INDEPENDENT POWER TRANSMISSION OPERATOR S.A.
TNPRD/ SUBSTATION SPECIFICATION & EQUIPMENT SECTION

April 2024

TECHNICAL DESCRIPTION TD-66/4
24KV OUTDOOR, SINGLE-POLE, VERTICAL BREAK, HOOKSTICK TYPE AC DISCONNECTOR MANUALLY OPERATED (DESIGNATED BY IPTO S.A AS No 5.1)

I. SCOPE

This technical description covers IPTO's requirements with regard the design features, rated characteristics and testing of 24 KV, single-pole, vertical break, hookstick, AC disconnectors manually operated.

II. KEYWORDS

ac disconnectors, disconnecting switches, isolators.

III. STANDARDS

The disconnector shall be in accordance with IEC 62271-102 & IEC-60694 standards. Furthermore, the disconnector's cylindrical post insulators shall be in accordance with IEC 60273 and IEC 60168 standards.

IV. USE

The disconnectors are to be used in the 20KV overhead distribution line bays (six(6) per bay).They are to be installed at both sides of the circuit breaker (three (3) for the main buses and three (3) for the auxiliary buses) for isolating purposes in outdoor air insulated 150/20kVsubstations which have all the 20KV primary equipment installed outdoors. They are also to be used in the 20KV capacitor banks bays (Three per bay) and in the 12Ω earthing resistor (two (2) per resistor).

V. OPERATING 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. 20 KV ELECTRICAL SYSTEM CHARACTERISTICS

1.Nomimal Voltage	: 20KV
2.Maximum Operating Voltage	: 24KV
3.Lightning impulse withstand voltage	: 150KV
4. Short circuit level	: 10KA
5. Number of phases	: 3
6. Nominal Frequency	: 50 Hz
7. Earthing (grounding) method	: The 20KV system is earthed via a 12Ω resistor
8. Auxiliary voltages	: 110V D.C, 1Φ 230V A.C, 3Φ 400V A.C

VII. DISCONNECTOR REQUIRED DESIGN FEATURES

1. Type
   The disconnector shall be of the outdoor type, single-pole (phase), vertical break, of the hookstick type having two(2) solid core cylindrical post insulators.
   The disconnector shall be operated manually by hand via a hookstick.

2. Type of metals of the non-current carrying parts of the disconnector
   The non-current caring parts shall be from hot-dip galvanized steel.

3. Type of metal of the contacts of the disconnector.
   The contacts shall be tin-plated copper.

4. Type of metal of the blade(arm)
   The blade shall be from tin-plated copper.

5. Type of metal and shape of the disconnector's terminals.
   The terminals shall be from tin-plated copper and of orthogonal shape and of 60mm x 70mm in dimentions and with thickness of 5 mm.
   Also the disconnector shall be equipped with suitable bronze connectors Ø 30 in diameter.
   The bronze connectors with the connecting material (bolts, nuts, washers and lock washers, from stainless steel) must be part of the supply and shall be installed on the disconnectors.

6. Type of metal of the connecting parts of the disconnector.
   All bolts, nuts and washers used shall either be from hot-dip galvanized steel or from stainless steel.

7. Base frame (support base) of the disconnector.
   The base frame (support base) of the disconnector on which the two post insulators are mounted on shall be part of the supply and of hot-dip galvanized steel and of dimensions as indicated in drawing No 5.1.

8. Contact features
   The contacts must be self cleaning and capable to maintain always contact pressure.

9. Material of the hook of the blade of the disconnector
   The hook shall be from stainless steel or hot-dip galvanized steel.

10. Hookstick
The hookstick shall not be part of the supply.

11. Method of mounting of the disconnector
The disconnector shall be mounted in a vertical underhung position or in a under - hung position with an angle of about 30° from the vertical (For steel structure type OP) .

12. Dimentions of the disconnector.
The dimensions of the disconnector shall be as indicated in the drawing No 5.1.

13. Characteristics of the blade (arm)
The blade of the disconnector must be secured in the closed position so that it can withstand seismic, wind forces and any other vibrational forces without opening.

VIII. DISCONNECTOR REQUIRED RATED ELECTRICAL AND OTHER CHARACTERISTICS

1. Number of poles	: One (1)
2. Installation	: Outdoors
3. Rated Voltage	: 24 KV
4. Rated insulation levels	
a. Power frequency withstand voltage	
- Phase to earth dry and wet for 1 min	: 50 KV rms
- Across the isolating distance	: 60 KV rms
b. Lightning impulse withstand voltage	
- Phase to earth	: 150KV peak
- Across the isolating distance	: 165KV peak
5. Rated frequency	: 50 Hz
6. Rated normal current	: 630 A
7. Rated short-time withstand current	: 10 KA rms
8. Rated peak withstand current	: 25 KA peak
9. Rated duration of short circuit	: 3 sec
10. Thickness of ice coating for which operation is possible	:10mm
11. Type of conductors used for the connection of the disconnector	: Rigid
12. Mechanical endurance class	: MO (1000 operations)

IX. POST 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	: Brown
4. Designation of the insulators as per IEC-60273	: C8-150
5. Power frequency withstand voltage wet	: 50 KV rms
6. Lightning impulse withstand voltage	: 150KV peak

7. Height of the post insulators : 355mm ± 1 mm
8. Creepage distance : 600mm
9. Failing load
   a. Bending : 8000 N
   b. Torsion : 1500 Nm

10. Maximum nominal diameter of the insulating part : 195mm
11. Bottom metal fitting pitch circle diameter : 76 mm
12. Top metal fitting pitch circle diameter : 76mm

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 50 KV rms for phase to earth and 60 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 and phase, across open contacts and between conductive parts and the frame are checked by measurements.

2. 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 Ru where Ru is equal to the resistance measured before the temperature rise test.

3. Design and visual checks

The disconnectors shall be checked to verify that they comply with this hereby technical description.

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 The test shall be performed on a completely assembled disconnector.

C. Type Tests

1. Dielectric tests

a. Power frequency voltage test

- Test voltage : 50 KV rms for 1min for phase to earth and
  : 60 KV rms for 1 min across the isolating distance
- Conditions : Dry and wet

b. Lightning impulse voltage test
- Test voltage : 150 KV peak of both polarities for phase to earth and
  : 165 KV peak, across the isolating distance
- Lightning impulse shape : 1.2/50μs
- Conditions : Dry

2. Temperature-rise test

- Test current : 630A
- 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

3. Short-time withstand and peak withstand current test

- Short-time test current : 10 KA rms
- Peak withstand test current : 25 KA peak
- Test frequency : 50 Hz ± 10%
- Test duration : 3 sec

4. Operating and mechanical endurance tests

The mechanical endurance test shall consist of 1000 close-open operations without voltage or current through the disconnector.

5. Operation test under severe ice conditions

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

XI. TESTS FOR THE DISCONNECTOR'S POST 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 tests
   The tests shall consist of:
   a. Bending test and
   b. Torsion 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, tensile, torsion and compression)
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

XII. NAMEPLATE

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

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

XIII. DATA SUBMITTED BY ALL BIDDERS WHICH MUST BE

1. Outline drawing of the disconnector, in which all 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 (support base) with complete dimensions.

XIV. DATA WHICH MUST BE SUBMITTED BY THE SUCCESSFUL BIDDER

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

2. A drawing indicating the disconnector on its base frame (support base).

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

4. The supplier shall submit (if possible) 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 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 inside of an entirely enclosed robust wooden box of at least 20mm thickness, one (1) disconnector per box.

The transmission motion rods of the disconnector shall be delivered packaged in a separate wooden box.

ATTACHMENT "A"
24 KV OUTDOOR, SINGLE-POLE,VERTICAL BREAK, HOOKSTICK TYPE AC DISCONNECTOR-MANUALLY OPERATED (DESIGNATED AS 5.1)

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. Type of metal used in the non-current carrying parts of the disconnector :…..……...

5. Type of metal used in the contacts of the disconnector :…….

6. Type of metal used in the blade (arm) of the disconnector :……..

7. Type of metals used in the terminals of the of the disconnector :……..

8. Dimensions of the terminals of the disconnector :……..

9. Type of metal used in the connecting parts of the disconnector :……..

10. Type of metals used for the base frame (support base) of the disconnector :……..

11. Are the contacts self-cleaning and always maintaining contact pressure ? :……..……

12. Material of the hook of the blade :……...
……

13. Are the dimentions of the disconnector in agreement with drawing No 5.1 :……

……

……

14. Disconnector's electrical and other characteristics

a. Numbers of poles :……

b. Installation :……

……

c. Rated voltage :……

d. Power frequency withstand voltage

- Phase to earth, dry and wet :……...
- Across the isolating distance :……...……

e. Lightning impulse withstand voltage

- Phase to earth :……...
- 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. Thickness of ice coating for which operation is possible :……

l. Mechanical endurance class :……

15. Post insulators characteristics

a.Type :…….……

…….…….

b. Manufacturer :……..

c. Material of the insulators ? :……...……...

d. Color of the porcelain :…….

e. Designation of the insulators as per IEC-60273 :……..

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

g. Lightning impulse withstand voltage :……..

h. Height of the post insulators :……..

i. Creepage distance :……..

j. Failing load

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

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

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

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

16. Indicate number of insulators per pole :……

17. Weight of the disconnector including its base frame (support base) :…….....

……...…

18. Weight of the each insulator :……..

…….

19. Is the blade (arm) of the disconnector secured in the

closed position so that it does not open under seismic, wind or other vibrational forces? :……

……..

20. Are the bronze connectors Ø 30 in diameter with the connecting materials (bolts, nuts, washers and lock washers from stainless steel) part of the supply? :……..

……

21. Are the disconnectors going to be delivered packed inside of entirely closed robust wooden boxes of at least 20mm thickness, three (3) disconnectors per box? :……..

……