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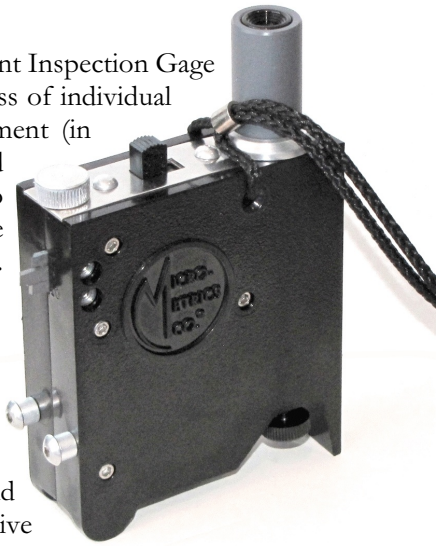
Micro-Metrics Company
OG204 Tooke Paint Inspection Gage
Technical Data Sheet

Description and Uses



Designed especially for use in the field as well as in the lab and 'on the line,' the Tooke Paint Inspection Gage has a unique capability of direct measurement of total coating thickness and the thickness of individual coats of paint. This precision tool is designed for inspection and thickness measurement (in accordance with ASTM D4138) of single or multiple coats on any substrate, and microscopic observation and measurement of substrate and film defects. In addition to routine use, it often serves as a "referee" instrument to calibrate indirect or non-destructive thickness measuring instruments. It is virtually the only tool for measuring paint on plastics.

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 Gage 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.

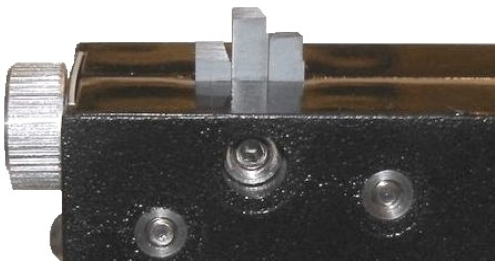
One of three included cutting tools (tungsten-carbide cutting tips) is used to incise a small precision V-groove through the paint film and into the substrate. This V-groove is observed vertically with an illuminated microscope bearing a measuring reticle.

Specifications

Material:	Polycarbonate plastic body
Gauge dimensions:	4.5" x 3.5" by 1" (11.4cm x 8.9cm x 2.5cm)
Microscope:	50-power, 45-degree, illuminated
Power:	Two 1.5V AA dry cells
Lamp:	LED #222 bulb, plus a spare
Cutting tips:	Tungsten-carbide 0.62" x 0.125" x 0.625" (1.6cm x 0.3cm x 1.6cm)
Shipping weight:	1.3 pounds (0.6 kg)

Construction

The gauge body is polycarbonate plastic . It contains a 50× microscope, 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 incised. A lanyard with keeper secures the instrument to the inspector's wrist to prevent accidental dropping. The entire unit is designed for convenience and completeness in field inspection tasks.



Micro-Metrics Company
4450 Ansley Lane
CUMMING, GA 30040-5252
www.micro-metrics.com

Tooke Gage Geometry

Measurements made using the Tooke Gage are a function of the cutting tip geometry (and not of the microscope). A detailed explanation of Tooke Gage geometry is posted here: www.micro-metrics.com/TDS-index.htm

Calibration

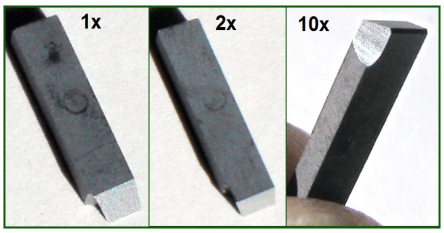
Original factory calibration is accomplished by setting the cutting tips in precise geometric alignment with the guide studs. Checks are also made with precision-applied film standards. For highest precision work, the user is advised to maintain painted panels of known thickness, and to check and calibrate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

Shipping Unit

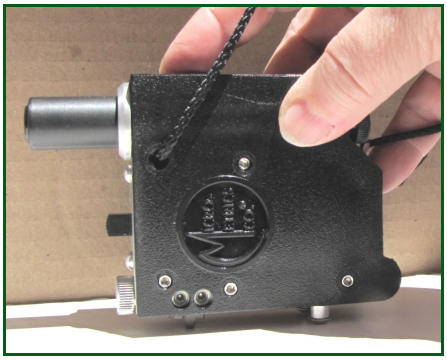
The OG204 Tooke Paint Inspection Gage (plastic) comes complete with an illuminated microscope, three cutting tips (1×, 2×, and 10×), hex wrench, black marking pen, spare batteries, and spare LED lamp bulb, in a plastic (polypropylene) carrying case, with instructions.

Measurement Procedure

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 chosen tip should be in working position, protruding above the other tips 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 cor-rect configuration for making an initial measurement on a film. The other tips will be bottomed in the tip-slot. (The narrow face of the tip bears an angular grind (the "cut-out") that should be oriented toward the guide studs.)



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. 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. Avoid excessive pressure on the guide studs.



Tip changes

To change the cutting tip, use the provided hex wrench to loosen the cutting tip set screw. 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

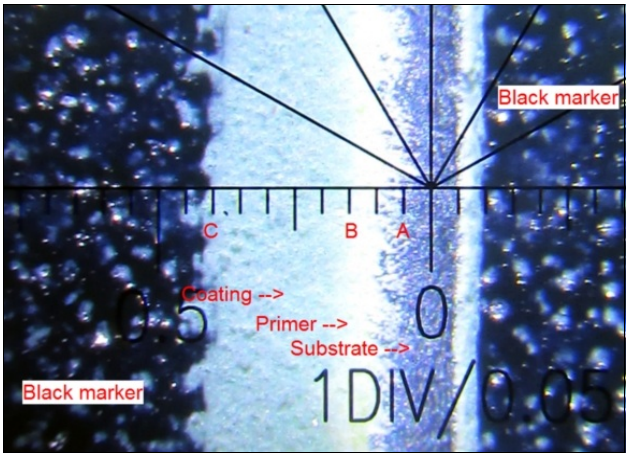
Suggestions to users

- 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. With some coatings, improved cuts can be achieved by wetting the surface, or by speeding or slowing the cutting rate.
- 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.
- 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.")

Viewing the Groove

Turn on the microscope lamp with the slide switch on top of the gage 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. If needed, turn the focus screw in the body below the microscope to focus.

With the microscope focused, view the intersection of the mark and the cut as shown at right. Position the microscope as required to align the edge of the cut with any convenient long line of the reticle and begin counting the small gradation until the next layer or the substrate is reached. If the result should be less than 2 mils or more than 20 mils, you may wish to use the 10× or 1× tips respectively.



Line "A" mark s the edge between substrate and primer.
Line "B" is the line between primer and top-coat.
Line "C" is the top of the coating, made easier to see by using the black marker.

(Using a "universal" scope, the thickness measured for each tip equals:)

Coating	0.05mm /hashmark space	1× tip	2× tip	10× tip
White primer	2 hashmark spaces	100 µm	50 µm	10 µm
Blue topcoat	5 hashmark spaces	250 µm	125 µm	25 µm

The "universal microscope" reticle accommodates measurement in mils, microns, and millimeters.

(Universal scope; per smallest hashmark)

	1X		2X		10X		
Mils*	2	(1.97)	1	(0.984)	0.2	(0.197)	Mils
Microns**	50	(50.0)	25	(25.0)	5	(5.0)	Microns
Millimeters	0.05	(0.050)	0.025	(0.025)	0.005	(0.005)	Millimeters

*1.0 mil = 1 "thou" = 0.001" = one thousandth of an inch **micron = micrometer = µm

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 Practices of Measurement of Dry Film Thickness of Protective Coatings Systems by Destructive, Cross-Sectioning Means," Designation: D4138-07a, approved July 1, 2007.
- "Method and Device for Measuring the Thickness of Films," W.R. Tooke, U.S. Patent No. 3,340,615.

Optional accessory: MG402 Microgroover

The Microgroover is a major accessory tool for creating coating incisions for film thickness measurements with the Tooke Paint Inspection Gage. 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) sub-stances. In addition, fibrous composites are incised easily and cleanly.

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