Measure what you see.

Mechanical Cupping Tester

Manual
Contents

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1. Warning

- The instrument must be securely positioned and fastened onto a level bench or table capable of supporting its weight.

DO NOT:
- use the instrument near water
- clean the instrument with solvents (apart from the indenter and clamping system)
- open the case. There are no user serviceable parts inside
- attempt to lift the instrument by the handles or panel clamping mechanism
- expose to; excessive heat or humidity, aggressive and/or solvent and/or corrosive substances, flammable substances, excessive vibration

Defects and Extreme Usage
If safe operation can no longer be presumed, shut down the unit and secure it against unintended operation. The unit must be presumed unsafe to operate if;
- It shows visible damage
- It no longer operates
- It has been stored for long periods under adverse conditions
- It has received harsh treatment during

*This instrument complies with standard EN61010-1 2001 Safety requirements for electrical equipment for measurement, control and laboratory use*
1. Cupping Tester

- Zero plate
- Clamp ring
- Operating handle
- Button
- LCD display
- Base plate
- Magnifying glass
2. System Description

The Cupping Tester was originally designed to assess the resistance of coatings of paints varnishes (and related products) to cracking and/or detachment from the substrate under different conditions of controlled deformation. The instrument has since been redesigned and now includes:

- 10:1 gear box for ease of use
- Double-handed operation
- Integral digital readout
- Zero datum retention at power-off
- Ergonomic design for ease of use and viewing of test
- Integrated x2.5 illuminated magnifier
- 20mm range with 0.01mm resolution
- Battery powered with auto switch-off

The BYK-Gardner Cupping Tester provides a means of carrying out such a test under precisely controlled conditions, resulting in repeatability of results.

*The machine meets the requirements specified in: BS 3900 E4, BS EN ISO 1520, DIN 53166, DIN 53232, JIS K5600-5-2 and JIS B7729.*
3. Start-up

**Unpacking:**
Carefully open the packaging, remove the smaller instruments before removing the instrument itself. Make sure all components in the component list are included.

**Installation:**
*Prior to installation, keep in mind that the instrument must not be exposed to; excessive heat or humidity, aggressive or corrosive substances, flammable substances, or excessive vibration

1. Ensure the instrument is situated on a firm, hard level surface, strong enough to support its weight without significant vibration with adequate access to the front and sides.

2. Remove the battery cover from the rear of the instrument by rotating ¼ turn anticlockwise. Insert two alkaline D cells with the positive contact pointing out of the instrument (see symbol on battery holder cover). Replace the cover. Use a coin or large screwdriver for the cover slot.

3. Position the instrument with the LCD towards the operator, leaving sufficient room to operate the two handles without obstruction.

4. Fix the instrument to the bench using the mounting holes provided in the base plate [6] (allowing enough room to replace the D cells at the rear in the future).
5. Slide off the battery cover on the magnifying glass. Insert the four AA cells into the body (see battery orientation indicated on the cover).

6. The magnifier assembly is supplied separately. Slide the magnifier clamp plate onto the body of the magnifier and tighten. Slide the circular shaft through the clamp plate and tighten the clamping knob. Slide the assembly onto the instrument and adjust its position for optimum viewing of the sample.

7. Turn the two handles on the top clamping ring anti-clockwise to release the zero plate [1] from the clamp ring [2] - see below. Rotate the operating handles [3] four turns anticlockwise (as viewed from the right hand side of the instrument) to lower the hemispherical indenter.

8. The Cupping Tester is now ready for use.
4. Operation

1. Rotate the handles [3] clockwise (as viewed from the right-hand side of the instrument) to lower the hemispherical indenter just below the level of the bottom clamping ring [2].

2. Switch on by pressing the operating button [4]. The LCD [5] will show - - - -, followed by its current position or ZEr0 (if below the zero datum position). Switch on the magnifier light [7], if required. Note that ZEr0 will flash if the indenter is lowered about 0.5mm below the zero datum position.

3. Insert the zero plate and rotate the handles on the clamping ring clockwise to securely retain the plate.

4. Lightly hold one of the operating handles with two fingers and slowly turn the handle anticlockwise (as viewed from the right-hand side of the instrument) to raise the hemispherical indenter until a slight resistance is encountered. When this position is reached, stop turning; the Indenter will now be in contact with the underside of the substrate. Briefly press the button [4] to zero the instrument's measurement system (datum position)1. The LCD will show 0.00. Remove the zero plate.

5. Carefully pass the prepared substrate (coated side facing upwards) through the slot (at 90° to the operator) so that the central axis of the substrate is at least 35 mm from the edge of the substrate.
6. Clamp the substrate in position by turning the handles on the clamping clockwise – hand force is sufficient.

7. There are two methods. Choose one of the two procedures below (8 or 9).

8. Method A – Go/No Go
   A pre-determined depth of deformation is applied to the substrate in order to test for compliance to a specification. The substrate may or may not fail at the applied depth of deformation. Having set the datum position (see 7), turn both the handles (anticlockwise as viewed from the right-hand side of the instrument) to raise the indenter to the depth required as shown on the LCD.

9. Method B – Failure Point
   The depth of substrate deformation is increased until the first moment cracking and/or detachment of the coating is observed; this marks the Failure Point, and no further deformation is required. Observe the deformation with standard corrected vision or, by agreement, with the use of the magnifying lens. The turn rate may be reduced slightly (in order to assist observation) at the first sign of coating failure. Take the LCD reading at the first-failure point.

   *For both methods turn the handle at a constant rate of 0.2 ±0.1 mm per second – i.e. at one revolution per second.

10. After completion, unclamp the sample (it will be necessary to allow the clamp-ring sufficient room for the indented-dome to be removed).
11. Check for any detached coating on the instrument and remove these before starting another test.

12. Turn the handles in a clockwise direction (as viewed from the right-hand side of the instrument) to lower the hemispherical indenter until ZEr0 is shown on the LCD and then reverse direction until 0.00 is shown. The Cupping Tester is now set at the datum position and is ready for the next test.

13. To conform to the standard, repeat the test on a new coated substrate, to confirm the previous result. If the results differ significantly, further testing is required in order to obtain consistent readings.

14. Record the values, stating whether the results were obtained using standard corrected eyesight or by use of the magnifying glass.

15. Carry on testing or switch off the instrument as required. Remove the batteries if the instrument is not to be used for long periods.

**Operation notes:**

- The instrument will accommodate panels with a maximum width of 100mm.
- When using 1.25mm thick panels, ensure that their tensile strength does not exceed 280N (MPa) when a deformation of 7mm may be achieved.
  *Damage to the instrument will occur if the maximum panel strength is exceeded.*
- Reference to the test method recommends the use of burnished steel panels with a
width and length of at least 70 mm and a thickness range of 0.3mm to 1.25mm (maximum).

- Do not exceed the above figures as this may cause permanent damage to the instrument.

Operation Notes (cont.)

Zero Datum
All measurements are taken from the zero datum position (where the indenter is level with the bottom sample clamp-ring). Press the button (at any position) to zero the display. Note that the LCD will display ZEr0 when the indenter is below the last zero position, but will change to a numeric display when the indenter is level with, or higher than the last zero position. ZEr0 will flash when the indenter is approximately 0.5 mm below the bottom clamp ring.

It is not necessary to re-zero the datum position when power is switched off and on. However, large ambient temperature changes will affect the readings to a small extent, and it is good practice to regularly re-zero the instrument. The datum will need resetting if the batteries are changed.

Power Off
The power will go off automatically after about 5 minutes if the instrument is not used (handle not moved). Power can also be removed by pressing the button and keeping it depressed. ZEr0 will flash off and on quickly for about 3 seconds followed by OFF on the LCD; the button may then be released. The zero position will NOT be altered by this process, provided the button is not released before OFF is shown.
LCD Display
In operation, the display will show one of the following states –

<table>
<thead>
<tr>
<th>LCD display</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZEr0</td>
<td>Indenter is below zero or un-zeroed</td>
</tr>
<tr>
<td>ZEr0 (flashing)</td>
<td>Indenter is below the zero position by at least 0.5mm</td>
</tr>
<tr>
<td>nn.nn</td>
<td>Normal distance reading</td>
</tr>
<tr>
<td>High</td>
<td>Reading exceeds maximum range</td>
</tr>
<tr>
<td>OFF</td>
<td>Manual power off indication</td>
</tr>
<tr>
<td>Bat (flashing intermittently)</td>
<td>Low Battery. Change battery soon</td>
</tr>
<tr>
<td>Cal- - Cal Cal- (flashing at start-up)</td>
<td>Instrument needs recalibrating^4</td>
</tr>
<tr>
<td>Err1</td>
<td>Measurement system error^5</td>
</tr>
</tbody>
</table>
5. Maintenance

The frequency of regular maintenance depends on the degree of use, together with the thickness of the substrates used –

- Heavy use – every 3 months
- Medium use – every 6 months
- Low use – every 12 months

1. Conduct a functional check to ensure that the Clamp Plate is free to rotate, treat the screw threads sparingly with light grease. If the two knobs and attached to the spindles are damaged, they may be replaced.

2. Turn the operating handles for complete travel of the indenter, (nominally 20 mm). Ensure the movement is smooth and even.

3. Inspect the hemispherical indenter for any signs of wear – for example, flats on the surface. Replace if necessary.

4. Check the magnifying glass condition. Clean if necessary.

5. Inspect the batteries physical condition for leakage, both in the main body and magnifying glass. Remove and replace if necessary.

6. Remove all batteries if leakage has occurred. Clean the housing and fit new batteries and re-check function.

*Remove the batteries if the Cupping Tester is not to be used for prolonged periods.
Maintenance Schedule

Between tests
   Clean the indenter and clamp system as necessary.

Daily
   Check the zero-datum as required.

Yearly
   Have the instrument serviced and calibrated by a trained and qualified service engineer

Cleaning

Do not use solvent to clean the instrument (apart from the clamp system and indenter). Painted surfaces may be cleaned with a slightly damp cloth and mild detergent solution.

*Do NOT apply a large side-force to the spindle when cleaning it.
6. Components/Ordering Guide

Mechanical Cupping Tester
Cat No. 5405
Complies with:
BS 3900, DIN 53166, DIN 53232, ISO 1520, JIS K 5600-5-2, JIS B 7729

<table>
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<th>Description</th>
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<tbody>
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<td>Mechanical Cupping Tester</td>
</tr>
<tr>
<td>5406</td>
<td>Indenter</td>
</tr>
<tr>
<td>5407</td>
<td>Magnifier</td>
</tr>
<tr>
<td>5408</td>
<td>Zero Plate</td>
</tr>
</tbody>
</table>

Service and Spare Parts
For all service and spare parts requirements please contact either:

BYK-Gardner USA
9104 Guilford Rd
Columbia, MD 21046
USA
800-343-7721
301-483-6500

Or:

BYK-Gardner GmbH
Lausitzer Straße 8
82538 Geretsried
Germany
0-800-4273637
+49-8171-3493-0
7. Technical Data

**Mechanical Cupping Tester:**

**Spherical Punch:**
20 mm (0.8 in)

**Full Travel:**
0.00 – 20.50 mm (0.0 – 0.81 in)

**Accuracy:**
± 0.05 mm (0.002 in), full range

**Calibrated Range:**
-0.5 to 20.5 mm (0.02 – 0.81 in)

**Gearing:**
1 revolution of handle moves punch
0.2 mm under load

**Display:**
LCD 4-digit

**Dimensions:**
420 x 350 x 500 mm
(16.5 x 13.8 x 19.7 in)

**Weight:**
16 kg (35.2 lb)

**Power:**
Main 2 alkaline D cells;
Magnifier 4 alkaline AA cells

**Operating Temperature:**
+15 - +35 °C (59 – 95 °F)