

# Water Cooled Cable for Electric Furnace



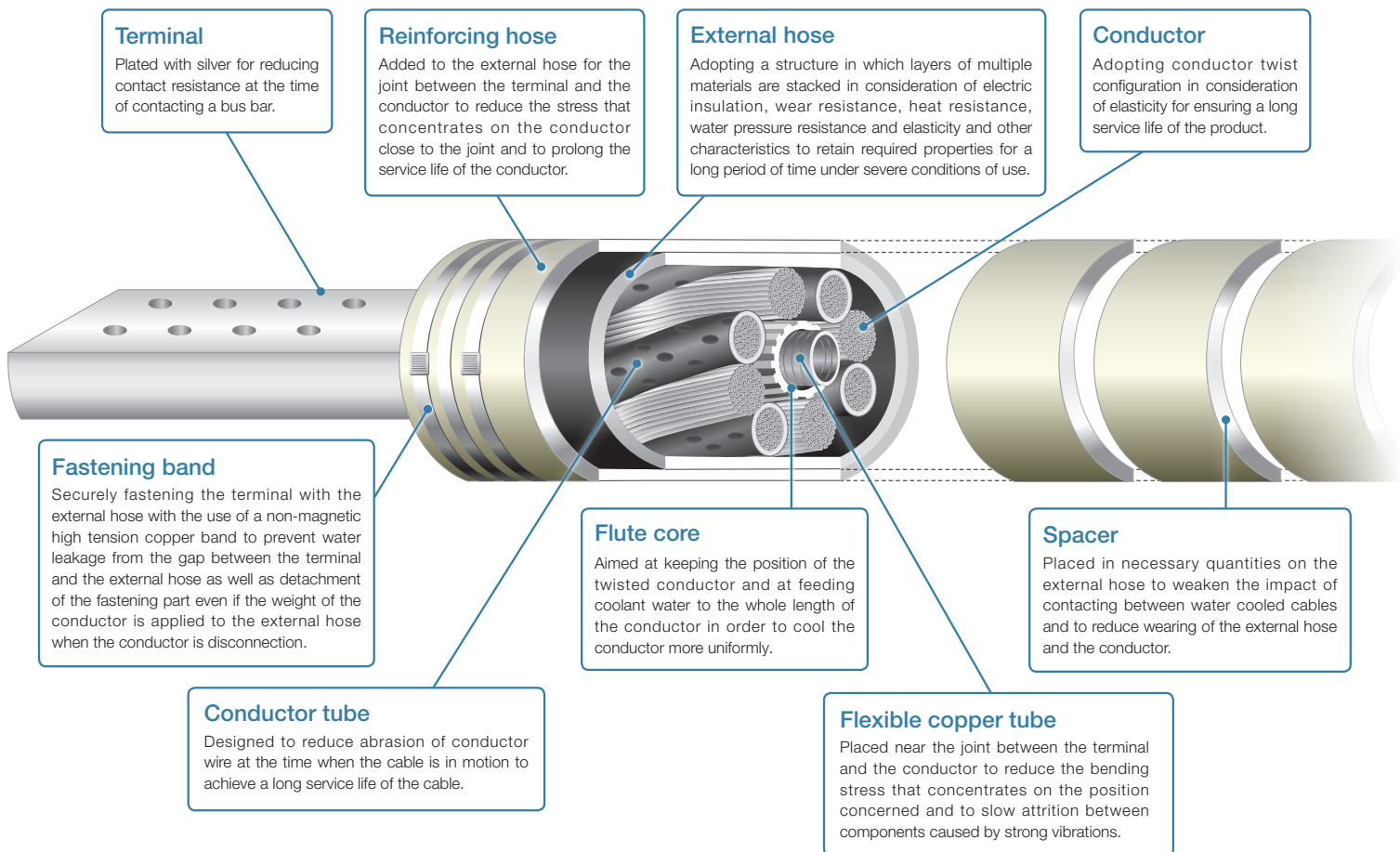
# A Brand with Reliability

A water cooled cable is mainly used as a secondary conductor in a steelmaking arc furnace. It is interlocked integrally with the arc furnace at the time of tilting the furnace body for tapping molten steel or in the event of rotating the furnace cover for injecting scraps. This means that bending, twisting or other stresses apply to the cable.

In addition, while the furnace is in operation, it is exposed to radiant heat from the electrodes. An electromagnetic effect produced by a high electric current applies to the cable repeated stress generated from the attracting and bouncing force in the same phase or between different phases of the cable.

The water cooled cable is used under severe conditions with high temperature atmosphere and mechanical external forces described above. Since 1965, we have delivered a large number of products to many different sectors of steelmaking. We have made several technical improvements to match the cable with the operating conditions of steelmaking furnaces to achieve quality enhancement and prolongation of the service life.

## Configuration



## Table of Configuration of Water Cooled Cables (standard models)

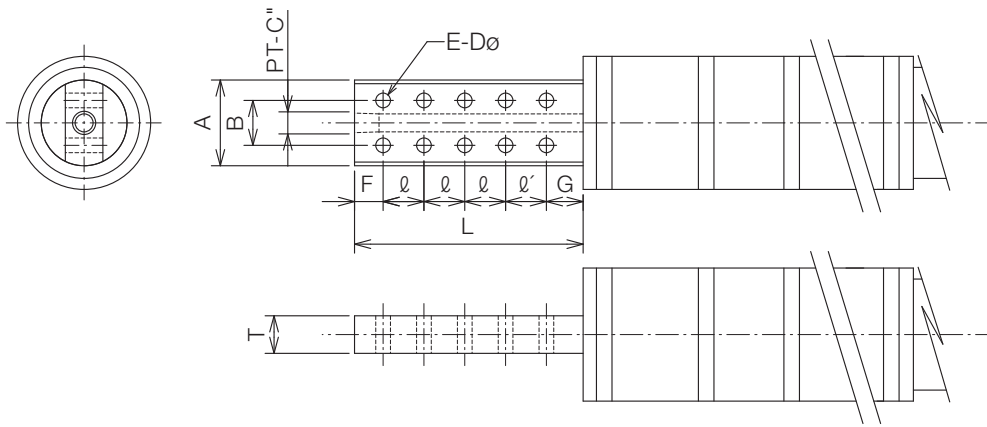
Nominal cross-section area (mm <sup>2</sup> )	Diameter of external hose (mm)	Reinforcing hose		Direct current conductor resistance (10 <sup>-6</sup> Ω/m at 20 deg. C)	Rated current (kA)	Approx. net weight (kg/m)	Bend radius (mm)
		Diameter (mm)	Length (mm)				
1,000	101	127	700	18.8	5.0	16.0	500
1,500	129	155	1,000	12.0	7.5	24.0	650
1,750	129	155	1,000	10.4	8.8	26.5	650
2,000	136	163	1,000	9.20	10.0	29.5	680
2,250	145	174	1,000	8.23	11.3	35.0	730
2,500	145	174	1,000	7.30	12.5	37.0	730
2,750	159	191	1,000	6.69	13.8	42.0	800
3,000	159	191	1,000	6.18	15.0	44.0	800
3,500	171	205	1,000	5.02	17.5	53.0	860
4,000	179	212	1,000	4.46	20.0	58.5	900
4,500	189	224	1,000	4.01	22.5	65.0	950
5,000	198	233	1,000	3.65	25.0	70.0	990

Notes: 1. We offer this product with a cross-section area of up to 6,500 mm<sup>2</sup>.

2. According to the environment for use, we propose an optimal configuration, such as extra spacers and an external hose with a thicker wall.



## Terminal Dimensions (standard models)

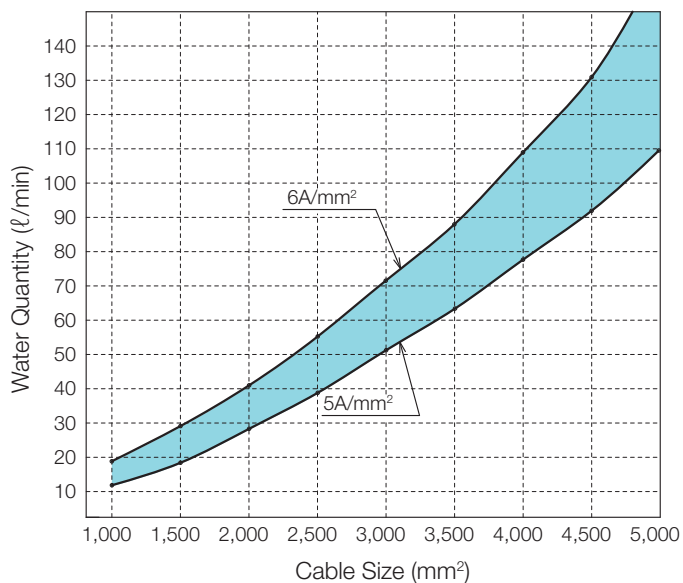


Nominal cross-section area (mm <sup>2</sup> )	Dimensions of the plate part of the standard terminal (mm, or inches for C only)										
	A	B	C	D	E	F	G	L	l	l'	T
1,000	74	50	1	14	8	30	55	250	55	—	45
1,500	87	51	1	18	10	40	40	300	55	55	50
1,750	87	51	1	18	10	40	40	300	55	55	50
2,000	96	64	1	18	10	40	50	310	55	55	50
2,250	104	70	1 ¼	18	10	45	55	320	55	55	50
2,500	104	70	1 ¼	18	10	45	55	320	55	55	50
2,750	116	74	1 ½	22	8	50	60	320	70	—	50
3,000	116	74	1 ½	22	8	50	60	320	70	—	50
3,500	124	74	1 ½	22	8	50	60	320	70	—	55
4,000	134	80	1 ½	22	8	50	60	350	80	—	55
4,500	141	80	1 ½	22	8	50	60	350	80	—	55
5,000	147	80	1 ½	22	8	50	60	350	80	—	55

- Notes:**
1. E represents the quantity of processing for making holes on terminals.
  2. The dimensions of the plate part of the terminal may be changed on request.
  3. According to requests, the tip of the terminal will be processed to enable attachment of an eye bolt.

## Quantity of Coolant Water (reference)

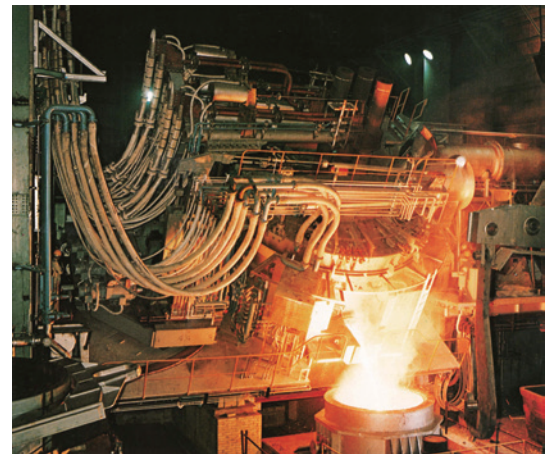
Table of Estimated Quantity of Coolant Water



- Notes:**
1. Cable strip length: 10 m
  2. Water temperature rise: 5 deg. C (Example: water entry temperature: 32 deg. C, water exit temperature: 37 deg. C)
  3. Use within the electric current density range from 5 A/mm<sup>2</sup> to 6 A/mm<sup>2</sup>.
  4. Standard pH level of coolant water: 6.5 to 10



An exterior view of the water cooled cable in the process of manufacturing



State of application to an electric furnace

## 1. Spare water cooled cables in stock

Water cooled cables are prone to deterioration or damage to the hose, as well as to breakage caused by accumulation of fatigue of the conductor. While the arc furnace is in operation, they are exposed to radiant heat from the electrodes. An electromagnetic effect produced by a high electric current applies to the cable repeated twisting, bending, vibrating and other stresses generated from attracting and bouncing force in the same phase or between different phases of the cable.

Breakage of a water cooled cable means that operation cannot be continued. It is considered necessary to keep spare water cooled cables in stock and to be prepared to restore the furnace operation in a short while.

## 2. Deterioration check

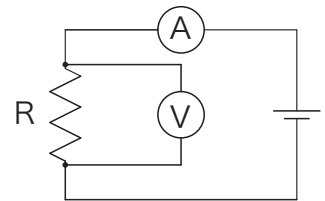
### (1) Investigation conductor burnout rate

For ensuring stability of operation, it is desirable to replace water cooled cables as expendable items in a regular cycle before they come into breakage or other trouble and we recommend replacing them in each phase at a time.

We propose regularly performing the deterioration check to measure the conductor burnout rate as a means of understanding and determining the cycle of replacement of water cooled cables and probing into the correlations between the number of charges on the water cooled cables and the conductor burnout rate.

### [Method of Measuring Conductor Burnout Rate]

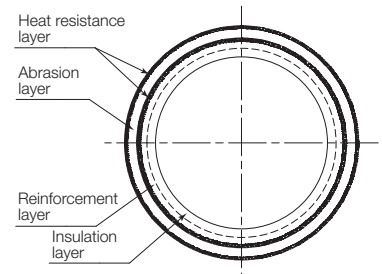
The four-terminal method is employed to measure the conductor resistance in a water-cooled cable. From the measurement results and the specification value of the conductor resistance, the burnout rate is calculated.



A resistance measuring circuit based on the four-terminal method

### (2) Visual inspection

We propose checking the wear of the external hose and replacing the water cooled cable or the external hose if hose breakage or water leakage is likely.



A General Structure of an External Hose

### (3) Proposal on operation cost cuts

According to the deterioration check results and the findings from subsequent operation confirm, we propose a configuration change. For example, if it is confirmed that the external hose is worn relatively quickly in comparison with the number of charges until the conductor breaks, we propose a thicker wall of the external hose as a measure for achieving a long cycle of replacing water cooled cables.

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\* The information contained in this brochure is correct as of July 2015.

\* The information contained in this brochure is subject to change without prior notice.