EXTENSION TO NEYRIZ 66/20KVSUBSTATION

SPECIFICATION FOR MEDIUM VOLTAGE SWITCHGEAR

Z	Issued For Approval	1405/02/17	M. E.	M. A.	M. A.	M. E.
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

Medium voltage outdoor switchgear shall mean 7.2, 12, 24, 36 and 52 kV metalclad switchgear cubicles and vacuum circuit breakers for indoor installation. Work of this section includes design, manufacture, factory testing, transportation and supervision over erection and commissioning of medium voltage indoor switchgear and all their accessories, including cable accessories, and the connection of this system.

3 TERMINOLOGY

Technical terminology is to be as defined in I.E.E.E. standard 100-1972 and / or ANSI standard C42-100-1972.

4 STANDARDS

Work of this section shall comply with the requirements of latest editions of IEC, BS, ANSI and NEMA standards. Standards and codes of other origin may be accepted with the Engineer's approval.

5 DESIGN

5.1 General

The contractor is totally responsible for mutual compatibility and adequacy of all medium voltage indoor switchgear and all other corresponding equipment in any respect.

The medium voltage indoor switchgear shall be of modular design with pull out breakers. metering and control will be located on the separate panels installed in control room, but protection equipment will be installed on MV switchgear cubicles.

The medium voltage circuit breakers shall be trip - free and pump free. The operating mechanism of the breakers shall be of the stored energy spring type.

Each medium voltage breaker shall have a manually operated grounding switch mechanically interlocked with the breaker.

Withdrawal and insertion of the breakers shall not be possible with breaker main contacts closed. The operation of circuit breakers inside cubicles shall be inhibited when MV busbars are earthed for maintenance.

The following auxiliary supplies are available for control (Voltages are nominal)

110 Volts D.C.

400 / 230 volts A.C. 50 Hz

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5.2 Detailed Data

(a) Nominal system voltage,	kV	6.3/11/20/33/33
(b) Maximum system voltage,	kV	7.2/12/24/36/52
(c) Rated frequency,	HZ	50
(d) rated continuous current	A	According to SLD
(e) Rated short circuit level	kA	According to SLD
(f) Three (3) second short time current rating	kA	According to SLD
(g) Rated breaking time, ms		$2.5 \times I_{sc}$
(h) rated operating sequence		0+0.3s + CO + 3min + Co
(I) Reclosing duty cycle		
(j) Rated 1min. power frequency withstand voltage	kV	28//38/5070/95
(k) Basic impulse insulation level (at site condition),	kV	60/95/125/170/250
(l) Power supply for operating mechanism and control voltage		110V.D.C.
(m) Power supply for auxiliaries		400/230 V A.C.

6 SUBMITTALS

6.1 Calculation Sheets

Submit four (4) copies of all calculation to establish adequacy, in any respect, of the medium voltage switchgear selected for the specified duties under all power system operation conditions - from normal to the most severe fault conditions envisaged - in accordance with – Submittals according to Summary of Works Document.

6.2 Shop Drawings and Manufacturer's literature

Submit electrical, design, fabrication and erection drawings for this section in accordance with the article entitled "shop Drawing" in submittals section. The following shall be considered a minimum:

(1) outline dimension drawings of panels and equipment.

(2) Assembly drawing and breaker name plate drawing.

(3) Schematic and wiring diagrams.

(4) Operating mechanism drawings.

(5) spare parts list.

(6) Shipping and packing details.

(7) Manufacturer's Descriptive Literature.

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6.3 Test Reports

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

6.4 Maintenance Data and operating Instructions

Submit maintenance manuals for this section in accordance with article entitled "Maintenance Manuals" in Submittals Document.

7 FABRICATION AND MANUFACTURE

7.1 Switchgear Cubicles

Unit type construction shall be used to form a rigid self-supporting, self - contained housing. Panel cladding shall be steel, minimum 3 mm reinforced where cutouts occur.

The all metal clad enclosure shall be complete with full length front doors, bottom cable entry, bolted rear panels for access to MV bus, top covers, terminals and shall be provided in such way to minimize the risk of danger to personnel.

All surfaces shall be cleaned free of all rust and foreign material, painted with a rust resistant paint, primed, sealed (sealer required on exterior only) and painted as outlined in section 1. the interior shall be white in color; the exterior color shall be ANSI # 61 light gray. Panels shall be bolted together; they shall not have welded. All panels shall be fitted with an interior light which is operated by a switch, a 220-volt single phase receptacle and a thermostat controlled heater to prevent condensation. The panels shall have structural steel base channels and shall be bolted to the floor.

The cubicles shall include:

- Draw out breaker and grounding switches.
- Copper bus bar shielded automatically when racking out breaker.
- Operating slot for grounding switch operation.
- Grounding switch mechanically interlocked with its associated breaker to prevent grounding into live circuit.
- Mechanically operated breaker operation counter inside each breaker cubicle.
- Heater and thermostat inside each cubicle.
- Lighting equipment inside each cubicle wherever necessary.
- Potential transformer, connected star - star with suitable protection for primary and secondary, as required.
- Current transformers with suitable burden for protection and measuring instruments.
- Adequate potheads for MV cables.
- Anti-pump feature.

MV CUBICLES SHALL HAVE THE FOLLOWING ITEMS FRONT MOUNTED ON THE CUBICLE:

- mimic diagram
- Discrepancy control switch for C.B.
- Earth switch position indicator.

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- Circuit breaker position indicator (semaphore) for indication of service, Test, with drawable position of C.B.
- Local / remote selector switch.
- Test blocks for current and voltage transformers connections with automatic shorting bars.
- Push button for lamp tests.
- Voltmeter with selector switch for bus VT cubicle.
- 3 Ameter for buscoupler and 3 Ameter and voltmeter with selector switches for incoming cubicles and 3 Ameter for outgoing cubicle.

MV CIRCUIT BREAKER SHALL HAVE THE FOLLOWING ITEMS FRONT MOUNTED

- Circuit breaker control switch
- Manual spring charging and manual close open facility
- Local/remote selector switch
- Other IEC standard equipment.

7.2 Instrument Transformers

Instrument transformers shall be dry type suitable for indoor use. Current transformers shall be rated to withstand the mechanical (momentary) and thermal (short time) effects of the short circuit currents of the system. Current transformers shall be capable of driving the combined burden of meters, relays, transducers and leads up to twenty (20) times nominal rating without saturation, plus margin to allow for DC off - set.

All current transformers shall be of multi ratio type with tappings on secondary winding. Main ration is given in Summary of Works Document secondary current shall be 1 amp.

Current transformer circuits shall be terminated on test links.

Potential transformers shall be of the same insulation class as the switchgear. All potential transformers shall be magnetic wound type.

The secondary voltage of the potential transformers shall be 110 /√3 volts and the primary nominal voltage the same as the switchgear. Burden of the potential transformers shall be chosen by the contractor for requirements of the projects plus 25% extra VA.

Adequately rated fuses shall be provided in the secondary and primary circuits. The potential transformers shall be capable of maintaining of rated accuracy up to 200VA burden.

Provision shall be made to prevent an arc on primary disconnecting contacts by arranging the secondary contacts to break before primary contacts part on withdrawal of the potential transformers. Provision shall be made to prevent personnel for coming in contact with the potential transformer primary fuses until after the primary disconnecting devices have separated by a safe distance and are properly grounded.

The tertiary winding voltage system is not effectively grounded.

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7.3 Busbar

Main bus shall be copper, insulated with flame retardant track resistant insulation and be complete with insulated supports. Bus bars shall be sized to adequately carry the currents listed in Summary of Works Document. Bus bars shall be color coded in red. Blue and yellow.

7.4 Ground Bus

A minimum 40mm * 3mm copper ground bus shall extend along the length of each panel. Clamp type connectors shall be provided for directly connecting together the ground bus of adjacent panels. The bus shall be so arranged that it does not interfere with the removal of any panel from a panel assembly or with the access to or operation of equipment within a panel.

7.5 Terminal

Stud type terminal blocks of unit construction shall be provided to accommodate all circuits entering or leaving the panels. A minimum of 10% spare terminals shall be included for spare or future circuits. Terminals shall have insulating barriers between points. The terminals shall be grouped and labeled according to their duty by strips securely attached to each block.

Ferrules identified with appropriate wire numbers shall be provided at both ends of each wire within panels.

Removable covers of clear transparent insulating material shall be provided over terminal blocks on which connections are provided for a circuit of greater than 220/200 Volts.

Potential terminal blocks shall not be used as junction points for cables which are not required in the panel.

7.6 Wiring and connection

Control wiring shall be thermoplastic insulated stranded copper of a size not less than the following:

- Panel Wiring - single conductor 2.5mm^2
- Wiring external to panels excluding current transformer circuits 2.5mm^2
- Current transformer secondary wiring 4mm^2 and above

Extra flexible wire shall be used for connections to equipment on hinged frames. wiring in panels shall be covered with a flame resistant cotton braid. All wiring shall be carried out without intermediate splicing. All cables shall enter the panels from the bottom. Flameproof plastic wiring ducts shall be provided at the sides and bottom of the panels to carry wiring vertically to the terminal blocks. the ducts shall be perforated and shall be provided with a detachable cover.

Wire ends shall be fitted with crimped ring type terminals.

Not more than two wires shall be terminated on any one stud or terminal. Each terminal point on the terminal block shall be indelibly labeled in accordance with wiring designations.

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The D.C. trip and A.C. voltage supplies and wiring to the main protection shall be segregated from those for back - up protection and also from protective apparatus of special purpose.

The incoming power supply to each panel shall be through fuses in such a manner that the supply to any one panel can be isolated from the remaining panels. Fuse holders shall be the dead front type.

All cubicle and control wiring shall confirm to the following color code:

Red yellow Blue	- Phase connections
Black	- A.C. neutrals
Yellow / Green	- ground connections (except grounded phase conductors)
Gray	- D.C. circuits

All secondary and control wiring within a high tension compartment shall be protected by a grounded armour shield.

7.7 Nameplates

Beveled sheet mica nameplates shall be provided. They shall be the same color as the panel with black engraving.

A panel nameplate approximately 25mm * 125 mm shall be placed on the front and rear of each panel.

Nameplates approximately 15mm * 60mm with lettering 4mm high, shall be placed on the front of each panel for indicating lamps, push buttons and control switches. Ampere ratings for fuses or circuit breakers and also nameplates with descriptive functions for switches or similar items shall be provided.

Nameplates are to be mounted 0.5 cm below indicating lights, control switches and push buttons.

7.8 Switches

All switches shall be of the rotary type with silver plated, self-cleaning contacts and rectangular deals on which function positions are clearly indicated.

Switches shall be suitable for interrupting the trip and close currents of the circuit breaker control circuits without requiring the use of interposing relays.

7.9 Pilot Lamp Assemblies

Pilot lamps of the standard switchboard type shall be provided for, but not necessarily limits to the following indications:

(I) Breaker “open” - “closed” (“green - red”)

(II) Shutter Closed (amber)

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.

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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.

In addition, submit satisfactory evidence of the medium voltage indoor switchgear having successfully undergone at least the following tests before delivery to site:

(1) Energizing of all low voltage control circuits using the appropriate voltage supply, and testing for operation and sequence of operation; polarity test where required.

(2) Di-electric strength test at 1500 volts A.C. on all wiring.

(3) Continuity of all low voltage circuits.

The Clients Representative reserves the right to have a representative present during final shop and functional testing and, so that it may be possible to take advantage of this, 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.

Supervise over installation erection and commissioning of medium voltage indoor switchgear to ensure satisfactory and proper operation in every respect.

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

(1) Installing the switchgear, leveling, aligning, grouting and bolting to floor.

(2) Removing shipping blocks and braces.

(3) Examining connections to ensure that they are not loose, tighten as required.

(4) Checking breaker contacts and make any necessary adjustment.

(5) Cleaning interiors, including all chutes, using vacuum cleaner.

(6) Installing breakers in appropriate cells and make any necessary adjustments.

(7) Operating breakers and checking for correct operation.

(8) Interconnecting panels.

(9) touching up all damaged paintwork.

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

(20) Notifying client in writing as soon as installation of the equipment is completed.

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

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

(a) Visual inspection of all internal parts.

(b) Continuity test of all low voltage circuits.

(c) Meggering on all low voltage and high voltage circuits.

(d) Phase rotation check.

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(e) Energizing of all low voltage circuits.

(f) Check of the operation of all meters, relays, instruments alarms and trips.

(g) Timing tests.

(h) Trip and close coils minimum operating voltage.

(I) Operating of C.B. with 80% of rated voltage applied to trip and close coils.

(j) Closing and opening coils current and resistance of C.B.

(k) Trip free and antidumping feature tests of C.B.

(L) C.B. contacts resistance

(m) Spring charging motor tests.

(n) Mechanical and electrical interlocking tests.

(o) Functional testing of all equipment.

(p) Energizing of all high voltage circuit.

10 SPARE PARTS

The following mandatory spare parts shall be provided for each complete substation assembly:

Quantities stated are total for one (1) installation.

One compete circuit breaker assembly adequately rated to the highest breaker rating of the installation.

One (1) set of arcing contacts, moving.

One (1) set of arcing contacts, stationary.

One (1) set of primary contacts, moving.

One (1) set of primary contacts, stationary.

One (1) set of primary contact finger springs.

Three (3) trip coil and three (3) closing coil.

Two (2) coils for each type of auxiliary switch.

One (1) set of stationary and moveable contacts for each type of auxiliary switch.

One (1) set of replacement fuses for HV and LV side of potential transformer.

One (1) set of special tools which may be required for the maintenance of the switchgear including maintenance closing device, control jumpers, inspection box, and a crank for disconnect mechanism.

One (1) set of indicating lamps.

One (1) year supply of paper and ink for recording meters (if provided)

One (1) liter of finish paint.

The Tender shall recommend any additional spare parts considered necessary.

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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