

SECTION-IVB

TOWER TESTING

**(Applicable for Transmission Lines
wherein Tower Testing is in Contractor's
scope)**

TECHNICAL SPECIFICATIONS

SECTION-IV B

TOWER TESTING

Revision History

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TECHNICAL SPECIFICATIONS

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1.0 Tower Load Tests

1.1 Testing of Tower

Tower of each type complete with 0m extension for 765 kV & with +9M extension for 400 kV, 220 kV & 132 kV shall be subjected to design and destruction tests by first applying test loads applied in a manner approved by the Employer. The tower shall withstand these design tests without showing any sign of failure or permanent distortion in any part. Thereafter, the tower shall be subjected to destruction by increasing the loads further in an approved manner. The tower shall be tested for specified loading conditions as approved by employer. The Contractor shall submit to the Employer, for approval, the detailed programme and proposal for testing the towers showing the methods of carrying out the tests and manner of applying the loads. After the Employer has approved the test procedures and programme, the Contractors will intimate the Employer about carrying out the tests at least 30 days in advance of the scheduled date of tests. Employer will arrange to depute his representative to be present at the time of carrying out the tests. Two (2) copies of the test reports shall be submitted after completion of the tests. The Contractor shall submit one set of shop drawings alongwith the bill of materials at the time of prototype tower testing for checking the tower material. Further, at the time of submitting test report, the contractor has to submit the final structural drawings, shop drawings and Bill of materials for Employer's reference and record.

1.1.1 In case of premature failure, the tower shall be retested and steel already used in the earlier test shall not be used again. However, in case of minor failures, the contractor can replace the members with higher section and carry out the testing. The Contractor shall provide facilities to the Employer or their representatives for inspection of materials during manufacturing stage and also during testing of the same.

1.1.2 In case of any premature failure even during waiting period, the tower is to be retested with rectified members. However, if the failures are major in nature and considerable portion of tower is to be re-erected, in such cases, all the tests which has been carried out earlier are required to be re-conducted again in compliance with Specification.

1.1.3 No part of any tower subject to test shall be allowed to be used on the line. The price for the tower tests will be quoted after allowing rebate for the scrap value of the tower material which will be retained by the Contractor.

- 1.1.4 The Contractor shall ensure that the specification of materials and workmanship of all towers actually supplied conform strictly to the towers which have successfully undergone the tests. In case any deviation is detected, the Contractor shall replace such defective towers free of cost to the Employer. All expenditure incurred in erection, to and fro transportation and any other expenditure or losses incurred by Employer on this account shall be fully borne by the Contractor. No extension in delivery time shall be allowed on this account. The contractor may do the spotting of towers, supply of stubs & casting of foundations before testing of towers at their own risk and cost and if any modification/strengthening is required after successful completion of testing of towers, same shall be carried out by the contractor without any financial implication to employer.
- 1.1.5 Each type of tower to be tested shall be a full-scale prototype galvanized tower and shall be erected vertically on rigid foundation of the stub protruding above ground level as provided in the design/ drawing between ground level and concrete level. This portion of the stub shall be kept un-braced while testing. The tower erected on test bed shall not be out of plumb by more than 1 in 360.
- 1.1.6 All the measuring instruments shall be calibrated in systematic/ approved manner with the help of standard weight/ device. Calibration shall be done before commencing the test of each tower up to the maximum anticipated loads to be applied during testing.
- 1.1.7 The suspension tower is to be tested with an arrangement similar to 'I' string. The tension tower is to be tested with strain plate as per approved design/ drawings.
- 1.1.8 The sequence of testing shall be decided by the Employer at the time of approving the rigging chart/ test data sheet.
- 1.1.9 The Employer may decide to carry out the tensile test, bend test etc. as per the relevant IS on few members of the test tower after completion of the test or in case of any premature failure. The Contractor shall make suitable arrangement for the same without any extra cost to the Employer.
- 1.1.10 Prefix 'T' shall be marked on all members of test tower in addition to the Mark No. already provided.
- 1.2 **Method of Load Application**
- 1.2.1 Loads shall be applied according to the approved rigging arrangement through normal wire attachments angles on bent plates.
- 1.2.2 The various types of loads, transverse, vertical and longitudinal shall be applied in such a way that there is no impact loading on the tower due to jerks from the winches.

- 1.2.3 All the loads shall be measured through a suitable arrangement of strain devices or by using weights. Positioning of the strain devices shall be such that the effect of pulley friction is eliminated. In case the pulley friction cannot be avoided, the same will be measured by means of standards weights and accounted for in the test loads.

1.3 **Tower Testing Procedure**

The procedure for conducting the tower test shall be as follows:

1.3.1 **Bolt Slip Test**

In a bolt slip test, the test loads shall be gradually applied up to the 50% of design loads under normal condition, kept constant for two (2) minutes at that loads and then released gradually.

For measurement of deflection, the initial and final readings on the scales (in transverse & longitudinal directions) i.e. before application and after the release of loads shall be taken with the help of theodolite. The difference between readings gives the values of the bolt slip.

1.3.2 **Normal Broken Wire Load Tests**

All the loads, for a particular load-combination test, shall be applied gradually upto the full design loads in the following steps and shall also be released in the similar manner:

25 percent,

50 percent,

75 per cent,

90 percent,

95 percent and

100 percent

1.3.3 **Observation Periods**

Under normal and broken wire load tests, the tower shall be kept under observation for sign of any failure for two minutes (excluding the time of adjustment of loads) for all intermediate steps of loading up to and including 95 percent of full design loads.

For normal, as well as broken wire tests, the tower shall be kept under observation for five (5) minutes (excluding the time for adjustment of loads) after it is loaded up to 100 percent of full design loads.

While the loading operations are in progress, the tower shall be constantly watched, and if it shows any tendency of failure anywhere, the loading shall be

immediately stopped, released and then entire tower shall be inspected. The reloading shall be started only after the corrective measures are taken.

The test shall be considered to be satisfactorily passed if it is able to support the specified full design loads for five (5) minutes with no visible local deformation after unloading (such as bowing, buckling etc.) and no breakage of elements or constituent parts.

Ovalization of holes and permanent deformation of bolts shall not be considered as failure.

1.3.4 **Recording**

The deflections of the tower in transverse and longitudinal directions shall be recorded at each intermediate and final stage of normal load and broken wire load tests by means of a theodolite and graduated scale. The scale shall be of about one meter long with marking up to 5 mm accuracy.

1.3.5 **Destruction Test**

The destruction test shall be carried out under normal condition or broken wire condition. Load condition for destruction test shall be mentioned in approved rigging chart/ test data sheet.

The procedure for application of load for normal/ broken wire test shall also be applicable for destruction test. However, the load shall be increased in steps of five (5) per cent after the full design loads have been reached till the load value reaches as specified in approved rigging chart or Lattice Tower fails (whichever is earlier).

1.3.5.1 Type tests specified above shall not be required to be carried out if a valid test certificate is available for a similar design meeting all technical specification requirements. The tests certificate shall be considered valid if

Tests certificate issued thereof by the Test Agency to the contractor approved by the representative(s) of any utility.

In the event of any discrepancy in the test report (i.e., any test not applicable due to any design/ manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the contractor at no extra cost to the Employer.

1.3.5.2 Type test charges for type test indicated above are deemed to be included in fabrication charges quoted by bidder.