

SCOPE

- I 1.1 This practice covers the design, construction and testing of fender systems for mounting on conventional marine facility berths. It does not cover fender systems based on a flexible pile design or flexible dolphin design that depends on the deflection of piles to absorb part of a berthing vessel's impact energy.
- I 1.2 **An asterisk (*)** indicates that a decision by the purchaser is required, or that additional information must be furnished by the purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the practices and standards that shall be used with this practice.

TABLE 1

PRACTICES	
IP 4-1-3	Design Loads for Structures
IP 4-4-1	Marine Piers and Mooring Facilities
IP 19-1-1	Paint and Protective Coatings
IP 20-1-1	Inspection of Equipment and Materials
IP 20-1-2	Administrative Procedures for Obtaining Exxon Engineering Inspection
STANDARDS	
ASTM Standard	
A123	Zinc Coating (Hot Dip) on Iron and Steel Hardware
AWS Standard	
D1.1	Structural Welding Code - Steel

- I * 2.2 The vendor shall comply with any **local rules or regulations** specified by the purchaser.

VENDOR DOCUMENTATION

- I * 3.1 **The bidder's proposal** shall include the following information:
 - a. Total equipment list (within vendor's scope of supply), with description of each item.
 - b. Materials of construction including specifications and grades.
 - c. Complete calculations of:
 - 1. Mounting Structure load capacity (unless specified by purchaser).
 - 2. Berthing impact energy of design vessel (unless specified by purchaser).
 - 3. Horizontal and vertical loads to vessel berthing.
 - 4. Deadweight load of fender system on support system.
 - 5. Maximum reaction forces imparted to mounting structure for design impact energy.
 - 6. Shear and tension capacities of fender support system.
 - 7. Fender spacing (unless specified by purchaser).
 - d. Component drawings.
 - e. Description of any modifications required to the existing dock structure in order to mount the fender system.
 - f. Price list for spare parts and list of recommended spares and special maintenance tools for first two years of service.
 - g. A schedule of documentation submission for approval by the Owner's Engineer prior to contract award.
 - h. A list of exceptions to this practice, including detailed explanations of reasons for the exceptions and proposed alternatives. If there are no exceptions, a statement to this effect shall be included.
 - i. A list of all sub-contractors and a description of work that they will be performing.
 - j. Inspection Plan covering materials, fabrication and testing quality control and assurance for all components.

IP 4-4-3		Marine Fender Systems	
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(This practice is appropriate for attachment to Inquiry or Purchase Document)

MATERIALS (CORROSION PROTECTION)

- M 4.1 All **hardware** e.g. bolts, brackets, bars, chains) shall be galvanized in accordance with **ASTM A123**.
- M 4.2 All **other ferrous metal surfaces** shall be protected in accordance with **IP 19-1-1 Service Category II (Marine Atmosphere)**.

DESIGN

- O * 5.1 The Owner's Engineer shall specify the maximum and minimum design vessel characteristics including:
 - a. Maximum and minimum "Vessel Size" (DWT or M³. Length Overall, Displacement, Draft, and Molded Depth).
 - b. Maximum and minimum "Length of Parallel Sides" (for use in calculating fender spacing).
 - c. Design berthing velocity (perpendicular to berthing line).
 - d. Vessel Impact Energy.
- O * 5.2 The Purchaser shall provide appropriate berth characteristics to allow the Vendor to design the fender system including:
 - a. Structural drawings.
 - b. High, mean, and low water levels referenced to berth deck elevation.
- O 5.3 The **fender system** shall be capable of accommodating the full range of design vessels at all specified water levels.
- O,R 5.4 **Design impact energy** shall be equal to 1.5 times the specified vessel impact energy.
- O,R 5.5 Vessels shall be assumed to approach at angles up to 10 degrees for tankers and 15 degrees for coasters and barges.
- R 5.6 **Restraint chains** shall be provided where necessary to support the buffer and fender panel, resist vertical and horizontal friction loads, and prevent the buffer unit from going into tension during angular berthings.
- O,R 5.7 The **standoff distance from the face of the pier to the face of the fender** shall be minimized in the interest of increasing the effective reach of loading equipment, but shall provide a sufficient buffer zone to prevent contact of any part of the vessel with the pier face with fenders at 55% compression (maximum rated deflection).
- O,R * 5.8 The **contact surface of an unfaced buffer or fender panel** shall be proportioned to keep the pressure against a tanker's hull below 2 tons/ft² (20 tonnes/m²). For barge and small coaster berths, the purchaser shall specify an allowable hull pressure.
- R,M 5.9 If a **segmented fender system** is used, the spacing between the segments shall prevent the smallest vessel's bow from contacting the pier between panels.
- R,M 5.10 The **fender system** shall be designed to prevent the smallest vessel, loaded and arriving at the lowest tide from traveling underneath it.
- O 5.11 **Fenders shall be spaced** within 25% to 50% of the vessel's length overall (LOA). The vessel overhang beyond the end of the breasting face shall be minimized to less than 33% of the vessel's length overall.

ACCESSORIES

- M 6.1 The Contractor shall design all associated hardware required to mount the new fender system and to protect against tensile and shear loads.
- R 6.2 **Tension and shear restraint chains**, if required, shall have a breaking strength three (3) times or greater than the maximum working load.
- R 6.3 **Chains required to prevent excessive deflection under lateral loads** shall remain taut under "no load" (undeflected) conditions.
- O,M 6.4 The **entire face of the fender system**, if required, shall be flush, faced with hardwood or high-density polyethylene pads, and the facing material shall be chamfered to prevent damage from the vessel hanging up on the fenders.
- O 6.5 The **frontal panel structure** shall be constructed of ASTM A36 or stronger steel and be capable of resisting all berthing loads. Minimum thickness shall be 3/8 ins. (9.5 mm).
- R 6.6 All **welding** shall be in accordance with the latest edition of AWS D1.1, and exposed welds shall be continuous and water tight.
- O 6.7 **Fender panels** shall not have any projections upon which mooring lines or vessel's hulls may become fouled or damaged.



Documents

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