OCEAN ENGINEERING DIVISION

UNITED STATES COAST GUARD

WASHINGTON, D.C.

MARCH 2000

SPECIFICATION FOR FABRICATION OF PLASTIC DISCREPANCY BUOY COMPONENTS

SPECIFICATION NO. 472

REVISION B

1. SCOPE

1.1 Scope. This specification defines the requirements for the fabrication of plastic discrepancy buoy components, which are used as temporary aids to navigation. The items covered by this specification are as follows:

- Foam Fill Plastic Hulls
- Plastic Nun Shaped Daymarks
- Plastic Can Shaped Daymarks
- Aluminum Radar Reflectors

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are referenced in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification which are recommended for additional information or used 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 the referenced documents are listed here.

2.2 Government Documents. The following documents form a part of this specification to the extent referenced herein. Suffixes denoting the specific issue of each document are omitted from future references to the documents in this specification.

SPECIFICATIONS

MIL-S-19622/1B 11 DEC 92	Stuffing Tube, Nylon; Straight Nylon Military Specification Sheet
MIL-S-19622/19D 11 DEC 92	Stuffing Tube, Nylon; Sizes 4 and 4T: Packing Assembly for: Military Specification Sheet
MIL-P-21929C(1) 27 MAY 94	Plastic Material, Cellular Polyurethane, Foam-in-Place, Rigid (2 Pounds per Cubic Foot)

STANDARDS

FED-STD-595B 15 DEC 89	Federal Standard Colors

2.3 Industry Publications. The following documents of the issues specified form a part of this specification to the extent referenced herein. Suffixes denoting the specific issue of each document will be omitted from future references to the document in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A36-97ae1	Standard Specification for Carbon Structural Steel
A153-98	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A276-98b	Standard Specification for Stainless Bars and Shapes
A666-99	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
B209-96	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
D638-98	Standard Specification for Tensile Properties of Plastics
D746-98	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
D1505-98	Standard Test Method for Density of Plastics by the Density-Gradient Technique
D1693-98	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
D2765-95	Standard Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
D2842-97	Standard Test Method for Water Absorption of Rigid Cellular Plastics

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

ANSI/ASQC Q9002-1994	Quality Systems - Model for Quality Assurance in Production, Inspection, and Servicing

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1-2000	Structural Welding Code - Steel

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J-444	Cast Shot and Grit Size Specification for Peening and Cleaning

2.4 Drawings. The latest revision of the following United States Coast Guard Ocean Engineering drawing forms a part of this specification to the extent referenced herein, and shall be referred to as "the drawing" throughout this specification:

Drawing Number	Title
121155	Plastic Discrepancy Buoy

2.5 Source of Documents. The documents may be obtained from the following sources:

Government Documents.

Standardization Documents Order Desk
Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094

Industry Publications.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1916 Race Street
Philadelphia, PA 19103-1187

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)
310 West Wisconsin Avenue
Milwaukee, Wisconsin 53203

AMERICAN WELDING SOCIETY (AWS)
550 NW LeJeune Road
PO Box 351040
Miami, Florida 33135

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)
400 Commonwealth Drive
Warendale, PA 15096

2.6 Precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First Article Inspection. When specified (paragraph 6.1), plastic discrepancy buoy components shall be subjected to first article inspection in accordance with paragraph 4.3.

3.2 Materials.

3.2.1 Plastic. The buoy hull and daymarks shall be rotationally molded using high-density cross-linked polyethylene or medium-density polyethylene plastic. After molding and cure, the selected material shall have the following characteristics:

a. It shall be composed of 100 percent virgin material.
b. It shall have a density of 58.2 pcf plus or minus 5 percent as determined in accordance with ASTM D1505.
c. It shall have an environmental stress-cracking resistance for the 50 percent failure point of greater than 1000 hr as determined in accordance with ASTM D1693.
d. It shall have an ultimate tensile strength of at least 2200 psi as determined in

accordance with ASTM D638, at a speed of testing of 2 in/min (Speed C).

e. It shall have a minimum elongation at break of 450 percent as determined in accordance with ASTM D638, at a speed of testing of 2 in/min (Speed C).
f. It shall have a brittleness temperature of less than minus 40 degrees F as determined in accordance with ASTM D746.
g. Ultraviolet stabilizers shall compose at least 0.5 percent of the material after molding. Quantum (Microthene) MP625661 containing 2000 parts per million of Cyanox 3346 light stabilizer is approved for use.
h. The maximum percent of extract shall not exceed 13 percent as determined in accordance with ASTM D2765, method A or B (for cross-linked polyethylene only).

3.2.2. Foam. The buoy hulls shall be completely filled with rigid closed-cell polyurethane foam having a density of 2.0 plus or minus 0.5 pcf, meeting the requirements of MIL-P-21929.

3.2.3 Steel.

3.2.3.1 Steel Bars, Shapes, and Plates. All steel bars, shapes, and plates shall meet the requirements of ASTM A36, unless otherwise specified.

3.2.3.2 Galvanization. All Steel items shall be hot-dip galvanized in accordance with ASTM A153.

3.2.3.3 Steel Shot. Steel shot shall meet the requirements of SAE J-444. Shot sizes 110 through 930 are acceptable.

3.2.4 Stainless Steel.

3.2.4.1 Stainless Steel Sheet, Plate, Strip, and Bar. Stainless steel sheet, plate, strip, and bar shall meet the requirements of ASTM A666, type 316 or 316L.

3.2.4.2 Stainless Steel Hardware. All stainless steel hardware (nuts, bolts, pins, washers, etc.) shall meet the requirements of ASTM A276, type 316 or 316L.

3.2.5 Aluminum Sheet and Plate. Aluminum sheet and plate shall meet the requirements of ASTM B209, Alloy 6061 T6.

3.3 Design and Construction.

3.3.1 Design, Dimensions, and Dimensional Tolerances. All items shall conform to the design, dimensions, and tolerances shown in the drawing.

3.3.2 Threads. The threads on all nuts and bolts shall be Unified Course Thread Series (UNC).

3.3.3 Color. Color compounding shall be added to the high density cross-linked polyethylene or medium density polyethylene plastic to give the buoy hulls a gray color, the nun-shaped daymarks a red color, and the can-shaped daymarks a green color. The color

shall be throughout the thickness of the plastic. The colors shall conform to FED-STD-595 as follows: gray shall be Federal Color Number 16187, red shall be Federal Color Number 11350, and green shall be Federal Color Number 14193.

3.3.4 Foaming. The buoy hulls shall be completely filled with polyurethane foam. Foaming equipment, job site requirements, and specific installation procedures shall be as recommended by the foam manufacturer. The foam shall be injected in multiple shots, and each shot shall be allowed to expand completely before the next shot is added. The shots shall be of the duration and quantity necessary for the expanding foam to completely fill the buoy hulls. The foam shall be injected through an 11-inch hole in the top portion of the hull, as shown on the drawing. After foaming, the hole shall be closed using excess material cut from the bottom of either the can-shaped or nun-shaped daymarks.

3.3.5 Counter Weight. The counterweight shall be steel shot meeting the size requirements of SAE J-444. Shot sizes 110 through 930 are acceptable. Different sizes of shot may be combined together for use in the same counterweight. The Contractor shall ensure that the weight of the shot is correct (plus or minus 5%) prior to insertion into the buoy.

3.3.6 Radar Reflector. Each buoy shall have an aluminum radar reflector installed as shown in the drawing. The radar reflector shall be assembled using bead welds, spot welds, rivets, screws, or any other method which will provide sufficient rigidity and strength to maintain the 90 degree angles, plus or minus one degree between any two plates, through handling and installation. Brass fasteners, however, shall not be used.

3.3.7 Stuffing Tube and Packing Gland. Each plastic daymark shall have a plastic stuffing tube and rubber-packing gland attached as indicated on the drawing. The stuffing tube shall meet the requirements of MIL-S-M19622/1B, size 4T (pin M19622/1-005). The rubber-packing gland shall meet the requirements of MIL-S-M19622/9D, size 4T (pin M19622/19-0004).

3.3.8 Workmanship. The finished plastic components shall be uniform in color and shall be free from defects such as cracks, wrinkles, ripples, creases, pits, bubbles, sharp edges, and all other imperfections. The color and finish of the components shall be uniform and free of foreign material. Flash at the parting lines shall be removed. Parting agent residue on the surface of the buoy shall be removed. The surface finish shall be smooth.

3.4 Government Loaned Property (GLP). The Coast Guard will loan the following items to the Contractor upon request:

PATTERN	STOCK NUMBER	PATTERN NO.
Mold, Rotary, Discrepancy Buoy Hull	NSN 2040-01-F93-0409	121155-1MOLD
Mold, Rotary, Nun, Discrepancy Buoy	NSN 2050-01-F93-0410	121155-27MOLD
Mold, Rotary, Can, Discrepancy Buoy	NSN 2050-01-F93-0411	121155-28MOLD

3.5 Welding. The plates, bars, rods and other shapes forming the various components of the items shall be fitted and faired prior to being welded in place. All welds shall be performed as indicated on the drawing. Shielded Metal Arc Welding (SMAW), Flux-Cored Arc Welding (FCAW), Gas Metal Arc Welding (GMAW), or Submerged Arc Welding

(SAW) shall be used to weld all steel parts. All welding procedures and weld quality shall meet the requirements of AWS D1.1. All welders employed for welding under this specification shall be qualified by the Contractor using procedures which meet the requirements of AWS D1.1.

3.6 Marking.

3.6.1 Identification Marking. For tracking purposes, each buoy hull shall be permanently marked with two lines of alphanumeric characters located on the top flat part of the hull. Block characters from 3/4 inch to 1 inch tall shall be used. The first line shall be "USCG". The second line shall consist of alphanumeric characters and be of the form 08-00-XX. The first two digits are the month the hull was built, the next two digits are the last two digits of the calendar year built and the last two letters are the Contractor's designation, which will be furnished by the Contracting Officer after contract award. For example, buoys built on 08 August, 2000 would be marked 08-00-XX.

3.6.2 Serial Number. For inspection purposes, the Contractor shall assign each item a unique serial number. The serial number shall be stamped, engraved, or otherwise permanently affixed to each item. The serial number shall consist of ½ inch tall block alphanumeric characters and be clearly visible.

3.7 Documentation.

3.7.1 Quality Assurance Inspection Form. The Contractor shall develop and provide a Quality Assurance Inspection Form (QAIF). The QAIF shall be used to document the inspections and tests performed on every item throughout its fabrication process. The form shall be typewritten on standard (i.e., 8½x11 inch) white paper. Inspection results may be handwritten on the form. The form shall be prepared in the Contractor's format and shall be legible, in English, and suitable for reproduction. The form shall be made available to the Contracting Officer's Technical Representative (COTR) for review.

3.7.1.1 QAIF Content. At a minimum the QAIF shall include:

a) Item serial number.
b) Date of test or inspection.
c) Test or inspection to be performed (list every test and inspection require by section 4.0).
d) Result of test or inspection.
e) Accept/Reject criteria for each test or inspection.
f) Corrective action taken (if any).
g) Notes.
h) Initials or signatures of Contractor's test personnel.

3.7.2 Material Certifications. When requested by the COTR, the Contractor shall furnish material certifications, either from the material manufacturers or an independent testing laboratory, to the effect that all of the material described in paragraphs 3.2.1 through 3.2.5 have been tested and found to meet the requirements of the applicable sections of this specification. The material certifications shall be stored by the Contractor for the life of the contract.

3.7.3 Material Inspection and Receiving Report (DD Form 250). A form DD-250 shall be used as a certification of product quality assurance, as a packing list, and as a certification of acceptance. The Contractor shall prepare a separate DD-250 for each shipping lot. Prior to shipment, the DD-250 must be signed by the COTR.

4. VERIFICATION

4.1 General. The Contractor's quality assurance program shall meet the requirements of ANSI/ASQC Q9002. However, the Contractor does not have to be Q9002 certified.

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

a. First article inspection (paragraph 4.3)
b. Contractor production inspection (paragraph 4.4)
c. Coast Guard production inspection (paragraph 4.5)

4.3. First Article Inspection. When first article samples are required (see paragraphs 3.1 and 6.1), the Contractor shall perform a first article inspection in accordance with paragraph 4.6.

4.3.1 First Article Tests and Inspections Notification. The Contractor shall notify the Contracting Officer in writing at least 7 calendar days prior to the scheduled commencement of any inspections and tests required by this specification.

4.3.2 Waiver of First Article Requirements. The Contracting Officer reserves the right to waive all or part of the first article requirements specified herein.

4.3.3 Rejection Criteria. The results of the first article inspection will be reviewed by the Contracting Officer to determine compliance with the requirements of this specification. Failure of any of the tests or inspections described herein will be cause for rejection of the first article. If the first article is rejected, the Contractor will be notified in writing by the Contracting Officer and allowed 14 calendar days to fix or resubmit a new first article. Repair or replacement of the first article shall be by the Contractor at the Contractor's expense.

4.3.4 Authorization to Proceed. Upon successful completion of the first article inspection, the Contracting Officer will provide the Contractor with written authorization to begin fabricating production quantities.

4.3.5 Standardization. Materials, parts, design, and fabrication methods used in the production quantities shall be identical to those used in the first articles, unless otherwise authorized in writing by the Contracting Officer.

4.4 Contractor Production Inspection. The tests and inspections required by this specification are not intended to supplant any controls, examinations, inspections, or tests normally employed by the Contractor to assure product quality. The Contractor shall perform the tests and inspections specified in paragraph 4.6 to ensure conformance to this specification. The Contractor shall provide space, personnel, and test equipment to conduct all inspection and test requirements.

4.5 Coast Guard Production Inspection. The Coast Guard reserves the right to observe, verify, or perform the tests and inspections outlined in paragraph 4.6.

4.6 Tests and Inspections. The following tests and inspections shall be conducted for each first article unit and subsequent production units:

a. Visual inspection
b. Documentation review

4.6.1 Visual Inspection. Each item shall be visually inspected for quality of workmanship and conformance to this specification and the drawing. The inspection shall include checks of dimensional conformance, mechanical fit, alignment of parts, and marking.

4.6.1.1 Destructive Inspection – buoy hulls. During the first article inspection, the following tests will be performed on the first article buoy hull. Failure of any test will result in rejection of the first article. During the production inspection, the COTR will choose a buoy hull at random from each lot (paragraph 6.2) for the tests. Failure of any test will result in rejection of the lot from which the test hull came. The buoy hulls used in the destructive tests shall be furnished at the Contractor's expense. Any buoy hull destroyed as a result of the testing or inspection procedures shall not be included as deliverables under the contract.

4.6.1.2 Procedure. The Contractor shall cut the test buoy hull into equal quarters. Salvageable parts of the test hull (i.e., metal work) that meet the requirements of this specification may be used in future production hulls.

4.6.1.3 Shell thickness. Shell thickness shall be measured in at least 6 different locations. If the shell thickness at any point falls outside the tolerances indicated on the drawing, it will be considered a failure.

4.6.1.4 Metal work. The metal work inside the buoy hull shall be visually inspected to ensure conformance with the requirements of this specification and the drawing. Metal work not in conformance with the requirements of this specification will be considered a failure.

4.6.1.5 Foam quality. Polyurethane foam shall be inspected for foam quality and for voids. Any foam void larger than 4 inches in diameter or with a volume greater than 64 cubic inches will be considered a failure. Multiple voids with a cumulative total volume greater than 64 cubic inches will be considered a failure.

4.6.1.6 Cross-linking of shell material. This test is applicable if high density cross-linked polyethylene (paragraph 3.2.1) is used in the buoy hulls. The Contractor shall submit samples of the test buoy hull to the tests outlined in ASTM D2765, method A or B, to determine the percent of extract. If the percent of extract is in excess of 13 percent, it will be considered a failure.

4.6.1.7 Independent testing of foam. For the first article inspection, at the start of production foaming, and at least once per 75 buoy hulls completed thereafter, the Contractor shall send a foam sample to an independent laboratory for testing to determine conformance to the requirements of paragraph 3.2.2. The laboratory shall test for density, water absorption, and unicellularity of the foam in accordance with ASTM D2842. The testing shall be at the Contractor's expense. Written results of the tests, certified by the testing laboratory, shall be furnished to the COTR. If the first article sample does not conform to the requirements of this specification, the first article will be rejected. If production samples do not conform to the requirements of this specification, all buoy hulls

foamed with the same materials and processes will be rejected.

4.6.2 Documentation Review. The documentation required by paragraph 3.6 shall be reviewed for conformance with this specification and provided to the COTR upon request.

4.7 Rejection for Defects. The Coast Guard will reject all items which do not conform to the requirements of this specification. Repair or replacement of the rejected items shall be by the Contractor at the Contractor's expense. All rejected items shall be resubmitted for inspection only when they conform to the requirements of this specification. Resubmitted items shall be identified as such, and shall be kept separate from new items. If defective items are found, no further items will be accepted by the Coast Guard until the Contractor has demonstrated that the defects have been corrected and that the cause of the defects has been eliminated from the production process.

5. PACKAGING.

5.1 Packaging requirements are specified in Section D, Part I, Contract Schedule.

6. NOTES

6.1 First Article Inspection. The type and quantity of first articles required will be listed in Section B, Part I, Contract Schedule. A first article inspection shall be performed by the Contractor and at the Contractor's facility. The first articles shall meet the requirements of this specification and shall pass all the tests and inspections listed in paragraph 4.

6.2 Lot. All components of the same type submitted for inspection at the same time will be considered a lot.

SPECIFICATION NO. 472B - FABRICATION OF PLASTIC DISCREPANCY BUOY COMPONENTS

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3/6/00