tolerance (°C) *4, *5	Class	Tolerance (°C) *4, *5
Pt100(R100/R0=1.3851)	A	±(0.15 + 0.002 |t|)	A	±(0.15+0.002 |t|)
	B	**±(0.3 + 0.005 |t|)**	**B**	**± (0.3+0.005 |t|)**

Note) The item underlined are the most commonly used specifications.
**4 Tolerance refers to the maximum error between the temperature value converted from the standard resistance table and the measured temperature.*
**5. \|t\| is the measured temperature (°C) regardless of the - or + symbol.*

Inspection specifications of sheathed resistance temperature detector

Table 15 Dimensional checks

Sheath external diameter (mm)		Ø 3.2, Ø 4.8	± 005%
		Ø 6.0, Ø 6.4	± 0.06%
		Ø 8.0	± 1%
Length (mm)	Welded	Under 150	± 2.0%
		Over 150	± 1.5%
	With spring	±3.0	
Nipple length		±3.0	

Note) Maximum length is up to 1 meter. For sheaths over 1 meter, please consult with a Yamatake representative.

Table 16 Resistance test

Type	Test temperature	Test condition
Pt100 (JPt100)	0°C	Freezing point of water

Note) Aside from the above, 0°C, 100°C, 300°C, 400°C tests are possible. Additionally, tests in such ranges as 10~70°C, 70~280°C, 280~560°C, -50~10°C, -80~-60°C are possible but with at additional costs.

Table 17 Insulation resistance test

Sheath external diameter (mm)	Ø3.2	Ø4.8	Ø6.4	Ø8.0
Test condition	100 MΩ / 500V DC			

Test report

The test report is for a sheathed resistance temperature detector itself as selected from the table for additional specifications. It is not for the integrated test with a model ATT61/71 temperature transmitter .

⚠Cautions on product selection

When selecting a temperature sensor:

The seal construction of the sheathed thermocouple or sheathed resistance temperature detector is available in either welded or spring-loaded movable types.
If sheath is inserted into a measuring object without a protecting well, sealing characteristics must be taken into consideration. The welded type should be used.
To improve temperature response with a protecting well, the spring-loaded type is effective. The spring-loaded type is also effective if vibration is severe.

When specifying a JIS Flameproof construction

The JIS Flameproof construction consists of a combination of a temperature transmitter and a temperature sensor. Since the temperature sensor's type and construction vary depending upon the explosion-proof certification number, consult with a nearby Yamatake Industrial Systems representative when replacing the temperature sensor.
To protect the temperature sensor's sheath in the JIS Flameproof constructuion, a protecting well must be used.

The JIS Flameproof construction complies with the JIS Flameproof, Technical Standard (February 1997), for use in -20 ~ +60°C ambient temperature, and has a xplosion-proof temperature range of -20~85°C.

MODEL SELECTION

Basic Model No.		Selection1											Option					
ATT90	-											-						

Sealing structure *1	Welded type	W										
	Spring loaded type	S										
Sheath length (mm) *2	4 digit (0050-1500)		1	2	3	4						
Sheath diameter (mm) *3	3.2						D					
	4.8						E					
	6.4						F					
	8						G					
Sensor *4	Thermocouple							2				
	RTD							3				
Sensor resistance *5	J								J			
	K								K			
	T								T			
	E								E			
	N								N			
	Pt100 Ω								P			
	JPt100 Ω Consult with a sales representative.								Q			
Sheath material *6	SUS316									C		
	SUS310S									D		
	NCF600									B		
	Hoskins2300 (Special prod.)									K		

Class *7	Thermocouple	JIS	1 (Special prod.)	1								
			2	2								
			3 (Special prod.)	3								
		ASTM	STD (Special prod.)	4								
			SP (Special prod.)	5								
	RTD	JIS	A (Special Req.)	A								
			B	B								
Process connection	R1/2 (Male)										R	
	1/2NPT Male. Consult with a sales representative.										N	

Options	No selection	X
	Certificate of traceability	A
	Test Report	T
	With union connection 100mm	U
	With union connetion 150mm	V
	With thermowell	W

Note) **1: Refer to Figures 1 and 2,*
**2: Refer to Tables 1-4 and 2-3*
**3: Refer to Tables 1-2~1-4 and 2-2~2-3*
**4: Refer to Tables 1-1, 1-5 and 2-1~2-4*
**5.: Refer to Tables 1-1~1-6 and 2-1~2-4*
**6: Refer to Tables 1-3 and 2-2*
**7: Refer to Table 1-6*
**8: Refer to Table 2-5*
**9: Refer to Drawing 3*

DIMENSIONS

External dimension

[Unit: mm]

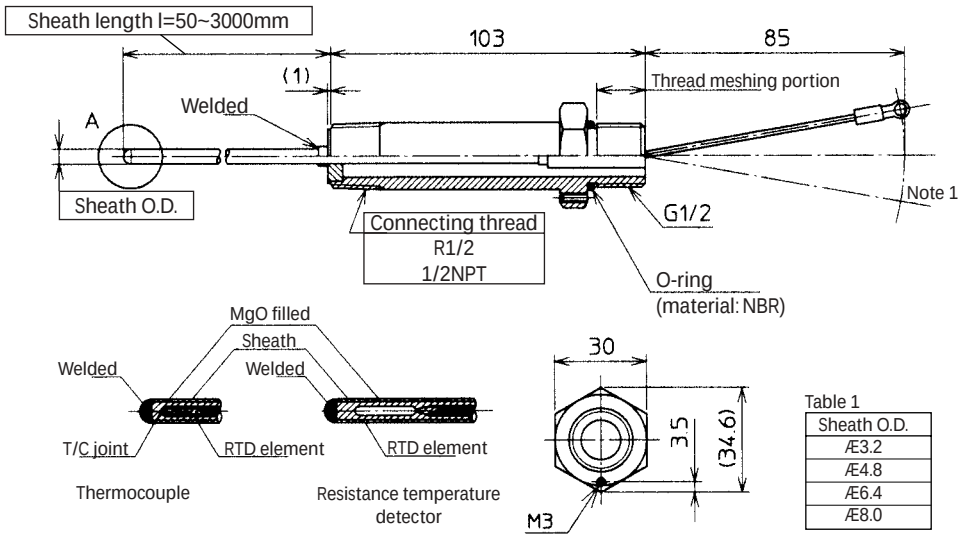


Table 1

Sheath O.D.
Æ3.2
Æ4.8
Æ6.4
Æ8.0

Note) 1.Number of elements in sheath T/C:2
2. Number of elements in sheathed RTD:3

Figure 1 Sheathed thermocouple/resistance thermal detector, welded construction

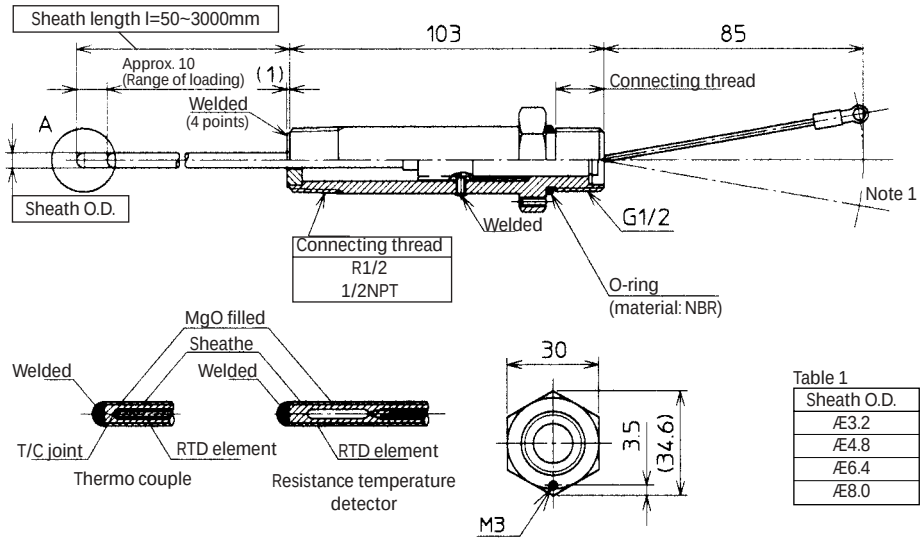


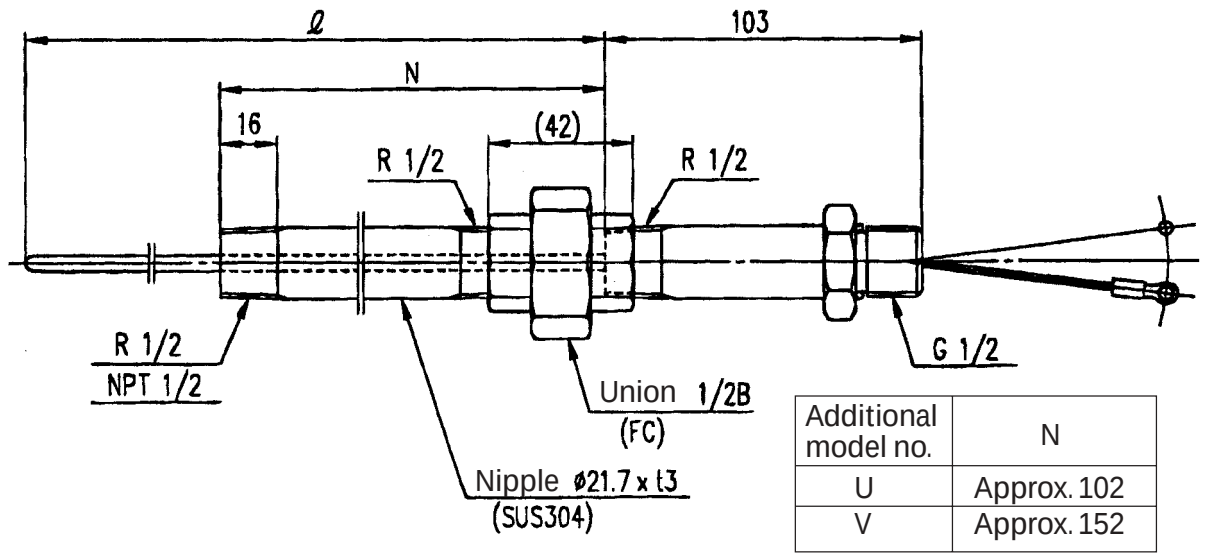
Table 1

Sheath O.D.
Æ3.2
Æ4.8
Æ6.4
Æ8.0

Note) 1.Number of elements in sheath T/C:2
2. Number of elements in sheathed RTD:3

Figure 2 Sheathed thermocouple/resistance thermal detector, springed movable construction with spring

[Unit: mm]



Additional model no.	N
U	Approx. 102
V	Approx. 152

Figure 3 Connecting union

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Kanagawa 251-8522 Japan

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