

**1.0 PURPOSE & SCOPE**

HR-97 is the designation for a 97% reflectance front surface mirror. This specification defines the quality and performance criteria for HR-97 Front Surface Mirror products on glass substrates.

**2.0 APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein:

- **MIL-M-13508C** Mirror, Front Surfaced Aluminized; for Optical Elements
- **MIL-STD-810E** Environmental Test Methods
- **MIL-C-48497A** Durability Requirements for Interference Coatings; Single or Multi-layer
- **OCLI 6600007H** Clear Float Glass Thickness 1.9mm - 10.0mm for Mirror and AR Coated product

**3.0 REQUIREMENTS**

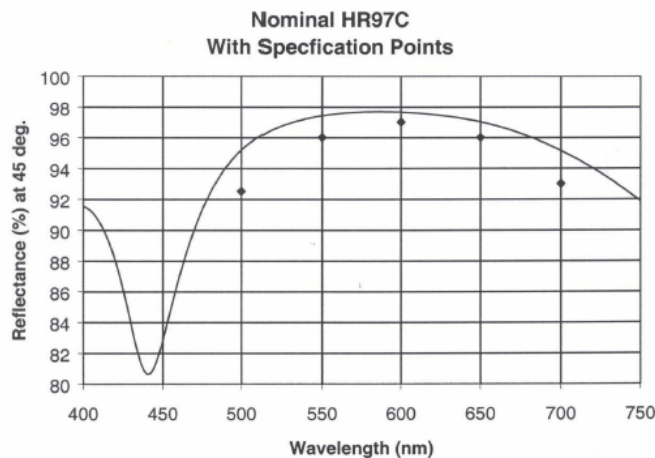
**3.1 Coating Performance**

HR-97 Front Surface Mirror for various applications meets the reflectance requirements as specified below:

**3.1.1**

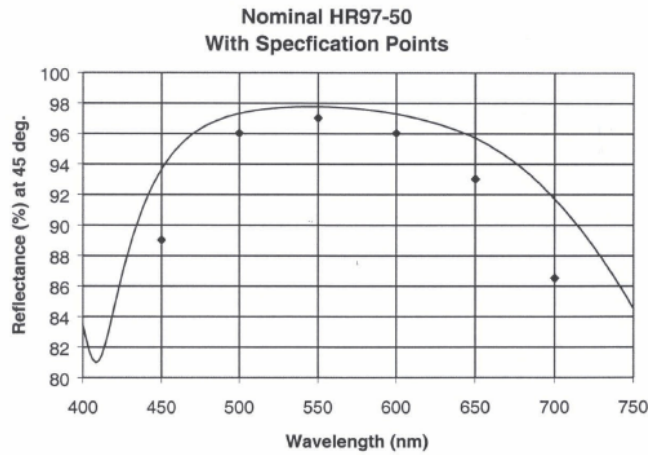
Spectral Reflectance HR97-C (S&P Avg)

Wavelength (nm)	Minimum Reflectance (45°)	Typical Reflectance (45°)
500	92.5%	95.0%
550	96.0%	97.5%
600	97.0%	97.5%
650	96.0%	96.5%
700	93.0%	94.5%



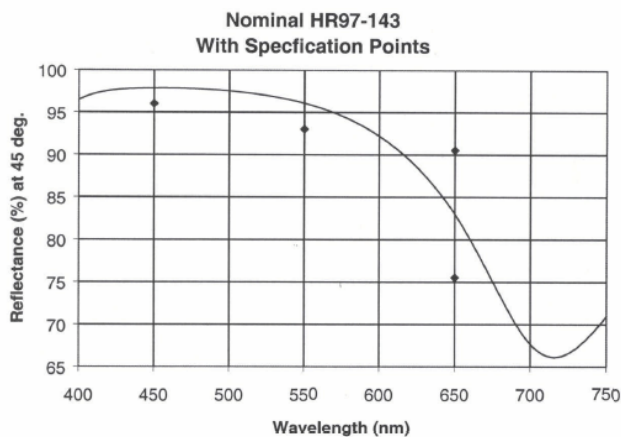
**3.1.2** Spectral Reflectance HR97-50 (S&P Avg)

Wavelength (nm)	Minimum Reflectance (45°)	Typical Reflectance (45°)
450	89.0%	94.0%
500	96.0%	97.0%
550	97.0%	98.0%
600	96.0%	97.0%
650	93.0%	96.0%
700	86.5%	92.0%



**3.1.3** Spectral Reflectance HR97-143 (S&P Avg)

Wavelength	Minimum Reflectance (45°)	Typical Reflectance (45°)
450	96.0%	98.0%
550	93.0%	96.0%
650	> 75.5% - <90.5%	82.0%





**3.2 Environmental Durability**

**3.2.1 Adhesion**

The coating shall show no damage after #M Scotch Brand 600 tape is pressed firmly against the coated surface and removed quickly by a snap of the wrist, according to MIL-C-48497A, para. 4.5.3.1.

**3.2.2 Abrasion Resistance**

The coating shall show no damage after 200 rub test with a cheese cloth pad. The bearing force shall be nominally one pound according to MIL-M-13508C, para. 4.4.5.

**3.2.3 Humidity Resistance**

The coating shall show no deterioration after exposure to a 24 hour humidity test according to MIL-C-48497A, para. 4.5.3.2.

**3.2.4 Corrosion Resistance (Salt Fog)**

The coating shall show no deterioration after 24 hour exposure to salt fog per MIL-STD-810C.

**3.3 Physical Specifications**

**3.3.1 Substrate Thickness** (Per OCLI Specification 6600007 for 0.075" – 3/8")

Nominal Thickness		Allowable Range	
Inches	mm	Inches	mm
3/8	10.0	0.374-0.401	9.50-10.19
1/4	6.0	0.228-0.244	5.79-6.20
3/16	5.0	0.189-0.197	4.80-5.00
1/8	3.0	0.115-0.122	2.92-3.10
3/32	2.3	0.085-0.101	2.16-2.57
0.060	1.5	0.050-0.070	1.27-1.78
0.048	1.2	0.041-0.052	1.12-1.32

**3.3.2 Stock Sheet Dimension**

Thickness	Dimension	Usable Area
3/32" - 3/8" (2.3 - 10mm)	32x50" (812x1270mm)	30"x48" (765x1220mm)
0.060" (1/6mm)	16"x25" (406x634mm)	15"x23" (381x584)
0.048" (1.2mm)	16"x25" (406x634mm)	15"x23" (381x584)

**3.3.3 Cut Parts**

When parts are cut from stock sheets from OCLI a standard manufacturing dimensional tolerance of  $\pm 0.030''$  ( $\pm 0.80\text{mm}$ ) is to be allowed. Special tolerance or seaming requirements will be quoted upon request.

**3.3.4 Flatness**

Flatness of the glass substrate, on which the mirror coating is deposited, is standard commercial grade soda lime glass. Applications where flatness is more critical will be quoted upon request.,

**3.3.5 Chips & Fractures**

Chips and fracture specifications for cut parts are as follows:

<b>Size</b>	<b>Specification</b>
0.090" (2.3mm)	None Allowed
0.010" - 0.090" (0.25mm - 2.3mm)	Cumulative Length $\leq 10\%$ of the perimeter part
<0.010"	Disregard

Undetermined fractures are not allowed on cut parts or stock sheets.

For stock sheets, no chips or fractures are allowed which infringe on the useable area specified in paragraph 3.3.2.

**3.4 Surface Quality**

**3.4.1** At least 90% of each mirror stock sheet shall meet the surface quality requirements of his specification. To determine conformance to specification, stock sheets are divided into 5" x 6" sectors on 32" x 50" sheets and 2" x 2" sectors on 16" x 25" sheets. Each sector is evaluated per the criteria outlined in paragraphs 3.4.2 through 3.4.5 below. If at least 90% of the sectors meet the requirements of the specification, the stock sheet is acceptable. Other stock sheet sizes will have similar acceptance criteria.

**3.4.2 Scratches**

Scratch specifications for cut parts are as follows:

<b>Width</b>	<b>Accumulated Length</b>
>0.003" (0.08mm)	None Allowed
0.001" - 0.003" (0.02 - 08mm)	Less than 1/4 mean of diameter of cut part
<0.001" (0.02mm)	Disregard



**3.4.3 Circular Defects**

Typical defects of this type are voids, digs, and spatter.

<b>Width</b>	<b>Accumulated Length</b>
>0.020" (0.5mm)	None Allowed
0.002" - 0.020" (0.05mm - 0.5mm)	The summed diameters shall be $\leq$ 0.080" (2.0mm) In any 0.75" (19mm) circle
<0.002"	Disregard

**3.4.4 Stains**

No stains allowed which are readily visible to the unaided eye when viewed under OCLI in-line inspection viewing conditions as described in 3.4.5.

**3.4.5 Viewing Conditions**

View at 30-60cm (12-24") with overhead lighting to observe the front surface at 100 foot-candles of fluorescent illumination (daylight conditions). Observe pinholes with bottom lighting of 100-foot candles of diffused fluorescent illumination. The ambient lighting is 30-50 foot candles. The total observation time is 30 to 35 seconds. The viewing angle can range from 0-75 degrees.

**4.0 PREPARATION FOR DELIVERY**

**4.1 Shipping Requirements**

**4.1.1 Packaging**

Coated parts shall be packaged in a manner to ensure adequate protection against damage during shipment. Standard packaging includes protective tape on the coated surface.

**4.1.2 Documentations**

Each shipping crate shall be marked on two sides with the following information:

**Customer's Name**  
**Purchase Order Number**  
**Glass Type & Thickness**  
**Size & Quantity of Glass Sheets**  
**Crate Number** \_\_\_\_\_  
**MADE IN USA**



#### 4.1.4 Typical Weights

Typical weights of a square foot of glass for each standard thickness category are given below as an aid in determining shipping weights.

Nominal Thickness (Inches)	Typical Weight Per Sq. Ft. (Pounds)	Typical Weight Per Sq. Meter (Kg)
3/8	5.0	24.4
1/4	3.3	16.1
3/16	2.5	12.2
1/8	1.6	7.8
3/32	1.2	5.9
.060	0.80	3.9
.048	0.64	3.1