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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR SUBMARINE POWER CABLES WITH INHERENT OPTICAL FIBERS

FIRST EDITION

JULY, 2005

IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the on going projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

REVISION INDEX

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian Petroleum Standard IPS-M- EL-273(2), revised on February 2014, with the modifications as specified herein after shall be strictly followed.

Articles 1 through 2 of this document replace entirely the related articles in the referenced IPS Standard.

1. SCOPE

- 1.1. This Specification covers the minimum requirements for materials, design, manufacture, inspection, testing and installation of submarine power cables accompanied by inherent optical fiber cables.
- 1.2. The cables will be installed in NIOEC offshore projects under the environmental and service conditions specified herein.
- 1.3. The general requirements are given in this Specification; the specific requirements of individual cases will be given in request for quotation and/or purchase order.
- 1.4. Deviations from this Specification will only be permitted on obtaining written approval from NIOEC.
- 1.5. Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced/relevant IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specifications, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references, after the cited date shall be mutually agreed upon between NIOEC and the Vendor/Contractor.

Cables shall be designed, manufactured, inspected and tested in accordance with applicable sections of the latest edition of international electrotechnical commission "IEC" standards. Where standards other than IEC are specified, it is understood that the equivalent IEC standard is acceptable.

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 60038	IEC Standard Voltages
IEC 60183	Guide to the Selection of High-Voltage Cables
IEC 60228	Conductors of insulated cables
IEC 60502-1	Power Cables with Extruded Insulation and their Accessories for Rated Voltages from 1 kV ($U_m = 1.2$ kV) up 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) Consolidated Edition
IEC 60502-2	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1.2$ kV) up to 30 kV ($U_m = 36$ kV) - Part 2: Cables for rated Voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)

IEC 60502-4	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) - Part 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 60793	Optical Fibers
IEC 60794	Optical Fiber Cables
IEC 60811	Common Test Methods for Insulating and Sheathing Materials of Electric Cables (formerly 540)
IEC 60874	Fiber Optic Interconnecting Devices and Passive Components- Connectors for optical fibers and cables
IEC 60885-3	Electrical Test Methods for Electric Cables Part 3: Test Methods for Partial Discharge Measurements on Lengths of Extruded Cables

ITU (INTERNATIONAL TELECOMMUNICATION UNION)

ITU-T	Recommendation G.650-1SERIES G: Transmission Systems and Media, Digital Systems and Networks- Transmission Media and Optical Systems Characteristics – Optical Fiber Cables- Definitions and Test Methods for Linear, Deterministic Attributes of Single-Mode Fiber and Cable
ITU-T	Recommendation G.650-2 SERIES G: Transmission Systems and Media, Digital Systems and Networks- Transmission Media and Optical Systems characteristics – Optical fiber cables- Definitions and Test Methods for Statistical and non-linear related attributes of single-mode fiber and Cable
ITU-T	Recommendation G.650-3 SERIES G: Transmission Systems and Media, Digital systems AND NETWORKS- Transmission media and optical systems characteristics – Optical Fiber Cables- Test Methods for Installed Single-Mode Optical Fiber Cable Links
ITU-T	Recommendation G. 652 SERIES G: Transmission Systems and Media, Digital Systems AND NETWORKS- Transmission Media and Optical Systems Characteristics – Optical Fiber Cables- Characteristics of a Single-Mode Optical Fiber and Cable

API (AMERICAN PETROLEUM INSTITUTE)

API Specification 17E	Specification for sub-sea Umbilicals
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IPS (IRANIAN PETROLEUM STANDARD)

IPS-M-EL-273	Material and Equipment Standard for Sub Marine Power Cables with Inherent Optical Fibers
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NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10	NIOEC Specification for Units.
NIOEC-SP-60-00	NIOEC Specification for General Design Philosophy for Electrical System Design.

3. ADDENDUM TO IPS STANDARD (IPS-M-EL-273(2))

This addendum revises the below listed articles of the referenced standard as follows:

8.7.8 (Addition):

The attenuation of the fibers shall not exceed 0.45 db/km at 1300 nm wavelength and 0.25 db/km at 1500 nm wavelength.

8.7.9 (Addition):

Fibers shall be laid inside a stainless steel tube with an overall covering of Polyethylene. The stainless steel tube shall be filled with jelly.

8.12 (Modification):

Add the following sentence at the end of first paragraph:

Where cable is installed in deep water (more than 200 m depth) a double galvanized steel wire contra-wound for torsional balance of the cable is required. Where cable is installed on rocky seabed, triple type steelwire armour shall be provided.

8.14 Minimum Allowable Bending Radius (Addition):

The SUPPLIER shall state the minimum allowable bending radius of the composite cable:

- During installation
- During storage with cable torsion
- During storage without torsion, cable on a drum.

8.15 Lead Sheath (Addition):

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 relevant IEC 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.

15.0 Cable Termination (Addition):

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 J-tube. The SUPPLIER shall provide drawings/details of the matching flange for the J-tube.

The cable with inner sheath, after passing through the hang off shall be enclosed in a heatshrinkable sleeve. The cable then shall be passed through a splitting box (breakout unit) to separate the power cores and the fiber optic steel tube; separation shall be made using aqua trifurcation glove. The individual cores shall be enclosed in heat shrinkable sleeve.

Then the power cores shall enter a power cable termination box through cable glands. The