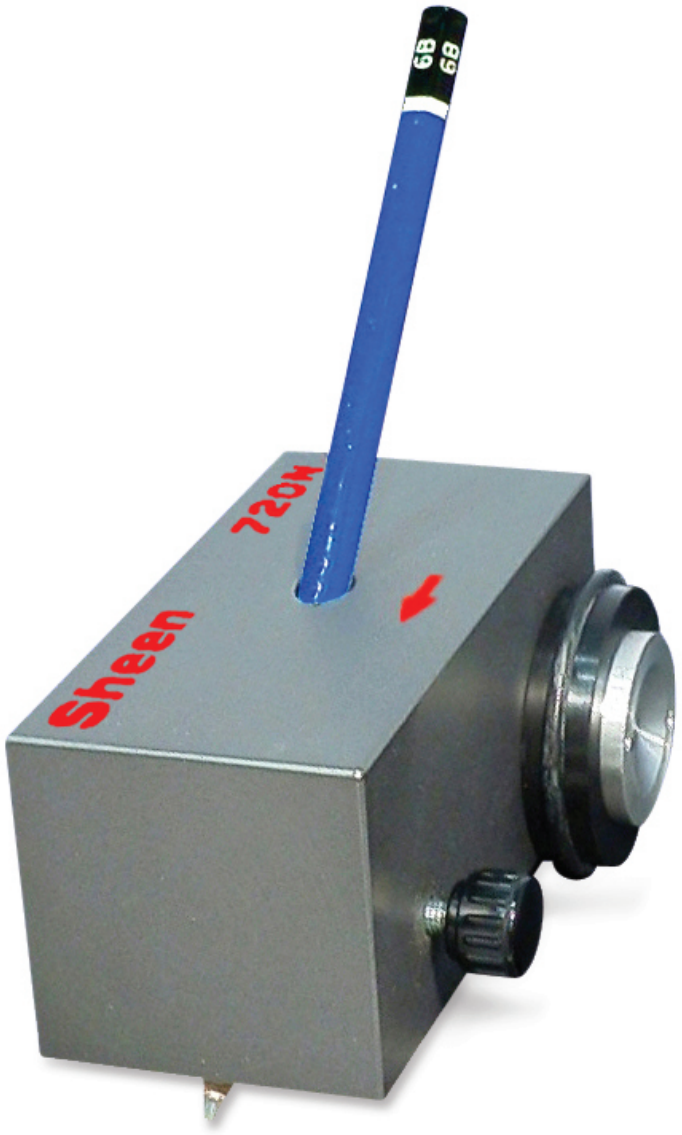
Physical Testing: Hardness

Pencil Hardness Tester (SH720N)

The purpose of scratch hardness test is to determine the resistance of coating materials or lacquers to scratch effects on the surface.

This test is of particular value for furniture or vehicle lacquers, but is also a useful aid in the development of synthetic resins or other film forming substances.

Generally scratch hardness is measured by moving a more or less sharp object under a known pressure over the surface of the material. The test result may either be the value of the pressure required to scratch through the material if a scratching tool of constant hardness is used, or alternatively the hardness of the scratching tool if this is varied whilst constant pressure is applied.



Test principle

The pencil test uses constant pressure and variable hardness of the test tool as its fundamental principal. Pencils of varying hardness, starting with the hardest lead, are moved over the surface under a fixed pressure of 7.5 Newtons (765 gms) and at a fixed angle of 45 degrees to the surface. The degree of hardness of the pencil which damages the surface is taken as a measurement for scratch hardness.

Twenty pencils from grade 9B to 9H (ISO 15184 / BS 3900 - E19) are used. The pencils can be exchanged quickly and easily. (Note: ASTM D3363 / ECCA T4 specifies only 14 pencils). The test method is fully described in the standards specified.

Results can either be viewed with the naked eye or by magnification by microscope (not included with the Pencil Tester).

A rating can be defined for pass/fail criteria whereby a pencil grade is selected that does not deface the surface to a grade that will.

Instructions for use

The test methods describe how the relative hardness of a coating is to be determined. This is achieved using a set of pencils of known hardness.

The test surface needs to be correctly prepared and smooth. (Please refer to the relevant test standard.) The test should be performed at 23°C ± 2°C with a relative humidity of 50 ± 5% (ECCA T4) or 25°C ± 2°C (ASTM D3363).

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1. Select a mid range pencil e.g. 2H.
2. For wood pencils, remove approximately 3/16 to 1/4 in. (5 to 6 mm) of wood from the point of each pencil using a draftsman-type mechanical sharpener, being careful to leave an undisturbed, unmarked, smooth cylinder of lead. Holding the pencil holder (when using drawing leads) at an angle of 90° to the abrasive paper, rub the lead against the paper maintaining an exact angle of 90° to the abrasive paper until a flat, smooth and circular cross section is obtained, free of chips or nicks in the edge of the cross section.
3. Stand the SH720N onto its end face and insert the pencil until its point touches the flat surface. Tighten the pencil clamping screw.
4. Place the SH720N on the test surface and push it forward by approximately 1/4 -1/2" (6-12 mm). Be sure to hold the gauge by the indentations on the wheels.
5. Rotate the pencil through 90° and move the gauge 1/2" (12 mm} to one side of the first test. Repeat step 4.
6. Repeat step 5.
7. Examine the coating for indentation and scratching. If there is none, repeat the test using a harder pencil e.g. 3H. If the surface is scratched or indented repeat with softer pencil e.g. H.
8. Repeat step 7 until a pair of pencils is found, one of which scratches / indents the coating, the other does not.

PLEASE NOTE: This method is only applicable to smooth surfaces and coatings.

Standards

ASTM: D 3363-05
ECCA: T4
BS EN: 13523-4
ISO: 15184
JIS: K5600-5-4

Standard supply includes:

Pencil Hardness Tester Block
Set of 20 pencils (9B to 9H)
Pencil sharpener
Abrasive paper (400 grit)
Operating manual
Carrying case

Ordering information

Product Ref	Description
SH720N	Pencil Hardness Tester (supplied with pencils, sharpener, 400 grit paper, case)
	Accessories
SH721	Replacement Pencil Set (20 grades 9B to 9H)

Owing to continuous development, we reserve the right to introduce improvements and modify specifications without prior notice.

Our sales team can be contacted on:
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