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USACE / NAVFAC / AFCEC / NASA **UFGS-35 59 13.19 (April 2006)**

Preparing Activity: NAVFAC **Replacing without change UFGS-02397 (May 2003)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2021
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DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 59 13.19

ARCH-TYPE RUBBER MARINE FENDERS

04/06

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SECTION 35 59 13.19

ARCH-TYPE RUBBER MARINE FENDERS
04/06

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NOTE: This guide specification covers the requirements for arch-type rubber marine fenders.

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: On the project drawings, show location of fenders and size and spacing of fasteners.

****

PART 1 GENERAL

1.1 REFERENCES

****

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 MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.22M	(1981; R 2017) Metric Plain Washers

ASTM INTERNATIONAL (ASTM)

ASTM A479/A479M	(2020) Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D573	(2004; R 2019) Standard Test Method for Rubber - Deterioration in an Air Oven
ASTM D575	(1991; R 2012) Rubber Properties in Compression
ASTM D624	(2000; R 2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D746	(2014) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D1171	(2016; E 2016) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors (Triangular Specimens)
ASTM D2000	(2018) Standard Classification System for

	Rubber Products in Automotive Applications
ASTM F593	(2017) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	(2009; R 2020) Standard Specification for Stainless Steel Nuts

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-907	(2020; Rev H) Antiseize Thread Compound, High Temperature

1.2 SUBMITTALS

****

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.

****

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-03 Product Data

Fender

Hardware

SD-05 Design Data

Reaction--energy--percent compression curve

Dimension

Fender material specifications

Design calculations

SD-06 Test Reports

Minimum Tensile Strength

Shore Hardness (Durometer)

Modulus at 400 Percent Elongation

Maximum Compression Set

Tear Resistance

Minimum Elongation

Ozone Resistance

Low Temperature Impact Resistance

Water Absorption

Heat Resistance

Compression Deflection Resistance

Fender Compression Test

Angular Fender Compression Test

Tests shall have been performed on the specified fender within 5 years of submittal of the reports for approval. Test reports shall be accompanied by notarized certificates from the manufacturer certifying that the tested material is of the same type, quality, manufacture and make as that proposed to be supplied.

SD-08 Manufacturer's Instructions

Installation Instructions

1.3 DELIVERY HANDLING AND STORAGE

Fenders shall be undamaged when delivered and shall be handled and stored

so as to prevent damage, such as bending or abrading end fittings, cutting of rubber, or damage to coating of hardware. Protect fenders from exposure to damaging liquids, oils, greases and extended exposure to sunlight.

PART 2 PRODUCTS

2.1 CONFIGURATION

****
NOTE: Coordinate angle with angular compression test requirements.
****

Fender shall be extruded and shall be continuous in the length indicated. The fenders shall have a truncated "A" cross section shape and be attached to the structure at the base, the widest dimension, of the arch. The connecting hardware shall be fully exposed. No encased hardware or molded fenders shall be allowed. The fender and hardware shall be designed and factory tested to the loads per linear meter foot of fender specified in paragraph entitled "PERFORMANCE," for angles of approach of 0 and 0.26 rad 0 and 15 degrees. Fender anchor bolts and method of anchorage shall be of the size and spacing required by the manufacturer's design and testing; however, the size and spacing of anchor bolts indicated on the drawings shall be construed to be the minimum required, unless exceeded by the requirements of the fender manufacturer's design.

2.2 ELASTOMER

The elastomer shall be the ethylene propylene dimonomer (EPDM), as specified in ASTM D2000, with the following properties:

****
NOTE: Coordinate values with calculated design requirements.
****

ELASTOMER PROPERTY REQUIREMENTS	
Minimum Tensile Strength (ASTM D412)	[14 MPa] [_____] [2000 psi] [_____]
Shore Hardness (Durometer) (ASTM D412)	[70 plus 5] [_____]
Modulus at 400 Percent Elongation (ASTM D412)	[6.2 MPa] [_____] [900 psi] [_____]
Maximum Compression Set (ASTM D395 Method B, Maximum Percent 22 Hr. at 70 Degrees C 158 Degrees F)	[25] [_____] Percent
Tear Resistance (ASTM D624; DIE B Min. 150 lb/in)	[300] [_____] lb/in.

ELASTOMER PROPERTY REQUIREMENTS	
Minimum Elongation (ASTM D412)	[500] [_____] Percent
Ozone Resistance (ASTM D1171 Exposure Method B; 70h Bent Loop at 38 Degrees C 100 Degrees F; 50pphm)	[80] [_____] H plus
Low Temperature Impact Resistance (ASTM D746 Procedure B; Non-Brittle at minus 55 Degrees C minus 67 Degrees F)	[0] [_____] Degrees C [minus 40] [_____] Degrees F
Water Absorption (ASTM D471 Method B; 70h at 100 Degrees C 212 Degrees F; Volume Change plus 5 Percent	[10.0] [_____] Percent
Heat Resistance (ASTM D573; 70h at 100 Degrees C 212 Degrees F Ch Tensile, Elong. minus 25 Percent, Hardness plus 10	Shall exceed requirements
Compression Deflection Resistance (ASTM D575 Method B; 3 S Dwell at 23 Degrees C 73 Degrees F	Shall exceed requirements

2.3 HARDWARE

2.3.1 Plates and Angles

ASTM A479/A479M, Type 316L stainless steel for plates, angles, and miscellaneous hardware required to attach the fenders to the structure.

2.3.2 Nuts, Bolts, and Washers

ASTM F593 or ASTM F594, Group 2 (316 alloy) stainless steel for nuts and bolts. ASME B18.22M ASME B18.21.1 for washers, except fabricate washers of 316 alloy stainless steel.

2.3.3 Antiseize Compound

MIL-PRF-907.

2.4 PERFORMANCE

****
NOTE: Coordinate values with calculated design requirements.
****

When vertically compressed by a plate extending the full length and width of a 0.30 m one foot section of the fender, the fender shall absorb [8950] [_____] joules [6,600] [_____] foot pounds of energy plus10 percent when [48] [_____] percent compressed (i.e., to a dimension of [52] [_____] percent of its original height) with a corresponding load of not more than

[85,402] [_____] N [19,200] [_____] pounds plus 10 percent.

2.4.1 FENDER COMPRESSION TEST

****
NOTE: Coordinate values with calculated design requirements.
****

Compress fender along its longitudinal axis between two parallel flat plate surfaces to a compressed dimension of [48] [_____] percent of its original height. Record load and the corresponding deflection at 6 mm 1/4 inch increments and plot as a graph of load versus deflection. The Load-Deflection curve shall then be integrated to generate an Energy-Deflection curve for the fender. After compression of the fender to [48] [_____] percent of its original height, the fender shall be rebound to 98 percent of its original height within [ten] [_____] minutes after the load is removed.

2.4.2 ANGULAR FENDER COMPRESSION TEST

****
NOTE: Coordinate values with calculated design requirements.
****

Compress fender along its longitudinal axis between two flat plate surfaces, at an angle of [0.26] [_____] rad [15] [_____] degrees to each other, to a compressed dimension of [48] [_____] percent of its original height. Record load and the corresponding deflection at 6 mm 1/4 inch increments and plot as a graph of load versus deflection. The Load-Deflection curve shall then be integrated to generate an Energy-Deflection curve for the fender. After compression of the fender to [48] [_____] percent of its original height, the fender shall rebound to 98 percent of its original height within [10] [_____] minutes after the load is removed.

PART 3 EXECUTION

3.1 INSTALLATION

Install fenders with the fender longitudinal axis vertical. Install the fenders in the position and at the spacing indicated on the drawings.

3.1.1 Antiseize Compound

Coat threads of bolts prior to applying washers and nuts. Recoat bolt thread projection beyond nut after tightening.

-- End of Section --