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**ELECTRICITE DU CAMBODGE**

**TECHNICAL SPECIFICATION**

**EDC-DTS-MV018**

**Under River 22 kV Cable**

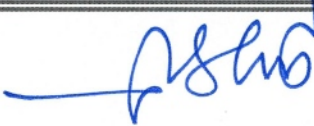
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**ELECTRICITE DU CAMBODGE**

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# Under River 22 kV Cable

## 1 Scope

This specification covers the design, manufacturing, supply, delivery, testing and performance requirement of under river 24 kV three core cables to be installed on the 22kV network of Electricité du Cambodge (EDC).

The cable screens shall withstand the following operating condition:

- 22 kV Neutral artificially created through Zn transformer and then grounded through a resistor at the HV/MV Substation. The fault Current is limited to 787 Ampere.

So, considering the capacitive currents, the cable screen of each phase shall withstand a Phase to earth short circuit current of 2.5 kA/1s.

The life expectancy of the 24 kV cable shall not be less than 25 years.

## 2 Standards

IEC : International Electro-technical Commission

IEC 60038	IEC Standard Voltage
IEC 60060-1	High – Voltage test technique
IEC 60183	Guide to the selection of high - voltage cables
IEC 60228	Conductors of insulated cables
IEC 60230	Impulse tests on cables and their accessories
IEC 60386	Guide to the short circuit temperature limits of electric cables with a rated voltage from 1.8/3 (3.6) kV to 18/30 (36) kV
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1.2 kV) up to 30 kV (Um = 36 kV)
IEC 60502-2	Cable for rated voltages of 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
IEC 63026	Submarine power cables with extruded insulation and their accessories for rated voltages from 6 kV (Um = 7.2 kV) up to 60 kV (Um = 72. kV) –Test methods and requirements
IEC 60502-4	Test requirements on accessories for cables with rated voltages from 6 kV (Um = 7.2 kV) up to 30 kV (Um = 36 kV)
IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
IEC 60885-2	Electrical test methods for electric cables
IEC 60949	Calculation of thermal Permissible Short Circuit Currents, taking into account non-adiabatic effects.



IEC 61238-1      Compression and mechanical connectors for power cables for rated voltages up to 30 kV ( $U_m = 36$  kV).

ISO      : International Standard Organization

ISO 48              Rubber, vulcanized or thermoplastic. Determination of hardness (hardness between 10 IRHD and 100 IRHD).

ISO 9001          Quality management systems – Requirements

Unless if standard year is specified, the latest version of the above standards apply.

The Supplier may propose alternative standards, provided it is demonstrated that they give an equivalent degree of quality as the referenced standard. Acceptability of any alternative standard is at the discretion of the Purchaser.

### 3 Definitions

The definition of the relevant IEC standards applies to this technical specification.

## 4 Testing and Inspection

### 4.1 General Notes for Test

Cables and accessories may be inspected at the manufacturer's factory by EDC's representatives.

The inspection and routine tests shall be carried out in accordance with the provisions of the relevant IEC or national recommendations.

The cable and all accessories shall be subjected to test as specified below.

### 4.2 Type Tests

All type tests required by the relevant IEC (60502-2 and 63026,) shall be carried out. Type tests carried out on very similar cables may be accepted.

Type test reports shall be carried out by internationally recognized electrical testing laboratories.

Full copies of type test reports shall be submitted within the bid of the manufacturer/supplier. Type test reports older than 7 years will not be accepted.

If the manufacturer is certified by EDC, it is not necessary to submit type test reports for the considered equipment.

Nevertheless, in case the testing laboratory is not internationally recognized, the testing laboratory shall be mandatorily accredited ISO/IEC 17025 by an international or national accreditation body specialized in testing laboratories accreditation/acceptance. In that case, the testing laboratory shall prove mandatorily its capability/capacity to carry out all type tests mentioned in the type tests reports by supplying: Full description of all tests the laboratory can carry out, list of testing equipment with full characteristics, drawing of testing rooms with location of testing equipment, etc., supported by pictures and copy of the ISO/IEC 17025 accreditation certificate.

Acceptability of any accredited testing laboratory is at the discretion of the EDC.





### 4.3 Routine Tests

The routine tests requested by relevant IEC standards shall be carried out on all equipment. Routine test reports shall be sent to EDC prior to the shipment for EDC acceptance.

### 4.4 Sample Tests

The sample tests as requested by paragraph 17 of IEC 60502-2 shall be carried out. Sample test reports shall be sent to EDC prior to the shipment for EDC acceptance.

## 5 Quality Management

Design, development and production of the proposed equipment shall be ISO 9001 certified. The ISO 9001 certificate shall be submitted within the bid.

## 6 Ambient Conditions

The cable will be laid directly inside river on the river bottom or buried inside the river.

The cable shall be suitable to operate in the ambient conditions described here after:

Altitude	Sea level to 1,000 meters
Climate	Tropical
Annual Rainfall	1,300 mm.140 days
Monsoon Period	June to November
Ambient Air Temperatures:	
Average	27.5°C
Minimum	13.3°C
Maximum	40.5°C
Relative Air Humidity	65-100%
Solar Emissivity	0.8
Solar absorption	0.8
Wind Velocity:	
Average	37 km/h (10.3 m/s)
Maximum	72 km/h (20 m/s)
Water depth	From 4 m to 30 m





## 7 Technical Requirements

### 7.1 Voltage Designations and Materials

The rated voltage of the cable  $U_0/U$  ( $U_m$ ) shall be 12.7/22 (24) kV

In the voltage designation of cables  $U_0/U$  ( $U_m$ ):

- $U_0$  is the rated power frequency voltage between conductor and earth or metallic screen for which the cable is designed;
- $U$  is the rated power frequency voltage between conductors for which the cables is designed;
- $U_m$  is the maximum value of the highest system voltage for which the equipment may be used (IEC 60038)

The rated voltage of the cable for given application shall be suitable for the operating conditions in the system in which the cable is used.

The system belongs to category A as per IEC 60502-2:

- Category A: This category comprises those systems in which any phase conductor that comes in contact with earth or an earth conductor, is disconnected from the system within 1 minute.

### 7.2 Maximum Permissible Temperatures

The maximum permissible temperature are as follows:

#### - Conductor

- 90°C during normal operation
- 120°C under a short time overload (a total of 24 hours a year in separate of 3 hours at the most)
- 250°C under multi-phase short-circuit conditions during 5 second,

#### - Screen

- 200°C under earth/phase fault conditions during 5 second.

These temperatures are based on the intrinsic properties of the insulating materials. The values can be only used for calculation permissible current rating.

## 8 General Characteristics

The under river/see cable shall be constituted of three single core cables twisted together under a same outer envelope that includes mechanical protection.

### 8.1 Constitution of each Single Core Cable

Each single core cable shall be constructed as follow

- Conductor,
- Conductor screen,
- Insulation,
- Insulation screen,
- Device preventing any longitudinal propagation of water,
- Copper wires metallic screen,
- Radial waterproofness aluminum screen,
- Core sheath.



### 8.1.1 Conductors

The conductors shall be of class 2 (IEC 60228) compacted aluminium. The cores shall be circular. The cable cross sections of the cable to be provided is: 240 mm<sup>2</sup>, 300 mm<sup>2</sup> and 400 mm<sup>2</sup>.

**Conductors shall be of watertight type by adjunction of hygroscopic powder, fibres, tapes or sealing compound.**

The manufacturer must declare the minimum and maximum diameters of the conductor. The manufacturer shall provide the average diameter of the core and shall declare, for information, the number of strands constituting the core and their diameter.

### 8.1.2 Conductor Screen

The conductor screen shall consist of extruded synthetic semi-conducting compound. Use of a separator on the conductor is allowed. In this case, the separator must be made of a semi-conducting material. The extruded semi-conducting compound shall be firmly bonded to the insulation.

#### 8.1.2.1 Conductor screen Thickness

The thickness of the conductor screen shall not be less than 0.5 mm.

### 8.1.3 Insulation

Insulation shall be made of extruded cross-linked polyethylene (XLPE).

#### 8.1.3.1 Insulation Thickness

The nominal thickness of cross-linked polyethylene (XLPE) insulation shall be 5.5 mm.

### 8.1.4 Insulation Screen

The insulation screen shall consist of a semi-conducting extruded directly upon the insulation and shall consist of strippable semi-conducting compound.

It shall be easy to remove this insulation screen by hand without any tool. The maximum effort for removing the screen shall be less than 25 N. After stripping the insulation screen, the surface of the insulation shall be free of visible semi-conductor trace.

#### 8.1.4.1 Insulation screen Thickness

The minimum nominal thickness of the insulation screen shall be 0.5 mm.

### 8.1.5 Triple Extrusion

The conductor screen, the insulation and the insulation screen shall be **extruded simultaneously**. Other extrusion method is not accepted.

### 8.1.6 Longitudinal Waterproofness Component

This cable component shall stop any longitudinal propagation of water. It shall be constituted of Hygroscopic tape(s) placed over the insulation screen. The tapes shall not isolate the conductor screen from the metallic screen. The verification of the hygroscopic capacity of the tape (s) shall be checked by the water penetration test required by Annex F of IEC 60502-2 standard



### 8.1.7 Metallic Screen

The metallic layer shall be applied over the longitudinal waterproofness component.

#### 8.1.7.1 Construction

The single core cables shall comprise a metallic screen surrounding the core.

The metallic screen shall be made of longitudinal round plain copper wires and counter-helix equalization copper tape.

### 8.1.8 Electrical Requirement

The metallic screen characteristics shall allow the single core cable to withstand the following operating conditions: 2.5kA, 1 second.

The manufacturer shall provide calculations based on IEC 60949 for Phase to earth short circuit current and the cross section and thickness of the metallic screen as well as a short circuit screen test.

### 8.1.9 Radial water barrier

The radial water barrier of the single core cable shall be constituted of an aluminum tape longitudinally applied around the cable with overlap of at least 5 mm. This overlap shall be glued against the tape in order to form a metallic pipe.

On the outside face of the tape, a varnish shall be applied for allowing the sticking of the tape with the single core cable outer sheath during its extrusion. The metallic screen shall be firmly bonded to the outer sheath.

This screen shall then form a metallic pipe that shall act as a radial water barrier.

#### 8.1.9.1 Thickness

The thickness of the laminated aluminium tape not be less than 0.2 mm.

### 8.1.10 Single core cable Sheath

The power core sheath shall be made of semi insulating PE of black colour. This sheath shall be extruded.

#### 8.1.10.1 Thickness

The nominal thickness of the core sheath shall be no less than 1.8 mm, which shall be determined by the manufacturer for a proper core protection.

### 8.1.11 Marking

Each phase conductor of bundled cable shall have the range of markings listed here below, engraved or embossed on the sheath surface of the individual cores at one meter intervals.

- Brand (Manufacturer): XXX
- Manufacturing year: YYYY
- Voltage: 12.7/22 (24) kV
- Conductor number: C1 or C2 or C3 (this marking can be replaced by a coloured (red, blue, yellow) thread or PE tape placed around the core
- Cross section: ZZZ





- Core metal: AL
- Standard reference: AAAAAAAA

The markings shall be made in the sequence indicated above. For example, if the manufacturer is YY and the cable is manufactured in 2015, the markings would be:

**XXX – 2015 – 12.7/22 (24) kV – C1- 240 AL – IEC xxxxxxxx**

## 8.2 Assembly of cores

Three single power cores shall be twisted together. The direction of assembling lay shall be left or right and the twisting pitch shall be comprised between 35 and 45 times the minimal diameter of a single core cable.

### 8.2.1 Fillers

Then the interstices between cores shall be filled using **polypropylene** strings or the pre-shaped filler to ensure a substantially circular shape of the core assembly..

Bidder tapes made of polypropylene or equivalent material are then applied around the core bundle and fillers.

These fillers shall be of non-hygroscopic type.

### 8.2.2 Binder tape

A binder tape made of non-hygroscopic material may be applied all around the assembly.

### 8.2.3 Inner Bedding

The bedding applied all around the assembly shall be constituted of polypropylene strings impregnated of bitumen. The approximate thickness of bedding shall be at least 1.5 mm.

### 8.2.4 Armour

The armour shall be constituted of galvanized steel wires with a diameter of at least 3.15 mm to provide adequate strength and mechanical protection for the cable

The wire armour shall be closed, i.e., with a minimum gap between adjacent wires. An open helix consisting of galvanized steel tape with a nominal thickness of at least 0.3 mm may be provided over round steel wire armour, if necessary.

The wires shall be coated with bitumen.

### 8.2.5 Outer serving

The serving (outer sheath) shall be made of 2 layers of polyethylene yarns coated (impregnated with bitumen).

The minimum thickness of this outer serving shall not be less than 3.5 mm.

All components of the serving shall be proved to have long lifespan of at least 25 years when constantly immersed under water

Around this serving a yellow PP tape may be applied in order to show this is a submarine cable.





### 8.3 Electrical characteristics of completed cables

Cross Section	Max DC resistance 20°C	Nominal current (1)	Capacitance	Reactance
mm <sup>2</sup>	Ω/km	A	μF/km	Ω/km
240	0.125	373	0.286	0.123
300	0.100	421	0.316	0.120
400	0.0778	481	0.345	0.115

(1) Soil temperature 30°C, soil thermal resistivity 1.2 °Km/W, and depth of laying 80 cm (load factor = 0.8). Earthing of screens is on both ends.

### 8.4 Protection for Storage and Delivery

The cable must be fitted with an end device preventing any penetration of water or moisture during storage, delivery and installation.

### 8.5 Packing and Marking

Under river cable shall be delivered in suitable round containers (drums for short lengths) allowing an easy lifting with cranes at sea/river port. This container shall be metallic, protect the cable efficiently and above all allow an easy cable installation from a boat.

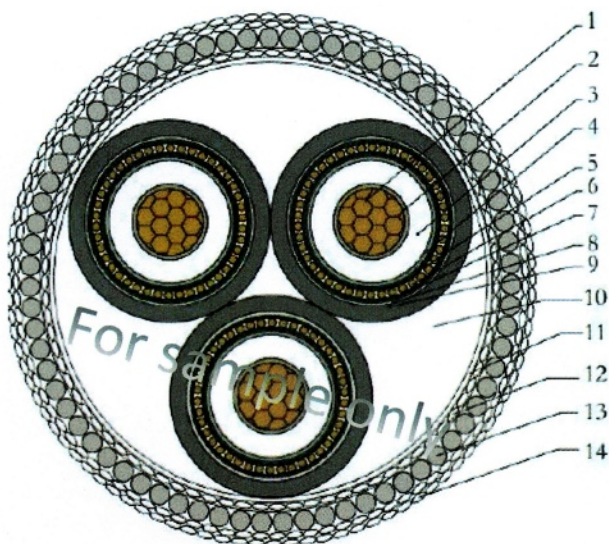
## 9 Accessories

The accessories (terminations or separable connectors) used on under river cables shall be strictly identical to the accessories required by EDC-DTS- EDC-DTS-MV003: 22 kV radially waterproof cables and accessories (copper screen). None of them will be installed under river but installed on river banks.



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## 10 Drawing



1	Conductor
2	Conductor screen
3	Insulation
4	Insulation screen
5	Semi conducting water blocking tape
6	Metallic screen
7	Semi conducting water blocking tape
8	Radial water barrier
9	Core sheath
10	Fillers
11	Inner bedding
12	Inner bedding
13	Armor
14	Outer serving

## 11 Technical Data Sheets

No.	Description	Unit	Requirement	Supplier's Offer
1	Manufacturing Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		IEC 60228, IEC 60502-2 IEC 63026	
5	Type test reports as per § 4.2 , IEC 60502 and IEC 63026		To be provided	
6	ISO 9001 for design, development and production		Yes. Certificate to be provided	
<b>General</b>				
1	Type: bundle consisting of three single-core cables inside one water proof outer envelop		Yes	
1a	Required cross section		3x240 mm <sup>2</sup> <input type="checkbox"/> 3x300 mm <sup>2</sup> <input type="checkbox"/> 3x400 mm <sup>2</sup> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
1b	Cable length	m	<input type="text"/>	
2	Life expectancy	Year	≥ 25	
3	Withstand the soil and ambient conditions required in §6		Yes	
4	U <sub>0</sub> /U (Um)	kV	12.7/22 (24)	
5	Impulse Withstand Voltage 1.2/50 μs	kV	125	
6	Charge current @U <sub>0</sub>	A/km	To be mentioned	
7	Nominal electrical stress at conductor screen @U <sub>0</sub>	kV/mm	To be mentioned	
8	Nominal electrical stress at insulation screen @U <sub>0</sub>	kV/mm	To be mentioned	
9	Short circuit current for conductor, 1s	kA	To be mentioned	





10	Short circuit current for screen, 1s	kA	To be mentioned	
11	Category A cable as per IEC 60502-2		Yes	
<b>Construction and physical characteristics</b>				
12	Maximum permissible temperature of conductor:  During normal operation  short time overload (a total of 24 hours a year in separate of 3 hours at the most)  multi-phase short circuit (5 second)	°C	90 120 250	
13	Maximum permissible temperature of metallic screen:  earth/phase fault (5 second).	°C	200	
14	<b>Conductors</b>  Aluminum class 2 (IEC 60228)		Yes	
14a	<b>Cross sections</b>  <b>240 mm<sup>2</sup> Aluminum</b>  Min diameter  Max diameter  Number of strands  Diameter of strands  Compacted core	mm  mm   mm	To be mentioned  To be mentioned  To be mentioned  To be mentioned  Yes	
14b	<b>300 mm<sup>2</sup> Aluminum</b>  Min diameter  Max diameter  Number of strands  Diameter of strands  Compacted core	mm  mm   mm	To be mentioned  To be mentioned  To be mentioned  To be mentioned  Yes	
14c	<b>400 mm<sup>2</sup> Aluminum</b>  Min diameter  Max diameter  Number of strands	mm  mm	To be mentioned  To be mentioned  To be mentioned	





	Diameter of strands Compacted core	mm	To be mentioned Yes	
15	<b>Conductor Longitudinal waterproofness component</b>  Conductors include water tight component  Type of conductor water tight component        Water penetration type test as per Annex F of IEC 60502-2 standard		Mandatory   To be mentioned        To be provided	Powder <input type="checkbox"/>  Fibres <input type="checkbox"/>  Tapes <input type="checkbox"/>  Compound <input type="checkbox"/>  Other <input type="checkbox"/>
16	<b>Conductor screen</b>  Separator between core and screen if any  Separator material (if any)  Extruded synthetic semi-conducting compound  Firmly bonded to the insulation  Thickness	mm	To be mentioned  To be mentioned  Yes  $\geq 0.5$	<input type="checkbox"/> Yes <input type="checkbox"/> No
17	<b>Insulation</b>  Cross linked polyethylene (XLPE)  Thickness  Diameter over insulation: 240 mm <sup>2</sup> 300 mm <sup>2</sup> 400 mm <sup>2</sup>	mm  mm  mm  mm	Yes  $\geq 5.5$  To be mentioned  To be mentioned  To be mentioned	
18	<b>Insulation screen</b>  semi-conducting extruded directly upon the insulation		Yes	



	strippable  maximum effort for removing the screen insulation  Free of visible semi-conductor trace after stripping  Nominal thickness of screen	N    mm	Yes  25   Yes  ≥ 0.5	
19	<b>Extrusion</b>  Simultaneous extrusion of conductor screen, insulation and the insulation screen		Mandatory	
20	<b>Screen Longitudinal waterproofness component</b>  Water blocking semi conducting tape over insulation screen  Description of water blocking tape		Mandatory  To be mentioned	
11	<b>Metallic Screen</b>  Applied over water blocking semi conducting tape of the insulation screen  Number copper wire  Diameter of wires  Thickness of equalization copper tape (s)  Phase to earth short circuit current metallic screen withstand (1 second):  240 mm <sup>2</sup>  300 mm <sup>2</sup>  400 mm <sup>2</sup>  Calculations based on IEC 60949  Screen short circuit test	    mm  mm    kA  kA  kA	Yes  To be mentioned  To be mentioned  To be mentioned   ≥ 2.5  ≥ 2.5  ≥ 2.5  To be provided  To be provided	
22	<b>Radial water barrier</b>  Laminated aluminum/polyethylene tape thickness longitudinally applied  Overlap of tap glued		Mandatory  Mandatory	



	Firmly bonded to core sheath		Mandatory	
	Thickness of tape	mm	To be mentioned	
23	<b>Single Core sheath</b>			
	Core sheath shall be made of semi insulating PE		Yes	
	Black color		Yes	
	This sheath is extruded.		Yes	
	Nominal thickness	mm	$\geq 1.8$	
	Diameter over core sheath			
	240mm <sup>2</sup>	mm	To be mentioned	
	300 mm <sup>2</sup>	mm	To be mentioned	
	400 mm <sup>2</sup>	mm	To be mentioned	
24	<b>Core Marking</b>			
	Each phase conductor is marked		Yes	
	Engraved or embossed on the sheath surface or printed tape around each core		Yes	Embossed <input type="checkbox"/>
				Engraved <input type="checkbox"/>
				Printed tape <input type="checkbox"/>
	Marking at one meter intervals.		Yes	
	• Brand (Manufacturer): XXX		Yes	
	• Manufacturing year: YYYY		Yes	
	• Voltage: 12.7/22 (24) kV		Yes	
	• Conductor number: C1 or C2 or C3 (this marking can be replaced by a colored (red, blue, yellow) thread or PE tape placed around the core		Yes	
	• Cross section		Yes	
	• Core metal		Yes	
	• Standard reference		Yes	
	The markings are made in the sequence indicated above		Yes	
25	<b>Cores assembling</b>			



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	<p>Three single power cores are twisted together.</p> <p>Direction of assembling</p> <p>The twisting pitch comprised between 35 and 45 times the nominal diameter of a single core cable.</p>		<p>Yes</p> <p>Left or Right</p> <p>Yes</p>	<p>Left <input type="checkbox"/> Right <input type="checkbox"/></p>
26	<p><b>Filler</b></p> <p>Interstices between cores are filled using polypropylene strings or the pre-shaped filler to ensure a substantially circular shape of the core assembly.</p> <p>Filler of non-hygroscopic type.</p>		<p>To be mentioned</p> <p>Yes</p>	
27	<p><b>Binding Tape</b></p> <p>Bidder tapes made of polypropylene or equivalent material</p> <p>Bidders are applied around the core bundle and fillers.</p>		<p>To be mentioned</p> <p>Mandatory</p>	
28	<p><b>Inner bedding</b></p> <p>The inner bedding is applied all around the assembly</p> <p>Made of polypropylene strings impregnated of bitumen.</p> <p>Approximate thickness of inner bedding</p>	mm	<p>Yes</p> <p>Mandatory</p> <p><math>\geq 1.5</math></p>	
29	<p><b>Aarmor</b></p> <p>The armor is made with galvanized steel wires</p> <p>Minimum diameter of wires</p> <p>Diameter of wires:</p> <p>3x240 mm<sup>2</sup></p> <p>3x300 mm<sup>2</sup></p> <p>3x400 mm<sup>2</sup></p> <p>Number of wires:</p> <p>3x240 mm<sup>2</sup></p> <p>3x300 mm<sup>2</sup></p>	<p>Mm</p> <p>mm</p> <p>mm</p> <p>mm</p>	<p>Mandatory</p> <p><math>\geq 3.15</math></p> <p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p>	





	<p>3x400 mm<sup>2</sup></p> <p>The wire armors are closed with a minimum gap between adjacent wires.</p> <p>An open helix consisting of galvanized steel tape with a nominal thickness of at least 0.3 mm may be provided over round steel wire armor, if necessary.</p> <p>The wires are coated with bitumen.</p>		<p>Mandatory</p> <p>Mandatory</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>
30	<p><b>Outer serving</b></p> <p>The serving (outer sheath) is made of 2 layers of polyethylene yarns coated and impregnated with bitumen.</p> <p>The minimum thickness outer serving shall not be less than 3.5 mm.</p> <p>All components of the serving shall be proved to have long lifespan of at least 25 years when constantly immersed under water</p> <p>Around this serving, a yellow PP tape may be applied in order to show this is a submarine cable.</p> <p>With mention of length</p>	mm	<p>Yes</p> <p>3.5</p> <p>Mandatory</p> <p>To be mentioned</p> <p>To be mentioned</p>	<p>Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>
30a	<p><b>Outer diameter of cable</b></p> <p>3x240 mm<sup>2</sup></p> <p>3x300 mm<sup>2</sup></p> <p>3x400 mm<sup>2</sup></p>	mm	<p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p>	
31	<p><b>Total cable weight in air</b></p> <p>3x240 mm<sup>2</sup></p> <p>3x300 mm<sup>2</sup></p> <p>3x400 mm<sup>2</sup></p>	kg/km	<p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p>	
32	<p><b>Total cable weight in water</b></p> <p>3x240 mm<sup>2</sup></p> <p>3x300 mm<sup>2</sup></p> <p>3x400 mm<sup>2</sup></p>	kg/km	<p>To be mentioned</p> <p>To be mentioned</p> <p>To be mentioned</p>	
33	<b>Max. pulling tension</b>	kN		



	3x240 mm <sup>2</sup> 3x300 mm <sup>2</sup> 3x400 mm <sup>2</sup>		To be mentioned To be mentioned To be mentioned	
34	<b>Min bending radius</b>  <b>During installation</b>  3x240 mm <sup>2</sup> 3x300 mm <sup>2</sup> 3x400 mm <sup>2</sup>  <b>Installed in water</b>  3x240 mm <sup>2</sup> 3x300 mm <sup>2</sup> 3x400 mm <sup>2</sup>	Mm      mm	To be mentioned To be mentioned To be mentioned  To be mentioned To be mentioned To be mentioned	
34	<b>Electrical characteristics of completed cables</b>			
34a	DC resistance 20°C  240 mm <sup>2</sup> AL 300 mm <sup>2</sup> AL 400 mm <sup>2</sup> AL	Ω/km	0.125 0.100 0.0778	
34b	<b>Continuous current carrying capacity in seabed (river bed)</b>  Soil temperature 30°C, soil thermal resistivity 1.2 °Km/W, and depth of laying 80 cm (load factor = 0.8). Earthing of screens is on both ends  240 mm <sup>2</sup> AL 300 mm <sup>2</sup> AL 400 mm <sup>2</sup> AL	A	373 421 481	
34c	<b>Capacitance</b>  240 mm <sup>2</sup> AL 300 mm <sup>2</sup> AL 400 mm <sup>2</sup> AL	μF/km	0.286 0.316 0.345	
34d	<b>Reactance</b>	Ω/km		



Handwritten signatures and initials in blue ink, including a large 'A' and various scribbles.

	240 mm <sup>2</sup> AL		0.123	
	300 mm <sup>2</sup> AL		0.120	
	400 mm <sup>2</sup> AL		0.115	
	<b>Protection for storage and delivery</b>			
	Each end is fitted with an individual end device preventing the penetration of water or moisture during storage and delivery		Yes	
	Description of the device		To be mentioned	
<b>Description of delivery method to be fully described</b>				
Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V, etc...."are not accepted.				
<p style="text-align: center;"><b>Deviation from the technical specification:</b></p> <p>The bidder shall list point after point and explain here in after all deviation from the requested technical specification.</p> <p>1/</p> <p>2/</p> <p>3/</p> <p style="text-align: center;"><b>Full technical information shall be supplied within the bid. If not, the offer shall not be considered.</b></p> <p style="text-align: center;">Bidder signature:</p>				



Handwritten signatures and initials in blue ink.