

**ALABAMA STATE PORT
AUTHORITY
MOBILE, ALABAMA**

TECHNICAL SPECIFICATIONS

FOR

**APM TERMINALS DOCK
EXTENSION**

SUPPLY OF FENDERS

FENDER SYSTEM

1.0 GENERAL

1.1 Introduction

The Alabama State Port Authority in conjunction with APM Terminals is constructing an addition to the existing APMT Dock Facility and as such desires to install a modern fender system for the dock extension as well the existing dock as retrofit for handling the required vessels that will utilize the facility. The work included under this section shall consist of the Design, Fabrication and Delivery to the Owner's facility of all components required for the complete installation of the fender system as specified herein and/or indicated on the drawings.

2.0 PANEL FENDER SYSTEM

2.1 Arrangement

The proposed fender system shall be comprised of rubber fender units with a steel frontal frame complete with weight, and tension chains and all related hardware including anchor plates, bolts, threaded rods, and any related hardware required for a complete installation.

2.2 Each system shall be capable of the following rated performance for the type of vessel listed:

	Vessel (assume 2 systems contacted)
Rated Energy Absorption	1074 ft.-kips
Hull Pressure	4.2 ksf

Fender manufacturer shall verify the load requirements shown based on the vessel parameters listed below.

MAERSK E CLASS	<u>Vessel</u>
LOA (Length Overall)	1312 ft.
Beam	185 ft.
Draft (Max.)	52.5 ft.
Max. Displacement	219,000 LT
Berthing Velocity	.4 ft/sec. (normal to berth)
Approach Angle	6 Degrees
Allow. Hull Pressure	4.2 ksf

Fender system shall account for barge contact forces to occur close to the water line.

Above performance values may be subject to a manufacturing tolerance of no more than +/-10%.

Above performance must be verified by full scale testing, see Section 3.3.

Each system shall be capable of absorbing a horizontal shearing force equal to 30% of its rated reaction while simultaneously absorbing the above-defined minimum energy without exceeding the defined maximum reaction.

Maximum reaction force from fender system to the dock structure is 614 kips. Maximum-allowable, undeflected standoff is 4 ft – 9.5 inches.

3.0 MATERIALS (RUBBER UNITS)

3.1 The rubber for proposed fender to be used must be of vulcanized natural or synthetic rubber or a mixture of them. These shall be reinforced with carbon black and resistant to aging, seawater, abrasion, and ultraviolet rays.

The rubber must be homogenous in quality and free from foreign materials, bubbles, injuries, cracks and other harmful defects.

The embedded fixing steel plates shall be firmly bonded into the rubber body through the process of vulcanization, and completely encapsulated so that no steel is exposed. The steel shall be encased with a minimum rubber thickness of 1/16”.

3.2 Rubber Properties

Property Tested	Test Method	Acceptance Requirements
Hardness (Before Aging)	ASTM D2240 Shore A	78° Max
Tensile Strength (Before Aging)	ASTM D412 Die C	16 MPa (2320 psi) Min
Ultimate Elongation (Before Aging)	ASTM D412 Die C	300% Min
Change in Hardness (After Aging)	ASTM D573 96 hrs @ 70°C	+10° Max
Change in Tensile Strength (After Aging)	ASTM D573 96 hrs @ 70°C	-20% Max
Change in Ultimate Elongation (After Aging)	ASTM D573 96 hrs @ 70°C	-20% Max
Compression Set	ASTM D395 Method B 22 hours at 70°C	30% Max
Ozone Resistance	ASTM D1171 Method B	100%
Water Resistance	ASTM D471 70 hours at 100°C	+10% Max by Volume

Property Tested	Test Method	Acceptance Requirements
Low Temperature Resistance	ASTM D2137 Method A 3 minutes at -40°C	No Cracks
Adhesion	ASTM D429 Method B	7 kN/m (40 lb/in) Min
Tear Resistance	ASTM D624 Die B	70 kN/m (400 lb/in) Min

3.3 Rubber Composition

Test	Standard	Specification
Density	ISO 2781	Max 1.20 g/cc
Polymer (rubber)	ASTM D6370	Min 45%
Carbon Black	ASTM D6370	Min 20%
Ash Content	ASTM D297	Max 5%
Rubber Filler Ratio		> 1:2*

* “Rubber Filler Ratio” is defined as Polymer % / (Ash content % + Carbon black %)

3.4 Performance Verification

Full scale load deflection tests shall be conducted on 10% of the fender elements supplied. The performance of the fender is expressed by the value of the energy absorbed during compression of the fender up to the designed deflection and the maximum value of the reaction load thus generated.

In the performance test of the fender, compression shall be applied toward the top face of the fender. The compression speed shall follow current PIANC Fender Performance Testing guidelines and shall be recorded during testing. Deflection of the fender is to be repeated for three times up to the designed deflection. A fourth cycle shall be conducted, after a minimum 1 hour wait period, and used for the performance of the fender. The fourth cycle performance value shall be more than the designed performance value for the energy absorption and less than the designed performance value for the maximum reaction load.

For the performance test of the fender, the room temperature at the time of the tests shall be recorded.

All testing must be conducted in the United States of America and shall either be witnessed by a recognized accreditation agency such as Lloyds Register or conducted by a 3rd party independent laboratory. Velocity corrections will not be allowed nor will scale model tests be allowed as an alternative. The Port Authority reserves the right to retest selected fender elements.

Certified performance curves for each fender shall be supplied and the owner reserves the right to witness testing and/or test the fenders again upon delivery.

3.5 Composition Testing Certification

Prior to Shipment of Rubber

The manufacturer will be required to submit rubber samples, approximately 50 grams in size, collected from 10% of the fenders prior to the fenders leaving the factory. The fender to be sampled shall be selected at random.

The sample does not necessarily have to be in one piece, it can be thin pieces sliced or scraped from the fender body without damaging the fender. The collection site should be repaired, if necessary, before the product is installed.

The manufacturer will submit this sample to an independent third-party rubber testing lab for testing to ensure that the final product adheres to the rubber property requirements for Density, Polymer %, Carbon Black %, Ash Content %, and Rubber to Filler Ratio as shown in the Rubber Composition table of this specification. Results of these tests shall be submitted to the engineer of record or owner representative for approval prior to shipping the fenders.

If the samples tested do not satisfy the requirements, the entire batch of fenders can be rejected.

Upon Delivery to the Jobsite

The contractor will be required to submit rubber samples, approximately 50 grams in size, collected from 10% of the fenders after delivery of all fenders to the jobsite. The fender to be sampled shall be selected at random on the jobsite by the engineer of record or owner representative.

The sample does not necessarily have to be in one piece, it can be thin pieces sliced or scraped from the fender body without damaging the fender. The collection site should be repaired, if necessary, before the product is installed. The vendor shall provide detailed collection and repair procedures to ensure that the fenders are not damaged in a way that will effect performance or durability.

The engineer of record or owner representative will submit this sample to an independent third party rubber testing lab for testing to ensure that the final product adheres to the rubber

property requirements for Density, Polymer %, Carbon Black %, Ash Content %, and Rubber to Filler Ratio as shown in the Rubber Composition table of this specification.

If the samples tested do not satisfy the requirements, the entire batch of fenders will be rejected. The engineer of record or owner representative reserves the right to request a second sample to confirm results from the initial testing.

3.6 Sampling

The specimen for testing and inspection of the materials, dimensions, and performance shall be sampled as specified below. The specimen to be used for the material test shall be taken directly from the product or from the rubber prepared in the quality check and under the condition of the same vulcanization as the products.

Test Item	Number of Sampling
Material	1 set from the lot of compound for the manufacture of the fenders.
Dimensions	All fenders.
Performance	1 piece per 10 pieces of fender. (To raise the fraction to a unit.)

3.7 Hardware

All hardware for mounting of the fender to the panel shall be supplied by the fender manufacturer. All hardware for mounting the fender to the concrete face including threaded rods, nuts, and washers shall be included. Manufacturer shall be responsible for recommending the desired core hole depth for the retrofit in the existing dock structure and the type of epoxy bonding agent to use. All mounting hardware shall be 316 stainless steel. Any socket type embedment shall have a 316 stainless steel female socket. The size and grade of the mounting hardware shall be according to the fender manufacturers published information.

All bolts, nuts, and washers for attaching fender elements to the contact panels, steel structures and to embedded anchor sleeves shall be of the size required per the manufacturer's published data. All exposed hardware shall be 316 stainless steel, embedded hardware shall be hot-dip-galvanized.

4.0 PANEL

4.1 Design and Construction

The proposed panel shall be of the size and shape as shown on the drawings. The panel shall be designed and constructed according to the AISC Steel Construction Manual Specifications. All welding shall be in accordance with AWS D1.1 latest edition standards.

All fillet welds shall be seal welds to prevent corrosion. All steel shall be ASTM A-36, or as necessary from stress calculations. All bolt holes shall be drilled.

Panel design shall be as shown on the drawings. Panel tops shall not be higher than elevation (+)15' and panel bottom shall extend to elevation (-) 1.5'. Face of panel shall be approx. 4'- 9 1/2" stand off from face of dock as shown on the drawings.

Minimum steel thickness shall be 1/2" for external plate and 3/8" for internal plates if of a closed box design and 1/2" if an open grillage design.

Consider the following cases in determining maximum moment to be resisted by panels:

- a Vertical line load in middle of panel or middle of span between elements
- b Any other load case which generates stresses exceeding the stresses from the above load cases

4.2 Coating

The proposed panel shall be coated with a two coat coal tar epoxy such as International Intertuf® 708 or an approved equal. All preparation and application shall be in compliance with the coating manufacturer's recommendations for immersion service. Surface preparation shall be by abrasive blast to SSPC-SP10 "Near White Blast Cleaning" with an anchor profile of 50 to 75 microns. The D.F.T. of the coating shall be 400 microns minimum. The finish coat shall be free of sags, voids, and orange peel and resistant to impact and abrasion. Minimum accepted rated adhesion strength of the coating system shall be 800 psi.

4.3 Hardware

4.3.1 Chains

The proposed chain system shall prevent excessive top tension, bottom tension, horizontal shear, vertical shear and weight-induced deflection of the fender. All hardware such as shackles and turnbuckles/Dogbone shackles required for attaching the chains shall be included and supplied by fender manufacturer. All chains and related hardware shall be hot dipped galvanized.

The chains and related hardware shall be sized considering the maximum possible shearing and tension forces on the fender. Shearing forces on the panel shall be calculated from the maximum reaction of the fender and the coefficient of friction of the proposed UHMW face pads.

Sizing of the weight chains shall include the shearing force from friction as well as the weight of the panel and one-half the weight of the proposed fenders. All metal chains and components shall be galvanized per ASTM A123 or A153. No chain assembly shall have

a breaking strength of less than 50,000 pounds no shall metal chains have a stock size of less than 3/4".

4.3.2 Anchor Plates

All anchor plates for attaching the proposed chains to the concrete face shall be included and supplied by the fender manufacturer prior to pouring of concrete as well as proper plates for installation into the existing dock concrete. All hardware for attaching the anchor plates including threaded rods, nuts, and washers shall be provided. All hardware shall be hot dipped galvanized.

4.4 Face Pads

UHMW face pads shall cover the face of the panel including the faces of the bevels. The pads shall be minimum of 1 1/2" thick and yellow in color. The proposed UHMW must be UV stabilized. UHMW materials must meet the following minimum standards. Test data for proposed UHMW must be submitted as part of bid submittal documentation.

4.4.1 Properties

Property	Test Method	Acceptance Requirements
Specific Gravity	ASTM D792	0.926 gm/cc
Ultimate Tensile Strength	ASTM D638A	4,000 psi, min
Izod Impact, Double Notch	ASTM D256A	18 ft-lbs/in, min
Abrasion Wear (carbon stl = 100)	Sand Slurry	18 max.
Water Absorption	ASTM D570	Nil
Coefficient of Friction	ASTM D1894	0.20 max
Color	Not Applicable	yellow

*Industry Standard testing method using slurry of 60% aluminum oxide and 40% water at a rotation speed of 1750 rpm for 2 hours. A lower number indicates better abrasion resistance.

4.4.2 UHMW Installation

The pads shall be drilled and counter bored for the mounting bolts. Mounting bolts shall be a minimum of 5/8" diameter and shall be 316 stainless steel. The face of the bolt head shall be a minimum of 1/2" below the face of the UHMW pad. All exposed edges of the UHMW shall include 3/4" X 3/4" bevels.

5.0 PACKAGING

The rubber fenders shall be packaged while being delivered to the Port so as to prevent damage to the fenders. The fender manufacturer, prior to shipment to the jobsite shall install the UHMW for the panels on the steel panels. All chain and hardware shall be packaged for shipment to the customer. Fender sections shall be safely stacked and blocked to provide safe storage until the marine contractor shall collect the materials for installation. All labor, equipment, and wood cribbing required to deliver and provide storage on the site shall be included in the supplier's proposal. The supplier shall make arrangements for offload prior to arrival of materials at the jobsite.

6.0 SCHEDULE

6.1 Schedule

All required concrete embeds for the fender systems and complete fender systems shall be delivered to the job site by October 15, 2018. A liquidated damage of \$700/day will be assessed for failure to comply with the delivery dates. Above dates are based on Notice to Proceed date of May 1, 2018.

7.0 SUBMITTALS (Panel Fender System)

7.1 Submittals Due with Bid

Items to be included with the bid proposal shall include at a minimum the following items:

- 7.1.1 A bill of materials drawing showing the general arrangement of the fender system and noting all included hardware with quantities.
- 7.1.2 Performance curves for reaction, energy, and deflection for the proposed fender.
- 7.1.3 Recently conducted same size element fender test reports
- 7.1.4 Price for supply of all fender systems required number and all items required to complete and mount the system including all crating and shipping to jobsite.
- 7.1.5 Confirmation of on-site installation supervision by manufacturer's engineer for 2 days during installation.
- 7.1.6 Supply list demonstrating that the manufacturer has been in the business of manufacturing molded/bonded buckling type rubber marine fenders for at least 10 years and show proof of 5 buckling type fender installations within the USA each having been in service for at least 5 years.
- 7.1.7 List of references including contact name and phone numbers.

7.1.8 Proposal shall be inclusive of all costs, duties, inland transportation to jobsite and offloading and stockpiling of materials as directed by the Owner.

7.2 Submittals Due Prior to Award

Items to be provided prior to award of the project shall include at a minimum the following items:

7.2.1 Final drawings of the complete proposed fender system with weld details, material dimensions, thicknesses, and fabrication specifications.

7.2.2 Calculations justifying the proposed design for the steel panels, link pieces and chains.

7.2.3 Welding procedures and individual qualifications and certifications.

7.2.4 Submittal must include drawings stamped by a P.E. within the United States.

7.2.5 UHMW material test data.

7.2.6 Fender performance curves and material specifications.

7.2.7 Test certificates for the rubber material properties as required in this specification.

7.3 Submittals Due with Delivery

Items to be provided upon delivery of the fender systems shall include at a minimum the following items:

7.3.1 Performance test certificates for fender performance as required in this specification.

7.3.2 Detailed installation procedures for the supplied fender system. (For both the new dock and the retrofit on the existing dock)

8.0 GENERAL SUPPLIER REQUIREMENTS

8.1 Bonding

Manufacturer shall provide a performance and labor bond upon notification of a Letter of Intent. Bond shall be for the value of the complete proposal of all fenders, hardware, and weldments and shall include coverage for on-site labor services for unloading and stacking of materials. Proof of adequate bonding capacity shall be submitted with the supplier's proposal at bid time.

8.2 Warranty

Manufacturer shall provide a two (2) year warranty on supplied materials from damage caused by normal use.

8.3 Other

The State reserves the right to award to the bidder determined to best suit the requirements of this installation if other than the lowest bidder.

8.4 Payment

The Owner shall withhold a 10% retainage on payment until after installation by the facility contractor to ensure proper fit up of provided system components.