STYRENE PARK OFFSITE

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Specification for Electrical Power and Control Cables

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1. INTRODUCTION

1.1 Applicable codes and standards

1.1.1 Design, materials, fabrication, inspection, testing and certification shall be in accordance with the requirements of the specified codes. Codes specified shall be taken as the latest issue including all appendices issued at the contract effective date. The SUPPLIER is responsible for implementing any regulations concerning the design, fabrication, testing and inspection of Power and Control Cables, which are mandatory to any applicable statutory or local regulations.

1.1.2 Before PO placement the CONTRACTOR and the SUPPLIER shall agree which editions/dates of the codes and specifications apply. The agreement shall be recorded in the updated specification issued for purchase.

1.1.3 The design of any part of supply, which is not covered by the specified code or this specification, shall be carried out according to the SUPPLIER'S standard and shall be agreed with the CLIENT / CONTRACTOR.

1.1.4 The design codes and standards shall be as indicated below and/or stated on the equipment data sheet.

GENERAL:

BS 4579	The Performance of Mechanical and Compression Joints in Electrical Cable and Wire Connectors. Part 1 – Compression Joints in Copper Conductors
BS 6724	Armored Cables for Electricity Supply Having Thermosetting Insulation with Low Emission of Smoke and Corrosive Gases when Affected by Fire.
BS EN 50262	Metric Cable Glands for Electrical Installation
IPS-C-EL-115	Construction Standard for Electrical Installation
IPS-M-EL-271(1)	Materials and Equipment Standard for Low Voltage Cables and Wires
BS 5467	Specification for 600V/1000 V and 1900V/3300V Armored Electric Cables Having Thermosetting Insulation
IPS-M-EL-272(1)	Materials and Equipment Standard for Medium and High Voltage Power Cables
IPS-E-EL-100	Engineering Standard for Electrical System Design, Appendix H, Power cables
BS 5467	Specification for 600V/1000 V and 1900V/3300V Armored Electric Cables Having Thermosetting Insulation
BS 6622	Specification for Cables with Cross Linked Polyethylene or Ethylene Propylene Rubber Insulation for Rated Voltages from 3.8kV/6.6 kV up to 19kV/33 kV

The design shall be performed based on the requirements detailed in this specification. Priority shall be determined as follows, unless agreed to by CLIENT:

a) Data sheet
b) Drawings
c) This job specification.
d) Other job specification mentioned in this document
e) IPS Standards
f) International Code & Standards
g) The Most Stringent Codes or Standards

1.2 Reference documents

EI027-000-EB-EL-DCR-001	Electrical Design Criteria

1.3 Conflicting requirement

This document shall be read in conjunction with the applicable IPS. It is SUPPLIER's responsibility to ensure that the relevant IPS is reviewed and in the event of conflict between IPS and this document or other international standards, the issue shall be referred to CLIENT for approval. However, in general any additional requirements shall be applied.

1.4 IPS clarification

The following clarification will be considered in conjunction with IPS-M-EL-271(1), the section reference:

Section Reference	Clarification
12.1 (IPS-M-EL-271(1))	For LV power cables, only stranded copper conductor shall be used.

2. DESIGN CONDITION

The electrical equipment shall be designed in due consideration of following design conditions, unless otherwise specified:

- Max. outdoor Recorded Temperature +48°C
- Max. indoor Recorded Temperature +45°C
- Min. outdoor Recorded Temperature 10°C
- Min. indoor Recorded Temperature 5°C
- Humidity 80%
- Soil Temperature 30°C

3. VOLTAGE DESIGNATIONS

The voltage levels adopted in the oil, gas and petrochemical industries of Iran are based on the IEC recommendation No. 60038.
Power cables are designated for the rated voltages Uo/U for which the cables are designed. Uo is the voltage between conductor and earth and U is the voltage between conductors.
The cables designated 0.6/1 kV rms are called low voltage (LV) cables, and will be used in services with voltages below 1000V.
The cables designated 3.6/6 kV rms are called medium voltage (MV) cables, and the cables designated 6/10 kV, 12/20 kV and 18/30 kV are called high voltage (HV) cables.
The available low voltage power in the Iranian Petroleum industry is 400 volt three phase and 230 volt single phase with solidly earthed neutral, and also instrument voltage level prepared by AC UPS shall be 230VAC and 110V DC UPS shall be used for electrical panel requirement.

4. CABLES CROSS SECTION

The conductor cross section of cables and wires will be determined according to relevant IPS publication and will be indicated in data sheet.
For four core cables reduced cross section for neutral conductors is acceptable. Neutral conductor shall be sized according to BS 6346 or equivalent IEC standard.
Unless otherwise approved by the client representative, the maximum conductor cross section of the low, medium, high voltage power cables shall be limited to 240 mm2 for 3 and 4 core cables and 300 mm2 for single core cables.
The minimum core sizes shall be:

- 2.5 mm2 for lighting & control cables
- 2.5 mm2 for LV power cables
- 50 mm2 for MV cables

When this specification is used as a part of an EPC contract, the contractor shall calculate the cross section of the conductors, taking into account the guidelines outlined in the relevant IPS including the following factors.

- Ambient temperature
- Method of installation
- Thermal resistivity of the soil for buried cables
- Maximum sunlight temperature for cables in trays
- Grouping factor
- Allowable voltage drop
- System short circuit current
- Current carrying capacity of cables according to manufacturer recommendation and IEC publication 60287.

5. INSULATION COLOR AND CABLE MARKING

The conductors' insulation color of 3 core medium and high voltage power cables shall be red, yellow and blue.
The conductors insulation color of 3 and 4 core low voltage power cables shall be red-yellow-blue for phase conductors and black for neutral conductor. In special cases, other colors can be specified by the client representative, which will be indicated in data sheet.
Colors shall be indelible. If colored material for insulation will not be available, each core shall be wrapped with tapes of appropriate color. The tapes shall be PVC or equivalent and shall cover 100% of the surface of each core.
The conductor insulation color of control cables shall be black with white identification numbers.
The insulation color of earthing cables shall be green/yellow.
The insulation color of low voltage wires can be red, yellow, blue and black. Red, yellow and blue shall be used as phase wires and black shall be used as neutral wire.
In DC power systems red shall be used as positive conductor and black shall be used as negative conductor.
The color of the outer sheath of all low voltage power and control cables shall be black and the color of the outer sheath of all medium voltage and high voltage power cables shall be red.
At least the following information shall be printed on the outer sheath of the cables, at reasonable intervals according to manufacturer standard.

- Manufacturer's name
- Year of manufacture
- Type of insulation
- Rated voltage
- Number of cores
- Size of conductors
- Other information requested in purchase order

Cable identification tags showing the cable identification number as appears in data sheet/s will be fixed on the cables (by installer). Tags shall be stainless steel or equivalent and shall be fixed on the whole length of each cable at intervals of every 20 meters, and also on bends and crossings.

6. CABLE ACCESSORIES

Where indicated in data sheet, cable accessories such as cable glands, termination kits, straight joints, branch joints, insulating tapes, sealing compounds etc. together with any special tools or testing equipment shall be provided by the cable supplier. Such items shall be quoted separately. The accessories for MV and HV cables shall fulfill the test requirements of IEC 60502-4.

7. POWER CABLES CONSTRUCTION

The low voltage cables shall be copper conductor with Cross Linked Polyethylene (XLPE) insulation 600/1000 V grade, single wire armoured, lead covered (if required), with PVC overall jacket and Medium and high voltage cables shall be copper conductor with Cross Linked Polyethylene (XLPE) insulation, single wire armoured, lead covered (if required), and PVC overall jacket. for MV single core cables the armour shall be made of non-magnetic materials (Aluminum Wire Armored).
The numbers of cores and cross section of conductors will be indicated in data sheet.

7.1 Conductors

For LV Cables,Conductors shall be plain annealed stranded copper in accordance with IEC 60228. Conductor sizes up to and including 10 mm2 can be solid copper. Type of conductor stranding shall be stated in data sheet. "For MV & HV cables, Conductors shall be circular plain annealed stranded copper conforming to class 2 of IEC 60 228."

7.2 Conductor Screen

For MV & HV cables, the conductor screen shall be non-metallic and shall consist of extruded semi-conducting compound, which may be applied on top of a semi-conducting tape. The extruded semi-conducting compound shall be firmly bonded to the insulation.

7.3 Insulation

Insulation of low voltage cables shall generally be Cross Linked Polyethylene (XLPE). The insulation thickness shall be according to IEC 60502-1.
LV power cable for lighting, small power and other branch circuits shall be 3 or 4 or 5 core copper conductor type, XLPE-insulated, overall PVC-sheathed and rated at 0.6/1 kV. Power cables installed inside of each building shall be provided neither steel armoured nor lead covered.
The insulation of medium voltage and high voltage cables shall be extruded Cross Linked Polyethylene (XLPE). The minimum thickness of the insulation shall be according to table 6 of IEC 60502-2.
Insulation of Control cables shall generally be PVC.

7.4 Insulation Screen

For MV & HV cables, the insulation screen shall consist of a non-metallic semi-conducting layer in combination with a metallic layer.
The non-metallic layer shall be extruded directly upon the insulation of each core and shall consist of either a bonded or strippable semi-conducting compound.
The metallic layer shall consist of a tape, or a braid, or a concentric layer of wires, conforming to the recommendations of IEC 60502-2.
The metallic layer shall be copper or other non magnetic metal of manufacturer standard, with a thickness of not less than 75 um and shall be applied with 15% overlap over the non-metallic layer.

7.5 Armour

The armour shall be galvanized round steel wire supplemented by a helix of galvanized steel tape to keep the armour wires tight.

For single core power cables the armour shall be made of non-magnetic materials.

7.6 Over Sheath

The outer sheath over the armour for LV cables shall be extruded black PVC complying with the requirements of IEC 60502-1 and for MV & HV cables shall be extruded red PVC complying with the requirements of IEC 60502-2.". To protect the cables against rodent and termite attack, suitable chemicals shall be added to PVC over sheath.
For cables to be installed on trays, as indicated in data sheet, the over sheath shall be made of flame retardant PVC or an elastomeric compound which satisfies the requirements of the latest edition of IEC publication series No 60332.

8. EARTHING CABLES AND WIRES

Earthing cables and wires shall be single core with plain stranded or solid copper conductor.
Insulation shall be PVC with rated voltage of 600 volt. no. armour is required.
Earthing cables are considered non-current carrying cables. The color of insulation for earthing cables and wires shall be PVC covered, coloured green/yellow.

9. PARTICULAR REQUIREMENT

Cables shall be drummed in maximum continuous length of non returnable cable drums. Allowance on delivered lengths shall be 0%-+5%.
Cable ends shall be sealed and fixed to the drum. Cable drums shall be fitted battens, fixed around the entire periphery of the drum.
Cores of multicore control cables shall be identified by contrasting numerals and words, as defined in IEC 60446 which shall be repeated at intervals along the whole length of the cable.

10. DRUMMING

The Supplier shall specify the quotation, his standard cable production lengths and respective drum sizes for the quantities of each type of cable required. All drum lengths stated shall be continuous. Cable or conductor joining in any form is unacceptable.
Cable drums shall be provided with two minimum 200mm x 200mm identification lables made from laminated plastic or similar durable material, surely affixed one per side and at the top and bottom of each drum recessed so as to resist loss or damage during transit and handling.
Cable shall be drummed with an accessible length of tail at each end of the cable. This tail shall be protected from damage and shall be used to test each drum on arrival at site.

11. GLAND COMPATIBILITY

The Supplier shall provide fully teloranced dimensional data of the cable outer diameter, diameter under and over armour.
As a minimum, material certification and traceability requirements shall be in accordance with referenced standards.

12. CABLE TESTS AND INSPECTION

Routine tests, sample tests and type tests shall be carried out at manufacturer work according to the recommendations of IEC 60502-1&2 and the relevant IEC publications referred to therein.
The cables shall be subject to tests base on cables relevent designing and construction standard.
Type tests, electrical and non-electrical, shall be performed on samples from each type of cable.
Test certificates shall be submitted to purchaser in three copies.
The purchaser may appoint representative/s or third party to witness the factory tests on cables. The supplier shall inform the date of performing such tests, at least four weeks in advance.
The purchaser's inspectors shall be granted the right for inspection at any stage of manufacture, testing and preparation for shipment.

13. PACKING FOR SHIPMENT

The cable drums shall be suitably protected to prevent mechanical damage and corrosion during shipment and for storage on site for a minimum period of 18 months.
This shall be ensured by covering unprotected, opened side with suitable wooden boards.
Boxes containing loose parts are to be clearly identified by description, the major equipment with which they are associated, the purchase order number and the equipment number.
A bill of material shall be attached to each shipment package or container.
Cables shall be marked on the outer sheath with the following indication:
a) Continuous cable length
b) Cable type
Drums are to be securely labeled with indestructible tags with the following markings on both sides:
a) Destination
b) Purchase order number
c) PURCHASER's equipment number
d) Cable type
e) Drum item number

14. GUARANTEE

The supplier of the equipment under this specification shall guarantee the equipment and shall replace any damaged equipment/parts resulting from poor workmanship and/or faulty design.
The supplier shall replace any equipment/part failed under the following condition:

- Failure under startup and commissioning tests performed according to IEC recommendations.
- Failure under normal usage for a period of 18 months, not exceeding 24 months from the date of dispatch from the manufacturers works.

Supply of spare parts for at least 10 years shall be guaranteed by vendor.