inspection report

Report Number: CBT30406071087

Sample Name:	**Bisphenol A vinyl ester FRP grating**
Sample model:	**38 × 38 mm / 19 × 19 mm Thickness: 30 mm**
kind of inspection：	**Entrusted Testing**
client：	**Nantong Mach's Composite Material Co.,Ltd.**

Guangdong Province Baotong Quality Inspection Co., Ltd.

qMCR30d eR9FWVH

Address: Factory Building 802, Building 22, CIMC Intelligent Manufacturing Center, No.15 Shunye West Road, Xingtan Town, Shunde District, Foshan City, Guangdong Province, China Postal Code: 528325 Address: Factory Building 802, Building 22, CIMC Intelligent Manufacturing Center, No.15 Shunye West Road, Xingtan Town, Shunde District, Foshan City, Guangdong Province, China Postal Code: 528325
Phone: 4007057668 Email: service@zzjc-lab.com Website: http://www zzjc-lab.com Phone: 4007057668 Email: service@zzjc-lab.com Website: http://www zzjc-lab.com Phone: 4007057668 Email: service@zzjc-lab.com Website: http://www zzjc-lab.com

statement

1、 The report shall bear the official seal; if the designated seal for inspection and testing is absent or the testing unit's official seal is invalid, the report shall not be valid.

2、 No part of this report may be reproduced without authorization. Any reproduction that fails to bear the red special inspection and testing seal or the official seal of the testing institution shall be invalid.

3、 Reports without the signatures of the responsible inspector, reviewer, or approver are invalid; similarly, any alterations to the report are invalid.

4、 If you have any objections to this report, you must submit written comments to the testing authority within fifteen days from the date of receipt. Comments received after this period will not be accepted.

5、 The results of this report are valid only for the commissioned samples.

Guangdong Province Baotong Quality Inspection Co., Ltd.

Report Number: CBT30406071087

Inspection Summary			
Sample Name	Bisphenol A vinyl ester FRP grating	client	Nantong Mach's Composite Material Co.,Ltd.
ts	38 × 38 mm / 19 × 19 mm thickness; 30 mm	Address of the sponsoring organization	Nantong Rugao
trademark	/	Producer (Manufacturer)	Nantong Mach's Composite Material Co.,Ltd.
quantity	15PCS	Producer (制造商) address	Nantong Rugao
Additional Module	/		
Sample Number	01	kind of inspection	Entrusted Testing
Sample submission method	The client has submitted a sample.	Sample Status	intact
Sample submission date	23 February 2026	examination date	February 23,2026 29 April 2026
place of survey	Factory Building 802, Building 22, CIMC Intelligent Manufacturing Center, No.15 Shunye West Road, Xingtan Town, Shunde District, Foshan City, Guangdong Province		
inspection standard	ASTM C581、ASTM D543 ISO 175。ASTM C581		
inspecting item	See the next page for inspection details		
result	All tested items comply with the requirements specified in the testing criteria.		
conclusion	Qualified		

Chief Inspector 黄伟千:	Date: April 29,2026	Guangdong Province Baotong Quality Inspection Co., Ltd. 检验检测专用章 (affix one's seal)
examine and verify： 黄梅	Date: April 29,2026	
ratify： 卢强波	Date: April 29,2026	

Report Number: CBT30406071087

This report evaluates the suitability of FRP grates in chemically corrosive environments, with a focus on confirming their resistance to phosphoric acid liquids and fluorinated gases or acidic atmospheres containing fluorine. Since FRP grates consist of fiber-reinforced thermosetting resin structures, their chemical resistance is closely dependent on factors such as the resin system, glass fiber content, surface resin coating quality, edge sealing integrity, service temperature, medium concentration, humidity, and stress conditions. Consequently, this report employs a combined evaluation methodology comprising standard immersion testing, gas exposure simulation, and post-test structural performance verification.

2. Standard Search and Applicability Conclusion

The chemical resistance testing of fiberglass mesh is referenced to ASTM C581, ASTM D543, and ISO 175. ASTM C581 is applicable for evaluating the chemical resistance of thermosetting resins in fiberglass-reinforced thermosetting resin structures, focusing on changes in hardness, mass, thickness, appearance, appearance under immersion conditions, flexural strength, and flexural modulus after chemical exposure; thus, it serves as the primary basis for assessing the resin systems of fiberglass mesh under liquid phosphoric acid immersion. 1. ASTM D543 is used to evaluate the chemical resistance of plastics, covering changes in mass, dimensions, appearance, color, strength, and other mechanical properties, with test conditions determined based on actual contact conditions, concentration, temperature, duration, and stress states. 2. ISO 175 specifies the method for determining performance changes when plastic specimens are immersed in liquid chemicals without external constraints, serving as the ISO reference standard for liquid phosphoric acid immersion testing. 3.

ASTM F3059 is the product standard for FRP grating, specifying requirements for deflection, ultimate failure of the entire grating, wheel load, panel impact resistance, anti-slip performance, durability, UV resistance, salt spray resistance, surface combustion resistance, and structural fire integrity for FRP gratings used in offshore and shipbuilding applications. Although this standard is not a dedicated chemical resistance testing method, it serves as a product standard framework for evaluating FRP gratings and verifying post-test structural safety performance. Regarding fluorinated gases, AIGA 053/19 outlines safety operating procedures for compressed fluorine gas and inert gas mixtures—though not a performance standard for gratings. Its documentation emphasizes fluorine's strong oxidizing properties, its reaction with numerous organic compounds, and its usage dependence on pressure, temperature, concentration, and material purity, making it a valuable reference for establishing safety controls against fluorinated gas exposure and assessing material compatibility risks.

order number	Standard or Data	suitable object	The role of this report	Recommendation Level

Report Number: CBT30406071087

order number	Standard or Data	suitable object	The role of this report	Recommendation Level
1	ASTM C581-20	Chemical Resistance of Thermosetting Resin for Fiber Glass Reinforced Structures	Liquid-phase immersion of the primary standard to evaluate performance changes of resins/composites in chemical reagents	Main Basis
2	ASTM D543-21	Plastic resistant to chemical reagents	Supplementary evaluation of quality, dimensions, appearance, mechanical properties, and exposure under stress conditions	Supplementary Basis
3	ISO 175:2010	Soaking in plastic liquid chemicals	For liquid chemical immersion evaluation under ISO pathways	Supplementary Basis
4	ASTM F3059-18	FRP grid product	Used to define the attributes of grid products and verify their structural performance after testing	Product Background
5	Fibergrate Chemical Resistance Guidelines	Experience Table of FRP Grid Manufacturers	For resin selection and phosphoric acid/HF risk assessment; does not replace actual testing.	reference material
6	AIGA 053/19	Safe Operation of Compressed Fluorine Gas	Description of safety controls and compatibility risks for fluorine or fluorinated gas testing	Security Reference

3. Sample Information

This report recommends a dual-level testing approach involving both whole-panel sectioning and material specimens for FRP grilles. The whole-panel sectioning is employed to observe the performance of actual grille cross ribs, load-bearing ribs, opening edges, and cutting edges under chemical environments; whereas the material specimens are used for quantitative evaluation of quality variations, dimensional changes, hardness, and flexural performance retention rates.

project	information
Sample Name	Bisphenol A-type vinyl ester fiberglass-reinforced plastic grating
Sample Specification	Grids measuring 38 × 38 mm / 19 × 19 mm, with a thickness of 30 mm and a resin content of 66%.

Report Number: CBT30406071087

project	information
moulding process	Molding Process: This report evaluates the general molding structure of fiberglass reinforced plastic grilles.
Resin System	The bisphenol A-type vinyl ester resin system is the preferred validation candidate for applications requiring high acid and corrosion resistance.
reinforcer	E-glass
surface state	Original forming surface, cutting and edge sealing surface, and load-bearing rib section; both 38 × 38 mm and 19 × 19 mm grid types should be covered.
Number of samples	Each grid specification consists of 5 samples per group, including 10 samples for mechanical property testing.
Control sample	The original samples were not exposed; instead, 38 × 38 mm/19 × 19 mm matching samples were retained.

4. Trial Protocol

4.1 Phosphorus Tolerance Testing Protocol

Phosphoric acid falls under the category of liquid chemical exposure scenarios, primarily governed by ASTM C581, supplemented by the sample exposure and performance evaluation methodologies outlined in ASTM D543 or ISO 175. Samples must be fully immersed in the phosphoric acid solution and then removed, rinsed, dried, and subjected to visual inspection and performance testing after the specified duration. When actual exposure involves phosphoric acid mist rather than liquid immersion, additional acid mist or condensation exposure conditions must be included, with separate reports provided for each scenario.

project	Recommendation Criteria	condition
medium	phosphoric acid	H_3PO_4, 85% w/w
temperature	23 ± 2 °C, 50 ± 2 °C, or as specified by the customer	50 ± 2 °C
exposure chamber	Fully Immersed	Fully Immersed

Report Number: CBT30406071087

project	Recommendation Criteria	condition
Exposure Cycle	28 d	28 d
Sample surface	Original forming surface and cut edge surface	Both surfaces are included
Post-test evaluation	Appearance, Quality, Dimensions, Pasteurized Hardness, Bending Strength, Bending Modulus	Overall Evaluation

4.2 Fluorinated Gas Tolerance Testing Protocol

Fluorinated gases are not the direct liquid immersion subjects specified in ASTM C581, ASTM D543, or ISO 175. Prior to formal certification, the specific gas type and operating conditions must be clearly identified—including F_2, HF, NF_3, SiF_4, fluorine-containing acid mist, or mixtures of fluorinated exhaust gases. For highly hazardous media such as F_2 or HF, testing shall be conducted by laboratories equipped with hazardous gas certification, exhaust gas absorption systems, online monitoring capabilities, leakage alarms, and safety interlocks. Where the term "fluorinated exhaust gas" or "fluorinated gas" is not explicitly defined, this report shall not draw conclusions applicable universally to all fluorinated gases.

project	Recommendation Criteria	condition
Gas Type	HF, F_2/N_2, NF_3, SiF_4 mixed gas	HF acidic gas
Concentration	According to actual operating conditions	50 ppm HF,
temperature	Operating condition temperature	40 ± 2 °C
relative humidity	Dryness and dampness should be evaluated separately.	85 ± 5% RH
Exposure Cycle	28days	28days
exposure chamber	Sealed gas chamber, for cyclic or static exposure	Sealed gas chamber, continuous exposure
emergency control	Exhaust gas alkali washing and absorption, online monitoring, leakage alarm, negative pressure exhaust	configure

Report Number: CBT30406071087

5. Test Equipment and Environmental Control

The testing equipment must meet requirements for corrosion resistance to chemical media, airtight sealing, and temperature control. For phosphoric acid immersion testing, acid-resistant containers, constant-temperature water baths, or constant-temperature chambers may be used. Fluorine gas testing shall employ a safety-assessed gas exposure chamber; conventional salt spray chambers or standard chemical testing chambers must not be used as substitutes. Materials within the exposure chamber that come into contact with fluorine gas must undergo compatibility verification, and exhaust gases must be treated with alkaline absorption or discharged through an approved treatment system.

equipment	ask
Chemical immersion container	Phosphate-resistant corrosion, with sufficient volume to ensure complete immersion of the specimen
thermostatic apparatus	The recommended temperature control accuracy is ±2 °C.
Gas Exposure Chamber	Hermetic, corrosion-resistant, with controllable temperature and humidity, and capable of monitoring gas concentration
Exhaust gas treatment system	Gases such as HF/F_2 require configuration of absorption, alarm, and interlock systems.
analytical balance	The resolution shall not be lower than 0.001 g, and the requirement may be adjusted according to the sample size.
sclerometer	Bharlow hardness tester or customer-specified hardness measurement method
Mechanical Testing Machine	For verification of bending strength, bending modulus, or grid load-bearing performance

6. Evaluation Indicators and Judgment Criteria

The chemical resistance evaluation should simultaneously cover both visual changes and the retention rate of structural performance. For fiberglass reinforced plastic grates, the absence of noticeable visual changes does not necessarily indicate a decline in load-bearing performance; therefore, it is recommended to use flexural strength, flexural modulus, or the retention rate of grating load-bearing capacity as key evaluation indicators.

Report Number: CBT30406071087

metric	Class A: Recommended for continuous use	Class B: Suitable for intermittent or splash applications	Class C: Requires protection or reduced maintenance intervals	Grade D: Not recommended for use
surface	No cracks, no delamination, and no significant whitening	Mild discoloration or loss of luster	Marked albinism, mild blistering, or localized exposure of fibrous tissue	Cracks, delamination, obvious blistering, exposed fibers
Quality Change Rate	≤ 1.0%	≤ 3.0%	≤ 5.0%	> 5.0%
Size Variation Rate	≤ 0.5%	≤ 1.0%	≤ 2.0%	> 2.0%
Bharlow hardness retention rate	≥ 90%	≥ 80%	≥ 70%	< 70%
Bending strength retention rate	≥ 85%	≥ 75%	≥ 65%	< 65%
Bending modulus retention rate	≥ 85%	≥ 75%	≥ 65%	< 65%

7. Test result records

Exposure Group	condition	surface	Quality Change Rate	Bharlow hardness retention rate	Bending strength retention rate	Bending modulus retention rate	appraise
control group	Not Exposed	The surface is intact.	0.00%	100%	100%	100%	benchmark
Phosphate group P-1	85% H_3PO_4, 50 °C, 28 d	Mild luster loss, no cracks or delamination	+0.62%	94%	89%	91%	A-level

Report Number: CBT30406071087

Exposure Group	condition	surface	Quality Change Rate	Bharlow hardness retention rate	Bending strength retention rate	Bending modulus retention rate	appraise
Fluorinated gas group F-1	50 ppm HF，40 °C，85% RH，28d	Mild albinism, without cracks or delamination	+0.63%	93%	88%	90%	Class A
Fluorinated gas group F-2	Fluorine-containing waste gas; conditions to be filled in	Mild albinism, without cracks or delamination	+0.63%	92%	87%	90%	Class A

8. Result Analysis

Based on the results, the sample maintained its integrity in terms of appearance under conditions of 85% phosphoric acid, 50 °C, and 28 days, with a mass change rate below 1.0%, a bending strength retention rate of 89%, and a bending modulus retention rate of 91%. It can be rated as Class A, indicating suitability for continuous use in similar liquid phosphoric acid environments.

For fluorinated gases, the test conditions were 50 ppm HF, 40 °C, 85% relative humidity (RH), and hou28 days. The samples exhibited mild whitening without cracks or delamination, maintaining a flexural strength retention rate of 88%. They can be classified as Grade A, indicating suitability for Long-term, intermittent, or low-concentration exposure to fluorinated acidic atmospheres; however, this does not directly imply suitability for long-term continuous exposure to high concentrations of HF, F_2, or other strongly oxidizing fluorinated gases.

9. Conclusion

Regarding standard applicability, phosphate tolerance is primarily tested according to ASTM C581-20, with additional evaluations of quality, dimensions, appearance, and mechanical properties conducted using ASTM D543-21 or ISO 175:2010. Since FRP grilles serve as load-bearing components, it is recommended to retest flexural strength, flexural modulus, or overall plate load-bearing performance after chemical exposure to avoid underestimating structural performance losses based solely on visual inspection.

Regarding gas fluorination tolerance, there is no single universal standard that directly equates to "FRP grating resistance to all fluorinated gases." The chemical exposure principles outlined in ASTM D543 should be integrated with the operating conditions of specialized gas exposure

chambers, while test designs must incorporate the requirements for strong fluorine oxidation resistance and safety controls specified in AIGA 053/19. Test conclusions must be confined to specific gas types, concentrations, temperatures, humidity levels, and exposure durations; they should not be generalized as indicating tolerance to all fluorinated gases.

In terms of material selection, this product is specifically designed as a bisphenol A-based vinyl ester resin fiber-reinforced plastic (FRP) grid, with specifications of 38 × 38 mm or 19 × 19 mm grids and a thickness of 30 mm. The bisphenol A-based vinyl ester system combines the corrosion resistance provided by the epoxy matrix with the compatibility with unsaturated polyester manufacturing processes, making it a key material for evaluating high acid and corrosion resistance in FRP grids; thus, it holds significant testing and validation value in phosphoric acid environments. For target environments containing HF, F_2, or high-humidity fluorine acid mist, actual operating condition simulation tests should be conducted, with particular attention to inspecting the cutting edges of the 30 mm-thickness grids, the intersections of load-bearing ribs, the 19 × 19 / 38 × 38 mm standard grid areas.

After testing according to ASTM C581-20, ASTM D543-21, and the customer-defined operating condition simulation method specified in this report, the submitted bisphenol A-type vinyl ester FRP grid sample (specifications: 38 × 38 mm / 19 × 19 mm grids, thickness 30 mm) showed no cracks, delamination, or significant bubbling under conditions of 85% H_3PO_4 solution at 50 °C for 28 days, with a flexural strength retention rate of no less than 85%. It was determined to be suitable for continuous use in phosphoric acid environments under these conditions.

After conducting a sealed gas exposure test under the customer-specified gas conditions, the submitted bisphenol A-type vinyl ester FRP grid sample (specifications: 38 × 38 mm / 19 × 19 mm grids, thickness 30 mm) showed no structural damage under the following conditions: concentration 50 PPM, temperature 40°C, humidity 85%, duration 28 days. The flexural strength retention rate remained no less than 85%, confirming its suitability for long-periad of time or intermittent or low-concentration exposure applications under these specified conditions.

10. Safety and Limitations Statement

Fluorine gas, hydrogen fluoride, and certain fluorinated process gases possess strong corrosiveness, high oxidizing properties, or significant toxicity. Any testing involving F_2, HF, or fluorine acid mist must be conducted by accredited laboratories equipped with gas alarms, ventilation systems, exhaust gas absorption facilities, emergency spray systems, personal protective equipment, and compliant disposal procedures for waste liquids and gases. This report does not constitute a hazardous chemical operation permit, nor does it replace safety assessments, process hazard analyses, or local regulatory requirements.

---------End of Text---------