



Specification for Apochromatic Lenses

1. Optical image quality

For systems of diameter up to 152mm

Wave front error RMS is no more than 0.035 of wave-length at 532 nm. Wave front error p.t.v. is no more than 0.24 of wavelength at 532 nm.

For systems of more than 152mm up to 254mm diameter

Wave front error RMS is no more than 0.033 of wave-length at 532 nm. Wave front error p.t.v. is no more than 0.166 of wave-length at 532 nm.

2. Dimensional parameters

Dimensions are to be clarified and coordinated finally on the stage of design documentation preparation.

3. Optical component surface finish

For systems of up to 105mm in diameter - IV class according to 11141-84.

For systems of more than 105mm up to 152mm in diameter - V class according to 11141-84.

Dimensions of scratches and points shall not exceed the following values:

Surface finish class Scratches Points Accumulation of defects Width, not more, mm Total length, not more, mm Diameter no more, mm Quantity, no more Diameter

Surface finish class	Scratches		Points		Accumulation of defects	
	Width, not more, mm	Total length, mm, not more	? no more, mm	Quantity, no more	? of a limited area, mm	Total area of scratches and points, not more, square mm
IV	0.02	2 clear apertures	0.3	0.5 clear aperture	5	0.1
V	0.04		0.5		10	0.4

The total scratch length and the point quantity that are close on width and diameter.

Surface finish class	Scratches		Points	
	Width, mm	Total length, mm, not more	?, mm	Quantity, no more
IV	0.01 to 0.02 inclusively	1 clear aperture	0.10 to 0.30 inclusively	0.2 clear aperture
V	0.02 to 0.04 inclusively		0.30 to 0.50 inclusively	

Scratches and points with the following dimensions are disregarded:

Surface finish class	Scratch width, not more, mm	Scratch width, not more, mm
IV	0.004	0.01
V	0.006	0.02



For lenses of more than 152mm up to 254 mm in diameter the following surface finish requirement shall be ensured:

Scratches and points with the following dimensions are disregarded:

Scratch width, not more, mm	Point ? , not more, mm
0.008	0.04

Dimensions of scratches and points shall not exceed the following values:

Scratches		Points		Accumulation of defects	
Width, not more, mm	0.06	Width, not more, mm	Quantity, no more	? of a limited area, mm	Total area of scratches and points, no more, square mm
0.06	2 clear apertures	0.7	0.5 clear aperture	25	3

The total scratch length and the point quantity that are close on width and diameter to the maximum permissible shall not exceed the following values:

Scratches		Po nts	
Width, mm	Total length, mm, not more	Diameter, mm	Quantity, no more
0.04 to 0.06 inclusively	1 clear aperture	0.50 to 0.70 inclusively	0.2 clear aperture

Delivery of lenses with scratches exceeding the values above shall be allowed only with consent of the customer.

4. Anti-reflection coating requirements

With consent of the customer non-uniformity of coating interference coloration, which doesn't degrade characteristics of coating optical parameters and doesn't touch output characteristics of a lens, is permissible on anti-reflection surfaces of optical elements.

5. Bubbles and inclusions requirements

Permissible dimensions of bubbles and inclusions:

For systems of diameter up to 152mm

In lens material bubbles and inclusions of no more than 0.3mm in size are allowable , and a number of bubbles of diameter 0.03mm to 0.3mm in each lens shall not exceed 3 pieces.

For systems of more than 152mm up to 254mm diameter

Number of bubbles and inclusions of size up to 0.3mm - not more than 20 pieces. - up to 0.5mm - not more than 3 pieces.

Bubbles and inclusions in material exceeding the requirements above shall be coordinated on the stage of optical blanks selection for the manufacturing of each lens.