



PUBLIC POWER CORPORATION
T/NPRD/SUBSTATION & EHV SUBSTATION
SPECIFICATIONS AND EQUIPMENT SECTION

January 2011

TECHNICAL DESCRIPTION TD-68/2
24KV OUTDOOR, THREE-POLE, VERTICAL TYPE AC DISCONNECTOR
MANUALLY OPERATED VIA SWING HANDLE
(DESIGNATED BY PPC S.A AS No 5.3)

I. SCOPE

This technical description covers PPC's requirements with regard the design features, rated characteristics and testing of 24 KV, three-pole, vertical type, AC disconnectors manually operated via swing handle.

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 distribution line bays for isolating purposes in outdoor air insulated 150/20kV substations which have all the 20kV primary equipment installed outdoors. There will be one(1) disconnectors per distribution line bay.

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. PPC's 20 KV ELECTRICAL SYSTEM CHARACTERISTICS

1. Nominal 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 12 Ω resistor
8. Auxiliary voltages	: 110V D.C, 1 Φ 230V A.C, 3 Φ 400V A.C.

VII. DISCONNECTOR REQUIRED DESIGN FEATURES

1. Type
The disconnector shall be of the outdoor type, three-pole (phase), vertical type, having three(3) solid core cylindrical post insulators per pole (phase) with one insulator capable of rotational movement for the purposes of the disconnecting function.
The disconnector shall be three-pole operated manually by swing handle and a transmission motion rod .
2. Type of metals of the non-current carrying parts of the disconnector
The non-current carrying 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 dimensions and of 5 mm in thickness.
Also the disconnector shall be equipped with suitable bronze connectors $\varnothing$ 30 in diameter as indicated in the attached drawing of this hereby technical description.
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 three post insulators are mounted on shall be part of the the supply and of hot-dip galvanized steel and of dimensions as indicated in drawing No 5.3.



8. Contact features

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

9. Material of the swing handle

The swing handle shall be tube from stainless steel or hot-dip galvanized steel.

10. Swing Handle

The swing handle shall be part of the supply and its length shall be as indicated in drawing 5.3.

11. Method of mounting of the disconnecter

The disconnecter shall be mounted in a vertical underhung position as indicated in drawing No 5.3.

12. Dimentions of the disconnecter.

The dimentions of the disconnecter shall be as indicated in the drawing No 5.3.

13. Characteristics of the blade (arm)

The blade of the disconnecter 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	: Three (3)
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 disconnecter	: Rigid
12. Mechanical endurance class	: MO (1000 operations)



IX. POST INSULATORS REQUIRED CHARACTERISTICS (FOR ALL THREE INSULATORS OF EACH POLE)

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 $\pm$ 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 disconnecter 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 disconnecter.

Power frequency voltage test.

The test voltage shall be 50 KV rms for phase to earth and phase to phase 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 phases, 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 R_u where R_u 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
phase to phase 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 between
phase and
: 165 KV peak, across
the isolating distance |
| Lightning impulse shape | : 1.2/50 μ s |
| - 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 $\pm$ 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 disconnect.

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 disconnect manufacturer is obliged to present to the PPC 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 current	✓
Rated duration of short circuit	✓
Mechanical endurance class	✓
Weight	✓

XIII. DATA WHICH MUST BE SUBMITTED BY ALL BIDDERS

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 PPC's judgment.
5. A drawing (3-pole arrangement) indicating the disconnector on its base frame (support base) with complete dimensions and also a drawing indicating the swing handle of the disconnector, its size and its characteristics and of the transmission motion rod as well.



XIV. DATA WHICH MUST BE SUBMITTED BY THE SUCCESSFUL BIDDER

1. Complete physical drawings of the disconnecter , indicating all dimensions details, for approval before the construction of the disconnecter (three sets).
2. A drawing (3-pole arrangement) indicating the disconnecter on its base frame (support base).
3. A drawing indicating dimensions and characteristics of the swing handle and of the transmission motion rod as well.
4. Maintenance and assembly instructions in detail for the disconnecter.

XV. WARRANTY

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

XVI. PACKING

Each disconnecter must be delivered packaged inside of an entirely enclosed robust wooden box **of at least 20mm thickness**, one (1) disconnecter per box.

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



ATTACHMENT “A”
24 KV OUTDOOR, THREE-POLE, VERTICAL TYPE AC
DISCONNECTOR MANUALLY OPERATED VIA SWING HANDLE
(DESIGNATED AS 5.3)

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 disconnecter :.....
5. Type of metal used in the contacts of the disconnecter :.....
6. Type of metal used in the blade (arm) of the disconnecter :.....
7. Type of metals used in the terminals of the of the disconnecter :.....
8. Dimensions of the terminals of the disconnecter :.....
9. Type of metal used in the connecting parts of the disconnecter :.....
10. Type of metals used for the base frame (support base) of the disconnecter :.....
11. Are the contacts self-cleaning and always maintaining contact pressure ? :.....
12. Material of the swing handle :.....



13. Is the shape of terminals
of the orthogonal shape ? :.....
14. Are the dimensions of the disconnecter
in agreement with drawing No 5.3 :.....
:.....
:.....
15. Disconnector's electrical and other characteristics
- a. Numbers of poles :.....
- b. Installation :.....
:.....
- c. Rated voltage :.....
- d. Power frequency withstand voltage
- Phase to earth and between phases
dry and wet :.....
 - Across the isolating distance :.....
- e. Lightning impulse withstand voltage
- 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. Thickness of ice coating for which
operation is possible :.....
- l. Mechanical endurance class :.....



16. 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 :.....

17. Indicate number of insulators per pole :.....

18. Weight of the disconnector including
its base frame (support base) per
pole. :.....



19. Weight of the disconnecter including
its base frame (support base) for the
three-poles
:.....
20. Weight of the each insulator
.....
21. Is the blade (arm) of the
disconnecter secured in the
closed position so that it
does not open under seismic
wind or other vibrational forces?
.....
22. Type of material, length and thickness of
the transmission motion rod
.....
23. Is the disconnecter suitable for 3-pole
operation with the means of a swing handle
and a transmission motion rod ?
.....
24. 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?
.....
25. Are the disconnectors going to be
delivered packed inside of entirely
closed robust wooden boxes of at least
20mm thickness, one disconnecter per box? :.....
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