

NOT MEASUREMENT SENSITIVE

MIL-R-19523B(SH)

30 March 1990

SUPERSEDING

MIL-R-19523A (SH)

30 December 1966

(See 6.8)

MILITARY SPECIFICATION

RELAYS, CONTROL

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 the requirements for control relays for Naval shipboard use.

1.2 Classification.

1 2 1 Part or Identifying Number (PIN) The PIN shall be of the following form, as specified (see 6.2):

M19523- AC B H B A 2

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1.2.1.1) 1 2.1.2) 1.2.1.3) 1.2.1.4) 1.2.1.5) 1.2.1.6) 1.2.1.7)

1 2 1.1 Military specification number. The military specification number consists of a prefix M which indicates a military specification item and the specification number.

1.2.1.2 Electrical service. The electrical service for coil operation shall be designated by two letters as follows:

AC - Alternating current (ac) service.

DC - Direct current (dc) service.

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 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1.2.1.3 Endurance. Endurance shall be designated by a single letter as follows:

- A - 500,000 operations.
- B - 100,000 operations
- C - 25,000 operations.

1.2.1.4 Operating voltage. The operating voltage (v) shall be designated by a single letter as follows:

- A - 115 Volts alternating current (Vac), 60 hertz (Hz).
- B - 230 Vac, 60 Hz.
- C - 440 Vac, 60 Hz.
- D - 28 Volts direct current (Vdc).
- E - 115 Vdc.
- F - 125 Vdc.
- G - 230 Vdc.
- H - 250 Vdc (nominal), operating range 175 to 355 volts (V), storage battery service.
- J - 500 Vdc (nominal), operating range 350 to 710 V, storage battery service
- K - Special

1.2.1.5 Number of poles. The number of poles shall be designated by a single letter as follows.

- A - 4 poles
- B - 8 poles.
- C - 12 poles.
- D - 16 poles.
- E - 24 poles.

1.2.1.6 Ambient temperature. The ambient temperature rating shall be designated by a single letter as follows:

- A - 50 degrees Celsius (°C).
- B - 90°C.
- C - Special.

1.2.1.7 Shock classification. The shock classification of relay contact chatter shall be designated by a single number as follows:

- 1 - Class I - Those relays whose contacts will not chatter in either the energized or deenergized position.
- 2 - Class II - Those relays whose contacts will not chatter long enough to either drop out the relay or drop out a standard relay having a dropout time of 4 milliseconds (ms). Contacts shall not alter state due to shock.
- 4 - Class III - Those relays whose contacts will not chatter long enough out a standard relay having a drop out time of 20 ms. Contacts shall not alter state due to shock.

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- 6 - Class IV - Those relays whose contacts will not alter state due to shock.
- 7 - Class V - No requirements for electrical operation.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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).

SPECIFICATIONS

FEDERAL

- PPP-F-320 - Fiberboard: Corrugated and Solid, Sheet Stock (Contained Grade) and Cut Shapes.

MILITARY

- MIL-S-901 - Shock Tests, H.I. (High-Impact), Shipboard Machinery, Equipment and Systems, Requirements for.
- MIL-E-917 - Electric Power Equipment, Basic Requirements (Naval Shipboard Use)
- MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
- MIL-P-15024/5 - Plates, Identification.
- MIL-E-17555 - Electronic and Electrical Equipment Accessories, and Provisioned Items (Repair Parts): Packaging of.
- MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated

STANDARDS

FEDERAL

- FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

MILITARY

- 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-454 - Standard General Requirements for Electronic Equipment.

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- MIL-STD-471 - Maintainability Verification/Demonstration/
Evaluation.
- MIL-STD-781 - Reliability Testing for Engineering Development,
Qualification and Production.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.4.

3.2 Materials, parts and processes. Except as otherwise specified herein, materials, parts and processes shall be in accordance with MIL-E-917.

3.2.1 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Design

3.3.1 Contacts. The rating of contacts shall be as specified (see 6.2).

3.3.2 Poles. Poles shall be single throw or double throw as specified (see 6.2).

3.3.3 Ambient temperature ratings. The ambient temperature ratings for the relays shall be in accordance with 3.3.3.1, 3.3.3.2 and 3.3.3.3.

3.3.3.1 50°C. Relays rated at 50°C shall operate over the range of 5°C to 50°C and be exposed to an ambient temperature of 85°C for 1 hour. During the exposure at 85°C, the relay may be energized but need not operate as specified herein. After the 1 hour period, and after the relay has cooled to a temperature within its normal operating range, it shall operate as specified herein.

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3.3.3.2 90°C. Relays rated at 90°C shall operate over the range of 5°C to 90°C and be exposed to an ambient temperature of 110°C for 1 hour. During the exposure at 110°C, the relay may be energized but need not operate as specified herein. After the 1 hour period and after the relay has cooled to a temperature within its normal operating range, it shall operate as specified herein.

3.3.3.3 Special ambient. For relays rated above 90°C, the temperature rating shall be as specified (see 6.2).

3.3.4 Duty. Relays shall be rated for continuous duty and continuous operation.

3.4 Construction (see 6.3).

3.4.1 Auxiliary devices. Auxiliary devices such as rectifiers or arc suppressors shall not be used for augmentation of current interruption by contacts.

3.4.2 Magnet coils. Removable type magnet coils shall be readily removable and replaceable without injury to the coil or any other part of the relay. The coils shall be rigidly held so as to prevent damage to the coil leads. Encapsulate insulation in accordance with MIL-E-917.

3.4.3 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance and strength.

3.5 Performance requirements.

3.5.1 Seals (sealed relays only). When tested as specified in 4.6.2, sealed relays shall show no evidence of leakage.

3.5.2 Dc coil resistance. When tested as specified in 4.6.3, the overall resistance of the coils shall be within plus or minus 10 percent of the design value, shown on the drawings.

3.5.3 Insulation resistance. When tested as specified in 4.6.4, the insulation resistance shall be not less than 100 megohms.

3.5.4 Heat run. When tested as specified in 4.6.5, the temperature rise of the relay shall not exceed the values shown in table I, except as specified in 3.5.4.1 and 3.5.4.2.

3.5.4.1 Dc coils designed for 250 V and 500 V storage battery service. Dc coils designed for 250 V and 500 V storage battery service shall have a maximum temperature rise of 120°C for class A insulation, and 140°C for class B insulation, at maximum voltage.

3.5.4.2 Special ambients. Maximum permissible temperature rise for special ambient relays shall be as specified (see 6.2).

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TABLE I. Permissible temperature rises.

Part/Insulation class	Temperature rise (max)	
	50°C ambient	90°C ambient
Bolted connections and terminal studs:		
Not silver plated	50	10
Silver plated	65	25
Shunt coils - ac:		
Class A insulation	60	20
Class B insulation	80	40
Class F insulation	105	65
Class H insulation	130	90
Class N insulation	150	110
Shunt coils - dc:		
Class A insulation	55	15
Class B insulation	75	35
Class F insulation	100	60
Class H insulation	125	85
Class N insulation	145	105

3 5 5 Pickup and dropout voltage When tested as specified in 4.6 6, the pickup and dropout voltage for relays shall be in accordance with 3 5.5.1 through 3.5.5.3.

3.5.5.1 Ac and dc relays Ac and dc relays shall pickup and seal at 80 percent or less of rated voltage with the relay at its maximum operating temperature and shall operate between the pickup and seal voltage and 110 percent of rated voltage

3.5.5.2 Storage battery service. Relays for storage battery service shall pickup and seal at 70 percent or less of rated voltage with the relay at its maximum operating temperature and shall operate between the pickup and seal voltage and 140 percent of rated voltage.

3.5.5.3 Dropout voltage. Relays shall drop out at not less than 10 percent of rated voltage.

3 5 6 Contact millivolt drop. Relays shall operate at rated voltage when inclined at angle of 60 degrees from the vertical in any direction.

3.5.7 Contact millivolt drop. Unless otherwise specified (see 6.2), relays, when tested as specified in 4.6.8, shall not exceed a contact millivolt (mV) drop of 175 mV for an individual reading or 150 mV for an average reading.

3.5.8 Vibration. When tested as specified in 4.6.9, relays shall experience no mechanical damage, contact chatter or failure to operate in either the energized or deenergized position due to vibration.

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3.5.9 High impact (H.I.) shock When tested as specified in 4.6.10, relays shall experience no mechanical damage or failure to operate in either the energized or deenergized position due to H I shock. Unsealed relays shall be disassembled to the extent where condition of the relay can be easily observed and inspected thoroughly for damage. Contact chatter shall meet the requirements for the class of relay specified in 1.2.1.7. Following the test, the relay shall meet the requirements of 3.5.3 and 3.5.5.

3.5.10 Endurance When tested as specified in 4.6.11, moving parts and parts subject to burning shall withstand the endurance requirements for the relay specified in 1.2.1.3 for mechanical durability and arc rupturing ability. Following the test, the relay shall meet the requirements of 3.5.2, 3.5.3, 3.5.5 and 3.5.6.

3.5.11 Dielectric withstanding voltage. When tested as specified in 4.6.12, relays rated at 600 V or less shall withstand for 1 minute a dielectric test voltage of twice rated voltage plus 1000 V root mean square (rms). Relays rated over 600 V shall withstand, for 1 minute, a dielectric test voltage of 2-1/4 times rated voltage plus 2000 V rms.

3.5.12 Overvoltage. When tested as specified in 4.6.13, relays operate at 130 percent of rated voltage for 24 hours. During this time, the relay does not have to meet the requirements of this specification, but must open or close the contacts when signaled. After the relay has returned to room ambient temperature it shall meet the requirements of 3.5.2, 3.5.3 and 3.5.5.

3.5.13 Response time. When tested as specified in 4.6.13, the relay shall have a response time no greater than the certified maximum specified for the particular relay (see 6.2).

3.5.14 Leakage current Leakage current shall be less than 5 milliamperes.

3.6 Reliability The upper test mean time between failure (MTBF) for continuous and intermittent operation, in accordance with MIL-STD-781 shall be 30,000 hours under the environmental conditions specified for the equipment when tested (see 4.6.16).

3.7 Maintainability. The relay shall permit troubleshooting, fault isolation and repair, down to the lowest non-repairable part or non-repairable assembly (see 4.6.17).

3.8 Identification plates Identification plates shall conform to type A, B or C of MIL-P-15024 and MIL-P-15024/5. These plates shall be installed on the relay for which they are intended. They shall be attached to the relay. When the size or construction of the relay is such that an identification plate as described above cannot be installed, the contractor shall obtain approval for alternate means of identifying the relay from the command or agency concerned. Unless otherwise specified (see 6.2), the minimum information to be marked on identification plates shall include the following items.

- (a) Manufacturer's name or logo.
- (b) Manufacturer's part or catalog number.

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(c) Blank space for Defense Contract Administration Services Management Area (DCASMA) official stamping.

3.9 Workmanship. Workmanship shall be in accordance with requirement 9 of MIL-STD-454.

4 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- (a) First article inspection (see 4.4).
- (b) Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, no correction shall be made for barometric pressure, humidity or for any deviation of the recorded ambient temperature from the standard ambient temperature of reference (see 6.3)

4.4 First article inspection. Except as otherwise specified in 4.4.3, first article inspection shall consist of the inspections in the order shown in table II

4.4.1 First article samples. A contractor shall manufacture and test the required samples (see 4.4.1.1). The samples shall be produced with equipment and procedures normally used in production.

4.4.1.1 Number of samples. The number of sample relays to be tested where the endurance of the relay is 500,000 or 100,000 operations shall be specified in 4.4.1.1.1 through 4.4.1.1.3. The number of sample relays to be tested where the endurance of the relay is to be 25,000 operations shall be determined by NAVSEA

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4.4.1.1.1 Single submission For a relay with a single coil rating and a single contact rating, a sample lot of 9 relays shall be tested

4.4.1.1.2 Combined submission. Relays of the same mechanical design which have more than one coil rating, more than one contact form, or more than one contact rating shall be tested in a combination sample lot. Coil voltage ratings and contact ratings shall be identified. A sample lot of 12 relays shall be submitted in combinations of coil rating, contact rating, and contact form. These combinations shall be as follows:

- (a) The coils having the largest ac voltage rating and the largest dc voltage rating shall be contained in the sample lot and equal number of each to make up the total of 12 relays.
- (b) Sample lot shall also be divided to cover each contact rating
- (c) Relays shall have the maximum number of contacts. The contact form shall be as follows.
 - (1) Three relays shall have the maximum number of normally open contacts
 - (2) Three relays shall have the maximum number of normally closed contacts.
 - (3) Six relays shall have at least one normally open and one normally closed contact (provided both normally open and normally closed contacts are included in the design).

4.4.1.1.3 Relays with double throw poles. Relays with double throw poles shall be considered to meet the combined requirements of 4.4.1.1.2 (c), therefore, the sample lot of 12 relays with identical contact forms may be furnished (see 6.5).

TABLE II. First article and quality conformance inspection.

Inspection	Requirement	Test	First article	Quality conformance
Visual and mechanical examination	3.2, 3.3, 3.4, 3.6 and 3.8	4.6.1	X	X
Sealing (sealed relays only)	3.5.1	4.6.2	X	
Coil resistance	3.5.2	4.6.3	X	
Insulation resistance	3.5.3	4.6.4	X	
Heat run	3.5.4	4.6.5	X	
Pickup and dropout voltages	3.5.5	4.6.6	X	X
Inclination	3.5.6	4.6.7	X	
Contact voltage drop	3.5.7	4.6.8	X	
Vibration	3.5.8	4.6.9	X	
Shock	3.5.9	4.6.10	X	
Endurance	3.5.10	4.6.11	X	
Dielectric withstanding voltage	3.5.11	4.6.12	X	X
Overvoltage	3.5.12	4.6.13	X	
Response time	3.5.13	4.6.14	X	

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4 4 2 Special inspection for vibration, shock and endurance Special inspection for vibration, shock and endurance shall be as specified in 4 4.2.1 and 4 4.2 2

4 4 2 1 Sample groupings After completion of the contact voltage drop tests the same relays shall be divided into 3 equal groups as follows

- (a) Each group shall contain an equal number of relays having coils with the highest ac voltage and the highest dc voltage, and relays having each contact rating
- (b) Each group shall have one relay with a maximum number of normally closed contacts, and the remaining relays having at least one normally open and one normally closed contact.

4.4.2.2 Order of tests The three groups shall then be subjected to shock, vibration and endurance tests in the order shown for the applicable group in table III After the vibration, shock and endurance tests, the remaining tests in table II shall be completed on all of the sample relays.

TABLE III. Order of tests.

Group 1	Group 2	Group 3
Vibration Shock Endurance	1/5 of endurance Vibration Shock Remainder of endurance	Endurance Vibration Shock

4.4.3 Failure. Any samples that fail to meet the requirements shall not be approved

4.5 Quality conformance inspection. Quality conformance inspection shall be as specified in table II (see 6.3).

4.5.1 Inspection of product for delivery.

4.5 1 1 Inspection lots Samples for inspection shall be selected from each lot as shown in table IV

TABLE IV. Inspection lots.

Lot size	Sample size	Accept	Reject 1/ 2/ 3/
2 - 8	All	0	1
9 - 50	8	0	1
51 - 150	12	0	1

- 1/ All defective items must be replaced with acceptable items prior to lot acceptance.
- 2/ Inspect sample size until conformance criteria is reached
- 3/ Rejected lots may be screened and resubmitted for inspection and retest.

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4 5.2 Rejection criteria The relay shall be rejected if it fails any one of the following:

- (a) Breakage or appreciable distortions of any parts
- (b) Electrical malfunction. The sensing features shall not malfunction, become inoperative, or deviate from specifications
- (c) Insulation resistance shall not vary from its original value

4 6 Examination and test.

4 6 1 Visual and mechanical examination. Relays shall be examined to verify that the materials, design, construction, marking and workmanship are in conformance with this specification (see 3 2, 3 3, 3 4, 3 8 and 3 10)

4.6.2 Sealing. Sealed relays shall be subjected to either sealing test I as specified in 4 6.2.1 or sealing test II as specified in 4 6.2.2, at the option of the manufacturer. Relays being inspected for quality conformance shall be subjected to the test specified in 4.6.2.3.

4.6 2 1 Sealing test I (nondestructive). Relays shall be immersed in a saturated solution of sodium chloride and shall be subjected to an absolute pressure equal to 2.5 inches of mercury for 4 hours. The immersed relay shall be observed for evidence of leakage indicated by bubbles emanating from the case

4.6.2.2 Sealing test II (destructive). Relays shall be immersed in a saturated solution of sodium chloride and shall be subjected to an absolute pressure equal to 2.5 inches of mercury for 4 hours and then returned to normal. After 4 hours at normal pressure, each relay shall be removed from its case and both the relay and the case shall be examined for any evidence of leakage. If this method of performing sealing test is selected, it shall be the last test performed

4 6.2 3 Sealing test for quality conformance. Sealed relays shall be immersed in an enclosure containing water and a suitable wetting agent. The enclosure shall be subjected to an absolute pressure of 2.5 inches of mercury for 1 minute, or until air bubbles cease to be given off by the water, whichever is longer. The immersed relay shall be observed for evidence of leakage indicated by bubbles emanating from the case

4.6.3 Dc coil resistance. Relays shall be tested in accordance with method 303 of MIL-STD-202

4 6.4 Insulation resistance Insulation resistance shall be tested in accordance with method 302, test condition B of MIL-STD-202. The time of test voltage application shall be not less than 60 seconds. However, if the insulation resistance meets specified limits and is steady or increasing, the test may be terminated. The temperature at the time of the test shall be measured

4 6 5 Heat run. Heat run tests shall be made to determine that the allowable temperature rises specified in 3 5 4 are not exceeded. Heat run tests shall be made at rated voltage, rated load, and the duty specified. Temperature rise measurements shall be in accordance with method 2 of MIL-E-917

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4.6.6 Pickup and dropout voltage Relays shall be tested at their maximum operating temperature to show that the pickup and dropout voltages are within the limits specified in 3.5.5. Tests on ac relays shall be at rated frequency.

4.6.7 Inclination. Tests of 4.6.6 shall be repeated with the relay inclined in each of the positions specified herein. This test may be done at any convenient ambient temperature.

Positions.

Inclined 60 degrees forward
 Inclined 60 degrees backward
 Inclined 60 degrees to right
 Inclined 60 degrees to left

Inclination shall not cause a change in the state of contacts (open contacts shall not close nor closed contacts open) with relay either energized or deenergized.

4.6.8 Contact millivolt drop Relays shall be tested in accordance with method 307 of MIL-STD-202. The contact millivolt drop across the relay shall be measured across one pair of mating contacts with the relay in the energized position and one pair with the relay in the deenergized position with rated current passing through the contact. The relay shall be operated 10 times and the millivolt drop shall be measured during each operation.

4.6.9 Vibration Relays shall be subjected to type I vibration tests in accordance with MIL-STD-167-1. Operation shall be checked at each frequency of vibration. An oscilloscope shall be used to check opening or closing of contacts during the test. Any maloperation shall be recorded with an oscillograph having a frequency response of at least 2000 Hz. At the end of the test, pickup and dropout voltages shall be measured and recorded (see 4.6.6).

4.6.10 H I shock The H I shock test shall be conducted in accordance with MIL-S-901 to determine the class of shock resistance of the relay (see 1.2.1.7). Relays shall be tested on standard mounting fixture 6E of MIL-S-901. The test circuits for the relay shall be as specified in 4.6.10.1 through 4.6.10.5.

4.6.10.1 Test circuit relays Unless otherwise specified, the test circuits shall consist of the test relay and a standard relay (see 4.6.10.2.1(a)). The standard relay shall be calibrated for a 4 ms or 20 ms dropout time as required for the shock resistance of the test relay. The standard relay calibration shall be verified as specified in 4.6.10.2.

4.6.10.2 Calibration verification of standard relay. The standard relay calibration shall be verified with the calibration circuit shown on figure 1. The calibration test equipment, circuit setup and procedures shall be as specified in 4.6.10.2.1 through 4.6.10.2.3.

4.6.10.2.1 Calibration test equipment The equipment used to verify calibration of the standard relay shall be as follows.

- (a) Standard relay The standard relay shall be a double pole-double throw (DPDT) relay with a coil voltage and contact rating as specified (see 6.2.1).

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- (b) Oscilloscope The oscilloscope shall be a 1 Megahertz (Mhz) dual trace oscilloscope with an input impedance of 10 megohms or more
- (c) Oscillograph. The oscillograph shall have at least a 2000 Hz frequency response in order to record test relay contact chatter
- (d) Dc voltage source The dc voltage source shall provide rated voltage and rated current to the standard relay.
- (e) Ac voltage source. The ac voltage source shall provide 115 Vac to the calibration source
- (f) Load resistance The load resistance, used to prevent a short circuit of the power supply, shall be sized to the coil voltage or contact rating of the standard relay and shall not interfere with the normal operation of the standard relay
- (g) Switch. The switch shall be a single pole-single throw (SPST) switch

4.6.10.2.2 Calibration circuit setup. Connect the calibration circuit as shown on figure 1, making certain that the switch is in the open position and that the current probe and voltage probe are properly connected to the oscilloscope. Typical oscilloscope traces and the definition of dropout time are shown on figure 2

4 6 10 2 3 Calibration verification procedure The calibration verification procedure shall be as follows

- (a) Turn on the oscilloscope and adjust for stable traces
- (b) Turn on both power supplies
- (c) Close the switch
- (d) Open and close the switch to verify that both traces can be measured during both states of the switch
- (e) Turn on the oscillograph.
- (f) Open the switch and measure the dropout time of the standard relay
- (g) Repeat (f) to verify a consistent calibrated dropout time for the standard relay. The calibrated dropout time shall be 4 ms or 20 ms as required for the shock resistance of the relay to be tested

4.6.10.3 Shock test equipment. The equipment used for the shock test circuits shall be in accordance with 4 6 10.2 1, as applicable, with the following additions and exceptions

- (a) Test relay The relay to be tested for the class of shock resistance specified in 1.2.1.
- (b) Voltage source for test relay The voltage source shall provide rated voltage and rated current to the test relay The leads from the voltage source to the test relay shall be of sufficient length to isolate the voltage source from the shock platform
- (c) Switch The switch shall be a normally open momentary push-button switch

4 6 10 4 Shock test circuits The shock test circuits shall be as specified in 4 6.10 4 1 through 4 6 10 4 5

4 6 10 4 1 Test for the opening of closed contacts The test circuit for either normally closed contacts in the deenergized state or normally open contacts in the energized state shall be setup as shown on figure 3

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4 6 10 4.2 Test for the closing of open contacts. The test circuit for either normally open contacts in the deenergized state or normally closed contacts in the energized state shall be setup as shown on figure 4

4 6 10 4.3 Test for class I through class III relays The test circuit used shall be the applicable test circuit as specified in 4 6 10 4 1 and 4 6 10.4 2

4 6.10 4 3 1 Class I relays. The oscillograph trace shall be the basis for acceptance or rejection of class I relays Any contact chatter recorded shall be cause for rejection (see 1.2 1.7 - 1).

4 6 10 4 3.2 Class II and class III relays The dropout of the relay(s) or the altering of the state of any of the contacts shall be the basis for acceptance or rejection of class II and class III relays (see 1 2 1 7 - 2, 3,

4 6.10 4 4 Test for class IV relays The shock test for class IV relays shall not use the test circuits The altering of the state of any of the contacts shall be cause for rejection (see 1.2 1 7 - 4)

4 6 10 4 5 Test for class V relays The shock test for class V relays shall not use the test circuits Any physical damage to the relay shall be basis for rejection (see 1 2 1 7 - 5)

4 6 10 5 Shock test procedure The procedure for the shock test shall be as follows

- (a) Turn on the oscilloscope and adjust for stable traces
- (b) Turn on power supply.
- (c) Turn on oscillograph
- (d) Depress switch
- (e) Shock the test relay and measure the dropout time from the oscillograph trace
- (f) Repeat (e) for each hammer drop to verify compliance with the shock resistance requirements of the relay specified in 1 2 1

4 6.11 Endurance Relays shall be subjected to the required number of operations (see 3.5 10) under conditions of rated voltage, current frequency, and temperature and to 100 on-off-on operations at 150 percent rated current at rated voltage and frequency Ac relays shall be tested using a 0 5 power factor inductive load Dc relays shall be tested with a resistive load The operating cycle shall be at least 10 cycles per minute except that in no case shall it be such that the temperature rise limits specified in 3.5.4 are exceeded by more than 20°C For 500,000 and 100,000 operations endurance tests the following tests should be made after every 50,000 cycles for the first 100,000 cycles and after every 200,000 cycles thereafter For 25,000 operation endurance test these tests should be made at the end of the endurance test

- (a) Coil resistance (see 4 6 3)
- (b) Insulation resistance (see 4.6 4).
- (c) Pickup and dropout voltage (see 4 6 6)
- (d) Contact voltage drop (see 4 6 8)

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4.6.12 Dielectric withstanding voltage test. The dielectric withstanding voltage test shall be in accordance with method 301 of MIL-STD-202. For quality conformance testing, a test voltage 20 percent higher than the required voltage may be applied for a period of not less than 1 second, where the standard test voltage is 2500 V or less

4.6.13 Overvoltage test. The overvoltage test shall consist of 3 parts. First, the resistance test (see 4.6.3), insulation resistance test (see 4.6.4), and the pickup and dropout voltage test (see 4.6.6) shall be performed and the results recorded. Second, exposure of the coil to the overvoltage shall be conducted in the respective ambient temperature of the relay. The coil shall have impressed a voltage of 130 percent rated voltage. During this exposure, two contacts closest to the coil structure shall be connected in series and rated current passed through these contacts during the test. The relay under test shall be energized for 24 hours. The relay shall be operated 5 times after 8 hours of test time and 5 times immediately prior to completion of the test to demonstrate relay operation and contact transfer. Third, after completion of the overvoltage exposure, the resistance test, insulation resistance test, and pickup and dropout voltage test shall be redone

4.6.14 Response time test. The relay shall be energized at rated voltage, frequency, and ambient temperature for a sufficient time to attain temperature equilibrium. A device capable of measuring the specified response time shall be used to monitor the time between energizing the coil and closure of a normally open contact and the time between deenergizing the coil and opening of a normally closed contact. The time measurement shall be made with step voltage changes from 0 volts to 90 percent of rated voltage and from rated voltage to 5 percent of rated voltage. Ten operations shall be monitored.

4.6.15 Leakage current test. Leakage current shall be in accordance with MIL-E-917 (see 3.5.14)

4.6.16 Reliability test

4.6.16.1 Demonstration phase. If required in the contract or order (see 6.2), the demonstration phase of reliability testing shall be conducted on at least 5 (but not more than 10) relays in accordance with MIL-STD-781. MTBF shall be as required in 3.6

4.6.16.1.1 Test schedule. The test shall consist of an uninterrupted series of three 8-hour periods per day. One of the three periods shall be manned. The remaining two periods need not be manned.

4.6.16.1.2 Stress conditions. Unless otherwise specified in the contract or order (see 6.2), environmental and electrical stress conditions shall be as specified under the combined environments for shipboard equipment (sheltered) in accordance with appendix B of MIL-STD-781 or as follows

- (a) Electrical stress: When operation from two or more nominal voltages is required, the nominal voltage for reliability testing shall be the highest required nominal voltage
- (b) Thermal stress: The test time for each thermal cycle shall be 8 hours

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4.6.16.2 Sampling phase If required in the contract or order (see 6.2), the sampling phase of reliability testing shall be conducted on at least 5 (but not more than 10) relays in accordance with test plan IVC of MIL-STD-781. The upper test MTBF shall be as required in 3.6. The test schedule and test conditions of 4.6.16.1.1 and 4.6.16.1.2 shall apply.

4.6.17 Maintainability demonstration. When required in the contract or order (see 6.2), compliance with 3.7 shall be verified through a maintenance demonstration procedure, maintenance test selection, and maintenance task performance in accordance with test method 1-A of appendices A and B of MIL-STD-471.

4.7 Inspection of packaging. Sample packs, and the inspection of the preservation, packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified herein.

5 PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.5.)

5.1 Packaging requirements Relays shall be preserved level A, C, or Commercial, packed level A, B, C or Commercial as specified (see 6.2) and marked in accordance with MIL-E-17555 and shall include bar codes and applicable packaging acquisition options therein as specified (see 6.2). In addition, for Navy acquisitions, the following applies:

(a) Navy shipboard stowage fire-retardant requirements.

- (1) Treated lumber and plywood When specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping containers and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B	- Type II - weather resistant
	Category 1 - general use.
Level C	- Type I - non-weather resistant
	Category 1 - general use

- (2) Fiberboard When specified (see 6.2), fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packaging forms shall meet the flamespread and specific optic density requirements of PPP-F-320 and amendments thereto.

6 NOTES

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

6.1 Intended use Relays conforming to this specification are intended for use in control circuits where a number of relays are interconnected to control the proper sequencing and functioning of a complex electrical, hydraulic or pneumatic

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system or combination of such systems. Such relays are also required to provide suitable indication and alarm circuits directly associated with these systems. The relays are also intended for use in motor controllers, and related electrical equipment aboard both surface ships and submarines.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Part or Identifying Number (PIN) (see 1.2.1).
- (c) Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1)
- (d) Contact ratings (see 3.3.1).
- (e) Whether poles are single throw or double throw (see 3.3.2)
- (f) Special ambient temperature and maximum permissible temperature rise for special ambient (see 3.3.3.3 and 3.5.4.2).
- (g) Contact millivolt drop, if other than specified (see 3.5.7).
- (h) Maximum response time (see 3.5.13)
- (i) Identification plate information, if other than specified (see 3.8)
- (j) Coil voltage and contact rating for standard relay (see 4.6.10.2.1(a))
- (k) Whether first article testing is required (see 3.1)
- (l) When fire-retardant treated material are not required (see 5.1)
- (m) Level of preservation, packing and marking required (see 5.1)
- (n) Demonstration phase and sampling phase of reliability testing relays (see 4.6.16.1 and 4.6.16.2)
- (o) Environmental and electrical stress conditions (see 4.6.16.1.2)
- (p) Maintainability demonstration (see 4.6.17).

6.3 Consideration of data requirements The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.4	Drawings, engineering and associated lists	DI-E-7031	Level 2
4.3	Certificate of compliance	DI-E-2121	-----
4.5	Reports, test	DI-T-2072	-----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

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6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection 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 contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Information for tests. The following information shall be submitted with first article test samples:

- (a) Coil - Rated voltage and frequency
Class of insulation
Size of wire
Duty
Overvoltage capability
Ambient temperature
- (b) Contacts - Rated voltage and frequency
Rated current and power factor (steady state and maximum make and break)
Contact material
Contact pressure
Contact gap
Contact resistance and method of measurement
Endurance
- (c) General - If hermetically sealed, the atmosphere (humidity, gases, pressure) inside enclosure
Method of mounting, (drawing if available)
Adjustable features of relay
Service for which relay is intended (surface ship, submarine, nuclear ship)
Time response

6.6. Rejected lots. If a sample fails to pass inspection, the contractor shall notify the cognizant inspection activity. The contractor shall take corrective action. This applies to all units which can be corrected and which were manufactured with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action is taken. After the corrective action, the inspection shall be repeated on additional samples (all tests and examinations, or the test which the original sample failed, at the option of the contracting activity). Final acceptance and shipment shall be withheld until the inspection shows the corrective action is successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the inspection activity and the contracting activity. Rejection criteria of 4.5.3 shall apply.

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6 7 Sub-contracted material and parts The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped

6 8 Material safety data sheets Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6 9 Subject term (key word) listing.

Coils, magnet
Voltage, dropout

6 10 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.

Preparing activity.
Navy - SH
(Project 5945-N671)

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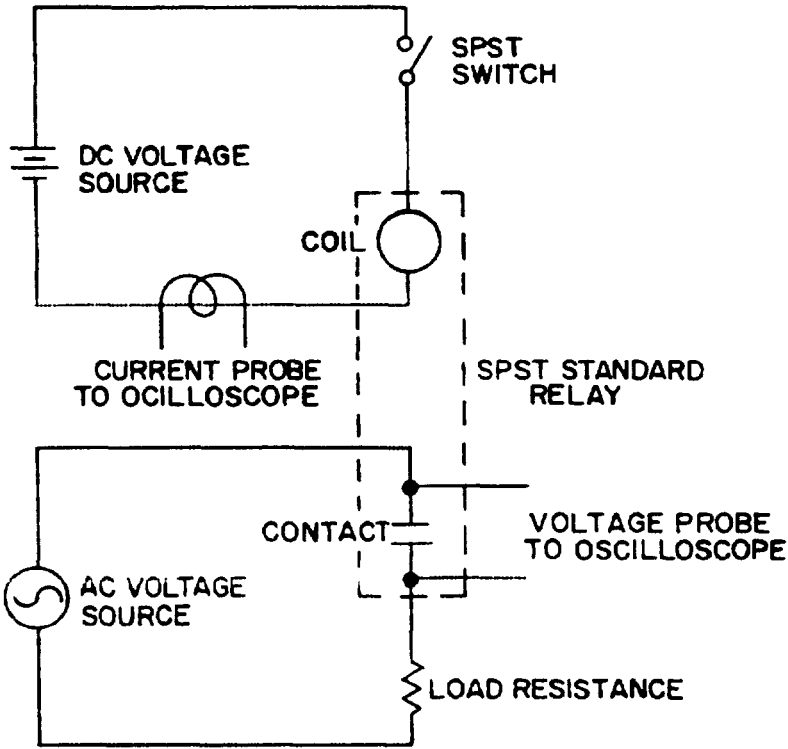


FIGURE 1 Relay calibration circuit

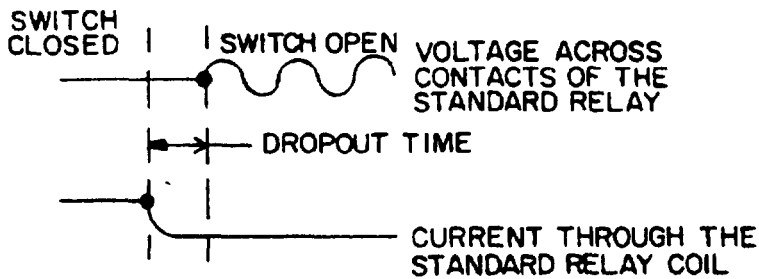


FIGURE 2. Typical oscilloscope trace and dropout time

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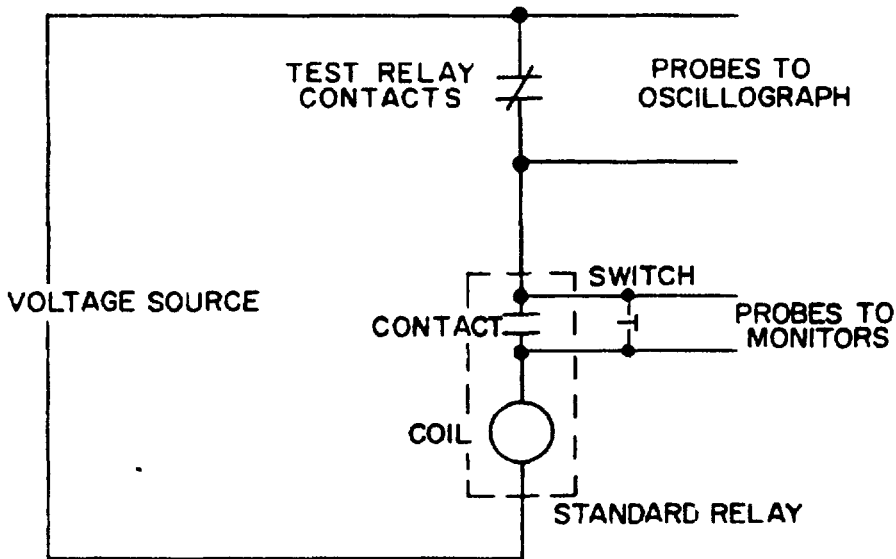


FIGURE 3. Test circuit for opening of closed contacts.

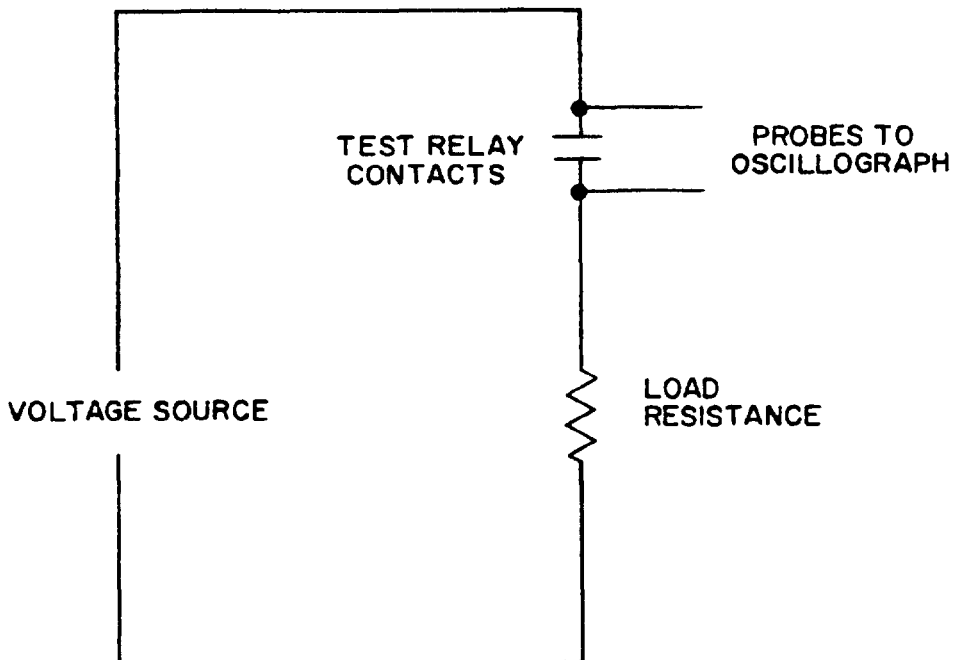


FIGURE 4. Test circuit for closing of open contacts.

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 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

I RECOMMEND A CHANGE:		1 DOCUMENT NUMBER MIL-R-19523B(SH)	2 DOCUMENT DATE (YYMMDD)
3. DOCUMENT TITLE RELAYS, CONTROL			
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) AUTOVON (if applicable)	7. DATE SUBMITTED (YYMMDD)
8 PREPARING ACTIVITY			
NAME Technical Point of Contact (TPOC): Mr. Michael Kuhlmann (SEA 56Z34)		b TELEPHONE (include Area Code) (1) Commercial (2) AUTOVON	
PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:		TPOC: 703-602-3123 8-332-3123	
c ADDRESS (include Zip Code) Commander, Naval Sea Systems Command Department of the Navy (SEA 5523) Washington, DC 20362-0101		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041 3466 Telephone (703) 756 2340 AUTOVON 289-2340	