

INCH-POUND

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SUPERSEDING  
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MILITARY SPECIFICATION  
RELAY, SENSITIVE  
(FOR TORPEDO MARK 37 MOD 2)

Inactive for new design after 31 July 1996.  
No superseding specification.

This specification is approved for use by the Naval Surface Warfare Center, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1. Scope. This specification describes the requirements for the acquisition of a double-pole, double-throw, sensitive electromagnetic relay, Drawing 1521140. The coil is rated at one watt at a voltage of 31.6 V dc. The relay is used in the control of functional circuits which operate on a nominal dc voltage of 25 volts and dc current up to two amperes.

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.

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 and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

FEDERAL

A-A-208	-	Ink, Marking, Stencil, Opaque, (Porous and Non-Porous Surfaces).
A-A-3003	-	Lacquer, Spraying, Clear and Pigmented, for Interior Use.
O-S-642	-	Sodium Phosphate, Tribasic, Anhydrous, Dodecahydrate; and Monohydrate; Technical.
FF-N-836	-	Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat.
FF-S-86	-	Screw, Cap, Socket-Head.
FF-S-92	-	Screw, Machine, Slotted, Cross Recessed or Hexagon Head.
TT-C-490	-	Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings.
TT-P-1757	-	Primer Coating, Alkyd Base, One Component.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC/VAT, Post Office Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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DEPARTMENT OF DEFENSE

- MIL-PRF-680 - Degreasing Solvent.
- MIL-DTL-1222 - Studs, Bolts, Screws and Nuts for Applications Where a High Degree of Reliability Is Required, General Specification for.
- MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
- MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys.
- MIL-DTL-15090 - Enamel, Equipment, Light Gray (Navy Formula No. 111).
- MIL-V-16399 - Varnish, Moistureproof.
- MIL-T-18404 - Torpedoes, Environmental Requirements, General Specification for.
- MIL-E-82590(OS) - Environmental Requirements and Tests (for Torpedo MK 37 Components and Assemblies).

STANDARDS

FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services.

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

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

NAVAL SURFACE WARFARE CENTER (NAVSEA, Ordnance Systems)

- OSTD 600 - Standard Parts.

DRAWINGS

- Drawing 1521140 - Relay, Sensitive.

PUBLICATIONS

- NAVORD OS 6341 - Ordnance Design Requirements, General Miscellaneous.

(Copies of specifications, standards, drawings, and publications requested by contractors in connection with specific acquisition functions should be obtained from the acquiring activity or as directed by the contracting officer.)

2.3 Non-Government publications. The following document(s) 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-J-006 - Requirements for Electronic Grade Solder Alloys and Fluxed and Non-fluxed Solid Solders for Electronic Soldering Applications.

(Applications for copies should be addressed to the American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B633 - Electrodeposited Coatings of Zinc on Iron or Steel.
- ASTM B700 - Electrodeposited Coatings of Silver for Engineering Use.

(Applications for copies should be addressed to the American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

- SAE-AMS-M-3171 - Magnesium Alloy, Processes for Retreatment and Prevention of Corrosion on Conversion Coatings.
- SAE-AMS-QQ-C-320 - Chromium Plating (Electrodeposited).
- SAE-AMS-QQ-N-290 - Nickel Plating (Electrodeposited).

(Applications for copies should be addressed to the Society of Automotive Engineers, Inc. (SAE), 400 Commonwealth Drive, Warrendale, PA 15096.)

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC-PAINT-25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II.

(Applications for copies should be addressed to the Society for Protective Coatings (SSPC), 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4643.)

2.4 Order of 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 Description. The sensitive relay (hereinafter called the relay), Drawing 1521140, is a sensitive, electromagnetic relay with a double-pole double-throw armature. With the coil in its normally deenergized state, the armature closes the circuit(s) through one pair of poles. When the coil is energized and the coil current reaches a predetermined value, the armature moves to close the circuit(s) through the opposite pair of poles, at the same time opening the circuit(s) through the initial pair of poles. When the current in a energized coil is reduced below a predetermined value, the armature will return to the position assumed when the coil is deenergized. The coil is energized from a nominal 10 V dc (or rectified ac) power source.

3.2 Definitions. Definitions applicable to the environmental requirements of this specification are contained in MIL-T-18404.

3.3 General requirements.

3.3.1 Conflicting requirements. Conflicting requirements arising between this specification or any specifications, publications, or drawings listed herein shall be referred in writing to the acquiring agency or appointed agent for interpretation, clarification, and resolution (or correction).

3.3.2 Data required. No data is required by this specification (other than reports accompanying samples submitted for preproduction and periodic production testing), or by applicable documents referenced in Section 2, unless specified in the contract or order (see 6.2).

3.3.3 Preproduction sample. Unless otherwise specified in the contract or order, preproduction samples of the relays shall be manufactured using the methods and procedures proposed for the production lot. These units shall be tested as specified in Section 4 herein and are for the purpose of determining, prior to starting production, that the contractor's production methods are capable of producing relays that comply with the technical requirements of the contract (see 4.2.1).

3.3.4 Materials. Unless otherwise specified in the contract, requisition, or order, all materials and purchased parts entering into the final assembly of the relay shall conform strictly to the applicable Federal or Military specifications. Materials which are not covered by specification or which are not specifically designated herein shall be of the best quality, or the lightest practicable weight consistent with strength and durability, and entirely suited to the purpose for which intended under all conditions of test and service operation. Recommendations concerning the use of a superior substitute for any part or material specified herein shall be accompanied by a description of the proposed substitute, the reasons therefore, together with evidence to substantiate any claim as to its suitability. At the discretion of the Naval Surface Warfare Center, test samples may be required to prove the suitability of the proposed substitute.

3.3.4.1 Critical materials. Materials shall be selected on the basis of suitability and availability, taking into consideration the additional restrictions created during a time of national emergency. Critical materials shall be used only when essential for satisfactory operation of the particular item or equipment. Substitution of less critical materials for materials required by this specification is subject to approval by the Naval Surface Warfare Center.

3.3.4.2 Magnesium. The use of magnesium requires the specific approval of the Naval Surface Warfare Center or its appointed agency.

3.3.4.3 Flammable materials. Materials that support combustion or which are capable of causing an explosion shall not be used.

3.3.4.4 Toxic materials. Materials that produce harmful toxic effects under conditions encountered in the Naval Service shall not be used.

3.3.5 Moisture, fungus, and corrosion. The relay shall be rendered moisture, fungus, and corrosion resistant as required by NAVORD OS 6341.

3.3.6 Finishes and coatings.

3.3.6.1 General. All machining operations shall be completed before the application of the corrosion-resistant treatment.

3.3.6.2 Plating. Electrodeposited metallic coatings shall conform to the following. The plating thickness in all cases shall be adequate to ensure conformance with the parts or equipment specification for conductivity and corrosion resistance:

Zinc	ASTM-B633, Type II, Class 2 or 3
Nickel	SAE-AMS-QQ-N-290
Chromium	SAE-AMS-QQ-C-320, Type I
Silver	ASTM B700

NOTE: Cadmium plating shall not be used.

3.3.6.3 Tin and lead-tin alloys. Plating of tin and lead-tin alloys, when used, shall be of adequate thickness and so continuous as to pass the marine environment test.

3.3.6.4 Corrosion resistant steel.

3.3.6.4.1 Cleaning. Remove all oil, grease, dirt, and other foreign matter from the metal by vapor degreasing, washing with petroleum spirits, MIL-PRF-680, Grade 1, or by immersion in a boiling solution of trisodium phosphate, O-S-642, followed by rinsing in cold water and a final rinse in hot water. If necessary because of scale, immerse in the following solution held at 60°C (140°F) until the scale is removed:

Nitric acid	20 percent by volume
Hydrofluoric acid	1 to 3 percent by volume
Water	77 to 79 percent by volume

Then rinse in cold water and blow dry with compressed air. If structures are fabricated with overlapping joints, the preferred method of cleaning is by vapor degreasing to avoid entrapment of caustic or acid solutions.

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3.3.6.4.2 Passivation. Immerse the clean metal in a solution of equal parts of nitric acid (40 degrees Baume) and water, held at a temperature of 71°C (160°F), for five minutes. Rinse first in clean cold water followed by a rinse in hot water. Then blow dry with compressed air.

3.3.6.5 Anodic film. Parts fabricated from aluminum or aluminum alloys shall be anodized in accordance with MIL-A-8625 or chemically treated in accordance with MIL-C-5541 when surfaces are to be painted.

3.3.6.6 Magnesium and magnesium alloys. Magnesium and magnesium alloys, when authorized, shall be finished in accordance with SAE-AMS-M-3171.

3.3.6.7 Painting. If painting is selected as the final finish, the following processes shall be used.

3.3.6.7.1 Cleaning. Surfaces to be painted shall be free of dirt, dust, grease, mill scale, welding flux, and other foreign matter. Cleaning may be accomplished with volatile grease solvent, vapor degreasing detergents, hot alkali cleaning solutions, or other processes which have no deleterious effect on the surfaces. Welding irregularities shall be removed. Alkali cleaning shall not be used on aluminum or aluminum alloy surfaces. When an alkali cleaning solution is used, the final rinse shall consist of a dilute chromic acid solution (0.5 pound of chromic acid per 100 gallons of water). When fabrication involves overlapping joints, vapor degreasing is the preferred method of cleaning.

3.3.6.7.2 Pretreatment. Steel surfaces to be painted shall be pretreated by either of the following:

- (a) One coat of wash pretreatment in accordance with best commercial practices, applied as a continuous film .0004 to .0005 inch thick; or,
- (b) A phosphate coating conforming to TT-C-490, Grade I.

3.3.6.7.3 Primer. All painted surfaces shall have a primer coat applied as a continuous film .0004 to .001 inch thick. For steel surfaces, the primer shall be in accordance with SSPC-PAINT-25 or TT-P-1757; and for nonferrous surfaces, the primer shall be in accordance with TT-P-1757.

3.3.6.7.4 Enamel. Two coats of enamel, light gray, MIL-DTL-15090, Class 2, applied as a continuous film approximately .001 inch thick.

3.3.6.7.5 Exceptions. The following surfaces shall not be painted: Mounting surfaces, pins, and threaded parts.

3.3.7 Marking. Marking shall be in accordance with Drawing 1521140. Marking shall be by means of engraving, metal stamping, embossing, by permanently affixed nameplate, or by marking with ink, stencil, A-A-208. Ink shall be black or a color contrasting to the surface to which applied. Ink A-A-208, when applied to an enamel surface, shall be covered with varnish, moistureproof, MIL-V-16399; when applied to other surfaces it shall be covered with lacquer, A-A-3003, Type I.

3.3.7.1 Marking data. Unless otherwise specified in the contract or order, or detailed in the applicable drawings, marking shall include the following:

- (a) In Area B, Drawing 1521140: Name of item or assembly; drawing number and drawing revision letter; operating voltage or current; contact rating; coil resistance; manufacturer's name, symbol, or trade mark; and manufacturer's part or assembly number (if desired).
- (b) In Area A, Drawing 1521140: Schematic diagram.
- (c) The index mark, as indicated on Drawing 1521140.

NOTE: The date and place of manufacture shall not be shown.

3.3.8 Threaded parts. Bolts, nuts, screws, and studs shall conform to the requirements of MIL-DTL-1222 or FF-S-86, FF-S-92, and FF-N-836. Screw threads for all threaded parts shall be in accordance with FED-STD-H28, and shall be of size 2-56, 4-40, 6-32, 8-32, 10-32, 1/4-20, or 1/4-28. If larger sizes are needed, they shall be of the coarse-thread series. Threaded parts (other than bolts, screws, studs, and nuts) requiring threads of special diameter and pitch shall employ the special pitch of 16 threads to the inch. For applications where a finer pitch is necessary, one of the following shall be selected: 20, 28, 36, 44, or 56.

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3.3.8.1 Thread projection. Screws or bolts secured by nuts or other retaining devices shall be of such length that a minimum of 1.5 threads and a maximum of .125 inch plus 1.5 threads for screws up to one inch in length and .25 inch plus 1.5 threads for screws over one inch in length, shall project beyond the retainer. These requirements shall not be construed to preclude the use of screws assembled in blind holes or spacers, or where design restrictions require that the threaded portion of the screw be flush with the retaining device. In no case shall the screw be clipped, bent, or otherwise shortened after plating.

3.3.8.2 Thread engagement. Screws and bolts in tapped parts other than nuts shall enter and engage for a distance at least equal to the diameter of the screw or bolt.

3.3.8.3 Setscrews. Where setscrews are used, they shall be in accordance with the requirements of Type G or H of FF-S-86.

3.3.8.4 Self-tapping screws. Self-tapping screws will not be acceptable except where employed in approved components and where their removal from the component is a remote possibility.

3.3.8.5 Locking devices. Locking devices shall be provided for all screw-thread assemblies except for captive screws on withdrawable units. The working loose of threaded parts during tests or in service will be considered a defect in design. All lockwashers shall conform to the standards of Section 3 of OSTD 600 or applicable Military Standards and shall be fabricated of corrosion-resistant steel, plated phosphor-bronze, or steel zinc-plated in accordance with ASTM B633, Type II, Class 2 or 3.

3.3.8.5.1 Exclusion. External-tooth lockwashers shall not be used with screws .25 inch or greater in diameter.

3.3.8.5.2 Spring-type lockwashers. Spring-type lockwashers may be used for screws of all sizes.

### 3.3.9 Methods of wiring.

3.3.9.1 Termination. No more than three wires, including wires from parts, shall terminate at any one terminal.

3.3.9.2 Pressure contacts. Electrical connections shall not depend upon wires, lugs, or terminals clamped between a metallic and an insulating or pliable material. Connections of this type shall be clamped between rigid metallic members, such as in an assembly of a machine screw, two nuts, and two washers. If such an assembly cannot be used and maintenance of a tight connection depends upon the resistance of an insulating or pliable material to compressive stress or shear, the connection shall be securely soldered.

### 3.4 Construction and design.

#### 3.4.1 General.

3.4.1.1 Objective. The basic design objectives are that the equipment will meet the needs of the Naval service and that the final product will reflect the utmost in simplicity, have maximum reliability consistent with the state of the art, be easy to operate and maintain, and be economical to produce.

3.4.1.2 Needs of the Naval service. The equipment shall be designed to withstand storage and service conditions over long periods.

3.4.1.3 Reliability. It is imperative that reliability of operation be considered of prime importance.

3.4.1.4 Simplicity. The equipment shall represent the simplest design consistent with the operational and environmental conditions set forth in this specification.

3.4.2 Dimensions and tolerances. Dimensions and tolerances of the relay shall conform to those shown on Drawing 1521140.

3.4.3 Weight. The weight of the relay shall not exceed three ounces.

3.4.4 Mechanical design.

3.4.4.1 Type. The relay shall be the self-aligning type, and shall remain in adjustment in any position.

3.4.4.2 Coil mounting. The coil of the relay shall be mounted in such a manner that it will not loosen or become displaced by any tests of environmental conditions described herein.

3.4.4.3 Adjustments. All adjustable features of the relay shall be so designed that the setting of any adjustment will not be altered by any tests or environmental condition described herein. There shall be no external adjustments.

3.4.4.4 Enclosure. The relay shall be sealed. The term "sealed" is construed to cover all methods of sealing; namely, vacuum or atmospheric, and pressurized with dry air or inert gas. When tested as specified in 4.4.5.3, the sealed relay shall show no evidence of leakage.

3.4.4.5 Mounting. The relay shall be mounted by two number 4-40 studs, located as shown on Drawing 1521140.

3.4.5 Electrical design.

3.4.5.1 Contacts. The contacts of the relay shall be of the proper size, material, and type to carry, to make and to break the rated current. The contacts shall be securely fastened to the stationary and movable current-carrying members.

3.4.5.1.1 Contact rating. The rated current of the contacts shall be 2.0 amperes at 28 volts resistive load.

3.4.5.2 Contact arrangement. The contact arrangement of the relay shall be double-pole double-throw, as shown in Drawing 1521140. With the relay coil deenergized, contact 4 shall be closed to contact 3, and contact 8 shall be closed to contact 7. The schematic diagram of the relay shown on the above drawing shall be included in the marking of the relay (see 3.3.7.1) in Area A.

3.4.5.3 Coil. The coil of the relay shall be evenly wound and properly insulated from the frame and other grounded parts.

3.4.5.4 Case. The case of the relay shall not be used for grounding nor shall it be electrically connected to any terminal of the relay.

3.4.5.5 Terminals. Eight J-hook type terminals, each capable of accommodating two number 18 wires, shall be provided and located as shown on Drawing 1521140. Terminals shall be hot-tin dipped or solder tinned.

3.4.6 Welding. All welds shall be of ample size with through penetration and good fusion, and shall be substantially free of injurious scabs, blisters, abnormal pockmarks, bruises, or other surface defects. Welds shall be capable of withstanding a strength test to destruction in which failure shall not occur within the weld itself. There shall be no evidence of harmful effects due to the welding process on the material adjacent to the weld. All welds shall be cleaned of scale, oxidation products, and excess flux by sand blasting, wire brushing, buffing, or other suitable means. Surfaces cleaned with acid shall be completely neutralized. Where tack or spot welds are employed, the number of welds shall be sufficient to provide adequate strength; at least two welds shall be used to hold any part.

3.4.7 Soldering. Only class SN60 solder in accordance with ANSI-J-STD-006 shall be used for electrical connections. Soldering processes shall be according to best commercial practices. No assembly shall depend solely on soft solder for mechanical strength except for relatively light parts which have by actual use proved to be suitable.

3.4.8 Brazing. All brazed joints shall be in accordance with best commercial practices and shall be of ample size to meet the individual requirements of the parts concerned.

3.4.9 Riveting. Riveting operations shall be carefully performed in order to ensure that the rivets are tight and satisfactorily headed.

3.5 Performance requirements and product characteristics. The relay shall meet the following performance requirements and product characteristics.

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3.5.1 Dielectric strength. The relay shall withstand the application of an ac voltage of 700 volts rms at 60 Hz for a period of one minute between any relay terminal and the relay case, and between any coil terminal and any contact terminal without damage, arcing, or breakdown (see 4.3.4.1).

3.5.2 Insulation resistance. The insulation resistance between any terminal of the relay and the case, and between any coil terminal and any contact terminal, shall be not less than 100 megohms (see 4.3.4.2).

3.5.3 Contact resistance. The resistance across contacts 3 and 4 and contacts 7 and 8 when the relay coil is deenergized, and across contacts 2 and 4 and across contacts 6 and 8 when the relay coil is energized and the contacts are carrying rated current (see 3.4.5.1.1), shall not exceed 0.05 ohm (see 4.3.4.3).

3.5.4 Contact bounce. The relay shall not exhibit any characteristics of contact bounce or chatter three milliseconds after the contacts make or break (see 4.3.4.4).

3.5.5 Coil resistance. The coil resistance of the relay shall be 1,000 ohms  $\pm$  10 percent, when measured at a temperature of 68°F (20°C) (see 4.3.4.5).

3.5.6 Coil current.

3.5.6.1 Operate. The maximum current at which contact 4 transfers from contact 3 to contact 2 and contact 8 transfers from contact 7 to contact 6 shall be not greater than 6.3 mA. Under the conditions of vibration (see 3.6.1.2) and acceleration (see 3.6.3) contact 4 shall remain closed to contact 3 and contact 7 shall remain closed to contact 6 with a coil current increasing up to, but not exceeding 5.0 mA (see 4.3.4.6.1).

3.5.6.2 Release. The minimum current at which contact 4 transfers from contact 2 to contact 3 and contact 8 transfers from contact 6 to contact 7 shall be not less than 6.3 mA. Under the conditions of vibration (see 3.6.1.2) and acceleration (see 3.6.3) contact 4 shall remain closed to contact 2 and contact 8 shall remain closed to contact 6 with a coil current decreasing to, but not below, 3.15 mA (see 4.3.4.6.2).

3.5.7 Sensitivity (see 4.3.4.7).

3.5.7.1 Operate. The operating sensitivity shall be a nominal 40 mW.

3.5.7.2 Release. The release sensitivity shall be a nominal 5 mW.

3.5.8 Operating and releasing time.

3.5.8.1 Operating. The operating time, when the coil of the relay is energized from a nominal 10 V dc source, shall be not greater than 30 ms.

3.5.8.2 Releasing. The release time, when an energized coil is deenergized, shall be not greater than 10 ms.

3.5.9 Operating life. The relay shall be capable of meeting the performance and product characteristics specified herein after experiencing 100,000 contact transfers under the environmental conditions described in 4.3.1.

3.6 Environmental requirements. The relay shall meet the other applicable requirements of this specification during or after the tests defined or specified in 4.4.

3.6.1 Vibration. The relay shall meet the following vibration requirements.

3.6.1.1 Vibration, nonoperating. The relay shall show no damage and shall meet all the performance requirements and product characteristics of this specification after being tested as in 4.4.1.2.

3.6.1.2 Vibration, operating. The relay shall show no damage and shall meet all the performance requirements and product characteristics of this specification during and after the test specified in 4.4.1.3.

3.6.1.3 Vibration, transportation. The relay shall show no damage and shall meet all the performance requirements and product characteristics of this specification after being tested as in 4.4.1.4.

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3.6.2 Shock, transportation. The relay shall show no damage and shall meet all the performance requirements and product characteristics of this specification after being tested as in 4.4.2.

3.6.3 Acceleration. The relay, mounted by its normal mounting means on a flat plate in an acceleration device, shall withstand an acceleration of 15g's applied for not less than 0.2 second, as specified in 4.4.3. These accelerations may occur in any direction. Thereafter the relay shall show no damage and shall meet all performance requirements and product characteristics of this specification.

### 3.6.4 Temperature and humidity.

3.6.4.1 High temperature and humidity, nonoperating. The relay shall show no damage and shall meet all the performance requirements and product characteristics of this specification after being tested as in 4.4.4.1.

3.6.4.2 High temperature, operating. The relay shall be capable of meeting all the performance requirements of this specification while undergoing the test specified in 4.4.4.2.

3.6.4.3 Low temperature, nonoperating. The relay shall meet all the performance requirements and product characteristics of this specification after being tested as in 4.4.4.3.

3.6.4.4 Low temperature, operating. The relay shall be capable of meeting all the performance requirements of this specification while undergoing the test specified in 4.4.4.4.

### 3.6.5 Pressure.

3.6.5.1 High altitude transportation. The relay shall withstand exposure to a pressure 1.7 pounds per-square-inch absolute (psia) as specified in 4.4.5.1 and thereafter shall show no damage and shall meet all the performance requirements and product characteristics of this specification.

3.6.5.2 Fluctuating pressure. The relay shall withstand exposure to pressure cycles between atmospheric pressure and 10 psia as specified in 4.4.5.2 and thereafter shall show no damage and shall meet all the performance requirements and product characteristics of this specification.

3.6.5.3 Immersion. The relay shall withstand exposure to immersion as specified in 4.4.5.3 and thereafter shall show no damage or corrosion and shall meet all the performance requirements and product characteristics of this specification.

3.7 Cleanup. Prior to and after final assembly; all parts, components, and the assembly shall be thoroughly cleaned of loose, splattered, or excess solder, metal chips, rosin flash, and other foreign matter.

3.8 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.

3.9 Workmanship. The relay, including all parts and accessories, shall be constructed and finished in a manner to ensure compliance with all requirements of this specification. Particular attention shall be paid to neatness and thoroughness of soldering, wiring, impregnation of coils, marking of parts and assemblies, painting, plating, riveting, machine screw assemblies, welding, brazing and freedom of parts from burrs and sharp edges. The standards of workmanship exhibited in any approved preproduction sample subject to any qualification stated in the Government's notice of approval, shall be determinative of the requirements of the contract relative to workmanship insofar as not specifically covered by applicable specifications.

## 4. VERIFICATION.

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

- (a) Preproduction inspection (see 4.4).
- (b) Conformance inspection (see 4.3).
- (c) Periodic production inspection (see 4.4).

## 4.2 Sampling.

4.2.1 Preproduction. A preproduction sample of five relays, manufactured in accordance with 3.3.3, shall be subjected to the preproduction tests detailed in 4.4 at an activity designated by the acquiring activity. Acceptance of the preproduction sample shall be based on no defects in the sample. Further production of the relays by the supplier, prior to the approval of the preproduction sample, shall be at the supplier's risk.

4.2.2 Lot size. Unless otherwise specified in the contract or order, each shipment of units of product shall be a separate "inspection lot" and may differ from the quantity specified in the total order or contract. In any event, all units of a single "inspection lot" shall be made to the same design, with the same materials and manufacturing techniques, and shall be part of one continuous production run.

4.2.3 Periodic production samples. From each succeeding lot or grand lot of 300 or less that have passed the conformance inspection of 4.3, a random sample of five relays will be selected for submission to an activity designated by the acquiring activity to determine compliance of the samples with the requirements of the contract, specification, and drawings. The relays shall be considered satisfactory if they meet all specification and pertinent drawings requirements and withstand the tests specified in 4.3 and 4.4. Failure of the periodic production sample to comply with these requirements will result in the rejection of the lot, as determined by the acquiring activity.

4.3 Conformance inspection. Each relay delivered under contract shall be subjected to the following tests and examinations. Failure to meet any requirement specified herein shall be considered cause for rejection.

4.3.1 Test conditions. Unless otherwise specified, the relay shall be subjected to conformance tests under the following conditions.

4.3.1.1 Temperature. Room ambient 65°F to 95°F (18°C to 35°C).

4.3.1.2 Altitude. Normal ground.

4.3.1.3 Vibration. None.

4.3.1.4 Humidity. Room ambient to 95 percent relative maximum.

4.3.2 Test and inspection equipment and facilities. The manufacturer shall furnish and maintain all necessary test equipment and facilities and shall provide personnel for performing all conformance tests. The test equipment shall be adequate in quantity and, unless definite requirements are specified, shall be of sufficient accuracy and quality to permit the performance of the required test.

4.3.3 Items of test equipment. The following items of test equipment are required to perform the conformance tests set forth in this specification.

4.3.3.1 Source. A source of 700 volts rms, 60 Hz, ac power.

4.3.3.2 Megohmmeter. A 500 V dc megohmmeter, with a midscale reading of not less than 100 megohms (or a megohm bridge).

4.3.3.3 Kelvin bridge. A Kelvin bridge, or equivalent, having a nominal 35-volt source of dc power, a resistance rated at 1.5 watts and variable from 5,000 to 35,000 ohms, a 1.5 ohm resistance rated at 70 watts, and a voltmeter, scale 0 to 50 volts, accurate to within  $\pm 1.0$  percent.

4.3.3.4 Oscillograph. An oscillograph of a make satisfactory to the Naval Surface Warfare Center or its appointed agent. An interrupter (or signal generator) capable of 6 Hz, with an output of 6 volts. A dc milliammeter, scale 0 to 10 mA, accurate to within  $\pm 1$  percent. Three dc ammeters, scale 0 to 5 amperes, accurate to within  $\pm 1$  percent.

4.3.4 Test procedure.

4.3.4.1 Dielectric strength. Apply ac power source (see 4.3.3.1) across each of contact terminals 2, 3, 4, 6, 7, and 8 and the relay case for a period of one minute  $\pm$  5 seconds. Apply this power source across coil terminal 1 (or 5) and each of contact terminals 4 and 8 for a like period (see 3.5.1).

4.3.4.2 Insulation resistance. With the relay deenergized, measure the insulation resistance between the following points, using the megohmmeter or bridge of 4.3.3.2 (see 3.5.2):

- (a) Terminals 1, 2, 3, 6, and 7 and the relay case.
- (b) Terminals 2, 3, 6, and 7 and terminal 1 (or 5).

4.3.4.3 Contact resistance. With the relay deenergized, measure the resistance across contacts 3 and 4 and across contact 7 and 8, using the Kelvin bridge or equivalent. With the rated current of 2 amperes flowing through contacts 3 and 4 and through contacts 7 and 8, measure the resistance across each pair of contacts. With the relay coil energized to close contact 4 to contact 2 and contact 8 to contact 6, and with the rated current flowing through these contacts, measure the resistance across each pair of contacts. The contact resistance of the contacts shall be as specified in 3.5.3. Upon completion of the operating life test (see 4.4.6), the contact resistance measured as above shall be no more than double the value specified in 3.5.3.

4.3.4.4 Contact bounce. With oscillograph (see 4.3.3.4), test the relay to determine whether or not it exhibits any evidence of chatter or contact bounce (see 3.5.4).

4.3.4.5 Coil resistance. Measure the coil resistance of the relay by any suitable means. The coil resistance shall be within the limits specified when corrected to the temperature indicated (see 3.5.5).

4.3.4.6 Coil current. With the relay deenergized, check continuity between terminals 3 and 4 and between terminals 7 and 8, using the dc voltage source and voltmeter in 4.3.3.3. With the coil energized with a coil current of 6.3 mA, check continuity between terminals 2 and 4 and between terminals 6 and 8 (see 3.5.6).

4.3.4.6.1 Operate. With rated current flowing through the appropriate contact terminals, apply a nominal ten V dc, through the variable resistance of 4.3.3.3 at maximum value and the milliammeter, across coil terminals 1 and 5. Gradually reduce the resistance value and accurately determine the current value at which contacts 4 and 8 transfer from 3 to 2 and from 7 to 6 respectively. The current value at which transfer takes place shall not exceed that specified in 3.5.6.1.

4.3.4.6.2 Release. With the circuit arrangement of 4.3.4.6.1 and the relay coil energized with a current of 6.3 mA, gradually increase the resistance value and accurately determine the current value at which contacts 4 and 8 transfer to contacts 3 and 7 respectively. The current value at which transfer takes place shall be not less than that specified in 3.5.6.2.

4.3.4.7 Sensitivity. From the values determined in 4.3.4.5 and 4.3.4.6, compute the operating and releasing sensitivity of the relay (see 3.5.7).

4.3.4.8 Operating and releasing time. With the oscillograph and interrupter (or signal generator) of 4.3.3.4, test the relay for chatter and contact bounce and determine the operating and releasing time of the relay at a rate of six transfers per second. The relay shall meet the requirements specified in 3.5.4 and 3.5.8.

4.3.4.9 Visual and dimensional examinations. Each relay shall be examined to determine conformance with the requirements for workmanship and dimensions.

4.3.4.10 Packaging, packing, and marking. Packaging, packing, and marking shall comply with the requirements of Section 5.

4.4 Preproduction and periodic production inspection. The preproduction and periodic production samples, after satisfactorily passing the conformance inspection detailed in 4.3, shall be subjected to the following tests and examinations. Certified inspection data covering the results of preproduction and periodic production inspections shall be forwarded to the acquiring activity.

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### 4.4.1 Vibration.

4.4.1.1 Mounting. The relay, less pack or packaging, shall be mounted securely to a vibration device by its mounting holes and vibration tested as specified in 4.4.1.2 and 4.4.1.3.

4.4.1.2 Vibration, nonoperating. The relay shall be subjected to the "Vibration, nonoperating" test of MIL-E-82590(OS) and thereafter shall meet the requirements of 3.6.1.1.

4.4.1.3 Vibration, operating. The relay shall be subjected to the "Vibration, operating" test of MIL-E-82590(OS) and during and thereafter shall meet the requirements of 3.6.1.2.

4.4.1.4 Vibration, transportation. The relay shall be subjected to the "Vibration, transportation" test of MIL-E-82590(OS) and thereafter shall meet the requirements of 3.6.1.3.

4.4.2 Shock, transportation. The relay shall be subjected to the "Shock transportation" test of MIL-E-82590(OS) and thereafter shall meet the requirements of 3.6.2.

4.4.3 Acceleration. The relay, mounted as specified in 3.6.3, shall be subjected to acceleration testing as specified in section 4 of MIL-T-18404 for a torpedo ready nonoperating, ready, or operating. At the conclusion of the test the relay shall meet the performance and other requirements specified in this specification.

### 4.4.4 Temperature and humidity.

4.4.4.1 High temperature and humidity, nonoperating. The relay shall be subjected to the "High temperature and humidity, nonoperating" test of MIL-E-82590(OS) and thereafter shall meet the requirements of 3.6.4.1.

4.4.4.2 High temperature, operating. The relay shall be subjected to the "High temperature, operating" test of MIL-E-82590(OS) and, while at the test temperature, shall meet the requirements of 3.6.4.2.

4.4.4.3 Low temperature, nonoperating. The relay shall be subjected to the "Low temperature, nonoperating" test of MIL-E-82590(OS) and thereafter shall meet the requirements of 3.6.4.3.

4.4.4.4 Low temperature, operating. The relay shall be subjected to the "Low temperature, operating" test of MIL-E-82590(OS) and, while at the test temperature, shall meet the requirements of 3.6.4.4.

### 4.4.5 Pressure.

4.4.5.1 Altitude. The relay shall be subjected to pressure testing as specified in Section 4 of MIL-T-18404 for altitude. At the conclusion of this test, the relay shall meet the performance and other requirements specified in this specification (see 3.6.5.1).

4.4.5.2 Fluctuating. The relay shall be subjected to pressure cycling as specified in Section 4 of MIL-T-18404 for a submarine launched torpedo. At the conclusion of this test, the relay shall meet the performance and other requirements specified in this specification (see 3.6.5.2).

4.4.5.3 Immersion. The relay shall be immersed in a saturated solution of sodium chloride under an absolute pressure of 2.5 inches of mercury for a period of four hours. The immersed relay shall be observed for leakage, as evidenced by bubbles emanating from the sealed case. Approximately one-half the relays so immersed shall have the case removed in order that the interiors may be further examined for evidence of leakage (see 3.6.5.3).

4.4.6 Operating life. Operate the relay, under the environmental conditions specified in 4.3.1, for a total of 100,000 contact transfers while the contacts are carrying the rated current of 2.0 amperes at 28 volts resistive load. The relay coil will be energized from a  $10 \pm 1$  V dc or rectified ac power source. The test pulse rate shall be at least 4 Hz with a  $50 \pm 10$  percent duty cycle. At the conclusion of the test, the relay shall meet the performance and other requirements specified in the specifications.

4.5 Waiver of tests. Tests specified in 4.4.1.4 and 4.4.2 may be waived by the acquiring agency for Level C packs only, provided the contractor guarantees safe delivery to the using activity.

4.6 Functional tests. At the conclusion of the tests specified in 4.4.1.4 and 4.4.2 above, functional and other tests, as applicable, shall be conducted on the relay to determine freedom from operational malfunction and compliance with all performance requirements and product characteristics of this specification.

## 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.

## 6. NOTES

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

6.1 Intended use. The relay is intended for use in Torpedo MK 37 Mod 2.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of the specification.
- (b) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- (c) Packaging requirements (see 5.1).
- (d) Assigned activity for preproduction and periodic production inspections.
- (e) Data required other than that specified in 3.3.2.
- (f) That additional samples required because of failure of any unit(s) to pass the prescribed periodic production inspections will be provided and inspected at the expense of the supplier.

6.3 Inherent or latent defects. When material which has been inspected, tested, and accepted contains inherent or latent defects subsequently exposed, the contractor may be required to replace the defective material without expense to the Government.

6.4 Part or Identifying Number (PIN). This specification requires a PIN that is as described in the appropriate reference to associated documents (see 3.1).

6.5 Subject term (key word) listing.

Contact rating  
Coil mounting  
Drawing 1521140

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

Custodians:  
Navy - OS  
DLA - CC

Preparing activity:  
DLA - CC

(Project 5945-1180)

**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, and send to preparing activity.
3. The preparing activity must provide a reply within 30 days from receipt of the 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.

<b>I RECOMMEND A CHANGE:</b>	<b>1. DOCUMENT NUMBER</b> MIL-R-19309D	<b>2. DOCUMENT DATE (YYMMDD)</b> 030307
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**1. DOCUMENT TITLE**  
RELAY, SENSITIVE (FOR TORPEDO MARK 37 MOD 2)

**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) (1) Commercial (2) DSN (if applicable)	<b>7. DATE SUBMITTED (YYMMDD)</b>

**8. PREPARING ACTIVITY**

a. NAME Defense Supply Center, Columbus	b. TELEPHONE (Include Area Code) (1) Commercial 614-692-0554      (2) DSN 850-0554
c. ADDRESS (Include Zip Code) ATTN: DSCC-VAT 3990 East Broad Street Columbus, OH 43216-5000	<b>IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:</b> Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888    DSN 427-6888