

INCH-POUND

MIL-DTL-24560A(SH)
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DETAIL SPECIFICATION

LIGHTS AND GLASSWARE FOR NAVIGATION, SIGNAL, AND WARNING,
NAVAL SHIPBOARD USE, GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers light assemblies and associated glassware used for navigation, signal, and warning purposes on Naval ships.

1.2 Classification. Light assemblies and glassware covered by this specification will be of the following types and classes, as specified (see 6.2):

Light Assemblies:

TYPE I - Splashproof.

TYPE II - Submersible.

Glassware:

CLASS 1 - Fresnel type lens.

CLASS 2 - Globe, roundel, and lens.

CLASS 3 - Fresnel globe.

2. 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 or 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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 03Q, 2531 Jefferson Davis Highway, Arlington, VA 22242-5160 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

- MIL-S-901 - Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for.
- MIL-E-917 - Electric Power Equipment Basic Requirements.
- MIL-S-8660 - Silicone Compound, NATO Code Number S-736.
- MIL-I-17214 - Indicator Permeability, Low-Mu (Go-No-Go).
- MIL-T-22361 - Thread Compound, Antiseize, Zinc Dust-Petrolatum.

(See supplement 1 for list of specification sheets.)

STANDARDS

DEPARTMENT OF DEFENSE

- MIL-STD-108 - Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment.
- MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-278 - Welding and Casting Standard.
- MIL-STD-2175 - Castings, Classification and Inspection of.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service (DAPs), 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay).

(Application for copies should be addressed to the American National Standards Institute, Inc., Attn: Customer Service, 11 West 42nd Street, New York, NY 10036.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

- ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes.

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(Application for copies should be addressed to the American Society for Quality, 611 East Wisconsin Avenue, Milwaukee, WI 53202-4606.)

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)
IESNA Lighting Handbook.

(Application for copies should be addressed to the Illuminating Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005-4001.)

INTERNATIONAL ORGANIZATION FOR STANDARDS (ISO)
ISO/CIE 10527 - CIE Standard Colorimetric Observers.

(Application for copies should be addressed to the American National Standards Institute, Inc., Attn: Customer Service, 11 West 42nd Street, New York, NY 10036.)

UNDERWRITERS LABORATORIES (UL)
UL 486A - Wire Connectors and Soldering Lugs for Use with
Copper Conductors.

(Application for copies should be addressed to the Underwriters Laboratories, Inc., Publications Stock, 333 Pfingsten Road, Northbrook, IL 60062.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the applicable specification sheet, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.3 Parts and materials. Parts and materials shall be as specified herein and in the applicable specification sheets. Where a definite material is not specified, a material shall be used which will enable the light assembly or glassware to meet the requirements of this specification.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3.2 Metals. Metals shall be of the corrosion-resistant type as specified in the applicable specification sheet, or they shall be treated to resist corrosion as specified in MIL-E-917. Dissimilar metals in contact with each other shall be in accordance with MIL-E-917.

3.3.2.1 Aluminum. Unless otherwise specified (see 3.1), aluminum alloys, except castings, shall conform to American Society for Testing and Materials (ASTM) standards. Aluminum alloy castings shall be manufacturer's choice except sand castings and permanent mold castings shall conform to class 4 of MIL-STD-2175; grade shall be manufacturer's choice.

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3.3.3 Nonmagnetic materials. Unless otherwise specified (see 3.1), all parts shall be of a nonferrous material or a material generally considered nonmagnetic. The magnetic permeability shall be 2.0 or less after fabrication (see 4.4.1.9).

3.3.4 Nonmetallic materials. Nonmetallic materials shall be nonflammable, nontoxic and fungus-inert as specified in MIL-E-917.

3.3.5 Plastics. Plastic materials shall conform to the requirements of MIL-E-917 and as specified hereinafter.

3.3.6 Glassware. Glassware shall be high-impact, heat resistant with an extremely low-temperature coefficient of expansion. The glass shall withstand exposure to atmospheric sea conditions, particularly that of salt water, high humidity, and bright sunlight without etching, discoloration, or any change in the light transmittance.

3.3.7 Commercial (hardware) parts. Where a definite material is not specified for utility hardware (items such as screws, bolts, and nuts), commercial items may be used provided they meet the requirements specified herein (see 3.3.2, 3.3.3, and 3.3.4).

3.3.8 Caulking compound. Caulking compound shall be of a good commercial grade material compatible with the material of the basic light assembly. Compound consistency shall be such that the light assembly can be disassembled without requiring the use of special agents or tools.

3.3.9 Antiseize coating. Aluminum and CRES fastening parts such as screws and bolts in contact with threaded aluminum shall be coated with an antiseize compound in accordance with MIL-T-22361.

3.3.10 Gaskets. Unless otherwise specified (see 3.1), gaskets shall be commercial type neoprene 6-75 Durometer hardness.

3.3.11 Prohibited materials. The prohibited materials shall be those specified in MIL-E-917. Unless otherwise specified (see 3.1), asbestos shall not be used.

3.4 Design and construction.

3.4.1 Light assemblies. Light assemblies shall be of the design, construction, and physical dimensions specified (see 3.1). Unless otherwise specified (see 6.2), lamps shall not be furnished.

3.4.1.1 Dimensional tolerances. Unless otherwise specified (see 3.1), the following tolerances shall apply to dimensions specified in the individual specification sheets:

- (a) Fractional dimensions - plus or minus 1/64 inch.
- (b) Decimal dimensions - plus or minus 0.005 inch.
- (c) Angular dimensions - plus or minus 1/2 degree.

Unless otherwise specified (see 3.1), a tolerance of plus or minus 1/32 inch is acceptable on fractional dimensions that are controlled by welding or brazing. The width tolerance shall not interfere with the interchangeability of assemblies or parts. A tolerance of plus or minus 1/32 inch with a draft angle is acceptable for cast parts.

3.4.1.2 Enclosures. Light assemblies shall be type I, splashproof or type II, submersible as specified (see 1.2 and 3.1).

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3.4.1.3 Drilling, countersinking, and tapping. Drilling, countersinking, and tapping shall be done before placing or finish is applied. All holes shall have burrs removed.

3.4.1.4 Sharp edges. Sharp edges and corners shall be given a slight radius.

3.4.1.5 Finishes. Surface finishes shall be in accordance with ANSI B46.1. Score marks on side walls of all light assemblies in the way of nylon stuffing tubes shall be not greater than 123 microinches.

3.4.1.6 Threaded parts and fastening devices. Screw threads in copper, aluminum and plastic and fastening of parts shall be in accordance with MIL-E-917 and as specified (see 3.1).

3.4.1.7 Wiring. Where required (see 3.1), internal wiring shall be furnished and installed. Connections at screw terminals shall be made with pressure grip (solderless) connectors in accordance with UL 486A. Splice connections shall be kept to a minimum and shall be made with UL approved insulated connectors, either crimp or screw type. There shall be no exposed uninsulated electrical terminal joints, junctions, wiring, or wiring accessories.

3.4.1.8 Castings and molded parts. Castings shall be free of cold shuts, blow holes, or any imperfections that may affect the strength or performance. Flash shall be removed from molded parts.

3.4.1.9 Stress relief.

3.4.1.9.1 Metals. Metals used in fabrication and assemblies which are susceptible to stress shall be stress relieved to prevent deterioration or failure.

3.4.1.9.2 Plastics. Measures shall be taken in molding or processing plastics to insure that stress buildup does not occur or is treated to relieve these stresses when required to prevent deterioration of the part or assembly.

3.4.1.10 Welding. Welding and allied processes used in fabrication shall be in accordance with MIL-STD-278 except welder qualification is not required.

3.4.1.11 Painting. Unless otherwise specified (see 3.1) painting, where required, shall be in accordance with MIL-E-917.

3.4.1.12 Gaskets. Rubber gaskets shall be securely cemented at the scarf joint and shall completely fill the groove without stretching or bunching. The gasket shall be retained in its groove without the use of cement.

3.4.1.13 Lubrication. O-ring and tubular gaskets shall be coated with a compound in accordance with MIL-S-8660 before final assembly in the light assembly.

3.4.2 Glassware. Glassware shall consist of lenses, globes, and roundels of the classes specified (see 1.2). The design, construction, and physical dimensions shall be as specified (see 3.1) and hereinafter.

3.4.2.1 Coloring. Colored glassware shall be of uniform coloring throughout the entire thickness of the portions designed for light transmittance.

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3.4.2.2 Thickness tolerances. Glassware shall be of uniform thickness throughout. Where thickness tolerances are not specified (see 3.1), a variation of 12 percent above or below the nominal dimensions will be permitted, except that these tolerances shall in no case exceed 1/16 inch.

3.4.2.3 Edges. Edges of all glassware shall be ground or molded to a true surface.

3.4.2.4 Fresnel type lens. The fresnel type lens of class 1 and 3 glassware shall have a central bulls eye with the required number of zones above and below the central zone to meet the performance requirements specified herein. Actual design as to the surface curvature, spacing of the zones, width of the zones and so forth shall be at the option of the manufacturer.

3.5 Performance characteristics.

3.5.1 Light assemblies.

3.5.1.1 Operation. Light assemblies, when operated as specified in 4.4.1.1, shall perform their specified function.

3.5.1.2 Degree of enclosure. Type I and type II light assemblies shall conform to the splashproof and submersible (1600 foot) requirements, respectively, of MIL-STD-108 (see 4.4.1.2). Following the enclosure test, the assemblies shall satisfactorily pass the dielectric withstanding voltage and insulation resistance tests (see 4.4.1.6 and 4.4.1.7).

3.5.1.3 Shock. Light assemblies shall conform to the class I or class II (see 3.1), grade A shock requirements of MIL-S-901 (see 4.4.1.3). Following the shock test, the light assemblies shall satisfactorily pass the dielectric withstanding voltage test (see 4.4.1.6). Lamp failure shall not be considered as an assembly failure.

3.5.1.4 Vibration. Light assemblies shall conform to the type I vibration requirement of MIL-STD-167-1 and shall exhibit no signs of damage or loosening of parts during and after the vibration test (see 4.4.1.4). Following the vibration test, the light assemblies shall satisfactorily pass the dielectric withstanding voltage test (if applicable) (see 4.4.1.6).

3.5.1.5 Salt spray. There shall be no signs of excessive corrosion when the light assemblies are subjected to the salt spray test (see 4.4.1.5). Excessive corrosion is defined as that which interferes with electrical or mechanical performance, or in the case of plated metals corrosion which has passed through the plating and attacked the base metal. Where corrosion resistance treatments are used, it will be permissible to have limited superficial corrosion such as would result from scratches.

3.5.1.6 Dielectric withstanding voltage. There shall be no evidence of breakdown, arcing, corona (audible or visible), or punctured insulation when the light assemblies are subjected to the test specified in 4.4.1.6.

3.5.1.7 Insulation resistance (wired assemblies). The insulation resistance between all current carrying parts and non-current carrying parts of the wired light assemblies (see 3.1) shall be not less than 100 megohms when tested as specified in 4.4.1.7.

3.5.1.8 Hydrostatic pressure (type II). Type II light assemblies shall withstand the stresses produced when subjected to the hydrostatic pressure specified (see 3.1) without visible or structural damage or evidence of leakage of water into the enclosure (see 4.4.1.8).

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3.5.2 Glassware.

3.5.2.1 Light output. Unless otherwise specified (see 3.1) the light output shall be as specified in 3.5.2.1.1 through 3.5.2.1.3 (see 4.4.2.1).

3.5.2.1.1 Class 1 - Fresnel type lens. Class 1 glassware shall have a minimum luminous intensity of 94 candelas for clear (colorless), and 12 candelas for red, green, and yellow from 5 degrees above to 5 degrees below the horizontal axis of the central zone of the bull's eye. At least 60 percent of the required minimum intensity shall be present from 7.5 degrees above to 7.5 degrees below the horizontal axis (see 4.4.2.1(a)).

3.5.2.1.2 Class 2 - Globe, roundel, and lens. Class 2 glassware shall have a minimum luminous transmittance of 17.5 percent for red, 40 percent for yellow, 20 percent for green, 2 percent for blue, and 85 percent for clear (colorless) when specimens are tested using CIE illuminant A (see 4.4.2.1(b)).

3.5.2.1.3 Class 3 - Fresnel globe. Class 3 glassware shall have a minimum luminous intensity of 94 candelas for clear (colorless), 12 candelas for red, green, and yellow and 4.5 candelas for blue from 5 degrees above to 5 degrees below the horizontal axis of the central zone of the bull's eye. At least 60 percent of the required minimum intensity shall be present from 7.5 degrees above to 7.5 degrees below the horizontal axis (see 4.4.2.1(c)).

3.5.2.2 Color (chromaticity). Unless otherwise specified (see 3.1), the chromaticity in CIE coordinates of the class 1, 2, and 3 glassware shall be as specified in 3.5.2.2.1 through 3.5.2.2.5, when installed in the appropriate light fixture (see 4.4.2.2).

3.5.2.2.1 Red transparent. Red transparent color shall fall within the areas bounded by the spectrum locus and the following coordinates (see figure 1):

X	0.680	0.660	0.735	0.721
Y	0.320	0.320	0.265	0.259

3.5.2.2.2 Yellow transparent. Yellow transparent color shall fall within the areas bounded by the spectrum locus and the following coordinates (see figure 1):

X	0.612	0.618	0.575	0.575
Y	0.382	0.382	0.425	0.406

3.5.2.2.3 Green transparent. Green transparent color shall fall within the areas bounded by the spectrum locus and the following coordinates (see figure 1):

X	0.028	0.009	0.300	0.203
Y	0.385	0.723	0.511	0.356

3.5.2.2.4 Blue transparent. Blue transparent color shall fall within the areas bounded by the spectrum locus and the following coordinates (see figure 1):

X	0.148	0.232	0.060	0.170
Y	0.025	0.167	0.230	0.230

3.5.2.2.5 Clear (colorless) transparent. Clear transparent color shall fall within the areas bounded by the spectrum locus and the following coordinates (see figure 1):

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X	0.525	0.525	0.452	0.310	0.310	0.443
Y	0.382	0.440	0.440	0.348	0.283	0.382

3.5.2.3 Painted glassware. Those portions of the glassware designated to be painted shall be uniformly coated with a baking enamel as specified (see 3.1). The glassware shall be baked at such a temperature and period of time as to insure adhesion of the enamel to the glass. There shall be no evidence of loosening, softening or dissolution of the enamel when glassware is tested as specified in 4.4.2.3.

3.5.2.4 Mechanical shock. When specified (see 3.1), glassware shall withstand the stresses produced when tested as specified in 4.4.2.4 without breaking, cracking, or chipping.

3.5.2.5 Thermal shock. When specified (see 3.1), glassware shall withstand the stresses produced when tested as specified in 4.4.2.5 without visible structural damage.

3.5.2.6 Hydrostatic pressure (class 3). Class 3 glassware shall withstand the stresses produced when tested as specified in 4.4.2.6 without visible or structural damage.

3.5.2.7 Breakage pattern. The breakage pattern shall be characterized by complete fracture of the glassware into small rectangular pieces predominantly not exceeding 2-1/2 by 5/8 inches (see 4.4.2.7).

3.5.3 Marking. The marking format, information, and location shall be as specified (see 3.1).

3.5.4 Workmanship. The light assemblies and glassware, shall be manufactured and finished in a thoroughly workmanlike manner. Light assembly joined parts shall fit as tightly as expected with good manufacturing practices and workmanship and shall be free of damage or displaced parts, burrs, and other defects which will affect the life, serviceability, or appearance. Finished glassware shall be of uniform quality as to color and clarity and shall be free from dead zones, striae, air bubbles, wrinkles, mold marks, chipped edges, cracks, or other blemishes which will affect the life, serviceability, or appearance.

4. VERIFICATION

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

- (a) First article inspection (see 4.2).
- (b) Conformance inspection (see 4.3).

4.1.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the GENERAL REQUIREMENTS of MIL-STD-202.

4.2 First article inspection. First article inspection shall consist of the examinations and tests as specified in table I.

4.2.1 Government inspection. When the contract specifies the first article inspection is to be performed by the Government, the contractor shall submit the first article sample and a set of prints of the manufacturing drawings to the laboratory specified (see 6.6) for the performance of the first article inspection.

4.2.2 Contractor inspection. When the first article inspection is to be performed by the contractor, the inspection will be witnessed and the test results verified by the Government inspector.

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TABLE I. First article inspection.

Test	Requirement	Test method
<u>Light Assemblies</u>		
Examination of product	3.1, 3.4.1, 3.5.3, 3.5.4	4.3.2
Magnetic permeability	3.3.3	4.4.1.9
Operation	3.5.1.1	4.4.1.1
Dielectric withstanding voltage <u>1/</u>	3.5.1.6	4.4.1.6
Insulation resistance <u>1/</u>	3.5.1.7	4.4.1.7
Vibration	3.5.1.4	4.4.1.4
Dielectric withstanding voltage <u>1/</u>	3.5.1.6	4.4.1.6
Shock	3.5.1.3	4.4.1.3
Dielectric withstanding voltage <u>1/</u>	3.5.1.6	4.4.1.6
Salt spray	3.5.1.5	4.4.1.5
Degree of enclosure	3.5.1.2	4.4.1.2
Hydrostatic pressure (type II)	3.5.1.8	4.4.1.8
Dielectric withstanding voltage <u>1/</u>	3.5.1.6	4.4.1.6
Insulation resistance <u>1/</u>	3.5.1.7	4.4.1.7
<u>Glassware</u>		
Examination of product	3.1, 3.4.2, 3.5.3, 3.5.4	4.3.2
Light output	3.5.2.1	4.4.2.1
Color (chromaticity)	3.5.2.2	4.4.2.2
Mechanical shock	3.5.2.4	4.4.2.4
Thermal shock	3.5.2.5	4.4.2.5
Paint removal	3.5.2.3	4.4.2.3
Hydrostatic pressure (class 3)	3.5.2.6	4.4.2.6
Breakage pattern	3.5.2.7	4.4.2.7
Color determination	3.4.2.1	4.4.2.8

1/ If applicable (see 3.1).

4.2.3 Combination of tests. Where advantageous, the contractor may combine tests in cases where the basic body of the light assembly to be tested is the same for different symbol numbered assemblies. For example, the symbol number changes when a red globe is substituted for a clear globe in the same basic light fixture.

4.4.2 Replacement glassware. When glassware is being furnished only as replacement parts, the Government will furnish the applicable light assemblies where required to complete the necessary first article tests.

4.2.5 Sampling size. One light assembly or one glassware furnished as a replacement part shall be subjected to first article inspection.

4.2.6 Inspection routine. When specified (see 3.1), the sample light assemblies and glassware shall be subjected the inspections shown in table I, in the order shown.

4.2.7 Failures. One or more failures shall be cause for refusal to grant first article approval.

4.3 Conformance inspection. Conformance inspection shall consist of the examinations and tests as specified in tables II and III.

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TABLE II. Conformance examination.

Examine	Defect
VISUAL	
<u>Light assemblies</u>	
Finish	Finish not as specified; blisters, peeled, chipped, or area of no film. Color not as specified.
Materials	Materials not as specified.
Construction and workmanship	Part missing; fractures, split, punctured, dented, deteriorated. Not in proper alignment; sharp burr or edge, sliver or splinter.
Welding and brazing (where applicable)	Missing, incomplete, burn holes, cracked, fractured, or otherwise not fused; slag inclusion, slight undercut, not smooth and uniform, scale of flux deposits not removed.
Soldering (where applicable)	Missing, not adherent or incomplete; not clean (flux or flux residue not removed); not smooth (surface not finished neatly), or pinholes in solder.
Bolts, nuts, screws, studs, pads, rivets, and other types of fasteners	Missing, broken, stripped, fractured, loose, bent, not peened or insufficiently peened.
Electrical assembly (where applicable)	Connections at screw terminals not as specified. Wiring not properly joined, loose at terminals.
Gaskets (where applicable)	Not coated where required; missing; not as specified.
Marking for identification	Missing; incomplete, not legible.
<u>Glassware</u>	
Construction and workmanship (may be combined with operation test specified in 4.7.1.1)	Color not as specified; dead zones, striae, air bubbles, wrinkles, mold marks, chipped edges, cracks or other blemishes. Paint not as specified. Bull's eye design for classes 1 and 3 not as specified. Refractive index not as specified.
Marking for identification	Missing; incomplete, not legible.
<u>WEIGHT AND DIMENSIONS (all)</u>	
Weight	Weight not as specified.
Dimensions	Dimensions not within specified tolerances.

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TABLE III. Conformance tests.

Test	Requirement	Test method
<u>Light Assemblies</u>		
Examination of product	3.1, 3.4.1, 3.5.3, 3.5.4	4.3.2
Operation	3.5.1.1	4.4.1.1
Hydrostatic pressure (type II only)	3.5.1.8	4.4.1.8
Dielectric withstanding voltage <u>1</u> /	3.5.1.6	4.4.1.6
Insulation resistance (wired assemblies only) <u>1</u> /	3.5.1.7	4.4.1.7
<u>Glassware</u>		
Examination of product	3.1, 3.4.2, 3.5.3, 3.5.4	4.3.2
Light output	3.5.2.1	4.4.2.1
Color (chromaticity)	3.5.2.2	4.4.2.2
Hydrostatic pressure (class 3 only)	3.5.2.6	4.4.2.6

1/ If applicable.

4.3.1 Inspection lot. An inspection lot shall consist of all light assemblies or glassware of the same part number and batch number, produced under essentially the same conditions, and offered for inspection at one time.

4.3.2 Examination. Light assemblies and glassware shall be examined to determine conformance to table II.

4.3.2.1 Sampling plan for conformance examination. Samples shall be selected at random from each lot in accordance with ASQC Z1.4 at inspection level I for the examination specified in 4.3.2 (see 6.7.1).

4.3.3 Conformance tests. Conformance tests shall be as specified in table III.

4.3.3.1 Sampling plan for conformance tests. Samples shall be selected at random from each lot in accordance with ASQC Z1.4 at inspection level B-2 for the tests specified in table III, except that 100 percent of type II light assemblies shall be subjected to the hydrostatic pressure test (see 6.7.2).

4.4 Test methods.

4.4.1 Light assemblies. The following tests for complete light assemblies shall be performed.

4.4.1.1 Operation. The light assembly, with specified lamp installed (see 3.1), shall light and remain steady when power is applied. Application of power shall be similar to that normally supplied the light assembly when installed onboard a ship (see 3.5.1.1).

4.4.1.2 Degree of enclosure. Splashproof and submersible assemblies shall be subjected to the water repellent and submergence tests, respectively, in accordance with MIL-STD-108 (see 3.5.1.2). Before conducting this test, all joints that have gaskets, or sealing compound or that have been painted, and which are subject to being opened, shall be opened and closed three times. Following this test the light assembly shall be subjected to the dielectric

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withstanding voltage test of 4.4.1.6 and insulation resistance test of 4.4.1.7 if applicable.

4.4.1.3 Shock test. The light assembly shall be subjected to the type A, class I or II, as applicable, grade A shock test for lightweight equipment in accordance with MIL-S-901 (see 3.5.1.3). Mounting of the light assembly on the shock machine shall simulate normal shipboard installation (see 3.1). Light assembly shall be energized during this test. The test records shall include photographs of the test set-up and any failed element. Following this test, the light assemblies shall be subjected to the dielectric withstanding voltage test of 4.4.1.6 (if applicable).

4.4.1.4 Vibration test. The light assembly shall be subjected to the type I vibration test in accordance with MIL-STD-167-1 (see 3.5.1.4). Mounting for the light assembly shall simulate shipboard installation (see 3.1). The light assembly shall be energized during this test. The test records shall include copies of the vibration test reports and photographs as outlined in MIL-STD-167-1. Following this test, the light assembly shall be subjected to the dielectric withstanding voltage test of 4.4.1.6 (if applicable).

4.4.1.5 Salt spray test. The light assembly shall be subjected to a salt spray test in accordance with method 101 of MIL-STD-202, test condition A (see 3.5.1.5).

4.4.1.6 Dielectric withstanding voltage. The light assembly shall be subjected for 1 minute to a dielectric withstanding voltage test, the effective potential of which is twice rated voltage (see 3.1), plus 1,000 volts, applied between points of polarity and also between live parts and ground. The frequency of the test voltage shall be 60 Hertz, root mean square alternating current, and shall approximate a true sine wave. The light assembly shall be examined for evidence of breakdown, arcing, corona (audible or visible) or punctured insulation (see 3.5.1.6).

4.4.1.7 Insulation resistance test. Insulation resistance test shall be conducted between all current carrying parts and non-current carrying parts with a megohmmeter at a voltage not less than 500 volts direct current (see 3.5.1.7). This test is not required for unwired light assemblies wherein plastic parts are certified by the manufacturer as meeting the requirements specified (see 3.1).

4.4.1.8 Hydrostatic pressure test (type II). Type II assemblies shall be submerged in water in a pressure tank. External hydrostatic pressures as specified in the applicable specification sheet shall be applied for the durations specified. Following the test, the assembly shall be examined for conformance to 3.5.1.8.

4.4.1.9 Magnetic permeability. The relative permeability when checked with a low- μ indicator in accordance with MIL-I-17214 shall not exceed the permeability level specified in 3.3.3.

4.4.2 Glassware. The following tests for glassware shall be performed.

4.4.2.1 Light output. The light output shall be measured in accordance with the appropriate guides for photometric and colorimetric testing as specified in the IESNA Lighting Handbook (see 3.5.2.1). Before any measurements are taken, the light assemblies shall be operated until the light has reached a stable temperature condition. Unless otherwise specified (see 3.1), the following applicable lamp, located at the focus of the system shall be used:

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- (a) Class 1 - Fresnel type lens. A standard 50-watt rough service tungsten filament lamp.
- (b) Class 2 - Globe, roundel, and lens. Light source shall be CIE illuminant A.
- (c) Class 3 - Fresnel globe. An industry no. 50/50T12 (primary filament) lamp.

4.4.2.2 Color (chromaticity). The chromaticity of the glassware shall be determined by colorimetric testing in accordance with ISO/CIE 10527 (see 3.5.2.2).

4.4.2.3 Paint removal test. Sample glassware shall be submerged in any commercially available paint and varnish remover for a period of not less than 3 minutes to determine conformance to 3.5.2.3.

4.4.2.4 Mechanical shock test. Sample glassware shall be placed with the flat surface on a soft 2-foot by 2-foot by 2-inch thick wood plank as shown on figure 2. A 3-pound polished steel ball shall be allowed to fall free one time from a height of 2 feet and strike the glassware on the center of the outside surface (see 3.5.2.4).

4.4.2.5 Thermal shock test. Sample glassware shall be uniformly heated to a temperature of 198 +/- 3.6 degrees Fahrenheit (°F) (110 +/- 2 degrees Celsius (°C)) and then immersed in cold water 35 +/- 5°F (1.7 +/- 2.8°C) for not less than 2 minutes. At least ten consecutive cycles shall be performed on each sample (see 3.5.2.5). Following the test, painted glassware shall be examined for conformance to 3.5.2.3.

4.4.2.6 Hydrostatic pressure test. Class 3 glassware shall be installed on a type II light assembly and subjected to the test of 4.4.1.8 (see 3.5.2.6).

4.4.2.7 Breakage pattern test. Sample glassware shall be placed with the flat surface on a soft 2-foot by 2-foot by 2-inch thick wood plank as shown on figure 2. A steel ball shall be allowed to fall free and strike the glassware on the center of the outside surface with a force great enough to break the glassware (see 3.5.2.7).

4.4.2.8 Color determination test. A small number of pieces of broken glassware (see 4.4.2.7) shall be visually examined to determine conformance to 3.4.2.1.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. Navigation lights covered by this specification are intended for use in Naval shipboard applications.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of the specification.
- (b) Type of light assembly or class of glassware when ordered as replacement parts (see 1.2).
- (c) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- (d) When first article is required (see 3.2).
- (e) When lamp is to be furnished with the light assembly (see 3.4.1).
- (f) Laboratory when first article inspection is to be performed by the Government (see 4.2.1 and 6.6).
- (g) Packaging requirements (see 5.1).

6.3 First article. When a first article is required, it should be tested and approved under the appropriate provisions of paragraph 7-104.55 of the Defense Acquisition Regulations. The first article should be a preproduction sample. The first article should consist of one unit. The contracting officer will include specific instructions in all acquisition instruments regarding arrangements of examinations, test, and approval of the first article. Contractors should contact NAVSEA before conducting tests to discuss technical details of testing.

6.3.1 Extension of first article approval. Invitations for bids should provide that the Government reserves the right to waive the requirement for the samples for first article inspection, as to those bidders, offering a product which has been previously acquired or tested by the Government, and that bidders offering such products who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending acquisition.

6.3.2 First article testing prior to contract award. The contractor, prior to award of a contract, may perform the first article inspection at a Government laboratory (see 6.4) at his own expense and risk. This action, however, neither constitutes an obligation by the Government to purchase nor authorizes the expenditure of Government funds.

6.4 Approval of the first article inspection report. The Purchasing Contracting Officer (Naval Shipyards, Private Shipyards/Supervisor of Shipbuilding Conversion and Repair, Naval Sea Systems Command field activities and Defense Supply Agencies) will, by written notice to the contractor, waive, approve, conditionally approve, or disapprove the first article inspection report. When it is deemed necessary, the Purchasing Contracting Officer will forward the first article inspection report to NAVSEA for resolution on acceptance or non-acceptance of marginal or nonconforming supplies.

6.5 Symbol number. Symbol number is a standard equipment designation. Symbol numbers are listed in publication NAVSHIPS 0960-000-4000.

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6.6 Government inspection. Unless otherwise directed by NAVSEA, Government inspection will be performed at the Portsmouth Naval Shipyard, Equipment Testing Laboratory, Portsmouth, New Hampshire 03801.

6.7 Lot acceptance and rejection criteria.

6.7.1 Conformance examination. The AQL is 2.5 percent defective. Samples containing one or more defects should not be offered for delivery, and if the number of nonconforming items exceeds the acceptance number for that sample, the lot represented by the samples should not be offered for delivery.

6.7.2 Conformance tests. If any sample fails to conform to these tests, the sample and the lot represented thereby should not be offered for delivery.

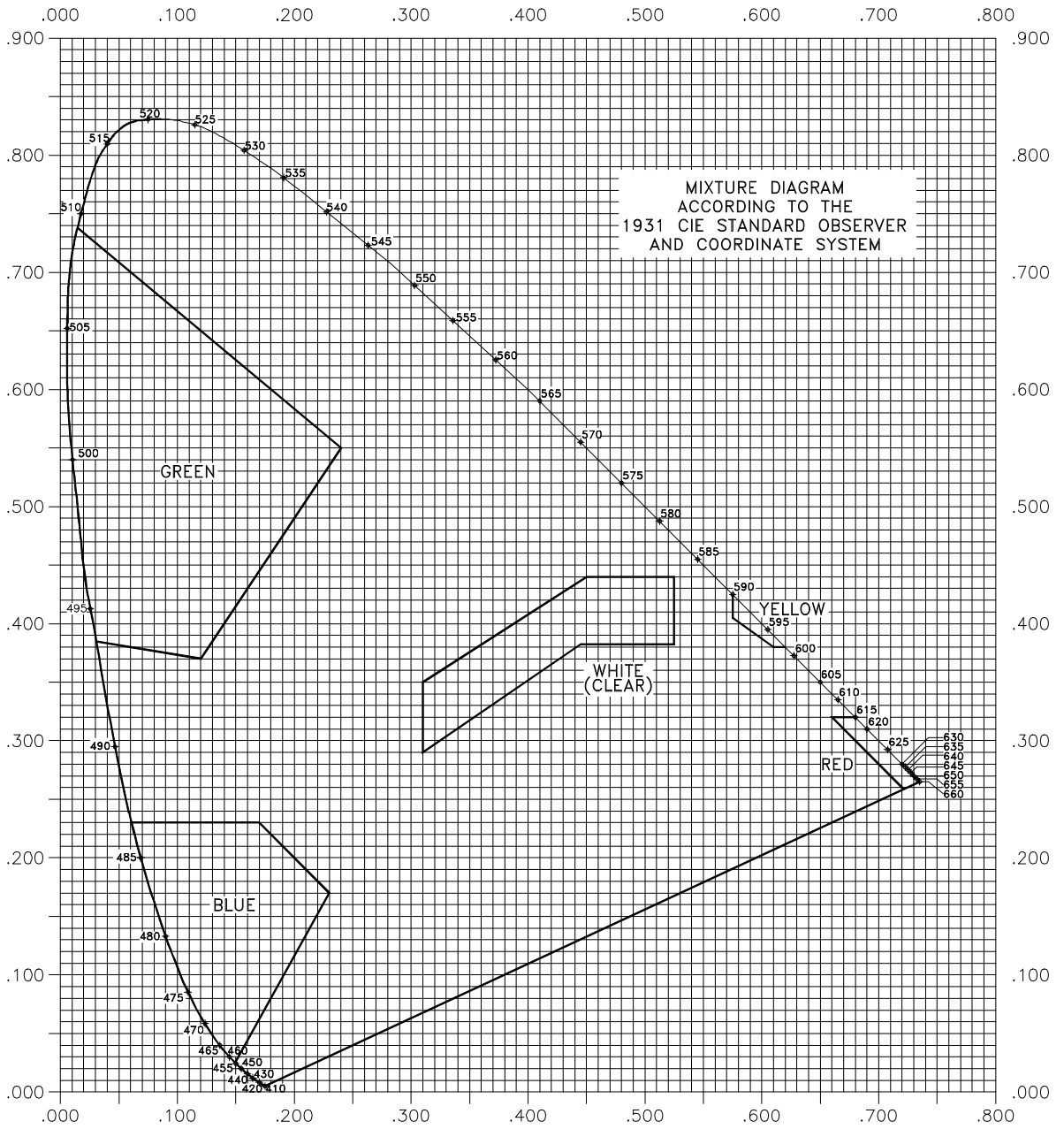
6.7.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots should be inspected using tightened inspection. Such lots should be kept separate from new lots, and clearly identified as reinspected lots.

6.8 Subject term (key word) listing.

Fresnel globe
Fresnel lens
Globe
Lens
Roundel

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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NOTES:

1. Figure is for information only. Colors shall be as specified in 3.5.2.2.1 through 3.5.2.2.5.

FIGURE 1. Chromaticity diagram.

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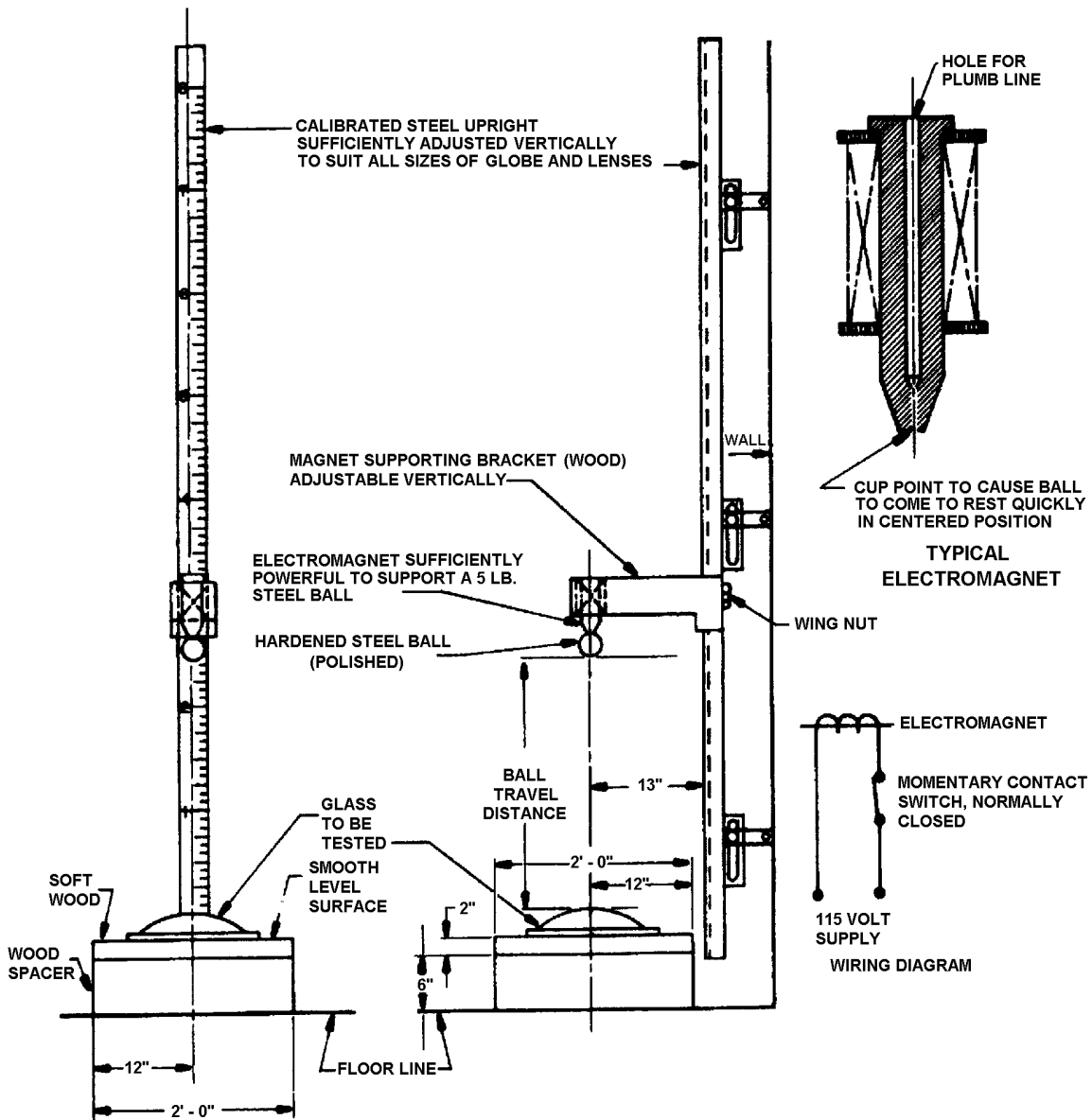


FIGURE 2. Typical ball impact equipment for shock and breakage pattern test for glassware.

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CONCLUDING MATERIAL

Preparing activity:
Navy - SH
(Project 6220-N379)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4,5,6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of this form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A

1. DOCUMENT NUMBER
MIL-DTL-24560

2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE: DETAIL SPECIFICATION, LIGHTS AND GLASSWARE FOR NAVIGATION, SIGNAL, AND WARNING, NAVAL SHIPBOARD USE, GENERAL SPECIFICATION FOR

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*

b. ORGANIZATION

c. ADDRESS *(Include Zip Code)*

d. TELEPHONE *(Include Area Code)*

7. DATE
SUBMITTED
(YYMMDD)

(1) Commercial
(2) AUTOVON
(if applicable)

8. PREPARING ACTIVITY

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Technical Point Of Contact (TPOC)
Mr. Alex Vangham

b. TELEPHONE *(Include Area Code)*

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(2) (2) AUTOVON

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Arlington, VA 22242-5160

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VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340