



UNIVERSAL  
PHOTONICS  
INCORPORATED

Scratch and dig standards are set by the US Government to describe the polishing quality of optical surfaces. There are standard reference samples of each grade for a visible comparison. (These can be purchased clear or with mirrored surfaces.) This parameter measures the allowable defects in a coating or on the surface of an optical element, and it is specified as a numerical value. For example, a specification may read "Scratch/Dig = 80/60", explained as follows:

## SCRATCH

SCRATCH#	MAX. WIDTH
80	0.08 mm (0.0031 inch)
60	0.06 mm (0.0024 inch)
40	0.04 mm (0.0016 inch)
20	0.02 mm (0.0008 inch)
10	0.01 mm (0.0004 inch)
5	0.005 mm (0.0002 inch)

Scratch numbers are the apparent widths of hairline scratches allowed in units of 0.001mm. A scratch number of 80 is really 0.08mm wide. Additionally, the combined length of maximum-size scratches on the surface of the lens in question cannot exceed ¼ the diameter of the usable lens area. This is according to the formula:

$$\text{Max. Combined Length of Scratches} \leq \sum \left( \text{Scratch \#} \times \frac{\text{Scratch Length}}{\text{Diameter of Aperture}} \right)$$

When there is no maximum size scratch on the lens surface, the following formula applies:

$$\text{Max. Combined Length of Scratches} \leq \frac{1}{2} \left[ \sum \left( \text{Scratch \#} \times \frac{\text{Scratch Length}}{\text{Diameter of Aperture}} \right) \right]$$

## DIG

DIG#	MAX. DIAMETER
50	0.50 mm (0.020 inch)
40	0.40 mm (0.016 inch)
30	0.30 mm (0.012 inch)
20	0.20 mm (0.008 inch)
10	0.10 mm (0.004 inch)
5	0.05 mm (0.002 inch)

Digs represent the apparent diameters of allowable defects such as bubbles, pinholes and inclusions on the surface of lens or coating. Digs are specified in units of 0.01mm, so a dig value of 60 is actually 0.6mm diameter allowable inclusion. The allowable number of maximum size digs within the useful area of the lens is one, and the sum of the diameters of all digs cannot exceed twice the diameter of the minimum size dig number specified.