SAE Aerospace
An SAE International Group

AEROSPACE
RECOMMENDED
PRACTICE

ARP4768

REV.
A

Issued   1993-04
Revised   2007-07

Superseding ARP4768

(R) Automatic Test Equipment, Relays Not Fully Rated
25 Amperes or Greater

RATIONALE

Five-Year Review and update of SAE ARP4768.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) is intended to be a guide for defining automatic test equipment (ATE) methods to be used in performing electrical acceptance tests to ensure repeatability and compatibility of results between manufacturers and between manufacturer and user.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 U.S. Military Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257; http://assist.daps.dla.mil/quicksearch/.

MIL-R-5757   Relays, Electromagnetic, General Specification for

MIL-PRF-6106   Relays, Electromagnetic, General Specification for

MIL-PRF-28776   Relays, Hybrid, Established Reliability, General Specification for

MIL-PRF-39016   Relays, Electromagnetic, Established Reliability, General Specification for

MIL-PRF-83536   Relays, Electromagnetic, Established Reliability, General Specification for

MIL-DTL-83725   Relays, Vacuum, General Specification for

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
                                    Tel: 724-776-4970 (outside USA)
                                    Fax: 724-776-0790
                                    Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

MIL-STD-202   Test Methods for Electronic and Electrical Component Parts

MIL-STD-704   Aircraft Electric Power Characteristics

2.1.2   ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI Z-540   Calibration Systems Requirements

ANSI Y10.19   Letter Symbols for Units Used in Science and Technology

ANSI/IEEE STD 100   IEEE Standard Dictionary of Electrical and Electronic Terms

2.1.3   ECA Publications

Available from ECA, 2500 Wilson Boulevard, Arlington, VA 22201, Tel: 703-907-8024, www.ec-central.org.

Engineer's Relay Handbook

2.2   Definitions

The definitions as stated in the Engineer's Relay Handbook shall apply unless otherwise stated herein.

3.   PERFORMANCE REQUIREMENTS

3.1   It is the intent of this document to adequately define test equipment capable of performing the electrical tests of relays not fully rated 25 A or more. These tests must be capable of performing without human assistance, except where specifically noted, and of recording the actual test results on electronic media and/or hard copy print out.

3.2   Pickup Voltage (Nonlatching Type Relays)

Pickup voltage shall be measured on the ATE by either linear ramp or step voltage methods as follows.

3.2.1   Linear Ramp Method

3.2.1.1   Procedure

Apply the coil voltage in a steady, linear increasing manner until all contacts transfer, i.e., when all NC contacts open and/or all NO contacts close (pickup voltage).

NOTE: The coil voltage ramp may be started at a value other than zero (programmed value) in order to facilitate the testing time, and must end by the maximum rated coil voltage as a safety feature.

3.2.1.2   ATE Details

The ATE shall be capable of providing a programmable value of slope rate equal to 25% ± 5% of rated volts/second. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC maximum open circuit voltage. The data returned from this test shall be the value at which all contacts transfer and pass/fail indication.

3.2.2   Step Method

3.2.2.1   Procedure

Step the coil voltage directly to the specified pickup voltage value, checking for pickup voltage completion, i.e., when all NO contacts open and/or all NO contacts close.

3.2.2.2   ATE Details

The ATE shall be capable of providing a single drive value. Any subsequent stepping must end by the maximum rated coil voltage as a safety feature. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC open circuit voltage maximum. The data returned from this test shall be a pass/fail indication only.

3.3   Latch and Reset Voltage (Latching Type Relays)

Latch or reset voltage shall be measured on the ATE by either linear ramp or step voltage methods as follows.

3.3.1   Linear Ramp Method

3.3.1.1   Procedure

Apply rated coil voltage to establish the last energized (or reset) position of the contacts. Apply voltage to the latch coil as in 3.2.1. At the completion of the measurement apply rated coil voltage to the latch coil. Apply voltage to the reset coil as in 3.1.1. At the completion of the measurement apply rated coil voltage to the reset coil.

3.3.1.2   ATE Details

Same as in 3.2.1.

3.3.2   Step Method

3.3.2.1   Procedure

Apply rated coil voltage to establish the last energized (or reset) position of the contacts. Apply voltage to the latch coil as in 3.2.2. At the completion of the measurement apply rated coil voltage to the latch coil. Apply voltage to the reset coil as in 3.1.2. At the completion of the measurement apply rated coil voltage to the reset coil.

3.3.2.2   ATE Details

Same as in 3.2.2.

3.4   Hold Voltage (Not Applicable to Latching Type Relays)

Hold voltage shall be tested on the ATE by either linear ramp or step voltage methods as follows.

3.4.1   Linear Ramp Method

3.4.1.1   Procedure

Rated voltage shall be applied to the coil then ramped toward zero until the first indication of change of state of any contact occurs.

3.4.1.2   ATE Details

The ATE shall be capable of providing a programmable slope rate equal to 25% ± 5% of rated volts/second. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC maximum open circuit voltage. The data returned from this test shall be the value of voltage at which the first indication of change of state of any contact occurs and pass/fail indications.

3.4.2   Step Method

3.4.2.1   Procedure

Rated voltage shall be applied to the coil, then stepped directly to the specified hold voltage, at which point no change of state of any contact shall have occurred.

3.4.2.2   ATE Details

The ATE shall be capable of providing a minimum of one drive value. The voltage stepping must include the rated or maximum rated (programmed value) as a safety feature. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC maximum open circuit voltage. The data returned from this test shall be a pass/fail indication only.

3.5   Dropout Voltage (Not Applicable to Latching Type Relays)

Dropout voltage shall be tested on the ATE by either linear ramp or step voltage methods as follows.

3.5.1   Linear Ramp Method

3.5.1.1   Procedure

Rated voltage shall be applied to the coil, then ramped toward zero until all contacts transfer, i.e., when all NC contacts close and/or all NO contacts open.

3.5.1.2   ATE Details

The ATE shall be capable of providing a programmable slope rate equal to 25% ± 5% of rated volts/second. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC maximum open circuit voltage. The data returned from this test shall be the value of voltage at which all the contacts transfer and pass/fail indication.

3.5.2   Step Method

3.5.2.1   Procedure

Rated voltage shall be applied to the coil, then stepped directly to the specified dropout voltage at which point all contacts shall have transferred.

3.5.2.2   ATE Details

The ATE shall be capable of providing a minimum of one drive value. The voltage stepping must include the rated or maximum rated (programmed value) as a safety feature. The ATE shall provide programmable values of contact loading no greater than 10 mA maximum, 6 V DC maximum open circuit voltage. The data returned from this test shall be a pass/fail indication only.

3.6   Coil Resistance (Applicable to Coils of DC Rated Relays without Steering Diodes)

Coil resistance shall be measured on the ATE. This test shall typically be the first performed to assure the measurement is made at the ambient temperature condition.

3.6.1   Procedure

A test current shall be applied through the relay coil or coils (for latching relays); the voltage drop measured and resistance calculated.

3.6.2   ATE Details

The ATE shall be capable of providing test currents of 10 madc (for coil resistance up to 5K ohms) and 1 madc (for coil resistance over 5K ohms). The duration of application of test current shall be the minimum necessary to effect an accurate measurement, without unnecessary heating of the coil. The data returned from this test shall be the resistance value calculated from the test currents and voltages and pass/fail indication.

3.7   KAC Coil Current (Applicable to Coils of AC Rated Relays)

AC coil current shall be measured on the ATE. This test shall typically be the first performed to assure the measurement is made at the ambient temperature condition.

3.7.1   Procedure

An AC test voltage shall be applied across the relay coil or coils (for latching relays); and the current measured.

3.7.2   ATE Details

The ATE shall be capable of programming the rated AC coil voltage. The duration of voltage application shall be the minimum necessary to effect an accurate measurement, without unnecessary heating of the coil. The data returned from this test shall be rms current measured and pass/fail indication.

3.8   DC Coil Current (Applicable to Coils with Steering Diodes)

DC coil current shall be measured on the ATE. This test shall typically be the first performed to assure the measurement is made at the ambient temperature condition.

3.8.1   Procedure

An AC test voltage shall be applied across the relay coil or coils (for latching relays); and the current measured.

3.8.2   ATE Details

The ATE shall be capable of programming the rated DC coil voltage. The duration of voltage application shall be the minimum necessary to effect an accurate measurement, without unnecessary heating of the coil. The data returned from this test shall be current measured and pass/fail indication.

3.9   Contact Voltage Drop

Contact voltage drop shall be measured on NO and NC contacts on the ATE.

3.9.1   Procedure

A DC test current shall be applied to each contact, in turn, through a four wire (Kelvin) socket connection and the resulting voltage drop measured.

3.9.2   ATE Details

The ATE shall be capable of providing currents and voltages over the range required by the applicable specification, either internally or externally (but controlled by the ATE). The contacts shall be switched "dry", i.e., contact current shall be off until the contacts are closed and stabilized. The ATE shall be programmable for the following:

a.   The number of contacts of the relay under test.

b.   The test current and voltage.

c.   The delay time between the time current is applied and voltage drop measured (the settings range shall be sufficient to enable the current supply to reach the programmed value before the voltage measurement is effected).

d.   The voltage drop range.

The ATE shall be capable of repeating this test consecutively any number of times. The data returned from this test shall be the measured value of voltage drop at the relay terminals of each contact and pass/fail indication.

3.10   Contact Resistance

Contact resistance shall be measured on NO and NC contacts on the ATE.

3.10.1   Procedure

A DC test current shall be applied to each contact, in turn, and the resulting voltage drop across each contact's terminals measured.

3.10.2   ATE Details

The ATE shall be capable of providing currents and voltages at the specified value per the applicable specification, either internally or externally (but controlled by the ATE). The contacts shall be switched "dry", i.e., contact current shall be off until the contacts are closed and stabilized. The ATE shall be programmable for the following:

a.   The number of contacts of the relay under test.

b.   The test current and voltage.

c.   The delay time between the time current is applied and voltage drop measured (the settings range shall be sufficient to enable the current supply to reach the programmed value before the voltage measurement is effected).

d.   The voltage drop range.

The ATE shall be capable of repeating this test consecutively any number of times. The data returned from this test shall be the calculated value of resistance through the terminals of each contact and pass/fail indication.

3.11   Operate (Latch and Reset) Time

Operate (latch and reset) time shall be measured on the ATE on each pole individually. The contact simultaneous operation requirement associated with operate (latch and reset) time shall be determined by way of ATE software.

3.11.1   Procedure

Rated voltage shall be applied to the coil, or each coil of a latching type relay, in turn, and the time interval between this application and contact transfer, i.e., when all NO movable contacts transfer to the NO fixed contacts, exclusive of any contact bouncing.

3.11.2 ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage; contact load levels; number of measurements, including a selection of either maximum, average, or peak reading, and the highest value of simultaneous operation. The data returned from this test shall be the measured value of time of each contact pole, exclusive of bounce, and pass/fail indication for timing and simultaneously.

3.12 Release Time (Not Applicable to Latching Type Relays)

Release time shall be measured on the ATE on each pole individually. The contact simultaneous operation requirement associated with release time shall be determined by way of ATE software.

3.12.1 Procedure

Rated voltage shall be applied to the coil, then removed, and the time interval between this removal and contact transfer, i.e., when all NC movable contacts transfer to the NC fixed contacts, exclusive of any contact bouncing.

3.12.2 ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage; contact load levels; number of measurements, including a selection of either maximum, average, or peak reading, and the highest value of simultaneous operation. The data returned from this test shall be the measured value of time of each contact pole, exclusive of bounce, and pass/fail indication for timing and simultaneously.

3.13 Contact Bounce Time (During Make)

Contact bounce time shall be measured on the ATE on all contacts, individually.

3.13.1 Procedure

Rated voltage shall be applied to the coil, or each of the latch and reset coils of a latching type relay, in turn, and the time interval between the first make of the operating contact and last make measured; the last make being defined as the last opening greater than 90% of the open circuit voltage with a pulse width of 10 µs or greater.

3.13.2 ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage, contact load levels, and number of measurements - including a selection of either average, maximum, or peak readings. The data returned from this test shall be the measured value of time of each contact and pass/fail indication.

3.14 Contact Break Bounce Time (Not Applicable to Latching Type Relays)

Break bounce time shall be measured on the ATE for all normally open contacts, individually.

3.14.1 Procedure

Rated voltage shall be applied to the coil, then removed, and the interval between the first break of the operating contact and the last break of the same contact measured; the last break being defined as the last opening greater than 90% of the open circuit voltage with a pulse width of 10 µs or greater.

3.14.2 ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage; contact load levels; and number of measurements - including a selection of average, maximum, or peak readings. The data returned from this test shall be the measured value of time of each contact and pass/fail indication.

3.15   Contact Stabilization Time

Contact stabilization time shall be measured on the ATE on all contacts, individually.

3.15.1   Procedure

Rated voltage shall be applied to the coil, or each of the coils of a latching type relay, in turn, and the time interval between the first make of the operating contact and the point wherein a specified contact resistance has been reached, measured (the sum of contact bounce and dynamic contact resistance above a specified value).

3.15.2   ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage and contact load levels. The data returned from this test shall be the measured value of time of each contact and pass/fail indication.

3.16   Coil Transient Suppression

Coil transient suppression shall be measured on the ATE on all applicable sets of coil terminals.

3.16.1   Procedure

Rated coil voltage shall be applied to all applicable sets of coil terminals in turn, immediately removed, and the resultant maximum induced voltage measured.

3.16.2   ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage. The data returned from this test shall be the measured value of voltage at each set of coil terminals and pass/fail indication.

3.17   Contact Bridging

Contact bridging shall be tested on the ATE for the normally open and normally closed contacts. For relays not designated as make-before-break, bridging is the condition where, during an operation, a contact makes on one side before all contacts break from the opposite side.

3.17.1   Procedure

Rated coil voltage shall be applied to the coil, then removed, or applied to each coil of a latching type relay, in turn.

3.17.2   ATE Details

The ATE shall be capable of providing programmable values of applied coil voltage. The data returned from this test shall be a pass/fail indication.

4.   ATE EQUIPMENT REQUIREMENTS

4.1   Hardware Specifications (Minimum)

4.1.1   Electrical Input to ATE

a.   Line Voltage: 115/230 V AC (±5%)

b.   Frequency: 50 to 60 Hz