SECTION 35 59 13.19

ARCH-TYPE RUBBER MARINE FENDERS
04/06

PART 1 GENERAL

1.1 REFERENCES

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) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A479/A479M	(2012) Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2240	(2005; R 2010) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D395	(2003; R 2008) Standard Test Methods for Rubber Property - Compression Set
ASTM D412	(2006a; E 2008; R 2008) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2012a) 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 D 6712	(2009) Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes

ASTM F593	(2002; R 2008; E 2012) Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	(2009; E 2011) 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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted 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 the past 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

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 foot of fender specified in paragraph entitled "PERFORMANCE," for angles of approach of 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:

ELASTOMER PROPERTY REQUIREMENTS	
Minimum Tensile Strength (ASTM D412)	16 Mpa 2320 psi
Shore Hardness(Durometer) (ASTM D2240)	Shore A
Modulus at 350 Percent Elongation (ASTM D412)	6.2 Mpa 900 psi

ELASTOMER PROPERTY REQUIREMENTS	
Maximum Compression Set (ASTM D395 Method B, Maximum Percent 22 Hr. at 158 Degrees F)	30 Percent
Tear Resistance (ASTM D624; DIE B Min. 150 lb/in)	400 lb/in 70 kN/m
Minimum Elongation (ASTM D412)	350 Percent
Ozone Resistance (ASTM D1149 Exposure Method B; 70h Bent Loop at 100 Degrees F; 50pphm) Method B1 100 hr	No Cracks
Water Absorption (ASTM D471 Method B; 70h 212 Degrees F; Volume Change plus 5 Percent	10.0 Percent
Heat Resistance (ASTM D573; 70h at 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 73 Degrees F	Shall exceed requirements

2.3 UHMW-PE

ASTM D 6712, virgin Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) for frictionless facing of fenders.

2.4 HARDWARE

2.4.1 Plates and Angles

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

2.4.2 Nuts, Bolts, and Washers

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

2.4.3 Antiseize Compound

MIL-PRF-907.

2.5 PERFORMANCE

When vertically compressed by a plate extending the full length and width

of a one foot section of the fender, the fender shall absorb 29,000 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 25,700 pounds plus 10 percent.

2.5.1 FENDER COMPRESSION TEST

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 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.

2.5.2 ANGULAR FENDER COMPRESSION TEST

Compress fender along its longitudinal axis between two flat plate surfaces, at an angle of 15 degrees to each other, to a compressed dimension of 48 percent of its original height. Record load and the corresponding deflection at 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 --