

THICKNESS MEASUREMENT OF PAINT FILMS

Application

This procedure details recommended practices and equipment for measurement of thickness of paint films on metallic substrates.

Apparatus Required

Permascope or Leptoscope, or equivalent

Note: If other measuring principles are applied these must be indicated in the test report and if required coordinated with Product Engineering.

Measurement Principle

Two (2) types of instruments can be used depending on whether the substrate is magnetic iron or steel, or non-magnetic metals.

The instrument consists of a gauge head connected to an indicating unit. A magnetic flux is produced when the probe tips are placed in contact with a paint film over a ferritic substrate. The paint film acts as an air gap in the magnetic circuit. The magnetic impedance of the gauge head varies as a function of the air gap length, i.e. the thickness of the paint film, and thickness is read directly on the scale of the recording instrument.

When the substrate is a non-magnetic metallic, an Eddy current system is utilized. A high frequency magnetic field is created in the probe's measuring system and Eddy currents are generated when the probe is placed onto the non-magnetic substrate. Magnitude of the Eddy current depends on distance between metal and probe, shape and electrical conductivity of specimen.

The gauge must be standardized against base materials of the same composition, geometry, heat treatment and surface treatment (such as phosphating or galvanizing) for maximum accuracy.

Note:

The following factors may have an influence on the results:

1. Surface roughness and waviness of the surface.

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2. Magnetic conditions of the substrate material.
3. Thickness of the substrate material.
4. Hardness of the coating and pressure applied to gauge head during test. (A constant pressure probe should be used where feasible.)
5. Curvature of the surface (measurement should be taken parallel to the curvature axis).
6. Distance from the measuring point to an edge of the material under test. Edge effects should be avoided.
7. Deviation of the magnetic probe axis from a perpendicular to the area to be measured. (The probe should be normal to the measured surface.)
8. Area of test piece, minimum 30 mm x 30 mm.
9. Some standards from instrument manufacturers are only of nominal film thickness. (see Note on Page 3)

Calibration

Thickness standards are furnished with the instrument and are used to calibrate the gauge as follows:

1. Warm up the instrument for 20 minutes before use.
2. Select the proper scale range for the estimated coating thickness.
3. Calibrate the instrument as prescribed in the manufacturer's manual.
4. For test panels and bodies the calibration must be performed on steel body skin panels ground to a surface finish of 0.9 - 1.8 micrometers, unless otherwise specified.

Calibrations in cases when either an uncoated specimen is not available or the magnetic properties of the coated and uncoated specimens are different:

1. Select proper scale range (first reading).
2. Place gauge head on coating (second readings).
3. Insert suitable thickness standard between coating and gauge head.
4. If the second reading on the instrument is not equal to the original reading plus the thickness of the standard, the calibrating control should be adjusted until the instrument indicates the expected value of coating thickness plus standard.