

Project : 400/220 kV S/S at Talaguppa & Guttur; 400/220 kV S/S at Nelamangla & Hoody;
Customer: KPTCL

Annexure-H

PRE-COMMISSIONING TESTS

- Reactor
- Circuit breaker
- Isolator
- Current transformer
- Surge arrestor

5.2.7.6 Measure and record the dew point of dry air/nitrogen at time of filling and after 24 hours in the transformer tank. Dew point of dry air/nitrogen at the time of transformer despatch should be better than -30 deg C. Also the dew point of dry air/nitrogen cylinders attached for make up during transportation should be of the order of -50 deg C.

5.2.7.7 Functioning of impact recorder(s) at their works before installing on the tank.

5.3 Inspection and Testing at Site

The Contractor/Manufacturer shall carry out a detailed inspection and testing programme for field activities, namely covering areas right from the receipt of material stage upto commissioning stage. An indicative programme of inspection as envisaged by the Employer is given below and in the document no. OS/T&C/Bay/95 (Pre commissioning Procedures and Formats for substation bay equipment), which will be available in the respective sites and shall be referred by the Contractor. However, it is Contractor's responsibility to draw up and carry out such a programme duly approved by the Employer. Testing of oil sample at site shall be carried out as per Cl.3.4 above.

5.3.1 Receipt and Storage Checks

5.3.1.1 Check and record condition of each package, visible part of the reactors etc. for any damage.

5.3.1.2 Check and record the gas pressure in the reactor tank as well as in the cylinder.

5.3.1.3 Visual check for wedging of core and coils before filling up with oil and also check for condition of core and winding in general.

5.3.1.4 Check and record reading of impact recorders at receipt and verify the allowable limits as per manufacturer's recommendation.

5.3.2 Installation Checks

5.3.2.1 Check the whole assembly for tightness, general appearance etc.

5.3.2.2 Oil leakage test

5.3.2.3 Visual check for Leakage on bushing before erection.

5.3.2.4 Measurement of capacitance and tan delta of the bushings before fixing/connecting to the reactor. Contractor shall furnish these values for site reference.

5.3.2.5 Measure and record the dew point of nitrogen in the main tank before assembly. Manufacturer shall submit dew point acceptable limits along with temperature correction

factor and shall for part of instruction manual. In case dew point values are not within permissible limit suitable drying out process shall be applied for dry out of active part in consultation with the Manufacturer.

5.3.2.6 Oil filling

5.3.2.6.1 Procedures for site drying, oil purification, oil filling etc shall be submitted for approval and complete instructions shall form part of the manual.

5.3.2.6.2 The duration of the vacuum treatment shall be demonstrated as adequate by means of water measurement with a cold trap or other suitable method but shall generally not be less than 72 hours. The vacuum shall be measured on the top of the reactor tank and should be less than 1mbar.

5.3.2.6.3 Oil filling under vacuum at site shall be done with transformer oil at a temperature not exceeding 65°C. Vacuum shall not be broken until the reactor is oil filled up to the Buchholz relay. Whenever the active insulation or any paper insulated HV connections, especially those from the windings to the bushings are exposed, these shall be re-impregnated under vacuum along with the complete reactor. For this purpose the reactor shall first be drained to expose all insulation material.

5.3.2.6.4 The minimum safe level of oil filling (if different from the Buchholz level) to which the reactor shall be oil filled under vacuum, shall be indicated in the manual.

5.3.2.6.5 The Ultra High Vacuum type oil treatment plant of suitable capacity (preferably 4500 to 6000 litres per hour) suitable for treatment of oil in EHV class reactor shall be used in order to achieve properties of treated oil. The plant shall be capable of treatment of new oil (as per IEC 60296/IS: 335 and reconditioning of used oil (as per IS: 1866/IEC: 422 for oil in service) at rated capacity on single pass basis as follow :

- (i) Removal of moisture from 100 ppm to 3 ppm (max.)
- (ii) Removal of dissolved gas content from 10% by Vol. To 0.1% by vol.
- (iii) Improvement of dielectric strength break down voltage from 20 to 70 KV
- (iv) Vacuum level of degassing chamber not more than 0.15 torr/0.2 mbar at rated flow and at final stage. Machine shall have minimum of two degassing chambers and these should have sufficient surface areas to achieve the final parameters.
- (v) Filter shall be capable of removing particle size more than 0.5 micron in the filtered oil.
- (vi) Processing temperature shall be automatically controlled and have a adjustable range from 40°C to 80°C

5.3.3 Commissioning Checks

5.3.3.1 Check the colour of silicagel breather.

5.3.3.2 Check the oil level in the breather housing, conservator tank, cooling system, condenser bushing etc.

5.3.3.3 Check the bushings for conformity of connection to the line etc.

5.3.3.4 Check for correct operation of all protection devices and alarms.

- (a) Buchholz relay
- (b) Excessive winding temperature
- (c) Excessive oil temperature
- (d) Low oil level indication

5.3.3.5 Check for adequate protection of electric circuit supplying the accessories.

5.3.3.6 Insulation resistance measurement for :

- (a) Control wiring
- (b) Main winding
- (c) Bushing current transformer

5.3.3.7 2 kV/minute test between bushing CT terminal and earth.

5.3.3.8 Check for cleanliness of the reactor and the surrounding.

5.3.3.9 Measure vibration and noise level

5.3.3.10 DGA of oil sample just before commissioning and after 24 hours of commissioning.

5.3.3.11 Capacitance and tan delta measurement of winding & bushing.

5.3.3.12 Frequency Response Analysis (FRA) at site by using owner's equipment which shall be provided free of cost.

5.3.3.13 Contractor shall prepare a comprehensive commissioning report including all commissioning test results and forward to Employer for future record.

~~6~~ **Technical Parameters**

	Technical specification. (ms)	
D17.9.	Rated break time as per IEC (ms)	Less than 75
D17.10.	Total closing time (ms)	Not more than 200
D17.11.	Rated operating duty	O-0.3S-CO-3min-CO Cycle
D17.12.	Operating mechanism	Spring
D17.13.	Trip coil and closing coil voltage	220V DC with variation as specified in clause 8.2.5 of Tech. spec.
D17.14.	Auxiliary contacts	Besides requirement of Technical specification, the contractor shall wire up 2 NO + 2 NC contacts for future use of Employer
D17.15.	Noise level at base and upto 50 m distance from base of breaker	140 dB (Max.)
D17.16.	Rated terminal load	As per IEC or as per the value calculated in section - GTR of Tech. Spec., whichever is higher.
D17.17.	Temperature rise over the design ambient temperature	As per IEC 60694
D17.18.	First pole to clear factor	1.5
D17.19.	No. of terminals in common control cabinet	All contacts & control circuits to be wired out upto common control cabinet plus 10 Terminals exclusively for Employer's use.

18.0 PRE-COMMISSIONING TESTS

18.1 An indicative list of tests is given below. All routine tests except power frequency voltage dry withstand test on main circuit breaker shall be repeated on the completely assembled breaker at site. Pre-commissioning tests, procedures and formats for circuit breakers, Doc.No.: MR/CF/CB/05/R-2, Dated 01/04/08 under POWERGRID Document no. D-2-01-03-01-02 will be the reference document. This document will be available at respective sites and shall be referred by the contractor. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Insulation resistance of each pole.
- (b) Check adjustments, if any suggested by manufacturer.
- (c) Breaker closing and opening time.
- (d) Slow and Power closing operation and opening.
- (e) Trip free and anti pumping operation.

- (f) Minimum pick-up voltage of coils.
- (g) Dynamic Contact resistance measurement.
- (h) Functional checking of compressed air plant and all accessories.
- (i) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.
- (j) Insulation resistance of control circuits, motor etc.
- (k) Resistance of closing and tripping coils.
- (l) SF6 gas leakage check.
- (m) Dew Point Measurement
- (n) Verification of pressure switches and gas density monitor.
- (o) Checking of mechanical 'CLOSE' interlock, wherever applicable.
- (p) testing of grading capacitor.
- (q) resistance measurement of main circuit.
- (r) checking of operating mechanisms
- (s) Check for annunciations in control room.

18.2 The contractor shall ensure that erection, testing and commissioning of circuit breaker shall be carried out under the supervision of the circuit breaker manufacturer's representative. The commissioning report shall be signed by the manufacturers representative.

D. Technical Parameters for 72.5 kV , 36 kV and 11 kV Isolator

1.	Rated voltage	72.5 kV	36kV	11 kV
2.	Rated current	400 A	400 A	400 A
3.	Standards	IEC 62271-102	IEC 62271-102	IEC 62271-102
4.	Rated short time withstand (in KA)	25KA for 3 sec.	25KA for 3 sec.	25KA for 3 sec.
5.	Operating drive	AC Motor operated (isol) Manual operated (E/S)	Manual operated	Manual operated
6.	Type	Double break Isolator without E/S, 3 pole, outdoor, Gang operated	Double break Isolator without E/S, 3 pole, outdoor, Gang operated	Double break Isolator without E/S, 3 pole, outdoor, Gang operated
7.	Interlock	Electrical interlock with circuit breaker. Mechanical castle key interlock to be provided between electrical and manual operation.	Pad locking of operating handle for preventing unauthorised operation.	Pad locking of operating handle for preventing unauthorised operation.
8.	Construction details	All ferrous parts to be galvanized except nuts and bolts which shall be electroplated as per relevant IS	All ferrous parts to be galvanized except nuts and bolts which shall be electroplated as per relevant IS	All ferrous parts to be galvanized except nuts and bolts which shall be electroplated as per relevant IS
9.	Terminal connector	To suit site conditions and layout requirements.	To suit site conditions and layout requirements.	To suit site conditions and layout requirements.
10	Operating time	12 seconds or less	--	--

12.0 PRE-COMMISSIONING TESTS

12.1 An indicative list of tests on isolator and earthswitch is given below. For pre-commissioning procedures and formats for Isolators and ground switch. Doc.No.: MR/CF/ISO/08/R-2, Dated 01/04/08 under POWERGRID Document no. D-2-01-03-01-02 will be the reference document. This

document will be available at respective sites and shall be referred by the contractor. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

- (a) Insulation resistance of each pole.
 - (b) Manual and electrical operation and interlocks.
 - (c) Insulation resistance of control circuits and motors.
 - (d) Ground connections.
 - (e) Contact resistance.
 - (f) Proper alignment so as to minimise to the extreme possible the vibration during operation.
 - (g) Measurement of operating Torque for isolator and Earth switch.
 - (h) Resistance of operating and interlocks coils.
 - (i) Functional check of the control schematic and electrical & mechanical interlocks.
 - (j) 50 operations test on isolator and earth switch.
- 12.2 The contractor shall ensure that erection, testing and commissioning of Isolators above 72.5 kV class shall be carried out under the supervision of the Isolator manufacturer's representative. The commissioning report shall be signed by the manufacturers representative.

9.0 PRE-COMMISSIONING TESTS

9.1 An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

9.2 Current Transformers

- (a) Insulation Resistance Test for primary and secondary.
- (b) Polarity test
- (c) Ratio identification test - checking of all ratios on all cores by primary injection of current.
- (d) Dielectric test of oil (wherever applicable).
- (e) Magnetising characteristics test.
- (f) Tan delta and capacitance measurement
- (g) Secondary winding resistance measurement
- (h) contact resistance measure-ment(wherever possible/accessible).
- (i) Test for SF6 (for SF6 filled CTs) – Dew point measurement, SF6 alarm/ lockout check.
- (j) DGA test of oil.

Dissolved gas analysis to be carried out at the time of commissioning. CTs must have adequate provision for taking oil samples from the bottom of the CT without exposure to atmosphere. Bidder/Manufacturer shall recommend the frequency at which oil samples should be taken and norms for various gases in oil after being in operation for different durations. Bidder/Manufacturer should also indicate the total quantity of oil which can be withdrawn from CT for gas analysis before refilling or further treatment of CT becomes necessary.

9.3 Voltage Transformers/Capacitive Voltage Transformers

- (a) Insulation Resistance test for primary (if applicable) and secondary winding.
- (b) Polarity test

- (c) Ratio test
- (d) Dielectric test of oil (wherever applicable).
- (e) Tan delta and capacitance measurement of individual capacitor stacks.
- (f) Secondary winding resistance measurement.

For pre-commissioning procedures and formats for Isolators and ground switch, Doc.No.: MR/CF/ / /R-2, Dated 01/04/08 under POWERGRID Document no. D-2-01-03-01-02 will be the reference document. This document will be available at respective sites and shall be referred by the contractor.

8.0 PRE-COMMISSIONING TESTS

8.1 An indicative list of tests is given below.

- (a) operation check of LA counter.
- (b) Insulation resistance measurement
- (c) Capacitance and Tan delta measurement of individual stacks.
- (d) Third harmonic resistive current measurement(to be conducted after energisation.)

Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests alongwith calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

For pre-commissioning procedures and formats for Surge arresters, refer Doc.No.: MR/CF/SA/04/R-2, Dated 01/04/08 under POWERGRID Document no. D-2-01-03-01-02. This document will be available at respective sites and shall be referred by the contractor.