



Exploration & Production

GENERAL SPECIFICATION

ELECTRICAL

GS EP ELE 765

Subsea cables

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1. Scope

This specification defines the minimum requirements for the design, manufacture, testing and supply of the composite electrical power and fiber optic cable, for use in a submarine environment. It also covers the minimum requirements for the design, manufacture, supply and testing of cable accessories, connectors, terminators and supports.

The installation shall be carried out by the Contractor, but Supplier shall provide data/information/services related to cable installation as required in this specification.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Cables shall conform in design, material and performances with the appropriate sections of the latest editions (with amendments) of the IEC standards.

Reference	Title
IEC 60183	Guide to the selection of high-voltage cables
IEC 60228	Conductors of insulated cables
IEC 60287 (All parts)	Electric cables - Calculations of current rating - (All parts)
IEC 60502-1	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1.2$ kV) to 30 kV ($U_m = 36$ kV) - Part 1: Cables for rated voltages of 1 kV ($U_m = 1.2$ kV) and 3 kV ($U_m = 3.6$ kV)
IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1.2$ kV) to 30 kV ($U_m = 36$ kV) - Part 2: Cables for rated voltages of 6 kV ($U_m = 7.2$ kV) to 30 kV ($U_m = 36$ kV)
IEC 60502-4	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1.2$ kV) to 30 kV ($U_m = 36$ kV) - Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ($U_m = 7.2$ kV) up to 30 kV ($U_m = 36$ kV)
IEC 60811 (All parts)	Common test methods for insulating and sheathing materials of electric cables and optical cables (formerly IEC 540) - (All parts)
IEC 60885-3	Electrical test methods for electric cables - Part 3: Test methods for partial discharge measurements on lengths of extruded cables



Professional Documents

Reference	Title
CIGRE ELT-171-3	Recommendations for mechanical tests on submarines cables

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ITU-T G650	Definition and test methods for the relevant parameters of single-mode fibres
ITU-T G652	Characteristics of a single-mode optical fibre cable

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP STR 901	Design rules and construction standards for ancillary structures of offshore installations
GS EP TEL 191	Telecom Fibre Optic System Design

3. Environmental conditions

The environmental conditions, such as installation depth and water temperature, used to design the cable, are defined in the Project particular specification, and or the data sheet.

4. Construction requirements

4.1 Rated voltages

The voltage designations shall be U_0/U (U_m) as defined in the [IEC 60502-1](#) and [IEC 60502-2](#) § 4.1.

The Category A of systems shall be considered to select the rated voltage of the cable for the operating conditions under single phase to earth fault.

Supply voltage may vary by $\pm 10\%$ (rated frequency = 50 Hz or 60 Hz $\pm 2\%$)

System Voltage	Rated Voltage Uo/U (Um)
≤ 6.6 kV	6/10 (12) kV
11 kV	8.7/15 (17.5) kV
20 or 22 kV	12/20 (24) kV
33 kV	18/30 (36) kV

4.2 Conductors

Conductors shall be class 2, manufactured from high conductivity annealed stranded copper wire in accordance with [IEC 60228](#).

Conductors shall have watertight cross-sections and construction to prevent transmission of water ingress in the event of external damage.

The longitudinal water-tightness shall be designed with a test pressure calculated with the formula:

$$P = \frac{D}{10} \text{ (P pressure in bar; D depth in meter)}$$

In every case the maximum test pressure shall be 30 bars which correspond to the pressure at 300 m depth.

Conductor cores shall be manufactured with the minimum number of joints required. Minimum cross-section shall be 25 mm².

4.3 Conductor screen

An extruded semi-conducting screen shall be applied to the conductors.

4.4 Insulation

The insulation material shall be XLPE (cross-linked polyethylene) or EPR (Ethylene Propylene Rubber).

4.5 Colour of main conductor insulation

The main voltage cores shall be colour tape coded Yellow, Blue, Red for three phase wire cable.

4.6 Screen over Insulation

A semi-conducting layer is extruded over the insulation. In addition a semi-conducting tape may be laid over the extruded semi-conducting layer.

4.7 Metallic screen

An individual metallic layer of high conductivity annealed copper tape shall be applied to each power core over the insulation semi-conducting screen.

The metallic screen cross-section shall be sized in accordance with the earth fault current.

The metallic screen shall be helically applied with an overlap.

The three metallic screens shall be in electrical contact.

4.8 Lead sheath

If necessary for cable stability reason, a lead sheath of sufficient cross-sectional area or lead filling to withstand the earth fault current shall be designed and applied over the insulation outer semi-conducting screen.

This lead sheath shall be manufactured according to standards, including also considerations regarding mechanical protection (during and after cable installation).

No lead sheath for radial water tightness is required ("dry" design) unless specified in the Project particular specification, and/or the data sheet.

4.9 Teredo protection

When cables are installed in Arabian Persian Gulf, an anti teredo bronze, copper or galvanized steel tape shall be provided.

4.10 Optical fibres

Fibres shall be designed as per Company General Specification **GS EP TEL 191** and Telecom Project particular specification

Fibres shall be laid inside a stainless steel tube filled with water repellent non-hygroscopic gel and protected by polyethylene sheath, galvanized steel wire armour, and an outer polyethylene sheath. The Fibre optic assembly shall be located in one of the interstices of the power cables.

Fibres shall be produced as one continuous length.

Fibres shall be strain tested by performing an elongation test on the complete cable. The force applied to the complete cable shall be defined in accordance with recommendations **CIGRE ELT-171-3** published in ELECTRA No. 171-3.

Optical units shall be designed to take account of the following effects:

- Anticipated strain during installation
- Free hydrogen
- Contact with sea water at the depth indicated
- Temperature effects
- Bending during and after installation.

The design shall be such that the maximum degradation over the operating life of the optical fibres (25 years) does not exceed the maximum attenuation indicated across the total length of either cable.



Fibres shall be identifiable throughout the length by colour coding or other means proposed by the Supplier.

4.11 Assembly, inner coverings and fillers

The assembly of three core cables with the optical fibres shall be arranged to form a round shape. The inner coverings may be extruded or lapped. Materials used shall be suitable for the operating temperature of the cable.

4.12 Metallic armour

The Metallic armour shall consist of one or more layers of galvanized steel wires, either round or flat shape.

Size of wires or tape shall be designed by the Manufacturer study according to all project environmental data, and taking into account all operations, from manufacture to site installation:

- Water depth
- In place stability
- Sea bed composition
- cable size
- type of anchoring (static or dynamic)
- Pulling strengths during laying
- Fatigue strengths
- Cable handling
- Storage conditions (coilable or spoolable cable).

4.13 Oversheath

An overall protective covering shall be applied to secure and protect the armouring during transit and laying.

The cover shall be bitumen impregnated polypropylene or extruded black Polyethylene (PE).

4.14 Cable marking

Cable shall have permanent, sea water resistant length marking every 100 meters except for "water depth at site + 200 meters" from either end of cable, where the marking shall be every 10 meters.

Marking shall be applied at each factory joint, if any.

5. Mechanical design requirements

5.1 General

This section outlines the design requirements for the mechanical design of the composite cable, which shall be implemented during cable design.



5.2 Service conditions

The Supplier's design interpretation of the specification shall take due account of all temporary and service conditions likely to be experienced throughout the subsea cable's service life:

- **Temporary condition:** All conditions experienced during the fabrication, mechanical completion, installation and testing of the composite cable including the environmental and safety conditions
- **System commissioning:** Including testing of electrical and fibre-optic lines
- **Service conditions:** All conditions during the service life, including accidental service conditions such as specified maximum short circuit, environmental, safety conditions and other service conditions as specified in the design basis.

5.3 Mechanical design

5.3.1 In-place stability

In-place stability shall be analyzed in accordance with the applicable Codes and Regulations, based upon the design data contained in the Contract documents.

The cable shall have sufficient negative buoyancy to prevent any instability on the sea bed. The Supplier shall state the specific gravity of the cable in sea water and shall perform his own calculations based of Company's on provided information.

The lateral stability analysis includes all environmental forces such as drag, lift and inertia as well as frictional resistance. After determination of the appropriate wave theory in combination with wind and tidal velocities, the hydrodynamic loads due to drag, lift and inertia shall be determined.

The design loads to be taken into account are the following:

- Functional loads:
 - Weight
 - External pressure
 - Residual loads
 - Installation loads.

The environmental loads applied to the cable are principally those arising from:

- Environmental loads:
 - Hydrodynamic loads resulting from waves, wind and tidal currents
 - Platform displacements.

Hydrodynamic loads arise from the relative motions between cable and sea water. They consist of drag, lift and inertia forces. The hydrodynamic coefficients used shall be justified.

Wind, wave and tidal induced velocities shall be added vectorially with respect to the direction perpendicular to the cable.

The wave induced water particle velocities and accelerations shall be determinate using the appropriate wave theory for the design wave height, period and water depth. Design



environmental parameters shall be extracted from the Project environmental specification included in the Contract documents.

5.3.2 Strength analysis

The composite cable system shall have sufficient strength to resist the loads and load combinations in all service phases of its design life, including installation.

The design of the core arrangement/layout shall be the responsibility of the Supplier and shall ensure that the design outside diameter allows safe installation of the cable. The Supplier shall provide drawings showing the design layout of the cable cross-section.

The Supplier shall perform his own calculations based on review and acceptance of Company's I-Tube design for size bending radii and orientation, covering also location of anchoring and termination box and routing of cable to termination.

The Supplier shall also carry out analysis to ensure that the cable can withstand dynamic bending cycles occurring during an interruption of lay operations, and at mid-water arch location during pull-in operations.

The Supplier shall submit to Company at tender stage a preliminary study justifying the cable mechanical design (stability, etc.).

5.3.3 Allowable spans

The Supplier shall perform allowable span calculations for the cable at the I-Tube bellmouth and along its length, based on Company's provided information.

The analysis shall take account of environmental and functional loads.

These allowable spans shall be used to determine the requirements for sweeping along the route before installation or remedial works after installation.

6. Cable termination

The **GS EP STR 901** shall be complied with for the I-Tube design requirements. In particular, ventilation openings in the top part of the I-Tube shall be provided to improve the cable cooling.

The Supplier shall provide all the necessary accessories to terminate the cable.

The Supplier shall provide composite armour hang off arrangement with suitable flanges which will be fixed on top of the I-Tube. The Supplier shall provide drawings/details of the matching flange for the I-Tube. The cable with inner sheath, after passing through the hang off shall be enclosed in a heat shrinkable sleeve. The cable then shall be passed through a split-out unit to separate the power cores and the fibre optic steel tube; separation shall be made using a quadrifurcation glove.

The optical termination unit shall meet requirements of the Telecom project particular specification.

The power cores shall be connected to aerial single core cables through a resin encapsulated electrical termination (cable transition joint) which will ensure the continuity of all layers (cores, semiconducting screens, insulation, metallic screens).

For shore to sea cables, a cable termination junction box may be proposed as alternate for shore connection.



When required, suitable termination kits shall be supplied for connection into the cable feeder cubicles.

Note: Location of splitting boxes, power termination boxes, optical termination unit, may require certified Zone 1 or Zone 2 equipment.

7. Loading/Installation

7.1 General

The Supplier shall specify guidelines to define the specific technical instructions applicable to the transportation, laying, installation and acceptance of the subsea cable.

Based on these guidelines, the particular specification for the installation issued by the Contractor shall be approved by the Supplier.

A cable Supplier representative shall be present during the laying of the cable.

7.2 Installation

The complete cable shall be loaded on a drum or a suitable cable laying ship/barge which shall have access alongside the cable Manufacturer plant.

The cable shall be stored on the ship/barge in a suitable manner.

The “open” end of the cable shall be fitted with a “bull-nose” to allow the cable pulling equipment to be fitted to facilitate the pulling of the cable through a I-Tube.

Two “bull-nose” fittings shall be provided and factory fitted for each length of cable by the Supplier.

Dimension of the “bull-nose” shall be suitable for I-Tube inner diameter. Bull-noses shall be designed to allow test of the cable at delivery and during installation.

The Supplier shall develop the procedures and design calculations for pulling the cable through the I-Tube. These calculations shall prove that the stresses imposed on the cable are well within the cable design characteristics. The procedures shall include details of the method of attaching the winch wire to the cable, and any precautions proposed. They shall also highlight any special requirements for the structure, such as support points for winching.

The Supplier shall detail and specify any additional type of extra reinforcement which may be required to the cable where it exits from the base of the I-Tube. Details shall be furnished giving full details on how the reinforcement shall be fitted.

In case of long cable lengths for which subsea joints are unavoidable, the supply, fabrication and laying of the joints shall be supervised by the Supplier.

8. Inspection and testing

8.1 General

The Supplier shall maintain comprehensive records of all tests undertaken and the results.

The Company reserves the right to witness any or all the tests.

Details about Supplier's test equipment capabilities shall be provided with the bid.



Test schedule and detailed test procedures, shall be prepared during detailed studies and shall include tests conditions, expected results and acceptance criteria.

8.2 Inspection

The Supplier shall apply his normal procedures and standards to control the quality of goods during all stages of preparation, unless modified and replaced by the Company's written requirements.

8.3 Testing

Tests shall be as per [IEC 60502-1](#) and [IEC 60502-2](#) as listed in the following section and detailed in the attached Project Data Sheet.

Should additional tests be required, in addition to those required by Company, Supplier shall include these tests in his proposal.

8.3.1 Type tests

Test approval certificates of Electric and Non Electric Type tests conducted for similar design cable as per requirement of [IEC 60502-1](#) or [IEC 60502-2](#) shall be furnished with the bid.

8.3.2 Routine tests on insulated cores before laying-up

The following tests shall be conducted on insulated cores before laying up.

	$U_m \leq 3.6 \text{ kV}$	$3.6 \text{ kV} < U_m \leq 36 \text{ kV}$
Partial discharge test	Not required	IEC 60502-2/16.3
High voltage AC test	IEC 60502-1/15.3	IEC 60502-2/16.4

8.3.3 Factory Acceptance Tests

FAT shall comprise Sample tests and routine tests as per [IEC 60502-1](#) or [IEC 60502-2](#) and tests listed in project data sheet.

8.3.4 Optical tests

Each fibre used in the optical unit shall have an associated manufacturing test/QA record document. The Supplier shall, as part of its response to this document, provide a copy of the test/QA procedures used for the fibre manufacture. The test shall cover as a minimum all parameters of the fibre.

Prior to laying up of the fibres in the optical unit, the fibres will be tested using an Optical Time Domain Reflectometry (OTDR) to measure loss against distance in the operating window specified ends of the fibre. The Supplier shall produce a schedule of the tests including results limits to be agreed with the Company prior to testing. The test results shall be recorded in a manner which allows easy comparison with later tests.

The test shall be conducted as per [ITU-T G652](#) and [ITU-T G650](#) recommendation.



8.3.5 Electrical tests on site before laying

Upon the cable arrival at destination and before laying, tests required before laying shall be carried out by the Supplier in presence of the Contractor (interface).

8.3.6 Electrical tests after installation

Tests shall be performed after completion of anchoring and transitional joints at both ends.

Supplier shall indicate recommendations for Voltage tests if such test are to be repeated after completion of termination kits for connection inside cable feeder cubicles.

According to the type of test proposed the Supplier shall include in his proposal the supply of equipment required for high voltage test and fault location.

8.3.7 Optical fibre cores

OTDR Optical Time Domain Reflectometry test and others tests recommended by the Supplier shall be carried out.

8.4 Test reports

A pro-forma of test reports shall be presented to the Company for approval before placing the order.

The test reports shall detail as a minimum:

- The expected theoretical values
- The tolerances
- The results of the measurements carried out, including any intermediate values, which lead to a temporary non-acceptance, if any.

The test reports shall be included in the contractual technical documents, and shall be considered as an integral part of them.

9. Cable repair

The **Supplier** shall design a method of cable repair and will issue the appropriate procedures. This will encompass the recovery method of the damaged cable, method of repair of power conductors and optical unit, and the manner of reinstallation. The **Supplier** shall design and supply the necessary junction boxes and accessories.

The repair joint will be such that the integrity of the cable shall be maintained and that the design life degradation is not affected.

An additional length of cable shall be supplied for retention to effect repairs on a separate steel drum. The cable ends shall be properly sealed for outdoor storage for a long duration.

10. Other references

Following standards are applicable: [IEC 60183](#), [IEC 60287 \(All parts\)](#), [IEC 60502-4](#), [IEC 60811 \(All parts\)](#), [IEC 60885-3](#).



Appendix 1 Subsea cable Datasheet


Exploration & Production

DATA SHEET	N°
Project:	
DS EP ELE 765 Rev. 03 - 01/2011	Subsea cables

Rev. Date						
Written						
Verified						
Approved						

1	I - CONDITIONS D'INSTALLATION									
2	INSTALLATION CONDITIONS									
3	Pays									
4	Country									
5	Liaison de / à	1				2				
6	Link from / to									
7	Longueur de la liaison				m					
8	Cable length									
9	Profondeur d'eau	1				m	2			m
10	Water depth at each end									
11	Profondeur d'eau maxi.				m					
12	maximum water depth									
13	Diamètre des I-Tube	1			Inch	Hauteur au dessus du fond marin				m
14	I-Tubes diameter	2				Height bellmouth to sea bed				m
15	Longueur posée onshore				m	Profondeur				m
16	Onshore length					Depth				
17	Ancrage	1	Statique / Static		☐	2	Statique / Static		☐	
18	Cable anchoring		Dynamique/Dynamic		☐		Dynamique / Dynamic		☐	
19	Température de l'eau	Maxi (surface)				°C				
20	Seawater temperature	Mini (sea bed)								
21	Température ambiante	Max				°C				
22	Ambient air temperature	Average								
23		Min								
24	Vitesse de courant marin	Surface				m/s	Au Fond			m/s
25	Ocean current velocity						Sea bed			
26	Résistivité thermique	Ensaillé	TR _e =		K.m/W	Enterré	TR _b =		K.m/W	
27	Soil thermal resistivity	embedded				buried				
28	II - DONNEES RESEAU									
29	NETWORK DATA									
30						Unité/ Unit	Notes			
31										
32	Tension d'alimentation					kV				
33	Supply Voltage									
34	Plage de tension					%				
35	Voltage variation									
36	Fréquence					Hz				
37	Frequency									
38	Icc triphasé maximum					kA	Temps d'élimination		s	
39	Maximum Short circuit						Clearing time			
40	Court-circuit phase/Terre					A	Temps d'élimination		s	
41	Earth fault current						Clearing time			

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DATA SHEET	N°
Project:	
DS EP ELE 765	Subsea Cable
Rev. 03 - 01/2011	

1	III – COMPOSITION DU CÂBLE					
2	CABLE DESCRIPTION					
3	PHASES	Requis / Required			Offre / Propose	
4	POWER CORES					
5	Nature des conducteurs	Cu				
6	Core					
7	Section	Class 2	mm ²	IEC60228		mm ²
8	Cross section					
9	Diamètre sur âme			IEC60228		mm
10	Core Diameter					
11	Etanchéité longitudinale	Oui / Yes	☐			
12	Water tightness	Non / No	☐			
13	Ecran sur âme	Semi conducteur extrudé		IEC 60502		
14	Core screen	Extruded semi conducting				
15	Epaisseur écran de l'âme			IEC 60502		mm
16	Core screen thickness					
17	Isolant					
18	Insulation					
19	Epaisseur de l'isolant			IEC 60502		mm
20	Insulation thickness					
21	Ecran sur Isolant	Semi conducteur extrudé		IEC 60502		
22	Insulation screen	Extruded Semi conductive				
23	Ecrans & Isolant	Extrusion tri-couches				
24	Screens & insulation	Three-layer extrusion				
25	Ecran métallique	Ruban cuivre		IEC 60502		mm
26	Metallic screen	Copper tape				
27		Matelas semi conducteur		IEC 60502		mm
28		Semi conductive bedding				
29	Section écran métallique					mm ²
30	Metallic screen cross sect.					
31	Diamètre sur écran					mm
32	Diameter over screen					
33	Nature du Bourrage					
34	Type of fillers					
35	Gaine d'assemblage	PE Extrudé				mm
36	Internal sheath	Extruded PE				
37	Diam. gaine d'assemblage					mm
38	Diam over internal sheath					
39	Protection anti tarets	Oui / Yes	☐			mm
40	Teredos protection	Non / No	☐			
43	Gaine d'étanchéité	Oui / Yes	☐			mm
44	Water barrier	Non / No	☐			
45	Diam. sur gaine étanchéité.					mm
46	Diam. over water barrier					



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Date: 01/2012

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Rev: 04

Appendix 1



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DATA SHEET	N°
Project:	
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1	III – COMPOSITION DU CÂBLE Suite									
2	CABLE DESCRIPTION Cont'									
3										
4	Offre / Proposal									
5	ARMURE METALLIQUE									
6	METALLIC ARMOUR									
7	Matelas sous armure :						Epaisseur			
8	Armour bedding :						Thickness			
9	Diamètre sous armure :						mm			
10	Diameter under armour						mm			
11	Fils ronds acier galvanisé				☐		Fils plats acier galvanisé			
12	Galvanized round steel wires						Galvanized flat steel wires			
13	Simple/1 layer		☐		Nombre					
14			Quantity							
15	Double/2 layers		☐		Nombre		1		Diamètre ou	
16			Quantity				2		taille des fils	
17									Wire	
18	Triple/3 layers		☐		Nombre		1		diameter or	
19			Quantity				2		size	
20							3		3	
21	Diamètre sur armure						mm			
22	Diameter over armour						mm			
23	Gaine extérieure				Extrudée		☐		PE ☐	
24	Outer sheath				Extruded				PVC ☐	
25									Polypropy- lene yarn + Bitumen ☐	
26	Diamètre extérieur						mm			
27	Overall diameter						mm			
28	Marquage métrique									
29	Length marking									
30	Poids dans l'air						Kg/m			
31	Weight in air						Kg/m			
32	Poids dans l'eau						Kg/m			
33	Weight in water						Kg/m			
34	Rayon de courbure Mini				Stocké :		m		En cours de pose :	
35	Minimum bending radii				Stored :				During laying :	
36					Posé		m			
37					installed					
38	Effort de traction maxi.						daN			
39	Maximum tensile force						daN			
40										
41										
42										
43										

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General Specification

Date: 01/2012

GS EP ELE 765

Rev: 04

Appendix 1



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DATA SHEET	N°
Project:	
DS EP ELE 765 Rev. 03 - 01/2011	Subsea Cable

1	IV – FIBRE OPTIQUE			
2	OPTICAL FIBRE			
3		Requis/required	Reference Doc	Offre / Proposal
4				
5	Nombre de fibres			
6	Number of cores			
7	Type	Monomode	ITU-T G652	
8				
9	Attenuation @ 1310nm	0.4	dB/km	
10				dB/km
11	Attenuation@ 1500nm	0.25	dB/km	
12				dB/km
13	PHYSICAL DATA	Offre / Proposal		
14				
15	Caractéristiques des fibres	Diamètre		µm
16	Cores characteristics	Diameter		
17		Revêtements		µm
18		Cladding		
19	Description du faisceau	Tube		
20	Description of assembly	Tubing		
21		Etanchéité		
22		Water tightness		
23		Protection mécanique		
24		Mechanical protection		
25				
26				
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1 2	V – CARACTERISTIQUES ELECTRIQUES / ELECTRICAL DATA						
3 4		Offre / Proposal					
5 6	Résistance linéique de l'âme Positive sequence linear resistance	R=	@20°C				
7 8	Résistance linéique Homopolaire Negative sequence linear resistance	R0=	Ω/km @20°C				
9 10	Inductance linéique Positive sequence linear impedance	L=	mH/km				
11 12	Réactance linéique homopolaire Positive sequence linear reactance	X=	Ω/km				
13 14	Réactance linéique homopolaire Zero sequence linear reactance	X0=	Ω/km				
15 16	Capacité linéique âme / écran Capacitance core / screen	C=	μF/km				
17 18	Susceptance linéique Positive sequence susceptance	Y=	S/km				
19 20	Susceptance homopolaire Negative sequence susceptance	Y0=	S/km				
21 22	Intensité admissible en régime permanent Permissible current rating for continuous operation						
23 34	Dans l'air In air		A @ θ°c =				
25 26	Dans l'air au soleil In air, exposed to sun shine		A				
27 28	Dans l'eau In water		A @ θ°c =				
29 30	Dans l-Tube vertical In Vertical I-Tube		A @ θ°c =				
31 32	Dans l-Tube vertical au soleil In Vertical ITube exposed to sunshine		A				
33 34	Ensouillé Embedded in sea bed		A @	θ°c =	TRe=		
35 36	Enterré Burried in trench		A @	θ°c =	TRb=		
37 38	Intensité admissible en court-circuit Permissible current rating in case of short circuits						
39 40	Dans l'âme à partir de l'état chaud In core from hot state	0.2s	kA	0,5s	kA	1s	kA
41 42	Dans un écran à partir de l'état chaud In one screen from hot state	0.2s	A	0,5s	A	1s	A



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1	V – ACCESSOIRES / ACCESSORIES			
2				
3		Requis required	Offre / Proposal	
4				
5			Quantité	Référence des documents fournis
6			Quantity	Reference of documents provided
7	Boîtes d’ancrages	☐		
8	Anchoring boxes			
9	Jonction aérienne	☐		
10	Aerial cable joint			
11	Kit de réparation sous marin	☐		
12	Subsea Repair kit			
13	Chaussettes de tirage	☐		
14	Chinese pulling fingers			
15	Capuchon d’extrémité	☐		
16	Heat shrink end cap			
17	Kits de raccordement	☐		
18	Cable terminations kits			
19	Centreurs	☐		
20	Centralisers			
21	VI – CONNEXIONS / CONNECTIONS			
22				
23		Requis Required		Offre / Proposal
24				
25	Cable aérien unipolaire	☐	Type	
26	Aerial single core cable			
27	Raccordement à l’Extrémité 1 Connection End 1	☐	Joint	☐
28			Transition joint	
29			Boîte à bornes	☐
30			Termination Box	
33	Extrémité 2 End 2	☐	Joint	☐
34			Transition joint	
35			Boîte à bornes	☐
36			Termination Box	
37				
38				
39				
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42				
43				
44				



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1	VII-A – TESTS / TESTING - Um ≤ 3.6 kV			
2				
3	Essais de type			
4	type tests			
5	Tests requis	Reference	Certificats fourni	
6	Required tests	Doc	Certificates provided	
7	Résistance d'isolement à température ambiante	IEC 60502-1.17.1	☐	
8	Insulation resistance at ambient temperature			
9	Résistance d'isolement à température max de l'âme	IEC 60502-1.17.2	☐	
10	Insulation resistance at maximum core temperature			
11	Essais de tension pendant 4h	IEC 60502-1.17.3	☐	
12	Voltage test for 4 h			
13	Essai aux ondes de choc	IEC 60502-1.17.4	☐	
14	Impulse test			
15	Essais de type non électrique	IEC 60502-1.18	☐	
16	Non Electrical type tests	Table 14		
17	Essais de réception usine : Essais sur prélèvements			
18	Factory Acceptance Tests : Sample tests			
19	Tests requis	Reference	Offre	
20	Required tests	Doc	Proposal	
21	Examen de l'âme	IEC 60502-1.16.4	☐	
22	Core examination			
23	Vérifications dimensionnelles	IEC 60502-1.	☐	
24	Check of dimensions	16.5 to 16.8		
25	Essai d'allongement à chaud des enveloppes isolantes	IEC 60502-1.16.4	☐	
26	Hot set Test			
27				
28				
29	Essais de réception usine : Essais individuels			
30	Factory Acceptance Tests : Routine tests			
31	Tests requis	Reference	Offre	
32	Required tests	Doc	Proposal	
33	Résistance électrique des âmes	IEC 60502-1.15.2	☐	
34	Core resistance			
35	Essai de tension	IEC 60502-1.15.2	☐	
36	Voltage test	Table 11		
37	Résistance d'isolement âmes/ écrans & écrans/armure		☐	
38	Insulation resistance core/screen & screen/armour			
39	Reflectométrie		☐	
40	Time Domain reflectometry test			
41				
42				
43				
44				


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1	VII-B – TESTS / TESTING - 3.6 kV < Um ≤ 36 kV			
2				
3	Essais de type			
4	type tests			
5	Tests requis	Reference	Certificats fourni	
6	Required tests	Doc	Certificates provided	
7	Essai d'enroulement et décharges partielles	IEC 60502-2.	☐	
8	Bending Test and partial discharge	18.1.3 /18.1.4		
9	Mesure Tanδ (si tension assignee ≥ 6-10(12)kV)	IEC 60502-2.	☐	
10	Tanδ measurement (for Rated Voltage ≥ 6-10(12)kV)	18.1.2 /18.1.5		
11	Essai de cycles de chauffage	IEC 60502-2.	☐	
12	Heating cycle tests	18.1.6		
13	Essai aux ondes de choc	IEC 60502-2.	☐	
14	Impulse test	18.1.7		
15	Essais de tension pendant 4h	IEC 60502-2.	☐	
16	Voltage test for 4 h	18.1.8		
17	Résistivité des écrans semi conducteurs	IEC 60502-2.	☐	
18	Resistivity of semi-conducting screens	18.1.9		
19	Essais de type non électrique	IEC 60502-2.19	☐	
20	Non Electrical type tests	Table 16		
21	Essais de réception usine : Essais sur prélèvements			
22	Factory Acceptance Tests : Sample tests			
23	Tests requis	Reference	Offre	
34	Required tests	Doc	Proposal	
25	Examen de l'âme	IEC 60502-2.17.4	☐	
26	Core examination			
27	Vérifications dimensionnelles	IEC 60502-2. 17.5	☐	
28	Check of dimensions	to 17.8		
29	Essais de tension pendant 4h	IEC 60502-2. 17.9	☐	
30	Voltage test for 4 h			
31	Essai d'allongement à chaud des enveloppes isolantes	IEC 60502-2.17.10	☐	
32	Hot set Test			
33	Essais de réception usine : Essais individuels			
34	Factory Acceptance Tests : Routine tests			
35	Résistance électrique des âmes	IEC 60502-2.16.2	☐	
36	Core resistance			
37	Essai de décharges partielles	IEC 60502-2.16.3	☐	
38	Partial discharge test			
39	Essai de tension	IEC 60502-2.16.4	☐	
40	Voltage test	Table 11		
41	Résistance d'isolement âmes/ écrans & écrans/armure		☐	
42	Insulation resistance core/screen & screen/armour			
43	Reflectométrie		☐	
44	Time Domaine reflectometry test			



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1	VII-C – TESTS / TESTING				
2					
3	Essais avant pose				
4	Tests before laying				
5	Tests requis		Offre		
6	Required tests		Proposal		
7	Résistance électrique des âmes	☐			
8	Core resistance				
9	Résistance électrique des écrans	☐			
10	Core resistance				
11	Résistance d'isolement âmes/ écrans	☐			
12	Insulation resistance cores/screens				
13	Résistance d'isolement écrans/armure	☐			
14	Insulation resistance screens/armour				
15					
16					
17	Essais après pose				
18	Tests after laying				
19	Test de continuité des âmes et des écrans	☐			
20	Metallic screens Continuity check				
21	Résistance d'isolement âmes/ écrans	☐			
22	Insulation resistance cores/screens				
23	Résistance d'isolement écrans/armure	☐			
34	Insulation resistance screens/armour				
25	Essais de tension	☐	Test type	Power frequency test	☐
26	Voltage test			Voltage Low Frequency (VLF)	☐
27				DC voltage test	☐
28					
29					
30					
31					
32					
33	Reflectométrie	☐			
34	Time Domaine reflectometry test				
35	Autres tests proposés par le Fournisseur				
36	Other tests proposed by SUPPLIER				
37					
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General Specification

Date: 01/2012

GS EP ELE 765

Rev: 04

Appendix 1



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1	VII-D – TESTS / TESTING		
2			
3	Tests optiques		
4	Optical tests		
5	Essais de réception usine		
6	Factory Acceptance Tests		
7	Tests requis	Offre	
8	Required tests	Proposal	
9	Vérification de la continuité des fibres	☐	
10	Optical continuity check		
11	Mesure de l'atténuation	☐	
12	Optical Attenuation measurement		
13			
14			
15	Autres tests proposés par le Fournisseur		
16	Other tests proposed by SUPPLIER		
17			
18			
19			
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21			
22			
23	Essais après pose		
24	Tests after laying		
25	Vérification de la continuité des fibres	☐	
26	Optical continuity check		
27	Mesure de l'atténuation	☐	
28	Optical Attenuation measurement		
29	Autres tests proposés par le Fournisseur		
30	Other tests proposed by SUPPLIER		
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