TELEDYNE RELAYS

GENERAL SPECIFICATION FOR

HIGH RELIABILITY RELAYS, ELECTROMECHANICAL

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1. SCOPE

1.1. Scope.

This specification covers the general requirements for electromechanical, hermetically sealed relays for use in high reliability applications (see 6.1). These relays are designed to operate over the full range from low level to power switching with contact ratings up to 1.0 A d.c. This specification is generally based on ESA/SCC General Specification 3601 and ESA/SCC 3601/002 for non-latching relays and ESA/SCC General Specification 3602 and ESA/SCC 3602/002 for latching relays. It is also generally based on S311-P-754 and detail specs.

1.2. Part number.

The part number shall consist of the alphanumeric designators specified in the individual detail specification (see 3.1).

2. APPLICABLE DOCUMENTS

The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the most recent version applies.

2.1. Teledyne Relays Documents.

0-40-115	Inspection Criteria, Pre-Cap Visual
0-40-193	Radiographic Inspection
0-40-265	Inspection, Pre-Cap Small Particle
0-40-824	Particle Impact Noise Detection
0-40-913	Inspection Criteria, External Visual and Mechanical

2.2. Miscellaneous Documents.

ANSI-J-STD-002	Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires
ANSI J-STD-006	Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications
QQ-S-571	Solder, Tin Alloy; Tin-Lead; and Lead Alloy
MIL-G-45204	Gold Plating, Electrodeposited
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts, General Requirements
MIL-STD-202, Method 107	Test Method: Thermal Shock
MIL-STD-202, Method 112	Test Method: Seal

MIL-STD-202, Method 204	Test Method: Vibration, High Frequency
MIL-STD-202, Method 208	Test Method: Solderability
MIL-STD-202, Method 210	Test Method: Resistance to Soldering Heat
MIL-STD-202, Method 211	Test Method: Terminal Strength
MIL-STD-202, Method 213	Test Method: Shock (specified pulse)
MIL-STD-202, Method 214	Test Method: Random Vibration
MIL-STD-202, Method 215	Test Method: Resistance to Solvents
MIL-STD-202, Method 301	Test Method: Dielectric Withstanding Voltage
MIL-STD-202, Method 302	Test Method: Insulation Resistance
MIL-STD-202, Method 303	Test Method: DC Resistance
MIL-STD-202, Method 307	Test Method: Contact Resistance
MIL-STD-202, Method 312	Test Method: Intermediate Current Switching
MIL-STD-750, Method 1041	Test Method for Semiconductor Devices: Salt Atmosphere (corrosion)
MIL-STD-883, Method 1014	Test Method and Procedure for Microelectronics: Seal

2.3. **Reference Documents.**

ESA/SCC 3601	Generic Specification, Relays Electromagnetic, Non-Latching
ESA/SCC 3601/002	Detail Specification, Relays Electromagnetic, Non-Latching, 1 Amp, 2PDT, TO5 Can
ESA/SCC 3602	Generic Specification, Relays Electromagnetic, Latching
ESA/SCC 3601/002	Detail Specification, Relays Electromagnetic, Latching, 1 Amp, 2PDT, TO5 Can
NASA S-311-P754	Generic Specification, Relays Electromagnetic
NASA S311-P-754/01	Detail Specification, Relays, Electromagnetic, Hermetically Sealed, Latching 2PDT (2C), Low Level to 1 Ampere (TO-5 Enclosure)
NASA S311-P-754/02	Detail Specification, Relays, Electromagnetic, Hermetically Sealed, Latching, 2PDT (2C), Low Level to 1 Ampere Internal Diode for Coil Transients (TO-5 Enclosure)
NASA S311-P-754/03	Detail Specification, Relays, Electromagnetic, Hermetically Sealed, Nonlatching, 2PDT, Low Level to 1 Ampere (TO-5 Enclosure)

NASA S311-P-754/04	Detail Specification, Relays, Electromagnetic, Hermetically Sealed, Nonlatching, 2PDT (2C), Low Level to 1 Ampere Internal Diode for Coil Transients (TO-5 Enclosure)
NASA S311-P-754/05	Detail Specification, Relays, Electromagnetic, Hermetically Sealed, Nonlatching, High Vibration, 2PDT (2C), Low Level to 1 Ampere (TO-5 Enclosure)

2.4. **Order of precedence.**

In the event of a conflict between the text of this specification and the references cited herein (except for detail specifications; see 3.1), the text of this specification shall take precedence. When an alternate Teledyne Relays' procedure is available and approved by the Orderer, the Teledyne Relays' procedure shall take precedence.

3. REQUIREMENTS

3.1. Detail Specification.

The individual item requirements shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of this specification and the detail specification, the latter shall govern.

3.2. Materials.

The manufacture shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the relays to meet the performance requirements of this specification.

3.2.1. Spreader pads and spacer pads.

Mounting spreader pads and spacer pads shall be as specified (see 3.1) and shall be attached to the relay.

3.3. Design and construction.

Relays shall be of the design, construction, weight, and physical dimensions specified in the individual detail specification (see 3.1).

3.3.1. Case.

Unless otherwise specified (see 3.1), the case shall not be electrically connected to the contacts or coil; however, it may be used as part of the magnetic circuit.

3.3.1.1. Case grounding.

When specified (see 3.1), means for connecting the relay case to ground shall be provided.

3.3.2. Contacts.

Contacts shall have load ratings and arrangements as specified in the individual detail specification (see 3.1) and unless otherwise specified (see 3.1), shall be capable of carrying the maximum rated current continuously, as well as making and breaking the specified current under all environmental conditions specified herein.

3.3.3. Coil.

Unless otherwise specified (see 3.1), coils shall be adequately insulated electrically from the contacts and the case. The resistance and rated voltage shall be as specified.

3.3.3.1. **Latching relays.**

Latching relays with two coils shall be so designed that if both coils are energized simultaneously and a neutral position (both the normally closed and normally open contacts are open) can be attained, the relay shall satisfy the requirements of 3.5.8. Specified dropout voltage and release time are not applicable to latching relays (see 7.2).

3.3.4. **Circuit diagram.**

The circuit diagram, as specified (see 3.1), shall be a terminal view.

3.3.5. **Terminals.**

Terminals shall be solderable. Unless otherwise specified (see 3.1), relay terminals may be either gold plated or solder coated per the following:

a. For gold plated terminals, the gold shall be per MIL-G-45204.

b. For solder coated terminals, the solder shall be Sn60 or Sn63 per QQ-S-571 or ANSI/J-STD-006.

3.4. **Contact Data Requirements**.

3.4.1. **Static.**

3.4.1.1. **Static contact resistance.**

When relays are tested as specified in 4.11.8.5.1, unless otherwise specified (see 3.1), the static contact resistance shall not exceed 0.100 Ω.

3.4.2. **Dynamic.**

3.4.2.1. **Contact bounce time.**

When relays are tested as specified in 4.11.8.5.2, the duration of the contact bounce shall not exceed 1.5 ms, when specified (see 3.1).

3.4.2.2. **Contact stabilization time.**

When relays are tested as specified in 4.11.8.5.3, the time to reach and maintain a static contact resistance state shall not exceed 2.0 ms, when specified (see 3.1). After overload, high level life, and intermediate current tests, contact bounce time shall be measured in lieu of contact stabilization time (see 3.4.2.1).

3.5. **Electrical Data Requirements.**

3.5.1. **Insulation resistance.**

When relays are tested as specified in 4.11.6, the insulation resistance shall be 10,000 MΩ or more, unless otherwise specified (see 3.1). After the overload, high level life, and intermediate current tests, the insulation resistance shall be 1,000 MΩ or more.

3.5.2. **Dielectric withstanding voltage.**

When tested as specified in 4.11.7, relays shall withstand the test voltage specified without damage, and there shall be no leakage current in excess of 100 µA r.m.s. nor external evidence of damage due to arcing (air discharge), flash over (surface discharge), or insulation breakdown (puncture discharge). After the overload, high level life, and intermediate current tests, the dielectric withstanding voltage shall be at least 75 % of the allowable initial atmospheric value (see 3.1).

3.5.3. **Operating characteristics.**

3.5.3.1. **Pickup voltage (applicable to non-latching relays only).**

When non-latching relays are tested as specified in 4.11.8.1.1, the pickup voltage shall be no greater than as specified (see 3.1).

3.5.3.2. **Set/reset voltage (applicable to latching relays only).**

When latching relays are tested as specified in 4.11.8.1.2, the set/reset voltage shall be no greater than as specified (see 3.1).

3.5.3.3. **Dropout voltage (applicable to non-latching relays only).**

When non-latching relays are tested as specified in 4.11.8.1.3, the dropout voltage shall be no less than as specified (see 3.1).

3.5.4. **Coil resistance (when specified).**

When relays are tested as specified in 4.11.8.2, the coil resistance shall be as specified (see 3.1). Unless otherwise specified, coil resistance of relays with polarity reversal protection diodes is not directly measurable at the relay terminals due to resistance of the diode.

3.5.5. **Coil current (when specified).**

When relays are tested as specified in 4.11.8.3, the coil current shall be as specified (see 3.1).

3.5.6. **Operate and release time.**

When non-latching relays are tested as specified in 4.11.8.4, the operate and release time shall be as specified (see 3.1). For latching relays, release time is not applicable. For double-throw contacts, there shall be no closing of open contacts before all closed contacts have opened. This applies to either state of the relay.

3.5.7. **Diode characteristics (applicable to relays supplied with internal diodes only).**

3.5.7.1. **Coil transient suppression (applicable to relays supplied with internal diode).**

When relays are tested as specified in 4.11.8.6.1, the coils shall not generate a back EMF greater than that specified (see 3.1), as maximum induced transient voltage.

3.5.7.2. **Diode block integrity (applicable to relays supplied with internal diode for polarity reversal protection).**

When relays are tested as specified in 4.11.8.6.2, the leakage current shall not exceed the specified value (see 3.1), as the block integrity maximum leakage current.

3.5.8. **Neutral screen (applicable to latching relays only).**

Latching relays shall be tested as specified in 4.11.8.7.

3.6. **Environmental Requirements.**

3.6.1. **Screening.**

When relays are tested as specified in 4.11.3.1, the insulation resistance shall be 10,000 MΩ or greater. When relays are tested as specified in 4.11.3.2.2, during cycling, the contact miss detectors monitoring level shall be no greater than 33 Ω.

3.6.2. **Solderability.**

When relays are tested as specified in 4.11.4, the criteria for acceptable solderability is as follows: any termination that has less than 5 % of the total solder coated area (except the area within 0.050 in. from the emergence from the seating plane) dewetted, nonwetted, or with pinholes is acceptable. Other anomalies shall not be cause for rejection.

3.6.3. **Seal.**

When tested as specified in 4.11.5, there shall be no leakage in excess of 1×10^{-8} atm-cm^3/s of air.

3.6.4. **Thermal shock.**

When non-latching relays are tested as specified in 4.11.9, insulation resistance, operating characteristics, and operate and release times shall meet the requirements of 3.5.1, 3.5.3, and 3.5.6, respectively, at each temperature extreme. Following the temperature excursions, there shall be no cracking, peeling, or flaking of the finish; dielectric withstanding voltage at atmospheric pressure shall meet the requirements of 3.5.2.

3.6.5. **Shock.**

When relays are tested as specified in 4.11.10, unless otherwise specified, there shall be no opening of closed contacts in excess of 10 µs, no closure or abnormal bridging of open contacts in excess of 1 µs, and no evidence of mechanical or electrical damage.

3.6.6. **Vibration.**

When relays are tested as specified in 4.11.11, unless otherwise specified (see 3.1), there shall be no opening of closed contacts in excess of 10 µs and there shall be no closure or abnormal bridging of open contacts in excess of 1 µs and no evidence of mechanical or electrical damage.

3.6.7. **Vibration miss test.**

When relays are tested as specified in 4.11.12, there shall be no detection of the presence of particulate contaminants which would adversely affect normal operation of the relay.

3.6.8. **Terminal strength (applicable to relays supplied with minimum ¾in. length terminals only).**

When relays are tested as specified in 4.11.20, there shall be no evidence of loosening or breaking of the terminals, nor shall there be any other damage which would adversely affect the normal operation of the relay. Bending of terminals and cracking of the header glass shall not be construed as damage. Kinks, cracks in the plating, and scratches on the terminals due to testing or test fixtures are not cause for rejection.

3.6.9. **Coil life.**

When non-latching relays are tested as specified in 4.11.21, the dielectric withstanding voltage, insulation resistance, contact resistance, coil resistance or coil current, as applicable, operate and release time, and contact bounce time shall meet the requirements specified in 3.5.2, 3.5.1, 3.4.1.1, 3.5.4 or 3.5.5, 3.5.6, and 3.4.2.1. There shall be no evidence of structural failure or damage which might impair the operation of the relay.

3.6.10. **Resistance to soldering heat.**

When relays are tested as specified in 4.11.17, there shall be no damage which would adversely affect normal operation of the relay.

3.6.11. **Salt atmosphere (corrosion).**

When relays are tested as specified in 4.11.13, there shall be no evidence of breaking, cracking, chipping, or flaking of the finish, nor exposure of the base metal, due to corrosion, which would adversely affect the application or performance characteristics of the relay.

3.6.12. **Overload.**

When relays are tested as specified in 4.11.18, the case-to-ground fuse shall remain electrically continuous.

3.6.13. **Life.**

When relays are tested as specified in 4.11.19, during cycling, the contact miss detectors' monitoring level shall be no greater than 33 Ω for low level testing and no greater than 5 % of the open circuit voltage for high level testing. The voltage across open contacts shall be no less than 95 % of the open circuit voltage for high level testing. The case to ground fuse shall remain electrically continuous. The contact voltage drop during and the static contact resistance following cycling shall be as specified (see 3.1).

3.6.14. **Intermediate current.**

When relays are tested as specified in 4.11.14, during cycling, the resistance of a closed contact shall be no greater than specified (see 3.1) and the voltage across an open contact shall be no less than 95% of the open circuit voltage. After cycling, the static contact resistance shall not exceed the specified limits (see 3.1).

3.6.15. **Mechanical life.**

When relays are tested as specified in 4.11.15, after cycling, the insulation resistance and dielectric withstanding voltage shall meet the requirements of 3.5.1 and 3.5.2. The operate and release time, as applicable, shall meet the requirements of 3.5.6, except they shall not exceed 120 % of the maximum limits specified (see 3.1). The case to ground fuse shall remain electrically continuous.

3.6.16. **Resistance to solvents.**

When relays are tested as specified in 4.11.16, the marking shall remain legible.

3.6.17. **Marking.**

Relays shall be permanently and legibly marked in accordance with the individual detail specification (see 3.1) and shall include the following information, as a minimum:

a. Teledyne Relays' Part Number (see 3.1).

b. Lot Number

c. Teledyne Relays.

d. Contact rating (the highest d.c. resistive load rating; see 3.3.2).

e. Circuit diagram (see 3.3.4).

f. Serial Number

3.6.18. **Visual Inspection.**

When relays are inspected as specified in 4.11.1, the relays shall be uniform in quality, and be free from cracked and displaced parts, sharp edges, burrs and other defects that will affect life and serviceability.

3.6.19. **Thermal Cycle/Miss Test.**

When relays are subjected to the temperature conditioning and miss tests specified in 4.11.3.2, they shall meet the criteria specified therein.

3.6.20. **Radiographic Inspection.**

When relays are subjected to the radiographic inspection specified in 4.11.22, they shall meet the criteria specified therein.

3.6.21. **Particle Impact Noise Detection (PIND) Test.**

When relays are subjected to the particle impact noise detection test specified in 4.11.23, they shall meet the criteria specified therein.

4. QUALITY ASSURANCE PROVISIONS

4.1. Responsibility for inspection.

a. Teledyne Relays is responsible for the performance of all inspection requirements using suitable facilities.

b. In the event that Teledyne Relays needs to perform additional tests, a complete description of the tests to be performed shall be provided to the Orderer. The description of the tests shall include as a minimum, the test methods and the location in the test sequence where the test shall be performed. Teledyne Relays shall obtain the approval of the Orderer prior to the start of any such tests.

4.2. Product assurance program.

An established product assurance program shall be maintained by Teledyne Relays.

4.3. Inspection Rights.

The Orderer reserves the right to monitor any of the tests and inspections required by this specification.

4.4. Classification of inspection.

The inspections specified herein are classified as follows:

a. Qualification Inspection (see 4.9)

b. Quality Conformance Inspection (see 4.10)

4.5. Inspection lot.

Unless otherwise specified, an inspection lot shall consist of a single production lot presented for inspection at one time.

4.6. Inspection conditions.

Where mechanical or electrical requirements are specified without tolerances, the acceptable tolerances shall be ± 10 %. All inspections done at room ambient conditions shall be done at the prevailing inspection work area temperature and humidity, unless otherwise specified herein. All other tests/inspections done at over the temperature range shall be performed in accordance with the test conditions specified in the “General Requirements” of MIL-STD-202.

4.6.1. **Power supply.**

Unless otherwise specified herein, the power supply shall have no more than 10 % regulation at 110 % of the specified test load current. A d.c. power supply shall have no more than 5 % ripple voltage. An a.c. power supply shall be within 1 % of the specified frequency and shall be sinusoidal with a form factor between 0.95 and 1.25.

4.6.2. **Grounding.**

The negative side of the dc power supply shall be grounded. One side of single-phase a.c. power supply shall be grounded.

4.6.3. **Load conditions during tests.**

The coil(s) of the relay being tested shall be connected to the grounded side of their power supply. Each stationary contact shall be connected to an individual load.

4.6.4. **Testing devices.**

Devices used in the testing of relays shall not load the contacts above 10 mA resistive at 6 V d.c. or peak a.c. maximum open circuit voltage, unless otherwise specified herein.

4.6.5. **Mounting relays for ambient temperature tests.**

When the relays are subjected to the coil life and intermediate current tests (4.11.21 and 4.11.14, respectively), they may be mounted on a heat sink in accordance with the following:

a. Each relay may be attached by its normal mounting means to a suitable heat sink. The leads shall not constitute a heat sink.

b. Chamber temperature shall be controlled to maintain the temperature at the specified ambient extremes.

4.6.6. **Methods of examination and test.**

Application of coil power to relays under test shall be such that plus polarity is applied as specified (see 3.1). Testing of dual-coil relays shall be repeated with each coil serving as the operating coil; and testing of latching relays shall be repeated with the relay in each operated position.

4.7. **Failed Components**.

A relay shall be considered as failed if it exhibits one or more of the failure modes indicated below:

a. Electrical parameters exceeding limits in Section 3 herein.

b. Catastrophic failures.

c. Mechanical failures.

4.8. **Failed Lots**.

An inspection lot shall be considered as failed based on the sampling plan being used for inspection as follows:

a. **Testing.** If the sum of all relays failed according to the failure modes (see 4.7) during Screening and Electrical Measurements is greater than 10% (rounded upward to the nearest whole number), the lot shall be considered as failed. In all other cases, discard all failed relays.

b. **Sample Testing.** If any relay failures (see 4.7) are encountered during Lot Acceptance tests, the lot shall be considered as failed.

Should a lot failure occur, the Orderer shall be notified in writing within two working days after detection of the lot failure, with information on the number of failures, mode of failure and suspected causes. No additional tests shall be performed on the failed relays except on instructions from the Orderer. The Orderer shall inform Teledyne Relays within two working days of receipt of notification, by the same means, as to what alternative action shall be taken. In the event that a failure analysis is required, it shall be done only on catastrophic failures resulting from sample testing.

4.9. **Qualification Inspection.**

Qualification Inspection can be met by either:

a. Similarity data.

A relay can be considered qualified if it is similar to a relay for which qualification test data exists, and the detailed test data is available. In order to be considered similar, the relay shall be made by Teledyne Relays using the same materials and processes as the qualified part.

b. Existing test data.

Relays can be qualified by existing test data resulting from periodic inspections performed by Teledyne Relays; this data shall be available to the Orderer.

c. Custom Qualification Plan.

A Statement of Work shall be prepared and joint agreement by the Orderer and Teledyne Relays on the test plan shall be reached.

4.10. **Quality Conformance Inspection.**

Quality Conformance Inspection shall consist of the following tests:

a. Final Production Tests (see 4.10.1).

b. Screening and Electrical Measurements (see 4.10.2).

c. Lot Acceptance Tests (see 4.10.3).

As a minimum, the Final Production Tests and the Screening and Electrical Measurements are to be performed (see 3.1).

4.10.1. **Final Production Tests.**

Final Production Tests shall consist of the tests and inspections shown in Table 1. Discard all failed components (see 4.7). Final Production Tests shall be performed in the order shown.

4.10.1.1. **Sampling plan.**

Perform on 100% of the inspection lot, unless otherwise indicated in Table 1.

4.10.1.2. **Data Requirements.**

See Section 5 for details.

4.10.2. **Screening and Electrical Measurements.**

All inspection lots that have successfully passed the Final Production Tests (see 4.10.1) shall be subjected to the Screening and Electrical Measurements of Table 2. Tests/Inspections shall be performed in the order shown.

4.10.2.1. **Sampling plan.**

Perform on 100% of the inspection lot, unless otherwise indicated in Table 2.

4.10.2.2. **Lot Failure.**

See 4.8.

4.10.2.3. **Data Requirements.**

See Section 5 for details.

4.10.3. **Lot Acceptance Tests.**

When specified (see 3.1), all inspection lots that have successfully passed both the Final Production Tests (see 4.10.1) and the Screening and Electrical Measurements (see 4.10.2) shall be subjected to the applicable Lot Acceptance Tests shown in Tables 3, 4 or 5. The Lot Acceptance Tests Levels are designated as 3, 2, and 1 and are comprised of tests as follows:

a. **Level 3** - Comprised of electrical measurements of characteristics and tests to prove the workmanship standards of the component. The tests of this subgroup are non-destructive. All samples that have successfully passed the non-destructive tests of this Subgroup shall form part of the delivery lot. See Table 3.

b. **Level 2** - Comprised of tests and inspections that prove the performance of the contacts at rated, intermediate and low levels under established loads and cycling rates. These tests are considered to be destructive and therefore, samples shall not form part of the delivery lot. See Table 4.

c. **Level 1** - Comprised of tests to verify relay design and manufacturing processes. These tests are considered to be destructive and therefore, samples shall not form part of the delivery lot. See Table 5.

The Orderer, upon placement of Purchase Order, shall specify which level(s) are required. The Orderer shall be notified at least two working days before commencement of Lot Acceptance Tests. The Orderer shall immediately notify Teledyne Relays whether or not the Lot Acceptance Tests are to be witnessed.

4.10.3.1. **Sampling plan.**

Based on level(s) selected by customer and chosen groups therein, the selected components shall be subjected to the tests of the applicable group(s) in the sequence shown (see 3.1). The samples shall be, whenever possible, randomly selected from the inspection lot. Samples selected for Lot Acceptance Tests are representative of the relays in the inspection lot and may be selected prior to the installation of mounting variants (ground pin, spacer pad, spreader pad - see 3.1) or the performance of operations ensuring that the applicable termination variants are met (e.g., trimmed leads, lead solder coating - see 3.1).

a. Level 3 - Per Table 3.

b. Level 2 - Per Table 4.

c. Level 1 - Per Table 5.

4.10.3.2. **Deliverable components.**

a. Level 3 - These tests are non-destructive and therefore, samples that have successfully passed the tests shall form part of the delivery lot.

b. Level 2 - These tests are considered to be destructive and therefore, samples shall not form part of the delivery lot.

c. Level 1- These tests are considered to be destructive and therefore, samples shall not form part of the delivery lot.

4.10.3.3. **Lot Failure.**

See 4.8.

4.10.3.4. **Data Requirements.**

See Section 5 for details.

Table 1. Final Production Tests.

Inspection	Requirement paragraph	Test method paragraph	Inspection Sample 1/
1. Verification of Precap inspection, Customer source inspection - Precap inspection; Marking/Serialization	Ref. 3.6.18; 3.6.17	Ref. 4.11.1.1	
2. Verification of Small particle inspection (when specified)	3.1	4.11.2	
3. Room temperature electrical measurements 2/			
a) Coil resistance (as applicable)	3.5.4	4.11.8.2	
b) Coil current (as applicable)	3.5.5	4.11.8.3	
c) Insulation resistance	3.5.1	4.11.6	
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7	
e) Static contact resistance	3.4.1.1	4.11.8.5.1	
f) Operating characteristics	3.5.3	4.11.8.1	
g) Operate and release time	3.5.6	4.11.8.4	
h) Dynamic contact characteristics	3.4.2	4.11.8.5	
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6	
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7	
4. Solderability (when specified)	3.6.2	4.11.4	3/
5. Seal	3.6.3	4.11.5	
6. Visual inspection, external	3.6.18	4.11.1.2	4/

Notes to Table 1:

1/ 100% inspection applies, unless otherwise noted. For 100 % inspection, discard all failed relays.

2/ Test sequence is optional.

3/ Perform on 2 relays from each lot. Failed relays resulting from Room Temperature Electrical Measurements may be used for test. Test is considered destructive, therefore relays used shall not form part of the delivery lot.

4/ Physical dimensions and weight shall be measured on two sample units per lot.

Table 2. Screening and Electrical Measurements.

Inspection	Requirement paragraph	Test method paragraph	Inspection Sample 1/ (100 % unless otherwise noted)
1. Vibration, sinusoidal	3.6.6	4.11.11.1	
2. Vibration, random (when specified)	3.6.6	4.11.11.2	
3. Vibration miss test (when specified)	3.6.7	4.11.12	
4. Particle impact noise detection test (when specified)	3.6.21	4.11.23	
5. Internal moisture	3.6.1	4.11.3.1	
6. Thermal shock/Miss test	3.6.19	4.11.3.2	
First hot/cold cycles:			
a) Coil continuity		4.11.3.2.1	
Fifth hot/cold cycle:			
b) High temperature soak		4.11.3.2.1	
c) High temperature electrical measurements 2/		4.11.3.2.1	
i) Insulation resistance	3.5.1	4.11.6	
ii) Operating characteristics	3.5.3	4.11.8.1	
iii) Static contact resistance	3.4.1.1	4.11.8.5.1	
iv) Operate and release time	3.5.6	4.11.8.4	
v) Operate and release contact bounce time	3.4.2.1	4.11.8.5.2	
d) High temperature miss test	3.6.1	4.11.3.2.1, 4.11.3.2.2	
e) Low temperature soak		4.11.3.2.1	
f) Low temperature electrical measurements 2/		4.11.3.2.1	
i) Operating characteristics	3.5.3	4.11.8.1	
ii) Static contact resistance	3.4.1.1	4.11.8.5.1	
iii) Operate and release time	3.5.6	4.11.8.4	
iv) Operate and release contact bounce time	3.4.2.1	4.11.8.5.2	
g) Low temperature miss test	3.6.1	4.11.3.2.1, 4.11.3.2.2	
h) Stabilize at room ambient temperature		4.11.3.2.1	
i) Room temperature miss test	3.6.1	4.11.3.2.1, 4.11.3.2.2	

See notes at end of Table.

Table 2. Screening and Electrical Measurements (cont'd).

Inspection	Requirement paragraph	Test method paragraph	Inspection Sample 1/ (100 % unless otherwise noted)
7. Room temperature electrical measurements 2/			
a) Coil resistance (as applicable)	3.5.4	4.11.8.2	
b) Coil current (as applicable)	3.5.5	4.11.8.3	
c) Insulation resistance	3.5.1	4.11.6	
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7	
e) Static contact resistance	3.4.1.1	4.11.8.5.1	
f) Operating characteristics	3.5.3	4.11.8.1	
g) Operate and release time	3.5.6	4.11.8.4	
h) Dynamic contact characteristics	3.4.2	4.11.8.5	
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6	
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7	
8. Seal 3/	3.6.3	4.11.5	
9. Radiographic inspection	3.6.20	4.11.22	
10. Visual inspection, external 4/	3.6.18	4.11.1.2	
11. Check for lot failure		4.8	

Notes to Table 2:

1/ For 100 % inspection, discard all failed relays.

2/ Test sequence is optional.

3/. Ground pin attachment, spacer/spreader pad attachment, lead trimming, or lead solder coating processes may be performed before, during, or after Screening and Electrical Measurements. An electrical inspection, and/or seal test, and/or external visual and mechanical inspection, as applicable, shall follow any of these processes.

4/ The header glass criteria is not applicable to relays supplied with attached spreader pads.

Table 3. Lot Acceptance Test 3.

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
1. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1		
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4		
h) Dynamic contact characteristics	3.4.2	4.11.8.5	3	1/
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
2. Seal	3.6.3	4.11.5		
3. Visual inspection, external 3/	3.6.18	4.11.1.2		

Notes to Table 3:
1/ See Paragraph 4.10.3.3.
2/ Test sequence is optional.
3/ The header glass criteria is not applicable to relays supplied with attached spreader pads.

Table 4. Lot Acceptance Test 2.

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group I				
1. Life	3.6.13	4.11.19		
2. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1	1 per load	1/
f) Operating characteristics	3.5.3	4.11.8.1	(see 3.6.2)	
g) Operate and release time	3.5.6	4.11.8.4		
h) Dynamic contact characteristics	3.4.2	4.11.8.5		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
3. Seal	3.6.3	4.11.5		
4. Visual inspection, external 3/	3.6.18	4.11.1.2		

See notes at end of Table.

Table 4. Lot Acceptance Test 2 (cont'd).

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group II				
1. Intermediate current	3.6.14	4.11.14		
2. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1		
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4	1	1/
h) Operate and release contact bounce time	3.4.2.1	4.11.8.5.2		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
3. Visual inspection, external 3/	3.6.18	4.11.1.2		

See notes at end of Table.

Table 4. Lot Acceptance Test 2 (cont'd).

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group III				
1. Overload (highest dc resistive load)	3.6.12	4.11.18		
2. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1	1	1/
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4		
h) Operate and release contact bounce time	3.4.2.1	4.11.8.5.2		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
3. Visual inspection, external 3/	3.6.18	4.11.1.2		

See notes at end of Table.

Table 4. Lot Acceptance Test 2 (cont'd).

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group IV				
1. Mechanical life	3.6.15	4.11.15		
2. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1	1	1/
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4		
h) Dynamic contact characteristics	3.4.2	4.11.8.5		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
3. Visual inspection, external 3/	3.6.18	4.11.1.2		

Notes to Table 4:

1/ See Paragraph 4.10.3.3.

2/ Test sequence is optional.

3/ The header glass criteria is not applicable.

4. Post-life operating characteristics, operate and release time, and contact dynamic characteristics, as applicable, are allowed to have a 10% variance from the initial allowable values.

Table 5. Lot Acceptance Test 1.

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group I				
1. Thermal shock	3.6.4	4.11.9		
2. Shock (specified pulse)	3.6.5	4.11.10		
3. Vibration (sinusoidal and random)	3.6.6	4.11.11		
4. Terminal strength	3.6.8	4.11.20		
5. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7	1	1/
e) Static contact resistance	3.4.1.1	4.11.8.5.1		
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4		
h) Dynamic contact characteristics	3.4.2	4.11.8.5		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6		
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
6. Seal	3.6.3	4.11.5		
7. Visual inspection, external 3/	3.6.18	4.11.1.2		

See notes at end of Table.

Table 5. Lot Acceptance Test 1 (cont'd).

Inspection	Requirement paragraph	Test method paragraph	Number of samples inspected	Number of failures allowed
Group II				
1. Coil Life	3.6.9	4.11.21		
2. Resistance to solvents	3.6.16	4.11.16		
3. Resistance to soldering Heat	3.6.10	4.11.17		
4. Room temperature electrical measurements 2/				
a) Coil resistance (as applicable)	3.5.4	4.11.8.2		
b) Coil current (as applicable)	3.5.5	4.11.8.3		
c) Insulation resistance	3.5.1	4.11.6		
d) Dielectric withstanding voltage (atmospheric pressure)	3.5.2	4.11.7		
e) Static contact resistance	3.4.1.1	4.11.8.5.1		
f) Operating characteristics	3.5.3	4.11.8.1		
g) Operate and release time	3.5.6	4.11.8.4		
h) Dynamic contact characteristics	3.4.2	4.11.8.5		
i) Diode characteristics (applicable to relays supplied with internal diodes only)	3.5.7	4.11.8.6	3	1/
j) Neutral screen (applicable to latching relays only)	3.5.8	4.11.8.7		
5. Visual inspection, external 3/	3.6.18	4.11.1.2		

Notes to Table 5:

1/ See Paragraph 4.10.3.3.

2/ Test sequence is optional.

3/ The header glass criteria is not applicable.

4. Post-life operating characteristics, operate and release time, and contact dynamic characteristics, as applicable, are allowed to have a 10 % variance from the initial allowable values.

4.11. **Methods of inspection.**

4.11.1. **Visual Inspection (see 3.6.18).**

4.11.1.1. **Internal.**

Perform in accordance with Teledyne Relays' procedure 0-40-115. The Orderer may witness or perform the internal visual inspection.

4.11.1.2. **External**.

Relays shall be examined to verify that the marking, header glass, external design and construction, physical dimensions and workmanship are in accordance with Teledyne Relays' procedure 0-40-913, which must be approved by the Orderer. Physical dimensions shall be measured on two sample units only during Final Production Tests.

Relays shall be examined for evidence of structural failure or other damage occurring as a direct result of Lot Acceptance Tests which might impair the operation of the relay.

4.11.2. **Small Particle Inspection.**

When specified (see 3.1), it shall be performed on 100% of the relays in the inspection lot per Teledyne Relays' procedure 0-40-265, which shall be approved by the Orderer.

4.11.3. **Screening (see 3.6.1).**

4.11.3.1. **Internal moisture.**

Relays (coils de-energized) shall be at ambient room temperature prior to the start of test. The insulation resistance of all contact pins to case only shall be measured and observed. The relay coil shall be energized with 140 % of rated voltage for a period of 2½ minutes. For latching relays, this test shall be repeated for each coil. The insulation resistance of all contact pins to case only shall be verified a minimum of once each 30 seconds during this period and the lowest value shall meet the requirements of 3.5.1.

4.11.3.2. **Thermal Cycle/Miss test (see 3.6.19).**

4.11.3.2.1. **Thermal Cycle.** Each relay shall be subjected to 5 cycles of thermal shock in accordance with MIL-STD-202, Method 107, Test Condition B at the minimum and maximum rated temperatures (see 3.1). The following details and exceptions apply:

The relay shall be de-energized during the first four temperature conditioning cycles, and the coil continuity shall be monitored continuously during this time. Monitoring current shall not exceed 300 µA. The relay shall be de-energized during low temperature.

Step one of each temperature cycle shall be high temperature; step 3 of each temperature cycle shall be low temperature.

At the end of each temperature extreme during the fifth temperature cycle (Steps 1 and 3), each relay shall be tested as follows:

a. Non-latching relays shall be energized with maximum rated coil voltage (see 3.1) for one hour minimum.

b. Latching relays shall be energized with the set and the reset coil alternately energized with maximum rated voltage for a minimum of ½ hour each.

c. At the end of this time and while still at the high temperature extreme, perform the following electrical measurements: insulation resistance (at high temperature only), static contact resistance, operating characteristics, operate and release time and contact bounce time as specified in 3.5.1, 3.4.1.1, 3.5.3, 3.5.6 and 3.4.2.1 respectively. Following the electrical measurements, perform the miss test per 4.11.3.2.2.

During Step 4 of the fifth cycle, stabilize the relays at room ambient for a minimum of 1 hour, with the coil(s) de-energized. Perform the miss test per 4.11.3.2.2.

4.11.3.2.2. **Miss test (see 3.6.1).**

Relays shall be subjected to a 2,500 cycle run-in test at each of the applicable ambient temperatures. The following details apply:

a. Coil energization conditions: The coil(s) shall be energized and cycled at maximum rated voltage (see 3.1).

b. Cycling Rate: 1 to 5 Hz.

c. Contact loading**:** Relays shall have the contacts loaded as follows: open circuit load voltage 10 to 50 mV d.c. or peak a.c., load current 10 to 50 µA.

d. Monitoring**:** The contact voltage drop or resistance for each pair of mated contacts shall be monitored during 40 % minimum of each "on" and each "off" period, within the latter 50 % of each period. The test equipment shall record all relay failures.

e. Number of misses allowed**:** None.

f. Applicable Ambient Temperature:

Ambient High Temperature	+125 ° C
Ambient Low Temperature	- 65 ° C
Ambient Room Temperature	+25 ° C

4.11.4. **Solderability (see 3.6.2).**

Relays shall be tested in accordance with MIL-STD-202, method 208. The following details and exceptions shall apply:

a. Number of terminations of each part to be tested: All.

b. The temperature of the molten solder shall be a uniform +245 °C ± 5 °C (+473 °F ± 9 °F).

4.11.5. **Seal (see 3.6.3).**

Relays sealed with a tracer gas shall be tested in accordance with MIL-STD-883, method 1014, or as an option, MIL-STD-202, method 112. In case of dispute, MIL-STD-883, method 1014, test condition B shall govern. The following details shall apply:

a. MIL-STD-883, method 1014, test condition B. No gross leak test required.

b. MIL-STD-202, method 112:

(1) Test condition C, procedure IV. Relays shall be back-filled with a helium tracer gas (90 % dry gas, 10 % helium). Silicone oil shall not be used.

(2) Measurements after test: Perform a gross leak test per MIL-STD-202, method 112, test condition D.

4.11.6. **Insulation resistance (see 3.5.1).**

Relays shall be tested in accordance with MIL-STD-202, method 302. The following details shall apply:

a. Test condition: 500 V d.c. ± 10 %.

b. Points of measurement: As specified in Table 6.

c. When latching relays are tested or when non-latching relays are tested in the de-energized position, coil leads of relays supplied with internal diode(s) should be connected together to avoid damage to the semiconductors.

4.11.7. **Dielectric withstanding voltage (see 3.5.2).**

Relays shall be tested at atmospheric pressure in accordance with MIL-STD-202, method 301. The following details shall apply:

a. Test condition: 500 V r.m.s. ± 5 % at 50 or 60 Hz (as applicable).

b. Points of application: As specified in Table 6.

c. Maximum leakage current: 100μA.

d. Duration of application: 5 cycles (50 or 60 Hz, as applicable) minimum.

e. When relays are tested in the de-energized position, coil leads of relays supplied with internal diode(s) should be connected together to avoid damage to the semiconductors.

Table 6. Points of Application / Measurement for Insulation Resistance and Dielectric Withstanding Voltage Tests.

Points of Application / Measurement	De-energized or Reset Position	Energized or Set Position
Between case, frame, or enclosure, and all contacts	✓	✓
Between case, frame, or enclosure and coil(s) (when specified)	✓	
Between all contacts and coil(s)	✓	
Between open contacts	✓	✓
Between contact poles (applicable to multi-pole relays)	✓	✓
Between coils (when specified for latching relays)	✓	

4.11.8. **Electrical characteristics.**

4.11.8.1. **Operating characteristics (see 3.5.3).**

Operating characteristics shall be measured as specified in 4.11.8.1.1, 4.11.8.1.2, or 4.11.8.1.3. The relay mounting position is optional. A suitable indicating device shall be used to monitor contact position. During the test, no contact shall change state (break or remake) when the coil is energized at or above the specified pickup voltage or when the coil voltage is reduced from the specified dropout voltage to zero.

To prevent overheating caused by slow ramping of coil voltage, it is permissible to perform pickup, set/reset, and dropout voltages using step function voltage changes. The step function shall be the governing method in cases of dispute.

4.11.8.1.1. **Pickup voltage (see 3.5.3.1).**

The coil voltage shall be increased from zero until all contacts transfer to the energized position and the pickup voltage shall be measured.

If using the step voltage method, step up to the maximum pickup voltage from zero. All contacts should transfer to the energized position.

4.11.8.1.2. **Set/reset voltage (see 3.5.3.2).**

Before measuring the set/reset voltage, ensure that all contacts are in their reset position. The voltage to the set coil shall be increased from zero until all contacts transfer to the set position and the set voltage shall be measured. Apply rated voltage to the set coil and reduce to zero. The voltage to the reset coil shall be increased from zero until all contacts transfer to the reset position and the reset voltage shall be measured.

If using the step voltage method, ensure that all contacts are in their reset position. The voltage to the set coil shall be stepped up to the specified set voltage from zero. All contacts should transfer to the set position. Apply rated voltage to the set coil and reduce to zero. Step up the voltage to the reset coil from zero to the specified reset voltage. All contacts should transfer to the reset position.

4.11.8.1.3. **Dropout voltage (see 3.5.3.3).**

Rated voltage shall be applied to the coil. The coil voltage shall then be reduced from rated voltage until all contacts return to the de-energized position and the dropout voltage shall be measured.

If using the step voltage method, step the voltage down from rated voltage to the specified dropout voltage. All contacts should transfer to the de-energized position.

4.11.8.2. **Coil resistance (see 3.5.4).**

Relay coils shall be tested in accordance with MIL-STD-202, method 303. The following detail shall apply:

a. Limit of error of measuring apparatus: ± 2.5 %.

4.11.8.3. **Coil current (see 3.5.5).**

Rated voltage shall be applied to the coil supply terminals, and the coil circuit current shall be measured using suitable means. Measurement shall be made at room ambient temperature at rated voltage for 5 seconds maximum. The limit of error of the measuring apparatus shall be ± 2.5 %.

4.11.8.4. **Operate and release time (see 3.5.6).**

Operate and release time shall be measured using an oscilloscope or other suitable means. Rated voltage shall be applied to the coil. Contact load conditions shall be 10 mA maximum at 6 V d.c. maximum or peak a.c. The circuit shown on Figure 1, or equivalent, shall be used. The operate and release time shall be exclusive of contact bounce Time or contact stabilization time. Timing measurements shall be made on all contact sets.

4.11.8.5. **Contact Data Characteristics (see 3.4).**

4.11.8.5.1. **Static contact resistance (see 3.4.1.1).**

Relays shall be tested in accordance with MIL-STD-202, method 307. The following details and exception shall apply:

a. Method of connection: This measurement shall be made approximately ⅛ inch (3.18 mm) from the emergence of the lead from the seating plane of the relay.

b. Test load: 10 mA maximum at 6 V maximum (d.c. or peak a.c.).

c. Post test loads for overload, high level life, and intermediate current: Current and voltage shall be the same as the life or intermediate current test, or 100 mA maximum at 28 V d.c. maximum.

d. Points of measurements:

- Between all normally closed mated contacts.
- Between all normally open mated contacts, with the coil energized with rated coil voltage.

e. Number of activations prior to measurement: None.

f. Number of test activations: Three.

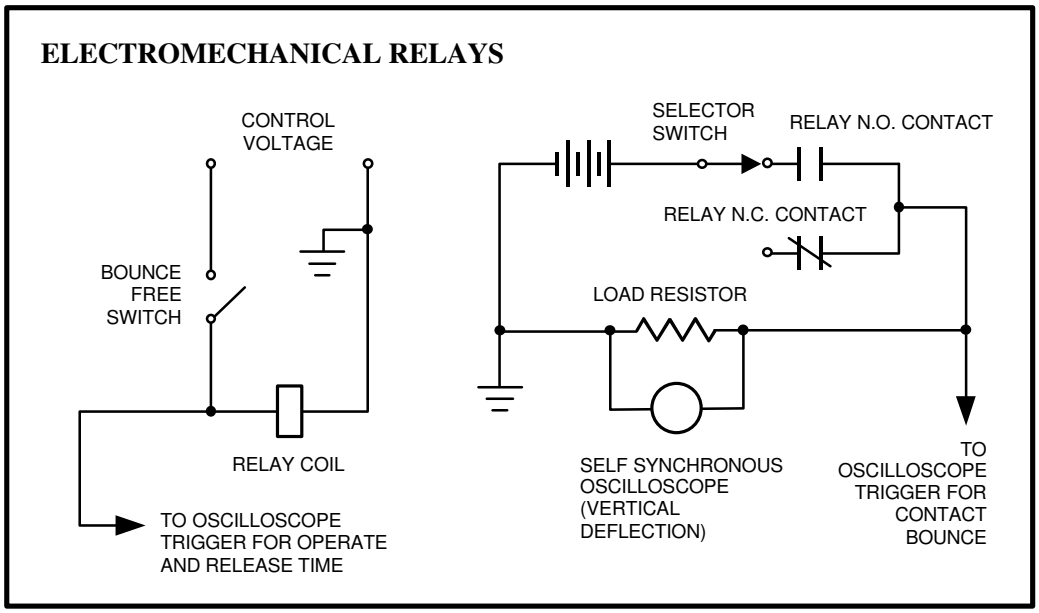
g. Number of measurements per activation: One in each closed contact position.

4.11.8.5.2. **Contact bounce time (see 3.4.2.1).**

Contact bounce time shall be measured on each contact set using an oscilloscope or other suitable means. The trace shall show contact switching at operate and release and appropriate timing markers or electronic equivalence. Rated voltage shall be applied to the coil. Contacts shall be loaded with 10 mA maximum at 6 V d.c. maximum or peak a.c. After the overload, high level life, and intermediate current tests, contact bounce time shall be measured at 100 mA maximum at 28 V d.c. maximum. A contact bounce shall be considered any occurrence equal to or greater than 90 % of the open circuit voltage with a pulse width of 10 µs or greater. The circuit shown on Figure 1, or equivalent, shall be used.

4.11.8.5.3. **Contact stabilization time (see 3.4.2.2).**

Contact stabilization time shall be measured on each contact set using an oscilloscope or other acceptable means. The equipment shall have the capability of indicating a failure pulse width of greater than 1 µs. Rated voltage shall be applied to the coil. Contacts shall be loaded with 50 mA maximum at 50 mV d.c. maximum or peak a.c. Contact stabilization time shall be defined as the maximum time allowed for the contacts to reach and maintain a static contact resistance state following the actual operate or release time of the relay (i.e., the sum of the contact bounce time and the time for the dynamic contact resistance to stabilize to the static contact resistance). After the overload, high level life, and intermediate current tests, contact bounce time shall be measured in lieu of contact stabilization time, as specified in 4.11.8.5.2.



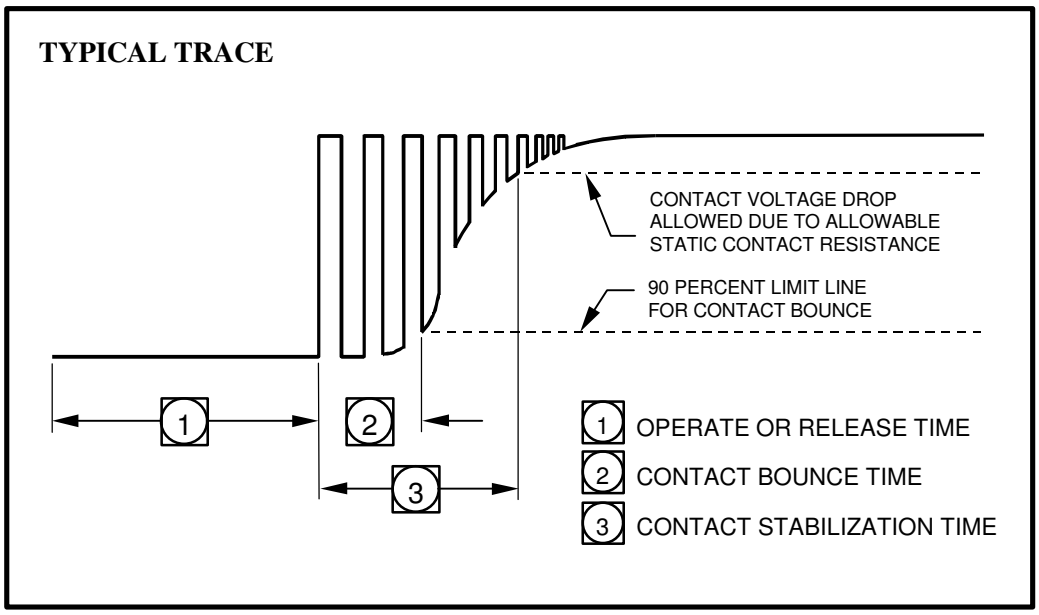


Figure 1. Typical circuit for operate and release time, contact bounce time and contact stabilization time with typical trace.

4.11.8.6. **Diode characteristics (applicable to relays supplied with internal diodes only) (see 3.5.7).**

4.11.8.6.1. **Coil transient suppression (see 3.5.7.1).**

Coil transient suppression shall be measured by suitable means.

a. The switching relay shall be closed for a minimum of ten times the operate time of the test relay, or switching relay, whichever is longer, to allow the oscilloscope, or equivalent circuit network to stabilize and then opened to obtain the induced voltage deflection trace. Relay shall be cycled at 10 Hz ± 2 Hz with approximately equal open and closed times.

(1) The reading shall be observed on an oscilloscope with a 40 kHz minimum bandwidth, or equivalent. The peak magnitude of the induced voltage transient shall be noted. A typical trace is presented on Figure 2.

(2) The maximum value of three consecutive readings shall be noted.

(3) Unless otherwise specified, the temperature at the time of the testing shall be the prevailing room temperature.

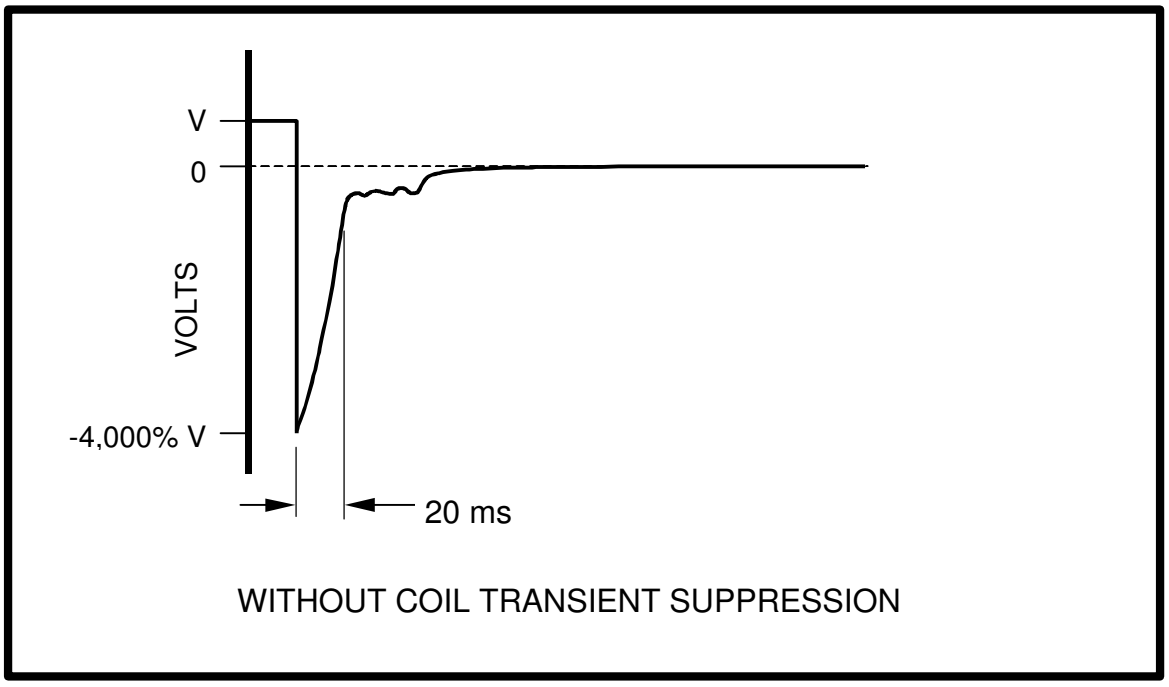
Equivalent electronic measurement methods may be used in lieu of the above.

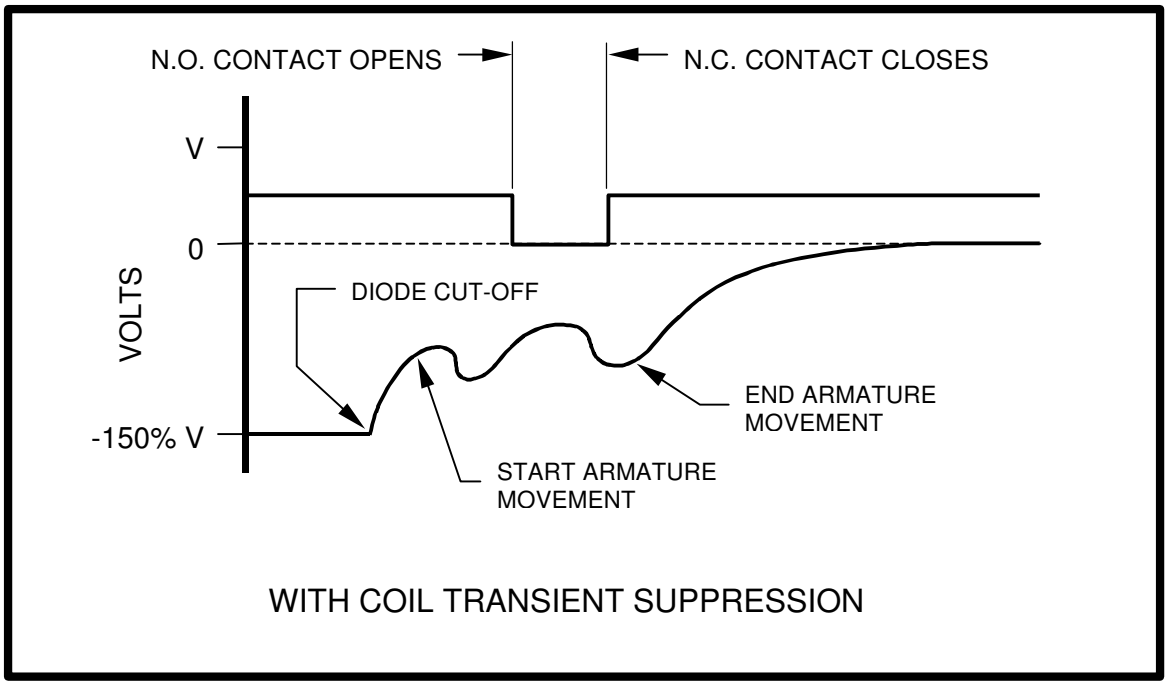
b. For tests other than Lot Acceptance Tests, only one measurement is required; other suitable test methods may be used to verify that the back EMF (coil kick) is within the specified limit.

4.11.8.6.2. **Diode block integrity (see 3.5.7.2).**

Diode block integrity shall be measured by a suitable means.

Figure 2. Typical transient voltage.





4.11.8.7. **Neutral screen (see 3.5.8).**

Relays shall be tested as follows:

a. Apply rated coil voltage to both coils simultaneously for a period of 10 ms minimum. After voltage is removed, determine if the relay contacts are in a neutral position.

b. If the relay contacts will not maintain a neutral position, repeat 4.11.8.7.a twice. A relay which will not assume a neutral position for these three successive cycles is considered an acceptable part and does not require further testing. Relays which remain in a neutral position shall be tested as follows:

(1) Apply a 10 ms ± 1 ms pulse of the specified set voltage (at +25 °C) to the set coil. Verify that the relay has set. Failure to set shall be cause for rejection.

(2) Repeat 4.11.8.7.a.

(3) Apply a 10 ms ± 1 ms pulse of the specified reset voltage (at +25 °C) to the reset coil. Verify that the relay has reset. Failure to reset shall be cause for rejection.

4.11.9. **Thermal shock (see 3.6.4).**

Relays shall be tested in accordance with MIL-STD-202, method 107. The following details and exception shall apply:

a. Special mounting: Relays shall be suspended in the test chamber by a suitable means. Test leads may be used for mounting; however, they shall not provide a heat sink.

b. Test condition B, except exposure time at temperature extreme during the fifth cycle shall be for 2 hours each.

c. Measurements at each temperature extreme: During steps 1 and 3 of the fifth cycle at the end of each temperature exposure, and with the relays still in the conditioning chamber, the following shall be measured:

Insulation resistance, operating characteristics, and operate and release time, shall be measured as specified in 4.11.6, 4.11.8.1, and 4.11.8.4, respectively. Operating characteristics shall be measured in only one plane.

d. Examination after test: Relays shall be visually examined for cracking, peeling, and flaking of the finish, and the dielectric withstanding voltage shall then be measured as specified in 4.11.7.

4.11.10. **Shock (specified pulse; see 3.6.5).**

Relays shall be tested in accordance with MIL-STD-202, method 213. The following details and exceptions shall apply:

a. Mounting method: Rigidly mounted by normal mounting means.

b. Test condition: As applicable (see 3.1).

c. Coil energization conditions:

(1) **Non-latching relays.** In each direction of shock, the coils shall be de-energized during two shock pulses and energized with rated coil voltage during one shock pulse.

(2) **Latching relays.** In each direction of shock, there shall be two shock pulses in the set position and two shock pulses in the reset position; coil voltage shall not be applied during these shock pulses.

d. Measurements during shock: Contacts shall be monitored by a suitable means. The test circuit shall verify that no opening of closed contacts in excess of 10 µs and no false closure or abnormal bridging of open contacts occurs in excess of 1 µs. The contact load shall be 10 mA maximum at 6 V d.c. maximum or peak a.c.

e. Examination after test: Relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relays.

4.11.11. **Vibration (see 3.6.6).**

4.11.11.1. **Vibration (sinusoidal).**

Relays shall be tested in accordance with MIL-STD-202, method 204. The following details and exceptions shall apply:

a. Mounting method: Rigidly mounted by normal mounting means.

b. Test condition D, except vibration level is the lesser of 0.195 inch double amplitude or 30 G peak, unless otherwise specified (see 3.1) and the frequency range shall be 10 Hz to 3,000 Hz.

c. Coil energization conditions:

(1) **Non-latching relays.** Non-latching relays shall be tested with the coil energized at rated voltage for 2 hours, and with the coil de-energized for 2 hours, in each of the three mutually perpendicular directions.

(2) **Latching relays.** Latching relays shall be tested in each latched position for 2 hours with no voltage applied to the coils, in each of three mutually perpendicular directions.

d. Measurements during vibration: Contacts shall be monitored by a suitable means. The test circuit shall verify that no opening of closed contacts in excess of 10 µs and no false closure or abnormal bridging of open contacts occurs in excess of 1 µs. The contact load shall be 10 mA maximum at 6 V d.c. maximum or peak a.c.

e. Measurements after vibration: At the end of each vibration sweep, prior to removal from test fixture and without disturbing the relay, the following tests shall be performed:

(1) **Non-latching relays.** Apply over the temperature range specified pickup voltage (see 3.1) to the coil, then verify that the relay contacts transfer. Remove the coil voltage, then verify that the relay contacts transfer.

(2) **Latching relays.** Apply over the temperature range specified set voltage (see 3.1) to the set coil, then verify that the relay contacts transfer. Apply over the temperature range specified reset voltage (see 3.1) to the reset coil, then verify that the relay contacts transfer.

Failure of the relay contacts to transfer shall be cause for rejection.

f. **Screening and Electrical Measurements Vibration test.** Only one cycle shall be performed over the frequency range from 100 Hz to 3,000 Hz, unless otherwise specified (see 3.1). The relay shall be vibrated in the direction of contact motion. As an option, the relay production lot may be divided in three equal groups and each group shall be tested in one of three mutually perpendicular axes. When relays are tested as specified in the optional procedure, a failure of any relay in any axis shall require 100 % inspection of all relays in the production lot in each axis.

(1) **Non-latching relays.** Non-latching relays shall be tested with the coil energized at rated voltage for 5 minutes during the up sweep (100 Hz to 3,000 Hz), and with the coil de-energized for 5 minutes during the down sweep (3,000 Hz to 100 Hz).

(2) **Latching relays.** Latching relays shall be tested in the set position for 5 minutes during the up sweep, and in the reset position for 5 minutes during the down sweep, with no voltage applied to the coils.

g. Examination after test: After removal from the test fixture, relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relay.

4.11.11.2. **Vibration (random).**

Relays shall be tested in accordance with MIL-STD-202, method 214. The following details and exceptions shall apply:

a. Mounting method: Rigidly mounted by normal mounting means.

b. Test condition: Table I, test condition G (0.4 G^2/Hz, 23.9 G r.m.s.).

c. Coil energization conditions:

(1) **Non-latching relays.** Non-latching relays shall be tested with the coil energized at rated voltage for 15 minutes and with the coil de-energized for 15 minutes, in each of the three mutually perpendicular axes.

(2) **Latching relays.** Latching relays shall be tested in each latched position for 15 minutes with no voltage applied to the coils, in each of three mutually perpendicular axes.

d. Measurements during vibration: Contacts shall be monitored by a suitable means. The test circuit shall verify that no opening of closed contacts in excess of 10 µs and no false closure or abnormal bridging of open contacts occurs in excess of 1 µs. The contact load shall be 10 mA maximum at 6 V d.c. maximum or peak a.c.

e. Measurements after vibration: Prior to removal from test fixture and without disturbing the relay, the following tests shall be performed:

(1) **Non-latching relays.** Apply over the temperature range specified pickup voltage (see 3.1) to the coil, then verify that the relay contacts transfer. Remove the coil voltage, then verify that the relay contacts transfer.

(2) **Latching relays.** Apply over the temperature range specified set voltage (see 3.1) to the set coil, then verify that the relay contacts transfer. Apply over the temperature range specified reset voltage (see 3.1) to the reset coil, then verify that the relay contacts transfer.

Failure of the relay contacts to transfer shall be cause for rejection.

f. Examination after test: After removal from test fixture, the relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relay.

4.11.12. **Vibration miss test (see 3.6.7).**

Relays shall be subjected to a 5,000 cycle sinusoidal vibration miss test at 16.6 ± 0.5 Hz, and 0.4 ± 0.04 inches double amplitude. The following details apply:

a. Mounting method: Rigidly mounted by normal mounting means.

b. Coil energization conditions: The coil(s) shall be energized and cycled at nominal rated voltage (see 3.1).

c. Cycling Rate: The relay shall be cycled at a rate 0.1 Hz below the nominal vibration frequency.

d. Contact loading**:** Relays shall have the contacts loaded as follows: open circuit load voltage 10 to 50 mV d.c. or peak a.c., load current 10 to 50 µA.

e. Monitoring**:** Contacts shall be monitored for a minimum of 50% of the actual opened and closed time of each contact. The resistance of closed contacts shall not exceed 33 ohms for more than 20 microseconds during the monitored time period. The voltage across an open contact shall not drop below 50% of the open circuit voltage for more than 500 microseconds during the monitored period.

f. Number of misses allowed**:** None.

g. The vibration shall be applied through each of three axes. The three axes shall be normal to each other, with two of the axes in the seating plane of the relay. One of these axes will be aligned with the header tab of the relay.

h. Test duration: 5 minutes ± 10 seconds per axis.

4.11.13. **Salt atmosphere (corrosion; see 3.6.11).**

Relays shall be tested in accordance with MIL-STD-750, method 1041. The following detail shall apply:

a. Examination after test: Relays shall be examined for evidence of peeling, chipping, blistering of the finish, and exposure of base metal due to corrosion which may affect life or serviceability.

4.11.14. **Intermediate current (see 3.6.14).**

Relays shall be tested as specified in MIL-STD-202, method 312. The following details and exceptions shall apply:

a. Maximum contact resistance: As specified in 3.6.14.

b. Coil energizing voltage: Rated voltage (see 3.1).

c. Cycling rate: 10 ± 2 cycles per minute with minimum of 75 % coil "on" time.

d. Contact load: 100 mA at 28 V dc.

e. Monitoring conditions: Contact resistance shall be monitored during 40 % minimum of the closed time of each contact during each cycle, within the latter 50 % of the closed time.

f. Number of cycles: 50,000 cycles.

g. Ambient temperature: +125 °C.

4.11.15. **Mechanical life (see 3.6.15).**

Relays shall be cycled 1,000,000 cycles at room ambient temperature. The minimum cycle time shall be 10× the sum of the maximum operate and release times for non-latching relays, 10× twice the maximum operate time for latching relays for the relay under test. Each contact load shall be 10 µA to 50 µA at 10 mV d.c. to 50 mV d.c. or peak a.c. Contact monitoring is not required. The coil shall be energized at rated voltage during 50 % ± 10 % of each cycle.

4.11.16. **Resistance to solvents (see 3.6.16).**

Relays shall be tested in accordance with MIL-STD-202, method 215. The following details and exceptions shall apply:

a. The temperature of solvents a and d shall be maintained at +63 °C to +70 °C.

b. Portion to be brushed: All marking.

c. Optional procedure for solvent d is not applicable.

d. Solvent b is not applicable.

e. Specimens to be tested: One specimen using each solvent solution. A total of three specimens shall be used.

f. Examination: Specimens shall be examined for legibility of marking.

4.11.17. **Resistance to soldering heat (see 3.6.10).**

Relays shall be tested in accordance with MIL-STD-202, method 210. The following details and exception shall apply:

a. Depth of immersion in molten solder: Within 0.060 in. ± 0.020 in. (1.53 mm ± 0.508 mm) of the seating plane of the relay.

b. Test condition B.

c. Measurements after test: Insulation resistance, contact resistance, operating characteristics, coil resistance or coil current , as applicable, shall be measured as specified in 4.11.6, 4.11.8.5.1, 4.11.8.2 and 4.11.8.3, respectively.

d. Examination after test: Relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relays.

4.11.18. **Overload (see 3.6.12).**

Relay contacts (both normally open and normally closed) shall be subjected to the following test. For double-throw relays, separate tests shall be performed for the normally open and the normally closed contacts. The number of operations shall be 100 for d.c. contact loads, with approximately equal "on" and "off" times. The coil shall be energized at rated voltage. Overload current shall be twice the highest rated resistive load current. Contact monitoring is not required during the overload test. The relay case shall be connected to system ground through normal-blow fuse rated at 5 % of the test current or 100 mA, whichever is greater. After the test, the fuse shall be tested for electrical continuity.

Suitable non-inductive loads shall be used. Cycling rate shall be 20 ± 2 cycles per minute (cpm).

Post overload test electrical performance characteristics are allowed to have a 10% variance from the initial allowable limits, unless otherwise specified.

4.11.19. **Life (see 3.6.13).**

Unless otherwise specified (see 3.1), relays shall be cycled for 100,000 cycles with contacts loaded in accordance with 4.11.19.1 through 4.11.19.4, as applicable, with approximately equal "on" and "off" times. Relay coil energization shall be non-synchronous with the power supply for a.c. loads. Each relay case shall be connected to system ground through an individual normal-blow fuse rated at the greater of 100 mA or 5 % of load current. Ambient temperature of relays shall be +125 °C minimum. Each contact shall be monitored during each operation in accordance with 4.11.3.2.2. All contacts in each sample unit shall switch identical loads. Following cycling, the electrical continuity of each case-grounding fuse shall be checked.

Post life test electrical performance characteristics are allowed to have a 10% variance from the initial allowable limits, unless otherwise specified.

4.11.19.1. **Resistive load.**

Suitable non-inductive loads shall be used. Cycling rate shall be 20 ± 2 cycles per minute (cpm). Current shall be rated resistive current as specified (see 3.1).

4.11.19.2. **Inductive load.**

Current shall be rated current. Appropriate inductive load components shall be used. A suitable resistor may be placed in the circuit to obtain rated steady-state current flow. Surge suppression should be included in the circuit to assure that circuit transient surges are not in excess of the contact ratings. Cycling rate shall be 10 ± 1 cycles per minute. Unless otherwise specified, d.c. inductive loads shall be computed in accordance with the following procedure:

a. The relay shall be mounted on a non-magnetic surface with no immediately adjacent metal.

b. The load circuit shall be energized through a bounce free contact from a power supply regulated to within 5 % of the specified rated voltage, using an acceptable means.

c. By measuring the time for the current to reach 63 % of its final value (see Figure 3), the d.c. inductance is calculated as:

$$L = R \cdot t,$$

where

L = inductance (H)
R = load resistance (Ω)
t = time (s) for current to reach 63 % of its final value

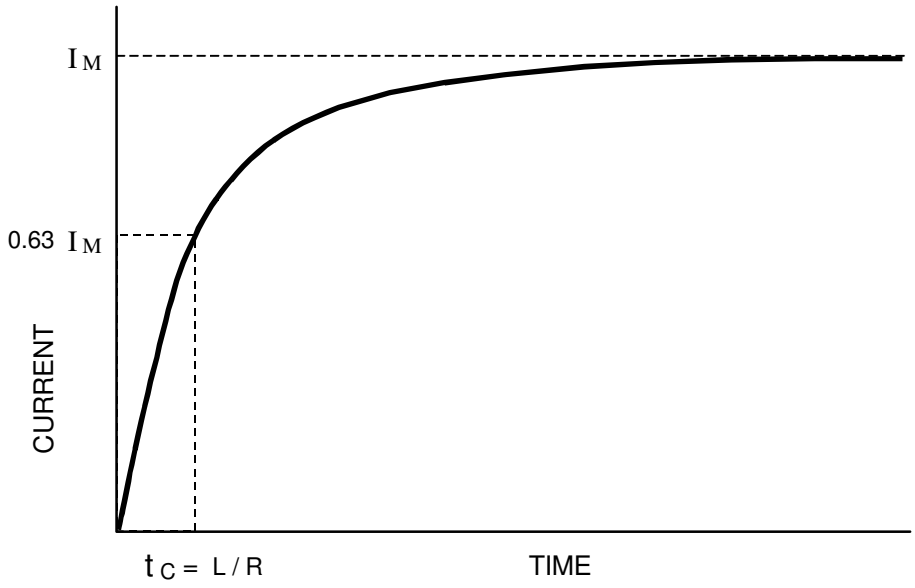


Figure 3. d.c. Inductive Load (Inductive Current Rise Time Curve)

4.11.19.3. **Lamp load.**

Unless otherwise specified, the lamp load test shall be performed with a 28 V d.c. power supply and with lamps rated for 100 mA at 28 V. Relays shall be used to turn on and turn off the lamps for the specified number of cycles (see 3.1). The "on" time shall be 2 seconds ± 0.05 seconds and the "off" time shall be 7 seconds ± 0.05 seconds.

Industrial grade incandescent lamps shall be used for the lamp load test. The lamps shall have an initial cold (room ambient temperature) inrush current of 12 times the rated lamp load.

4.11.19.4. **Low level load.**

The minimum cycle time shall be 10× the sum of the maximum operate and release times for non-latching relays, 10× twice the maximum operate time for latching relays for the relay under test. Each contact load shall be 10 µA to 50 µA at 10 mV d.c. to 50 mV d.c. or peak a.c. The coil shall be energized at rated voltage during 50 % ± 10 % of each cycle.

4.11.20. **Terminal strength (see 3.6.8).**

Relays shall be tested in accordance with MIL-STD-202, method 211 in accordance with the following, as applicable. Unless otherwise specified herein, two terminals of each relay shall be tested.

4.11.20.1. **Pull test.**

Terminals shall be tested as specified in test condition A and the force shall be 1 lb.

4.11.20.2. **Bend test.**

Terminals shall be tested as specified in test condition C. Loads shall be ½lb.

4.11.20.3. **Twist test.**

All terminals shall be tested as specified in test condition D, except during application of torsion, each terminal shall be rotated 45°, then returned to start. Each terminal shall be subjected to two such rotations and returns. Each terminal shall be held at a point ¾in. from the point of emergence from the relays and in one plane shall be bent 20° ± 5° in one direction, then returned to start; bent in the opposite direction 20° ± 5°, then returned to start. This procedure shall then be repeated in the perpendicular plane.

Following these tests, relays shall be examined for evidence of loosening or breaking of the terminals and other damage that could adversely affect the normal operation of the relay.

4.11.21. **Coil life (see 3.6.9).**

Non-latching relays shall be tested for 1,000 hours, and latching relays shall be tested for 500 hours for each coil, as follows (see Figure 4):

a. Method of connection: Relays shall be mounted in an appropriate test socket. Each contact terminal shall be connected at approximately inch from the emergence of the lead from the seating plane of the relay. The provisions of 4.6.5 apply.

b. Test conditions: Ambient temperatures shall be varied as shown in Figure 6, with heating and cooling rates not to exceed 1 °C/s average. For latching relays, the test shall be repeated with each coil serving as the operating coil.

c. Coil energization and contact loading conditions:

(1) **Non-latching relays.** During the +125 °C portion of the test, rated coil voltage (see 3.1) shall be applied continuously and at least half of the normally open contacts shall carry rated current. During +25 °C and –65 °C exposures, the coil shall be de-energized and contacts shall not be loaded.

(2) **Latching relays.** During the +125 °C portion of the test, rated coil voltage (see 3.1) shall be applied continuously to the operating (set or reset) coil and at least half of the normally open contacts shall carry rated current. At the +25 °C and -65 °C exposures, the non-operating (reset or set) coil shall be pulsed with rated voltage to establish contact position. During the +25 °C and –65 °C exposures, coil voltage shall not be applied and contacts shall not be loaded.

d. Measurements during test:

(1) **Non-latching relays.** After the first 100 hours, and while still at -65 °C, contact resistance, operate and release time, shall be measured as specified in 4.11.8.5.1, 4.11.8.4 respectively, and the values shall be recorded. Measurements of coil resistance or coil current, as applicable, and contact resistance as specified in 4.11.8.2 or 4.11.8.3, and 4.11.8.5.1, respectively, shall be taken at +25 °C initially, then again after 250 hours ± 25 hours, 500 hours ± 25 hours and 750 hours ± 25 hours and the values shall be recorded. Operating characteristics (only in the special mounting plane; see 4.6.5) measurements shall be made as specified in 4.11.8.2, during the last temperature cycle after allowing the relays to stabilize, de-energized, at each of the temperature extremes, and the value shall be recorded.

(2) **Latching relays.** After the first 50 hours, and while still at -65 °C, contact resistance and operate time shall be measured as specified in 4.11.8.5.1 and 4.11.8.4, respectively, and the values shall be recorded. Measurements of coil resistance or coil current, as applicable, and contact resistance as specified in 4.11.8.2 or 4.11.8.3, and 4.11.8.5.1, respectively, shall be taken at +25 °C initially, then again after 125 hours ± 12.5 hours, 250 hours ± 12.5 hours and 375 hours ± 12.5 hours and the values shall be recorded. Specified set/reset voltage (only in the special mounting plane; see 4.6.5) measurements shall be made as specified in 4.11.8.1.2 during the last temperature cycle after allowing the relays to stabilize, de-energized, at each of the temperature extremes, and the value shall be recorded.

e. The following measurements after test shall be taken at room ambient temperature: Dielectric withstanding voltage, insulation resistance, contact resistance, coil resistance or coil current, as applicable, operate and release time, and contact bounce time shall be measured as specified in 4.11.7, 4.11.6, 4.11.8.5.1, 4.11.8.2 or 4.11.8.3, 4.11.8.4, and 4.11.8.5.2, respectively.

f. Examination after test: Relays shall be examined for evidence of structural failure or other damage which might impair the operation of the relay.

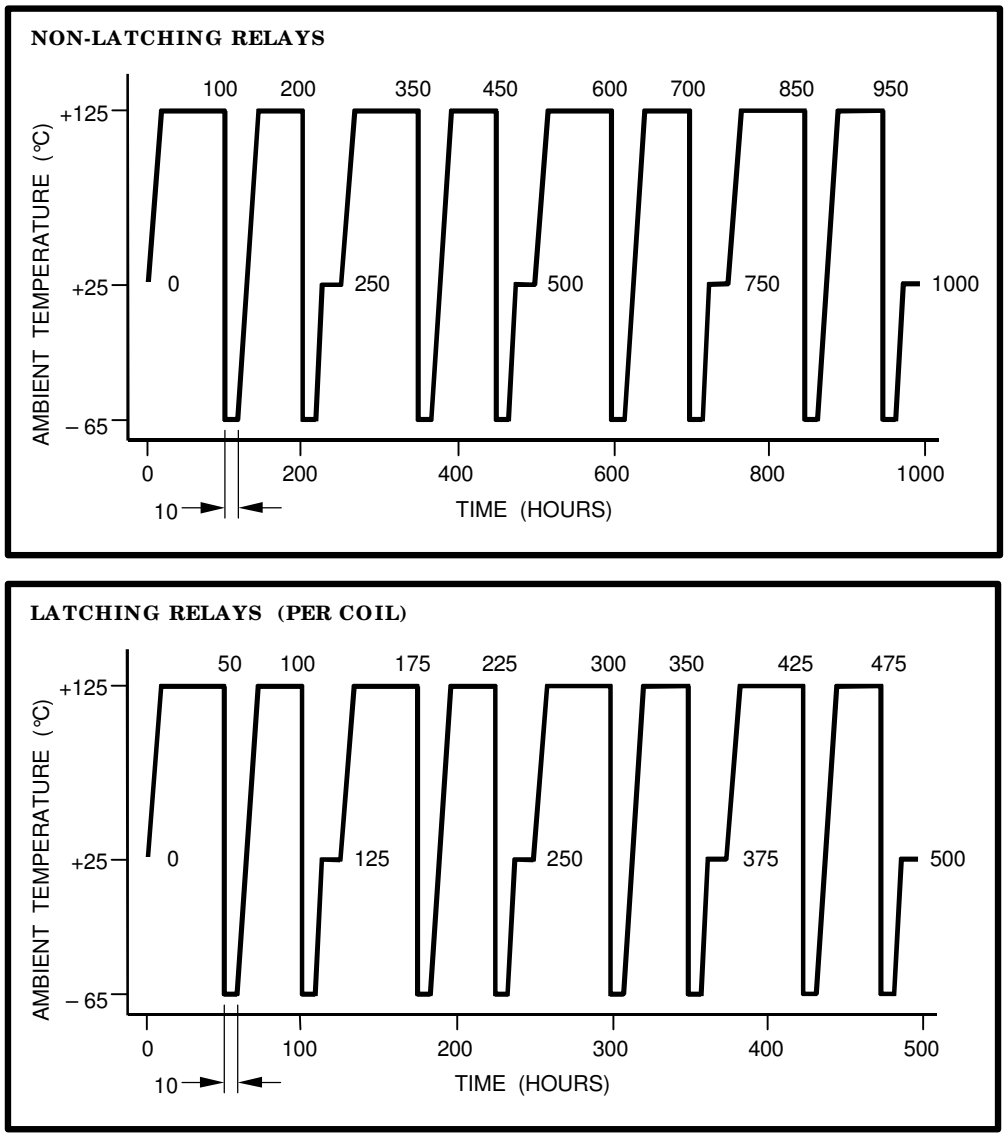


Figure 4. Coil Life Test Ambient Temperatures

4.11.22. **Radiographic Inspection (see 3.6.20).**

Each relay shall be examined to determine proper internal construction in accordance with the requirements of Teledyne Relays' Procedure 0-40-193, which must be approved by the Orderer.

4.11.23. **Particle Impact Noise Detection (PIND) Test (see 3.6.21).**

When specified, each relay shall be subjected to a PIND test capable of detecting the presence of loose particles within the relay enclosure in accordance with the requirements of Teledyne Relays' Procedure 0-40-824, which must be approved by the Orderer. Relays so tested shall exhibit no evidence of loose particle contamination.

5. DOCUMENTATION

Each delivered inspection lot shall be accompanied by a data package, which shall include the items listed below as a minimum. The data package shall be preferably grouped as indicated below.

- Cover Sheet
- Final Production Test Data
- Screening Tests and Electrical Measurement Data
- Lot Acceptance Test Data Report (when applicable)
- Failure Analysis Report (when applicable)
- Certificate of Conformance

5.1. Cover Sheet.

As a minimum, the cover sheet shall have the following information:

a. This specification number (TR-HIREL-1) and issue

b. Detail specification number (e.g. TR-HIREL-1/412) and issue

c. Teledyne Relays' Part Number (see 3.1)

d. The Orderer's Part Number (if applicable)

e. Lot Number

f. Quantity

g. Relay coil voltage (V d.c.)

h. Range of serial numbers

i. Purchase Order number (Teledyne Relays' and The Orderer's)

j. Additional information if the order specifies deviations from the detail or general specifications

k. Teledyne Relays' name and address

l. Signature on behalf of Teledyne Relays

m. Total number of pages of the data package.

5.2. **Final Production Test Data.**

Summary of the attributes data shall be provided indicating the total number of relays submitted to Final Production Tests and the total number of relays rejected upon completion of each of the tests specified in Table 1. If additional documentation exists to support the performance of tests and inspections specified in Table 1, it need not be delivered. However, certification stating that the data is available for review shall be placed in the data package.

5.3. **Screening Tests and Electrical Measurement Data.**

In addition to the requirements stated in 5.2, the actual values obtained during electrical measurements stated in Table 2 at temperature extremes and at room ambient temperature shall be recorded. All data shall be related to the relevant serial numbers. Any applicable decoder sheets used to correlate recorded values shall also be included.

5.4. **Lot Acceptance Test Data.**

In addition to the requirements stated in 5.2 and 5.3, the actual values obtained during electrical measurements stated in Tables 3, 4, or 5 as applicable, at temperature extremes and at room ambient temperature shall be recorded. All data shall be related to the relevant serial numbers. Any applicable decoder sheets used to correlate recorded values shall also be included.

5.5. **Failure Analysis Report.**

If requested by the Orderer (see 4.8), a Failure Analysis report shall be provided.

5.6. **Certificate of Conformance.**

Teledyne Relays shall certify that all requirements of the applicable Purchase Order are met.

6. PACKAGING

Relays provided against this specification shall be packaged in such a manner that they are:

a. adequately safeguarded against damage under normal shipping conditions,

b. suitable for storage,

c. easily identified.

6.1. Preservation.

Preservation is not applicable. Relays shall be generally clean and free of grease, oils, etc.

6.2. Packaging.

6.2.1. Primary Package.

Each relay shall be enclosed in a primary container, which shall provide adequate protection to prevent damage under normal shipping conditions and be easily opened without the need for special tools, and whenever practicable, re-packaging shall be possible.

6.2.2. Intermediate Package.

Intermediate packages shall only contain relays in their primary package, of the same part number and lot date code. Intermediate packages shall be easily opened, leaving the enclosed relays intact in their primary packages, without the need for special tools. Whenever practicable, re-packaging shall be possible.

6.2.3. Shipping Container.

For delivery to the Orderer, one or more intermediate packages shall be assembled into a final shipping container. Whenever physically possible, the size of a shipping container shall be such that it can be handled by one person.

The design of the shipping container shall be such that the bulk and weight are kept to a minimum, consistent with affording adequate protection under normal shipping conditions. Dunnage shall be used as applicable. The relevant packing slip shall accompany the shipping container.

6.3. **Package Marking.**

It is essential that there is ready and accurate identification of the relays within a given package.

6.3.1. **Primary Package.**

If the relay marking is not readily visible though the primary package, the following data shall appear on the primary package:

a. Teledyne Relays' Part Number (see 3.1)

b. The Orderer's Part Number (if applicable)

c. Relay voltage and contact rating (see 3.2.3 and 3.3.1)

d. Lot Number

e. Serial Number

f. Quantity

g. Date when packaged

Relays used during Sample Tests (e.g. Lot Acceptance Test samples) shall be properly annotated as such and shall be separated from the rest of the inspection lot.

6.3.2. **Intermediate Package.**

Intermediate packages shall be marked with all the data specified in 6.3.1. Serial numbers may be shown as a range if consecutive, but must be individually listed if not.

6.3.3. **Shipping Container.**

Shipping containers shall bear all pertinent information regarding Purchase Order and any particulars necessary for Customs clearance (if applicable).

7. NOTES

7.1. Intended use.

Relays conforming to this specification are intended for high reliability applications generally involving electronic and communications equipment.

7.1.1. Precautions.

a. Each relay possesses high level and low level capabilities. However, relays previously tested or used above 10 mA resistive at 6 V d.c. maximum or peak a.c. open circuit are not recommended for subsequent use in low level applications.

b. The use of any coil voltage less than the rated coil voltage may affect the electrical and dynamic characteristics of the relay.

c. For a double-throw contact configuration, the moving contact should not be used to transfer the load from ground to 115 V a.c., between phases, nor between unsynchronized a.c. sources.

d. When used in application at high level loads, surge current protection is recommended.

e. When latching relays are installed in equipment, the set and reset coils should not be pulsed simultaneously. Coils should not be pulsed with less than the rated coil voltage and the pulse width should be a minimum of three times the specified operate time of the relay.

7.1.2. Contact rating.

The contact ratings of relays covered by this specification are based on load endurance tests which establish the relay capability to switch rated loads.

7.2. **Glossary.**

The definitions listed below are not a complete glossary of relay terminology, but rather are intended as definitions of the technical terms as applied within the specification.

Coil	A wire assembly wound around an insulating bobbin or spool.
Contact arrangement	The combination of contacts that make up the entire relay switching structure.
Contact bounce	Internally caused intermittent and undesired opening of closed contacts, or closing of open contacts.
Contact bounce time	The interval between first make of the contact until the uncontrolled opening and closing of the contact ceases.
Contact chatter	The momentary opening of a closed contact due to external shock or vibration.
Contact force	The force exerted by a movable contact against its matching stationary contact when the contacts are closed.
Contact gap	The minimum distance between a moving contact and its matching stationary contact when the contacts are open.
Contact Stabilization Time	The interval between the first closure of a contact until the contacts reach and maintain a static contact resistance state.
Contact weld	The fusing of contacts, resulting in their failure to open.
Contacts	The current-carrying parts of a relay that open or close electrical circuits.
Cycle, relay	One opening and one closure of a contact set. One cycle consists of two operations.
Dropout voltage, specified	As the voltage on an energized relay is decreased, the voltage at or above which all relay contacts must return to their de-energized positions. Not applicable to latching relays.
Electromechanical relay	A relay in which the motion of the contacts are dependent upon the magnetic attraction or repulsion of an armature to or from a pole face. The magnetic force is generated by a coil which may or may not incorporate suppression and/or polarity reversal protection methods.
Hermetically sealed relay	A relay contained within an enclosure that is sealed by welding to insure a low rate of gas leakage.

7.2. **Glossary (cont'd).**

Inspection lot	A grouping of relays based upon their similarity in manufacturing process characteristics and screening requirements submitted for inspection at one time.
Latching (bistable) relay	A two-position relay whose contacts transfer only as a result of coil energization of a particular coil, remain in that position with no coil energization, and transfer to the alternate position only as a result of coil energization of the other coil.
Miss	Failure to establish the intended contact conditions.
Neutral position	An anomalous state in latching (bistable) relays normally produced by insufficient coil signal or simultaneous pulsing of set and reset coils. Analogous to "don't care" condition in electronic latches. This condition is not harmful to the relay.
Normal mounting means	A method of mounting whereby an intended test is performed on a relay and the fixture(s) employed adequately supports the relay and neither attenuates nor amplifies the intended condition.
Normally closed contact	Those contacts that are closed with the relay de-energized. Not applicable to latching relays.
Normally open contact	Those contacts that are open with the relay de-energized. Not applicable to latching relays.
Operate time	The interval between the application of an input signal and first closing of a normally open contact. Bounce time is not included.
Operation, relay	One opening or closure of a contact set. One relay operation is one-half of a cycle.
Output	The circuit within a relay which controls an external load circuit and is changed from a conducting to a non-conducting state (and vice versa) by the relay operation.
Pickup voltage, specified	As the current or voltage on a de-energized relay is increased, the voltage at or below which all contacts must achieve their energized positions.
Polarized relay	A relay, the operation of which is primarily dependent upon the direction (polarity) of the energizing current(s) and the resultant magnetic flux.
Production lot	A grouping of relays released for production as a single lot.

7.2. **Glossary (cont'd).**

Rated coil voltage	The coil voltage at which the relay is designed to operate and meet all specified electrical, mechanical and environmental requirements.
Relay	An electrically controlled switch.
Release time	The interval between the removal of an input signal and first closing of a normally closed contact. Bounce time is not included. Not applicable to latching relays.
Reset Voltage	The voltage required to return the contacts of a latching relay from a set position to a specified initial condition. There is no universally defined reset position.
Saturation	The condition attained in a magnetic material when an increase in magnetizing (coil) current produces no appreciable increase in flux.
Set Voltage	The voltage required to change the contact position of a latching relay from a specified initial condition. There is no universally defined set position.
Supply voltage	The voltage source that supplies power to drive the relay coil.

Document Change History

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