Materials testing and certification
Technology and expertise for speed to market

Advanced technology.
Extensive capabilities.

Being one of the leading global providers of testing and certification of thermoplastics, elastomers, thermosets and composites, our facilities offer a broad range of services: from compounding and test specimen production to testing and certification of high-performance plastics and components.

Let us apply our experience, resources and creativity to solve your compliance challenges.

When choosing UL Solutions, you are opting for the proven performance of an independent and accredited testing partner. Benefit from our highly experienced team of experts and long history of expertise in plastics testing.

UL Solutions offers comprehensive services and competitive turnaround times.

Faster, more efficient market launch thanks to:
• Advanced production systems.
• Electronic processing from receipt of order to delivery of results.
• Comprehensive service packages streamline the processing of complex orders.

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Production of test specimens

Compounding

Twin screw extrusion
- Small quantity compounds up to 200 kg*
- The main thermoplastics processed are:
  - Polycarbonates (PC, PC-HT).
  - Polyamides and polyesters (PA 6, PA 6.6, Co-PA, PET, PBT).
  - Styrenics (ABS, ASA and SAN).
  - Blends of the above-mentioned plastics.
- Weighing in of formulations
- Mixing of raw materials in high-speed mixer

Determination of processing properties

- Injection pressure.
- Gate open time.
- Plasticising performance.
- Demoulding properties/friction coefficient.
- Shrinkage

Test specimens from semi-finished and finished parts

- Produced by high-speed cutting, sawing and punching.

*Other quantity on request
Flat test specimens

<table>
<thead>
<tr>
<th>Size</th>
<th>Thicknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>80x10x</td>
<td>1,0/3,0/4,0</td>
</tr>
<tr>
<td>125x13x</td>
<td>0,75/0,8/0,85/0,9/1,0/1,2/1,6/1,8/2,2/2,6/2,8/3,2</td>
</tr>
<tr>
<td>127x12,7x</td>
<td>0,75/0,8/1,0/1,2/1,4/1,5/1,6/2,0/2,2/2,4/2,6/2,8/3,0/3,2/3,8/6,4</td>
</tr>
</tbody>
</table>

Thin wall test specimens (compression moulding)

<table>
<thead>
<tr>
<th>Size</th>
<th>Thicknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>60x60x</td>
<td>0,4/0,5/0,6/0,7/0,8/0,9/1,0</td>
</tr>
<tr>
<td>125x13x</td>
<td>0,4/0,5/0,6/0,7/0,8</td>
</tr>
</tbody>
</table>

Other wall thicknesses on request. Dimensions are in mm.
### Sheet production

**Sheets with optical quality**  
(only unreinforced materials)

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 x 105 x 1.5</td>
<td>150 x 105 x 4.0</td>
</tr>
<tr>
<td>150 x 105 x 1.6</td>
<td>150 x 105 x 6.0</td>
</tr>
<tr>
<td>150 x 105 x 2.0</td>
<td>150 x 105 x 6.4</td>
</tr>
<tr>
<td>150 x 105 x 3.0</td>
<td>250 x 105 x 1.6</td>
</tr>
<tr>
<td>150 x 105 x 3.2</td>
<td>250 x 105 x 2.3</td>
</tr>
</tbody>
</table>

**Sheets with grained surfaces**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 x 105 x 3.0</td>
<td>150 x 105 x 4.0</td>
</tr>
<tr>
<td>150 x 105 x 3.2</td>
<td>220 x 140 x 4.0</td>
</tr>
</tbody>
</table>

**Sheets 150 x 105 x d**

d = 1.0/1.2/1.5/2.0/2.2/2.4/2.5/2.7/3.0/3.2/4.0/6.0/10.0

(shrinkage marks on one side)

**Sheets 150 x 150 x d**

d = 2.0/2.5/3.0

**Sheets for shrinkage measurement**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular sheet</td>
<td>60 x 60 x 2.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>150 x 105 x 3.0</td>
</tr>
</tbody>
</table>

**Rectangular sheets; also with optical quality**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample sheet</td>
<td>60 x 40 x 2.0</td>
</tr>
<tr>
<td>Sample sheet</td>
<td>60 x 40 x 4.0</td>
</tr>
<tr>
<td>Sample sheet with step</td>
<td>60 x 40 x 4/2-step</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>150 x 38 x 2.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>155 x 75 x 2.3</td>
</tr>
<tr>
<td>Rectangular sheet with hole</td>
<td>155 x 75 x 2.3</td>
</tr>
<tr>
<td>Rectangular sheet with hole and ribs</td>
<td>155 x 75 x 2.3</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>60 x 60 x 1.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>60 x 60 x 2.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>60 x 60 x 3.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>75 x 50 x 2.0</td>
</tr>
<tr>
<td>Rectangular sheet</td>
<td>75 x 50 x 4.0</td>
</tr>
<tr>
<td>Sample sheet with step</td>
<td>75 x 50 x 4/1-step</td>
</tr>
<tr>
<td>Sample sheet with step</td>
<td>75 x 50 x 3/2-step</td>
</tr>
</tbody>
</table>

**Round test specimen; also with optical quality**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>D25 x 1.7</td>
<td>D80 x 0.8</td>
</tr>
<tr>
<td>D60 x 1.0</td>
<td>D80 x 1.0</td>
</tr>
<tr>
<td>D60 x 2.0</td>
<td>D80 x 1.2</td>
</tr>
<tr>
<td>D60 x 3.0</td>
<td>D80 x 1.5</td>
</tr>
<tr>
<td>D60 x 4.0</td>
<td>D80 x 1.6</td>
</tr>
<tr>
<td>D80 x 0.5</td>
<td>D80 x 2.0</td>
</tr>
</tbody>
</table>

Other wall thicknesses on request
### Special test specimens

**Flat test specimens**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 6 x 4,0</td>
<td></td>
</tr>
<tr>
<td>60 x 10 x 1,0</td>
<td></td>
</tr>
<tr>
<td>63,5 x 12,7 x 3,2</td>
<td></td>
</tr>
<tr>
<td>80 x 10 x 1,0</td>
<td></td>
</tr>
<tr>
<td>80 x 10 x 4,0</td>
<td></td>
</tr>
<tr>
<td>80 x 10 x 4,0 (with weld line)</td>
<td></td>
</tr>
<tr>
<td>120 x 10 x 4,0</td>
<td></td>
</tr>
<tr>
<td>120 x 15 x 4,0</td>
<td></td>
</tr>
</tbody>
</table>

**Dumbbell test specimens**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>63,5 x 3,2 x 0,8 (Type L)</td>
<td></td>
</tr>
<tr>
<td>63,5 x 3,2 x 0,8 (Type S)</td>
<td></td>
</tr>
<tr>
<td>63,5 x 3,2 x 1,5 (Type L)</td>
<td></td>
</tr>
<tr>
<td>63,5 x 3,2 x 1,5 (Type S)</td>
<td></td>
</tr>
<tr>
<td>63,5 x 3,2 x 3,0 (Type L)</td>
<td></td>
</tr>
<tr>
<td>63,5 x 3,2 x 3,0 (Type S)</td>
<td></td>
</tr>
<tr>
<td>85 x 5,0 x 1,5 (ISO 527-2 Typ 1BA)</td>
<td></td>
</tr>
<tr>
<td>105 x 6 x 1,5</td>
<td></td>
</tr>
<tr>
<td>105 x 6 x 2,0</td>
<td></td>
</tr>
<tr>
<td>105 x 6 x 3,0</td>
<td></td>
</tr>
<tr>
<td>105 x 6 x 4,0</td>
<td></td>
</tr>
<tr>
<td>105 x 10 x 0,75</td>
<td></td>
</tr>
<tr>
<td>105 x 10 x 1,5</td>
<td></td>
</tr>
<tr>
<td>105 x 10 x 3,0</td>
<td></td>
</tr>
<tr>
<td>120 x 7 x 2,0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 x 10 x 1,5</td>
<td></td>
</tr>
<tr>
<td>130 x 10 x 2,0</td>
<td></td>
</tr>
<tr>
<td>130 x 10 x 3,0</td>
<td></td>
</tr>
<tr>
<td>130 x 10 x 4,0</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 1,0</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 1,5</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 2,0</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 3,0 (according to ISO 527-2 Typ 1A)</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 3,2 (according to ISO 527-2 Typ 1B)</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 4,0</td>
<td></td>
</tr>
<tr>
<td>170 x 10 x 4,0 with weld line</td>
<td></td>
</tr>
<tr>
<td>170 x 13 x 3,2 (ASTM D638 Typ 1)</td>
<td></td>
</tr>
</tbody>
</table>

**Others**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow strip 440 x 50 x 1,0</td>
<td></td>
</tr>
<tr>
<td>Flow strip 440 x 50 x 1,5</td>
<td></td>
</tr>
<tr>
<td>Flow strip 440 x 50 x 2,0</td>
<td></td>
</tr>
<tr>
<td>Flow strip 440 x 50 x 3,0</td>
<td></td>
</tr>
<tr>
<td>Flow spiral – f at 1150 x 5 x 2,0</td>
<td></td>
</tr>
<tr>
<td>Flow spiral – f at 1170 x 8 x 2,0</td>
<td></td>
</tr>
</tbody>
</table>

Other test specimens on request.

All dimensions listed in mm.
**Test procedures**

**Mechanical test procedures**

**Tensile test**
-40°C to +230°C
- ISO 37
- ISO 527
- ASTM D638

**High speed tensile test**
Optical deformation measurement by ultra high speed camera
-40°C to +200°C
0.1 m/s to 20 m/s
- In-house standard

**Flexural test with modulus of elasticity**
-40°C to +230°C
- ISO 178
- ASTM D790

**Izod and Charpy flexural impact tests** (notched and unnotched)
-60°C to +80°C
- ISO 179-1
- ISO 180
- ASTM D256

**Penetration test**
-60°C to +80°C
- ISO 6603-2
- ASTM D3763

**Determination of hardness**
Ball indentation hardness
- ISO 2039-1
Micro hardness IRHD
- ISO 48
Rockwell hardness
- ISO 2039-2
- ASTM D785
Shore A/Shore D
- ISO 868
- ASTM D2240

**Tensile impact test**
- ISO 8256
- ASTM D1822

**Tear propagation/separation/peeling tests**
- ISO 34-1
- DIN 53507*
- DIN 53515*
- ASTM D1004
- ASTM D624
- ASTM D1938

**Compression test**
(to max. 100kN)
- ISO 604
- ASTM D695

**Shear test**
- ASTM D732

**Tensile creep test**
Room temperature to 250°C
- ISO 899-1
- DIN 53444*
- ASTM D2990

**Compression set**
- ISO 815
- ASTM D395

**Rheological test procedures**

**Melt index**
Melt volume flow rate (MVR)
Melt mass flow rate (MFR)
Time-dependent melt volume rate (IMVR)
Time-dependent melt flow rate (IMFR)
- ISO 1133-1
- ASTM D1238
- ISO 1133-2

**Melt shear viscosity**
- ISO 11443
- DIN 54811*

**Solution viscosity**
of polycarbonate with/without film
- ISO 1628-1/-4

**Oscillatory shearing**
(rotational rheometer), e.g., zero shear viscosity, frequency sweep, time sweep/thermal stability
- ISO 6721-10
- ASTM D4440

**Special rheological tests**
- Capillary and rotational rheometer

**PvT behaviour**
- ISO 17744

*Standard is inactive, but we can test to them if required.

Additional standards and tests (as well automotive and electrical test regulations) on request.
**Heat resistance**

**Vicat**
Temperature to 300°C
- ISO 306
- ASTM D1525

**Heat distortion temperature (HDT)**
Temperature to 290°C
- ISO 75-1,-2,-3
- ASTM D648

**Ball pressure**
- IEC 60695-10-2 (IEC 60335-1)

**Electrical test procedures**

**Dielectric measurement**
Dielectric constant \(\varepsilon_r\)
dissipation factor \(\tan \delta\)
- IEC 62631-3-1
- UL 746A
- ASTM D257

**Volume resistivity of insulating material**
- IEC 62631-3-1
- UL 746A
- ASTM D257

**Volume resistivity of conductive plastics**
- ISO 3915

**Dielectric strength**
- IEC 60243-1
- ASTM D149
- UL 746A

**Comparative tracking index (CTI)**
- IEC 60112
- ASTM D3638

**Arc resistance**
- IEC 61621
- ASTM D495
- VDE 0303 Part 70

**Electrolytic Corrosion**
- IEC 60426

**Inclined plane tracking (IPT)**
- IEC 60587
- ASTM D2303

**Flammability**

**Flame Tests**
- ANSI/UL 94, the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
  - HB - Horizontal Burning
  - V - 50 watt-20mm vertical burning
  - 5V - 500 watt-125mm vertical burning
  - VTM - thin material vertical burning
  - HBF - horizontal burning foamed material

**Flame Tests UL 746C**, the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations
- 20 mm (3/4 inch) flame
- 127 mm (5 inch) flame

**Density**
- ASTM D1622
- ISO 845

**Limiting oxygen index (LOI)**
- ISO 4589-2 (Procedure A)
- ASTM D2863

**Test with electrical ignition source**
- IEC 60695-2-11 glow wire end product testing (GWEPT)
- IEC 60695-2-12 glow wire flammability index (GWFI)
- IEC 60695-2-13 glow wire ignition temperature (GWIT)
- ANSI/UL 746A

**Needle flame test**
- IEC 60695-11-5

**Ash content**
- ISO 3451-1
- In-house standard (rapid ash)
- ISO 1172

**Automotive**
- DIN 75200 (KFZ-interior)
- ISO 3795 (KFZ-interior)
- TL 1010 (KFZ-interior)
- PV 3357 (insulation material)
- DBL 5307
- TSM 0500G
- 7-G2000
- GMW 3232
- VCS 5031.19
- GB 8410-2006
- SAE J369
- GS 97038
- D45 1333/-G
- ASTM D5132-20
- M0094
- STD 4466
- VW 96243 - PTL 8501
- RNES-B-00071
- UN Regulation No. 118
- 49 CFR 571.302

Additional standards and tests (as well automotive and electrical test regulations) on request.

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Thermal aging
Hot air aging in no-load conditions
• DIN 53497
• ISO 188

Determination of relative temperature index (RTI)
• IEC 60216
• UL 746B, the Standard for Polymeric Materials - Long Term Property Evaluations
• VDE 0304

Weathering
Artificial weathering
Many standards available on request for accelerated aging test with various customer specifications with different machines like Xenon-WOM, Xenotest, Fluorescence (UVA/UVB Light 313 nm, 340 nm, 351 nm)

• AATCC TM 16
• AATCC TM 169
• ASTM G154
• ASTM G155
• ASTM D7869
• ISO 4892-2,-3
• ISO 105-B06
• DIN EN ISO 16474
• SAE J 2412 (SAE J1885)
• SAE J 2527 (SAE J1960)

Automotive
• PV 1303
• PV 1306
• PV 3929 Kalahari test
• PV 3930 Florida test
• FLTM BO 116-01
• D27 1389
• D27 1911
• NES M 0135
• GMW 14650
• VDA 75202

Climate testing
Climate tests
On request various standards for climate change tests and constant climate conditions

Autoclave storage
• Up to +150 C

Automotive
• PV 1200
• PV 2005
• PR 303.5

Gray scale determination
• ISO 105-A02

Gloss factor
• ISO 2813
• ASTM D523

Haze
• ASTM D1003

Yellowness index
• DIN 6167
• ASTM E313

Spectroscopic methods
UV-VIS-NIR spectroscopy
• 175 nm to 3300 nm

Additional standards and tests (as well automotive and electrical test regulations) on request.
**Thermal analyses**
Thermomechanical analysis (TMA)
Coefficient of linear thermal expansion
-150°C to 600°C
- ISO 11359-1/-2
- ASTM E831

Differential scanning calorimetry (DSC)
Also temperature modulated method
- ISO 11357
- ASTM D3418

Thermogravimetric analysis (TGA)
- ISO 11358
- DIN 51006
- ASTM D3850
- ASTM E1131

Torsion pendulum test
(shear modulus determination)
- ISO 6721-7 forced vibration

**Chemical resistance**
Environmental stress cracking (ESC)
Bent strip test
- ISO 22088-3

Internal stresses
TnP test
- In-house standard

Petrol test
(iso-octane/toluene)

Fuel resistance
- DIN 51604-1
- DBL 5416

Media aging, no load
- ISO 175
- ISO 1817

**Physical test procedures**
Thermal conductivity
NanoFlash™ test method
- ISO 22007-4
- ASTM E1461

Determination of density
- ISO 1183
- ASTM D792

Density
- ISO 845

Apparent density
- ISO 60

Determination of water content
- ISO 760
- DIN 53715*
- ISO 15512

Water absorption
- ISO 62
- ISO 1110

**Shrinkage**
Production and measurement of shrinkage sheets on fully-automated shrinkage station
- ISO 294-4
- In-house standard

**Emissions testing**
Odor
- VDA 270
- PV 3900

Fogging
- DIN 75201-11
- PV 3015
- ISO 6452
- SAE J1756
- TP0000912 (Tesla)

Formaldehyd
- VDA 275
- PV 3925

Chamber test
- VDA 276
- PV 3942
- DIN ISO 12219-4
- ISO 16000-6

Thermodesorption
- VDA 278

*Standard is inactive, but we can test to them if required.

Reliable test data
ISO/IEC 17025 accreditation

The ISO/IEC 17025 accreditation of our laboratory in Krefeld confirms the competence and ability to conduct selected physical and technological tests on innovative plastics.

Dedicated to safety and performance

Safety and performance are crucial. UL Solutions helps increase consumer confidence that your plastic components, like the ones in electronic appliances or motor vehicles, have been reliably tested to comply with the latest safety and performance standards.

The added value of experience
UL Solutions employees make the difference

UL Solutions experts offer a wealth of experience. They constantly advance their professional skills with hands-on experience and regular training sessions conducted both externally and on-site.

UL Solutions expertise worldwide

Our laboratory in Krefeld is known as a Center of Excellence for plastics testing within UL Solutions. By supporting the development of new laboratories and contributing to the on-site training of our colleagues around the world, we can continue to offer industry-leading service to our customers.