SECTION 471
POLYMERIC FENDER SYSTEMS

471-1 Description.

Construct fender systems using components in accordance with this Section, the Plans, Design Standards and, if applicable, the Department's Approved Product List (APL) drawings.

If piling configurations listed on the APL are allowed by the Plans, at the Contractor's option, either use a APL listed piling configuration or develop a custom design. Develop a custom design if required by the Plans. For all Contractor-developed custom designs, follow the design criteria and guidelines in the Structures Design Guidelines (SDG), Chapter 3 and applicable Structures Design Bulletins.

471-2 Materials.

Meet the following requirements:

Fiberglass fiber reinforced composite lumber (Dimensional Lumber) .....Section 973

Fiberglass structurally reinforced composite lumber (Wales)* .....Section 973

Concrete used to fill hollow piles .....Section 347

*or alternate wales as described below

471-3 Performance Criteria.

471-3.1 General: Provide a report from an independent lab as verification that the product meets the following minimum performance criteria.

471-3.2 Alternate Wales: For Contractor developed designs only, the wales must meet the following minimum performance criteria:

a) Be structurally continuous across a minimum of two spans.

b) Designed to accommodate recessing of any attachment hardware to avoid potential for vessel snagging and sparking during impact.

c) Provide sufficient creep resistance to prevent loosening of attachments over time.

d) Provide adequate stiffness to distribute vessel impact loading so as to achieve the maximum efficiency of the system where the critical design section remains within the piles.

e) For wale sections remaining hollow under service conditions, a minimum bolt pull-through resistance of 10 kips when equipped with manufacturer's detailed connection hardware at a maximum distance of 2 feet from the end of a wale with a minimum length of 4 feet is required.

f) Wale sections remaining hollow under service conditions must be capable of resisting crushing loads perpendicular to the axis of the member as required for the impact force applied to fender in the analysis used to determine the associated energy absorption capacity of the system. This impact force may be equally distributed between two lines of wales and over a longitudinal distance of 5 feet.

g) Wales shall be black unless otherwise shown in the Plans.

h) Wales must meet the minimum requirements in Section 973, Tables 5.1 and 5.2 for Water Absorption, Brittleness, Impact Resistance, Ultraviolet, Abrasion, Chemical Resistance, and Static Coefficient of Friction (wet).

471-3.3 Polymeric Piles: All polymeric piles must meet the following minimum performance criteria:

a) Pile surfaces that may be exposed to contact with the impacting vessel must accommodate recessing of any attachment hardware to avoid potential for vessel snagging and sparking.

b) Provide sufficient creep resistance to prevent loosening of attachments over time.

c) For pile sections remaining hollow under service conditions, a minimum bolt pull-through and crushing resistance of 10 kips when equipped with manufacturer's detailed connection hardware at a maximum distance of 2 feet from the end of a pile with a minimum length of 4 feet is required.

d) Piles shall be black unless otherwise shown in the Plans.

471-4 Product Acceptance.

Manufacturers seeking evaluation of piling configurations for inclusion on the APL must submit an application in accordance with Section 6.

Submit all Contractor developed custom designs to the Engineer for review and approval by the State Structures Design Office.

Design fender piling, wales and connections in accordance with the latest edition of the SDG and applicable Structures Design Bulletins based on the desired energy capacity rating. Sign and seal all drawings in 11 inches x 17 inches PDF format and all design calculations by a Professional Engineer licensed in the State of Florida. Design calculations may be either by hand or by a computer program with hand calculations verifying the program output.

For evaluation of Contractor developed custom designed fender systems or piling configurations for listing on the APL, provide the following additional information:

Written certification that the custom designed fender system or APL piling configuration meets the requirements of this Section.

A report from an independent lab verifying the flexural properties of the piling as derived from ASTM D6109 with the following modification. Supports shall be located to provide a minimum span to depth ratio of 16:1 and a maximum span to depth ration of 20:1.

For custom designed fender systems using wales not in accordance with Section 973, a report from an independent lab verifying the structural properties used in the design of the wales.

Detailed material specifications showing material type, quality, certifications, acceptance and rejection criteria and placement procedures.

Other information pertinent to the design and performance of the pile configuration or custom designed fender system as necessary.

471-5 Construction Details.

Unless otherwise shown in the manufacturer's approved field construction manual, use the following construction details.

Protect materials at all times against exposure to extreme heat or impact. Transport products in a manner that will minimize scratching or damage to the outer surfaces, stack on dunnage above ground so that it may be easily inspected and store in a manner that will avoid damage. Handle and lift products with nylon slings. Do not use sharp instruments in handling the product. Products damaged in shipping or handling will be rejected.

Products containing cracks in the reinforcing rods or cracks, partial or full depth, across the section or splits will be rejected.

Cut, bevel, drill, countersink and otherwise install products in accordance with the manufacturer's recommendations. Set all material accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Securely attach all materials to substrate by anchoring and fastening as shown in the Plans. Perform all cutting and drilling in a manner that allows for the collection of all debris and dispose of properly.

Install piles in accordance with Section 455.

471-6 Method of Measurement.

When using APL listed piling configurations, the quantity of dimensional fiberglass fiber reinforced lumber and fiberglass structurally reinforced composite lumber to be paid for will be the plan quantity, computed based upon the dimensions shown in the Plans and the quantity of polymeric piles to be paid will be lump sum.

When using custom designed fender systems the quantity for the entire fender system to be paid will be lump sum.

471-7 Basis of Payment.

471-7.1 APL Listed Pile Configuration: Price and payment for plastic marine lumber will be full compensation for the work specified in this Section including all material, storage costs, disposal of unused material and waste, transportation costs, labor, equipment, fasteners and other necessary items required for completing the work. No separate payment will be made for plates, bolts, screws or other hardware necessary to complete the work.

Price and payment for polymeric piles will be full compensation for all labor, equipment and materials required to furnish and install the piles to the pile cut-off elevations shown in the Plans.

Payment will be made under:

Item No. 471-1	Fender System, Plastic Marine Lumber - MB.
Item No. 471-2	Fender System, Polymeric Piles – LS

471-7.2 Custom Fender System Designs: Price and payment for polymeric fender system will be full compensation for the work specified in the Section including all labor, equipment and materials required to furnish and install the piles to the pile cut-off elevations shown in the Plans, wales, dimensional lumber, material, storage costs, disposal of unused material and waste, transportation costs, fasteners and other necessary items required for completing the work.

Payment will be made under:

Item No. 471-3	Fender System, Polymeric – LS.