

TINCH-POUND

MIL-R-6106J
AMENDMENT 3
25 August 1989
SUPERSEDING
AMENDMENT 2
13 April 1984

MILITARY SPECIFICATION

RELAYS, ELECTROMAGNETIC (INCLUDING ESTABLISHED RELIABILITY
(ER) TYPES), GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-R-6106J dated 2 November 1981 and is approved for use by all Departments and Agencies of the Department of Defense.

The attached insertable replacement pages listed below are replacements for stipulated pages. When the new pages have been entered in the document, insert the amendment as the cover sheet to the specification.

<u>Replacement page</u>	<u>Page replaced</u>
2a/2b	New
69	New
70	New
71	New
72	New
73/74	New

PAGE 4

Applicable documents, standards, military: Delete "MIL-STD-706".

PAGE 5

3.2.2. delete and substitute:

"3.2.2 Qualification by similarity. Relays furnished under this specification may be qualified by similarity to the extent specified in the applicable detail specification sheet (see 3.1). Three basic categories (loads, dynamics, environmental) are established for the purpose of grouping relays considered similar with each category having a group of tests associated with it (see table IVA). Each detail specification sheet shall provide a table listing these three categories for this similarity grouping. Within this table, each of the three basic categories are divided into subgroups. These subgroups are listed alphabetically (as required) to further categorize relays considered similar. Each detail specification sheet shall define what these subgroups consist of. Relays listed under subgroups are assigned a numeric value (1, 2, 3 etc.). Relays assigned a numeric 1 are considered to be devices most representative of those listed in that subgroup. Relays assigned higher numeric values (i.e. 2, 3 etc.) are considered less representative of those listed in that subgroup and as such can only represent relays within that subgroup which have equal or higher numeric values assigned to them.

AMSC N/A
DISTRIBUTION STATEMENT A.

1 of 8
Approved for public release; distribution is unlimited.

FSC 5945

MIL-R-6106J
AMENDMENT 3

EXAMPLE:

A relay listed as a 1 within a given subgroup may represent relays listed as 1, 2, 3, etc. within that subgroup in the performance of these tests (see table IVA) associated with that category/subgroup combination. A relay listed as a 2 within a given subgroup may represent relays listed as 2, 3, etc. within that subgroup in the performance of these tests (see table IVA) associated with that category/subgroup combination. A relay listed as a 3 within a given subgroup may represent relays listed as 3, etc. within that subgroup in the performance of those tests (see table IVA) associated with that category/subgroup combination.

The appendix of this specification establishes the guidelines for determining how relays are to be grouped and ranked within each subgroup. In some instances, qualification by similarity may be granted on relays defined on different detail specification sheets. In these instances, an individual matrix or outline of the reduced test program shall be provided the qualifying activity along with the rationale (using the appendix as a guide) used to justify the program.

It is the responsibility of the manufacturer to select devices for which qualification shall be performed. Qualification by similarity to any existing qualified relay automatically qualifies the similar relay for the valid retention period of the original relay. For group C inspection, any qualified relay within a given category and subgroup with the same numeric value as the device originally qualified may be used for those tests applicable to that category/subgroup combination."

Add the following new paragraph:

"3.2.2.1 Verification and retention of qualification by similarity. For group B inspection (verification of qualification) and/or group C (retention inspection type IER) the basis and rationale for similarity shall be as provided in 3.2.2 and the appendix."

PAGE 6

3.4: Delete "and MIL-STD-706."

PAGE 7

3.4.5.2, last sentence, delete and substitute:

"Adjunct sealant (see 6.4.22), if used, must comply with the following characteristics:

If a hermetically sealed relay has passed all MIL-R-6106 requirements except the final fine leak test of 1×10^{-8} (passes the gross leak test of 1×10^{-5}) and is clean of all silicone oil, a permanent (non-silicone, noncorrosive) adjunct sealant may be applied to the header.

MIL-R-6106J
AMENDMENT 3

The adjunct sealant shall comply with the following conditions:

- a. Shall not penetrate into the relay interior.
- b. Shall not extend above 20 percent of the length of the exposed terminals above the glass meniscus.
- c. Shall form a permanent non-conductive, non-outgassing, non-migrating, non-corrosive, non-contaminating, non-cracking seal under all relay environments.
- d. Shall not be applied to more than 20 percent of the exposed terminal. Trace color is permitted if it is a natural result of the sealant process."

After 3.4.5.2, add the following:

"3.4.5.2.1 After the cover has been welded to the header, no rework shall be performed that requires removal of this cover from the header. Relays whose lowest specified load (resistive, inductive, and motor) for the power contacts is 25 amperes or greater are exempt from this requirement."

PAGE 8

3.4.8.2.1, last sentence: Delete "See 3.1" and substitute "See 4.4.3".

PAGE 12

Add the following new paragraphs:

"3.4.18 Solderability. When relays are tested as specified in 4.7.34 the dipped surface of solid wire-lead and pin terminals shall be at least 95 percent covered with a continuous new solder coating. The remaining 5 percent may contain only small pinholes or rough spots; these shall not be concentrated in one area. Bare base metal where the solder dip failed to cover the original coating is an indication of poor solderability, and shall be cause for failure. For solder-lug terminals greater than 0.045 inch in diameter, 95 percent of the total length of fillet, which is between the standard wrap wire and the terminal, shall be tangent to the surface of the terminal being tested, and shall be free of pinholes, voids, etc. A ragged or interrupted line at the point of tangency between the fillet and the terminal under test shall be considered a failure."

"3.4.19 Resistance to soldering heat. When relays are tested as specified in 4.7.35, there shall be no damage which would adversely affect normal operation of the relay."

PAGE 18

3.34, title: Delete "Circuit breaker compatibility" and substitute "Time current characteristics @ 25 C".

MIL-R-6106J
AMENDMENT 3

PAGE 19

- * 3.43e, delete and substitute: "Coil voltage (coil voltage, ac or dc, and frequency, as applicable, shall be shown)."
- * 3.43g, delete and substitute: "Date code (the date code shall indicate the week of completion of group A acceptance inspection by the manufacturer. If relays are retested in accordance with group A acceptance inspection, the latest date code of retest must be added. The original date code shall not be removed)."
- * 3.43i, delete and substitute: "Serial number (when specified)."

PAGE 20

Add new paragraph as follows:

"3.43.2.1 Failure rate letter. Where a relay application document, such as an existing drawing or detail sheet, specifies a military part dash number designating a type I ER relay, but does not specify a failure letter, any failure rate lettered part may be supplied and used."

- * 3.43.3.1: Delete footnotes "1/ and "2/."

PAGE 22

4.5.1, at the end of paragraph, add the following:

"For qualification by similarity, a minimum of one (1) sample of each type relay declared to be qualified by similarity shall be subjected to group A testing. Sample(s) shall be supplied to the qualifying activity together with the applicable test data."

Third sentence: Delete "table XV" and substitute "table XVI."

PAGE 23

*4.5.4, delete and substitute:

"4.5.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery, group A, indicating as a minimum the number of lots and units that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. The results performed for periodic check tests (groups B and C, when applicable), including the number and mode of failures. The test report shall include results of all periodic check tests performed and completed during the 12-month period. If the test results indicate nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

MIL-R-6106J
AMENDMENT 3

Failure to submit the report within 30 days after the end of each 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time that the inspection data indicates noncompliance of the product to meet the requirements of this specification.

In the event that no production occurred during the 3 reporting periods, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the relay. If during 6 consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative relay to testing in accordance with the qualification inspection requirements."

PAGE 24

TABLE XV, inspection column, continuous current: Add "16/".

PAGE 25

TABLE XV: Delete "Circuit breaker compatibility" and substitute "Time-current characteristics @ 25°C".

PAGE 26

TABLE XV, add "Solderability, 3.4.18, 4.7.34" and "Resistance to soldering heat, 3.4.19, 4.7.35" following insertion and withdrawal force. Test samples 12 and 14. Test sequence for solderability is 21, resistance to soldering heat is 22.

TABLE XV, Vibration scan: Add testing sequence number "11" under sample unit number 3.

Add new footnote as follows:

"16/ For 50/400 Hz relays: one additional sample relay will be required. One relay will be tested for each frequency."

PAGE 27

TABLE XVI, requirement paragraph reference: Delete "3.34" and substitute "3.35".

Delete "4.7.25.X.X" and substitute "4.7.26.X.X".

4.5.4.1a: Delete "4.7.2.1" and substitute "4.6.2.1".

4.5.4.1a, at end of paragraph, add the following:

"Relays using semiconductor devices or rectification networks must meet conditions governing qualification by similarity as stated in the appendix."

4.5.4.1c: Delete "(4.7.26)" and substitute "(4.7.26.4)".

MIL-R-6106J
AMENDMENT 3

PAGE 28

4.6.1.2.2, delete and substitute:

"4.6.1.2.2 Failure criteria. Rework of sealed, welded relays is not permitted except for cosmetic external corrections only. Replating is not permitted unless the manufacturing process includes a seal test immediately after sealing. (Relays whose lowest specified load (resistive, inductive, motor and lamp) for the power contacts is 25 ampere or greater are exempt from this requirement."

PAGE 29

4.6.2.1, 11th line: Delete "raing" and substitute "rating".

PAGE 30

TABLE XX, add after contact voltage drop or resistance: "Solderability 3/, 3.4.18, 4.7.34", and "Resistance to soldering heat 3.4.19, 4.7.35".

Following table XX, add 5/:

"5/ Two samples each."

TABLE XX: Delete "Insulation resistance, 3.11, 4.7.5" and "Dielectric withstanding voltage, 3.12, 4.7.6." Delete "1/" and substitute "1/ immediately after stabilizing at room temperature, insulation resistance, dielectric withstanding voltage and contact voltage drop shall be measured as specified in 4.7.5, 4.7.6 and 4.7.7."

* 4.6.2.1.1, first sentence delete and substitute: "For group B inspection, two relays rated up to 25 amperes shall be selected at random from every 500 units or two units for every 3 months production unless these two units constitute more than 10 percent of that period's production in which case the period shall be extended as required but not to exceed 12 months."

PAGE 32

TABLE XXII: Delete "Resistive load" and substitute "Resistive load, ac".

4.6.2.2.2, second line, add ")" after 4.7.26.

PAGE 34

4.7.4, second line: Delete "3.8" and substitute "3.10".

PAGE 46

4.7.26, 12th line, insert "tested" between "are" and "separately".

PAGE 47

4.7.26.3, title: Delete "Circuit breaker compatibility" and substitute "Time-current characteristics @ 25°C."

PAGE 48

4.7.26.4.4, 6th line, following "normally", add "open and one normally".

PAGE 56

Add the following new paragraphs:

"4.7.34 Solderability (see 3.4.18). Relays shall be tested in accordance with method 208 of MIL-STD-202. The following detail and exception shall apply:

- a. Number of terminations of each part to be tested - all.
- b. The temperature of the molten solder shall be a uniform $260^{\circ} \pm 5^{\circ}\text{C}$ ($500^{\circ} \pm 9^{\circ}\text{F}$).

"4.7.35 Resistance to soldering heat (see 3.4.19). Relays shall be tested in accordance with method 210 of MIL-STD-202. The following details and exception shall apply:

- a. Depth of immersion in molten solder - with $.060 \pm 0.020$ inch of relay base.
- b. Test condition - B.
- c. Measurements after test - Insulation resistance, contact resistance, pickup and dropout voltage and coil resistance shall be measured as specified.
- d. Examination after test. Relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relay."

PAGE 60

6.4.22, delete and substitute:

"Adjunct sealant. Any material that is specifically added to any surface of a relay to improve the hermetic seal".

PAGE 65

6.4.49, title: Delete "Circuit breaker compatibility" and substitute "Time current characteristics @ 25°C ".

PAGE 67

6.7, delete in its entirety and substitute:

"6.7 Shelf life. Relays conforming to this specification should be designed for a shelf life of 7 years from the original manufacturing date code. Following this time limit, relays may be required by the contracting activity to be tested in accordance with table XVIII, to determine their suitability for use in the intended application. Relays should then be remarked in accordance with 3.43.g, 3/. Rework is permitted per failure criteria, 4.6.1.2.2 only.

"6.7.1 Relays which incorporate semiconductor devices. Relays which incorporate semiconductor devices may be required by the contracting activity to be tested in accordance with table XVIII after a period of 3 years from the original manufacturing date code. No rework will be permitted."

MIL-R-6106J
AMENDMENT 3

The margins of this amendment are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, irrespective of the marginal notations and relationship to the previous amendments.

CONCLUDING MATERIAL

Custodians:

Army - ER
Navy - AS
Air Force - 85

Review activities:

Navy - EC
Air Force - 11, 99
DLA - ES

Preparing activity:
Air Force - 85

Agent:
DLA - ES

(Project 5945-0819)

MIL-R-6106J
AMENDMENT 3

TABLE IVA. Tests related to basic categories for qualification by similarity.

Basic categories					
LOADS		DYNAMICS		ENVIRONMENTAL	
Associated tests	Test paragraph	Associated tests	Test paragraph	Associated tests	Test paragraph
Resistive load (ac)	4.7.26.4.7	Vibration sinusoidal	4.7.17	High temperature pickup	4.7.2.2
Inductive load (ac)	4.7.26.4.5	Vibration random	4.7.17	Low temperature operation	4.7.13
		Shock	4.7.16	EMI	4.7.10
Motor load (ac)	4.7.26.4.6	Acceleration	4.7.24	Thermal shock	4.7.12
Resistive load (dc)	4.7.26.4.3	Acoustical noise	4.7.18	Sand and dust	4.7.14
Inductive load (dc)	4.7.26.4.1			Salt spray	4.7.19
Lamp load	4.7.26.4.4			Altitude-temperature humidity	4.7.21
Motor load (dc)	4.7.26.4.2				
Load transfer (single or polyphase, ac)	4.7.26.5			Humidity	4.7.22
Overload (ac)	4.7.26.1			Ozone	4.7.23
Overload (dc)	4.7.26.1			Explosion proof	4.7.25
Rupture	4.7.26.2			Seal	4.7.28
Mixed loads	4.7.26.8			Resistance to solvents	4.7.31
High/low load transfer	4.7.26.9				
Intermediate current	4.7.26.6				
Low level	4.7.26.7				
Time-current characteristics @ 25°C	4.7.26.3				
Mechanical life	4.7.20				
Continuous current	4.7.15				

MIL-R-6106J
AMENDMENT 3

APPENDIX

GUIDELINES FOR QUALIFICATION BY SIMILARITY

10. SCOPE

10.1 Scope. This appendix lists those specific relay characteristics and attributes which must be considered during the process of determining relay similarity (section 30). It also establishes the detailed decision making considerations which shall be utilized in ranking relays considered similar in the various subcategories of the basic categories of loads, dynamics, environmental (see section 40). As specified in 3.2, the devices are ranked according to degree or value of position. The lower numeric value indicates a pre-eminent station or hierarchy for selection.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. CRITERIA FOR SIMILARITY

30.1 Coil characteristics.

- a. A JAN device will qualify itself, a non-military JAN TX screened, a JAN TX, or a non-suppressed coil. JAN TX screened non-military will qualify itself, a JAN TX, or non-suppressed coil. A JAN TX will qualify itself and a non-suppressed coil. A non-suppressed coil will only qualify itself. (Example: A suppressed DC coil using a JAN 1N4975 will qualify itself and a JAN 1N4975 non-military screened to JAN TX, or a JAN TX 1N4975 zener diode, or a non-suppressed coil.)
- b. The 50/400 Hz device should qualify the 400 Hz device, provided the same basic semiconductor network is used. Networks using JAN devices will qualify itself, a JAN TX screened non-military, and a JAN TX device provided the same basic semiconductor networks are used. A JAN TX screened non-military will qualify itself and a JAN TX network provided the same basic semiconductor network is used. A JAN TX network will only qualify itself.

NOTE: Qualification to a specific voltage does not provide qualification by similarity to any other voltage (e.g., 28 V dc device is not similar to 48 V dc device).

30.2 Construction.

- a. Internal: Relays are considered similar for qualification purposes, providing they have the same number of major poles (a major pole being considered disassociated from the auxiliary poles), one motor assembly and are of identical basic construction. Where qualification for relays with and without auxiliary contacts is required, the testing shall be performed on the relay with the greatest number of auxiliary contacts. This relay will then qualify all similar relays with fewer and/or no auxiliary contacts.
- b. Contacts and contact systems: Relays shall be considered similar when materials, contact size, and contact assembly construction are identical.

MIL-R-6106J
AMENDMENT 3

APPENDIX

- c. External: Header - For qualification by similarity, the same header plate design, seal size, and basic material shall be used.
- d. Terminations: Different types of terminations shall be considered dissimilar, except as noted in the applicable detailed specification sheet.

30.3 Enclosures.

- a. Different variations of enclosures shall be considered dissimilar, except as noted in the applicable specification sheet. For similarity, the devices shall be of the same basic design, material, and construction.
- b. Mounting: Different variations of mounting shall be considered dissimilar, except as noted in the applicable specification sheet. For similarity, the devices shall be of the same method of attachment, basic design, material, and construction.

30.4 Loads.

- a. When a relay is qualified to a specific contact rating unsuppressed, a similar relay, except with suppressed contacts, shall be considered approved to the requirement by similarity.
- b. A relay qualified at a particular load (e.g., 15 A resistive, 10 A inductive, etc.) shall qualify a similar relay, meeting all previous requirements at a lower full load rating (e.g., 10 A resistive, 8 A inductive, etc.). This does not apply to intermediate current or low level load ratings.
- c. For each load test, socket pin terminals are considered the worst case. Solder pins and hooks may be qualified by similarity.

30.5 Environmental tests.

A relay that has successfully completed any of the following environmental tests shall qualify a relay of identical external construction (except for mounting brackets and terminations) for the same environment:

Sand and dust	Ozone
Salt spray	Explosion proof
Altitude-temperature humidity	Resistance to solvents
Humidity	

30.6 Dynamics.

Any similarity in this area will be as specified in the applicable specification sheet and section 40 of this appendix.

40. CRITERIA FOR RANKING RELAYS WITHIN THE SUBGROUPS OF BASIC CATEGORIES (LOADS, DYNAMICS, AND ENVIRONMENTAL)

MIL-R-6106J
AMENDMENT 3

APPENDIX

40.1 Loads. Table XXXIX establishes the criteria for grouping/ranking relays within the subgroups of the basic category of loads (see appendix section 30).

TABLE XXXIX. Group/ranking criteria for basic category loads.

Basic criteria for subgroup assignment	Assigned subgroup	Design features for ranking within subgroup	Numerical ranking
Non-ER dc coil	A	JAN diode suppressed coil	1
		JAN TX screened non-military diode suppressed coil	2
		JAN TX semiconductor suppressed coil	3
		Non-suppressed coil	4
Non-ER ac coil (400 Hz)	B	JAN semiconductor network	1
		JAN TX screened non-military semiconductor network	2
		JAN TX semiconductor network	3
Non-ER ac coil (50/400 Hz)	C	JAN semiconductor network	1
		JAN TX screened non-military semiconductor network	2
		JAN TX semiconductor network	3
Type I ER dc coil	D	JAN TX screened non-military semiconductor suppressed coils	1
		JAN TX (semiconductor) suppressed coils	2
		Non-suppressed coils	3
Type I ER ac coil (400 Hz)	E	JAN TX screened non-military semiconductor networks	1
		JAN TX semiconductor networks	2
Type I ER ac coil (50/400 Hz)	F	JAN TX screened non-military semiconductor network	1
		JAN TX semiconductor network	2

MIL-R-6106J
 AMENDMENT 3

APPENDIX

40.2 Dynamics. Table XXX establishes the criteria for grouping/ranking relays within the subgroups of the basic category of dynamics (see appendix section 30).

TABLE XXX. Grouping/ranking criteria for basic category dynamics.

Basic criteria for subgroup assignment	Assigned subgroup	Design features for ranking within subgroup	Numerical ranking
Mounting style 1 dc coil	A	JAN suppressed coils assuming the physical mountings are identical	1
		Non-suppressed coils	2
Mounting style 2 dc coil	B	Suppressed coils assuming the physical mountings are identical	1
		Non-suppressed coils	2
NOTE: Subgroups continue to be assigned until all relay mounting styles are exhausted. Ranking within subgroup for dc coil device is same as above			
Mounting style 1 ac coil (400 Hz)	Next available letter	All equal per dc logic above	1
NOTE: Subgroups continue to be assigned until all relay mounting styles are exhausted. All ac coil (400 Hz) devices within a subgroup are equal per dc logic above.			
Mounting style 1 ac coil (50/400 Hz)	Next available letter	All equal per dc logic above	1
NOTE: Subgroups continue to be assigned until all relay mounting styles are exhausted. All ac coil (50/400 Hz) devices within a subgroup are equal per dc logic above.			

MIL-R-6106J
AMENDMENT 3

APPENDIX

40.3 Environmental. Table XXXI establishes the criteria for grouping/ranking relays within the subgroups of the basic category of environmental (see appendix section 30).

TABLE XXXI. Grouping/ranking criteria for basic category environmental.

Basic criteria for subgroup assignment	Assigned subgroup	Design features for ranking within subgroup	Numerical ranking
DC coil <u>1/</u>	A	JAN semiconductor suppressed coil	1
		JAN TX-screened non-military diode suppressed coils	2
		JAN TX semiconductor suppressed coils	3
		Non-suppressed coils	4
AC coil (400 Hz) <u>1/</u>	B	JAN semiconductor network	1
		JAN TX-screened non-military semiconductor network	2
		JAN TX semiconductor networks	3
AC coil (50/400 Hz) <u>1/</u>	C	JAN semiconductor network	1
		JAN TX-screened non-military semiconductor network	2
		JAN TX semiconductor networks	3

1/ Although socket and solder pins are considered equal under loads, they must be treated separately under environmental due to potential dielectric problems.