

Non-Glare Polycarbonate Material Specification

November 2005

Material specification

General Information

- Clear non-glare coated polycarbonate for the protection and enhancement of electronics displays

Polycarbonate

- UV-stabilised polycarbonate with UL94 V-2 flammability and fulfils all the stated values in ASTM D 3935-94.

UV cured hard coating

- Highly transparent lacquer coating on the front surface of the polycarbonate sheet only.
- Matting agent is introduced to the lacquer to produce the non-glare finish.

Properties

General properties	Standard	Dimension	Result
Bulk density	ISO 1183	g/cm ³	1.2
Water absorption 24h, 23°C	ISO 62	Mg/kg	<8
Mechanical characteristics			
Mechanical characteristics	Standard	Dimension	Result
Tensile strength	ISO 527	MPa	60
Elongation at tear	ISO 527	%	110
Modulus of elasticity	ISO 527	KJ/m ²	Not broken
Impact resistance	ISO 179	µm	4 – 8
Adhesive properties 0,5/1,0/2,0 h boiling period 100°C	ISO 2409	GT 0/0/0	
Pencil Hardness	3H		
Taber Abrasion	3.5%	ASTM D1044-82 100 cycles 500g load, CS10F wheels	
Thermal characteristics			
Thermal characteristics	Standard	Dimension	Result
Vicat diluting temperature VST/B 50	ISO 306	°C	150
Constancy temperature HDT/A (1.8N/mm ²)	ISO 75	°C	135
Temperature of permanent use	DIN 53446	°C	115
Linear coefficient of cubical thermal expansion (α) 0-50°C	DIN 53752	K ⁻¹	65 x 10 ⁻⁶
Heat conductivity (λ)	DIN 52612	W/mK	0,21
Specific heat (c)		J/gK	1,3
Optical characteristics			
Optical characteristics	Standard	Dimension	Result
Transparency 380-780nm D=3mm	DIN 5036	%	>86

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Gloss Level at 60'	DIN 67530		65 – 75
Haze	ASTM D 1003	%	<10
Electrical characteristics			
	Standard	Dimension	Result
Specific volume resistivity	DIN VDE 0303	Ωcm	10 ¹⁵
Dielectric strength	DIN EN 60243	kV/mm	>30
Fire characteristics			
	Standard		Result
Flammability Rating	UL94		B2
Chemical Resistance			
	Chemical and Concentration		Result
	Acetone – 100% Benzene – 100% Benzole – 100% Chloroform – 100% Ethanol – 99% Soda lye – 40% Diluent for cellulose lacquers – 100% Nitric acid – 65% Chloric acid – 32% Sulfuric acid – 100% Xylene – 100% # alkali proof up to pH 12		Resistant

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Handling instructions

Overview

This section reviews the general handling procedures that should be followed to avoid damaging parts during unpacking, inspection and installation.

Packaging

- All products are supplied with a removable protective plastic film on both surfaces.
- The quality of the protective foils have been inspected for any penetration or visible damage prior to shipping.
- Parts are packed in clean foam bags and sheets with in a strong cardboard shipping box.

Goods Receiving

- All products are shipped in new outer boxes. If the outer box is damaged the goods should be inspected and any damage noted on the shipping documents.
- When checking the quantity delivered do not remove the individual packaging from the parts or discard any quality documents included with the shipment which are essential for tracing the inspection and batch production records for the product.

Inspection area

- Optical polycarbonate products can easily be damaged and opening products in a uncontrolled area or by persons not trained to handle optical parts may result in surface damage.

Handling procedures

Inspection should only be carried out in a clean dust free environment under the conditions detailed in OIS4/01. If these conditions are not available then a sheet of clean lint free cloth or plastic should be placed on a clean bench in a suitable area.

1. Use clean lint free wipe or dry clean compressed air to remove dust from the surface.
2. Handle parts by the edges only if and when the protective foil is removed, if necessary wear clean protective gloves.
3. Remove half the protective foil on both sides whilst holding the filter on the protective half, complete the evaluation of this area and replace the protective foil. Repeat this on the opposite side to inspect the total area with the minimal risk of damage.
4. Do not slide or drag parts across any surface.
5. Never place the filter down without placing it back into its packaging.
6. The rear uncoated surface of the polycarbonate is the most sensitive to damage. Do not touch or clean this surface with a cloth or liquid. Clean only with dry compressed air.

Cleaning specifications (note this is for the coated surface only)

- The UV cured hard coating has excellent chemical resistance and permits cleaning. Adhesive residue, dust and dirt may be removed by regular glass cleaner or weak non abrasive detergent. A soft clean cloth should be used for this process.
- We have tested and approved for use:
 - Windex glass cleaner
 - Weak solution of IPA (ISO Propanol Acolhol)

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Quality specifications - Extracts from OIS.4

Overview

These inspection criteria reflect the manufacturing and raw materials standards currently in use at Optical Filters and a commercial level of quality required to satisfy most display requirements.

The group classification covers 5 window sizes as detailed in the criteria tables. The concept of this classification is that the window should be viewed as a whole as opposed to an arbitrary unit size such as a 100mm square or circle.

Defect – Inclusions/Digs

These are defects that are circular in nature and are located on the surface or within the filter/window and are visible when using the specified inspection conditions and procedures. Typical defects falling within the inclusion/dig specification are: dark, opaque and bright spots, air bubbles, pitting of the surface. Defects where the ratio of width to length is less than 3:1 are classified as inclusion/digs and are assessed by their mean diameter $D = (\text{width} + \text{length}) / 2$. Defects where the width to length ratio is greater than 3:1 are classified as Linear Defects.

Defects – Linear

These are defects where the ratio of width to length is greater than 3:1. Typical linear defects are surface scratches, and linear inclusions of hair, fibre and lint.

They may be dark clear or opaque in nature and inspection must be carried out against a dark and light background using the specified conditions and procedures.

Linear defects are defined by width (W) and length (L). The acceptance criteria for linear defects are classified into three groups: Opaque (dark), Translucent (White) and surface scratches.

Reject Criteria for Linear Defects

- Reject if width (W), Length (L), Separation distance between defects or accumulated length are outside the accept criteria.
- Reject immediately if any linear defect has a width greater than 0.10mm or a length longer than 15mm.

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Accept Criteria for Inclusion/Digs

Defect Size D (mm)	Group:1 Area cm ² <100	Group:2 Area cm ² 100<400	Group: 3 Area cm ² 400<1600	Group:4 Area cm ² 1600<3600	Group:5 Area cm ² 3600+
D<0.20	Ignore	Ignore	Ignore	Ignore	Ignore
D>0.2 <0.3	3	Ignore	Ignore	Ignore	Ignore
D>0.3 <0.4	1	3	5	5	Ignore
D>0.4 <0.5	0	1	3	5	10
D>0.5<1.0	0	0	0	2	5
D>1.0	0	0	0	0	0
Total Defects	3	3	5	7	10

Accept Criteria for Opaque Linear Defects (Typically dark mesh fragments or hairs)

Defect Size D (mm)	Group:1 Area cm ² <100	Group:2 Area cm ² 100<400	Group: 3 Area cm ² 400<1600	Group:4 Area cm ² 1600<3600	Group:5 Area cm ² 3600+
W<0.025	Ignore	Ignore	Ignore	Ignore	Ignore
W </=0.030	3	5	10	10	10
L	<3.0	<5	<10	<10	<10
W <0.030 <0.060	3	5	5	10	15
L	<3.0	<5	<10	<10	<10
W<0.060 <0.100	0	0	0	5	10
L				<5	<5
W>0.100	0	0	0	0	0
Separation of defects	>10	>10	>10	>10	>10
Accumulated length	<10	<30	<50	<100	<150

Accept Criteria for Translucent Linear Defects (typically white fibres or lint)

Defect Size (mm)	Group:1 Area cm ² <100	Group:2 Area cm ² 100<400	Group: 3 Area cm ² 400<1600	Group:4 Area cm ² 1600<3600	Group:5 Area cm ² 3600+
W<0.025 and L <5	Ignore	Ignore	Ignore	Ignore	Ignore
W<0.025 and L>5<25	0	2	5	Ignore	Ignore
W >0.025<0.050	5	5	10	10	10
L	<10	<10	<15	<20	<20
W>0.050	0	0	0	1	3
L				<10	<15
Separation of defects	>10	>10	>10	>10	>10
Accumulated length	<20	<30	<50	<100	<150

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Accept Criteria for surface scratches

Defect Size (mm)	Group:1 Area cm ² <100	Group:2 Area cm ² 100<400	Group: 3 Area cm ² 400<1600	Group:4 Area cm ² 1600<3600	Group:5 Area cm ² 3600+
W<0.010	Ignore	Ignore	Ignore	Ignore	Ignore
W>0.010<0.025	5	5	10	15	15
L	<10	<20	<25	<30	<50
W>0.025<0.050	0	2	5	10	10
L	0	<20	<25	<25	<25
W>0.050	0	0	0	1	3
L				<10	<15
Separation of defects	>10	>5	>5	>5	>5
Accumulated length	<20	<30	<100	<150	<150

Accept Criteria for all Linear Defects (Total number and length allowed – all types)

Defect Size (mm)	Group:1 Area cm ² <100	Group:2 Area cm ² 100<400	Group: 3 Area cm ² 400<1600	Group:4 Area cm ² 1600<3600	Group:5 Area cm ² 3600+
Quantity	5	5	10	15	20
Accumulated length	<20	<50	<100	<200	<250