

# DGA Deutsche Gesellschaft für Akkreditierung mbH

## Annex to the Accreditation Certificate DGA-PL-2614.16 Accreditation based on DIN EN ISO/IEC 17025:2005

Period of validity: 2009-12-17 to 2014-12-16

Owner of the certificate: **Federal Institute for Materials Research and Testing (BAM)**

Unter den Eichen 87  
12205 Berlin

for its

**Department V  
Materials Engineering**

Tests in the fields: **selected tests of materialography;  
mechanical-technological and fracture mechanical testing  
of metallic and ceramic materials as well as metallic or  
ceramic matrix composites;  
testing of service loading fatigue of metallic materials  
and components;  
physical testing of anorganic non-metallic raw and fin-  
ished materials**

Used abbreviations: see last page

### **1 Structure and Microstructure of Materials Selected tests of materialography**

DIN EN ISO 945-1  
2009-03      Microstructure of cast irons - Part 1 Graphite classification by  
visual analysis

ASTM E 562-08      Standard Test Method for Determining Volume Fraction by  
Systematic Manual Point Count

### **2 Mechanical Behaviour of Materials Mechanical-technological and fracture mechanical testing of metallic and ceramic materials as well as metallic or ceramic matrix composites**

DIN EN ISO 6506-1  
2006-03      Metallic materials - Brinell hardness test - Part 1: Test method



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ASTM E 10 2008	Standard Test Method for Brinell Hardness of Metallic Materials
DIN EN ISO 6508-1 2006-03	Metallic Materials - Rockwell Hardness Test - (Scales A, B, C, D, E, F, G, H, K, N, T) - Part 1: Test Method
ASTM E 18 b 2008	Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
DIN EN ISO 6507-1 2006-03	Metallic Materials - Vickers Hardness Test - Part 1: Test Method
ASTM E 92 1982	Standard Test Method for Vickers Hardness of Metallic Materials
DIN EN ISO 6892-1 2009-12	Metallic materials - Tensile testing - Part 1: Method of testing at room temperature
DIN EN 10002-5 1992-02	Tensile testing of metallic materials - Part 5: method of testing at elevated temperature
DIN EN ISO 2639 2003-04	Steels - Determination and verification of the depth of carburized and hardened cases
DIN EN 10328 2005-04	Iron and steel - Determination of the conventional depth of hardening after surface heating
DIN 50190-3 1979-03	Hardness depth of heat-treated parts; determination of the effective depth of hardening after nitriding
ASTM E 8 2004	Standard Test Methods for Tension Testing of Metallic Materials
ASTM E 8M 2008	Standard Test Methods for Tension Testing of Metallic Materials [Metric]
ASTM E 21 2005	Standard Test Method for Elevated Temperature Tension Test of Metallic Materials
ASTM E 111 2004	Standard Test Method for Young's Modulus, Tangent Modulus and Chord Modulus
DIN EN 10291 2001-01	Metallic materials - Uniaxial creep testing in tension - Method of test
ISO 12106 2003-03	Metallic materials - Fatigue testing - Axial-strain-controlled method
ASTM E 139 2006	Standard Test Method for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials
ASTM E 606 2004	Standard Practice for Strain-Controlled Fatigue Testing



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ASTM E 2368 2004	Standard Practice for Strain Controlled Thermomechanical Fatigue Testing
ASTM E 466 2007	Standard Practice for Conducting Free Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials
CoP 2006-06	Validated Code-of-Practice for Strain-Controlled Thermo-Mechanical Fatigue Testing
ISO/DIS 12111 2008-09	Strain-Controlled Thermo-Mechanical Fatigue Testing
DIN EN 658-1 1999-01	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Part 1: Determination of tensile properties
DIN EN 658-2 2003-03	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Part 2: Determination of compression properties
DIN EN 658-3 2002-11	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Part 3: Determination of flexural strength
DIN EN 658-4 2003-05	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Part 4: Determination of interlaminar shear strength by compression loading of notched test specimens
DIN EN 658-5 2003-03	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature - Part 5: Determination of interlaminar shear strength by short span bend test (three-points)
DIN EN 820-1 2003-01	Advanced technical ceramics - Methods of testing monolithic ceramics; Thermo-mechanical properties - Part 1: Determination of flexural strength at elevated temperatures
DIN EN 820-5 2009-10	Advanced technical ceramics - Thermomechanical properties of monolithic ceramics - Part 5: Determination of elastic moduli at elevated temperatures
DIN EN 843-1 2008-08	Advanced technical ceramics - Mechanical properties of monolithic ceramics at room temperature - Part 1: Determination of flexural strength
DIN EN 843-2 2007-03	Advanced technical ceramics - Mechanical properties of monolithic ceramics at room temperature - Part 2: Determination of Young's modulus, shear modulus and Poisson's ratio
DIN EN 843-5 2007-03	Advanced technical ceramics - Mechanical properties of monolithic ceramics at room temperature - Part 5: Statistical analysis
ASTM E 1875-08 2000	Standard Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio by Sonic Resonance

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ASTM C 1198-08 2008	Standard Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Sonic Resonance
ASTM C 623-92 2000 (reapproved)	Standard Test Method for Young's Modulus, Shear Modulus and Poisson's Ratio for Glass and Glass-Ceramics by Resonance
DIN EN 13763-5 2004-02	Explosives for civil uses - Detonators and relays Part 5: Determination of resistance to cutting damage of leading Wires and shock tubes; German Version EN 13763-5:2003
DIN EN 13763-6 2004-02	Explosives for civil uses - Detonators and relays Part 6: Determination of resistance to cracking at low Temperatures of leading wires; German Version EN 13763-6:2003

### 3 Service Loading Fatigue and Structural Integrity Testing of service loading fatigue of metallic materials and components

DIN 969 1997-12	Threaded fasteners - Axial load fatigue testing - Test methods and evaluation of results
DIN 50100 1978-02	Testing of materials: fatigue test (Woehler test); definitions, symbols, execution, evaluation
DIN 50113 1982-03	Testing of metals; Rotating bar bending fatigue test
DIN 50142 1982-03	Testing of metallic materials; Flat bending fatigue test
ISO 1099 2006-04	Metallic materials - Fatigue testing - Axial force-controlled method
ISO 1143 1975-11	Metals - Rotating bar bending fatigue testing
ISO 1352 1977-12	Steel - Torsional stress fatigue testing
ISO 12106 2003-03	Metallic materials - Fatigue testing - Axial-strain-controlled method
ASTM E 466 2007	Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials
ASTM E 606 2004	Standard Practice for Strain-Controlled Fatigue Testing
ASTM E 647 2008	Standard Test Method for Measurement of Fatigue Crack Growth Rates
BS 7270 2006-12	Metallic materials. Constant amplitude strain controlled axial fatigue. Method of test



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BS ISO 12108 2002	Metallic materials - Fatigue testing Fatigue crack growth method
SEP 1240 2006	Test and documentation guidelines for the experimental inquiry of mechanical identity values of sheet metals from steel for the CAE calculation
DIN EN ISO 6892-1 2009-12	Metallic materials - Tensile testing - Part 1: Method of testing at room temperature
DIN EN 10002-5 1992-02	Metallic materials - Tensile testing; Part 5: Method of testing at elevated temperature
DIN 50115 1991-04	Notched bar impact testing of metallic materials using test pieces other than ISO test pieces
DIN EN 10045-1 1991-04	Charpy impact test on metallic materials; part 1: test method
DIN EN ISO 14556 2006-10	Steel - Charpy V-notch pendulum impact test - Instrumented test method
ESIS P2-92 1992	ESIS Procedure for Determining Fracture Behaviour of Materials
ASTM E 399 2009	Standard Test Method for Linear-Elastic Plane-Strain Fracture Toughness $K_{Ic}$ of Metallic Materials
ASTM E 1820 2008	Standard Test Method for Measurement of Fracture Toughness
ISO 12135 2002-12	Metallic materials - Unified method of test for the determination of quasistatic fracture toughness
BAM-V.32-7.111 1998-12	Fatigue test with variable amplitude
BAM-V.32-7.202 1998-12	Measurements with strain gauges

### 3.1 Vibration and shock tests

#### 3.1.1 Types of tests

**Table 1:** Vibration and shock tests on technical products, for example safety-related systems, equipment and components as well as dangerous goods packaging

Type of test	Quantity to be measured / test parameter	Testing and measuring range	Uncertainty of measurement*	Typical test methods
Vibration test	frequency	> 0 ... 9.000 Hz	approx. 0,1%	DIN EN 60068-2-6, DIN EN 60068-2-64, MIL-STD 810F, ASTM D 4728
	acceleration	> 0 ... 1.000 m/s <sup>2</sup> at 5 ... 1000 Hz	< 5 %	
	displacement amplitude	> 0 ... 125 mm at > 0 ... 10 Hz	< 2 %	
Shock test	acceleration	< 1.600 m/s <sup>2</sup> at D <sub>max</sub> = 4,5 ms	< 5 %	DIN EN 60068-2-27

\*Smallest attainable extended uncertainty of measurement (k=2)

These tests can be performed simultaneously with temperature and climatic tests given in table 2.

Within the testing fields given in table 1, without prior information to and approval by DGA Deutsche Gesellschaft für Akkreditierung mbH, the laboratory is permitted to:

- use standard test methods or test methods equivalent to them, not listed in the certificate
- implement modifications and developments in the test methods

The listed test methods are only seen as examples.



#### 3.1.2 Characteristic test methods

DIN EN 60068-2-6 2008-10	Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)
DIN EN 60068-2-64 2009-04	Environmental testing - Part 2: Test methods - Test Fh: Vibration, broad-band random (digital control) and guidance
DIN EN 60068-2-27 1995-03	Basic environmental testing procedures - Part 2: Tests - Test Ea and guidance: Shock
DIN EN ISO 13355 2003-10	Packaging - Complete, filled transport packages and unit loads - Vertical random vibration test
DIN EN 61373 1999-11	Railway applications - Rolling stock equipment - Shock and vibration tests
49CFR178.608 2006-10	Title 49 - Transportation; Chapter I - Research and special programs administration, Department of Transportation; Part 178 - Specification for Packagings; Subpart M - Testing of non-bulk Packagings and Packages; Sec. 178.608 - Vibration standard
49CFR178.819	Title 49 - Transportation; Chapter I - Research and special programs administration, Department of Transportation; Part 178 -

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2006-10	Specification for Packagings; Subpart O - Testing of IBCs; Sec. 178.809 - Vibration test
ASTM D 4169 2008	Standard Practice for Performance Testing of Shipping Containers and Systems
ASTM D 4728 2006	Standard Test Method for Random Vibration Testing of Shipping Containers
MIL-STD-810G 2008-10	Department of Defense (U.S.A.); Test Method Standard for Environmental Engineering Considerations and Laboratory Tests; Method 514.6: Vibration, Method 516.6: Shock

### 3.2 Temperature and climatic tests

#### 3.2.1 Types of tests

Table 2: Temperature and climatic tests on technical products, for example safety systems, equipment and components as well as dangerous goods packaging

Type of test	Quantity to be measured / test parameter	Testing and measuring range	Uncertainty of-measurement *	Typical test method
Dry heat test	temperature	up to +200 °C RT up to +75 °C	- < 0,7 K	DIN EN 60068-2-2
Damp heat test	temperature	+10 ... +95 °C +10 ... +70 °C	- < 0,7 K	DIN EN 60068-2-30, DIN EN 60068-2-78,
	relative humidity	10 ... 95 % r.F. 35 ... 80 % r.F.	- < 2,5 % r.F.	
Cold test	temperature	up to -60 °C RT up to -20 °C	- < 0,7 K	DIN EN 60068-2-1

\*Smallest attainable extended uncertainty of measurement (k=2)

These tests can be performed simultaneously with vibration and shock tests given in table 1.

Within the testing fields given in table 2, without prior information to and approval by DGA Deutsche Gesellschaft für Akkreditierung mbH, the laboratory is permitted to:

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- implement modifications and developments in the test methods

The listed test methods are only seen as examples

#### 3.2.2 Characteristic test methods

DIN EN 60068-2-1 2008-01	Environmental testing - Part 2: Tests - Test A: Cold
DIN EN 60068-2-2 2008-05	Environmental testing - Part 2: Tests - Test B: Dry heat
DIN EN 60068-2-30 2006-06	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 + 12 h cycle)



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DIN EN 60068-2-78  
2002-09 Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state

### 4 Advanced Technical Ceramics Physical testing of ceramics of anorganic non-metallic raw and finished materials

EN 725-5  
2007-04 Advanced technical ceramics - Methods of test for ceramic powders - Part 5: Determination of the particle size distribution

ISO 13320-1  
2009-10 Particle size analysis - Laser diffraction methods - Part 1: General Principles

DIN ISO 9277  
2003-05 Determination of the specific surface area of solids by gas adsorption using the BET method

DIN ISO 7884-1  
1998-02 Glass - Viscosity and viscometric fixed points - Part 1: Principles for determining viscosity and viscometric fixed points

DIN ISO 7884-2  
1998-02 Glass - Viscosity and viscometric fixed points - Part 2: Determination of viscosity by rotation viscometers

DIN ISO 7991  
1998-02 Glass - Determination of coefficient of mean linear thermal expansion

DIN ISO 7884-8  
1998-02 Glass - Viscosity and viscometric fixed points - Part 8: Determination of (dilatometric) transformation temperature

DIN EN 1159-1  
2007-11 Advanced technical ceramics - Ceramic composites - Thermophysical properties - Part 1: Determination of thermal expansion

#### Abbreviations used:

ASTM American Society of Testing and Materials  
BS British Standard  
CFR Code of Federal Regulations, USA  
DGZfP Deutsche Gesellschaft für Zerstörungsfreie Prüfung e. V.  
DIBt Deutsches Institut für Bautechnik  
DVGW Deutscher Verein des Gas- und Wasserfaches e. V.  
DVM Deutscher Verband für Materialforschung und -prüfung e. V.  
DVS Deutscher Verband für Schweißen und verwandte Verfahren e. V.  
EGF European Group of Fracture  
EN V Europäische Norm, Vornorm  
ESIS European Structural Integrity Society  
GL Germanischer Lloyd  
LGA Landesgewerbeamt Bayern  
MIL-STD US Military Standard  
NF Norme Française  
SEP Stahl-Eisen-Prüfblatt  
TRbF Technische Richtlinien für brennbare Flüssigkeiten  
VDE Verband Deutscher Elektrotechniker (VDE) e. V.  
VDG Verein Deutscher Gießereifachleute e. V.  
VDI Verein Deutscher Ingenieure  
VdTÜV Verband der Technischen Überwachungs-Vereine e. V.  
VMPA Verband der Materialprüfungsämter e. V.

