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inspection report

Report Number: CBT30406071088

Sample Name:	**Bisphenol A vinyl ester FRP grating**
Sample model:	**VCF 38x38/19x19 thickness 30mm**
kind of inspection :	**Entrusted Testing**
client :	**Nantong Mach's Composite Material Co.,Ltd.**

Guangdong Province Baotong Quality Inspection Co., Ltd.

广东省宝通质量检测有限公司 检验检测专用章

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Inspection Summary			
Sample Name	Bisphenol A vinyl ester FRP grating	client	Nantong Mach's
ts	VCF 38x38/19x19 thickness 30mm	Address of the sponsoring organization	Nantong Rugao
trademark	/	Producer (Manufacturer)	Nantong Mach's
quantity	14PCS	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	March 23,2026 29 March 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	FRP-G-DWI-01 "Test Method for Free-Fall Impact of Fiberglass Reinforced Plastic Grid Plates under Heavy Weight"		
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: March 29,2026	Guangdong Province Baotong Quality Inspection Co., Ltd. (affix one's seal)
examine and verify : 黄楠	Date: March 29,2026	
ratify : 卢碧珍	Date: March 29,2026	

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This report optimizes the general drop/impact test protocol into a specialized hammer drop impact test version tailored for fiberglass-reinforced plastic (FRP) grid panels. As FRP grids are open-cell, rib-supported composite components with distinct impact behavior compared to transportation packaging, complete electronic equipment, or conventional plastic panels, direct application of packaging drop tests or standard rigid plastic 镖 impact tests is inappropriate. The recommended technical approach involves using ASTM F3059 as the primary reference, supplemented by ASTM D7136 and ASTM D5628 as methodological guidelines, combined with actual installation boundary conditions for acceptance testing by manufacturers/clients. ASTM F3059 specifies FRP grids for marine and shipbuilding applications, explicitly detailing impact resistance requirements for assembled grids; ASTM D7136 emphasizes that composite hammer impact results depend critically on specimen geometry, thickness, stiffness, impact energy, and support conditions; while ASTM D5628 provides reference principles for free-fall 镖/hammer impact energy thresholds and the influence of clamping conditions. 1 2 3

This report recommends using finished grating plates as test specimens, with supports either simply supported on both sides or configured according to actual installation conditions. The evaluation should record the appearance before and after impact, maximum instantaneous deflection, residual deflection, damage to load-bearing strips, exposed fibers, through-breakage, and post-impact re-evaluation of load-bearing capacity. For assessment, the criterion should not rely solely on the presence of cracks but rather employ a comprehensive evaluation method incorporating structural safety, repairability, and classification of visual damage.

List of accompanying images

This report includes four additional experimental illustrations to demonstrate the apparatus structure, support span and impact point arrangement, recommended impact energy levels, and post-impact damage classification for the pendulum free-fall impact test. The illustrations provide schematic diagrams of the testing method; actual testing should be conducted based on photographs of field equipment, specimen images, and measured data.

figure number	Image caption	use
graph 1	Schematic diagram of the fiberglass grid pendulum free-fall impact test apparatus	Formula explaining the heavy hammer, drop height, guide frame, support span, and impact energy
graph 2	Schematic diagram of the support span of the grid specimen and the plane arrangement of the impact point	Description of simply supported edge, free edge, support span, and recommended impact point
graph 3	Recommended heavy hammer free-fall impact energy level	說明 the energy levels A–F and the common acceptance ranges for customers

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figure number	Image caption	use
graph 4	Illustration of damage classification of fiberglass reinforced plastic grating after impact	Graphical representation of Grade 0–4 injury assessment

1. Standard Search and Applicability Analysis

There is no single universal standard for the free-fall impact testing of fiberglass reinforced plastic (FRP) grating weights that can comprehensively cover all application scenarios for civil, industrial, and marine platforms. For finished grating products, the most critical factor is defining the testing objective: if the purpose is ensuring the safety of passages for ship or offshore engineering personnel, ASTM F3059 or the customer-designated classification society specification should be prioritized; for research comparisons or factory verification, the enterprise methodology recommended in this report is appropriate; for impact damage studies on the material laminate itself, ASTM D7136 is more suitable; and for failure energy comparisons of plastic plates, ASTM D5628 is preferable. 1 2 3

Standard/Documentation	standard object	Relationship with the free-fall test of fiberglass-reinforced plastic grating weights	The recommended uses in this report
ASTM F3059	FRP grilles for marine construction and shipbuilding	The public abstract outlines the test items including impact resistance, deflection, ultimate failure, wheel load, anti-slip performance, durability, and salt spray resistance for the assembly plate.	Primary reference standard for the performance framework of finished grilles
ASTM D7136/D7136M	Continuous fiber-reinforced polymer-based composite laminated plate	The impact event with a drop hammer is used to evaluate the damage impedance of composite materials, emphasizing the influence of specimen geometry, support conditions, impact head characteristics, and energy input.	Methodological reference for describing energy, damage, and boundary conditions
ASTM D5628	Rigid plastic specimen for tablets	Determine the crack/rupture threshold energy using free-fall boomerang or pendulum tests, emphasizing the mass-height method and the clamping effect.	Methodological reference for expressing free-fall energy and failure thresholds

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Standard/Documentation	standard object	Relationship with the free-fall test of fiberglass-reinforced plastic grating weights	The recommended uses in this report
Fibergrate FRP Molded Grating Drop Test Report	Public demonstration case of FRP molded grid finished panels using a drop hammer testing method	A approximately 3 ft × 3 ft grid with simply supported sides, impacted by a 340 lb impactor falling freely from a height of 2 ft to 6 ft.	Industry case references are not equivalent to standards.

> The official summary of ASTM F3059 states that this specification defines testing and performance requirements for FRP grids used in marine and ship construction to ensure personnel safety. Testing requirements include items such as "assembled panel impact resistance."

> The official ASTM D7136/D7136M webpage states that this method is used to measure the damage impedance of multidirectional polymer matrix composite laminates under drop hammer impact tests, emphasizing that the impact results are highly dependent on the specimen geometry, lamination configuration, impact head geometry, impact mass, impact force, impact energy, and boundary conditions.

2. Test Method: FRP-G-DWI-01

This report names the method FRP-G-DWI-01, "Free-Fall Impact Test Method for FRP Grid Panels under Heavy Hammers from Height." It is designated as an enterprise standard or customer acceptance method, applicable to FRP molded grids, pultruded grids, and FRP grid panels with anti-slip sand surfaces. The core principle of the method involves subjecting finished grid panels in near-real installation conditions to concentrated hammer impacts, followed by evaluation of their structural integrity and serviceability post-impact.

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Figure 1 Schematic Diagram of Free-Fall Impact Test Setup for FRP Grating with Heavy Hammer

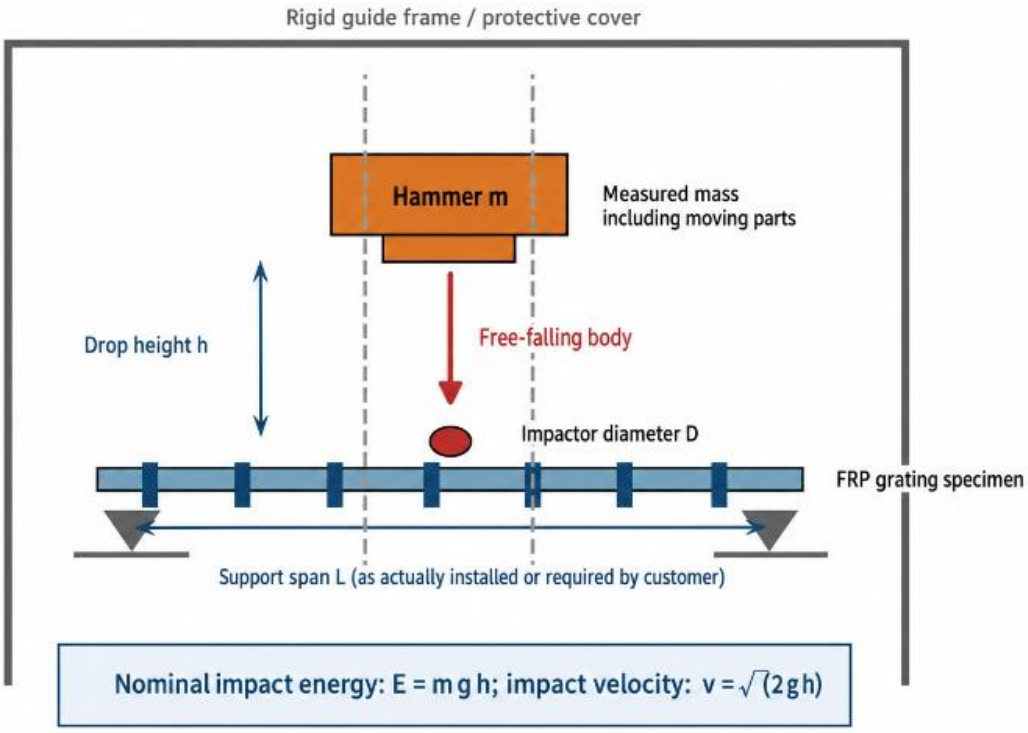


Figure 1 provides a side view schematic of the recommended test apparatus. The formal test report shall record the total mass of the pendulum weight, drop height, geometry of the impact head, support span, clamping method, and protective measures. The nominal impact energy is calculated as $E = mgh$, and the impact velocity is estimated as $v = \sqrt{(2gh)}$.

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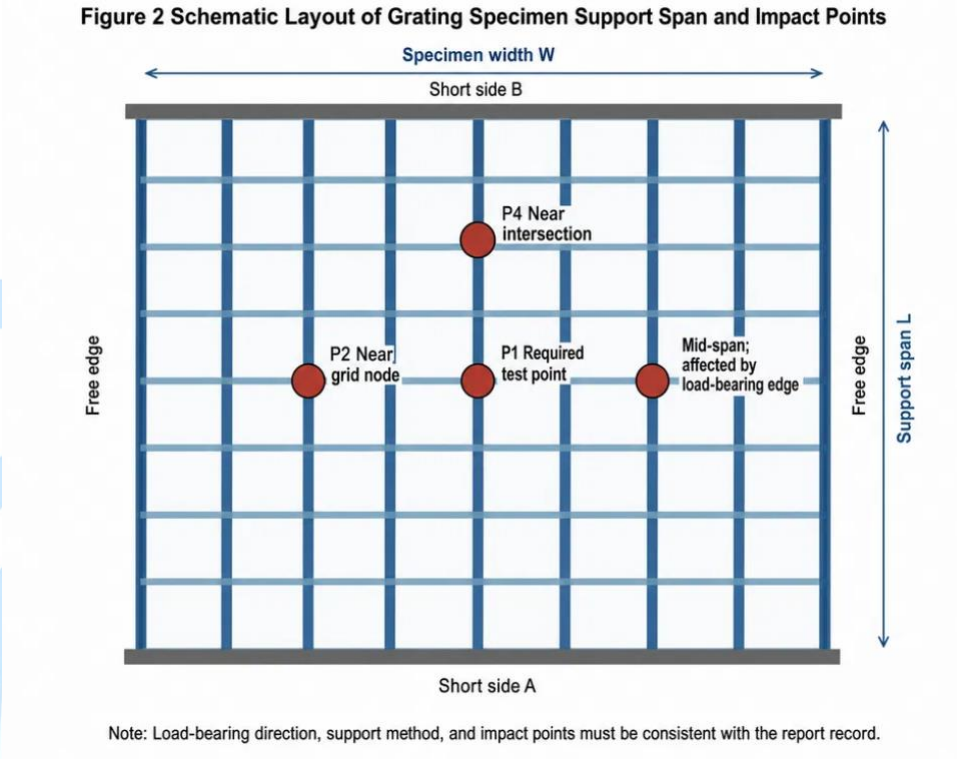


Figure 2 illustrates the planar arrangement of the grid specimen. P1 denotes the position of the central load-bearing strip in the mid-span, which is recommended as the mandatory impact test point; P2, P3, and P4 can be used to evaluate local damage differences in regions adjacent to the mesh openings, at the edges, and in intersecting adjacent areas.

project	Recommended Settings	Technical Reason
specimen size	Not less than 1000 mm × 1000 mm; when equipment is limited, not less than 900 mm × 900 mm.	The specimen should contain an adequate number of load-bearing strips and complete mesh openings to ensure that a single specimen cannot represent the finished grating plate.
Number of samples	No fewer than 3 units for each specification and energy level; 5 units are recommended for type validation.	Reduce the randomness caused by variations in local pore size and resin distribution
Support method	Two opposite sides are simply supported, while the other two sides are free; or supported/clamped on all four sides according to the actual installation method.	The support conditions significantly influence impact damage and deflection; therefore, they must be secured and documented.
Test Span	600 mm, 900 mm, 1200 mm, or the actual design span	Prioritize coverage based on the customer's actual installation span and the most unfavorable span.

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project	Recommended Settings	Technical Reason
Impact Point	The central load-bearing strip is a mandatory test point; additional test points may include adjacent mesh intersection points, edge adjacent points, and fixture adjacent points.	Covers the most adverse bending, localized crushing, and clamping effects
Heavy Hammer Shape	Cylindrical flat end or hemispherical tip, with a contact end diameter of 50–150 mm	The smaller the tip, the more severe the local puncture and crushing; the geometry of the tip must be reported.
Impact Direction	Perpendicular to the grid working surface, falling freely from top to bottom	The simulation tool, part, or heavy object fell from above the platform.
data logging	Quality, drop height, impact velocity, nominal energy, maximum instantaneous deflection, residual deflection, damage dimensions, photographs and videos	Facilitates re-examination of test conditions and batch comparison

3. Impact Energy Calculation and Recommended Level

The nominal potential energy of a free-fall pendulum impact is calculated using the formula $E = mgh$, where E represents the nominal impact energy in joules; m is the total mass of the pendulum in kilograms; g is the gravitational acceleration (9.80665 m/s^2); and h is the release height in meters. When air resistance is neglected, the impact velocity can be estimated as $v = \sqrt{(2gh)}$. The ASTM D5628 standard also states that the velocity of a freely falling object is proportional to the square root of its drop height; thus, the effect of drop height on velocity is non-linear, whereas its influence on potential energy is directly proportional to the drop height.

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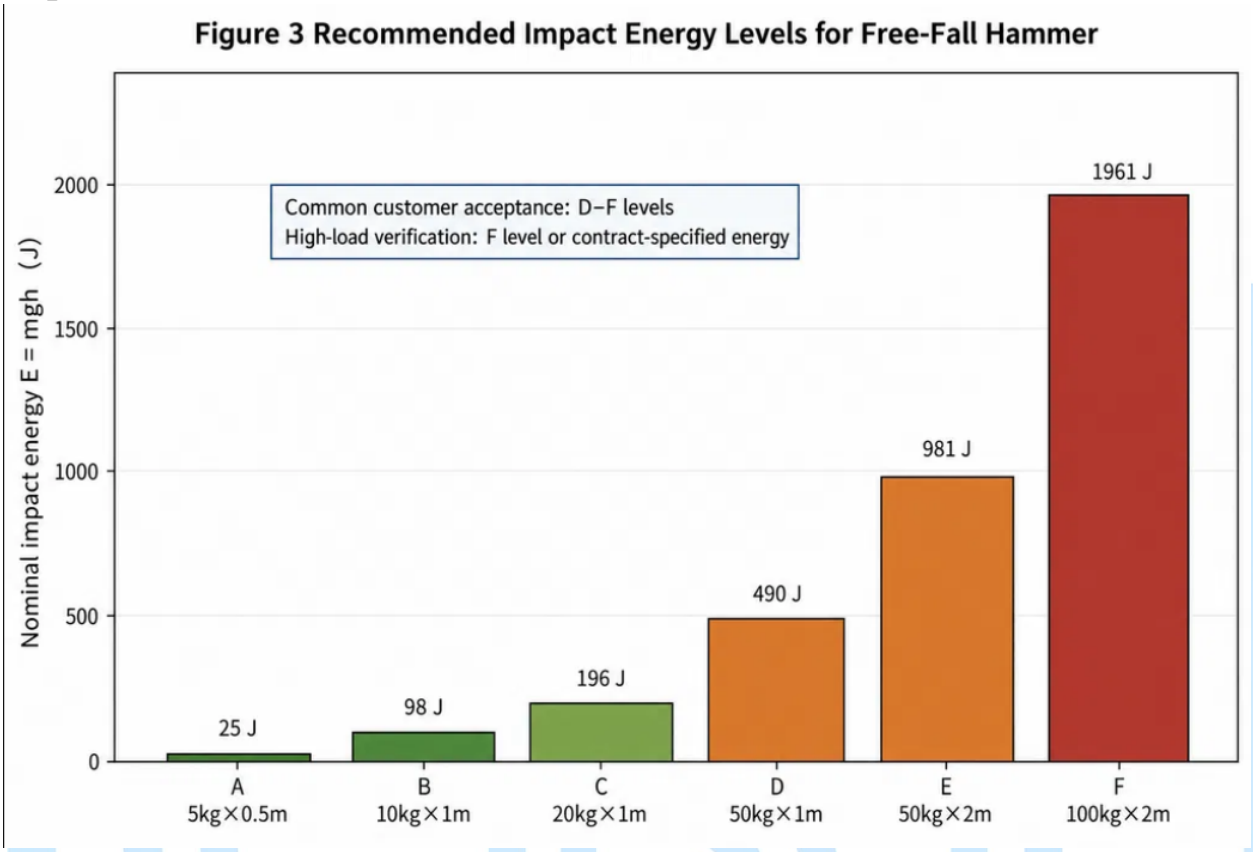


Figure 3 visually presents the recommended impact energy levels. For general customer acceptance, levels D–E are recommended as the priority; for high-load or high-risk scenarios, level F or the contract-specified energy level may be selected.

Level/Operating Condition	Heavy hammer mass (kg)	Descent height (m)	striking velocity m/s	Nominal impact energy J	Nominal impact energy: kJ
Grade A: Daily Tool Fall Simulation	5.00	0.500	3.13	25	0.02
Grade B: Light maintenance tools/parts	10.00	1.000	4.43	98	0.10
Class C: Medium-sized tools/components	20.00	1.000	4.43	196	0.20
D Grade: Heavy Maintenance Impact	50.00	1.000	4.43	490	0.49
E Level: Heavy Hammer Impact from a Height	50.00	2.000	6.26	981	0.98

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Level/Operating Condition	Heavy hammer mass (kg)	Descent height (m)	striking velocity m/s	Nominal impact energy J	Nominal impact energy: kJ
Grade F: High-load grid verification	100.00	2.000	6.26	1961	1.96
Industry case reference: 340 lb × 24.75 in	154.22	0.629	3.51	951	0.95
Industry case reference: 340 lb × 36.75 in	154.22	0.933	4.28	1412	1.41
Industry case reference: 340 lb × 48.75 in	154.22	1.238	4.93	1873	1.87
Industry case reference: 340 lb × 60.75 in	154.22	1.543	5.50	2334	2.33
Industry case reference: 340 lb × 71.9375 in	154.22	1.827	5.99	2763	2.76

For standard industrial platform grilles, it is recommended that customer acceptance begin with Grade D or E; for high-load grilles, maintenance platforms, or scenarios with heavy object falling risks, Grade F or the energy specified in the contract may be applied. To compare with publicly available FRP molded grille drop hammer tests, parameters such as a 154 kg hammer, drop height of 0.63–1.83 m, and energy range of 0.95–2.76 kJ may be used, but such cases should not be presented as mandatory standards.

4. Test Equipment and Environmental Conditions

The testing apparatus shall include a rigid frame, a guiding and release mechanism, a calibratable weight, an adjustable drop height device, a specimen support platform, a mechanical protective cover, and a measurement and recording system. The guiding mechanism must ensure that the weight falls nearly vertically after release, preventing significant oscillation, jamming, or secondary collisions. If a guide rod is used, the report shall specify whether the guide rod is included in the total mass; if the impact head is replaceable, the diameter of its tip, the radius of the fillet, its hardness, and material should be recorded.

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class	ask
mass measurement	The total mass of the heavy hammer and its follower components should be measured experimentally, with a recommended accuracy of no less than ±0.5%.
Drop height measurement	The calculation should be based on the vertical distance from the lowest contact point of the impact head to the impact point on the upper surface of the specimen, with a recommended accuracy of no less than ±2 mm.
Support platform	The stiffness must be sufficient; no overall sliding or permanent deformation that could affect the results shall occur during the testing process.
protect	The equipment shall be equipped with protective covers, limit devices, and remote release mechanisms to prevent injury caused by hammer rebound.
environment	The routine test is recommended to be conducted at 23 ± 5 °C and a relative humidity of 30%–75%. Upon customer request, impact tests may be performed after low-temperature exposure, water immersion, salt spray exposure, or ultraviolet aging.

5. Sample Information and Test Conditions

project	
Sample Name	FRP molded grating panel
Sample Model	FRP-VCF-38×38/ 19X19 30
Material System	Fiber glass reinforced bisphenol A-type vinyl resin with anti-slip sand coating on the surface
specimen size	1000 mm × 1000 mm × 30 mm
Pore size specification	38 mm × 38 mm/19X19
Number of samples	3 items
Support method	Two opposite sides are simply supported with a support span of 900 mm; the other two sides are free.

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project	
Impact location	The geometric center of the specimen is located in the mid-span region of the main load-bearing strip.
Heavy Hammer Mass	50.00 kg
Drop height	2.000 m
Nominal impact energy	981 J
Impact Head	Cylindrical flat head, contact end diameter 100 mm, steel 製
Impact Count	1 impact per item; if the customer requests repeated impacts, 3 impacts per item with cumulative damage recorded

6. Experimental Steps

Before the test, verify the sample number, specifications, visual condition, and dimensions, and take photographs prior to impact testing. Place the samples on the support platform at the specified span, ensuring the orientation of the main load-bearing strips aligns with the actual installation direction. If fixtures are used, record their quantity, position, and tightening status; if no fixtures are employed, note whether the samples can rotate or slide freely on the support.

During the test, raise the weight hammer to the specified height so that the impact head's centerline aligns with the predetermined impact point. Release the weight hammer after confirming that personnel have evacuated the protection area, and record the impact process, rebound characteristics, instantaneous deflection of the specimen, and any abnormal sounds. Upon completion of the impact and confirmation that the weight hammer has stopped, inspect the specimen for damage on its upper surface, lower surface, load-bearing strips, crossbars, edges, and near the fixture. If necessary, perform a post-impact static load verification to confirm whether the grid still meets the specified load-bearing or deflection requirements.

step	Key Operating Points	Record Content
1	Sample Verification and Dimension Measurement	Specification, thickness, mesh size, quality, defects

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step	Key Operating Points	Record Content
2	Installation, Support, and Positioning	Span, support width, clamping method, direction of load-bearing strip
3	Set the hammer	Heavy hammer mass, impact head geometry, drop height
4	Execution Impact	Video, impact point, rebound, maximum instantaneous deflection
5	Injury Examination	Cracks, exposed fibers, delamination, fracture of load-bearing strips, through-breaking failure
6	Review and Evaluation	Residual deflection, reparability, post-impact load-bearing capacity

7. Injury Classification and Qualification Assessment

Resin edge chipping, whitening, or localized fiber exposure on FRP grids after impact does not necessarily indicate structural failure; however, fracture of load-bearing strips, through-crack damage, complete collapse, or clamping failure directly compromise pedestrian safety. Therefore, this report recommends adopting a Grade 0–4 damage assessment system and evaluating residual deflection alongside post-impact load-bearing capacity in compliance determination.

Figure 4 Schematic Damage Classification of FRP Grating After Impact

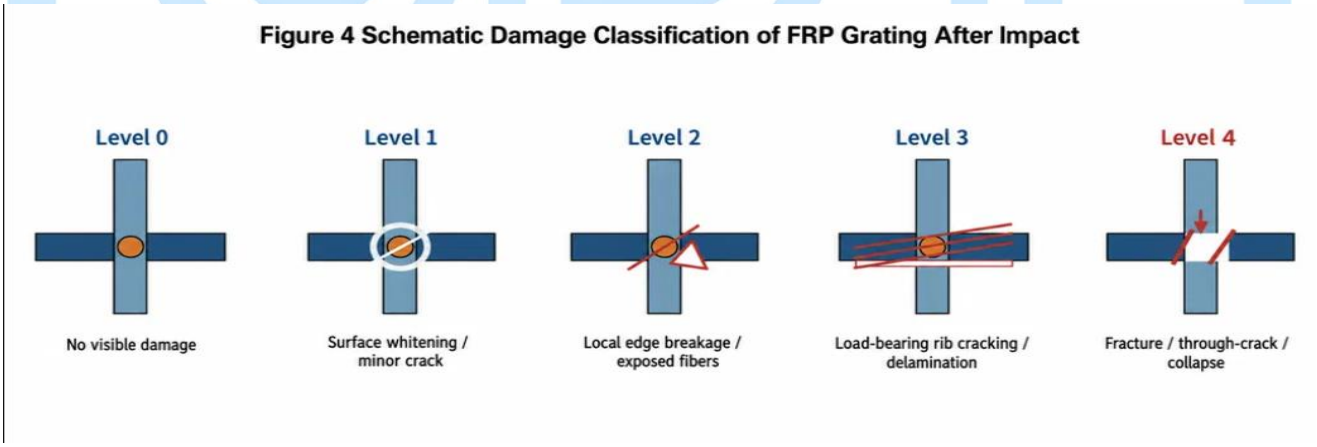


Figure 4 categorizes post-impact damage from mild to severe into grades 0–4. For formal assessment, visual photographs, residual deflection, condition of load-bearing strips, and post-impact static load verification results should be comprehensively evaluated; the presence of surface cracks alone should not serve as the sole criterion.

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Injury Level	Damage Description	Recommended Diagnosis
Level 0	No visible damage, or only minor marks.	Qualified
Level 1	The surface resin exhibits slight whitening, minor cracks, or localized detachment of the anti-slip sand surface without exposing the fibers.	Qualified
Level 2	Local resin fracture with minimal exposed fibers or small-area edge collapse; the load-bearing strip remains intact without rupture or penetration.	If the conditions are met, it is recommended to repair the resin anticorrosion layer.
Level 3	The bearing layer exhibits localized splitting, stratification, or pronounced cracking of the fiber bundles on the bottom surface, but without overall collapse; post-impact static load verification meets requirements.	The restriction is valid; it requires evaluation for downgrading usage or retesting after repair.
Level 4	The load-bearing member is completely fractured, subjected to through-breaking damage, fully collapsed, experienced failure of the support/fixture, or has become incapable of bearing load after impact.	Unqualified

The recommended qualification criteria are as follows: No through-breaking failure shall occur after impact; no overall collapse of the grid shall occur; no complete fracture of more than one main load-bearing strip shall occur; the residual deflection shall not exceed **1.0%** of the support span or the value specified by the client; if fiber exposure occurs, sealing repairs shall be performed and the repair materials recorded. For pedestrian platforms, it is recommended to verify the platform's safety for continued use by applying the specified design load or the client-specified static load after impact.

8. Sample Test Record

The table below contains sample data to demonstrate the report format. The actual report should replace it with measured results.

Sample Number	Heavy hammer mass (kg)	Descent height (m)	Nominal Energy J	Maximum instantaneous deflection mm	residual deflection mm	Primary injury	Injury Level	judge

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Sample Number	Heavy hammer mass (kg)	Descent height (m)	Nominal Energy J	Maximum instantaneous deflection mm	residual deflection mm	Primary injury	Injury Level	judge
S-01	50.00	2.000	981	28.5	3.2	The impact point causes whitening of the surface resin, with localized peeling of the sand surface and no exposure of fibers.	1	Qualified
S-02	50.00	2.000	981	31.0	4.1	The impact point exhibits shallow cracking of the resin, with no splitting observed on the bottom surface of the load-bearing strip.	1	Qualified
S-03	50.00	2.000	981	30.2	3.8	The impact point exhibits localized edge chipping of approximately 12 mm, which is not penetrating or fragmented.	2	The conditions are met; repair is recommended.

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statistical item	Result
Average maximum instantaneous deflection	29.9 mm
Average residual deflection	3.7 mm
Maximum residual deflection rate	0.46% (based on a span of 900 mm)
Highest injury level	Level 2
Through-and-through damage	Not occurred
The main load-bearing strip is completely fractured.	Not occurred
Comprehensive Assessment	Qualified

9. Conclusion

Under the experimental conditions of this study, the FRP grid specimens were subjected to a single free-fall impact using a 50.00 kg hammer dropped from a height of 2.000 m, resulting in a nominal impact energy of 981 J. None of the three specimens exhibited through-breaking failure, complete collapse, or full fracture of the primary load-bearing strips; the maximum residual deflection rate was less than 1.0%, corresponding to damage grades 1−2. According to the evaluation criteria established in this report, the specimens were deemed compliant under these impact conditions. Notably, specimen S-03 exhibited localized edge chipping; it is recommended to apply a repair resin compatible with the original resin system for sealing treatment to restore surface corrosion protection.

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If customers wish to establish higher-level product comparison data, it is recommended to conduct additional stepwise energy tests at 50 kg × 1.0 m, 50 kg × 2.0 m, 100 kg × 2.0 m, or approximately 154 kg × 0.63−1.83 m, and combine these with post-impact static load verification to establish a product database covering "impact energy − damage grade − remaining load capacity."

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