

Introduction

Adhesion

In order to perform satisfactorily, coatings must adhere to the substrates on which they are applied. In practice, three different test procedures are used to assess the resistance of paints and coatings to separation from substrates:

Cross-Cut Test

This test method specifies a procedure for assessing the resistance of paints and coatings to separation from substrates when a right-angle lattice pattern is cut into the coating, penetrating through to the substrate.

The method may be used for a quick pass/fail test. When applied to a multi-coat system, assessment of the resistance to separation of individual layers of the coating from each other may be made.

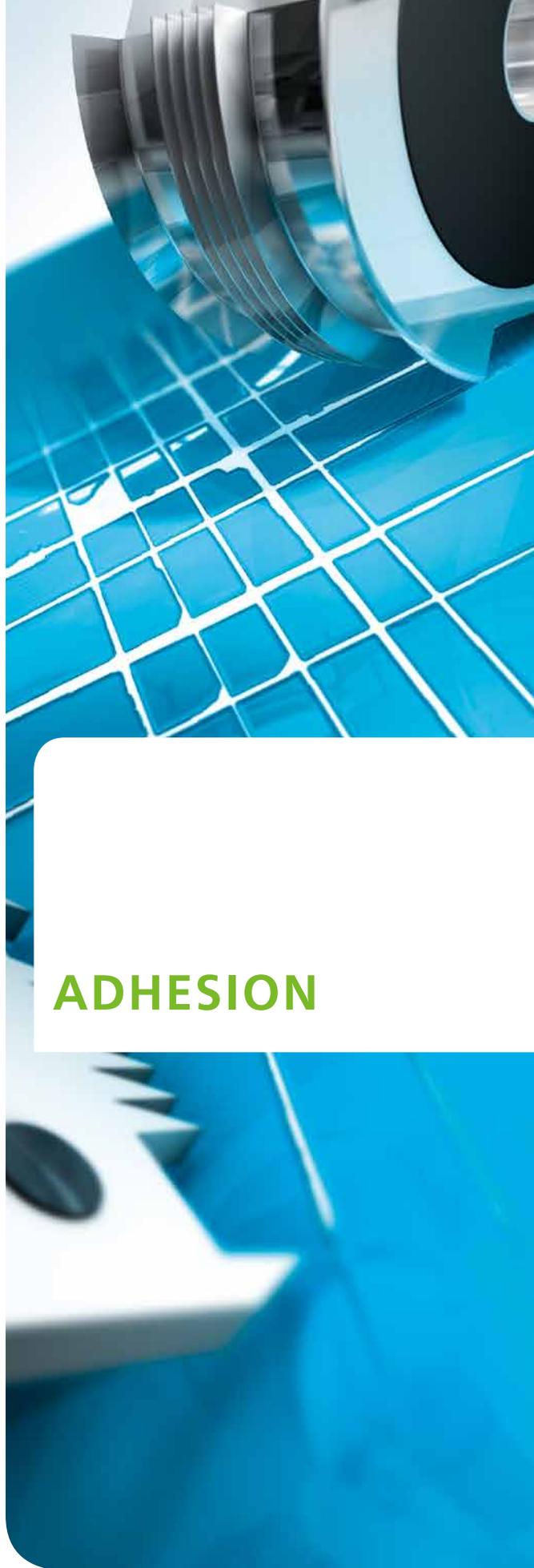
Scrape Adhesion

This test method covers the determination of the adhesion of organic coatings such as paint, varnish, and lacquer when applied to smooth, flat (planar) panel surfaces. It has been found useful in providing relative ratings for a series of coated panels exhibiting significant differences in adhesion.

The materials under test are applied at uniform thickness to flat panels, usually sheet metal of uniform surface texture. After drying, the adhesion is determined by pushing the panels beneath a rounded stylus or loop that is loaded with increasing amounts of weight until the coating is removed from the substrate surface.

Pull-Off Test

Adhesion of a single coating or a multi-coat system of paint, varnish or related products is assessed by measuring the minimum tensile stress necessary to detach or rupture the coating in a direction perpendicular to the substrate. This method maximizes tensile stress as compared to the shear stress applied by other methods such as scratch adhesion and results may not be comparable. The test is performed by securing a loading fixture (dolly) perpendicular to the surface of the coating with an adhesive. After the adhesive is cured, a testing apparatus is attached to the loading fixture and aligned to apply tension perpendicular to the test surface. The force applied is gradually increased and monitored until either a plug of coating material is detached, or a specified value is reached.



ADHESION

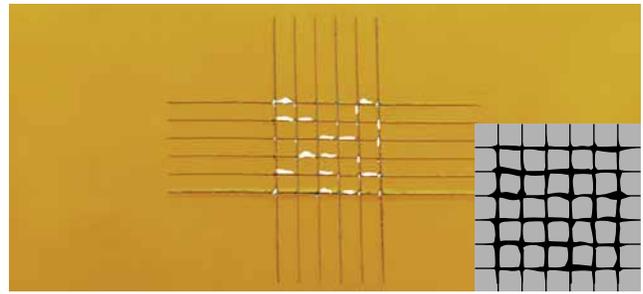
The cross-cut test is a simple and easily practicable method for evaluating the adhesion of single- or multi-coat systems.

Procedure

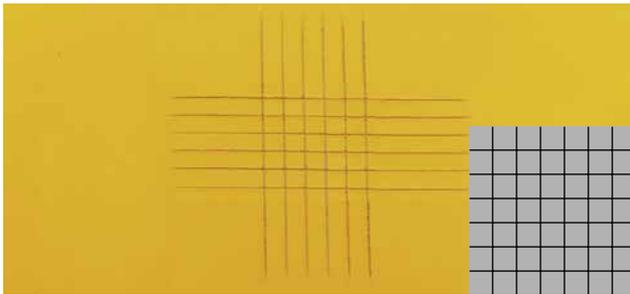
- Make a lattice pattern in the film with the appropriate tool, cutting to the substrate
- Brush in diagonal direction 5 times each, using a brush pen or tape over the cut and remove with Permacel tape
- Examine the grid area using an illuminated magnifier

Cross-Cut Results

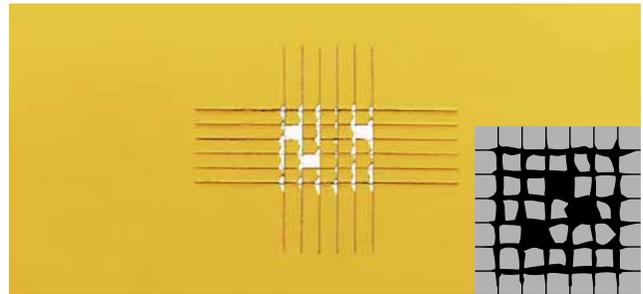
Adhesion is rated in accordance with the scale below.



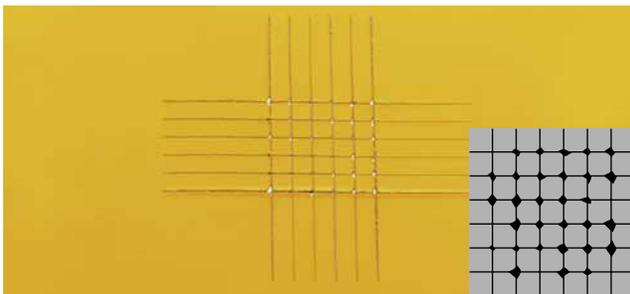
- ISO Class.: 2 / ASTM Class.: 3 B
The coating has flaked along the edges and/or at the intersections of the cuts. A cross-cut area significantly greater than 5 %, but not significantly greater than 15 %, is affected.



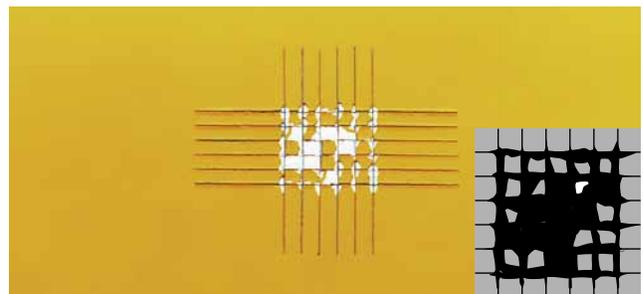
- ISO Class.: 0 / ASTM Class.: 5 B
The edges of the cuts are completely smooth; none of the squares of the lattice is detached.



- ISO Class.: 3 / ASTM Class.: 2 B
The coating has flaked along the edges of the cuts partly or wholly in large ribbons, and/or it has flaked partly or wholly on different parts of the squares. A cross-cut area significantly greater than 15 %, but not significantly greater than 35 %, is affected.



- ISO Class.: 1 / ASTM Class.: 4 B
Detachment of small flakes of the coating at the intersections of the cuts. A cross-cut area not significantly greater than 5 % is affected.



- ISO Class.: 4 / ASTM Class.: 1 B
The coating has flaked along the edges of the cuts in large ribbons and/or some squares have detached partly or wholly. A cross-cut area significantly greater than 35 %, but not significantly greater than 65 %, is affected.
- ISO Class.: 5 / ASTM Class.: 0 B
Any degree of flaking that cannot even be classified by classification 4.

Standard

ASTM	D 3002	D 3359
ISO		2409