

# SPECIFICATION

## PHOTOPIC HEA® - FLAT DISPLAYS

6102009

PROPRIETARY      YES      NO  
                                      

REV	DATE	DESCRIPTION	WRITTEN BY
Original	3/19/86	Issued	Tom Jones, Thad Ball
A	8/9/89	Complete rewrite. Title change.	Bob McLean, Tim Engel
B	11/12/99	Include stock sheet yield and misc. other updates	Tom Jones

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This document shall be reviewed within 1 year of the latest release date by the releasing authority.

AUTHORIZED FOR RELEASE BY: <i>Michael X Beard</i>	RELEASE DATE: 10-21-99
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**1.0 SCOPE**

This specification defines the product requirements for the multilayer HEA® (High Efficiency Antireflection) coating for flat displays.

**2.0 APPLICABLE DOCUMENTS**

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

MIL-C-675C	Coating of Glass Optical Elements (Antireflection)
MIL-C-14806A	Coating, Reflection Reducing for Instrument Cover Glasses and Lighting Wedges.
MIL-STD-105D	Sampling Procedures and Tables for Inspection by Attributes
ASTM C1036-85	Standard Specification for FLAT GLASS

**3.0 GLASS**

This coating is available on a variety of glass sheet sizes and thicknesses or can be purchased to specific sizes. Maximum sheet size is 32" x 50".

**4.0 SPECTRAL PERFORMANCE****4.1 Reflectance**

The brightness (reflected luminance) of the HEA® coated surface when measured at 10 degrees angle of incidence shall be no greater than 0.2%.

Brightness is a term used for the value of average reflectance weighted by the human eye response and is a measure of the level of sensation a person perceives as a result of reflection of light from an object.

Brightness is calculated as follows:

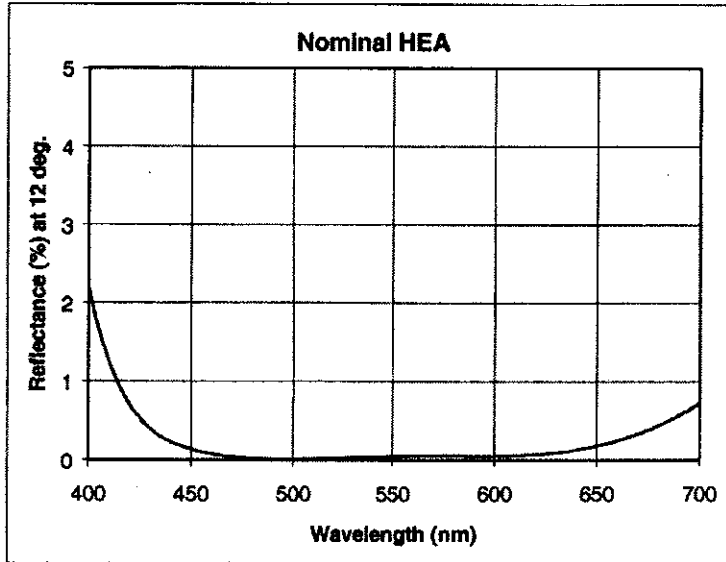
$$\text{Brightness} = \frac{\Sigma (S(\lambda) V(\lambda) R(\lambda))}{\Sigma (S(\lambda) V(\lambda))}$$

where S is an equal energy light source, V is the Photopic eye response curve and R is reflectance of the coated surface.

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4.1.1 Typical Reflectance Performance (one side coated)

	450nm	550nm	650nm
Reflectance at 10 degrees	0.30%	0.15%	0.30%



4.2 Color

The reflected color of the HEA® coated surface when measured at 10 degree incidence shall fall within the following color limits:

See Attachment A

Point	u'	v'	CIE 1976 UCS Chromaticity Diagram
A	.258	.020	
B	.125	.344	
C	.210	.471	
D	.353	.441	
E	.466	.308	

Point	X	Y	CIE 1931 Chromaticity Diagram
A	.177	.006	
B	.155	.190	
C	.330	.330	
D	.450	.250	
E	.425	.125	

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5.0 COATING ENVIRONMENTAL AND DURABILITY REQUIREMENTS

5.1 Adhesion

The coating shall show no evidence of damage after "snap tape" test by which Scotch brand #610 cellulose tape is pressed firmly against the coated surface and removed quickly with a snap of the wrist as referenced in paragraph 4.5.12 of MIL-C-675C.

5.2 Abrasion Resistance

The coating shall be subjected to a 20 rub eraser abrasion resistance test and meet the requirements referenced in paragraph 4.5.10 of MIL-C-675C for sleeking at the area of abrasion.

5.3 Humidity Resistance

The coating shall be subjected to continuous exposure for 24 hours in an atmosphere of 120 degrees F.  $\pm$  4 degrees and 98%  $\pm$ 2% relative humidity without evidence of deterioration as referenced in paragraph 4.5.8 of MIL-C-675C.

5.4 Solubility (verified periodically)

The coating shall show no evidence of deterioration after being immersed for 24 hours in water containing six ounces of Sodium Chloride per gallon as referenced in paragraph 4.5.7 of MIL-C-675C.

5.5 Temperature Resistance (verified periodically)

The coating shall show no evidence of deterioration after being exposed to an ambient temperature of -65 degrees F. and +160 degrees F. for a period of four hours at each specified temperature as referenced in paragraph 3.11.3 of MIL-C-14806A.

6.0 WORKMANSHIP REQUIREMENTS

Unless otherwise specified on the purchase order the following workmanship standards will be used.

6.1 Inspection Conditions and Area: The parts will be inspected by transmission and reflection at a distance of approximately 18 inches against a flat black background using fluorescent lighting adjusted to 85  $\pm$ 20 foot-candles. Inspection time is to be no more than 30 seconds for 32" x 50" stock sheets and less for smaller parts.

6.1.1 Transmission Inspection: Inspect the parts in front of the flat black background at a normal angle and inspect the glass by transmission.

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6.1.2 Reflection Inspection: - Inspect the parts at approximately a 45 degree angle in front of the flat black background and use the overhead fluorescent lights to inspect by reflection.

6.2 Circular Defects (such as digs, pinholes or spot stains) (L + W)/ 2

> 0.024"	None Allowed
0.010" - 0.024"	3 Maximum per 4 " Circle Area, 6 per Panel
< 0.010"	Disregard

6.3 Linear Defects (such as scratches and lint marks) (Widest Area)

> 0.003"	None Allowed
0.0015" - 0.003"	Maximum Single Length 1.0" Maximum Accumulated Length 3.0"
< 0.0015"	Disregard

6.4 Stain (such as color shifts or surface irregularities)

The surface shall be free from distinct and objectionable color or stain. Heavy or distinct stains visible under transmission inspection are not allowed. Light stains visible only under reflection inspection conditions are acceptable. Stains that do not exceed the circular or linear defect criteria are allowed.

6.5 Edge Chips.

Intrusion of edge chips shall not be greater than 0.125". Depth of edge chips shall not be greater than half the glass thickness. Accumulated length shall not be greater than 0.5" over any 10" length and the maximum length of a single chip shall be less than 0.5".

6.6 Fractures (visible to the unaided eye)

None Allowed.

## 7.0 QUALITY ASSURANCE PROVISIONS

Each part is certified to meet the requirements of this specification.

## 8.0 STOCK SHEETS

8.1 The useable area of a 32" x 50" stock sheet is 48" x 28".

8.2 Individual stock sheets (32" x 50") will yield a minimum of 90% useable parts when cut into pieces 5" x 6". Other stock sheet sizes will have similar acceptance criteria for area yield.

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9.0 PREPARATION FOR DELIVERY

Finished parts shall be clean and packaged in a manner to ensure protection against breakage or damage during reasonable handling and transportation.

10.0 CUSTOMER CLEANING OF HEA® COATED SURFACES

HEA® coating is impervious to dust and dirt in normal environments. Dusting with a dry, soft, clean cloth is sufficient. Heavier contaminants may be removed with:

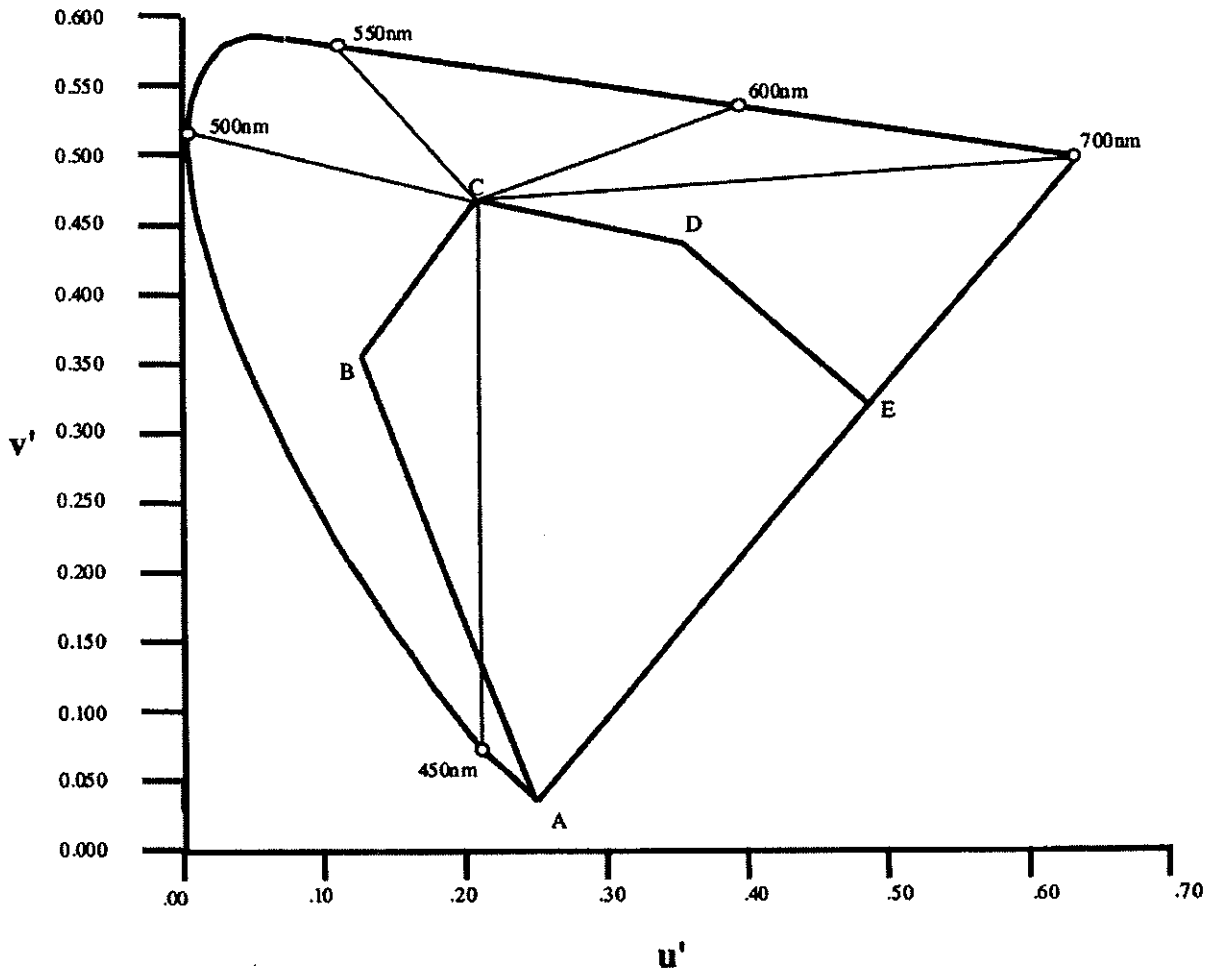
Detergent and water - Joy, Sparkle, Alconox, Liquinox  
Window cleaner - OCLI TFC, Windex, Glass X

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Attachment A

HEA Coated Product

**OCLI COLOR BOX**  
WITH  $u'$  AND  $v'$  COORDINATES



Color is calculated using an equal energy light source

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