TURKISH ACCREDITATION AGENCY

ACCREDITATION CERTIFICATE

As a Testing Laboratory

ASTOR ENERJİ A.Ş. Test Laboratuvarı

Central Address: ALCI OSB MAH. 2001 CAD. A BLOK NO:5 A SİNCAN Ankara / Türkiye

is accredited in accordance with TS EN ISO/IEC 17025:2017 standard within the scope given in Annex following the assessment conducted by TURKAK.

Accreditation Number : AB-0650-T

Accreditation Date : 12.06.2013

Revision Date / Number : 20.11.2023 / 13

This certificate shall remain in force until **08.08.2025**, subject to continuing compliance with the standard **TS EN ISO/IEC 17025:2017**, related regulations and requirements.

Gülden Banu Müderrisoğlu
Secretary General

Turkish Accreditation Agency (TURKAK) is a signatory to the European co-operation for Accreditation (EA) Multilateral Agreement (MLA) and International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Agreement (MRA) in the scope of ISO/IEC 17025.

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AB-0650-T

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Electrical,Electronic and IT Products and Devices

Tested Materials / Products	Name of Test	Testing Method (National, International Standards, In-house Methods)
Power Transformers	Power Transformers – Part 1: General **Measurement of winding resistance** **Measurement of voltage ratio and check of phase displacement** **Measurement of short-circuit impedance and load loss** **Measurement of no-load loss and current (at rated voltage, at 90% and 110% of rated voltage)** **Measurement of D.C. insulation resisance between each winding to earth and between windings** **Measurement of zero-sequence impedance(s) on three-phase transformers** **Determination of capacitances windings-to-earth and between windings.** **Measurement of dissipation factor (tan δ) of the insulation system capacitances.** **Tests on on-load tap-changers – Operation test** **Leak testing with pressure for liquid immersed transformers (tightness test)** **Check of core and frame insulation** **Check of external coating** **Check of the ratio and polarity of built-in current transformers** **Measurement of the power taken by the fan and liquid pump motors** **Winding hot-spot temperature-rise measurements** **Determination of transient voltage transfer characteristics**	TS EN 60076-1 IEC 60076-1 **Clause 11.2** **Clause 11.3** **Clause 11.4** **Clause 11.5** **Clause 11.1.2.2.b, 11.1.4.h** **Clause 11.6** **Clause 11.1.2.2.a, 11.1.2.2.c, 11.1.4.c, 11.1.4.d** **Clause 11.7** **Clause 11.8** **Clause 11.12** **Clause 11.1.4.m** **Clause 11.1.2.1.i** **Clause 11.1.3.d** **Clause 11.1.4.b** **Clause 11.1.4.e**
Power Transformers	Power transformers – Part 2: Temperature rise for liquid-immersed transformers	TS EN 60076-2 IEC 60076-2
Power Transformers	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air **Applied voltage test (AV)** **Induced voltage withstand test (IVW)** **Induced voltage test with partial discharge measurement (IVPD)** **Lightning impulse tests (LI, LIC, LIN, LIMT)** **Line terminal AC withstand test (LTAC)** **Switching impulse test (SI)** **Overvoltage transferred from the high-voltage winding to a low-voltage winding** **Induced voltage tests (IVW and IVPD)** **Partial discharge (PD) measurement** **Insulation of auxiliary wiring (AuxW)**	TS EN 60076-3 IEC 60076-3 **Clause 10** **Clause 11.2** **Clause 11.3** **Clause 13** **Clause 12** **Clause 14** **Annex B** **Clause 11** **Clause 11.3.4** **Clause 9**
Power Transformers	Power transformers - Part 10: Determination of sound levels	TS EN 60076-10 IEC 60076-10
Power Transformers	Power transformers - Part 11: Dry-type transformers **Measurement of winding resistance** **Measurement of voltage ratio and check of phase displacement** **Measurement of short-circuit impedance and load loss** **Measurement of no-load loss and current** **Applied voltage test (AV)** **Induced voltage withstand test(IVW)** **Measurement of sound level** **Temperature-rise test** **Partial discharge measurement for transformers operated under a single phase line-to-earth fault condition** **Full wave lightning impulse test (LI)**	TS EN 60076-11 IEC 60076-11 **Clause 14.2.1** **Clause 14.2.2** **Clause 14.2.3** **Clause 14.2.4** **Clause 14.2.5** **Clause 14.2.6** **Clause 14.4.2** **Clause 14.3.2** **Clause 14.4.1** **Clause 14.3.1**
Insulating Liquids	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method	TS 3989 EN 60156 IEC 60156
Insulating Liquids	Insulating liquids -Measurement of relative permittivity, dielectric dissipation factor (tan d) and d.c. resistivity	ASTM D924 TS EN 60247 IEC 60247

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Insulating Liquids	Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment **Colour and appearance**	TS EN IEC 60296 IEC 60296 **Clause 6.7**
Insulating Liquids	Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration	TS EN 60814 IEC 60814 ASTM D1533
Insulating Liquids	Insulating liquids - Determination of acidity - Part 1: Automatic potentiometric titration	TS EN 62021-1 IEC 62021-1
High-voltage switchgear and controlgear	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear **Power-frequency voltage tests** **Lightning impulse voltage tests** **Dielectric tests on auxiliary and control circuits** **Continuous current tests** **Resistance measurement of contacts and connections in the main circuit as a condition check** **Dielectric test on the main circuit** **Tests on auxiliary and control circuits** **Measurement of the resistance of the main circuit** **Design and visual checks**	TS EN 62271-1 IEC 62271-1 **Clause 7.2.7.2** **Clause 7.2.7.3** **Clause 7.2.11** **Clause 7.5** **Clause 7.4.4** **Clause 8.2** **Clause 8.3** **Clause 8.4** **Clause 8.6**
High-voltage switchgear and controlgear	High-voltage switchgear and controlgear - Part 100: Alternating-current circuit-breakers **Power-frequency voltage tests** **Lightning impulse voltage tests** **Dielectric tests on auxiliary and control circuits** **Continuous current tests** **Resistance measurement of contacts and connections in the main circuit as a condition check** **Dielectric test on the main circuit** **Tests on auxiliary and control circuits** **Measurement of the resistance of the main circuit** **Design and visual checks**	TS EN 62271-100 IEC 62271-100 **Clause 7.2.7.2** **Clause 7.2.7.3** **Clause 7.2.11** **Clause 7.5** **Clause 7.4.4** **Clause 8.2** **Clause 8.3** **Clause 8.4** **Clause 8.6**
High-voltage switchgear and controlgear	High-voltage switchgear and controlgear - Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV **Power-frequency voltage tests** **Lightning impulse voltage tests** **Dielectric tests on auxiliary and control circuits** **Continuous current tests** **Resistance measurement of contacts and connections in the main circuit as a condition check** **Mechanical operation tests** **Dielectric test on the main circuit** **Tests on auxiliary and control circuits** **Measurement of the resistance of the main circuit** **Design and visual checks** **Mechanical operation tests**	TS EN 62271-200 IEC 62271-200 **Clause 7.2.7.2** **Clause 7.2.7.3** **Clause 7.2.11** **Clause 7.5** **Clause 7.4.4** **Clause 7.102** **Clause 8.2** **Clause 8.3** **Clause 8.4** **Clause 8.6** **Clause 8.102**
Non-magnetic coatings on magnetic metals	Paint and varnishes - Determination of film thickness	TS EN ISO 2178 EN ISO 2178 TS EN ISO 2808 EN ISO 2808

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Accreditation Scope

TÜRKAK Test TS EN ISO/IEC 17025 AB-0650-T	**ASTOR ENERJİ A.Ş. Test Laboratuvarı** **Accreditation Nr: AB-0650-T** **Revision Nr: 13 Date: 20.11.2023**
	Testing Laboratory
	Address : ALCI OSB MAH. 2001 CAD. A BLOK NO:5 A SİNCAN Ankara / Türkiye Phone : +90 312 267 0156 Fax : +90 312 267 0034 Email : test@astoras.com.tr Website : www.astoras.com.tr

Power Transformers	Power Transformers – Part 1: General **Measurement of the harmonics of the no-load current**	TS 267 EN 60076-1:1998 **Clause10.6 (*)** IEC 60076-1:2000 **Clause 10.6 (*)** (* This standard was withdrawn on 12.04.2012, however, it is given temporarily in this accreditation scope upon the request of the laboratory)
Power transformers	Power transformers - Part 18: Measurement of frequency response	TS EN ISO 60076-18 IEC 60076-18
Power Transformers	Medium power transformers 50 Hz, with highest voltage for equipment not exceeding 36 kV - Part 1: General requirements **Special Test for Corrugated Tank (Endurance Test)**	TS EN 50588-1 (*) EN 50588-1(*) **Clause 9.4** TS EN 50464-4:2007/A1 (**) EN 50464-4:2007/A1 (**) (* This standard was withdrawn on 09.11.2020, however, it is given temporarily in this accreditation scope upon the request of the laboratory) (** This standard was withdrawn on 18.12.2017, however, it is given temporarily in this accreditation scope upon the request of the laboratory)
Power Transformers	Dielectric Frequency Response Test	IEEE Std. C57.152 Annex G IEEE Std. C57.161
Transformers	IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers **Measurement of Winding Resistance** **Measurement of Voltage Ratio and Check of Phase Displacement** **Measurement of Short-Circuit Impedance and Load Loss** **Measurement of No-Load Loss and Current** **Applied Voltage Test (AV)** **Induced Voltage Withstand Test (IVW)** **Determination of Sound Levels** **Measurement of D.C. Insulation Resistance Between Each Winding to Earth and Between Windings** **Zero-phase-sequence impedance** **Determination of Capacitances Windings-to-Earth and Between Windings.** **Measurement of Dissipation Factor (tan δ) of the Insulation System Capacttances.** **Partial Discharge Measurement (IVPD, PD)** **Lightning Impulse Tests (LI, UC, LIN, LIMT)** **Switching Impulse Test (SI)**	IEEE C57.12.90 **Clause 5** **Clause 6 - 7** **Clause 9** **Clause 8** **Clause 10.6** **Clause 10.7** **Clause 13** **Clause 10.11** **Clause 9.5** **Clause 10.10** **Clause 10.9** **Clause 10.3** **Clause 10.2**
Shunt Reactors	Requirements, Terminology, and Test Code for Shunt Reactors Rated Over 500 kVA **Measurement of winding resistance** **Determination of reactance and linearity of reactance Impedance Test** **Measurement of Loss in Ambient Temperature Loss Measurements** **Applied Voltage Test (AV) (Separate Source A.C. Withstand Voltage Test)** **Lightning impulse test (LI, LIC, LIN, LIMT)** **Switching impulse test (SI)** **Induced Voltage Tests (IVW and IVPD)** **Partial discharge measurements (PD)** **Measurement of Insulation Resistance and/or Capacitance and Dissipation Factor (tano) of the Winding Insulation to Earth for Liquid-Immersed Reactors** **Insulation Power Factor Test** **Vibration Tests on Oil-Immersed Shunt Reactors** **Temperature Rise Test** **Measurement of Zero-Sequence Reactance on Three-Phase Reactors** **Measurement of Magnetic Characteristic of Magnetically Shielded Air Core Reactor with Intermittent Iron Core Reactors** **Measurement of Acoustic Sound Level, Audible-Sound Level Test**	IEEE C57.21 **Clause 10.2** **Clause 10.4.2** **Clause 10.4.3** **Clause 10.3.2** **Clause 10.3.4, 10.3.6** **Clause 10.3.8** **Clause 10.3.3.1, 10.3.3.2** **Clause 10.3.3.2.4** **Clause 10.3.10** **Clause 10.7** **Clause 10.5** **Clause 10.4.2.5** **Clause 10.9** **Clause 10.6**

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Power Transformers	Power transformers - Part 6: Reactors **Determination of Reactance and Linearity of Reactance Impedance Test (Reactor)** **Measurement of Loss in Ambient Temperature Loss Measurements (Reactor)** **Applied Voltage Test (AV) (Separate Source A.C. Withstand Voltage Test) (Reactor)** **Lightning Impulse Test (LI, LIC, LIN, LIMT) (Reactor)** **Switching Impulse Test (SI) (Reactor)** **Induced Voltage Tests (IVW and IVPD) (Reactor)** **Measurement of Insulation Resistance and/or Capacitance and Dissipation Factor (tano) of the Winding Insulation to Earth for Liquid-Immersed Reactors** **Insulation Power Factor Test (Reactor)** **Vibration Tests on Oil-Immersed Shunt Reactors (Reactor)** **Temperature Rise Test (Reactor)** **Measurement of Zero-Sequence Reactance on Three-Phase Reactors (Reactor)** **Measurement of Mutual Reactance on Three-Phase Reactors (Reactor)** **Measurement of Harmonics of the Current (Reactor)** **Measurement of Magnetic Characteristic of Magnetically Shielded Air Core Reactor with Intermittent Iron Core Reactors (Reactor)** **Measurement of Acoustic Sound Level Audible-Sound Level Test (Reactor)** **Measurement of Loss Close to Reference Temperature in the Case of Liquid-Immersed Reactors (Reactor)** **Measurement of Power Consumption of Fans and Oil Pumps, if any (Reactor)**	TS EN 60076-6 IEC 60076-6 **Clause 7.8.5** **Clause 7.8.6** **Clause 7.8.10.2** **Clause 7.8.10.4** **Clause 7.8.10.6** **Clause 7.8.10.3** **Clause 7.8.2** **Clause 7.8.13** **Clause 7.8.14** **Clause 7.8.8** **Clause 7.8.9** **Clause 7.8.7** **Clause 7.8.11** **Clause 7.8.12** **Clause 7.8.6** **Clause 7.8.3**
Power Transformers	The measurement of Frequency Response Analysis (FRA) of oil-immersed power transformers	IEEE C57.152 Annex F IEEE C57.149
High-voltage switchgear and controlgear	High-voltage switchgear and controlgear - Part 100: Alternating-current circuit-breakers **Mechanical operation test at ambient air temperature** **Mechanical operating tests**	TS EN 62271-100 EN 62271-100 IEC 62271-100 **Clause 7.101.2** **Clause 8.101**
Power transformers	Power transformers - Additional European requirements - Part 2-4: Medium power transformer - Special tests **Special test for corrugated tank (Tests for pressurised corrugated tanks)**	EN 50708-2-4 **Clause 5**
Power Transformers	IEEE Guide for Diagnostic Field Testing of Fluid-Filled Power Transformers, Regulators and Reaktors **Excitation current test**	IEEE C57.152 **Clause 7.2.11.2**
Power Transformers	Power transformers - Part 6: Reactors **Measurement of Voltage Ratio and Check of Voltage Vector Relationship (Earthing Transformer)** **Measurement of No-Load Loss and Current (Earthing Transformer)** **Measurement of Short-Circuit Impedance and Load Loss (Earthing Transformer)** **Applied Voltage Test (AV) (Earthing Transformer)** **Lightning Impulse Tests (LI, LIC, LIN, LIMT) (Earthing Transformer)** **Induced Voltage Tests (IVW) (Earthing Transformer)** **Measurement of Loss at Rated Continuous Neutral Current (Earthing Transformer)** **Temperature Rise Test (Earthing Transformer)** **Measurement of Zero-Sequence Impedance (Earthing Transformer)** **Measurement of Acoustic Sound Level Audible-Sound Level Test (Earthing Transformer)**	TS EN 60076-6 IEC 60076-6 **Clause 10.9.2** **Clause 10.9.2** **Clause 10.9.2** **Clause 10.9.7** **Clause 10.9.7** **Clause 10.9.7** **Clause 10.9.9** **Clause 10.9.6** **Clause 10.9.5** **Clause 10.9.4**

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Lubricants

Tested Materials / Products	Name of Test	Testing Method (National, International Standards, In-house Methods)
Insulating Liquids	Dissolved Gas Analysis (DGA) (H2,CH4,CO,C02,C2H4,C2H6,C2H2, N2, 02) Gas Chromatography Method	TS EN 60567 ASTM D3612 IEC 60567
Insulating Liquids	Determination of Total Acid Number by Potentiometric Titration	ASTM D664
Insulating Liquids	Determination of ASTM Color	ASTM D1500 TS 1713 ISO 2049 ISO 2049
Insulating Liquids	Determination of DBPC (2,6-di-tert-Butyl- p-Cresol) Content by FT-IR Method	ASTM D2668 TS EN 60666 IEC 60666
Insulating Liquids	Determination of Interfacial Tension	ASTM D971
Insulating Liquids	Determination of Density and Relative Density by Oscillating U-tube Method	TS EN ISO 12185 ASTM D4052 ISO 12185
Insulating Liquids	Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity	ASTM D445 ISO 3104 TS EN ISO 3104
Insulating Liquids	Determination of Flash Point by Cleveland Open Cup Tester	ASTM D92 TS EN ISO 2592 ISO 2592
Insulating Liquids	Determination of Aniline Point	ASTM D611 TS 1615 ISO 2977 ISO 2977
Insulating Liquids	Determination of Pour Point by Automatic Tilt Method	ASTM D5950

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