



# RESISTANCE WIRE



# INDEX

• Properties and characteristics of various metal	3
• Temperature characteristic chart	5
• Products manufactured and sold	7
• NCH1 Nickel Chrome Heating Wire Type 1	11
• NCH2 Nickel Chrome Heating Wire Type 2	16
• FCH1 Fe-Chrome Heating Wire Type 1	21
• No.30 Fe-Chrome Heating Wire Type 1	26
• FCH2 Fe-Chrome Heating Wire Type 2	30
• Kanthal A-1 Fe-Chrome Heating Wire	35
• Kanthal AF Fe-Chrome Heating Wire	40
• Kanthal D Fe-Chrome Heating Wire	45
• CN49 (CuNi44) Copper Nickel Resistance Wire Type 49	49
• CN30 (CuNi23) Copper Nickel Resistance Wire Type 30	54
• CN15 (CuNi10) Copper Nickel Resistance Wire Type 15	59
• CN10 (CuNi6) Copper Nickel Resistance Wire Type 10	64
• CN5 (CuNi2) Copper Nickel Resistance Wire Type 5	69
• CM44 Copper Nickel Mangan Wire	74
• Nikrothal LX Precision Resistance Wire	77
• Ni Pure Nickel Wire	80
• Monel Nickel Alloy Wire,Ribbon	83
• 2%MnNi Nickel Alloy Wire,Ribbon	86
• 42%NiFe Nickel Alloy Wire,Ribbon	89
• 52%NiFe Nickel Alloy Wire,Ribbon	92
• Kovar Nickel Alloy Wire,Ribbon	95
• SUS304 Stainless steel	98
• SUS310S Stainless steel	100
• SUS316L Stainless steel	102
• PBW2,PBW3	104
• Various types of Ribbon	106
• Ribbon dimensions and effective cross-sectional area	108
• Insulating Coatings (Glass , Silk rolling) Dimensions	110
• Insulating Coatings (Polyester,Polyurethane,Polyamide-imide)	112
• Spiral Precess	115
• Wire Drawing Technology	117
• Twisted Wire	119
• Thermocouple Alloys	121
• Spool Specifications	123

---

# Properties and characteristics of various metal

# Properties and characteristics of various metal

Metal type	Code	Electrical Resistivity ( $\mu\Omega\text{m}$ )		Average TCR ( $\times 10^{-6}/^{\circ}\text{C}$ )	Thermal Expansion Coefficient ( $\times 10^{-6}/^{\circ}\text{C}$ )	Melting Point ( $^{\circ}\text{C}$ )	Density ( $\text{g}\cdot\text{cm}^3$ )	Max Operating Temperature ( $^{\circ}\text{C}$ )
Nickel Chrome	NCH1	1.08	$\pm 0.05$	* 80	17.0	1400	8.41	1100
	NCH2	1.12	$\pm 0.05$	* 180	17.0	1400	8.25	1000
	Nikrothal 80	1.09				1400	8.30	1200
	Nikrothal 60	1.11				1390	8.20	1125
Fe-Chrome	FCH1	1.42	$\pm 0.06$	* -20	13.0	1520	7.20	1250
	FCH2	1.23	$\pm 0.06$	* 90	12.5	1500	7.35	1100
	No.30	1.42	$\pm 0.06$		13.0	1520	7.20	1300
Kanthal Fe-Cr Alloy	Kanthal A-1	1.45			15.0	1500	7.10	1400
	Kanthal AF	1.39			15.0	1500	7.15	1300
	Kanthal D	1.35			15.0	1500	7.25	1300
Precision resistance wire	Nikrothal LX	* 1.33		$\pm 5, \pm 10$		1390	8.30	250
K thermocouple strands	Alumel KN(-)	0.28		2200	12.0	1399	8.60	Depends on wire diameter
	Chromel KP(+)	0.69		350	13.1	1427	8.73	Depends on wire diameter
Copper Nickel Resistance Wire	CN49 (CuNi44)	0.49	$\pm 0.03$	* $\pm 40$	13.5	1240	8.90	400
	CN30 (CuNi23)	0.30	$\pm 0.024$	* 180	17.5	1150	8.90	300
	CN15 (CuNi10)	0.15	$\pm 0.015$	* 490	17.5	1100	8.90	250
	CN10 (CuNi6)	0.10	$\pm 0.012$	* 710	17.5	1090	8.90	220
	CN5 (CuNi2)	0.05	$\pm 0.0075$	* 1300	17.5	1080	8.90	200
	Monel 400	0.50			13.9	1350	8.80	400
Manganin 44 $\mu$	CM44	0.44	$\pm 0.03$	* $\pm 50$	18.0	* 1020	8.44	150
Pure Nickel	Ni(NW2200)	* 0.095	$\pm 0.015$	* 4500	15.0	1400	8.90	400
	Ni(NW2201)	* 0.095	$\pm 0.015$	* 4500	15.0	1400	8.90	400
	Ni99.6	* 0.095	$\pm 0.015$	* 4500	15.0	1400	8.90	400
Manganese nickel	2%MnNi	* 0.11		* 4300	14.0	1360	8.90	400
Fe-Nickel	42%NiFe	* 0.65		* 2360	* 4.0~7.4		8.10	
	52%NiFe	* 0.37		* 3900	* 9.7~10.5		8.35	
Iron-nickel-cobalt	Kovar KOV	0.49		* 3500	4.9~6.2	1450	8.24	
Stainless steel	SUS 304	0.72		1100	17.3	1400	7.93	
	SUS 310S	0.78			14.4	1400	7.98	
	SUS 316L	0.77			16.0	1370	7.98	
phosphor bronze	PBW2(C5191)	0.115			18.0	1050	8.83	
	PBW3(C5212)	0.140			18.2	1040	8.80	
iron wire 60C	SWRH62A	0.204					7.8~7.9	
Inconel 600	INCONEL 600	1.03					8.47(8.415)	

---

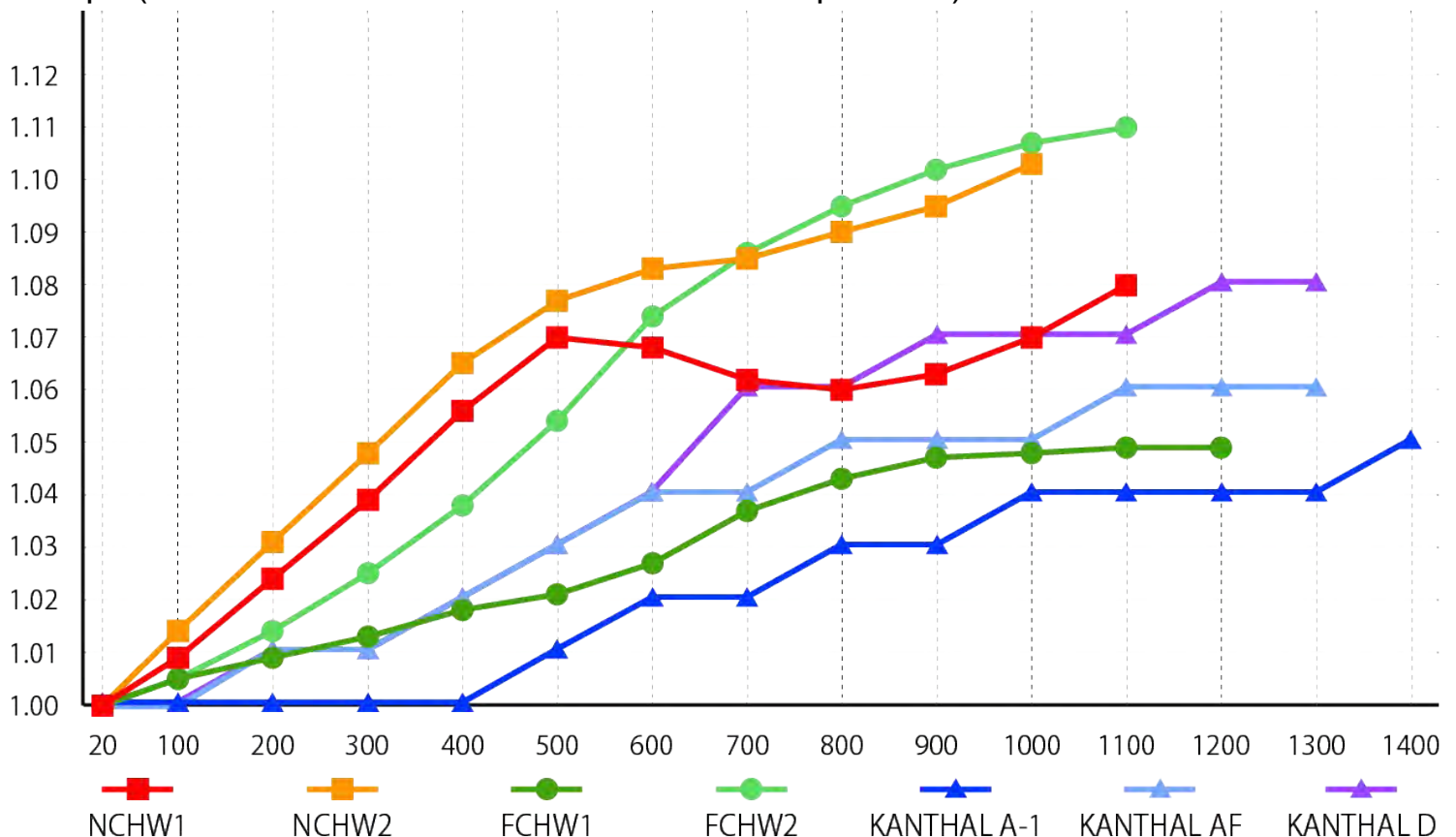
# Temperature characteristics chart

# Temperature characteristics chart

Coefficient of increase in resistance with temperature (nickel-chromium electric heating wire, iron-chromium resistance wire)

Temperature (°C)	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
NCHW1	1.000	1.009	1.024	1.039	1.056	1.070	1.068	1.062	1.060	1.063	1.070	1.080	—	—	—
NCHW2	1.000	1.014	1.031	1.048	1.065	1.077	1.083	1.085	1.090	1.095	1.103	—	—	—	—
FCHW1	1.000	1.005	1.009	1.013	1.018	1.021	1.027	1.037	1.043	1.047	1.048	1.049	1.049	—	—
FCHW2	1.000	1.005	1.014	1.025	1.038	1.054	1.074	1.086	1.095	1.102	1.107	1.110	—	—	—
Kanthal A-1	1.000	1.000	1.000	1.000	1.000	1.010	1.020	1.030	1.030	1.030	1.040	1.040	1.040	1.040	1.050
Kanthal AF	1.000	1.000	1.010	1.010	1.020	1.030	1.040	1.040	1.050	1.050	1.050	1.060	1.060	1.060	—
Kanthal D	1.000	1.000	1.010	1.010	1.020	1.030	1.040	1.060	1.060	1.070	1.070	1.070	1.080	1.080	—

Graph (coefficient of resistance increase with temperature)



---

# **Products manufactured and sold**

# Products manufactured and sold

Materials for electricity Alloys for electric heating Wire, strip and foil

Metal type	Code	Type	Dimension (mm)	
Nickel Chrome Type 1	NCHW1	Wire	φ6.00~0.020	
	NCHR1	Ribbon	t=2.90~0.05	w=40~0.2 (Varies depending on thickness)
	NCH1P	Plate	Pls consult	
	NCH1	Coil / Foil	Pls consult	
Nickel Chrome Type 2	NCHW2	Wire	φ6.00~0.030	
	NCHR2	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	NCH2P	Plate	Pls consult	
	NCH2	Coil / Foil	Pls consult	
Fe-Chrome Type 1	FCHW1	Wire	φ6.00~0.16	
	No.30	Wire	Φ1.00~0.08	
	No.30	Ribbon	Pls consult	
	FCHR1	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
Fe-Chrome Type 2	FCHW2	Wire	φ6.00~0.15	
	FCHR2	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
Kanthal Fe-Cr Alloy	Kanthal A-1	Wire	φ10.0~1.00	
	Kanthal A-1	Ribbon	t=2.0, 2.5, 3.0	w=20, 25, 30
	Kanthal AF	Wire	φ10.00~0.30	
	Kanthal AF	Ribbon	t=1.0, 1.2, 1.5, 2.0, 2.5, 3.0	w=10, 15, 20, 25, 30
	Kanthal D	Wire	φ6.50~0.13	



# Products manufactured and sold

Electrical materials Wires, strips and plates for electrical resistance

Metal type	Code	Type	Dimension (mm)	
Copper Nickel Resistance Wire Type 49	CN49W (CuNi44)	Wire	φ6.00~0.025	
	CN49R (CuNi44)	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	CN49P (CuNi44)	Plate	Pls consult	
	CN49 (CuNi44)	Coil / Foil	Pls consult	
Copper Nickel Resistance Wire Type 30	CN30W (CuNi23)	Wire	φ6.00~0.05	
	CN30R (CuNi23)	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	CN30P (CuNi23)	Plate	Pls consult	
	CN30 (CuNi23)	Coil / Foil	Pls consult	
Copper Nickel Resistance Wire Type 15	CN15W (CuNi10)	Wire	φ6.00~0.06	
	CN15R (CuNi10)	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	CN15P (CuNi10)	Plate	Pls consult	
	CN15 (CuNi10)	Coil / Foil	Pls consult	
Copper Nickel Resistance Wire Type 10	CN10W (CuNi6)	Wire	φ6.00~0.06	
	CN10R (CuNi6)	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	CN10P (CuNi6)	Plate	Pls consult	
	CN10 (CuNi6)	Coil / Foil	Pls consult	
Copper Nickel Resistance Wire Type 5	CN 5W (CuNi2)	Wire	φ6.00~0.06	
	CN 5R (CuNi2)	Ribbon	t=2.90~0.08	w=40~0.4 (Varies depending on thickness)
	CN 5P (CuNi2)	Plate	Pls consult	
	CN 5 (CuNi2)	Coil / Foil	Pls consult	
Monel	Monel400	Wire	φ5.00~0.03	
	Monel400	Ribbon	Pls consult	
Manganin 44μ	CM44W	Wire	φ6.00~0.04	
	CM44R	Ribbon	Pls consult	
	CM44P	Plate	(Standard) 1.0t×180w×1200L	
	CM44	Coil / Foil	Pls consult	
Kanthal Precision resistance wire	NIKROTHAL LX	Wire	φ0.5~0.02	

※Nikrothal LX is registered trademarks of Sandvik AB.

# Products manufactured and sold

Category	Metal type		Code	Type	Dimension (mm)
Nickel and Nickel Alloys	Pure nickel (NW2200,NW2201)		NiW	Wire	φ6.00~0.02
			NiR	Ribbon	Pls consult
			NiP	Ribbon	Pls consult
			Ni	Coil / Foil	Pls consult
Manganese Nickel Alloy	Manganese nickel		2%MnNi	Wire	φ5.00~0.03
			2%MnNi	Ribbon	Pls consult
Iron-nickel-cobalt	Kovar		KOV	Wire	φ5.00~0.03
			KOV	Ribbon	Pls consult
Stainless steel wire	Stainless steel		SUS 304	wire/ ribbon	Pls consult
			SUS 305J-1	wire/ ribbon	Pls consult
			SUS 310S	wire/ ribbon	Pls consult
			SUS 316L	wire/ ribbon	Pls consult
Copper alloy products	phosphor bronze		PBW2	wire/ ribbon	Pls consult
			PBW3	wire/ ribbon	Pls consult
Iron-nickel alloy	iron-nickel		52%NiFe	Wire	φ5.00~0.03
			52%NiFe	Ribbon	Pls consult
			42%NiFe	Wire	φ5.00~0.03
			42%NiFe	Ribbon	Pls consult
Category	+side	—side	Code	Type	Dimension (mm)
Thermocouple compensation conductor	Nickel Chromium Alloy	Nickel Alloy	K	Wire	Pls consult
			KX	Wire	Pls consult
Category	others		Processing Type		Dimension (mm)
Others	Processing method		(resin, silk, glass) film resistance wire		Pls consult
			Spiral Process		Pls consult
			Wire Drawing Technology		Pls consult
			Rolling Process		Pls consult

---

# **NCH1**

## **Nickel Chrome No 1**

# Alloys : NCH1 (Nickel Chrome Type 1)

[JIS C 2520]  
[JIS C 2532]

It has good heat resistance, good oxidation resistance, high strength at high temperatures, and is non-magnetic. Its workability does not become embrittled even after heating at high temperatures, and it has good cold workability. It is suitable for high-temperature heating elements such as electric furnaces and high-resistance resistance materials.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
NCH1	C 2520	1.08 $\pm$ 0.05	* 80
GNC108	C 2532		

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
+0.4 ~ +0.7	17.0	0.42	15	8.41	1400	1100

Chemical Composition	C	Si	Mn	Ni	Cr	Fe
(%)	$\leq 0.15$	0.75~1.6	$\leq 2.5$	$\geq 77$	19~21	$\leq 1$

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100
Coefficient	1.000	1.009	1.024	1.039	1.056	1.070	1.068	1.062	1.060	1.063	1.070	1.080

Alloys	Type	Diameter (mm)	
NCHW1	Wire	$\phi 6.00 \sim 0.020$	
NCHR1	Ribbon	t=2.90~0.05	w=40~0.2 (Depends on thickness)
NCH1P	Plate	Please consult	
NCH1	Foil	Please consult	

# NCH1 (Nickel Chrome Type 1)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°C μΩm) 1.08±0.05

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0382	4.21	238
5.50	±0.063	23.76	±5	0.0455	5.00	200
5.00	±0.063	19.64	±5	0.0550	6.06	165
4.50	±0.063	15.90	±5	0.0679	7.48	134
4.00	±0.063	12.57	±5	0.0859	9.46	106
3.50	±0.050	9.621	±5	0.112	12.4	80.9
3.20	±0.050	8.042	±5	0.134	14.8	67.6
2.90	±0.050	6.605	±5	0.164	18.0	55.5
2.60	±0.040	5.309	±5	0.203	22.4	44.7
2.30	±0.040	4.155	±5	0.260	28.6	34.9
2.00	±0.040	3.142	±5	0.344	37.8	26.4
1.80	±0.040	2.545	±5	0.424	46.7	21.4
1.60	±0.032	2.011	±5	0.537	59.1	16.9
1.50	±0.032	1.767	±5	0.611	67.3	14.9
1.40	±0.032	1.539	±5	0.702	77.2	12.9
1.30	±0.032	1.327	±5	0.814	89.6	11.2
1.20	±0.025	1.131	±5	0.955	105	9.51
1.10	±0.025	0.9503	±6	1.14	125	7.99
1.00	±0.025	0.7854	±6	1.38	151	6.61
0.90	±0.025	0.6362	±6	1.70	187	5.35
0.85	±0.025	0.5675	±6	1.90	210	4.77
0.80	±0.020	0.5027	±6	2.15	237	4.23
0.75	±0.020	0.4418	±6	2.44	269	3.72
0.70	±0.020	0.3848	±6	2.81	309	3.24
0.65	±0.020	0.3318	±6	3.25	358	2.79
0.60	±0.020	0.2827	±6	3.82	421	2.38
0.55	±0.016	0.2376	±7	4.55	500	2.00
0.50	±0.016	0.1964	±7	5.50	606	1.65
0.45	±0.016	0.1590	±7	6.79	748	1.34
0.40	±0.016	0.1257	±7	8.59	946	1.06
0.35	±0.013	0.09621	±7	11.2	1236	0.809
0.32	±0.013	0.08042	±7	13.4	1478	0.676
0.29	±0.013	0.06605	±7	16.4	1800	0.555
0.26	±0.010	0.05309	±8	20.3	2240	0.447
0.23	±0.010	0.04155	±8	26.0	2862	0.349
0.20	±0.010	0.03142	±8	34.4	3785	0.264
0.18	±0.008	0.02545	±8	42.4	4673	0.214
0.16	±0.008	0.02011	±8	53.7	5914	0.169
0.15	±0.008	0.01767	±8	61.1	6729	0.149
0.14	±0.008	0.01539	±8	70.2	7724	0.129
0.13	±0.006	0.01327	±9	81.4	8958	0.112
0.12	±0.006	0.01131	±9	95.5	10514	0.0951
0.11	±0.006	0.009503	±9	114	12512	0.0799
0.10	±0.006	0.007854	±9	138	15140	0.0661
0.09	±0.006	0.006362	±10	170	18691	0.0535
0.08	±0.005	0.005027	±10	215	23656	0.0423
0.07	±0.005	0.003848	±10	281	30897	0.0324
0.06	±0.004	0.002827	±11	382	42054	0.0238
0.05	±0.004	0.001964	±11	550	60558	0.0165
0.04	±0.003	0.001257	±12	859	94622	0.0106
0.03	±0.003	0.0007069	±12	1528	168217	0.00594
0.025	±0.0025	0.0004909	±13	2200	242233	0.00413
0.020	±0.0025	0.0003142	±13	3438	378489	0.00264

# NCH1 (Nickel Chrome Type 1)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 1.08±0.05 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
6.00	56.0	78.0	98.0	119	147	175	210	250	290	325
5.50	49.0	69.0	97.0	105	130	155	190	220	255	290
5.00	43.0	59.0	75.0	90.0	112	135	164	190	220	250
4.50	36.0	50.0	64.0	77.0	94.0	115	140	160	190	215
4.00	31.0	42.0	54.0	65.0	80.0	94.0	113	133	159	180
3.50	25.0	34.0	44.0	53.0	66.0	78.0	96.0	113	130	150
3.20	22.0	30.0	39.0	46.0	57.0	68.0	83.0	98.0	114	130
2.90	18.8	26.0	34.0	40.0	49.0	59.0	72.0	84.0	98.0	111
2.60	15.5	22.0	28.0	34.0	42.0	50.0	62.0	72.0	83.0	93.0
2.30	13.2	18.1	24.0	29.0	35.0	42.0	52.0	60.0	69.0	79.0
2.00	11.0	15.0	20.0	24.0	29.0	35.0	41.0	49.0	56.0	64.0
1.80	9.70	13.2	17.3	21.0	25.0	30.0	33.0	42.0	48.0	55.0
1.60	8.20	11.3	15.0	17.5	21.0	26.0	31.0	35.0	41.0	46.0
1.50	7.60	10.4	13.6	16.0	19.5	23.0	28.0	32.0	37.0	42.0
1.40	7.00	9.50	12.5	14.6	18.0	21.0	26.0	29.0	34.0	39.0
1.30	6.40	8.70	11.3	13.3	16.2	19.0	23.0	26.0	30.0	35.0
1.20	5.90	7.80	10.5	11.8	14.0	16.1	20.0	23.0	27.0	31.0
1.10	5.20	7.00	9.00	10.8	13.0	15.4	18.2	21.0	24.0	27.0
1.00	4.70	6.10	8.00	9.40	11.5	13.5	15.5	17.5	20.0	23.0
0.90	4.10	5.50	7.10	8.20	10.0	11.8	14.0	16.0	18.2	21.0
0.85	3.90	5.10	6.60	7.70	9.30	10.8	12.8	14.8	17.0	19.3
0.80	3.50	4.70	6.10	7.00	8.50	10.0	11.8	13.5	15.5	17.5
0.75	3.30	4.30	5.60	6.50	7.80	9.00	10.7	12.4	14.0	16.0
0.70	3.00	3.90	5.10	5.90	7.10	8.30	9.70	11.0	12.9	14.7
0.65	2.80	3.60	4.70	5.40	6.50	7.50	8.70	10.0	11.6	13.2
0.60	2.50	3.20	4.20	4.80	5.80	6.80	7.80	9.00	10.3	12.0
0.55	2.30	2.90	3.80	4.30	5.20	6.00	7.00	8.00	9.20	10.5
0.50	2.00	2.60	3.40	3.80	4.60	5.30	6.30	7.10	8.20	9.20
0.45	1.80	2.30	2.90	3.30	4.00	4.60	5.20	5.90	6.70	7.60
0.40	1.50	1.90	2.50	2.90	3.40	3.90	4.50	5.20	5.90	6.70
0.35	1.26	1.60	2.10	2.50	2.90	3.30	3.70	4.30	4.80	5.50
0.32	1.13	1.45	1.86	2.20	2.60	2.90	3.40	3.90	4.40	4.90
0.29	1.00	1.30	1.65	1.90	2.30	2.60	3.00	3.40	3.80	4.30
0.26	0.88	1.13	1.45	1.70	2.00	2.30	2.60	2.90	3.30	3.70
0.23	0.76	1.00	1.25	1.45	1.70	1.90	2.20	2.50	2.80	3.20
0.20	0.64	0.84	1.05	1.21	1.42	1.63	1.85	2.10	2.40	2.60
0.18	0.56	0.74	0.92	1.06	1.25	1.42	1.62	1.85	2.00	2.30
0.16	0.49	0.64	0.79	0.91	1.06	1.23	1.40	1.60	1.79	1.98
0.15	0.45	0.59	0.73	0.84	0.98	1.12	1.30	1.46	1.63	1.80
0.14	0.42	0.55	0.67	0.78	0.90	1.05	1.20	1.34	1.50	1.65
0.13	0.38	0.50	0.61	0.71	0.82	0.95	1.09	1.22	1.38	1.50
0.12	0.35	0.46	0.56	0.64	0.74	0.86	1.00	1.10	1.23	1.35
0.11	0.31	0.42	0.50	0.58	0.67	0.77	0.88	1.00	1.10	1.20
0.10	0.28	0.37	0.45	0.52	0.59	0.68	0.78	0.88	0.98	1.07
0.09	0.23	0.31	0.37	0.44	0.51	0.57	0.64	0.77	0.78	0.86
0.08	0.20	0.27	0.32	0.38	0.44	0.49	0.55	0.61	0.67	0.73
0.07	0.17	0.22	0.27	0.32	0.37	0.41	0.46	0.51	0.56	0.61
0.06	0.14	0.19	0.23	0.26	0.30	0.40	0.38	0.42	0.46	0.50
0.05	0.11	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39
0.04	0.08	0.11	0.13	0.15	0.18	0.20	0.22	0.24	0.26	0.29
0.03	0.06	0.07	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.19

# NCH1 (Nickel Chrome Type 1)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 1.08±0.05

[Unit:Ω/m]

Thickness (mm)	Width (mm)														
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4	0.2
2.90	0.0095	0.0119	0.0152	0.0190	0.0238	0.0292	0.0380								
2.60	0.0106	0.0132	0.0170	0.0212	0.0265	0.0326	0.0424	0.0666							
2.30	0.0120	0.0150	0.0192	0.0240	0.0299	0.0369	0.0479	0.0753	0.10						
2.00	0.0138	0.0172	0.0220	0.0276	0.0344	0.0424	0.0551	0.0865	0.11						
1.80	0.0153	0.0191	0.0245	0.0306	0.0383	0.0471	0.0612	0.0962	0.13						
1.60	0.0172	0.0215	0.0276	0.0344	0.0430	0.0530	0.0689	0.108	0.14						
1.40	0.0197	0.0246	0.0315	0.0394	0.0492	0.0606	0.0787	0.124	0.16						
1.20	0.0230	0.0287	0.0367	0.0459	0.0574	0.0706	0.0918	0.144	0.19						
1.00	0.0276	0.0344	0.0441	0.0551	0.0689	0.0848	0.110	0.173	0.23						
0.90		0.0383	0.0490	0.0612	0.0765	0.0942	0.122	0.192	0.25	0.391	0.521				
0.80		0.0430	0.0551	0.0689	0.0861	0.106	0.138	0.216	0.28	0.439	0.586				
0.70			0.0630	0.0787	0.0984	0.121	0.157	0.247	0.32	0.502	0.670				
0.60			0.0735	0.0918	0.115	0.141	0.184	0.288	0.38	0.586	0.781				
0.50			0.0882	0.110	0.138	0.170	0.220	0.346	0.45	0.703	0.938				
0.45			0.0980	0.122	0.153	0.188	0.245	0.385	0.50	0.781	1.04	1.56			
0.40					0.172	0.212	0.276	0.433	0.56	0.879	1.17	1.76			
0.35						0.242	0.315	0.495	0.64	1.00	1.34	2.01			
0.32						0.265	0.344	0.541	0.70	1.10	1.46	2.20			
0.29							0.380	0.597	0.78	1.21	1.62	2.42	4.85		
0.26							0.424	0.666	0.87	1.35	1.80	2.70	5.41	10.8	
0.23								0.753	0.98	1.53	2.04	3.06	6.11	12.2	
0.20								0.865	1.13	1.76	2.34	3.52	7.03	14.1	
0.18								0.962	1.25	1.95	2.60	3.91	7.81	15.6	
0.16										2.20	2.93	4.39	8.79	17.6	
0.14										2.51	3.35	5.02	10.0	20.1	
0.12											3.91	5.86	11.7	23.4	
0.10												7.03	14.1	28.1	
0.08												8.79	17.6	35.2	70.3
0.07													20.1	40.2	80.4
0.06														46.9	93.8
0.05														56.3	

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **NCH2**

## **Nickel Chrome Type 2**



# Alloys : NCH2 (Nickel Chrome Type 2)

[JIS C 2520]

[JIS C 2532]

Compared to nickel-chrome type 1, it has slightly lower oxidation resistance and high-temperature strength, and is weakly magnetic.

Since it has good cold workability and corrosion resistance, it is suitable for electric furnaces, electric heaters, resistors, etc., in the same way as Type 1 except for the operating temperature.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
NCH2	C 2520	1.12 $\pm$ 0.05	* 180
GNC112	C 2532		

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
-0.1 ~ +0.3	17.0	0.46	13	8.25	1400	1000

Chemical Composition	C	Si	Mn	Ni	Cr	Fe
(%)	$\leq 0.15$	0.75~1.6	$\leq 1.5$	$\geq 57$	15~18	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000
Coefficient	1.000	1.014	1.031	1.048	1.065	1.077	1.083	1.085	1.090	1.095	1.103

Alloys	Type	Diameter (mm)	
NCHW2	Wire	$\phi 6.00 \sim 0.030$	
NCHR2	Ribbon	$t=2.90 \sim 0.08$	$w=40 \sim 0.4$ (Depends on thickness)
NCH2P	Plate	Please consult	
NCH2	Foil	Please consult	

# NCH2 (Nickel Chrome Type 2)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°C μΩm) 1.12±0.05

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0396	4.29	233
5.50	±0.063	23.76	±5	0.0471	5.10	196
5.00	±0.063	19.64	±5	0.0570	6.17	162
4.50	±0.063	15.90	±5	0.0704	7.62	131
4.00	±0.063	12.57	±5	0.0891	9.65	104
3.50	±0.050	9.621	±5	0.116	12.6	79.4
3.20	±0.050	8.042	±5	0.139	15.1	66.4
2.90	±0.050	6.605	±5	0.170	18.4	54.5
2.60	±0.040	5.309	±5	0.211	22.8	43.8
2.30	±0.040	4.155	±5	0.270	29.2	34.3
2.00	±0.040	3.142	±5	0.357	38.6	25.9
1.80	±0.040	2.545	±5	0.440	47.6	21.0
1.60	±0.032	2.011	±5	0.557	60.3	16.6
1.50	±0.032	1.767	±5	0.634	68.6	14.6
1.40	±0.032	1.539	±5	0.728	78.7	12.7
1.30	±0.032	1.327	±5	0.844	91.3	11.0
1.20	±0.025	1.131	±5	0.99	107	9.33
1.10	±0.025	0.9503	±6	1.18	128	7.84
1.00	±0.025	0.7854	±6	1.43	154	6.48
0.90	±0.025	0.6362	±6	1.76	191	5.25
0.85	±0.025	0.5675	±6	1.97	214	4.68
0.80	±0.020	0.5027	±6	2.23	241	4.15
0.75	±0.020	0.4418	±6	2.54	274	3.64
0.70	±0.020	0.3848	±6	2.91	315	3.17
0.65	±0.020	0.3318	±6	3.38	365	2.74
0.60	±0.020	0.2827	±6	3.96	429	2.33
0.55	±0.016	0.2376	±7	4.71	510	1.96
0.50	±0.016	0.1964	±7	5.70	617	1.62
0.45	±0.016	0.1590	±7	7.04	762	1.31
0.40	±0.016	0.1257	±7	8.91	965	1.04
0.35	±0.013	0.09621	±7	11.6	1260	0.79
0.32	±0.013	0.08042	±7	13.9	1507	0.66
0.29	±0.013	0.06605	±7	17.0	1835	0.54
0.26	±0.010	0.05309	±8	21.1	2283	0.438
0.23	±0.010	0.04155	±8	27.0	2917	0.343
0.20	±0.010	0.03142	±8	35.7	3858	0.259
0.18	±0.008	0.02545	±8	44.0	4763	0.210
0.16	±0.008	0.02011	±8	55.7	6029	0.166
0.15	±0.008	0.01767	±8	63.4	6859	0.146
0.14	±0.008	0.01539	±8	72.8	7874	0.127
0.13	±0.006	0.01327	±9	84.4	9132	0.110
0.12	±0.006	0.01131	±9	99.0	10717	0.0933
0.11	±0.006	0.009503	±9	118	12755	0.0784
0.10	±0.006	0.007854	±9	143	15433	0.0648
0.09	±0.006	0.006362	±10	176	19053	0.0525
0.08	±0.005	0.005027	±10	223	24114	0.0415
0.07	±0.005	0.003848	±10	291	31496	0.0317
0.06	±0.004	0.002827	±11	396	42870	0.0233
0.05	±0.004	0.001964	±11	570	61733	0.0162
0.04	±0.003	0.001257	±12	891	96457	0.0104
0.03	±0.003	0.0007069	±12	1584	171480	0.00583

# NCH2 (Nickel Chrome Type 2)

## Temperature Current Characteristics · Diameter · Temperature · Current

Wire Electrical Resistivity (23°CμΩm) 1.12±0.05 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
6.00	53.8	74.9	94.1	114	141	168	202	240	278	312
5.50	47.0	66.2	93.1	101	125	149	182	211	245	278
5.00	41.3	56.6	72.0	86.4	108	130	157	182	211	240
4.50	34.6	48.0	61.4	73.9	90.2	110	134	154	182	206
4.00	29.8	40.3	51.8	62.4	76.8	90.2	108	128	153	173
3.50	24.0	32.6	42.2	50.9	63.4	74.9	92.2	108	125	144
3.20	21.1	28.8	37.4	44.2	54.7	65.3	79.7	94.1	109	125
2.90	18.0	25.0	32.6	38.4	47.0	56.6	69.1	80.6	94.1	107
2.60	14.9	21.1	26.9	32.6	40.3	48.0	59.5	69.1	79.7	89.3
2.30	12.7	17.4	23.0	27.8	33.6	40.3	49.9	57.6	66.2	75.8
2.00	10.6	14.4	19.2	23.0	27.8	33.6	39.4	47.0	53.8	61.4
1.80	9.31	12.7	16.6	20.2	24.0	28.8	31.7	40.3	46.1	52.8
1.60	7.87	10.8	14.4	16.8	20.2	25.0	29.8	33.6	39.4	44.2
1.50	7.30	10.0	13.1	15.4	18.7	22.1	26.9	30.7	35.5	40.3
1.40	6.72	9.12	12.0	14.0	17.3	20.2	25.0	27.8	32.6	37.4
1.30	6.14	8.35	10.8	12.8	15.6	18.2	22.1	25.0	28.8	33.6
1.20	5.66	7.49	10.1	11.3	13.4	15.5	19.2	22.1	25.9	29.8
1.10	4.99	6.72	8.64	10.4	12.5	14.8	17.5	20.2	23.0	25.9
1.00	4.51	5.86	7.68	9.02	11.0	13.0	14.9	16.8	19.2	22.1
0.90	3.94	5.28	6.82	7.87	9.60	11.3	13.4	15.4	17.5	20.2
0.85	3.74	4.90	6.34	7.39	8.93	10.4	12.3	14.2	16.3	18.5
0.80	3.36	4.51	5.86	6.72	8.16	9.60	11.3	13.0	14.9	16.8
0.75	3.17	4.13	5.38	6.24	7.49	8.64	10.3	11.9	13.4	15.4
0.70	2.88	3.74	4.90	5.66	6.82	7.97	9.31	10.6	12.4	14.1
0.65	2.69	3.46	4.51	5.18	6.24	7.20	8.35	9.60	11.1	12.7
0.60	2.40	3.07	4.03	4.61	5.57	6.53	7.49	8.64	9.89	11.5
0.55	2.21	2.78	3.65	4.13	4.99	5.76	6.72	7.68	8.83	10.1
0.50	1.92	2.50	3.26	3.65	4.42	5.09	6.05	6.82	7.87	8.83
0.45	1.73	2.21	2.78	3.17	3.84	4.42	4.99	5.66	6.43	7.30
0.40	1.44	1.82	2.40	2.78	3.26	3.74	4.32	4.99	5.66	6.43
0.35	1.21	1.54	2.02	2.40	2.78	3.17	3.55	4.13	4.61	5.28
0.32	1.08	1.39	1.79	2.11	2.50	2.78	3.26	3.74	4.22	4.70
0.29	0.960	1.25	1.58	1.82	2.21	2.50	2.88	3.26	3.65	4.13
0.26	0.845	1.08	1.39	1.63	1.92	2.21	2.50	2.78	3.17	3.55
0.23	0.730	0.960	1.20	1.39	1.63	1.82	2.11	2.40	2.69	3.07
0.20	0.614	0.806	1.01	1.16	1.36	1.56	1.78	2.02	2.30	2.50
0.18	0.538	0.710	0.883	1.02	1.20	1.36	1.56	1.78	1.92	2.21
0.16	0.470	0.614	0.758	0.874	1.02	1.18	1.34	1.54	1.72	1.90
0.15	0.432	0.566	0.701	0.806	0.941	1.08	1.25	1.40	1.56	1.73
0.14	0.403	0.528	0.643	0.749	0.864	1.01	1.15	1.29	1.44	1.58
0.13	0.365	0.480	0.586	0.682	0.787	0.912	1.05	1.17	1.32	1.44
0.12	0.336	0.442	0.538	0.614	0.710	0.826	0.960	1.06	1.18	1.30
0.11	0.298	0.403	0.480	0.557	0.643	0.739	0.845	0.960	1.06	1.15
0.10	0.269	0.355	0.432	0.499	0.566	0.653	0.749	0.845	0.941	1.03
0.09	0.221	0.298	0.355	0.422	0.490	0.547	0.614	0.739	0.749	0.826
0.08	0.192	0.259	0.307	0.365	0.422	0.470	0.528	0.586	0.643	0.701
0.07	0.163	0.211	0.259	0.307	0.355	0.394	0.442	0.490	0.538	0.586
0.06	0.134	0.182	0.221	0.250	0.288	0.384	0.365	0.403	0.442	0.480
0.05	0.106	0.144	0.173	0.202	0.230	0.259	0.288	0.317	0.346	0.374
0.04	0.077	0.106	0.125	0.144	0.173	0.192	0.211	0.230	0.250	0.278
0.03	0.058	0.067	0.086	0.096	0.115	0.125	0.144	0.154	0.173	0.182

(\* )Reference value

# NCH2 (Nickel Chrome Type 2)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 1.12±0.05

[Unit:Ω/m]

Thickness (mm)	Width (mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00985	0.0123	0.0158	0.0197	0.0246	0.0303	0.0394							
2.60	0.011	0.0137	0.0176	0.022	0.0275	0.0338	0.044	0.069						
2.30	0.0124	0.0155	0.0199	0.0248	0.0311	0.0382	0.0497	0.078	0.10					
2.00	0.0143	0.0179	0.0229	0.0286	0.0357	0.044	0.0571	0.0897	0.117					
1.80	0.0159	0.0198	0.0254	0.0317	0.0397	0.0488	0.0635	0.0997	0.13					
1.60	0.0179	0.0223	0.0286	0.0357	0.0446	0.0549	0.0714	0.112	0.146					
1.40	0.0204	0.0255	0.0327	0.0408	0.051	0.0628	0.0816	0.128	0.167					
1.20	0.0238	0.0298	0.0381	0.0476	0.0595	0.0733	0.0952	0.15	0.194					
1.00	0.0286	0.0357	0.0457	0.0571	0.0714	0.0879	0.114	0.179	0.233					
0.90		0.0397	0.0508	0.0635	0.0794	0.0977	0.127	0.199	0.259	0.405	0.54			
0.80		0.0446	0.0571	0.0714	0.0893	0.11	0.143	0.224	0.292	0.456	0.608			
0.70			0.0653	0.0816	0.102	0.126	0.163	0.256	0.333	0.521	0.694			
0.60			0.0762	0.0952	0.119	0.147	0.19	0.299	0.389	0.608	0.81			
0.50			0.0914	0.114	0.143	0.176	0.229	0.359	0.467	0.729	0.972			
0.45			0.1020	0.127	0.159	0.195	0.254	0.399	0.52	0.81	1.08	1.62		
0.40					0.179	0.22	0.286	0.449	0.583	0.911	1.22	1.82		
0.35						0.251	0.327	0.513	0.667	1.04	1.39	2.08		
0.32						0.275	0.357	0.561	0.73	1.14	1.52	2.28		
0.29							0.394	0.619	0.805	1.26	1.68	2.51	5.03	
0.26							0.44	0.69	0.897	1.4	1.87	2.80	5.61	11.2
0.23								0.78	1.01	1.59	2.11	3.17	6.34	12.7
0.20								0.897	1.17	1.82	2.43	3.65	7.29	14.6
0.18								0.997	1.3	2.03	2.70	4.05	8.1	16.2
0.16										2.28	3.04	4.56	9.11	18.2
0.14										2.6	3.47	5.21	10.4	20.8
0.12											4.05	6.08	12.2	24.3
0.10												7.29	14.6	29.2
0.08												9.11	18.2	36.5

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **FCH1**

## **Fe-Chrome Type 1**

# Alloys : FCH1 (Fe-Chrome Type 1)

[JIS C 2520]

Good heat resistance and oxidation resistance, suitable for high temperature use. High temperature strength is small and ferromagnetic.

Workability is hard and cold workability is not good.

Workability can be improved by warm working (100-300°C).

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
FCH1	C 2520	1.42±0.06	* -20
GNC142	C 2532		

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
-0.4	13.0	0.46	13	7.20	1520	1250

Chemical Composition	C	Si	Mn	Cr	Al	Fe
(%)	≤0.11	≤1.5	≤1.0	23~26	4~6	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200
Coefficient	1.000	1.005	1.009	1.013	1.018	1.021	1.027	1.037	1.043	1.047	1.048	1.049	1.049

Alloys	Type	Diameter (mm)	
FCHW1	Wire	φ6.00~0.16	
FCHR1	Ribbon	t=2.90~0.08	w=40~0.4 (Depends on thickness)

# FCH1 (Fe-Chrome Type 1)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°C μΩm) 1.42±0.06

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0502	4.91	204
5.50	±0.063	23.76	±5	0.0598	5.85	171
5.00	±0.063	19.64	±5	0.0723	7.07	141
4.50	±0.063	15.90	±5	0.0893	8.73	115
4.00	±0.063	12.57	±5	0.113	11.1	90.5
3.50	±0.050	9.621	±5	0.148	14.4	69.3
3.20	±0.050	8.042	±5	0.177	17.3	57.9
2.90	±0.050	6.605	±5	0.215	21.0	47.6
2.60	±0.040	5.309	±5	0.267	26.2	38.2
2.30	±0.040	4.155	±5	0.342	33.4	29.9
2.00	±0.040	3.142	±5	0.452	44.2	22.6
1.80	±0.040	2.545	±5	0.558	54.6	18.3
1.60	±0.032	2.011	±5	0.706	69.1	14.5
1.50	±0.032	1.767	±5	0.804	78.6	12.7
1.40	±0.032	1.539	±5	0.922	90.2	11.1
1.30	±0.032	1.327	±5	1.07	105	9.56
1.20	±0.025	1.131	±5	1.26	123	8.14
1.10	±0.025	0.9503	±6	1.49	146	6.84
1.00	±0.025	0.7854	±6	1.81	177	5.65
0.90	±0.025	0.6362	±6	2.23	218	4.58
0.85	±0.025	0.5675	±6	2.50	245	4.09
0.80	±0.020	0.5027	±6	2.82	276	3.62
0.75	±0.020	0.4418	±6	3.21	314	3.18
0.70	±0.020	0.3848	±6	3.69	361	2.77
0.65	±0.020	0.3318	±6	4.28	419	2.39
0.60	±0.020	0.2827	±6	5.02	491	2.04
0.55	±0.016	0.2376	±7	5.98	585	1.71
0.50	±0.016	0.1964	±7	7.23	707	1.41
0.45	±0.016	0.1590	±7	8.93	873	1.15
0.40	±0.016	0.1257	±7	11.3	1105	0.905
0.35	±0.013	0.09621	±7	14.8	1444	0.693
0.32	±0.013	0.08042	±7	17.7	1727	0.579
0.29	±0.013	0.06605	±7	21.5	2103	0.476
0.26	±0.010	0.05309	±8	26.7	2616	0.382
0.23	±0.010	0.04155	±8	34.2	3343	0.299
0.20	±0.010	0.03142	±8	45.2	4421	0.226
0.18	±0.008	0.02545	±8	55.8	5458	0.183
0.16	±0.008	0.02011	±8	70.6	6908	0.145

# FCH1 (Fe-Chrome Type 1)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 1.42±0.06 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
6.00	42.6	59.3	74.5	90.4	112	133	160	190	220	247
5.50	37.2	52.4	73.7	79.8	98.8	118	144	167	194	220
5.00	32.7	44.8	57.0	68.4	85.1	103	125	144	167	190
4.50	27.4	38.0	48.6	58.5	71.4	87.4	106	122	144	163
4.00	23.6	31.9	41.0	49.4	60.8	71.4	85.9	101	121	137
3.50	19.0	25.8	33.4	40.3	50.2	59.3	73.0	85.9	98.8	114
3.20	16.7	22.8	29.6	35.0	43.3	51.7	63.1	74.5	86.6	98.8
2.90	14.3	19.8	25.8	30.4	37.2	44.8	54.7	63.8	74.5	84.4
2.60	11.8	16.7	21.3	25.8	31.9	38.0	47.1	54.7	63.1	70.7
2.30	10.0	13.8	18.2	22.0	26.6	31.9	39.5	45.6	52.4	60.0
2.00	8.36	11.4	15.2	18.2	22.0	26.6	31.2	37.2	42.6	48.6
1.80	7.37	10.0	13.1	16.0	19.0	22.8	25.1	31.9	36.5	41.8
1.60	6.23	8.59	11.4	13.3	16.0	19.8	23.6	26.6	31.2	35.0
1.50	5.78	7.90	10.3	12.2	14.8	17.5	21.3	24.3	28.1	31.9
1.40	5.32	7.22	9.50	11.1	13.7	16.0	19.8	22.0	25.8	29.6
1.30	4.86	6.61	8.59	10.1	12.3	14.4	17.5	19.8	22.8	26.6
1.20	4.48	5.93	7.98	8.97	10.6	12.2	15.2	17.5	20.5	23.6
1.10	3.95	5.32	6.84	8.21	9.88	11.7	13.8	16.0	18.2	20.5
1.00	3.57	4.64	6.08	7.14	8.74	10.3	11.8	13.3	15.2	17.5
0.90	3.12	4.18	5.40	6.23	7.60	8.97	10.6	12.2	13.8	16.0
0.85	2.96	3.88	5.02	5.85	7.07	8.21	9.73	11.2	12.9	14.7
0.80	2.66	3.57	4.64	5.32	6.46	7.60	8.97	10.3	11.8	13.3
0.75	2.51	3.27	4.26	4.94	5.93	6.84	8.13	9.42	10.6	12.2
0.70	2.28	2.96	3.88	4.48	5.40	6.31	7.37	8.36	9.80	11.2
0.65	2.13	2.74	3.57	4.10	4.94	5.70	6.61	7.60	8.82	10.0
0.60	1.90	2.43	3.19	3.65	4.41	5.17	5.93	6.84	7.83	9.12
0.55	1.75	2.20	2.89	3.27	3.95	4.56	5.32	6.08	6.99	7.98
0.50	1.52	1.98	2.58	2.89	3.50	4.03	4.79	5.40	6.23	6.99
0.45	1.37	1.75	2.20	2.51	3.04	3.50	3.95	4.48	5.09	5.78
0.40	1.14	1.44	1.90	2.20	2.58	2.96	3.42	3.95	4.48	5.09
0.35	0.958	1.22	1.60	1.90	2.20	2.51	2.81	3.27	3.65	4.18
0.32	0.859	1.10	1.41	1.67	1.98	2.20	2.58	2.96	3.34	3.72
0.29	0.760	0.988	1.25	1.44	1.75	1.98	2.28	2.58	2.89	3.27
0.26	0.669	0.859	1.10	1.29	1.52	1.75	1.98	2.20	2.51	2.81
0.23	0.578	0.760	0.950	1.10	1.29	1.44	1.67	1.90	2.13	2.43
0.20	0.486	0.638	0.798	0.920	1.08	1.24	1.41	1.60	1.82	1.98
0.18	0.426	0.562	0.699	0.806	0.950	1.08	1.23	1.41	1.52	1.75
0.16	0.372	0.486	0.600	0.692	0.806	0.935	1.06	1.22	1.36	1.50

(\* )Reference value



# FCH1 (Fe-Chrome Type 1)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 1.42±0.06

[Unit: Ω/m]

Thickness (mm)	Width mm)														
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4	
2.90	0.0128	0.0159	0.0204	0.0255	0.0319	0.0392	0.0510	0.0785							
2.60	0.0142	0.0178	0.0228	0.0284	0.0356	0.0438	0.0569	0.0875							
2.30	0.0161	0.0201	0.0257	0.0322	0.0402	0.0495	0.0643	0.0989	0.129						
2.00	0.0185	0.0231	0.0296	0.0370	0.0462	0.0569	0.0740	0.114	0.148						
1.80	0.0205	0.0257	0.0329	0.0411	0.0514	0.0632	0.0822	0.126	0.164						
1.60	0.0231	0.0289	0.0370	0.0462	0.0578	0.0711	0.0924	0.142	0.185						
1.40	0.0264	0.0330	0.0423	0.0528	0.0660	0.0813	0.106	0.163	0.211						
1.20	0.0308	0.0385	0.0493	0.0616	0.0770	0.0948	0.123	0.190	0.247						
1.00	0.0370	0.0462	0.0592	0.0740	0.0924	0.114	0.148	0.228	0.296						
0.90		0.0514	0.0657	0.0822	0.103	0.126	0.164	0.253	0.329	0.514	0.685				
0.80		0.0578	0.0740	0.0924	0.116	0.142	0.185	0.284	0.370	0.578	0.770				
0.70			0.0845	0.106	0.132	0.163	0.211	0.325	0.423	0.660	0.880				
0.60			0.0986	0.123	0.154	0.190	0.247	0.379	0.493	0.770	1.03				
0.50			0.118	0.148	0.185	0.228	0.269	0.455	0.592	0.924	1.23				
0.45			0.131	0.164	0.205	0.253	0.329	0.506	0.657	1.03	1.37	2.05			
0.40					0.231	0.284	0.370	0.569	0.740	1.16	1.54	2.31			
0.35						0.352	0.423	0.650	0.854	1.32	1.76	2.64			
0.32						0.356	0.462	0.711	0.924	1.44	1.93	2.89			
0.29							0.510	0.785	1.02	1.59	2.13	3.19	6.38		
0.26							0.569	0.875	1.14	1.78	2.37	3.56	7.11	14.2	
0.23								0.989	1.29	2.01	2.68	4.02	8.04	16.1	
0.20								1.14	1.48	2.31	3.08	4.62	9.24	18.5	
0.18								1.26	1.64	2.57	3.42	5.14	10.3	20.5	
0.16										2.89	3.85	5.78	11.6	23.1	
0.14										3.30	4.40	6.60	13.2	26.4	
0.12											5.14	7.70	15.4	30.8	
0.10												9.24	18.5	37.0	
0.08													11.6	23.1	46.2

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **No.30**

## **Fe-Chrome Type 1**

# Alloys : No.30 (Fe-Chrome Type 1)

[JIS C 2520]

[JIS C 2532]

Good heat resistance and oxidation resistance, suitable for high temperature use. High temperature strength is small and ferromagnetic. Workability is hard and cold workability is not good. Workability can be improved by warm working (100-300°C).

The properties are almost the same as those of FCH1 iron-chromium electric heating wire type 1, but the composition contains rare metals, making it superior in workability and maximum operating temperature.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
FCH1	C 2520	1.42 $\pm$ 0.05	
GNC142	C 2532		

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
-0.4	13.0	0.46	13	7.20	1520	1300

Chemical Composition	C	Si	Mn	Cr	Al	Fe
(%)	$\leq 0.11$	$\leq 1.5$	$\leq 1.0$	23~26	4~6	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300
Coefficient	1.000	1.005	1.009	1.013	1.018	1.021	1.027	1.037	1.043	1.047	1.048	1.049	1.049	

Alloys	Type	Diameter (mm)
No.30	Wire	$\Phi 1.00 \sim 0.08$
	Ribbon	Please consult

# No.30 (Fe-Chrome Type 1)

## Resistance·Length·Weight

Wire

Electrical Resistivity (23°CμΩm) 1.42±0.06

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
1.00	±0.025	0.7854	±6	1.81	177	5.65
0.90	±0.025	0.6362	±6	2.23	218	4.58
0.85	±0.025	0.5675	±6	2.50	245	4.09
0.80	±0.020	0.5027	±6	2.82	276	3.62
0.75	±0.020	0.4418	±6	3.21	314	3.18
0.70	±0.020	0.3848	±6	3.69	361	2.77
0.65	±0.020	0.3318	±6	4.28	419	2.39
0.60	±0.020	0.2827	±6	5.02	491	2.04
0.55	±0.016	0.2376	±7	5.98	585	1.71
0.50	±0.016	0.1964	±7	7.23	707	1.41
0.45	±0.016	0.1590	±7	8.93	873	1.15
0.40	±0.016	0.1257	±7	11.3	1105	0.905
0.35	±0.013	0.09621	±7	14.8	1444	0.693
0.32	±0.013	0.08042	±7	17.7	1727	0.579
0.29	±0.013	0.06605	±7	21.5	2103	0.476
0.26	±0.010	0.05309	±8	26.7	2616	0.382
0.23	±0.010	0.04155	±8	34.2	3343	0.299
0.20	±0.010	0.03142	±8	45.2	4421	0.226
0.18	±0.008	0.02545	±8	55.8	5458	0.183
0.16	±0.008	0.02011	±8	70.6	6908	0.145
0.15	±0.008	0.01767	±8	80.4	7859	0.127
0.14	±0.008	0.01539	±8	92.2	9022	0.111
0.13	±0.006	0.01327	±9	107	10464	0.0956
0.12	±0.006	0.01131	±9	126	12280	0.0814
0.11	±0.006	0.009503	±9	149	14615	0.0684
0.10	±0.006	0.007854	±9	181	17684	0.0565
0.09	±0.006	0.006362	±10	223	21832	0.0458
0.08	±0.005	0.005027	±10	282	27631	0.0362

# No.30 (Fe-Chrome Type 1)

## Temperature Current Characteristics · Diameter · Temperature · Current

Wire Electrical Resistivity (23°CμΩm) 1.42±0.06 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
1.00	4.70	6.10	8.00	9.40	11.5	13.5	15.5	17.5	20.0	23.0
0.90	4.10	5.50	7.10	8.20	10.0	11.8	14.0	16.0	18.2	21.0
0.85	3.90	5.10	6.60	7.70	9.30	10.8	12.8	14.8	17.0	19.3
0.80	3.50	4.70	6.10	7.00	8.50	10.0	11.8	13.5	15.5	17.5
0.75	3.30	4.30	5.60	6.50	7.80	9.00	10.7	12.4	14.0	16.0
0.70	3.00	3.90	5.10	5.90	7.10	8.30	9.70	11.0	12.9	14.7
0.65	2.80	3.60	4.70	5.40	6.50	7.50	8.70	10.0	11.6	13.2
0.60	2.50	3.20	4.20	4.80	5.80	6.80	7.80	9.00	10.3	12.0
0.55	2.30	2.90	3.80	4.30	5.20	6.00	7.00	8.00	9.20	10.5
0.50	2.00	2.60	3.40	3.80	4.60	5.30	6.30	7.10	8.20	9.20
0.45	1.80	2.30	2.90	3.30	4.00	4.60	5.20	5.90	6.70	7.60
0.40	1.50	1.90	2.50	2.90	3.40	3.90	4.50	5.20	5.90	6.70
0.35	1.26	1.60	2.10	2.50	2.90	3.30	3.70	4.30	4.80	5.50
0.32	1.13	1.45	1.86	2.20	2.60	2.90	3.40	3.90	4.40	4.90
0.29	1.00	1.30	1.65	1.90	2.30	2.60	3.00	3.40	3.80	4.30
0.26	0.88	1.13	1.45	1.70	2.00	2.30	2.60	2.90	3.30	3.70
0.23	0.76	1.00	1.25	1.45	1.70	1.90	2.20	2.50	2.80	3.20
0.20	0.64	0.84	1.05	1.21	1.42	1.63	1.85	2.10	2.40	2.60
0.18	0.56	0.74	0.92	1.06	1.25	1.42	1.62	1.85	2.00	2.30
0.16	0.49	0.64	0.79	0.91	1.06	1.23	1.40	1.60	1.79	1.98
0.15	0.45	0.59	0.73	0.84	0.98	1.12	1.30	1.46	1.63	1.80
0.14	0.42	0.55	0.67	0.78	0.90	1.05	1.20	1.34	1.50	1.65
0.13	0.38	0.50	0.61	0.71	0.82	0.95	1.09	1.22	1.38	1.50
0.12	0.35	0.46	0.56	0.64	0.74	0.86	1.00	1.10	1.23	1.35
0.11	0.31	0.42	0.50	0.58	0.67	0.77	0.88	1.00	1.10	1.20
0.10	0.28	0.37	0.45	0.52	0.59	0.68	0.78	0.88	0.98	1.07
0.09	0.23	0.31	0.37	0.44	0.51	0.57	0.64	0.77	0.78	0.86
0.08	0.20	0.27	0.32	0.38	0.44	0.49	0.55	0.61	0.67	0.73

(\* )Reference value

Ribbon Electrical Resistivity (23°CμΩm) 1.42±0.06

### Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **FCH2**

## **Fe-Chrome Type 2**

# Alloys : FCH2 (Fe-Chrome Type 2)

[JIS C 2520]

Iron chromium electric heating wire Compared to Class 1, it is easier to cold work.  
Suitable for home appliances and resistors.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
FCH2	C 2520	1.23 $\pm$ 0.06	* 90
GFC123	C 2532		

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
-0.3	12.5	0.46	13	7.35	1500	1100

Chemical Composition	C	Si	Mn	Cr	Al	Fe
(%)	$\leq 0.11$	$\leq 1.5$	$\leq 1.0$	17~21	2~4	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100
Coefficient	1.000	1.005	1.014	1.025	1.038	1.054	1.074	1.086	1.095	1.102	1.107	1.110

Alloys	Type	Diameter (mm)	
FCHW2	Wire	$\phi 6.00 \sim 0.15$	
FCHR2	Ribbon	t=2.90~0.08	w=40~0.4 (Depends on thickness)

# FCH2 (Fe-Chrome Type 2)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°CμΩm) 1.23±0.06

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0435	4.81	208
5.50	±0.063	23.76	±5	0.0518	5.73	175
5.00	±0.063	19.64	±5	0.0626	6.93	144
4.50	±0.063	15.90	±5	0.0773	8.55	117
4.00	±0.063	12.57	±5	0.0979	10.8	92.4
3.50	±0.050	9.621	±5	0.128	14.1	70.7
3.20	±0.050	8.042	±5	0.153	16.9	59.1
2.90	±0.050	6.605	±5	0.186	20.6	48.5
2.60	±0.040	5.309	±5	0.232	25.6	39.0
2.30	±0.040	4.155	±5	0.296	32.7	30.5
2.00	±0.040	3.142	±5	0.392	43.3	23.1
1.80	±0.040	2.545	±5	0.483	53.5	18.7
1.60	±0.032	2.011	±5	0.612	67.7	14.8
1.50	±0.032	1.767	±5	0.696	77.0	13.0
1.40	±0.032	1.539	±5	0.799	88.4	11.3
1.30	±0.032	1.327	±5	0.927	103	9.76
1.20	±0.025	1.131	±5	1.09	120	8.31
1.10	±0.025	0.9503	±6	1.29	143	6.98
1.00	±0.025	0.7854	±6	1.57	173	5.77
0.90	±0.025	0.6362	±6	1.93	214	4.68
0.85	±0.025	0.5675	±6	2.17	240	4.17
0.80	±0.020	0.5027	±6	2.45	271	3.69
0.75	±0.020	0.4418	±6	2.78	308	3.25
0.70	±0.020	0.3848	±6	3.20	354	2.83
0.65	±0.020	0.3318	±6	3.71	410	2.44
0.60	±0.020	0.2827	±6	4.35	481	2.08
0.55	±0.016	0.2376	±7	5.18	573	1.75
0.50	±0.016	0.1964	±7	6.26	693	1.44
0.45	±0.016	0.1590	±7	7.73	855	1.17
0.40	±0.016	0.1257	±7	9.79	1083	0.924
0.35	±0.013	0.09621	±7	12.8	1414	0.707
0.32	±0.013	0.08042	±7	15.3	1692	0.591
0.29	±0.013	0.06605	±7	18.6	2060	0.485
0.26	±0.010	0.05309	±8	23.2	2563	0.390
0.23	±0.010	0.04155	±8	29.6	3275	0.305
0.20	±0.010	0.03142	±8	39.2	4331	0.231
0.18	±0.008	0.02545	±8	48.3	5347	0.187
0.16	±0.008	0.02011	±8	61.2	6767	0.148
0.15	±0.008	0.01767	±8	69.6	7699	0.130



# FCH2 (Fe-Chrome Type 2)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 1.23±0.06 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
6.00	49.3	68.6	86.2	105	129	154	185	220	255	286
5.50	43.1	60.7	85.4	92.4	114	136	167	194	224	255
5.00	37.8	51.9	66.0	79.2	98.6	119	144	167	194	220
4.50	31.7	44.0	56.3	67.8	82.7	101	123	141	167	189
4.00	27.3	37.0	47.5	57.2	70.4	82.7	99.4	117	140	158
3.50	22.0	29.9	38.7	46.6	58.1	68.6	84.5	99.4	114	132
3.20	19.4	26.4	34.3	40.5	50.2	59.8	73.0	86.2	100	114
2.90	16.5	22.9	29.9	35.2	43.1	51.9	63.4	73.9	86.2	97.7
2.60	13.6	19.4	24.6	29.9	37.0	44.0	54.6	63.4	73.0	81.8
2.30	11.6	15.9	21.1	25.5	30.8	37.0	45.8	52.8	60.7	69.5
2.00	9.68	13.2	17.6	21.1	25.5	30.8	36.1	43.1	49.3	56.3
1.80	8.54	11.6	15.2	18.5	22.0	26.4	29.0	37.0	42.2	48.4
1.60	7.22	9.94	13.2	15.4	18.5	22.9	27.3	30.8	36.1	40.5
1.50	6.69	9.15	12.0	14.1	17.2	20.2	24.6	28.2	32.6	37.0
1.40	6.16	8.36	11.0	12.8	15.8	18.5	22.9	25.5	29.9	34.3
1.30	5.63	7.66	9.94	11.7	14.3	16.7	20.2	22.9	26.4	30.8
1.20	5.19	6.86	9.24	10.4	12.3	14.2	17.6	20.2	23.8	27.3
1.10	4.58	6.16	7.92	9.50	11.4	13.6	16.0	18.5	21.1	23.8
1.00	4.14	5.37	7.04	8.27	10.1	11.9	13.6	15.4	17.6	20.2
0.90	3.61	4.84	6.25	7.22	8.80	10.4	12.3	14.1	16.0	18.5
0.85	3.43	4.49	5.81	6.78	8.18	9.50	11.3	13.0	15.0	17.0
0.80	3.08	4.14	5.37	6.16	7.48	8.80	10.4	11.9	13.6	15.4
0.75	2.90	3.78	4.93	5.72	6.86	7.92	9.42	10.9	12.3	14.1
0.70	2.64	3.43	4.49	5.19	6.25	7.30	8.54	9.68	11.4	12.9
0.65	2.46	3.17	4.14	4.75	5.72	6.60	7.66	8.80	10.2	11.6
0.60	2.20	2.82	3.70	4.22	5.10	5.98	6.86	7.92	9.06	10.6
0.55	2.02	2.55	3.34	3.78	4.58	5.28	6.16	7.04	8.10	9.24
0.50	1.76	2.29	2.99	3.34	4.05	4.66	5.54	6.25	7.22	8.10
0.45	1.58	2.02	2.55	2.90	3.52	4.05	4.58	5.19	5.90	6.69
0.40	1.32	1.67	2.20	2.55	2.99	3.43	3.96	4.58	5.19	5.90
0.35	1.11	1.41	1.85	2.20	2.55	2.90	3.26	3.78	4.22	4.84
0.32	0.994	1.28	1.64	1.94	2.29	2.55	2.99	3.43	3.87	4.31
0.29	0.880	1.14	1.45	1.67	2.02	2.29	2.64	2.99	3.34	3.78
0.26	0.774	0.994	1.28	1.50	1.76	2.02	2.29	2.55	2.90	3.26
0.23	0.669	0.880	1.10	1.28	1.50	1.67	1.94	2.20	2.46	2.82
0.20	0.563	0.739	0.924	1.06	1.25	1.43	1.63	1.85	2.11	2.29
0.18	0.493	0.651	0.810	0.933	1.10	1.25	1.43	1.63	1.76	2.02
0.16	0.431	0.563	0.695	0.801	0.933	1.08	1.23	1.41	1.58	1.74
0.15	0.396	0.519	0.642	0.739	0.862	0.986	1.14	1.28	1.43	1.58

# FCH2 (Fe-Chrome Type 2)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 1.23±0.06

[Unit:Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.0108	0.0135	0.0173	0.0216	0.0270	0.0333	0.0433							
2.60	0.0121	0.0151	0.0193	0.0241	0.0302	0.0371	0.0483	0.0758						
2.30	0.0136	0.0171	0.0218	0.0273	0.0341	0.0420	0.0546	0.0857	0.111					
2.00	0.0157	0.0196	0.0251	0.0314	0.0392	0.0483	0.0628	0.0986	0.128					
1.80	0.0174	0.0218	0.0279	0.0349	0.0436	0.0536	0.0697	0.110	0.142					
1.60	0.0196	0.0245	0.0314	0.0392	0.0490	0.0603	0.0784	0.123	0.160					
1.40	0.0224	0.0280	0.0359	0.0448	0.0560	0.0690	0.0897	0.141	0.183					
1.20	0.0261	0.0327	0.0418	0.0523	0.0654	0.0805	0.105	0.164	0.214					
1.00	0.0314	0.0392	0.0502	0.0628	0.0784	0.0965	0.126	0.197	0.256					
0.90		0.0436	0.0558	0.0697	0.0872	0.107	0.139	0.219	0.285	0.445	0.593			
0.80		0.0490	0.0628	0.0784	0.0981	0.121	0.157	0.246	0.320	0.500	0.667			
0.70			0.0717	0.0897	0.112	0.138	0.179	0.282	0.366	0.572	0.763			
0.60			0.0837	0.105	0.131	0.161	0.209	0.329	0.427	0.667	0.890			
0.50			0.100	0.126	0.157	0.193	0.251	0.394	0.513	0.801	1.07			
0.45			0.112	0.139	0.174	0.215	0.279	0.438	0.569	0.890	1.19	1.78		
0.40					0.196	0.241	0.314	0.493	0.641	1.00	1.33	2.00		
0.35						0.276	0.359	0.563	0.732	1.14	1.53	2.29		
0.32						0.302	0.392	0.616	0.801	1.25	1.67	2.50		
0.29							0.433	0.680	0.884	1.38	1.84	2.76	5.52	
0.26							0.483	0.758	0.986	1.54	2.05	3.08	6.16	12.3
0.23								0.857	1.11	1.74	2.32	3.48	6.96	13.9
0.20								0.986	1.28	2.00	2.67	4.00	8.01	16.0
0.18								1.10	1.42	2.22	2.97	4.45	8.90	17.8
0.16										2.50	3.34	5.00	10.0	20.0
0.14										2.86	3.81	5.72	11.4	22.9
0.12											4.45	6.67	13.3	26.7
0.10												8.01	16.0	32.0
0.08												10.0	20.0	40.0

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **Kanthal A-1**

## **Fe-Chrome**

# Alloys : Kanthal A-1 (Fe-Chrome)

A high temperature alloy used up to an exothermic temperature of 1,400°C. Commonly used in high temperature furnaces in the heat treatment, ceramic glass, steel and electronics industries. It has better oxidation resistance than AF at temperatures above 1,300°C.

Electrical Resistivity [μΩm]
1.45

Thermal Expansion Coefficient ×10-6/	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
15.0	7.10	1500	1400

化学成分	Cr	Al	Fe	その他
(%)	22	5.8	BAL	Fe+Special Additives

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
Coefficient	1.000	1.000	1.000	1.000	1.000	1.010	1.020	1.030	1.030	1.030	1.040	1.040	1.040	1.040	1.050

Alloys	Type	Diameter (mm)	
A-1	Wire	φ10.0~1.00	
A-1	Ribbon	t=2.0、2.5、3.0	w=20、25、30

# Kanthal A-1 (Fe-Chrome)

## Resistance • Length • Weight

Wire

Electrical Resistivity (20°CμΩm) 1.45

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
10.00	±0.06	78.50	±5	0.01847	1.794	557.4
9.50	±0.05	70.85	±5	0.02047	1.988	503.0
8.25	±0.05	53.43	±5	0.02714	2.636	379.3
8.00	±0.05	50.24	±5	0.02886	2.803	356.7
6.00	±0.04	28.26	±5	0.05131	4.984	200.6
5.00	±0.03	19.63	±5	0.07389	7.177	139.3
4.50	±0.03	15.90	±5	0.09122	8.860	112.9
4.00	±0.03	12.56	±5	0.1154	11.21	89.18
3.50	±0.03	9.616	±5	0.1508	14.65	68.28
3.25	±0.03	8.292	±5	0.1749	16.99	58.87
3.20	±0.03	8.038	±5	0.1804	17.52	57.07
3.00	±0.03	7.065	±5	0.2052	19.94	50.16
2.90	±0.02	6.602	±5	0.2196	21.33	46.87
2.80	±0.02	6.154	±5	0.2356	22.89	43.70
2.60	±0.02	5.307	±5	0.2732	26.54	37.68
2.50	±0.02	4.906	±5	0.2955	28.71	34.83
2.30	±0.02	4.153	±5	0.3492	33.92	29.48
2.00	±0.02	3.140	±5	0.4618	44.86	22.29
1.80	±0.02	2.543	±5	0.5701	55.38	18.06
1.60	±0.02	2.010	±5	0.7215	70.09	14.27
1.50	±0.02	1.766	±5	0.8209	79.74	12.54
1.40	±0.02	1.539	±5	0.9424	91.54	10.92
1.30	±0.02	1.327	±5	1.093	106.2	9.419
1.20	±0.02	1.130	±5	1.283	124.6	8.026
1.10	±0.02	0.9499	±5	1.527	148.3	6.744
1.00	±0.02	0.7850	±5	1.847	179.4	5.574

# Kanthal A-1 (Fe-Chrome)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 1.45 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
8.25	63.6	88.8	111	135	167	200	241	281	326	370
8.00	52.5	73.3	92.5	111	133	163	200	233	266	303
6.00	41.4	57.7	72.5	88.1	109	130	155	185	215	241
5.00	31.8	43.7	55.5	66.6	82.9	100	121	141	163	185
4.50	26.6	37.0	47.4	57.0	69.6	85.1	104	118	141	159
4.00	22.9	31.1	40.0	48.1	59.2	69.6	83.6	98.4	118	133
3.50	18.5	25.2	32.6	39.2	48.8	57.7	71.0	83.6	96.2	111
3.20	16.3	22.2	28.9	34.0	42.2	50.3	61.4	72.5	84.4	96.2
2.90	13.9	19.2	25.2	29.6	36.3	43.7	53.3	62.2	72.5	82.1
2.60	11.5	16.3	20.7	25.2	31.1	37.0	45.9	53.3	61.4	68.8
2.30	9.77	13.4	17.8	21.5	25.9	31.1	38.5	44.4	51.1	58.5
2.00	8.14	11.1	14.8	17.8	21.5	25.9	30.3	36.3	41.4	47.4
1.80	7.18	9.77	12.8	15.5	18.5	22.2	24.4	31.1	35.5	40.7
1.60	6.07	8.36	11.1	13.0	15.5	19.2	22.9	25.9	30.3	34.0
1.50	5.62	7.70	10.1	11.8	14.4	17.0	20.7	23.7	27.4	31.1
1.40	5.18	7.03	9.25	10.8	13.3	15.5	19.2	21.5	25.2	28.9
1.30	4.74	6.44	8.36	9.84	12.0	14.1	17.0	19.2	22.2	25.9
1.20	4.37	5.77	7.77	8.73	10.4	11.9	14.8	17.0	20.0	22.9
1.10	3.85	5.18	6.66	7.99	9.62	11.4	13.5	15.5	17.8	20.0
1.00	3.48	4.51	5.92	6.96	8.51	9.99	11.5	13.0	14.8	17.0

(\* )Reference value

# Kanthal A-1 (Fe-Chrome)

## Conductor resistance · Length · Weight

Ribbon Electrical Resistivity (20°C μΩm) 1.45

[Unit: Ω/m]

Diameter (mm)	Cross-sectional area (mm <sup>2</sup> )	Conductor resistance tolerance (%)	Conductor resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
3.0×30	88.20	±5	0.01611	1.565	639.0
2.0×25	49.00	±5	0.02900	2.817	355.0
2.5×25	61.25	±5	0.02320	2.254	443.8
2.0×20	39.20	±5	0.03625	3.521	284.0

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **Kanthal AF**

## **Fe-Chrome**



# Alloys : Kanthal AF (Fe-Chrome)

It is a high-temperature alloy that can be used at heat generation temperatures up to 1,400°C. It has improved shape stability, especially at high temperatures.

## Electrical Resistivity [ $\mu\Omega\text{m}$ ]

1.39

Thermal Expansion Coefficient $\times 10^{-6}/$	Density $\text{g/cm}^3$ (20°C)	Melting Point °C	Max Operating Temperature °C
15.0	7.15	1500	1300

Chemical Composition	Cr	Al	Fe
(%)	22	5.3	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300
Coefficient	1.000	1.000	1.010	1.010	1.020	1.030	1.040	1.040	1.050	1.050	1.050	1.060	1.060	1.060

Alloys	Type	Diameter (mm)	
AF	Wire	$\phi 10.00 \sim 0.30$	
AF	Ribbon	t=1.0、1.2、1.5、2.0、2.5、3.0	w=10、15、20、25、30

# Kanthal AF (Fe-Chrome)

## Resistance • Length • Weight

Wire

Electrical Resistivity (20°CμΩm) 1.39

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
10.00	±0.06	78.50	±5	0.01771	1.782	561.3
8.00	±0.05	50.24	±5	0.02767	2.784	359.2
7.50	±0.05	44.16	±5	0.03148	3.167	315.7
6.50	±0.05	33.17	±5	0.04191	4.217	237.1
6.00	±0.04	28.26	±5	0.04919	4.949	202.1
5.50	±0.04	23.75	±5	0.05854	5.890	169.8
5.00	±0.04	19.63	±5	0.07083	7.127	140.3
4.50	±0.03	15.90	±5	0.08744	8.798	113.7
4.00	±0.03	12.56	±5	0.1107	11.14	89.80
3.50	±0.03	9.616	±5	0.1445	14.54	68.76
3.20	±0.03	8.038	±5	0.1729	17.40	57.47
3.00	±0.03	7.065	±5	0.1967	19.80	50.51
2.90	±0.03	6.602	±5	0.2105	21.18	47.20
2.70	±0.03	5.723	±5	0.2429	24.44	40.92
2.60	±0.02	5.307	±5	0.2619	26.36	37.94
2.50	±0.02	4.906	±5	0.2833	28.51	35.08
2.30	±0.02	4.153	±5	0.3347	33.68	29.69
2.00	±0.02	3.140	±5	0.4427	44.54	22.45
1.80	±0.02	2.543	±5	0.5465	54.99	18.19
1.60	±0.02	2.010	±5	0.6917	69.60	14.37
1.50	±0.02	1.766	±5	0.7870	79.18	12.63
1.40	±0.02	1.539	±5	0.9034	90.90	11.00
1.30	±0.02	1.327	±5	1.048	105.4	9.486
1.20	±0.02	1.130	±5	1.230	123.7	8.082
1.10	±0.02	0.9499	±5	1.463	147.2	6.791
1.00	±0.02	0.7850	±5	1.771	178.2	5.613
0.90	±0.014	0.6359	±5	2.186	220.0	4.546
0.85	±0.014	0.5672	±5	2.451	246.6	4.055
0.80	±0.014	0.5024	±5	2.767	278.4	3.592
0.75	±0.014	0.4416	±5	3.148	316.7	3.157
0.70	±0.014	0.3847	±5	3.614	363.6	2.750
0.65	±0.014	0.3317	±5	4.191	421.7	2.371
0.60	±0.014	0.2826	±5	4.919	494.9	2.021
0.55	±0.012	0.2375	±5	5.854	589.0	1.698
0.50	±0.012	0.1963	±5	7.083	712.7	1.403
0.45	±0.012	0.1590	±5	8.744	879.8	1.137
0.40	±0.012	0.1256	±5	11.07	1114	0.8980
0.35	±0.012	0.09616	±5	14.45	1454	0.6876
0.30	±0.010	0.07065	±5	19.67	1980	0.5051

# Kanthal AF (Fe-Chrome)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (20°CμΩm) 1.39 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
8.00	67.1	93.6	117	143	176	211	254	296	343	390
6.50	49.1	68.6	87.4	105	129	154	189	220	254	285
6.00	43.7	60.8	76.4	92.8	115	137	164	195	226	254
5.50	38.2	53.8	75.7	81.9	101	121	148	172	199	226
5.00	33.5	46.0	58.5	70.2	87.4	105	128	148	172	195
4.50	28.1	39.0	49.9	60.1	73.3	89.7	109	125	148	168
4.00	24.2	32.8	42.1	50.7	62.4	73.3	88.1	104	124	140
3.50	19.5	26.5	34.3	41.3	51.5	60.8	74.9	88.1	101	117
3.20	17.2	23.4	30.4	35.9	44.5	53.0	64.7	76.4	88.9	101
2.90	14.7	20.3	26.5	31.2	38.2	46.0	56.2	65.5	76.4	86.6
2.60	12.1	17.2	21.8	26.5	32.8	39.0	48.4	56.2	64.7	72.5
2.30	10.3	14.1	18.7	22.6	27.3	32.8	40.6	46.8	53.8	61.6
2.00	8.58	11.7	15.6	18.7	22.6	27.3	32.0	38.2	43.7	49.9
1.80	7.57	10.3	13.5	16.4	19.5	23.4	25.7	32.8	37.4	42.9
1.60	6.40	8.81	11.7	13.7	16.4	20.3	24.2	27.3	32.0	35.9
1.50	5.93	8.11	10.6	12.5	15.2	17.9	21.8	25.0	28.9	32.8
1.40	5.46	7.41	9.75	11.4	14.0	16.4	20.3	22.6	26.5	30.4
1.30	4.99	6.79	8.81	10.4	12.6	14.8	17.9	20.3	23.4	27.3
1.20	4.60	6.08	8.19	9.20	10.9	12.6	15.6	17.9	21.1	24.2
1.10	4.06	5.46	7.02	8.42	10.1	12.0	14.2	16.4	18.7	21.1
1.00	3.67	4.76	6.24	7.33	8.97	10.5	12.1	13.7	15.6	17.9
0.90	3.20	4.29	5.54	6.40	7.80	9.20	10.9	12.5	14.2	16.4
0.85	3.04	3.98	5.15	6.01	7.25	8.42	10.0	11.5	13.3	15.1
0.80	2.73	3.67	4.76	5.46	6.63	7.80	9.20	10.5	12.1	13.7
0.75	2.57	3.35	4.37	5.07	6.08	7.02	8.35	9.67	10.9	12.5
0.70	2.34	3.04	3.98	4.60	5.54	6.47	7.57	8.58	10.1	11.5
0.65	2.18	2.81	3.67	4.21	5.07	5.85	6.79	7.80	9.05	10.3
0.60	1.95	2.50	3.28	3.74	4.52	5.30	6.08	7.02	8.03	9.36
0.55	1.79	2.26	2.96	3.35	4.06	4.68	5.46	6.24	7.18	8.19
0.50	1.56	2.03	2.65	2.96	3.59	4.13	4.91	5.54	6.40	7.18
0.45	1.40	1.79	2.26	2.57	3.12	3.59	4.06	4.60	5.23	5.93
0.40	1.17	1.48	1.95	2.26	2.65	3.04	3.51	4.06	4.60	5.23
0.35	0.983	1.25	1.64	1.95	2.26	2.57	2.89	3.35	3.74	4.29

(\* )Reference value

# Kanthal AF (Fe-Chrome)

## Conductor resistance · Length · Weight

Ribbon

Electrical Resistivity (20°C μΩm) 1.39

[Unit: Ω/m]

Diameter (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
3.0×30	88.20	±5	0.01544	1.554	643.5
3.0×25	73.50	±5	0.01853	1.865	536.3
3.0×20	58.80	±5	0.02317	2.331	429.0
2.5×25	61.25	±5	0.02224	2.238	446.9
2.5×20	49.00	±5	0.02780	2.797	357.5
2.0×25	49.00	±5	0.02780	2.797	357.5
2.0×20	39.20	±5	0.03475	3.497	286.0
2.0×15	29.40	±5	0.04633	4.662	214.5
1.5×20	29.40	±5	0.04633	4.662	214.5
1.5×15	22.05	±5	0.06178	6.216	160.9
1.2×15	17.64	±5	0.07722	7.770	128.7
1.2×12	14.11	±5	0.09653	9.713	103.0
1.0×10	9.80	±5	0.13900	13.99	71.5

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **Kanthal D**

## **Fe-Chrome**

# Alloys : Kanthal D (Fe-Chrome)

A resistive alloy suitable for use in heating element temperatures up to 1,300°C, used primarily for appliances.

This alloy is widely used for various appliances including furnaces because of its higher resistance, lower specific gravity, and higher heat resistance than austenitic nickel-chromium.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]
1.35

Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Melting Point °C	Max Operating Temperature °C
15.0	7.25	1500	1300

Chemical Composition	Cr	Al	Fe
(%)	22	4.8	BAL

## Resistance increase by temperature

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300
Coefficient	1.000	1.000	1.010	1.010	1.020	1.030	1.040	1.060	1.060	1.070	1.070	1.070	1.080	1.080

Alloys	Type	Diameter (mm)
D	Wire	$\phi 6.50 \sim 0.13$

# Kanthal D (Fe-Chrome)

## Resistance • Length • Weight

Wire

Electrical Resistivity (20°C μΩm) 1.35

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.50	±0.04	33.17	±5	0.04070	4.159	240.5
5.50	±0.03	23.75	±5	0.05685	5.809	172.2
5.00	±0.03	19.63	±5	0.06879	7.028	142.3
4.00	±0.03	12.56	±5	0.1075	10.98	91.06
3.50	±0.03	9.616	±5	0.1404	14.34	69.72
3.20	±0.03	8.038	±5	0.1679	17.16	58.28
2.90	±0.02	6.602	±5	0.2045	20.89	47.86
2.60	±0.02	5.307	±5	0.2544	25.99	38.47
2.30	±0.02	4.153	±5	0.3251	33.22	30.11
2.00	±0.02	3.140	±5	0.4299	43.93	22.77
1.80	±0.02	2.543	±5	0.5308	54.23	18.44
1.60	±0.02	2.010	±5	0.6718	68.64	14.57
1.50	±0.02	1.766	±5	0.7643	78.09	12.81
1.40	±0.02	1.539	±5	0.8774	89.65	11.15
1.30	±0.02	1.327	±5	1.018	104.0	9.618
1.20	±0.02	1.130	±5	1.194	122.0	8.195
1.10	±0.02	0.9499	±5	1.421	145.2	6.886
1.00	±0.02	0.7850	±5	1.720	175.7	5.691
0.90	±0.014	0.6359	±5	2.123	216.9	4.610
0.85	±0.014	0.5672	±5	2.380	243.2	4.112
0.80	±0.014	0.5024	±5	2.687	274.5	3.642
0.75	±0.014	0.4416	±5	3.057	312.4	3.201
0.70	±0.014	0.3847	±5	3.510	358.6	2.789
0.65	±0.014	0.3317	±5	4.070	415.9	2.405
0.60	±0.014	0.2826	±5	4.777	488.1	2.049
0.55	±0.012	0.2375	±5	5.685	580.9	1.722
0.50	±0.012	0.1963	±5	6.879	702.8	1.423
0.45	±0.012	0.1590	±5	8.493	867.7	1.152
0.40	±0.012	0.1256	±5	10.75	1098	0.9106
0.35	±0.012	0.09616	±5	14.04	1434	0.6972
0.32	±0.010	0.08038	±5	16.79	1716	0.5828
0.30	±0.010	0.07065	±5	19.11	1952	0.5122
0.29	±0.010	0.06602	±5	20.45	2089	0.4786
0.26	±0.010	0.05307	±5	25.44	2599	0.3847
0.25	±0.010	0.04906	±5	27.52	2811	0.3557
0.23	±0.010	0.04153	±5	32.51	3322	0.3011
0.20	±0.010	0.03140	±5	42.99	4393	0.2277
0.18	±0.008	0.02543	±5	53.08	5423	0.1844
0.16	±0.008	0.02010	±5	67.18	6864	0.1457
0.13	±0.008	0.01327	±5	101.8	10397	0.09618

# Kanthal D (Fe-Chrome)

## Temperature Current Characteristics · Diameter · Temperature · Current

Wire Electrical Resistivity (20°CμΩm) 1.35 [Unit: Ampere]

Diameter (mm)	200 (°C)	300 (°C)	400 (°C)	500 (°C)	600 (°C)	700 (°C)	800 (°C)	900 (°C)	1000 (°C)	1100 (°C)
6.50	50.4	70.4	89.6	108	132	158	194	226	260	292
5.50	39.2	55.2	77.6	84.0	104	124	152	176	204	232
5.00	34.4	47.2	60.0	72.0	89.6	108	131	152	176	200
4.00	24.8	33.6	43.2	52.0	64.0	75.2	90.4	106	127	144
3.50	20.0	27.2	35.2	42.4	52.8	62.4	76.8	90.4	104	120
3.20	17.6	24.0	31.2	36.8	45.6	54.4	66.4	78.4	91.2	104
2.90	15.0	20.8	27.2	32.0	39.2	47.2	57.6	67.2	78.4	88.8
2.60	12.4	17.6	22.4	27.2	33.6	40.0	49.6	57.6	66.4	74.4
2.30	10.6	14.5	19.2	23.2	28.0	33.6	41.6	48.0	55.2	63.2
2.00	8.80	12.0	16.0	19.2	23.2	28.0	32.8	39.2	44.8	51.2
1.80	7.76	10.6	13.8	16.8	20.0	24.0	26.4	33.6	38.4	44.0
1.60	6.56	9.04	12.0	14.0	16.8	20.8	24.8	28.0	32.8	36.8
1.50	6.08	8.32	10.9	12.8	15.6	18.4	22.4	25.6	29.6	33.6
1.40	5.60	7.60	10.0	11.7	14.4	16.8	20.8	23.2	27.2	31.2
1.30	5.12	6.96	9.04	10.6	13.0	15.2	18.4	20.8	24.0	28.0
1.20	4.72	6.24	8.40	9.44	11.2	12.9	16.0	18.4	21.6	24.8
1.10	4.16	5.60	7.20	8.64	10.4	12.3	14.6	16.8	19.2	21.6
1.00	3.76	4.88	6.40	7.52	9.20	10.8	12.4	14.0	16.0	18.4
0.90	3.28	4.40	5.68	6.56	8.00	9.44	11.2	12.8	14.6	16.8
0.85	3.12	4.08	5.28	6.16	7.44	8.64	10.2	11.8	13.6	15.4
0.80	2.80	3.76	4.88	5.60	6.80	8.00	9.44	10.8	12.4	14.0
0.75	2.64	3.44	4.48	5.20	6.24	7.20	8.56	9.92	11.2	12.8
0.70	2.40	3.12	4.08	4.72	5.68	6.64	7.76	8.80	10.3	11.8
0.65	2.24	2.88	3.76	4.32	5.20	6.00	6.96	8.00	9.28	10.6
0.60	2.00	2.56	3.36	3.84	4.64	5.44	6.24	7.20	8.24	9.60
0.55	1.84	2.32	3.04	3.44	4.16	4.80	5.60	6.40	7.36	8.40
0.50	1.60	2.08	2.72	3.04	3.68	4.24	5.04	5.68	6.56	7.36
0.45	1.44	1.84	2.32	2.64	3.20	3.68	4.16	4.72	5.36	6.08
0.40	1.20	1.52	2.00	2.32	2.72	3.12	3.60	4.16	4.72	5.36
0.35	1.01	1.28	1.68	2.00	2.32	2.64	2.96	3.44	3.84	4.40
0.32	0.904	1.16	1.49	1.76	2.08	2.32	2.72	3.12	3.52	3.92
0.29	0.800	1.04	1.32	1.52	1.84	2.08	2.40	2.72	3.04	3.44
0.26	0.704	0.904	1.16	1.36	1.60	1.84	2.08	2.32	2.64	2.96
0.23	0.608	0.800	1.00	1.16	1.36	1.52	1.76	2.00	2.24	2.56
0.20	0.512	0.672	0.840	0.968	1.14	1.30	1.48	1.68	1.92	2.08
0.18	0.448	0.592	0.736	0.848	1.00	1.14	1.30	1.48	1.60	1.84
0.16	0.392	0.512	0.632	0.728	0.848	0.984	1.12	1.28	1.43	1.58
0.13	0.304	0.400	0.488	0.568	0.656	0.760	0.872	0.976	1.10	1.20

(\*) Reference value

※Kanthal D is registered trademarks of Sandvik AB.



---

# **CN49 (CuNi44)**

## **Copper Nickel No 49**

# Alloys : CN49 (CuNi44 Copper Nickel)

[JIS C 2532]

Heat-resistant, oxidation-resistant, and can be used up to 400°C. Non-magnetic, small temperature coefficient at room temperature.

Good processability such as thin wire and rolling, and good solderability.

Used in precision grade AC resistors, precision resistors for communication equipment, etc.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
GCN49	C 2532	0.49 $\pm$ 0.03	* $\pm$ 40

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
-41	13.5	0.41	23	8.90	1240	400

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	0.5~2.5	42~48	$\geq$ 99

Alloys	Type	Diameter (mm)	
CN49W	Wire	$\phi$ 6.00~0.025	
CN49R	Ribbon	t=2.90~0.08	w=40~0.4 (Depends on thickness)
CN49P	Plate	Please consult	
CN49	Foil	Please consult	

# CN49 (CuNi44 Copper Nickel)

## Resistance·Length·Weight

Wire Electrical Resistivity (23°CμΩm) **0.49±0.03**

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0173	3.97	252
5.50	±0.063	23.76	±5	0.0206	4.73	211
5.00	±0.063	19.64	±5	0.0250	5.72	175
4.50	±0.063	15.90	±5	0.0308	7.06	142
4.00	±0.063	12.57	±5	0.0390	8.94	112
3.50	±0.050	9.621	±5	0.0509	11.7	85.6
3.20	±0.050	8.042	±5	0.0609	14.0	71.6
2.90	±0.050	6.605	±5	0.0742	17.0	58.8
2.60	±0.040	5.309	±5	0.0923	21.2	47.3
2.30	±0.040	4.155	±5	0.118	27.0	37.0
2.00	±0.040	3.142	±5	0.156	35.8	28.0
1.80	±0.040	2.545	±5	0.193	44.2	22.6
1.60	±0.032	2.011	±5	0.244	55.9	17.9
1.50	±0.032	1.767	±5	0.277	63.6	15.7
1.40	±0.032	1.539	±5	0.318	73.0	13.7
1.30	±0.032	1.327	±5	0.369	84.7	11.8
1.20	±0.025	1.131	±5	0.433	99.3	10.1
1.10	±0.025	0.9503	±6	0.516	118	8.46
1.00	±0.025	0.7854	±6	0.624	143	6.99
0.90	±0.025	0.6362	±6	0.770	177	5.66
0.85	±0.025	0.5675	±6	0.864	198	5.05
0.80	±0.020	0.5027	±6	0.975	224	4.47
0.75	±0.020	0.4418	±6	1.11	254	3.93
0.70	±0.020	0.3848	±6	1.27	292	3.43
0.65	±0.020	0.3318	±6	1.48	339	2.95
0.60	±0.020	0.2827	±6	1.73	397	2.52
0.55	±0.016	0.2376	±7	2.06	473	2.11
0.50	±0.016	0.1964	±7	2.50	572	1.75
0.45	±0.016	0.1590	±7	3.08	706	1.42
0.40	±0.016	0.1257	±7	3.90	894	1.12
0.35	±0.013	0.09621	±7	5.09	1168	0.856
0.32	±0.013	0.08042	±7	6.09	1397	0.716
0.29	±0.013	0.06605	±7	7.42	1701	0.588
0.26	±0.010	0.05309	±8	9.23	2116	0.473
0.23	±0.010	0.04155	±8	11.8	2704	0.370
0.20	±0.010	0.03142	±8	15.6	3577	0.280
0.18	±0.008	0.02545	±8	19.3	4415	0.226
0.16	±0.008	0.02011	±8	24.4	5588	0.179
0.15	±0.008	0.01767	±8	27.7	6358	0.157
0.14	±0.008	0.01539	±8	31.8	7299	0.137
0.13	±0.006	0.01327	±9	36.9	8465	0.118
0.12	±0.006	0.01131	±9	43.3	9935	0.101
0.11	±0.006	0.009503	±9	51.6	11823	0.0846
0.10	±0.006	0.007854	±9	62.4	14306	0.0699
0.09	±0.005	0.006362	±10	77.0	17662	0.0566
0.08	±0.005	0.005027	±10	97.5	22353	0.0447
0.07	±0.005	0.003848	±10	127	29196	0.0343
0.06	±0.004	0.002827	±11	173	39739	0.0252
0.05	±0.004	0.001964	±11	250	57224	0.0175
0.04	±0.003	0.001257	±12	390	89413	0.0112
0.03	±0.003	0.0007069	±12	693	158956	0.00629
0.025	±0.002	0.0004909	±13	998	228896	0.00437

# CN49 (CuNi44 Copper Nickel)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 0.49±0.03 [Unit: Ampere]

Diameter (mm)	50 (°C)	100 (°C)	150 (°C)	200 (°C)	250 (°C)	300 (°C)	350 (°C)	400 (°C)
6.00	23.0	33.0	59.6	75.0	90.2	106	121	138
5.50	20.6	37.9	52.4	66.0	79.3	93.3	107	122
5.00	17.8	32.8	45.5	57.4	68.9	81.0	92.8	105
4.50	15.3	28.2	39.0	49.2	59.1	69.6	79.6	90.5
4.00	13.3	24.6	34.2	42.8	51.2	60.2	68.7	77.8
3.50	11.0	20.3	28.1	35.3	42.2	49.5	56.6	64.1
3.20	9.60	17.7	24.5	31.0	37.0	43.3	49.4	56.2
2.90	8.33	15.8	21.4	26.8	32.0	37.6	42.9	48.7
2.60	7.46	13.7	18.8	23.7	28.2	33.0	37.8	42.5
2.30	6.24	11.4	15.9	19.8	23.7	27.6	31.6	35.5
2.00	5.10	9.36	12.9	16.2	19.3	22.6	25.8	29.1
1.80	4.65	8.46	11.6	14.5	17.3	20.1	22.9	25.9
1.60	3.94	7.17	9.87	12.3	14.6	17.1	19.4	21.8
1.50	3.58	6.52	8.98	11.2	13.3	15.6	17.6	19.9
1.40	3.25	5.91	8.14	10.2	12.1	14.1	16.1	18.0
1.30	3.06	5.57	7.68	9.60	11.3	13.2	15.0	16.7
1.20	2.72	5.00	6.82	8.53	10.1	11.7	13.3	14.9
1.10	2.50	4.42	6.05	7.53	8.93	10.4	11.7	13.2
1.00	2.12	3.88	5.30	6.62	7.85	9.09	10.3	11.6
0.90	1.80	3.30	4.61	5.63	6.67	7.73	8.76	9.82
0.80	1.63	3.00	4.09	5.10	6.03	6.94	7.86	8.55
0.70	1.35	2.49	3.38	4.22	5.01	5.76	6.51	7.09
0.65	1.21	2.24	3.05	3.80	4.50	5.18	5.87	6.38
0.60	1.14	2.12	2.89	3.59	4.24	4.86	5.48	6.07
0.55	1.02	1.88	2.56	3.19	3.76	4.32	4.87	5.38
0.50	0.890	1.66	2.25	2.79	3.30	3.97	4.28	4.72
0.45	0.733	1.43	1.95	2.44	2.87	3.29	3.70	4.10
0.40	0.701	1.30	1.77	2.19	2.58	2.95	3.32	3.68
0.35	0.587	1.09	1.49	1.83	2.17	2.47	2.79	3.09
0.32	0.522	0.969	1.32	1.64	1.93	2.20	2.47	2.75
0.29	0.459	0.851	1.16	1.43	1.69	1.94	2.17	2.40
0.26	0.426	0.785	1.07	1.32	1.55	1.77	1.97	2.19
0.23	0.366	0.672	0.914	1.13	1.33	1.51	1.70	1.87
0.20	0.303	0.557	0.757	0.943	1.10	1.25	1.40	1.50
0.18	0.272	0.503	0.684	0.843	0.987	1.13	1.26	1.42
0.16	0.230	0.427	0.574	0.716	0.863	0.956	1.07	1.20
0.15	0.214	0.396	0.537	0.664	0.776	0.888	0.989	1.11
0.14	0.195	0.360	0.490	0.604	0.706	0.808	0.900	1.01
0.13	0.185	0.337	0.459	0.567	0.662	0.765	0.842	0.927
0.12	0.163	0.302	0.413	0.509	0.594	0.678	0.750	0.832
0.11	0.145	0.270	0.367	0.459	0.528	0.602	0.670	0.738
0.10	0.126	0.233	0.317	0.392	0.458	0.523	0.583	0.644
0.09	0.112	0.207	0.281	0.347	0.406	0.463	0.516	0.567
0.08	0.0975	0.181	0.247	0.305	0.353	0.403	0.450	0.488
0.07	0.0814	0.151	0.220	0.256	0.291	0.338	0.376	0.412
0.06	0.0685	0.127	0.172	0.201	0.246	0.282	0.312	0.344
0.05	0.0533	0.0688	0.134	0.164	0.192	0.219	0.244	0.268
0.04	0.0398	0.0742	0.100	0.123	0.144	0.164	0.182	0.201
0.03	0.0269	0.0502	0.0679	0.0834	0.0978	0.111	0.123	0.136
0.025	0.0217	0.0402	0.0543	0.0668	0.0782	0.0886	0.0981	0.108

# CN49 (CuNi44 Copper Nickel)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) **0.49±0.03**

[Unit: Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00431	0.00539	0.00690	0.00862	0.0108	0.0133	0.0172							
2.60	0.00481	0.00601	0.00769	0.00962	0.0120	0.0148	0.0192	0.0302						
2.30	0.00543	0.00679	0.0087	0.0109	0.0136	0.0167	0.0217	0.0341	0.0444					
2.00	0.00625	0.00781	0.0100	0.0125	0.0156	0.0192	0.0250	0.0393	0.0510					
1.80	0.00694	0.00868	0.0111	0.0139	0.0174	0.0214	0.0278	0.0436	0.0567					
1.60	0.00781	0.00977	0.0125	0.0156	0.0195	0.0240	0.0313	0.0491	0.0638					
1.40	0.00893	0.0112	0.0143	0.0179	0.0223	0.0275	0.0357	0.0561	0.0729					
1.20	0.0104	0.0130	0.0167	0.0208	0.0260	0.0321	0.0417	0.0654	0.0851					
1.00	0.0125	0.0156	0.0200	0.0250	0.0313	0.0385	0.0500	0.0785	0.102					
0.90		0.0174	0.0222	0.0278	0.0347	0.0427	0.0556	0.0873	0.113	0.177	0.236			
0.80		0.0195	0.0250	0.0313	0.0391	0.0481	0.0625	0.0982	0.128	0.199	0.266			
0.70			0.0286	0.0357	0.0446	0.0549	0.0714	0.112	0.146	0.228	0.304			
0.60			0.0333	0.0417	0.0521	0.0641	0.0833	0.131	0.170	0.266	0.354			
0.50			0.0400	0.0500	0.0625	0.0769	0.100	0.157	0.204	0.319	0.425			
0.45			0.0444	0.0556	0.0694	0.0855	0.111	0.175	0.227	0.354	0.473	0.709		
0.40					0.0781	0.0962	0.125	0.196	0.255	0.399	0.532	0.798		
0.35						0.110	0.143	0.224	0.292	0.456	0.608	0.911		
0.32						0.120	0.156	0.245	0.319	0.498	0.665	1.00		
0.29							0.172	0.271	0.352	0.550	0.733	1.10	2.20	
0.26							0.192	0.302	0.393	0.613	0.818	1.23	2.45	4.91
0.23								0.341	0.444	0.694	0.925	1.39	2.77	5.55
0.20								0.393	0.510	0.798	1.06	1.60	3.19	6.38
0.18								0.436	0.567	0.886	1.18	1.77	3.54	7.09
0.16										0.997	1.33	1.99	3.99	7.98
0.14										1.14	1.52	2.28	4.56	9.11
0.12											1.77	2.66	5.32	10.6
0.10												3.19	6.38	12.8
0.08												3.99	7.98	16.0

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

---

# **CN30 (CuNi23)**

## **Copper Nickel No 30**

# Alloys : CN30 (CuNi23 Copper Nickel)

[JIS C 2532]

Heat-resistant, oxidation-resistant, and can be used up to 300°C.

Non-magnetic and slightly less workable than Type 49.

Used for low-temperature heating elements, heaters for circuit breakers, and other medium-resistance resistance materials.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
GCN30	C 2532	0.30 $\pm$ 0.024	* 180

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
17.5	8.90	1150	300

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	$\leq 1.5$	20~25	$\geq 99$

Alloys	Type	Diameter (mm)	
CN30W	Wire	$\phi 6.00 \sim 0.05$	
CN30R	Ribbon	t=2.90~0.05	w=40~0.4 (Depends on thickness)
CN30P	Plate	Please consult	
CN30	Foil	Please consult	

# CN30 (CuNi23 Copper Nickel)

## Resistance·Length·Weight

Wire

Electrical Resistivity (23°CμΩm)  $0.30 \pm 0.024$

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0106	3.97	252
5.50	±0.063	23.76	±5	0.0126	4.73	211
5.00	±0.063	19.64	±5	0.0153	5.72	175
4.50	±0.063	15.90	±5	0.0189	7.06	142
4.00	±0.063	12.57	±5	0.0239	8.94	112
3.50	±0.050	9.621	±5	0.0312	11.7	85.6
3.20	±0.050	8.042	±5	0.0373	14.0	71.6
2.90	±0.050	6.605	±5	0.0454	17.0	58.8
2.60	±0.040	5.309	±5	0.0565	21.2	47.3
2.30	±0.040	4.155	±5	0.0722	27.0	37.0
2.00	±0.040	3.142	±5	0.0955	35.8	28.0
1.80	±0.040	2.545	±5	0.118	44.2	22.6
1.60	±0.032	2.011	±5	0.149	55.9	17.9
1.50	±0.032	1.767	±5	0.170	63.6	15.7
1.40	±0.032	1.539	±5	0.195	73.0	13.7
1.30	±0.032	1.327	±5	0.226	84.7	11.8
1.20	±0.025	1.131	±5	0.265	99.3	10.1
1.10	±0.025	0.9503	±6	0.316	118	8.46
1.00	±0.025	0.7854	±6	0.382	143	6.99
0.90	±0.025	0.6362	±6	0.472	177	5.66
0.85	±0.025	0.5675	±6	0.529	198	5.05
0.80	±0.020	0.5027	±6	0.597	224	4.47
0.75	±0.020	0.4418	±6	0.679	254	3.93
0.70	±0.020	0.3848	±6	0.780	292	3.43
0.65	±0.020	0.3318	±6	0.904	339	2.95
0.60	±0.020	0.2827	±6	1.06	397	2.52
0.55	±0.016	0.2376	±7	1.26	473	2.11
0.50	±0.016	0.1964	±7	1.53	572	1.75
0.45	±0.016	0.1590	±7	1.89	706	1.42
0.40	±0.016	0.1257	±7	2.39	894	1.12
0.35	±0.013	0.09621	±7	3.12	1168	0.856
0.32	±0.013	0.08042	±7	3.73	1397	0.716
0.29	±0.013	0.06605	±7	4.54	1701	0.588
0.26	±0.010	0.05309	±8	5.65	2116	0.473
0.23	±0.010	0.04155	±8	7.22	2704	0.370
0.20	±0.010	0.03142	±8	9.55	3577	0.280
0.18	±0.008	0.02545	±8	11.8	4415	0.226
0.16	±0.008	0.02011	±8	14.9	5588	0.179
0.15	±0.008	0.01767	±8	17.0	6358	0.157
0.14	±0.008	0.01539	±8	19.5	7299	0.137
0.13	±0.006	0.01327	±9	22.6	8465	0.118
0.12	±0.006	0.01131	±9	26.5	9935	0.101
0.11	±0.006	0.009503	±9	31.6	11823	0.0846
0.10	±0.006	0.007854	±9	38.2	14306	0.0699
0.09	±0.005	0.006362	±10	47.2	17662	0.0566
0.08	±0.005	0.005027	±10	59.7	22353	0.0447
0.07	±0.005	0.003848	±10	78.0	29196	0.0343
0.06	±0.004	0.002827	±11	106	39739	0.0252
0.05	±0.004	0.001964	±11	153	57224	0.0175



# CN30 (CuNi23 Copper Nickel)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 0.30±0.024 [Unit: Ampere]

Diameter (mm)	50 (°C)	100 (°C)	150 (°C)	200 (°C)	250 (°C)	300 (°C)	350 (°C)	400 (°C)
6.00	37.5	53.8	97.1	122	147	173	197	225
5.50	33.6	61.8	85.4	108	129	152	174	199
5.00	29.0	53.5	74.2	93.6	112	132	151	171
4.50	24.9	46.0	63.6	80.2	96.3	113	130	148
4.00	21.7	40.1	55.7	69.8	83.5	98.1	112	127
3.50	17.9	33.1	45.8	57.5	68.8	80.7	92.3	104
3.20	15.6	28.9	39.9	50.5	60.3	70.6	80.5	91.6
2.90	13.6	25.8	34.9	43.7	52.2	61.3	69.9	79.4
2.60	12.2	22.3	30.6	38.6	46.0	53.8	61.6	69.3
2.30	10.2	18.6	25.9	32.3	38.6	45.0	51.5	57.9
2.00	8.31	15.3	21.0	26.4	31.5	36.8	42.1	47.4
1.80	7.58	13.8	18.9	23.6	28.2	32.8	37.3	42.2
1.60	6.42	11.7	16.1	20.0	23.8	27.9	31.6	35.5
1.50	5.84	10.6	14.6	18.3	21.7	25.4	28.7	32.4
1.40	5.30	9.63	13.3	16.6	19.7	23.0	26.2	29.3
1.30	4.99	9.08	12.5	15.6	18.4	21.5	24.5	27.2
1.20	4.43	8.15	11.1	13.9	16.5	19.1	21.7	24.3
1.10	4.08	7.20	9.86	12.3	14.6	17.0	19.1	21.5
1.00	3.46	6.32	8.64	10.8	12.8	14.8	16.8	18.9
0.90	2.93	5.38	7.51	9.18	10.9	12.6	14.3	16.0
0.80	2.66	4.89	6.67	8.31	9.83	11.3	12.8	13.9
0.70	2.20	4.06	5.51	6.88	8.17	9.39	10.6	11.6
0.65	1.97	3.65	4.97	6.19	7.34	8.44	9.57	10.4
0.60	1.86	3.46	4.71	5.85	6.91	7.92	8.93	9.89
0.55	1.66	3.06	4.17	5.20	6.13	7.04	7.94	8.77
0.50	1.45	2.71	3.67	4.55	5.38	6.47	6.98	7.69
0.45	1.19	2.33	3.18	3.98	4.68	5.36	6.03	6.68
0.40	1.14	2.12	2.89	3.57	4.21	4.81	5.41	6.00
0.35	0.957	1.78	2.43	2.98	3.54	4.03	4.55	5.04
0.32	0.851	1.58	2.15	2.67	3.15	3.59	4.03	4.48
0.29	0.748	1.39	1.89	2.33	2.75	3.16	3.54	3.91
0.26	0.694	1.28	1.74	2.15	2.53	2.89	3.21	3.57
0.23	0.597	1.10	1.49	1.84	2.17	2.46	2.77	3.05
0.20	0.494	0.908	1.23	1.54	1.79	2.04	2.28	2.45
0.18	0.443	0.820	1.11	1.37	1.61	1.84	2.05	2.31
0.16	0.375	0.696	0.936	1.17	1.41	1.56	1.74	1.96
0.15	0.349	0.645	0.875	1.08	1.26	1.45	1.61	1.81
0.14	0.318	0.587	0.799	0.985	1.15	1.32	1.47	1.65
0.13	0.302	0.549	0.748	0.924	1.08	1.25	1.37	1.51
0.12	0.266	0.492	0.673	0.830	0.968	1.11	1.22	1.36
0.11	0.236	0.440	0.598	0.748	0.861	0.981	1.09	1.20
0.10	0.205	0.380	0.517	0.639	0.747	0.852	0.950	1.05
0.09	0.183	0.337	0.458	0.566	0.662	0.755	0.841	0.924
0.08	0.159	0.295	0.403	0.497	0.575	0.657	0.734	0.795
0.07	0.133	0.246	0.359	0.417	0.474	0.551	0.613	0.672
0.06	0.112	0.207	0.280	0.328	0.401	0.460	0.509	0.561
0.05	0.0869	0.112	0.218	0.267	0.313	0.357	0.398	0.437
0.04	0.0649	0.121	0.163	0.200	0.235	0.267	0.297	0.328
0.03	0.0438	0.0818	0.111	0.136	0.159	0.181	0.200	0.222
0.025	0.0354	0.0655	0.0885	0.109	0.127	0.144	0.160	0.176

# CN30 (CuNi23 Copper Nickel)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm)  $0.30 \pm 0.024$

[Unit: Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00264	0.00330	0.00422	0.00528	0.00660	0.00812	0.0106							
2.60	0.00294	0.00368	0.00471	0.00589	0.00736	0.00906	0.0118	0.0185						
2.30	0.00333	0.00416	0.00532	0.00665	0.00832	0.0102	0.0133	0.0209	0.0272					
2.00	0.00383	0.00478	0.00612	0.00765	0.00957	0.0118	0.0153	0.0240	0.0313					
1.80	0.00425	0.00531	0.00680	0.00850	0.0106	0.0131	0.0170	0.0267	0.0347					
1.60	0.00478	0.00598	0.00765	0.00957	0.0120	0.0147	0.0191	0.0300	0.0391					
1.40	0.00547	0.00683	0.00875	0.0109	0.0137	0.0168	0.0219	0.0343	0.0446					
1.20	0.00638	0.00797	0.0102	0.0128	0.0159	0.0196	0.0255	0.0401	0.0521					
1.00	0.00765	0.00957	0.0122	0.0153	0.0191	0.0235	0.0306	0.0481	0.0625					
0.90		0.0106	0.0136	0.0170	0.0213	0.0262	0.0340	0.0534	0.0694	0.109	0.145			
0.80		0.0120	0.0153	0.0191	0.0239	0.0294	0.0383	0.0601	0.0781	0.122	0.163			
0.70			0.0175	0.0219	0.0273	0.0336	0.0437	0.0687	0.0893	0.140	0.186			
0.60			0.0204	0.0255	0.0319	0.0392	0.0510	0.0801	0.104	0.163	0.217			
0.50			0.0245	0.0306	0.0383	0.0471	0.0612	0.0962	0.125	0.195	0.260			
0.45			0.0272	0.0340	0.0425	0.0523	0.0680	0.107	0.139	0.217	0.289	0.434		
0.40					0.0478	0.0589	0.0765	0.120	0.156	0.244	0.326	0.488		
0.35						0.0673	0.0875	0.137	0.179	0.279	0.372	0.558		
0.32						0.0736	0.0957	0.150	0.195	0.305	0.407	0.610		
0.29							0.106	0.166	0.216	0.337	0.449	0.673	1.35	
0.26							0.118	0.185	0.240	0.376	0.501	0.751	1.50	3.00
0.23								0.209	0.272	0.425	0.566	0.849	1.70	3.40
0.20								0.240	0.313	0.488	0.651	0.977	1.95	3.91
0.18								0.267	0.347	0.543	0.723	1.09	2.17	4.34
0.16										0.610	0.814	1.22	2.44	4.88
0.14										0.698	0.930	1.40	2.79	5.58
0.12											1.085	1.63	3.26	6.51
0.10												1.95	3.91	7.81
0.08												2.44	4.88	9.77

\*Allowable tolerance of conductor resistance : Width 10mm or more  $\pm 7\%$  , Width 10mm or less  $\pm 8\%$

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	$\pm 8$
	10above	$\pm 7$

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **CN15 (CuNi10)**

## **Copper Nickel No 15**

# Alloys : CN15 (CuNi10 Copper Nickel)

[JIS C 2532]

It is heat resistant, oxidation resistant, and can be used up to 250°C.  
It is non-magnetic and has better workability than copper for electrical applications.  
It is used for low-temperature heating elements and heaters for circuit breakers.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
GCN15	C 2532	0.15 $\pm$ 0.015	* 490

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
17.5	8.90	1100	250

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	$\leq 1.0$	8~12	$\geq 99$

Alloys	Type	Diameter (mm)	
CN15W	Wire	$\phi 6.00 \sim 0.06$	
CN15R	Ribbon	$t = 2.90 \sim 0.05$	$w = 40 \sim 0.4$ (Depends on thickness)
CN15P	Plate	Please consult	
CN15	Foil	Please consult	

# CN15 (CuNi10 Copper Nickel)

## Resistance·Length·Weight

Wire

Electrical Resistivity (23°CμΩm) 0.15±0.015

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.00531	3.97	252
5.50	±0.080	23.76	±5	0.00631	4.73	211
5.00	±0.080	19.64	±5	0.00764	5.72	175
4.50	±0.080	15.90	±5	0.00943	7.06	142
4.00	±0.080	12.57	±5	0.0119	8.94	112
3.50	±0.080	9.621	±5	0.0156	11.7	85.6
3.20	±0.060	8.042	±5	0.0187	14.0	71.6
2.90	±0.060	6.605	±5	0.0227	17.0	58.8
2.60	±0.060	5.309	±5	0.0283	21.2	47.3
2.30	±0.050	4.155	±5	0.0361	27.0	37.0
2.00	±0.050	3.142	±5	0.0477	35.8	28.0
1.80	±0.050	2.545	±5	0.0589	44.2	22.6
1.60	±0.040	2.011	±5	0.0746	55.9	17.9
1.50	±0.040	1.767	±5	0.0849	63.6	15.7
1.40	±0.040	1.539	±5	0.0974	73.0	13.7
1.30	±0.040	1.327	±5	0.113	84.7	11.8
1.20	±0.040	1.131	±5	0.133	99.3	10.1
1.10	±0.030	0.9503	±6	0.158	118	8.46
1.00	±0.030	0.7854	±6	0.191	143	6.99
0.90	±0.030	0.6362	±6	0.236	177	5.66
0.85	±0.030	0.5675	±6	0.264	198	5.05
0.80	±0.030	0.5027	±6	0.298	224	4.47
0.75	±0.025	0.4418	±6	0.340	254	3.93
0.70	±0.025	0.3848	±6	0.390	292	3.43
0.65	±0.025	0.3318	±6	0.452	339	2.95
0.60	±0.025	0.2827	±6	0.531	397	2.52
0.55	±0.020	0.2376	±7	0.631	473	2.11
0.50	±0.020	0.1964	±7	0.764	572	1.75
0.45	±0.020	0.1590	±7	0.943	706	1.42
0.40	±0.015	0.1257	±7	1.19	894	1.12
0.35	±0.015	0.09621	±7	1.56	1168	0.856
0.32	±0.015	0.08042	±7	1.87	1397	0.716
0.29	±0.012	0.06605	±7	2.27	1701	0.588
0.26	±0.012	0.05309	±8	2.83	2116	0.473
0.23	±0.012	0.04155	±8	3.61	2704	0.370
0.20	±0.010	0.03142	±8	4.77	3577	0.280
0.18	±0.010	0.02545	±8	5.89	4415	0.226
0.16	±0.010	0.02011	±8	7.46	5588	0.179
0.15	±0.008	0.01767	±8	8.49	6358	0.157
0.14	±0.008	0.01539	±8	9.74	7299	0.137
0.13	±0.008	0.01327	±9	11.3	8465	0.118
0.12	±0.008	0.01131	±9	13.3	9935	0.101
0.11	±0.006	0.009503	±9	15.8	11823	0.0846
0.10	±0.006	0.007854	±9	19.1	14306	0.0699
0.09	±0.005	0.006362	±10	23.6	17662	0.0566
0.08	±0.005	0.005027	±10	29.8	22353	0.0447
0.07	±0.005	0.003848	±10	39.0	29196	0.0343
0.06	±0.004	0.002827	±11	53.1	39739	0.0252

# CN15 (CuNi10 Copper Nickel)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 0.15±0.015 [Unit: Ampere]

Diameter (mm)	50 (°C)	100 (°C)	150 (°C)	200 (°C)	250 (°C)	300 (°C)	350 (°C)	400 (°C)
6.00	75.0	108	194	245	294	346	394	450
5.50	67.2	124	171	215	259	304	349	398
5.00	58.0	107	148	187	225	264	303	342
4.50	49.9	91.9	127	160	193	227	259	295
4.00	43.4	80.2	111	140	167	196	224	254
3.50	35.9	66.2	91.6	115	138	161	185	209
3.20	31.3	57.7	79.9	101	121	141	161	183
2.90	27.2	51.5	69.8	87.4	104	123	140	159
2.60	24.3	44.7	61.3	77.3	91.9	108	123	139
2.30	20.3	37.2	51.8	64.5	77.3	90.0	103	116
2.00	16.6	30.5	42.1	52.8	62.9	73.7	84.1	94.9
1.80	15.2	27.6	37.8	47.3	56.4	65.5	74.7	84.4
1.60	12.8	23.4	32.2	40.1	47.6	55.7	63.2	71.1
1.50	11.7	21.3	29.3	36.5	43.4	50.9	57.4	64.9
1.40	10.6	19.3	26.5	33.3	39.4	46.0	52.5	58.7
1.30	9.98	18.2	25.0	31.3	36.8	43.0	48.9	54.4
1.20	8.87	16.3	22.2	27.8	32.9	38.1	43.4	48.6
1.10	8.15	14.4	19.7	24.5	29.1	33.9	38.1	43.0
1.00	6.91	12.6	17.3	21.6	25.6	29.6	33.6	37.8
0.90	5.87	10.8	15.0	18.4	21.7	25.2	28.6	32.0
0.80	5.31	9.78	13.3	16.6	19.7	22.6	25.6	27.9
0.70	4.40	8.12	11.0	13.8	16.3	18.8	21.2	23.1
0.65	3.94	7.30	9.94	12.4	14.7	16.9	19.1	20.8
0.60	3.72	6.91	9.42	11.7	13.8	15.8	17.9	19.8
0.55	3.33	6.13	8.35	10.4	12.3	14.1	15.9	17.5
0.50	2.90	5.41	7.34	9.10	10.8	12.9	14.0	15.4
0.45	2.39	4.66	6.36	7.95	9.36	10.7	12.1	13.4
0.40	2.29	4.24	5.77	7.14	8.41	9.62	10.8	12.0
0.35	1.91	3.55	4.86	5.97	7.07	8.05	9.10	10.1
0.32	1.70	3.16	4.30	5.35	6.29	7.17	8.05	8.97
0.29	1.50	2.77	3.78	4.66	5.51	6.32	7.07	7.82
0.26	1.39	2.56	3.49	4.30	5.05	5.77	6.42	7.14
0.23	1.19	2.19	2.98	3.68	4.34	4.92	5.54	6.10
0.20	0.988	1.82	2.47	3.07	3.59	4.08	4.56	4.89
0.18	0.887	1.64	2.23	2.75	3.22	3.68	4.11	4.63
0.16	0.750	1.39	1.87	2.33	2.81	3.12	3.49	3.91
0.15	0.698	1.29	1.75	2.16	2.53	2.89	3.22	3.62
0.14	0.636	1.17	1.60	1.97	2.30	2.63	2.93	3.29
0.13	0.603	1.10	1.50	1.85	2.16	2.49	2.74	3.02
0.12	0.531	0.985	1.35	1.66	1.94	2.21	2.45	2.71
0.11	0.473	0.880	1.20	1.50	1.72	1.96	2.18	2.41
0.10	0.411	0.760	1.03	1.28	1.49	1.70	1.90	2.10
0.09	0.365	0.675	0.916	1.13	1.32	1.51	1.68	1.85
0.08	0.318	0.590	0.805	0.994	1.15	1.31	1.47	1.59
0.07	0.265	0.492	0.717	0.835	0.949	1.10	1.23	1.34
0.06	0.223	0.414	0.561	0.655	0.802	0.919	1.02	1.12
0.05	0.174	0.224	0.437	0.535	0.626	0.714	0.795	0.874
0.04	0.130	0.242	0.326	0.401	0.469	0.535	0.593	0.655
0.03	0.0877	0.164	0.221	0.272	0.319	0.362	0.401	0.443
0.025	0.0707	0.131	0.177	0.218	0.255	0.289	0.320	0.352

# CN15 (CuNi10 Copper Nickel)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 0.15±0.015

[Unit: Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00132	0.00165	0.00211	0.00264	0.00330	0.00406	0.00528							
2.60	0.00147	0.00184	0.00235	0.00294	0.00368	0.00453	0.00589	0.00925						
2.30	0.00166	0.00208	0.00266	0.00333	0.00416	0.00512	0.00665	0.0105	0.0136					
2.00	0.00191	0.00239	0.00306	0.00383	0.00478	0.00589	0.00765	0.0120	0.0156					
1.80	0.00213	0.00266	0.00340	0.00425	0.00531	0.00654	0.00850	0.0134	0.0174					
1.60	0.00239	0.00299	0.00383	0.00478	0.00598	0.00736	0.00957	0.0150	0.0195					
1.40	0.00273	0.00342	0.00437	0.00547	0.00683	0.00841	0.0109	0.0172	0.0223					
1.20	0.00319	0.00399	0.00510	0.00638	0.00797	0.00981	0.0128	0.0200	0.0260					
1.00	0.00383	0.00478	0.00612	0.00765	0.00957	0.0118	0.0153	0.0240	0.0313					
0.90		0.00531	0.00680	0.00850	0.0106	0.0131	0.0170	0.0267	0.0347	0.0543	0.0723			
0.80		0.00598	0.00765	0.00957	0.0120	0.0147	0.0191	0.0300	0.0391	0.0610	0.0814			
0.70			0.00875	0.0109	0.0137	0.0168	0.0219	0.0343	0.0446	0.0698	0.093			
0.60			0.0102	0.0128	0.0159	0.0196	0.0255	0.0401	0.0521	0.0814	0.109			
0.50			0.0122	0.0153	0.0191	0.0235	0.0306	0.0481	0.0625	0.0977	0.130			
0.45			0.0136	0.0170	0.0213	0.0262	0.0340	0.0534	0.0694	0.109	0.145	0.217		
0.40					0.0239	0.0294	0.0383	0.0601	0.0781	0.122	0.163	0.244		
0.35						0.0336	0.0437	0.0687	0.0893	0.140	0.186	0.279		
0.32						0.0368	0.0478	0.0751	0.0977	0.153	0.203	0.305		
0.29							0.0528	0.0829	0.108	0.168	0.224	0.337	0.673	
0.26							0.0589	0.0925	0.120	0.188	0.250	0.376	0.751	1.50
0.23								0.105	0.136	0.212	0.283	0.425	0.849	1.70
0.20								0.120	0.156	0.244	0.326	0.488	0.977	1.95
0.18								0.134	0.174	0.271	0.362	0.543	1.09	2.17
0.16										0.305	0.407	0.610	1.22	2.44
0.14										0.349	0.465	0.698	1.40	2.79
0.12											0.543	0.814	1.63	3.26
0.10												0.977	1.95	3.91
0.08													1.22	4.88

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **CN10 (CuNi6)**

## **Copper Nickel No 10**



# Alloys : CN10 (CuNi6 Copper Nickel)

[JIS C 2532]

Heat and oxidation resistance equal to or higher than that of electrical copper materials.  
It is non-magnetic and has better workability than electrical copper.  
Used in road heaters, floor heaters, electrical fuses, etc.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
GCN10	C 2532	0.10 $\pm$ 0.012	* 710

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density g/cm <sup>3</sup> (20 $^{\circ}\text{C}$ )	Melting Point $^{\circ}\text{C}$	Max Operating Temperature $^{\circ}\text{C}$
17.5	8.90	1090	220

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	$\leq 1.0$	4~7	$\geq 99$

Alloys	Type	Diameter (mm)	
CN10W	Wire	$\phi 6.00 \sim 0.06$	
CN10R	Ribbon	$t=2.90 \sim 0.05$	$w=40 \sim 0.4$ (Depends on thickness)
CN10P	Plate	Please consult	
CN10	Foil	Please consult	

# CN10 (CuNi6 Copper Nickel)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°CμΩm) 0.10±0.012

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.00354	3.97	252
5.50	±0.080	23.76	±5	0.00421	4.73	211
5.00	±0.080	19.64	±5	0.00509	5.72	175
4.50	±0.080	15.90	±5	0.00629	7.06	142
4.00	±0.080	12.57	±5	0.00796	8.94	112
3.50	±0.080	9.621	±5	0.0104	11.7	85.6
3.20	±0.060	8.042	±5	0.0124	14.0	71.6
2.90	±0.060	6.605	±5	0.0151	17.0	58.8
2.60	±0.060	5.309	±5	0.0188	21.2	47.3
2.30	±0.050	4.155	±5	0.0241	27.0	37.0
2.00	±0.050	3.142	±5	0.0318	35.8	28.0
1.80	±0.050	2.545	±5	0.0393	44.2	22.6
1.60	±0.040	2.011	±5	0.0497	55.9	17.9
1.50	±0.040	1.767	±5	0.0566	63.6	15.7
1.40	±0.040	1.539	±5	0.0650	73.0	13.7
1.30	±0.040	1.327	±5	0.0753	84.7	11.8
1.20	±0.040	1.131	±5	0.0884	99.3	10.1
1.10	±0.030	0.9503	±6	0.105	118	8.46
1.00	±0.030	0.7854	±6	0.127	143	6.99
0.90	±0.030	0.6362	±6	0.157	177	5.66
0.85	±0.030	0.5675	±6	0.176	198	5.05
0.80	±0.030	0.5027	±6	0.199	224	4.47
0.75	±0.025	0.4418	±6	0.226	254	3.93
0.70	±0.025	0.3848	±6	0.260	292	3.43
0.65	±0.025	0.3318	±6	0.301	339	2.95
0.60	±0.025	0.2827	±6	0.354	397	2.52
0.55	±0.020	0.2376	±7	0.421	473	2.11
0.50	±0.020	0.1964	±7	0.509	572	1.75
0.45	±0.020	0.1590	±7	0.629	706	1.42
0.40	±0.015	0.1257	±7	0.796	894	1.12
0.35	±0.015	0.09621	±7	1.04	1168	0.856
0.32	±0.015	0.08042	±7	1.24	1397	0.716
0.29	±0.012	0.06605	±7	1.51	1701	0.588
0.26	±0.012	0.05309	±8	1.88	2116	0.473
0.23	±0.012	0.04155	±8	2.41	2704	0.370
0.20	±0.010	0.03142	±8	3.18	3577	0.280
0.18	±0.010	0.02545	±8	3.93	4415	0.226
0.16	±0.010	0.02011	±8	4.97	5588	0.179
0.15	±0.008	0.01767	±8	5.66	6358	0.157
0.14	±0.008	0.01539	±8	6.50	7299	0.137
0.13	±0.008	0.01327	±9	7.53	8465	0.118
0.12	±0.008	0.01131	±9	8.84	9935	0.101
0.11	±0.006	0.009503	±9	10.5	11823	0.0846
0.10	±0.006	0.007854	±9	12.7	14306	0.0699
0.09	±0.005	0.006362	±10	15.7	17662	0.0566
0.08	±0.005	0.005027	±10	19.9	22353	0.0447
0.07	±0.005	0.003848	±10	26.0	29196	0.0343
0.06	±0.004	0.002827	±11	35.4	39739	0.0252

# CN10 (CuNi6 Copper Nickel)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°CμΩm) 0.10±0.012 [Unit: Ampere]

Diameter (mm)	50 (°C)	100 (°C)	150 (°C)	200 (°C)	250 (°C)	300 (°C)	350 (°C)	400 (°C)
6.00	113	162	292	368	442	519	593	676
5.50	101	186	257	323	389	457	524	598
5.00	87.2	161	223	281	338	397	455	515
4.50	75.0	138	191	241	290	341	390	443
4.00	65.2	121	168	210	251	295	337	381
3.50	53.9	99.5	138	173	207	243	277	314
3.20	47.0	86.7	120	152	181	212	242	275
2.90	40.8	77.4	105	131	157	184	210	239
2.60	36.6	67.1	92.1	116	138	162	185	208
2.30	30.6	55.9	77.9	97.0	116	135	155	174
2.00	25.0	45.9	63.2	79.4	94.6	111	126	143
1.80	22.8	41.5	56.8	71.1	84.8	98.5	112	127
1.60	19.3	35.1	48.4	60.3	71.5	83.8	95.1	107
1.50	17.5	31.9	44.0	54.9	65.2	76.4	86.2	97.5
1.40	15.9	29.0	39.9	50.0	59.3	69.1	78.9	88.2
1.30	15.0	27.3	37.6	47.0	55.4	64.7	73.5	81.8
1.20	13.3	24.5	33.4	41.8	49.5	57.3	65.2	73.0
1.10	12.3	21.7	29.6	36.9	43.8	51.0	57.3	64.7
1.00	10.4	19.0	26.0	32.4	38.5	44.5	50.5	56.8
0.90	8.82	16.2	22.6	27.6	32.7	37.9	42.9	48.1
0.80	7.99	14.7	20.0	25.0	29.5	34.0	38.5	41.9
0.70	6.62	12.2	16.6	20.7	24.5	28.2	31.9	34.7
0.65	5.93	11.0	14.9	18.6	22.1	25.4	28.8	31.3
0.60	5.59	10.4	14.2	17.6	20.8	23.8	26.9	29.7
0.55	5.00	9.21	12.5	15.6	18.4	21.2	23.9	26.4
0.50	4.36	8.13	11.0	13.7	16.2	19.5	21.0	23.1
0.45	3.59	7.01	9.56	12.0	14.1	16.1	18.1	20.1
0.40	3.43	6.37	8.67	10.7	12.6	14.5	16.3	18.0
0.35	2.88	5.34	7.30	8.97	10.6	12.1	13.7	15.1
0.32	2.56	4.75	6.47	8.04	9.46	10.8	12.1	13.5
0.29	2.25	4.17	5.68	7.01	8.28	9.51	10.6	11.8
0.26	2.09	3.85	5.24	6.47	7.60	8.67	9.65	10.7
0.23	1.79	3.29	4.48	5.54	6.52	7.40	8.33	9.16
0.20	1.48	2.73	3.71	4.62	5.39	6.13	6.86	7.35
0.18	1.33	2.46	3.35	4.13	4.84	5.54	6.17	6.96
0.16	1.13	2.09	2.81	3.51	4.23	4.68	5.24	5.88
0.15	1.05	1.94	2.63	3.25	3.80	4.35	4.85	5.44
0.14	0.956	1.76	2.40	2.96	3.46	3.96	4.41	4.95
0.13	0.907	1.65	2.25	2.78	3.24	3.75	4.13	4.54
0.12	0.799	1.48	2.02	2.49	2.91	3.32	3.68	4.08
0.11	0.711	1.32	1.80	2.25	2.59	2.95	3.28	3.62
0.10	0.617	1.14	1.55	1.92	2.24	2.56	2.86	3.16
0.09	0.549	1.01	1.38	1.70	1.99	2.27	2.53	2.78
0.08	0.478	0.887	1.21	1.49	1.73	1.97	2.21	2.39
0.07	0.399	0.740	1.08	1.25	1.43	1.66	1.84	2.02
0.06	0.336	0.622	0.843	0.985	1.21	1.38	1.53	1.69
0.05	0.261	0.337	0.657	0.804	0.941	1.07	1.20	1.31
0.04	0.195	0.364	0.490	0.603	0.706	0.804	0.892	0.985
0.03	0.132	0.246	0.333	0.409	0.479	0.544	0.603	0.666
0.025	0.106	0.197	0.266	0.327	0.383	0.434	0.481	0.529

# CN10 (CuNi6 Copper Nickel)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 0.10±0.012

[Unit: Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00088	0.00110	0.00141	0.00176	0.00220	0.00271	0.00352							
2.60	0.00098	0.00123	0.00157	0.00196	0.00245	0.00302	0.00392	0.00616						
2.30	0.00111	0.00139	0.00177	0.00222	0.00277	0.00341	0.00444	0.00697	0.00906					
2.00	0.00128	0.00159	0.00204	0.00255	0.00319	0.00392	0.00510	0.00801	0.0104					
1.80	0.00142	0.00177	0.00227	0.00283	0.00354	0.00436	0.00567	0.00890	0.0116					
1.60	0.00159	0.00199	0.00255	0.00319	0.00399	0.00491	0.00638	0.0100	0.0130					
1.40	0.00182	0.00228	0.00292	0.00364	0.00456	0.00561	0.00729	0.0114	0.0149					
1.20	0.00213	0.00266	0.00340	0.00425	0.00531	0.00654	0.0085	0.0134	0.0174					
1.00	0.00255	0.00319	0.00408	0.00510	0.00638	0.00785	0.0102	0.0160	0.0208					
0.90		0.00354	0.00454	0.00567	0.00709	0.00872	0.0113	0.0178	0.0231	0.0362	0.0482			
0.80		0.00399	0.00510	0.00638	0.00797	0.00981	0.0128	0.0200	0.0260	0.0407	0.0543			
0.70			0.00583	0.00729	0.00911	0.0112	0.0146	0.0229	0.0298	0.0465	0.0620			
0.60			0.00680	0.00850	0.0106	0.0131	0.0170	0.0267	0.0347	0.0543	0.0723			
0.50			0.00816	0.0102	0.0128	0.0157	0.0204	0.0321	0.0417	0.0651	0.0868			
0.45			0.00907	0.0113	0.0142	0.0174	0.0227	0.0356	0.0463	0.0723	0.0965	0.145		
0.40					0.0159	0.0196	0.0255	0.0401	0.0521	0.0814	0.109	0.163		
0.35						0.0224	0.0292	0.0458	0.0595	0.093	0.124	0.186		
0.32						0.0245	0.0319	0.0501	0.0651	0.102	0.136	0.203		
0.29							0.0352	0.0553	0.0718	0.112	0.150	0.224	0.449	
0.26							0.0392	0.0616	0.0801	0.125	0.167	0.250	0.501	1.00
0.23								0.0697	0.0906	0.142	0.189	0.283	0.566	1.13
0.20								0.0801	0.104	0.163	0.217	0.326	0.651	1.30
0.18								0.0890	0.116	0.181	0.241	0.362	0.723	1.45
0.16										0.203	0.271	0.407	0.814	1.63
0.14										0.233	0.310	0.465	0.930	1.86
0.12											0.362	0.543	1.09	2.17
0.10												0.651	1.30	2.60
0.08												0.814	1.63	3.26

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **CN5 (CuNi2)**

## **Copper Nickel No 5**

# Alloys : CN5 (CuNi2 Copper Nickel)

[JIS C 2532]

Heat and oxidation resistance equal to or higher than that of electrical copper materials.  
It is non-magnetic and has better workability than electrical copper.  
Used in road heaters, floor heaters, electrical fuses, etc.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
GCN5	C 2532	0.05 $\pm$ 0.0075	* 1300

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density g/cm <sup>3</sup> (20 $^{\circ}\text{C}$ )	Melting Point $^{\circ}\text{C}$	Max Operating Temperature $^{\circ}\text{C}$
17.5	8.90	1080	200

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	$\leq 1.0$	0.5~3	$\geq 99$

Alloys	Type	Diameter (mm)	
CN5W	Wire	$\phi 6.00 \sim 0.06$	
CN5R	Ribbon	$t=2.90 \sim 0.05$	$w=40 \sim 0.4$ (Depends on thickness)
CN5P	Plate	Please consult	
CN5	Foil	Please consult	

# CN5 (CuNi2 Copper Nickel)

## Resistance • Length • Weight

Wire

Electrical Resistivity (23°C μΩm) 0.05 ± 0.0075

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.00177	3.97	252
5.50	±0.080	23.76	±5	0.00210	4.73	211
5.00	±0.080	19.64	±5	0.00255	5.72	175
4.50	±0.080	15.90	±5	0.00314	7.06	142
4.00	±0.080	12.57	±5	0.00398	8.94	112
3.50	±0.080	9.621	±5	0.00520	11.7	85.6
3.20	±0.060	8.042	±5	0.00622	14.0	71.6
2.90	±0.060	6.605	±5	0.00757	17.0	58.8
2.60	±0.060	5.309	±5	0.00942	21.2	47.3
2.30	±0.050	4.155	±5	0.0120	27.0	37.0
2.00	±0.050	3.142	±5	0.0159	35.8	28.0
1.80	±0.050	2.545	±5	0.0196	44.2	22.6
1.60	±0.040	2.011	±5	0.0249	55.9	17.9
1.50	±0.040	1.767	±5	0.0283	63.6	15.7
1.40	±0.040	1.539	±5	0.0325	73.0	13.7
1.30	±0.040	1.327	±5	0.0377	84.7	11.8
1.20	±0.040	1.131	±5	0.0442	99.3	10.1
1.10	±0.030	0.9503	±6	0.0526	118	8.46
1.00	±0.030	0.7854	±6	0.0637	143	6.99
0.90	±0.030	0.6362	±6	0.0786	177	5.66
0.85	±0.030	0.5675	±6	0.0881	198	5.05
0.80	±0.030	0.5027	±6	0.0995	224	4.47
0.75	±0.025	0.4418	±6	0.113	254	3.93
0.70	±0.025	0.3848	±6	0.130	292	3.43
0.65	±0.025	0.3318	±6	0.151	339	2.95
0.60	±0.025	0.2827	±6	0.177	397	2.52
0.55	±0.020	0.2376	±7	0.210	473	2.11
0.50	±0.020	0.1964	±7	0.255	572	1.75
0.45	±0.020	0.1590	±7	0.314	706	1.42
0.40	±0.015	0.1257	±7	0.398	894	1.12
0.35	±0.015	0.09621	±7	0.520	1168	0.856
0.32	±0.015	0.08042	±7	0.622	1397	0.716
0.29	±0.012	0.06605	±7	0.757	1701	0.588
0.26	±0.012	0.05309	±8	0.942	2116	0.473
0.23	±0.012	0.04155	±8	1.20	2704	0.370
0.20	±0.010	0.03142	±8	1.59	3577	0.280
0.18	±0.010	0.02545	±8	1.96	4415	0.226
0.16	±0.010	0.02011	±8	2.49	5588	0.179
0.15	±0.008	0.01767	±8	2.83	6358	0.157
0.14	±0.008	0.01539	±8	3.25	7299	0.137
0.13	±0.008	0.01327	±9	3.77	8465	0.118
0.12	±0.008	0.01131	±9	4.42	9935	0.101
0.11	±0.006	0.009503	±9	5.26	11823	0.0846
0.10	±0.006	0.007854	±9	6.37	14306	0.0699
0.09	±0.005	0.006362	±10	7.86	17662	0.0566
0.08	±0.005	0.005027	±10	9.95	22353	0.0447
0.07	±0.005	0.003848	±10	13.0	29196	0.0343
0.06	±0.004	0.002827	±11	17.7	39739	0.0252

# CN5 (CuNi2 Copper Nickel)

## Temperature Current Characteristics • Diameter • Temperature • Current

Wire Electrical Resistivity (23°C μΩm) 0.05±0.0075 [Unit: Ampere]

Diameter (mm)	50 (°C)	100 (°C)	150 (°C)	200 (°C)	250 (°C)	300 (°C)	350 (°C)	400 (°C)
6.00	225	323	584	735	884	1039	1186	1352
5.50	202	371	514	647	777	914	1049	1196
5.00	174	321	446	563	675	794	909	1029
4.50	150	276	382	482	579	682	780	887
4.00	130	241	335	419	502	590	673	762
3.50	108	199	275	346	414	485	555	628
3.20	94.1	173	240	304	363	424	484	551
2.90	81.6	155	210	263	314	368	420	477
2.60	73.1	134	184	232	276	323	370	417
2.30	61.2	112	156	194	232	270	310	348
2.00	50.0	91.7	126	159	189	221	253	285
1.80	45.6	82.9	114	142	170	197	224	254
1.60	38.6	70.3	96.7	121	143	168	190	214
1.50	35.1	63.9	88.0	110	130	153	172	195
1.40	31.9	57.9	79.8	100	119	138	158	176
1.30	30.0	54.6	75.3	94.1	111	129	147	164
1.20	26.7	49.0	66.8	83.6	99.0	115	130	146
1.10	24.5	43.3	59.3	73.8	87.5	102	115	129
1.00	20.8	38.0	51.9	64.9	76.9	89.1	101	114
0.90	17.6	32.3	45.2	55.2	65.4	75.8	85.8	96.2
0.80	16.0	29.4	40.1	50.0	59.1	68.0	77.0	83.8
0.70	13.2	24.4	33.1	41.4	49.1	56.4	63.8	69.5
0.65	11.9	22.0	29.9	37.2	44.1	50.8	57.5	62.5
0.60	11.2	20.8	28.3	35.2	41.6	47.6	53.7	59.5
0.55	10.0	18.4	25.1	31.3	36.8	42.3	47.7	52.7
0.50	8.72	16.3	22.1	27.3	32.3	38.9	41.9	46.3
0.45	7.18	14.0	19.1	23.9	28.1	32.2	36.3	40.2
0.40	6.87	12.7	17.3	21.5	25.3	28.9	32.5	36.1
0.35	5.75	10.7	14.6	17.9	21.3	24.2	27.3	30.3
0.32	5.12	9.50	12.9	16.1	18.9	21.6	24.2	27.0
0.29	4.50	8.34	11.4	14.0	16.6	19.0	21.3	23.5
0.26	4.17	7.69	10.5	12.9	15.2	17.3	19.3	21.5
0.23	3.59	6.59	8.96	11.1	13.0	14.8	16.7	18.3
0.20	2.97	5.46	7.42	9.24	10.8	12.3	13.7	14.7
0.18	2.67	4.93	6.70	8.26	9.67	11.1	12.3	13.9
0.16	2.25	4.18	5.63	7.02	8.46	9.37	10.5	11.8
0.15	2.10	3.88	5.26	6.51	7.60	8.70	9.69	10.9
0.14	1.91	3.53	4.80	5.92	6.92	7.92	8.82	9.90
0.13	1.81	3.30	4.50	5.56	6.49	7.50	8.25	9.08
0.12	1.60	2.96	4.05	4.99	5.82	6.64	7.35	8.15
0.11	1.42	2.65	3.60	4.50	5.17	5.90	6.57	7.23
0.10	1.23	2.28	3.11	3.84	4.49	5.13	5.71	6.31
0.09	1.10	2.03	2.75	3.40	3.98	4.54	5.06	5.56
0.08	0.956	1.77	2.42	2.99	3.46	3.95	4.41	4.78
0.07	0.798	1.48	2.16	2.51	2.85	3.31	3.68	4.04
0.06	0.671	1.24	1.69	1.97	2.41	2.76	3.06	3.37
0.05	0.522	0.674	1.31	1.61	1.88	2.15	2.39	2.63
0.04	0.390	0.727	0.980	1.21	1.41	1.61	1.78	1.97
0.03	0.264	0.492	0.665	0.817	0.958	1.09	1.21	1.33
0.025	0.213	0.394	0.532	0.655	0.766	0.868	0.961	1.06



# CN5 (CuNi2 Copper Nickel)

## Conductor resistance

Ribbon

Electrical Resistivity (23°CμΩm) 0.05±0.0075

[Unit: Ω/m]

Thickness (mm)	Width mm)													
	40.0	32.0	25.0	20.0	16.0	13.0	10.0	6.5	5.0	3.2	2.4	1.6	0.8	0.4
2.90	0.00044	0.00055	0.00070	0.00088	0.00110	0.00135	0.00176							
2.60	0.00049	0.00061	0.00078	0.00098	0.00123	0.00151	0.00196	0.00308						
2.30	0.00055	0.00069	0.00089	0.00111	0.00139	0.00171	0.00222	0.00348	0.00453					
2.00	0.00064	0.00080	0.00102	0.00128	0.00159	0.00196	0.00255	0.00401	0.00521					
1.80	0.00071	0.00089	0.00113	0.00142	0.00177	0.00218	0.00283	0.00445	0.00579					
1.60	0.00080	0.00100	0.00128	0.00159	0.00199	0.00245	0.00319	0.00501	0.00651					
1.40	0.00091	0.00114	0.00146	0.00182	0.00228	0.00280	0.00364	0.00572	0.00744					
1.20	0.00106	0.00133	0.00170	0.00213	0.00266	0.00327	0.00425	0.0067	0.00868					
1.00	0.00128	0.00159	0.00204	0.00255	0.00319	0.00392	0.00510	0.0080	0.0104					
0.90		0.00177	0.00227	0.00283	0.00354	0.00436	0.00567	0.0089	0.0116	0.0181	0.0241			
0.80		0.00199	0.00255	0.00319	0.00399	0.00491	0.00638	0.0100	0.0130	0.0203	0.0271			
0.70			0.00292	0.00364	0.00456	0.00561	0.00729	0.0114	0.0149	0.0233	0.0310			
0.60			0.00340	0.00425	0.00531	0.00654	0.0085	0.0134	0.0174	0.0271	0.0362			
0.50			0.00408	0.00510	0.00638	0.00785	0.0102	0.0160	0.0208	0.0326	0.0434			
0.45			0.00454	0.00567	0.00709	0.00872	0.0113	0.0178	0.0231	0.0362	0.0482	0.0723		
0.40					0.00797	0.00981	0.0128	0.0200	0.0260	0.0407	0.0543	0.0814		
0.35						0.01120	0.0146	0.0229	0.0298	0.0465	0.0620	0.0930		
0.32						0.01230	0.0159	0.0250	0.0326	0.0509	0.0678	0.102		
0.29							0.0176	0.0276	0.0359	0.0561	0.0748	0.112	0.224	
0.26							0.0196	0.0308	0.0401	0.0626	0.0835	0.125	0.250	0.501
0.23								0.0348	0.0453	0.0708	0.0944	0.142	0.283	0.566
0.20								0.0401	0.0521	0.0814	0.109	0.163	0.326	0.651
0.18								0.0445	0.0579	0.0904	0.121	0.181	0.362	0.723
0.16										0.102	0.136	0.203	0.407	0.814
0.14										0.116	0.155	0.233	0.465	0.930
0.12											0.181	0.271	0.543	1.09
0.10												0.326	0.651	1.30
0.08												0.407	0.814	1.63

\*Allowable tolerance of conductor resistance : Width 10mm or more ±7% , Width 10mm or less ±8%

## Conductor Resistance Tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08above 3.15below	10below	±8
	10above	±7

\*We can manufacture products other than the standard (size and tolerance), so please contact us.

---

# **CM44**

## **Copper Nickel Mangan**

# Alloys : CM44 (Copper Nickel Mangan)

[JIS C 2532]

Since it has poor resistance to corrosion and oxidation, it is desirable to use it with a moisture-proof and oxidation-resistant coating. It is non-magnetic. Can be used up to 150°C.

Small temperature coefficient of resistance and thermal electromotive force against copper. Good solderability.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]	Grade
CM44	C2532	0.440 $\pm$ 0.03	* $\pm$ 50	General

(\* )Reference value

Cuprous Electromotive Force Mv/K (0~100°C)	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Thermal Conductivity w/m·K	Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
$\pm 1$	18.0	0.41	22	8.44	* 1020	150

(\* )Reference value

Chemical Composition	Mn	Ni	Cu+Ni+Mn
(%)	10~13	1~4	$\geq 98$

Alloys	Type	Diameter (mm)		
CM44W	Wire	$\phi 6.00 \sim 0.04$		
CM44R	Ribbon	Please consult		
CM44P CMP·CMR	Plate	1.0t $\times$ 180w $\times$ 1200L (In stock)		
		Quality	softness	O
			hardness	H
CM44	Foil	Please consult		

# CM44 (Copper Nickel Mangan)

## Resistance·Length·Weight

Wire

Electrical Resistivity (23°CμΩm) 0.440±0.03

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.080	28.27	±5	0.0156	4.21	238
5.50	±0.063	23.76	±5	0.0185	5.01	200
5.00	±0.063	19.64	±5	0.0224	6.06	165
4.50	±0.063	15.90	±5	0.0277	7.49	134
4.00	±0.063	12.57	±5	0.0350	9.47	106
3.50	±0.050	9.621	±5	0.0457	12.4	80.8
3.20	±0.050	8.042	±5	0.0547	14.8	67.6
2.90	±0.050	6.605	±5	0.0666	18.0	55.5
2.60	±0.040	5.309	±5	0.0829	22.4	44.6
2.30	±0.040	4.155	±5	0.106	28.7	34.9
2.00	±0.040	3.142	±5	0.140	37.9	26.4
1.80	±0.040	2.545	±5	0.173	46.8	21.4
1.60	±0.032	2.011	±5	0.219	59.2	16.9
1.50	±0.032	1.767	±5	0.249	67.4	14.8
1.40	±0.032	1.539	±5	0.286	77.3	12.9
1.30	±0.032	1.327	±5	0.331	89.7	11.1
1.20	±0.025	1.131	±5	0.389	105.3	9.50
1.10	±0.025	0.9503	±6	0.463	125	7.98
1.00	±0.025	0.7854	±6	0.560	152	6.60
0.90	±0.025	0.6362	±6	0.692	187	5.34
0.85	±0.025	0.5675	±6	0.775	210	4.77
0.80	±0.020	0.5027	±6	0.875	237	4.22
0.75	±0.020	0.4418	±6	0.996	269	3.71
0.70	±0.020	0.3848	±6	1.14	309	3.23
0.65	±0.020	0.3318	±6	1.33	359	2.79
0.60	±0.020	0.2827	±6	1.56	421	2.38
0.55	±0.016	0.2376	±7	1.85	501	2.00
0.50	±0.016	0.1964	±7	2.24	606	1.65
0.45	±0.016	0.1590	±7	2.77	749	1.34
0.40	±0.016	0.1257	±7	3.50	947	1.06
0.35	±0.013	0.09621	±7	4.57	1237	0.808
0.32	±0.013	0.08042	±7	5.47	1480	0.676
0.29	±0.013	0.06605	±7	6.66	1802	0.555
0.26	±0.010	0.05309	±8	8.29	2242	0.446
0.23	±0.010	0.04155	±8	10.6	2865	0.349
0.20	±0.010	0.03142	±8	14.0	3789	0.264
0.18	±0.008	0.02545	±8	17.3	4678	0.214
0.16	±0.008	0.02011	±8	21.9	5921	0.169
0.15	±0.008	0.01767	±8	24.9	6737	0.148
0.14	±0.008	0.01539	±8	28.6	7733	0.129
0.13	±0.006	0.01327	±9	33.1	8969	0.111
0.12	±0.006	0.01131	±9	38.9	10526	0.095
0.11	±0.006	0.009503	±9	46.3	12527	0.0798
0.10	±0.006	0.007854	±9	56.0	15158	0.066
0.09	±0.005	0.006362	±10	69.2	18713	0.0534
0.08	±0.005	0.005027	±10	87.5	23684	0.0422
0.07	±0.005	0.003848	±10	114	30934	0.0323
0.06	±0.004	0.002827	±11	156	42104	0.0238
0.05	±0.004	0.001964	±11	224	60630	0.0165
0.04	±0.003	0.001257	±12	350	94735	0.0106

Ribbon

Electrical Resistivity (23°CμΩm) 0.440±0.03

\* Please contact us for more information as the sizes we can manufacture are limited.

---

# **Nikrothal LX**

## **Precision Resistance Wire**

# Nikrothal LX (Precision Resistance Wire)

Excellent temperature coefficient of resistance.

It is used as precision resistance wire for potentiometers and precision wire wound resistors.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
*1.33	$\pm 5, \pm 10$

(\* )Reference value

Density g/cm <sup>3</sup> (20°C)	Melting Point °C	Max Operating Temperature °C
8.30	1390	-55~+250

Chemical Composition	C	Si	Mn	Cr	Fe	Al	Ni	Cu
(%)	$\leq 0.02$	0.5~0.7	2.1~2.3	18~20	$\leq 0.1$	2.4~2.6	BAL	1.6~1.8

Alloys	Type	Diameter (mm)
NIKROTHAL LX	Wire	$\phi 0.5 \sim 0.02$

# Nikrothal LX (Precision Resistance Wire)

## Resistance • Length • Weight

Wire Electrical Resistivity (23°C μΩm) 1.33

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
0.500		0.196	±5	6.77	614	1.63
0.475		0.177	±5	7.51	680	1.47
0.450		0.159	±5	8.36	758	1.32
0.425		0.142	±5	9.38	849	1.18
0.400		0.126	±5	10.6	959	1.04
0.375		0.110	±5	12.0	1091	0.917
0.350		0.0962	±5	13.8	1252	0.799
0.320		0.0804	±5	16.5	1498	0.668
0.300		0.0707	±5	18.8	1704	0.587
0.280		0.0616	±5	21.6	1957	0.511
0.260		0.0531	±5	25.1	2269	0.441
0.250		0.0491	±5	27.1	2454	0.407
0.240		0.0452	±5	29.4	2663	0.375
0.230		0.0415	±5	32.0	2900	0.345
0.220		0.0380	±5	35.0	3169	0.316
0.210		0.0346	±5	38.4	3479	0.287
0.200		0.0314	±5	42.3	3835	0.261
0.190		0.0284	±5	46.9	4249	0.235
0.180		0.0254	±5	52.3	4735	0.211
0.170		0.0227	±5	58.6	5308	0.188
0.160		0.0201	±5	66.1	5992	0.167
0.150		0.0177	±5	75.3	6818	0.147
0.140		0.0154	±5	86.4	7827	0.128
0.130		0.0133	±5	100	9077	0.110
0.120		0.0113	±8	118	10653	0.0939
0.110		0.00950	±8	140	12678	0.0789
0.100		0.00785	±8	169	15340	0.0652
0.090		0.00636	±8	209	18939	0.0528
0.080		0.00503	±8	265	23969	0.0417
0.070		0.00385	±8	346	31307	0.0319
0.060		0.00283	±8	470	42612	0.0235
0.050		0.00196	±8	677	61361	0.0163
0.045		0.00159	±10	837	75754	0.0132
0.040		0.00126	±10	1058	95876	0.0104
0.035		0.000960	±10	1382	125226	0.00799
0.030		0.000707	±10	1882	170447	0.00587
0.028		0.000615	±10	2160	195666	0.00511
0.025		0.000491	±10	2709	245443	0.00407
0.022		0.000380	±10	3499	316946	0.00316
0.020		0.000314	±10	4234	383505	0.00261

---

# **Ni**

## **Pure Nickel Wire**



# Alloys : Ni (Pure Nickel Wire)

[JIS H 4554]

Good corrosion resistance and resistance to corrosion by neutral salt and alkaline solution.

Large temperature coefficient of electrical resistance.

Used as resistance material for temperature-sensitive elements such as resistance thermometers and hygrometers, and as resistance wire for temperature compensation.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
Ni	NW2200 NW2201	* 0.095 $\pm$ 0.015	* 4,500

(\* )Reference value

Volume resistivity and average temperature coefficient may vary depending on the base material manufacturer. Please contact us.

JIS	JIS Code	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat J/g·K (20°C)	Melting Point °C	Max Operating Temperature °C
NW2200	Ni99.0	15.0	8.90	1400	400
NW2201					
	Ni99.6				

Chemical Composition	Alloy Number	C	Si	Mn	Ni	Cu	Fe	S
(%)	NW2200	$\leq 0.15$	$\leq 0.3$	$\leq 0.3$	$\geq 99$	$\leq 0.2$	$\leq 0.4$	$\leq 0.01$
	NW2201	$\leq 0.02$	$\leq 0.3$	$\leq 0.3$	$\geq 99$	$\leq 0.2$	$\leq 0.4$	$\leq 0.01$
	Ni99.6	$\leq 0.02$	$\leq 0.3$	$\leq 0.3$	$\geq 99.6$	$\leq 0.2$	$\leq 0.3$	$\leq 0.01$

Alloys	Type	Diameter (mm)
NiW	Wire	$\phi 6.00 \sim 0.02$
NiR	Ribbon	Please consult
NiP	Plate	Please consult
Ni	Foil	Please consult

# Ni (Pure Nickel Wire)

(\*) Reference value Depends on nickel content

## Resistance·Length·Weight

Wire Electrical Resistivity (23°CμΩm) \*0.095±0.015

Please contact us as the characteristics of the material vary depending on the manufacturer.

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
6.00	±0.060	28.27	±5	0.00336	3.97	252
5.50	±0.060	23.76	±5	0.00400	4.73	211
5.00	±0.060	19.64	±5	0.00484	5.72	175
4.50	±0.050	15.90	±5	0.00597	7.06	142
4.00	±0.050	12.57	±5	0.00756	8.94	112
3.50	±0.050	9.621	±6	0.00987	11.7	85.6
3.20	±0.040	8.042	±6	0.0118	14.0	71.6
2.90	±0.040	6.605	±6	0.0144	17.0	58.8
2.60	±0.040	5.309	±6	0.0179	21.2	47.3
2.30	±0.040	4.155	±6	0.0229	27.0	37.0
2.00	±0.030	3.142	±6	0.0302	35.8	28.0
1.80	±0.030	2.545	±6	0.0373	44.2	22.6
1.60	±0.030	2.011	±7	0.0472	55.9	17.9
1.50	±0.030	1.767	±7	0.0538	63.6	15.7
1.40	±0.030	1.539	±7	0.0617	73.0	13.7
1.30	±0.030	1.327	±7	0.0716	84.7	11.8
1.20	±0.030	1.131	±7	0.0840	99.3	10.1
1.10	±0.030	0.9503	±7	0.100	118	8.46
1.00	±0.030	0.7854	±7	0.121	143	6.99
0.90	±0.030	0.6362	±7	0.149	177	5.66
0.85	±0.030	0.5675	±7	0.167	198	5.05
0.80	±0.020	0.5027	±7	0.189	224	4.47
0.75	±0.020	0.4418	±7	0.215	254	3.93
0.70	±0.020	0.3848	±7	0.247	292	3.43
0.65	±0.020	0.3318	±7	0.286	339	2.95
0.60	±0.020	0.2827	±7	0.336	397	2.52
0.55	±0.020	0.2376	±8	0.400	473	2.11
0.50	±0.010	0.1964	±8	0.484	572	1.75
0.45	±0.010	0.1590	±8	0.597	706	1.42
0.40	±0.010	0.1257	±8	0.756	894	1.12
0.35	±0.010	0.09621	±8	0.987	1168	0.856
0.32	±0.010	0.08042	±8	1.18	1397	0.716
0.29	±0.010	0.06605	±8	1.44	1701	0.588
0.26	±0.010	0.05309	±8	1.79	2116	0.473
0.23	±0.010	0.04155	±8	2.29	2704	0.370
0.20	±0.006	0.03142	±9	3.02	3577	0.280
0.18	±0.006	0.02545	±9	3.73	4415	0.226
0.16	±0.006	0.02011	±9	4.72	5588	0.179
0.15	±0.006	0.01767	±9	5.38	6358	0.157
0.14	±0.006	0.01539	±9	6.17	7299	0.137
0.13	±0.006	0.01327	±9	7.16	8465	0.118
0.12	±0.006	0.01131	±9	8.40	9935	0.101
0.11	±0.006	0.009503	±9	10.0	11823	0.0846
0.10	±0.006	0.007854	±9	12.1	14306	0.0699
0.09	±0.005	0.006362	±9	14.9	17662	0.0566
0.08	±0.005	0.005027	±9	18.9	22353	0.0447
0.07	±0.005	0.003848	±10	24.7	29196	0.0343
0.06	±0.004	0.002827	±10	33.6	39739	0.0252
0.05	±0.004	0.001964	±10	48.4	57224	0.0175
0.04	±0.003	0.001257	±12	75.6	94622	0.0106
0.03	±0.003	0.0007069	±12	134	168217	0.00594
0.02	±0.002	0.0003140	±12	303	357833	0.00279

(\*) Reference value

---

# **Monel**

## **Nickel Alloy Wire, Ribbon**

# Alloys : Monel (Nickel Alloy Wire, Ribbon)

It has excellent corrosion resistance and is used for seawater desalination plants, heat exchange equipment, and coating materials for marine structures.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]
0.50

( \* ) Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density $\text{g/cm}^3$ (20°C)	Melting Point °C	Max Operating Temperature °C
13.9	8.80	1350	400

Chemical Composition	C	Si	Mn	Ni	Cu	Fe	S
(%)	$\leq 0.3$	$\leq 0.5$	$\leq 2.0$	$\geq 63$	BAL	$\leq 2.5$	$\leq 0.024$

Alloys	Type	Diameter (mm)
Monel400	Wire	$\phi 5.00 \sim 0.03$
	Ribbon	Please consult

# Monel (Nickel Alloy Wire, Ribbon)

## Resistance • Length • Weight

Wire Electrical Resistivity (23°C μΩm) 0.5 (\* )Reference value

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
5.00	±0.060	19.6		0.0255	5.73	175
4.50	±0.050	15.9		0.0315	7.07	141
4.00	±0.050	12.6		0.0398	8.95	112
3.50	±0.050	9.62		0.0520	11.7	85.6
3.20	±0.040	8.04		0.0622	14.0	71.5
2.90	±0.040	6.60		0.0757	17.0	58.8
2.60	±0.040	5.31		0.0942	21.2	47.2
2.30	±0.040	4.15		0.0120	27.1	37.0
2.00	±0.030	3.14		0.0159	35.8	27.9
1.80	±0.030	2.54		0.0197	44.2	22.6
1.60	±0.030	2.01		0.0249	55.9	17.9
1.50	±0.030	1.77		0.0283	63.6	15.7
1.40	±0.030	1.54		0.0325	73.0	13.7
1.30	±0.030	1.33		0.0377	84.7	11.8
1.20	±0.030	1.13		0.0442	99.4	10.1
1.10	±0.030	0.950		0.0526	118	8.45
1.00	±0.030	0.785		0.0637	143	6.99
0.90	±0.030	0.636		0.0786	177	5.66
0.85	±0.030	0.567		0.0882	198	5.05
0.80	±0.020	0.502		0.0995	224	4.47
0.75	±0.020	0.442		1.13	254	3.93
0.70	±0.020	0.385		1.30	292	3.42
0.65	±0.020	0.332		1.51	339	2.95
0.60	±0.020	0.283		1.77	398	2.52
0.55	±0.020	0.237		2.11	473	2.11
0.50	±0.010	0.196		2.55	573	1.75
0.45	±0.010	0.159		3.15	707	1.41
0.40	±0.010	0.126		3.98	895	1.12
0.35	±0.010	0.0962		5.20	1168	0.856
0.32	±0.010	0.0804		6.22	1398	0.715
0.29	±0.010	0.0660		7.57	1702	0.588
0.26	±0.010	0.0531		9.42	2117	0.472
0.23	±0.010	0.0415		12.0	2706	0.370
0.20	±0.006	0.0314		15.9	3578	0.279
0.18	±0.006	0.0254		19.7	4418	0.226
0.16	±0.006	0.0201		24.9	5591	0.179
0.15	±0.006	0.0177		28.3	6361	0.157
0.14	±0.006	0.0154		32.5	7303	0.137
0.13	±0.006	0.0133		37.7	8469	0.118
0.12	±0.006	0.0113		44.2	9940	0.101
0.11	±0.006	0.00950		52.6	11829	0.0845
0.10	±0.006	0.00785		63.7	14313	0.0699
0.09	±0.005	0.00636		78.6	17671	0.0566
0.08	±0.005	0.00502		99.5	22365	0.0447
0.07	±0.005	0.00385		130	29211	0.0342
0.06	±0.004	0.00283		177	39759	0.0252
0.05	±0.004	0.00196		255	57253	0.0175
0.04	±0.003	0.00126		398	89458	0.0112
0.03	±0.003	0.000707		708	159037	0.00629

---

# **2%MnNi**

## **Nickel Alloy Wire,Ribbon**

# Alloys : 2%MnNi (Nickel Alloy Wire, Ribbon)

The temperature at which it softens is higher than that of nickel wire, and it has a characteristic of low gas release under vacuum heating, making it suitable for inner lead wires for electron tubes.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
* 0.11	* 4300

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$	Density $\text{g}/\text{cm}^3$ (20 $^{\circ}\text{C}$ )	Melting Point $^{\circ}\text{C}$	Max Operating Temperature $^{\circ}\text{C}$
14.0	8.90	1360	400

Chemical Composition	C	Si	Mn	Ni	Cu	Fe	S
(%)	$\leq 0.1$	$\leq 0.2$	1.5~2.5	$\geq 97.00$	$\leq 0.1$	$\leq 2.0$	$\leq 0.008$

Alloys	Type	Diameter (mm)
2%MnNi	Wire	$\phi 5.00 \sim 0.03$
	Ribbon	Please consult

# 2%MnNi (Nickel Alloy Wire, Ribbon)

## Resistance·Length·Weight

Wire Electrical Resistivity (23°CμΩm) \*0.11 (\* )Reference value

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
5.00	±0.060	19.6	±5	0.00561	5.73	175
4.50	±0.050	15.9	±5	0.00692	7.07	141
4.00	±0.050	12.6	±5	0.00876	8.95	112
3.50	±0.050	9.62	±6	0.0114	11.7	85.6
3.20	±0.040	8.04	±6	0.0137	14.0	71.5
2.90	±0.040	6.60	±6	0.0167	17.0	58.8
2.60	±0.040	5.31	±6	0.0207	21.2	47.2
2.30	±0.040	4.15	±6	0.0265	27.1	37.0
2.00	±0.030	3.14	±6	0.0350	35.8	27.9
1.80	±0.030	2.54	±6	0.0432	44.2	22.6
1.60	±0.030	2.01	±7	0.0547	55.9	17.9
1.50	±0.030	1.77	±7	0.0623	63.6	15.7
1.40	±0.030	1.54	±7	0.0715	73.0	13.7
1.30	±0.030	1.33	±7	0.0829	84.7	11.8
1.20	±0.030	1.13	±7	0.0973	99.4	10.1
1.10	±0.030	0.950	±7	0.116	118	8.45
1.00	±0.030	0.785	±7	0.140	143	6.99
0.90	±0.030	0.636	±7	0.173	177	5.66
0.85	±0.030	0.567	±7	0.194	198	5.05
0.80	±0.020	0.502	±7	0.219	224	4.47
0.75	±0.020	0.442	±7	0.249	254	3.93
0.70	±0.020	0.385	±7	0.286	292	3.42
0.65	±0.020	0.332	±7	0.332	339	2.95
0.60	±0.020	0.283	±7	0.389	398	2.52
0.55	±0.020	0.237	±8	0.463	473	2.11
0.50	±0.010	0.196	±8	0.561	573	1.75
0.45	±0.010	0.159	±8	0.692	707	1.41
0.40	±0.010	0.126	±8	0.876	895	1.12
0.35	±0.010	0.0962	±8	1.14	1168	0.856
0.32	±0.010	0.0804	±8	1.37	1398	0.715
0.29	±0.010	0.0660	±8	1.67	1702	0.588
0.26	±0.010	0.0531	±8	2.07	2117	0.472
0.23	±0.010	0.0415	±8	2.65	2706	0.370
0.20	±0.006	0.0314	±9	3.50	3578	0.279
0.18	±0.006	0.0254	±9	4.32	4418	0.226
0.16	±0.006	0.0201	±9	5.47	5591	0.179
0.15	±0.006	0.0177	±9	6.23	6361	0.157
0.14	±0.006	0.0154	±9	7.15	7303	0.137
0.13	±0.006	0.0133	±9	8.29	8469	0.118
0.12	±0.006	0.0113	±9	9.73	9940	0.101
0.11	±0.006	0.00950	±9	11.6	11829	0.0845
0.10	±0.006	0.00785	±9	14.0	14313	0.0699
0.09	±0.005	0.00636	±10	17.3	17671	0.0566
0.08	±0.005	0.00502	±10	21.9	22365	0.0447
0.07	±0.005	0.00385	±10	28.6	29211	0.0342
0.06	±0.004	0.00283	±11	38.9	39759	0.0252
0.05	±0.004	0.00196	±11	56.1	57253	0.0175
0.04	±0.003	0.00126	±12	87.6	89458	0.0112
0.03	±0.003	0.000707	±12	156	159037	0.00629



---

# **42%NiFe**

## **Nickel Alloy Wire,Ribbon**

# Alloys : 42%NiFe (Nickel Alloy Wire,Ribbon)

It is used in the electronics field such as IC leads using corrosion resistance such as hard and soft glass sealing materials.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
* 0.65	* 2360

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$		Density g/cm <sup>3</sup> (20°C)
30~300°C	4.0~4.7	8.10
30~450°C	6.7~7.4	

Chemical Composition	C	Si	Mn	Ni	Fe
(%)	$\leq 0.05$	$\leq 0.3$	$\leq 0.6$	41.0	BAL

Alloys	Type	Diameter (mm)
42%NiFe	Wire	$\phi 5.00 \sim 0.03$
	Ribbon	Please consult

# 42%NiFe (Nickel Alloy Wire, Ribbon)

## Resistance·Length·Weight

Wire      Electrical Resistivity (23°CμΩm) \* 0.65      ( \* )Reference value

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
5.00	±0.060	19.6	±5	0.0357	6.18	162
4.50	±0.050	15.9	±5	0.0440	7.63	131
4.00	±0.050	12.6	±5	0.0557	9.65	104
3.50	±0.050	9.62	±6	0.0728	12.6	79.3
3.20	±0.040	8.04	±6	0.0871	15.1	66.3
2.90	±0.040	6.60	±6	0.1060	18.4	54.5
2.60	±0.040	5.31	±6	0.1319	22.8	43.8
2.30	±0.040	4.15	±6	0.169	29.2	34.3
2.00	±0.030	3.14	±6	0.223	38.6	25.9
1.80	±0.030	2.54	±6	0.275	47.7	21.0
1.60	±0.030	2.01	±7	0.348	60.3	16.6
1.50	±0.030	1.77	±7	0.396	68.6	14.6
1.40	±0.030	1.54	±7	0.455	78.8	12.7
1.30	±0.030	1.33	±7	0.528	91.4	10.9
1.20	±0.030	1.13	±7	0.619	107	9.33
1.10	±0.030	0.950	±7	0.737	128	7.84
1.00	±0.030	0.785	±7	0.892	154	6.48
0.90	±0.030	0.636	±7	1.101	191	5.25
0.85	±0.030	0.567	±7	1.234	214	4.68
0.80	±0.020	0.502	±7	1.393	241	4.14
0.75	±0.020	0.442	±7	1.585	275	3.64
0.70	±0.020	0.385	±7	1.82	315	3.17
0.65	±0.020	0.332	±7	2.11	365	2.74
0.60	±0.020	0.283	±7	2.48	429	2.33
0.55	±0.020	0.237	±8	2.95	510	1.96
0.50	±0.010	0.196	±8	3.57	618	1.62
0.45	±0.010	0.159	±8	4.40	763	1.31
0.40	±0.010	0.126	±8	5.57	965	1.04
0.35	±0.010	0.0962	±8	7.28	1260	0.793
0.32	±0.010	0.0804	±8	8.71	1508	0.663
0.29	±0.010	0.0660	±8	10.60	1836	0.545
0.26	±0.010	0.0531	±8	13.19	2284	0.438
0.23	±0.010	0.0415	±8	16.9	2919	0.343
0.20	±0.006	0.0314	±9	22.3	3860	0.259
0.18	±0.006	0.0254	±9	27.5	4766	0.210
0.16	±0.006	0.0201	±9	34.8	6032	0.166
0.15	±0.006	0.0177	±9	39.6	6863	0.146
0.14	±0.006	0.0154	±9	45.5	7878	0.127
0.13	±0.006	0.0133	±9	52.8	9137	0.109
0.12	±0.006	0.0113	±9	61.9	10723	0.0933
0.11	±0.006	0.00950	±9	73.7	12761	0.0784
0.10	±0.006	0.00785	±9	89.2	15441	0.0648
0.09	±0.005	0.00636	±10	110.1	19063	0.0525
0.08	±0.005	0.00502	±10	139.3	24127	0.0414
0.07	±0.005	0.00385	±10	182	31512	0.0317
0.06	±0.004	0.00283	±11	248	42892	0.0233
0.05	±0.004	0.00196	±11	357	61764	0.0162
0.04	±0.003	0.00126	±12	557	96506	0.0104
0.03	±0.003	0.000707	±12	991	171567	0.00583

---

# **52%NiFe**

## **Nickel Alloy Wire,Ribbon**

# Alloys : 52%NiFe (Nickel Alloy Wire,Ribbon)

It is used in the electronics field such as IC leads using corrosion resistance such as hard and soft glass sealing materials.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
0.37	* 3900

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$		Density g/cm <sup>3</sup> (20°C)
30~300°C	9.7~10.2	8.35
30~450°C	10.0~10.5	

Chemical Composition	C	Si	Mn	Ni	Fe
(%)	$\leq 0.05$	$\leq 0.3$	$\leq 0.6$	50.5	BAL

Alloys	Type	Diameter (mm)
52%NiFe	Wire	$\phi 5.00 \sim 0.03$
	Ribbon	Please consult

# 52%NiFe (Nickel Alloy Wire, Ribbon)

## Resistance·Length·Weight

Wire Electrical Resistivity (23°CμΩm) 0.37 ( \* )Reference value

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
5.00	±0.060	19.6	±5	0.0219	6.10	164
4.50	±0.050	15.9	±5	0.0271	7.53	133
4.00	±0.050	12.6	±5	0.0342	9.54	105
3.50	±0.050	0.62	±6	0.0447	12.5	80.3
3.20	±0.040	8.04	±6	0.0535	14.9	67.1
2.90	±0.040	6.60	±6	0.0651	18.1	55.1
2.60	±0.040	5.31	±6	0.0810	22.6	44.3
2.30	±0.040	4.15	±6	0.104	28.8	34.7
2.00	±0.030	3.14	±6	0.137	38.1	26.2
1.80	±0.030	2.54	±6	0.169	47.1	21.2
1.60	±0.030	2.01	±7	0.214	59.6	16.8
1.50	±0.030	1.77	±7	0.243	67.8	14.7
1.40	±0.030	1.54	±7	0.279	77.8	12.8
1.30	±0.030	1.33	±7	0.324	90.3	11.1
1.20	±0.030	1.13	±7	0.380	106	9.44
1.10	±0.030	0.950	±7	0.453	126	7.93
1.00	±0.030	0.785	±7	0.548	153	6.55
0.90	±0.030	0.636	±7	0.676	188	5.31
0.85	±0.030	0.567	±7	0.758	211	4.74
0.80	±0.020	0.502	±7	0.856	238	4.20
0.75	±0.020	0.442	±7	0.974	271	3.69
0.70	±0.020	0.385	±7	1.12	311	3.21
0.65	±0.020	0.332	±7	1.30	361	2.77
0.60	±0.020	0.283	±7	1.52	424	2.36
0.55	±0.020	0.237	±8	1.81	504	1.98
0.50	±0.010	0.196	±8	2.19	610	1.64
0.45	±0.010	0.159	±8	2.71	753	1.33
0.40	±0.010	0.126	±8	3.42	953	1.05
0.35	±0.010	0.0962	±8	4.47	1245	0.803
0.32	±0.010	0.0804	±8	5.35	1490	0.671
0.29	±0.010	0.0660	±8	6.51	1814	0.551
0.26	±0.010	0.0531	±8	8.10	2257	0.443
0.23	±0.010	0.0415	±8	10.4	2884	0.347
0.20	±0.006	0.0314	±9	13.7	3814	0.262
0.18	±0.006	0.0254	±9	16.9	4709	0.212
0.16	±0.006	0.0201	±9	21.4	5959	0.168
0.15	±0.006	0.0177	±9	24.3	6780	0.147
0.14	±0.006	0.0154	±9	27.9	7784	0.128
0.13	±0.006	0.0133	±9	32.4	9027	0.111
0.12	±0.006	0.01130	±9	38.0	10595	0.0944
0.11	±0.006	0.00950	±9	45.3	12608	0.0793
0.10	±0.006	0.00785	±9	54.8	15256	0.0655
0.09	±0.005	0.00636	±10	67.6	18835	0.0531
0.08	±0.005	0.00502	±10	85.6	23838	0.0420
0.07	±0.005	0.00385	±10	112	31135	0.0321
0.06	±0.004	0.00283	±11	152	42378	0.0236
0.05	±0.004	0.00196	±11	219	61024	0.0164
0.04	±0.003	0.00126	±12	432	96351	0.0105
0.03	±0.003	0.000707	±12	609	169512	0.00590

---

# **Kovar**

## **Nickel Alloy Wire, Ribbon**

# Alloys : Kovar (Nickel Alloy Wire,Ribbon)

It is an iron-nickel-cobalt alloy with a low coefficient of thermal expansion near room temperature among metals, and is widely used for electron tube materials, etc., as it is suitable for sealing with hard glass and ceramics.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Average TCR [ $\times 10^{-6}/^{\circ}\text{C}$ ]
0.49	* 3500

(\* )Reference value

Thermal Expansion Coefficient $\times 10^{-6}/$		Density g/cm <sup>3</sup> (20°C)	Melting Point °C
25-200°C	5.2	8.24	1450
25-300°C	5.1		
25-400°C	4.9		
25-45°C	5.3		
25-500°C	6.2		

Chemical Composition	C	Si	Mn	Ni	Co	Fe
(%)	$\leq 0.015$	$\leq 0.5$	$\leq 1.0$	28~30	15.5~17.5	BAL

Alloys	Type	Diameter (mm)
KOV	Wire	$\phi 5.00 \sim 0.03$
	Ribbon	Please consult



# Kovar (Nickel Alloy Wire,Ribbon)

## Resistance·Length·Weight

Wire Electrical Resistivity (23°CμΩm) **0.49** (\* )Reference value

Diameter (mm)	Tolerance (mm)	Cross section (mm <sup>2</sup> )	Resistance Tolerance (%)	DC Resistance (Ω/m)	Length (m/Kg)	Weight (g/m)
5.00	±0.060	19.6	±5	0.0250	6.18	162
4.50	±0.050	15.9	±5	0.0308	7.63	131
4.00	±0.050	12.6	±5	0.0390	9.65	104
3.50	±0.050	0.62	±6	0.0510	12.6	79.3
3.20	±0.040	8.04	±6	0.0610	15.1	66.3
2.90	±0.040	6.60	±6	0.0742	18.4	54.5
2.60	±0.040	5.31	±6	0.0923	22.8	43.8
2.30	±0.040	4.15	±6	0.118	29.2	34.3
2.00	±0.030	3.14	±6	0.156	38.6	25.9
1.80	±0.030	2.54	±6	0.193	47.7	21.0
1.60	±0.030	2.01	±7	0.244	60.3	16.6
1.50	±0.030	1.77	±7	0.277	68.6	14.6
1.40	±0.030	1.54	±7	0.318	78.8	12.7
1.30	±0.030	1.33	±7	0.369	91.4	10.9
1.20	±0.030	1.13	±7	0.433	107	9.33
1.10	±0.030	0.950	±7	0.516	128	7.84
1.00	±0.030	0.785	±7	0.624	154	6.48
0.90	±0.030	0.636	±7	0.771	191	5.25
0.85	±0.030	0.567	±7	0.864	214	4.68
0.80	±0.020	0.502	±7	0.975	241	4.14
0.75	±0.020	0.442	±7	1.11	275	3.64
0.70	±0.020	0.385	±7	1.27	315	3.17
0.65	±0.020	0.332	±7	1.48	365	2.74
0.60	±0.020	0.283	±7	1.73	429	2.33
0.55	±0.020	0.237	±8	2.06	510	1.96
0.50	±0.010	0.196	±8	2.50	618	1.62
0.45	±0.010	0.159	±8	3.08	763	1.31
0.40	±0.010	0.126	±8	3.90	965	1.04
0.35	±0.010	0.0962	±8	5.10	1260	0.793
0.32	±0.010	0.0804	±8	6.10	1508	0.663
0.29	±0.010	0.0660	±8	7.42	1836	0.545
0.26	±0.010	0.0531	±8	9.23	2284	0.438
0.23	±0.010	0.0415	±8	11.8	2919	0.343
0.20	±0.006	0.0314	±9	15.6	3860	0.259
0.18	±0.006	0.0254	±9	19.3	4766	0.210
0.16	±0.006	0.0201	±9	24.4	6032	0.166
0.15	±0.006	0.0177	±9	27.7	6863	0.146
0.14	±0.006	0.0154	±9	31.8	7878	0.127
0.13	±0.006	0.0133	±9	36.9	9137	0.109
0.12	±0.006	0.01130	±9	43.3	10723	0.0933
0.11	±0.006	0.00950	±9	51.6	12761	0.0784
0.10	±0.006	0.00785	±9	62.4	15441	0.0648
0.09	±0.005	0.00636	±10	77.1	19063	0.0525
0.08	±0.005	0.00502	±10	97.5	24127	0.0414
0.07	±0.005	0.00385	±10	127	31512	0.0317
0.06	±0.004	0.00283	±11	173	42892	0.0233
0.05	±0.004	0.00196	±11	250	61764	0.0162
0.04	±0.003	0.00126	±12	390	96506	0.0104
0.03	±0.003	0.000707	±12	694	171567	0.00583

---

# **SUS304**

## **Stainless steel**

# Alloys : SUS304 (Stainless steel)

SUS304 is classified as austenitic stainless steel, and is called 18-8 stainless steel (18Cr-8Ni), which contains more than 18% chromium to provide good corrosion resistance. It is a typical stainless steel wire that is widely used in general.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat $\text{J/g}\cdot\text{K}$ (20°C)	Melting Point °C
0.72	17.3	7.93	1400

Chemical Composition	C	Ni	Cr	Mo	Si	Mn	P	S
(%)	$\leq 0.08$	8.0~10.5	18.0~20.0	—	$\leq 1.00$	$\leq 2.00$	$\leq 0.045$	$\leq 0.030$

Alloys	Type	Diameter (mm)	
SUS304	Wire	$\phi 6.00 \sim 0.020$	
	Ribbon	$t=2.90 \sim 0.05$	$w=40 \sim 0.2$ (Depends on thickness)

---

# **SUS310S**

## **Stainless steel**

# Alloys : SUS310S (Stainless steel)

SUS310S is classified as austenitic stainless steel and is a general-purpose heat-resistant stainless steel.

It is used for combustion chamber parts, combustion appliances, furnace parts, etc. It is resistant to repeated heating at about 1000°C.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat $\text{J/g}\cdot\text{K}$ (20°C)	Melting Point °C
0.78	14.4	7.98	1400

Chemical Composition	C	Ni	Cr	Mo	Si	Mn	P	S
(%)	$\leq 0.08$	19.0~22.0	24.0~26.0	—	$\leq 1.50$	$\leq 2.00$	$\leq 0.045$	$\leq 0.030$

Alloys	Type	Diameter (mm)	
SUS310S	Wire	$\phi 6.00 \sim 0.020$	
	Ribbon	$t = 2.90 \sim 0.05$	$w = 40 \sim 0.2$ (Depends on thickness)

---

# **SUS316L**

## **Stainless steel**

# Alloys : SUS310S (Stainless steel)

SUS316 is classified as an austenitic stainless steel (16-18Cr-10-14Ni), and by adding molybdenum (Mo: 2-3%), it has better corrosion resistance than SUS304, even under high concentration of hydrochloric acid solution such as seawater. SUS316L is low carbon steel and has excellent hardening workability.

Electrical Resistivity [ $\mu\Omega\text{m}$ ]	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat $\text{J/g}\cdot\text{K}$ (20°C)	Melting Point °C
0.77	16.0	7.98	1370

Chemical Composition	C	Ni	Cr	Mo	Si	Mn	P	S
(%)	$\leq 0.03$	12.0~15.0	16.0~18.0	2.0~3.0	$\leq 1.00$	$\leq 2.00$	$\leq 0.045$	$\leq 0.030$

Alloys	Type	Diameter (mm)	
SUS304	Wire	$\phi 6.00 \sim 0.020$	
	Ribbon	$t = 2.90 \sim 0.05$	$w = 40 \sim 0.2$ (Depends on thickness)

---

# **PBW2,PBW3**

## **Phosphor Bronze Wire**



# Alloys : PBW2, PBW3 (Phosphor Bronze Wire)

[JIS H 3270]

Good fatigue resistance, corrosion resistance, and wear resistance. Used in coil springs, spiral springs, wire mesh, etc.

JIS	JIS Code	Electrical Resistivity [ $\mu\Omega\text{m}$ ]
PBW2	C5191W	0.13
PBW3	C5212W	0.14

JIS	Thermal Expansion Coefficient $\times 10^{-6}/$	Specific Heat $\text{J/g}\cdot\text{K}$ ( $20^\circ\text{C}$ )	Melting Point $^\circ\text{C}$	
			liquid phase	solid phase
C 5191	18.0	8.83	1045	910
C 5212	18.2	8.8	1020	880

Chemical Composition	Alloy Number	Sn	P	Cu + Sn + P
(%)	C 5191	5.5~7.0	0.03~0.35	$\geq 99.5$
	C 5212	7.0~9.0	0.03~0.35	$\geq 99.5$

Alloys	Type	Diameter (mm)
C5191W	Wire	$\phi 1.00 \sim 0.03$
C5212W	Wire	$\phi 1.00 \sim 0.03$

JIS Code
O
1/2H
H

---

# Various types of Ribbon

# Various types of Ribbon

Code	Alloys
NCHR1	Nickel Chrome Type 1
NCHR2	Nickel Chrome Type 2
FCHR2	Fe-Chrome Heating Wire Type 2
CN49R	Copper Nickel Resistance Wire No 49
CN30R	Copper Nickel Resistance Wire No 30
CN15R	Copper Nickel Resistance Wire No 15
CN10R	Copper Nickel Resistance Wire No 10
CN 5R	Copper Nickel Resistance Wire No 5

\* Please contact us if you need materials other than those listed above,  
or if you need products in sizes other than those listed.

## Dimensions of alloy strip for electric heating and tolerance of conductor resistance

### Conductor resistance tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.08 above 3.15 below	Less than 10	±8
0.08 above 3.15 below	10 or more	±7

### Dimensional tolerance of Ribbon

Thickness [mm]	Width [mm]	Resistance Tolerance [%]
0.080 above 0.090 below		±0.010
0.090 above 0.118 below		±0.013
0.118 above 0.160 below		±0.016
0.160 above 0.224 below		±0.020
0.224 above 0.315 below		±0.025
0.315 above 0.425 below		±0.032
0.425 above 0.600 below		±0.040
0.600 above 0.850 below		±0.050
0.850 above 1.180 below		±0.063
1.180 above 1.700 below		±0.080
1.700 above 2.500 below		±0.100
2.500 above 3.150 below		±0.130
	0.40 or more, 50 or less	±0.11√W

\* We can manufacture products other than the standard (size and tolerance), so please inquire.

---

# **Ribbon dimensions and effective cross-sectional area**

# Ribbon dimensions and effective cross-sectional area

Thickness (m)	Width (mm)														
	40	32	25	20	16	13	10	6.5	5.0	3.2	2.4	1.6	0.8	0.4	
2.90	113.7	90.94	71.05	56.84	45.47	36.95	28.42								
2.60	101.9	81.54	63.70	50.96	40.77	33.12	25.48	16.22							
2.30	90.16	72.13	56.35	45.08	36.06	29.30	22.54	14.35	11.04						
2.00	78.40	62.72	49.00	39.20	31.36	25.48	19.60	12.48	9.600						
1.80	70.56	56.45	44.10	35.28	28.22	22.93	17.64	11.23	8.640						
1.60	62.72	50.18	39.20	31.36	25.09	20.38	15.68	9.984	7.680						
1.40	54.88	43.90	34.30	27.44	21.95	17.84	13.72	8.736	6.720						
1.20	47.04	37.63	29.40	23.52	18.82	15.29	11.76	7.488	5.760						
1.00	39.20	31.36	24.50	19.60	15.68	12.74	9.800	6.240	4.800						
0.90		28.22	22.05	17.64	14.11	11.47	8.820	5.616	4.320	2.765	2.074				
0.80		25.09	19.60	15.68	12.54	10.19	7.840	4.992	3.840	2.458	1.843				
0.70			17.15	13.72	10.98	8.918	6.860	4.368	3.360	2.150	1.613				
0.60			14.70	11.76	9.408	7.644	5.880	3.744	2.880	1.843	1.382				
0.50			12.25	9.800	7.840	6.370	4.900	3.120	2.400	1.536	1.152				
0.45			11.03	8.820	7.056	5.733	4.410	2.808	2.160	1.382	1.037	0.69120			
0.40					6.272	5.096	3.920	2.496	1.920	1.229	0.9216	0.61440			
0.35						4.459	3.430	2.184	1.680	1.075	0.8064	0.53760			
0.32						4.077	3.136	1.997	1.536	0.9830	0.7373	0.49150			
0.29							2.842	1.810	1.392	0.8909	0.6682	0.44540	0.2227		
0.26							2.548	1.622	1.248	0.7987	0.5990	0.39940	0.1997	0.09984	
0.23								1.435	1.104	0.7066	0.5299	0.35330	0.1766	0.02204	
0.20								1.248	0.9600	0.6144	0.4608	0.30720	0.1536	0.07680	
0.18								1.123	0.8640	0.5530	0.4147	0.27650	0.1382	0.06912	
0.16										0.4915	0.3686	0.24580	0.1229	0.06144	
0.14										0.4301	0.3226	0.21500	0.1075	0.05376	
0.12											0.2765	0.18430	0.09216	0.04608	
0.10												0.15360	0.07680	0.03840	
0.08													0.12290	0.06144	0.03072

---

# **Insulating Coatings**

## **(Glass , Silk rolling) Dimensions**

# Insulating Coatings

## (Glass , Silk rolling) Dimensions

Diameter (mm)	SG(Single glass rolling) Maximum temperature 180°C		DG(Double glass rolling) Maximum temperature 180°C		SS(Single glassrolling) Maximum temperature 105°C		DS(Double glass rolling) Maximum temperature 105°C	
	Heat resistance differentiation A		Heat resistance differentiation A		Heat resistance differentiation H		Heat resistance differentiation H	
	Minimum thickness (mm)	Maximum outside diameter (mm)	Minimum thickness (mm)	Maximum outside diameter (mm)	Minimum thickness (mm)	Maximum outside diameter (mm)	Minimum thickness (mm)	Maximum outside diameter (mm)
1.20			0.10	1.49				
1.00	0.06	1.170	0.10	1.29	0.030	1.08	0.050	1.160
0.90	0.06	1.060	0.10	1.18	0.025	0.960	0.040	1.040
0.85	0.06	1.010	0.10	1.13	0.025	0.940	0.040	0.970
0.80	0.06	0.960	0.10	1.08	0.025	0.860	0.040	0.940
0.75	0.06	0.910	0.10	1.03	0.025	0.840	0.040	0.870
0.70	0.06	0.860	0.10	0.980	0.025	0.760	0.040	0.840
0.65	0.06	0.810	0.10	0.920	0.025	0.710	0.040	0.780
0.60	0.06	0.760	0.10	0.880	0.020	0.670	0.040	0.710
0.55	0.06	0.710	0.10	0.830	0.020	0.620	0.040	0.660
0.50	0.06	0.650	0.10	0.750	0.020	0.570	0.040	0.610
0.45	0.06	0.600	0.10	0.700	0.020	0.520	0.040	0.560
0.40	0.06	0.550	0.10	0.650	0.020	0.465	0.040	0.510
0.35	0.06	0.500	0.10	0.600	0.020	0.415	0.035	0.453
0.32	0.06	0.470	0.10	0.570	0.020	0.380	0.035	0.415
0.29	0.06	0.440	0.10	0.540	0.020	0.350	0.035	0.385
0.26	0.06	0.410	0.10	0.510	0.020	0.320	0.035	0.353
0.23	0.06	0.378	0.10	0.478	0.020	0.290	0.035	0.323
0.20	0.06	0.348	0.10	0.448	0.020	0.258	0.035	0.298
0.18	0.06	0.328	0.10	0.428	0.015	0.223	0.030	0.267
0.16	0.06	0.308	0.10	0.408	0.015	0.213	0.030	0.246
0.15	0.06	0.298	0.10	0.398	0.015	0.201	0.030	0.236
0.14	0.06	0.288	0.10	0.388	0.015	0.191	0.030	0.226
0.12			0.06	0.300	0.015	0.171	0.030	0.205
0.10			0.06	0.270	0.015	0.150	0.025	0.181
0.09			0.06	0.260	0.015	0.140	0.025	0.171
0.08			0.06	0.250	0.015	0.129	0.025	0.162
0.07			0.06	0.240				
0.06			0.06	0.230				

---

# **Insulating Coatings**

**(Polyester, Polyurethane, Polyamide-imide)**



# Insulating Coatings

(Polyester, Polyurethane, Polyamide-imide)

## UE (Polyurethane)

### Feature

Can be soldered and is versatile.

### Usage

Coils for electronic devices, relay coils, etc.

## PE (Polyester)

### Feature

It is widely used as a general-purpose product.

### Usage

General-purpose motors, transformers, etc.

## AI (Polyamide-imide)

### Feature

Excellent heat resistance, wear resistance, and refrigerant resistance.

### Usage

Heat-resistant coils for electronic devices, etc.

Type	Temperature Index	nylon coat	colorant	Soldering
UE	130°C	○	○	○ (380°C)

Type	Temperature Index	nylon coat	colorant	Soldering
PE	155°C	○	✖	✖

Type	Temperature Index	nylon coat	colorant	Soldering
AI	210°C	✖	✖	✖

## UE·PE·AI Method (Type 1)

Method [mm]					Dielectric breakdown voltage [V]
Conductor diameter		Minimum film thickness [mm]	Maximum outside diameter [mm]	Outer Diameter Center Value [mm]	
diameter [mm]	Tolerance [mm]				
0.70	±0.020	0.019	0.776	0.757	3050
0.65	±0.020	0.018	0.724	0.705	3050
0.60	±0.020	0.017	0.672	0.653	3050
0.55	±0.020	0.017	0.620	0.602	3050
0.50	±0.010	0.017	0.560	0.547	3050
0.45	±0.010	0.016	0.508	0.495	2800
0.40	±0.010	0.015	0.456	0.443	2800
0.35	±0.010	0.014	0.402	0.390	2800
0.32	±0.010	0.014	0.372	0.360	2800
0.29	±0.010	0.013	0.340	0.328	2400
0.26	±0.010	0.013	0.310	0.298	2400
0.23	±0.008	0.013	0.278	0.267	2400
0.20	±0.008	0.012	0.246	0.235	2400
0.18	±0.008	0.012	0.226	0.215	2400
0.16	±0.008	0.011	0.204	0.193	2200
0.15	±0.008	0.010	0.192	0.181	2200
0.14	±0.008	0.010	0.182	0.171	2200
0.13	±0.008	0.010	0.172	0.161	2200
0.12	±0.008	0.010	0.162	0.151	2000
0.11	±0.008	0.009	0.150	0.139	2000
0.10	±0.008	0.009	0.140	0.129	2000

## UE·PE·AI Method (Type 2)

Method [mm]					Dielectric breakdown voltage [V]
Conductor diameter		Minimum film thickness [mm]	Maximum outside diameter [mm]	Outer Diameter Center Value [mm]	
diameter [mm]	Tolerance [mm]				
0.70	±0.008	0.013	0.746	0.735	2150
0.65	±0.008	0.012	0.694	0.684	2150
0.60	±0.008	0.012	0.644	0.634	2150
0.55	±0.006	0.012	0.592	0.583	2150
0.50	±0.006	0.012	0.542	0.533	2150
0.45	±0.006	0.011	0.490	0.481	2000
0.40	±0.005	0.011	0.439	0.4305	2000
0.35	±0.005	0.010	0.387	0.3785	2000
0.32	±0.005	0.010	0.357	0.3485	2000
0.29	±0.004	0.010	0.324	0.3160	1600
0.26	±0.004	0.009	0.294	0.2860	1600
0.23	±0.004	0.009	0.262	0.2560	1600
0.20	±0.003	0.008	0.231	0.2235	1600
0.18	±0.003	0.008	0.211	0.2035	1600
0.16	±0.003	0.007	0.189	0.1815	1300
0.15	±0.003	0.006	0.177	0.1695	1300
0.14	±0.003	0.006	0.167	0.1595	1300
0.13	±0.003	0.006	0.157	0.1495	1300
0.12	±0.003	0.006	0.147	0.1395	1300
0.11	±0.003	0.005	0.135	0.1275	1100
0.10	±0.003	0.005	0.125	0.1175	1100
0.09	±0.003	0.005	0.113	0.1065	1100
0.08	±0.003	0.005	0.103	0.0965	1100

# Comparative characteristics of magnet wire

Comparative characteristics of magnet wire		UEW	PEW	AIW	
Temperature Index		120	155	200	
Thermal Characteristics	Resistance to cut through (°C)	240	270	400<	
	Heat shock resistance	△	○	◎	
	Spec of limit temp. (°C x 1h)	130	150	220	
	High temp. deterioration BDV	180	180	250	
Dielectric strength		○	○	○	
Crazing	Abrasion strength	△	○	◎	
	Crazing resistance	○	◎	◎	
	Flexibility	○	◎	◎	
Solderability		◎	✖	✖	
Water resistance	Moisture resistance 60°C 80%RH×72H		○	✖	◎
	Resistance to high temp., high moisture and high pressure (Quantity of water 0.2wt%)	120°C×72H	○	△	○
		130°C×72H	○	✖	○
		150°C×72H	✖	✖	○
chemical resistance	Acid resistance		○	◎	◎
	Alkali resistance		○	○	○
	Oil resistance		◎	◎	◎
	Varnish resistance		◎	◎	◎
	Xylene resistance		◎	◎	◎
	Alcohol resistance		○	◎	◎
	Gasoline resistance		◎	◎	◎
	Refrigerant resistance		△	○	◎

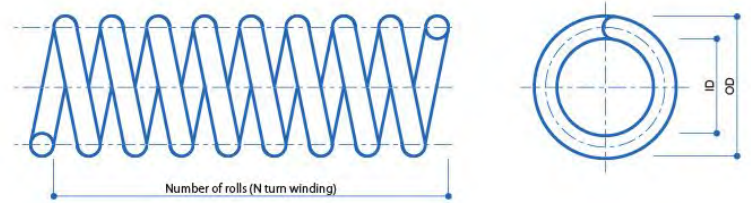
---

# Spiral Process

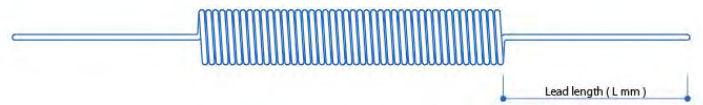
# Spiral Precess

Please contact us with your desired value and we will give you an estimate. For other details, please contact us. Please send us the specifications or your desired manufacturing drawing if you have one. We will consider the manufacturing method and make a proposal.

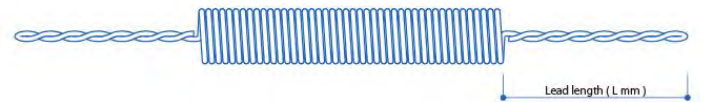
Material Type	
Wire diameter ( $\phi$ mm)	
Roll outer diameter (OD $\phi$ mm)	
Roll inner diameter (ID $\phi$ mm)	
Voltage (V)	
Use of electricity (W)	
Number of rolls (N turn winding)	
Resistance ( $\Omega$ )	
Lead length (L mm)	
Lead S (single) or Lead W (two-ply twist)	
Other Specifications	



## Lead S (Single) straight



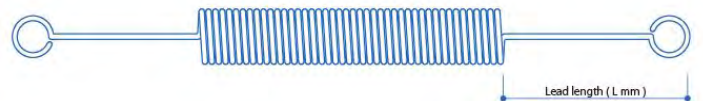
## Lead W (two-ply twist) straight



## Example of specification

Material Type	Kanthal AF
Wire diameter ( $\phi$ mm)	0.8mm
Roll outer diameter (OD $\phi$ mm)	$\phi$ 10mm
Roll inner diameter (ID $\phi$ mm)	$\phi$ 8mm
Voltage (V)	200V
Use of electricity (W)	1KW
Number of rolls (N turn winding)	500 rolls
Resistance ( $\Omega$ )	40 $\Omega$
Lead length (L mm)	500mm
Lead S (single) or Lead W (two-ply twist)	Lead W (two-ply twist)
Other Specifications	Lead shape Centering Round tip $\phi$ 5.0mm Pitch winding

## Lead Round tip



## Lead Ears



## Lead W (two-ply twist) freeze-out



---

# Wire Drawing Technology

# Wire Drawing Technology

Various types of electric heating wire, resistance wire, pure nickel wire, stainless steel wire, etc. can be processed in straight lines.

Wire diameter range	$\phi 0.15 \sim 6.00$ mm
---------------------	--------------------------

## Available length (approximate)

Wire diameter range	$\phi 0.15 \sim 0.30$ mm	$\phi 0.30 \sim 1.50$ mm	$\phi 1.50 \sim 6.00$ mm
Length range	L=1.0~100mm	L=1.0~2000mm	L=40~2000mm

\*It varies slightly depending on the material and quality.

---

# Twisted Wire

# Twisted Wire

Various types of electric heating wire, resistance wire, pure nickel wire, stainless steel wire, etc. can be stranded.

Superfine wire (collective, same core) twisted	Wire size	Product Variations
	$\varphi 0.02 \sim 0.08\text{mm}$	7/0.02 - 19/0.025 ~ 60/0.08

Various types of twisted cores	Wire size	Product Variations
	$\varphi 0.10 \sim 1.00\text{mm}$	7/0.1 ~ 88/0.45



---

# Thermocouple Alloys

# Thermocouple Alloys

Code	Compensation conductor Code		positive conductor	negative conductor
	(1981)	(1995)		
<b>K</b>	KX	KX·KCA	Cromel(Ni-Cr)	Almel(Ni-Al-Mn-Si)

Use classification and tolerance classification

:(1981) General grade, precision grade, heat resistant (1995) Class 1,Class 2

:ANSI STANDARARD , ANSI SPESICIAL

\*Please contact us for the availability of each production.

---

# Spool Specifications

# Spool Specifications

Code	diameter [D] [mm]	diameter [d] [mm]	Width [W] [mm]	Hole diameter [h] [mm]	diameter [a] [mm]	Total length [L] [mm]	Weight [g]
P-2G	60	30	50	15	5	60	30
P-3G	70	35	50	15	5	60	50
P-5G	80	40	70	15	6	82	85
P-1	100	50	70	16	10	90	105
P-3	130	60	90	20	10	110	170
P-5	160	70	90	20	12	114	300
P-10	200	90	110	25	12	134	500
P-15	250	110	110	30	15	140	890
P-30	300	130	130	30	15	160	1300
P-3R	130	80	90	20	10	110	250
P-5R	160	90	90	20	12	114	390
DIN80	80	50	64	16	8	80	70
DIN100	100	63	80	16	10	100	125
NS-5	120	54	130	15	10	150	195
HK76/16-60	63	44	51	16	4	60	50

