CHAPTER 16

WEAPONS SYSTEMS TEST EQUIPMENT

Aviation ordnance personnel use test equipment in all phases of electrical testing of various weapons systems. The testing procedures used are required at specific maintenance levels, such as organizational, intermediate, and depot. Test equipment varies in complexity, from a small handheld tester to a very large and complex unit. Regardless of size or complexity, the purpose of the test equipment is to make sure that the weapon and the launching platform (aircraft) function correctly.

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to do the following:

1. Identify the test equipment used with aircraft weapons systems.
2. Recognize the purpose of test equipment used with aircraft weapons systems.
3. Recognize the safety precautions to follow while working with aircraft weapons systems test equipment.

TEST EQUIPMENT

Not all test equipment used will be described in this chapter, but several common piloted aircraft, countermeasures, maintenance/test assembly (ALM) and piloted aircraft, armament, maintenance/test assembly (AWM) testing sets will be. Also, the step-by-step procedures required to operate the test equipment are not listed. To perform a specific job, personnel need to be able to identify the equipment, know what it is used for, and know how it is used. The specific step-by-step procedures that should be followed when using test equipment can be found in applicable publications.

77/BN Digital Multimeters

The 77/BN digital multimeter (Figure 16-1) is a portable, multi-range, alternating current (ac) - direct current (dc), volt-ohm multimeter used for general electronic and electrical service. Multimeters are used to measure resistance (ohms) and voltage (ac or dc) in an electrical circuit. They are used to test aircraft circuits when no special test equipment is available, or when reasonably accurate measurements are required.

Figure 16-1 — 77/BN digital multimeter.
AN/ALM-286 Countermeasures Chaff Dispensing Set, Test Set Group

The Army/Navy (AN)/ALM-286 countermeasures chaff dispensing set, test set group consists of a transit case containing two stray voltage/flight line payload simulators (SV/FLPS). The SV/FLPS (Figure 16-2) is a portable load simulator used to count fire pulses and test for stray voltage in the air-launched expendable (ALE)-47 countermeasure dispensing system (CMDS). A minimum of two simulators is required for system testing.

Figure 16-2 — AN/ALM-286.

AN/ALM-290 Countermeasures Dispenser Test Set

The AN/ALM-290 is a portable load simulator used to count fire pulses and test for stray voltage in the ALE-47 CMDS. The AN/ALM-290 consists of two SV/IFLPS, in one transit case. Test set modes of operation include:

- Built-in-test (BIT)/stray voltage results—pass/fail
- Valid fire count—total valid fire pulses
- Valid fire list—dispenser pin numbers with valid fires
- Invalid fire list—dispenser pin numbers with invalid fires
- No fire list—dispenser pin numbers with no fires
**AN/ALM-291 Countermeasure Dispenser Test Set**

The AN/ALM-291 countermeasure dispenser test set (*Figure 16-3*) is a portable test set used at the organizational maintenance level for preflight testing of the AN/ALE-39 CMDS. The test set permits an end-to-end preflight check of the AN/ALE-39 CMDS and its associated equipment, including the CP-1293/ALR-67 radar warning processor/ALE-39 interface. The test set provides the capability to determine that the D-64/ALE-39 or D-65/ALE-39 dispenser housing does not have the potential for hazardous energy prior to installing a loaded block and printed wiring board payload module. Additional information on the AN/ALM-291 is contained in Countermeasure Dispensing System Test Set AN/ALM-291, NAVAIR 16-30ALM291-1.

*Figure 16-3 — AN/ALM-291.*
AN/AWM-42A Fuze Function Control Test Set

The AN/AWM-42A fuze function control test set (Figure 16-4) is used to check the dc fuzing capabilities of fuze function control circuits. It is used to check for continuity and resistance in the electric fuzing. The test set has its own power source. The AN/AWM-42A fuze function control test set is used on all Navy and Marine Corps aircraft that have electric fuzing capabilities.

More information on the AN/AWM-42A is contained in Fuze Function Control Test Set AN/AWM-42A, NAVAIR 16-30AWM42-1.

Figure 16-4 — AN/AWM-42A fuze function control test set.
AN/AWM-102 Firing Circuit Test Set

The AN/AWM-102 firing circuit test set (Figure 16-5) is a solid-state electronic test set that is used for flight line testing of the aircraft’s bomb release and missile firing circuits and for checking stray voltages prior to arming. The test set provides a GO/NO-GO indication for the circuit being tested. The AN/AWM-102 test set uses various test set adapters (Figure 16-6).

Additional information on the AN/AWM-102 is contained in Firing Circuit Test Set AN/AWM-102, NAVAIR 16-30AWM102-1.

Figure 16-5 — AN/AWM-102 firing circuit test set.
Figure 16-6 — AN/AWM-102 firing circuit test set adapters.

AN/AWM-103A Stores Management Subassembly Test Set

The AN/AWM-103A stores management subassembly test set is a weapon release and control test set designed to perform release and control testing. The test set is comprised of an electrical unit (EU) with case, and test set accessories with case. Through the use of various adapters, the test set mounts on the launcher rail and interfaces with the launcher/aircraft via the umbilical connectors. It provides signals to simulate a missile on the launcher/rack/pylon to provide indication of the operational status.

The test set is a piece of support equipment (SE) designed to perform weapon release and control testing on multiple aircraft platforms. Each designated platform should receive two test sets accompanied by the interconnecting groups (IGs) of adapters and cables peculiar to the aircraft and its weapon systems.

Electrical Unit with Case

The AN/AWM-103A consists of a transit case and the EU (Figure 16-7).

The case assembly stores and transports the EU.

The electrical unit contains the operational circuitry and software of the test set. It consists of an upper rail and lower housing. The upper rail provides physical mounting to the aircraft weapon station. The primary test interface (J1) and EU grounding point are located on the rail. The lower
housing contains the display and three front panel switches. The display provides readout of test data and test set information. The switches are an UP/DOWN switch, POWER switch, and Enter/Escape (ENT/ESC) switch. The UP/DOWN and ENT/ESC switches are used to select and display menu items and test results. The POWER switch is a circuit breaker that applies +28 volts direct current (Vdc) to the EU power circuitry.

Test Set Accessories

The test set accessories are the cables and adapters common to all platforms (Figure 16-8).

The components of the test set accessories are described as follows:

- Case assembly—stores and transports the test set accessories
- Power supply—provides 28 Vdc power to the test set for use in shop spaces; may be used to replace aircraft power when performing self-test, aircraft setup, test results review, software loading, and test results printing
- W1 cable, power—connects J3 of the EU to the aircraft power adapter in the appropriate IG during aircraft testing or J1 of the W6 wrap-around adapter during self-test
- W2 cable, RS-232—connects J2 of the EU to the serial port of a personal computer (PC); this setup used to download and store test results information from the test set
- W5 cable, grounding—connects grounding point on upper rail of the EU to a certified aircraft ground point
- W6 wrap-around test (WAT) adapter—connects to J1 of the EU and the W1 power cable to perform self-test; for certain aircraft, also connects to the W10 breech adapter cable for self-test
Interconnecting Groups and Associated Aircraft

Unique to each platform, IGs contain the necessary cables, adapters, and hardware that enable the test set to perform weapon systems release and control checks. More information on the AN/AWM-103A is contained in Test Set, Stores Management Subsystem AN/AWM-103A, NAVAIR 16-30AWM-103-1.

Wrap-Around Test Adapter

The WAT adapter (Figure 16-9 and Figure 16-10) is a set of passive adapters and cables that allows the aircraft avionics to perform release and control checks. The adapter used on the F/A-18E/F is for the BRU-32/BRU-33, High-Speed Anti-Radiation Missile (HARM), Maverick, Sparrow, Department of Defense Interface Standard (MIL-STD)-1760 interface Harpoon/Standoff Land Attack Missile (SLAM), Advanced Medium Range Air-to-Air Missile (AMRAAM), and BRU-55 for MIL-STD-1760 and non MIL-STD-1760 stores. The adapter used on the EA-18G is for the BRU-32, HARM, AMRAAM, and Tactical Aircrew Combat Training System (TACTS) pod.
Figure 16-9 — F/A-18E/F wrap-around test adapter set.
Figure 16-10 — EA-18G wrap-around test adapter set.
A/E-24T-230 Test Set

The A/E-24T-230 test set (*Figure 16-11*) is designed and developed to meet the functional, firing, and stray voltage testing requirements of the M61A1 and M61A2 20 millimeter (mm) gun firing systems. The test set is a portable GO/NO-GO tester, which allows quick connection and disconnection of the M61A1 and M61A2 gun firing connector via an adapter cable. The A/E-24T-230 test set checks two ranges of voltages: 21 to 28 Vdc and 240 to 290 Vdc.

*Figure 16-11 — A/E-24T-230 test set.*
TTU-304/E Guided Missile Test Set

The TTU-304/E guided missile test set (Figure 16-12) is used as an infrared (IR) source when performing AIM-9(series) Sidewinder missile tone checks. The TTU-304/E guided missile test set is used on all Navy aircraft that have Sidewinder missile capabilities.

Figure 16-12 — TTU-304/E guided missile test set.

Force Retention Gauge

The force retention gauge (Figure 16-13) is used to functionally check the bomb rack nose and tail arming solenoids. The applicable maintenance instruction manual should be used for the proper retention readings.

Figure 16-13 — Force retention gauge (typical).
**AN/GYQ-79A Test Program Set**

The AN/GYQ-79A common munitions built-in-test (BIT)/reprogramming equipment (CMBRE Plus) test program set (TPS) (*Figure 16-14*) is used alone or in conjunction with the ADU-891(V)1/E and ADU-892A/E adaptor group and its computer test set, the HRU-1128/U (W23) special purpose cable assembly, and the MX-12307/GYQ-79 cable assembly set.

![AN/GYQ-79A Test Program Set Diagram](image)

*Figure 16-14 — AN/GYQ-79A test program set.*

The AN/GYQ-79A (CMBRE Plus) TPS is portable munitions SE used to initiate munitions BIT, provide munitions BIT status, reprogram munitions operational flight programs (OFPs), load mission planning and Global Positioning System (GPS) crypto keys, and upload/download munitions data. The AN/GYQ-79A is composed of three boxes of components as shown in *Figure 16-14*. The current CMBRE-supported systems include Advanced Anti-Radiation Guided Missile (AARGM), air-launched aerial intercept guided missile (AIM)-9X, AMRAAM, Dual Mode Laser Guided Bomb (DMLGB), Joint Direct Attack Munition (JDAM)/Laser JDAM (LJDAM), Joint Standoff Weapon (JSOW), and SLAM Expanded Response (SLAM-ER) weapons.
ADU-891(V)1/E Computer Test Set Adapter

The ADU-891(V)1/E computer test set adapter (Figure 16-15) is used in conjunction with the CMBRE Plus TPS to perform a BIT or reprogram the AIM-9X and AMRAAM.

Figure 16-15 — ADU-891(V)1/E computer test set adapter.
ADU-892A/E Computer Test Set Adapter

The ADU-892A/E computer test set adapter (*Figure 16-16*) is used in conjunction with the CMBRE Plus TPS to test the laser portion of the WGU-53/B guidance kit and to perform a BIT or reprogram the DMLGB.

*Figure 16-16 — ADU-892A/E computer test set adapter.*
HRU-1128/U (W23) Special Purpose Cable Assembly
The HRU-1128/U (W23) special purpose cable assembly (*Figure 16-17*) is used in conjunction with the CMBRE Plus TPS to perform a BIT or reprogram multiple JDAMs.

![HRU-1128/U (W23) Special Purpose Cable Assembly](image1)

*Figure 16-17 — HRU-1128/U (W23) special purpose cable assembly.*

MX-12307/GYQ-79 (W24 and W25) Special Purpose Cable Assembly
The MX-12307/GYQ-79 (W24 and W25) special purpose cable assembly (*Figure 16-18*) is used in conjunction with the CMBRE Plus TPS to perform a BIT or reprogram the AARGM.

![MX-12307/GYQ-79 (W24 and W25) Special Purpose Cable Assembly](image2)

*Figure 16-18 — MX-12307/GYQ-79 (W24 and W25) special purpose cable assembly.*
A/E 37T-35A Common Rack and Launcher Test Set (CRALTS)

The common rack and launcher test set (CRALTS) (Figure 16-19) is an automatic/semiautomatic universal GO/NO-GO tester for various aircraft specific bomb racks, missile launchers, weapon rails, aircraft pylons, and other units under test (UUTs) that have been removed for maintenance verification/repair. The test set determines operational status of a UUT and provides fault isolation to defective shop replaceable assemblies (SRAs). The test set and adapter assemblies provide all cables, stimuli, and measurement equipment required for testing UUT.

Figure 16-19 — CRALTS.

The test set allows the technician to test, diagnose, troubleshoot, and perform operational and functional checkout, and acceptance of Navy and Marine Corps bomb racks, missile launchers, and other weapon stores assemblies that have been removed from the aircraft.

Testing

The CRALTS is fully menu-driven and all testing is performed in an automatic or semiautomatic (manual) mode. Initialization of CRALTS starts with system Warm-up and Auto Alignment/Turn-on BIT. The CRALTS screen display provides complete hookup and operating procedures. In the event abnormal condition is indicated within the test equipment, the Organizational Level Manual Test Set, Common Rack and Launcher, NAVAIR 16-30AE37T-35-1, or Intermediate Maintenance Manual Test Set, Common Rack and Launcher, NAVAIR 16-30AE37T-35-2, should be consulted for necessary corrective actions.

TEST EQUIPMENT SAFETY SUMMARY

Many safety precautions are associated with weapons systems test equipment. Some of these safety precautions are discussed in the following paragraphs.

Personnel should be warned that certain components of the test set can be dangerous and, if not properly handled, could result in loss of life or serious injury to personnel and damage to equipment.

Personnel performing the checks must be thoroughly familiar with the electrical and ground handling safety precautions pertaining to the aircraft.
The test equipment discussed in this chapter is designed to perform various functions. Two of the most important functions are listed below:

- Ensuring the correct firing voltage is available at the appropriate station when the cockpit switches are properly set
- Ensuring that voltage or stray voltage is not present before electrical connection of certain launchers, such as rocket launchers, is made

These two functions are called aircraft release and system control checks. Normally, aircraft release and system control checks are performed before the weapons are installed on the aircraft. However, some checks require the weapons to be loaded on the aircraft.

Prior to and following the use of the AN/AWM-102 test set for checking any armament circuit, a self-test should be performed to ensure the test set is functioning properly.

When performing aircraft release and system control checks, always use the step-by-step procedures (checklist) provided in the aircraft loading manual. In addition, you must observe a few safety precautions when performing aircraft release and system control checks. These precautions are listed below.

- Before you begin an aircraft release and system control checks, make sure the aircraft is parked in a designated area, secured, and electrically grounded
- Before you apply external electrical power to the aircraft, make sure all cockpit switches have been positioned to OFF, SAFE, or NORMAL
- Release and control system checks will NOT be performed with weapons loaded on the aircraft; checks may be performed with airborne stores (fuel tanks, empty improved multiple ejector racks/improved triple ejector racks (IMERs/ITERs), vertical ejector racks (VERs), pods, etc.) installed on the aircraft stations, provided cartridge retainers, breech caps, and ejector cartridges are removed
- Test equipment should only be used by personnel who have become qualified through an established qualification and certification program

Stray voltage checks are normally performed with the weapon loaded on the aircraft, but they are made before making an electrical connection between the weapon and the aircraft. Additionally, this check is normally performed after the aircraft’s engines have been started and all aircraft preflight checks have been completed. The stray voltage check is performed at the last possible moment before the aircraft takes off. This is to ensure that no voltage has been induced in the aircraft firing circuitry from external sources, such as the ship’s radar. When performing stray voltage checks on aircraft aboard aircraft carriers, you must not remove the launcher electrical safety pin until the aircraft is positioned on the catapult for takeoff.
End of Chapter 16

Weapons Systems Test Equipment

Review Questions

16-1. Which of the following digital multimeters is used for general electronic and electrical service?

A. AN/ALM-286
B. AN/ALM-290
C. 77/BN digital
D. LM-225 digital

16-2. What countermeasures chaff dispensing test set group consists of a transit case containing two stray voltage flight line payload simulators used to test for stray voltage in the air-launched expendable (ALE)-47 countermeasure dispensing set?

A. AN/ALM-286
B. AN/ALM-290
C. AN/ALM-291
D. AN/AWM-42A

16-3. Which of the following weapons system test sets permits an end-to-end preflight check of the Army/Navy air-launched expendable (AN/ALE)-39 countermeasure dispenser set?

A. 77/BN
B. AN/ALM-291
C. AN/AWM-442A
D. TTU-304

16-4. What weapons system test set is used to check for continuity and resistance in the electric fuzing system on Navy and Marine Corps aircraft with electric fuzing capabilities?

A. AN/ALM-291
B. AN/AWM-42A
C. AN/AWM-102
D. AN/AWM-103A

16-5. What weapons system test set is used on the flight line to check for stray voltages prior to arming and provides a GO/NO-GO indication for the circuit being tested?

A. AN/ALM-291
B. AN/AWM-42A
C. AN/AWM-102
D. A/E-24T-230
16-6. What weapons system test set mounts on an aircraft launcher rail and interfaces with the launcher/aircraft via the umbilical connectors?

A. AN/AWM-42A  
B. AN/AWM-102  
C. AN/AWM-103A  
D. AN/ALM-291

16-7. What weapons system test is designed to test the functional, firing, and stray voltage for the 20 millimeter gun system?

A. AN/AWM-102  
B. AN/AWM-103A  
C. A/E-24T-230  
D. TTU-304/E

16-8. Which of the following weapons system test sets is used to reprogram munitions operational flight programs?

A. A/E-27-230  
B. AN/ALM-286  
C. AN/AWM-42A  
D. AN/GYQ-79A

16-9. Prior to and following use, what should be performed to ensure that the Army/Navy piloted aircraft, armament, maintenance/test assembly (AN/AWM)-102 test set is functioning properly?

A. Stray voltage test  
B. Self-test  
C. Electrical ground test  
D. Nothing needs to be performed

16-10. Why are stray voltage checks performed on an aircraft weapons system?

A. To ensure that no voltage has been induced in the aircraft firing circuitry  
B. To ensure release and control systems checks have been completed  
C. To ensure the system is functional  
D. To ensure the launcher safety pins have been installed properly
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