

15. PROTECTION SYSTEM**15.1. Type Tests**

The contractor is required to carry out all type tests as per relevant IEC / International Standards on one apparatus of each type of similar rating and shall submit the reports to the Employer. The type test may not be mandatory if similar equipment has been type tested and test certificate(s) for relevant tests are accepted by the Employer.

15.2. Shop Tests

All Relays shall be routine tested as per IEC: 60255 and British Standards 142 and 5992 and submit reports to Employer. Following shop tests shall be carried out at the manufacturers works:-

- ◆ Visual inspection,
- ◆ Check for BOM,
- ◆ Wiring test,
- ◆ Insulation test,
- ◆ High voltage test on outgoing circuits,
- ◆ Functional tests of all relays,
- ◆ Functional tests of protection scheme.

The details of tests are given in Model Quality Assurance Plan of Protection System.

15.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance test shall submitted well in advance, at least six(6) month before start of relevant testing, for approval by the Employer.

15.3.1. Tests during installation and pre commissioning

Following tests shall be performed by the Contractor:

- ◆ Ratio and polarity of CTs, CVTs and PTs,
- ◆ Correctness of interconnections between CTs, CVTs and PTs as well as CT groups and associated relays,
- ◆ Testing, calibration and adjustment of protection relays,

(QTS)

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(QTS)

2/7

- ◆ Check of functional characteristics of each of the electrical protections,
- ◆ Check of tripping sequence,
- ◆ Check of orders issued by each of the protections with respect to the corresponding tripping sequence,
- ◆ The systematic testing of the operation of each chain forming the protection, the associated tripping sub-assembly, the links to the connected systems and all fault simulations by test kit for which the system is to react,
- ◆ The co-ordination of protection and relay setting,
- ◆ The testing of the protection system behaviour during failure of one of its components,
- ◆ The testing of the protection system behaviour in the event of failure of one of the connected system to which it is connected,
- ◆ Synchronizing schemes for unit and line CBs.

15.3.2. Commissioning tests

Following tests shall be performed by the Contractor:

- ◆ The systematic testing of the operation of each chain forming the protection, the associated tripping sub-assembly, the links to the connected systems and all fault simulations by creating real fault for which the system is to react,
- ◆ The final co-ordination of protection and final relay setting,
- ◆ The testing of the protection system behaviour in the event of failure of one of the connected system to which it is connected.

Checks shall be made after the protection systems have been commissioned to ensure that all connections and test links have been replaced and test leads removed and relay setting has been done, as well as to confirm the integrity of the current transformer circuits. Where necessary, voltage readings shall be taken at the terminals on each relay to ensure that loop connections between the relays are complete.

PROTECTION SYSTEM



220KV/33 KV SWITCHYARD

3/7

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(QTS)

12.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance test shall submitted well in advance, at least six(6) month before start of relevant testing, for approval by the Employer.

Following tests shall be performed after installation:

◆ Test on CVT:

- Ratio test,
- IR value test,
- Measurement of secondary voltage at rated voltage.

◆ Test on LA :

- Record of Leakage current and surge counter reading.



220 KV / 33 KV SWITCHYARD



12-2

582

DC SYSTEM

4/7

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- Ampere – Hour Capacity,
- Crank Ability (when applicable, excluding types L&M),
- Retention of Charge,
- Insulation Resistance.
 - ◆ Following Test on DC Distribution Board shall be performed as per IEC
- HV and IR Test,
- Scheme Checking.
 - ◆ Following Test on Inverter shall be performed as per IEC 146 and 439 and IS13314
- Light Load Test,
- Synchronization Test,
- Checking of Protective Devices,
- Measurement of Inherent Voltage Regulation,
- Alternating current Input Return Test,
- Manual Switching from Inverter to Mains and Back at Full Load,
- Rated Full load Test,
- Measurement of Neutral Grounding Resistance,
- HV and IR Test,
- No Load Test,
- Out Put Test.

The Details of the tests are given in Model Quality Assurance Plan of 220 and 48 Battery Charger, 220 and 48 V Battery Bank, DC Distribution Board (DCDB) and Inverter.

13.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

13.3.1. Tests during installation, pre commissioning and commissioning

At least the following tests shall be performed:

- ◆ Installation check of all components installed according to as-built drawings and engineering,

DC SYSTEM



13-2



584

CABLING SYSTEM

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- ◆ Swedish Chimney test (SS-424 14 75),
- ◆ Ladder Test (IEEE-383),
- ◆ Heat Shock Test (IS:1554) and
- ◆ Anti Rodent and Termite Test.

Following test on Cable Trays as per relevant IS

- ◆ Galvanization Test,
- ◆ Load Capacity Test (Deflection Test).

The details of tests are given in Model Quality Assurance Plan of Power and Control Cables including Cable Trays.

✓ 16.3.

Field Tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

Before commissioning of complete system, all cabling system shall be checked as per cable schedule and complete report shall be prepared by Contractor and shall be submitted.

Field test shall include:

- ◆ Cabling checking,
- ◆ Continuity checking,
- ◆ Meggar testing in accordance with the applicable codes and standards,
- ◆ Resistance checking.
- ◆ Insulation resistance measurement,
- ◆ Verification of phase order,
- ◆ HV test.



LT SWITCHGEAR & AUX TRANSF.

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(QTS)

6/7

19.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

19.3.1. Tests during installation and pre commissioning

At least following inspections/ tests shall be performed:-

19.3.1.1. Transformers

- ◆ Correct functioning of the various protection systems,
- ◆ Inspection of the insulation to earth of the various parts of the transformers.
- Phase order checking,
- Measurement of the winding resistance,
- Ratio test,
- Measurement of the no load current at 415 V,
- Calibration and setting of WTI,
- Final IR values between windings and winding and earth.

19.3.1.2. 415 V switchgear

- ◆ Functional and operational tests,
- ◆ Measurement of the insulating resistance of the different power and control circuits, including cables, instruments and apparatus, against earth,
- ◆ Adjustment of the protection equipment,
- ◆ Calibration of releases,
- ◆ Verification of component temperatures,
- ◆ Verification of interlocks: ensure that interlocks are correctly installed and that access is prevented to live portions of the system when interlocks are in place and that access is permitted when interlocks are removed,
- ◆ Other test as suggested by the Contractor and/or the Employer at site.

415 V SWITCHGEAR AND AUXILIARY TRANSFORMER



7/7

26. GROUNDING SYSTEM

26.1. Type Tests

Not specified.

26.2. Shop Tests

Not specified.

26.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

- ◆ Earthing resistance measurement at four distant points at PH, Potheadyard, Transformer, and GI switchyard.

