UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in Agreement with UMRL dated January 2021
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05/18

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USACE / NAVFAC / AFCEC / NASA	**UFGS-06 73 01 (May 2018)**

Preparing Activity: NASA	**Superseding**
	UFGS-06 73 01 (February 2015)

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SECTION 06 73 01

FIBERGLASS REINFORCED PLASTIC (FRP) GRATING
05/18

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NOTE: This guide specification covers requirements for fiberglass reinforced plastic (FRP) gratings.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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NOTE: Units of work normally included in this section should be FRP items that require specific fabrication to meet the desired project requirements.
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NOTE: Show the following information on the drawings:

1. Location and configuration of all FRP grates.

2. All sizes and dimensions.

3. Special fastenings, attachments, or anchoring.

4. Location and special details of expansion joint covers.

5. Connection details, other than manufacturer's

standard details for grating.

8. Locations and details of removable sections of handrails.

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PART 1 GENERAL

This Section includes, but is not limited to, new fiberglass reinforced plastic (FRP) grating for elevated platforms and walkways.

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer

ASTM D790	(2017) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D953	(2019) Standard Test Method for Pin-Bearing Strength of Plastics
ASTM D2344/D2344M	(2016) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D2863	(2019) Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E662	(2019) Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
ASTM G154	(2016) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
ASTM G155	(2013) Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

SAE CMH-17-36	(2012) Composite Materials Handbook, Vol. 3, Polymer Matrix Composites Material Usage, Design, and Analysis

UNDERWRITERS LABORATORIES (UL)

UL 94	(2013; Reprint Jun 2020) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that

require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings, Templates, and Directions; G[, [____]]

SD-03 Product Data

FRP Grating; G[, [____]]

Clips and Anchorage; G[, [____]]

SD-06 Test Reports

Bearing Strength Testing

Flexural Properties

Ultraviolet Testing

Shear Strength

Tensile Properties

Toxicity Testing

Coefficient of Lineal Thermal Expansion

Flame Spread Testing

SD-07 Certificates

Manufacturer's Sample Warranty

[Manufacturer's Certification of State Product Approval

] Certification of Anchorage System compliance with ASCE 7-16

[Proof of Certification from a minimum of two quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR)

] SD-08 Manufacturer's Instructions

Shipping, Handling, And Erection Procedures

Care and Maintenance Instructions

SD-09 Manufacturer's Field Reports

Manufacturer's Certification of Installation

SD-11 Closeout Submittals

Manufacturer's Warranty

1.3 QUALITY CONTROL

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NOTE: For jobs in Iceland, in lieu of AWS welders and inspectors, use "Technological Institute of Iceland"-certified welders and inspectors.
****

Provide items by manufacturers having a minimum of [10][_____] years of experience in the design and manufacture of similar products and systems. In addition, if requested, provide a record of at least [five][_____] separate, similar, successful installations in the last [5][_____] years. Submit manufacturer's catalog data, to include two copies of the manufacturer's specifications, load tables, dimension diagrams, and anchor details for the following items:

a. FRP Grating

b. Clips and Anchorage

Provide [3][_____]-year manufacturer's limited warranty on all FRP products against defects in materials and workmanship. Submit the Manufacturer's Sample Warranty before work starts.

Submit installation drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are embedded in concrete or masonry.

Submit Certification of Anchorage System compliance with ASCE 7-16. Deliver such items to the Contracting Officer and the project site before installation starts.

[Ensure that the manufacturer is certified to ISO 9001-2008.[Submit the Manufacturer's Certification of State Product Approval.][Submit the Proof of Certification from a minimum of two quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).

]]1.4 DELIVERY, HANDLING, AND STORAGE

Submit the manufacturer's recommendations for shipping, handling, and erection procedures, and care and maintenance instructions. Deliver manufactured materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Ensure that all adhesives, resins, and their catalysts and hardeners are crated or boxed separately, and noted as such.

Handle all materials to prevent abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store adhesives, resins and their catalysts in dry indoor facilities between 21 and 30 degrees C 70 and 85 degrees F until they are required.

PART 2 PRODUCTS

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NOTE: Select products based on esthetic values, reliability, and cost. Delete alternate requirements where they occur.
****

2.1 SYSTEM DESCRIPTION

Provide gratings composed of continuous roving fiberglass reinforcement and resin in qualities, quantities, properties, arrangements, and dimensions as necessary to meet the design requirements and dimensions as specified.

Provide resin of isophthalic polyester with chemical formulations as necessary to provide the corrosion resistance, strength, and other physical properties conforming to the specified requirements.

Ensure that all surfaces of FRP items and fabrications are [smooth] [nonslip grit], resin-rich, and free of voids, dry spots, cracks, and unreinforced areas. Completely cover all glass fibers with resin to protect against their exposure to ultraviolet light, wear, or weathering.

2.1.1 Design Requirements

Submit documentation for the following product tests before work starts:

Test	Standard	Structural Performance Requirements	Minimum Flexural Strength	Minimum Flexural Modulus
Bearing Strength Testing	ASTM D953			
Flexural Properties	ASTM D790		30,000 psi	(1.8 x 10 to power of 6) psi
Ultraviolet Testing	ASTM G155 ASTM G154			
Shear Strength	ASTM D2344/D2344M	4,500 psi		
Tensile Properties	ASTM D638	30,000 psi		
Toxicity Testing	SAE CMH-17-36			
Coefficient of Lineal Thermal Expansion	ASTM D696	8.0 x 10 power minus 6 in/in/degree F		
Flame Spread Testing	ASTM D2863 ASTM E662 UL 94			

2.1.2 Performance Requirements

2.1.2.1 Structural Performance of Gratings

Provide gratings capable of withstanding the effects of gravity loads in accordance with ASCE 7-16, ICC IBC, and the following loads and stresses within the limits and under the conditions indicated:

[Walkways and Elevated Platforms Other Than Exits: Uniform load of 2.873 kilopascal 60 lb/square foot.

][Walkways and Elevated Platforms Used as Exits: Uniform load of 4.788 kilopascal 100 lb/square foot.

][High Load Capacity (HLC)Grating for AASHTO - H-20 LOADING: 14.515 kg 32,000 lb Axle Dual Wheels; minimum 3.8 to 5.1 cm 1.5 to 2 inch thickness.

][Automobile Traffic: 2268 kg 5000 lb vehicle

][Forklift: [4.54] [2.72] [.907] tonne [5] [3] [1] ton capacity
]

Provide grating products with a flame spread rating of 25 or less per ASTM E84 Tunnel Test. Test gratings for burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

2.2 FABRICATION

2.2.1 Molded FRP Grating

Ensure that all field-fabricated and shop-fabricated grating cuts are coated with vinyl ester resin to provide maximum corrosion resistance in accordance with the manufacturer's instructions.

Provide grating made as one-piece molded construction with tops and bottoms of bearing bars and cross bars in the same plane with a rectangular mesh pattern providing unidirectional strength and reinforced with continuous roving of an equal number of layers in each direction. Ensure that the top layer of reinforcement is no more than 3 mm 1/8 inch below the top surface of the grating to provide maximum stiffness and prevent resin chipping of unreinforced surfaces having percentage of glass (by weight) not exceeding 35 percent.

Ensure that no dry glass fibers are visible on any surface of bearing bars or cross bars after molding, and that all bars are smooth and uniform, with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin-rich areas or resin-starved areas.

[Provide nonslip surfacing manufactured with a concave, meniscus profile on the top of each bar providing maximum slip resistance.

] Fillet grating bar intersections to a minimum radius of 1.6 mm1/16 inch to eliminate local stress concentrations and the possibility of resin cracking at these locations.

Provide fire-retardant grating with a tested flame spread rating of 25 or less when tested in accordance with ASTM E84.

2.2.2 Fasteners

Provide Type 316 stainless-steel fasteners, clips, and anchorage for exterior use. Select fasteners for type, grade, and class required.

PART 3 EXECUTION

3.1 INSTALLATION

Install items at locations indicated, according to the manufacturer's instructions.[Submit [_____] copies of manufacturer's Certification of Installation to the Contracting Officer.] Verify all measurements and take all field measurements necessary before fabrication. Include all materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines; and levels and free of rack. Comply with recommendations of cited bar grating standards, including installation clearances and standard anchoring details.

a. Attach removable units to supporting members with the type and size of clips and fasteners indicated or, if not indicated, as recommended by the grating manufacturer for the type of installation conditions shown.

b. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.1.1 Anchorage, Fastenings, and Connections

Provide anchorage where necessary for fastening miscellaneous FRP items securely in place.

3.2 CLOSEOUT ACTIVITIES

3.2.1 Manufacturer's Warranty

Submit original and [_____] copies of manufacturer's signed Warranty.

-- End of Section --