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

NIOEC SP

NIOEC SPECIFICATION FOR INSTRUMENTATION CONTROL CABLES, CABLE TRAYS, CONDUITS, JUNCTION BOXES AND CABLE GLANDS

FIRST EDITION

JULY, 2005

THIS SPECIFICATION IS THE PROPERTY OF NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY. IT IS CONFIDENTIAL AND ALL RIGHTS RESERVED TO THE OWNER. NEITHER WHOLE NOR ANY PART OF THIS DOCUMENT MAY BE DISCLOSED TO ANY THIRD PARTY, REPRODUCED, STORED IN ANY RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS WITHOUT THE PRIOR WRITTEN CONSENT OF THE NATIONAL IRANIAN OIL ENGINEERING & CONSTRUCTION COMPANY

IN THE NAME OF GOD**FOREWORD**

By their very nature, technical standard 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 standard 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 standard 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 Division of the Engineering and Construction 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 Division of the Engineering and Construction 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 Deputy of the Engineering and Construction Director of NIOEC for evaluation and consideration.

S. R. KASAEIZADEH



EXECUTIVE DIRECTOR

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 4) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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1. SCOPE

This specification defines NIOEC's minimum requirements for instrumentation wires and cables, the related cable trays and conduits, junction boxes and conduits.

Deviations from this specification will only be permitted on obtaining written approval from NIOEC.

2. REFERENCES

Throughout this specification the following dated and undated standards and codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this specification. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in the dated references that occur after the cited date shall be mutually agreed upon by NIOEC and the vendor /contractor.

API	(AMERICAN PETROLEUM INSTITUTE) API-RP-552 "Transmission System"
IEC	(INTERNATIONAL ELECTRO-TECHNICAL COMMISSION) IEC 60331 "Test on Electric Cables under Fire Conditions" IEC 60332 "Test on Electric Cables and Optical fibre cables under Fire Conditions" IEC 60502 "Power cables with Extruded Insulation" EN 50170-2 "General Purpose Field Communication System"
UL	(UNDERWRITERS' LABORATORIES)
NIOEC-SP	(NIOEC SPECIFICATIONS) NIOEC-SP-00-10 " Specification For Units"

BS (BRITISH STANDARDS)

BS-5308 PART2 "SPECIFICATION FOR PVC INSULATED CABLES"

IPCEA (INSULATED POWER CABLE ENGINEERS ASSOCIATION)

3. UNITS

International System of Units (SI) shall be used in accordance with [NIOEC-SP-00-10](#), unless otherwise specified.

4. DEFINITIONS

Throughout this specification, the following definitions shall apply:

4.1 Standard application is defined as follows:

- Solenoid valves
- Discrete signals

4.2 Critical application is defined as follows:

- Thermocouple signal
- Resistance bulb signal
- Pulse signal
- 4 to 20 mA DC Signal
- Digital communication based on HART protocol or field bus

5. ENVIRONMENTAL PROTECTION

5.1 Temperature range shall be based on the project site ambient conditions.

5.2 Cable outer sheath material has generally been specified as PVC type in this document. However alternative materials shall be selected if PVC can not provide adequate resistance to the chemicals.

5.3 Insulation and jackets shall be made of high quality materials and have excellent resistance to chemicals, oils, heat and aging.

5.4 Field Cables on cable trays shall be flame retardant to IEC 60332 and the outer jacket resistant to UV exposure. Cables used for Safe guarding Systems, such as ESD, shall conform to IEC 60331.

5.5 Fibre optic cables shall be guarded using galvanized steel wire armour.

6. CABLES DESIGN AND SPECIFICATIONS**6.1 Instrumentation Signal Cables**

Cable type designation, type II to type VI, is in accordance with API-RP-552.

Suffix **A** will designate "Armoured" type, and suffix **M** will indicate overall "Moisture" barrier for direct burial applications.

6.1.1 Cable Type II -Single Pair Instrument Cable for Standard Application**A- APPLICATIONS**

To be used only in Conduits outdoor, Or without conduit indoor

B- CONSTRUCTION

Conductor	2/c 1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair
Primary Insulation	1-0.5 mm nominal thickness, 120C PVC. 2- One layer of polyester tape 0.023 mm thick helically applied over the twisted pair
Pair Colour Code	Black and white
Lay of Twist	50 mm
Pair Jacket	1.15 mm nominal 100C PVC
Jacket Colour Code	Light blue for intrinsically safe

6.1.2 Cable Type III - Single Pair or Triad Instrument Cable for Critical Application**A- APPLICATIONS**

To be used only in Conduits outdoor, Or without conduit indoor

B- CONSTRUCTION

Conductor	1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair or triad
Primary Insulation	0.5 mm nominal thickness, 120C PVC
Colour Code	Single pair - black and white, triad-black, white and red
Lay of Twist	50 mm
Shield	1- One layer of polyester tape of 0.023 mm thick over the cores 2- 100% coverage by a tape shield of 0.012 mm aluminium laminated with 0.012 mm Mylar polyester tape, helically applied over the polyester tape with the aluminium on the inside in continuous contact with a bare minimum 0.75 mm² (#18 AWG) 7-strand tinned copper drain wire. 3- 100% coverage of 1 layer of polyester tape 0.023 mm thick shall be applied over the Aluminium Mylar tape shield.
Pair Jacket	1.15 mm nominal 100°C PVC
Jacket Colour Code	Light blue for intrinsically safe

6.1.3 Cable Type IIA- Single Pair Instrument Cable with Armour for Standard Application**A- APPLICATIONS**

To be used in Proper vertical cable trays

B- CONSTRUCTION

Conductor	2/c 1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair
Primary Insulation	1-0.5 mm nominal thickness, 120C PVC. 2- One layer of polyester tape 0.023 mm thick helically applied over the twisted pair
Lay of Twist	50 mm
Colour Code	Black and white
Pair Jacket	1.15 mm nominal 100C PVC
Cable Armour	Cable armour shall be single galvanized steel wire having 90% nominal coverage. (Round type, diameter of cable armour wire based on IEC 60502)
Overall Cable Jacket	80°C PVC, thickness as listed below: <u>Diameter-Cable Core Thickness</u> (under the jacket) 6.38 to 10.80 mm 1.143 mm 10.81 to 17.78 mm 1.524 mm
Pair jacket	Black
Overall Jacket Colour Code	Light blue for intrinsically safe

6.1.4 Cable Type IIAM- Single Pair Instrument Cable with Armour and Overall Moisture Barrier for Standard Application

A- APPLICATIONS

To be used in direct burial trenches

B-CONSTRUCTION

Conductor	2/c 1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair
Primary Insulation	1-0.5 mm nominal thickness, 120C PVC. 2- One layer of polyester tape 0.023 mm thick helically applied over the twisted pair
Lay of Twist	50 mm
Colour Code	Black and white
Pair Jacket	1.15 mm nominal 100C PVC
Moisture barrier	Aluminium copolymer bonded to the outer sheath to render moisture barrier thickness
Cable Armour	Cable armour shall be single galvanized steel wire having 90% nominal coverage. (Round type, diameter of cable armour wire based on IEC 60502)
Overall Cable Jacket	80°C PVC, thickness as listed below: <u>Diameter-Cable Core Thickness</u> (under the jacket) 6.38 to 10.80 mm 1.143 mm 10.81 to 17.78 mm 1.524 mm
Pair jacket	Black
Overall Jacket Colour Code	Light blue for intrinsically safe

6.1.5 Cable Type IIIA – Single Pair or Triad Instrument Cable with Armour for Critical Application

A-APPLICATIONS

To be used in cable trays

B-CONSTRUCTION

Conductor	1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair or triad								
Primary Insulation	0.5 mm nominal thickness, 120C PVC								
Colour Code	Single pair - black and white, triad-black, white and red								
Lay of Twist	50 mm								
Shield	1- One layer of polyester tape of 0.023 mm thick over the cores 2- 100% coverage by a tape shield of 0.012 mm aluminium laminated with 0.012 mm Mylar polyester tape, helically applied over the polyester tape with the aluminium on the inside in continuous contact with a bare minimum 0.75 mm² (#18 AWG) 7-strand tinned copper drain wire. 3- 100% coverage of 1 layer of polyester tape 0.023 mm thick shall be applied over the Aluminium Mylar tape shield. There shall be complete isolation between drain wire and cable armour.								
Pair Jacket	1.15 mm nominal 100°C PVC								
Cable Armour	Cable armour shall be single galvanized steel wire having 90% nominal coverage. (Round type, diameter of cable armour wire based on IEC 60502)								
Overall Cable Jacket	100°C PVC, thickness as listed below: <table> <thead> <tr> <th><u>Diameter-Cable Core</u></th><th><u>Thickness</u></th></tr> </thead> <tbody> <tr> <td>(Under the jacket)</td><td></td></tr> <tr> <td>6.38 to 10.80 mm</td><td>1.143 mm</td></tr> <tr> <td>10.81 to 17.78 mm</td><td>1.524 mm</td></tr> </tbody> </table>	<u>Diameter-Cable Core</u>	<u>Thickness</u>	(Under the jacket)		6.38 to 10.80 mm	1.143 mm	10.81 to 17.78 mm	1.524 mm
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(Under the jacket)									
6.38 to 10.80 mm	1.143 mm								
10.81 to 17.78 mm	1.524 mm								
Jacket Colour Code	Light blue for intrinsically safe								

6.1.6 Cable Type IIAM – Single Pair or Triad Instrument Cable with Armour and Overall Moisture Barrier for Critical Application

A-APPLICATIONS

To be used in Direct burial trenches

B-CONSTRUCTION

Conductor	1.5 mm ² nominal (#16 AWG) stranded annealed copper conductors twisted pair or triad								
Primary Insulation	0.5 mm nominal thickness, 120C PVC								
Colour Code	Single pair - black and white, triad-black, white and red								
Lay of Twist	50 mm								
Shield	1- One layer of polyester tape of 0.023 mm thick over the cores 2- 100% coverage by a tape shield of 0.012 mm aluminium laminated with 0.012 mm Mylar polyester tape, helically applied over the polyester tape with the aluminium on the inside in continuous contact with a bare minimum 0.75 mm² (#18 AWG) 7-strand tinned copper drain wire. 3- 100% coverage of 1 layer of polyester tape 0.023 mm thick shall be applied over the Aluminium Mylar tape shield. There shall be complete isolation between drain wire and cable armour.								
Pair Jacket	1.15 mm nominal 100°C PVC								
Moisture barrier	Aluminium copolymer bonded to the outer sheath to render moisture barrier thickness.								
Cable Armour	Cable armour shall be single galvanized steel wire having 90% nominal coverage. (Round type, diameter of cable armour wire based on IEC 60502)								
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(Under the jacket)									
6.38 to 10.80 mm	1.143 mm								
10.81 to 17.78 mm	1.524 mm								
Jacket Colour Code	Light blue for intrinsically safe								