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Indian Standard

CODE OF PRACTICE FOR USE OF STRUCTURAL STEEL IN OVERHEAD TRANSMISSION LINE TOWERS

PART III TESTING

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BUREAU OF INDIAN STANDARDS
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Indian Standard

CODE OF PRACTICE FOR USE OF STRUCTURAL STEEL IN OVERHEAD TRANSMISSION LINE TOWERS

PART III TESTING

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 25 October 1978, after the draft finalized by the Structural Engineering Sectional Committee had been approved by the Structural and Metals Division Council and the Civil Engineering Division Council.

0.2 With the publication of IS : 802 (Part I)-1977* and IS : 802 (Part II)-1978† provisions regarding loads, material, permissible stresses, design aspects, fabrication, galvanizing, inspection and packing requirements of overhead transmission line towers have been covered. In this part requirements regarding testing of overhead transmission line towers have been covered.

0.3 This standard keeps in view the practices being followed in the country in this field. Assistance has also been derived from the 'Guide for design of steel transmission line towers' issued by the American Society of Civil Engineers and from the draft 'Loading tests of overhead line towers' issued by International Electrotechnical Commission.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Code of practice for use of structural steel in overhead transmission line towers: Part I Loads and permissible stresses (*second revision*).

†Code of practice for use of structural steel in overhead transmission line towers: Part II Fabrication, galvanizing, inspection and packing.

‡Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part III) covers the provisions relating to the testing requirements of prototype self supporting steel lattice towers for overhead transmission lines.

1.1.1 Provisions regarding loads, permissible stresses and design requirements have been covered in Part I of this standard.

1.1.2 Provisions regarding fabrication, galvanizing, inspection and packing requirements have been covered in Part II of this standard.

1.1.3 For provisions regarding erection of towers, reference shall be made to IS : 5613 (Part II/Sec 2)-1976*.

1.2 This code does not cover guyed towers and special towers for river crossing or other long spans.

2. GENERAL

2.1 Testing of tower generally serves as a guide to good tower design and therefore shall not be considered as a requisite proof test for all towers. The test shall be conducted on full scale prototype tower as per the approved loading schedules and rigging diagrams. The members constituting the prototype shall be of the same grade of steel as specified in the design and fabrication shall conform to the provisions stipulated in IS : 802 (Part II)-1978†. The tower shall be tested on rigid foundation.

2.1.1 The test tower shall successfully withstand the ultimate loads specified for various conditions.

2.2 Leg Anchorages — The tower shall be erected vertically on rigid foundations with as much unbraced portion of the stub protruding above ground level as provided in the drawing.

2.3 The tower erected on test bed shall not be out of plumb by more than 1 in 360.

3. CALIBRATION OF MEASURING INSTRUMENTS

3.1 All measuring instruments shall be calibrated in a systematic manner with the help of standard weights. The calibration shall, before commencing the test on each tower, be done up to the maximum anticipated load to be applied during testing. Calibration curves for the instruments to be used during testing shall be drawn by the testing authorities and the test loads shall be suitably corrected with the help of these curves.

*Code of practice for design, installation and maintenance of overhead power lines: Part II Lines above 11 kV and up to and including 220 kV, Section 2 Installation and maintenance.

†Code of practice for use of structural steel in overhead transmission line towers: Part II Fabrication, galvanizing, inspection and packing.

4. METHOD OF LOAD APPLICATION

4.1 Loads shall be applied according to rigging diagram through normal wire attachments, angles, or bent plates. U bolts/D shackles or swinging brackets (hangers) may be used in the test tower if desired by the purchaser, provided that satisfactory and safe rigging is attained.

4.2 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.

4.3 Loading cases (values, directions and points of application of loads) are to be given by the client.

5. LOAD AND DEFLECTION MEASUREMENTS

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

5.2 Tower deflections under load shall be measured by suitable procedure at the top cross arm level on the front sides of the transverse and longitudinal faces or front and rear sides of transverse faces. Deflection readings shall be recorded for the 'before load', 'load on' and 'load off' conditions.

6. TESTING PROCEDURES

6.1 Bolt Slip Test — In a bolt slip test, the test loads are gradually applied up to the design loads, kept constant for 2 minutes at the design loads and then the loads are released gradually.

The initial and final readings on the scales before application and after the release of loads respectively shall be taken with the help of theodolite. The difference between these readings gives the values of the bolt-slip.

6.2 Normal Load/Broken Wire Load Tests — All the loads shall be applied gradually up to the ultimate design loads (design load × F.O.S.) in the following steps and shall be released in the similar manner:

25 percent,
50 percent,
75 percent,
90 percent,
95 percent, and
100 percent.

7. OBSERVATION PERIODS

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

7.2 For normal as well as broken wire tests, the tower shall be kept under observation for five minutes after it is loaded up to 100 percent ultimate design loads.

7.3 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 the entire tower shall be inspected. The re-loading shall be started only after the corrective measures are taken.

8. RECORDINGS

8.1 The deflections of the tower shall be recorded at each intermediate and final stage of normal load/broken wire load test by means of a theodolite and graduated scales.

8.2 The graduated scales which are fitted on the tower shall be about one metre long with marking up to 5 mm accuracy.

9. DESTRUCTION TEST

9.1 If the purchaser so desires, the tower shall be tested to destruction.

9.2 Destruction test shall be carried out under normal condition or broken wire condition as agreed between the purchaser and the contractor.

9.3 All the provisions of this code for normal load/broken wire load test are applicable to destruction test as well. However, the loads shall be increased in steps of 5 percent after the ultimate design loads have been reached.

10. CHECK FOR MECHANICAL STRENGTH OF TOWER

10.1 The structure is considered to be satisfactory if it is able to support the specified ultimate load for 5 minutes as stipulated in **6.2**, with no visible local deformation after unloading (such as bowing, buckling), and no breakage of elements or constituent parts.

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

10.3 Material Test — If so desired by the purchaser, coupons shall be cut from test tower members and tested in a laboratory.

11. PROCEDURE FOR REPETITION OF TESTS IN THE EVENT OF PREMATURE FAILURE

11.1 In the event of premature failure of tower, the part that has failed may be replaced by another with greater mechanical strength. The modified structure shall be required to pass the test for the specified ultimate load values (100 percent step).

12. TEST REPORT

12.1 The report shall include the following:

a) The type of tested tower.

b) The name and address of the tower manufacturer.

c) The name and address of the client.

d) The dates and location of testing.

e) The names of persons present during the tests.

f) A list of various assembly and shop drawings relating to the tower tested, including any modification of the drawings referred to.

g) A dimensioned line diagram of the tower showing the various load points and directions of loading to be applied and table with the specified loads.

h) Diagram showing the rigging arrangement used to apply the test loads.

j) Brief description of the test facility including the number, location, range and calibration charts or tables of every load transducer, as well as the accuracy of the equipment used to measure the test loads.

k) One table per test, showing the loads required at the various points on the structure and for the various loading steps.

m) One table per test, showing the various deflection values which may have been recorded.

n) In the case of failure:
   1) a table showing the maximum loads applied to the structure, just before the collapse;
   2) a brief description of the failure; and
   3) the dimensional and mechanical characteristics of the failed elements.

p) A certain number of photographs, showing the whole of the structure and, possibly, details of the failure.

12.2 Certified steel producer test reports and physical test reports for members used in test towers shall be furnished as specified by the purchaser.

12.3 Test reports of coupons (*see* **10.3**) shall also be furnished.

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117/418 B Sarvodaya Nagar, KANPUR 208005	21 68 76 21 82 92
Patliputra Industrial Estate, PATNA 800013	6 23 05
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Inspection Offices (With Sale Point):	
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Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	5 24 35

*Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, Calcutta 700072 — 27 68 00

†Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 — 89 65 28

‡Sales Office in Bangalore is at Unity Building, Narasimharaja Square, Bangalore 560002 — 22 36 71

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