Saudi Electricity Company	الشركة السعودية للكهرباء

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Rev 0

SPECIFICATIONS

FOR

GAS INSULATED METAL CLAD MV SWITCHGEAR (11, 13.8, 33 & 34.5KV)

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1.0 SCOPE

This SEC Distribution Materials Standard Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, inspection, testing and performance of Metal-clad Gas Insulated Medium Voltage Switchgear with voltage classes of 11kV, 13.8kV, 33kV & 34.5 kV intended to be used in the system of the Saudi Electricity Company, Saudi Arabia.

2.0 CROSS REFERENCES

This Material Standard Specification shall always be read in conjunction with SEC General Specification No. 01-SDMS-01, titled "General Requirements for All Equipment/Materials", which shall be considered as an integral part of this SDMS.

This SDMS shall also be read in conjunction with SEC Purchase Order or Contract Schedules for project, as applicable.

3.0 APPLICABLE CODES AND STANDARDS

The latest revision/amendments of the following Codes and Standards shall be applicable for the equipment/material covered in this SDMS. In case of conflict, the vendor/manufacturer may propose equipment/material conforming to one group of Industry Codes and Standards quoted hereunder without jeopardizing the requirements of this SDMS.

3.1	IEC 61892-1	Instrument Transformers, Par 1 : General Requirements
3.2	IEC 61869-2	Instrument Transformers, Part 2: Additional requirements for Current Transformers
3.3	IEC 61869-3	Instrument Transformers, Part 3: Additional requirements for Inductive Voltage Transformers
3.4	IEC 60044-7	Instrument transformers- Part 7: Electronic Voltage Transformers
3.5	IEC 60044-8	Instrument transformers- Part 8: Electronic Current Transformers

3.6	IEC 60051	Direct Acting Indicating Analog Electrical Measuring Instruments and their Accessories.Part :1 Definition and General Requirements for all parts
3.7	IEC 60073	Basic and safety principles for man-machine interface, marking and identification-coding principles for Indication Devices and Actuators
3.8	IEC 60112	Method for the determination of the proof and the comparative tracking indices of solid insulating materials
3.9	IEC 60255-21-1	Vibration, shock, bump and seismic tests on measuring Relays and Protection Equipment-Section 1: Viberation Tests (sinusoidal)
3.10	IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
3.11	IEC 60480	Guidelines for the checking and treatment of Sulphur Hexafluoride (SF6) taken from electrical equipment and specification and its re-use
3.12	IEC 60529	Degrees of protection provided by enclosure (IP Code)
3.13	IEC 60947-1	Low-voltage Switchgear and Controlgear – General rules
3.14	IEC 60947-5-1	Low-Voltage Switchgear and Controlgear, Part 5: Control Circuit Devices and Switching Elements, Section 1: Electromechanical Control circuit devices
3.15	IEC 62271-1	High-voltage Switchgear and Controlgear-Part 1: Common Specifications
3.16	IEC 62271-100	High-voltage Switchgear and Controlgear Part 100: High-voltage alternating-current circuit-breakers IEC 62271-101 High-voltage Switchgear and Controlgear-Synthetic Testing
3.17	IEC 62271-102	High-voltage Switchgear and Controlgear-Part 102: Alternating current Disconnectors and Earthing switches

3.18	IEC 62271-200	AC Metal-Enclosed Switchgear and Controlgear for Rated Voltages above 1kV and up to and including 52 Kv
3.19	ANSI C37.06	AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis-Preferred Ratings and Related Required Capabilities
3.20	ANSI/IEEE C37.20.2	Metal-clad Switchgear
3.21	IEEE C57.13.2	Conformance Test Procedures for Instrument Transformers
3.22	ASTM D 2472	Standard Specification for Sulfur Hexafluoride

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 General

The switchgear shall be natural cooled SF6 gas insulated metal-clad type with modular design for indoor service and shall be of manufacturer's standard design which meets or exceeds the requirements of this Specification in all respects.

4.2 Switchgear Assembly

4.2.1 The switchgear assembly shall be of single bus bar type and suitable for extension at both ends without cutting and drilling. Welding is also prohibited for field assembly of the cubicles. It shall be possible to dismantle and remove any middle panel from the switchgear line-up without dismantling/removing the adjacent switchgear panel.

4.2.2 Each switchgear feeder panel shall consist of bus bar, disconnector, earthing switch, circuit breaker, current transformer, voltage transformer (if specified), cable compartment, low voltage compartment with control devices, protection devices as per the protection requirement and gas monitoring system.

4.2.3 Bus bar, circuit breaker, disconnector and earthing switch shall be hermetically pressure sealed with SF6. Each element shall be in independent modules (Independent compartment) and safe to touch and fully ensure operational security and personnel safety under all normal and fault conditions. Combination of disconnector and earthing switch (3-position switch) in one module or busbar, disconnect and earthing switch in one

module shall also be considered. Gas compartments other than specified above may be accepted if the manufacturer proves with adequate documents that the equipment have superior quality, equivalent or better electrical and mechanical properties in comparison with the other design. The switchgear design shall have proven that the design will withstand the service conditions of SEC Distribution system as stipulated in specification.

4.2.4 Current transformer and voltage transformer are either installed inside the gas zone or outside the gas zone. No ring core type CT shall be perimitted for istallation directly on cables.

4.2.5 Circuit breaker, disconnector and grounding switches shall be operated from the front of the panel and shall be accessed from outside of enclosure.

4.2.6 Doors and panels shall have sufficient thickness and rigid to support devices, and doors shall be easy to open and close.

4.2.7 The door of the low voltage compartment shall have a door stopper to hold the door in the "open" position.

4.2.8 The switchgear enclosure and the internal barriers shall be adequately rigid and able to withstand short circuit stresses and arc-proof tests as per IEC 62271-200 of identical switchgear units.

4.2.9 Site assembly of modules/panels shall be simple and rigid.

4.2.10 Mimic diagram shall be provided on the front panel of the switchgear.

4.2.11 The switchgear enclosure color finish shall be as per 01-SDMS-01.

4.2.12 Interior color finish of LV box shall be RAL 9003 (signal white).

4.3 Ratings

4.3.1 Unless otherwise specified in SOW/TS, continuous current rating of circuit breakers and bus bars shall be as given in the table as below at design ambient temperature of 40 degree C with natural cooling without temperature rise of various parts exceeding the limit stated in IEC 62271-1:

Table

System Nominal Voltage (kV)	Rated Continuous Current (Amps)
33 or 34.5	630, 1250, 1600
11 or 13.8	630, 1250, 2000

4.3.2 The switchgear and controlgears shall have the short time current rating as specified in the Data Schedule.

4.3.3 All equipment and components of the switchgear including bus support insulators shall be free of partial discharges when operated at rated voltage.

4.3.4 The insulation level requirements shall be as specified in 01-SDMS-01.

4.3.5 Switchgear shall be enclosed in a ventilated general purpose enclosure. Degree of Protection to all SF6 gas enclosed compartments shall be IP65 and for all air insulated compartments it shall be IP4X as per IEC 60529.

4.3.6 A warning sign shall be fastened by screws or rivets on each panel where accessibility is denied on live condition. The sign shall be written in both Arabic and English as follows:

"لا تفتح هذه الخلية الا عندما يكون المفتاح في وضع التأريض"

"DO NOT OPEN THIS PANEL UNLESS THE GROUNDING SWITCH IS IN 'ON' POSITION".

4.3.7 Each switchgear panel shall be provided with hinged front door(s) with lock(s). Rear shall be with hinged door fastened with bolts instead of lock(s) or removable bolted panel cover. Cable compartment front access shall be with door and lock or bolted removable panel cover.

4.3.8 The cable compartment enclosure design shall allow clear access to the cable termination compartment. The entry of primary cables to the enclosure shall be from the rear bottom of the switchgear. Adequate clearance shall be provided to permit high voltage testing of the complete installation and of individual cables.

4.3.9 Ventilation or pressure relief openings shall be so arranged such that in case of arcing caused by the internal fault in the switchgear, the hot gas or vapor produced by internal arc shall not endanger the switchgear operators and shall not enter into adjacent panels thereby preventing spreading of the fault. If required, integrated arc duct shall be provided to direct gas/vapor away from operators and prevent solid particles from uncontrolled spreading. The pressure surge shall be cooled in the absorber before its release into the switchgear room.

4.3.10 All ventilation louvers shall be vermin-proof and shall be provided with filter to minimize ingress of dust.

4.4 Main Bus Conductors and Connections

4.4.1 The main bus conductors and connections shall be made of electrolytic grade copper. Vertical sections (tee-off droppers) shall be connected to the main busbar by means of sub-busbar. Interconnection of main busbars in each switchgear panel shall be plug-in type or equivalent means for easy installation.

4.4.2 Bus bars shall be in three phase or single phase enclosure with independent SF6 gas insulated module with provision for extending at either end without the need for cutting or drilling the copper bar.

4.4.3 Provision shall be made to allow the thermal expansion of the busbar conductors due to normal load current and short circuit currents.

4.4.4 The bus bar and its connections shall be able to withstand the mechanical stresses under the specified short circuit conditions.

4.5 Power Circuit Breaker

4.5.1 Power circuit breakers shall be single throw, vacuum or SF6 type fixed and suitable for local and remote control. The circuit breakers shall comply with IEC 62271-100 or ANSI C37.06.

4.5.2 Power circuit breaker shall be an independent module in SF6 gas medium.

4.5.3 The circuit breaker shall be single pole or three pole and designed for simultaneous three (3) pole operation.

4.5.4 Live parts of circuit breaker shall be in SF6 gas compartment and operating mechanism shall be accessible from outside the gas compartment.

4.5.5 The circuit breaker operating sequence (operating duty cycle) shall be O-0.3s-CO-3min.-CO or O-0.3s-CO-15s-CO as per data schedule.

4.5.6 The first pole-to-clear factor shall be 1.5.

4.5.7 The operating mechanism shall be of the motor-charged spring-operated stored energy type suitable for rapid/fast auto-reclosing of the circuit breaker. Prior approval shall be obtained from SEC for any other operating mechanism arrangement.

4.5.8 The operating mechanism shall employ a 125 Vdc motor to charge the closing spring(s) that retains this stored energy until a closing operation is made. The motor shall operate satisfactorily at voltage ranges between 90 Vdc and 140 Vdc. The energy storage capability of the mechanism must be sufficient for an O-CO operation at rated short circuit current or at related required capabilities specified in Data Schedule. Recharging of closing spring shall occur automatically as soon as the closing spring is released.

4.5.9 Means for manual spring charging shall be provided with the circuit breaker both in the "Open" and "Closed" positions. The spring charging motor DC circuit shall be automatically cut off during manual charging or suitable means of protection shall be provided to the manual charging mechanism to ensure the safety of operator during the restoration of power supply.

4.5.10 The operating mechanism shall be electrically and mechanically "trip free". Anti-pump features shall be provided.

4.5.11 Each circuit breaker shall be provided with one (1) closing coil and two (2) electrically independent trip coils. The tripping mechanism shall operate correctly when either or both trip coils are energized.

4.5.12 The control power supply to trip and closing coil circuits shall be provided with isolating switch. One auxiliary contact of this switch shall be wired to alarm when the switch is in open position. Both positive and negative poles of the close coil shall be switched.

4.5.13 Circuit breakers shall be designed so that they cannot be closed unless the closing spring is fully charged.

4.5.14 Each circuit breaker shall be provided with a visible mechanical position indicating device. The device shall be positively driven in both directions to show whether the breaker is in the "open" or "closed" position and shall be identified with color coding "Green" and "Red", respectively with white lettering. Similar positively driven indicating device shall be provided to indicate the state of the spring. It shall indicate "SPRING CHARGED" when the spring is in a condition to close the breaker and "SPRING DISCHARGED" when the spring is not in a condition to close the breaker.

4.5.15 The circuit-breaker and its operating mechanism have to perform the number of breaking operations at rated current and at rated short-circuit current without maintenance per relevant IEC or ANSI standards. Each circuit breaker shall have a mechanical 5-digit operation counter which is not possible to reset and shall be readable from the front of the switchgear.

4.5.16 Each breaker shall be provided with minimum ‘two NO’ and ‘two NC’ potential-free auxiliary contacts, mounted on the breaker for remote interlocking service. In addition ‘four spare NO’ and ‘four spare NC’ contacts shall be provided on each breaker for use on SER (Sequence of Events Recorder) and SCADA. Minimum contact rating shall be 10 A at 125 Vdc. Contact surfaces shall be of a metal, which is not subject to oxidization leading to an increase in contact resistance. They shall be mounted so as to be readily accessible for maintenance and designed to facilitate inspection, cleaning and adjustment.

4.6 Disconnector and Grounding Switch

4.6.1 Disconnector and Grounding/earthing switch shall be an independent element (unit) or combination of Disconnector and Grounding/earthing Switch (3-position) in an independent SF6 gas insulated module. Disconnector and Grounding/earthing Switch in busbar compartment module are also acceptable.

4.6.2 The disconnector and grounding/earthing switches shall be three (3) pole gang operated, no-load break and single stroke type, shall generally comply with the requirement of IEC 62271-102.

4.6.3 Live parts of disconnector and grounding/earthing switch shall be in SF6 gas compartment and operating mechanism shall be accessible from outside the gas compartment.

4.6.4 Disconnector shall be of class "M1" minimum and grounding/earthing switch of class "E1" minimum as per IEC 62271-102.

4.6.5 The disconnector switch shall fully comply with the specified requirements of insulation level for the isolating distance as stated in 01-SDMS-01/Scope of Work.

4.6.6 The disconnector switch shall be with manual/motor driven operating mechanism and equipped with adjustable, self-aligning, high pressure type silver-faced copper contacts. The contacts shall be capable of carrying full rated and short circuit currents without overheating or welding.

4.6.7 The spring charging motor DC circuit shall be automatically cut off during manual charging or suitable means of protection shall be provided to the manual operating mechanism to ensure the safety of operator during the restoration of power supply. Once initiated, the motor mechanism shall complete an open or close operation without requiring the initiating contact to be held closed.

4.6.8 Motor operated disconnector/earthing switch shall have manual operation facility.

4.6.9 Manual operating handles of disconnector and grounding switches shall be anti-reflex type insulated rod.

4.6.10 Grounding switch shall be with manual/motor drive having full short circuit fault making capability.

4.6.11 Disconnector and grounding/earthing switches shall have mechanical position indicator for the main contact open and closed position, directly coupled to the driving shaft. The marking shall be in white letters as "Open" or "O" on a green background and "Closed" or "C" on a red background. Position indication shall be visible without the need to open switchgear compartment doors.

4.6.12 Disconnector and grounding switches shall be provided with pad-locking facilities to permit locking both in open and closed positions.

4.6.13 Integral grounding switches shall be provided for incoming and outgoing feeders and bus bars. Grounding/earthing switch and disconnector switch shall be provided on both sides of bus-section circuit breaker.

4.6.14 Grounding shall be through grounding/earthing switch or through circuit breaker.

4.6.15 Disconnector and ground switch operating mechanism shall have an auxiliary switch with contacts for interlocking, local mechanical on/off indication and remote on/off indication.

4.7 Cable compartment

4.7.1 Cable compartment shall be Air Insulated.

4.7.2 The cable connections/termination shall be done by cable socket and plug. The terminations shall be suitable for copper or aluminum cables.

4.7.3 Cable size up to 630 mm2 shall be able to terminate in the cable box. Provision shall be made for connection of two or more cables per phase as per circuit capacity (viz. transformer incomer, feeder, etc.).

4.7.4 Facilities for easy cable testing including cable high voltage test and fault location and primary injection with bus bar live are to be provided.

4.7.5 The height of the plug-in connection point shall be minimum 700 mm from cable box bottom plate for clear access for cable installation and cable testing.

4.7.6 In case of an extension box is required to meet the vertical space requirement, the extension box shall be a part of the switchgear supply to be manufactured by the switchgear manufacturer.

4.7.7 The Bottom plate for power cable entry to the switchgear panels shall be of non-magnetic material. The bottom plate for outgoing feeder panels shall be of two pieces with holes drilled for entry of cable. The bottom plate for incoming and station service transformer panels shall be of a simple piece without any holes drilled.

4.7.8 Incoming / outgoing cable support and clamps, earthing busbar and fixing facility for other accessories such as Voltage Transformer shall be provided in the cable compartment.

4.8 Instrument Transformers

Conventional current transformer and inductive voltage transformer as per IEC 61869-2 and 61869-3 are preferred. For other option, prior approval from SEC shall be obtained to use any other type of voltage and current transformers; such as combined modern voltage/current sensors as per IEC 60044-7 and 60044-8 and toroidal Current Transformers.

4.8.1 Current Transformers (CTs)

a. The mechanical and thermal current ratings of CTs shall be coordinated with the momentary and short circuit current of the associated circuit breaker, respectively.

b. Switchgear shall be delivered with all CT secondary windings shorted out. All CT secondary leads shall be wired out to terminal blocks. The secondary windings of each CT shall be rated as specified in Data Schedule and shall be connected to the ground bus by a direct copper connection, via a removable link at one point only.

c. CTs for bus bar differential and restricted earth fault (REF) relays shall be of single-ratio type. Other relaying CTs shall be of dual-ratio type. Metering CTs shall be single or dual-ratio as per SOW/PTS.

d. Relaying and metering accuracy class for standard burdens shall be as specified in Data Schedule.

e. For multi ratio CTs, core ratio taps shall be provided on the secondary winding as per IEEE C57.13 for CTs manufactured per IEEE. For CTs manufactured as per IEC, it shall be as per CT sizing criteria specified in PTS/SOW. For multiple ratio CTs, the through fault stability and adequacy calculation should be made for all ratios, especially for the smallest one.

f. Primary and secondary terminals and polarity shall be marked per applicable standards.

4.8.2 Voltage Transformers (VTs)

a. Voltage transformers (VTs) shall be of standard three (3)-winding type for the voltage class of the switchgear and shall have voltage marked

ratio and accuracy class for standard burden as specified in Data Schedule.

b. VT shall be provided with isolating facility.

c. VT shall be located in a readily accessible place. VT shall be of electromagnetic epoxy encapsulated dry type design per IEC 61869-3 and suitable for three-phase star connection with star point solidly grounded. VT shall be provided in each bus section and incoming feeders. VT primary connected through the power cable from the main bus bar is not acceptable.

d. VTs shall have two (2) secondary windings. Secondary circuits of all VTs shall be protected by miniature circuit breakers (MCB). MCB's shall have auxiliary contacts for alarm indication. All secondary leads shall be terminated in the terminal blocks in low voltage compartment.

e. Provisions shall be made for disconnecting the secondary circuit of VT when the primary circuit is disconnected. Provision shall also be made for momentary grounding of the primary winding during the disconnecting operation to remove any residual charges from the windings.

4.9 SF6 Gas system Requirements

4.9.1 The SF6 gas shall conform to IEC 60376 or ASTM D2472.

4.9.2 The manufacturer shall provide the data regarding gas characteristics corresponding to the degree of deterioration beyond which treatment or replacement of gas would become necessary along with procedural instructions for gas treatment to restore original quality.

4.9.3 The switchgear module/compartment shall be fully gas tight. The sealing system shall ensure effective protection against ingress of moisture, dust and other contaminants into gas compartments. All gas compartments shall contain suitable agent to absorb moisture and any other decomposition products of SF6 gas.

4.9.4 Each compartment shall be provided with safety devices (bursting disc) activated by overpressure.

4.9.5 The relative leakage rate of SF6 gas in each gas compartment shall not exceed 0.5% per year.

4.9.6 The GIS enclosure shall be sectionalized for each equipment into modular units or compartments, separated by solid gas barriers with an effective sealing system. Each gas compartment shall be provided with self-closing non-return valves for sampling and testing, evacuation and refilling of SF6 gas without evacuation of any other section or loss of gas. Preferably busbar shall be segregated for each panel.

4.9.7 Gas barrier and sealing system shall have adequate mechanical strength to withstand the dynamics forces caused by short circuits and effects of internal arc faults as well as maximum pressure differential that could exist between adjoining compartments.

4.9.8 SF6 gas in each individual compartment shall be monitored by suitable temperature-compensated pressure gauges (gas-density continuous monitoring) switches/relays to monitor the loss of SF6 gas. The dial of the pressure gauges shall be graduated to read pressures and coloured green, yellow and red to indicate normal, Alarm Stage 1 (non-urgent) and Alarm Stage II (urgent) pressure conditions respectively. The gas-density monitors shall be capable of being calibrated with the monitored equipment in service. The indicator shall be visible and readable from finished ground level. Each pressure switch shall be provided with two convertible potential-free auxiliary contacts for two-stage alarm initiation. The alarm contacts shall be wired to the annunciator. It shall be possible to test and replace each pressure gauge and the density switch/relay with the GIS in service.

For SF6 Circuit Breaker the alarms shall be as follows:

Stage I: Alarm at 10% above minimum safe operating gas density (and block breaker closing) - (Refill stage).

Stage II: Alarm in the event of gas density falling below the minimum safe operating limit (and block breaker tripping).

4.9.9 At each gas compartment, provisions shall be made for connecting moisture measurement instrument and the gas service cart. The moisture content in the gas shall not exceed 150 ppmv (parts per million per volume) in circuit breakers and 250 ppmv in other equipments. Provision for disconnection of gas pipelines shall be incorporated. 100μm or smaller sintered stainless steel

particles filter disk, suitable for pressure involved shall be installed at the gas service connection.

4.9.10 All piping for SF6 gas and its fittings shall be made of copper, brass or stainless steel.

4.9.11 A coloured diagram with legends showing various gas compartments, monitoring system etc. together with normal and alarms ranges shall be mounted on the switchgear.

4.9.12 The switchgear assembly supplies shall include:

a. The initial complete filling of SF6 gas for the assembly, if required and in addition, any gas lost during installation and commissioning procedures.

b. An additional 10% supply of gas complete with containers and monitoring equipment for use during the warranty period.

4.10 Low Voltage Compartment

4.10.1 The Low voltage compartment of the switchgear shall be provided, as applicable, with the following:

4.10.2 One (1) Local/Remote selector switch. Provision shall be made for locking the switch in either position.

4.10.3 One (1) circuit breaker control switch. The switch shall have three positions (trip-normal-close) with a spring return to normal and padlocking facility in the normal position.

The control switch shall follow the convention of closing the circuit breaker in the clockwise direction.

4.10.4 Indicator lights shall be LED type to indicate the breaker status as follows:

Red: breaker closed, one for each trip coil adjacent to the control switch

Green: breaker open, one for closing coil adjacent to the control switch

For outgoing and station service feeder panels only, the red and green lights shall be wired in series with the trip and close coils, respectively to supervise the status of each coil, in accordance with clause 4.12.10.

For incomers and bus tie breakers, the red and green light indications shall be achieved through the breaker auxiliary switches. The healthiness of the breaker trip coils shall be monitored via the trip circuit supervision relays which are located in the control room.

4.10.5 One (1) multifunction meter and one (1) electronic KWH meter with data saving and remote communication facility for each incoming and outgoing feeder panel, and one (1) voltmeter for each bus section shall be provided. KWH meter shall conform to 40-SDMS-02A.

4.10.6 If specified in the Data Schedule, one (1) auto-reclose IN/OUT selector switch and one (1) auto-reclose lockout reset push button shall be provided for outgoing feeder panels only.

4.10.7 One (1) 230Vac LED light. The light shall be controlled by toggle and door switch. Switch shall be identified with engraved or embossed nameplate.

4.10.8 One (1) thermostatically controlled space heater rated 230 Vac and designed for continuous operation with a manual ON/OFF control switch.

4.10.9 One (1) 15A, 230Vac and one (1) 10A, 400Vac flush type, parallel slot, grounding type convenient outlets shall be provided in the incoming and bus-tie breaker panels.

4.10.10 Lot, Nameplates

4.10.11 Lot, Relays and Relay manufacturer's test blocks (see clause 4.12). SCADA Interposing Relays for Trip and Close.

4.10.12 The bus riser/metering panel shall contain the following :

a. Bus differential protection relay and supervision relay or protection as specified in SOW/TS with relay manufacturer's test blocks.

b. One (1) multifunction meter

4.10.13 Indication lamps in addition to specified shall be provided on the front of transformer and feeder panels and connected through capacitor voltage dividers to monitor the cable circuits dead or live.

4.10.14 Interior color finish of LV compartment shall be RAL 9003 (signal white).

4.11 Relays, Meters and Instruments

4.11.1 Relays, meters and instruments shall be provided as specified in the Project Scope of Work (SOW/TS) and shall be located in a low voltage compartment of the same feeder breaker panel while for the other breaker panels, they shall be installed in separate relay and control panels. All outgoing feeder breaker panels shall be povided with SEF Relays.

4.11.2 All protective relays shall be mounted in 19 inch racks. If relays cannot be rack mounted they may be flush mounted.

4.11.3 Target indicators shall be provided on all relays performing protective or tripping functions. Relay contacts shall be self-aligning.

4.11.4 All meters shall be switchboard fixed-type and flush or semi-flush mounted. Accuracy class of all digital meters shall be 0.5 per IEC or 0.3 per ANSI. Accuracy class of all revenue meters shall be 0.2 per 40-SDMS-02.

4.11.5 The meters shall be fitted with dust and moisture proof covers and shall have non-reflecting glass. Analog meters shall have 240°scale and dimensions 96 x 96mm.

4.11.6 Meters, instruments and indicating type transducers shall have test facilities separate from protective relays, so that testing and calibration can be done without equipment outages. Test facilities, suitably shrouded, shall be similar in function to type FT-1 test switches and shall be mounted on the front panel.

4.11.7 Upper edge of protective relays and meters shall be no higher than 2.2m to allow convenient maintenance, inspection, target reset, and testing from ground level. As a special case, where upper edge of protective relays higher than 2.2 m, suitable means shall be provided for the accessibilty to the relays with SEC prior approval.

4.11.8 All accessories such as DC/DC converters and transducers shall be located inside the panel or as specified in SOW/TS.

4.11.9 For outgoing and station service feeder panels, each indicating light shall have a current limiting resistor to facilitate replacing the bulb without activating the respective trip/close coil. The rating of the resistor shall be selected to provide adequate illumination of the lamp at normal operating conditions. Shorting of the lamp terminals shall not damage the resistor itself or blow the control circuit fuses (or trip the control circuit MCBs) considering that maximum DC control voltage is limited to 110% of its nominal rating. This shall be met by restricting the current passing through the trip coil to less than 25% of its minimum pick-up current.

4.11.10 The trip 1, trip 2, close and spring charge circuit MCBs shall be located at the switchgear in the LV compartment.

4.11.11 All switchgear MCBs shall have normally open auxiliary contacts. Each breaker shall have its MCB contacts connected in series with the Trip Circuit 1 positive supply located on that breaker. Any MCB operation shall de-energize the breaker DC supervision relay and provide an alarm.

4.11.12 In substations, with Substation Automation IEDs shall be installed in the LV compartment. Control and Protection requirements, Communication protocol etc. shall be as per relevant Material specification, IEC standards or SOW/TS.

4.12 External Cabling

4.12.1 Power Cable

a. The cable entry shall be through the bottom plate of the cable box exactly below the termination point.

b. Termination of power cables shall be plug-in type.

c. Terminal plugs for power cables shall be suitable for use with copper or aluminum conductor material.

4.12.2 Control Cables/Wires

a. All external control cables/wires shall be brought to the panel from the bottom, unless otherwise specified.

b. Control cables/wires shall enter the panel through suitable cable glands to prevent contact with sharp metal edges. The gland-plate assembly shall be vermin proof.

4.13 Interface

4.13.1 Control wiring connections between stationary structure and removable element, if any, shall be provided with self-coupling contacts or manual plug and receptacle for disconnection. The male contacts shall be placed on the removable element while the female receptacles on the stationary structure. Secondary isolating contacts shall be so positioned or designed to prevent the danger of electric shock when disconnected.

4.14 Interlocks and Safety Features

4.14.1 The switchgear shall be provided with a system of preventive mechanical interlocks to protect the equipment, operator and service personnel from the dangers of mal-operation. CB, DS and ES shall be provided with adequate number of auxiliary contacts for interlocking purposes without the use of contact multiplying relays.

4.14.2 Grounding switches shall be mechanically and electrically interlocked with associated disconnect such that closing operation of grounding switch shall not be possible unless the related disconnect is in open position.

4.14.3 Grounding switch of an incoming transformer line shall also be interlocked with transformer HV breaker and transformer HV disconnect switch such that closing operation of grounding switch in LV side shall not be possible unless HV breaker and HV disconnect switch are open and HV breaker closing operation is not possible unless grounding switch in LV side is open. LV circuit breaker closing shall not be possible unless HV circuit breaker is closed.

4.14.4 Bus bar grounding switch shall be interlocked with the incoming circuit breaker and bus section breaker as well as with all outgoing breakers on the

respective bus side, such that closing operation of grounding switch shall not be possible unless all associated circuit breakers and disconnectors are open and vice versa, the associated circuit breakers and disconnectors closing operations shall not be possible unless the bus bar grounding switch is open.

4.15 DC Control Power

Unless otherwise specified, the nominal DC control voltage for closing and tripping of all circuit breakers shall be 125 V_{dc} supplied from station batteries. Trip coils shall operate satisfactorily at voltage ranges between 70 V_{dc} and 140 V_{dc} and closing coils shall operate satisfactorily at voltage ranges between 90 V_{dc} and 140 V_{dc}. The motor operated operating mechanism shall operate satisfactorily at voltage ranges between 90 V_{dc} and 140V_{dc}.

Voltage dropping resistors shall not be used in the trip coil and closing coil circuits.

4.16 Wiring and Terminal Blocks

4.16.1 All wiring within the switchgear shall be installed and tested at the factory unless otherwise specified. All wiring shall be heat and flame retardant, rated 90°C maximum operating temperature, rated 600/1000V, insulated, tinned, stranded annealed copper conductor, and shall not be smaller than 2.5 mm² for CT circuits.

For SCADA digital and analog input signals, SOE, Annunciator and status/alarm signaling circuits wiring size shall not be less than 0.5mm^2 up to the first termination point, only if the associated device cannot accommodate larger wire sizes. For SCADA Control Output Signals and all other circuits the wiring size shall not be less than 1.5mm^2.

All wires shall be adequately rated for thermal withstand of short circuit currents, in accordance with back-up tripping time.

4.16.2 Color coding of panel wiring shall be as follows:

DC circuits: Generally Grey (Trip circuits shall be provided with Red ferrule at the terminal block) unless SEC specified.

VT circuits:	Generally Red unless SEC specified (fitted with R, Y, B sleeves).
Alarm circuits:	Blue
CT circuits:	Generally Yellow unless SEC specified (fitted with R, Y, B sleeves).
AC power circuits:	4 Core; Red, Yellow, Blue, Black (Neutral)
	3 Core; Red, Yellow, Blue for 3 phase
	3 Core; Red, Yellow, Black (Neutral) for 2-phase
	2 Core; Red, Black (Neutral)
	1 Core; Black
	1 Core; (Usage limited to grounding conductor) Green or Green with Yellow stripes

4.16.3 All wiring shall be made without splices. The control wires shall be multi-stranded flexible and shall be terminated with size 1 hooked crimps or ring type terminals as applicable. Spade type, pin type or boot lace type crimp terminals are not acceptable.

4.16.4 Terminal blocks shall be screw clamp type termination and shall be heat and fire resistant. If a common termination is required between terminal blocks, preformed wire jumpers or manufacture's own shorting bar can be used. Compatible end stops, end plates, barriers and terminal block identifiers shall be used. Groups of terminal blocks shall be identified using engraved labels. The comparative tracking index of terminal blocks shall be at least 500 as per IEC 60112 or equivalent standard.

Not more than 2 (two) terminations shall be connected to one side of a terminal block. In special circumstances where wire sizes exceed the terminal block capability, correctly sized terminal blocks shall be used after SEC approval.

In all instances, terminal blocks shall be mounted on DIN rails.

4.16.5 Terminal blocks shall be grouped according to function, i.e. Power Supplies (AC or DC), VT, CT, DC controls, annunciation, SCADA etc. and the function shall be labeled accordingly. Terminal blocks for different voltages (AC/DC) shall be located on separate DIN rails.

4.16.6 The CT terminal blocks at the first accessible point of termination shall have shorting and grounding facilities by means of a copper bar with shorting screws.

Each CT circuit shall be provided with a disconnectable ground link.

Opening of the link shall enable all CT and relay wiring to be tested clear of ground. There shall be only one ground link per CT circuit. The termination between the ground bus bar and the isolatable link shall be numbered C90 for Overcurrent CT, M90 for Metering CT, B90 for Bus Differential and D90 for Remote Tap Charger Control (RTCC) overcurrent block applications.

CT terminals shall be grouped by function and then sub-grouped by phase. Each phase shall be labeled by appropriate labels attached to the terminal blocks. Each complete CT shall be identified by function and reference number. Where a CT has a dual ratio using secondary tappings, such as S1, S2, S3; the CT terminal block shall have four (4) terminals: S1, S2, S3 and ground.

The shorting bar shall cover the four terminals of each phase. The bar shall be grounded through the grounding terminal block. The other end of the bar shall be held by an insulated screw.

Adjacent to the CT terminal blocks two end stops shall be located with an appropriate label mounted between them. Each stop shall have formed holes that shall be used to store the CT shorting screws.

4.16.7 All tapping of dual-ratio CTs shall be terminated at the terminal blocks which shall be clearly marked to designate the CTs phase and ratio in use.

4.16.8 All VT circuits shall be provided with sliding link type terminal blocks to facilitate isolation of VTs from the circuit to perform voltage injection tests. These terminal blocks shall be clearly marked with phase, function, core number and ratio.

4.16.9 Not less than ten percent (10%) spare terminals shall be provided on each terminal block.

4.16.10 All spare contacts from protective relays or tripping relays shall be wired to the terminal blocks for future use. At least two (2) spare (1 NO + 1 NC) contacts of lockout relay shall be wired to the terminal block for future use.

4.16.11 All wiring internal to the switchgear assembly shall be laid in accessible wiring troughs throughout the entire length of the switchgear assembly. Internal wiring between the breaker and the LV compartment shall be bundled and neatly formed. There shall be no wiring run as single cores through grommets. The AC wiring shall be bundled separately from DC wiring in the same raceway. Signaling cables shall be shielded type and run in a separate raceway and shall be separated as far as practical from all LV power cables and at right angle to such wiring when the spacing is less than 300 mm.

4.16.12 Cable supports shall be provided for wiring run directly to instruments or devices. Wiring extensions from raceways or bundles to instruments and devices shall be neatly formed, securely tied or clamped and supported to the switchgear framework. Bends in the wiring shall be carefully made in such a manner that the insulation is not damaged.

4.16.13 Wiring for lights, space heaters and convenience outlets may be run in the same raceway in individual panels and in rigid or PVC jacketed flexible conduits between panels. Wiring of meters/relays mounted on doors shall be mechanically protected.

4.16.14 All internal wiring terminations shall be identified by legible markings at the device terminals in accordance with the connection diagrams. Each end of every wire leaving a terminal block shall be identified indicating local termination point and destination as per Figure 1. Markers shall be of ferrule type, permanently marked and shall be made of material that will not deform or deteriorate and shall withstand a temperature of 90°C. Adhesive type terminal markers are not acceptable.

4.16.15 Where panels are to be shipped in sections and assembled in the field, the wiring between sections shall be provided preformed. One end of the wire shall be terminated on terminal block and the other end shall be bundled and tagged properly.

4.17 Device Identification

4.17.1 Appropriate identification in the form of engraved or embossed nameplate shall be provided on each instrument, relay, control/test switch and other devices. These nameplates shall be made of non-corrodible material and shall be of appropriate size.

4.17.2 Each device shall be permanently identified to correspond to the device identification symbol utilized on the wiring diagrams. This identification shall be adjacent to the terminals of the device. Standard relay device numbers shall be provided for protective relays. For switchgears phase conductors when viewed from operating side, the phase designation shall be R, Y, B from left to right, from front to back and from top to bottom. For reinforced substations the three phases shall be designated as per the existing system.

4.18 Nameplates

4.18.1 Switchgear assembly shall also bear a nameplate permanently and legibly marked in English with the information in accordance with IEC 62271-200 or equivalent ANSI Standards, plus the following additional information:

a. SEC Purchase Order Number or Contract Number or J.O. Number

b. 32-TMSS-03, Rev.0

4.18.2 Each circuit breaker shall have a nameplate as per IEC 62271-100 or ANSI C37.06.

4.18.3 The circuit breaker operating mechanism, CTs, VTs and FT-1 switches shall also bear nameplates. Each FT-1 switch shall have a separate nameplate of dimensions 160 mm by 44 mm. Minimum letter height shall be 12 mm for cubicle/circuit labels and 7 mm for all other labels.

4.18.4 The nameplate for the switchgear assembly and the circuit breakers shall be made of stainless steel of adequate size to indicate the function of the panel. The panel designation shall be as per PTS drawing. The nameplate shall be fastened by stainless steel screws or rivets. Other nameplates for CTs, VTs etc. may be made of non-corrodible material rather than plastic.

4.19 Grounding

4.19.1 An un-insulated electrolytic copper grounding bus sized for the rated short circuit current and running the entire length of the switchgear assembly shall be provided. Provision shall be made for extending the ground bus at either end without the need for cutting or drilling the copper bar.

4.19.2 Two (2) solderless type ground connectors shall be provided on the ground bus, one on each end section of the bus. The ground connectors shall be suitable for a bare copper ground conductor 120mm² thru 240mm².

4.19.3 All hinged doors and panels shall be properly bonded by unspliced flexible wire or 10mm2 Cu braids.

4.19.4 All devices or equipment shall be grounded as required. Each grounding connection to the ground bus shall be arranged so that each may be disconnected without disturbing the continuity of the ground bus or any other ground connection.

4.20 Accessories

The following accessories shall be supplied as applicable:

4.20.1 A set of each relay manufacturer's test plugs accessories for relay testing and protective relay test set and portable test equipment for meters, and laptop including software and communication cable.

4.20.2 One set of high voltage portable testing plugs of continuous current rating of 200A.

4.20.3 A suitable box or container shall be supplied for storage of test plugs.

4.20.4 Crank lever or equivalent device for manual charging of the spring-operated stored energy closing mechanism of the circuit breaker, disconnector and earthing switch.

4.20.5 Any special tools required for circuit breaker maintenance and relay adjustments.

4.20.6 Gas handling devices such as:

- SF6 Gas filling trolley
- SF6 Gas leakage detector
- Gas Purity Test Set
- Dew Point Test set
- Density Monitor Calibrator
- Earthing set (if required)

4.21 Drawings

Manufacturer shall at least provide the following drawings of size 'A3' (minimum):

4.21.1 General arrangement and sectional view drawing of Switchgear Panel of each type.

4.21.2 Switchgear Layout Drawing.

4.21.3 Single Line Diagram.

4.21.4 General Arrangement and Component List of Circuit Breaker.

4.21.5 DC Schematic.

4.21.6 Panel Wiring Diagram.

4.21.7 Component List of Switchgears with sub-supplier (make) and country of manufacture.

4.21.8 GIS SF6 Gas diagram

5.0 BASIC REQUIREMENTS AND GUIDELINES

5.1 General

a) Switchgear shall be compact, simple for operation with highly secured performance.
b) Switchgear shall be suitable to operate at ambient temperature varying from 55°C to – 5 °C, under dusty, dry climate out-door conditions as given in (01DMS-01)
c) Switchgear shall comply to the Specifications of SEC and relevant IEC Standards.

5.2 Bid Proposal

The Manufacturer shall provide the following along with his bid proposal, in addition to the requirements stipulated in the Purchase Order or Contract documents:

(a) Scope of Equipment Supply.

(b) Data Schedule for all SEC Materials Standard Specifications (SDMS, TMSS and SMSS) as given in this SDMS shall be duly filled-in.

(c) Technical literature, brochures and list of users in the electric utility sector.

(d) Complete type test reports/certificates of all major equipment.

(e) A declaration from the Manufacturer that the bid proposal is in accordance with the technical Specifications and associated SEC, material Standard Specifications. Otherwise the Manufacturer must state clearly any exception or deviation items from SEC Standards, these guideline Specifications and drawing plans and the reasons for exceptions or deviations.

(f) All documentation relating to this project shall be in English.

5.3 Base Design Phase

The base design phase is a period of 4-6 weeks of preliminary design following the issue of Purchase Order or award of Contract. Six (6) sets of the base design package shall be submitted to SEC for review and comments at the base design review meeting which will be held by the SEC four (4) weeks after the receipt of the base design package.

The base design document shall consist of :

a) Detailed list of equipment to be supplied.

b) Following design drawings, as a minimum, but not limited to:

- Drawing Control Sheet.
- One-Line Diagram (Main one-line diagram, AC and DC auxiliary one-line diagram, etc.)
- General arrangement of the switchgear (giving details of various components)

c) Literature (specifications, manuals, brochures, drawings and completed Data Schedules) of the following materials, as a minimum, but not limited to:

1) Switchgear.
2) Relays.
3) Instruments.
4) Control Panels.
5) CTs/PTs.

d) Following calculations and specifications, as a minimum, but not limited to:

1) CT and PT Sizing, including auxiliary CTs.
2) AC and DC auxiliary supply design with sizing of auxiliary transformer, batteries, chargers, etc.
3) Grounding Conductor Sizing.

e) Details of site commissioning tests to be carried out.

5.4 Design Review Drawings

Following the base design phase, other detailed/manufacturer drawings shall be submitted by the Manufacturer for approval by SEC. The list of detailed drawings to be submitted for approval shall be mutually agreed to between the Manufacturer and SEC.

5.5 Manufacturer Progress Reporting

The Manufacturer shall submit to SEC, a monthly progress report on the manufacture of the switchgear.

The progress report shall include among other items:

a) Design.
b) Procurement of Components.
c) Testing and Commissioning.
d) Overall Completion.

The format shall be mutually agreed to between the Manufacturer and SEC.

5.6 Test and Inspection.

All equipment and materials shall be subject to inspection and tests as required in relevant SEC Materials Standard Specification, QA/QC Procedures and applicable industry standards or as may be decided by the SEC.

All design (type) and production (routine) tests prescribed in this SDMS and relevant SEC Materials Standard Specifications shall be performed in accordance with the applicable industry standards. In lieu of actual design (type) tests, the Manufacturer may submit complete certificate reports or tests performed previously on identical units to the SEC for review and approval during the bidding stage.

a) The Manufacturer shall submit for all major equipment a detailed testing and Inspection program of respective manufacturers to the SEC for review, at least three (3) months before the commencement of manufacturing.

b) The Manufacturer shall employ a reputable independent vendor inspection agency to witness factory tests and inspect the equipment and materials that will be purchased for the manufacture of this switchgear. The Manufacturer shall submit pre-qualification documents for his proposed vendor inspection agency for approval of SEC.

The Manufacturer shall provide all technical specifications to the independent vendor inspection agency. The entire test inspection report shall be submitted for acceptance by the SEC.

c) SEC will also send its employees or its inspectors to witness the factory tests and Manufacturer will bear all the expenses involved.

d) Four (4) initial sets of all factory tests reports shall be submitted by the Independent inspection agency to the SEC for review and approval. The equipment shall not be shipped ex-factory unless the test reports have been accepted, and shipping clearance is given by SEC.

e) It shall be the vendor's responsibility to obtain all the necessary Certificates of Conformity and/or other documentation required for import and/or registration of the unit.

f) The unit shall undergo the vendor's mandatory Pre-Delivery Inspection (PDI). Prior to the delivery, the PDI documents shall be forwarded to SEC for approval.

5.7 Commissioning and Site Tests.

The guidelines for Commissioning Tests and Checks as per SEC Standards and Specifications witnessed by SEC personnel:

The Manufacturer shall develop detailed commissioning and equipment site tests based on the requirements of SEC Standard to be performed at a SEC station.

During or after commissioning, training shall be given to operations staff covering the Operations and Maintenance of the complete unit.

A list giving full details of the site tests, tools and equipment to be used shall be submitted by the Manufacturer for review and acceptance by SEC, six (6) months prior to the scheduled date of tests. Scheduled dates of all field/site tests shall be submitted to SEC two (2) months prior to arrange for the REPRESENTATIVES of SEC to witness the tests.

The commissioning and equipment site testing shall be done in strict compliance with the normal work schedule of SEC i.e. 8 hours per day, 5 days per week.

5.8 Record Books

Upon completion of the manufacture, the Manufacturer shall submit eight (8) sets of record books containing the following documents as a minimum:

a) Approved design and manufacturer drawings.

b) All calculation sheets.

c) Brief technical specification of all components.

d) Operation and maintenance manual consisting of:

- Manufacturer's instructions manual applicable to each component or material.
- Manufacturer's set-up procedures, including mechanical tolerances for maintenance or repair purposes.
- Complete set of Manufacturer's drawings and catalogs with identified parts for each device and other essential information for SEC cataloging and ordering replenishment parts.

Note: All documents in item (d) shall be originals.

5.9 Spare Parts

Manufacturer shall provide recommended spare parts list required for O&M of switchear without including as part of bid.

5.10 Warranty

A minimum warranty of twenty four (24) months shall be granted with effect from the final acceptance/commissioning date by SEC. The limits shall be those submitted with the bid and accepted by SEC.

6.0 TESTS

6.1 All equipment shall be tested in accordance with the latest applicable IEC or ANSI/IEEE Standards.

6.1.1 Type (Design) Tests

a. All type tests prescribed in the applicable IEC or ANSI/IEEE Standards shall be performed on the first unit of every new design, rating or size of the corresponding equipment to be supplied to SEC, in accordance with the table below.

b. Arc-proof test shall also be performed on an identical switchgear panel including bus bars and cable boxes in accordance with Annexure A of IEC 62271-200 or equivalent.

c. Certified test reports of type tests performed on identical equipment acceptable to SEC may be submitted for review and acceptance in lieu of the required type tests above.

6.1.2 Routine (Production) Tests

a. All routine tests prescribed as per the compliance standard to the equipment (IEC or ANSI/IEEE Standards) shall be performed on the corresponding equipment in accordance with the table below and test reports shall be submitted for review and acceptance.

b. Routine test reports from original manufacturer of all circuit breakers, instrument transformers, disconnect switch and grounding switches shall be submitted for review and acceptance.

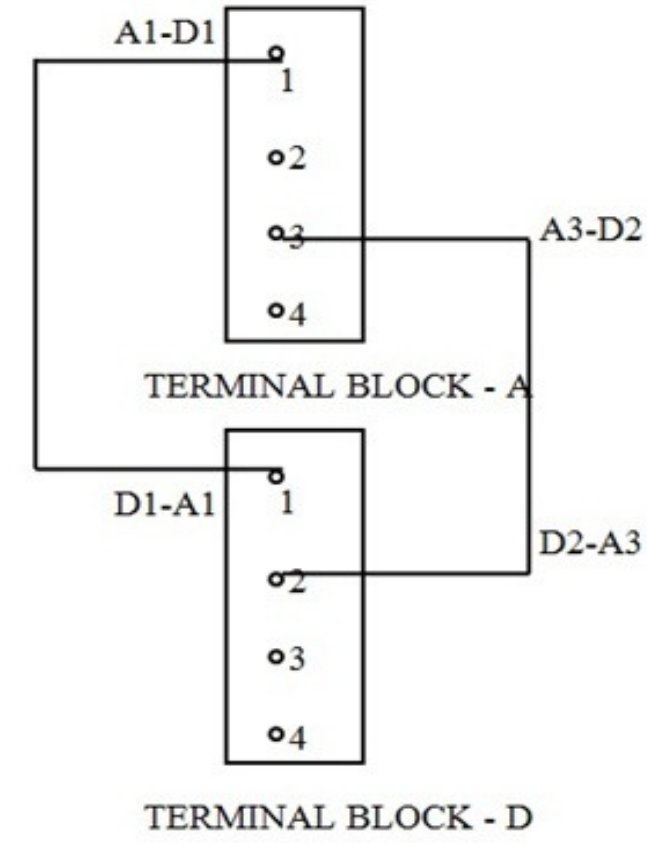
c. Timing tests are required on all circuit breakers.

6.1.3 The site tests shall be performed on the gas insulated metal-clad equipment and its component in accordance with relevant IEC Recommendations & SEC Commissioning Test Procedure TCS-P-105.

6.2 Tests for relays, meters and instruments may comply with the manufacturer's standard tests. Relay circuit shall be tested with simulated fault currents for proper operation.

6.3 Applicable Standards for tests:

EQUIPMENT	APPLICABLE STANDARD
High-voltage switchgear and control gear -Part 1: Common Specification	IEC 62271-1
Complete Switchgear Assembly	IEC 62271-200 or ANSI/IEEE C37.20.2
Circuit Breakers	IEC 62271-100 or ANSI/IEEE C37.09
Disconnector/ Grounding Switches	IEC 62271-102
Instrument Transformers	IEC 61869-2 and IEC 61869-3 or IEEE C57.13.2



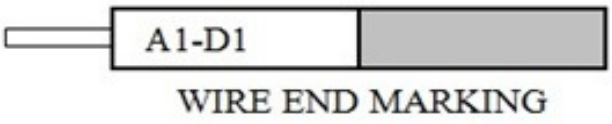


Figure 01: Internal Wire Identification

7.0 DATA SCHEDULE

GAS INSULATED METAL CLAD MV SWITCHGEAR (11, 13.8, 33 & 34.5KV)

SEC Enquiry No. _____ Date: _____

SEC Purchase Order No. or Contract No. _____ Date: _____

SEC PTS No./Project Title with J.O. No. _____

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
3.0	APPLICABLE CODES AND STANDARDS	*		
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	Mean Altitude above Sea Level (m)			
	Type of Upstream Neutral Grounding (Solidly grounded, resistance grounded)			
4.2	Switchgear Assembly			
	Switchgear Model Designation	*		
	No. of Panels in the Switchgear for:			
	Incoming Feeders			
	Outgoing Feeders/Capacitor Banks			
	Bus tie/Bus Section			
	Bus Riser/Metering			
	Station Service Transformer			
	Dedicated Feeder(s)			

Rating andMaterial of Bus Support Insulators		*		
Switchgear Enclosure RAL Color Finish		7033		
Type of cooling		Natural		
Design Ambient Temperature of Switchgear & Breaker	(ºC)	40		
Nominal Voltage of Switchgear & Breaker (11, 13.8, 33 or 34.5)	(kV_{rms})	11, 13.8, 33 or 34.5		
Maximum Voltage Withstand (Emergency conditions) of Switchgear & Breaker (12.1, 15.2, 36.3 or 38)	(kV_{rms})	*		
Power Frequency Withstand Voltage of Switchgear, Breaker, Disconnector & Earthing Switch, CT & VT:				
To ground and between phases	(kV_{rms})			
Across Isolating Distance (for disconnector/Earthing Switch)	(kV_{rms})			
Lightning Impulse Withstand Voltage of Switchgear, Breaker, Disconnector & Earthing Switch, CT & VT:				
To ground and between phases	(kV_{peak})			
Across Isolating Distance (for Disconnector/Earthing Switch)	(kV_{peak})			
Power Frequency Withstand Voltage of Auxiliary Circuits	(kV_{rms})			

	Lightning Impulse Withstand Voltage of Auxiliary Circuits	(kV_{peak})			
	Internal Fault Current for 1 s	(kA)	(*)		
	Rated Continuous Current of:				
	Switchgear Main Bus bar	(A_{rms})			
	Incomer Circuit	(A_{rms})			
	Bus Tie Circuit	(A_{rms})			
	Outgoing/Capacitor Feeder Circuit	(A_{rms})			
	Metering Feeder Circuit	(A_{rms})			
	Station service transformer circuit/Dedicated Circuit	(A_{rms})			
	Rated Short-time Withstand Current of Switchgear & Breaker (I_{sc})	(kA_{rms})	25		
	Rated duration of Short Circuit	(s)	1		
	Rated Peak withstand current of Switchgear ($2.6 \times I_{sc}$)	(kA_{peak})			
4.3	Degree of Protection of indoor enclosure				
	SF6 gas enclosed compartments		IP65		
	Air insulated compartments		IP4X		
	Type of material used				
	For gas enclosure		*		
	For metal-cladding		*		
	Minimum thickness of enclosure	(mm)	*		
4.4	Primary Bus Conductors				
	Material for bus bar	(Cu)	*		
	Insulation medium	(SF6)	*		
4.5	Power Circuit Breakers				

Breaker Model Designation		*		
Breaker interrupter insulation medium	(SF6 or Vacuum)	*		
Additional insulation to Breaker if any		*		
Breaker Close lockout pressure (if applicable)	(kPa)	*		
Breaker trip lockout pressure (if applicable)	(kPa)	*		
Rated Symmetrical Interrupting Current of Breaker at Nominal Voltage	(kA_{rms})			
Rated Peak Withstand Current/ Making current of Breaker	(kA_{peak})			
First Pole To Clear Factor of Breaker		1.5		
Rated Interrupting Time of Breaker	(Cycles/ ms)	5/80		
Closing Time (max) of Breaker	(ms)	*		
Arcing Time				
Maximum	(ms)	*		
minimum	(ms)	*		
Rated Reclosing Time	(ms)	*		
Rated Close-Open Time	(ms)	*		
Rated Permissible Tripping Delay	(s)	*		
Rated opening time	(ms)	*		

Minimum Opening Time of the first opening pole of the Breaker	(ms)	*		
Rated Operation Sequence		O-0.3s-CO-3min-CO or O-0.3s-CO-15s-CO		
Breaker Design X/R Ratio		*		
Maximum DC resistance of the power carrying circuit from terminal to terminal of circuit breaker	(Ohm)	*		
Temperature Rise at Rated Continuous Current of circuit breaker				
Main Contacts	(°C)	*		
Terminals	(°C)	*		
Rated Out-of-Phase breaking current capability	(kA_{rms})	*		
Rated Cable Charging Current Breaking Capability	(A_{rms})	*		
Rated Single Capacitor Bank Breaking Current, if applicable	(A_{rms})	*		
Rated back to back capacitor bank breaking current, if applicable	(A_{rms})	*		
Rated Capacitor Bank In-rush Making Current, if applicable	(kA_{peak})	*		
Rated Transient Recovery Voltage for Terminal Fault	(kV_{peak})	*		

Operating Mechanism: Type		*		
Spare Auxiliary Contacts: Total Number of Normally Open		*		
Total Number of Normally Closed		*		
Rated current	(A_{dc})	*		
Rated voltage	(V_{dc})	*		
Number of close-open operations that can be performed by the mechanism before spring recharge		*		
Time required to charge the closing spring	(s)	*		
Manual Operation		*	Yes/No	
Auto-reclose IN/OUT selector switch Required for Outgoing Feeders?		Yes/No		
Auto-reclose lockout reset push button Required for Outgoing Feeders?		Yes/No		
DC Control Power				
Breaker Charging Motor: Rated Voltage (48 or 125)	(V_{dc})			
Range of Operating voltage	(V_{dc})	*		
Rated Current	(A_{dc})	*		
Maximum Starting Current	(A_{dc})	*		
Breaker Closing Coil: Range of Operating voltage	(V_{dc})	*		

	Current at rated voltage	(A_{dc})	*		
	Breaker Tripping Coil				
	Range of Operating voltage	(V_{dc})	*		
	Current at rated voltage	(A_{dc})	*		
4.6	Disconnector/Earthing Switch				
	Type and designation number		*		
	Type of operating mechanism for disconnector				
	Motor Operation		Yes/No		
	Rated Voltage (48 or 125)	(V_{dc})	*		
	Range of Operating voltage	(V_{dc})	*		
	Rated current for the motor		*		
	Manual Operation		Yes/No		
	Type of operating mechanism for Earthing Switch				
	Motor Operation		Yes/No		
	Rated Voltage (48 or 125)	(V_{dc})			
	Range of Operating voltage	(V_{dc})	*		
	Rated current for the motor		*		
	Manual Operation		Yes/No		
	Rated Short time Withstand Current for Disconnector & Earthing Switch	(kA_{rms})	(*)		
	Rated duration of short time withstand current for Disconnector & Earthing Switch	(s)	1		
	Rated Peak Withstand Current for Disconnector & Earthing Switch	(kAp)	(*)		

	Short circuit making current for Earthing switch	(kA_{ap})	(*)		
	Number of Spare Auxiliary Contacts				
	Normally Open	(No)	*		
	Normally Closed	(No)	*		
	Rated breaking current	(A_{dc})	*		
	Rated Voltage	(V_{dc})	*		
	Opening Time of disconnector Max./min.	(s)	*		
	Closing Time disconnector Max./min.	(s)	*		
4.8	Instrument Transformers				
	Type of CT		*		
	Make		*		
	Type of CT Insulation Class & locations		*		
	Rated Current of CT Secondary	(A)	1 or 5		
	CT Continuous Thermal Rating				
	Single ratio CT		120%		
	Dual ratio CT		120%		
	Rated Short Time Withstand Current of CT:				
	Thermal, I_{th}	(kA_{rms})	*		
	Dynamic	(kAp)	$2.6xI_{th}$		
	Short time thermal current duration	(s)	*		

Rated primary short circuit current of CT, (I_{PSC})	(kA_{rms})	*			
Maximum Temperature Rise of CT	(°C)	*			
CT Ratio(s)					
Incomer Circuit					
Bus Tie Circuit					
Outgoing Feeder Circuit					
Protection					
Metering					
Protection					
Station Transformer					
Bus bar Differential					
Restricted Earth Fault					
CT Burden(s) (VA)/Resistive burden -Rb					
Incomer Circuit	(ohms)				
Bus Tie Circuit	(ohms)				
Outgoing Feeder Circuit	(ohms)				
Station Transformer	(ohms)				
Relaying Accuracy Class(es) of CT					
Incomer Circuit					
Bus Tie Circuit					
Outgoing Feeder Circuit					
Station Transformer					
Metering Accuracy Class of CT					
Incomer Circuit					
Bus Tie Circuit					
Outgoing Feeder Circuit					
Station Transformer					
CT Secondary winding	(ohms)	*			

Resistance at 20ºC, R_{ct}				
<u>For class TPS CTs per IEC</u>				
Rated symmetrical short circuit current factor (K_{SSC})		*		
Dimensioning parameter (K)		*		
Excitation limiting secondary Voltage, U_{al}	(Volts)	*		
Accuracy limiting secondary exciting Current, I_{al}	(mA)	*		
Secondary excitation current, I_{mag} at half excitation limiting secondary voltage	(mA)	*		
<u>For class C or K CTs per IEEE / Class P CTs per IEC</u>				
CT Magnetizing current, I_{mag}	(mA)	*		
CT Knee point voltage, $V_{k/}$ Secondary limiting e.m.f	(Volts)	*		
Voltage Transformer Type of Construction		*		
Make		*		
Insulation Class		*		
Winding Material		(Cu)		
Configuration		*		
Rated Voltage Factors				
VT Secondary MCB current	(A_{rms})	*		

	rating				
	VT Secondary Voltage	(V_{rms})			
	Extended tap Voltage of VT	(V_{rms})	*		
	VT Voltage Marked Ratio		*		
	VT Burden	(VA)			
	VT Accuracy Class (Metering/Relaying)		0.5/3P		
4.9	SF6 Gas System Number of gas compartments	(No)	*		
	Components in compartment-1		*		
	Components in compartment-2		*		
	Components in compartment-3		*		
	Components in compartment-4		*		
	Rated Operating SF6 Gas Pressure at 20ºC (List for each compartment)	(kPa)	*		
	Maximum Operating SF6 Gas Pressure (List for each compartment)	(kPa)	*		
	Minimum Operating SF6 Gas Pressure (List for each compartment)	(kPa)	*		
	Maximum Relative Leakage Rate per Compartment per year	%	0.5		

	Permissible Concentration of impurities in SF6 gas in service (List each compartment)		*		
4.10	Low Voltage Compartment				
	Light Points				
	Voltage	($V_{ac\ rms}$)	230		
	Power	(Watts)	*		
	Space Heaters				
	Voltage	($V_{ac\ rms}$)	400		
	Power	(Watts)	*		
	Receptacles				
	Voltage	($V_{ac\ rms}$)	230		
	Current	(Amp)	15A		
	Voltage	($V_{ac\ rms}$)	400		
	Current	(Amp)	10A		
	Transducers				
	Input current	(Amp)	1 or 5		
	Output current	(mA)	0-1		
	Accuracy		$\geq$ 0.25		
	Type of indicator		Lamp/LED		
4.11	Relays, Meters, transducers and Instruments				
	(Specify details, provide a complete list and metering one-line diagram for review)		*		
	Type of meter	Analog/ digital	*		
	Metering Accuracy Class				
	Digital meters		0.5		

	Analog meters		1.0		
	Revenue meters		0.2		
4.12	External Cabling (Details to be provided by the main Contractor)				
	Type of termination		Plugging		
	Type of the socket		*		
	Socket size		*		
	Max. acceptable cable size in the socket	(mm^2)	*		
	Power Cable Details:				
	Type of insulation				
	Voltage class	(kV_{rms})			
	Incomer circuit				
	No. of cables/phase	No			
	Conductor material		(Cu/Al)		
	Area of cross section	(mm^2)			
	Out going feeder				
	No. of cables/phase	No			
	Conductor material		(Cu/Al)		
	Area of cross section	(mm^2)			
	Station Service Transformer -1				
	No. of cables/phase	No			
	Conductor material		(Cu/Al)		
	Area of cross section	(mm^2)			
	Station Service Transformer -2				
	No. of cables/phase	No			
	Conductor material		(Cu/Al)		
	Area of cross section	(mm^2)			

4.19	Grounding					
	Copper grounding bus size	(mm x mm)	*			
	Provision for Bus bar grounding		*	Yes/No		
	Method of bus bar grounding		*			
	Bonding of hinged door	(mm^2)	≥ 10			
4.20	Accessories					
	Relay Test Plug with Laptop complete with Software and Commmunication Cable		Yes/No			
	High voltage test plug		Yes/No			
	Manual operating handle for CB, DS & ES		Yes/No			
	SF6 gas leakage detector and Other Test Sets (Gas Purity, Dew Point, Density, etc)		Yes/No			
	SF6 gas filling trolley		Yes/No			
	Special tools for CB maintenance		*	Yes/No		
	Earthing set (if required)		*	Yes/No		
	Recommended Clearances:					
	In front of the Switchgear	(mm)	*			
	At rear of the Switchgear	(mm)	*			
	Panel Dimensions (H x D x W):					

Incoming Feeder Panel	(mm)	*		
Station Service Transformer feeder panel	(mm)	*		
Outgoing Feeder Panel	(mm)	*		
Bus tie Panel	(mm)	*		
Bus Riser/Metering Panel	(mm)	*		
Panel Weight:				
Incoming Feeder Panel	(kgs.)	*		
Station Service Transformer feeder	(kgs.)	*		
Outgoing feeder	(kgs.)	*		
Bus tie Panel	(kgs.)	*		
Bus Riser/Metering Panel	(kgs.)	*		

6.0 TESTS

Optional or Special Test Requirements (if any)

'A'- SEC SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

7.0 DATA SCHEDULE

GAS INSULATED METAL CLAD MV SWITCHGEAR
(11, 13.8, 33 & 34.5KV)

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY SEC:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address		
Name and Signature of authorized Representative and date		
Official Seal/Stamp of the Company & Date		