

**SPEC. NO. ELRS/SPEC/L.O.GLASS/0016, REV. '0'**

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**

**SPECIFICATION  
FOR  
STONE PROOF LOOK OUT GLASS FOR USE  
IN  
ELECTRIC LOCOMOTIVES / EMUS / MEMUS**

**Specification No. ELRS/SPEC/L.O.GLASS/0016, Rev. '0'**

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## **Specification for ( STONE PROOF) LOOK OUT GLASS FOR use on Electric Locomotives / EMUs / MEMUs**

### **1.0 Foreword :**

1.1 The glass presently being used as 'look out glass' in Electric Locomotives is 'Laminated Safety Glass' conforming to IS- 2553. Though, it is abrasion resistant and offers excellent visual clarity but its impact strength is only moderate. There have been numerous incidences on the running locomotives/EMUs/MEMUs wherein stones pelted by miscreants have penetrated the lookout glass resulting into the injury to the driving crew. To avoid such incidences, Central as well as Western Railways had extensively experimented with look out glass made of 'Poly Carbonate' sheet procured to their spec./drg. no. SK/4053 on EMUs in the last two years and have observed satisfactory performance in respect of visual clarity, impact strength (unbreakable), abrasion resistance and yellowing etc. Therefore, RDSO had taken up the job of preparing a tentative draft specification for the 'Poly Carbonate' sheet for use as 'Lookout Glass' on Electric Locomotives/EMUs/MEMUs.

1.1.1 Railway Board vide letter no. 96/Elec.(G)/181/29/EMU dated 5.12.97 had directed Railways to put the item on trials and asked RDSO to issue the technical specification.

1.2 In preparing this specification, assistance has been taken from the material collected from following web sites ;

- i) <http://www.sundancesupply.com>
- ii) <http://www.modernplastics.com>
- iii) <http://www.gestructuredproducts.com>
- iv) <http://www.polygalusa.com>

### **2.0 Scope :**

2.1 This specification covers the technical requirements, details of expected performance, guarantee obligations and physical/mechanical/thermal properties with desired values and cross references for their testing methods of 'poly- carbonate sheet' to be used for manufacture and supply of look out glasses for Electric Locomotives/EMUs/MEMUs as per Indian Railways' drawings.

2.2 The manufacturer/supplier before executing the order shall furnish all the technical details including 'Guarantee Obligation Details' from the original manufacturer to Railways.

### **3.0 General Requirements :**



The poly-carbonate sheet to be used for manufacture of look out glass shall have high impact strength combined with abrasion resistance and high light transmission surface that approaches glass in performance. The detailed functional requirements shall be as follows ;

**3.1 Light Transmission :**

The light transmission should be better than 85% for a 6 mm thick poly-carbonate sheet. The sheet should preferably have coating of enhanced ultra-violet absorbers to protect the sheet from the debilitating effects of sunlight.

**3.2 Impact Resistance :**

The sheet should be able to offer extremely high impact resistance ( up to 250 times the impact strength of glass) to minimize the risk of breakage even when subjected to violent blows by pelted stones on trains running at high speeds. The impact resistance should not vary significantly over a wide temperature range i. e  $-10^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$  or after prolonged outdoor exposure.

**3.3 Abrasion Resistance :**

The sheet shall have a unique hard surface coating which shall provides a high level of protection against unsightly scratching. Also, the coating shall virtually defy graffiti to stick and, despite frequent cleaning, should maintain a like-new appearance of the surface for years.

**3.4 High Resistance to the effects of Weathering :**

The unique surface coating on the sheet shall enhance protection against performance losses and yellowing caused by exposure to winds, rains, hailstones, dust and ultra-violet radiation in sunlight for at least 5 years.

**3.5 High Resistance to Chemicals :**

The sheet surface should be immune to contact with chemicals such as cleaning fluids, paints and adhesives. Its surface should also resist graffiti enabling easy restoration to a 'good as new' condition.



### 3.6 Weight & Thermal Insulation :

The sheet shall be light weight with better thermal insulation vis-a-vis glass.

### 4.0 Typical Property Values :

- 4.1 The typical values of physical, mechanical and thermal properties of the poly-carbonate sheet for 'look out glass' application and also test methods will be as follows ;

Property	Test Method	Units	Value
<b>1.0 Physical</b>			
1.1 Specific gravity	ASTM D 792	-	1.2
1.2 Light transmission (average)	ASTM D 1003	%	> 85%
1.3 Chemical resistance	ANSI Z 26.1	-	Passes
<b>2.0 Mechanical</b>			
2.1 Ultimate Tensile Strength	ASTM D 638	psi	9,500
2.2 Flexural strength	ASTM D 790	psi	13,500
2.3 Flexural Endurance @ 1800 cycles/min., 73 <sup>0</sup> F, 50% RH	ASTM D 671	psi	1000
2.4 Compressive strength.	ASTM D 695	psi	12,500
2.5 Modulus of Elasticity	ASTM D 638	psi	340,000
<b>3.0 Thermal :</b>			
3.1 Coefficient of thermal expansion.	ASTM D 696	in/in/ <sup>0</sup> F	-5
3.2 Heat Deflection Temperature	ASTM D648	<sup>0</sup> F	3.75 x 10
C ~ 264 psi			270

- 4.2 The typical values of abrasion resistance comparison with glass should be as follows ;

	% Haze		
	Test Method	Glass	Poly Carbonate Sheet
Taber Abrasion 100 Cycles CS10F	ASTM D 1044 Z .26.1	0.5	1- 4



Falling Silica Carbide 1600 grams	-do-	5.0 – 8.0	15.0- 20.0
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## 5.0 **Cleaning and Maintenance Instructions :**

The supplier/manufacturer should recommend proper procedure for periodic cleaning along with compatible cleaners for prolong service life of unique surface coating on the sheet. The instructions for ‘Graffiti Removal’, if different than cleaning, then they shall be advised separately.

## 6.0 **Inspection & Testing :**

For each lot of supply of look out glass, manufacturer/supplier will have to produce inspection certificate as well as warranty certificate from the OEM authorizing the supplier/ manufacturer to deal all warranty cases on his behalf. However, in case of any doubt, the consignee will reserve the rights to get the material of the look out glass tested in any of the recognized national test laboratories.

## 7.0 **Drawings :**

The look out sheets’ dimensions, size, shape except thickness shall conform to following drgs. as applicable for safety glass sheet. The thickness for poly-carbonate sheet shall be 6.00 mm for all applications.

S. N.	Loco/EMU	Drawing Reference
1.	WAP1/WAP4	CLW’s Drawing No. 03/1/35/6, alt. ‘3’
2.	WAG7/WCM6/WAG5/WAM4	CLW’s Drawing No. 06/4/35/22, alt. ‘2’
3.	EMUs ( D.C./A.C. )	ICF’s drawing No. EMU-5-4-002, alt. 5/12, item no. 3
4.	MEMUs	ICF’s drawing No. EMU-5-4-002, alt. 5/12, item no. 9

**NOTE :** 1.The drawing for rubber joint for front look out glass made of poly carbonate



sheet for WAG-7/WCM-6/WAG-5/WAM-4 will be as per SKEL-4606, alt. '0' at annexure I.

2 The thickness of felt, item no. 5 of CLW's drg. no. 03/1/35/6, alt. '3' shall be 5.00 mm for poly carbonate look out sheet.

#### **8.0 Packing and Transportation :**

The proper packing of the look out glass to protect both side surfaces during transportation and long time storage will be the responsibility of the manufacturer/supplier. The manufacturer/supplier shall have to make arrangement for transportation of the material to consignee.

#### **9.0 Product Warranty :**

The lookout glass made of poly-carbonate sheet having properties as stated in paras above shall be guaranteed a minimum for 5 years from the date of sale against breakage, incurring coating failures, exhibiting excessive increased haze, exhibiting excessive yellowing or loss of light transmission due to manufacturing defects. For each case of look out glass failure, the supplier/manufacturer will supply a free replacement against return of the damaged look out glass free of cost