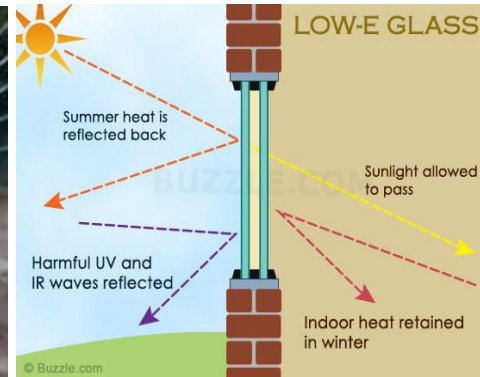


Laminated Glass Changing the world as you see it...

What is laminated glass and why choose laminated glass???

Let's start with what is laminated glass? Two or more lites (pieces) of glass bonded together with various types of interlayers. Laminated glass has been used extensively in the automotive industry for over 80 years. The windshield of your vehicle is a tested and certified laminated glass product specifically designed to keep you and other occupants safe. For over 50 years designers, builders and architects have used laminated glass for a myriad of benefits. Besides the known safety attributes of laminated glass, there are also design, acoustical, UV and IR reduction benefits, and the ability of high performance laminates to help reduce air conditioning loads. This results in a cooler, more comfortable interior environment and a savings in fuel consumption.



What is HPML-CG??

High performance marine laminated chemically strengthened glass (HPML-CG) designed originally for the marine industry provides 2-3 times the strength of tempered, tempered/laminated or annealed/laminated glass. HPML-CG is a durable, light weight, aesthetically superior glass option for naval architects, boat builders, captains, workboat and cruise ship applications. If glass breakage does occur the interlayer holds the unit in place and maintains the same glass integrity prior to breakage without dangerous glass fragments.

Why choose HPML-CG over tempered glass??

Tempered glass is traditionally the low cost solution for windows. A significant shortcoming with tempered glass is that it offers no barrier protection once broken, resulting in no protection against flying objects, threatening weather or forcible entry.

Broken tempered glass significantly obscures viewing through windows as seen here.



In contrast, the protection offered by HPML-CG is that the unit will continuously maintain a safe and secure environment. HPML-CG can also be designed to protect against potential ballistic threats. As a custom glass fabricator, ProCurve Glass will work with boat builders, captains, engineers and international agencies to develop a product that fulfills the end use requirements. Testing, certification and compliance to international standards is an option when requested.



Aesthetically, tempered glass can have “roller wave distortion” which is an inherent consequence of the process to make this product. When looking through distorted tempered glass objects will seem appear distorted as if looking at a funhouse mirror. Why risk causing a person looking through the tempered glass to feel, sick and dizzy if better solutions exist! HPML-CG as a laminated glass product will eliminate these concerns and enhance the value of the glass as intended.



HPML-CG Weight saving solution:

The weight saving benefits of a HPML-CG product are priceless. HPML-CG will be thinner on equivalent compliance standards, ultimately providing a lighter weight result. This benefits large marine vessels such as cruise ships, large and small work boats and passenger ferries. Weight reduction translates into fuel savings and a lower center of gravity reducing roll tendencies.



*****ISO 614 Test for Various tempered glass and Laminated combinations
(*performed by Hydrostatic test)***

Tempered Monolithic Glass	Tempered/Laminated Glass	HPML-CG 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***

PRODUCT BENEFITS & CAPABILITIES:

Flat & Bent HPML-CG / laminated glass sizes up to: 130" (3302mm) x 240" (6100mm)

Interlayer Options:

Privacy glass and switchable tint interlayer

Heated glass offered by heated interlayer

Sound reduction

Solar energy control (IR & UV)

Ballistic and bomb blast protection

Special edgework: Standard marine, flat polished, and pencil polished

Design Versatility: Endless glass color and light transmission options

- Extra clear (low iron) or very dark gray glass with as low as 6% light transmission
- Post breakage performance and continued water-tight integrity
- Rigorously tested to withstand adverse effects found in marine environmental conditions



Architectural and naval designs to enhance the comfort for passengers while capitalizing on reduced mechanical loads and better fuel efficiency.



Design Assistance:

Have questions let us help you with information! ProCurve Glass has all the resources you need, at our finger tips. We love glass and thrive on changing the world as we see it. Creative solutions to address your design. No need to be concerned or stressed anymore, knowing you have the right custom marine glass mfgs working beside you.

***** Contact us to discuss your next marine project!***

Email: steve@procurveglass.com

Telephone: 1.215.441.9101

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			
	σ_f	E_f	σ_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



Florian Pohl
Hamburg Technical Support Office
Lloyd's Register EMEA

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