


<b>Client</b> <i>Client</i> XPLOSAFE AS Økrisletta 15 1340 SKUI		<b>Performing unit/lab.</b> <i>Department/laboratory responsible</i> Kiwa AS  3601 KONGSBERG	
<b>Report no.</b> <i>Report no.</i> <div style="text-align: center;"><b>24NO-00234OR01</b></div>			
<b>Title</b> <i>Title</i> <div style="text-align: center;"><b>Protection iht. ISO 3449.</b></div>			
<b>Date</b> <i>Date</i> 31.5.2024	<b>Prepared by</b> <i>Prepared by</i> Ásgeir Haukaás 		<b>Date</b> <i>of receipt of test object</i> NA
			<b>Sampling by Kiwa</b> <i>Sampling by Kiwa</i> No No
<b>Revision no.</b> <i>Revision no.</i> -	<b>Config.contr.</b> Yes Yes	<b>Number of pages</b> <i>No. of pages</i> 7+4	<b>Ant. Appendix</b> <i>No. of Append.</i> 1 a 4 pages
<b>Copy no.</b> <i>Copy no.</i>	<b>Accredited test (ISO 17025)</b> <i>Accredited test (ISO 17025)</i> No No	<b>Customer's ref.</b> <i>Client's ref.</i> Espen Weldingh	<b>Order No.</b> <i>Order no.</i> -
<b>Distribution</b> <i>Distribution</i>  Client: PDF KIWA AS			

Test results apply only to the tested objects. Excerpts from the report must not be reproduced without written approval from Kiwa Technological Institute as.

Test results relate only to the items tested. The report shall not be reproduced except in full, without the written approval of the laboratory.

1. Introduction.....	2
2. References.....	4
3. Execution.....	4
4. Demand.....	4
5. Dropdor.....	5
6. Test results.....	6
7. Conclusion.....	7
8. Data sheet. SAPHIR.....	1
9. Data sheet frame.....	4

## 1. Introduction

XploSafe AS has engaged Kiwa AS to witness a drop test against a specially made window that will replace the original window from the factory in construction machinery. The window is made of PolyCarbonate and has the name: **Polycarbonate Sahpir HC**. See datasheet in the appendix to this report.

The drop test was carried out on May 7, 2024 at the company's own address in Skui. The test is in accordance with ISO 3449:2005 level 2.

The frame that attaches the Saphir glass is similar to the quality used in construction machinery.



Picture 1. The door used weighs 227 kg and complies with ISO 3449



Picture 2. The test setup with drop of weights in free fall. The height of fall is **5.22** meters

## 2. References

ISO 3449:2005; Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements

## 3. Execution

Both the frame and frame were cooled to -20°C and kept in a cold chamber for 2 hours. The frame and window were then picked up by forklift and placed under the weight within 3 minutes. The weight hung from a release cord and the weight was released free fall 5.22 meters down the window.

## 4. Demand

A test has been carried out where the window is mounted at 30° and the drop height is 5.22 meters, the weight weighs 227 KG and the test temperature of the object must be at least -18°C.

**Energy requirements are level 2 and the route must withstand: 11,600 Joules**

Based on free fall formula:  $J=mGh$

J= Joule

M= mass (KG)

G= acceleration of gravity in  $m/sec^2$

H= free fall height (meters)

$$\underline{227 \text{ KG} \times 9,81 \text{ m/sec}^2 \times 5,22 \text{ meter} = 11 \text{ 624, 3 Joule}}$$

## 5. Dropdor

The door is made of S355 steel and weighs 227 kg. It has the following dimensions that are in accordance with ISO 3449

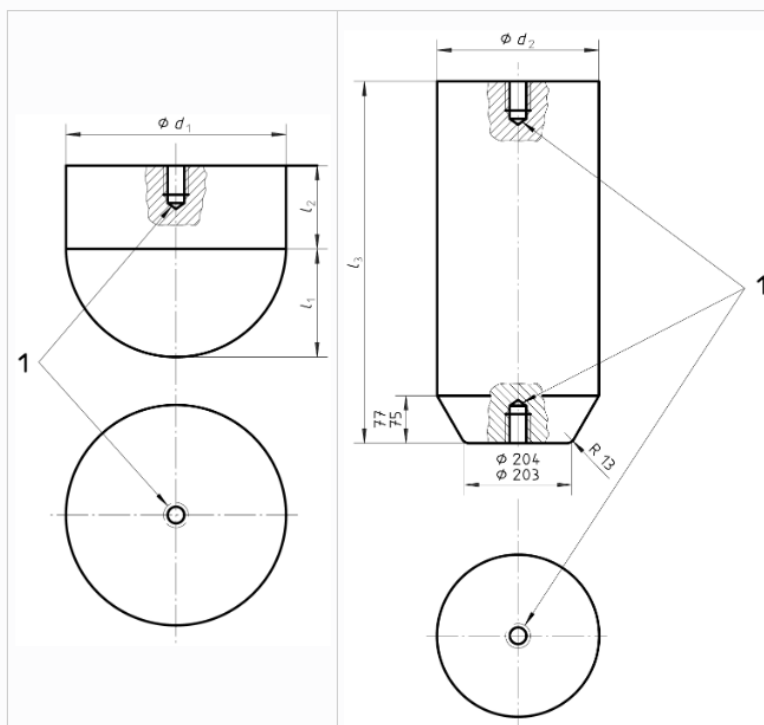
### 5.1.2

**Drop test object for Level II testing**, made of steel, designed as shown in [figure 1](#), and possessing the potential energy required for loading. See [8.1](#) or [8.2](#) and [figure 2](#) to determine the mass and/or drop height ratio necessary to obtain the required energy. Typical mass is 227 kg for Level II.

Figure 1

#### Examples of laboratory drop test object

Dimensions in millimetres



#### Key

1 May be drilled and tapped for lifting eye.

Åpne tabell i eget vindu

$\emptyset d_1 \approx 204$ ;  $\emptyset d_2 = 255$  to  $260$ ;  $l_1 \approx 102$ ;  $l_2 \approx 68$ ;  $l_3 = 583$  to  $585$

#### NOTE

Dimensions  $d_1$ ,  $d_2$ ,  $l_1$ ,  $l_2$  and  $l_3$  are optional. Dimensions of the drop test object are determined with respect to both its mass and drop height (as determined from [figure 2](#)) that shall provide the required energy.

Figure 1. Picture of the door

## 6. Test results



Picture 3. Just before the test. Drop height 5.22 m and window has -18°C



Picture 4. After drop test. No crack or broken glass. Only a slight dent and a few scratches

## 7. Conclusion

With the above tests, Kiwa AS confirms that Polycarbonate Saphir can withstand the tests as discussed in this report

## 8. Data sheet. SAPHIR



TRANSPARENT PRODUCTS – POLYCARBONATE SHEETS

# SAPHIR®

SAPHIR® is hard coated polycarbonate sheet with glass like appearance suitable for flat applications. The high impact strength of polycarbonate is combined with improved weather and chemical resistance. The product offers protection against abrasion compared to standard plastic sheets.

SAPHIR® is resistant to many of the most common chemicals, and the hard coat also provides an excellent protection against graffiti and vandalism.

SAPHIR® weighs about half of standard glass, yet the product is virtually unbreakable. SAPHIR® has an outstanding clarity, the hard coat improves the light transmission of the polycarbonate sheet.

#### ALSO AVAILABLE:

Double side coating, one side coating, any transparent colour or tint.

#### SAPHIR® BENEFITS:

- Abrasion and Impact Resistant
- Chemical Resistance
- UV Stability
- High optical quality and outstanding clarity
- More than 10 times the impact strength of high impact PMMA

#### APPLICATION AREAS:

Anti-vandal glazing, security glazing, safety screens and acoustic screens, Industrial equipment (machine coverings, machine protections), Indoor and outdoor signs, vending machine faces and many different kinds of technical parts.

#### DELIVERY PROGRAM:

Standard size: 2000 x 3000 mm

Thickness range: 2 – 12 mm


1 side or 2 sides coated

Special sizes and thicknesses on request


### SAPHIR® TECHNICAL SPECIFICATIONS

Property	Value	Unit	Standard
<b>Physical properties</b>			
Density	1,2	g/cm <sup>3</sup>	ISO 1183
Refractive index (20 °C)	1,586		ISO 489
Moisture absorption 24 hours, 23 °C, 50% RH	0,15	%	ISO 62
<b>Mechanical properties</b>			
Tensile strength at yield (at break)	60 (70)	N/mm <sup>2</sup>	ISO 527
Elongation at yield (at break)	6 (110)	%	ISO 527
Elastic modulus	>2300	N/mm <sup>2</sup>	ISO 527
Flexural modulus	>2300	N/mm <sup>2</sup>	ISO 178
Charpy unnotched impact strength -40 °C	NB	kJ/m <sup>2</sup>	ISO 179/1eU
Charpy notched impact strength -30 °C	11	kJ/m <sup>2</sup>	ISO 179/1eA
Izod notched impact strength +23 °C	65	kJ/m <sup>2</sup>	ISO 180/1A
Izod notched impact strength -30 °C	10	kJ/m <sup>2</sup>	ISO 180/1A
<b>Thermal properties</b>			
Linear coefficient of thermal expansion (20-70 °C)	65x10 <sup>-6</sup>	K <sup>-1</sup>	ISO 11359-2
Thermal conductivity	0,20	W/m.K	ISO 8302
<b>Coating properties</b>			
Adhesion	GT-0		DIN 53151 / ISO 2409
Taber Abrasion, CS 10F, 500g, 100 / 500 cycles	2 / <9	% Haze	ASTM D1044

Properties reported here are typical values. Arla Plast makes no representation that the material in any particular shipment will conform exactly to the values given. The above information is based upon experience and given in good faith. Due to many factors which are outside our knowledge and control, no warranty is given or is to be implied with respect to such information. Detailed product specification and technical manual/information is available on request.

 1173	
Arla Plast AB Box 33 S - 591 75 Borensberg 17 <b>DoP Nr.: AB-007010301120001-21-1</b> <a href="http://www.arlaplast.com">www.arlaplast.com</a>	
<b>EN 16240:2013</b> <b>Saphir, 12 mm</b> Platta, genomlysiga polykarbonatskivor för invändiga och utvändiga tak, väggar och undertak	
<b>Färg</b>	Klar
<b>Reaktion vid brandpåverkan</b>	E
<b>Permeabilitet vattenånga</b>	$3,8 \times 10^{-5}$ mg/m.h.Pa
<b>Vatten-/lufttäthet</b>	Uppfyller
<b>Dimensionella toleranser</b>	Uppfyller
<b>Splittringsegenskaper (Mekanisk brottsäkerhet) som:</b>	
– Beständighet, liten hård kropp	Uppfyller
– Beständighet, stor mjuk kropp (i installation)	Uppfyller
<b>Mekaniskt resistans (deformationbeteende)</b>	$E_{f,medel} \geq 2200$ MPa
	$E_{f,karakt} \geq 2000$ MPa
	$\sigma_{M,medel} \geq 60$ MPa
	$\sigma_{M,karakt} \geq 55$ MPa
<b>Ljudisolering i luft</b>	$R = 34_{(-1,-4)}$ dB
<b>Termisk Transmittans</b>	$U = 4,4$ W/m <sup>2</sup> K
<b>Ljustransmission</b>	$\tau_v = 82$ %
<b>Total solenergiöverföring</b>	NPD
<b>Hållbarhet vid fixering</b>	se installationsmanual
– Hållbarhet, Gulningsindex	$\Delta D$
– Hållbarhet, Ljustransmission	$\Delta D$
– Hållbarhet, böjmodul	Cu1
– Hållbarhet, draghållfasthet	Ku1

## 9. Data sheet frame

		<b>ALLOY DATA SHEET</b> <b>EN AW-6082 [AlSi1MgMn]</b>						<b>Type:</b> <b>High strength structural alloy</b>		
<p>The alloy EN AW-6082 is a high strength alloy for highly loaded structural applications. Typical applications are scaffolding elements, rail coach parts, offshore constructions, containers, machine building and mobile cranes. Due to the fine grained structure this alloy exhibits a good resistance to dynamic loading conditions. EN AW-6082 is certified for use in marine applications.</p>										
<p><b>Chemical composition according to EN573-3 (weight%, remainder Al)</b></p>										
Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	remarks	others	
									each	total
0.7 – 1.3	max. 0.50	max. 0.10	0.40 – 1.0	0.6 – 1.2	max 0.25	max 0.20	max 0.10		max 0.05	max 0.15
<p><b>Mechanical properties according to EN755-2</b></p>										
Temper*	Wallthickness e***	Yield stress Rp0.2 [MPa]	Tensile strength Rm [MPa]	Elongation		Hardness** HB				
				A [%]	A50mm [%]					
T4	e ≤ 25	110	205	14	12	65				
T5	e ≤ 5	230	270	8	6	80				
T6	e ≤ 5	250	290	8	6	95				
	5 < e ≤ 25	260	310	10	8	95				
<p>*Temper designation according to EN515: T4-Naturally aged to a stable condition, T5-cooled from an elevated temperature forming operation and artificially aged, T6-Solution heat treated, quenched and artificially aged (T6 properties can be achieved by press quenching)</p> <p>** Hardness values are for indication only</p> <p>***For different wall thicknesses within one profile, the lowest specified properties shall be considered as valid for the whole profile cross section</p>										
<p><b>Physical properties (approximate values, 20 °C)</b></p>										
Density	Melting range	Electrical conductivity	Thermal conductivity	Co-efficient of thermal expansion	Modulus of elasticity					
[kg/m <sup>3</sup> ]	[°C]	[MS/m]	[W/m.K]	10 <sup>-6</sup> /K	[GPa]					
2700	585-650	24-32	170-220	23.4	~70					
<p><b>Weldability<sup>1</sup></b>            Gas: 3 TIG: 2 MIG: 1 Resistance welding: 3 Spot welding: 2            Typical filler materials (EN ISO18273): AlMg5Cr(A), AlMg4.5Mn0.7(A) or AlSi5. Due to the heat input during welding the mechanical properties will be reduced by approximately 50% (ref. EN1999-1).</p>										
<p><b>Machining characteristics<sup>1</sup>:</b>            T4 temper: 4 T5 and T6 temper: 2</p>										
<p><b>Corrosion resistance<sup>1</sup></b>            General: 2 Marine: 2</p>										
<p><b>Coating properties<sup>1</sup></b>            Hard/protective anodising: 2 Bright/colour anodising: 3</p>										
<p><sup>1</sup> Relative qualification ranging from 1-very good to 6 – unsuitable</p>										
Nedal Aluminium P.O.-Box 2020 NL-3500 GA Utrecht, The Netherlands T. +31 30 2925711 F. +31 30 2939512 <a href="mailto:sales@nedal.nl">sales@nedal.nl</a> <a href="http://www.nedal.com">www.nedal.com</a>				Alloy data sheet EN AW-6082				jun-2005 rev.00		