

GES 34710



Technical Specification of GECOL

Low Voltage Switchgear and Controlgear Assembly for Distribution Stations

(Revision history)

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General Electricity Company of Libya

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GES (Technical Specification of GECOL)

Low Voltage Switchgear and Controlgear Assembly for Distribution Stations

1 Scope and service conditions

1.1 Scope

- (a) This specification covers the low-voltage metal-enclosed switchgear and controlgear assembly for distribution stations (hereinafter referred as the switchboards) and designed for indoor installation.
- (b) The switchboard will be installed as to distribute the low-tension electric power through the underground cables.
- (c) The primary terminals of the switchboard will be connected to the secondary terminals of the distribution transformer.

1.2 Service conditions

1.2.1 Normal service conditions for the switchboards

(a) Ambient air temperature

- Maximum ambient air temperature: 55 °C
- Maximum 24 hour average value of the ambient air temperature: 35 °C
- Minimum ambient air temperature: -5 °C

(b) Maximum pollution level: Degree 3 (according to 6.1.2.3 of IEC 60439-1)

2 Normative references

The switchboards shall conform to the latest edition of following international standards:

- (a) IEC 60050(441): IEV – Part 441: Switchgear, controlgear, fuses
- (b) IEC 60059: IEC standard current ratings
- (c) IEC 60269-1: Low-voltage fuses – Part 1: General requirements
- (d) IEC 60269-2: Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons
- (e) IEC 60439-1: Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies
- (f) IEC 60529: Degrees of protection provided by enclosures (IP code)
- (g) IEC 60664-1: Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests – Basic safety publication

- (h) IEC 60947-1: Low-voltage switchgear and controlgear – Part 1: General rules
- (i) IEC 60947-2: Low-voltage switchgear and controlgear – Part 1: Circuit breakers

3 Definitions

3.1 Low-voltage switchgear and controlgear assembly

The combination of one or more low-voltage switching devices together with associated control, measuring, signaling, protective, regulating equipment, etc., completely assembled under the responsibility of the manufacturer with all the internal electrical and mechanical interconnections and structural parts

3.2 Busbar

The low-impedance conductor to which several electric circuits can be separately connected

3.3 Main busbar

The busbar to which one or several distribution busbars and/or incoming and outgoing units can be connected

3.4 Distribution busbar

The busbar within one section which is connected to a main busbar and from which outgoing units are supplied

3.5 Enclosed switchboard

The switchboard which is enclosed on all sides with the possible exception of its mounting surface in such a manner as to provide a degree of protection

3.6 Cubicle type switchboard

The enclosed switchboard in principle of the floor-standing type which may comprise several sections, sub-sections or compartments

3.7 Stationary switchboard

The switchboard which is designed to be fixed at its place of installation, for instance to the floor or to a wall, and to be used at this place

3.8 Functional unit

The part of an assembly comprising all the electrical and mechanical elements that contribute to the fulfillment of the same function

3.9 Incoming unit

The functional unit through which electrical energy is normally fed into the assembly

3.10 Outgoing unit

The functional unit through which electrical energy is normally supplied to one or more outgoing circuits

4 Kinds and ratings

4.1 Kinds

The switchboard shall be a stationary and cubicle type switchboard, and the kinds of the switchboards shall be selected from the Table 1 and Table 2 of this specification.

4.1.1 Kinds of switchboards according to the busbars

Table 1 - Kinds of switchboards according to the busbars

Rated voltage Number of Buses	400 V
Single busbar	O
Double busbars	O
O : Applicable	

4.1.2 Kinds of switchboards according to switchboard types

Table 2 - Kinds of switchboards according to the switchboard types

Rated voltage Switchboard type	400 V
Type A	O
Type B	O
Type C	O
Type D	O
O : Applicable	

4.1.3 Specification numbers

Table 3 - Specification numbers

Spec numbers	Number of Busbars	Type of switchboards
3471010	Double busbar	Type A
3471030	Single busbar	Type B
3471050		Type C

3471070		Type D
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4.2 Ratings

4.2.1 Rated operational voltage

The rated operational voltage shall be 400/230 V.

4.2.2 Rated insulation voltage

The rated insulation voltage shall not be less than 480 V between lines.

4.2.3 Rated impulse withstand voltage

The rated impulse withstand voltage shall not be less than 6,000 V

4.2.4 Rated frequency

The rated frequency shall be 50 Hz.

4.2.5 Rated current

(a) The rated current of the switchboard shall be 1,600 A.

(b) This current shall be carried without the temperature-rise of the switchboard exceeding the limits specified in the Table 2 of IEC 60439-1 when verified according to the clause 8.2.1 of IEC 60439-1.

4.2.6 Rated short-time withstand current

The rated short-time withstand current of the switchboard shall be stated by the supplier according to the clause 4.3 of IEC 60439-1.

4.2.7 Rated peak withstand current

The rated peak withstand current of the switchboard shall be stated by the supplier according to the clause 4.4 of IEC 60439-1.

4.2.8 Rated conditional short-circuit current

The rated conditional short-circuit current of the switchboard shall be stated by the supplier according to the clause 4.5 of IEC 60439-1.

5 Requirements

5.1 General requirements

The switchboard shall comply with the terms below, and be designed so that all operations, maintenances and inspections can be carried out safely.

5.1.1 Required structures

- (a) The switchboard shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses. And the parts of switchboard which are made of insulating material shall provide a specified degree of resistance to abnormal heat and fire.
- (b) The protection against corrosion shall be ensured by the use of suitable materials or by the application of equivalent protective coatings to the exposed surface, taking account of the intended conditions of use and maintenance.
- (c) The apparatus and circuits in the switchboard shall be so arranged as to facilitate their operation and maintenance, and at the same time to ensure the necessary degree of safety.

5.1.2 Compatibility

All removable parts and components of the same type, rating, and construction shall be mechanically and electrically interchangeable.

5.1.3 Enclosure

The enclosure of the switchboard shall be made of equal to or better than the rolled steel with antirust, and the thickness of the enclosure shall not be less than 3 mm.

5.1.4 Degree of protection (IP code) by enclosures

When the switchboard is installed, the enclosure shall provide at least the degree of protection IP 41.

5.1.5 Clearances, creepage distances and isolating distances

The clearances, creepage distances and isolating distances of the switchboard shall be in compliance with the clause 7.1.2 of IEC 60439-1.

5.1.6 Terminals for external conductors

- (a) The terminals for external conductors shall be suitable for connection of copper or aluminum conductors, or both. The terminals shall be such that the external conductors may be connected by suitable means such as screws, connectors, etc. which ensures that the necessary contact pressure corresponding to the current rating and the short-circuit strength of the apparatus and the circuit is maintained.
- (b) For single busbar type switchboard, the terminals shall be capable of accommodating 14 aluminum and/or copper conductors of up to 400 mm².
- (c) For double busbar type switchboard, the terminals shall be capable of accommodating 28 aluminum and/or copper conductors of up to 400 mm².
- (d) There shall be proper connections between the terminals and busbars as followings.
 - The busbar for neutral shall be electrically connected with 2 terminals.

- The busbar for phase, respectively, shall be electrically connected with 4 terminals.
- (e) The connections shall be able to withstand the ratings in the clause 4.2 of this specification.
- (f) The identification of the connections between the terminals and busbars shall be clearly marked at the suitable places near by the busbars.
- (g) Unless otherwise mentioned, the clause 7.1.3 of 60439-1 shall be taken into consideration.

5.1.7 Resistance to abnormal heat and fire

The Parts of insulating materials which might be exposed to thermal stresses due to electrical effects, and the deterioration of which might impair the safety of the switchboard, shall not be adversely affected by abnormal heat and by fire.

5.1.8 Protection against electric shock

For protection against electric shock, the clause 7.4 of IEC 60439-1 shall be taken into consideration.

5.1.9 Short-circuit protection and short-circuit withstand strength

The clause 7.5 of IEC 60439-1 shall be taken into consideration.

5.1.10 Switching devices and components installed in the switchboard

The switching devices and components installed in the switchboard shall comply with the clause 7.6 of IEC 60439-1.

5.1.11 Busbars and insulated conductors in the switchboard

- (a) The connections of current-carrying parts shall not suffer undue alteration as a result of normal temperature rise, ageing of the insulating materials and vibrations occurring in normal operation.
- (b) The connections between current-carrying parts shall be established by means which ensure a sufficient and durable contact pressure.
- (c) The rated current of the busbar shall not be less than 1,600 A.
- (d) The busbars shall be completely insulated except for connection parts to prevent an electric shock and a power failure by proper means, such as heat shrinkable insulation tubes, epoxy coating or etc.

5.1.12 Earthing of the enclosure

- (a) The earthing terminal having a clamping screw or bolt for connection to an earthing conductor shall be suitable for fault conditions. And the diameter of the clamping screw or bolt of the earthing terminal shall be at least 12 mm.
- (b) The connecting point shall be marked with the "protective earth" symbol as below,

and the size of the symbol shall be at least 10 mm.



5.1.13 Single diagram

The single diagram shall be provided on the front of the switchboard with the suitable graphical symbols.

5.2 Particular Requirements

5.2.1 MCCB

The switchboard shall be equipped with MCCBs and the MCCBs for the switchboard shall comply with the following sub-clauses. Unless otherwise mentioned, the GES titled 'Molded Case Circuit Breakers' shall be taken into consideration.

- (a) MCCBs shall be installed in the switchboard according to the Table 4 of this specification.

Table 4 - MCCB installation

Type of switchboard Description	Type A	Type B	Type C	Type D
Number of busbars	Double	Single	Single	Single
MCCB for incoming	2*	1	-**	-**
MCCB for bus-tie	1	-	-	-
MCCB for outgoing	8	4	4	-***
MCCB for auxiliary power	1	1	-	-
* : One MCCB per busbar ** : No protection device for the primary side of the switchboard *** : Low-voltage fuses shall be installed instead of MCCBs. Note 1: For reference, see Annex B.				

- (b) The MCCB intended for incoming and bus-tie shall be 3 pole or 4 pole 1,600 A.
- (c) The MCCB intended for outgoing shall be 3 pole or 4 pole 400 A.
- (d) The MCCB intended for auxiliary power shall be single pole or 2 pole 40 A.

5.2.2 Fuse

The switchboard shall be equipped with the low-voltage fuses and the Fuses for the switchboard shall comply with the following sub-clauses. Unless otherwise mentioned, the GES titled 'Low-voltage Fuses' shall be taken into consideration.

- (a) Fuses shall be installed in the switchboard according to the Table 5Table 4 of this specification.

Table 5 - Fuse installation

Type of switchboard Description	Type A	Type B	Type C	Type D
Fuses for outgoing	- *	- *	- *	12 **
* : MCCBs shall be installed instead of Fuses. ** : 3 phases and 4 circuits Note 1: For reference, see Annex B.				

- (b) The rated current of the fuses intended for outgoing shall be 400 A.
- (c) The fuse shall be able to be easily replaced with another when the fuse blows out.

5.2.3 Meter

The switchboard shall be equipped with a meter and the meter for the switchboard shall comply with the following sub-clauses. Unless otherwise mentioned, the GES titled 'Microprocessor-based Static Meters' shall be taken into consideration.

- (a) For type A and type B switchboard, the 3 phase meter capable of metering active energy, reactive energy and peak demand shall be installed in the switchboard.
- (b) The meter shall be digital type, and the accuracy class of the meter shall be at least 1.0.

5.2.4 Ampere meter

- (a) For the type A switchboard, the two ampere meters for measuring the primary side current shall be provided for each busbar respectively.
- (b) For the type B switchboard, the ampere meter for measuring the primary side current shall be provided.
- (c) The ampere meters shall cover the current up to 1,600 A.

6 Tests

6.1 Type tests

The type tests shall be carried out in accordance with the clause 8.2 of IEC 60439-1, and the type tests for switchboard are listed in the Table 6 of this specification.

Table 6 - Type test

Rating	Type tests	Related clauses in IEC 60439-1
--------	------------	--------------------------------

Temperature-rise test	O	8.2.1
Dielectric properties test	O	8.2.2
Short-circuit withstand strength test	O	8.2.3
Effectiveness of the protective circuit	O	8.2.4
Clearances and creepage distances	O	8.2.5
Mechanical operation test	O	8.2.6
Verification of the degree of protection	O	8.2.7
EMC tests	O	7.10, Annex H
O : Mandatory		

6.2 Routine tests

The routine tests shall be performed in accordance with the clause 8.3 of IEC 60439-1, and the routine tests for the switchboard and the related clauses are listed below;

- (a) Inspection of the switchgear including inspection of wiring and, if necessary, electrical operation test: 8.3.1 of IEC 60439-1
- (b) Dielectric test: 8.3.2 of IEC 60439-1
- (c) Checking of protective measures and of the electrical continuity of the protective circuit: 8.3.3 of IEC 60439-1
- (d) Verification of insulation resistance: 8.3.4 of IEC 60439-1

The routine tests shall be repeated in the presence of GECOL's representatives on 10% of the quantity to be offered, chosen at random, subject to a minimum of 2 Nos. per each type of the switchboards.

7 Rating plate

7.1 Requirements for rating plate

- (a) The rating plate shall be plainly visible in the position of normal service and installation.
- (c) The letters on the rating plate shall be marked by means of lasting visibility during the life of the switchboard.
- (e) The font, size and colors of letters shall comply with the Table 7 of this specification.

Table 7 – Letter font, size and colors of the rating plate

Letter type	Font	Roman
	Size	4 mm high at least
Colors	Letters	Black, dark gray, depressed engraving

	Background	White, silver or light gray

7.2 Information of rating plate

The information of rating plate shall be in accordance with Table 8 of this specification.

Table 8 - Rating plate information

Rating	Unit	Type A, B, C	Type D
Supplier and/or manufacturer		O	O
Type designation and serial number		O	O
Year and Month of manufacture		O	O
Rated operational voltage	V	O	O
Rated insulation voltage	V	O	O
Rated impulse withstand voltage	kV	O	O
Rated current			
- Busbar	A	O	-
- Incoming MCCB*	A	O*	-
- Outgoing MCCB	A	O	-
- Outgoing Fuse	A	-	O
Rated frequency	Hz	O	O
Short-circuit withstand strength	kA	O	O
Degree of protection (IP code)		O	O
Weight	kg	O	O
Dimensions	mm	O	O
Relevant standard with date of issue		O	O
O : The marking of these values is mandatory.			
* : Type A and B only			

8 Packing and delivery

The supplier shall provide packing of the switchboards to prevent their damage or deterioration during transit to their final destination and long period of storage. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and open storage.

- All switchboards and their components shall be shipped from the factory to the specified site.
- The switchboard shall be wrapped in vinyl sheets of proper thickness to prevent ingress of humidity. The sufficient dehumidifying agent shall be inside the packing. The switch shall be on a wooden pallet and the base of switch shall be tied to the pallet with galvanized steel bolts and nuts. A wooden box shall cover the whole

switch and shall be connected to the pallet without any looseness or disconnection. The pallet and packing case shall be suitable for handling by forklift truck and they shall have enough strength and thickness for protection of the switch. The wood material should be disinfected to avoid import of insects or virus.

- (c) The size and weight of packing cases shall be taken into consideration, where appropriate, the remoteness of the switchboards' final destination and the absence of heavy handling facilities at all points in transit.
- (d) The switchboards shall be packed one by one even though the numbers of switchboards to be supplied are plural.
- (e) Each shipment shall include a detailed packing list identifying all items by part number, including hardware.
- (f) All material shall be carefully loaded for protection during shipment.
- (g) Small parts and fasteners shall be carefully boxed, crated, bagged or otherwise containerized and protected for shipment.
- (h) All materials shall be arranged to allow safe unloading at the site.
- (i) There shall be handling instruction to minimize damage.

The outer packing must be clearly marked on at least four (4) sides as follows;

- (a) Name of the procuring department
- (b) Name of the supplier
- (c) Contract description and number
- (d) Loading place
- (e) Final destination
- (f) Gross weight
- (g) Net weight
- (h) Special lifting instructions, if any
- (i) Special handling instructions, if any
- (j) Relevant pollution or environment classifications, if any

9 Documents and certificates

9.1 Information to be given by GECOL

9.1.1 Service conditions

Excluding the normal conditions referred to the clause 1.2.1 of this specification, service conditions at which the switchboard will be located shall be stated by GECOL.

9.1.2 Rated values and characteristics

The specific ratings shall be stated by GECOL.

- (a) Type of switchboards according to the Table 2 of this specification
- (b) Kind and size of the cable to be connected to the switchgear (primary and secondary)

9.2 Information to be given by supplier

9.2.1 Technical data sheet

The technical data sheet shall be filled and provided by supplier according to the annex A of this specification.

9.2.2 Certificates of type tests and routine tests

- (a) The certificates of type tests according to clause 6.1 of this specification shall be provided by supplier.
- (b) The certificates of routine tests according to clause 6.2 of this specification shall be provided by supplier if required by GECOL.

9.2.3 Guidelines and manuals

The supplier should provide instructions for the transport, storage, installation, operation and maintenance of the switchboard. The instructions for the transport and storage should be given before delivery, and the instructions for the installation, operation and maintenance should be given by the time of delivery at the latest.

The guidelines and manual shall be provided by means of softcopy as well as hardcopy.

- (a) The instructions for installation provided by the supplier should comply with clause 5.2 of IEC 60439-1.
- (b) The instructions for operation provided by the supplier should comply with clause 5.2 of IEC 60439-1.
- (c) The instructions for maintenance provided by the supplier should comply with clause 5.2 of IEC 60439-1.
- (d) The schedule for maintenance shall be specified by supplier.

9.2.4 Safety standards

The safety standards for installation, operation and maintenance shall be provided by supplier.

9.2.5 Related drawings

The related drawings including the shape and dimensions of the switchboard shall be provided by supplier.

10 Warranty

The supplier shall provide the full warranty on all equipment supplied during the period specified below. The warranty shall cover all parts and all costs, which are directly attributable to the supplier. Warranty coverage shall begin on the date that the equipment is received.

The warranty period shall be 3 years.

Annex A

Technical Data Sheet

No.	Description	Particulars
	General	
1	Manufacturer	
2	Temperature class	
	Ratings and characteristics	
3	Rated operational voltage	
4	Rated insulation level	
5	Rated frequency	
	Busbar	
6	Number of busbar	
7	Rated current	
8	Rated short-time withstand current	
9	Rated peak withstand current	
	MCCB for incoming and bus-tie (if any)	
10	Rated current	
11	Frame size	
12	Number of poles	
13	Trip method (Thermal, Electronic, etc)	
14	Dimensions of enclosure (Height x Width x Depth)	
15	Weight	
	MCCB for outgoing (if any)	
16	Rated current	
17	Frame size	
18	Number of poles	
19	Trip method (Thermal, Electronic, etc)	
20	Dimensions of enclosure (Height x Width x Depth)	
21	Weight	
	Fuse for outgoing (if any)	
22	Rated current	
23	Dimensions of enclosure (Height x Width x Depth)	
24	Weight	

Signature : _____

Technical Data Sheet

No.	Description	Particulars
25	Degree of protection (IP code)	
26	Weight	
27	Dimensions	
28	Relevant standard with date of issue	

Signature : _____

Designation : _____

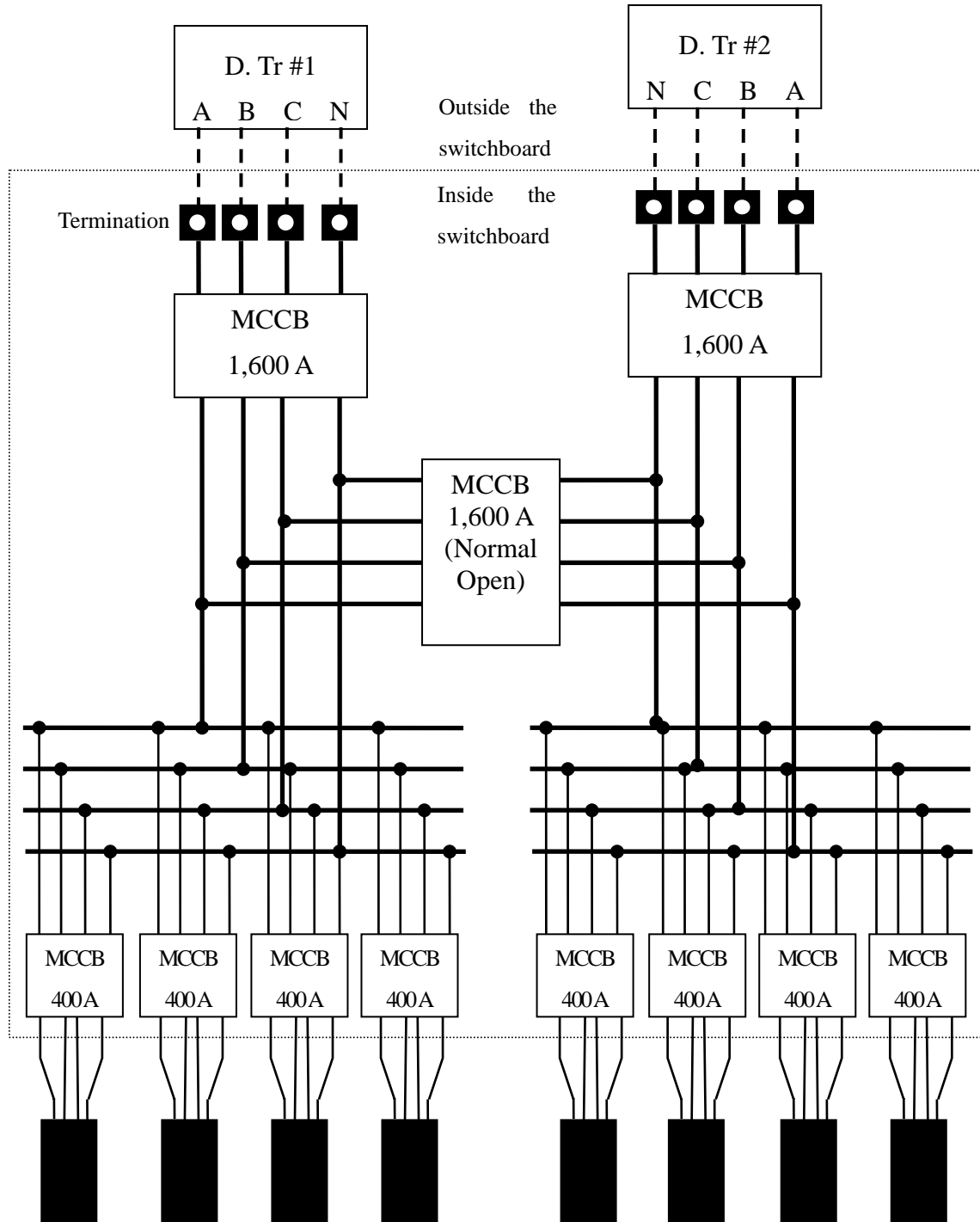
Name of Tenderer : _____

Date : _____

Annex B

Sample Electrical diagram of the switchboard

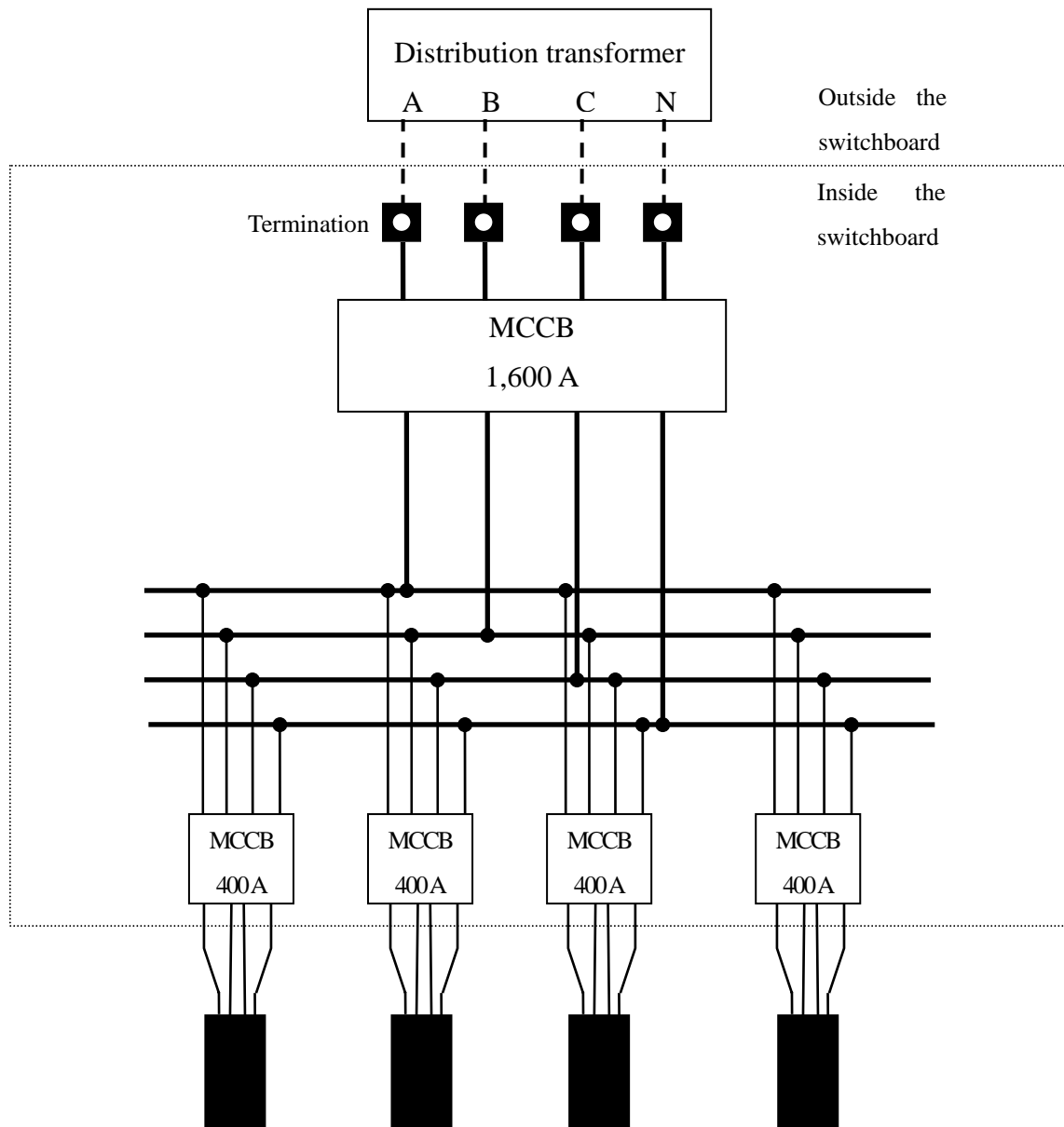
1. Switchboard of type A



Note 1: The MCCB for auxiliary power shall be added in addition to the above diagram.

Note 2: 4 pole MCCBs can be replaced with 3 pole MCCBs.

2. Switchboard of type B

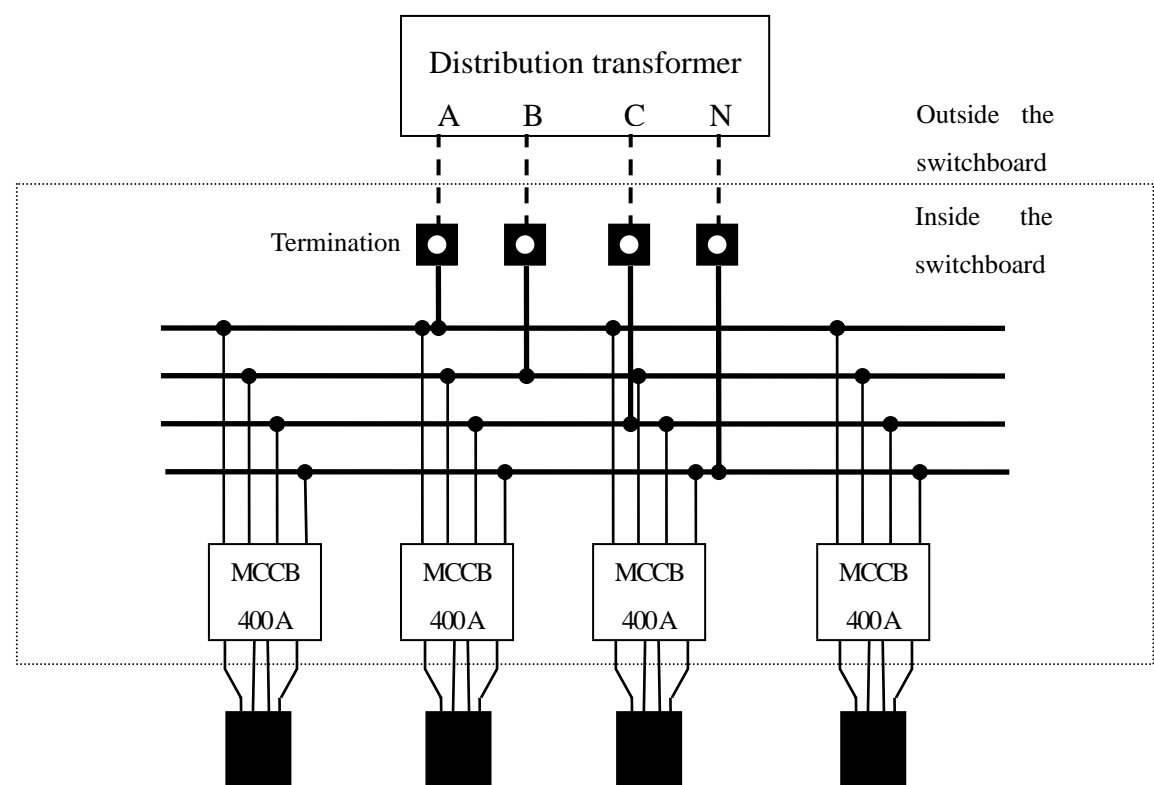


Note 1: The MCCB for auxiliary power shall be added in addition to the above diagram.

Note 2: 4 pole MCCBs can be replaced with 3 pole MCCBs.

Note 3: The busbar for the neutral can be located below the MCCBs.

3. Switchboard of type C



Note 1: 4 pole MCCBs can be replaced with 3 pole MCCBs.

4. Switchboard of type D

