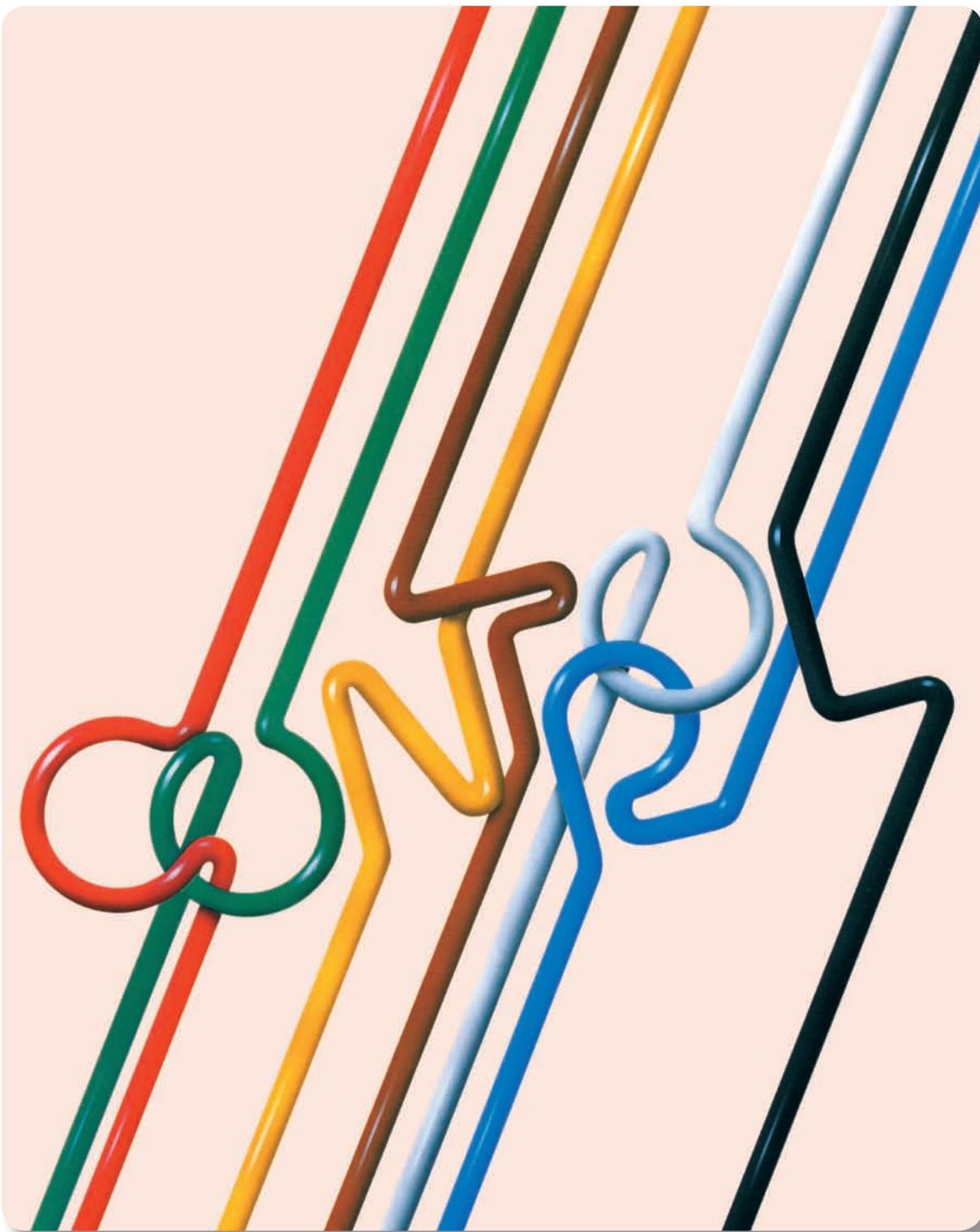


*Bound to* Innovate

# FURUKAWA CONTROL COPPER TUBE



**FURUKAWA ELECTRIC**

## ● Introduction

Furukawa Control Copper Tube is manufactured by the combined techniques of our company widely known as the leading maker of metals and electric wires and cables in Japan. We recommend the tube to customers as a most suitable product for use for piping of an automatic control system operated by pneumatic power in such industries as petroleum refining, petrochemistry, natural gas chemistry, synthetic fiber, steel, fertilizer, paper, medicine, and thermal power generation, and also ships.



## ● Salient Features of Furukawa Control Copper Tube



In building an air or oil-pressure automatic remote control system it has hitherto been customary to joint many of short-length copper tubes, which fact has required complicated supplementary work. In contrast, Furukawa Control Copper Tube is easily applied to such system because it can be laid, as it is, in any desired number and length, thereby greatly reducing the cost of laying.

Furukawa Long-Length Copper Tube, which is recognized as the best in Japan for its perfect performance, is used for our control copper tube. Made by our unique processes of casting, drawing, bright annealing, stranding, and covering with selected polyvinyl chloride, our tube excels in the undermentioned properties which are of utmost importance to the tube of this kind, and will, we are confident, meet our customers' satisfaction in every respect:

- |                         |                               |
|-------------------------|-------------------------------|
| 1. Pressure resistance  | 5. Aging resistance           |
| 2. Strength             | 6. Oil or chemical resistance |
| 3. Flexibility          | 7. Abrasion resistance        |
| 4. Corrosion resistance | 8. Outer appearance           |

Our tube, specially covered with bright and beautiful color polyvinyl chloride, is readily distinguishable at a glance. The coloring stays unchanged for long. The tube is so designed as to simplify color distinction and handling even in case it is cut into desired length or jointed.

Control copper tube must be free from any imperfection, and such high-quality product can be made only by a combination of outstanding techniques on nonferrous metals and those on electric wires and cables. Our products invariably undergo strict tests, and have naturally earned a reputation for excellent and uniform quality.

# ● Principal Specification of Furukawa Control Copper Tube

## 1. Construction

Copper tube used: Phosphorus deoxidized copper tube (C1220T-0)

Coloring: The color polyvinyl chloride used for the copper tube are as per Table 1.

Stranding: Concentric, adjacent layers in opposite directions.

Covering: Thickness of color polyvinyl chloride covering and black polyvinyl chloride covering are as per Table 2.

## 2. Tests

Construction test is made according to the test for electric wires and cables. (JIS C 3005)

Bending test is made by bending the tube by 180° at a radius 5 times its finished diameter.

Air pressure test is made by subjecting the tube to 0.69MPa (7kgf/cm<sup>2</sup>G) for 30 minutes.

## 3. Packing

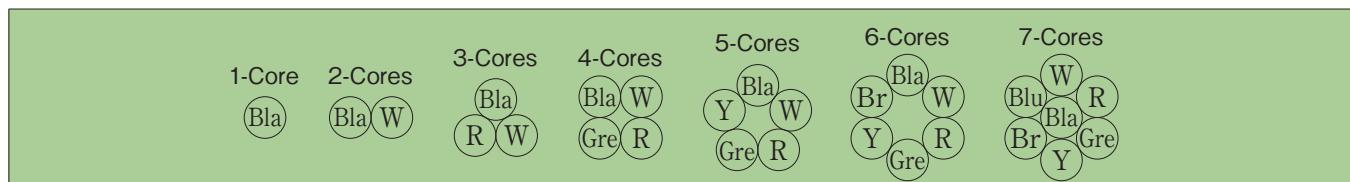
The tube is supplied on drum or in bundle.

## ● Furukawa Control Copper Tube coloring

Table 1 Coloring

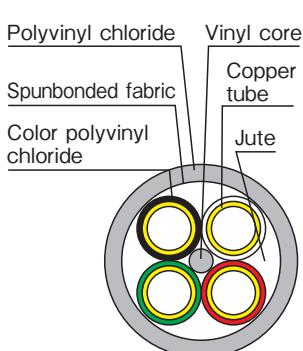
No. of stranded tubes	1	2	3	4	5	6	7
coloring	Black	White	Red	Green	Yellow	Brown	Blue

Note: In case only one tube is given a vinyl covering, no color covering.



## ● Furukawa Control Copper Tube Construction

Table 2 Construction



Copper tube			Thickness of color polyvinyl chloride covering (mm)	Outer diameter of strand (mm)	Spunbonded fabric (mm)	Thickness of polyvinyl chloride covering (mm)	Finished outer diameter (mm)	Maximum length (m)	Approximate weight (kg/km)
No. of stranded tubes	Outer diameter (mm)	Wall thickness (mm)							
<b>■ 6 × 1</b>									
1	6.0	1.0	—	—	—	1.0	8.0	1,000	175
2	6.0	1.0	0.5	14.0	0.2	1.4	17.2	1,000	420
3	6.0	1.0	0.5	15.1	0.2	1.4	18.3	1,000	580
4	6.0	1.0	0.5	16.9	0.2	1.5	20.3	1,000	760
5	6.0	1.0	0.5	18.9	0.2	1.6	22.5	1,000	940
6	6.0	1.0	0.5	21.0	0.2	1.6	24.6	1,000	1,115
7	6.0	1.0	0.5	21.0	0.2	1.6	24.6	1,000	1,270
<b>■ 8 × 1</b>									
1	8.0	1.0	—	—	—	1.1	10.2	600	245
2	8.0	1.0	0.5	18.0	0.2	1.5	21.4	600	570
3	8.0	1.0	0.5	19.4	0.2	1.6	23.0	600	805
4	8.0	1.0	0.5	21.7	0.2	1.7	25.5	600	1,055
5	8.0	1.0	0.5	24.3	0.2	1.8	28.3	600	1,300
6	8.0	1.0	0.5	27.0	0.2	1.9	31.2	600	1,555
7	8.0	1.0	0.5	27.0	0.2	1.9	31.2	600	1,770
<b>■ 10 × 1</b>									
1	10.0	1.0	—	—	—	1.1	12.2	600	315
2	10.0	1.0	0.5	22.0	0.2	1.7	25.8	600	750
3	10.0	1.0	0.5	23.7	0.2	1.7	27.5	600	1,035
4	10.0	1.0	0.5	26.6	0.2	1.9	30.8	600	1,365
<b>■ 12 × 1</b>									
1	12.0	1.0	—	—	—	1.1	14.2	450	385
2	12.0	1.0	0.6	26.4	0.2	1.9	30.6	450	950
3	12.0	1.0	0.6	28.4	0.2	1.9	32.6	450	1,305
4	12.0	1.0	0.6	31.9	0.2	2.1	36.5	450	1,710

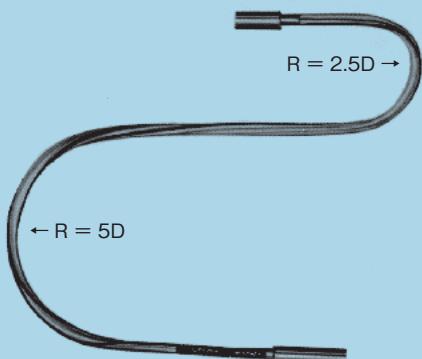
# ● Performance of Furukawa Control Copper Tube

## 1. Bending property

The tube, when given 180° U-turn bending at a bending radius 5 times, as specified, and more rigidly 2.5 times, its finished diameter, developed no disorder in the strand nor tearing at the color polyvinyl chloride.

Fig.1 shows a 4-cores control copper tube which has no

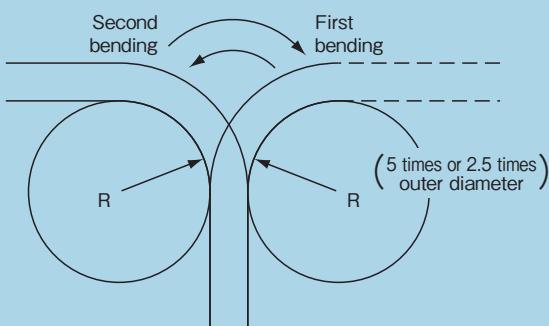
Fig.1 180° U-turn Bending Test for a 4-Cores Control Tube  
(as seen after the polyvinyl chloride covering is stripped off)



## 2. Repeated bending property

After repeated 180° bending test as shown in Fig.3, the polyvinyl chloride covering showed no change in appearance in case the bending of the tube was made at a radius 5 times its finished diameter, while it developed some distortion at the bent part in case of bending at a radius 2.5 times.

Fig.3



defects inside after being stripped of its polyvinyl chloride covering after 180° U-turn bending test.

Fig.2 shows changes in the outer diameter of the polyvinyl chloride covering after 180° U-turn bending test.

Copper tube size: 6.0mm outer diameter, 1.0mm thickness.

Fig.2 Changes in Outer Diameter of the Polyvinyl Chloride Covering after 180° U-turn Bending Test.

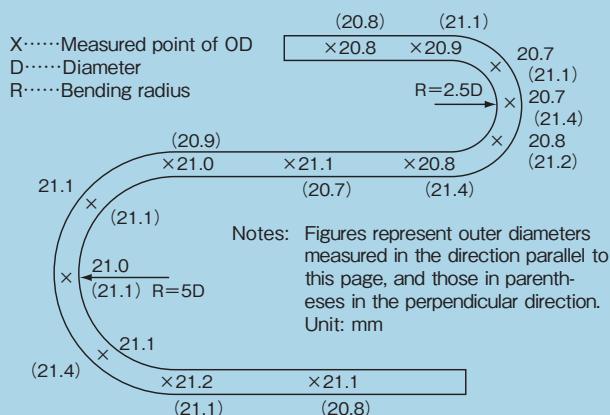
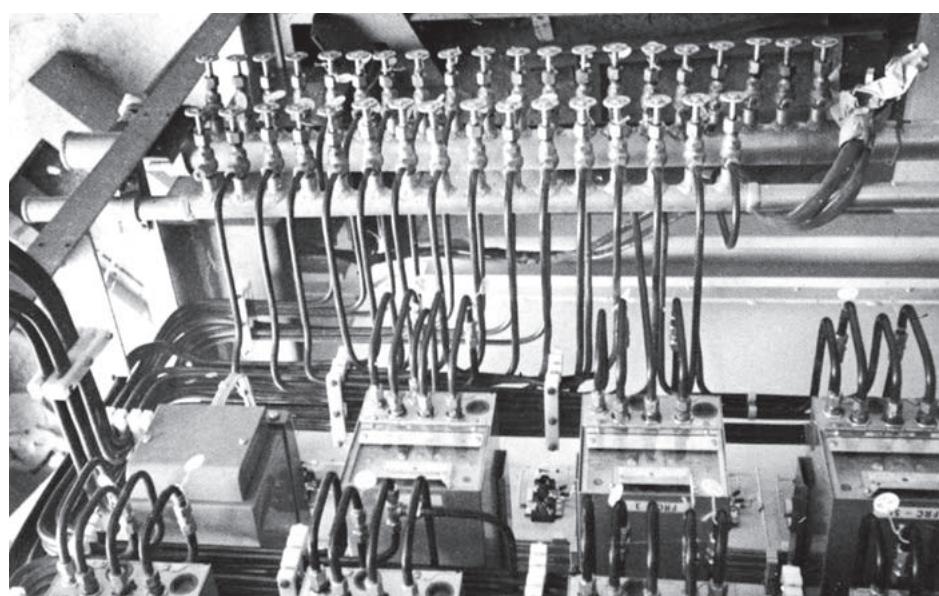


Fig.4 Repeated Bending Test

Before test	Bending radius: 2.5 times the diameter of a sample		Bending radius: 5 times the diameter of a sample	
	2 times	10 times	2 times	10 times
				Bent part



Furukawa Control Copper Tube  
in actual use ▶

### 3. Load property

Fig.6 and Table 3 show changes of the outer diameters of the polyvinyl chloride covering and copper tube that were given 0 to 98,000 N loads by the use of a universal tester as illustrated in Fig.5.

Fig.5

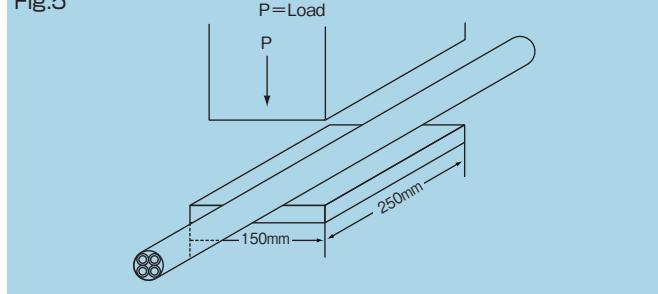


Fig.6 Load Test Results

Load (N)	0	4,900	9,800	14,700	24,500	49,000	98,000
Degree of Deformation							

Table 3 Changes in Outer Diameters of the Polyvinyl Chloride Covering and Copper Tubes after Load Test (4-Cores)

Load (N)	Outer diameter change after loading (mm)		Change in outer diameter of copper tubes after loading (After the color polyvinyl chloride covering is removed.) (mm)							
			White		Red		Green		Black	
	Large dia.	small dia.	Large dia.	small dia.	Large dia.	small dia.	Large dia.	small dia.	Large dia.	small dia.
0	—	—	5.99	— 6.01	5.93	— 6.07	5.96	— 6.04	5.98	— 6.02
4,900	22.0	19.5	6.02	5.98	6.11	5.84	6.03	5.93	6.04	5.96
9,800	22.5	19.0	6.07	5.93	6.05	5.93	6.05	5.95	6.02	5.98
14,700	23.0	18.5	6.30	5.53	6.40	5.57	6.06	5.94	6.65	5.21
24,500	26.0	17.0	6.92	4.68	6.50	5.30	6.87	4.80	6.65	5.20
49,000	30.0	14.5	7.46	3.42	7.34	5.30	7.42	3.57	7.39	3.58
98,000	34.5	13.0	7.72	2.24	7.75	2.90	7.76	2.34	7.70	2.77

### 4. Aging resistance

Fig.7 shows changes in the tensile strength and elongation of the polyvinyl chloride covering after being put in a 100°C air thermostatic bath for 23 days, indicating very good results.

### 5. Oil resistance

Table 4 shows the rates of weight increase of the polyvinyl chloride covering after being immersed in transformer oil for about 20 days.

Table 4

No. of immersion (day)	1	3	5	15	22
Rates of weight increase (%)	0.15	0.15	0.15	0.15	0.3

### 6. Abrasion resistance

The polyvinyl chloride covering proved good in abrasion test, showing 0.06–0.34% weight-decrease rate after being given 10,000 rotations by an abrasion tester.

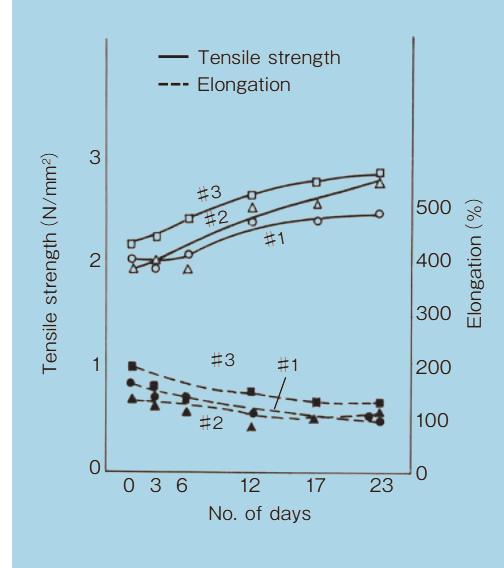
### 7. Cold resistance

At -15°C, the copper tube as well as the polyvinyl chloride covering showed no trouble when bent at a radius 5 times its finished diameter.

### 8. Heat resistance

The polyvinyl chloride covering showed no deformation due to softening at temperatures up to 60°C.

Fig.7



## ● Fittings for Furukawa Control Copper Tube

For installation of Furukawa Control Copper Tube we recommend our fittings specifically made for the purpose, which are easy to handle, light in weight, beautiful in outer appearance, and perfect in corrosion resistance and leak prevention. We don't sell these fittings, but introduce a maker of these fittings to our customer's requirements.



### Tube coupling

(The degree of fastening can be checked using a gauge.)



SWAGELOK Body

SWAGELOK Front ferrule



SWAGELOK Back ferrule



SWAGELOK Nut



Available tube size: 1/16 inch  
(2 mm) to 2 inch (38 mm)

Products approved by the Japanese Ministry of Economy, Trade and Industry are also available.

スウェージロック  
**Swagelok®**

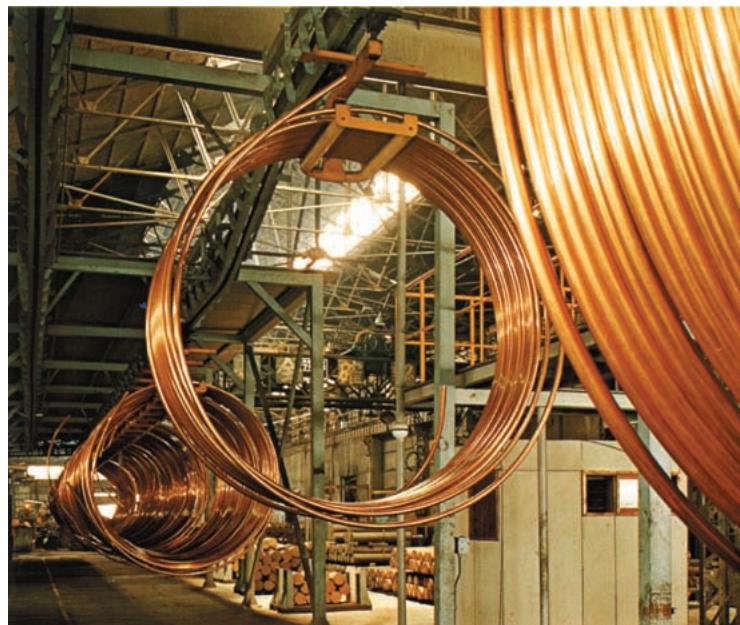
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## ● Manufacturing Facilities for Furukawa Control Copper Tube

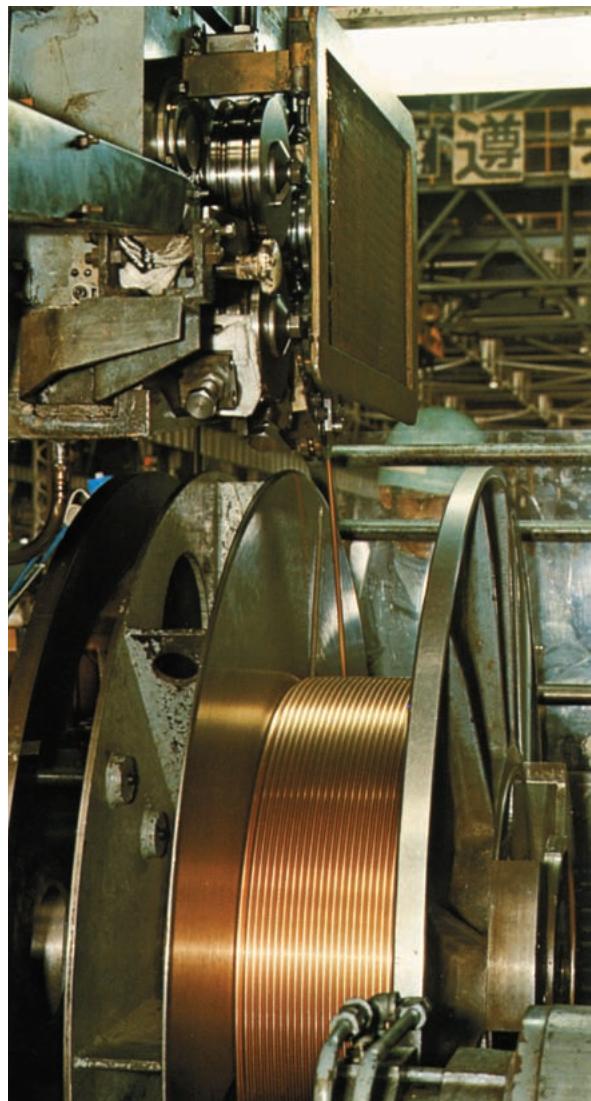
Based on its excellence involving modern manufacturing facilities, outstanding manufacturing technologies, high-quality raw materials and R&D power, Furukawa Electric offers with confidence Furukawa Control Copper Tube to meet customers' needs. The products complying with the JIS, ASTM, MIL, FS, BS and DIN standards in terms of specifications are also available.



▲ Osaka Works



▲ Manufacturing Line for Tubes



▲ Bull Block



▲ Bull Block



**FURUKAWA ELECTRIC CO., LTD.**

<http://www.furukawa.co.jp/english/>

**Head Office** Marunouchi Nakadori Bldg., 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100-8322, Japan  
TEL: +81-3-3286-3835 FAX: +81-3-3286-3663

**FURUKAWA ELECTRIC SINGAPORE PTE. LTD. (FES)** 10Anson Road, #25-07/08, International Plaza, Singapore 079903  
TEL: 65-6224-4686 FAX: 65-6224-2362

**FURUKAWA SHANGHAI LTD. (FSL)** Room 1006, 1 Hongyi Plaza, 288 Jiujiang Road, Shanghai 200001, P. R. China  
TEL: 86-21-3366-5301 FAX: 86-21-3366-5308

**FURUKAWA ELECTRIC HONG KONG LTD. (FEHK)** Suite 2606, Shell Tower, Times Square, 1 Matheson Street, Causeway Bay, Hong Kong  
TEL: 852-2512-8938 FAX: 852-2512-9717

**AMERICAN FURUKAWA, INC. (AFI)** 47677 Galleon Drive, Plymouth, MI 48170 U.S.A.  
TEL: 1-734-446-2 FAX: 1-734-446-2260

**FURUKAWA ELECTRIC EUROPE LTD. (FEEL)** 3rd Floor, Newcombe House, 43-45, Notting Hill Gate, London W11 3FE, U.K.  
TEL: 44-20-7313-5324 FAX: 44-20-7313-5310

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●For inquiry, contact