

# Thermocouple Wires (Duplex Type)



## What is Thermocouple Wire (Duplex Type)?

Thermocouple Wire (Duplex type) is one kind of Thermocouple Sensors. Let's introduce some models of our products as follows:

Thermocouple Wire (Duplex Type) is insulated and sheathed by the materials such as PVC, Glass Fiber, Teflon®, Silica Glass Fiber and Alumina Fiber, etc.

It is also called Thermocouple wire because the appearance and shape are similar to Thermocouple Extension/Compensating Cable, the difference between them are in the conductor combination. The feature of Thermocouple Wire (Duplex type) is composed of a solid wire because of the characteristics of the Thermal Electro-Motive-Force(EMF). Most of the conductors of Thermocouple Extension/Compensating Cables are mostly composed of stranded wire(\*1)

(\*1) As regards the conductor combination of 16AWG and 20AWG in Thermocouple Extension/Compensating Cable, there are two kinds as follows:

16AWG ( solid conductor : 1/1.29), (stranded conductor: 4/0.65)

20AWG( solid conductor : 1/0.81), (stranded conductor: 7/0.32)

## How to Choose a Model

An example, based on JIS C 1602

**K-JIS- (Class 1) -GGB F-OBS 1P × 1/0.65**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Wire Type, ② Standard (Color Code), ③ Division Symbols(Class & Tolerance), ④ Materials of Insulation & Sheath, ⑤ Shape, ⑥ Armor(if necessary), ⑦ Pair, ⑧ Conductor Combination

●**Wire Type:** Select from K, E, J, T, and N

●**Standard:** ASTM, IEC, JIS, and other international Standards

●**Division Symbols:** ①ASTM Standard(SP: Special Tolerance, ST: Standard Tolerance)  
②IEC Standard(Class 1: Precision Class, Class 2: Normal Class)

●**Insulation & Sheath:** Heat-resistant PVC, Glass Fiber, Silica Glass Fiber, Alumina Fiber, Teflon® (FEP)

●**A armor:** Stainless-Steel Wire Braided(OBS), Tinned Copper Wire Braided (OBT), etc.

**Usage:** To cut the Thermocouple wire according to a necessary length and then peel the insulation and sheath from the ends of Positive and Negative, and expose the core of both ends to be welded together.

**Features:** The cost is cheaper than the type of Metallic Protection Tube, etc.

**Please confirm the wired environment (eg: temperature range, damp, water, etc.), and then choose the type below.**

**Insulated and Sheathed Heat-resistant PVC(HV) Thermocouple Wire(Duplex Type)**

Type (P30)

Division Symbol (P30)

**-HVVF**

Temp. **80°C**

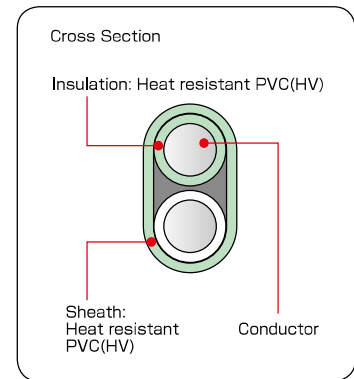
**This kind of Thermocouple Wire(Duplex Type) is insulated and sheathed Heat-resistant PVC(HV), Flat shape(F).**

**Features:** Excellence in Damp-proof, Water-proof



**PVC Type**

Conductor	Conductor (No./mm)	1/0.2	1/0.32	1/0.65	1/1.0
	Nom.O.D (mm)	0.2	0.32	0.65	1.0
	Nominal sectional area (SQ)	0.03	0.08	0.33	0.75
Insulation	Nom.thick (mm)	0.20	0.30	0.40	0.40
	Approx.O,D(mm)	0,60	0,92	1,45	1,80
Sheath	Nom.thick (mm)	0,30	0,50	0,50	0,50
	Approx.O,D (mm)	1,2 × 1,8	1,9 × 2,9	2,5 × 3,9	2,8 × 3,6
Electric Characteristics	Voltage resistance (V/min)	DC500	AC500	AC500	AC500
	Insulation resistance ( MΩ /km)	40	50	50	50
Max Length (m)		1000			
Weight (kg/km)		3,4	7,9	16,1	27,2



**Glass Fiber Braided Insulation and Sheath(GB) Thermocouple Wire(Duplex Type)**

Type (P30)

Division Symbol (P30)

**-GGBF**

Temp. **200°C**

**This kind of Thermocouple Wire(Duplex Type) is Glass Fiber braided(GB) Insulation and Sheath,Flat shape(F).**

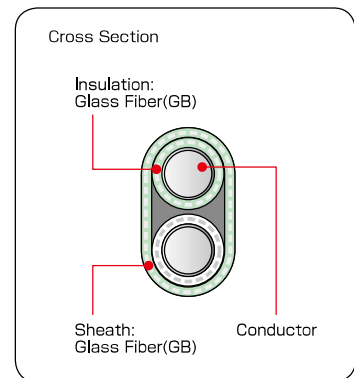
**Features:** Excellence in Heat-resistance

**Attention:** It can not be used in an environment of damp and water.



**Glass Fiber Braided Type**

Conductor	Conductor (No./mm)	1/0.1	1/0.2	1/0.32	1/0.65	1/1.0
	Nom.O.D (mm)	0.1	0.2	0.32	0.65	1.0
	Nominal sectional area (SQ)	0.008	0.03	0.08	0.33	0.75
Insulation	Nom.thick (mm)	0.10	0.10	0.30	0.32	0.32
	Approx.O,D(mm)	0.30	0.40	0.92	1.29	1.64
Sheath	Nom.thick (mm)	0.20	0.20	0.25	0.25	0.45
	Approx.O,D (mm)	0.7 × 1.0	0.8 × 1.2	1.4 × 2.3	1.8 × 3.1	2.5 × 4.2
Electric Characteristics	Voltage resistance (V/min)	DC500				
	Insulation resistance ( MΩ /km)	0.1				
Max Length (m)		100	100	1000	1000	1000
Weight (kg/km)		2.0	2.7	7.7	14.1	30.9



**Silica Glass Fiber Braided Insulation and Sheath(SB) Thermocouple Wire(Duplex Type)**

Type (P30) - Division Symbol (P30) - **-SSBF** Temp. 400°C

This kind of Thermocouple Wire(Duplex type) is Silica Glass Fiber (SB) Braided Insulation and Sheath, Flat Shape (F).

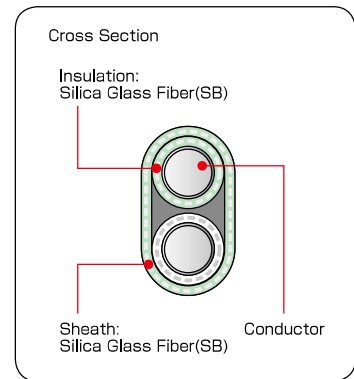
**Features:** Excellence in High Heat-resistance

**Attention:** It can not be used in an environment of damp and water.



**Silica Glass Fiber Braided Type**

Conductor	Conductor (No./mm)	1/0.65	1/1.0
	Nom.O.D (mm)	0.65	1.0
	Nominal sectional area (SQ)	0.33	0.75
Insulation	Nom.thick (mm)	0.45	0.45
	Approx.O.D(mm)	1.55	1.90
Sheath	Nom.thick (mm)	0.45	0.45
	Approx.O.D (mm)	2.5 × 4.0	2.8 × 4.7
Electric Characteristics	Voltage resistance (V/min)	DC500	
	Insulation resistance ( MΩ /km)	0.1	
Max Length (m)		500	
Weight (kg/km)		23.8	30.0



**Alumina Fiber Braided Insulation and Sheath(CB) Thermocouple Wire(Duplex Type)**

Type (P30) - Division Symbol (P30) - **-CCBF** Temp. Range 450 ~ 750°C

This kind of Thermocouple Wire (Duplex type) is Alumina Fiber (CB) Braided Insulation and Sheath, Flat Shape (F).

**Features:** More super Heat-resistance than Silica Glass Fiber (SB) type

**Attention:** It can not be used in an environment of damp and water.



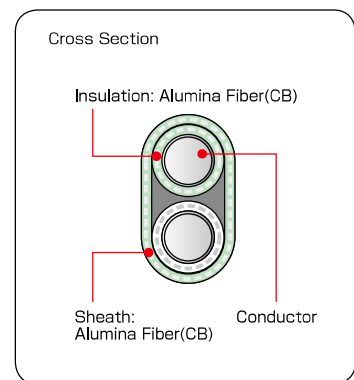
**Alumina Fiber Braided Type**

(1/0.32mm: Heat-resistant Temp.450°C)

(1/0.65mm: Heat-resistant Temp.650°C)

(1/1.0mm: Heat-resistant Temp.750°C)

Conductor	Conductor (No./mm)	1/0.32	1/0.65	1/1.0
	Nom.O.D (mm)	0.32	0.65	1.0
	Nominal sectional area (SQ)	0.08	0.33	0.75
Insulation	Nom.thick (mm)	0.20	0.20	0.35
	Approx.O.D(mm)	0.72	1.05	1.70
Sheath	Nom.thick (mm)	0.20	0.35	0.35
	Approx.O.D (mm)	1.1 × 1.8	1.8 × 2.8	2.4 × 4.1
Electric Characteristics	Voltage resistance (V/min)	Conductor ends of Positive & Negative can be connected only		
Max Length (m)		500	500	500
Weight (kg/km)		7.2	12.6	26.3



Thermocouple Wires (Duplex Type)

Insulated and Sheathed FEP Thermocouple Wire (Duplex type)

Type (P30)

Division Symbol (P30)

**-FEPFEPF**

Temp. **200°C**

This kind of Thermocouple Wire (Duplex type) is Insulated and Sheathed FEP, Flat Shape (F).

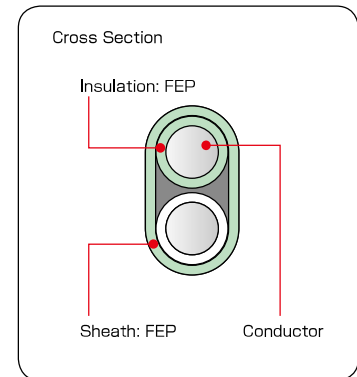
Features: Excellence in Heat-resistance, Cold-proof, Chemical proof, Damp-proof, Water-proof

Applicable for PFA type (Heat Resistance Temp.260°C)



Teflon® FEP/PFA Type

Conductor	Conductor (No./mm)	1/0.1	1/0.2	1/0.32	1/0.65	1/1.0
	Nom.O.D (mm)	0.1	0.2	0.32	0.65	1.0
	Nominal sectional area (SQ)	0.008	0.03	0.08	0.33	0.75
Insulation	Nom.thick (mm)	0.15	0.15	0.15	0.25	0.30
	Approx.O,D(mm)	0.40	0.50	0.62	1.15	1.60
Sheath	Nom.thick (mm)	0.20	0.20	0.20	0.30	0.30
	Approx.O,D (mm)	0.8 × 1.2	0.9 × 1.4	1.0 × 1.6	1.8 × 2.9	2.2 × 3.8
Electric Characteristics	Voltage resistance (V/min)	AC500				
	Insulation resistance ( MΩ /km)	500				
Max Length (m)		500	500	1000	1000	1000
Weight (kg/km)		2.0	2.8	4.1	13.1	25.4



Insulated and Sheathed FEP Thermocouple Wire (Duplex type)

Type (P30)

ASTM

SP

**-FEPFEP (UL) F**

Temp. **200°C**

This kind of Thermocouple Wire (Duplex type) is Insulated and Sheathed UL Certificated FEP, Flat Shape (F).

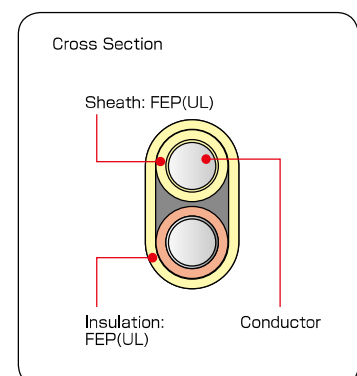
Features: Excellence in Heat-resistance, Cold-proof, Chemical proof, Damp-proof, Water-proof



\*UL Certificate (Style No.: UL13, File No.: E254583, Category: CL3R)

Teflon® FEP ( UL ) Type

Conductor	Conductor (No./mm)	1/0.65
	Nom.O.D (mm)	0.65
	Nominal sectional area (SQ)	0.33
Insulation	Nom.thick (mm)	0.25
	Approx.O,D(mm)	1.15
Sheath	Nom.thick (mm)	0.30
	Approx.O,D (mm)	1.75 × 2.9
Electric Characteristics	Voltage resistance (V/min)	AC1500
	Insulation resistance ( MΩ /km)	1500
Max Length (m)		153
Weight (kg/km)		23.8



**Insulated and Sheathed FEP Thermocouple Wire(Duplex type), with a Molding Cover**

Type (P30) - Division Symbol (P30) - **FEPFEPF (M)** Temp. 200°C

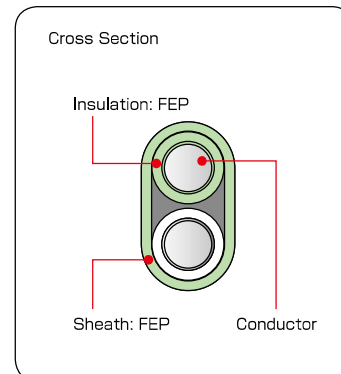
**This kind of Thermocouple Wire(Duplex type) is Insulated and Sheathed FEP, with a molding cover\*1, Flat shape (F).**

\*1:The Measuring Junction is fitted with a molding cover by using the same material of Insulation and Sheath.

**Features:** Excellence in Anti-corrosion, Air tight can be used in variety of environments within the temperature range of 200°C. Especially excellence in water, soil and place where electric insulation is required, and proper for the temperature measurement in a limited space.



Types	K/T/J (Class1 or Class 2)				
Conductor	Conductor (No./mm)	1/0.1	1/0.2	1/0.32	1/0.65
	Nom.O,D (mm)	0,1	0,2	0,32	0,65
	Nominal sectional area (SQ)	0.008	0.03	0.08	0.33
Insulation	Nom.thick (mm)	0.15	0.15	0.15	0.25
	Nom.thick (mm)	0.2	0.2	0.2	0.3
Sheath	Approx.O,D (mm)	0,8x1,2	0,9x1,4	1,0x1,6	1,8x2,9



**The Table of Types and Tolerance of Thermocouple Wires (Duplex type)**

Types	Conductor Composition		JIS1995 Class	JIS1981 Grade	Temp.Range(°C)	Tolerance °C	Measuring Temp. °C	JIS-1981		JIS-2012 / 1995 (1)	
	(+)Positive	(-)Negative						(+)/(−)	Sheath	(+)/(−)	Sheath
K	Chromel®	Alumel®	Class1	0.4	-40 ~ +375	± 1.5	-40 ~ +1000	Red/White	Blue	Green/White	Green
					375 ~ 1000	± 0.004 ·  t					
					-40 ~ +333	± 2.5					
E	Chromel®	Constantan	Class2	0.75	333 ~ 1200	± 0.0075 ·  t	-40 ~ +1200	Red/White	Purple	Violet/White	Violet
					-167 ~ +40	± 2.5					
					-200 ~ -167	± 0.015 ·  t					
J	Iron	Constantan	Class3	1.5	-40 ~ +375	± 1.5	-40 ~ +750	Red/White	Yellow	Black/White	Black
					375 ~ 750	± 0.004 ·  t					
					-40 ~ +333	± 2.5					
T	Copper	Constantan	Class1	0.4	-40 ~ +125	± 0.5	-40 ~ +350	Red/White	Brown	Brown/White	Brown
					125 ~ 350	± 0.004 ·  t					
					-40 ~ +133	± 1					
N	Nickel-Chromium-Silicon	Nickel-Silicon	Class2	0.75	133 ~ 350	± 0.0075 ·  t	-40 ~ +350	Red/White	Brown	Brown/White	Brown
					-67 ~ +40	± 1					
					-200 ~ -67	± 0.015 ·  t					
N	Nickel-Chromium-Silicon	Nickel-Silicon	Class3	1.5	-40 ~ +375	± 1.5	-40 ~ +1000	-	-	Pink/White	Pink
					375 ~ 1000	± 0.004 ·  t					
					-40 ~ +333	± 2.5					
N	Nickel-Chromium-Silicon	Nickel-Silicon	Class3	1.5	333 ~ 1200	± 0.0075 ·  t	-40 ~ +1200	-	-	Pink/White	Pink
					-167 ~ +40	± 2.5					
					-200 ~ -167	± 0.015 ·  t					

(JIS C 1605 - 1995)

Thermocouple Wires (Duplex Type)

The Limit of Temperature Range of Each Type

Types	Conductor Size(mm)	Common use limit (°C)	Overheat use limit (°C)
K	0.65	650	850
	1.00	750	950
	1.60	850	1050
	2.30	900	1100
	3.20	1000	1200
E	0.65	450	500
	1.00	500	550
	1.60	550	600
	2.30	600	750
	3.20	700	800
J	0.65	400	500
	1.00	450	550
	1.60	500	650
	2.30	550	750
	3.20	600	750
T	0.32	200	250
	0.65	200	250
	1.00	250	300
	1.60	300	350
N	0.65	850	900
	1.00	950	1000
	1.60	1050	1100
	2.30	1100	1150
	3.20	1200	1250

(JIS C 1602-1995)

The Table of Standards and Thermal Electro-Motive-Force(EMF) of Thermocouple Wires (Duplex Type)

Types	Temp(°C)	- 40	- 20	50	100	150	200	250	300	350	400	600
K	Standard value ( μ V )	- 1527	- 778	2023	4096	6138	8138	10153	12209	14293	16397	24905
	Class 1(0.4grade)	± 055	± 057	± 061	± 062	± 060	± 059	± 060	± 061	± 063	± 067	± 101
	Class2(0.75grade)	± 091	± 095	± 103	± 103	± 100	± 099	± 101	± 103	± 110	± 126	± 191
E	Standard value ( μ V )	- 2255	- 1152	3048	6319	9789	13421	17181	21036	24964	28946	45093
	Class 1(0.4grade)	± 080	± 084	± 094	± 101	± 106	± 111	± 114	± 117	± 118	± 128	± 193
	Class2(0.75grade)	± 134	± 140	± 158	± 168	± 177	± 185	± 190	± 194	± 206	± 240	± 362
J	Standard value ( μ V )	- 1961	- 995	2585	5269	8010	10779	13555	16327	19090	21848	33102
	Class 1(0.4grade)	± 070	± 073	± 079	± 081	± 082	± 083	± 083	± 083	± 082	± 088	± 140
	Class2(0.75grade)	± 118	± 122	± 131	± 136	± 137	± 138	± 138	± 138	± 144	± 165	± 262
T	Standard value ( μ V )	- 1475	- 757	2036	4279	6704	9288	12013	14862	-	-	-
	Class 1(0.4grade)	± 017	± 018	± 021	± 023	± 030	± 042	± 055	± 069	-	-	-
	Class2(0.75grade)	± 035	± 037	± 043	± 046	± 056	± 079	± 103	± 130	-	-	-
N	Standard value ( μ V )	- 1023	- 518	1340	2774	4320	5913	7597	9341	11136	12974	20613
	Class 1(0.4grade)	± 037	± 038	± 041	± 044	± 047	± 049	± 051	± 053	± 054	± 059	± 093
	Class2(0.75grade)	± 061	± 063	± 069	± 073	± 078	± 082	± 086	± 088	± 095	± 111	± 175

(JIS C 1602-1995)