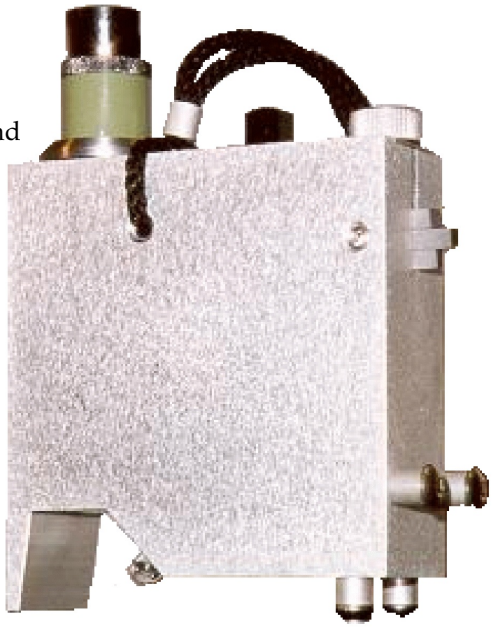
Micro-Metrics Company
OG202 Tooke Paint Inspection Gauge
(with old-style microscope)
Technical Data Sheet



Description and Uses

The Tooke Paint Inspection Gauge is a precision tool for inspection and thickness measurement (in accordance with ASTM D4138) of single or multiple coats on any substrate, and for microscopic observation and measurement of substrate and film defects.

Direct measurement of total coating thickness and thickness of individual coats of paint is a unique capability of the Tooke Paint Inspection Gauge. Thus, it often serves as a "referee" instrument to calibrate indirect or non-destructive thickness-measuring instruments. Other uses include assessment of substrate conditions and coating adhesion, and observation of microscopic cracking, tendency for brittleness, cratering, or other microscopic film symptoms. Surface contamination and wettability can be effectively visualized with the illuminated microscope.

The Tooke Gauge also has been used to assess sandblast cleaning work; to measure plating and paint thickness on ceramics, metal, wood, and concrete; and even to measure protective backing thickness on mirrors. It is virtually the only tool for measuring paint on plastics.

The Tooke Paint Inspection Gauge has a special cutting tool (tungsten-carbide cutting tip) used to incise a small precision V-groove through the paint film and into the substrate. This V-groove is observed vertically with an illuminated microscope bearing a measuring reticle (scale).

Construction

The Gauge body is a one-piece aluminum casting. It contains the microscope and lamp batteries and the groove-cutting tungsten-carbide cutting tips mounted on the narrow side. Two adjustable threaded guide studs project from the body on the same side as the cutting tips. The tripod thus formed by the three legs (guide studs and cutting tip) provides precise alignment of the tool with the surface to be grooved. A lanyard with keeper looped through the body secures the instrument to the inspector's wrist. The entire unit is designed for convenience and completeness in field inspection tasks.

Shipping Unit

The OG202 Tooke Paint Inspection Gauge II (Metal) comes complete with illuminated microscope, three cutting tips, hex wrench, felt tip marker, extra batteries and lamp bulb, leatherette carrying case, and instructions.

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Tooke Gauge Geometry

As shown in Figure 1 right, the observed horizontal projection of the film in the groove wall is related to the film thickness by the equation:

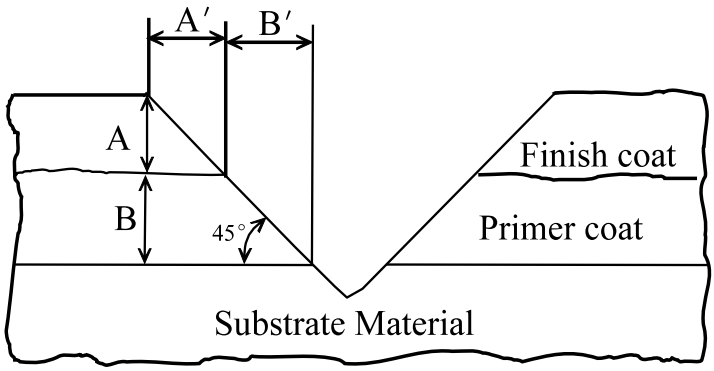
$$A = A' \tan\theta$$

At a 45-degree groove angle:

$$\tan\theta = 1$$

And:

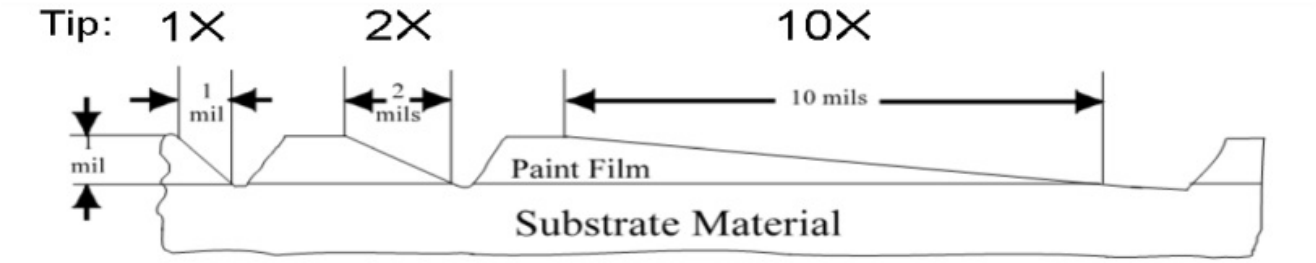
$$A = A'$$



(A – A′) Finish coat thickness
(B – B′) Primer coat thickness

Figure 1 Geometry of Thickness Measurement

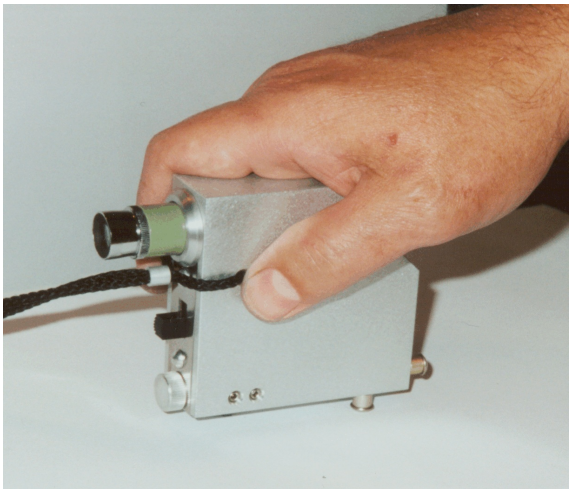
Similarly, other groove angles may be cut for convenience and precision-of-measurement of coating films over a wide range of thicknesses.



(A more-detailed explanation of Tooke Gauge geometry is available here: ww.micro-metrics.com/TDS-index.htm)

Measurement Procedure

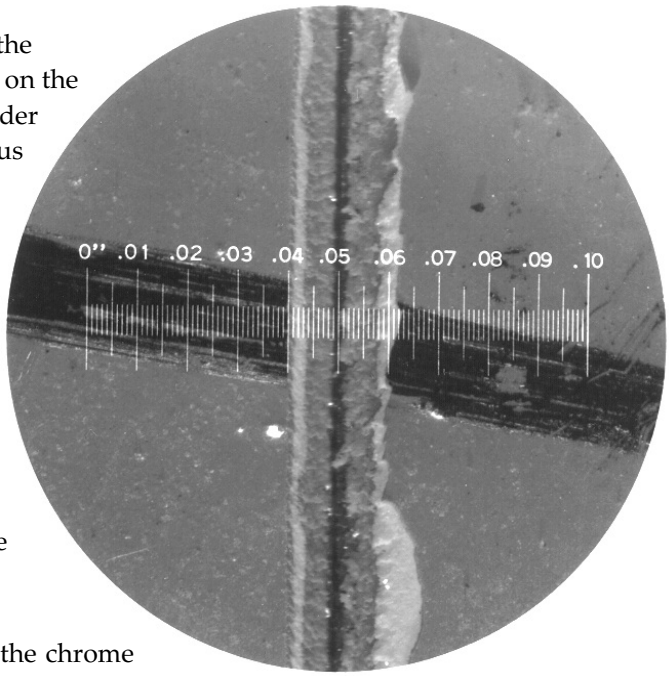
For field use, secure the safety lanyard to your wrist to prevent accidental dropping. Check the position of the cutting tips. As originally supplied, the cutting tip positions will be from top to bottom: 1×, 2× and 10×. The numerals 1, 2 and 10 are incised in the body alongside each tip respectively. The 2× tip (center position) should be in working position, protruding from the case so the body of the Gauge is parallel to the work surface and the cutting tip perpendicular to the work surface. In general, this is the correct configuration for making an initial measurement on a film. The 1× and 10× tips will be bottomed in the slot.



Make a small mark with the marking pen at the desired measurement location on a painted surface. Grasp the instrument with the cutting tip down as shown at left. Place the cutting tip and guide studs in firm contact with the surface with the tip slightly above the mark and aligned to scribe across the mark. Align your forearm with the intended cutting direction to ensure a straight cut. Draw the cutting tip straight across the mark, applying only sufficient pressure at the tip to cleanly penetrate through the film to the substrate. In this operation, the cutting tip trails midway between the two guide studs, and continuous 3-point surface contact should be maintained to ensure precise vertical alignment of the groove. Excessive pressure on the guide studs should be avoided.

Viewing the Groove

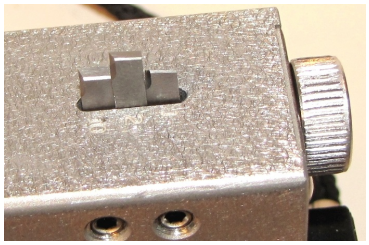
Turn on the microscope lamp with the slide switch on top of the Gauge next to the eyepiece. Center the foot of the microscope on the scribed line with the mark slightly inside the foot, directly under the microscope objective. Focus as needed by turning the focus screw in the body below the microscope.



With the microscope focused, view the intersection of the mark and the cut as shown at right. Note how the mark delineates the top edge of the cut. Position the microscope as required to align the left edge of the cut with any convenient long line of the reticle and begin counting the small gradation inwardly (to the right) until the next layer or the substrate is reached. This count, divided by the tip designation (1, 2, or 10) is the film thickness. If the result should be less than 2 mils or more than 10 mils, you may wish to use the 10× or 1× tips respectively.

Note: If the reticle seems out of focus, unscrew or tighten the chrome eyepiece of the microscope slightly, until the reticle sharpens.

Tip changes



To change the cutting tip, use the hex wrench provided in the case to loosen the cutting tip set screws. Allow the three tips to bottom in their slots, then pull the selected tip out so that the body of the Gauge will be parallel with the work surface when applied thereto and re-tighten all the tips with moderate finger pressure.

For convenience, always keep the tips in their designated locations: 1× in the top of the slot; 2× in the middle; and 10× in the bottom. Note also that the narrow face of the tip bears an angular (relief) grind (the "cut-out") that should face toward the guide studs.

Cutting tip designations and appropriate film thickness ranges

Cutting tip Designation	Maximum coating thickness in mils	Precision of thickness determinations in mils	1 division on reticle represents in mils
1×	100	± 0.25	1.0
2×	20	± 0.13	0.5
10×	3	± 0.025	0.1

Suggestions to users

- On wood or other directional material, make incisions in the grain or "machine" direction to avoid ragged cuts.
- Soft or elastic materials can sometimes be cooled or frozen with ice or dry ice to obtain good cutting characteristics.
- Dyes or indicator solutions such as phenolpthalein are sometimes helpful to develop appearance contrast between metals (iron-galvanizing) or paint coats.
- Liquid erase, such as White-Out® may be useful as a benchmarker on dark surfaces.
- With some coatings, improved cuts can be achieved by wetting the surface, or by speeding or slowing the cutting rate.
- Coatings with poor adhesion will exhibit a ragged line at the substrate interface. In these cases, read the thickness from the left incision edge in the SUBSTRATE. (See reference: "Coatings Adherence Measurement by an Angular Scribe-Stripping Technique.")

Specifications

Material:	Cast aluminum body	Power:	Two 1.5V AA dry cells
Overall dimensions:	4.5" x 3.5" by 1" (11.4 cm x 8.9 cm x 2.5 cm)	Lamp:	Penlight bulb: #222GE
Microscope:	50-power, 45-degree, illuminated	Cutting tips:	Tungsten-carbide

Calibration

Original factory calibration is accomplished by setting the cutting tips in precise geometric alignment with the guide studs. Checks are also made with precision-applied film standards. For highest precision work, the user is advised to maintain painted panels of known thickness, and to check and calibrate the instrument measurements periodically.

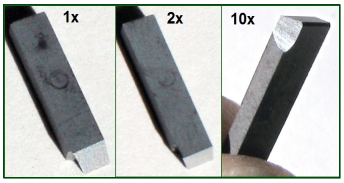
References

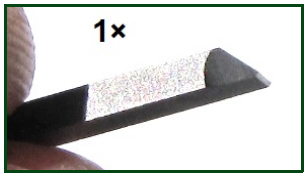
- "A Paint Inspection Gage," by Raymond Tooke, Jr. *Official Digest*, July 1963, 35, pp 691–698.
- "Coatings Adherence Measurement by an Angular Scribe-Stripping Technique," W.R. Tooke and J. Montalvo, *Journal of Paint Technology*, January 1968, 38, pp 18–28.
- "Development of Specifications for Measurement of Paint Thickness on Structural Steel," J.D. Keene and T.L. Shoemaker, *Journal of Paint Technology*, 45, No. 585, October 1973, pp. 46–47.
- "How Instruments Boost Coatings Application Productivity," W.R. Tooke, Jr., *Professional Decorating and Coating Action*, October 1976, pp 16–18.
- "Standard Method of Measurement of Dry Film Thickness of Protective Coatings Systems by Destructive Means," Designation: D4138-82, *1988 Annual Book of ASTM Standards*, pp. 695–697.
- "Method and Device for Measuring the Thickness of Films," W.R. Tooke, U.S. Patent No. 3,340,615.

Optional accessories

Replacement tungsten-carbide cutting tips:

Available in 1× (45°), 2× (26.6°), 5× (10.2°), and 10× (5.7°) configurations. (5× cutting tip not shown.)

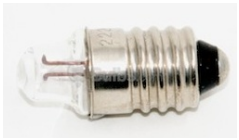




Plastic (polypropylene) carrying case:

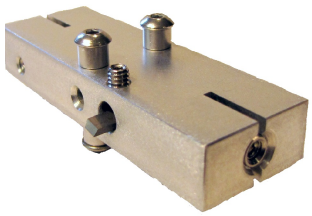
This new case come with a spare marker, wrench, batteries and LED bulb. (Shown, left, with new-style OG202.)

LED replacement bulb



CTH01 (single) and CTH02 (double):

Cutting Tip Holders allows easy use of one (or two) cutting tip(s) without having to manipulate the Tooke Gauge to make the incision and then manipulate it again to view the incision through the microscope.



MG402 Microgroover:

The Microgroover is a major accessory tool for creating coating incisions for film thickness measurements with the Tooke Paint Inspection Gauge. This tool greatly extends the range of the measuring technique to include almost any coating on any substrate. The Microgroover is especially effective on hard and brittle (concrete) materials, as well as soft or elastomeric (rubber) substances. In addition, fibrous composites are incised easily and cleanly. This device eliminates the deformations of coating and substrate that may occur when conventional gage cutting tips are used.

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