



36KV EARTHING TRANSFORMERS **FOR SUBSTATIONS**

1. **PURCHASER:** The Israel Electric Corporation Limited (IECo).
2. **NAME OF ITEM & PROJECT:** 36 kV Earthing Transformers.
3. **LOCATION OF ITEM & PROJECT:** 161/36 kV IECo substations
4. **SCOPE OF WORK:**
 - Design, develop, manufacture, cooperate with others where necessary, factory tests, supply all relevant electrical and electromechanical information necessary for complete design for all purposes linked with proper operation as well as for storage, commissioning and maintenance, preserve, pack and furnish the earthing transformers (ET), delivery in Purchaser's stores or sites, tests and verify equipment on site, provide technical guidance and assistance, all in accordance with this Specification as detailed hereunder.
 - ET shall be installed on IECo 161/36 kV indoor and outdoor substations.
 - 36 kV earthing transformers are zigzag-connected transformers of a three-phase design, liquid-immersed, natural cooled for indoor or outdoor installation. Line terminals of earthing transformers are connected to the phases of 33 kV distribution network. The neutral terminal of earthing transformer may be connected to earth as follows
 - Directly through earthing switch (not in the scope of supply)
 - Through arc-suppression coil (not in the scope of supply)
 - Through an earthing resistor (not in the scope of supply).
 - ET shall be complete with all accessories and appurtenances as specified hereinafter.
 - ET shall be capable of withstanding electrical, mechanical, and thermal ratings of the specified systems.

All joints and connections shall be able to withstand the forces of expansion, contraction, vibration, torsion, specified seismic requirements and environmental conditions without damage, deformation, malfunction and leakage.

Optimized arrangement is required to reduce installation space, installation time, provide ease operation, minimize maintenance and repair costs and facilitate future additions and extensions.

4.1. **SCOPE OF SUPPLY / SERVICE:**

The Contractor shall supply the following items:

4.1.1. **Item 1:**

36 kV, 350 A, three phase, single winding, oil-immersed, ONAN cooling, earthing transformer (ET) for indoor and outdoor installation including all accessories and appurtenances.

Quantity of item 1: See Annexure "C".

4.1.2. **Item 2- Spare and renewal parts:**

See "Summary of Data" cl. 7.

The contractor is required to submit a detailed list of spare parts and renewal materials, including manufacturer catalog numbers as specified in Appendix 11.

4.1.3. **Item 3 - Special equipment, tools, and instruments (option)**

See "Summary of Data" cl. 8.

The contractor is requested (if applicable) to submit a detailed list of recommended special and test equipment (including hardware and software for setting) and maintenance tools including manufacturer catalog numbers.

The Purchaser reserves the right to purchase this service directly from the Manufacturer or another supplier.

Quantity of item 3: See Annexure "C".

4.1.4. **Item 4 – Training course (option)**

The contractor shall ensure a training course for IECo erection and operating people, performed on the purchaser's premises, and the syllabus of the offered course shall be submitted.

Quantity of item 4: See Annexure "C".

4.1.5. **Item 5 - Start-Up supervision (option)**

Supervision by contractor of field tests carried out by Purchaser's personnel, starting and placing the equipment into successful service. The contractor shall provide the services of competent start-up staff to supervise and be responsible for directing the Purchaser's personnel in the starting and placing the equipment into successful service. Field personnel provided by the Contractor shall be capable, qualified, and able to perform the duties required to the satisfaction of the Purchaser.

Start-up supervision will be needed in the first delivery only for one (1) unit of the equipment.

Quantity of item 5: See Annexure "C".

4.1.6. In addition to the a/m equipment, the Contractor shall provide technical documentation for all the items including all technical data, relevant drawings, and other information as required in this Specification.

5. GENERAL REQUIREMENTS

- 5.1. The Contractor is requested to propose the ET as a whole. In case the Contractor doesn't have in his production line one or more of the required components, he can offer components manufactured by other manufacturers. The Contractor shall be responsible for the integration of all components and will guarantee for the whole ET. The list of subcontractors shall be approved by the Purchaser.
- 5.2. The Contractor shall use components and accessories manufactured in Israel wherever possible.
- 5.3. The Contractor shall be responsible for all equipment damage until the time of Purchaser equipment reception.
- 5.4. The ET shall be installed indoor or outdoor and shall be connected to the 36 kV busbars of the substation.
- 5.5. The ET shall be delivered factory tested. The ET can be supplied only after approval of all type, special, acceptance and routine test reports as required in Appendix № 1.

6. INTERCHANGEABILITY

Equipment components of the same type and ratings shall be respectively interchangeable with each other, both electrically and mechanically. Like parts shall be entirely interchangeable between components of the same rating, and when so interchanged, shall perform their function equally well in every respect.

7. STANDARDS AND CODES

- 7.1. Unless otherwise specified all equipment shall be designed, manufactured and tested in accordance with the requirements of the latest relevant published standards of the International Electrotechnical Commission (IEC) or local standards of the Manufacturer's country as amended up to date.
- 7.2. All aspects, tests, etc, not covered by the above-mentioned standards, shall be executed according to the latest published issue of official or otherwise approved standards of the Manufacturer's country.
- 7.3. All relevant standards shall be stated by Bidder. In the event of a variance between the general requirements of the standards and particular requirements of this Specification, the Specification shall take precedence.
- 7.4. If after issuing this Specification some of the mentioned standards are updated, amended, withdrawn, or replaced with another one, the impact of these changes on the Specification will be subjected to agreements between the Contractor and the Purchaser.

7.5 The following standards are applicable in the relevant parts to the individual components of the earthing transformer (ET):

- ☞ **IEC 60071-1 /2019** Insulation co-ordination. Part 1: definitions, principles and rules.
- ☞ **IEC 60076-1 /2011** Power transformers – Part 1: General.
- ☞ **IEC 60076-2 /2011** Power transformers – Part 2: Temperature rise for liquid-immersed transformers.
- ☞ **IEC 60076-3 /2018** Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air.
- ☞ **IEC 60076-4 /2002** Power transformers – Part 4: Guide to the lightning impulse and switching impulse testing – Power transformers and reactors.
- ☞ **IEC 60076-5 /2006** Power transformers – Part 5: Ability to withstand short circuit.
- ☞ **IEC 60076-6 /2007** Power transformers – Part 6: Reactors.
- ☞ **IEC 60076-7 /2018** Power transformers – Part 7: Loading guide for mineral-oil-immersed power transformers.
- ☞ **IEC 60076-10 /2016** Power transformers – Part 10: Determination of sound levels.
- ☞ **IEC 60085 /2007** Electrical insulation – Thermal evaluation and designation.
- ☞ **IEC 60137 /2017** Insulating bushings for alternating voltages above 1000 V.

- ☞ **IEC 60255-26 /2023** Measuring relays and protection equipment – Part 26: electromagnetic compatibility requirements.
- ☞ **IEC 60317-0-1 /2013+A1 2019** Specifications for particular types of winding wires – Part 0-1: General requirements - Enameled round copper wire.
- ☞ **IEC 60404-8-7 /2020** Magnetic materials – Part 8-7: Specifications for individual materials – Cold-rolled gran oriented electrical steel strip and sheet delivered in the fully-processed state.
- ☞ **IEC 60417 DB** Graphical symbols for use on equipment.
- ☞ **IEC 60529 /2013** Degrees of protection provided by enclosures (IP code).
- ☞ **IEC 60721-3-4 /2019** Classification of environmental conditions – Part 3-4: classification of groups of environmental parameters and their severities

	– stationary use at non-weather-protected locations.
⇒ IEC 60815-1 /2025	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles.
⇒ IEC 60815-3 /2025	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems.
⇒ IEC 61462 /2023	Composite hollow insulators – pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1000 V. Definitions, test methods, acceptance criteria and design recommendations.
⇒ IEC 61869-2 /2012	Instrument transformers – Part 2: additional requirements for current transformers.
⇒ IEC 61936-1 /2021	Power installations exceeding 1 kV AC and 1.5 kV DC – Part 1: AC.
⇒ IEC 62271-1 /2017+A1 2021	High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear.
⇒ IEEE Std. 693 /2018	Recommended practice for seismic design of substations.
⇒ IEEE C57.12.00 /2021	IEEE Standard for general requirements for liquid-immersed distribution, power and regulating transformers.
⇒ ISO 9001 /2015	Quality management systems.
⇒ ISO 9223 /2012	Corrosion of metals and alloys – corrosivity of atmospheres – classification, determination and estimation.
⇒ ISO 17025 /2017	General requirements for the competence of testing and calibrating laboratories.
⇒ ASTM A 153 /2023	Standard specification for zing coating (hot-dip) on iron and steel hardware.
⇒ ASTM B 579/2022	Standard specification for electrodeposited coatings of tin-lead alloy (solder plate).
⇒ ASTM B 580-79 /2019	Standard specification for anodic oxide coatings on aluminum.
⇒ ASTM F1941/F1941M-16	Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric

☞ **DIN ISO 12944-2 /2017**

Paints and varnishes – corrosion protection of steel structures by protective paint systems- Part 2: classification of environments.

☞ **DIN EN 13190/2002**

Dial thermometers – requirements and testing.

8. SYSTEM DATA:

8.1	Rated system voltage (line to line) (kV RMS)	33
8.2	Highest system voltage (line to line) (kV RMS)	36
8.3	Rated frequency (Hz)	50
8.4	Range of frequency variation (Hz)	47.2-50.5
8.5	System neutral	The neutral terminal of ET may be connected to Earth through the earthing switch, arc-suppression coil, or an earthing resistor
8.6	Symmetrical short-circuit current (kA RMS)	16
8.7	Fault duration (three phase fault, sec)	1
8.8	Fault duration if neutral connection through arc-suppression coil (single phase fault, hour)	1
8.9	Fault duration if neutral connection through earthing switch or resistor (single phase fault, sec)	1
8.10	Earth fault factor for 1 sec	1.85
8.11	Earth fault factor for 1 hour	1.73
8.12	Line auto - reclosing policy	Tree-phase, two shots
8.13	<p>The ET shall be connected to the 36 kV busbars of substations fed by 161/36kV transformers with vector group YNd11. The neutral terminal of the earthing transformer may be connected to earth as follows:</p> <ul style="list-style-type: none"> • Directly through earthing switch. • Through arc-suppression coil. • Through an earthing resistor. 	

9. SPECIAL REQUIREMENTS FOR ENVIRONMENTAL PROTECTION

Due to the severe environmental conditions to which the equipment may be subjected during its service life, the following requirements for its protection form an integral part of the Specification. They are in addition to the standard design and protective measures that the manufacturer would normally invoke for these conditions:

- 9.1 Bolts, nuts, and washers greater than 1/2" shall be hot dip galvanized according to ASTM A 153 /2023 or equivalent. Hot dipped, as well as electrolytically galvanized nuts, bolts, and washers shall be passivated according to ASTM F1941, or equivalent standard and finish.
- 9.2 Components such as springs, pins and those for which a tight maintained dimensional tolerance is required shall be made of stainless steel. The preferred stainless steel is an austenitic grade; however, if physical requirements are overriding, other stainless-steel grades will be acceptable. Austenitic grades will be subject to a solution quench. Before being placed into service all stainless-steel components will be cleaned and passivated.
- 9.3 All aluminum components shall be fabricated from grades of aluminum that show resistance to salt spray and moist conditions; e.g., Al-Mg base alloys. Al-Cu alloys are not acceptable. After fabrication, all aluminum components shall be anodized to ASTM B 580-79 /2019 Type A, or equivalent.
- 9.4 All copper or copper alloy components shall be electrolytically tinned to ASTM B 579/2022 Condition SC4 or equivalent.
- 9.5 Components such as sleeves or bushings which may be fabricated having an inner face of one metal and a supporting outer face of another, or conductors which are used with connectors of a dissimilar metal should have their exposed interfaces protected against moisture.
- 9.6 All bearings shall be sealed type. The seal shall be guaranteed to be protective against sand, salt spray, and moisture for a minimum period of 10 years.

- 9.7 All grease-packed bearings shall be shipped lubricated.
- 9.8 All exposed metal surfaces of the Earthing Transformers shall be coated according to Appendix № 7 "Specification for coating requirements of power transformers and/or arc suppression coil".
- 9.9 Metal spraying and painting may be used for protecting metal surfaces only after approval by the Purchaser.
- 9.10 The paint's system shall be compatible with the Corrosive Environment "C5-M very high (marine)", according to DIN EN ISO 12944-2 /2017, item 5, classification of Environmental Conditions.
- 9.11 All Earthing Transformers components shall successfully withstand in operation the climatic and environmental conditions as defined in Summary of Data, clauses 1.5, 1.6.
- 9.12 Manufacturer is requested to describe or indicate deviations (see Summary of Data, cl. 16) from the above requirements. In case no deviations are mentioned, it will be understood that the Manufacturer's offer entirely complies with the above-mentioned requirements.

10. RELIABILITY, AVAILABILITY, MAINTAINABILITY, SAFETY (RAMS)

The Bidder is requested to fill in the enclosed Appendix № 3 "Reliability, availability, maintainability, and safety" based on relevant information from users. Bidder shall describe the system of relevant data collection from users. This data is to establish the Contractor's reliability statements.

11. REFERENCES

- Technical evaluation – see "Summary of Data", cl. 1.1.
- Comments by the Bidder – see "Summary of Data", cl. 1.2 and cl. 15.
- Deviations of the offer from the requirements – see "Summary of Data", cl. 1.3 and cl. 16.
- Conformity with proposal documents – see "Summary of Data", cl. 1.4 and cl. 17.
- Climatic and environmental conditions – see "Summary of Data", cl. 1.5 and cl. 1.6.
- Seismicity on the site – see "Summary of Data", cl. 1.7.
- Acceleration during transportation – see "Summary of Data", cl. 1.8.
- Electromagnetic environment – see "Summary of Data", cl. 1.9.
- Other requirements – see "Summary of Data", cl. 1.10.
- Manufacturer – see "Summary of Data", cl. 2.
- Ratings – see "Summary of Data", cl. 3.
- Design and construction – see "Summary of Data", cl. 4.
- Commissioning – see "Summary of Data", cl. 5.
- Operation and maintenance – see "Summary of Data", cl. 6.
- Spare and renewal parts – see "Summary of Data", cl. 7.
- Special tools – see "Summary of Data", cl. 8.
- Tests – see "Summary of Data", cl. 9 and Appendix № 1.
- Delivery, packing, shipment, and storage – see "Summary of Data", cl. 10.
- Quality management system and quality control – see "Summary of Data", cl. 11 and Appendix № 2.
- Technical documents to accompany the proposal – see "Summary of Data", cl. 12.
- Technical documents after notification of award – see "Summary of Data", cl. 13.
- Follow-on engineering and support after purchase – see "Summary of Data", cl. 14.