

FABRICATION AND ERECTION OF LATTICE TOWER STEELWORK

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TABLE OF CONTENTS

PURPOSE AND SCOPE	1
PART 1 – PROCEDURAL	1
1 QUALITY ASSURANCE	1
2 MATERIALS.....	3
3 WORKMANSHIP.....	4
4 ERECTION MARKS.....	7
5 PROTECTIVE TREATMENT	7
6 QUALITY CONTROL	7
7 ERECTION OF TOWER STEELWORK	8
8 FORMS AND RECORDS.....	10
PART 2 - DEFINITIONS AND DOCUMENT HISTORY	10
9 DEFINITIONS	10
10 AMENDMENTS RECORD	10
11 IMPLEMENTATION	10
PART 3 - GUIDANCE NOTES AND APPENDICES.....	11
12 REFERENCES	11
APPENDIX A - ENGINEERING DOCUMENTS	14
APPENDIX B – NOTIFICATION AND HOLD POINTS.....	15

PURPOSE AND SCOPE

This document forms part of a suite of documents which define National Grid (NG) functional and performance requirements for new plant and equipment.

This specification defines the requirements for the fabrication and erection of tower steelwork, including materials, workmanship, marking, protective treatment and check erection. It replaces NGTS 2.10 Section 501.

PART 1 – PROCEDURAL

1 QUALITY ASSURANCE

The Quality Assurance arrangements shall conform to the relevant requirements of BS EN ISO 9000 Series.

The systems and procedures, which the Contractor will use to ensure that the Works comply with the Contract requirements, shall be defined in the Contractor's Quality Plan for the Works.

1.1 Quality Plan

A Quality Plan for the Works shall be submitted to National Grid's appointed Engineer or representative for review a minimum of one week prior to commencement of the Works. The Quality Plan shall give a description of the Quality System for the Works and shall, as a minimum, include the following:

- a) An outline of the proposed work and programme sequence;
- b) The structure of the Contractor's organisation for the Contract, both on site and at head office, particularly identifying the individuals responsible for site safety, inspection and testing;
- c) A schedule of the Contractor's procedures for ensuring quality of workmanship and materials. These procedures shall be made readily available to the Engineer or representative for inspection on request;
- d) A schedule of Inspection and Test Plans (see 1.2);
- e) The arrangements for the Contractor's Quality Assurance auditing, including that for sub-contractors.

The prime responsibility for inspection and testing rests with the Contractor. The inspection or its waiver by the Engineer or representative does not release the Contractor of any obligations or responsibilities to carry out the work in accordance with the Contract.

1.2 Inspection and Test Plans

The inspection and testing shall be documented such that it is possible to verify that it has been performed. In order to comply with this requirement the Contractor shall draw up and operate Inspection and Test Plans for each section of the work. These shall be made readily available to the Engineer or representative for inspection on request.

The Inspection and Test Plans shall set out the testing and inspection requirements in the sequence in which they are to be performed and, unless agreed otherwise with the Engineer or representative, shall include the following:

- a) **Hold and Notification Points** (see section 9 - Definitions);
- b) Submission of Engineering documents required by the specification;
- c) Inspection on receipt of materials, during fabrication/ construction and on completion stating the identity of the inspector/tester, date, acceptance criteria and acceptability.

1.3 Non-conforming Product

The Engineer or representative shall be responsible for review and disposition of non-conforming product in accordance with BS EN ISO 9000 Series.

1.4 Monitoring of Quality Assurance Arrangements

During the course of the contract the Engineer or representative may monitor the implementation of the Quality Assurance arrangements. Monitoring will be by surveillance of activities at work locations and/or by formal audits of the adherence of the Contractor to the systems and procedures which constitute his Quality Assurance arrangements. Corrective actions shall be agreed and implemented in respect of any deficiencies.

The Contractor shall provide any facilities, including access, which may be required by the Engineer or representative for monitoring activities.

The Engineer or representative may participate on an agreed basis in the Contractor's monitoring of a sub-contractor's Quality Assurance arrangements.

1.5 Sub-contractors

The Contractor shall ensure that any sub-contractor appointed by him under the Contract follows the Quality Assurance requirements of this Specification.

The Contractor shall assess the sub-contractor's Quality Assurance arrangements prior to his appointment to ensure their compliance with this Specification.

The Contractor shall, when requested by the Engineer or representative, provide Quality Plans for all works that are to be carried out by sub-contractors carrying out specialised work on their behalf. This is a **Notification Point**.

2 MATERIALS

2.1 General

All steel shall comply with BS EN 10025-1, BS EN 10025-2 or BS EN 10210 as appropriate.

High yield steel shall be grade S355JR for sections less than 19 mm thick and S355JO for sections greater than or equal to 19 mm thick.

Mild steel shall be grade S275JR.

Mild and high tensile steel hollow sections shall be grades S275J2H and S355J2H respectively.

Steel angle sections shall comply with BS EN 10056-1 and BS EN 10056-2

If material (for angles greater than 10 mm in section thickness) is to be used for fabrication of corner legs, and is found to have a -ve. tolerance of greater than 2.5%, permission to use this material must be obtained from the Engineer or representative before fabrication commences. This is a **Hold Point**.

Quality of finished steel shall be in accordance with BS EN 10163 or BS EN 10210 as appropriate. All steel shall be free from blisters, scale, laminations, segregation and other defects. There shall be no rolling laps at toes of angles or rolled-in mill scale.

2.2 Bolts, Nuts and Washers

Steel for bolts of 16 mm diameter and over shall be Grade S355JR or Grade 8.8 to BS EN ISO 898-1.

Steel for non-structural step bolts shall be Grade S275JO or S355JR.

Step bolt dimensions shall be as detailed in 3.04.14 Appendix A.

Nut Grade shall match the associate bolt material Grade.

Bolts and nuts shall be ISO Metric Black Hexagon to BS 4190 with the following variations:

- | | | |
|------|---|--|
| i) | Plus tolerance on diameter | 0.1 mm |
| | Plus tolerance on diameter (after galvanising) | 0.2 mm |
| | Minus tolerance on diameter | 0.3 As BS 4190 |
| ii) | Tolerance on nominal length of bolt | ± 1 mm |
| iii) | a) Length of thread (NG standard) | Bolt diameter (d) + 10 mm |
| | b) Length of thread (with Lock Nuts) | d + 20 mm for M16
d + 25 mm for M20
d + 27 mm for M22
d + 30 mm for M24 |
| | NB. Lock Nut to be standard Full Nut | |
| iv) | a) Distance from the underside of bolt head to face of screw ring gauge which has been screwed minus as far as possible on the bolt by hand. | Nominal bolt length (d + 10) mm |
| | b) Distance from the underside of bolt head to face of screw ring gauge which has been screwed minus as far as possible by hand. (for Nut and Locknut bolt) (7.1 paragraph 7) | Nominal bolt length d + 20 mm for M16
d + 25 mm for M20
d + 27 mm for M22
d + 30 mm for M24 |
| v) | Tolerance on iv) above | + 0.5 mm |

Bolts and nuts shall be threaded ISO Metric Course Pitch to BS 3643: Part 2, Tolerance Class 7H/8g.

All washers shall be of steel Grade S275JR. Washers immediately under the nut shall be 4 mm thick with an external diameter of nominal bolt diameter + 15 mm and a hole diameter of nominal bolt diameter + 2 mm.

Pack washers shall have an external diameter of twice nominal bolt diameter + 15 mm, a hole diameter of nominal bolt diameter + 2 mm and thickness as specified on the tower erection drawings and bolt lists. The required thickness shall not be made up by the use of multiple washers.

2.3 Welding

Consumables for use in metal arc welding shall comply with BS EN ISO 14341, BS EN ISO 2560 and BS EN 756 or BS EN 760 as appropriate.

3 WORKMANSHIP

3.1 Fabrication of Steelwork

Except for butt jointed main legs and members specified otherwise, material shall be sheared to length. Ends shall be free from burrs and square with the length to ± 0.3°, unless otherwise specified.

3.2 Tolerances

Fabrication tolerances, which are not to be considered cumulative, shall be as follows:

- | | | |
|------|---|--------------------------|
| i) | On the overall length of any bar other than legs | ± 2 mm |
| ii) | On the specified hole diameter in the black (on the punch side when punched) | + 0.3 mm
– 0.0 mm |
| iii) | On the specified hole diameter in the black (on the die side when punched) t = thickness of metal | Larger of 0.8 mm or t/10 |
| iv) | On centres of holes in a group | ± 1 mm |
| v) | On the centres of groups of holes | ± 1.5 mm |
| vi) | On back marks | ± 1 mm |
| vii) | On the dimension from the end of the bar to the centre of the nearest hole (for free ends) | ± 1 mm |

Special tolerances that shall apply to the ends of main leg members in a butt joint are as follows:

- | | | |
|------|---|------------------------|
| i) | Overall length of leg | ± 1 mm |
| ii) | Distance from the ends of bar to the centre of nearest hole | + 0 mm
– 1 mm |
| iii) | Centre to centre of holes in splice material (at centre only of Cover plates and/or Bosom angles) | + 2 mm
– 0 mm |
| iv) | Squareness of cut at the ends of main leg members in a butt-joint | ± 0.25 mm / 100 mm |

All groups of holes at ends of main legs must be worked on separately to achieve the above requirements.

3.3 Straightness

Straightness shall be measured in the plane of each leg with the measured leg being horizontal.

The permitted tolerance from straightness for finished material, i.e. after galvanising, shall be in accordance with BS EN 10056-2.

Straightness for 250 x 250 Section Steel shall conform to BS EN 10056-2.