

## ***Product Information***

### ***ProCurve High-Performance Marine Glass***

***Description:*** High-Performance Marine Glass (HPML-CG) is laminated glass comprised of two plies of chemically strengthened glass. Originally designed for the marine industry, this product provides 2-3 times the strength of tempered, tempered/laminated or annealed/laminated glass. HPML-CG is a durable, light weight, and aesthetically pleasing, and has been widely specified by naval architects, boat builders, and captains worldwide.



#### ***Why choose laminated glass over monolithic tempered glass?***

A significant shortcoming with tempered glass is that it offers no barrier protection once broken. This means that if breakage occurs, the particles of tempered glass will fall out of the frame, creating an opening through which wind and rain can enter. Because ProCurve's High-Performance Marine Glass is laminated, it will remain in place until a replacement can be made. HPML-CG can also be designed to protect people from any potential ballistic threats.



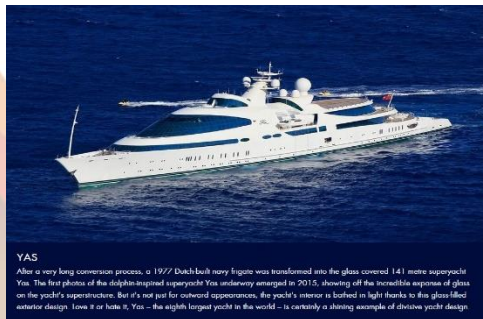
A second issue with tempered glass is distortion that can occur in manufacturing. This distortion is often distracting to the viewer. In extreme cases, distortion in tempered glass can cause the person looking through the glass to feel sick and dizzy. Chemically strengthened glass is not subject to optical distortion, thus, eliminating the possibility of these effects.

## Hydrostatic Testing

The chart below presents the nominal thicknesses of tempered and tempered laminated glass, as well as the thicknesses of High-Performance Marine Glass, to meet the designated proof loads according to ISO 614.

Tempered Monolithic Glass	Tempered/Laminated Glass	HPML-CS ProCurve	ISO 614 Proof Load (N) Type A
10mm	11.5mm	7.89mm	10,200 (N)
12mm	13.5mm	8.89mm	15,500 (N)
15mm	15.5mm	11.89mm	24,000 (N)
19mm	17.5mm	15.78mm	33,400 (N)
25mm	19.5mm	17.58mm*	53,000 (N)
28mm	22.5mm	19.58mm*	65,000 (N)

\*\*\* See also Lloyd's Register "Type Approval Certificate" and ProCurve PDA Results for HPML-CG



## Manufacturing Capabilities

**Maximum size:** 130" (3302mm) x 240" (6100mm)

**Glass options:** Extra clear (low iron) or very dark gray glass (as low as 9% light transmission)

**Interlayer options:**

Privacy glass and switchable tint interlayer

Heated glass offered by heated interlayer

**Special edgework:** Standard marine, seamed, pencil polished

### PROCURVE PDA RESULTS FOR HPML-CG MARINE LAMINATED GLASS

Company : Procurve Glass Technology, LLC, 3535 Davisville Road, Hatboro, PA, USA 18040

Model Name: HPML-CG Glass Products

PDA: 18-HS1732459-PDA, Revision:0, Issuance Date: 05/09/2018, Expiration Date: 05/09/23

Specimen	Flexural Strength* and Flexural Modulus			
	$\sigma_f$	$E_f$	$\sigma_f$	$E_f$
	psi	ksi	MPa	GPa
2.89mm HPML-CG 2ply	61,328	7,859	423	54.00
3.89mm HPML-CG 2ply	39,767	4,220	274	29.00
4.89mm HPML-CG 2ply	54,901	6,451	379	44.00
6.89mm HPML-CG 2ply	53,558	8,787	369	60.6
7.89mm HPML-CG 2ply	47,750	15,717	329	108.39
8.89mm HPML-CG 2ply	48,423	8,174	334	56.37
9.89mm-A HPML-CG 2ply	31,856	10,066	220	69.42
9.89mm-B HPMLCG 2ply	30,128	8,294	208	57.2
10.89mm-A HPML-CG 2ply	46,801	7,166	323	49.42
10.89mm-B HPML-CG 2ply	31,154	9,392	215	64.78
11.89mm HPML-CG 2ply	39,176	11,673	270	80.51
12.89mm HPML-CG 2ply	40,125	8,731	277	60.21
16.89mm-A HPML-CG 2ply	27,052	8,837	187	60.94
16.89mm-B HPML-CG 2ply	33,894	5,983	234	41.27
5.78mm HPML-CG 3ply	51,541	5,492	355	38.00
7.78mm HPML-CG 3ply	36,585	4,296	252	30.00
10.78mm HPML-CG 3ply	53,512	8,785	369	60.59
11.78mm HPML-CG 3ply	42,545	8,625	293	59.49
12.78mm HPML-CG 3ply	55,398	9,790	382	67.52
13.78mm HPML-CG 3ply	42,127	9,029	291	62.27
14.48mm HPML-CG 3ply	59,371	9,206	409	63.49
14.78mm HPML-CG 3ply	35,116	7,539	242	51.99
15.78mm HPML-CG 3ply	30,681	7,073	212	48.78
16.78mm HPML-CG 3ply	40,473	8,133	279	56.09
17.78mm HPML-CG 3ply	38,065	8,076	263	55.7
18.78mm HPML-CG 3ply	29,375	6,979	203	48.13
19.78mm HPML-CG 3ply	27,321	8,059	188	55.58
25.78mm HPML-CG 3 ply	27,961	6,315	193	43.55

\* Characteristic Flexural Strength and Flexural Modulus based on a 90% confidence limit corresponding to the number of specimens tested.

Testing based on DS EN 1288-3 - "FOUR POINT BENDING TEST" and ASTM C158- "FOUR POINT BENDING TEST"



## Type Approval Certificate

*This is to certify that the undernoted product(s) has/have been tested with satisfactory results in accordance with the relevant requirements of the LR Type Approval System.*

This certificate is issued to:

COMPANY NAME	ProCurve Glass Technology, LLC & ProCurve Glass Design, Inc.
PLACE OF PRODUCTION	3535 Davisville Road, Hatboro, Pa 19040 USA
DESCRIPTION	Windows based on laminated, chemically toughened glass: - Glass panels: 3, 4, 5, 6, 8 and 10 mm - Interlayer: structural ionoplast interlayer - Thickness range: 6.89 – 19.78 mm - Configuration of laminate: Symmetric, Asymmetric
TYPE	HPML-CG
APPLICATION	Ship's windows and bonded installations for construction in accordance with: LLOYD'S REGISTER RULES AND REGULATIONS FOR THE CLASSIFICATION OF SHIPS and SPECIAL SERVICE CRAFTS (SSC).
STANDARD	Equivalence to BSMA 25
RATINGS	The laminated chemically toughened glass (CSG) thickness need not be greater than the single plate TSG for the same window.

*"This Certificate is not valid for equipment, the design, ratings or operating parameters of which have been varied from the specimen tested. The manufacturer should notify Lloyd's Register EMEA of any modification or changes to the equipment in order to obtain a valid certificate."*

*The Design Appraisal Document No. HTS/STAT 28290-17 dated 13.03.2017 and its supplementary Type Approval Terms and Conditions form part of this Certificate.*

Certificate No.	17/20025
Issue Date	13 March 2017
Expiry Date	12 March 2022
Sheet	1 of 1



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