Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory

Universität Stuttgart
with its testing laboratory
Materialprüfungsanstalt Universität Stuttgart
Bereich Maschinenbau
Pfaffenwaldring 32, 70569 Stuttgart

is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields:

Mechanical-technological testing of metallic materials, fusion-welded joints and structural parts at high and low temperatures under static, rapid, sudden and cyclic, uniaxial and multiaxial loading; Material and fracture-mechanical testing of metallic materials at high and low temperatures, fatigue strength testing (LCF, HCF); Operational stability and proficiency testing, vibration tests (sine, shock, random); Experimental stress analysis of metallic and non-metallic materials of components used in the aviation and aerospace industries, plant, automotive and mechanical engineering and in semi-finished products using strain measurement with strain gauges and residual stress determination with the hole drilling, ring core and slitting methods; Metallographic analysis using hardness testing and microanalysis; Chemical analysis; Manual and (partially) mechanised non-destructive testing (ultrasonic testing, radiographic testing, magnetic particle testing, liquid-penetrant testing, visual testing) of metallic materials (forgings, castings, welds), of components used in plant, automotive and mechanical engineering, and of semi-finished products; Testing in the area of passive driver safety (seat belts, restraint systems, safety helmets)

The accreditation certificate shall only apply in connection with the notice of accreditation of 10.09.2020 with the accreditation number D-PL-11027-04. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 13 pages.

Registration number of the certificate: D-PL-11027-04-01

Berlin,
04.12.2020
Dr Heike Manke
Head of Division

Translation issued:
01.02.2021
Head of Division

The certificate together with the annex reflects the status as indicated by the date of issue.
The current status of any given scope of accreditation may be found respectively in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH https://www.dakks.de/en/content/accredited-bodies-dakks.

This document is a translation. The definitive version is the original German accreditation certificate.
See notes on verso.
Deutsche Akkreditierungsstelle GmbH

Office Berlin
Spittelmarkt 10
10117 Berlin

Office Frankfurt am Main
Europa-Allee 52
60327 Frankfurt am Main

Office Braunschweig
Bundesallee 100
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other’s accreditations.

The up-to-date state of membership can be retrieved from the following websites:

EA:  www.european-accreditation.org
ILAC: www.ilac.org
IAF:  www.iaf.nu
Deutsche Akkreditierungsstelle GmbH

Annex to the Accreditation Certificate D-PL-11027-04-01 according to DIN EN ISO/IEC 17025:2018

Valid from: 10.09.2020
Date of issue: 04.12.2020

Holder of certificate:

Universität Stuttgart
with its testing laboratory

Materialprüfungsanstalt Universität Stuttgart
Bereich Maschinenbau
Pfaffenwaldring 32, 70569 Stuttgart

Tests in the fields:

Mechanical-technological testing of metallic materials, fusion-welded joints and structural parts at high and low temperatures under static, rapid, sudden and cyclic, uniaxial and multiaxial loading;
Material and fracture-mechanical testing of metallic materials at high and low temperatures, fatigue strength testing (LCF, HCF);
Operational stability and proficiency testing, vibration tests (sine, shock, random);
Experimental stress analysis of metallic and non-metallic materials of components used in the aviation and aerospace industries, plant, automotive and mechanical engineering and in semi-finished products using strain measurement with strain gauges and residual stress determination with the hole drilling, ring core and slitting methods;
Metallographic analysis using hardness testing and microanalysis, chemical analysis;

The management system requirements of DIN EN ISO/IEC 17025 are written in the language relevant to the operations of testing laboratories. Laboratories that conform to the requirements of this standard, operate generally in accordance with the principles of DIN EN ISO 9001.

The certificate together with the annex reflects the status as indicated by the date of issue. The current status of any given scope of accreditation may be found respectively in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH https://www.dakks.de/en/content/accredited-bodies-dakks.

Abbreviations used: see last page

This document is a translation. The definitive version is the original German annex to the accreditation certificate.
Manual and (partially) mechanised non-destructive testing (ultrasonic testing, radiographic testing, magnetic particle testing, liquid penetrant testing, visual testing) of metallic materials (forging, casting, welds), of components used in plant, automotive and mechanical engineering, and of semi-finished products;
Testing in the area of passive driver safety (seat belts, restraint systems, safety helmets)

Within the scope of accreditation marked with ***, the testing laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use standards or equivalent testing methods listed here with different issue dates.

Within the given testing field marked with *, the testing laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, the free choice of standard or equivalent testing methods.

Within the given testing field marked with **, the testing laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, the following:
1) the free choice of standard or equivalent testing methods.
2) the modification, development and refinement of testing methods.

The testing laboratory maintains a current list of all testing procedures within the flexible scope of accreditation.
1 Mechanical-technological testing of metallic materials, fusion-welded joints and structural parts, material and fracture-mechanical testing of metallic materials, fatigue strength testing, operational stability and proficiency testing, vibration tests

1.1 Determination of mechanical properties at different temperatures and ambient conditions

<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>DIN EN ISO 148-1 ***</td>
<td>Metallic materials – Charpy pendulum impact test – Part 1: Test method</td>
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<tr>
<td>DIN EN ISO 204 ***</td>
<td>Metallic materials – Uniaxial creep testing in tension – Method of test</td>
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<td>DIN EN ISO 6892-1 ***</td>
<td>Metallic materials – Tensile testing – Part 1: Method of test at room temperature</td>
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<td>DIN EN ISO 6892-2 ***</td>
<td>Metallic materials – Tensile testing – Part 2: Method of test at elevated temperature</td>
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<tr>
<td>DIN EN ISO 6892-3 ***</td>
<td>Metallic materials – Tensile testing – Part 3: Method of test at low temperature</td>
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<td>DIN EN ISO 7438 ***</td>
<td>Metallic materials – Bend test</td>
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<tr>
<td>DIN EN ISO 14556 ***</td>
<td>Metallic materials – Charpy V-notch pendulum impact test – Instrumented test method</td>
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<td>DIN EN ISO 26203-2 ***</td>
<td>Metallic materials – Tensile testing at high strain rates – Part 2: Servo-hydraulic and other test systems</td>
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<tr>
<td>DIN EN 10319-1 ***</td>
<td>Metallic materials – Tensile stress relaxation testing – Part 1: Procedure for testing machines</td>
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<tr>
<td>DIN EN 10319-2 ***</td>
<td>Metallic materials – Tensile stress relaxation testing – Part 2: Procedure for bolted joint models</td>
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<td>2007-01</td>
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<tr>
<td>DIN 50100 ***</td>
<td>Load controlled fatigue testing – Implementation and evaluation of cyclic tests at constant load amplitudes on metallic specimens and components</td>
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<tr>
<td>2016-12</td>
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<td>DIN 50106 ***</td>
<td>Testing of metallic materials – Compression test at room temperature</td>
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<tr>
<td>2016-11</td>
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<tr>
<td>DIN 50134 ***</td>
<td>Testing of metallic materials – Compression test of metallic cellular materials</td>
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<table>
<thead>
<tr>
<th>Standard Test Method/Procedure</th>
<th>Description</th>
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<tr>
<td>ASTM E 9 ***</td>
<td>Standard Test Methods of Compression Testing of Metallic Materials at Room Temperature</td>
</tr>
<tr>
<td>ASTM E 208 ***</td>
<td>Standard Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels</td>
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<tr>
<td>ASTM E 606 ***</td>
<td>Standard Practice for Strain-Controlled Fatigue Testing</td>
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<td>ASTM E 647 ***</td>
<td>Standard Test Method for Measurement of Fatigue Crack Growth Rates</td>
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<td>ASTM E 2714 ***</td>
<td>Standard Test Method for Creep-Fatigue Testing</td>
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<tr>
<td>SEP 1230 ***</td>
<td>Determination of Mechanical Properties of Sheet Metal at High Stain Rates in High Speed Tensile Tests</td>
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<tr>
<td>SEP 1231 ***</td>
<td>Determination of Mechanical Properties on Joined Sheet Metals by High-Speed Tensile Testing</td>
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<tr>
<td>SEP 1240 ***</td>
<td>Testing and Documentation Guideline for the Experimental Determination of Mechanical Properties of Steel Sheets for CAE-Calculations</td>
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<tr>
<td>SEP 1325 ***</td>
<td>Falling weight test according to W. S. Pellini</td>
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<tr>
<td>MPAS-PA 52240-01</td>
<td>Implementation of internal pressure and external pressure swell tests</td>
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<tr>
<td>MPAS-PA 52240-02</td>
<td>Implementation of internal pressure tests on hollow bodies up to a specified internal pressure or until failure</td>
</tr>
<tr>
<td>MPAS-PA 55610-05</td>
<td>Tensile test in hydrogen in the temperature range from -50 °C to 290 °C</td>
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1.2 Fracture-mechanical analysis

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<thead>
<tr>
<th>Standard Test Method/Procedure</th>
<th>Description</th>
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<tbody>
<tr>
<td>ISO 12135 ***</td>
<td>Metallic materials – Unified method of test for the determination of quasistatic fracture toughness</td>
</tr>
<tr>
<td>DIN EN ISO 15653 ***</td>
<td>Metallic materials – Method of test for the determination of quasistatic fracture toughness of welds</td>
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<tr>
<th>Standard Test Method</th>
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<td>ASTM E 561 ***</td>
<td>Standard Test Method for K-R Curve Determination</td>
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<tr>
<td>ASTM E 1221 ***</td>
<td>Standard Test Method for Determining Plane-Strain Crack-Arrest Fracture Toughness, $K_{ia}$, of Ferritic Steels</td>
</tr>
<tr>
<td>ASTM E 1457 ***</td>
<td>Standard Test Method for Measurement of Creep Crack Growth Rates in Metals</td>
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<td>ASTM E 1820 ***</td>
<td>Standard Test Method for Measurement of Fracture Toughness</td>
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<tr>
<td>ASTM E 1921 ***</td>
<td>Standard Test Method for Determination of Reference Temperature, $T_{o'}$, for Ferritic Steels in the Transition Range</td>
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<tr>
<td>ESIS P1 ***</td>
<td>ESIS Recommendations for Determining the Fracture Resistance of Ductile Materials</td>
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<td>ESIS P2 ***</td>
<td>ESIS Procedure for Determining the Fracture Behaviour of Materials</td>
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<tr>
<td>MPAS-AA 52220-01</td>
<td>Identification of the stretched zone for the determination of $J_i$ and CTOD$_i$ values from crack growth resistance curves</td>
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<td>MPAS-PA 55610-06</td>
<td>Fracture-mechanical test in hydrogen in the temperature range from -50 °C to 290 °C</td>
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<td>MPAS-PA 55610-07</td>
<td>Cyclic crack growth tests in hydrogen in the temperature range from -50 °C to 290 °C</td>
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<td>MPAS-PA 55610-08</td>
<td>Low-cycle fatigue (LCF) tests in the temperature range from -50 °C to 290 °C</td>
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2 Experimental stress analysis of metallic and non-metallic materials of components used in the aviation and aerospace industries, plant, automotive and mechanical engineering and in semi-finished products using strain measurement with strain gauges and residual stress determination with the hole drilling, ring core and slitting methods **

2.1 Measurement of mechanical variables

MPAS-PA 53230-01 Implementation of strain measurements with strain gauges 2014-05

2.2 Determination of residual stress and implementation of strain measurements

MPAS-PA 53230-11 Implementation of residual stress determination with destructive methods 2014-05

MPAS-PA 53230-12 Implementation of residual stress determination using the borehole method 2015-06

MPAS-PA 53230-13 Implementation of residual stress measurements using the toroidal core method 2015-06

MPAS-PA 53230-14 Implementation of residual stress measurements using the longitudinal groove method 2015-06

3 Metallography ***

3.1 Hardness testing

DIN EN ISO 2639 Steels – Determination and verification of the depth of carburized and hardened cases 2003-04

DIN EN ISO 6506-1 Metallic materials – Brinell hardness test – Part 1: Test method 2015-02


DIN EN ISO 9015-1 Destructive tests on welds in metallic materials – Hardness testing – Part 1: Hardness test on arc welded joints 2011-05
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<td>DIN EN ISO 9015-2</td>
<td>Destructive tests on welds in metallic materials – Hardness testing – Part 2: Microhardness testing of welded joints</td>
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<tr>
<td>DIN EN ISO 14271</td>
<td>Resistance welding – Vickers hardness testing (low-force and microhardness) of resistance spot, projection, and seam welds</td>
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<tr>
<td>DIN EN 10328</td>
<td>Iron and steel – Determination of the conventional depth of hardening after surface heating</td>
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<tr>
<td>DIN 50190-3</td>
<td>Hardness depth of heat-treated parts – Determination of the effective depth of hardening after nitriding</td>
</tr>
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#### 3.2 Macroscopic and microscopic structural examination

<table>
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<tr>
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<th>Description</th>
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<tr>
<td>ISO 4968</td>
<td>Steel; Macrographic examination by sulfur print (Baumann method)</td>
</tr>
<tr>
<td>DIN EN ISO 643</td>
<td>Steels – Micrographic determination of the apparent grain size</td>
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<td>DIN EN ISO 945-1</td>
<td>Microstructure of cast irons – Part 1: Graphite classification by visual analysis</td>
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<td>DIN EN ISO 1463</td>
<td>Metallic and oxide coatings – Measurement of coating thickness – Microscopical method</td>
</tr>
<tr>
<td>SEP 1520</td>
<td>Microscopic examination of carbide structure in steels by means of diagram series</td>
</tr>
<tr>
<td>SEP 1572</td>
<td>Microscopic testing of free-cutting steels for sulphide non-metallic inclusions using standard images</td>
</tr>
<tr>
<td>VGB S 517</td>
<td>Guidelines for rating the microstructure and creep rupture damage of creep-resistant steel for high pressure pipelines and boiler components and their weld connections – Sections 6 &amp; 7</td>
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</tbody>
</table>
4 Chemical analysis

MPAS-PA 55320-02  Chemical analysis of low-alloy steels, chromium/chromium-nickel and free-cutting steels and of aluminium-silicon alloys by optical emission spectrometry (OES)

5 Manual non-destructive testing methods (NDT)

5.1 Radiographic testing for volume defects in metallic forged and cast components and in welds on film and digital detectors using X-rays *

DIN EN ISO 5579  Non-destructive testing – Radiographic testing of metallic materials using film and X- or gamma rays – Basic rules

DIN EN ISO 17636-1  Non-destructive testing of welds – Radiographic testing – Part 1: X- and gamma-ray techniques with film

DIN EN ISO 17636-2  Non-destructive testing of welds – Radiographic testing – Part 2: X- and gamma-ray techniques with digital detectors

DIN EN 12681-1  Founding – Radiographic testing – Part 1: Film techniques

5.2 Ultrasonic testing – Testing of metallic materials for volume and surface defects in forged parts, cast components and welded joints, adhesion tests of multilayer plain bearings and section thickness determination using ultrasound *

DIN ISO 4386-1  Plain bearings – Metallic multilayer plain bearings – Part 1: Non-destructive ultrasonic testing of bond of thickness ≥ 0.5 mm

DIN EN ISO 10893-8  Non-destructive testing of steel tubes – Part 8: Automated ultrasonic testing of seamless and welded steel tubes for the detection of laminar imperfections

DIN EN ISO 10893-10  Non-destructive testing of steel tubes – Part 10: Automated full peripheral ultrasonic testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of longitudinal and/or transverse imperfections

DIN EN ISO 16809  Non-destructive testing – Ultrasonic thickness measurement
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DIN EN ISO 16810  
Non-destructive testing – Ultrasonic testing – General principles  
2014-07

DIN EN ISO 16823  
Non-destructive testing – Ultrasonic testing – Transmission technique  
2014-07

DIN EN ISO 16826  
Non-destructive testing – Ultrasonic testing – Examination for discontinuities perpendicular to the surface  
2014-06

DIN EN ISO 16827  
Non-destructive testing – Ultrasonic testing – Characterisation and sizing of discontinuities  
2014-06

DIN EN ISO 17640  
Non-destructive testing of welds – Ultrasonic testing – Techniques, testing levels, and assessment  
2019-02

DIN EN 10160  
Ultrasonic testing of steel flat product of thickness equal to or greater than 6 mm (reflection method)  
1999-09

DIN EN 10228-3  
Non-destructive testing of steel forgings – Part 3: Ultrasonic testing of ferritic or martensitic steel forgings  
2016-10

DIN EN 10307  
Non-destructive testing – Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method)  
2002-03

DIN EN 10308  
Non-destructive testing – Ultrasonic testing of steel bars  
2002-03

DIN EN 12680-1  
Founding – Ultrasonic examination – Part 1: Steel castings for general purposes  
2003-06

DIN EN 12680-2  
Founding – Ultrasonic examination – Part 2: Steel castings for highly stressed components  
2003-06

DIN EN 12680-3  
Founding – Ultrasonic examination – Part 3: Spheroidal graphite cast iron castings  
2012-02

SEP 1913  
Ultrasonic surface testing of seamless and longitudinally welded steel pipes with surface waves  
1997-09

SEP 1920  
Ultrasonic testing of rolled semi-finished products on internal material discontinuities  
1984-12

SEP 1923  
Ultrasonic testing of steel forgings to stringent standards, in particular for components in turbine and generator systems  
2009-02

Valid from: 10.09.2020  
Date of issue: 04.12.2020
5.3 Magnetic particle testing for the detection of surface defects on magnetisable forged and cast components and weld seams *

DIN EN ISO 9934-1 2017-03  Non-destructive testing – Magnetic particle testing – Part 1: General principles

DIN EN ISO 17638 2017-03  Non-destructive testing of welds – Magnetic particle testing

DIN EN 1369 2013-01  Founding – Magnetic particle testing

DIN EN 10228-1 2016-10  Non-destructive testing of steel forgings – Part 1: Magnetic particle testing

5.4 Liquid penetrant testing for the detection of surface defects on magnetisable and non-magnetisable forged and cast components and weld seams *

DIN EN ISO 3452-1 2014-09  Non-destructive testing – Liquid penetrant testing – Part 1: General principles

DIN EN 1371-1 2012-02  Founding – Liquid penetrant testing – Part 1: Sand, gravity die and low pressure die castings

DIN EN 1371-2 2015-04  Founding – Liquid penetrant testing – Part 2: Investment castings

DIN EN 10228-2 2016-10  Non-destructive testing of steel forgings – Part 2: Penetrant testing

5.5 Visual testing of metallic parts and components and welds with and without the aid of video endoscopes

DIN EN ISO 17637 * 2017-04  Non-destructive testing of welds – Visual testing of fusion-welded joints

DIN EN 13018 * 2016-06  Non-destructive testing – Visual testing – General principles

MPAS-PA 55310-02 2017-12  Visual inspection of components with a video endoscope
5.6 Cross-process testing of cast components, forgings and weld seams *

DIN EN ISO 17635 2017-04  Non-destructive testing of welds – General rules for metallic materials
AD-2000 Information Sheet P 5/3 2015-04  Manufacture and testing of joints – Non-destructive testing of welded joints – Annex 1
SEP 1914 1983-08  Non-destructive testing of fusion-welded seams in pipes of stainless steels
SEP 1916 1989-12  Non-destructive testing of fusion-welded pipes of ferritic steels
SEP 1917 1994-09  Non-destructive testing of resistance-welded pipes of ferritic steels

6 Testing in the area of passive driver safety

6.1 Testing of seat belts and restraint systems

DIN EN ISO 9227 ***  Corrosion tests in artificial atmospheres – Salt spray tests 2017-07
DIN EN ISO 11997-1 ***  Paints and varnishes – Determination of resistance to cyclic corrosion conditions – Part 1: Wet (salt fog)/dry/humid 2018-01
DIN EN ISO 11997-2 ***  Paints and varnishes – Determination of resistance to cyclic corrosion conditions – Part 2: Wet (salt fog)/dry/humidity/UV light 2013-12
77/541/EWG ***  Directive on safety belts and restraint systems of motor vehicles (component, installation), 2006/96/EC 2006
97/24/EG ***  Directive on certain components and characteristics of two or three-wheel motor vehicles, here: Section 11 Annex VI (component) 2006
ECE-R 16 ***  Safety belts and restraint systems for adults in motor vehicles, here: Annexes 1-16 2019-05

Valid from: 10.09.2020
Date of issue: 04.12.2020
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6.2 Installation of seat belts ***

77/541/EWG 2006  Directive on safety belts and restraint systems of motor vehicles (installation), 2006/96/EC

97/24/EG 2006  Directive on certain components and characteristics of two or three-wheel motor vehicles, here: Section 11 Annexes II and VI, 2006/120/EC

ECE-R 16 2019-05  Safety belts and restraint systems for adults in motor vehicles, here: Appendix 17

6.3 Testing of safety helmets and visors


ECE-R 22 *** 2012-07  Uniform provisions concerning the approval of safety helmets and their visors for riders and passengers of motorcycles and mopeds, Amendment 05 Supplement 2

MPAS-PA 53240-04 2015-03  Testing of a glare shield for motorcyclist helmets
Abbreviations used:

AD 2000 Technical rule of Arbeitsgemeinschaft Druckbehälter (pressure vessel working group)
AGW/AGH Guidelines for analysis in the working groups
ASTM American Society for Testing and Materials
DIN Deutsches Institut für Normung e. V. (German Institute for Standardization)
DVGW GW Work sheet of Deutscher Verein des Gas- und Wasserfaches e.V. (German Association of the Gas and Water Industry)
ECE-R ECE Regulations: International technical regulations for motor vehicles
EN European standard
ESIS P European Standardised Information Sheet
ISO International Organization for Standardization
MPAS-AA XXXX-YY In-house method of the Stuttgart Materials Testing Institute
MPAS-PA XXXX-YY In-house method of the Stuttgart Materials Testing Institute
SEP Regulations of Stahl-Eisen-Prüfblatt (steel-iron test sheet)
VGB S Guidelines/Information Sheet of VGB PowerTech e. V.
XX/XXX/EEC Directive of the European Council