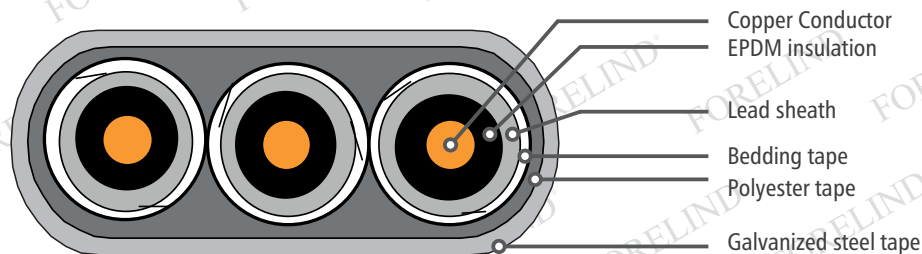
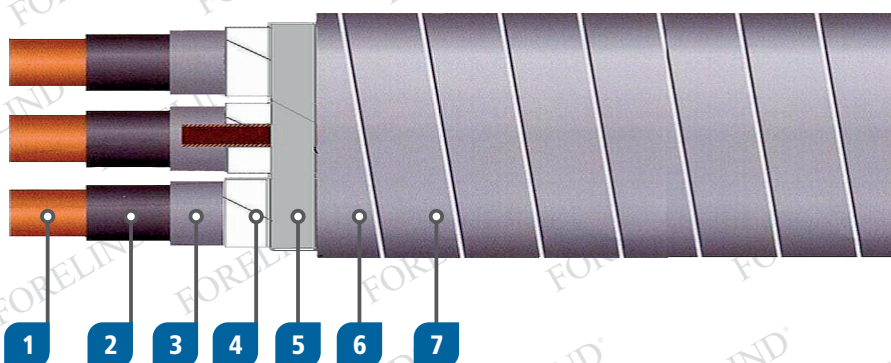


## FLAT POWER ARMoured CABLES FOR OIL WELLS OF HIGHER THERMAL CLASS



### CABLE CONSTRUCTION AND SPECIFICATIONS



#### CONSTRUCTION DESCRIPTION

1	Phase cores	Solid round annealed copper wire
2	Insulation	Special rubber compound based on EPDM elastomer
3	Sheath	Lead sheath
4	Bedding	Insulating bedding overlapped tape
5	Separator	Polyester tape
6	Marking tape	Identification tape
7	Armour	Galvanized steel tape

#### CHARACTERISTICS

Nominal voltage	2.31 / 4 kV
Test voltage	in acc. with standard
Ambient temp. range	- 60°C up to + 230°C
Operating temp. range	- 40°C up to + 200°C

Issued: DT // Approved: QA

This is a part of our products range. For any technical information or change of cable type do not hesitate to contact our sales department.

## DESIGN OF REQUIREMENTS

### CONDUCTOR in acc. with IEC 60228

**Power Conductors:** Electrolytic solid round annealed copper, class 1

### INSULATION special compound

Special elastomer based on EPDM compound of higher thermal class in black colour

### SHEATH

Extruded lead sheath, fatigue and corrosion resistant which provides protection of insulation from oil, chemicals, gases and insulation decompression

### BEDDING TAPE

Suitable tape is helically wrapped with overlaps which protects the lead sheath during armouring and provides additional protection against decompression

### SEPARATOR

Polyester tape over parallelly placed phase cores helically wrapped with overlaps

### MARKING TAPE

Identification tape with marking stamped at regular intervals shall be resistant in operating ambient

### ARMOUR

Fully galvanized steel tape (on four sides) will be wrapped with overlaps (45-50)% in "Q" profile. It provides excellent mechanical and anti-corrosion protection.

Issued: DT // Approved: QA

This is a part of our products range. For any technical information or change of cable type do not hesitate to contact our sales department.

## GENERAL DATA

<b>REQUIREMENT</b>	In acc. P 51777 or IEEE1018
<b>CERTIFICATE</b>	ISO 9001
<b>APPLICATION</b>	Flat power armoured cables with special rubber insulation based on EPDM compound are used in oil wells for installations of submersible power electric pumps
<b>OPERATING VOLTAGE (U<sub>0</sub>/U)</b>	2.31 / 4 kV
<b>AC TEST VOLTAGE</b>	9 kV - cross section 10 mm <sup>2</sup>   10 kV - core over 10 mm <sup>2</sup>   min. during - 1 min
<b>DC TEST VOLTAGE</b>	20 kV - cross section 10 mm <sup>2</sup>   25 kV - core over 10 mm <sup>2</sup>   min. during - 5 min   max I <sub>0</sub> = 25 μA/km
<b>CONDUCTOR CURRENT</b>	in acc. with table 2
<b>AMBIENT TEMPERATURE RANGE</b>	- 60°C up to + 230° C
<b>TESTING OF INSULATED CORE OIL TIGHTNESS</b>	Sample 5 m - pressure 0.1 MPa 2.5 h in acc. with GOST 982 (GOST 10121) - satisfied -
<b>CABLE BENDING TEST</b>	Bending of 3 m sample at angle of 360° around a cylinder - no clearances (bare places) in armour (GOST R 51777)
<b>MINIMUM BENDING RADIUS</b>	> 18 x cable width
<b>SPECIAL CABLE BENDING TEST AT LOWER TEMPERATURE</b>	Bending of 1.5 m sample at angle of 180° at -40°C, 3 cycles around a cylinder - satisfied -

Issued: DT // Approved: QA

This is a part of our products range. For any technical information or change of cable type do not hesitate to contact our sales department.

## CONSTRUCTION DATA

TABLE 1

CABLE CONSTRUCTION	CONDUCTOR DIA. (1)	INSULATION THICKNESS (2)	INSULATED CORE DIAMETER	CONDUCTOR RESISTANCE AT 20°C	INSULATION RESISTANCE AT 20°C	LEAD SHEATH THICKNESS (3)	LEAD COATED CORE DIA.	CABLE OUTER DIMENSIONS (APPROX) (4)
N <sub>e</sub> xmm <sup>2</sup>	mmØ	mm	(mmØ)	(Ω/km)	(MΩ km)	(mm)	(mmØ)	(mm x mm)
3 x 10	3.56	1.6	6.8	1.83	1400	0.9	8.6	11.5 x 29.5
3 x 13.3	4.10	1.6	7.3	1.33	1400	0.9	9.1	12.0 x 31.5
3 x 16	4.50	1.6	7.7	1.15	1400	0.9	9.5	12.5 x 32.5
3 x 21.2	5.18	1.8	8.8	0.83	1400	1.0	10.8	13.5 x 36.0
3 x 33.6	6.55	1.6	10.2	0.52	1400	1.0	12.2	15.0 x 40.5

### NOTE

- (1) Conductor diam. can have smaller value if the conductor does not exceed the max. allowed el. resistance  
 (2) Permissible tolerance in the nominal insulation thickness is ± 0.2 mm  
 (3) Permissible tolerance in the nominal thickness of lead sheath is ± 0.2 mm  
 (4) Permissible tolerance in nominal dimension of the cable ± 1.0 mm by height, ± 1.0 mm by width

## CONSTRUCTION DATA

TABLE 2

CABLE CONSTRUCTION	NET MASS PER 1 KM LENGHT (APPROX)			PRODUCTION LENGTH	GROSS MASS PER DRUM	DRUM SIZE (DIAMETER / WIDTH)
	COPPER	LEAD	TOTAL			
N <sub>e</sub> xmm <sup>2</sup>	(kg / km)	(kg / km)	(kg / km)	(m)	(kg / km)	(m / m)
3 x 10	267	750	1500	2000	3285	1.6 / 0.99
3 x 13.3	353	885	1830	2000	3945	1.6 / 0.99
3 x 16	426	930	1970	2000	4350	1.7 / 1.15
3 x 21.2	563	1050	2300	1700	4600	1.8 / 1.15
3 x 33.6	900	1195	2890	1400	4505	1.8 / 1.15

Issued: DT // Approved: QA

This is a part of our products range. For any technical information or change of cable type do not hesitate to contact our sales department.



## ELECTRICAL PARAMETERS

TABLE 1

CABLE CONSTRUCTION	CONDUCTOR RESISTANCE AT 20°C (R20)	CONDUCTOR ELECTRICAL RESISTANCE AT 230°C (r)	INDUCTIVE REACTANCE AT 50 Hz (x)	IMPEDANCE AT 230°C (Z)	MAXIMUM CONDUCTOR CURRENT RECOMMENDED AT BHT (BOTTOM HOLE TEMPERATURE 200°C) (I)	VOLTAGE DROP AT 200°C, 50 Hz $\cos \phi = 0.8$ ( $\Delta U$ )
N <sub>x</sub> mm <sup>2</sup>	(Ω/km)	(Ω/km)	(Ω/km)	(MΩ km)	(A)	(V/km)
3 x 10	1.83	4.907	0.134	4.909	40	196
3 x 13.3	1.33	3.749	0.128	3.751	49	184
3 x 16	1.15	2.988	0.125	2.991	58	173
3 x 21.2	0.83	2.417	0.121	2.420	66	160
3 x 33.6	0.52	1.585	0.115	1.569	87	137

**NOTE**

$$Z = \sqrt{r^2 + x^2} \quad (\Omega/\text{km})$$

Z - (Cable impedance at operating temperature)

Issued: DT // Approved: QA

This is a part of our products range. For any technical information or change of cable type do not hesitate to contact our sales department.



**FORELIND<sup>®</sup>**  
Special Electrical Cables

**FOR.EL.IND S.p.A.**

Via Europa, 6 - 24055 Cologno al Serio (BG) - ITALY

Phone +39 035 899191 - Fax +39 035 4819224

[www.forelind.com](http://www.forelind.com) E-mail: [sales@forelind.com](mailto:sales@forelind.com)