

Main Technical Requirements Guide
For
170kV STATION POST INSULATORS

January 24

| | Name | Signature | Date |
|--------------|---------------|--|-------------|
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Scope of work:

This document describes the 170 kV station post insulators components of and focuses on the description and threshold requirements that each element must meet.

This document should not be considered as a "170 kV Station Post Insulators Specification".

The main objective is to serve as a guide to those interested in carry out a detailed Specification for an appropriate Station Post Insulators that fulfill the Local Regulations and Purchaser requirements.

Terms and conditions:

1. Any item, that has not received from NOGA - Israel Independent System operator an official approval of fulfillment of the requirements according to the latest published version of this document, shall not be installed in Israeli electrical grid.
2. The technical data, procedures and regulations in this document should be considered as part of the Threshold Requirements of the System.
3. The final Station Post Insulators Specification must be evaluated by the customer and the manufacturer to arrive at the final design of each component, considering the Customer Connection Procedure
4. The customer is responsible for providing all data and information requested in this document, as well as ensuring that all technical requirements are fulfilled by the manufacturer.
5. This document must be approved and signed by:
 - 5.1. Customer
 - 5.2. Design body (if applicable)
 - 5.3. Station Post Insulators manufacturer
6. All documents, instructions, test certificates, drawings and meetings with manufacturer/costumer contact person shall be in English or Hebrew

7. The customer will be also responsible for verifying the veracity of all data provided by the manufacturer.

| | Name | Company | Date | Sign |
|------------------------------------|-------------|----------------|-------------|-------------|
| Customer | | | | |
| Design body (if applicable) | | | | |
| Manufacturer | | | | |

General:

- **Type:** porcelain Insulators with external metal fittings.
- **Location:** Outdoor installation.
- **Required information and documentation:** see following table 'System Requirements and Essential Information'.
- **Applicable standards:** see following table, next to the appropriate clause / requirement.

Table of Contents:

1. Service conditions
2. Environment Conditions
3. Functional Specifications
4. Tests
5. Required Data and Documentation

System Requirements and Essential Information

| | Description | Acc. to Required Value and/or Applicable Standard |
|-------------|--|---|
| 1. | Service conditions | |
| 1.1. | System frequency | Customer Connection Procedure |
| 1.1.1. | Rated frequency [Hz] | 50 |
| 1.2. | System voltages | Customer Connection Procedure |
| 1.2.1. | Rated system voltage (line to line) [kV r.m.s] | 161 |
| 1.2.2. | Highest system voltage (line to line) [kV r.m.s] | 170 |
| 1.2.3. | Rated phase-to-earth voltage [kV r.m.s] | 93 |
| 1.3. | System currents | IEC 60059 |
| 1.3.1. | Rated current (A) | 3150 |
| 1.3.2. | Symmetrical short circuit current [kA] | 50 |
| 1.3.3. | Rated duration of short circuit [sec] | 1 |
| 1.3.4. | Rated peak withstands current [kA peak] | 125 |
| 1.4. | Methods of system neutral earthing | Customer Connection Procedure |
| 1.5. | Earth fault factor (EFF) | 1.4 |

| 2. | Environment Conditions | |
|-------------|--|----------------------------------|
| 2.1. | General information | |
| 2.1.1. | 8-9 months a year without rain with more than 100 nights with dew and high humidity in the air as experienced in coastal and desert areas in this country. | |
| 2.1.2. | Severe atmospheric and industrial air pollution, dust, salt spray and sandstorms | |
| 2.1.3. | Altitude over the sea level up to 1000 [m]. | |
| 2.2. | Permissible ambient air temperature | |
| 2.2.1. | Minimum Maximum [°C] | -5 +50 |
| 2.2.2. | Monthly average [°C] | +37 |
| 2.2.3. | Yearly average [°C] | +27 |
| 2.3. | Climatic Conditions | IEC 60721-3-4 |
| 2.3.1. | Normal Climatic Conditions | Table 1 class 4K26 |
| 2.3.2. | Special Climatic Conditions | Table 2 class 4Z5 |
| 2.4. | Chemically active substances | ISO 9223 |
| 2.5. | Mechanically active substances | IEC 60721-3-4 Table 4 class 4S13 |
| 2.6. | Pollution Conditions | IEC 60815-1 |
| 2.6.1. | Pollution severity type | B |
| 2.6.2. | site pollution severity (SPS) class | e (very heavy) |
| 2.7. | Seismicity of site | IEEE 693 & Israeli Standard 413 |
| 2.7.1. | peak ground acceleration (PGA) [g] | 0.5 |

| 3. | Functional Specifications | |
|-------------|--|--|
| 3.1. | Main characteristics | |
| 3.1.1. | Designation type | IEC 60273 Figure 4 type C IEC 60168 Figure 1 |
| 3.1.2. | Insulating body material | IEC 60672-3 Table 1a type C130 |
| 3.1.3. | Surface condition | RTV Factory pre-coated, IEEE 1523 |
| 3.2. | Insulation levels | IEC 60071-1 Tables 1-3 |
| 3.2.1. | Lightning impulse withstand voltage [kV peak] | 750 |
| 3.2.2. | Short-duration power frequency withstands voltage [kV r.m.s] | 325 |
| 3.2.3. | Minimum air clearances between metal parts [mm] | Table A.1 |
| 3.3. | Mechanical strengths | IEC 60273 Table IV |
| 3.3.1. | Vertical installation [kN] | 12.5 |
| 3.4. | Creepage distance | IEC 60815-2 |
| 3.4.1. | Reference unified specific creepage distance [mm/kV] | 53.7 Figure 1 |
| 3.4.2. | Correction for insulator diameter (Kad) | IEC 60815-2 clause 10.3 |
| 3.5. | Design | IEC 60815-2, CIGRE TB 631 & 634 |
| 3.5.1. | Sheds profile | IEC 60815-2 Figure 5b (Alternating) |
| 3.5.2. | Minimum arcing distance [mm] | 1500 |
| 3.5.3. | Minimum Alternating sheds and shed overhang [mm] | 15 IEC 60815-2 clause 9.2 |

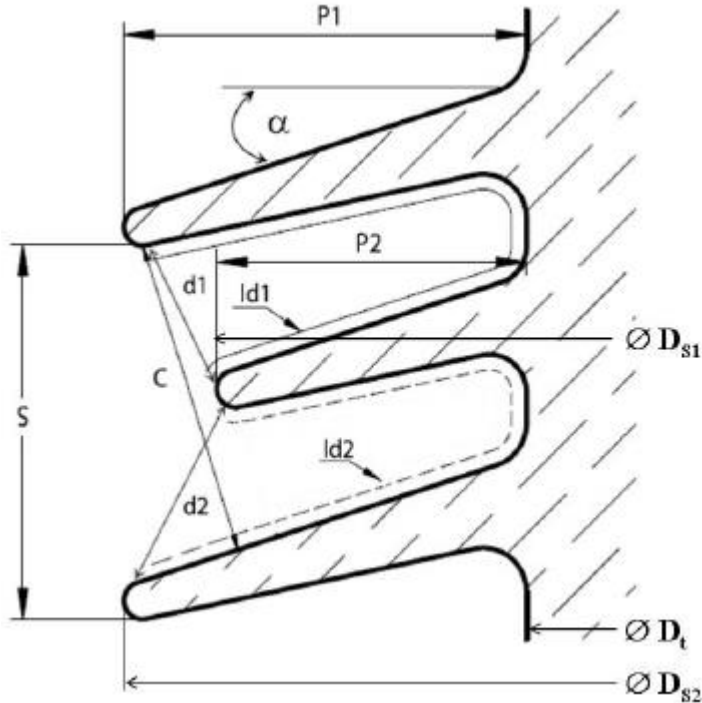
| 3. | Functional Specifications | |
|-------------|---|---|
| 3.5.4. | Minimum Spacing versus shed overhang | 0.75 IEC 60815-2 clause 9.3 |
| 3.5.5. | Minimum distance between sheds [mm] | 40 CIGRE TB 634 & IEC 60815-2 clause 9.4 |
| 3.5.6. | Creepage distance versus clearance | 2.5 ÷ 4.5 IEC 60815-2 clause 9.5 |
| 3.5.7. | Shed angle (α) [degrees] | $7 \leq \alpha \leq 14$ CIGRE TB 631 & IEC 60815-2 clause 9.6 |
| 3.5.8. | Creepage Factor (CF) | $3.0 \leq CF \leq 4.5$ IEC 60815-2 clause 9.7 |
| 3.6. | Additional requirements | |
| 3.6.1. | The equipment shall be vermin proof | |
| 3.6.2. | The corrosion/erosion protection, painting and galvanization issues (material, thickness etc.) of any metallic parts (steel, aluminum, copper, copper alloy components), internal and external part, of complete Post insulators shall be according to ISO/ASTM standards and Israeli Standard 918 or equivalent considering all the environmental & service conditions | |
| 3.6.3. | In case of multiple unit insulator columns, the manufacturer responsibility to supplied complete post insulators with all hardware (bolts, nuts and spring washers) for the interconnection of the insulator units | |
| 3.6.4. | The Top/bottom metal fitting dimensions (e.g pitch circle diameter, number of holes, depth of the tapped blind holes, bolt holes tapped, bolt holes plain, maximum diameter of mounting face) shall be according to IEC 60273 considering all the mechanical loads, seismic stresses and service conditions | |

| 4. | Tests | |
|-------------|---|------------------------|
| 4.1. | General | |
| 4.1.1. | The following tests must meet the specified requirements in accordance with clause 1 - 3 | |
| 4.1.2. | The tests shall be performed on Post Insulator with the same design as approved by NOGA-IISO. Drawing as approved by NOGA-IISO shall be attached as part of test report. | |
| 4.1.3. | The test reports shall include a list of all measuring instruments including their accuracy class, the tools and measurement devices calibrations. | |
| 4.1.4. | The test reports shall include a description of the test method with test circuits (if applicable). The reference to the appropriate sub-clause of the standard must include. | |
| 4.1.5. | The test reports shall include the acceptance criteria, excepted values with tolerances and the test result | |
| 4.2. | Type tests | |
| 4.2.1. | general instruction | |
| 4.2.1.1. | The tests will be performed by a neutral laboratory accredited to the accreditation requirements of ISO 17025 | |
| 4.2.1.2. | The test certificates shall be valid for 10 years from the date of issue | |
| 4.2.2. | Dielectric Tests | |
| 4.2.2.1. | Lightning impulse withstand voltage test | IEC 60168 clause 4.5 |
| 4.2.2.2. | Power frequency withstand voltage test, wet 1min | IEC 60168 clause 4.8 |
| 4.2.3. | Mechanical failing load tests | |
| 4.2.3.1. | Bending test (on complete & individual & top metal fittings) | IEC 60168 clause 5.2.4 |
| 4.2.3.2. | Torsion test | IEC 60168 clause 5.2.5 |
| 4.2.3.3. | Tensile test | IEC 60168 clause 5.2.6 |
| 4.2.3.4. | Compressive test | IEC 60168 clause 5.2.7 |

| 4. | Tests | |
|-------------|--|------------------------|
| 4.3. | Special tests | |
| 4.3.1. | general instruction | |
| 4.3.1.1. | The test must be performed as a part of type test and in accordance with all type tests requirements above | |
| 4.3.2. | Tests | |
| 4.3.2.1. | Test for deflection under load | IEC 60168 clause 5.3 |
| 4.3.2.2. | Radio interference voltage (RIV) test | IEC 60437 |
| 4.3.2.3. | Artificial pollution test | IEC 60507 & 60815-1&2 |
| 4.3.2.4. | Seismic qualification test | IEEE 693 |
| 4.4. | Sample tests | |
| 4.4.1. | general instruction | |
| 4.4.1.1. | The tests shall be performed as applicable on the number of post insulators selected at random from the specific manufacturer batch | |
| 4.4.1.2. | The number of post insulators selected for tests shall be according to IEC 60168 table 1 | |
| 4.4.1.3. | Post insulators which has been tested with sample tests shall not be used in service. The serial number of those Post insulators shall be indicated. | |
| 4.4.2. | Tests | |
| 4.4.2.1. | Verification of the dimensions | IEC 60168 clause 5.1 |
| 4.4.2.2. | Temperature cycle test | IEC 60168 clause 5.4 |
| 4.4.2.3. | Porosity test | IEC 60168 clause 5.6 |
| 4.4.2.4. | Galvanizing test | IEC 60168 clause 5.7 |
| 4.4.2.5. | Mechanical failing load tests | See clause 4.2.3 above |

| 4. | Tests | |
|----------|---|--------------------------------|
| 4.5. | Routine tests | |
| 4.5.1. | general instruction | |
| 4.5.1.1. | The test reports must include a list of all serial number of tested Post Insulators. | |
| 4.5.1.2. | The serial number of relevant post Insulators of specific project shall be indicated. | |
| 4.5.2. | Tests | |
| 4.5.2.1. | Visual inspection | IEC 60168 clause 5.8 |
| 4.5.2.2. | Ultrasonic test | IEC 60168 clause 6.3 NOTE 1 |
| 4.5.2.3. | Mechanical bending test (complete & top metal fittings) | IEC 60168 clause 5.9.1 |

| 5. | Required Data and Documentation | |
|-------------|--|--|
| 5.1. | ISO qualifications | |
| 5.1.1. | ISO 9001 for Quality management system (QMS) | |
| 5.1.2. | ISO 14001 for environmental management system (EMS) | |
| 5.1.3. | ISO 14025 for environmental product declaration (EPD) | |
| 5.1.4. | ISO 45001 for occupational health and safety management system (OH&SMS) | |
| 5.1.5. | ISO 17025 for testing and calibration laboratories | |
| 5.2. | Test Reports | |
| 5.2.1. | Inspection and Test Plan | |
| 5.2.2. | Type and Special Test certificate | |
| 5.2.3. | Routine and Sample Test certificate | |
| 5.3. | Drawings | |
| 5.3.1. | Manufacturer's Insulator dimensional Drawing, shall include: | |
| 5.3.1.1. | Post Insulator and sheds profile geometrical dimensions (see clause 3.4, 3.5, 5.4) | |
| 5.3.1.2. | View of the top and the bottom flanges | |
| 5.3.1.3. | Mechanical loads | |
| 5.3.1.4. | Materials | |
| 5.3.1.5. | Type, sample, and routine tests according to IEC standards | |
| 5.3.2. | Nameplate drawings, shall include: | |
| 5.3.2.1. | Insulator type designation, Manufacturer name, Year of manufacture, Serial number, Seismic qualification level | |

| Required Data and Documentation | | |
|--|---|-------------------------------------|
| 5.4. | Flat Alternating Sheds | |
| 5.4.1. | The profile parameters shall be according to the following values | |
|  | $P_1 - P_2$ | > 15 mm |
| | S/P_1 | > 0.75 |
| | C | > 40 mm |
| | α | $7^\circ \leq \alpha \leq 14^\circ$ |
| | D_a | < 300 mm |
| | K_{ad} | 1 |
| | USCD | 53.7 mm/kV |
| | A | > 1500 mm |
| | $CF = L/A$ | $3.0 < CF < 4.5$ |
| | l_1/d_1 | $2.5 \div 4.5$ |
| l_2/d_2 | $2.5 \div 4.5$ | |
| <p>$P_1, P_2, S, C, \alpha, l_{d1}, d_1, l_{d2}, d_2, D_{s1}, D_{s2}, D_t$: see drawing.</p> $D_a = \frac{D_{s1} + D_{s2} + 2D_t}{4}$ <p>L: creepage distance.</p> <p>A: arcing distance.</p> | | |

| Required Data and Documentation | |
|--|---|
| 5.5. | Recommendation & descriptions |
| 5.5.1. | Manufacturer recommendation for painting & corrosion protection |
| 5.5.2. | Operating and Instruction book |
| 5.5.3. | Spare parts |
| 5.5.3.1. | Spare parts for station post insulators shall be available for a period of life duration of station post insulators |

| Rev. | changes detail (sub-clause) | Approved by | Date |
|-------------|--|--------------------|-------------|
| 01 | EFF factor value (1.5), profile parameters (5.4) | Michael swisa | 04.2024 |
| 02 | profile parameters (3.5.4, 3.5.5, 5.4) | Michael swisa | 12.2024 |
| 03 | <p>Changes were made to the following clauses:</p> <ul style="list-style-type: none"> • Operational experience - has been removed from this document and uploaded into Threshold Requirements document on NOGA-ISO website. • RAMS Requirements – has been removed from this document and uploaded to NOGA-ISO site as separate doc. | Michael swisa | 02.2026 |