
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 April 2018

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04/06

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ARCH-TYPE RUBBER MARINE FENDERS 04/06

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).

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.

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.

ASME INTERNATIONAL (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 (2018) Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

ASTM D1171 (2016; E 2016) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors (Triangular Specimens)

ASTM D2000 (2012; R 2017) Standard Classification System for Rubber Products in Automotive Applications

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 2010) Standard Test Method for Rubber - Deterioration in an Air Oven

ASTM D575 (1991; R 2012) Rubber Properties in Compression

ASTM D624 (2000; R 2012) 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 F593 (2017) Standard Specification for
Stainless Steel Bolts, Hex Cap Screws, and
Studs

ASTM F594 (2009; E 2015) Standard Specification for
Stainless Steel Nuts

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-907 (2004; Rev F) 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 to reflect only the submittals
required for the project.

The Guide Specification technical editors have
designated 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 submittals requiring Government approval on Army
projects, a code of up to three characters within
the submittal tags may be used following the "G"
designation 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.

Use the "S" classification only in SD-11 Closeout
Submittals. The "S" following a submittal item
indicates that the submittal is required for the
Sustainability eNotebook to fulfill federally
mandated sustainable requirements in accordance with
Section 01 33 29 SUSTAINABILITY REPORTING.

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" designation;
submittals not having a "G" designation are [for Contractor Quality Control
approval.][for information only. When used, a designation following the
"G" designation identifies the office that will review the submittal for

the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. 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.**

<u>ELASTOMER PROPERTY REQUIREMENTS</u>	
Minimum Tensile Strength (ASTM D412)	[14 MPa] [____] [2000 psi] [____]
Shore Hardness (Durometer) (ASTM D412)	[70 <u>plus</u> 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

ELASTOMER PROPERTY REQUIREMENTS	
Tear Resistance (ASTM D624; DIE B Min. 150 lb/in)	[300] [_____] lb/in.
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 <u>plus</u>
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 <u>plus</u> 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 plus 10 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 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 --