Rapport
Report

Client *Client*	**Performing unit/lab.** *Department/laboratory responsible*
XPLOSAFE AS Økrisletta 15 1340 SKUI	Kiwa AS 3601 KONGSBERG

Report no. *Report no.*

24NO-00234OR02

Title *Title*

Protection according to ISO 10262

Date *Date*	**Prepared** *by Prepared by*	**Date** *of receipt of test object*
27.5.2024	Ásgeir Haukaás	NA
		Sampling by Kiwa *Sampling by Kiwa*: No *No*

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-	Yes *Yes*	10 total incl attachments	1 a 4 pages

Copy no. *Copy no.*	**Accredited test (ISO 17025)** *Accredited test (ISO 17025)*	**Customer's ref.** *Client's ref.*	**Order No.** *Order no.*
	No *No*	Espen Weldingh	-

Distribution *Distribution*

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1. Introduction

XploSafe AS has engaged Kiwa AS to witness a drop test against a specially made window that will replace the original window and safety grille on construction machinery. The pane is made of polycarbonate Saphir HC, ref datasheet, and the frame is made of aluminum.

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 10262:1998 Front Guard level 2

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

Picture 1. The free-fall drop weights test setup

2. References

ISO 10262:1998; Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards

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 onto the window.

4. Demand

The frame with pane lies flat and the drop height is 2.61 meters and a minimum of -18°C. Energy requirements are level 2 and the route must withstand: 5,800 Joules

Picture 2. The door weighs 227 kg and according to ISO 10262

5. Dropdor

The door is made of S355 steel and weighs 227 kg. It has the following dimensions that are in accordance with ISO 10262

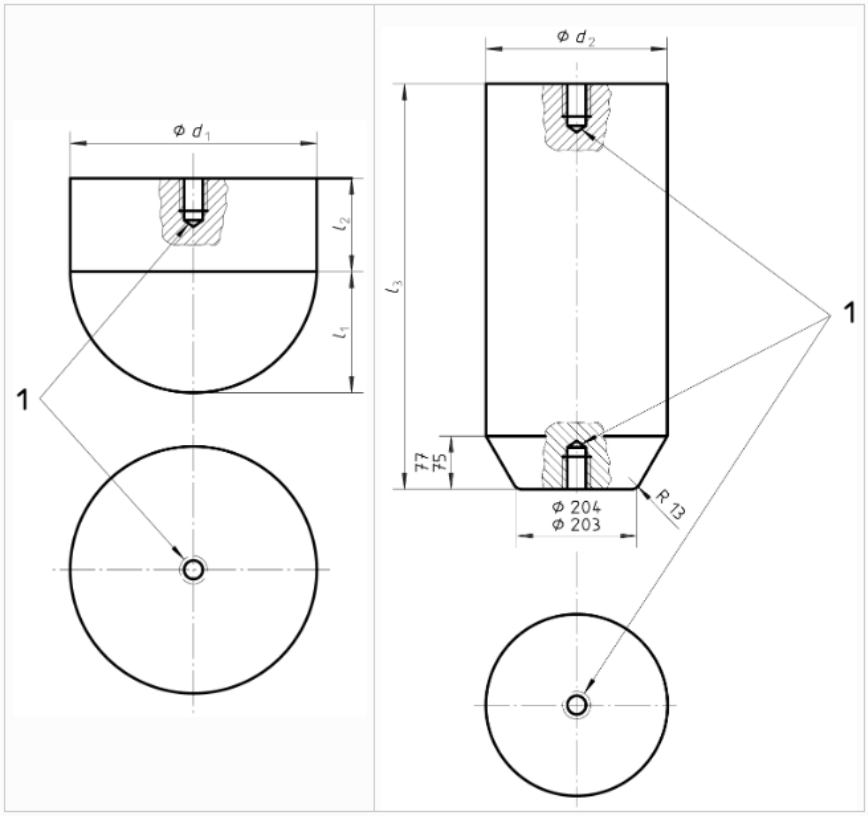
5.1.2

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

$Ød_1 \approx 204$; $Ød_2 = 255$ 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. The door's version, which is made of S355 steel and is in accordance with ISO 10262

6. Result from test 1

Picture 3. Just before the test. Drop height 2.61m 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 meets the requirements of ISO 10262:1998 – Front Guard level 2

8. Data sheet. SAPHIR

TRANSPARENT PRODUCTS – POLYCARBONATE SHEETS

SAPHIR®

arla
www.arlaplast.com

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

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arla
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9. CE Mark for Protective GlassSaphir 12mm Safety Glass

CE
1173

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DoP Nr.: AB-007010301120001-21-1

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EN 16240:2013
Saphir, 12 mm

Platta, genomlysliga polykarbonatskivor för invändiga och utvändiga tak, väggar och undertak

Färg	Klar
Reaktion vid brandpåverkan	E
Permeabilitet vattenånga	$3{,}8 \times 10^{-5}$ mg/m.h.Pa
Vatten-/lufttäthet	Uppfyller
Dimensionella toleranser	Uppfyller
Splittringsegenskaper (Mekanisk brottsäkerhet) som:	
– Beständighet, liten hård kropp	Uppfyller
– Beständighet, stor mjuk kropp (i installation)	Uppfyller
Mekaniskt resistans (deformationbeteende)	$E_{f,medel}$ ≥ 2200 MPa
	$E_{f,karakt}$ ≥ 2000 MPa
	$\sigma_{M,medel}$ ≥ 60 MPa
	$\sigma_{M,karakt}$ ≥ 55 MPa
Ljudisolering i luft	R = 34 $_{(-1,-4)}$ dB
Termisk Transmittans	U = 4,4 W/m^2K
Ljustransmission	τ_v = 82 %
Total solenergiöverföring	NPD
Hållbarhet vid fixering	se installationsmanual
– Hållbarhet, Gulningsindex	ΔD
– Hållbarhet, Ljustransmission	ΔD
– Hållbarhet, böjmodul	Cu1
– Hållbarhet, draghållfasthet	Ku1

10. Data sheet for the window frame

Nedal ALUMINIUM

ALLOY DATA SHEET EN AW-6082 [AlSi1MgMn]

Type: High strength structural alloy

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.

Chemical composition according to EN573-3 (weight%, remainder Al)

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

Mechanical properties according to EN755-2

Temper*	Wallthickness e***	Yield stress $Rp_{0.2}$ [MPa]	Tensile strength Rm [MPa]	Elongation A [%]	Elongation A_{50mm} [%]	Hardness** HB
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

*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)
** Hardness values are for indication only
***For different wall thicknesses within one profile, the lowest specified properties shall be considered as valid for the whole profile cross section

Physical properties (approximate values, 20°C)

Density [kg/m³]	Melting range [°C]	Electrical conductivity [MS/m]	Thermal conductivity [W/m.K]	Co-efficient of thermal expansion 10^{-6}/K	Modulus of elasticity [GPa]
2700	585-650	24-32	170-220	23.4	~70

Weldability[1]
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).

Machining characteristics[1]**:**
T4 temper: 4 T5 and T6 temper: 2

Corrosion resistance[1]
General: 2 Marine: 2

Coating properties[1]
Hard/protective anodising: 2 Bright/colour anodising: 3

[1] Relative qualification ranging from 1-very good to 6 – unsuitable

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