Specification No. 52 /TRD/CE/MM/2016

HARYANA VIDYUT PRASARAN NIGAM LIMITED

(REVISED)

TECHNICAL SPECIFICATION

FOR

TRANSMISSION LINE TOWERS

AND

SUB-STATION STRUCTURES

SEPTEMBER-2016
HARYANA VIDYUT PRASARAN NIGAM LIMITED

TECHNICAL SPECIFICATION

FOR

TRANSMISSION LINE TOWERS

AND

SUB-STATION STRUCTURES

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ANNEXURE

I

TECHNICAL PARTICULARS

II

HOT DIP GALVANISED HEXAGONAL HEAD BOLTS

WITH NUTS, ELECTRO GALVANISED SPRING

WASHERS AND HOT-DIP GALVANISED STEP BOLTS
Technical specification for transmission line towers and sub-station structures

1.0 Scope

1.1 This specification provides for proto fabrication as per the assembly drawings to be supplied by the purchaser, assembly into tower/structures for inspection, mass fabrication, galvanizing and delivery FOR destination of transmission line towers and sub-station structures comprising super structures, Extensions, Sub-station Gantry structures/Equipment Structures, stubs and tower accessories such as hanger, D-shakle, Extension Link, U-bolts, flat washers, Anti-climbing devices, Bird-guards etc., as per Board’s assembly drawings as described hereafter in this volume.

1.2 Bidders are required to quote for all material as detailed in the specification. Quoted prices shall include all components of Accessories (which may or may not be specifically mentioned in the BOM/ Structural drawings, but which are necessary for satisfactory operation and usual in similar equipment and they shall not be paid extra for these items. Supply of fasteners for tower members is also in the scope of tower material supplier (Technical Specification of Hot Dip Galvanised Hexagonal Head bolts with nuts, Electro Galvanised Spring Washers and Hot-Dip Galvanised Step Bolts is placed at Annexure-II). The nuts and bolts required for hangers, D-shakle, U-bolts, ACDs and Bird Guards etc. and foundation and counter sunk bolts for sub-station structures are in the scope of supply.

2.0 Standards

2.1 Except as modified in this specification, the materials covered under “scope” clauses 1-1 to 1-2, shall conform to the latest revision with amendments thereof of the following bureau of Indian standards and other international standards.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Bureau of Indian Standards (BIS)</th>
<th>Title</th>
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<tbody>
<tr>
<td>1.</td>
<td>IS 209</td>
<td>Specification for Zinc</td>
<td>ISO/R/752</td>
</tr>
<tr>
<td>2.</td>
<td>IS 2062/2006 its latest Version</td>
<td>Structural steel (Standard quality)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>IS 802</td>
<td>Code of practice for use of Structural steel in overhead Transmission line towers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part-I</td>
<td>Material, loads and permissible Stresses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part-II</td>
<td>Fabrication, Galvanizing Inspection and packing</td>
</tr>
<tr>
<td>4.</td>
<td>IS 1367</td>
<td>Technical supply conditions For threaded fasteners (First revised)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>IS2016</td>
<td>Plain washers</td>
<td>ISO/R/987</td>
</tr>
</tbody>
</table>
6. IS2629  Recommended practice for hot dip galvanizing of Iron and steel
7. IS 2633  Method of testing uniformity of Casting of zinc coated articles
8. IS 3063  Single coil rectangular section Spring washers for bolts, Nuts, screws
9. IS 5358  Hot dip galvanized coatings on Fasteners
10. IS 6610  Specifications for heavy washers For steel structures
11. IS 12427  Hexagonal bolts for steel structures
12. IS 6745  Methods of determination of weight of zinc coating of iron and steel articles

3.0 **Climatic conduction:**

The Structures covered under this specification are to be used in the State of Haryana, and shall be suitable for the climatic conditions prevailing in the area as per details given below:

<table>
<thead>
<tr>
<th>Location</th>
<th>Haryana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. ambient air temperature (°C)</td>
<td>50</td>
</tr>
<tr>
<td>Max. ambient air temperature (°C)</td>
<td>(-) 2.5</td>
</tr>
<tr>
<td>Max. relative humidity (%)</td>
<td>100</td>
</tr>
<tr>
<td>Min. relative humidity (%)</td>
<td>26</td>
</tr>
<tr>
<td>Average rainfall per annum (mm)</td>
<td>900</td>
</tr>
<tr>
<td>Max. altitude above mean sea level (m)</td>
<td>1000</td>
</tr>
<tr>
<td>Basic wind speed (m/s)</td>
<td>47</td>
</tr>
<tr>
<td>Isoceraunic level (days per year)</td>
<td>50</td>
</tr>
<tr>
<td>Seismic level (Horizontal acceleration)</td>
<td>0.3G</td>
</tr>
</tbody>
</table>
4.0 **General technical requirements:**

4.1 **General description**

i) The specification covers fabrication of tower material of 400kV /220kV/132kV /66kV (as applicable) of M/C / D/C / S/C type of various design required as per requirement of design.

ii) The Sub-station structures of HVPN Design.

iii) Tower accessories as detailed in the specification.

4.1.1 The towers shall be of the self supporting type, built up of lattice steel sections or members.

4.1.2 The towers and structures shall be fully galvanized structures built up of structural Mild steel & High Tensile steel sections.

4.1.3 Stubs and superstructures:

i) The stubs shall mean a set of four stub angles fully galvanized.

ii) Superstructures/ Sub-station structures shall mean the galvanized tower/ structure assembly above the stubs which includes structural members like angle sections, cross arms, earth wire peak, gusset plates and pack washers. Steel and zinc required for manufacturing these items shall be arranged by the bidder.

iii) Supply of Hangers for attaching suspension strings, U bolts for attaching ground-wire suspension assemblies, D-shakle, link, flat washers, bird guards and anti-climbing devices are included in the scope of supply since these are required for completing the towers in all respects:

a) The steel used for fabrication of tower and structure parts shall be of Mild steel and High tensile steel of tested quality as per IS-2062:2006 its latest Version and relevant structural drawings.

b) The bidder shall take into account the fabrication wastage while quoting the rates. No reduction in weight due to drilling, punching of bolt holes, screw cuts, clipping, notching, chamfering, etc. shall be made while computing the calculated weight of the members.

Detailed drawings will be made available to the successful bidder only.

c) Substitutions, if any, of steel sections of the tower parts by higher sizes, due to non-availability or otherwise, shall be to the supplier’s account. The purchaser will not accept any liability on this account.

d) The copy of invoices of steel sections purchased for fabrication shall be supplied to inspector deputed by HVPN during inspection.
e) The zinc used for galvanizing fabricated material shall be of high grade electrolytic zinc of 99.95% purity.

The purchaser shall be at liberty to have samples of zinc used, test checked in any laboratory and reject the particular supply if it is not found upto requisite quality.

4.2 **Stub setting templates:**

Stub templates are not in the scope of supply

4.3 **Tower accessories:**

4.3.1 Insulator strings and earthwire clamp attachments:

a) For the attachment of suspension insulator strings, a swinging hanger on the tower shall be supplied as per the drawing enclosed so as to obtain requisite clearance under extreme swinging conditions and free swinging of the string. The hanger shall be fabricated to withstand an ultimate tensile strength of 70kN/90kN/120kN (as the case may be). The hanger set shall be hot dip galvanized and shall comprise of the hanger rod, bolt etc. as detailed in the drawing.

b) For earth wire at suspension towers suitable U-bolts shall be supplied as per drawing enclosed to accommodate the hook of the earthwire suspension clamps. The U-bolt shall be hot dip galvanized and shall comprise of a U bolt with nuts as detailed in the drawing.

c) For the attachment of tension insulator string, D-shackle and Links shall be supplied as per drawing enclosed. These shall be hot dip galvanized.

4.3.2 **Bird Guards:**

Hot dip galvanized bird guards shall be supplied as per the drawing enclosed for use with tangent towers.

4.3.3 **Anti-climbing devices:**

Hot dip anti-climbing devices with wrapping of galvanized iron barbed wire shall be supplied as per drawing enclosed for use on all the towers.

4.4 **Details of tower fabrication workmanship:**

4.4.1 The tower structures shall be accurately fabricated to bolt together easily at site without any strain on the bolts.

4.4.2 The diameter of the holes shall be 17.5mm i.e. equal to the diameter of 16mm bolt plus 1.5mm, unless otherwise specified.

4.4.3 All steel sections before any work is done on them, shall be carefully leveled, straightened and made true to detailed drawings by methods which shall not injure the material so that when assembled, the different matching surfaces are in close contact throughout. No rough edges shall be permitted anywhere in the structures.
4.4.4. Drilling and punching

4.4.4.1 Before any cutting work is started, all steel sections shall be carefully straightened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled.

4.4.4.2 Holes for bolts shall be drilled or punched with a jig out drilled holes are preferred. The following maximum tolerance of accuracy of punched holes is permissible. Holes must be perfectly circular and no tolerance in this respect is permissible.

4.4.4.3 All burrs left by drills or punches shall be removed completely, when the tower members are in assembled position, the holes shall be truly opposite to each other. Drilling or reaming to enlarge defective holes is not permitted.

4.4.5 Tolerances:-

4.4.5.1 The tolerances as per IS: 1852/1979 or its latest revisions would be applicable for angles, plates & rounds:-

   a). Angle Equal & Unequal
       clause 4.3.1, 4.3.2, 4.3.3, 4.3.4 & 4.3.5 shall govern rolling and weight tolerance.

   b). Rounds: Clause 5.1.1, 5.1.2 & 5.1.3 shall govern rolling and weight tolerances on tolling of round which will be used for Anchor Bolts.

   c). Plates: Clause 7.3, 7.3.1 & 7.3.2 shall govern the tolerances on thickness and weight of plate members.

4.4.5.2 Fabrication tolerance shall conform to those specified in clause 6.2 to 6.5 of IS:802/Part-II-1978 which are however also detailed below:

   The maximum allowable difference in diameter of the holes on the two sides of plate or angle shall be 0.8mm, that is, the allowable taper in a punched hole shall not exceed 0.8mm on diameter.

   The tolerance cumulative and between consecutive holes shall be within + 2mm and ± 1mm respectively.

   Tolerance on the overall length of a member shall be within +1 mm.

   Tolerance on gauge distance shall be within +0.5 mm. tolerance not specified above shall in general conform to IS:7215/1974 or the latest revision.

4.4.6 Erection work:-

Each individual member shall have an erection mark conforming to the component number given to it in the fabrication drawings. This mark shall be marked with marking dies of 16 mm size before galvanizing and shall be legible after galvanizing.

The erection mark shall be A-BB-CC-DDD-H where:-

A- Owner code assigned to the bidder (Alphabet)
4.5 **Galvanizing:-**

All the structures shall be fully galvanized. Galvanized shall be in conforming with IS:2629, IS:4759 and shall be done after all fabrication work has been completed. Threads of bolts and nuts in respect of hanger and U bolt after galvanizing shall have a near fit and shall be such that they can be turned with fingers through out the threads of bolts and they shall be capable of developing the full strength of the bolts. Galvanizing for U bolts shall conform to IS:5358.

4.6 **Quantities and Weights:**

4.6.1 The quantities to be purchased are stated in Annexure-I.

4.7 **Tower steel sections:**

4.7.1 All the steel sections to be used in towers, structures and stubs shall be of tested quality in conformity with IS:-2062:2006 its latest Version / as per structural drawings. While designing the towers only rationalized steel sections are used. During execution of the project, if any particular section is not available, the same shall be substituted by higher section at no extra cost. However, approval for such substitution shall be obtained from the Purchaser.

4.7.2 **Bolt Arrangement**

The minimum bolt spacing and rolled edge distance and sheared edge distances of sections from the centres of the bolt holes to be maintained are given below:

<table>
<thead>
<tr>
<th>Dia. of bolts (mm)</th>
<th>Hole dia. (mm)</th>
<th>Min. bolt spacing (mm)</th>
<th>Min. rolled distance (mm)</th>
<th>Min. edge (mm)</th>
<th>sheared distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>17.5</td>
<td>40</td>
<td>20</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>21.5</td>
<td>48</td>
<td>25</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>25.5</td>
<td>60</td>
<td>33</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

4.8 **Packing:-**

Angle sections shall be wire bundled.

Cleat angles, gusset plates, bird guards, hangers, anti-climbing devices and similar other loose items shall be nutted and bolted together in multiples or securely wired together through holes.
U Bolts and pack washers shall be packed in double gunny bags, accurately tagged, in accordance with the contents.

The packing shall be properly done to avoid losses / damages during transit. Each bundle or package shall be appropriately marked.

5.0 Tests

5.1 Since the detailed structural drawings will be provided by the purchaser, proto testing of towers is not required. However, proto assembly of each type of tower, and structure shall be done by the supplier and offered for inspection to the Purchaser before taking up mass fabrication of the structures required.

5.2 The Visual, mechanical and chemical tests on each such size of section will be conducted on the samples to be selected by the inspecting officer of HVPN at an independent lab at no extra cost of HVPN as per IS:2062:2006/IS:802:1978 its latest Version.

5.3 Galvanization of the members of the tower shall withstand tests as per IS:2633.

6.0 INSPECTION

6.1 The material shall be inspected by the Purchaser or his authorized agent before dispatch unless dispensed with in writing by the Purchaser. The successful Bidder shall keep the Purchaser informed will in advance of the commencement of manufacture, progress of manufacture thereof and fabrication of various tower parts at various stages, so that arrangements could be made for inspection by the Purchaser.

6.2 The acceptance of any batch of items shall in no way relieve the supplier of any of his responsibilities for meeting all the requirements and intent of this specification and shall not prevent subsequent rejection if any item of that batch is later found defective.

6.3 The Purchaser or his authorized representatives shall have free access at all reasonable times to those parts of the Supplier's works connected with the fabrication of the material covered under the contract for satisfying themselves provisions of this specification.

6.4 Unless specified otherwise, inspection shall be made at the place of manufacture prior to dispatch and shall be conducted so as not to interfere unnecessarily with the operation of the work.

The mechanical and chemical test on steel sections selected by the Inspecting Officer of Purchaser will be conducted at an independent laboratory at the expenses of the supplier.

6.5 Should any member of the structure be found not to comply with the approved drawing, it shall be liable for rejection. No member once rejected shall be resubmitted for inspection, except in cases where the owner or his authorized representative considers that the defects can be rectified.

6.6 Defects which occur during fabrication shall be made good with the consent of, and according to the procedure to be laid down by the Purchaser.
6.7 All gauges and templates necessary to satisfy the Purchaser for conducting tests shall be made available at the test site by the Supplier.

6.8 The correct grade and quality of steel shall be used by the Supplier. To ascertain the quality of steel, the Purchaser may at his discretion get the material tested at an approved Laboratory such as National Physical Laboratory, New Delhi or Shree Ram Test Centre, New Delhi at Purchaser’s cost and the test results obtained will have to be accepted by the Supplier.

7.0 SCHEDULE OF REQUIREMENTS:

The successful Bidder has to match the supply and delivery of material to complete the works within the time schedule desired by the Purchaser.

The supply of unit tower / structures shall be deemed to be completed when all member constituents / accessories of a tower / structures have been supplied.
# TECHNICAL PARTICULARS

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Description</th>
<th>To be filled by the bidder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Standards to which the quality of <strong>MS &amp; HT steel</strong> for the sections conform</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Standards to which galvanizing conforms</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Minimum sheared edge distances</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Minimum rolled edge distances</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Quality of zinc used for galvanizing</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Maximum percentage increase in tower weight due to galvanization</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Quantity of zinc required per metric tone of tower weight</td>
<td></td>
</tr>
</tbody>
</table>

Name of bidder:- __________________

Signature of bidder:- __________________

Designation: __________________

Authorized common rubber

Stamp seal of bidder: __________________

Date:- __________________
HARYANA Vidyut Prasar Nigam Ltd.


Technical Specification

For

Hot Dip Galvanised Hexagonal Head Bolts and Nuts,
Electro Galvanised Spring Washers and
Hot Dit Galvanised Step Bolts

Chief Engineer/MM
Transmission Design Directorate
Haryana Vidyut Prasar Nigam Ltd.
Panchkula-134 109
Haryana
India
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<td>2.0</td>
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<td>4.0</td>
<td>GENERAL TECHNICAL REQUIREMENTS</td>
<td>2</td>
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<td>5.0</td>
<td>TEST AND TEST CERTIFICATES</td>
<td>6</td>
</tr>
<tr>
<td>6.0</td>
<td>SAMPLING AND ACCEPTANCE OF MATERIAL</td>
<td>7</td>
</tr>
<tr>
<td>7.0</td>
<td>INSPECTION</td>
<td>7</td>
</tr>
<tr>
<td>8.0</td>
<td>PACKING AND MARKING</td>
<td>8</td>
</tr>
<tr>
<td>9.0</td>
<td>QUANTITY AND DELIVERY REQUIREMENT</td>
<td>8</td>
</tr>
<tr>
<td>10.0</td>
<td>GUARANTEED TECHNICAL PARTICULARS</td>
<td>8</td>
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</table>

ANNEXURES

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II GUARANTEED TECHNICAL PARTICULARS 10-11
TECHNICAL SPECIFICATIONS FOR
HOT DIP-GALVANISED HEXAGONAL HEAD BOLTS AND NUTS,
ELECTRO-GALVANISED SPRING WASHERS AND HOT DIP
GALVANISED STEP BOLTS

1. SCOPE:

1.1 This specification provides for design, manufacture, testing at
manufacturer’s works before dispatch, supply and delivery of Hot Dip
Galvanised Hexagonal Head bolts with nuts, Electro Galvanised Spring
Washers and Hot-Dip Galvanised Step Bolts for use on 66kV and above
power transmission lines and substation structures in the state
of Haryana.

2. STANDARDS:

Hot Dip Galvanised Hexagonal Head Bolts with nuts, Electro-Galvanised Hexagonal
Spring Washers and Hot Dip Galvanised Step Bolts shall
comply in all respects with the following Indian Standards which shall
mean latest revision, amendments/changes adopted and published
unless otherwise specified hereafter.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Indian Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>IS- 12427</td>
<td>Specification for Transmission tower bolts</td>
</tr>
<tr>
<td>ii.</td>
<td>IS-3063</td>
<td>Single coil rectangular section spring washers for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bolts, nuts and screws.</td>
</tr>
<tr>
<td>iii.</td>
<td>IS-10238</td>
<td>Specification for step bolts for steel structure</td>
</tr>
<tr>
<td>iv.</td>
<td>IS-1363 (All Parts)</td>
<td>Black hexagon bolts, nuts &amp; lock nuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(diameter 6 to 39mm) and Black hexagon screws</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(diameter 6 to 24mm)</td>
</tr>
<tr>
<td>v.</td>
<td>IS-1367 (All Parts)</td>
<td>Technical supply conditions for threaded steel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fasteners.</td>
</tr>
<tr>
<td>vi.</td>
<td>IS-4218 (All Parts)</td>
<td>ISO metric screw threads.</td>
</tr>
<tr>
<td>vii.</td>
<td>IS-2633</td>
<td>Methods of testing uniformity of coating on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zinc-coated articles</td>
</tr>
<tr>
<td>viii.</td>
<td>IS-2614</td>
<td>Methods for sampling of fasteners</td>
</tr>
<tr>
<td>ix.</td>
<td>IS-4072</td>
<td>Steel for spring washers</td>
</tr>
<tr>
<td>x.</td>
<td>IS-1586</td>
<td>Methods for Rockwell hardness test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(B and C scales) for steel.</td>
</tr>
<tr>
<td>xi.</td>
<td>IS-6821</td>
<td>Methods for sampling non-threaded fasteners.</td>
</tr>
<tr>
<td>xii.</td>
<td>IS-2016</td>
<td>Plain washers</td>
</tr>
<tr>
<td>xiii.</td>
<td>IS-4759</td>
<td>Hot dip Zinc coatings on structural steel and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>other allied products</td>
</tr>
</tbody>
</table>
2.2 Material manufactured according to any other international and authoritative standards which ensures an equal or better quality material than in the specification mentioned above, shall also be acceptable. The salient points of differences between the standard adopted and the Indian Standard Specifications referred above, or these specifications shall be brought out in a comparative statement to be attached with the tender. The specific standard to which the material quoted by the tenderer shall comply, shall be clearly stated and copies of such standard specifications in English must be attached.

3. **CLIMATIC CONDITIONS:-**

i. Location In the state of Haryana

ii. Maximum Ambient Air Temperature Degree C 50

iii. Minimum Ambient Air Temperature Degree C (-) 2.5

iv. Minimum relative humidity (%) 26

v. Maximum relative humidity (%) 100

vi. Average rainfall per annum (mm) 900

vii. Maximum altitude above mean sea level (mtrs.) 1000

viii. Isoceraunic level (Days/annum) 45

ix. Basic wind speed (m/s) 47

x. Seismic level (Horizontal Acceleration) 0.3G

4.0 **GENERAL TECHNICAL REQUIREMENTS**

4.1 **GENERAL TECHNICAL REQUIREMENTS FOR HOT DIP GALVANISED HEXAGONAL HEAD BOLTS WITH NUTS**

G.I. nuts and bolts shall have hexagonal head with threads conforming to clause 8 g of IS:4218 (Part-6) 1978. 'ISO metric Screw threads' with latest amendments for M 16 size bolts with nuts.
4.1.1 **DIMENSIONS**
The dimensions of the bolts shall be as per IS:12427-1988.

4.1.2 **GRADES**
The bolts shall be of product grade C as specified in IS:1367 (Part-2)-1979 “Technical supply conditions for threaded steel fasteners” (Part-2) for product grades and tolerances (second revision).

4.1.3 **MATING NUTS**
4.1.3.1 The hexagonal nuts used with these bolts shall conform to the requirements of IS:1363 (Part-3) 1984. The nuts shall be of property class 5 as specified in IS:1367 (Part-6)-1980. The proof stress for the nominal nuts size M 16 shall be 490N/mm².

4.1.3.2 Nuts shall be hot dip Galvanised in accordance with clause 6 of IS:12427-1988.

4.1.4 **MECHANICAL PROPERTIES**
4.1.4.1 The mechanical properties of bolts will conform to class 5.6 as specified in IS:1367 (Part-3) -1979 and shall be tested full size.

For Tensile, proof load and wedge loading tests, three threads only shall be exposed between the grips. This is obtained by freely running the nut or fixture to the fullest extent and then unscrewing the specimen three full turns. These tests are to be done after chemically degalvanising the bolts.

Bolts having nominal length less than the 3 times the nominal diameter shall meet the hardness requirements of HB-147 to HB-242 (or HRB-79 to HRB-100 or HV-155 to HV-255).

4.1.4.2 The shear strength and the testing for shear strength of the bolts shall be in accordance with clause 5.2 of IS:12427-1988.

4.1.5 **FINISH**
4.1.5.1 The bolt’s heads shall be neatly finished and free from fins, scales and other defects. The threads of nut shall not be torn or rubbed and shall be of proper contour, bolts and nuts shall be completely inter-changeable. The bolts and nuts shall be hot dip Galvanised in accordance with the requirements of IS:1367 (Part-13)-1983. The uniformity of zinc coating shall be tested as per IS:2633-1986.
4.1.5.2 Hot dip Galvanised bolts and nuts shall be passivated by dipping, Immediately after galvanizing in a 0.15%. Solution of Sodium dichromate with 0.5% concentrated sulphuric acid maintained at a temperature more than 32°C to provide protection against wet storage.

4.1.6 GENERAL REQUIREMENTS

4.1.6.1 Bolts upto M 16 and having length upto 10times the diameter of the bolts should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolts for 5.6 grade should be 310-MPa minimum as per IS:12427, bolts should be provided with washer in accordance with IS:1363 Part-1 to ensure proper bearing.

4.1.6.2 To ensure effective in-process Quality Control it is essential that the manufacturer should have all the testing facilities for test like weight of zinc coating, shear strength, other testing facilities etc. in house. The manufacturer should also have proper Quality Assurance System which should be in line with the requirement of this specification and IS:14000 Quality System.

4.1.6.3 The permissible surface, discontinuities of the bolts shall conform to IS:1367 (Part-9)-1979, ‘Technical supply conditions for threaded steel Fasteners’ (Second revision).

4.1.6.4 The requirements which are not covered under the standard IS:12427-1988, shall conform to IS:1367 (Part-1) 1980 (Second revision).

4.1.7 DESIGNATION

The bolts shall be designated by nomenclature, threaded size, nominal length and the number of B.I.S. standard. The letters N and W shall be added to the designation to indicate supply with nut and plain washers respectively.

For example a transmission tower bolt of thread size M 16 and nominal length 50mm with nut shall be designated as

Transmission Tower Bolt M 16x50N IS:12427.

4.2 GENERAL TECHNICAL REQUIREMENTS FOR ELECTRO-GALVANISED SPRING WASHERS

4.2.1 MATERIAL AND FINISH

The spring washers shall be 3.5mm thick corresponding to nominal size 16 and shall be single coil rectangular section conforming to IS:3063-1972. The spring washers shall be made from suitable steel according to IS:4072-1975 ‘Specification for steel for spring washers’ (1st revision) to meet the requirements specified in clause 5 of IS: 3063-1972. The surface of the washers shall be free from scale and burrs. The spring washers shall be Electro-Galvanised. The washers shall be coiled without any kinks. The outer edges may be slightly rounded or sharp. The ends of the washers shall not about when washers are compressed. The ends shall be so severed as to prevent tangling.
4.2.2 **TYPES**
The spring washers shall be of type B-Spring washers with flat ends.

4.2.3 **DIMENSIONS:**
The dimensions of the spring washers shall be as per IS:3063:1972.

4.2.4 **DESIGNATIONS:**
Spring washers shall be designated by the nominal size, type, the number of this standard and surface protection, if any.

For example a single coil spring washer having a nominal size 16 type-B with Electro-Galvanised shall be designated as-spring washer B16-IS:3063 Electro-Galvanised.

4.2.5 **HEAT TREATMENT**
Spring washers after coiling shall be suitably heat treated, so as to result in the finished washer having hardness in the range of 43 to 50HRC, when tested in accordance with, IS:1586 'Methods for Rockwell hardness test (B and C scales) for steel' (1ST revision).

4.3 **GENERAL TECHNICAL REQUIREMENTS FOR HOT DIP GALVANISHED STEP BOLTS.**

Step bolts conforming to IS:10238-1982 shall be suitable for use on transmission towers and sub-station structures to gain access to the top.

Each bolt shall be supplied with two hexagonal nuts and two plain washers of thickness 5+1.-0mm. The hexagon nuts to be used with step bolts shall conform to the requirement given in IS:1363-1967 ‘Specification for black hexagonal bolts, nuts and lock nuts’ (First revision).

The plain-washers used on these step bolts shall conform to the requirements of IS:2016-1967 ‘Specification for Plan-Washers’ (First Revision). The washers shall be punched-washers type “A” of thickness 5+1/-0 min.

The plain-washers shall be Hot-Dip Galvanised in accordance with the requirements of IS:4759-1984 “Specification for Hot-Dip Zinc coating on structural steel and other allied products” (Second-revision) except that the minimum value of the average mass of coating shall be 300g/m².

4.3.1 DIMENSIONS AND TOLERANCES;

The dimensions & tolerances for the step bolts shall be conforming to IS:10238-1982. (Amendments No. 2).

4.3.2 GRADE

The step bolts shall be product grade C as specified in IS:1367 (Part-III)-1979 ‘Technical supply conditions for threads steel fasteners Part-II Product grades and tolerances’ (Second revision).

4.3.3 MECHANICAL PROPERTIES

Step bolts shall conform to property class 4.6 as specified in IS:1367 (part-III)-1979’ Technical supply condition for threaded steel fasteners (Part-III). Mechanical properties and tests methods for bolts, screws and nuts with loadability (Second revision)

4.3.4 DESIGNATION

The step bolt shall be designated by size, length and number of BIS standard.

For example a step bolt of size M 16 and length 175mm with 2 nuts and 2 plain washers shall be designated as.

STEP BOTL M 16X175mm NNWW IS:10238.

5.0 TEST AND TEST CERTIFICATES

The hexagonal head bolts and nuts, Electro Galvanised spring washers and Hot Dip Galvanised step bolts shall be subjected before dispatch from the works to all the tests as specified in the relevant ISS.

Hardness Test, permanent set test and Twist-Test shall be carried on spring washers in accordance with IS:3063-1972.
The step bolt shall not have any permanent set when subjected to the cantilever test as per clause 7 amendment No. 2 to IS:10238.

6.0 SAMPLING AND ACCEPTANCE OF MATERIAL

6.1 Sampling and criteria of acceptance for hot dip Galvanised hexagonal head bolts with nuts shall be in accordance with IS:2614-1969 ‘Methods for sampling of fasteners; (1st revision).

6.2 Sampling size and acceptance criteria for Electro Galvanised spring washers shall be in accordance with IS:6821-1973 ‘Methods for sampling non-threaded fasteners’.

6.3 The method of sampling and acceptance criteria for Hot Dip Galvanised step bolt shall be in accordance with IS:2614-1969 ‘Methods for sampling of fasteners (1st revision).

6.4 The Hot Dip Galvanised Hexagonal head bolts with nuts, electro-Galvanised spring washers and hot dip Galvanised step bolts offered against this specification shall be subjected to all the tests specified in the latest editions of the relevant Indian Standard Specifications as referred in this specification and the test result shall conform therewith. Every test shall be performed in the presence of Inspecting Authority appointed by the purchaser, and the manufacturer shall have to give intimation of the place, date, time and detail of each test to be carried out, to the said inspecting authority well in advance to enable the later to be present to witness the tests. All test results must be recorded in the presence of the Inspecting Authority. In the event of the purchaser deciding to accept certificates of routine tests carried out by the supplier, the same shall be got approved before dispatch of the material.

7.0 INSPECTION

7.1 The purchaser and its representatives shall have access at all times to the works and all other places of manufacture, where the hot dip Galvanised hexagonal head bolts with nuts, electro Galvanised spring washers and hot dip Galvanised step bolts are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier’s works, raw materials, manufacture and for conducting necessary tests as detailed herein.

7.2 The supplier shall keep the purchaser informed in advance for the time of starting and of the progress of manufacture so that arrangements could be made for inspection.

7.3 No material shall be dispatched without prior inspection by the purchaser or its authorized representative unless authorized otherwise.
7.4 The acceptance of any quantity of material shall in no way relieve the supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection if such material is later found to be defective.

8.0 PACKING AND MARKING

8.1 The hot dip Galvanised hexagonal head transmission tower bolts shall be marked with the following symbols on the top surface of the bolt head either embossed or indented as given below:-

   a) The manufacturer's identification symbol and
   b) Transmission tower bolt identification symbol T

Minimum height of markings shall be 3.0mm. When embossed, marking shall project not less than 0.3mm above the surface of the head and total head height (Head plus marking) shall not exceed the specified maximum head height plus 0.4mm.

8.2 Electro Galvanised spring washers shall be packed in cartons of 500 or 1000 numbers.

Each carton containing the spring washers shall be marked with the manufacturer's name or trade mark, type, nominal size and quantity of the washers.

8.3 Hot dip Galvanised step bolts shall be marked and packed as specified in IS:1367 (Part-XVIII)- 1979.

9.0 QUANTITY AND DELIVERY REQUIREMENT

The tenderers are required to quote on per metric tonne rate basis for each size of bolt with nut, electro Galvanised spring washers and step bolts.

The quantity and delivery schedule shall be as per Annexure-I attached herewith.

10.0 GUARANTEED TECHNICAL PARTICULARS

The guaranteed technical particulars duly signed are required to be furnished by the Bidder along with the tender as per Annexure-II attached herewith.
## QUANTITY AND DELIVERY REQUIREMENT

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description of Material</th>
<th>Qty. (Metric Tonne)</th>
<th>Destination</th>
<th>Desired Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hot Dip Galvanised Hexagonal Head Bolts with nuts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) M16 X 35 N IS:12427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) M16 X 40 N IS:12427</td>
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<tr>
<td></td>
<td>iii) M16 X 45 N IS:12427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv) M16 X 50 N IS:12427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>v) M16 X 55 N IS:12427</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>vi) M16 X 60 N IS:12427</td>
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<tr>
<td></td>
<td>vii) M16 X 70 N IS:12427</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>viii) M16 X 75 N IS:12427</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>3.5MM THICK Spring Washers B-16-IS:3063 Electro-Galvanised</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>Step Bolts with two hexagon Nuts and two Plain washers M16 X 175 N NWW IS:10238</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
# ANNEXURE-II

**GUARANTEED TECHNICAL PARTICULARS OF HOT DIP GALVANISED HEXAGONAL HEAD BOLTS WITH NUTS AND STEP BOLTS TO BE SUPPLIED BY THE BIDDER**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Mechanical Property/Particulars</th>
<th>Hot Dip Galvanised Hexagonal head bolts with nuts M 16</th>
<th>Hot Dip Galvanised step bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical properties/particulars of bolts conforming to IS:1367 (Part-2)- 1979 Product Grade-C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Tensile Strength</td>
<td>N/mm² (Strength under wedge loading)</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Rockwell hardness</td>
<td>HRB</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Yield stress</td>
<td>N/mm²</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>Stress under proof load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>v)</td>
<td>Strength under wedge</td>
<td>Kg/ mm²</td>
<td></td>
</tr>
<tr>
<td>vi)</td>
<td>vii) Loading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>viii)</td>
<td>Weight of zinc coating</td>
<td>gm/ m²</td>
<td></td>
</tr>
<tr>
<td>ix)</td>
<td>Shear strength</td>
<td>N/mm²</td>
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</tr>
<tr>
<td>2</td>
<td>Mechanical properties/particulars of Nuts conforming to IS:1367 (Part-6) property class 5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Rockwell hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Proof load stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Raw materials being used in manufacture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) MS Round</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>IS to which conforming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Sources of receipt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Contents of Sulphur, Carbon and Phosphorous</td>
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<td></td>
</tr>
<tr>
<td>B) Zinc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>% purity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>IS and grade to which conforming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Sources of receipt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C) Recommended tightening Torque and Clamping load</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signature of the Bidder…………………………………..

Name ………………………………………………………

Designation………………………………………………

Date………………………………………………………

Authorised Common Rubber Stamp/Seal. of the Bidder………………………………….
GUARANTEED TECHNICAL PARTICULARS OF ELECTRO-GALVANISED SPRING-WASHERS
To be supplied by the Bidder

1. GENERAL
Maker’s Name
Address
Place of Manufacturer
Identification Mark

2. SPECIFICATION AND STANDARD
Electro-Galvanised Spring
Washers Galvanizing

3. SIZE

4. RAW MATERIAL
Grade
Type of steel used

5. CHEMICAL COMPOSITION
Carbon
Phosphorous (Max.)
Sulphur (Max.)
Silicon (Max.)
Magnise

6. STANDARD TO WHICH SPRING WASHERS SHALL CONFORM
Sampling procedure conforming to ISS Inspection/Checking/Testing as per ISS

7. PACKING DETAILS
Any other particulars as the tenderers may line to give

Signature of the Bidder……………………………………

Name …………………………………………………….

Designation………………………………………………

Date……………………………………………………

Authorised Common Rubber Stamp/Seal. of the Bidder…………………………….