



ADDENDUM TO THE CONTRACT

for the

Port of Juneau Cruise Ship Berths Contract No. DH12-001

ADDENDUM NO.: FIVE

CURRENT DEADLINE FOR BIDS:
November 12, 2013

PREVIOUS ADDENDA: FOUR

ISSUED BY: City and Borough of Juneau
ENGINEERING DEPARTMENT
155 South Seward Street
Juneau, Alaska 99801

PREVIOUS DEADLINE FOR BIDS:
November 12, 2013

DATE ADDENDUM ISSUED: November 5, 2013

The following items of the contract are modified as herein indicated. All other items remain the same. This addendum has been issued and is posted online. Please refer to the CBJ Engineering Contracts Division webpage at:

<http://www.juneau.org/engineering ftp/contracts/Contracts.php>

INFORMATIONAL ITEM:

Drawings from 1991 Juneau Cruise Ship Dock and 1999 Ferry Dock Mooring Dolphin are posted to the website referenced above.

ADDENDUM NO. 1:

Item No. 1 REPLACEMENT SECTION 00200 – BIDDER QUALIFICATIONS, Article 1.1 BIDDER QUALIFICATIONS, Paragraph C. Supporting Documents: **Delete** Subparagraph 3 and **replace** it with the following:

3. Rock Socket and Anchor Superintendent (individual): List of at least three similar projects, when taken in combination, demonstrate experience in a responsible position involving the following features: steel pipe piles ranging in size from 36 to 48 inch in diameter on a marine dock project; bedrock pile socketing; and drilling and rock anchoring operations. For each project, provide the project name, brief project description, position on project, year(s) in which work was performed, owner, and name and phone number of owner's representative who has knowledge of the proposed rock socket and anchor superintendent's work.

Note to Bidders: Submit Bidder Qualifications on form provided under Addendum No. 1.

ADDENDUM NO. 3:

Item No. 2 Under Item No. 7, **change** "2.3 FLEXIBLE HOSE AND FITTINGS" **to read** "2.2 FLEXIBLE HOSE AND FITTINGS".

Item No. 3 **Delete** Item No. 10 in its entirety.

Item No. 4 **Delete** Item No. 13 in its entirety and **replace** it with the following:

Item No. 13 SECTION 02901 – CONCRETE PONTOONS

PART 1 – GENERAL:

Article 1.1 DESCRIPTION: **Add** the following Paragraph:

- C. Specifications for materials under this Section take precedence over other concrete specification sections contained elsewhere within the Contract Documents.

Article 1.6 DESIGN REQUIREMENTS, Paragraph B. Design Loads: **Add** the following subparagraphs:

10. Bridge Landings and Pontoon Mooring Frames

- a. Pontoon bolted connections shall be designed to resist 100% of the sum of the breaking strengths in shear and tension of all bolts in the connection.
- b. Pontoon tension rod connections shall be designed to resist 100% of the sum of the ultimate tensile strength of all rods in the connection.

Add the following Article:

Article 1.7 SPECIAL CONCRETE PONTOON WARRANTY

- A. The CONTRACTOR shall provide a written warranty that the concrete pontoons and all associated appurtenances furnished and installed shall be free from defects in materials and workmanship for a period of two (2) years following final completion and acceptance by the OWNER.
- B. The warranty shall include all necessary remedy from defects such as inappropriate freeboard or listing due to inadequate design for freeboard and remedy from defects such as surface delaminations, spalling, scaling, abnormal cracking, water tightness and other concrete defects attributable to inadequate design or quality of concrete mixtures, reinforcement, placement and curing.

PROJECT MANUAL:

Item No. 5 SECTION 02401 – WASTEWATER SERVICE DISCHARGE SYSTEM, PART 2 – PRODUCTS, Article 2.1 – HIGH DENSITY POLYETHYLENE PRESSURE SEWER PIPE AND FITTINGS, Paragraph A: **Delete** subparagraph 2 in its entirety.

Item No. 6 SECTION 02601 – WATER SYSTEM, PART 2 – PRODUCTS, Article 2.4 – HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS: **Delete** paragraph C in its entirety.

Item No. 7 SECTION 02611 – DRY LINE FIRE SUPPRESSION SYSTEM, PART 2 – PRODUCTS, Article 2.1- PIPE AND FITTINGS: **Delete** paragraph C in its entirety.

- Item No. 8 SECTION 02883 – MARINE FENDERS, **Delete in its entirety and replace** with the attached SECTION 02883 – MARINE FENDERS, labeled Addendum No. 5 in the footer.
- Item No. 9 SECTION 02892 – TRANSFER BRIDGE, PART 3 – EXECUTION, Article 3.1 – FABRICATION, Paragraph A - Quality Assurance: **Delete** the first sentence in its entirety and **replace** it with the following:
- The fabricator shall possess certification as an AISC Simple Steel Bridge (SBR) fabricator.
- Item No. 10 SECTION 02893 – TRANSFER BRIDGE LANDING AND ABUTMENT, PART 3 – EXECUTION, Article 3.1 FABRICATION, A - Quality Assurance: **Delete** the first sentence in its entirety and **replace** it with the following:
- For the transfer bridge landings only, the fabricator shall possess certification as an AISC Simple Steel Bridge (SBR) fabricator; otherwise, fabricator qualifications shall be as specified in Section 05120 Metal Fabrication.
- Item No. 11 SECTION 02895 – CONCRETE MOORAGE FLOATS,
- PART 1 – GENERAL, Article 1.1 - DESCRIPTION: **Add** the following Paragraph:
- C. Specifications for materials under this Section take precedence over other concrete specification sections contained elsewhere within the Contract Documents.
- PART 2 – PRODUCTS, Article 2.2 - CONCRETE:
- Paragraph A.5: **Change** “3/8-inch” **to read** “3/4-inch”.
- Paragraph B.2: **Add** the following to the end of the third sentence:
- “..., excluding chromating process.”
- Item No. 12 SECTION 02896 – STEEL PIPE PILES, PART 2 – PRODUCTS, Article 2.2 - PILES:
- Delete** Paragraph C and **replace** it with the following:
- C. All 48-inch diameter pontoon dolphin piles shall conform to API 5L X-65. Carbon Equivalency (CE) shall not exceed 0.45.
- Alternately, spiralweld pipe used for pontoon dolphin piles may be DSAW pipe conforming to the requirements of ASTM A252, Grade 3 modified to have a minimum yield strength of 65 ksi and minimum tensile strength of 77 ksi. Mechanical and dimensional properties shall be per API 5L. Carbon Equivalency (CE) shall not exceed 0.45. ASTM A252, Grade 3 spiralweld pipe piles shall also conform to the following requirements:
1. The outside circumference of each pipe end shall not vary from the corresponding diameter shown on the drawings.
 2. The maximum allowable variation in edge alignment for adjacent steel pipe ends to be welded shall be 0.1875 times the wall thickness, but not more than 0.125 inch.

3. Steel pipe pile straightness shall conform to the requirements of API 5L, Section 7.6, "Straightness."
4. Welds made at a permanent manufacturing facility shall be performed by either a SAW, automatic fusion weld process, or an electric resistance weld process. Welds shall have complete joint penetration.
5. One hundred percent of each longitudinal, circumferential, and spiral weld made at a permanent manufacturing facility shall receive non-destructive testing (NDT) by either radiographic, radiosopic, real time imaging systems or ultrasonic methods that are in conformance with the requirements of, AWS D1.1, A53 or API 5L Pipe weld NDT records. Records of this testing shall be submitted to the ENGINEER. The repair criteria shall conform to the requirements of AWS D1.1, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed. The additional NDT shall be made on both sides of the repair for a length equal to 10 percent of the length of the pipe outside circumference. After the additional NDT is performed, and if more repairs are required that have a cumulative length equal to or more than 100 percent of the length of the pipe outside circumference, then the entire splice weld shall receive NDT.
6. Perform all welding for piles in accordance with AWS D1.1, (except as modified in this section) using certified welders, welding operators, tackers and qualified joint welding procedures.

Delete the third sentence of Paragraph E. in its entirety.

Item No. 13 SECTION 02901 – CONCRETE PONTOONS

PART 1 – GENERAL, Article 1.6 - DESIGN REQUIREMENTS

Paragraph M: **Delete** this paragraph in its entirety and **replace** it with the following:

M. The keel slab and top slab shall be continuous pours with no construction joints unless other means and methods of fabrication are determined acceptable by the PONTOON DESIGNER.

Paragraph O: **Delete** the last sentence of this paragraph and **replace** it with the following:

The interior walls shall be located such that the pontoon shall remain afloat and upright with no one corner submerged in the event of water filling a minimum of two consecutive, adjacent interior cells.

PART 2 – PRODUCTS, Article 2.2 - CONCRETE

Paragraph A. Concrete Mix Specification:

Subparagraph 2: **Delete** this subparagraph in its entirety and **replace** it with the following:

2. Portland cement – ASTM C150, Type I, II or III sulfate resisting with maximum alkali content of 0.6% and maximum tri-calcium aluminate content of 8%.

Subparagraph 4: **Delete** this subparagraph in its entirety and **replace** it with the following:

4. Minimum compressive strength at form release shall be 4,000 psi unless, otherwise approved by the PONTOON DESIGNER with supporting structural calculations.

Subparagraph 8: **Delete** this subparagraph in its entirety and **replace** it with the following:

8. Rapid Chloride Permeability: 1,500 Coulombs maximum at 56 days per AASHTO T227 or ASTM C1202.

Paragraph B: **Add** the following to the end of the third sentence:

“..., excluding chromating process.”

PART 3 – EXECUTION, Article 3.1 - FABRICATION:

Paragraph C: **Delete** the first sentence in its entirety and **replace** it with the following:

An independent testing laboratory, accredited by the American Association for Laboratory Accreditation (A2LA), or a FABRICATOR with a well-established and audited quality control program approved by PCI or state DOT, shall test the concrete.

Paragraph I. CONCRETE PLACEMENT AND FINISHING

Subparagraph 4: **Add** the following to the end of this subparagraph:

Alternative construction joint methods shall be approved in advance by the PONTOON DESIGNER.

Subparagraph 7: **Delete** the first sentence and **replace** it with the following:

Seal the outside of all exterior walls and the pontoon deck prior to shipping to the site.

Paragraph J and all sub-paragraphs J.1 through J.5: **Delete** in their entirety and **replace** with the following:

- J. The concrete finish shall be free of structural defects. Structural defects include but are not limited to bug holes, rock pockets, and cracks larger than those specified herein. Repair of defects shall be in compliance with ACI 546R-04 and approved by the PONTOON DESIGNER. All repair products shall be used in accordance the manufacturer's instructions. All structural defects shall be repaired in accordance with PONTOON DESIGNER recommendations, subject to ENGINEER review, using the following procedures as a guide.
 1. Obtain materials for patching, coating, sealing, and crack repair from a single source manufacturer to ensure match quality, color, texture and detailing.

2. Maximum crack width shall be as determined by ACI 224R-01, Control of Cracking in Concrete Structures, utilizing limited allowable reinforcement/prestressing steel stresses specified in ABS Rules for Building and Classing Offshore Installations, Table 3/5.1. Cracks with a width greater than this maximum shall be repaired. Crack inspection, evaluation, and repair methods shall embody the recommendations provided by ACI 201.1R, ACI 224.1R-07, ACI 357R, ACI 546R-04, as well as specific instructions provided by suppliers and manufacturers of the repair materials.

PLANS:

Item No. 14 DRAWING SHEET S1.01, GENERAL NOTES AND DESIGN CRITERIA

Delete the following note under LIVE LOAD:

NOTE: Where live load is used in combination with snow load, the live load shall be reduced by 50 percent due to operational restrictions on all structures with the exception of the 80-FT gangways and floats.

Item No. 15 DRAWING SHEET S5.01, NORTH BERTH CONCRETE PONTOON PLAN AND ELEVATION and DRAWING SHEET S5.02, SOUTH BERTH CONCRETE PONTOON PLAN AND ELEVATION:

Add the following sheet note on both drawings: Final locations for watertight bulkheads shall be as determined by the Pontoon Designer.

Change number of hatches per enclosed space **from 2 to 1**.

Item No. 16 DRAWING SHEET U1.07, APPROACH DOCK AND TRANSFER BRIDGE DETAILS, Detail C/U1.03 SOUTH APPROACH DOCK UTILITY SUPPORT @ REMOVABLE SPAN TRANSITION DETAIL:

Add the following note:

4. Welded steel pipe and fittings may be used on the removable span in lieu of threaded fittings at locations approved by the ENGINEER. Mandatory flanged connections are as shown.

Item No. 17 DRAWING SHEET E5.01, NORTH BERTH CONCRETE PONTOON PLAN AND ELEVATION:

Replace designation for illustrated Type C luminaires with C1 where single fixtures are illustrated, and C2 where two fixtures at a 90 degree orientation are illustrated.

Item No. 18 DRAWING SHEET E5.02, SOUTH BERTH CONCRETE PONTOON PLAN AND ELEVATION:

Replace designation for illustrated Type C luminaires with C1 where single fixtures are illustrated, and C2 where two fixtures at a 90 degree orientation are illustrated.

Item No. 19 DRAWING SHEET E6.05, GANGWAYS AND DOLPHIN, Detail 3 - PROFILE 2:

Add the following notes at callout to 4"x4"x6' HDG Steel Post: Weld 10x10x1/2 base

plate to post and secure to pontoon at ENGINEER determined location with (4) each 3/8" epoxy resin anchors. Provide (4) bolt holes in plate for anchor bolts.

Item No. 20 DRAWING SHEET E8.01, MOORING FLOAT:

Replace all Type D luminaire designations with D2.

Item No. 21 DRAWING SHEET E8.02, GANGWAYS, ELEVATION 1 - TYPICAL GANGWAY, LOW TIDE Configuration:

Replace the Type C luminaire designation with G.

Item No. 22 DRAWING SHEET E9.02, SINGLE LINE DIAGRAM – SOUTH BERTH DISTRIBUTION, 1- SINGLE LINE DIAGRAM – SOUTH BERTH DISTRIBUTION:

Change the feeder conduit designation from SWBDS to SB-H2 from 4" to 3".

Add notation to the circuits feeding the Mooring Float Lighting and Water Pedestal Heat Trace as follows:

- ◆ From the SWBDS to the junction box at the gangway: 1"C, 2 No. 10 (lighting), 2 No. 10 (heat trace), 1 No. 10 Gnd.
- ◆ From the junction box at the gangway to the luminaire posts: 3C, No. 8 Type W.
- ◆ From the junction box at the gangway to the heat trace junctions: 3C, No. 8 Type W.
- ◆ The two Type W cables shall be installed in one 3"C beneath the gangway and then in a chase in the float.

By: 
Gary Gillette,
Port Engineer

Total number of pages contained within this Addendum: 16

SECTION 02883 – MARINE FENDERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The WORK in this Section shall include all labor, materials, tools and equipment necessary to furnish and install complete floating foam filled fender assemblies, complete arch fender assemblies, and all miscellaneous appurtenances and hardware, and all other related WORK in accordance with the requirements of the Contract Documents and as shown on the Plans.

1.2 REFERENCES

- A. DOD (U.S. Department of Defense):

RR-C-271 - (1995) Chains and Attachments, Welded and Weldless.

- B. FED-STD (Federal Standards):

PPP-C-1752B - (1990) Polyethylene Plastic Foam.

- C. ASTM (American Society for Testing and Materials (ASTM):

ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

ASTM A 153/A 153M – Tubing.

ASTM D412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.

ASTM A413/A413M - Carbon Steel Chains.

ASTM D470 - Cross Linked Insulations and Jackets for Wire and Cable.

ASTM D624 - Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

ASTM D885 - Test Method for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Man-Made Organic-Base Fibers.

ASTM D1052 - Measuring Rubber Deterioration - Cut Growth Using Ross Flexing Apparatus.

ASTM D1630 - Rubber Property - Abrasion Resistance (NBS Abrader).

ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

ASTM D2240 - Rubber Property - Durometer Hardness.

ASTM D3575 - Flexible Cellular Materials Made From Olefin Polymers.

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ASTM F2192-02 - Test Method for Determining and Reporting the Berthing Energy and Reaction of Marine Fenders.

D. AWS (American Welding Society):

AWS D1.1 – Structural Welding Code - Steel.

E. PIANC (International Navigation Association):

Report of WG33 – Guidelines for the Design of Fender Systems.

1.3 SUBMITTALS

A. Floating Foam Filled Fenders: Submit the following for PONTOON DESIGNER and ENGINEER's approval.

1. Product Data:

- a. Dimensions, material specifications and method of manufacture.
- b. Test data for repair materials.
- c. Manufacturer shall have an experienced engineering and production staff with more than 10 years experience in the manufacture of this product.

2. Design Data:

- a. Submit calculations, including computer analysis and other design data.

3. Test Reports:

- a. Fender compression test.
- b. Fender cyclic-compression test
- c. Fender sustained-load test
- d. Fender pull-through test
- e. Elastomeric skin thickness test
- f. Foam Core Density Test
- g. Test reports showing that the foam core in the fender meets the minimum requirements specified.
- h. Test reports showing that the elastomer used in the fenders meets the minimum requirements specified.
- i. Test reports showing that the filament reinforcing in the fender skin meets the minimum requirements specified.
- j. Test reports showing that the hardware used to attach the fenders meets the minimum requirements specified.

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- B. Arch Fenders: Submit manufacturer’s product data for specific product including material specifications, load capacity/reaction data, energy absorption data, and associated connection hardware for PONTOON DESIGNER and ENGINEER’s approval.

1.4 QUALITY ASSURANCE

A. Elastomeric Skin

- 1. The elastomer skin of the fender shall be free from cracks, burrs, warpage, checks, chipped or blistered surfaces, and shall have a smooth surface.

B. Steel Fabrication

- 1. The steel used in fabrication of the fenders shall be free from kinks, sharp bends, and other conditions, which would be detrimental to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. Make bends by controlled means to insure uniformity of size and shape.
- 2. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

C. Foam Core

- 1. The foam core shall be homogeneous and of one piece fabricated construction and shall not be in chip or granular form. The foam core construction shall utilize only a heat-laminated process, and yield a single solid foam core. The foam core shall not contain scraps, strips, or sheets of foam either rolled or stuffed into the required shape unless pieces are bonded together in layers of uniform patterns to form a homogeneous, one piece core. Homogeneous foam rings of adequate thickness to insure performance of the fender is acceptable provided the Contractor could show a minimum 5-year performance of similar fenders.
- 2. Tests shall be carried out on every batch of foam delivered, and shall be in accordance to ASTM D 3575 or comparable ISO methods.
- 3. All foam used shall be traceable to the manufacturer of the foam, by means of production data and lot number, or other positive means. Production/Quality Control records of the fender manufacturer shall record this information for each fender manufactured. The fender manufacturer’s records must be able to trace all foam used in each fender back to the manufacturer of the foam, and identify the date the foam was manufactured and tested.
- 4. The manufacturer of the foam shall provide certified test reports for each lot of foam delivered, and the fender manufacturer must maintain these records for a period of 10 years. The fender manufacturer shall provide proof that the sufficient quantity of foam was purchased to complete this contract. The fender manufacturer shall retain samples from each lot of foam used in the fenders. The samples shall be subject to re-tests at the request of the purchaser of the fenders.

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1.5 DELIVERY, STORAGE AND HANDLING

- A. Fenders shall be undamaged when delivered and shall be handled and stored so as to prevent damage such as bending or abrading end fittings or cutting of rubber. Protect fenders from exposure to damaging liquids, oils, and greases.

1.6 WARRANTY

- A. Furnish the manufacturer's warranty. The warranty shall be issued directly to the Customer and shall not be limited in dollar value. The warranty period shall be not less than 1 year from the date of acceptance of the work.

PART 2 - PRODUCTS

2.1 ARCH FENDERS

- A. Arch fenders shall be ANP400 Arch Fender with UHMW Face, as manufactured by *Trelleborg*, or approved equal. UHMW color shall be yellow. Corresponding hardware shall be as indicated on the Plans, and shall comply with Section 05120 – Metal Fabrication.

2.2 FLOATING FOAM FILLED FENDERS

A. Performance Requirements

- 1. The resilient, foam filled fenders shall be designed so that when compressed across its diameter by two parallel flat plates extending the full length and width of the fender, the fender shall absorb 733 kip-foot of energy ± 15 percent when 60 percent compressed (i.e. to a dimension of 40 percent of its original diameter) with a corresponding load of not more than 341 kips ± 15 percent. The fender shall also be designed to withstand a sustained reaction force of 230 kips for a duration of not less than 24 hours each occurrence for at least 200 occurrences during its 10-year life.

B. Fender Configuration

- 1. Fenders shall have cylindrical mid-bodies with conical or hemispherical shaped ends terminating in an end fitting on the cylinder's centerline at each end. The diameter of the mid-body shall be 96 inches minimum, and the length of the mid-body shall be 121 inches minimum. If conical ends are provided, they shall have an angle of 60 to 75 degrees, when measured from the central axis of the fender. The fittings at either end shall be connected through the center of the fender by a chain; shall terminate in a clevis fitting sized for a 2.0 inch shackle; and shall swivel to allow the end fitting to rotate freely on the axis of the fender. The length of the fender from eye to eye of the end fittings shall be a minimum of 192 inches. Design end fitting as small as possible to transmit the ultimate load of the shackle to the fender. End fitting shall be sized so as not to contact loading surfaces when the fender is compressed to 30 percent of its original diameter (70 percent

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compression). Each end fittings shall not be a continuous member, however each independent end fitting shall be of sufficient length to span all of 3 feet in the center of the fender. The end fitting shall be permanently affixed to the fender core prior to applying the skin. Fill interior of the fender with energy absorbing closed-cell foam as specified. The use of chipped or particulate foam is not acceptable.

2. Dimensional Tolerance: +5% - 0%

C. Fender Foam Core

1. The energy absorbing foam core shall be closed-cell cross-linked polyethylene foam. The foam core construction shall utilize only a heat-laminated process, and yield a single solid foam core. Use of chipped or granulated particulate foam or foam widths less than 48 inches is not acceptable. The foam shall have the minimum following properties:
 - a. Density, ASTM D 1667, 3.3 to 4.4 lbs/ft³
 - b. Tensile strength, ASTM D 3575 or ASTM D 412, 80 psi minimum
 - c. Elongation (ultimate), ASTM D 3575 or ASTM D 412, 120 percent minimum.
 - d. Water absorption percent volume after 24 hour exposure, ASTM D 1667, 5.0 percent maximum.
 - e. Continuous service temperature, -65 to +120 degrees F
 - f. 50 percent compressive set, ASTM D 3575, 16 percent maximum.

There shall be no deviation of the foam core density. If manufacturer requests or submits a deviation from foam core density specified, ENGINEER shall randomly select 1 fender from each completed lot of 15 fenders minimum, mark the fender with a permanent identification and witness the fender full scale testing at an independent testing laboratory. ENGINEER shall review and verify test report prior to shipment of fenders.

C. Fender Skin

1. The outer fender skin shall be minimum 1.5 inches thick and constructed of elastomer as specified. Reinforcing is mandatory. A minimum of ten separate filament-reinforcing wraps shall be applied as specified under "Filament Wrap". The filament wraps shall be evenly distributed in the inner 75 percent to 90 percent of the coating thickness. The outer 10 percent to 25 percent of elastomer shall have no filament reinforcing. The elastomer and filaments shall be applied in a continuous manner to assure adhesion between the various layers. The connection of the skin to the end fittings shall be designed and sized to transmit twice the safe tensile capacity of the chain into the fender skin.
 - a. Elastomer - The elastomer used in the fender skin shall be a non-marking solvent free 100 percent PTMEG (polytetramethylene ether glycol), and

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aromatic diamine polyether urethane elastomer, with UV inhibitors and antioxidants and shall have the following unreinforced properties:

- 1) Shore A. hardness, ASTM D 2240, 75 to 95.
 - 2) Tensile strength, ASTM D 412, 2600-psi minimum.
 - 3) Elongation (ultimate), ASTM D 412, 300 percent minimum.
 - 4) Tear strength, ASTM D 470, 70 Lbs/inch minimum.
 - 5) Flex life (Ross), ASTM D 1052, 200,000 cycles minimum.
 - 6) Abrasion resistance (NBS), ASTM D 1630, 100 minimum.
- b. Filament Wrap - Construct each filament-reinforcing wrap of continuous filaments applied in a helical pattern, at a helix angle of 45 to 60 degrees to the longitudinal axis of the fender. A wrap shall consist of two such filament helixes of equal but opposing helix angles. The spacing between the filaments in the same helix shall be no more than 1/8 inch, measured in a direction parallel to the longitudinal axis of the fender. Each wrap shall extend along the entire longitudinal axis of the fender and shall also encase the fender end fittings and secure them to the fender body.
- c. Filament Reinforcing - the reinforcing filaments in the outer skin shall be nylon tire cord of 2540 denier weight with the following properties:
- 1) Breaking strength, 53 pounds
 - 2) Elongation (ultimate), ASTM D 412, 16 percent
- d. Reinforced Skin Properties - The reinforced skin, when constructed in accordance with this specification, shall exhibit the following properties when tested in accordance with the guidelines below:
- 1) Tensile Strength: When a full-thickness specimen of the skin is tested in tension, with the longitudinal direction of pull aligned with the filament direction (in one helix direction), the specimen shall have the following breaking strength: Tensile Strength, ASTM D 412, 4,500-psi minimum.
 - 2) Elongation (Ultimate): In the test for Tensile Strength, the specimen shall have the following Ultimate elongation at break: Elongation (ultimate), ASTM D 412, 16% minimum.
 - 3) Tear Strength: When a full-thickness specimen of the skin is tested in tear, with the specimen Shaped like Die C in ASTM D-624, and with the direction of pull aligned with the filament Direction (in one helix direction), the specimen shall have the following tear strength: Tear strength, ASTM D 470, 450 lb/in.
- e. Hardware - The internal chain connecting the two end fittings shall be galvanized in accordance with ASTM A123 or ASTM A153/A153M as appropriate. The chain and end clevis fitting shall have a minimum working load capacity of 35 tons. The internal chain and end clevis fitting shall have a minimum working load capacity of 35 tons.. Shackles shall be 2.0 inches and shall have a minimum working load capacity of 35 tons. All hardware

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shall conform to RR-C-271. All chains shall conform to the requirements of ASTM A413/A413M.

- f. Color - Fender skin color shall be black throughout the entire thickness. Galvanized hardware shall be unpainted.
- g. Reparability - The fender casing shall be repairable in the event of tears or punctures in the elastomer skin. The repaired area shall have not less than 90 percent of the properties as specified in paragraph entitled "Elastomer." Required repair materials shall be readily available from the fender manufacturer.

D. Source Quality Control

- 1. An approved laboratory shall conduct all testing.
- 2. Fender Compression Test.
 - a. Compress fender along its diameter between two parallel flat plate surfaces to a compressed dimension of 40 percent of its original diameter. Record load and the corresponding deflection at one-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. The fender shall meet the energy and force performance requirements of the paragraph entitled "Performance Requirements." After compression of the fender to 40 percent of its original diameter (60 percent compression) the fender shall rebound to 90 percent of its original diameter within two minutes after the load is removed, and to 95 percent of its original diameter within 30 minutes after the load is removed.
- 3. Fender Cyclic – Compression Test.
 - a. Compress the fender along its diameter between two parallel flat plate surfaces to a compressed dimension of 40 percent of its original diameter. Release the load and recompress as before. Repeat the compression and release cyclic loadings for a minimum of 10 full cycles of compression. Both the loading and unloading shall last one (1) minute each. A five-minute interval shall be provided between cycles. Permanent deformation, cracking, or tearing of the fender skin, fender core, or end fittings shall constitute failure of this test.
- 4. Fender Sustained – Load Test.
 - a. Apply a 230,000-pound compressive load as in paragraph entitled "Fender Compression Test," and hold this load for 24 hours. Record load and deflection each hour. Immediately after release of the load, measure rebound of the fender. Continue to record fender rebound for 24 hours. Failure of the fender or foam core to rebound to 90 percent of its original diameter after 24 hours shall constitute failure of this test. If the foam core is not bonded to the skin of the fender, devise and execute a means for measuring rebound of the

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foam core and for measuring the void between the foam core and the skin. The maximum rate of compression per minute shall be 20 percent of the total reaction force at 60 percent compression. The full compression cycle, not including rebound, shall take a minimum of 5 minutes.

5. Fender Pull-Through Test.
 - a. Devise and perform a test, which will measure the resistance of the end fittings and internal chain to pull through the longitudinal axis of the fender. Failure of the chain, end fittings, or skin to resist at least 50,000 pounds of pull-through tension shall constitute failure of this test. After loading, evidence of permanent deformation, cracking, or tearing of the fender or end fittings shall also constitute failure of this test.

6. Elastomeric Skin Thickness Test.
 - a. Prior to delivery of all of the fenders to the construction site, the CONTRACTOR and/or fender manufacturer shall perform a minimum of 3 skin thickness tests per fender for each of 4 fenders to be selected at random by the ENGINEER. The ENGINEER will select test locations on the fenders. Each test shall consist of taking a 1/2-inch diameter (minimum) to 2.0-inch diameter (maximum) core from the fender skin, which can be removed from the skin and examined for thickness of elastomer and placement of reinforcing (when reinforcing is required). Take skin thickness measurements from the core sample and record measurements noting placement of reinforcing. Where the skin thickness measurement is less than the specified minimum, or the minimum required by the design (whichever is greater) by more than 10 percent, reject the fender. In addition, if the average of skin thickness tests for one fender is not equal to or greater than the specified minimum, or the minimum required by the design (whichever is greater), reject the fender. If tested fender is rejected, at the option of the ENGINEER, the fender manufacturer shall then conduct thickness tests for additional fenders. Rejected fenders shall be replaced with fenders meeting the provisions of this specification. Replacement fenders shall be tested for skin thickness as specified herein. The ENGINEER will witness all skin thickness tests. The CONTRACTOR shall notify the ENGINEER 10 working days prior to conducting skin thickness tests. After skin thickness and foam core testing, core holes shall be patched with elastomer of the same composition and thickness as the specified elastomer skin. Nylon reinforcing is not required in core hole patches. Core hole patching shall be performed according to fender manufacturer's recommendations and all product requirements for temperature, preparation, etc.

7. Foam Core Test and Inspection.
 - a. During the skin thickness testing, the CONTRACTOR and/or fender manufacturer shall core to the center of the fender (up to the internal chain). An appropriately configured hole saw long enough to reach the center of the fender shall be used to extract the foam sample. The foam sample shall be tested at one-foot incremental depths to determine the conformance to the

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density requirements of this specification. Fenders with nonconforming foam shall be rejected.

- b. After skin thickness and foam core testing, core holes shall be patched with foam of the same density (provided by the fender manufacturer with the delivery of the fenders) and elastomer of the same composition and thickness as the specified elastomer skin. Nylon reinforcing is not required in core hole patches.
8. Foam core test and in-process manufacturing shall be verified by ENGINEER prior to shipment.

PART 3 - EXECUTION

3.1 FENDER INSTALLATION

- A. The complete fender assemblies and all miscellaneous appurtenances and hardware shall be accurately assembled and installed as shown on the Plans, and in accordance with manufacturer recommendations and the highest industry standards if not fully shown on the Plans.
- B. Pontoon FABRICATOR and PONTOON DESIGNER shall coordinate all required fender attachment embeds/anchoring with fender manufacturer attachment recommendations.
- C. Construction methods and products not specified in these Contract Documents shall be utilized using reasonable care and the highest quality construction practices. Final inspection and acceptance of all WORK and products not specifically identified in these Contract Documents shall be made by the ENGINEER. Approval shall be based upon conformance to the Contract Documents, quality of workmanship, applicable industry standards, and pertinent manufacturer's recommendations.

END OF SECTION