

OCEAN ENGINEERING DIVISION
UNITED STATES COAST GUARD
WASHINGTON, D.C.

MARCH 2000

SPECIFICATION FOR CONSTRUCTION
OF
FOAM-FILLED
UNLIGHTED STEEL RIVER BUOYS

SPECIFICATION NO. 455

REVISION D

1.0 SCOPE

1.1 Scope. This specification describes the requirements for foam-filled, unlighted steel buoys used as aids to navigation in the coastal and inland waters of the United States.

1.2 Buoy classification. The buoys covered by this specification are classified as fourth and sixth class buoys. They are furnished in red with a nun-shaped upper body, in green with a can-shaped upper body, and in radar reflector or tall type. Table I summarizes these design characteristics and lists the designations by which the buoys are identified.

Table I
Buoy Design and Designation

<u>Designation</u>	<u>Class</u>	<u>Upper Body Shape</u>	<u>Color</u>	<u>Type</u>
4NR	4th	nun	red	radar
4CR	4th	can	green	radar
6NR	6th	nun	red	radar
6CR	6th	can	green	radar
6NT	6th	nun	red	tall
6CT	6th	can	green	tall

2.0 APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this specification to the extent referenced herein. Unless otherwise specified, the issues are those listed in the GSA Index of Federal Specifications, Standards or Commercial Item Descriptions, or the DOD Index of Specifications and Standards (DODISS), and supplements thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-P-21929	Plastic Material, Cellular Polyurethane, Foam-in-Place, Rigid (2 and 4 Pounds per Cubic Ft)
MIL-DTL-24441	Paint, Epoxy-Polyamide, General Specification for
MIL-P-24647	Paint System, Anticorrosive and Antifouling, Ship Hull

STANDARDS

FEDERAL

FED-STD-595B	Federal Standard Colors
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Unless otherwise indicated, copies of these documents are available as stated in the solicitation/contract clauses stating availability of specifications and standards listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions and the DOD Index of Specifications and Standards (DODISS).

DOT AND USCG SPECIFICATIONS, STANDARDS, HANDBOOKS AND SIMILAR DOCUMENTS

G-ECV-393(A)	High-Intensity Retroreflective Material
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Unless otherwise indicated, copies of these documents are available as stated in the solicitation/contract clauses stating availability of specifications and standards not listed in the GSA Index of Federal Specifications, Standards And Commercial Item Descriptions and the DOD Index of Specifications And Standards (DODISS).

2.2.2 Drawings. The latest revisions of the following United States Coast Guard Office of Civil Engineering drawings form a part of this specification to the extent referenced herein, and shall be referred to as "the drawings" throughout this specification:

<u>Number</u>	<u>Title</u>
121116	River Buoy, Fourth Class Nun, Radar Reflector Type (4NR)
121117	River Buoy, Fourth Class Can,

	Radar Reflector Type (4CR)
121118	River Buoy, Sixth Class Nun, Radar Reflector Type (6NR)
121119	River Buoy, Sixth Class Can, Radar Reflector Type (6CR)
121120	River Buoy, Sixth Class Nun, Tall Type (6NT)
121121	River Buoy, Sixth Class Can, Tall Type (6CT)

2.3 Non-Government documents and publications.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

(Available from 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, 610-832-9585)

A36	Standard Specification for Carbon Structural Steel
A607-98	Steel Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled

AMERICAN WELDING SOCIETY (AWS)

(Available from 550 NW LeJeune Rd., Miami, FL 33126, 1-800-334-9353)

A5.1-91	Covered Carbon Steel Arc Welding Electrodes, Specification for
A5.17	Carbon Steel Electrodes and Fluxes, for Submerged Arc Welding, Specification for
A5.18-93	Carbon Steel Filler Metal for Gas Shielded Arc Welding, Specification for
A5.20-95	Carbon Steel Electrodes for Flux Cored Arc Welding, Specification for

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

(Available from 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, 414-281-2331)

SSPC-SP-6	Commercial Blast Cleaning
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AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

(Available from PO Box 3066, Milwaukee, WI 53201-3066, 1-800-248-1946)

ANSI/ASQ C1-1996 General Requirements for a Quality Program (Item #T60)

2.4 Order of precedence within this specification. In the event of a conflict between the text of this specification and the references cited herein, the drawings of paragraph 2.2 take precedence, followed by the text of this specification, followed by any applicable specifications, standards, handbooks, or similar documents listed in paragraph 2.2 or 2.3. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 General. The buoys shall be manufactured of steel and shall be filled with polyurethane foam. They shall be blast-cleaned and painted prior to shipment.

3.2 First article testing. Sample buoys shall be subjected to first article testing in accordance with paragraph 4.3.

3.3 Structural materials.

3.3.1 Steel sheet. Steel sheet shall meet the requirements of ASTM A607, Grade 50, Class 1 or 2.

3.3.2 Steel shapes, bars, and plate. Steel shapes, bars, and plate shall meet the requirements of ASTM A36.

3.3.3 Counterweights and fastening hardware. Counterweights and fastening hardware shall be commercial grade carbon steel.

3.4 Design. Configuration, dimensions, and tolerances of the buoys shall be in accordance with the drawings in paragraph 2.2.2.

3.5 Welding. Welding shall be by shielded metal arc welding (SMAW), gas metal arc welding (GMAW), or submerged arc welding (SAW). Welds shall be as indicated on the drawings. Prior to finish welding, the interior of the buoys shall be dry and free from scrap metal, debris, and other foreign material.

3.5.1 Filler metals and electrodes. SMAW electrodes shall conform to AWS A5.1, series E60XX or E70XX. GMAW filler metal shall conform to AWS A5.18 or A5.20. SAW filler metal shall conform to AWS A5.17.

3.5.2 Surface preparation. The buoy components shall be fitted and faired prior to welding in place. The gap between

parts shall not exceed 3/16 inch. Surfaces to be welded shall be smooth, uniform, and free of tears, fins, cracks, and other defects. Surfaces to be welded and surfaces adjacent to a weld shall be free of loose scale, slag, rust, moisture, grease, and other foreign material.

3.5.3 Weld quality. All welds shall be uniform in size and shape. Fillet welds shall be extended around the ends of members to form closed loops. Intermittent welds shall begin and end with complete increments. Craters at the ends of increments shall be filled to prevent cracking. All welding slag, oxide, and spatter shall be removed from exterior surfaces. Welds shall be free of defects such as undercut, overlap, porosity, cracks, and voids. There shall be no burn-through. Welds shall not be peened or caulked.

3.5.4 Surface repair. Upon removal of clips, brackets, and other fixtures which have been temporarily welded to the buoys, the temporary welds shall be chipped off and ground flush. All gouges, undercuts, and scars in the base metal deeper than 1/16 inch shall be filled with weld metal and ground flush.

3.6 Foaming. After welding, the interior of the buoys shall be filled with polyurethane foam. After the foam has cured, there shall be no more than a 1-inch gap between the top of the foam and the inside of the buoy top head. There shall be no voids of such quantity or size that could cause the buoy to be susceptible to flooding. Foaming equipment, job site requirements, and specific installation procedures shall be in accordance with the foam manufacturer's recommendations.

3.6.1 Foam material. Foam shall meet the requirements of MIL-P-21929, Class I. Fire resistance is not required.

3.6.2 Installation. The buoys shall be positioned upright while the foam is installed. The foam shall be injected into the buoys through fill holes located in the buoy top head as shown on the drawings. The foam shall be injected in multiple shots, and each shot shall be allowed to expand completely before the next shot is added. The temperature of the buoys shall be between 40 degrees F and 110 degrees F during foam installation.

3.6.3 Fill hole caps. After foam installation, the buoy fill holes shall be closed with fill hole caps. The fill hole caps shall be rubber or plastic, and shall be sized to prevent water penetration through the buoy fill hole. To permit inspection of the cured foam, the fill hole caps shall be removable and easily reinstalled. The fill hole caps shall have flat or convex heads which do not protrude more than 1/4 inch above the buoy top head when installed in the buoy fill hole.

3.7 Blast cleaning. After foaming, the exterior of the buoys shall be blast cleaned in accordance with SSPC-SP-6. Prior to painting, all blast material shall be removed from the exterior surfaces of the buoys.

3.8 Painting. The buoys shall be painted with the coating system outlined below. All painting shall be performed after the buoys have been cleaned in accordance with paragraph 3.7. All welding, machining, cutting, drilling, forming, or any other operation that would damage the coating system shall be performed prior to painting. The paint shall be applied by spraying, using the methods, equipment, and safety procedures recommended by the paint manufacturer. Prior to coating, the buoy shall be striped; i.e., paint shall be sprayed across sharp edges, corners, welds, and other areas which are difficult to coat. The finished surface shall be free from runs, sags, holidays, and embedded foreign material.

3.8.1 Coating system. The buoy coating system includes an epoxy primer and an epoxy acrylic gloss topcoat. The paints in the coating system are commercial products available from a variety of manufacturers. However, the paints shall be applied as a complete system; i.e., the paints used on any given buoy (primer and topcoat) shall be from the same manufacturer. The paints shall be VOC-compliant and free of lead and chromium.

3.8.1.1 Epoxy primer. This paint shall consist of two coats, 4.0 to 5.0 mils dry film thickness each, covering the entire exterior surface of the buoy. The paint shall meet the requirements of MIL-P-24441 or MIL-P-24647. The first coat shall be a neutral color such as gray or buff. The second coat shall be the appropriate color as described in paragraph 3.8.2.

3.8.1.2 Epoxy acrylic topcoat. All exterior surfaces above the waterline shall be coated with an epoxy acrylic gloss topcoat, 1.5 to 2 mils dry film thickness. This shall be a commercial product from the same manufacturer that supplies the epoxy primer. It shall be suitable for use in a marine environment, retain its gloss and color for a minimum of two years in service, and be of the appropriate color as described in paragraph 3.8.2.

3.8.2 Color. The required colors shall be in accordance with FED-STD-595. For 4NR, 6NR, and 6NT buoys, the color shall be red conforming to Federal Color No. 11350. For 4CR, 6CR, and 6CT buoys, the color shall be either light green conforming to Federal Color No. 14193 or dark green conforming to Federal Color No. 14062, as specified in the delivery order.

3.9 Retroreflective material. Retroreflective material shall be installed as shown on the drawings. Retroreflective material shall meet the requirements of G-ECV-393(A).

3.9.1 Color. Red retroreflective material shall be used for the 4NR, 6NR, and 6NT buoys. Green retroreflective material shall be used for the 4CR, 6CR, and 6CT buoys.

3.9.2 Application. Paint shall be thoroughly cured before retroreflective material is applied. Surfaces to receive retroreflective material shall be clean and dry, and their temperature shall be 50 degrees F or above. A rubber hand roller shall be used to roll the retroreflective material flat onto the buoys. Retroreflective material shall be applied in continuous sheets, and shall not be spliced.

3.10 Surfaces. The surfaces of completed buoys shall be free of sharp edges, burrs, slag, or other defects which would affect serviceability or present a safety hazard during handling.

3.11 Marking. Each buoy shall be marked with a self-adhesive sticker. The self-adhesive sticker shall contain two lines of alphanumeric characters. The first line shall consist of the letters "USCG". The second line shall consist of the last two digits of the calendar year that the buoy was manufactured, and a two-letter manufacturer's code, separated by hyphens (for example, buoys built in the year 2000 would be marked "00-XX", where "XX" represents the manufacturer's code). The manufacturer's code will be assigned by the Government after contract award.

3.11.1 Size and location. The self-adhesive sticker shall have block characters at least 1/4 inch high. The sticker shall be applied to the buoy top head after painting, and shall not be larger than 4 inches by 4 inches square.

3.11.2 Adhesives. The adhesive on the sticker shall be a low temperature pressure sensitive adhesive of an aggressive tack type requiring no heat, solvent, or other preparation for adhesion to smooth, clean surfaces. It shall be suitable for application when the film and surface are at temperatures from 20 degrees F to 120 degrees F. The sticker shall remain legible, and shall not loosen, lift, peel, or bubble when exposed to the marine environment for at least two years.

3.12 Documentation

3.12.1 Material Certifications. The Contractor shall maintain certificates of conformance, either from the material manufacturers or certified independent testing laboratories, which demonstrate that all of the materials described in the paragraphs listed below have been tested and found to meet the requirements of this specification. These certificates shall be made available for review when requested by the COTR.

- 3.3 Structural materials (and all associated subparagraphs)
- 3.5.1 Filler metals and electrodes
- 3.6.1 Foam material
- 3.8.1 Coating system
- 3.9 Retroreflective material

4.0 VERIFICATION

4.1 Quality assurance and control plan. A quality assurance and control plan shall be provided to the Contracting Officer prior to commencing production of the first articles (see paragraph 4.3). The plan shall describe the Contractor's quality assurance program in terms of meeting the requirements of ANSI/ASQC C1. See Contract Data Requirements List (CDRL).

4.1.1 Test plan. The Contractor shall develop and provide a test plan for first article and production buoys. The plan shall describe how the tests and inspections in paragraphs 4.5 and 4.6

will be performed and documented. See Contract Data Requirements List (CDRL).

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First Article Inspection (paragraph 4.3)
- b. Conformance Inspection (paragraph 4.4)

4.3 First article inspection. The Contractor shall provide first article buoys for inspection prior to the commencement of the production buoys. The first articles shall consist of the following buoys: 10 each 4NR, 10 each 6CR, and 10 each 6NT. Five of each buoy type (a total of 15 buoys) shall not be painted until after the first article tests and inspections have been completed to permit inspection of welds. First article inspection shall consist of the visual examination of paragraph 4.5 and the tests and inspections of paragraph 4.6. Production on each buoy type shall not begin until each first article for that buoy type has passed the first article tests and inspections. First article tests and inspections shall be conducted by the Contractor at the Contractor's facility, and will be witnessed by the Contracting Officer's Technical Representative (COTR).

4.3.1 Notification of first article tests and inspections. The Contractor shall notify the Contracting Officer in writing at least 10 working days prior to the scheduled commencement of first article tests and inspections.

4.3.2 Rejection Criteria. Any first article buoy that fails to meet the requirements of this specification shall be rejected. If any first articles are rejected, the Contractor shall correct the defects and demonstrate to the COTR that the process that caused the defects has been corrected. The Contractor shall bear the costs incident to correcting deficiencies and conducting re-tests.

4.3.3 First article test reports. The Contractor shall submit a test report within 15 days after the completion of first article tests and inspections. A separate report is required for each of the first article buoy types (for example: one report for the 10 4NRs, one report for the 10 6CRs, and one report for the 10 6NTs). The test report shall include the documentation required by the test plan (paragraph 4.1.1), material certifications (paragraph 3.12), test and inspection failures (if any), and corrective action taken.

4.3.4 Authorization to Proceed. After all first article buoys have passed the inspection, the Contracting Officer will provide the Contractor with written authorization to begin fabricating production quantities.

4.3.5 Waiver of First Article Requirements. The Contracting

Officer may waive any or all of the first article requirements.

4.4 Conformance inspection. Conformance inspection shall consist of the visual examination of paragraph 4.5 and the tests and inspections of paragraph 4.6 (not to include paragraph 4.6.4). The visual examination, tests, and inspections required are not intended to supplant any controls, examinations, inspections, or tests normally employed by the Contractor to ensure product quality.

4.5 Visual examination. The Contractor shall conduct a visual examination of the buoys to ensure compliance with the paragraphs listed below. Buoys failing this visual examination shall be rejected.

- 3.4 Design
- 3.5 Welding (and all associated subparagraphs)
- 3.7 Blast cleaning
- 3.8 Painting (and all associated subparagraphs)
- 3.9 Retroreflective material (and all associated subparagraphs)
- 3.10 Surfaces
- 3.11 Marking (and all associated subparagraphs)

4.6 Tests and inspections. The following tests and inspections are required for first article and production buoys.

4.6.1 Independent testing of foam. During first article tests, at the beginning of initial production, and thereafter at the request of the COTR (not to exceed every 800 buoys), the Contractor shall send a foam sample to an independent laboratory for testing. The laboratory shall test for density, water absorption, and unicellularity of the foam to ensure conformance with MIL-P-21929. The testing shall be at the Contractor's expense. Written results of the tests, certified by the testing laboratory, shall be maintained by the Contractor and made available for review by the COTR.

4.6.2 Material inspection. The Contractor shall ensure that all materials used in the buoys are in accordance with the requirements of this specification. Material certifications required by paragraphs 3.12 shall be maintained by the Contractor and made available for review by the COTR. Buoys built with incorrect materials shall be rejected.

4.6.3 Demonstration of foaming. During first article tests and inspections, and at intervals mutually agreeable to the Contractor and the Coast Guard during subsequent production, the Contractor shall demonstrate that correct foaming procedures are being used. This demonstration shall include filling a disposable, 2 cubic foot capacity container with foam, using the same equipment, materials, and techniques used

in filling the buoys. If the foaming procedures are not in accordance with this specification, all buoys foamed with the same procedures shall be rejected. The Contractor shall also measure the level of foaming in finished buoys to ensure compliance with paragraph 3.6. Buoys with insufficient foam shall be rejected.

4.6.4 First Article inspection of internal foaming. The Contractor shall cut open with a saw one buoy from each of the three first article buoy types (one 4NR, one 6CR, and one 6NT) to allow inspection for the requirements listed in paragraph 3.6. The COTR will determine which three buoys are to be cut open. The buoys shall be cut in half down the length of the buoy from the top head to the bottom head, and split open. If one or more of the buoys fails to meet the requirements of paragraph 3.6, the COTR may require that additional buoys be cut open to determine the extent of the defect. Salvageable parts of the buoys may be used in future production. The Contractor shall be responsible for the disposal of the buoys destroyed in this test.

5.0 PACKAGING AND DELIVERY

5.1 Packaging and delivery requirements are specified in the Contract Schedule.

SPECIFICATION NO. 455D -- FOAM-FILLED UNLIGHTED STEEL RIVER
BUOYS

MARCH 2000

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