Main Technical Requirements Guide

For

170kV STATION POST INSULATORS

January 24

	Name	Signature	Date
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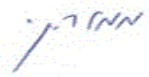
Checked by:	Leon Mamorsky		02.01.2024
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02	7, 12	profile parameters (3.5.4, 3.5.5, 5.4)	Michael swisa	12.2024

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:

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

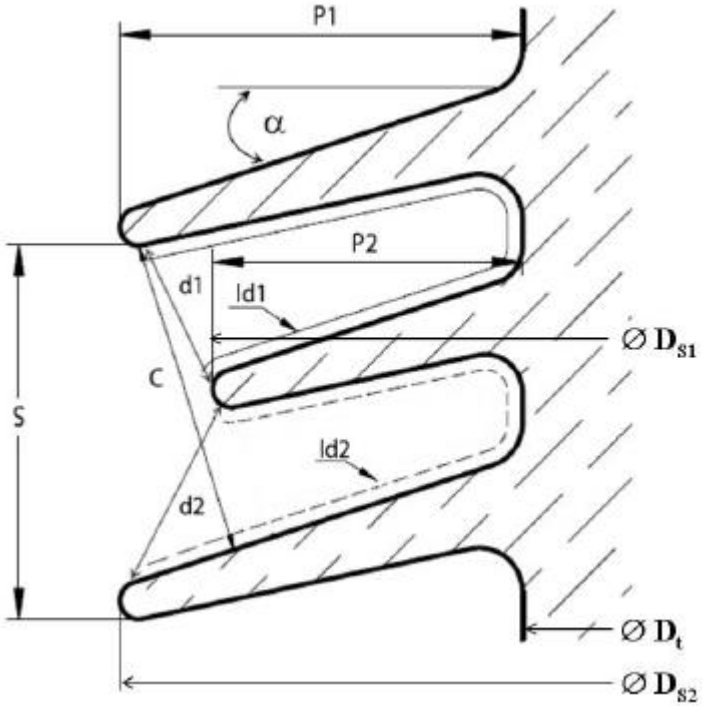
3.	**Functional Specifications**	
3.5.4.	Minimum Spacing versus shed overhang	0.75 IEC 60815-2 clause 9.3
3.5.5.	Minimum distance between sheds [mm]	40 CIGRE TB 634 & IEC 60815-2 clause 9.4
3.5.6.	Creepage distance versus clearance	2.5 ÷ 4.5 IEC 60815-2 clause 9.5
3.5.7.	Shed angle (α) [degrees]	7 ≤ α ≤ 14 CIGRE TB 631 & IEC 60815-2 clause 9.6
3.5.8.	Creepage Factor (CF)	3.0 ≤ CF ≤ 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° ≤ α ≤ 14°
		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 ÷ 4.5
		l_2/d_2	2.5 ÷ 4.5

P_1, P_2, S, C, α, ld_1, d_1, ld_2, d_2, D_{s1}, D_{s2}, D_t: see drawing.

$$D_a = \frac{D_{s1} + D_{s2} + 2D_t}{4}$$

L: creepage distance.

A: arcing distance.

<table>
<tr><td></td><td colspan="2">Required Data and Documentation</td></tr>
<tr><td>5.5.</td><td>Recommendation & descriptions</td><td></td></tr>
<tr><td>5.5.1.</td><td colspan="2">Manufacturer recommendation for painting & corrosion protection</td></tr>
<tr><td>5.5.2.</td><td colspan="2">Operating and Instruction book</td></tr>
<tr><td>5.6.</td><td>Reliability, Maintainability and Safety (RMS) information</td><td></td></tr>
<tr><td>5.6.1.</td><td colspan="2">Reference list</td></tr>
<tr><td>5.6.1.1.</td><td colspan="2">The reference list of station post insulators shall include a production of at least 12.5kN mechanical strengths and no less than 170 kV, from the last 9 years.</td></tr>
<tr><td>5.6.1.2.</td><td colspan="2">The reference list shall include at least 50 units of such equipment supplied for at least 3 different clients (with an electrical transmission system of 170KV and above) and operated successfully for at least 1 year, and purchased during last 7 years.</td></tr>
<tr><td>5.6.1.3.</td><td colspan="2">In order to prove compliance with above mentioned, the bidder is required to submit (for example) the following table, duly filled and signed by a qualified officer
<table>
<tr><th>No.</th><th>170-245 kV station post insulators data</th><th>Quantity</th><th>Purchaser name & address</th><th>Supplied date</th><th>Energizing date</th><th>Contact details</th></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>5.6.2.</td><td>Spare parts</td><td></td></tr>
<tr><td>5.6.2.1.</td><td colspan="2">Spare parts for station post insulators shall be available for a period of life duration of station post insulators</td></tr>
<tr><td>5.6.3.</td><td colspan="2">See Appendix 1 - RAM requirements: RELIABILITY, AVAILABILITY, MAINTAINABILITY (RAM) for 170 kV STATION POST INSULATORS</td></tr>
</table>

Appendix 1

RELIABILITY, AVAILABILITY, MAINTAINABILITY (RAM) for 170kV STATION POST INSULATORS

1. Reliability

The Bidder shall present the reliability tasks and methods which are used to improve the design for reliability, and evaluate the MTTF/MTBF for (*)**Major Failures** only, of the 170 kV STATION POST INSULATORS components.

The Bidder shall provide expected values for the relevant parameters of the 170 kV STATION POST INSULATORS components, and shall add their distribution whenever possible.

2. Failure Analysis

From his Failure Reporting Analysis and Corrective Action System (FRACAS), Bidder shall present a failure report and the analysis of the failures which occurred during the service life of similar 170 kV STATION POST INSULATORS components **manufactured by him**. The report should include the withdrawn conclusion and the corrective actions subsequently undertaken.

(*) According to IEC 62271-1 subclause 3.1.12

major failure (of switchgear and controlgear)

failure of switchgear and controlgear which causes the cessation of one or more of its fundamental functions

Note 1 to entry: A major failure may result in an immediate change in the system operating conditions, for example, the backup protective equipment will be required to remove the fault or will result in mandatory removal from service within 30 min for unscheduled maintenance.

3. 170 kV STATION POST INSULATORS RAM DATA

Bidder shall submit the following 170 kV Station Post Insulators RAM data:

	Component	MTBF (Yrs)	EOL (Yrs)	MTTR (Hrs)
1.	Station Post Insulators			
2.	Porcelain Insulator			
3.	End Metal Fitting			

Where:

- MTBF: Mean Time between Failures, For *Major Failure
- EOL: Expected Operating Life.
- MTTR: Mean Time To Repair, for Major Failures.

4. Field Data

The bidder will fill the following table:

Field RAM Data		2013	2014	2015	2016	2017	2018	2019	2020	2021
Total number of installed SPI's										
Major Failures										
Specific Part which undergo Major Failure	Porcelain Insulator									
	End Metal Fitting									
Mean Time to Repair/Replace										

5. Unreliability Demonstration Procedure (UDP)/Reliability Test

NOGA IISO could conduct an Unreliability Demonstration Procedure (UDP)/Reliability Test, according to NOGA IISO's Judgement. The manufacturer may request NOGA to see example for a UDP. The final UDP could be change according to each individual case and circumstances, as to be decided by NOGA IISO.