EXTENSION TO NEYRIZ 66/20KVSUBSTATION

SPECIFICATION FOR CABLE SYSTEM

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Rev.	**Purpose of Issue**	**Date**	**Prepared**	**Check**	**Approved**	**Authorized**

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1 INTRODUCTION

1.1 Purpose

This document has been prepared to specify and establish the minimum technical requirements for the design, supply, installation, and commissioning of the Extension to Neyriz 66/20 kV Substation.

1.2 Definitions

Within the context of this document, the following definitions will be applicable:

Project: Extension to Neyriz 66/20 kV Substation

Client: Petro Kavian Sanat Pars Co.

Owner: Fars Regional Electric Co.

Consultants: Aria Niroo Jam Co.

EPC Contractor: Any firm who is responsible for providing any service and material with respect to detailed engineering, procurement, construction of all items and material in accordance with the contract between the CLIENT and him.

Vendor/Supplier: The company, which has been selected to supply the equipment and material and products technical documentation mainly, related to the production of the ordered supply.

The word "shall" indicate a requirement. The word "should" indicate a recommendation.

Contractor shall be responsible for vendor goods.

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2 DESCRIPTION

Cable system shall mean the supply and supervision over installation and commissioning of control cables, power cables, H.V. power cables, coaxial cables, cable trays, marshalling boxes distribution frames, cable protection, cable conduits and all their accessories.

Work of this section includes all measurements and materials required to complete the work of this section.

The extent of work shall include cable systems for the following locations wherever applicable:

(1) Marshalling cabinets.

(2) Control, relaying, metering and synchronizing panels.

(3) Indoor switchgear

(4) Outdoor Switchgear

(5) Battery room

(6) Switchyard equipment

(7) D.C. systems

(8) A.C. station service systems.

(9) Power system / dispatch system interface.

(10) Switchyard AC distribution board.

(11) Switchyard Lighting board.

3 TERMINOLOGY

Technical terminology is to be as defined in latest edition of IEC 50, I.E.E.E. 100 and / or ANSI C42 100 standards.

4 STANDARDS

Work of this section shall comply with the requirements of latest edition of IEC, BS and DIN standards within which IEC standard is preferred.

5 DESIGN

The contractor is totally responsible for mutual compatibility and adequacy of all cable system and all other corresponding equipment, in any respect.

Cables shall be color coded as follows:

- Red, yellow, blue for phase conductors .
- Black for A.C. neutrals and other connections.
- Yellow, Green for ground connections.
- Grey for D.C. circuits

All cables shall have a unique number and the cores within that cable shall bear the same number such that they may be easily identified after the cable has been terminated. This shall be accomplished

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by the use of number ferrules. CT and VT cables shall have red ferrules with black numbers and all other cores shall have black ferrules with white numbers.

The circuit burden for all instrument transformer circuits, including meters, transducers, relays, conductor resistance, etc. shall not exceed the instrument transformer accuracy rating and voltage.

Drop on D.C. control and trip circuits will allow satisfactory service of the equipment supplied. All wiring which is, or may become connected to potential sources other than the power supplied for communication apparatus shall be capable of withstanding the appropriate high voltage test.

All cables shall be installed in concrete trenches, or PVC pipes. Direct burial of a cable in earth is not allowed.

Power cable conductors shall be sized for the proper current carrying capacity to the standards specified in this section. All single - phase power cables shall have 1 full sized conductor plus 1 earth continuity conductor which its rated amper is not less than 100% of the phase conductor. Three phase power cables shall have 3 full size conductors. plus 1 earth continuity conductor which is rated not less than 58% of the phase conductor.

Power cables shall conform to BS - 6346 / IEC 502. Cable insulation shall be suitable for 70 oC operation. 400/230 V cables shall be approved 600/1000 V grade cables. The overall voltage drops in power cables shall be limited to 5%.

Control cables to be used for all CT, VT, 110/125 /250VDC and all transducer signal outputs shall be rated 600/1000 V.

Radial feeder circuits shall be used wherever possible.

All cables shall be furnished on lagged reels of sufficiently large diameter to prevent modification of the physical properties of the conductor. The reels shall be of such design, construction and strength as to guarantee satisfactory delivery of the conductor to its without displacement, chafing or other damage incurring during shipment of field handling. The reels shall be capable of withstanding all stresses due the installation operations. Each end of the conductor shall be properly and securely sealed and fastened, each reel head shall be marked to show serial number, size and number of conductors, length of conductor, arrow showing the end of the conductor, and gross tare and net weights. Measurement marks shall be provided over the whole length of cable in each 1.0 m intervals.

Outdoor cables shall be protected from direct sun, i.e.: all cables above ground shall be covered or encased.

All cables with the exception of the coaxial cable shall be of stranded copper construction. Coaxial cables may be solid copper. Cables used for transducer signals shall be screen twisted pairs.

All power and control cable runs shall be of a single length with no splicing or jointing.

CT and PT cables shall be 4 core design except cables for synchronizing signals which may be 2 cores.

All switchyard cables shall have a PVC jacket over the individual cable core insulation and an over - all galvanized steel wire armour and screen for CT & PT cables to make the cable vermin - proof and PVC overall sheath.

Electrical screening is necessary for all cable rated 0.6/1kV and above.

All holes and recesses in concrete shall be closed after cable erection by fire resistant material.

Conductors belonging to different feeders or group wires may NOT be located in the same cable.

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Where cables pass under roadways, they shall be laid in pipes with a depth not less than 80 cm below the surface.

Each bay shall be equipped with properly chosen and placed marshalling kiosks or kiosks for CT, VT, DC and AC distribution circuits.

Arrangement of the marshalling kiosks and their interconnections shall be to subject approval of the Engineer.

Conductors belonging to cubicle heaters or AC circuits may not be located in the control cables.

The cable size shall be properly calculated by the contractor and approved by the Engineer. For connections in cubicles e.g. complex electronic equipment, where established well - tried techniques use smaller areas, this can be permitted.

The risk of fire shall be restricted by selecting cables with self-extinguishing sheaths and by suitable arrangement of the cable runs.

Conductors within cubicles and between terminal blocks and apparatus shall be laid in plastic ducts.

All wiring shall be marked, except for conductors between terminals on a given item of equipment.

Control cables, conductors and wiring shall have digit markings. Each end of every cable shall be marked with an individual cable number.

Each end of every conductor shall be marked with an individual conductor number and the cable number. It is desirable that the conductor in addition is marked with the identification of its terminal. Power cable circuits shall furthermore have AC power marking.

Protective earth wires shall be marked with yellow / green.

If the shield and its connection cannot withstand the maximum 50Hz current estimated to flow through the shield for 0.5 second in the event of an earth fault, parallel earthing conductors must be alongside the cable.

Detailed data for cables:

Description	***L.V. system***	***20kV***	***33kV***
Cable voltage rating (kV)	0.6/1	12/20/24	18/30/36
Conductor material	Cu	Cu	Cu
Insulation	PVC	XLPE	XLPE

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6 SUBMITTALS

6.1 Calculation Sheets

Submit four (4) copies of all calculations to establish adequacy of the cable systems selected, in any respect, for the specified duties under all power system operation conditions (from normal to the most severe fault conditions envisaged) in accordance with submittals Document.

6.2 Contractor's Drawing and Design Data

Submit cabling, cable tray and conduit drawings and information for this section in accordance with submittals Document. The following shall be included:

(1) Details of all cables and estimated lengths to be supplied.

(2) Details of all cable trays to be supplied.

(3) Details of all electrical conduit, marshalling boxes, etc. to be supplied.

(4) Manufacturer's data concerning cable construction and splicing materials.

(5) Details of cable termination.

6.3 Test Reports

Submit four (4) copies of final type test and routine test reports together with the certification of compliance of the equipment with type and routine tests stipulated in the applicable standards.

7 FABRICATION AND MANUFACTURE

7.1 Control Cables

Control cables shall be thermoplastic insulated, armoured, stranded, soft drawn copper of a size not less than the following:

All control cable jackets shall be non – hydroscopic, self-extinguishing and suitably protected against oxidation and ultra violet rays.

Panel Wiring, single conductor:	1.5 mm^2
All other control cables, not including current transformer circuits	2.5 mm^2
Current transformer secondary circuits	4.0 mm^2 and above

The percentage voltage drops permissible in measuring cables from voltage transformers shall be:

1. Instruments and statistical measurement	1.0%
2. Debiting measurement	0.1%

The choice of conductors shall take into account the following factors:

1. Burdens and overcurrent factors of measuring transformer.
2. Highest conceivable load current.
3. Safe tripping in short - circuit.
4. Permissible voltage drop from the functional aspect.
5. The ambient temperature.

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Cables used for secondary connection of VTs shall be sized so that the minimum short circuit current at the remote end (in the relay building) shall (with adequate margin of safety) ensure proper operation of the protective equipment at the VTs end.

Control cables may be of multicore design for the routing of signals and indications to the main relay building.

When two systems of protection are specified, the route of signals to or from both systems protections in the same cables is not allowed.

Control cable insulation shall be of P.V.C., 0.40 mm thick minimum according to BS - 6231. Individual insulated conductors shall be bundled into a cable core using self-extinguishing non-hygroscopic tapes and wrappers.

A self-extinguishing PVC jacket suitably protected against oxidation and ultra violet rays shall be added over the cable core. Jacket minimum thickness shall be as follows:

Cable Core Diameter	Jacket Thickness
0 mm - 18 mm	1.5 mm
18 mm - 38 mm	2.1 mm
38 mm - 64 mm	2.8 mm
64 mm and above	3.5 mm

7.2 Power Cables

Power cable shall be armored, stranded soft drawn copper or aluminum conductors as desired. Precautions shall be taken to preclude any galvanic activity when joining dissimilar metals. Stress cones shall be provided for each H.V. cable termination.

All low voltage 400/230 V cables shall have 1000-volt class insulation. Cable jackets shall be non - hygroscopic, self-extinguishing and suitably protected against oxidation and ultra violet rays.

All higher voltage cables shall have XPLE (cross linked polyethylene) insulation suitable for their classes. The cable jackets shall be as specified for low voltage cables above.

All power cables shall be suitable for minimum 70 °C operation (for PVC) and 90 °C (for XPLE) in ambient conditions.

Unless otherwise approved, a continuous screen consisting of non - ferrous metal tape shall be applied between the XPLE insulation and sheath.

The sheathing shall be impervious to moistures, close fitting and free from defects.

All materials used in the protective bedding and serving (outer covering) shall be to approval and shall be of such a nature that in the finished cable, they do not crack or run at any temperature likely to be attained in transit to the site or on the site before or after laying or when the cables are in operation.

The materials shall adhere properly to the sheath and shall be applied evenly around the cable.

Immediately after the works tests, both ends of every length of the cable shall be sealed in an approved manner and shall remain sealed until installed in its final position.

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7.3 Cable Trays

Cable trays where used shall be fabricated from hot dip galvanized steel. The tray shall be of such construction that it shall not sag more than 0.5 cm at the midpoint between supports when the tray has been loaded with cables.

Cable tray supports shall be placed at 1.5 meter intervals maximum.

7.4 Conduits

Conduit for installation above ground shall be full weight and size, rigid steel zinc galvanized. Each length shall be threaded at both ends and shall be zinc treated. Aluminum conduit may also be used. Conduit for installation below ground shall be of PVC or polyethylene.

7.5 Marshalling Boxes and Pull Boxes

All marshalling and pull boxes shall be made of galvanized sheet steel or cast aluminum and shall have gasketed covers secured by cadmium plated steel screws All boxes shall be adequately sized and of rigid construction. In no case shall the sheet be less than 2.5 mm thickness. All boxes above floor level shall have drain holes to permit condensed moisture to escape.

7.6 Coaxial Cables

For coaxial cables and coaxial cable connecting unit see sect Line Traps Document "line traps and line tuning equipment"

8 INSPECTION AND TESTS

Perform all inspection, routine tests and type tests stipulated in applicable standards to ensure that material and workmanship conform to the specification and drawings.

Give Engineer access to the works for determination or assessment of compliance with the provision of this specification or to witness the contractor's inspection or tests.

Produce a certificate of compliance of the equipment with the design, routine and type tests stipulated in the applicable standards.

Owner reserves the right to have representative present during final shop and functional testing. The contractor shall advise the date of test at least sixty (60) days in advance.

9 SUPERVISION OVER INSTALLATION AND ERECTION

Perform visual inspection before installation to ensure that there is no damage resulting from shipment.

Supervise over installation, erection and commissioning of cable systems to ensure satisfactory and proper operation in every respect.

This supervision shall cover but not be limited to the following:

(1) Installing cable system and making all the connections necessary.

(2) Testing dielectric strength of installed cable systems including all

joints and accessories in compliance with the applicable standards.

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(3) Inspecting, making necessary adjustment, field testing and placing the equipment in commercial service.

(4) Notifying Owner in writing as soon as installation of the equipment is completed.

(5) On completion of the installation, carrying out all tests subject to the requirements and operating conditions of the Owner system in co - operation with and in presence of Engineer and in accordance with a program approved by him.

(6) Performing field tests and inspections including but not limited to the following:

(a) Visual inspection.

(b) Checks - on grounding connections.

(c) Meggering tests:

High voltage to ground with 5000 V megger.

Low voltage to ground with 1000 V megger.

(d) Phase sequence and colour code checks.

(e) Continuity tests.

(f) Functional tests.

(g) Energizing all high voltage circuits.

10 SPARE PARTS

The following mandatory spares shall be supplied to cover all cable systems supplied and the cost shall be included in the tender amount of the contract price for cable systems. spare parts should be supplied separately.

Five (5) percent of each type of connector, cable number tag, conductor identifying marker used in the works. Five (5) percent of each type of conduit and conduit fitting used.

Ten (10) percent of each type of cable, cable gland, cable sealing end and accessories.

11 MEASUREMENT AND PAYMENT

Payment of this section will be a lump sum and will be made in accordance with the schedule of prices.

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