

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 1 of 84		

SPECIFICATION NCS – 232

FOR TRANSMISSION LATTICE TOWERS AND FOUNDATION LEGS FABRICATION

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NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 2 of 84		

Table of Contents

1.	General	7
1.1	Contract Clauses for Specification	7
1.2	Drawings Updating	9
1.3	Specification Descriptions and Requirements	9
2.	Threshold conditions.....	10
3.	Documents for the proposal.....	10
3.1	For all the bidders	10
3.2	For Manufacturer Proposals that have not Previously Supplied Lattice Transmission Towers to the I.E.C.....	11
3.3	For Manufacturer Proposals that have Previously Supplied Lattice Transmission Towers to the I.E.C.....	11
3.4	General Notes.....	11
4.	Examining the Proposals and the Bidders	11
5.	The Materials	12
5.1	Structural Steel Designation Standard	12
5.2	Bolts, Nuts, Spring Washers, Climbing Steps & Safety Rings	13
5.2.1	Bolts.....	13
5.2.2	Nuts.....	13
5.2.3	Spring Washers.....	13
5.2.4	Climbing Steps	14
5.2.5	Safety Rings.....	14
5.3	Manufacturing standards - Dimensions, Shapes and Tolerances	14
5.3.1	Angle Iron.....	14
5.3.2	Channel Profiles	14
5.3.3	Flat Profiles and Strips	14
5.3.4	Plates.....	15
5.3.5	Hollow Section Profiles.....	15
5.3.6	General Note for the Raw Materials	15

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 3 of 84		

5.4	Materials Tests	15
6.	Fabrication	16
6.1	General	16
6.2	Cutting.....	16
6.3	Bending	17
6.4	Punching and Drilling	18
6.5	Welding.....	19
6.5.1	Type of Welds	19
6.5.2	Type of Welded Joints.....	19
6.5.3	Bevel Preparation	20
6.5.4	Inspection and Testing of Welds	20
6.5.5	Changes in Method of Welding	20
7.	Tolerances	21
8.	Marking.....	22
8.1	Towers, Crossarms, Extensions & Foundation Legs Marking.....	22
8.2	Bolts Marking	22
8.3	Climbing Steps Marking	22
8.4	Safety Rings Marking	22
8.5	Additional Guidelines for Marking the Foundation Legs	22
9.	Post-Production Geometric Inspection	23
9.1	Manufacturer Geometric Inspection	23
9.2	Prototype Assembly Requested by I.E.C.....	23
9.3	I.E.C. Inspection	24
9.4	Securing the Legs Connections	24
10.	Galvanizing	24
11.	Packing.....	26
11.1	General Packing Instructions.....	26
11.2	Packing Method.....	26
11.3	Labeling the Packages	27

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 4 of 84		

11.4	Packing of Towers, Extensions and Disassembled Crossarms	27
11.5	Packing of Angles with Welded Plates	28
11.6	Packing of Assembled CrossArms	28
11.7	Plates Packing.....	28
11.8	Packing of Bolts, Nuts, Climbing Steps, Spring Washers and Safety Rings...	28
11.9	Packing of Foundation Legs.....	30
11.9.1		30
11.9.2		31
11.9.3		31
11.9.4		31
11.9.5		31
11.9.6		32
11.10	Packing Control & Inspections for Towers and Foundation Legs.....	32
12.	Quality Assurance	33
13.	Quality Control	33
14.	Delivery Approval Conditions for the First Shipment	34
14.1	Conditions.....	34
14.1.1	Steel Manufacturers.....	34
14.1.2	Bolts Manufacturers	34
14.1.3	Welding Certificates.....	35
14.1.4	Materials Tests Certificates	35
14.1.5	Samples.....	36
14.1.6	Local Subcontractor	37
14.1.7	Prototype Assembly	37
14.2	Acceptance test.....	38
14.3	Delivery	38
15.	Delivery Approval Conditions for Ongoing Shipments	39
15.1	Test Certificates.....	39

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 5 of 84		

15.2	Delivery	39
16.	Service During Warranty Period	40
16.1	Services Provided	40
16.2	Schedule for Repair & Completion of Parts.....	40
17.	Time Schedule for Materials, Welding Procedure and Subcontractor Approval	41
18.	Time Schedule for Delivery.....	41
19.	Appendices.....	42
19.1	Appendix "A1": Questionnaire for the Manufacturer	42
19.2	Appendix "A2": Requirements from the manufacturer	43
19.3	Appendix "B1": Statement of Manufacturing Experience for Lattice Transmission Towers	46
19.4	Appendix "B2": Statement of Manufacturing Experience for Foundation Legs	47
19.5	Appendix "B3": Declaration of Supply Lattice Towers for IEC in the past	48
19.6	Appendix "C1": Declaration of Commitment to Comply with Specification NCS-232.....	49
19.7	Appendix "C2": Material Availability	50
19.8	Appendix "D": Annexures 1, 2, 3, 4, 5, 6A, 6B, 7, 10, 12, 13, 15, 16, 17, 18, 20	51
19.8.1	Annexure 1	52
19.8.2	Annexure 2	53
19.8.3	Annexure 3	54
19.8.4	Annexure 4	55
19.8.5	Annexure 5	56
19.8.6	Annexure 6A	57
19.8.7	Annexure 6B.....	58
19.8.8	Annexure 7	59
19.8.9	Annexure 10	60
19.8.10	Annexure 12.....	61

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 6 of 84		

19.8.11	Annexure 13	62
19.8.12	Annexure 15	63
19.8.13	Annexure 16	64
19.8.14	Annexure 17	65
19.8.15	Annexure 18	66
19.8.16	Annexure 20	67
19.9	Appendix "E1": An example of I.E.C. Catalog Numbers and Their Drawings for Transmission Lattice Towers	68
19.10	Appendix "E2": An example of I.E.C. Catalog Numbers and Their Drawings for Foundation Legs	72
19.11	Appendix "E3": An example of quantities of Bolts, Nuts and Spring Washer for Foundation Connection According to Tower's Type	73
19.12	Appendix "F1": I.E.C Quality Specification Q-APP-02-PR	74
19.13	Appendix "F2": Quality Control Inspection Steps	75
19.14	Appendix "F3": Check list for Transmission Towers and Foundation Legs (161,400 kV) NCS-232	76
19.15	Appendix "G": Hot plating of Zinc, Process control	82
19.15.1	Objective	82
19.15.2	General	82
19.15.3	Process Control	82
19.15.4	Documentation	82
19.15.5	Final Inspections	83
20.	Revisions	84

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 7 of 84		

1. General

This specification describes the requirements of ISRAEL ELECTRIC CORPORATION (a.k.a. I.E.C.) pertaining to the manufacture and supply of Steel Transmission Lattice Towers and foundation legs.

The towers and all parts shall be provided including all bolts, nuts, climbing steps, spring washers and safety rings, required for the tower assembly according to the assembly drawings.

All materials, details, and fabrication methods shall be compliant with the drawings and the requirements described hereafter.

In the event of any discrepancy or omission of essential fabrication details (such as dimensions, materials, profiles, quantities, etc.) within the I.E.C. drawings, the manufacturer shall contact I.E.C. for clarification and completion of the required information prior to commencing the fabrication process.

1.1 Contract Clauses for Specification

Contract clauses mentioned in this specification document include several part numbers and their catalog numbers.

A. The bidder shall offer a price for all I.E.C.'s Steel Transmission Lattice Towers catalog numbers listed in RFP.

The price shall include production and assembly of cross arms which are provided assembled. The price shall include production, assembling of cross arms, bolts, nuts, spring washers, climbing steps and safety rings, and delivery under the terms of the tender. Drawings of this section will be sent to provider with the order.

Catalog numbers may have more than one drawing, as indicated in tower structure layout drawing.

An example of the general layout drawing of the lattice tower and its sub drawings can be found in [Appendix E1](#).

If a crossarm marked in the drawing to be supplied assembled will be ordered disassembled, the price will be according to Section B of disassembled parts by weight.

The price for each I.E.C. catalog number shall include all the accessories, bolts, nuts, spring washers, climbing steps and safety rings as indicated in the drawings.

B. Price for 1 ton of towers or their parts such as head, bottom part, middle part, extension, cross arm (only supplied disassembled) etc. The price shall include production, bolts, nuts, spring washers, climbing steps and safety rings, and delivery under the terms of the tender. I.E.C. catalog number 5284415.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 8 of 84		

This section is intended for ordering towers or their parts, or extensions or cross arms that their design is similar to the design of towers, extensions and cross arms in the previous section.

The weight to be taken into account for payment is only the weight written in the drawings, rather than the actual weight (not including all accessories, bolts, nuts, spring washers, climbing steps and safety rings, and weight of welding and galvanizing).

An order under this section will be done by a separate order (each item and its catalog number and weight). The supplier shall handle any item in this section as in the previous section, regarding packing, marking, shipping etc.

C. Price for 1 ton of cross arms which are provided assembled. The price shall include production, assembling, bolts, nuts, spring washers and delivery under the terms of the tender. Example for cross arm supplied assembled can be seen in [annexure 15](#). I.E.C Catalog number 5284447. The weight to be taken into account for payment is only the weight written in the drawings, rather than the actual weight (not including all accessories, bolts, nuts, spring washers, climbing steps and safety rings, and weight of welding and galvanizing).

D. Price for assembling 1 ton of prototype tower assembly. The price shall include assembling the prototype, film the assembly, disassemble, and sending a report. I.E.C. catalog number 1100010833.

E. The bidder shall offer a price for all I.E.C.'s Tower Foundation Legs and Cross Profiles catalog numbers listed in RFP.

The price shall include production, assembling, all accessories, bolts, nuts, spring washers, and delivery under the terms of the tender. Drawings of this section will be sent to provider with the order.

An example of the foundation legs of the lattice tower can be found in [Appendix "E2"](#).

F. Price for 1 ton of Tower Foundation Legs and Cross Profiles. The price shall include production, bolts, nuts, spring washers, and delivery under the terms of the tender. I.E.C. catalog number 5296749.

This section is intended for ordering tower foundation legs, that their design is similar to the design of tower foundation legs, in Section **E**.

The weight to be taken into account for payment is only the weight written in the drawings, rather than the actual weight (not including all accessories, bolts, nuts, spring washers, and weight of welding and galvanizing).

An order under this section will be done by separate order (each item and its catalog number and weight). The supplier shall handle any item in this section as in the previous section, regarding packing, marking, shipping etc.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 9 of 84		

The bidder must fulfill the prices of one of the following in the commercial stage of the tender:

- **Sections A, B, C and D**
or
- **Sections E and F**
or
- **Sections A, B, C, D, E and F**

If any price in one section of the above possibilities will be missed, the proposal will be disqualified.

The price for 1 ton of towers, extensions and disassembled crossarms (Section B) shall be suitable to the prices for I.E.C catalog numbers of towers, extensions and disassembled crossarms (Section A) per 1 ton.

The price for 1 ton of tower legs and profile crosses (Section F) shall be suitable to the prices for I.E.C catalog numbers of tower legs and cross profiles (section E) per 1 ton.

All prices (in all sections) will be considered for the decision about the winner in the tender.

I.E.C reserves the right to divide the winning in the tender between some bidders.

1.2 Drawings Updating

I.E.C is permitted, from time to time, to update the production drawings. Updated drawings will be sent to supplier. Within two weeks, the supplier shall reference the changes and in accordance with the agreement – it will be carried out.

1.3 Specification Descriptions and Requirements

This specification describes fabrication procedures such as: cutting, bending, punching, drilling, welding, bolting, marking, and galvanizing according to the shop drawings.

This specification defines requirements for packing (some of the crossarm will be supplied assembled), transportation, quality control, shop assembly, prototype tower assembly and service during warranty period.

Quality Control requirements shall be according to Q-AAP-02.

For fabrication procedures that are not covered in this specification the latest edition of other industrial standards shall be applicable.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 10 of 84		

In case of discrepancies or nonconformity between documents, priority shall be as follows:

1. The drawings.
2. The present specification or written approval by qualified I.E.C. engineers.
3. Other industrial standards, as specified or approved by qualified I.E.C. engineers.

For time schedule requirements regarding materials, welding procedure, and sub-contractor approval – see Chapter 17.

For time schedule requirements regarding delivery – see Chapter 17.

2. Threshold conditions

Threshold conditions will be in accordance with the attached documents of the procurement division.

3. Documents for the proposal

The bidder shall submit together with his offer the following documents:

3.1 For all the bidders

1. Completed and filled-in Manufacturer Questionnaire, see [Appendix A1](#) & [Appendix A2](#).
2. Adjustment to this specification, according to [Appendix C1](#) as follows:
 - Declaration indicating that the proposal fully meets all requirements of present specification and fabrication drawings.
 - Declaration indicating that the raw materials (steel, bolts, nuts, spring washers, climbing steps, and safety rings) shall be according to I.E.C. requirements as mentioned in chapter 5, and will be approved by I.E.C. after the winning. The raw material manufacturer shall have a valid ISO 9001 certificate for the scope of the material.
 - For foreign bidders only: in case of winning the tender, a local Israeli subcontractor will be employed by the bidder for services, as written in para. 14.1.6 and chapter 16.
3. A valid ISO 9001 certificate as defined in the threshold conditions.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 11 of 84		

3.2 For Manufacturer Proposals that have not Previously Supplied Lattice Transmission Towers to the I.E.C.

- Statement of manufacturing experience:
 - For lattice transmission towers – see [Appendix B1](#)
 - For foundation legs – see [Appendix B2](#)
- Manufacturers Fabrication facility description (Brochure, Catalog) of capability with respect to items in the tender.

3.3 For Manufacturer Proposals that have Previously Supplied Lattice Transmission Towers to the I.E.C.

- Statement of manufacturing experience:
 - For lattice transmission towers & foundation legs – see [Appendix B3](#)

3.4 General Notes

- All The above-mentioned documents shall be in English or in Hebrew.
- Bidder which will not submit the above documents will be disqualified.
- In the event that the proposal is submitted by an agent, I.E.C. shall be entitled to deal directly with the manufacturer.

4. Examining the Proposals and the Bidders

I.E.C. representatives shall be entitled to visit any plant, site, or office, which are held or operated by the bidder. I.E.C. representatives are entitled to request and to receive any information concerning the bidder and/or the services offered. The visit to the factory located outside of Israel is contingent on the possibility of a visit by employees holding an Israeli passport.

I.E.C. shall be entitled to disqualify any proposal, if it is deemed that the person submitting the proposal did not cooperate with I.E.C. representatives or did not furnish the information as required.

The purpose of the visit:

- To check whether the manufacturer and his sub-contractors can meet the specification requirements and the threshold conditions.
- To verify the data filled out in [appendix A1](#) & [appendix A2](#) (questionnaire).

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 12 of 84		

5. The Materials

The contractor shall purchase steels, bolts, nuts, climbing steps and safety rings only from the list of manufacturers that have Valid ISO 9001 certificates and approved by I.E.C. in advanced. The contractor can change the manufacturers of steel, bolts, nuts, climbing steps, safety rings, only after I.E.C. approval.

5.1 Structural Steel Designation Standard

- Designation of steel shall conform to EN 10025 – part 1 & 2 ("Steel for General Structural Purposes").
- The steel shall be "suitable for hot galvanizing".
- The steels shall have Si (Silicon) and P (Phosphorus) contents:
 $Si \leq 0.03\%$ and $(Si + 2.5P) \leq 0.09\%$
or
 $0.14\% \leq Si \leq 0.25\%$ and $P \leq 0.035$
- Designation of steel for all items:
According to European standard - EN10025 steel S235JR or S235JO,
According to European standard - EN10025 steel S355JO or S355J2,
- All materials shall be brand new.
- Before starting any work on the raw material, the structural material shall be straight and shall be cleaned of all rust and dirt. If straightening is necessary, it shall be done by methods that will not damage the metal.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 13 of 84		

5.2 Bolts, Nuts, Spring Washers, Climbing Steps & Safety Rings

5.2.1 Bolts

- The degree of bolts strength shall be 50 kg/mm²
- The bolts shall be according to ASTM – A-394, Type 0 – zinc-coated bolts made of low or medium carbon steel.
- The ultimate tensile strength tests, the yield strength tests, and the elongation tests shall be according to ASTM – A-394, Type 0.
- Tension test wedge angles for bolts and screws shall be according to ASTM F606/F606M – 14a
- The bolts hardness shall be Rockwell B Min. 80, Max 100.
- The bolts shall be hot dip galvanized – minimum thickness 40 µm.
- For the dimensions and the tolerances, see appendix D, [annexure 13](#) (Drawing no. NCD4149_EN).

5.2.2 Nuts

- The nuts shall be according to ASTM-A 563 GrA.
- The material shall be from carbon steel.
- The nuts hardness shall be Brinell MIN 116, MAX 302. Rockwell MIN B68, MAX C32.
- The nuts shall be hot dip galvanized, minimum thickness 40 µm.
- For the dimensions and the tolerances, see appendix D, [annexure 13](#) (Drawing no. NCD4149_EN).

5.2.3 Spring Washers

- The spring washer shall be according to ASME B18.21.1.
- The material shall be from carbon steel.
- The dimensions of regular helical spring lock washer shall be according to table 1 in ASME B18.21.1.
- The hardness requirements shall be: HRC 38-46, 372-458 HV.
- The bending tests shall be according to ASME B18.21.1.
- The spring washers shall be hot dip galvanized – minimum thickness 40 µm.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 14 of 84		

5.2.4 Climbing Steps

- The climbing steps shall be according to EN10025-2.
- The steel material shall be S355J0 or S355J2.
- For the dimensions and the tolerances, see appendix D, [annexure 17](#) (Drawing no. JDHK5571_EN).
- The tensile tests, the yield tests, and the elongation tests shall be according to EN10025-2.
- The climbing steps shall be hot dip galvanized – minimum thickness 40 µm.

5.2.5 Safety Rings

- The safety rings shall be according to EN10025-2.
- The steel material shall be S355J0 or S355J2.
- For the dimensions and the tolerances, see appendix D, [annexure 18](#) (Drawing no. NCD5806_EN).
- The safety rings shall be hot dip galvanized – minimum thickness 70 µm.

5.3 Manufacturing standards - Dimensions, Shapes and Tolerances

The dimensions and tolerances of all the items must conform to the following standards:

5.3.1 Angle Iron

Hot Rolled Round Edge Equal & Unequal Angles - according to, EN 10056-1,2.

5.3.2 Channel Profiles

Hot Rolled Round Edge/Channels - according to EN 10279.

5.3.3 Flat Profiles and Strips

- Hot Rolled Flat Steel for General Purposes 5/10-60/150 - according to DIN 1017 -1 & EN 10058.
- Hot Rolled Wide Plates 5/150-60/1250 - according to DIN 59200.
- Hot Rolled Strips, Hot Rolled Sheets 0.8/10-10/120 - according to, EN 10048.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 15 of 84		

5.3.4 Plates

- Hot Rolled Plates (3 mm to 150 mm thick) - according to EN 10029.
- Cold Rolled Plates less than 3 mm thick - according to EN 10131.

5.3.5 Hollow Section Profiles

Hot Rolled hollow section profiles: RHS, SHS & CHS - according to DIN EN 10210.

5.3.6 General Note for the Raw Materials

Other raw materials equivalent properties (which are not listed in this specification) shall be proposed for approval by I.E.C. in advance.

5.4 Materials Tests

During the approval conditions stage described here, the contractor shall send the mill test reports to the Engineering Headquarter Department.

For following shipments, the mill test reports will be sent to the quality control department.

The tests to be carried out shall include:

- Yield strength
- Ultimate tensile strength
- Percentage elongation
- Impact test
- Chemical properties

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 16 of 84		

6. Fabrication

6.1 General

All manufacturing checks and procedures are to be performed according to ISO 9001 standard. The manufacturer shall verify correct fitting of every part using suitable inspection jigs.

The production shall be performed with suitable machines (such as drilling and punching that will be done by CNC machines), appropriate work areas and by suitable and competent manpower to perform various works.

During the manufacturing process, safety precautions will be taken according to "Standard Practice for Safeguarding Against Embrittlement of Hot – Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement" – ASTM A 143 – Latest edition.

If there is discrepancy, it shall be settled by writing, prior to fabrication.

6.2 Cutting

The materials may be sheared to the length, but the ends, unless otherwise noted, shall be square with the length and free of burrs to prevent difficulty of assembly caused by the interference between two ends of members.

The use of a burning torch is permissible for cutting members providing all irregular edges are trimmed smoothly before galvanizing. Stresses shall not be transmitted into the metal through burned surface.

The use of a burning torch for cutting bolt holes is not allowed.

Materials with thickness of less than 18 mm may be cut with a suitable guillotine on condition that no distortion is caused.

Materials with thickness of more than 18mm must be cut with a saw or burning torch.

Note: Other cutting methods are possible only with pre-approval of I.E.C.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 17 of 84		

6.3 Bending

The possibility of using cold bending normally depends on the shape of the part (angle, plate, etc.), the type of the steel, the angle and the radius of bending and the equipment used for bending.

The radius of the bend will not be less than 3 times of part thickness.

All the bent items of a difficult nature on structural steel shall be performed while the material is hot.

The hot bent items shall be heated in a non-oxidizing flame over a sufficient area to prevent excessive deformation.

The hot bent items shall be placed in air for slow cooling.

All the bent items shall be finished, free from waves and folds.

An item that accidentally has been bent wrongly with respect to the location of the bending line, must be rejected.

It is not possible to re-bend an over-bending flexion.

In bent elements (profiles or plates), discrepancies may occur between the dimensions listed in the material list of the drawing and those detailed in the fabrication drawings. In all such cases, the dimensions specified in the fabrication drawings shall take precedence and be considered the governing values for manufacturing and inspection purposes.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 18 of 84		

6.4 Punching and Drilling

The manufacturer must carry out the drilling and punching with CNC machines.

The holes must be punched with racks and jigs employed to ensure accuracy throughout.

The punches and dies for this work must be maintained sufficiently sharp to produce clean round holes.

The holes may be punched and drilled in high-strength structural steel only under 11 mm thick. Holes of over 11 mm can be punched to preliminary hole and then shall be finished by drilling to the final dimension and reamed.

Table no.1 shows the dimensions of preliminary and final holes.

Table no. 1

Bolt	Preliminary hole (mm) (punching or drilling)	Final hole (mm) (drilling)
1/2"	10	14.5
5/8"	14	17.5
3/4"	17	21
7/8"	20	24
1"	23	27

Before welding reinforcement plates to L and U profiles, it is the manufacturer's responsibility to check the measurements between the holes in the L and U profiles to the holes in reinforcement plates, so that they are according to the drawing.

In the event of two separate elements with overlapping holes that requires a welding joint between them, the manufacturer is required to ensure that the centers of all the holes will be concentric.

Holes in bent items which may be affected by the bending operation shall be laid out and punched or drilled after bending. Holes that due to the bending are elongated or distorted in any way, will not be accepted.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 19 of 84		

Special care shall be exercised to ensure exact spacing of holes and their distance from back of angle and to end of piece.

No welding, filling, or plugging will be permitted unless otherwise approved by I.E.C.

Plates can be produced using computerized machines laser or water, if plate edges and holes will be clean and smooth and on condition that will not cause damage.

6.5 Welding

All welding shall be performed in the shop.

Welding shall be according to the latest edition (at the time of the signing of the contract) of AWS D1.1 American Welding Society Structural Welding Code.

Welding process – any welding process/technique approved by AWS D1.1

Welding quality shall be according to AWS D1.1 Code.

Welding symbols shall be according to AWS A2.4.

For drawings in which the welding symbols are not specified with a note indicating that the symbols are as per AWS D1.1, the welding symbols shall comply with the old Israeli Standard 1061. See [annexure 20](#).

All welding shall be performed by qualified welders or welder operators, using qualified welding procedures and in accordance with AWS D1.1 code.

6.5.1 Type of Welds

- Types of welds shall be as indicated on the drawings; where not specified, they shall be in accordance with AWS D1.1, including prequalified joints.

6.5.2 Type of Welded Joints

Structural welding joints:

- Two Angles Connected with a Back Plate, see [annexure 1](#).
- Angle to Plate Connection, see [annexure 2](#).
- Internal Connection of Two Angles with an Angle Profile, see [annexure 3](#).
- U Profiles Connection, see [annexure 4](#).
- Other additional joints, as indicated on the drawings. Otherwise, according to AWS D1.1.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 20 of 84		

6.5.3 Bevel Preparation

- Bevels shall be prepared by grinding or machining, by Arc air gouging or plasma cutting. After cutting, surface must be ground smooth and must be free of burrs and all oxides.
- Bevels shall be prepared according to the welding details as shown in [annexures 1-4](#).

6.5.4 Inspection and Testing of Welds

1. The default extent of inspection shall be as follows:
 - For all welds: 100% Visual Testing (VT) and 10% Magnetic Particle Testing (MT).
 - In addition, butt welds shall be inspected as specified below:
 - Weld types according to Annexures 1, 3, and 4: 100% Radiographic Testing (RT) or Ultrasonic Testing (UT).
 - Weld types according to Annexure 2: 10% Radiographic Testing (RT) or Ultrasonic Testing (UT).

Failure in non-destructive testing (NDT) shall require additional testing of a further 10% of the welds. In the event of failure within this additional 10%, all affected welds shall be corrected, and 100% of the welds shall subsequently be subjected to NDT.

2. Visual Testing (VT) of penetration and fillet welds shall be performed as a directive compliance check; refer to [annexure 5](#).
3. All inspection and testing reports, including Visual Testing (VT), Magnetic Particle Testing (MT), Radiographic Testing (RT), and Ultrasonic Testing (UT), shall be compiled and submitted to I.E.C.

6.5.5 Changes in Method of Welding

Any changes to the above shall be subject to I.E.C. approval in advance.

In case the manufacturer is wishing to suggest an alteration to any welding preparation detail, a copy of the suggested revised drawing shall be submitted to I.E.C. approval in advance, showing the details of amended preparation.

I.E.C. reserves the right to visit the manufacturer's workshop, at any reasonable time during fabrication of the items in plant, and to perform and/or require additional and complementary tests and inspections to the welding and welds.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 21 of 84		

7. Tolerances

The tower and all parts shall be produced according to the following tolerances:

- The parts of tower shall be manufactured in accordance with the drawings.
- The tolerance of the length of each part shall be $+2.0/-1\text{mm.}$, for part elements and braces.
- The tolerances of the distance from hole center to hole center shall be $+/-0.5\text{mm.}$ and shall not be gathered.
- The tolerance of the distance between hole center to the end of steel part shall be $+1/-0\text{mm.}$
- The tolerance of hole diameter shall be $-0/+0.5\text{mm.}$
- The tolerance of length and width dimensions of plate shall be $+1/-0\text{mm.}$
- The tolerance of bending plates or bars dimensions shall be $+/-1\text{mm.}$
- The tolerance of weld length dimension shall be $+/-1\text{mm.}$
- The tolerances of hinge connection dimension on cross arms shall be $-0/+1\text{mm.}$
- The tolerance of cross arm connection to tower shall be $+2/-1\text{mm.}$
- The tolerance of the distance from center of bolted segmentation to the edge corner of L profile, (in external joint) shall be $+1/-0\text{mm,}$ and $+0/-0.5\text{mm.}$ (in internal joint).
- The tolerances of the distance from center-to-center holes in braces shall be $+/-0.5\text{mm.}$
- The tolerances of bolts, nuts, climbing stages, spring washers and safety rings shall be as specified in the production drawings and standards.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 22 of 84		

8. Marking

8.1 Towers, Crossarms, Extensions & Foundation Legs Marking

All disassembled section members shall be stamped with distinguishing numbers or letters corresponding to the information below. These marks shall be impressed before galvanizing and shall be clearly readable afterwards.

The following information shall be stamped on each item:

- Trademark of manufacturer
- Type of tower (for example TMH2T)
- Item number according to the drawing

The height of letters or numbers shall be 12 – 20 mm.

Example of marking appears in appendix D, [annexure 6A](#).

8.2 Bolts Marking

The bolts shall be marked according to ASTM-A 394 Type 0 with addition of the manufacturer name or trademark.

8.3 Climbing Steps Marking

The climbing steps shall be marked as shown in drawing JDHK5571_EN, see appendix D, [annexure 17](#).

8.4 Safety Rings Marking

The safety rings shall be marked as shown in drawing NCD5806_EN, see appendix D, [annexure 18](#).

8.5 Additional Guidelines for Marking the Foundation Legs

The marking will be on the outside of the item and will start at the edge at about 50 mm from the last hole (on their upper side).

Short items can be marked on one side of.

For long items, with a length of 3.0 m and above, the marking shall be done on both ends.

Example of marking appears in appendix D, [annexure 6B](#).

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 23 of 84		

9. Post-Production Geometric Inspection

9.1 Manufacturer Geometric Inspection

At the end of production and before sending to galvanizing, the manufacturer must check geometric dimensions of the items, holes locations, bending angles, welding, etc.

All tests shall match the requirements mentioned in the drawings and in this specification. If there are discrepancies, the manufacturer shall repair or replace the items on his account.

9.2 Prototype Assembly Requested by I.E.C.

I.E.C. may order a prototype assembly from the manufacturer to verify a design. The price will be as stated in chapter 1.1, Section D. The assembly shall be assembled while lying in horizontal position and shall include supports as needed. Remaining of mismatched holes will not be permitted. A reasonable amount of drifting will be allowed in the assembling.

The bolts for the prototype assembly shall be the same as mentioned in the drawings.

For more details on prototype assembly, see appendix D, [annexure 10](#).

For instruction for steel structure connections with bolts, see appendix D, [annexure 7](#).

I.E.C. reserves the right to visit the prototype assembly site during prototype assembly process.

The prototype assembly shall be controlled and approved by I.E.C. before being disassembled.

The Prototype assembled parts shall be disassembled for shipment.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 24 of 84		

9.3 I.E.C. Inspection

I.E.C. reserves the right to obtain samples from any material's lot that is being fabricated, sample coupons for independent testing by I.E.C. laboratory and to reject any material lot that failed in the tests.

9.4 Securing the Legs Connections

For every tower or extension production, the manufacturer shall prepare templates to check the connection to the foundation legs – see appendix D, [annexure 16](#). For towers that will be ordered according to the weight of tower (according to the price for 1 ton), I.E.C will send to the manufacturer suitable drawings of legs top parts.

10. Galvanizing

Galvanizing plant shall have a valid ISO 9001 certificate. The certificate shall be valid for hot deep galvanizing of steel.

Galvanizing shall be according to ASTM A123/A 123M-09, or EN ISO 1461.

Except where specified otherwise, all steel used in the construction of the tower shall be galvanized after all sawing, shearing, drilling, punching, filling, bending and all the machinery process is completed. The zinc coating shall be of uniform thickness, clean, smooth, and free from spangles as possible. Galvanizing shall be applied by hot deep process and the coating thickness is as follow:

Material	Coating Thickness in Hot Zinc (micron)
Steel more than 8 mm thickness	85
Steel from 5 to 8 mm thickness	70
Bolts	40
Climbing steps	40
Spring washers	40
Safety rings	70

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 25 of 84		

A different coating method can be offered by the bidder for approval by I.E.C.

All holes shall be free after galvanizing. Minimum free holes diameters shall be:

- 14 mm for 1/2 " bolt
- 17 mm for 5/8 " bolt
- 20.5 mm for 3/4 " bolt
- 23.5 mm for 7/8 " bolt
- 26.5 mm for 1" bolt.

A manufacturer's Inspection Certificate for hot-dip galvanized coatings on structural steel (see [appendix G](#)) shall include the following information:

- Purchase order number.
- Date of inspection.
- Number of pieces tested for thickness of zinc coating, and the maximum, minimum and average thickness of each.
- Number of pieces tested coating adherence.
- Number of rejections, because of defective coating and other reasons.

Certified test reports shall be submitting to I.E.C., see chapter 14.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 26 of 84		

11. Packing

11.1 General Packing Instructions

All the comments for packing refer to the tower and all its parts as well as: foundation legs, extensions etc.

The tower (including all its parts) shall be provided with bolts, nuts, spring washers, climbing steps and safety rings, as a complete kit for assembling the tower. The quantities are as shown in the production drawings of the specific I.E.C. catalog number.

All towers and extensions shall be supplied disassembled to I.E.C warehouses. Some crossarms shall be supplied partially assembled, according to I.E.C. drawings.

Each I.E.C catalog number, together with all its parts, will be supplied separately to I.E.C warehouses.

The contractor will send by email to I.E.C. Head Office copies of the shipment contents, for each shipment.

11.2 Packing Method

Each tower and all its parts, each extension and all its parts and each crossarm and all its parts, that have one I.E.C. catalog number, must be supplied together at the same time.

When packing a tower, each element (element no.1, element no.2, etc.) shall be packed separately. It is forbidden to mix items from different elements in the same package.

Each tower (and all its parts), each extension (and all its parts) and each crossarm (and all its parts), shall be supplied separately from other towers, extension and crossarm (and all their parts), even if they have the same I.E.C. catalog number.

All the packages of the towers, the extensions and the arms shall be secured with double galvanized steel bands of minimum width of 2", in at least three locations. The distance between the bands shall not exceed 2 meters.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 27 of 84		

A minimum of two wooden beams shall be tied under each profiles package. Every wooden beam has to be made from one piece. The wooden beams underneath of the profiles package shall have a minimum width of 10 cm and shall be 10 cm height. If a higher beam is required, the height can be raised up to 20 cm and the width will be the same as the height. For deliveries that shall arrived to "Orot Rabin" warehouse, the wooden beam height shall be 15 cm. The length of the wooden beam shall be suitable to the package width (with a minimum of 30 cm). The contents of the package shall not exceed the length of the wooden beams.

11.3 Labeling the Packages

Each package shall be labeled with an identification and marking label. The list of parts attached to each package will be a photocopy of the production drawing of that part. The number of the package in the drawing shall be surrounded by a circle, as shown in appendix D, [annexure 12](#). The list shall be wrap in a strong plastic bag sealed from water penetration.

Each label shall contain the following information:

- Manufacturer name
- Production country
- I.E.C. catalog number
- Type of tower part
- Package no. from total package quantity (for example: 1/8, 2/8, 3/8, etc.)
- Tower part (Element no.1, Element no.2, etc.)
- List of items marked on parts list drawing
- Order number
- Bundle Weight (kg)

11.4 Packing of Towers, Extensions and Disassembled Crossarms

All parts of the tower (element no. 1, element no. 2, etc.) shall be packed with double galvanized steel bands (as stated in section 11.2), in various packages, according to the production drawings (packaging table).

The packages must be organized so that the long and wide angles are at the bottom, the shorter and narrow angles will be above them, arranged by the length gradually.

Plates shall be stored in wooden boxes, as specified in the packaging table of the production drawing.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 28 of 84		

All the fillet plates of each element shall be connected separately with a galvanized steel wire of 4 mm diameter. The identification and marking label, on which the part number is indicated, will also be threaded on the galvanized steel wire. The fillet plates shall be stored in the wooden boxes as specified in the packaging table of the production drawing.

11.5 Packing of Angles with Welded Plates

In all packages containing reinforcement plates welded to the angles, the reinforcement plates will be packed facing upwards and not downwards towards the wooden beams.

11.6 Packing of Assembled CrossArms

When required, the lower base of the crossarm shall be provided to I.E.C. warehouses assembled, unless otherwise stated in the production drawing.

The lower base of the crossarm shall be assembled with bolts, nuts and spring washers as specified in the device drawing. The appropriate bolts (length and diameter) for each item shall be used as specified in the device drawings and according to the instructions how to connect the bolts. See appendix D, [annexure 7](#).

Profiles external to the crossarm lower base (such as the hangers and diagonals) shall be bundled and attached together to the side of a crossarm leg, and not on the top or the bottom surface of the crossarm leg. A minimum of two galvanized metal bands shall be used to tie them, see appendix D, [annexure 15](#). These profiles shall be properly tied to the crossarm lower base so that it will not be released during transportation.

When packaging multiple crossarms (with the same I.E.C. catalog number) together in a single pack, the quantity of crossarms must be indicated on the package label.

11.7 Plates Packing

All the plates of a tower shall be provided in a wooden box(es) together with the tower.

All the plates of an extension or a (disassembled) cross arm shall be supplied so that they are tied to the extension pack or cross arm pack.

11.8 Packing of Bolts, Nuts, Climbing Steps, Spring Washers and Safety Rings

The quantities of bolts, nuts, climbing steps, spring washers and safety rings are as required in the production and assembly shop drawings. Spring washers shall be provided for all bolts and climbing steps.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 29 of 84		

The manufacturer shall provide an additional of 5% of the quantities, of each type and length of the above items, listed in the drawings (minimum one item of each type and length).

The manufacturer must supply the nuts already bolted to the bolts and climbing steps.

Each type of bolts, climbing steps and the safety rings shall be packed in a separate strong sealed plastic bag that fits the amount of items.

All the sealed plastic bags containing the bolts, nuts, climbing steps, spring washers and safety rings shall be packed in a sealed wooden box (waterproof, stiffness for weight content).

The weight of each plastic bag shall not exceed 25 kg.

The wooden boxes shall be marked on the outside surface with a plastic sticker.

The sticker shall contain the following information:

- Manufacturer name
- I.E.C. catalog number of the tower/extension/crossarm/etc.
- For bolts – size and quantity
- For climbing steps – size and quantity
- For spring washers – size and quantity
- For safety rings – quantity

Bolts for Foundation Connection

The bolts designated for the connection of the tower to the foundation leg must be individually packed. These bolts, including the nuts and spring washers, shall be stored in a separate sealed plastic bag of a different color and shall be put in the sealed wooden box. If this separate sealed plastic bag is packed in a sealed wooden box with other bolts of the tower, this sealed plastic bag of the foundation bolts shall be positioned on top of the other ones.

The wooden box shall be marked in the same manner as all other shipment boxes, and with an additional clearly visible sticker stating, "**Bolts for Foundation Connection**".

- Foundation bolts are specified in the bolt table provided in the Tower Structure Layout drawing for each relevant I.E.C. catalog number representing a tower item. Where applicable, foundation bolts may also be specified in the corresponding part drawings.
- For every I.E.C. catalog number representing a tower item, foundation bolts shall be supplied in the quantities specified in the bolt table provided in the Tower Structure Layout drawing.
- If the required quantity is not indicated in the Tower Structure Layout drawing, the manufacturer shall contact I.E.C. to obtain the missing information.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 30 of 84		

- Where the Tower Structure Layout drawing explicitly includes the note "Foundation bolts are not required to be supplied", no foundation bolts should be supplied with the tower.
- Examples of foundation bolt quantities are provided in [Appendix E3](#).

All boxes that are associated to one I.E.C. catalog number (a tower, an extension, a crossarm, etc.) shall be stored together on one wooden pallet. The boxes shall be wrapped by plastic wrap and secured with galvanized steel strips to the wooden pallet in such a method that prevents a box to fall apart, and that the wooden pallet can be transported as one package by a forklift.

The top surface of the wooden pallet surface shall be at least 2.5 cm thick, and the height of the pallet shall be at least 15 cm so that a forklift fork can enter inside.

The manufacturer can offer another method of sealed boxes instead of wooden sealed boxes for approval by I.E.C. in advance.

A different packaging method for bolts, nuts, spring washers, climbing steps and safety rings, can be proposed for I.E.C. approval in advance.

11.9 Packing of Foundation Legs

The foundation legs shall be provided as a kit according to the catalog number.

The cross profiles shall be provided with all the bolts and nuts as a complete kit according to the catalog number.

All the quantities shall be according to I.E.C. drawings.

Each I.E.C catalog number, together with all its parts, will be supplied separately to I.E.C warehouses.

The contractor will send copies of the shipment contents by email to I.E.C. Head Office for each shipment.

11.9.1

In all packages containing reinforcement plates welded to the angles, the reinforcement plates will be packed facing upwards and not downwards towards the wooden beams.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 31 of 84		

11.9.2

All the foundation legs and the cross profiles shall be supplied disassembled to I.E.C. warehouses.

11.9.3

All the packages of the foundation legs and the cross profiles shall be secured with fastened double galvanized steel bands of minimum width of 2", in at least 3 locations. The distance between the strips shall not exceed 2 meters.

11.9.4

A minimum of two wooden beams shall be tied under each profiles package. Every wooden beam shall be made from one piece. The wooden beams underneath the profiles package shall have a minimum width of 10 cm and shall be 10 cm height. If a higher beam is required, the height can be raised up to 20 cm, and the width will be the same as the height. For deliveries that shall arrive at the "Orot Rabin" warehouse, the wooden beam height shall be 15 cm. The length of the wooden beam shall be suitable to the package width (with a minimum of 30 cm). The contents of the package shall not exceed the length of the wooden beams.

11.9.5

Each package shall be labeled with an identification and marking label. The list of parts attached to each package will be a photocopy of the production drawing of that part. The list shall be wrapped in a strong plastic bag sealed from water penetration.

Each label shall contain the following information:

- Manufacturer name
- Production country
- I.E.C. catalog number
- Type of tower part
- Package no. from total package quantity (for example: 1/8, 2/8, 3/8, etc.)
- Tower part (Element no.1, Element no.2, etc.)
- List of items marked on parts list drawing
- Order number
- Bundle Weight (kg)

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 32 of 84		

11.9.6

The quantities of bolts and nuts are as required in the production and assembly shop drawings

The manufacturer shall provide an additional of 5% of the quantities, of each type and length of the above items, listed in the drawings (minimum one item of each type and length).

The manufacturer must supply the nuts already bolted to the bolts.

The bolts and nuts shall be packed in a separate strong sealed plastic bag that fits the amount of items.

The weight of each plastic bag shall not exceed 25 kg.

The bolts and nuts shall be packed in sealed boxes (waterproof, stiffness for weight content).

The boxes shall be marked on the outside surface with a plastic sticker.

The sticker shall contain the following information:

- Manufacturer name
- Bolts size and quantity

11.10 Packing Control & Inspections for Towers and Foundation Legs

The manufacturer must control the package contents. The manufacturer shall verify by inspection that all the items of the tower/parts are packed and that there are no missing elements and labels in the package.

Control processes shall be documented and transmitted with the delivery of goods.

I.E.C. will check randomly the content of packages, according to the relevant drawing and attached packing list.

Care must be taken during handling and shipping, to avoid damage to the elements and to galvanization.

Transportation will be via sea and then via land - approximately 100 km from the port to I.E.C. warehouse (for the port in the Mediterranean). Each I.E.C. catalog number will be provided separately, in such a way that it will be possible to identify it in warehouse.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 33 of 84		

12. Quality Assurance

Manufacturer's Quality Assurance Program shall meet the requirements described in ISO 9001 as described in threshold conditions.

13. Quality Control

Quality Control requirements shall be according to the following I.E.C. documents:

- Q-APP-02-PR, see [appendix F1](#).
- Quality Control Inspection Steps, see [appendix F2](#).
- Check list for Transmission Lattice Towers (161,400 kV) NCS-232, see [appendix F3](#).

I.E.C. 's approval of any assembly at the plant, or any other parts thereof — such as during quality control, prototype assembly, or any other stage — shall not relieve the manufacturer of their full and sole responsibility for any errors, omissions, flaws, or defects that may be detected at a later date. Furthermore, the manufacturer shall remain fully and exclusively responsible for dimensional accuracy within the required tolerances, as well as for the quality and workmanship of the structure, even after delivery.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 34 of 84		

14. Delivery Approval Conditions for the First Shipment

14.1 Conditions

According to the time schedule described in Chapter 17, the contractor will submit the following information to I.E.C's Transmission Lines Engineering Headquarter:

14.1.1 Steel Manufacturers

The list of steel manufacturers and their Valid ISO 9001 certificates shall be sent for I.E.C. approval. The certificates shall be valid for the scope of activities in the requested proposal.

I.E.C. approval will be within one week.

14.1.2 Bolts Manufacturers

The list of bolts manufacturers and their Valid ISO 9001 certificates shall be sent for I.E.C. approval. The certificates shall be valid for the scope of activities in the requested proposal.

I.E.C. approval will be within one week.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 35 of 84		

14.1.3 Welding Certificates

The following documentation shall be sent for I.E.C. approval, according to the time schedule described in Chapter 17:

- WPS (Welding procedure specification) and corresponding PQR (procedure qualification record). A PQR is required only when the WPS is not prequalified in accordance with AWS D1.1.
- WPQR – All Welders Procedure Qualification Records
- MTR (Material Test Records) of base materials

I.E.C. approval will be within two weeks.

The following documentation shall be sent for I.E.C. approval after manufacturing and before delivery:

- All NDT reports as described in chapter 6.

14.1.4 Materials Tests Certificates

Materials tests certificates shall be sent for I.E.C. approval. The certificates shall be submitted for I.E.C. approval within two months from starting point (see time schedule on chapter 17) for the first delivery.

I.E.C. approval will be within two weeks.

The tests to be carried out shall include:

- Yield strength
- Ultimate tensile strength
- Percentage elongation
- Impact test
- Chemical properties

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 36 of 84		

14.1.5 Samples

Within one month from starting point (see time schedule on chapter 17), five samples and test reports shall be submitted to I.E.C. of all the following items:

- Bolts of each one of the diameters
- Nuts for each one of the diameters of the bolts
- Climbing steps of each one of the diameters
- Nuts for each one of the diameters of the climbing steps
- Safety rings
- Spring washers for each one of the diameters

The test report shall include the following:

- Yield strength
- Ultimate tensile strength
- Percentage elongation
- Chemical properties
- Impact test only for climbing steps
- Tension test wedge for bolts (see chapter 5.2.1)

Bolts according to ASTM – A-394

Nuts according to ASTM-A 563

Spring washers according to ASME B18.21.1

Climbing steps and safety rings according to EN10025-2

I.E.C. will check the samples and reply within three weeks.

A manufacturer that supplied to I.E.C. in the past bolts, nuts, spring washers and climbing steps, is released from submitting samples.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 37 of 84		

14.1.6 Local Subcontractor

Within 7 weeks from starting point (see time schedule on chapter 17), a local Israeli subcontractor in Israel who will be responsible for services written in chapter.16, shall be proposed for I.E.C. approval.

The following documents shall be provided by the local subcontractor:

- Declaration that the proposed subcontractor has experience in manufacturing steel constructions for at least 2 years during the 5 last years.
- Declaration that the subcontractor has his own equipment for punching (CNC), drilling (CNC), cutting, and welding.

I.E.C. reserves the right to visit the proposed local subcontractor site.

I.E.C. approval will be within three weeks.

14.1.7 Prototype Assembly

If a prototype assembly is required, the scheduled date and location of the finished prototype assembly shall be sent to I.E.C. 4 weeks prior to the date.

I.E.C. or one of its representatives has the right to be present and check the prototype assembly.

The manufacturer will film and document the assembly, issue a report, and send it to I.E.C.

Only after receiving I.E.C.'s approval will it be possible to dismantle the assembly and send the items for galvanization.

The time between the order until I.E.C. approval of the prototype assembly shall be within 8 weeks.

I.E.C. 's approval of any assembly at the plant, or any other parts thereof — such as during quality control, prototype assembly, or any other stage — shall not relieve the manufacturer of their full and sole responsibility for any errors, omissions, flaws, or defects that may be detected at a later date. Furthermore, the manufacturer shall remain fully and exclusively responsible for dimensional accuracy within the required tolerances, as well as for the quality and workmanship of the structure, even after delivery.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 38 of 84		

14.2 Acceptance test

I.E.C. reserves the right to verify the compliance of the delivered items with this specification.

Delivery, which will not pass acceptance test, will be rejected at the expense of the manufacturer.

14.3 Delivery

All the items ordered shall be supplied to I.E.C. warehouse according to I.E.C.'s order.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 39 of 84		

15. Delivery Approval Conditions for Ongoing Shipments

15.1 Test Certificates

Before every delivery, the following test certificates will be submitted to I.E.C. Quality Control Department – see appendices F2 & F3:

- Certificates of inspection on welds as required
- Test certificates for fabrication
- Test certificates for galvanizing
- Packaging inspection certificates

The manufacturer must ensure all documentation is in his possession. I.E.C. has the right to request it as needed.

The contractor shall identify all materials on the appropriate mill test reports and shall provide them to I.E.C.

The contractor is required to perform the physical tests on the samples of structural steel parts (raw material, bolts, nuts, spring washers, climbing steps, safety rings)

The tests to be carried out shall include:

- Yield strength
- Ultimate tensile strength
- Percentage elongation
- Impact test
- Chemical properties

The contractor shall supply samples for approval, including test certificates, if required by I.E.C. Quality Control Department

15.2 Delivery

All the items ordered shall be supplied to I.E.C. warehouse according to I.E.C.'s order.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 40 of 84		

16. Service During Warranty Period

16.1 Services Provided

In case of defects that can be caused, for instance, from one or more of the following:

- A missing element
- The production of an element is not accurate, such as tolerances, holes, length, wrong profile, etc.
- Damage from transportation, etc.
- Damaged galvanizing coat from any cause.

I.E.C. reserves the right to decide on the preferred solution:

- To re-galvanize the item or
- To paint the item over the damage area by two layers of zinc-rich paint.

The contractor shall provide the following services (by a subcontractor or by himself):

- Repairing the elements
- Re-manufacturing of the missing or damaged or defective parts.

The repair must be approved by I.E.C.

16.2 Schedule for Repair & Completion of Parts

- Completion of missing parts weighting up to 200 kg per paragraph in PO for towers/extensions/crossarms – the supplier shall provide the missing parts within 5 days, at no additional costs.
- Completion of missing parts weighting over 200 kg per paragraph in PO for towers/extensions/crossarms – cost will be determined after clarification with the supplier. The supplier shall provide the missing parts within 5 days from the date of clarification.
- Repair parts within 2 working days.
- Agreed compensation will be according to the tender documents, for each day of late for failing to comply with the terms of service and the schedule.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 41 of 84		

17. Time Schedule for Materials, Welding Procedure and Subcontractor Approval

Remarks:

1. Starting point is the date on which a binding contractual obligation has been created, as specified in the invitation to submit proposal.
2. Total schedule for all procedures up to 10 weeks from starting point

No.	STAGE	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Submit list of steel manufactures																
2	IEC approval steel manufacturer																
3	Submit list of bolts manufactures																
4	IEC approval of bolst manufacturers																
5	Submit samples and test report of bolts, climbing steps, spring washers and safety rings																
6	IEC approval for samples																
7	Submit welding procedure																
8	IEC approval of welding procedure																
9	Materials certificates tests																
10	IEC approval certificates tests																
11	Propose the Local subcontractor																
12	IEC approval of subcontractor																

18. Time Schedule for Delivery

In accordance with the tender documents.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 42 of 84		

19. Appendices

19.1 Appendix "A1": Questionnaire for the Manufacturer

Please fill in the following questionnaire:

General Details:

Manufacturer / Fabricator Name:

Company's Address:

Tel No.:

Email:

Web. Site:

Fax No.:

Contact Persons Names:

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 43 of 84		

19.2 Appendix "A2": Requirements from the manufacturer

Table listing the requirements from the manufacturers:

All documents required in this appendix must be submitted as a single PDF file, organized according to the order of the sections in the following table.

Manufacturer Name: _____

	Requirements	Submission method of the requirement by the manufacturer
1	Quality Control System see chapter 13	Sign and attach: Appendix "F1": I.E.C Quality Specification Q-APP-02-PR Appendix "F2": Quality Control Inspection Steps Appendix "F3": Check list for Transmission Towers and Foundation Legs (161,400 kV) NCS-232
2	Manufacturing capabilities (min. 4,500 tons per year for lattice towers) (min. 200 tons per year for foundation legs)	Please state manufacturing capabilities: _____
3	A list of Automatic/computerized machinery suitable for cutting, punching, and drilling. see chapter 6	A list must be attached
4	Forklifts and cranes:	
	Quantities of forklifts	Please state number of forklifts: _____
	Quantities of cranes	Please state number of cranes: _____

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 44 of 84		

	Requirements	Submission method of the requirement by the manufacturer
5	Storage areas:	
	Storage area for shop assembly (min. 2,000 sq.m.)	Please state the area: _____
	Storage area size for raw materials and for finished production (min. 1,000 sq.m.)	Please state the area: _____
6	Quantities of Manpower:	
	Engineers (min. 1)	Please state number of engineers: _____
	Technical office	Please state number of technical office employees: _____
	Manufacturing employees	Please state number of manufacturer employees: _____
7	A list of welding equipment and machines	A list must be attached
8	WPS (Welding procedure specification) and corresponding PQR (procedure qualification record). A PQR is required only when the WPS is not prequalified in accordance with AWS D1.1.	The documents must be attached
9	WPQR – All Welders Procedure Qualification Records	The documents must be attached

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 45 of 84		

	Requirements	Submission method of the requirement by the manufacturer
10	NDT credentials of personnel – must be level 2 and above	The documents must be attached
11	A List of Customers from the last 5 years	A list must be attached
12	Material availability	Sign and attach: Appendix "C2": Material Availability

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 46 of 84		

19.3 Appendix "B1": Statement of Manufacturing Experience for Lattice Transmission Towers

I, _____ (enter name), hereby state the following:

1. I _____ (enter name), am authorized to sign this statement on behalf of _____ ("enter Manufacturer name").
2. I hold the position of _____ (enter job title and description, i.e. partner, production manager, sales manager, etc.) at the Manufacturer.
3. I have been in this position since _____ (enter date).
4. I am providing this statement with regards to I.E.C.'s tender number _____ ("the Tender").
5. The facts & details given in this statement have been checked and verified by me.
6. _____, the manufacturer factory has at least 2 years (in the last 5 years) of proven experience in in production and supply of steel lattice transmission towers with height of at least 30 m
7. _____, the manufacturer factory has capabilities to manufacture at least 4,500 tons per year of steel lattice towers.
8. _____, the manufacturer owns CNC machinery suitable for cutting, punching, and drilling for profiles and plates.

I hereby undertake to provide, upon I.E.C.'s request and at its sole discretion, any other documents (reference list, quantities, dates of supply, letters of recommendations etc.), or other information requested for this tender for purposes of proving said experience.

Date

Signature

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 47 of 84		

19.4 Appendix "B2": Statement of Manufacturing Experience for Foundation Legs

I, _____ (enter name), hereby state the following:

1. I _____ (enter name), am authorized to sign this statement on behalf of _____ ("enter Manufacturer name").
2. I hold the position of _____ (enter job title and description, i.e. partner, production manager, sales manager, etc.) at the Manufacturer.
3. I have been in this position since _____ (enter date).
4. I am providing this statement with regards to I.E.C.'s tender number _____ ("the Tender").
5. The facts & details given in this statement have been checked and verified by me.
6. _____, the manufacturer factory has at least 2 years (in the last 5 years) of proven experience in in production and supply of steel structures with length or height of at least 6 m. and has experience with welding, punching and drilling of steel.
7. _____, the manufacturer factory has capabilities to manufacture at least 200 tons per year of steel constructions.
8. _____, the manufacturer owns CNC machinery suitable for cutting, punching, and drilling for profiles and plates.

I hereby undertake to provide, upon I.E.C.'s request and at its sole discretion, any other documents (reference list, quantities, dates of supply, letters of recommendations etc.), or other information requested for this tender for purposes of proving said experience.

Date

Signature

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 48 of 84		

19.5 Appendix "B3": Declaration of Supply Lattice Towers for IEC in the past

I, _____ (enter name), hereby state the following:

1. I _____ (enter name), am authorized to sign this statement on behalf of _____ ("enter Manufacturer name").
2. I hold the position of _____
(enter job title and description, i.e. partner, production manager, sales manager, etc.)
at the Manufacturer.
3. I have been in this position since _____ (enter date).
4. I am providing this statement with regards to
I.E.C.'s tender number _____ ("the Tender").
5. The facts & details given in this statement have been checked and verified by me.
6. Mark the relevant proposed group:
 - ☐ **Option 1:** The manufacturer has manufactured and supplied at least one lattice tower for transmission lines to the Israel Electric Corporation (IEC) during the last 7 years.
 - ☐ **Option 2:** The manufacturer has manufactured and previously supplied lattice towers for transmission lines to IEC, but it has been over 7 years since they last supplied. The manufacturer still possesses the necessary CNC machinery for cutting, punching, and drilling profiles and plates as well as welders, locksmiths, storage/assembly areas, handling equipment, and a technical office, in accordance with the requirements of specification NCS232.

I hereby undertake to provide, upon I.E.C.'s request and at its sole discretion, any other documents (reference list, quantities, dates of supply, letters of recommendations etc.), or other information requested for this tender for purposes of proving said experience.

Date

Signature

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 49 of 84		

19.6 Appendix "C1": Declaration of Commitment to Comply with Specification NCS-232

1.

We

hereby declare that the proposal fully meets all requirements of present specification and fabrication drawings.

2.

We

hereby declare that the raw materials: the steel and the bolts, nuts, spring washers, climbing steps and safety rings, purchased from manufacturers that have a valid ISO 9001 certificates for the scope of the material, and will be approved by I.E.C. after winning the tender.

3.

We

hereby declare that an Israeli subcontractor will be employed by us for services as written in para.15, in case of winning the tender

(only for foreign contractor).

Name:

Duly authorized to sign this declaration:

Date

Signature

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 50 of 84		

19.7 Appendix "C2": Material Availability

The following is a list of the angle and channel profiles used in the production drawings. Each manufacturer is required to confirm their ability to source these profiles for the fabrication of the towers.

Angle profiles			
Size	Material	Size	Material
L 50x50x5	EN10025-S235JR	L 130x130x12	EN10025-S355J0
L 60x60x6	EN10025-S235JR	L 140x140x13	EN10025-S355J0
L 60x40x7*	EN10025-S235JR	L 150x150x14	EN10025-S355J0
		L 160x160x15	EN10025-S355J0
L 60x60x6	EN10025-S355J0	L 180x180x16	EN10025-S355J0
L 70x70x7	EN10025-S355J0	L 180x180x18	EN10025-S355J0
L 80x80x8	EN10025-S355J0	L 200x200x16	EN10025-S355J0
L 90x90x9	EN10025-S355J0	L 200x200x18	EN10025-S355J0
L 100x100x10	EN10025-S355J0	L 200x200x20	EN10025-S355J0
L 110x110x10	EN10025-S355J0	L 200x200x24	EN10025-S355J0
L 120x120x11	EN10025-S355J0		
UNP profiles			
Size	Material	Size	Material
65	EN10025-S235JR	160	EN10025-S235JR
80	EN10025-S235JR	180	EN10025-S235JR
100	EN10025-S235JR	180	EN10025-S355J0
120	EN10025-S235JR	220	EN10025-S235JR
140	EN10025-S235JR		
Hollow Section Profile**			
SHS 40x40x3.2	EN10025-S235JR	CHS 4"x4.76	EN10025-S235JR

*- The L60x40x7 angle profile may be replaced with an L60x60x6 angle made of EN10025-S355J0 steel.

** - Increased wall thickness may be suggested for hollow section profiles.

Remark: The profiles listed in the table are the primary profiles required; there may be additional, or different profiles.

Date

Signature

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 51 of 84		

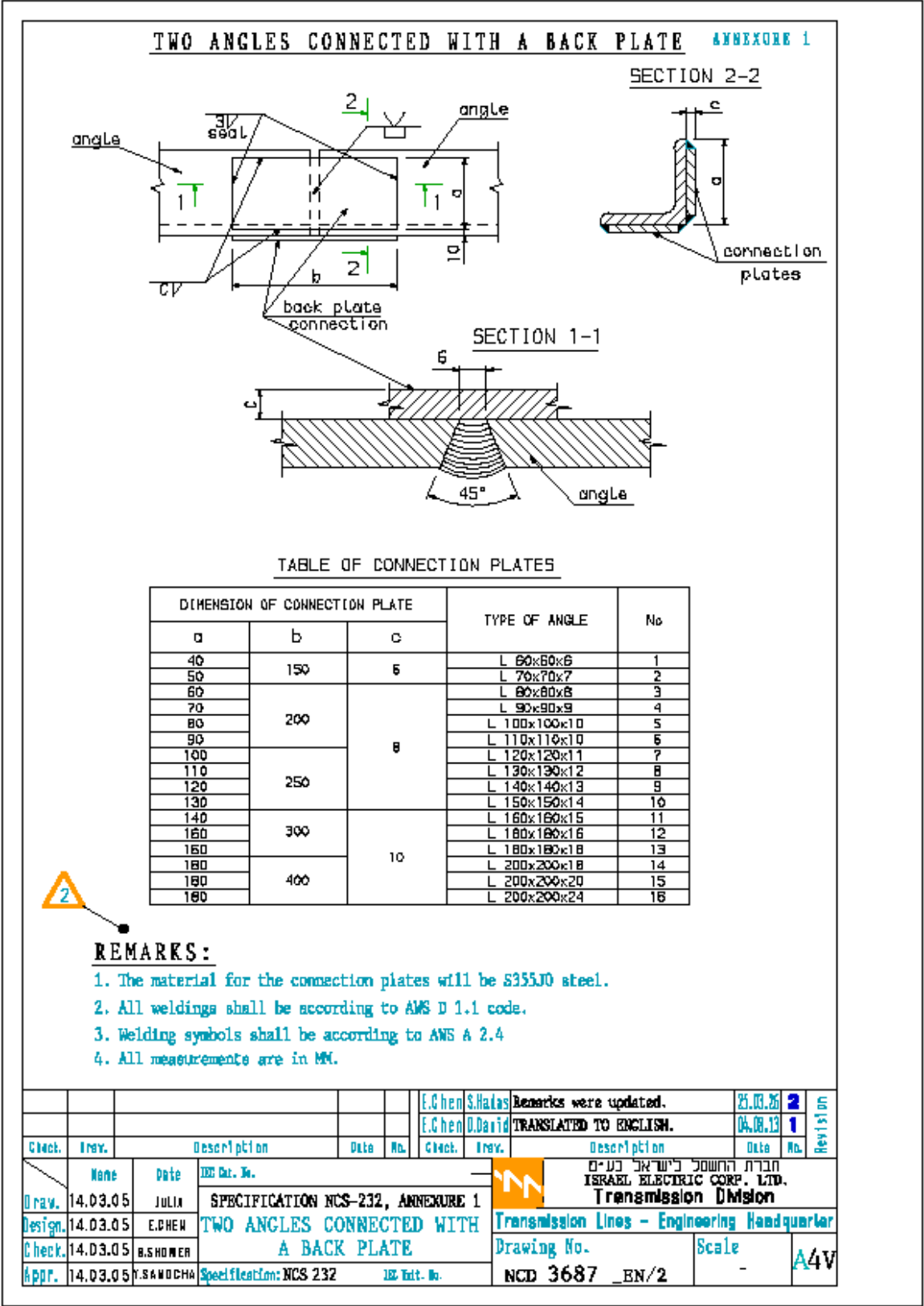
19.8 Appendix "D": Annexures 1, 2, 3, 4, 5, 6A, 6B, 7, 10, 12, 13, 15, 16, 17, 18, 20

The annexures list with their respective drawing number:

Chapter No.	Annexure No.	Drawing No.	Description
19.8.1	1	NCD3687_EN	Two Angles Connected with a Back Plate
19.8.2	2	NCD3692_EN	Angle to Plate Connection
19.8.3	3	NCD3681_EN	Internal Connection of Two Angles with an Angle Profile
19.8.4	4	NCD3682_EN	U Profiles Connection
19.8.5	5	NCD3691_EN	Directive for penetration and fillet weld check
19.8.6	6A	NCD3684_EN	Example: Tower elements – parts marking
19.8.7	6B	NCD9913_EN	Example: Foundation Legs – parts marking
19.8.8	7	NCD3683_EN	Instruction for steel structures connection with bolts
19.8.9	10	NCD3694_EN	Prototype Assembly
19.8.10	12	NCD5697_EN	Example For Marking Labels
19.8.11	13	NCD4149_EN	Hexagonal Bolts and Nuts - UNC
19.8.12	15	NCD9074_EN	Example For Crossarm Packing View
19.8.13	16	NCD9312_EN	Top Part of Legs to be Used as Templates
19.8.14	17	JDHK5571_EN	Climbing steps
19.8.15	18	NCD5806_EN	Threaded safety ring for climbing step
19.8.16	20	NCD13765_EN	Welding symbols according to I.S. 1061

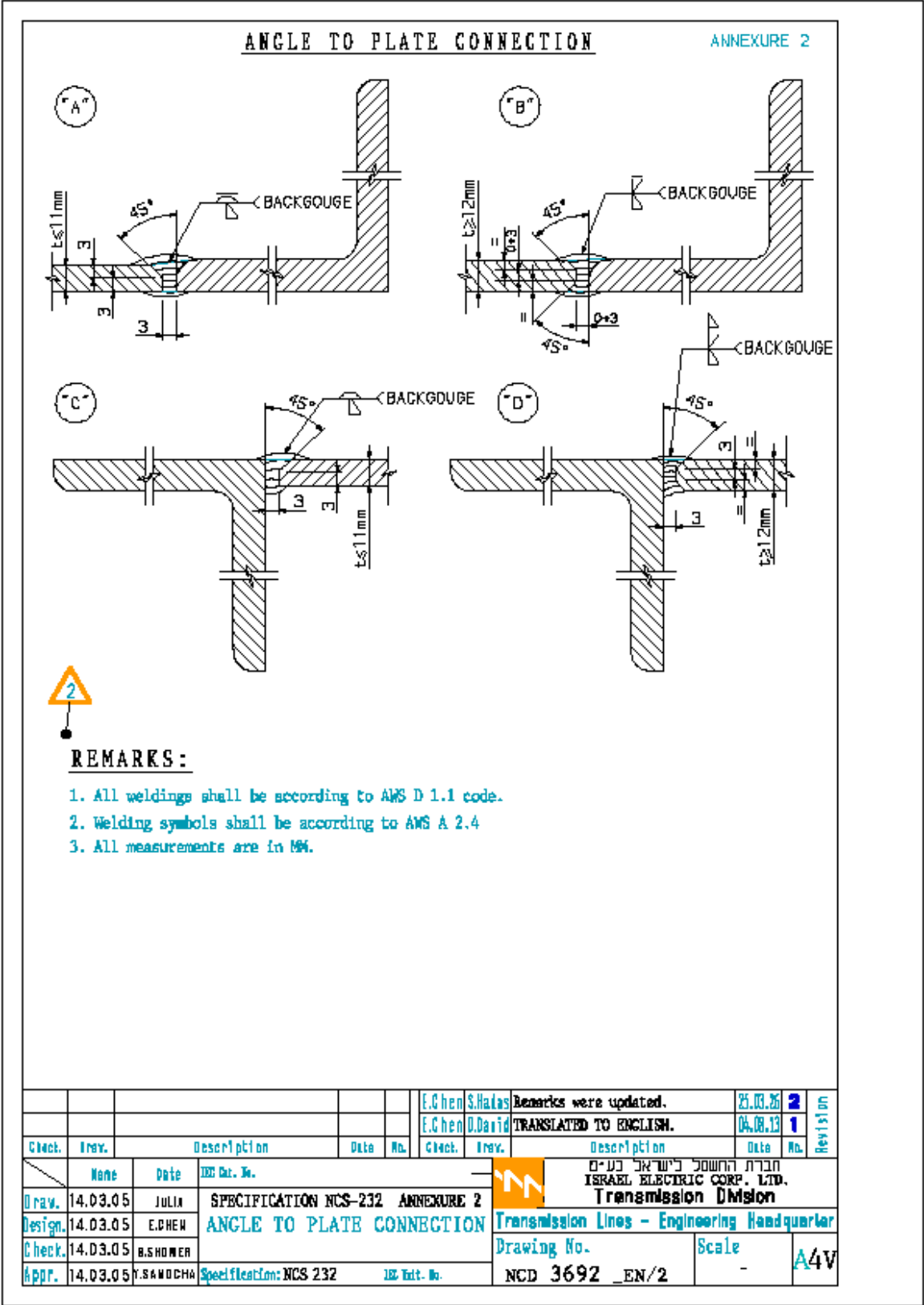
NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 52 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.1 Annexure 1



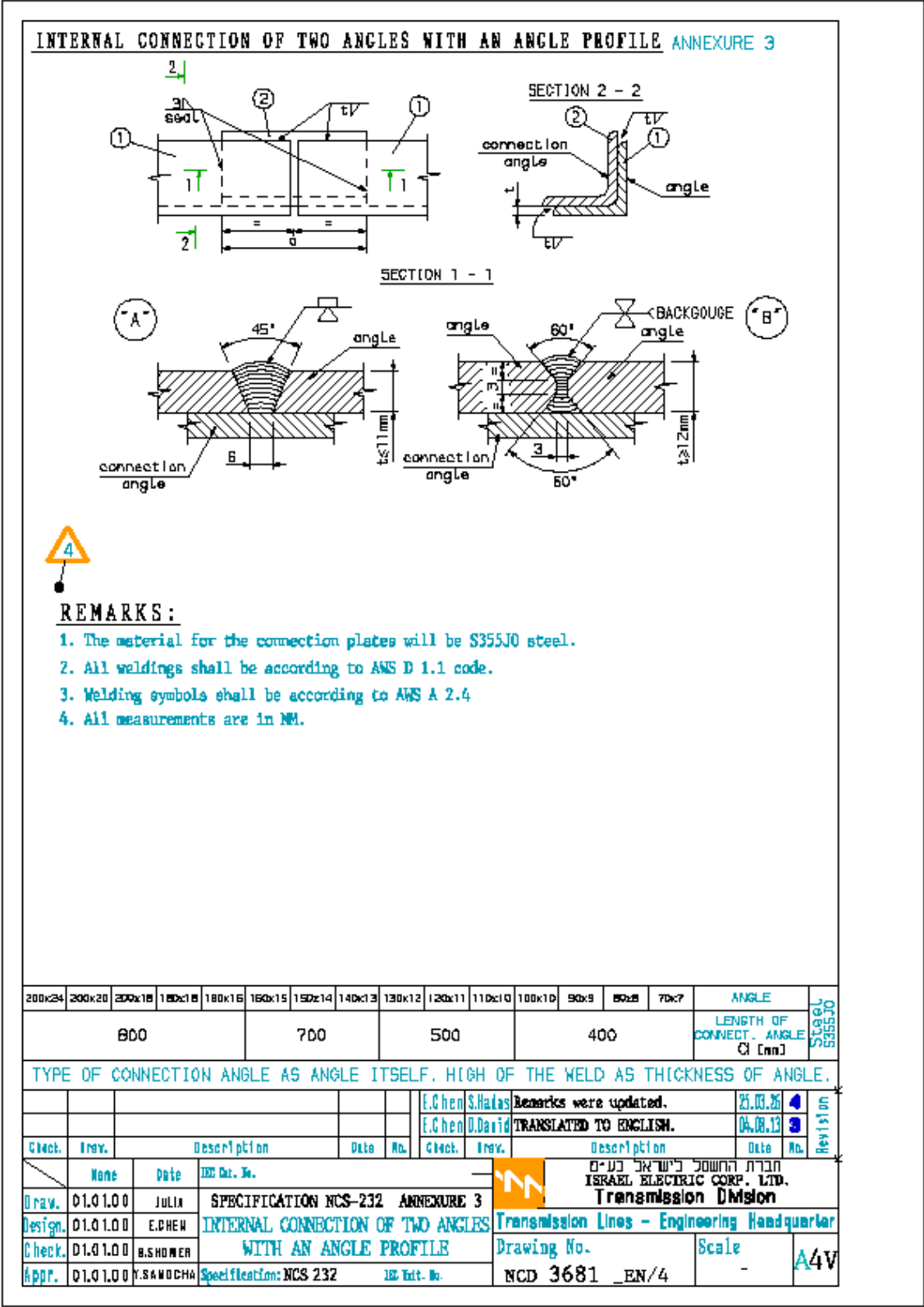
NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 53 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.2
 Annexure 2



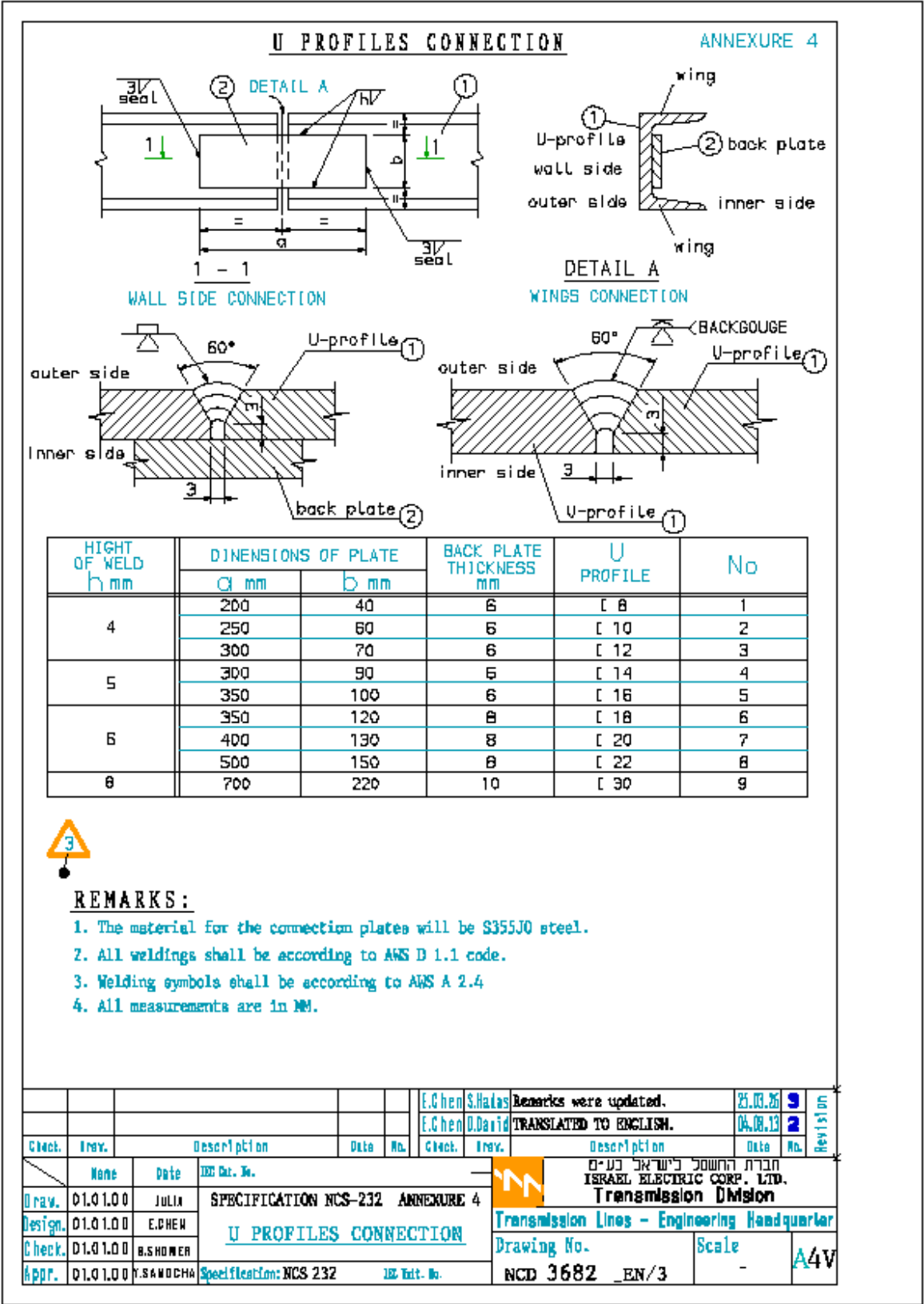
NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 54 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.3 Annexure 3



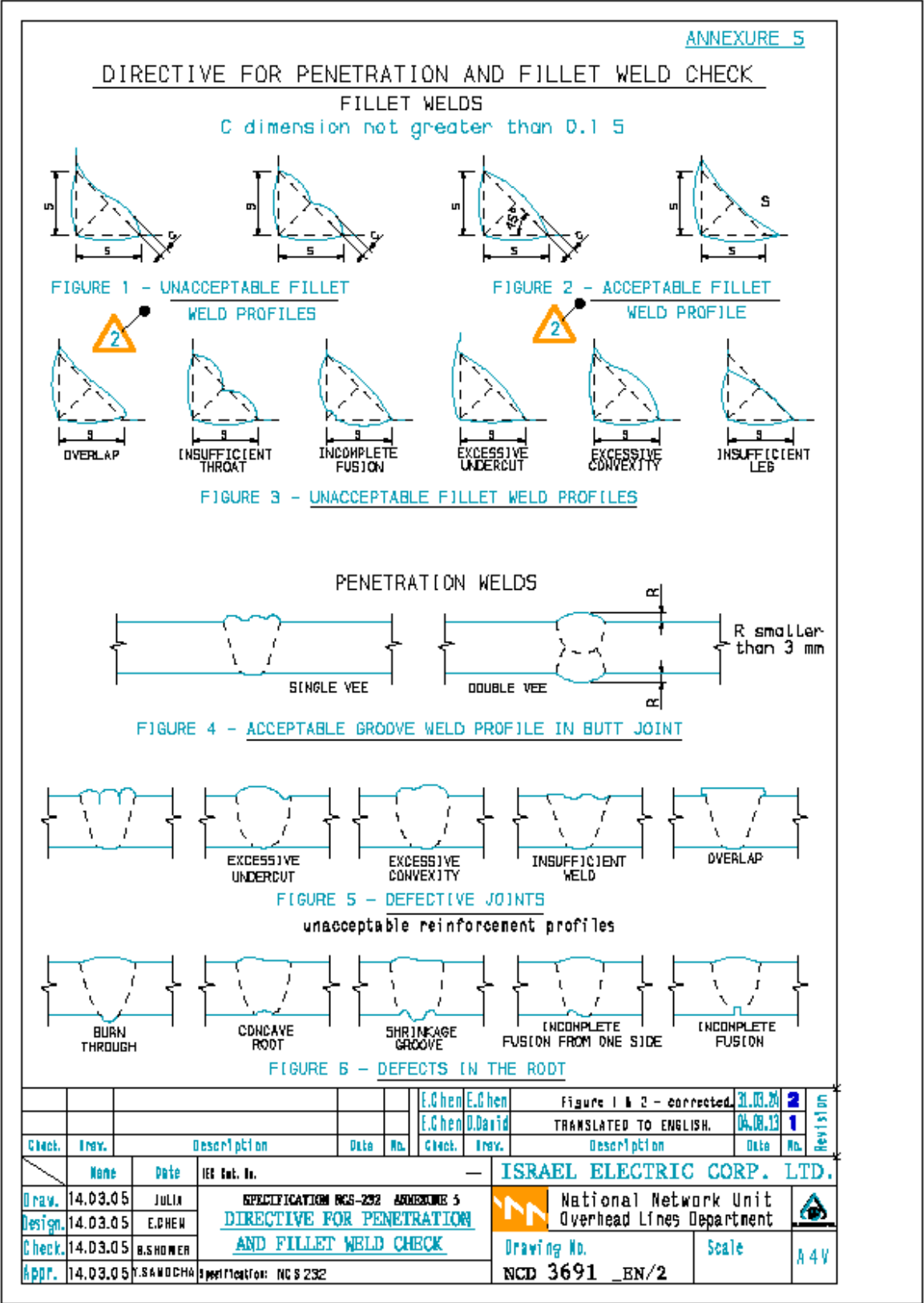
NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 55 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.4 Annexure 4



NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 56 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.5 Annexure 5

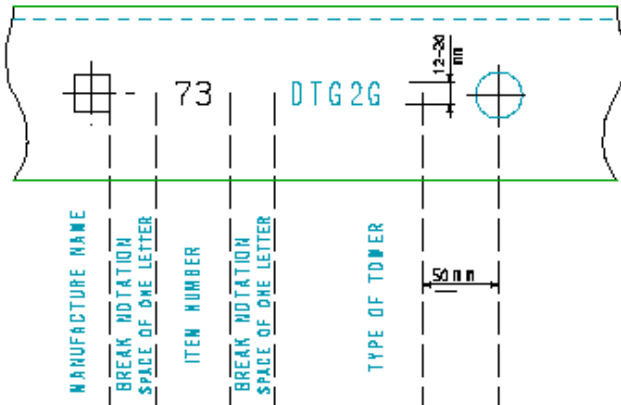


NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 57 of 84		

19.8.6 Annexure 6A

ANNEXURE 6A

EXAMPLE: TOWER ELEMENTS PARTS MARKING



MANUFACTURE NAME

BREAK NOTATION SPACE OF ONE LETTER

ITEM NUMBER

BREAK NOTATION SPACE OF ONE LETTER

TYPE OF TOWER

5

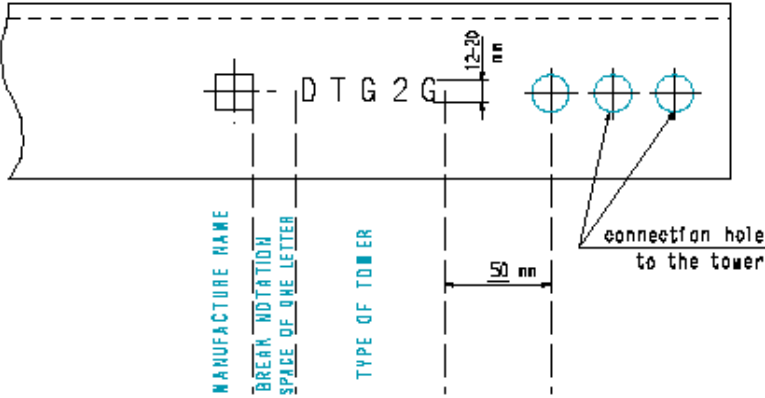
					E.Chen	A.Yablon	TOWER ELEMENTS PARTS MARKING - UPDATED	22.01.14	4	Revision	
E.Chen	E.Chen	legs - deleted	16.02.17	5	E.Chen	O.David	TRANSLATED TO ENGLISH.	04.08.13	3		
Check.	Rev.	Description	Date	No.	Check.	Rev.	Description	Date	No.		
ISRAEL ELECTRIC CORP. LTD.											
Draw.	D1.01.00	JULIA	SPECIFICATION NCS-232 ANNEXURE 6A			National Network Unit		A 4 V			
Design.	D1.01.00	E.CHEN	EXAMPLE: TOWER ELEMENTS			Overhead Lines Department					
Check.	D1.01.00	B.SHOMER	PARTS MARKING			Drawing No.		Scale			
Appr.	D1.01.00	T.SAMUCHA	Specification: NCS -			NCD 3684 _EN/5					

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 58 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

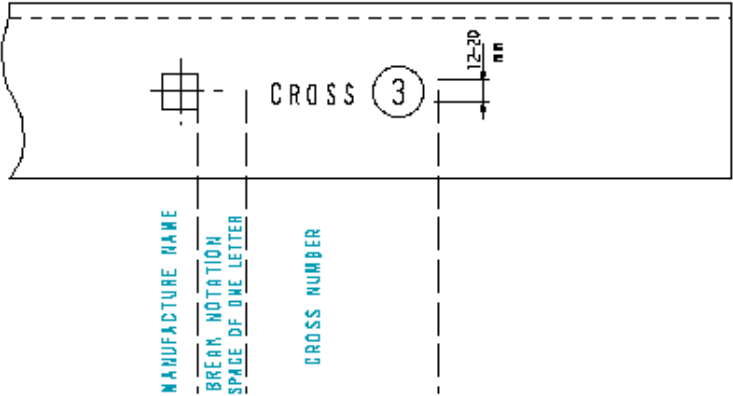
19.8.7 Annexure 6B

ANNEXURE 6B

EXAMPLE: FOUNDATIONS LEGS ELEMENTS PARTS MARKING



EXAMPLE: CROSS PROFILES ELEMENTS PARTS MARKING



Check.	Rev.	Description	Date	No.	E.Jaber/Urifery E.Jaber/Urifery	Added Specification NCS232 The drawing was translated into English	04.06.25 03.07.24	2 1	Revision
Draw.	23.12.18	אוריאל							
Desig.	23.12.18	אוריאל							
Check.	23.12.18	אוריאל							
Appr.	23.12.18	אוריאל							

2

SPECIFICATION NCS232 ANNEXURE 6B
 EXAMPLE: Foundation Legs Elements
 and Cross profiles parts MARKING


 חברת החשמל לישראל בע"מ
 ISRAEL ELECTRIC CORP., LTD.
Transmission Lines Division
Transmission Lines - Engineering Headquarter

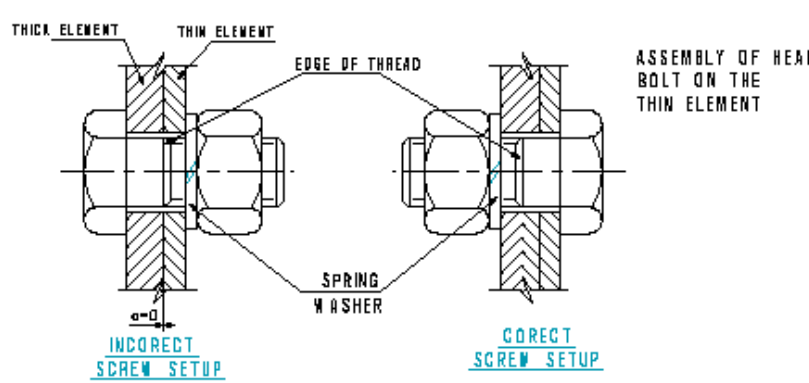
Drawing No. NCD 9913 _EN /2
 Scale 1:- , 1:-
 A 4 V

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 59 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.8 Annexure 7

INSTRUCTION FOR STEEL STRUCTURES CONNECTION WITH BOLTS

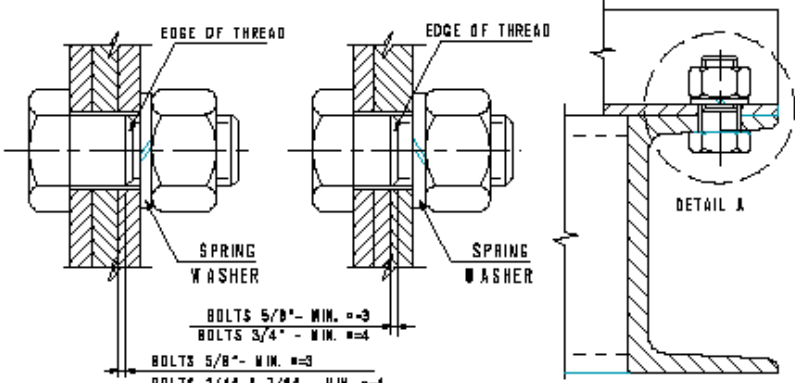
ANNEXURE 7



THREE ELEMENTS CONNECTION

TWO ELEMENTS CONNECTION

PROFILES U CONNECTION WITH ANGLE PROFILE



Remarks:

When there are elements with equal thickness or elements with different thickness $\leq 3\text{mm}$ or 4mm and the screw head is on the thin side of the element, use a longer bolt.

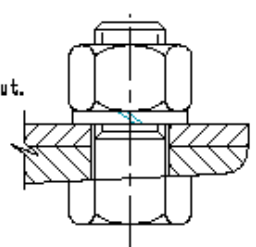
If the thread length does not allow stretching the nut, add flat washer, additionally to spring washer.

Nuts will be closed by:

a) Manually tightening with suitable wrench.

or:

b) A mechanical device with a few keystrokes.

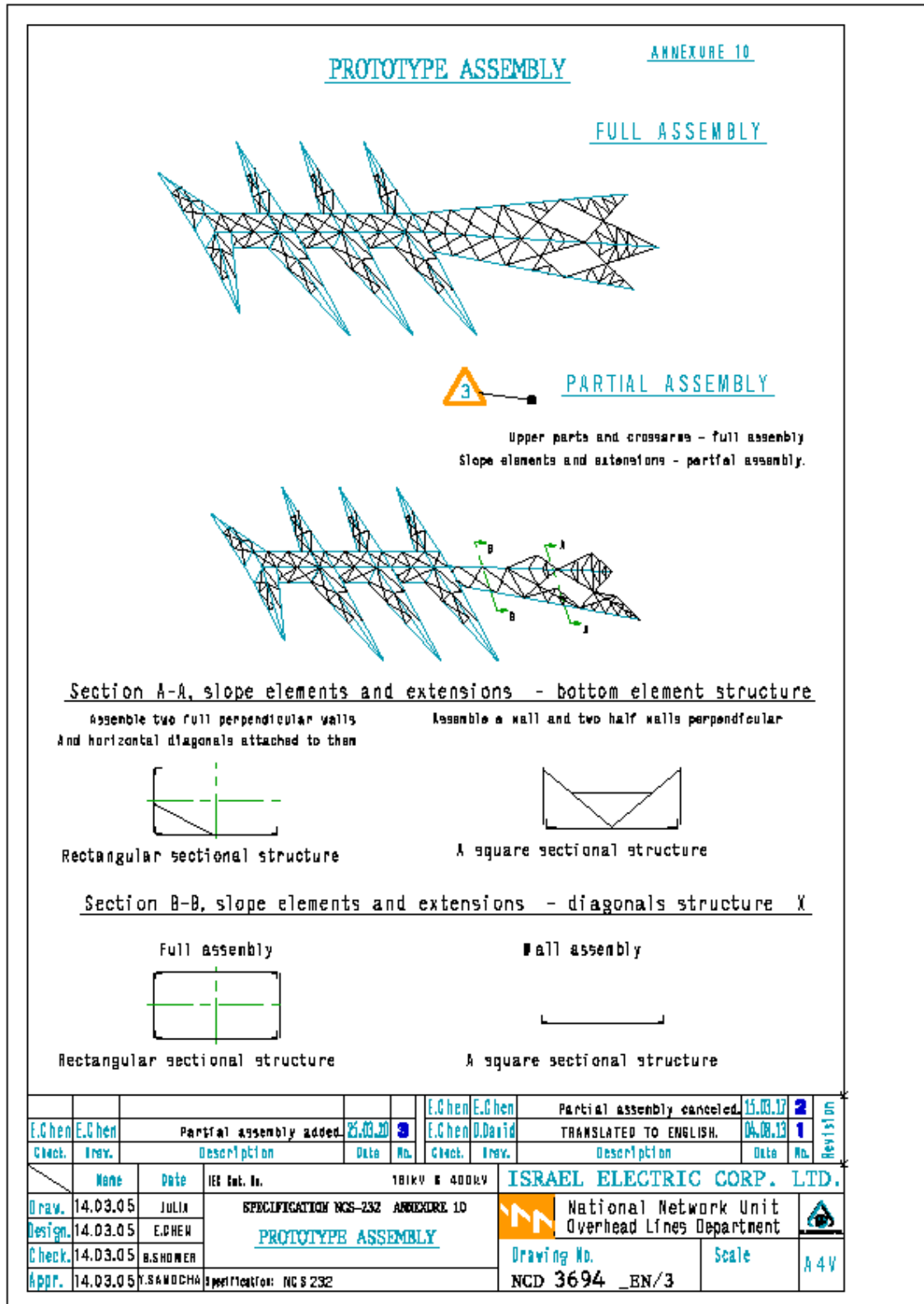


Check.	Rev.	Description	Date	No.	Check.	Rev.	Description	Date	No.	Revision
					E.Chen	D.David	TRANSLATED TO ENGLISH.	04.08.13	3	

Name					Date	IEE Est. No.	ISRAEL ELECTRIC CORP. LTD.				
Draw.	D1.01.00	JULIA	SPECIFICATION NCS-232 ANNEXURE 7				National Network Unit				
Design.	D1.01.00	E.CHEN	INSTRUCTION FOR STEEL STRUCTURES				Overhead Lines Department				
Check.	D1.01.00	B.SHOMER	CONNECTION WITH BOLTS				Drawing No.		Scale		
Appr.	D1.01.00	T.SAWOCHA	Specification: NCS —				NCD 3683 _BN/3		A4V		

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 60 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.9 Annexure 10



NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12 Update Date: 29 July 2026 Page No.: 61 of 84	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	

19.8.10 Annexure 12

Example For Marking Labels

ANNEXURE 12

Material Packing Table - Numbers & Quantities in each package

Items Number	Plates & Items in Box Pallet			Profiles		
	threaded	packed	single	package 1	package 2	package 3
569-570	552-553,567-568	0	554-565	551,561A	0	
Quantities	40	20	0	88	4	0

1. All items shall be packed in packages according to this packing table.
 2. For each package, a photocopy of the material and packing tables shall be attached.
 3. A circle on the photocopy shall be drawn, showing the relevant package. Also fill in:
 Packing supervisors name, date of packing and signature.
 4. The photocopy shall be placed in a sealed nylon envelope, And well attached to the package.
 5. The above mentioned requirements are according to the packing instruction requirements as
 Listed Inspection NCS232.

Total Weight: 1801.5 kg

570	18	Fillet	THK 12 mm	100x55	0.0860 m³	8.9		
569	24	Fillet	THK 12 mm	140x50	0.2016 m³	19.0		
568	8	Reinforcement	THK 12 mm	390x155	0.2600 m³	26.4		
567	4	Connection Plate	THK 12 mm	425x280	0.4760 m³	44.8		
566	4	Diagonal	L 50x50x5	805	3220	12.1		
565	4	Diagonal	L 50x50x5	1588	6352	23.9		
564	4	Diagonal	L 60x60x6	2256	9024	48.9		
563	4	Diagonal	L 50x50x5	1259	5036	19.0		
562	8	Horizontal	L 50x50x5	581	4728	17.8		
561	8	Diagonal	L 50x50x5	1080	8640	32.6		
560	8	Horizontal	L 50x50x5	1145	9160	34.5		
559	8	Diagonal	L 50x50x5	1439	11512	43.4		
558	8	4+4	Horizontal	L 60x60x6	1670	13360	72.4	
557	8	Diagonal	L 50x50x5	1440	11520	43.4		
556	8	Horizontal	L 50x50x5	942	7536	28.4		
555	8	4+4	Diagonal	L 90x90x9	3616	28928	352.9	
554	8	4+4	Diagonal	L 90x90x9	2782	22096	289.6	
553	4	Connection Plate	THK 14 mm	940x185	0.6260 m³	68.8		
552	4	Connection Plate	THK 14 mm	940x185	0.6260 m³	68.8		
551A	2	Leg	L 130x130x12	6000	12000	283.2		
551	2	Leg	L 130x130x12	6000	12000	283.2		
Item Number	Qty	Item Description		Unit Length Unit	Total Length Unit/ Area Unit	Total Weight Unit	Notes	

Revision	Name	Date	10KV	ISRAEL ELECTRIC CORP. LTD.		
	Draw. L. Silvestro	31.08.04	SUSPENSION POLE TYPE HHS-2		National Network Unit Overhead Lines Department	AD
	Design. E. Chen	02.08.04	ELEMENT No 5 - 6.D.m			
	Check. K. Toab	01.08.05	Specification: NCS ----		Drawing No.	Scale
	Appr. Y. Samocha	01.08.05			NCD 3361	_EN/6 1:10, 1:5

MARKING SUPERVISOR.....
 DATE OF PACKING (MONTH/YEAR).....
 SIGNATURE.....

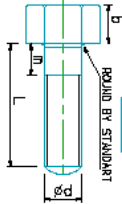
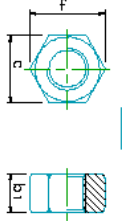
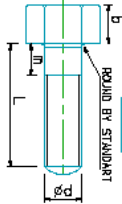
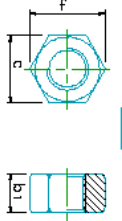
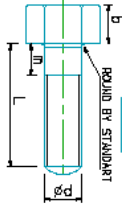
Check.	Draw.	Description	Date	No.	Check.	Draw.	Description	Date	No.	Revision

Name	Date	10KV	ISRAEL ELECTRIC CORP. LTD.		
Draw. D. David	10.06.13	SPECIFICATION NCS-232 ANNEXURE 12		National Network Unit Overhead Lines Department	A4V
Design. E. Chen	10.06.13	EXAMPLE FOR MARKING LABELS			
Check. B. Shomer	15.07.13			Drawing No.	Scale
Appr. Y. Samocha	15.07.13	Specification: NCS 232		NCD 5697	_EN/0

Page No.: 62 of 84

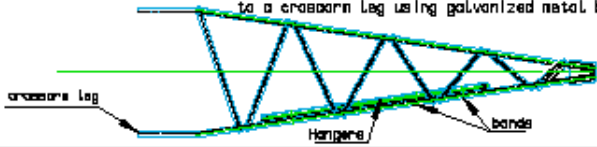
TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION



NOTES		I.E.C. CAT. NO.		DIMENSIONS (MM)					NOMINAL DIAMETER (INCH)	
	BOLTS STS2	F	C	b ₁	b	m*	L*	d		
	419267				11.35			3/4"		
	419263				15.40					
	419317				19.45					
	419333				23.50					
	419358				31.60			3/4"		
	419382				38.70					
	1850601				45.80					
	1850643				55.100					
	1850985				100.150			1/2"		
	1851013				140.200					
	1851054				150.250					
	1923666				13.40					
	419415				16.45			7/8"		
	419432				21.50					
	419473				27.60					
	419515				37.70					
	419549				47.80			5/8"		
	681262				52.90					
	1304336				55.100					
		37.2		32.35 + 33.34		18.39 + 19.71				
		32.35 + 33.34		13.50 + 14.30						
				</						

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 63 of 84		

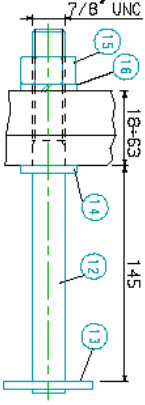
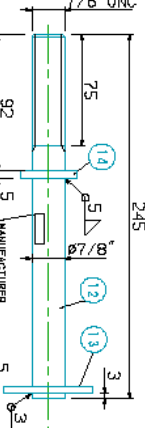
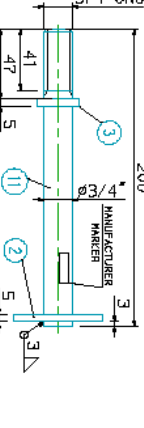
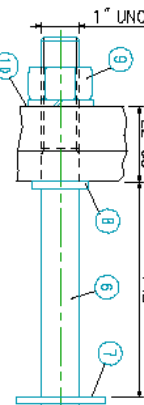
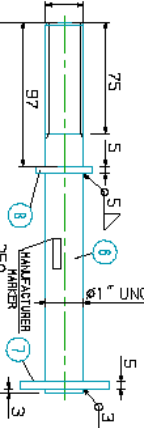
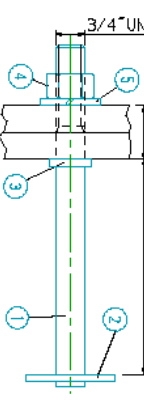
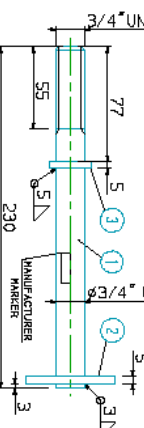
19.8.12 Annexure 15

EXAMPLE FOR CROSSARM PACKING VIEW										ANNEXURE 15																																																																																																																																																					
SUPPLY REMARK: The manufacturer will provide the crossarm surface assembly, fitted with bolts, nuts and spring washers. The hangers and the vertical diagonals should be tied to a crossarm leg using galvanized metal bands. CROSSARM PACKING VIEW 																																																																																																																																																															
Total Weight: 199.1 kg <table border="1" style="width: 100%; border-collapse: collapse; font-size: 0.8em;"> <thead> <tr> <th>Item Number</th> <th>Qty</th> <th>Item Description</th> <th>Unit</th> <th>Length (mm)</th> <th>Total Length (mm)</th> <th>Total Weight (kg)</th> <th>Notes</th> </tr> </thead> <tbody> <tr><td>20</td><td>1</td><td>Horizontal L 60x60x6</td><td>633</td><td>633</td><td>3.4</td><td></td><td></td></tr> <tr><td>19</td><td>1</td><td>Reinforcement 40x40x6</td><td>284</td><td>284</td><td>1.2</td><td>related to item 17</td></tr> <tr><td>18</td><td>4</td><td>Reinforcement 40x40x6</td><td>200</td><td>800</td><td>3.4</td><td>related to legs</td></tr> <tr><td>17</td><td>1</td><td>Connection U 100</td><td>400</td><td>400</td><td>4.3</td><td></td></tr> <tr><td>16</td><td>2</td><td>Plate THK 8 mm 232x217</td><td>0.0540 m²</td><td></td><td>4.4</td><td>related to items 14 & 15</td></tr> <tr><td>15</td><td>1</td><td>Sup. arrangement L 70x70x7</td><td>155</td><td>155</td><td>1.1</td><td>related to item 18</td></tr> <tr><td>14</td><td>1</td><td>Sup. arrangement L 70x70x7</td><td>195</td><td>195</td><td>1.4</td><td>related to item 18</td></tr> <tr><td>13</td><td>1</td><td>Vertical L 60x60x6</td><td>423</td><td>846</td><td>4.6</td><td></td></tr> <tr><td>12</td><td>1</td><td>Hanger L 60x60x6</td><td>3553</td><td>7106</td><td>38.5</td><td></td></tr> <tr><td>11</td><td>2</td><td>Hanger L 60x60x6</td><td>1895</td><td>3790</td><td>19.6</td><td></td></tr> <tr><td>10</td><td>1</td><td>Diagonal L 70x70x7</td><td>377</td><td>377</td><td>2.8</td><td></td></tr> <tr><td>9</td><td>1</td><td>Diagonal L 50x50x5</td><td>559</td><td>559</td><td>2.1</td><td></td></tr> <tr><td>8</td><td>1</td><td>Diagonal L 50x50x5</td><td>662</td><td>662</td><td>2.5</td><td></td></tr> <tr><td>7</td><td>1</td><td>Diagonal L 50x50x5</td><td>759</td><td>759</td><td>2.8</td><td></td></tr> <tr><td>6</td><td>1</td><td>Diagonal L 50x50x5</td><td>872</td><td>872</td><td>3.3</td><td></td></tr> <tr><td>5</td><td>1</td><td>Diagonal L 50x50x5</td><td>991</td><td>991</td><td>3.7</td><td></td></tr> <tr><td>4</td><td>1</td><td>Diagonal L 50x50x5</td><td>1113</td><td>1113</td><td>4.2</td><td></td></tr> <tr><td>3</td><td>1</td><td>Diagonal L 50x50x5</td><td>1297</td><td>1297</td><td>4.7</td><td></td></tr> <tr><td>2</td><td>1</td><td>Leg U 100</td><td>4399</td><td>4399</td><td>45.0</td><td></td></tr> <tr><td>1</td><td>1</td><td>Leg U 100</td><td>4399</td><td>4399</td><td>45.0</td><td></td></tr> </tbody> </table>											Item Number	Qty	Item Description	Unit	Length (mm)	Total Length (mm)	Total Weight (kg)	Notes	20	1	Horizontal L 60x60x6	633	633	3.4			19	1	Reinforcement 40x40x6	284	284	1.2	related to item 17	18	4	Reinforcement 40x40x6	200	800	3.4	related to legs	17	1	Connection U 100	400	400	4.3		16	2	Plate THK 8 mm 232x217	0.0540 m²		4.4	related to items 14 & 15	15	1	Sup. arrangement L 70x70x7	155	155	1.1	related to item 18	14	1	Sup. arrangement L 70x70x7	195	195	1.4	related to item 18	13	1	Vertical L 60x60x6	423	846	4.6		12	1	Hanger L 60x60x6	3553	7106	38.5		11	2	Hanger L 60x60x6	1895	3790	19.6		10	1	Diagonal L 70x70x7	377	377	2.8		9	1	Diagonal L 50x50x5	559	559	2.1		8	1	Diagonal L 50x50x5	662	662	2.5		7	1	Diagonal L 50x50x5	759	759	2.8		6	1	Diagonal L 50x50x5	872	872	3.3		5	1	Diagonal L 50x50x5	991	991	3.7		4	1	Diagonal L 50x50x5	1113	1113	4.2		3	1	Diagonal L 50x50x5	1297	1297	4.7		2	1	Leg U 100	4399	4399	45.0		1	1	Leg U 100	4399	4399	45.0	
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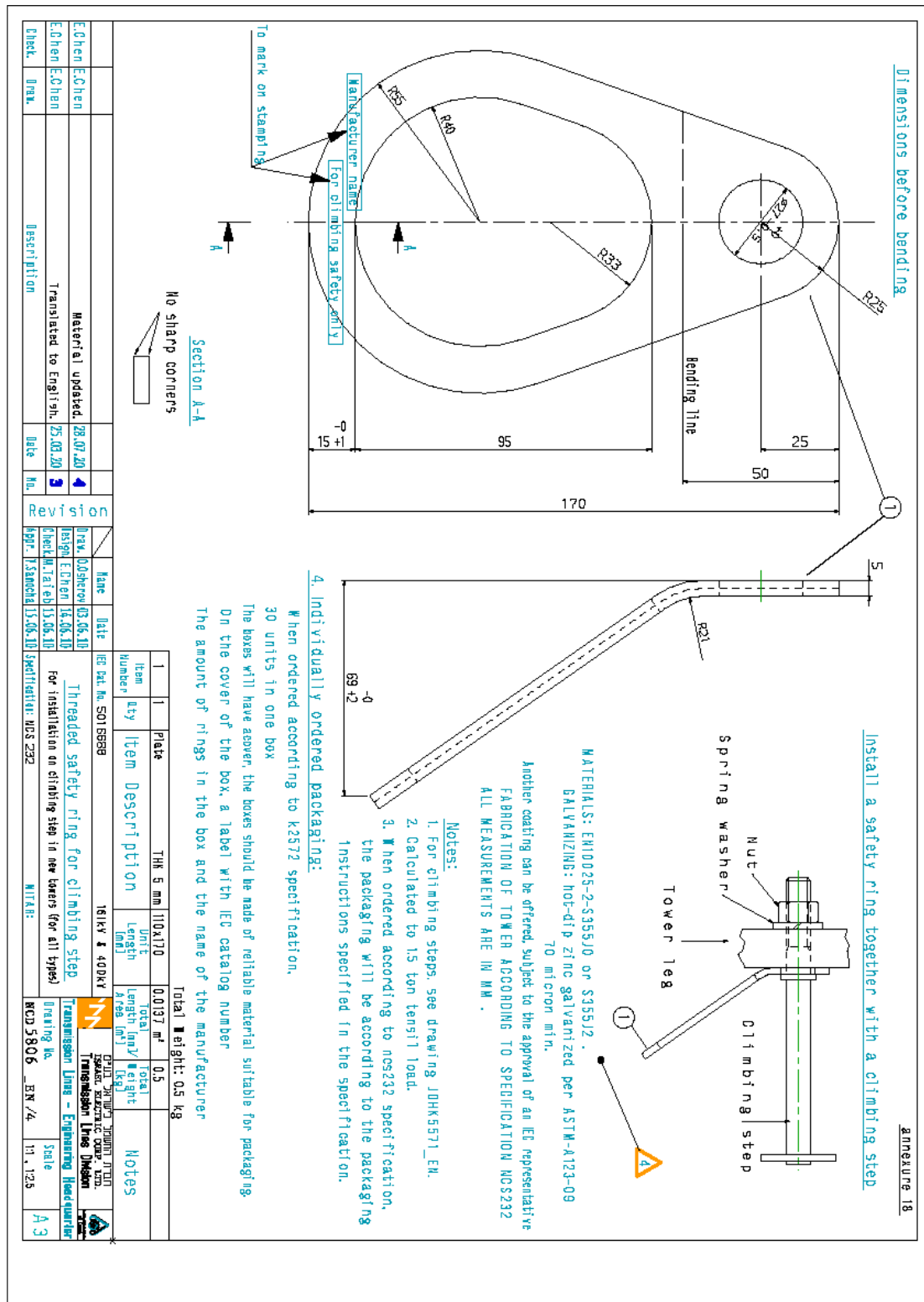
NCS-232 Specification Edition No. 12 Update Date: 29 July 2026 Page No.: 65 of 84	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	 Israel Electric
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19.8.14 Annexure 17

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TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION

19.8.15 Annexure 18



NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 68 of 84		

19.9 Appendix "E1": An example of I.E.C. Catalog Numbers and Their Drawings for Transmission Lattice Towers

I.E.C. catalog numbers for towers, extensions, heads, crossarms, and tower's parts for transmission line towers according to I.E.C. tower's type are listed in the following table:

Tower Type	I.E.C. Cat. No.	Description	Drawing No.
MSR2G	---	Tower structure layout	NCD6320_EN
	5227199	Standard tower without head	NCD6320_EN including NCD6321_EN, NCD6322_EN, NCD6323_EN, NCD6324_EN, NCD6325_EN
	5270120	Head 4.5m	NCD6331_EN
	5227350	Extension No.'1 3m	NCD6326_EN
	5227351	Extension No.'1 6m	NCD6327_EN
	5227345	Extension No.'2 3m	NCD6328_EN
	5227347	Extension No.'2 6m	NCD6329_EN
	5227348	Extension No.'3 6m	NCD6330_EN
	5253427	Upper extension 3m	NCD7991_EN
	4132700	Upper middle and lower Un-independent crossarm 4.2m	NCD3366_EN
	5253452	Un-independent crossarm for earth wire 2.6m	NCD7992_EN
	5264587	CHANGES IN TOP PART-1 TO CONNECT GROUND CONDUCTOR	NCD8426_EN
MMSH2	---	Tower structure layout	NCD3355_EN
	5267716	Tower without head	NCD3355_EN including JDHK3357_EN, JDHK3358_EN, JDHK3359_EN, JDHK3360_EN, JDHK3361_EN
	4137337	Head 3m	NCD3356_EN
	5267795	HEAD 5.34M	NCD8610_EN
	4055083	Extension No.'1 3m	NCD3112_EN
	4054888	Extension No.'1 6m	NCD3109_EN
	4111621	Extension No.'2 3m	NCD3313_EN
	4132791	Tow-sides asymmetric crossarm 3.75+4.65m	NCD3365_EN
	4132700	Upper middle and lower un-independent crossarm 4.2m	NCD3366_EN
	5253452	Un-independent crossarm for earth wire 2.6m	NCD7992_EN

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
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Update Date: 29 July 2026		
Page No.: 69 of 84		

Tower Type	I.E.C. Cat. No.	Description	Drawing No.
TMH2G	---	Tower structure layout	NCD5160_EN
	5000546	Tower without head	NCD5160_EN including NCD5161_EN, NCD5162_EN, NCD5163_EN, NCD5164_EN, NCD5165_EN
	4513255	Head 3.0m	NCD4845_EN
	4513263	Head 6.5m	NCD4844_EN
	5253369	Upper extension 4m	NCD7965_EN
	5253451	Un-independent crossarm for earth wire 2.6m	NCD7966_EN
	5000548	Extension No.'1 3m	NCD5166_EN
	5000547	Extension No.'1 6m	NCD5167_EN
	5011382	Extension No.'1 9m	NCD5168_EN
	5011383	Extension No'.2 6m	NCD5169_EN
	4143582	Upper middle and lower un-independent crossarm 4.2m	NCD3399_EN
TMH2T	---	Tower structure layout	NCD3437_EN
	5010491	Standard tower without head	NCD3437_EN including NCD3416_EN, NCD3417_EN, NCD3418_EN, NCD3419_EN, NCD3420_EN
	4513255	Head 3.0m	NCD4845_EN
	4513263	Head 6.5m	NCD4844_EN
	4162079	Extension No.'1 3m	NCD3421_EN
	4102364	Extension No.'1 6m	NCD3268_EN
	5253387	Upper extension 4m	NCD7968_EN
	5260345	EXTENSION 9M	NCD8205_EN
	4144119	Upper middle and lower un-independent crossarm 5m	NCD3406_EN
	5253386	Un-independent crossarm for earth wire 3.4m	NCD7967_EN
	5253451	Un-independent crossarm for earth wire 2.6m	NCD7966_EN

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 70 of 84		

Tower Type	I.E.C. Cat. No.	Description	Drawing No.
DSG2G	---	Tower structure layout	JDHK8800_EN
	2797124	Standard tower	JDHK8800_EN including JDHK8801_EN, JDHK8802_EN, JDHK8803_EN, JDHK8804_EN, JDHK8805_EN, JDHK8806_EN, JDHK8807_EN
	4486221	Standard tower without element No. 7	JDHK8800_EN including JDHK8801_EN, JDHK8802_EN, JDHK8803_EN, JDHK8804_EN, JDHK8805_EN, JDHK8806_EN
	2797132	Extension No. 1 3m	JDHK8808_EN
	2797157	Extension No. 1 6m	JDHK8809_EN
	3662657	Earth wire crossarm un-independent for assembly 5.5m	JDHK8810_EN
	3662665	Upper and lower crossarm un-independent for assembly 10.7m	JDHK8811_EN, JDHK8811a_EN
	3662673	Middle crossarm un-independent for assembly 11.5m	JDHK8812_EN, JDHK8812a_EN
	3505401	Upper and lower crossarm un-independent for assembly 7.5m	NCD1057_EN, NCD1057a_EN
	3505419	Middle crossarm un-independent for assembly 8.5m	NCD1058_EN, NCD1058a_EN

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 71 of 84		

Tower Type	I.E.C. Cat. No.	Description	Drawing No.
DTGM2G	---	Tower structure layout	NCD9970_EN
	5297849	Standard tower	NCD9970_EN including NCD9971_EN, NCD9972_EN, NCD9973_EN, NCD9974_EN, NCD9975_EN, NCD9976_EN, NCD9977_EN
	5298614	Standard tower without element no. 7	NCD9970_EN including NCD9971_EN, NCD9972_EN, NCD9973_EN, NCD9974_EN, NCD9975_EN, NCD9976_EN
	5298425	Extension No. 1 6m (-3)	NCD9963_EN
	5298426	Extension No. 2 6m (+3)	NCD9964_EN
	5298387	Extension No. 1 6m (+6)	NCD9965_EN
	5298422	Extension No. 1 9m (+9)	NCD9966_EN
	5298421	Extension No. 2 6m (+12)	NCD9967_EN
	5298423	Extension No. 2 6m (+15)	NCD9968_EN
	5345146	Element No. 7	NCD9977_EN
	3692837	Crossarm for earth wire 5m	JDHK8831_EN, JDHK8831a_EN
	3692977	Crossarm for earth wire 8.5m	JDHK8834_EN, JDHK8834a_EN
	3692951	Upper and lower crossarm un-independent for assembly 6.5m	JDHK8832_EN, JDHK8832a_EN
	3692985	Upper and lower crossarm un-independent for assembly 11m	JDHK8835_EN, JDHK8835a_EN
	3692969	Middle crossarm un-independent for assembly 7.5m	JDHK8833_EN, JDHK8833a_EN
	3692993	Middle crossarm un-independent for assembly 12m	JDHK8836_EN, JDHK8836a_EN
	5011770	Upper and lower crossarm un-independent for assembly 7.8m	NCD5830_EN, NCD5830a_EN
	5011774	Middle crossarm un-independent for assembly 8.8m	NCD5831_EN, NCD5831a_EN

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 72 of 84		

19.10 Appendix "E2": An example of I.E.C. Catalog Numbers and Their Drawings for Foundation Legs

I.E.C. catalog numbers for foundation legs, cross profiles, leg's extensions, for foundation legs according to I.E.C. tower's type are listed in the following table:

Tower Type	I.E.C Ca. No.	Description	Drawing No.
DSG2G	5009946	FOUNDATION BENT LEGS	NCD 5755_EN
	4485611	FOUNDATION BENT LEGS (-9)	NCD4796_EN
DTGM2G	3351350	FOUNDATION BENT LEGS	NCD191_EN
TMH2G	5001849	FOUNDATION STRAIGHT LEGS	NCD5402_EN
	5002317	FOUNDATION BENT LEGS	NCD5447_EN
TMH2T	5001063	FOUNDATION STRAIGHT LEGS	NCD5356_EN
	4213179	FOUNDATION BENT LEGS	NCD2971_EN
MSR2G	5237689	FOUNDATION STRAIGHT LEGS	NCD7291_EN
	5237968	FOUNDATION BENT LEGS	NCD7372_EN
MMSH2	5001951	FOUNDATION STRAIGHT LEGS	NCD5232_EN
	5002316	FOUNDATION BENT LEGS	NCD5108_EN

	5216197	FOUNDATION STRAIGHT LEGS (+9) (+6)	NCD6451_EN
	5013116	FOUNDATION BENT LEGS (+9) (+6)	NCD5874_EN
	5002062	STRAIGHT FOUNDATION LEGS	NCD5242_EN
TH2G	5002313	FOUNDATION BENT LEGS	NCD5372_EN
TH2H	4525192	FOUNDATION BENT LEGS	NCD4983_EN
MMSHG2	5212863	FOUNDATION BENT LEGS	NCD5259_EN
TMK2 D	3846466	FOUNDATION BENT LEGS	NCD2542_EN
MS2D special	2034502	FOUNDATION BENT LEGS	JDHK7466_EN

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 73 of 84		

19.11 Appendix "E3": An example of quantities of Bolts, Nuts and Spring Washer for Foundation Connection According to Tower's Type

Quantities of bolts, nuts and spring washers for the foundation connection according to tower's type are listed in the following table. These bolts, including the nuts and spring washers, shall be supplied in a separate sealed plastic bag with a different color.

Tower Type	I.E.C Cat. No.	BoltsType (including nuts and spring washers)	Quantity
MSR2G	5227199	3/4"x50	36
MMSH2	5267716	3/4"x50	36
TMH2G	5000546	7/8"x60	64
TMH2T	5010491	1"x70	72
DSG2G	2797124	1"x60	60
		1"x80	16
DSG2G without Element No. 7	4486221	1"x60	64
		1"x80	32
DTGM2G	5297849 & 5298614	1"x100	128

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 74 of 84		

19.12 Appendix "F1": I.E.C Quality Specification Q-APP-02-PR

Find attached to this document.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 75 of 84		

19.13 Appendix "F2": Quality Control Inspection Steps

No.	Inspection activities/ Part examined	Document	Inspection by		Applicable Standards	Remarks
			Sup	I.E.C.		
Raw material, Workshop procedures, WPS and PQR.						
1	Raw material chemical comp., mechanical prop.	Material certificate, MTR. I.E.C National Grid Spec.	H	H	Documented as per EN 10204 3.1, part of final documentation.	Shall be verified by I.E.C Metallurgic Laboratory. All hot galvanized steel shall contain less than 0.04% or 0.12% - 0.25% silicon
2	WPS and PQR (if applicable) NDT procedures	Work procedure, Workforce certificate	H	H	As per Spec. Welders will be certified for weld fillet and tangent welding	Must be approved by I.E.C Metallurgic Laboratory.
In-Process Inspection						
3	Approved manufacturing drawing. Machine tools alignment.	I.E.C Spec., Supplier work procedures.	R	SW		At least 10% of parts.
4	Visual Inspection of parts, Geometric measurements.	I.E.C spec., Approved drawings	R	SW		At least 10% of parts.
5	Visual inspection of welds. NDT (if needed)	I.E.C spec., Approved drawings	H	SW	AWS D1.1	At least 10% of parts. NDT results must be approved by I.E.C Metallurgy Laboratory.
6	Full Assembling of one of each type of tower	I.E.C spec., Approved drawings	H	H	I.E.C Spec., Approved drawings	
Galvanization						
	Visual inspection. Thickness measurement.	I.E.C spec., Approved drawings	H	SW	I.E.C Spec., Suppl. Records	At least 10% of parts. Repair if needed, must be approved by I.E.C before conducting.
8	Packing, Final documentation.	I.E.C spec., Parts Packing Lists	H	H	I.E.C Spec., Suppl. Records	At least 10% of packing shall be verified.
	R - Quality Record	W - Witness Point				
	H - Hold Point	SW - Sample Witness Point				

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 76 of 84		

19.14 Appendix "F3": Check list for Transmission Towers and Foundation Legs (161,400 kV) NCS-232

This is a control document that allows uniform verification between the manufacturer, an Inspection Company on behalf of I.E.C. and I.E.C. quality control.

- **It is mandatory to email this document, filled and signed, FOR EACH DELIVERY**
- **All written bellow refers to the attached Inspection invitation sent for I.E.C.**

Revisions of specifications, drawings, standard are according to PO (purchase order).

Manufacturer: _____

IEC PO: _____

IEC Catalog No.: _____

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 77 of 84		

#	Inspection	NCS232 Requirements	Approved ☒	Inspector Remarks
1.1	Raw material	Mill test report Comply to relevant IEC drawing	☐	
1.2		Mill test report cast/heat number is validate on product	☐	
1.3		Mill test report comply with chemical requests for galvanize: Silicon max content 0.04% OR in range 0.14-0.25%	☐	
1.4		Laboratory chemical and mechanical properties tests comply with standards: Profiles: ISO 10025-2 Bolts: ASTM A-394, drawing NCD4149 Marked Type 0, manufacturer name OR trademark Nuts: ASTM-A 563 Spring washers: ASME B18.21.1 Climbing steps: Drawing NCD5571 Safety rings: Drawing NCD5806	☐	
2.1	Manufacture	Each item is marked in minimum 10 mm font size, 5cm from hole and visible after full assembly and galvanized: 1. Trademark of manufacturer 2. Type of tower 3. Item number According NCS232, annexure 6A and 18	☐	
2.2		Geometric dimensions of the items, hole locations, bending measurement, cut, grind, drilled, punched Comply to relevant IEC drawings and tolerances	☐	

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 78 of 84		

2.3		Holes in elements with welded reinforcement plates will be drilled only after welding. Unless otherwise specified in the manufacturing drawing. Holes in bent items, which may be affected by the bending operation, shall be laid out and punched or drilled after bending. Holes are free from burrs.	☐	
2.4		Assembly complies to relevant IEC drawings	☐	
2.5		WPQ, PQR, WPS- all according to AWS D1.1 OR EN ISO 1011-2+A1	☐	
2.6		Welding material was made only by AWS A5.18 OR TS EN ISO 14341A G3Si1, ER70S6, ER70T1, ER70T5	☐	
2.7		Weld visual test include marked inspection locations over a drawing. Clean and uniform seams. Without pore, undercut, lack of penetration, carter, crack, spatters, slag.	☐	
3.1	Hot Deep Galvanize	Cleaning process pre-galvanize according ASTM A123/A+M, OR EN ISO 1461	☐	
3.2		Visual test- Uniform thickness, clean, smooth and free from spatters as possible	☐	
3.3		Uniformity test according to ASTM A239	☐	
3.4		PREECE- Mass of zinc test according to ASTM A90, Acceptance criteria ISO 1461	☐	
3.5		Adhesion test according to ASTM A123	☐	
3.6		Minimum Dry Film Thickness (DFT) ISO 1461 Steel thickness>6 mm, DFT≥85um Safety rings and steel 3mm≤thickness≤6mm, DFT≥70um Bolts, Climbing steps and Spring washer DFT ≥40um	☐	
3.7		Fixing galvanize defects using products with minimum 95% zinc	☐	
4.1	Packing	Comply with relevant drawing guidelines- notes and material packing table- numbers & quantities in <u>Each package</u> . Regardless of PO quantity.	☐	

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 79 of 84		

4.2	Assembled arms	Regardless clause 4.1- CAN be pack in even number	☐	
4.3		Bolts, nuts, spring washers ("Line" column in bolts table on relevant drawing) are pack in durable labeled bags (wood box is preferred): waterproof, stiffness for weight content and UV resistance. The bag will be securely fastened to the arm inside U profile.	☐	
5.1	Packing- Profile	Profile packages larger than 4 meters required additional support - in the form of another wooden block in the middle of the package.	☐	
5.2		Profile packages for Orot Rabin warehouse will have wooden blocks sizes (minimum): 15 cm height, 15 cm width, 30 cm length	☐	
5.3		Profile packages for any IEC warehouse, Other than Orot Rabin will have wooden blocks sizes (minimum): 10 cm height, 10 cm width, 30 cm length	☐	
5.4		Profile packages are with fastened double galvanized steel strips, in at least 3 locations. The distance between the strips shall not exceed 2 meters	☐	
5.5		Between each profile place a cloth thread for separation	☐	
5.6		Disassembled crossarms will be in maximum even quantity	☐	
6.1	Packing- Box	Each box will contain only accessories like bolts/climbing steps/ plates and safety rings of <u>ONE</u> IEC Part number/ Tower	☐	
6.2		Bolts and accessories- each individual package shall not exceed a total weight of 25 kg	☐	
6.3		The height of the wooden box blocks shall be minimum 15 cm for Orot Rabin	☐	
6.4		For any other than Orot Rabin the height of the wooden box blocks shall be minimum 10 cm	☐	
6.5		Box is durable: waterproof, stiffness for weight content and UV resistance	☐	

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 80 of 84		

6.6		For complete tower ONLY: bolts for foundation connection will be packed in a separate plastic bag with different color than other bags. Located on top.	☐	
7.1	Labeling Profile	Durable metal label is readable include: 1. Manufacturer name 2. Production country 3. IEC catalog number 4. Type of tower part (if applicable, e.g. DSG2G) 5. Package number in bigger font size 6. Name of tower part (if applicable, e.g. Element 2) 7. Number of order 8. Bundle weight 9. Disassembled crossarms quantity, e.g. 6 units	☐	
7.2		Metal label location for packages with profiles above 150 mm will be assembled vertical instead of horizontal in order to keep the metal label not bend	☐	
7.3		Table of items, and Material packing table-numbers & quantities in each package according NCS232 annexure 12+15 English only	☐	
7.4		Profile tied up packages that are for the same IEC P.N / tower must be marked (preferably with a permanent marker) with catalog number and its internal package numbers. Marking must be visible on the top profile of each bundle- intended for forklift worker	☐	

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 81 of 84		

8.1	Labeling Box	Durable metal label readable include: 1. Manufacturer name 2. Production country 3. IEC catalog number 4. Type of tower part (if applicable, e.g. DSG2G) 5. Package number in bigger font size 6. Name of tower part (if applicable, e.g. Element 2) 7. Number of order 8. Bundle weight	□	
8.2		Packing list- durable plastic bag sealed from water penetration, readable label includes size and quantity of all content, English only, validate amount is 105%	□	
8.3		For complete tower ONLY- bolts for foundation connection will be packed in a separate plastic bag and labeled: "bolts for foundation connection". According NCS232 Annexure 14	□	

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 82 of 84		

19.15 Appendix "G": Hot plating of Zinc, Process control

19.15.1 Objective

The purpose of this appendix is to define the means of control and treatment of parts that go through Zinc coating, to guarantee final product quality and reliability within a corrosive environment.

19.15.2 General

To guarantee adequate control of the process it is necessary to establish a quality control system and document all stages of the process with regards to each batch of parts that undergo the coating. The contractor shall appoint a trustee, who is responsible for the maintenance of the system described above and in addition shall document all activity aimed at guaranteeing final product quality, delivered to I.E.C. as described below.

19.15.3 Process Control

The manufacturer shall submit to I.E.C. quality control full documentation with regards to all the process stages. The documentation shall include the following information regarding each process stage:

1. Type and concentration of materials as well as measurement method and control.
2. Process temperature and means of measurement.
3. Process duration and means of measurement.
4. Criteria which define adequate completion of any given process stage and its progress towards subsequent treatment.
5. Production line maintenance procedures: methods of inspection, concentration levels of active material components and documentation of the findings, frequency of inspection/monitors, documentation of introduction of materials to the bath etc.

19.15.4 Documentation

1. Documentation shall be performed by means of a "route card", located within proximity to the batch and associated with each and every stage of the process: clean, rinse and flux, dry, soak in Zinc, cool, etc. Matching between identification/marketing of a given batch and the corresponding documentation must be ensured.
2. A contractor representative shall provide his/her signature indicating proper and completion of the specific process stage.
3. The signed certificates shall be submitted to I.E.C. quality control prior to delivery of the batch for approval.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 83 of 84		

19.15.5 Final Inspections

1. The manufacturer shall establish and document criteria, based upon relevant and approved standards (such as Israeli standard 918, 265 etc.), to enable acceptance\rejection of the final product.
2. Inspected products shall be marked or labeled as "approved", "further processing required" etc. The label must include the date, batch number and a distinct signature of the inspector.
3. Corrective action – the manufacturer shall establish procedures for corrective action in the event of defects revealed during inspection of the final product, including root cause identification, means of fixing the defect, approval, and documentation.

NCS-232 Specification	Israel Electric Corp. Ltd. Transmission Division Transmission Lines Engineering Headquarter	 Israel Electric
Edition No. 12	TECHNICAL SPECIFICATION NCS 232 FOR LATTICE TRANSMISSION TOWERS AND FOUNDATION LEGS FABRICATION	
Update Date: 29 July 2026		
Page No.: 84 of 84		

20. Revisions

Revision	Change	Date
1	Appendix "B" – updated. Added Annexure 13 – bolts dimensions Para. 8 - Marking changed, Annexure 6a changed Added Annexure 14 – I.E.C Ca. No.' Added Annexure 15 – Example for crossarm, packing view.	
2	Annexure 14 - updated	
3	Para 5.2.3: spring washers HRC – updated	
4	Para 11: Packing – updated. Para 16: Time schedule	
5	Para 5 - bolts, nuts, climbing steps, spring washers and safety rings will be provided by manufacturers. Para. 9 - Packing – updated. Annexure 14, 17 & 18 – added. Para 17 – added. Types of towers in annexure 14 – updated	
6	Para 17.2 – updated	
7	Para 15 – updated	
8	Foundation legs – added. Packing instructions – Chapter 11 – updated. Chapter 13 – Check list for Transmission Towers (161,400 kV) NCS-232 – added.	09/2025
9	Chapter 3 – documents for the proposal was updated Appendix A2 - updated	01/2026
10	Chapter 6.5 – updated Chapter 14.1.3 - updated Chapter 19.2 – updated Chapter 19.6 – Annexures 1-4 updated Annexure 20 added	03/2026
11	Appendixes B3, C1 – added Chapters: 1.1, 3.2, 11.8, 18, 19.2, 19.7, 19.8, 19.9 – updated	06/2026
12	Chapter 1 – updated Chapter 11.8 – "Bolts for Foundation Connection" section updated Chapter 13, 14.1.7 – updated	07/2026