TNPRD/ SUBSTATION SPECIFICATION & EQUIPMENT SECTION

April 2024

TECHNICAL DESCRIPTION TD-58/4
170KV OUTDOOR, 3-POLE, DOUBLE BREAK AC DISCONNECTOR WITH ELECTRIC MOTOR OPERATING MECHANISM (DESIGNATED BY IPTO S.A No 3.23H)

I. SCOPE

This technical description covers IPTO's requirements with regard to the design features, rated characteristics and testing of 170 KV, 3-pole, double brake, AC disconnectors with motor operating mechanism.

II. KEYWORDS

AC disconnectors, disconnecting switches, isolators.

III. STANDARDS

The disconnector shall be in accordance with IEC 62271-102 and IEC 62271-1 standards. Furthermore the disconnector's cylindrical post insulators shall be in accordance with IEC 60273 and IEC 60168 standards.

IV. USE

The disconnector is to be used in the 150/20 KV transformer bays for isolating purposes in air insulated (AIS) 150/20 KV substations.

V. SERVICE CONDITIONS

1. Installation	: Outdoors
2. Ambient temperature range	: Maximum + 45°C
	: Minimum - 25°C
3. Altitude	: Up to 1000m above sea level
4. Relative humidity	: ≤ 95%
5. Ice coating	: 10mm maximum
6. Pollution level	: moderate to heavy depending on location
7. Wind speed	: 150Km/h
8. Other conditions	: Snow and fog

VI. 150 KV ELECTRICAL SYSTEM CHARACTERISTICS

1. Nominal Voltage	: 150KV
2. Maximum Operating Voltage	: 170KV
3. Lightning impulse withstand voltage	: 750KV
4. Short circuit level	: 31KA
5. Number of phases	: 3
6. Nominal Frequency	: 50 Hz
7. Earthing (grounding) method	: The 150KV system is solidly earthed (grounded)
8. Auxiliary voltages	: 110V D.C and 220V A.C

VII. DISCONNECTOR REQUIRED DESIGN FEATURES

1. Type
   The disconnector shall be three-pole (phase) of horizontal double break, having three (3) cylindrical post insulators per pole (phase). The central insulator, to which the blade (arm) is rigidly attached, shall rotate on a weather – proof ball shape, greaseless bearing or on auto-lubricated bush, to achieve the opening and closing function.
   This three-pole (phase) disconnector, shall be operated by an electric motor operating mechanism.

2. Blade (arm) angle of rotation
   The blade (arm) of the disconnector shall pivot at about 80° to 90° angle to ensure the opening and closing of the disconnector.

3. Material of the blade (arm)
   The blade (arm) of the disconnector shall be either of tubular hard drawn electrolytic copper or aluminium alloy.

4. Type of material of the blade (arm) contacts (movable contacts)
   The contact ends (tips) of the blade (arm) shall be silver-plated copper.

5. Type of material of the fixed finger (jaw) type contacts
   The fixed finger (jaw) type contacts shall be silver-plated copper.

6. Characteristics of the blade (arm) contacts
   The blade (arm) contacts must be self-cleaning and self-aligned and of such design so that short circuit currents increase their contact pressure.

7. Characteristics of the fixed finger (jaw) contacts
   The fixed contacts must be self-cleaning and of such design, so that short circuit currents increase their contact pressure.

8. Material of the bolts, nuts and washers of the live parts of the disconnector
   All bolts, nuts and washers of the live parts of the disconnector shall be either of

stainless steel or of hot-dip galvanized steel.

9. Base frame of the insulators of the disconnector
   The three insulators per pole (phase) shall be mounted on a common solid hot dip galvanized steel base, which shall have height ranging from 220mm to 280mm maximum.

10. Method of operation of the disconnector
    Three-pole operation.

11. Pole arrangement of the disconnector
    The disconnector shall be suitable for parallel pole connection.

12. Terminals
    Each pole of the disconnectors shall be fitted with two (2) copper or aluminium tin-plated or silver-plated terminals of orthogonal shape and with dimensions of about 50mm x 80mm and thickness of 10mm for the copper and 13mm for the aluminium.

13. Method of mounting of the disconnector on its base frame
    Each pole of the disconnectors shall be mounted on a hot-dip galvanized steel bar with the central insulator to be connected to the bar through greaseless ball type bearing for the purposes of the rotation.

14. Earthing (grounding)
    The vertical operating rods of the disconnector shall be equipped with flexible copper earthing strip of suitable current capability, ending in a rectangular in shape terminal which shall be used for connection to the earthing (grounding) mat of the substation.

15. Dimensions of disconnector

    a. The distance between poles of the disconnector (axis to axis), shall be 3m.

    b. The distance between insulators of the same pole shall be 1.10m (±3%) (axis to axis).

    c. The disconnector shall be mounted on a steel support structure of 3m in height, which shall be provided by IPTO.

16. Transmission motion system of the disconnector

    a. The transmission motion system of the disconnector shall be comprised of horizontal and vertical operating rods, bearing, etc in accordance with drawing No. 3.23H/2 and the whole system shall be suitable, along with the three-pole disconnector and its base frame, to be mounted on steel support structure (not part of the supply) of 3m in height, as indicated in the attached drawing No 3.23H/1 of this hereby technical description.

b. In case of vertical rod accidental dismantling, the blades (arms) of the disconnector shall not be possible to be moved from the open to closed position or vice versa by the force of the wind or short circuits.

c. The entire system must be designed for smooth noiseless and precise operation, and to avoid any undesired operations.

d. All metallic parts including nuts, bolts and washers of the transmission motion system, shall be made of hot dip galvanized steel or of stainless steel.

17. Mounting

The disconnector and its operating mechanism shall be mounted on the steel structure as indicated in the attached drawing No. 3.23H/2.

18. Operating Mechanism of the disconnector

a. The operating mechanism of the disconnector shall be motor operable. There shall be one common operating mechanism for the three (3) poles of the disconnector, for the rotation of the axis via metallic gear wheels.

b. The electric motor operating mechanism shall be of the reversible motion type.

c. The electric motor operating mechanism must be capable of being locally operated electrically and also capable of being tele-operated from a remote place. Furthermore, the mechanism shall include provision for manual operation in case of an emergency.
The local electrical and remote electrical command for the operation of the disconnector is given by a pulse of 200ms in duration and for this reason a latching shall be produced to the supply circuit of the motor until the completion of the motion of the operating mechanism. In case during the execution of the motion, the supply voltage of the motor is lost (or the interlocking coil is deenenergized), then the movement of the disconnector shall be stopped and the disconnector shall remain in the position it had when it stopped. After the supply voltage is restored (or the re-energization of the interlocking coil), a new command must be given in order the movement to be completed.

d. The supply of the motor of the operating mechanism shall be 110V DC.

e. The manual emergency operation shall be carried out via rotary motion and metallic reduction gear with a hand-handle which shall be removable. The electric control circuit shall be placed automatically out of service when the hand-handle is inserted for the manual emergency operation. The parts of the handle which come in contact with the human hands shall be covered with insulating material.
The insertion of the removable hand-handle to the housing shall be possible through an opening in the outer surface of the housing of the operating mechanism. This opening shall be capable of being secured with a padlock. The removable handle shall be kept inside the housing of

the operating mechanism.

f. The motor operated mechanism shall be equipped with a rotary selector switch which shall allow the following four (4) modes of operation:

- Position 1 : Manual operation. Operation only via the hand-handle
- Position 2 : Local operation-Local electrical control
- Position 3 : Tele-operation. Electrical operation from a remote place
- Position 4 : Off. No electrical or manual operation is allowed

The selection of any one of the above positions shall exclude the possibility of operation form in any other position. The selector switch shall be capable of being locked to the selected positions with a lock. In the off position, the disconnector is locked in this position and

- There is no access to the opening of the housing for the hand-handle
- All voltage commands to the motor are isolated (cut off)
- The transmission motion system is mechanically blocked from the motor towards the reduction gear.

g. No sliding disks or electrical brakes are allowed for the transmission of moment to the transmission motion mechanism or to the blades (arms) in order to cease motion at the end of the blades travel and to avoid overtravel.

h. The immobilization of the rotation axis of the electric operable mechanism shall be controlled electrically by limit switches. For extra safety reasons only, mechanical stops may also be used.

i. The mechanism shall be equipped with limit switches which shall interrupt the operation of the electrical motor when the disconnector's blades have reached their final position in both positions (opened-closed)

j. The electrical motor operating mechanism shall be equipped with an interlocking coil, of coil voltage 110V DC, which shall be used for electrical interlocking between the disconnector and its corresponding circuit breaker. The interlocking coil in the deenergized state shall prevent the electrical operation of the mechanism by means of an auxiliary contact, and the manual operation by means of a mechanical blocking.

k. The electric motor operating mechanism shall be equipped with the following auxiliary contacts of high reliability as to ensure the exact

status of the disconnector:

- Seven (7) make contacts
- Seven (7) break contacts
- Two (2) make – early closing contacts
- Two (2) break – late opening contacts

l. The signal for "Disconnector is closed'' shall be given only after complete closing which means that a short circuit current can run through the disconnector, while the signal for " Disconnector is open" shall be given only after the complete opening when the isolating distance is sufficient to withstand with success the required dielectric tests.

m. All control cables of the operating mechanism shall be of cross section of 1.5mm^2 and shall bear proper markings. All terminal blocks however, shall be suitable for 8mm^2 size conductors.

n. The housing of the operating mechanism shall be either of stainless steel or hot-dig galvanized steel or aluminum alloy.

o. The degree of protection for the housing shall be IP 42D, as per IEC 60529.

p. The operating mechanism shall be equipped with a spare terminal block of at least four positions. The terminal block shall be suitable for 8mm^2 size conductors.

q. The housing of the operating mechanism shall be equipped with anti-condensation heater or heaters, controlled by a thermostat.
The supply voltage to the heaters shall be 220V AC.

r. All electric circuits of the mechanism shall be suitable for 110V DC and shall be protected by miniature circuit breakers or fuses.

s. The housing of the operation mechanism shall allow cable entrance from its bottom (IPTO's cables).

t. The housing of the operating mechanism shall be installed (mounted) on the steel support structure, which shall be provided by IPTO as indicated in drawing No. 3.23H/2.
For this reason all bolts, nuts, brackets and any other mounting component must be part of the supply.
All connection parts, for example bolts, nuts, brackets, etc must be either from stainless steel or hot-dip galvanized steel.

19. Tolerances

The design of the disconnector's arms (blades) shall be such as to allow proper contact under all conditions and even with the following tolerances which can exist at the same time.

a. Tolerance regarding the rotation of the arms (blades) in the horizontal level: ±2°

b. Tolerance in the slope of the arms (blades) in the vertical level due to possible unparallel alignment of the insulators: ±0.5°

c. Tolerance in the height of the arms (blades) : ±2.5mm

VIII. DISCONNECTOR REQUIRED RATED ELECTRICAL AND OTHER CHARACTERISTICS

1. Number of poles	: Three (3)
2. Installation	: Outdoors
3. Rated Voltage	: 170 KV
4. Rated insulation levels	
a. Power frequency withstand voltage	
- Phase to earth and between phases	: 325 KV rms
- Across the isolating distance	: 375 KV rms
b. Lightning impulse withstand voltage	
- Phase to earth and between phases	: 750KV peak
- Across the isolating distance	: 860KV peak
5. Rated frequency	: 50 Hz
6. Rated normal current	: 1250 A
7. Rated short-time withstand current	: 31.5 KA rms
8. Rated peak withstand current	: 78.8 KA peak
9. Rated duration of short circuit	: 3 sec
10. Rated static mechanical terminal load	
- Straight load	: 600N at least
- Cross-load	: 200N at least
- Vertical Force	: 1000N at least
11. Thickness of ice coating for which operation shall be possible	: 10 mm
12. Type of conductors used for the connection of the disconnector	: Flexible
13. Mechanical endurance class	: M1

IX. SUPPORT INSULATORS REQUIRED CHARACTERISTICS

1. Type	: Outdoor solid core cylindrical post insulators with external metal fittings
2. Material of the cylindrical post insulators	: Porcelain

3. Color of the porcelain	: Gray
4. Designation of the insulators as per IEC-60273	: C8-750
5. Power frequency withstand voltage wet	: 325 KV rms
6. Lightning impulse withstand voltage	: 750KV peak
7. Height of the post insulator	: 1700mm ± 2.5 mm
8. Creepage distance	: 4250mm
9. Failing load	
a. Bending	: 8000 N
b. Torsion	: 4000 Nm
c. Tension	: ≥ 125000 N
d. Compression	: ≥ 650000 N
10. Bottom metal fitting pitch circle diameter	: 127mm
11. Maximum nominal diameter of insulating part	: 350mm
12. Top metal fitting pitch circle diameter	: 127mm

X. TESTS

The disconnector shall be subject to the following tests.

A. Routine tests

The routine tests shall be carried out on all disconnectors of the order.

1. Dielectric test on the main circuit of the disconnector.

Power frequency voltage test.

The test voltage shall be 325 KV rms for phase to earth and between phases and 375 KV rms across the isolating distance. The test conditions shall be in accordance with table 6 of IEC 62271-102.

Alternatively, the power frequency voltage withstand test may be omitted if the dimensions between the conductive parts – between phases, across open contacts and between conductive parts and the frame – are checked by measurements.

2. Dielectric test on auxiliary and control circuits

The test voltage shall be 1 KV, with duration of 1 sec.

3. Measurement of the resistance of the main circuit

The test current shall be between 50A and the rated normal current. The measured resistance shall not exceed 1.2 R_u where R_u is equal to the resistance measured before the temperature rise test.

4. Design and visual checks

The disconnectors shall be checked to verify that they comply with this hereby technical description and approved drawings. A functional test shall be performed on the auxiliary and control circuits.

B. Special Tests

The special test shall be carried out only on one (1) disconnector of the order

because of the assembly complexities involved.

1. Mechanical operating tests

The tests shall be performed without voltage or current flowing through the main circuit. The test program shall consist of five close-open operating cycles at minimum supply voltage and five manual close-open operating cycles.
The test shall be performed on a completely assembled disconnector.

C. Type Tests

1. Dielectric tests

a. Power frequency voltage test

- Test voltage	: 325 KV rms for 1min for phase to earth and between phases
	: 375 KV rms for 1 min across the isolating distance
- Conditions	: Dry and wet

b. Lightning impulse voltage test

- Test voltage	: 750 KV peak of both polarities for phase to earth and between phases
	: 860 KV peak across the isolating distance
Lightning impulse shape	: 1.2/50μs
- Conditions	: Dry

2. Test on auxiliary and control circuits

Power frequency voltage withstand test with test voltage 2KV for 1min
The test shall be performed between the auxiliary and control circuits, connected together as a whole, and the frame of the disconnector.

3. Radio interference voltage (r.i.v) test

The test shall be applied as follows:

a. In closed position between terminals and earthed frame
b. In open position between one terminal and the other terminals connected to the earthed frame

Level of radio interference at 108 KV : ≤ 2500μV

4. Temperature-rise test

- Test current	: 1250A
- Test frequency	: 50 HZ +2%, -5%
- Test duration	: Up to the time at which the increase of

temperature rise does not exceed 1K in 1h

5. Measurement of the resistance of the main circuit

The test will be performed before and after the temperature rise test. The test current shall be between 50A and the rated normal current. The measured resistance after the temperature rise test shall not exceed by more than 20% the resistance measured before the temperature rise test.

6. Short-time withstand and peak withstand current test

- Short-time test current	: 31.5 kA rms
- Peak withstand test current	: 78.8 kA peak
- Test frequency	: 50 Hz ± 10%
- Test duration	: 3 sec

7. Operating and mechanical endurance tests

The mechanical endurance test shall consist of 2000 close-open operations with 50% of the rated static terminal load applied at both sides of the disconnector but in opposite directions, without voltage on or current through.

8. Operation test under severe ice conditions

The test shall be conducted with class 10 of ice coating (10mm of ice coating).

9. Verification of the IP degree of protection for the control housing

XI. TESTS FOR THE DISCONNECTOR'S INSULATORS

The disconnector manufacturer is obliged to present to the IPTO inspector, when the inspector is at the manufacturer's premises for the inspection and testing of the disconnectors, the following routine, sample and type test insulator certificates. Type test certificates are not required to be presented, if they have been submitted in the technical offer of the inquiry and have been found to be satisfactory.
All tests shall be in accordance with IEC-60168.

A. Routine tests

1. Visual inspection
2. Mechanical test (bending test)

B. Sample tests
Sample tests shall be carried out after the routine tests on a few numbers of insulators of the order selected, at random.

1. Verifications of dimensions
2. Temperature cycle test (This prior to the mechanical failing load test)
3. Mechanical failing load test (Bending and torsion)

4. Porosity test
5. Galvanizing test

C. Type Tests

1. Dry lightning impulse withstand voltage test
2. Wet power – frequency withstand voltage test
3. Mechanical failing load test (bending and torsion)

XII. NAMEPLATES

The nameplates for the disconnector, and for the operating mechanism, shall be of non-corrosive material, visible from ground and shall bear the following information:

	Disconnector	Operating Mechanism
Manufacturer	√	√
Type	√	√
Serial Number	√	√
Year of Manufacture	√	√
Rated Voltage	√	
Rated Lightning Impulse withstand voltage	√	
Rated normal current	√	
Rated duration of short circuit	√	
Rated supply voltage of auxiliary circuits		√
Mechanical endurance class	√	
Electrical endurance class		
Mass	√	√

XIII. DATA WHICH MUST BE SUBMITTED BY ALL BIDDERS

1. Outline drawing of the disconnector, in which the physical dimensions of the disconnector are clearly depicted.

2. Brochures, technical pamphlets and any other information which is deemed necessary for the technical evaluation process.

3. All bidders are required to answer all items of **Attachment "A"**. Failure to comply or partial filling of the attachment will constitute sufficient reason for rejection of the offer.

4. Any test certificates for the type tests specified in this hereby technical description.
   Acceptance or not of these certificates lies on IPTO's judgment.

5. A drawing indicating the disconnector on its base frame with complete dimensions.

6. A preliminary drawing indicating mounting of the disconnector, along with its operating mechanism on the steel support structure, which shall be supplied by IPTO. Failure to comply with this request will result in rejection of the offer.

XIV. DATA WHICH MUST BE SUBMITTED BY THE SUCCESSFUL BIDDER

1. Complete schematic and wiring drawings of the disconnector, for approval before the construction of the disconnector.

2. Complete physical drawings of the disconnector, indicating all dimensions details, for approval before the construction of the disconnector (3 sets).

3. A drawing indicating the disconnector on its base frame.

4. Maintenance and assembly instructions in detail for the disconnector.

5. A drawing indicating mounting of the disconnector, along with its operating mechanisms, on the steel support structure, which will be supplied by IPTO.

6. The supplier shall submit the final "as manufactured" drawings in digital format, as follows:

a) The 3D model of the complete equipment shall be submitted in Autodesk AutoCAD format (dwg file), using 3D solids modelling. Alternatively, the 3D model can be submitted in Entegra Primtech 3D format. The 2D drawings of the equipment shall be also submitted in Autodesk AutoCAD format (dwg files), but also in Adobe Acrobat format (pdf files).

b) The wiring drawings of the equipment shall be submitted in Autodesk AutoCAD format (dwg files), using attributed symbol blocks and attributed title block on every page, following IEC standards for the symbols and the design. Alternatively, the wiring drawings shall be submitted in Autodesk AutoCAD / Electrical Toolset project format, following IEC standards. The wiring drawings shall be also submitted in Adobe Acrobat format (pdf files).

All above Autodesk AutoCAD drawings should be open for editing and preferred to be submitted with digital sign by the manufacturer.

XV. WARRANTY

The supplier must provide a warranty of two (2) years, beginning from the date of delivery of the disconnector, for damages due to faulty design, or due to unreliable components, or due to combination of the two.

XVI. PACKING

Each disconnector must be delivered packaged as follows:

1. Metallic base in a separate wooden box.

2. Insulators in a separate wooden box.

3. Live parts of the disconnector in a separate wooden box.

4. Operating rods of disconnector tied together.

5. Operating mechanism in a separate wooden box, protected internally by an insulating material (e.g. nylon).

The wooden boxes will be entirely closed and robust of at least 20mm thickness. The boxes will be of “pallet type”, with strengthened base.

ATTACHMENT "A"
170 KV OUTDOOR, 3-POLE, DOUBLE BREAK, AC DISCONNECTOR WITH ELECTRIC MOTOR OPERATING MECHANISM

All bidders must provide the following data. Failure to comply in full, shall constitute sufficient reason for rejection of the offer.

1. Type :……..……

……..

2. Manufacturer :…….

…….

3. Ambient temperature range during operation :..…….…..…….

4. Disconnector's blade (arm) angle of rotation :…..……...

5. Type of material of the disconnector's blade (arm) :……..

6. Type of material of the blade (arm) contacts (movable contacts) :……..

7. Type of material of the fixed finger (jaw) type contacts :……..

8. Are the blade (arm) contacts self-cleaning and self-aligned? :……..

9. Are the fixed finger (jaw) type contacts self-cleaning? :……..

10. Are the fixed finger (jaw) type contacts and the blade contacts of such design, that short-circuit currents increase their contact pressure? :……..

11. Type of material of bolts, nuts and washers of the live parts of the disconnector :……..……

12. Type of material of the base frame of the disconnector :……

13. Is the base frame of the disconnector hot-dip galvanized? :……

14. Operation method of the disconnector :……

……

……

15. Indicate pole arrangement of the disconnector :……

……

16. Indicate method of mounting of the disconnector on its base frame :……

……

……

……

17. Describe how the disconnector is earthed :……

……

……

……

……

18. Does the transmission motion system of the disconnector, meet the requirements of paragraph VII-16 of this technical description? :……

……

……

……

19. Does the central insulator rotate on a weather-proof, ball shape, greaseless bearing or on auto-lubricated bush? ……

……

20. Disconnector's operating mechanism characteristics

a. Is the operating mechanism of the disconnector electric motor operated? :…….

b. Number of operating mechanisms for the three-phase disconnector :…….

c. Is the electric motor operating mechanism of the reversible motion type? :…….

…….

d. Can the electric motor operating mechanism be capable of being operated electrically locally and also electrically from a remote place? :……

……

e. Does the electric motor operating mechanism include provision for manual operation in case of emergency via hand-handle? :……..

f. Is the supply circuit of the electric motor equipped with latching capability in order for the operating mechanism to complete its motion given the fact that the command pulse is 200ms in duration? :……..

……...

……

……...

g. Is the motion of the disconnector stopped when the supply voltage of the electric motor is lost or the interlocking coil is deenergized? :……..

……..

……..

h. When the motion of the disconnector is stopped due to voltage supply loss to the electric motor, does the disconnector remain in the stopped position until a new command for motion is given?:……..

……..

……..

……..

i. Indicate the supply voltage for the electric motor :……..

j. Is the manual emergency operation carried out via rotary motion and metallic reduction gear with a hand-handle? :……..

……..

k. Is the hand-handle removable? :……..

l. Is the electric control circuit of the operating mechanism placed automatically out of service when the hand-handle is inserted for the manual emergency operation? :……..

……..

……..

m. Are the parts of the hand-handle which come in contact with the human hands covered with an insulating material? :……..

……..

n. Can the opening in outer surface of the housing of the mechanism in which the hand-handle is inserted, be secured with a padlock? :……..

o. Can the removable hand-handle be kept inside the housing of the operating mechanism? :……..

……..

p. Is the motor operated mechanism equipped with a rotary type selector switch of four positions as described in paragraph VII-18-f? :…….

…….

q. Does the offered disconnector and its electric motor operating mechanism comply with the requirements of paragraph VII-18-g? :…….

…….

…….

r. Indicate compliance with paragraph VII-18-h? :…….

…….

…….

s. Is the electric motor operating mechanism equipped with limit switches which shall interrupt operation of the motor and the disconnector's blades, when the blades have reached their final position? :…….

…….

…….

…….

t. Is the electric motor operating mechanism equipped with an interlocking coil which shall be used for electrical interlocking between the disconnector and its corresponding circuit breaker?:……..

……

……

u. Voltage of the interlocking coil? :……

v. Can the interlocking coil in its deenergized state prevent the electrical operation of the mechanism via an auxiliary contact and the manual operation by a mechanical block? :……

……

……

w. Indicate the number and type of the auxiliary contacts of the electric motor operating mechanism :……

……

……

……

……

x. Size of control cables used, in the wiring of the operating mechanism :…….

y. Material of the housing of the operating mechanism and degree of protection as per IP :…….

……..

z. Is the operating mechanism equipped with a spare terminal block? :…….

a1. Is the operating mechanism housing equipped with anti-condensation heaters, controlled by a thermostat? :…….

b1. Is the housing of the operating mechanism suitable for bottom entrance of cables? :…….

c1. Are all necessary bolts, nuts, washers and brackets provided for the mounting of the housing of the operating mechanism? :…….

d1. Is the manual operation carried out via rotary motion and metallic reduction gear? :……..……..

e1. Are the circuits protected by miniature breakers or fuses? :…….

f1. Supply voltage of the anti-condensation heaters :…….

g1. Auxiliary voltage of the circuits of the operating mechanism :…….

h1. Can the rotary selector switch be secured in its four positions with the aid of a lock? :……

……

21. Is the disconnector a three-pole with three insulators per pole? :……

22. Type of material and dimensions of the disconnector terminals :……

…….

23. Disconnector's characteristics

a. Numbers of poles :……

b. Installation :……

…….

…….

c. Rated voltage :……

d. Power frequency withstand voltages

- Phase to earth and between phases :……...
- Across the isolating distance :……...……

e. Lightning impulse withstand voltages

- Phase to earth and between phases :……...
- Across the isolating distance :……...……

f. Rated frequency :……...……

g. Rated normal current :…….….

h. Rated short-time withstand current :……..

i. Rated peak withstand current :……..

j. Rated duration of short circuit :……..

k. Rated static mechanical terminal load

- straight load :……....
- Cross load :……
- Vertical force :……

l. Thickness of ice coating for which operation is possible :……

m. Mechanical endurance class :……

24. Insulators characteristics

a. Are the insulators of the outdoor, solid core, cylindrical post insulator type, with external fittings? :…….……

b. Type of material of the cylindrical solid core post insulators? :……..

c. Color of the porcelain? :……..……...

d. IEC 60273 designation of the insulators :……..

e. Power frequency withstand voltage, wet :……..

f. Lightning impulse withstand voltage :……..

g. Height of the post insulator :……..

h. Minimum creepage distance :……..

i. Failing load

- Bending :……..
- Torsion :…….
- Tension :…….
- Compression :…….

j. Bottom metal fitting pitch circle diameter :……..

k. Maximum normal diameter of the insulating part :……..

l. Top metal fitting pitch circle diameter :……..

25. Total weight of the disconnector with its frame base :…….....

……...…

26. Minimum clearances in air

a. Between poles :……...

b. To earth :……...

c. For isolating distance :……...

27. Can the disconnector be mounted on the steel structure as indicated in drawing No. 3.23H/2? :…..…….

……...

……...

……...

28. Distance between poles of the disconnector :……..

29. Distance between insulators of the same pole of the disconnector :…….....

30. Anticondensation heater data

a. Rated voltage :……...

b. Power consumption :……...

31. Interlocking coil data

a. Rated voltage :……...

b. Power consumption :……...

32. Rated current of the auxiliary contacts :……...

……

……

33. Are the three (3) insulators of each pole of the disconnector mounted on a common base frame? :……...

34. Are all terminal blocks suitable for 8mm^2 size conductors? :……...

35. Indicate tolerances in relation to paragraph VII-19 of this hereby technical description and confirm that proper contact can be achieved under these conditions. :……...

……

……

……

36. Is the packing according to the requirements of par. XVI? :……...