

**Islamic Republic of Iran
Vice Presidency for Strategic Planning and Supervision**

**General Technical Specification and
Execution Procedures for Transmission
and Subtransmission Networks
Metalclad Switchgear at HV Substations**

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Technical Specification for Metal clad Switchgears



1- General Requirements

This specification covers the requirements for design, manufacture, factory testing, packing and marking of assembled switchgear of the metal clad type as well as all accessories necessary for proper operation.

The switchgear shall be complete ready for installation and containing circuit breaker, earthing switch, instrument transformers, protective relays, switches, auxiliary equipment, measuring and indicating devices, wiring, lights, heaters and etc. In some cases protection and control equipment is installed in a separate panel.

The metal clad switchgear and components shall be designed, manufactured and tested according to the following standards unless otherwise specified in this specification.

IEC 62271-200 AC metal enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.

IEC 62271-100 High voltage alternating current circuit- breakers

IEC 60044-1 Current transformers

IEC 60044-2 Voltage transformers

IEC 60694 Common specification for high voltage switchgears and controlgear standards

IEC 62271-102 High voltage alternating current disconnectors and earthing switch

IEC 60529 Degree of protection provided by enclosures (IP code)

ISO 1461 Hot dip galvanized coatings on fabricated articles- specifications and test methods

All amendments, supplements and reference publications listed in the following standards shall also apply.

Basic necessary data and ratings shall be as specified in MECL I.

2- General Specification

The switchgear shall be of the indoor, single busbar, totally enclosed, metalclad with drawout vacuum or SF₆ circuit breaker.

Metal clad switchgear and controlgear shall be designed so that normal service, fault, inspection and maintenance operations, including of phase sequence, earthing of connected cables, locating of cable faults, voltage tests on connected cables or other apparatus and elimination of dangerous electrostatic charges and ...can be carried out safely.

All components of the same rating and construction which may need to be replaced shall be interchangeable.

If there are removable parts with different ratings and if, parts are interchangeable within the assembly of metal – enclosed switchgear and controlgear, any possible combination of removable and fixed parts shall withstand the rated insulation level specified for the all parts of the metalclad switchgear concerned.

The various components contained within the enclosure shall subject to the individual specifications applying to them.

For main circuits with current limiting fuses, the manufacture of switchgear and controlgear may assign the fused short- circuit current.

Each arranged switchgear shall be suitable, and prepared for future extension on either sides and without any drilling, cutting or welding on the existing equipment.

The switchgear shall be of the self- supporting bolted construction, suitably subdivided into individual compartments, at least for busbars, circuit breaker, cable termination and low voltage equipment.

It is prime objective of purchaser to obtain switchgear that offers a maximum degree of safety for the operators and by-stands under all normal operating and fault conditions. In particular, it must be impossible to perform operations that lead to arcing faults. In addition, if arcing fault occurs, nevertheless, due to external reasons, the equipment must offered complete protection against injury for an operator who might happen to stand in from of the switchgear, or for other persons in the vicinity of the faulty equipment.

For protection and control circuit design, opening and closing operation and appropriate logic shall be considered. For measurement of SF₆ pressure, adequate equipment which installed in visible position shall be used.

Medium voltage circuit breakers shall manually operate from substation control system as well as medium voltage switchgear panel and earthing switches shall have position indicator in control panel.

To ensure safety during maintenance work, all parts of the main circuit to which access is required or provided shall be capable of being earthed prior to becoming accessible. This does not apply to withdrawable and removable parts which become accessible after being separated from the switchgear.

3- Medium Voltage Cubicles

The cubicles shall be so structured and segregated from each other as to prevent the spread of fire to other compartments of a cubicle or adjacent cubicles when so occur.

The frame of the switch-panels shall be constructed from steel angle sections of sufficient torsion strength, bolted together.

Unit type construction shall be used to form a rigid self-supporting, self-contained housing.

Enclosures shall be metallic. The steel sheets of the enclosure should bolted to the frame.

Metallic parts of the enclosures shall be designed to carry 30 A (dc) with a voltage drop of maximum 3V to the earthing point provided.

If the manufacturer states that it is necessary to stand or walk upon the switchgear or controlgear during operation or maintenance, the design shall be such that the relevant areas will support the weight of the operator without undue distortion and the equipment will remain suitable for its purpose. In such cases, those areas on the equipment where it is not safe to stand or walk for example, pressure relief flaps, shall be clearly identified.

Barriers of steel shall separate the individual compartments for busbars, C.B., cable termination, and L.V equipment. In addition mechanical stresses associated with commonly used shipping and handling gears may not result in measurable deformation to the cubicle.

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 finished with two coats of indoor paint suitable for the environmental conditions. All surfaces to be painted shall be clean and free from moisture at the time of painting. Paint coating shall be applied as soon as practicable after surface has been cleaned. Requirements for painting shall conform to the published standard by Tavanir entitled apparent paint of substations and transmission lines equipment in power industry and paint and coating of power industry equipment standards.

The busbar and the cable termination compartments shall be effectively sealed against the C.B. compartment to prevent the ingress of contamination vermin and ionized gases that could lead to a fault.

The low voltage equipment compartment shall be completely metal enclosed with separate front access door that is suitable for the installation of indicators, control and measuring devices. All low voltage wiring that required the connection of field cable shall be terminated on a freely accessible terminal strip inside the low voltage compartment. Wiring to the door-mounted equipment shall be run inside flexible conduit, suitably routed to prevent stressing of the conductors when opening the door to its extreme stop.

Covers and doors which are parts of the enclosure shall be metallic. Excepted are covers and doors that may be of insulating material, provided that HV parts are enclosed by metallic partitions and shutters intended to be earthed.

When cover and doors that are parts of the enclosure are closed, they shall provide the degree of protection specified for the enclosure.

Covers or doors shall not be made of woven wire mesh, expanded metal or similar.

Covers or doors should only be opened when the part of the main circuit contained in the compartment being made accessible is dead.

The cable connecting compartment shall provide sufficient space to terminate the specified or required type and number of conductors, including their shields, armor and cable head. Feeder cables shall enter the switchgear from below if not otherwise specified.

After installation of the cables, the bottom of the switchgear cubicles must be sealed by means of suitable plates.

The floor surface, even not metallic, may be considered as part of the enclosure. The measures to be taken in order to obtain the degree of protection provided by floor surfaces shall be subject to an agreement between manufacturer and user.

Manually operated and suitably interlocked grounding switches shall be installed in the cable termination area. Where the cable could be energized despite the breaker being open, there shall exist the make-proof grounding switches. All grounding switches shall have enough auxiliary switches for remote position signaling with at least 4 normally open contacts and 2 normally closed contacts, which wired to the terminal strip.

All parts of cubicle shall be easily accessible for inspection and repairing.

All panels shall be fitted with an interior light which is operated by a door switch, heater with thermostat and a 230 volt single phase socket.

Inspection windows shall provide the degree of protection specified for the enclosure.

They shall be covered by a transparent sheet of mechanical strength comparable to that of the enclosure. Precautions shall be taken to prevent the formation of dangerous electrostatic charges, either by clearance or by electrostatic shielding (for example a suitable earthed wire- mesh on the inside of the window).

The insulation between live parts of the main circuit and the inspection windows shall withstand the specified test voltages.

Ventilating openings and vent outlets shall be so arranged or shielded that the same degree of protection as that specified for the enclosure is obtained. Such openings may make use of wire mesh or the like provided that is of suitable mechanical strength.

Ventilating openings and vent outlets shall be arranged in such a way that gas or vapor escaping under pressure does not endanger the operator.

The cubicles shall have the following equipment:

- Drawout breaker equipped with anti-pumping and trip free features.
- Copper busbars, shielded automatically with shutters when breaker is racked out. These shutters shall prevent an operator to accidental reach live parts when the breaker module is withdrawn with the front door open. Padlock shall be provided to lock the shutter in closed position. It should be possible to open the shutter manually for contact inspection or testing of primary circuit.
- Manually operated earthing switch, suitably interlocked with the circuit breaker to prevent the switching of the live circuit to earth.
- Front mounted breaker control selector switch having “Trip-Neutral-Close” positions or “Stop-Neutral-Start” depending on the function of the switch.

- Mechanically operated breaker operation counter mounted inside cubicle.
- Thermostat controlled heater to prevent condensation.
- Current transformers
- Potential transformers
- Relays, mimic and devices for control.
- Adequate space for the installation of stress cones on the cable terminations.

Burden, accuracy class, ratio, number of cores of current and potential transformers and function of protective relays are shown on protection single line diagram.

Each circuit breaker cubicle shall have the following items front mounted on the cubicle:

- Circuit breaker position indicator.
- Test blocks for current transformer connections with automatic shorting bars.
- Local/Remote selector switch.
- Manual spring charging and manual close-open facility.
- Push button for lamp tests.
- Earthing switch indicator.
- Circuit breaker position indicator.

3-1- Earthing of the Enclosure

The frame of each switching device shall be provided with a reliable earthing terminal having a clamping screw or bolt for connection to an earthing conductor suitable for specified fault conditions. The diameter of the clamping screw or bolt shall be at least 12 mm. The connecting point shall be marked with "protective earth" symbol. Parts of metallic enclosures connected to the earthing system may be considered as an earthing conductor.

An earthing conductor shall be provided extending the whole length of the metal-enclosed switchgear and controlgear. The current density in the earthing conductor, if of copper, shall under the specified earth fault conditions not exceed 200 A/mm² for a rated duration of short circuit of 1 s, and 125 A/mm² for a rated duration of short circuit of 3 sec. However, its cross-section area shall be not less than 30 mm². It shall be terminated by an adequate terminal intended for connection to the earth system of the installation. If the earthing conductor is not made of copper, equivalent thermal and mechanical requirements shall be met.

In general, the continuity of the earth system shall be ensured taking into account the thermal and mechanical stresses caused by the current it may have to carry. The maximum value of earth fault currents depends upon the type of system neutral earthing employed and shall be indicated by the user.

Where earthing connections have to carry the full three-phase short-circuit current these connections shall be dimensioned accordingly.

The enclosure of each functional unit shall be connected to this earthing conductor. All the metallic parts intended to be earthed and not belonging to a main or auxiliary circuit, shall also be connected to the earthing conductor directly or through metallic structural parts.

For the interconnection within the functional unit, fastening by bolting or welding is acceptable for providing electrical continuity between the frame, covers, doors, partitions or other structural parts. Doors of the high-voltage compartments shall be connected to the frame by adequate means.

4- Circuit Breaker

Circuit breakers shall be withdrawable and interchangeable and vacuum or SF₆ type. Circuit breakers shall be re-striking free. The circuit breakers shall be complete with all linkages and wiring and all necessary accessories for proper operation.

Specification of circuit breakers used for capacitors switching shall conform to IEC 62271-100.

The primary isolating contacts shall be of silver plated, spring loaded, multi finger, self aligning type to ensure correct arrangement when the C.B is moved into the service position.

Operation mechanism shall keep its correct operation in longevity and need few maintenance.

All circuit breakers which have same rating shall identically arrange and interchangeability. Transient recovery voltage which record during tests shall not less than specified values in IEC 62271-100.

Circuit breakers interrupting chamber shall be from reputable manufacturer and withstand against interior pressure caused by remove the rated short circuit current.

All joints shall be absolutely leak proof. The frame or bases shall be fabricated of hot-dip galvanized structural steel. Bolts, nuts, washers, steel shapes, plates, etc. shall be galvanized in accordance with the requirements of ISO 1461.

The noise made by the circuit breaker, when opening or closing under all specified conditions shall be kept to a minimum.

When circuit breaker contacts in closed position the possibility of drawing out and in of circuit breaker shall not exist. When MV busbars is earthed for maintenance, the possibility of operation not exists.

Operation of the breaker shall be possible for testing purposes with the breaker in test position.

Circuit breaker shall not make from components which effected with deterioration and corrosion or chemical undesirable operation caused by arcing during closing or other conditions occur in service position. Chamber shall have adequately withstood against internal pressure during switching and provided with reduction pressure devices.

All insulators and enclosures shall be designed that there will be no stressing of any part due to temperature changes and adequate means shall be provided to accommodate the expansion of current carrying parts and conductors.

Proper outdoor insulation distance and creepage distance shall be provided for the satisfactory operation guarantee of circuit breaker under service position.

The circuit breakers design shall be such as to reduce the mechanical shocks to a minimum during operation in order to prevent inadvertent operation due to vibration or other reasons.

The circuit breakers shall be mechanically dimensioned for stress owing to short circuit forces, earthquake and operation.

The SF₆ gas which is used in SF₆ circuit breaker shall comply with IEC 61634.

5- Operating Mechanisms

The circuit breakers operating mechanism shall be of motor operated spring driven type.

Each circuit breaker shall be provided with a visual mechanical indicating device. It shall be positively driven in both directions to show whether the circuit breaker is in the “open” or “closed” position, and shall be operative when the circuit breaker is in the “isolated”, “service” and “earthed” locations. Lamp indication shall be provided in addition to a mechanical indicator.

The circuit breakers shall be suitable for remote closing and opening operation. A manually operated local trip pushbutton shall be provided as well.

The tripping mechanism shall be designed so that the circuit- breaker is free to open immediately, the tripping circuit is energized and without the use of any additional external power. Mechanism shall be “trip-free” and shall have an anti-pumping feature and shall be in accordance with IEC 62271-100. It is recognized that it may be necessary for contacts to close momentarily prior to opening to ensure satisfactory current interruption.

Working parts of the mechanism shall be corrosion resisting materials and all bearings which require grease shall be equipped with pressure type grease fittings, or shall be permanently lubricated.

Emergency hand operated charging device shall be supplied.

A contact shall be provided to initiate a “Circuit Breaker Inoperative” alarm if the operating spring is not recharged within a predetermined time.

Following provisions shall also be incorporated with the mechanism:

- Electrical closing facilities.
- Manual and electrical trip facilities.
- Electrical and mechanical trip free type mechanism.

- Plug and sockets for disconnecting control wiring on withdrawal.
- Control circuitry, relays and auxiliary contacts.
- Anti-pumping circuitry and controls.
- Inhibition of circuit breakers operation inside cubicle when busbars are earthed for maintenance.
- Charge or discharge indicator of spring mechanism

Access door and local-remote switches shall be equipped with locking facilities.

Circuit breaker and its associated earth switch shall be provided with auxiliary switches having sufficient NO/NC contacts for proper operation of switch gear regarding control, indication, interlocking and alarm.

Sliding earthing contacts shall be provided to ensure earthing of withdraw able parts.

Mechanism shall be rigid, strong, positive and fast, and shall not have objectionable rebound or require critical adjustment. The mechanism and breaker shall be such that the failure of any spring will not prevent tripping and will not cause tripping or closing.

6- Interlock System

Interlocks between different components of the equipment are provided for reasons of safety and for convenience of operation. These interlocks shall be agreed upon manufacturer and user.

The interlocking system must positively prevent operator from reaching or creating unintentionally a dangerous or potentially dangerous condition.

The withdrawable part can only be moved from the disconnected position to the service position if the low voltage connection is plugged in.

The C.B. can only be operated when the withdrawable part is properly in the test or service position.

The withdrawable part can only be moved from the test position to the service position and vice versa if the C.B. is off.

When the withdrawable part is in service position, the low voltage plug socket can not be removed.

The withdrawable part can not be moved from the test position to the service position if the earthing switch is closed.

The earthing switch can only be closed when the withdrawable part is properly in the disconnected position.

When the manual emergency handle for the breaker is used it shall be impossible to charge the spring electrically.

Auxiliary contactors shall be provided only where the circuit requirement cannot be met by the auxiliary switch arrangements and multiple contactors and relays will not be accepted in lieu of auxiliary switches except as specifically approved by the Engineer.

Contactor coils shall be insulated and rated in accordance with this specification and in particular shall be capable of operation within the same voltage limits as specified for the associated circuit breaker close and trip coils. Two close and trip coils for circuit breaker in tertiary winding of power transformer shall be used.

The connection of all auxiliary switches, including spares, and contactors as well as the associated coil connections and interconnections between auxiliary switches, shall be wired to a terminal board located in the operating cubicle or other approved position.

Auxiliary switches and contactors shall be mounted in suitable accessible position. Which is recognizable in main operating mechanism, but additional mechanical connections shall be minimum and to be placed in a weather resistant box. Where adjustable linkages are provided to facilitate the timing of the auxiliary switches with respect to the main equipment, approved locking devices shall be fitted.

Auxiliary switch contacts shall be positively operated, made with a wiping action and where necessary, discharge resistors shall be provided to prevent arcing when breaking inductive circuits.

The provision of additional or alternative interlocks shall be subject to agreement between manufacturer and user. The manufacturer shall give all necessary information on the character and function of interlocks.

It is recommended that earthing switches having a short-circuit making capacity less than the rated peak withstand current of the circuit should be interlocked with the associated disconnections.

Apparatus installed in main circuits, the incorrect operation of which can cause damage or which are used for assuring isolating distances during maintenance work, shall be provided with locking facilities.

The following provisions are mandatory for main circuits:

- Metal –enclosed switchgear and controlgear with removable parts

The interlock shall prevent the closing of the circuit-breaker, switch or contactor in the service position unless any auxiliary circuits associated with the automatic opening of these devices are connected. Conversely, it shall prevent the disconnection of the auxiliary circuits with the circuit-breaker closed in the service position.

- Metal-enclosed switchgear and controlgear provided with disconnectors

Interlocks shall be provided to prevent operation of disconnectors interlocks under conditions other than those for which they are intended. The operation of a disconnector shall be prevented unless the circuit-breaker, switch or contactor in the open position. The operation of the circuit-breaker, switch or contactor shall be prevented unless the associated disconnector is in the closed, open or earthing position.

The provision of additional or alternative interlocks shall be subject to agreement between manufacturer and user. The manufacturer shall give all necessary information on the character and function of interlocks.

Earthing switches having a rated short-circuit making capacity less than the rated peak withstand current of the main circuit should be interlocked with the associated disconnectors.

Apparatus installed in main circuits, the incorrect operation of which can cause damage or which are used for securing isolation distances during maintenance work, shall be provided with locking facilities (for example, provision for padlocks).

If non-mechanical interlocks are provided, the design shall be such that no improper situations can occur in case of lack of auxiliary supply. However, for emergency control, the manufacturer may provide additional means for manual operation without interlocking facilities. In such case, the manufacturer shall clearly identify this facility and define the procedures for operation.

7- Current Transformers

Current transformers shall be dry type and shall be designed in proper size for installation in metalclad switchgear and shall have high mechanical and electrical strength and high resistance to arcing and temperature changes.

Each winding shall have an output as mentioned in this technical specification and shall be electrically separated from the other windings.

Primary terminals shall be of proper material and equipped with connection screws of appropriate size. Primary winding may be made single turn or multi-turn.

Where dual purpose current transformers are used for both measurement and protection, the requirements shall be met for all secondary winding being connected to their max burdens simultaneously and leads up to twenty times nominal rating without saturation, plus margin to allow for D.C. offset.

Low voltage terminals shall be covered with appropriate transparent cover which is tightened and sealed to the transformer body and base plate shall be equipped with enough cable glands for cables. An earth terminal shall be provided and marked with symbol beside the secondary terminals.

All current transformers shall be of multi ratio type with tapping on secondary winding. Main ratio is given in MECL (I). Rated secondary current shall be 1 amp.

All Components exposed to corrosion shall be made by non-corrosive material, or be hot-galvanized to thickness as specified in ISO 1461.

The current transformer set shall be fixed on the base plate with adequate mechanical strength. An earth terminal shall be provided for earth connection.

Current transformers should be maintenance free.

The current transformer shall be suitable for mounting in any desired position using four screws.
Current transformers secondary circuits shall be terminated on test links.

8- Potential Transformers

Potential transformers shall be inductive wound type and proper size for installation in metal clad switchgear and shall have high mechanical and electrical strength and high resistance to arcing and temperature changes.

The potential transformer set shall be fixed on a base plate with adequate mechanical strength and shall be suitable for mounting in any desired position, using four screws.

For potential transformers which have two separate windings for measuring and protection, each winding should fulfill its respective accuracy requirement within its output range, whilst at the same time the other winding has an output of any value from zero up to 100% of upper limit of its output range.

All components exposed to corrosion shall be made by non-corrosive material, or be hot-galvanized to thickness as specified in ISO 1461.

Each secondary winding for measuring and protection shall be electrically separated from the other winding. Each winding shall have an output which is suitable for the correct operation of related protection and measuring devices and instruments over the required range of load.

Adequately rated MCB/Fuse shall be provided in the secondary and primary circuits. Where potential transformers are of withdrawable type, plug-in contacts shall be used and provisions shall be made for locking them in the service or withdrawn position.

Provision shall be made to proper personnel for coming in contact with the potential transformers primary fuses until the primary disconnecting devices have separated by a safe distance and are properly grounded. Potential transformers shall be equipped with test links on the secondary side.

Primary and secondary terminals shall be of proper material and equipped with connection screws of appropriate size. Low voltage terminals shall be covered with appropriate transparent cover which is tightened and sealed to the transformer body and base plate and shall be equipped with enough cable gland for cables.

Potential transformers should be maintenance free.

9- Busbars

Main busbars shall be copper and insulated with flame retardant thermo fit insulation. Also busbars shall be complete with insulated supports. All busbar joints shall be silver plated.

The busbars shall be adequately supported against short-circuit forces and provision shall be made to allow for thermal expansion of them due to normal load currents and short-circuit currents.

The busbars shall be contained in a separate compartment within the general casing of the switchgear.

Door relevant to busbar and incomings shall be so designed to operate automatically and certainly when circuit breakers in disconnected or removed position close and shall be IP20 according to IEC 62271-200.

All the shutters on each equipment shall operate simultaneously and means shall be provided for each set to be locked independently of the other. The shutters shall form reasonably dust, drip, fire and insect proof enclosures.

Busbar orifice shutters shall be painted signal red clearly labeled "BUSBAR" in white letters. Circuit orifice shutters shall be painted bright yellow.

Busbars shall be color coded in red, yellow and blue.

A copper ground bus with 3mm×40mm cross section shall be extended along the length of each panel.

Clamp type connectors shall be provided for directly connecting together the earth bus of adjacent panels.

The ground bus shall be so arranged that it does not interfere with the removal of any panel from panel assembly or with the access to or operation of equipment mounted within a panel.

10- Wiring and Connection

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

- Panel wiring – wiring external to panels excluding current transformer circuits 2.5mm²
- Current transformer secondary wiring 4 mm²

The incoming control power supply to each panel shall be through "MCB" in such a manner that the supply to any one panel can be isolated from the remaining panels.

The DC trip and AC 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. Provision shall be made to prevent closing of the breaker if the dc tripping source is not available.

Wiring in panels shall be covered with a flame resistant cotton braid. All wiring shall be carried out without intermediate splicing.

The color of the cubicle wiring shall preferably be different for AC and DC circuit. All cubicle and control wiring shall conform to the following color code:

- Red, yellow, Blue: phase connections
- Black: A.C. neutral

- 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 ground armored shield.

Tripping circuit supervision shall be included.

Wire ends shall be fitted with crimped rung type terminals. Not more than two wires shall be terminated on any stud or terminal.

Each terminal point on the terminal block shall be indelibly labeled in accordance with wiring designations.

11- Temperature Rise

The temperature rise of any part of switchgear at an ambient air temperature not exceeding 40 °C shall not exceed the temperature – rise limits specified in table 1 under the nominal conditions.

The temperature rise of parts which are not covered in table 1, shall not exceeding of the mentioned value in their relevant standards.

Maximum permissible value of temperature and temperature rise of the busbars shall be assume equal to the specified values for contacts, connections and metal parts connected to insulating parts.

Temperature rise for accessible enclosure shall not exceed 30 °C.

For enclosure which is accessible but not necessary to touch them in normal operation, the range of temperature rise can be add with 10 °C.

Table 1: limits of temperature and temperature rise for various parts, materials and dielectrics of high- voltage switchgear

Nature of the part, of the material and of the dielectric (See points 1,2 and 3)	Maximum value	
	Temperature °C	Temperature rise at ambient air temperature not exceeding 40 °C K
1- Contacts (see point 4)		
1-1- Bare- copper or bare- copper alloy	75	35
1-2- Silver – coated or nickel – coated (see point 5)	105	65
1-3- Tin- coated (see point 5)	90	50
2- Connection, bolted or the equivalent (see point 4)		
2-1- Bare- copper, bare – copper alloy or bare- aluminum alloy	90	50
2-2- Silver – coated or nickel – coated (see point 5)	115	75
2-3- Tin- coated	105	65
3- All other contacts or connection made of bare metals or coated with other materials	(see point 6)	(see point 6)
4- Terminals for the connection to external conductors by screws or bolts (see point 7)		
- bare	90	50
- silver, nickel or tin- coated	105	65
- other coatings	(see point 6)	(see point 6)
5- Metal parts acting as springs	(see point 8)	(see point 8)
6- Materials used as insulation and metal parts in contact with insulation of the following classes (see point 9)		
-Y	90	50
-A	105	65
-E	120	80
-B	130	90
-F	155	115
-Enamel: oil base	100	60
synthetic	120	80
- H	180	140
- C other insulating material	(see point 10)	(see point 10)
7- Any part of metal or of insulating material in contact with oil, except contacts	100	60
8- Oil for oil switching devices	90	50
9- Accessible parts		
- expected to be touched in normal operation	70	30
- which need not to be touched in normal operation	80	40

The following points are referred to in table 1 and complete it.

Point 1 According to its function, the same part may belong to several categories as listed in table 1. In this case the permissible maximum values of temperature and temperature rise to be considered are the lowest among the relevant categories.

Point 2 For vacuum switching devices, the values of temperature and temperature-rise limits are not applicable for parts in vacuum. The remaining parts shall not exceed the values of temperature and temperature rise given in table 1.

Point 3 Care shall be taken to ensure that no damage is caused to the surrounding insulating materials.

Point 4 When engaging parts have different coatings or one part is of bare material, the permissible temperatures and temperature rises shall be:

a) For contacts, those of the surface material having the lowest value permitted in item 1 of table 1.

b) For connections, those of the surface material having the highest value permitted in item 2 of table 1.

Point 5 The quality of the coated contacts shall be such that a continuous layer of coating material remains in the contact area:

a) after making and breaking test (if any) :

b) after short –time withstand current test :

c) after the mechanical endurance test :

Otherwise, the contacts shall be regarded as "bare".

Point 6 When materials other than those given in table 1 are used, their properties shall be considered, notably in order to determine the maximum permissible temperature rises.

Point 7 The values of temperature and temperature rise are valid even if the conductor connected to the terminals is bare.

Point 8 The temperature shall not reach a value where the elasticity of the material is impaired.

Point 9 Classes of insulation materials are those given in IEC 60085.

Point 10 Limited only by the requirement not to cause any damage to surrounding parts.

12- Terminals

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.

Each terminal shall have terminal number.

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 AC circuit of greater than 220 volts. Terminal blocks shall not be used as junction points for cables which are not required in the panel.

13- Partitions and Shutters

Partitions and shutters shall provide the specified degree of protection.

Partitions and shutters made of insulating material shall meet the following requirements:

- The insulation between live parts of the main circuit and the accessible surface of insulating partitions and shutters shall withstand the specified test voltages.
- The insulation between live parts of the main circuit and the inner surface of insulation partitions and shutters facing these shall withstand at least 150% of the rated voltage of the equipment.
- If a leakage current may reach the accessible side of the insulating portions and shutters by a continuous path over insulating surfaces or by a path broken only by small gaps of gas or liquid, it shall be not greater than 0.5 mA under the specified test conditions.

Openings in the enclosure of metal-enclosed switchgear and controlgear and in the partitions of metalclad or compartmented switchgear and controlgear through which contacts of removable parts engage fixed contacts shall be provided with automatic shutters properly operated in normal service operations to assure the protection of persons in any of the defined positions.

If maintenance requirements imply that one set of fixed contacts shall be accessible through opened shutters, all the shutters shall be provided with means of locking them independently in the closed position or it shall be possible to insert a screen to prevent the live set of the fixed contacts being exposed. Conductors passing through metallic partitions are insulated by bushings or other equivalent means and the opening may be provided by bushings or shutters having non-metallic parts. Bushing shall comply with IEC 60137.

Partitions of metalclad switchgear and controlgear shall be metallic and earthed.

If partitions and shutters become part of the enclosure they shall be metallic, earthed and provide the degree of protection specified for the enclosure.

14- Earthing Switches

For earthing incoming or outgoing feeders of the switchgear, earthing switches shall be used. This equipment shall conform to IEC 62271-102.

The requirement that it shall be possible to know the operating position of the disconnect or earthing switch is met if one of the following conditions is fulfilled:

- The isolating distance is visible;
- The position of the withdrawable part, in relation to the fixed part, is clearly visible and the positions corresponding to "full connection" and "full isolation" are clearly identified.
- The position of the disconnect or earthing switch is indicated by a reliable indicating device.

Any removable part shall be so attached to the fixed part that its contacts will not open inadvertently due to forces which may occur in service, in particular those due to a short circuit.

15- Auxiliary Equipment

Auxiliary circuits shall conform to the followings:

- Rated continuous current: 10 A, with temperature rise lower than specified range in table 1.
- Rated short – time withstand current: 100 A for 30 msec.
- Rated insulation level: shall passed relevant tests.

Auxiliary and control contacts shall be suitable for their intended duty in terms of environmental conditions, making and breaking capacity and timing of the operation of the auxiliary and control contacts in reaction to the operation of the main equipment. These contacts shall be able to making and breaking in minimum 2 A under 220 V d.c. with minimum time constant 20 msec.

Auxiliary switches shall be suitable for the number of electrical and mechanical operation cycles specified for the switching device.

The number of free auxiliary and pilot switching contacts shall be specified to the manufacture. Auxiliary switches, which are operated in conjunction with the main contacts, shall be positively driven in both directions. Auxiliary and control equipment and its circuits except short wires in instrument transformer terminals, trip coils, auxiliary contacts and ... shall be separated from the main circuit by disconnect.

Auxiliary equipment which is required for attention in service shall be accessible without hazard of direct connection to the HV parts.

Auxiliary and control circuit components shall comply with the related IEC standards.

16- Operation of Releases

The operation limits of releases shall be as follows:

16-1- Shunt Closing Release

A shunt closing release shall operate correctly between 85% and 110% of the rated supply voltage of the closing device. The frequency, in the case of a.c., being the rated supply frequency of the closing device.

16-2- Shunt Opening Release

A shunt opening release shall operate correctly under all operating conditions of the switching device up to its rated short-circuit breaking current, and between 70% in the case of d.c. – or 85% in the case of a.c.- and 110% of the rated supply voltage of the opening device. The frequency, in the case of a.c., being the rated supply frequency of the opening device.

16-3- Capacitor Operation of Shunt Releases

When, for stored energy operation of a shunt release, a rectifier-capacitor combination is provided as an integral part of the switching device, the charge of the capacitors to be derived from the voltage of the main circuit, the capacitors shall retain a charge sufficient for satisfactory operation of the release 5 s after the voltage supply has been disconnected from the terminals of the combination and replaced by a short-circuiting link. The voltage of the main circuit before disconnection shall be taken as the lowest voltage of the system associated with the rated voltage of the switching device.

16-4- Under Voltage Release

An under-voltage release shall operate to open the switching device when the voltage at the terminals of the release falls below 35% of its rated voltage, even if the fall is slow and gradual. On the other hand, it shall not operate the switching device when the voltage at its terminals exceeds 70% of its rated supply voltage.

The closing of the switching device shall be possible when the values of the voltage at the terminals of the release are equal to or higher than 85% of its rated voltage. Its closing shall be impossible when the voltage at the terminals is lower than 35% of its rated supply voltage.

17- Nameplates

Nameplates shall be provided with abraided mica. They shall be the same color as the panel with black engraving.

The dimension of nameplate shall be $25 \times 125 \text{ mm}^2$ and be placed on the front and rear of each panel.

Nameplates shall be placed on the front of each panel for indicating lamps, push buttons and control switches with approximate $15 \times 60 \text{ mm}^2$ dimensions. Thickness of writing on this metalclad switchgear shall be 4 mm.

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 mm below indicating lights, control switches and push buttons.

All nameplates shall be fixed and secured with brass or steel screws which have received a rust preventive treatment.

Nameplates shall contain the information in accordance with table 2.

Table 2: Nameplate information

	Abbreviation	Unit	**	Condition: marking only required if
(1)	(2)	(3)	(4)	(5)
Manufacture			X	
Type designation			X	
Serial number			X	
Instruction book reference			X	
Year of manufacture			X	
Applicable standard			X	
Rated voltage	U_r	kV	X	
Rated frequency	f_r	Hz	X	
Rated lightning impulse withstand voltage	U_p	kV	X	
Rated power frequency withstand voltage	U_d	kV	X	
Rated normal current	I_r	A	X	
Rated short- time withstand current (for main and earthing circuits)	I_k	kA	X	
Rated peak withstand current (for main and earthing circuits)	I_P	kA	Y	Different from 2.5 for 50 Hz
Rated duration of short circuit (for main and earthing circuits)	t_k	s	X	
Rated filling level for insulation	p_{re}	Pa or kg	(X)	
Alarm level for insulation	p_{ae}	Pa or kg	(X)	
Minimum functional level for insulation	p_{me}	Pa or kg	(X)	
Insulating fluid and mass		kg	(X)	
Internal arc classification	IAC		(X)	
Accessibility type (code)		A(F,L,R), B(F,L,R) or C	(X)	
Arc test current		kA	(X)	
Arc test current duration		s	(X)	
(**)X= the marking of these values is mandatory; (X) = the marking of these values is as applicable; Y= conditions for marking of these values are given in column 5.				
NOTE 1 The abbreviation in column (2) may be used instead of the terms in column (1).				
NOTE 2 When terms in column (1) are used, the word "rated" need not appear.				

18- Accessories

Accessories shall be included with the switchgear as they are required to properly operated and maintain the equipment. Manufacturer shall provide permanent accessibility to required spare parts for the purpose of maintenance for the minimum period of 10 years from the time of preparation of metalclad switchgear. As a minimum, the following must be provided:

- Handle for manual charging of spring
- One release device for shutters
- Handle for switch earthing
- Facilities for operation test of C.B. outside of cubicle.
- Two sets of lubricants
- Two sets of matching-paint for touch paint

19- Tests

The following tests shall be performed on metalclad switchgear in accordance with 62271-200.

19-1- Type Test

- Tests to verify the insulation level of the equipment
- Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of circuits
- Tests to prove the capability of the main and earthing circuits to be subjected to the rated peak and rated short-time withstand currents
- Tests to prove making and breaking capacity of the included switching devices
- Tests to verify the protection of persons against access to hazardous parts and the protection of equipment against solid foreign objects
- Test to access the effects of arcing due to an internal fault (for switchgear classification IAC)
- Electromagnetic compatibility tests (EMC)

Despite of mentioned tests, the following tests shall be performed on interior component of metalclad switchgear in accordance with IEC 62271-100, 60044-1 and 60044-2.

- Mechanical and environmental tests on circuit breaker including mechanical operation tests in ambient temperature and higher and lower temperature tests.
- Resistance temperature of circuit breaker contacts
- Capacitive current switching tests including single capacitor bank and back-to-back capacitor bank
- Accuracy tests for instrument transformers
- Other equipment shall test in accordance with relevant IEC

19-2- Routine Tests

According to IEC 62271-200 following tests shall be carried out on metalclad switchgear components:

- Mechanical operation tests
- Tests of auxiliary electrical , pneumatic and hydraulic devices
- Tests after erection on site

In spite of aforesaid tests, following tests shall be performed on metalclad switchgear

- Resistance measurement of circuit breaker contacts and lightning impulse test in accordance with IEC 62271-100
- Accuracy test on instrument transformers
- Routine tests on other equipments in accordance with relevant standards

20- Commissioning

After a metalclad switchgear has been installed and all connections have been completed, commissioning tests are recommended to be performed to confirm that transportation and storage have not damaged the metalclad switchgear.

The manufacturer shall produce a program of site commissioning checks and tests. Repetition of the full program of routine tests, already performed in the factory, shall be avoided. For this purpose the commissioning tests shall include, but not limited to the following items. The results of the tests shall be recorded in a test report.

- Visual inspection and assurance of erection, correct installation, lack of damaging and electrical connections correctness.
- Assurance of direct connection existence of metal body to ground network.
- Visual inspection of inner components of switchgear, assurance of damaging lack and control of electrical connections.
- Insulation resistance test with megger.
- Control of high voltage phase consequences.
- Operation test and circuit breaker adjustment.
- Operation test of mechanical and electrical interlocks.
- Operation test of explosion valve and relevant interlocks.
- Current transformer test.
- Voltage transformer test.
- Not being short circuit of CT secondary is in connection and being short circuit of CT secondary is not in connection.
- Test and adjustment of measurement apparatus.
- Operation test of alarming and indicating devices.
- Test of cells ventilation.

21- Drawings & Documents

21-1- Documents to be given by tenderer

- Filled schedule MECL (II)
- Catalogue & technical pamphlets
- Summary of type test reports
- Outline drawing
- Detailed summary of exceptions to tender specifications
- List of spare parts
- Reference list of switchgear and main components
- List of special tools

21-2- Documents to be given by contractor /supplier

The electrical and mechanical design, fabrication, factory testing, working and packing, transportation, erection, site test, operation and maintenance drawings, documents and manuals shall be submitted not limited to the following:

- Design calculation sheets to establish adequacy of metalclad switchgear in any respect;
- Outline dimension and cut away drawings
- Packing details
- Shipping, warehousing, assembling, erection, commissioning, operating and maintenance instruction manuals.
- Name plate drawings
- Control and wiring diagrams
- Operation mechanism drawings
- Site test instruction manuals
- Routine test documents
- List of components
- Type test documents
- Work schedules and monthly progress report
- Drawing list
- Final as built Doc./Dwg.
- Dismantling, reassembling & adjusting manuals

SCHEDULE MECL (I)
RATING AND CHARACTERISTICS OF METAL CLAD SWITCHGEAR AND COMPONENTS

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
1	Particulars of system	
1-1	Nominal system voltage kV	20/33
1-2	Highest system voltage kV	24/36
1-3	Nominal system frequency Hz	50
1-4	System neutral earthing	Non effectively earthed
1-5	Nominal short circuit current kA _{rms}	16/20/25/31.5
1-6	Number of phases	3
2	Service condition	
2-1	Max. Ambient temperature C°	40/45/50/55
2-2	Min. Ambient temperature C°	-40/-35/-30/-25
2-3	Average value of daily temperature C°	*
2-4	Solar radiation W/m ²	*
2-5	Altitude above sea level m	1000/1500/2000/2500
2-6	Pollution level	Low/medium/high/Very high/special
2-7	Max. wind velocity m/s	30/40/45
2-8	Wind velocity at ice condition m/s	20
2-9	Ice coating thickness mm	5/10/20/25
2-10	Seismic acceleration m/s ²	0.2g/0.25g/0.3g/0.35g
2-11	Relative humidity %	90/95/more than 95
3	Metalclad switchgear	
3-1	Rated voltage kV	24/36
3-2	Rated frequency Hz	50
3-3	Rated insulation levels	
3-3-1	Lightning impulse withstand voltage kV _{peak}	*
3-3-2	1 min. power frequency withstand voltage kV	*
3-4	Rated normal currents (at standard conditions)	
3-4-1	Bus-bar A	*
3-4-2	Transformer feeder circuit A	In accordance with power of the transformer
3-4-3	Capacitor bank feeder circuit A	In accordance with capacity of capacitor bank
3-4-4	Outgoing feeder circuit A	*

SCHEDULE MECL (I)
RATING AND CHARACTERISTICS OF METALCLAD SWITCHGEAR AND COMPONENTS

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
3-5	Minimum rated short time withstand current kA	*
3-6	Rated duration of short circuit sec	1
3-7	Min rated peak withstand current kA _{peak}	*
3-8	Allowable temperature rise °C	*
3-9	Degree of protection	IP4X
3-10	Finishing color (outside/inside)	RAL 7035/ Enamel white /RAL 7032
3-11	Indoor or outdoor installation	Indoor
4	Auxiliary voltages	
4-1	Motor of circuit breaker VDC	110/125
4-2	Heaters and lights V AC	230
4-3	Control circuits V DC	110/125
5	Power circuit breaker	
5-1	Class (fix or draw-out)	Draw-out
5-2	Type	SF6/vacuum
5-3	Number of trip/close coils	1/1(2)
5-4	Rated normal current at standard conditions A	*
5-5	Minimum rated short circuit breaking current kA	*
5-6	Minimum rated short circuit making current kA _{peak}	*
5-7	Rated cable charging breaking current A	*
5-8	Operating counter is required Yes/No	Yes
5-9	First pole to clear factor	1.5
6	Current transformers	
6-1	Type	Dry. With epoxy resin
6-2	Rated primary current A	*
6-3	Rated secondary current A	1/5
6-4	Rated continuous thermal current (% of rated primary current) %	120
6-5	Number of secondary cores	
6-5-1	For metering	*
6-5-2	For protection	*

SCHEDULE MECL (I)
RATING AND CHARACTERISTICS OF METAL CLAD SWITCHGEAR AND COMPONENTS

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
6-6	Accuracy class:	
6-6-1	For metering	0.5
6-6-2	For protection	10P/5P
6-7	Burden:	
6-7-1	For metering VA	20/30
6-7-2	For protection VA	20/30
7	Voltage transformer	
7-1	Type	Dry with Epoxy resin
7-2	Rated primary voltage kV	$20/\sqrt{3} / 33/\sqrt{3}$
7-3	Rated secondary voltage V	$110/\sqrt{3} / 100/\sqrt{3}$
7-4	Number of secondary windings	
7-4-1	Incoming feeder	*
7-4-2	Bus-bar	*
7-5	Accuracy class	0.5+3P
7-6	Rated output VA	50
7-7	Temperature rise limit at site condition °C	Acc. to substation condition
8	Earth switch	
8-1	Rated voltage kV	20/33
8-2	Fault current kA	*

* These will be specified by engineer.

SCHEDULE MECL (II)
GURANTEED TECHNICAL INFORMATION OF METAL CLAD SWITCHGEAR
(TO BE SUPPLIEED WITH TENDER)

ITEM	DESCRIPTION	Technical particular:
1	Applicable site & ambient condition	
1-1	Max. design ambient temperature	C°
1-2	Min. design ambient temperature	C°
1-3	Average value of daily temperature	C°
1-4	Solar radiation	W/m ²
1-5	Design altitude above sea level	m
1-6	Pollution level	
1-7	Max. permissible ice thickness	mm
1-8	Design seismic acceleration	m/s ²
1-9	Max. permissible wind velocity	m/s
1-10	Documents (test reports/ outline drawings/ catalogues/ maintenance & installation manuals/ reference list/ list of spare parts)	
2	Metalclad switchgear	
2-1	Manufacturer	
2-2	Indoor or outdoor	
2-3	Dimensions	m×m×m
2-4	Weight	kg
2-5	RAL color	
2-6	Number of phases	
2-7	Number of busbars	
2-8	Rated voltage	kV
2-9	Rated insulation level:	
2-9-1	Power frequency withstand voltage	kV
2-9-2	Lightning impulse withstand voltage	kV _{Peak}
2-10	Rated currents	A
2-11	Rated short time withstand current	kA
2-12	Rated duration of short circuit	Sec
2-13	Rated peak withstand current	kA _{peak}
2-14	Rated current of busbar	A
2-15	Rated current of incoming feeder circuit	A
2-16	Rated current of outgoing feeder circuit	A
2-17	Rated current of capacitor feeder circuit	A
2-18	Rated current of bus coupler	A

SCHEDULE MECL (II)
GURANTEED TECHNICAL INFORMATION OF METALCLAD SWITCHGEAR
(TO BE SUPPLIEED WITH TENDER)

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
2-19	Degree of protection	
2-19-2	Between LV and HV compartments	
2-19-3	Between HV compartments	
2-20	Min. clearances (ph to earth/ph to ph)	mm/mm
3	CIRCUIT BREAKER	
3-1	Manufacturer	
3-2	Type (Vacuum/ SF ₆)	
3-3	Number of trip coil	
3-4	Number of closing coil	
3-5	Applicable standard	
3-6	Min. clearances (ph to ph /ph to earth)	mm/mm
3-7	Rated voltage	kV
3-8	Insulation level	
3-8-1	Rated lightning impulse withstand voltage	kV _{peak}
3-8-2	Rated power frequency withstand voltage	kV
3-9	Rated normal current	A
3-10	Short time withstand rated current	kA
3-11	Rated short circuit	kA
3-12	Breaking current (asymmetric)	%
3-13	Allowable temperature rise	°C
3-14	Rated short circuit breaking current	kA _{rms}
3-15	Rated single capacitor bank breaking current	A
3-16	Rated back- to-back capacitor bank breaking time	A
3-17	Rated capacitor bank breaking inrush current	A
3-18	Max. over voltage factor of breaking capacitive current	
3-19	First-pole-to-clear factor	
3-20	Rated operating sequence	
3-21	Break time	ms
3-22	Make time:	
3-22-1	No load	ms
3-22-2	In 100% of rated current	ms
3-23	No. of operating cycle permissible before inspection and maintenance of contacts and other essential parts:	
3-23-1	At 50% rated current	
3-23-2	At 100% rated current	

SCHEDULE MECL (II)
GURANTEED TECHNICAL INFORMATION OF METALCLAD SWITCHGEAR
(TO BE SUPPLIEED WITH TENDER)

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
3-23-3	At 50% short circuit breaking current	
3-23-4	At 100% short circuit breaking current	
3-24	Mechanical working life of interrupter (number of CO)	
3-25	No. of switching operation that after those is recommended investigate the mechanism	
3-26	No. of years that the vacuum condition can be maintained	Year
3-27	Operating mechanism:	
3-27-1	Type of mechanism	
3-27-2	Motor voltage	V
3-27-3	Motor power demand	W
3-27-4	Locked rotor and max. running current required by motor at rated voltage	A
3-27-5	Heater voltage / Power demand	V/W
3-27-6	Closing control current	A
3-27-7	Closing control voltage	V
3-27-8	Opening control current	A
3-27-9	Opening control voltage	V
2-27-10	Time required by the motor to charge the spring completely	Sec
3-28	Auxiliary switches:	
3-28-1	No. of normally opened contacts	
3-28-2	No. of normally closed contacts	
3-28-3	Voltage rating	V(dc)
3-28-4	Continuous current rating	A(dc)
3-29	SF ₆ gas characteristics:	
3-29-1	Nominal service gas pressure	bar(abs)
3-29-2	Gas refill alarm pressure	bar(abs)
3-29-3	Max. leakage of gas per circuit breakers	%
3-29-4	List of special tools and equipment required for commissioning and maintenance	
3-29-5	Company name of gas provider	
3-30	Weight and dimensions:	
3-30-1	Overall length	mm
3-30-2	Overall width	mm
3-30-3	Overall height	mm
3-30-4	Max. shipping dimension	m×m×m
3-30-5	Total weight of complete circuit breaker	kg
3-30-6	Max. shipping weight	kg

SCHEDULE MECL (II)
GURANTEED TECHNICAL INFORMATION OF METAL CLAD SWITCHGEAR
(TO BE SUPPLIEED WITH TENDER)

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
4	CURRENT TRANSFORMERS	
4-1	Manufacturer	
4-2	Type designation	
4-3	Class	
4-4	Type of insulation	
4-5	Insulation level	
4-5-1	Rated lightning impulse withstand voltage	kV _{peak}
4-5-2	Power frequency withstand voltage	kV
4-6	Rated primary current	A
4-7	Rated secondary current	A
4-8	Rated ratio	
4-9	Changing ratio from secondary is required	
4-9-1	For measuring	Yes/No
4-9-2	For protection	Yes/ No
4-10	Rated short time current for 1 sec	kA
4-11	Rated dynamic current	kA _{Peak}
4-12	Rated continuous thermal current (% of rated primary current)	%
4-13	Number of secondary cores:	
4-13-1	For measuring	
4-13-2	For protection	
4-14	Accuracy class:	
4-14-1	For measuring	
4-14-2	For protection	
4-15	Burden at rated output	
4-15-1	For measuring	VA
4-15-2	For protection	VA
4-16	Secondary winding resistance in 75 °C	
4-16-1	For measuring	Ω
4-16-2	For protection	Ω
4-17	Temperature rise at rated continuous thermal	°C
4-18	Terminal type and material	
5	VOLTAGE TRANSFORMERS	
5-1	Manufacturer	
5-2	Type designation	
5-3	Class	

SCHEDULE MECL (II)
GURANTEED TECHNICAL INFORMATION OF METAL CLAD SWITCHGEAR
(TO BE SUPPLIEED WITH TENDER)

ITEM	DESCRIPTION	TECHNICAL PARTICULARS
5-4	Rated primary voltage	kV _{rms}
5-5	Rated secondary voltage	V _{rms}
5-6	Rated frequency	Hz
5-7	Insulation level	
5-7-1	Rated lightning impulse withstand voltage	kV _{peak}
5-7-2	Rated power frequency withstand voltage	kV _{rms}
5-8	Ratio	
5-9	No. of secondary winding	
5-10	Accuracy class	
5-11	Rated burden	VA
5-12	Allowable time of fault in secondary while voltage rest in primary	Sec
5-13	Temperature rise at rated continuous thermal current	°C
5-14	Power frequency withstand voltage in primary winding	kV _{rms}
5-15	Weight and dimensions:	
5-15-1	Overall dimension	mm×mm×mm
5-15-2	Total weight of a signal ph.	kg
6	Earth switch	
6-1	Type of installation	
6-2	Rated making fault current	