



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

External hose Conductor Terminal Reinforcing hose Plated with silver for reducing Added to the external hose for the Adopting a structure in which layers of multiple Adopting conductor twist contact resistance at the time joint between the terminal and the materials are stacked in consideration of electric configuration in consideration of contacting a bus bar. conductor to reduce the stress that insulation, wear resistance, heat resistance, of elasticity for ensuring a long concentrates on the conductor water pressure resistance and elasticity and other service life of the product close to the joint and to prolong the characteristics to retain required properties for a service life of the conductor. long period of time under severe conditions of use. Fastening band Securely fastening the terminal with the external hose with the use of a non-magnetic Flute core Spacer high tension copper band to prevent water leakage from the gap between the terminal Aimed at keeping the position of the Placed in necessary quantities on the and the external hose as well as detachment twisted conductor and at feeding external hose to weaken the impact of of the fastening part even if the weight of the coolant water to the whole length of contacting between water cooled cables conductor is applied to the external hose the conductor in order to cool the and to reduce wearing of the external hose when the conductor is disconnection. conductor more uniformly. and the conductor.

Conductor tube

Designed to reduce abrasion of conductor wire at the time when the cable is in motion to achieve a long service life of the cable.

Flexible copper tube Placed near the joint between the terminal and the conductor to reduce the bending stress that concentrates on the position concerned and to slow attrition between components caused by strong vibrations.

Table of Configuration of Water Cooled Cables (standard models)

Nominal cross- section area (mm ²)	Diameter of external hose (mm)	Reinforcing hose		Direct current	Rated current	Approx. net	Bend radius
		Diameter (mm)	Length (mm)	$(10^{-6}\Omega/m \text{ at } 20 \text{ deg. C})$	(kA)	(kg/m)	(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 mm².

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-	Dimensions of the plate part of the standard terminal (mm, or inches for C only)										
section area (mm²)	А	В	С	D	E	F	G	L	Q	Q'	т
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 ¹ / ₄	18	10	45	55	320	55	55	50
2,500	104	70	1 ¹ /4	18	10	45	55	320	55	55	50
2,750	116	74	1 ¹ /2	22	8	50	60	320	70		50
3,000	116	74	1 ¹ /2	22	8	50	60	320	70	—	50
3,500	124	74	1 ¹ / ₂	22	8	50	60	320	70	—	55
4,000	134	80	1 ¹ / ₂	22	8	50	60	350	80	_	55
4,500	141	80	1 ¹ / ₂	22	8	50	60	350	80		55
5,000	147	80	1 ¹ / ₂	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)



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/mm² to 6 A/mm².
- 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.

(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.





based on the four-terminal method



A General Structure of an External Hose

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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