

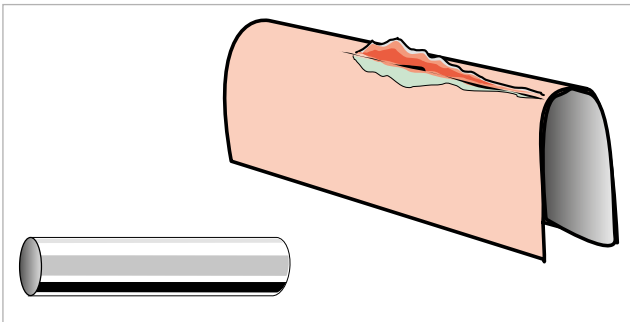
# Introduction

## Flexibility / Elasticity

In practice, three different empirical test procedures are used to assess the resistance of coatings and allied products to cracking and/or detachment from the substrate under different conditions of deformation.

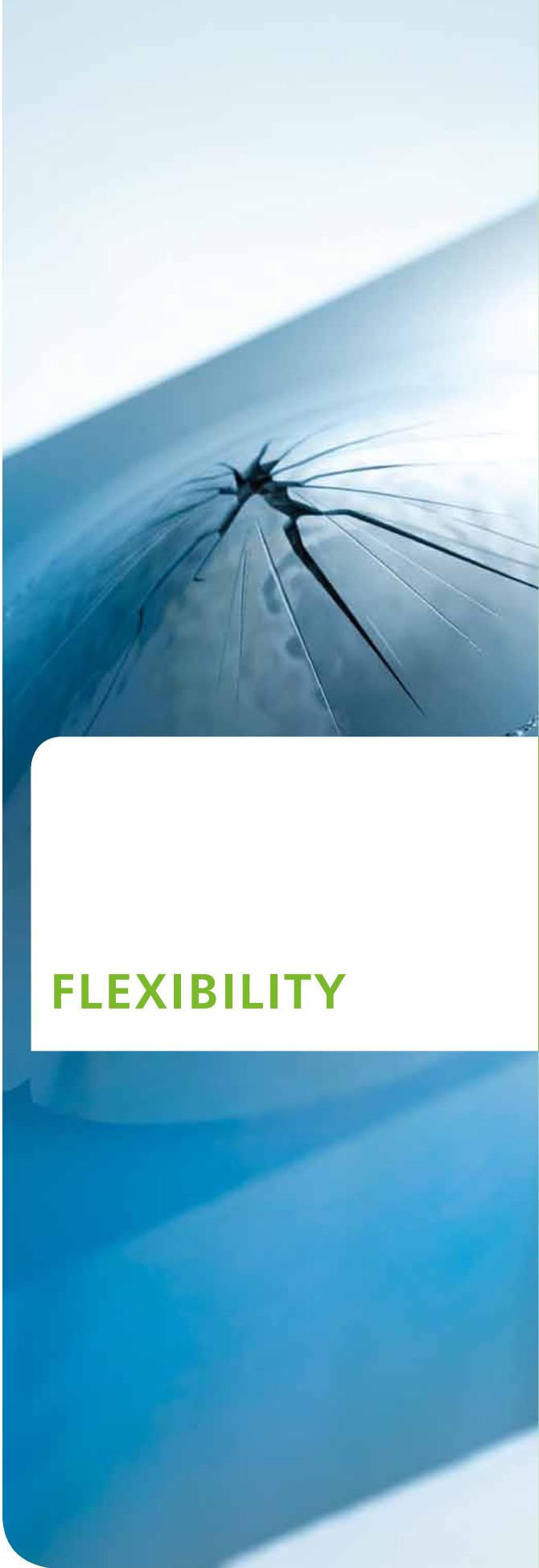
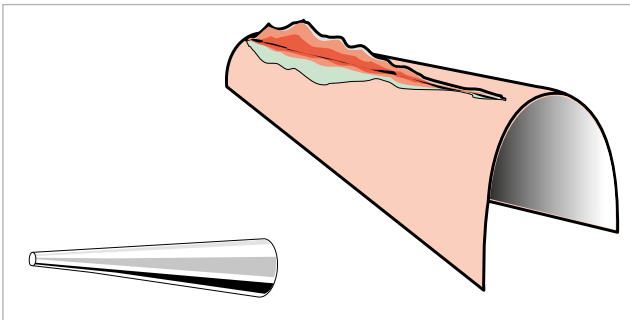
## Bend Test

Bending lacquered sheet metal over a defined radius allows an indication of the elongation and adhesion of a paint film due to bending stress.



The DIN EN ISO 1519 standard only permits the use of cylindrical mandrels.

The ASTM D 522 and the DIN EN ISO 6860 standards describe the test method by means of a conical or cylindrical mandrel. The use of a conical mandrel bending tester enables testing of a large variety of bending radii at the same time.



# FLEXIBILITY

## Impact Test – “Falling-weight Test”

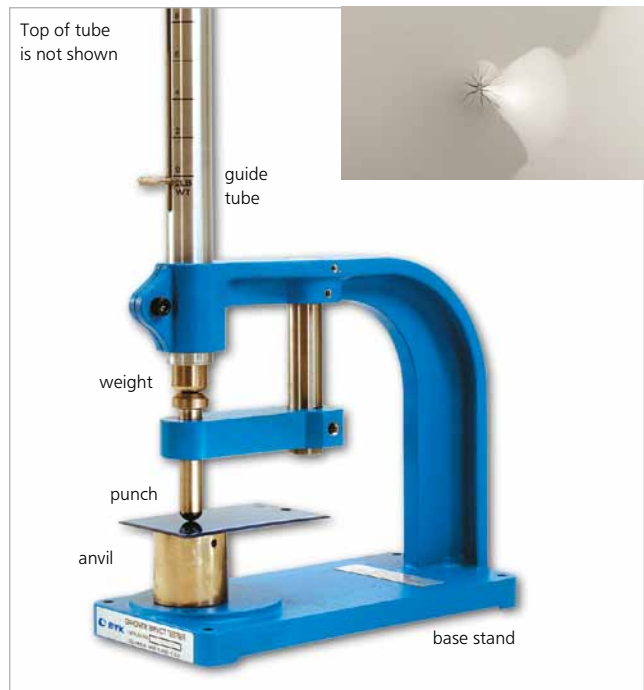
The impact tester has gained wide acceptance in testing the impact resistance of many types of coatings and substrates. International standards describe a method for evaluating impact resistance of a coating to cracking and peeling from a substrate when it is subjected to a deformation caused by a falling weight, dropped under standard conditions yielding rapid deformation.

### Impact Tester

- Consists of a solid base with a guide tube support
- The guide tube has a slot to direct a weight that slides inside the guide tube
- A collar fits on the tube that helps the user slide the weight up to the accurate height
- Graduations are marked along the slot to facilitate readings

### Procedure

- Place sample under the punch
- Lift the weight to desired height on guide tube and let it drop
- View the damage of the sample visually or with low powered magnification
- Adjust the height and weight of the impacter to determine exact point of failure or establish pass/fail specifications

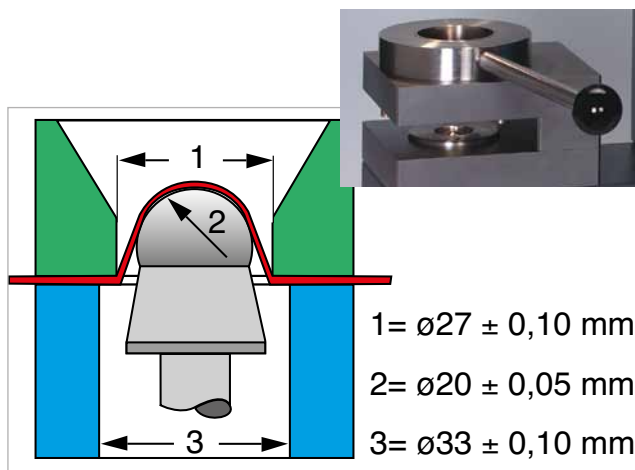


The impact force is calculated using the following equation:

**Falling Height x Weight = Impact Force**

<b>in</b>	<b>lbs</b>	<b>in-lb</b>
<b>m</b>	<b>kg</b>	<b>mkg</b>

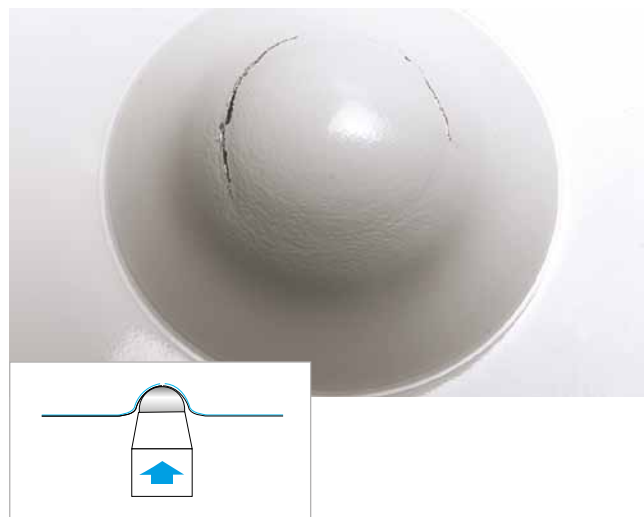
Note: The coated or uncoated side of the panel can be tested to simulate either indentation or bulging.



## Cupping Test

In addition to determining the deformability or elongation of a film, the cupping test method supplies information on adhesion properties. Single-layer systems can be tested as well as multiple-layer systems.

The ISO standard describes a method for evaluating the resistance of a coating to cracking and/or detachment from a metal substrate when it is subjected to a gradual deformation by indentation under standard conditions.



A die having a hardened and polished surface and a sample holder with a retaining ring are the heart of a cupping tester. The indenter that contracts the test panel is of hardened polished steel and forms a hemisphere of 20 mm (8 in) diameter. The maximum cupping depth is approx. 14 mm. The test process is observed through a microscope or magnifying glass.

When evaluating the test results, it must be carefully assessed when the coating system starts cracking.