SIEMENS
Ingenuity for life

Scope of testing

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Siemens AG - Material testing laboratory Nuremberg

Contents:

DAkkS
Deutsche Akkreditierungsstelle
D-PL-11055-12-00

1. Our services

The material testing laboratory of Siemens Nuremberg is specialized in laboratory diagnostics of oil filled electric equipment. The highly qualified laboratory personnel works up solutions quickly and reliably, for problems of high complexity according to customer´s requirements.
Our service includes our core competency of analyses of liquid insulation materials and other transformer materials in the following fields:

- Chemische chemical analytics
- Material testing
- Technical consultation
- Research and development projects
- Analysis of damage events

Our technical competency is also evidenced by the membership in various standardization committees, e.g. DKE, Cigre and IEC.
For orders of a large sample volume or long-term contracts, we can offer prices for special terms.
We make the price agreement after consulting. Urgent orders will be treated short dated, after communication to you, we impose a surcharge on urgent orders. For special tests, advisory and development services, a written of-fer can be submitted to you for specific problem cases.
We are keen to support you in solving your tasks, please take advantage of the expertise of our experienced specialists.

2. Quality assurance

The material testing laboratory is accredited by the Deutsche Akkreditierungsstelle (DAkkS) since February 2012.
The international recognition of the German accreditation guaranteers the reliability and the competence of the laboratory. Interlaboratory tests are regularly carried out in various fields with the aim of the continual updating and strengthening our grown know-how in the fields of our laboratory activities. Our material testing laboratory is equipped with high performance analysis instruments in accordance with the latest technology.
The goals of the material testing laboratory are the optimising the quality of our services in terms of the standard DIN EN ISO 17025, the encreasing of the competitiveness and achieving of high levels of customer satisfaction.
The most important requirements test results from our company have to fulfill are the reliability, the measurability and the repeatability of analyses and their sustained safeguarding. To acquire and maintain the confidence of our customers and partners, we make high demands on quality and reliability of the results of our work.
For us as laboratory staff, timely execution of tests and transmission of test results to the customer is an important principle.
Our accreditation certificate can be seen in the file below:
„ s. DAkkS – Akkreditation Certificate of material testing laboratory

3. Sampling and sample bottles

We gladly offer you an oil sampling, however, it can also be carried out by the customer.The sampling for the Dissolved Gas Analysis (DGA) is performed as per standard DIN EN 60567, for the inspection of characteristic oil values as per standard DIN EN 60475.
The professional execution of sampling is extensively described in the following sampling guidance and the video. It should be noted that the sample bottles are to be filled with oil always to the brim.
„ s. Form for taking samples
„ s. Video instruction for sampling
When choosing sampling vessels, pay attention that they are preferably made of aluminium. These are not fragile and are easier to transport thanks to its low weight.
Glass bottles are generally suitable, but they entail the disadvantage that the transformer oil has to be filled to the brim. (That is necessary to avoid ingress of air into the bottle). After sealing the bottle and cooling of the oil, glass bottles pose a danger of implosion. Furthermore, glass bottles are slightly fragile.
Plastic bottles are unsuitable because of their high air permeability.
Glass syringes can be used as suitable sampling vessels, dependent on the amount of the insulating liquid to be analysed.
Glass syringes and aluminium bottles are suitable for the Dissolved Gas Analysis (DGA), for the inspection of characteristic oil values only, both aluminium and glass bottles are suitable.
Sampling can be done using a sampling device.
„ s. Instruction for sampling device

4. Scope of testing of material testing laboratory

Analysis	Test method	necessary amount of sample
Sampling	DIN EN 60567 Oil-filled electrical equipment - Sampling of gases and analysis of free and dissolved gases DIN EN 60475 Method of sampling insulating liquids	1000-2000ml
* DGA (Dissolved Gas Analysis) and interpretation (The material testing laboratory is accredited according to IEC 60567)	IEC 60599 Mineral oil-impregnated electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis * IEC 60567 Oil-filled electrical equipment - Sampling of gases and analysis of free and dissolved gases – Guidance IEC/TR2 61464 Insulated bushings - Guide for the interpretation of dissolved gas analysis (DGA) in bushings where oil is the impregnating medium of the main insulation ASTM D 3612 Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography IEEE C57.104 Guide for the interpretation of gases generated in oil-immersed transformers	200ml
Colour	ISO 2049 / ASTM D1500 Petroleum products - Determination of colour / Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)	100ml
Purity (visual)	IEC 60296 / ASTM D 1524 Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear / Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field	100ml
Purity (membrane filter)	IEC 60422, Annex C Mineral insulating oils in electrical equipment - Supervision and maintenance guidance	500ml
* Acidity and saponification number (The material testing laboratory is accredited according to IEC 62021-1 and IEC 62021-2)	DIN 51559 Testing of mineral oils - Determination of the saponification number ASTM D 974 Standard Test Method for Acid and Base Number by Color-Indicator Titration * IEC 62021-1 Insulating liquids - Determination of acidity - Part 1: Automatic potentiometric titration * IEC 62021-2 Insulating liquids - Determination of acidity - Part 2 Colourimetric titration	50ml
* Breakdown voltage (The material testing laboratory is accredited according to IEC 60156)	ASTM D1816 Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes * IEC 60156 Insulating liquids - Determination of the breakdown voltage at power frequency - Test method	500ml

Analysis	Test method	necessary amount of sample
* Dielectric loss factor (The material testing laboratory is accredited according to IEC 60247)	ASTM D 924 Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids * IEC 60247 Insulating liquids - Measurement of relative permittivity, dielectric dissipation factor (tan) and d.c. resistivity	200ml
* Water content (The material testing laboratory is accredited according to IEC 60814)	* IEC 60814 Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration	50ml
* Density (The material testing laboratory is accredited according to ISO 12185 und ASTM D7042)	DIN 51757 Testing of mineral oils and related materials - Determination of density * ISO 12185 Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method * ASTM D7042 Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity) ISO 1183-1 Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method ASTM D1298 Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method	100ml
Refraction number	DIN 51423-1 Testing of mineral oils - Part 1: Measurement of the relative refractive index with the precision refractometer DIN 51423-2 Testing of mineral oils - Part 2: Measurement of the relative refractive index with the Abbe-refractometer	50ml
* Interfacial tension (The material testing laboratory is accredited according to EN 14210)	ASTM D971 Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method * EN 14210 Surface active agents - Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method	50ml
Particles	IEC 60970 Insulating liquids - Methods for counting and sizing particles	300ml
* Determination of additives with FTIR und HPLC (inhbitor / passivator) (The material testing laboratory is accredited according to IEC 60666)	ASTM D2668 Standard Test Method for 2,6-di-tert-Butyl- p-Cresol and 2,6-di-tert-Butyl Phenol in Electrical Insulating Oil by Infrared Absorption * IEC 60666 Detection and determination of specified additives in mineral insulating oils	100ml
* Analysis of furane (The material testing laboratory is accredited according to IEC 61198)	ASTM D5837 Standard Test Method for Furanic Compounds in Electrical Insulating Liquids by High-Performance Liquid Chromatography (HPLC) * IEC 61198 Mineral insulating oils; methods for the determination of 2-furfural and related compounds	100ml

Analysis	Test method	necessary amount of sample
* Corrosive Sulfur (The material testing laboratory is accredited according to IEC 62535)	DIN 51353 Testing of insulating oils; detection of corrosive sulfur; silber strip test * IEC 62535 Insulating liquids - Test method for detection of potentially corrosive sulphur in used and unused insulating oil ASTM D1275 Standard Test Method for Corrosive Sulfur in Electrical Insulating Oils	150ml
Gassing behaviour	IEC 60628/ ASTM D 2300 Gassing of insulating liquids under electrical stress and ionization / Standard Test Method for Gassing of Electrical Insulating Liquids Under Electrical Stress and Ionization	50ml
PCB content (The material testing laboratory is accredited according to EN 12766-1 and EN 12766-2)	IEC 61619 Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography ASTM D4059 Standard Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography * EN 12766-1 Petroleum products and used oils - Determination of PCBs and related products - Part 1: Separation and determination of selected PCB congeners by gas chromatography (GC) using an electron capture detector (ECD) * EN 12766-2 Petroleum products and used oils - Determination of PCBs and related products - Part 2: Calculation of polychlorinated biphenyl (PCB) content	50ml
Aromatic content	IEC 60590 Determination of the aromatic hydrocarbon content of new mineral insulating oils	50ml
Oxidation stability tests	IEC 61125 /DIN 51554 / ASTM D 2440 Unused hydrocarbon-based insulating liquids; test methods for evaluating the oxidation stability/ Testing of mineral oils; Test of susceptibility to ageing according to Baader/ Standard Test Method for Oxidation Stability of Mineral Insulating Oil	2000ml
* Viscosity (The material testing laboratory is accredited according to ASTM D7042)	ISO 3104 Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity ASTM D445 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity) * ASTM D7042 Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)	50ml
Flash point / Fire point	ISO 2719/ ASTM D 92 Determination of flash point - Pensky-Martens closed cup method Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester	50ml
Pour Point	ISO 3016/ ASTM D97 Petroleum products - Determination of pour point Standard Test Method for Pour Point of Petroleum Products	50ml
Determination of Dibenzyldisulfide (DBDS)	DIN EN 62697-1 Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids - Part 1: Test method for quantitative determination of dibenzyldisulfide (DBDS)	100ml

Analysis	Test method	necessary amount of sample
Conductivity	IEC 61620 Insulating liquids - Determination of dielectric dissipation factor by measurement of the conductance and capacitance - Test method	250ml
Element determination (using RFA)	DIN 51829 Petroleum products - Determination of additive and wear elements in greases - Analysis by wavelength dispersive X-ray fluorescence spectrometry	100ml
Öl Screening	GC/MS	100ml
Mecanical tests (tensile, flexural and compressive strength) at different temperatures	ISO 527/ISO 178/ISO 604 / ISO 1924 /ISO 6892-1 Plastics - Determination of tensile /flexural / compressive properties Paper and board - Determination of tensile properties/ Metallic materials - Tensile testing - Part 1: Method of test at room temperature	on request
Hardness test	ISO 868 Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness)	
* Degree of polymerisation (DP) (The material testing laboratory is accredited according to IEC 60450)	* IEC 60450 Measurement of the average viscometric degree of polymerisation of new and aged cellulosic electrically insulating materials ASTM D 4243 Standard Test Method for Measurement of Average Viscometric Degree of Polymerization of New and Aged Electrical Papers and Boards	2g
Conductivity and pH-value of aqueous media	ISO 6587/ISO 10523/ISO 29681 Paper, board and pulps; determination of conductivity of aqueous extracts/ Water quality - Determination of pH/ Paper, board and pulps - Determination of pH of salted water extracts	10g
* Magnetic properties (using SST) (The material testing laboratory is accredited according to IEC 60404-3)	* IEC 60404-3 Magnetic materials; part 3: methods of measurement of the magnetic properties of magnetic sheet and strip by means of a single sheet tester	on request
* Surface resistance and insulation resistance (The material testing laboratory is accredited according to IEC 60404-11)	* IEC60404-11 Magnetic materials; part 11: method of test for the determination of surface insulation resistance of magnetic sheet and strip	on request
Stacking factor	IEC 60404-13 Magnetic materials - Part 13: Methods of measurement of density, resistivity and stacking factor of electrical steel sheet and strip	on request
Compression set	ISO 815 Rubber, vulcanized or thermoplastic - Determination of compression set	on request
Breakdown voltage in im shot bath	EN 60851-5 Winding wires - Test methods - Part 5: Electrical properties	3 m
Compatibility tests	ASTM D5282/D3455 Standard Test Methods for Compatibility of Construction Material with Silicone Fluid Used for Electrical Insulation / Standard Test Methods for Compatibility of Const Standard Test Methods for Compatibility of Construction Material with Electrical Insulating Oil of Petroleum Origin	on request

Analysis	Test method	necessary amount of sample
Thermal and temperature conductivity	DIN EN 993-15 Methods of test for dense shaped refractory products - Part 15: Determination of thermal conductivity by the hot-wire (parallel) method	100ml / on request
Total sulfur	DIN EN ISO 8754 Petroleum products - Determination of sulfur content - Energy-dispersive X-ray fluorescence spectrometry	500ml
Monitoring and maintenance of electrical equipment	IEC 60422 Mineral insulating oils in electrical equipment - Supervision and maintenance guidance IEC 60296 Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear IEEE C57.106 Guide for Acceptance and Maintenance of Insulating Oil in Equipment ASTM D117 Standard Guide for Sampling, Test Methods, and Specifications for Electrical Insulating Oils of Petroleum Origin IEC 61099 Insulating liquids - Specifications for unused synthetic organic esters for electrical purposes IEC 61203 Synthetic organic esters for electrical purposes; guide for maintenance of transformer esters in equipment IEC 62770 Fluids for electrotechnical applications - Unused natural esters for transformers and similar electrical equipment ASTM D6871 Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus IEEE C57.147 Guide for acceptance and maintenance of natural ester fluids in transformers IEC 60836 Specifications for unused silicone insulating liquids for electrotechnical purposes IEC 60944 Guide for the maintenance of silicone transformer liquids ASTM D2225 Standard Test Methods for Silicone Fluids Used for Electrical Insulation IEEE C57.111 Guide for acceptance of silicone insulating fluid and its maintenance in transformers IEEE C57/146 Guide for the Interpretation of Gases Generated in Silicone-Immersed Transformers	3000ml

Analysis	Test method	necessary amount of sample
Evaluation of new and used insulating liquids	DIN 51554 Testing of mineral oils; Test of susceptibility to ageing according to Baader IEC 61125 Unused hydrocarbon-based insulating liquids; test methods for evaluating the oxidation stability ASTMD 2440 Standard Test Method for Oxidation Stability of Mineral Insulating Oil IEC 62770 Fluids for electrotechnical applications - Unused natural esters for transformers and similar electrical equipment	

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