



ZTT Document No:	92408-E02-02		
Rev No:	03	Date: Mar. 22, 2019	
Project:	MaMPU-1 FPSO - AJK Field Project		
Appendix Ref:	Cable Technical Specification		

Technical Specification
For
6/10kV XLPE Insulated Nine-cores
Dynamic Submarine Power Cable
of
MaMPU-1 FPSO - AJK Field Project

03	Mar.22, 2019	Issued for Bidding	James Zhan	Chen Guo
Version	Date	Description	Prepared	Approved



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02		
Rev No:	03	Date:	Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project		
Appendix Ref:	Cable Technical Specification		

AMENDMENTS AND REVISIONS

Amendment and revision	Date	Page	Description
1	Nov.25, 2018	/	/
2	Jan .7,2019	2-15	Updated the cable structure
3	Mar. 22, 2019	/	/



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

INDEX

1. GENERAL	4
2. ACRONYMS	4
3. REFERENT STANDARDS	5
4. MANUFACTURING FEATURES	6
6. CABLE STRUCTURE & DATA SHEET	10
7. PERFORMANCE PARAMETER	11
8. PACKING	13
9. INSPECTION AND TEST	14



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

1. GENERAL

This listed specification covers the structure and performance of the offered cable as manufactured by ZTT. Matters not mentioned or defined in this technical specification shall be discussed and negotiated by customer and ZTT.

2. ACRONYMS

AC	Alternating Current
Approx.	Approximate
DC	Direct Current
HDPE	High Density Polyethylene
ITP	Production Inspection and Test Plan
Max.	Maximum
Min.	Minimum
No.	Number
Nom.	Nominal
O.D	Outer Diameter
PE	Polyethylene
PP	Polypropylene
TR-XLPE	Water Tree-retardant Cross-linked Polyethylene
ZTT	Jiangsu Zhongtian Technology Co., Ltd



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

3. REFERENT STANDARDS

The cable which ZTT offered shall be designed, manufactured and tested according to related standards as follows.

Ref	Document No.	Title
/1/	IEC 60228-2004	Conductors of Insulated Cables
/2/	IEC 60502-2-2014	Power Cables for Rated Voltages from 6 kV ($U_m = 7.2$ kV) up to 30 kV ($U_m = 36$ kV)
/3/	IEC 60811-1-1-2001	Common Test Methods for Insulating And Sheathing Materials of Electric Cables—Part 1: Methods for General Application-Section1: Measurement of Thickness and Overall Dimensions-Tests for Determining The Mechanical Properties
/4/	IEC 60949-2008	Calculation Of Thermally Permissible Short-Circuit Currents, Taking Into Account Non-Adiabatic Heating Effects.
/5/	BS EN 10257-2-2011	Zinc or Zinc Alloy Coated Non-Alloy Steel Wire for Armouring Either Power Cables or Telecommunication Cables - Submarine Cables
/6/	BS EN 10244-2-2009	Steel Wire and Wire Products — Nonferrous Metallic Coatings On Steel Wire-Part 2: Zinc or Zinc Alloy Coatings
/7/	CIGRE TB 490-2012	Recommendations for Testing of Long AC Submarine Cables With Extruded Insulation for System Voltage above 30(36) to 500(550) kV
/8/	CIGRE TB 623-2015	Recommendations for Mechanical Testing of Submarine Cables



ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

4. MANUFACTURING FEATURES

Conductor

The conductor shall be of a compact round design constructed of plain annealed circular copper wires complying with IEC60228 Class. Continuous semi-conducting water blocking tapes shall be applied longitudinally in the interstices of the strands.

Conductor screen, Insulation and Insulation screen

The insulation system is constructed of conductor screen, insulation and insulation screen.

Conductor screen consists of extruded semi-conducting thermosetting compound.

Insulation shall consist of extruded dry-cured water tree-retardant cross-linked polyethylene free from voids and contaminant.

Insulation screen consists of an extruded, semi-conducting thermosetting compound.

The three layers shall be extruded simultaneously.

Semi-conducting water blocking tape

A semi-conducting water blocking tape shall be applied between the insulation screen and metallic screen to achieve the longitudinal water-tightness and also to be a separator.

Phase identification

Each phase shall be identified by colored synthetic tapes (black, brown, grey) applied beneath the semi-conducting water blocking tape.

Metallic screen

Two plain copper tapes shall be applied over the semi-conducting water blocking tape with suitable overlap to accommodate the required fault current.

Water blocking tape

Water blocking tape shall be wrapped over the metallic screen to assist in achieving the longitudinal water-tightness.

Extruded core sheath

A layer of extruded HDPE shall be applied over the water blocking tape to protect each core and also act as a radial barrier.

Fillers between three power cores

Interstices between phases shall be filled with suitable material. The filler material is suitable for the application, which is not prone to aging in seawater, has a stable dimension and gives a substantially round shape. It is not deleterious to the other materials in the cable over the life of the cable.

Assembly of three power cores

The three power cores and fillers shall be laid up together using a planetary type lay-up machine which avoids the



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

imposition of torsion stresses on the cable cores.

Binder over three-core cable

Binder tapes shall be applied to confine the three power cores and fillers with a suitable overlap. The material is suitable for the application and doesn't deteriorate over the life of the cable. The assembly of three power cores with fillers shall act as one integrated cable.

Fillers between three integrated cables

Interstices between three cables shall be filled with suitable material. The filler material is suitable for the application, which is not prone to aging in seawater, has a stable dimension and gives a substantially round shape. It is not deleterious to the other materials in the cable over the life of the cable.

Earthing line

One earthing line consists of copper conductor and extruded HDPE with green/yellow stripe shall be positioned in the interstices of the integrated cable to withstand earth fault currents.

Assembly of three integrated cables

The three integrated cables, earthing line and fillers shall be laid up together using a planetary type lay-up machine which avoids the imposition of torsion stresses on the cable cores.

Binder over the three integrated cables

Binder tapes shall be applied to confine the three integrated cables, earthing line and fillers with a suitable overlap. The material is suitable for the application and doesn't deteriorate over the life of the cable.

Inner sheath

Extruded HDPE sheath shall be applied over the binder to protect the integrated cables and act as a radial barrier.

Armor

Double layers of galvanized steel wire armor shall be applied over the sheath to act as cable mechanical protection and anti-corrosive compound like bitumen shall be applied over the armor wires. The laying directions shall be the opposite. Between two layers of the armor, a layer of PP yarn bedding layer shall be applied.

Outer sheath

Binder tapes shall be over the armor, and extruded HDPE sheath shall be applied over them to protect the armor from water ingressing.



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

Cable marking

a. Marking on the sheath of each power core

The following information shall be repeated continuously, printed on outer sheath at 1m interval.

Brand\Year\Voltage\Conductor No. and Cross section

Example: ZTT 2018 6/10kV 3×3C 95mm²

Meter marking will be only on black phase for length checking.

Example: ZTT 2018 6/10kV 3×3C 95mm² **m

b. Marking on the outer sheath

Out marking is necessary to assist the installation operation.

The following information shall be repeated continuously, printed on outer sheath at 1m interval.

Brand\Year\Voltage\Conductor No. and Cross section\length

Example: ZTT 2018 6/10kV 3×3C 95mm² **m

The marking tape with the following length information shall be wrapped over the outer sheath at 20 m interval by protection tapes:





ZTT Document No:	92408-E02-02	
Rev No:	03	Date: Mar. 22, 2019
Project:	MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

5. NOMENCLATURE

H YJ Y 44 3 6/10 3 × 3 × 95+16

H: Code of submarine cable

YJ: XLPE insulation

Y: PE inner sheath

44: Double layers of thick steel wires armor

3: PE outer sheath

6/10: Rated voltage of cable (kV)

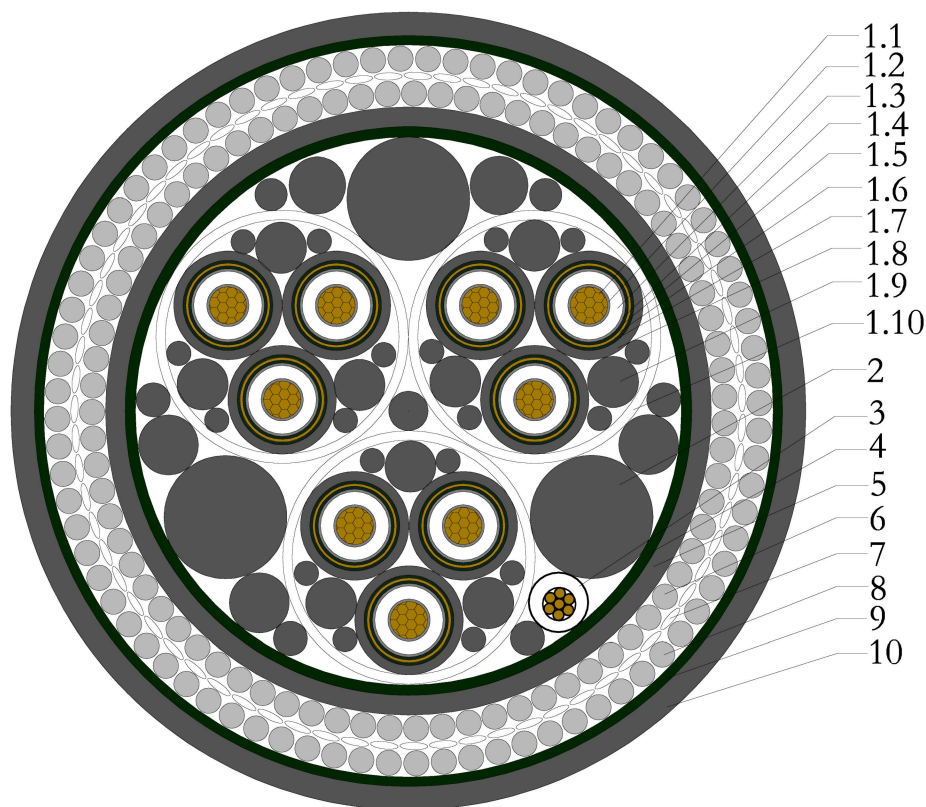
3×3: No. of Power conductor

95: Cross section of power conductor (mm²)

16: Cross section of earthing line conductor (mm²)



6. CABLE STRUCTURE & DATA SHEET



HYJY443 6/10 3×3×95+16

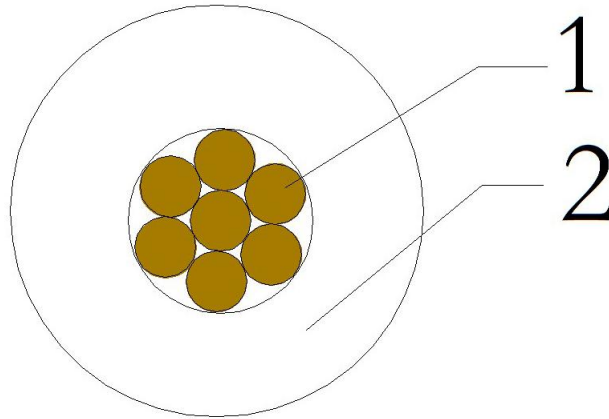
No.	Description	Nom. Thickness (mm)	Approx. O.D (mm)
1.1	Conductor (plain copper)	Cross section:95mm ²	11.5
1.2	Conductor screen (semi-conducting)	0.7(min.0.5)	12.9
1.3	Insulation (TR-XLPE)	3.4(min2.96)	19.7
1.4	Insulation screen (semi-conducting)	0.7(min.0.5)	21.1
1.5	Semi-conducting water blocking tape	0.3	21.7
1.6	Copper tape (plain copper)	0.1	22.0
1.7	Water blocking tape	0.3	22.6
1.8	Extruded core sheath (HDPE)	1.5(min1.00)	25.6
1.9	Filler (PE strip/PP string)	/	/
	Assembly	/	55.3
1.10	Binder (Synthetic tape)	0.5	56.3
2	Filler (PE strip/PP string)	/	/
3	Earthing line	Cross section:16mm ²	11.8
	Assembly	/	121.6
4	Binder (Synthetic tape)	0.5	123.6
5	Inner sheath (HDPE)	4.5(min.3.4)	133.1
6	1st Armour (galvanized steel wire, G65)	(68±2)×Φ6.0	145.1
7	Aarmor bedding (PP yarns)	Φ1.0	146.9
8	2 nd Armour (galvanized steel wire, G65)	(75±2)×Φ6.0	158.9
9	Binder (Synthetic tape)	0.5	160.8
10	Outer sheath (HDPE)	5.5(min.4.20)	172.3
	Cable weight (approx.)		
	in air	57.4kg/m	
	in water	33.5kg/m	



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	02	Date: Mar. 22, 2019
Project:	Subsea Composite Power Cable For MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

Earthing Line



No.	Description	Approx. O.D (mm)
1	Conductor (plain copper) Cross section: 16mm ²	4.8
2	HDPE outer sheath (with green/yellow stripe) Nominal thickness of outer sheath(mm) Nominal cable O.D(mm)	3.5 11.8



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	02	Date: Mar. 22, 2019
Project:	Subsea Composite Power Cable For MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

7. PERFORMANCE PARAMETER

Electrical Performance Parameter

Rated voltage U_0/U (kV) (U_m)	6/10(12)
Frequency (Hz)	50
Max operation temperature of power conductor($^{\circ}\text{C}$)	90
Max short circuit temperature of power conductor($^{\circ}\text{C}$)	250
Power conductor DC resistance @ 20°C (Ω/km)	0.193
Adiabatic short circuit current of power conductor @ 1s(kA) (single phase)	13.6($250^{\circ}\text{C}/90^{\circ}\text{C}$)
Adiabatic short circuit current of metallic screen @ 1s(kA) (single phase)	0.8($180^{\circ}\text{C}/81^{\circ}\text{C}$)

Mechanical Performance Parameter

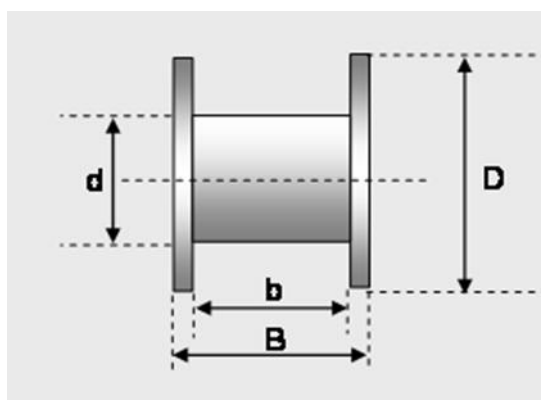
Minimum Bend Radius (MBR) during Laying (mm)	3446
Minimum Bend Radius (MBR) after Installation (mm)	2585
Minimum Breaking Load(kN)	2628
Maximum Permissible Tensile Strength (kN)	657
Axial Stiffness (N)	7.90E+08
Torsional Stiffness ($\text{kN}\cdot\text{m}^2$)	3.16E+02
Bending Rigidity (EI) ($\text{kN}\cdot\text{m}^2$)	7.85E+01



ZTT Document No:	92408-E02-02	
Rev No:	02	Date: Mar. 22, 2019
Project:	Subsea Composite Power Cable For MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

8. PACKING

The cable shall be wound on non-returnable steel drum. Both ends of cable shall be securely fastened and sealed with a shrinkable cap. The required marking is printed with a weather-proof material on the outsides of pack according to customer's requirement. The below size and weight is estimated and shall be confirmed before shipment.



Cable type	Cable dia.	Length	D	d	b	B	Estimated gross weight
HYJY443 6/10 3×3×95+16	mm	km	mm	mm	mm	mm	T
	172.3	1.5	7400	5600	5000	6500	113



Zhongtian Technology Submarine Cable Co., Ltd (ZTTSC)

ZTT Document No:	92408-E02-02	
Rev No:	02	Date: Mar. 22, 2019
Project:	Subsea Composite Power Cable For MaMPU-1 FPSO - AJK Field Project	
Appendix Ref:	Cable Technical Specification	

9. INSPECTION AND TEST

Unless separate ITP has been agreed, only below tests will be executed for factory acceptance.

No.	Items	Frequency	Instrument	Acceptance criteria	Applicable standards
1	D.C. conductor resistance	Entire cable	D.C. double bridge (Wheatstone)	No more than $0.193 \Omega/\text{km}$ @ 20 degree C	IEC 60228
2	A.C. voltage test	Entire cable	High voltage resonance system	A.C. voltage $3.5U_0$ for 5min, no breakdown of insulation shall occur. Test frequency shall be between 20Hz to 300Hz.	IEC 60502-2,
4	Visual inspection of cable appearance and marking	Entire cable	Visual	As per section 5 "Cable marking"	/