CDC 2W251A

Nuclear Weapons Journeyman

Volume 4. Test and Handling Equipment

Air Force Career Development Academy

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VOLUME 4 of CDC 2W251A, *Nuclear Weapons Journeyman*, discusses general and special test and handling equipment (T&H) procedures. The first unit covers general inspection and maintenance procedures standard for most items of T&H equipment. You will also learn about nuclear certified equipment, meters, and hoisting equipment. The second unit familiarizes you with limited-life component (LLC) container procedures and permissive action link (PAL) terms, equipment, and security procedures. As you study the material, keep in mind that security restrictions prevent the "whole" story from being told. Always refer to the applicable technical orders (TO) and instructions when performing any maintenance.

A glossary is included for your use.

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NOTE:

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

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Unit 1. General Test and Handling Equipment

IN THIS UNIT, we discuss the Master Nuclear Certification List (MNCL) and the equipment items listed within. It is crucial to understand that the listed equipment undergoes various design and development phases prior to being used in nuclear operations. Special considerations must be placed on the test, handling, and support equipment to include its inspection, preparation, handling, and usage. Follow the prescribed procedures in technical orders (TO) and the restrictions listed in the MNCL. Your level of commitment to the care and handling of nuclear weapons must be synonymous to the care and handling of equipment used in nuclear weapons.

1–1. Master Nuclear Certification List

The Air Force Nuclear Certification Program ensures all procedures, equipment, and software is certified before conducting nuclear operations with nuclear weapons or nuclear weapon systems. Nuclear certification occurs when the Air Force (AF) makes a determination that procedures, equipment, and software are sufficient to perform nuclear weapon functions. In-depth analysis and testing goes into designing and developing nuclear certified equipment to meet nuclear surety requirements.

601. Description, positive identification, and restrictions

The Air Force Safety Center (AFSEC) is the approval authority for safety design certification. The Air Force Nuclear Weapons Center (AFNWC) is responsible for listing certified items and use restrictions on the Web-based MNCL.

Description

The MNCL identifies nuclear certified equipment, hardware, and software in accordance with (IAW) Air Force Instruction (AFI) 63–125, *Nuclear Certification Program*. The MNCL is the sole authority for determining certification status of nuclear certified weapon systems, support equipment, software, and facilities. As a note, host nations are authorized to use Engineering Liaison Office (ELO)–4, *Master Nuclear Certification List Extract for User Nation Use*, for determining the certification status of host-nation-owned support equipment, hardware, and software.

The MNCL is broken into six main category filters to narrow the scope

of your search:

Section	Description
Aircraft	Covers handling equipment, test equipment, and subcomponents associated to specific aircraft and includes the Secure Transportable Maintenance System (STMS).
Intercontinental ballistic missile (ICBM)	Covers the Airborne Launch Control System and Minuteman weapon systems including the Wing Code Processing System.

Section	Description
Air-launched missile	Covers the munitions handling and test equipment and subcomponents associated to the air-launched cruise missiles (ALCM).
Facilities	Covers the various types of hoists located within the continental United States (CONUS) locations including the specific hook adapters used with nuclear loads.
Non-specialized	Lists all munitions handling, general support, and test equipment used with nuclear weapons systems. This includes aircraft cargo loaders, forklifts, lift trucks (jammers), semitrailers, tow vehicles, and truck tractors.
General guidance	Covers the purpose, scope, positive identification (ID), general restrictions, and additional information.

Although each item listed in the MNCL contains the information needed (e.g., nomenclature, model number, etc.), the user must be able to positively identify the information contained in the MNCL against the physical equipment in question. This positive ID ensures the item is nuclear certified prior to use.

Positive identification

The MNCL positively identifies equipment by using several elements of information: the national item identification number (NIIN), computer program identification number (CPIN), part number, model number, and nomenclature, as applicable.

Positive ID shall be made by using all possible ID elements of the nameplate, label, appropriate markings, or by official aircraft/maintenance documents. If available, only the nameplate, label, or appropriate markings need to be verified against the MNCL. If a discrepancy exists (characters do not match) with any element of the item ID, the item is considered not certified until the discrepancy can be resolved. However, the absence of a data element on the nameplate or label, when all other identifying elements are correct, does not constitute a discrepancy.

When the national stock number (NSN) is used as an element of ID, only the NIIN (last 9 digits) portion of the NSN will be used for ID. In some cases, a two-alpha-character materiel management aggregation code (MMAC) suffix may follow the NIIN such as “CM”. When this appears, the MMAC will not be used for ID purposes.

Restrictions

Items listed in the MNCL may have restrictions placed against the system or fleet (e.g., a restriction that limits the maximum towing capacity of a tow vehicle). A specific nuclear certified item may be restricted from use with nuclear weapons at any time and for any reason (e.g., damage, modification, and changes to intended usage). Such restrictions do not constitute removal of nuclear certification or system decertification. The restriction is placed to preclude use of a particular item with nuclear weapons. Again, such restrictions will be clearly marked in the MNCL listing under the restrictions block for that particular item and reflect individual item ID information (e.g., item serial number).

602. Perform nuclear certification verification using the Master Nuclear Certification List

The AFNWC manages the MNCL; therefore, access to the MNCL database must first be requested through this organization. Users must have a computer with an Internet browser operating from a .mil or .gov domain. In addition, the common access card authentication from a government network is required. Once AFNWC grants users access to the MNCL, the users are able to log into the database and verify a piece of equipment is nuclear certified.

Performing the verification

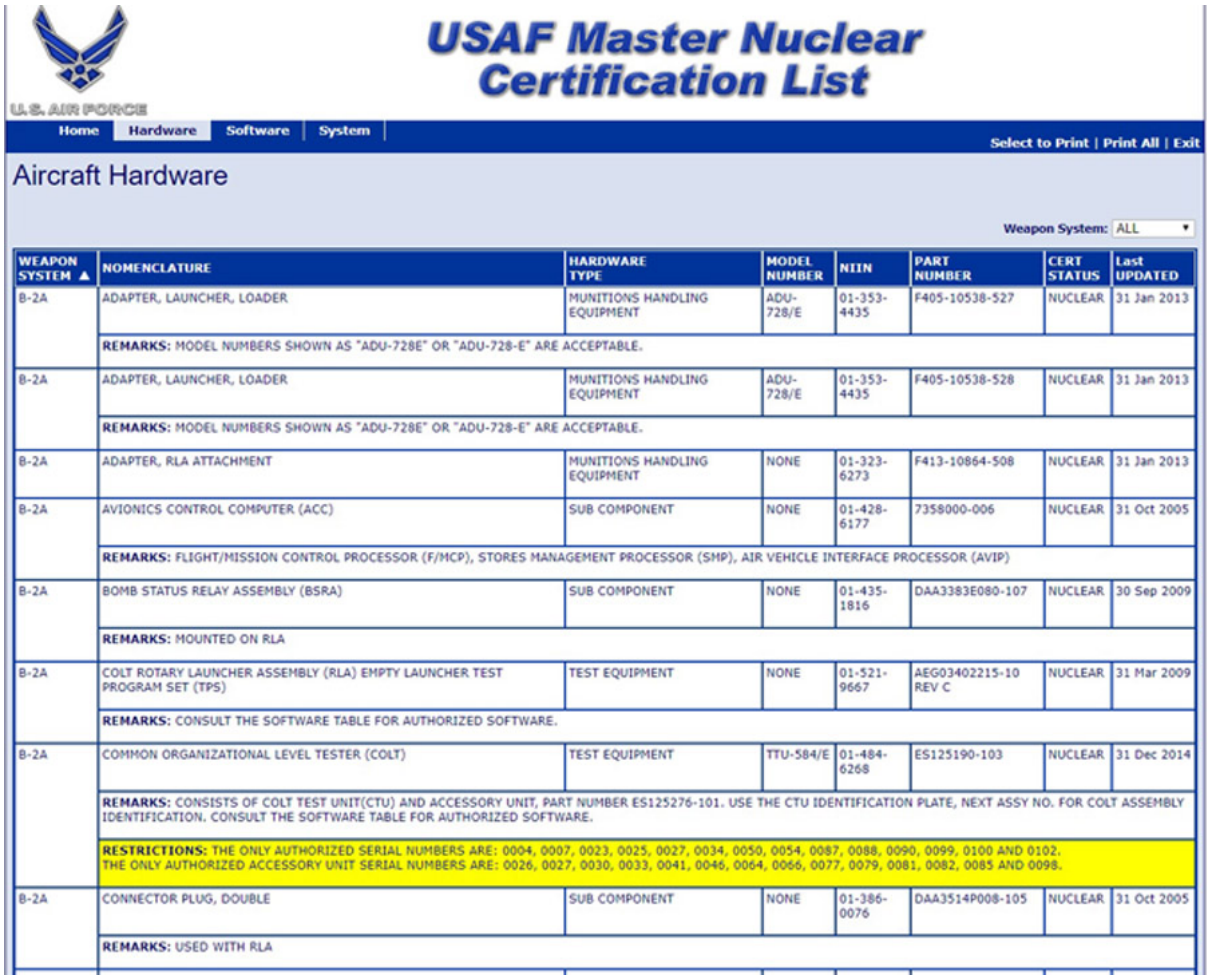
Before using any piece of support equipment or other nuclear certified item, check to make sure it is listed in the MNCL. Once you log into the database, the disclosure and distribution page will first be displayed. After reading and clicking the “I Agree” hyperlink at the bottom of the disclosure and distribution page, the “General Guidance” page is displayed next. Once you have read and understood

this page, scroll to the bottom of the page and click “Continue” to advance to the “Main Menu” screen. From here, the user is able to use the main category filters in search of the equipment in question. As a note, the Department of Energy (DOE) is responsible for nuclear design and testing and analyzing nuclear support weapon systems. When the DOE designed the handling equipment, as listed in TO 11N–H–61, *Operation and Maintenance Instructions with Illustrated Parts Breakdown (Active Systems Special Handling Equipment)*, it constituted nuclear safety certification for the Department of Defense (DOD).

If you do not know the category of the specific item you are searching for, use the MNCL search engine. The search engine is global and queries the entire database by using two methods: keyword search or data range search. You can perform each of these search methods independently or simultaneously to pinpoint the specific item you are trying to find.

The report shows the following ID elements for the item requiring verification (fig. 1–1):

- Weapon System: the system(s) associated with the item (e.g., B–2A, B–52, and ALCM).
- Nomenclature: the name of the item.
- Hardware Type: the category in which the item is organized (i.e., subcomponent, support equipment, munitions-handling equipment, test equipment, etc.) to show its relationship to the certified item.
- Model number: a combination of letters, numbers, and/or characters assigned by the manufacturer to identify the unit as a whole (e.g., aircraft delivery unit [ADU]–468/E, munitions adapter unit [MAU]–191/A, etc.).
- NIIN: the last nine digits of the NSN.
- Part number: a combination of letters or numbers to specifically identify a whole unit or individual pieces of a whole unit.
- Cert Status: the certification status of the item as either “nuclear” or “design.”
- Last Updated: the last time the item’s status has been changed.
- Remarks: reserved for any pertinent information concerning the certified item.
- Restrictions: imposed limits in which the certified item can or cannot function under.



U.S. AIR FORCE

USAF Master Nuclear Certification List

Home | Hardware | Software | System

Select to Print | Print All | Exit

Aircraft Hardware

Weapon System: ALL

WEAPON SYSTEM	NOMENCLATURE	HARDWARE TYPE	MODEL NUMBER	NIIN	PART NUMBER	CERT STATUS	Last UPDATED
B-2A	ADAPTER, LAUNCHER, LOADER	MUNITIONS HANDLING EQUIPMENT	ADU-728/E	01-353-4435	F405-10538-527	NUCLEAR	31 Jan 2013
	REMARKS: MODEL NUMBERS SHOWN AS "ADU-728E" OR "ADU-728-E" ARE ACCEPTABLE.						
B-2A	ADAPTER, LAUNCHER, LOADER	MUNITIONS HANDLING EQUIPMENT	ADU-728/E	01-353-4435	F405-10538-528	NUCLEAR	31 Jan 2013
	REMARKS: MODEL NUMBERS SHOWN AS "ADU-728E" OR "ADU-728-E" ARE ACCEPTABLE.						
B-2A	ADAPTER, RLA ATTACHMENT	MUNITIONS HANDLING EQUIPMENT	NONE	01-323-6273	F413-10864-508	NUCLEAR	31 Jan 2013
B-2A	AVIONICS CONTROL COMPUTER (ACC)	SUB COMPONENT	NONE	01-428-6177	7358000-006	NUCLEAR	31 Oct 2005
	REMARKS: FLIGHT/MISSION CONTROL PROCESSOR (F/MCP), STORES MANAGEMENT PROCESSOR (SMP), AIR VEHICLE INTERFACE PROCESSOR (AVIP)						
B-2A	BOMB STATUS RELAY ASSEMBLY (BSRA)	SUB COMPONENT	NONE	01-435-1816	DAA3383E080-107	NUCLEAR	30 Sep 2009
	REMARKS: MOUNTED ON RLA						
B-2A	COLT ROTARY LAUNCHER ASSEMBLY (RLA) EMPTY LAUNCHER TEST PROGRAM SET (TPS)	TEST EQUIPMENT	NONE	01-521-9667	AEG03402215-10 REV C	NUCLEAR	31 Mar 2009
	REMARKS: CONSULT THE SOFTWARE TABLE FOR AUTHORIZED SOFTWARE.						
B-2A	COMMON ORGANIZATIONAL LEVEL TESTER (COLT)	TEST EQUIPMENT	TTU-584/E	01-484-6268	ES125190-103	NUCLEAR	31 Dec 2014
	REMARKS: CONSISTS OF COLT TEST UNIT(CTU) AND ACCESSORY UNIT, PART NUMBER ES125276-101. USE THE CTU IDENTIFICATION PLATE, NEXT ASSY NO. FOR COLT ASSEMBLY IDENTIFICATION. CONSULT THE SOFTWARE TABLE FOR AUTHORIZED SOFTWARE.						
	RESTRICTIONS: THE ONLY AUTHORIZED SERIAL NUMBERS ARE: 0004, 0007, 0023, 0025, 0027, 0034, 0050, 0054, 0087, 0088, 0090, 0099, 0100 AND 0102. THE ONLY AUTHORIZED ACCESSORY UNIT SERIAL NUMBERS ARE: 0026, 0027, 0030, 0033, 0041, 0046, 0064, 0066, 0077, 0079, 0081, 0082, 0085 AND 0098.						
B-2A	CONNECTOR PLUG, DOUBLE	SUB COMPONENT	NONE	01-386-0076	DAA3514P008-105	NUCLEAR	31 Oct 2005
	REMARKS: USED WITH RLA						

Figure 1–1. MNCL.

Once you have determined an item to be nuclear certified, you'll need to determine the serviceability of the item IAW the item-specific TO.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

601. Description, positive identification, and restrictions

1. What organization is responsible for listing certified items and restrictions on the MNCL?

2. What are host nations authorized to use for determining the certification status of host-nation-owned support equipment?

3. What are the six main categories filters used to narrow the scope of item searches?

4. What does the general guidance section cover?

5. If available, what items of positive ID need to be verified against the MNCL?

6. Is it a discrepancy when a nameplate contains the nomenclature, model number, and part number, but is missing the NSN?

7. How are you able to positively identify restrictions on nuclear certified equipment?

602. Perform nuclear certification verification using the Master Nuclear Certification List

1. What domain must computers have in order to access the MNCL?

2. What is the first screen to display once you log into the MNCL, and how should you advance?

3. In the MNCL, what should you use if you do not know the category of the specific item you're trying to find?

4. Match the MNCL elements in column B with their definition in column A. Each item in column B can only be used once.

Column A	*Column B*
____ (1) The last nine digits of the NSN.	a. Cert status.
____ (2) The name of the item.	b. Hardware type.
____ (3) Reserved for pertinent information.	c. Model number.
____ (4) Category in which the item is organized to show its relationship.	d. NIIN.
____ (5) Imposed limits in which the certified item can or cannot function under.	e. Nomenclature.
____ (6) Combination of letters, numbers, and/or characters assigned by the manufacturer to identify the unit as a whole.	f. Part number.
	g. Remarks.
____ (7) Is either identified as "nuclear" or "design."	h. Restrictions.
____ (8) Combination of letters or numbers to specifically identify a whole unit or individual pieces of a whole unit.	

1–2. Test Equipment Procedures

Perform preventive maintenance on test equipment to prolong its useful life. A conscientiously applied program will do just that, but eventually, normal wear and tear takes its toll. Then you must turn to the corrective maintenance program to keep equipment functional for the longest period of time possible. The possibilities of exposure to hazardous voltages exist while you repair, adjust, or troubleshoot electrical equipment. The general guidelines in this section will help you perform work on electrical equipment safely.

603. Electrical principles

Air Force Manual (AFMAN) 91–203, *Air Force Occupational Safety, Fire, and Health Standards,* describes general safety requirements for electronic equipment. Electrical installations and equipment present a shock or electrocution hazard from contact with energized systems and can produce arc-flash burns from electrical arcs. Excessive scraping, kinking, stretching, and exposure can cause the equipment to fail prematurely. Explosions may occur if flammable liquids, gases, or dusts are exposed to ignition sources generated from electrical equipment.

Safety precautions

The following paragraphs provide the necessary guidance to work in and around electrical systems and equipment safely.

Safety observer

All equipment shall be de-energized prior to being maintained. However, there may be cases where you must work on energized circuits. The commander, applicable technical data, or manufacturer's instructions can authorize this, as necessary, to support a critical mission, to prevent injury to personnel, or to protect property. While working on energized equipment, a safety observer is required to be present. The safety observer will not be assigned any other duties during the operation. The most important job of the safety observer is to immediately disconnect power if a mishap occurs. The observer should be trained in techniques of first aid for electrical shock and in cardiopulmonary resuscitation (CPR) procedures. Exposed energized circuits are always hazardous. Even though a safety observer is not required for low voltages, never work on live circuits without a helper.

Insulation

Always provide nonconductive insulation between you and the floor when you work with high-voltage electrical equipment and circuits. It is best to use rubber insulating floor matting.

Clothing and jewelry

While working on or around live electrical equipment, workers are prohibited from wearing garments with exposed metallic fasteners or flammable articles. Remove articles such as jewelry, earrings, rings, hair fasteners, bracelets, key chains, or metallic ID (dog) tags with metal chains. Secure metal-framed eyeglasses with a band or cord to prevent them from falling into energized electrical circuits or machinery. As a note, it is best to wear nonmetallic eyeglasses and neck lanyards (e.g., ID cardholders) with a breakaway band or cord. Additionally, as a warning, do not place tape over rings or wear gloves to cover rings. This does not provide protection or eliminate the requirement to remove finger rings.

Flexible cords and extension cords

Extension cords are responsible for numerous fires, and using them should be kept to an absolute minimum. If used, use those that have a single connection. Report, replace, or dispose of worn, cracked, or frayed electrical extension cords; loose or broken electrical wires; and worn or broken electrical plugs. Supervisors shall inspect cords frequently for signs of fraying, cracking, or wear, and any damage that could be an indication of possible short-circuiting. Use electrical extension cords as outlined in the National Electrical Code (NEC). Do not use electrical extension cords as a substitute for fixed wiring. Do not walk on electrical extension cords, and do not allow any equipment to run over them. Properly protect cords placed in well-traveled areas by using molded housing, bridges, or

other covers approved for such use. Disconnect cords when they are not in use and at the end of each work shift (except low ampere [amp] devices, such as wall clocks, pencil sharpeners, and radios). Extension cords used with portable tools and equipment must have the three-prong plugs; it is prohibited to use the two-wire extension cords. In addition, do not connect the extension cords and surge protectors in a series. Finally, you may only use commercially procured extension cords bearing the Underwriters Laboratory (UL) or host-nation-equivalent certification. Extension cords must be rated at 10 amps minimum above the required power draw and will not be manufactured or altered.

AC/DC terms

Now let's look at some very basic terms used with electricity that you need to be familiar with while troubleshooting or performing maintenance on electrical equipment.

Electrical Terms and Definitions	
Term	**Definition**
Amp	The unit of current is called the amp. The rate at which electrons pass a given point in a conductor is a measure of the amount of current flowing. The rate of current flow is 1 unit (1 amp) when a specific number of electrons pass a point in the conductor in one second.
Conductor	Materials that contain many free electrons permitting a large current to flow in response to a relatively low electrical pressure. Most metals (such as copper, silver, aluminum, gold, and platinum) are good conductors. There is no perfect conductor. All conductors offer at least some opposition to current flow.
Current	Commonly defined as the flow or drift of electrons through a conductor. The electron flow is from negative to positive. This current continues to flow until the two bodies become equally charged. The one-way flow of electrons is called direct current (DC). An electric current that reverses direction at regular intervals is called alternating current (AC).
Insulators	Materials that contain very few free electrons permitting relatively little current flow in response to an electrical pressure. Glass, plastics, porcelain, and rubber are examples of materials in this category.
Open circuit	There must be a complete path through which the current can flow. If a break in one of the paths exists, there is no longer a complete path for the current to flow. We call this condition an open circuit. Although an open occurs any time a switch is thrown to de-energize a circuit, an open may develop accidentally due to abnormal circuit conditions. To restore a circuit to proper operation, we must locate the open and determine its cause. Sometimes we can locate an open with a visual inspection. We can usually discover a defective component, such as a burned-out fuse, with this method. Other defective components may not be visible to the naked eye and would require the use of a voltmeter or ohmmeter to locate the open component.
Parallel circuit	There is more than one path through which voltage can force the current. We determine the current through each path by the amount of resistance in that path. The total current in the circuit is equal to the sum of the current in all the paths. If one resistance burns out or is disconnected, the other paths continue to operate. The only change is that the total current is reduced.
Resistance	The opposition that either a conductor or insulator offers to the flow of electrons is called resistance. Resistance is the current-controlling factor in a circuit; we measure it in ohms.
Series circuit	Have only one path through which the voltage can force the current. Current is constant throughout the circuit since it is forced through each resistance by means of only one path. If one device in a series circuit burns out or is disconnected, the remaining devices will not function because there is no longer a complete path or circuit. For example, when one bulb of a string of colored lights on a holiday tree burns out, the whole string goes out. This means that the bulbs are wired in series.
Series parallel circuit	Some of the components are connected in series and some are connected in parallel. We must observe each resistance in the circuit in relation to the remainder of the circuit. The individual rules for parallel circuits apply to the parallel section; the rules for series circuits apply to the items that are wired in series.
Short circuit	An accidental path of low resistance that passes an abnormal amount of current. It exists whenever the resistance of the circuit or part of a circuit drops in value to almost zero Ω and often occurs as a result of improper wiring, broken insulation, or accidental contact between two normally insulated conductors or points.

Electrical Terms and Definitions	
Term	**Definition**
Voltage	The pressure or force that causes electron movement through a conductor from a negative point to a positive point, producing current. Another term used for this is electromotive force (EMF).
Wattage	Used to rate electrical power. One watt is the power consumed in a circuit through which one amp flows under the pressure of one volt (V).

Troubleshooting practices

Always treat a circuit as if it were live (has an electric current) even though the plug has been pulled. You can receive a shock after you've pulled the plug. This shock can result from an electrical component inside that retains a charge. A classic example of a component that retains a charge is a capacitor.

Personnel should not hold test meters in their hands while performing measurements on energized circuits or equipment. Use non-conductive, insulted gloves when it is necessary to hold meters. Keep workbenches clean at all times. Use stools made of wood, fiberglass, or other non-conductive material.

Emergency equipment

Emergency equipment is at each operating location where you perform maintenance on energized high-voltage equipment. The definition of high voltage is 600 V, nominal, or more. The following items may be included in an emergency equipment board:

- The safety operating instruction.
- CPR instructions.
- CPR face mask with disposable mouthpiece.
- Emergency phone numbers and building number.
- First aid kit provided by the unit if the medical facility is located more than three to four minutes away.
- Disposable gloves, impervious to body fluids, for first aid use.
- Nonconductive cane or hook with insulated handle (with less than 180 degrees of bend).
- 15 feet in length of natural fiber rope, preferably ½- or $^{5}/_{8}$-inch diameter. Do not use synthetic rope since it may melt or burn quickly when exposed to an electric arc, heat, or flame.
- Flashlight with nonmetallic case in operating condition.
- Grounding stick.
- Emergency signs constructed of nonconductive materials.
- Wool blanket(s) for extinguishing clothing fires and keeping injured personnel warm.
- Non-conductive signs for the operation to be performed.
- An automated external defibrillator (AED) may be required if work is in a remote facility.

604. Using digital meters

The two effects of electrical current that provide a practical basis for electrical measurement are the heating effect and the electromagnetic effect. When current flows in a circuit containing resistance, heat is produced. Current also produces a magnetic field around the conductor in which it flows. Most common electrical measuring instruments (meters) use one of these two effects as the basis for their operation. The magnitude or strength of these effects depends on the amount of current in the circuit. The current is dependent on the voltage and resistance. If we can measure the current and we know the voltage, we can find the resistance. If we know the resistance and current, we can determine the voltage.

Instruments using the magnetism effect are the most common because they give readings that are more accurate. In a sense, all meters are “eyes” specially developed to measure invisible forces and quantities. They collect data inside the electrical system and deliver it to the outside, where it answers the question, “How much?” on some type of numerical scale or dial. In this lesson, we cover different types of meters and how to use them.

Troubleshooting weapons

Do not use volt-ohm-milliammeter-type instruments to check continuity or to troubleshoot a nuclear weapon unless such use is specifically authorized by the maintenance procedures in the applicable TOs. An ohmmeter, or a multimeter containing an ohmmeter, contains internal batteries that may produce enough voltage to fire a squib, explosive switch, explosive bolt, or electrostatic sensitive devices (ESSD) within the weapon.

Ammeter

Use an ammeter to measure the amount of current flowing in an electrical circuit. To measure current, connect the ammeter in series with the load. Never connect an ammeter directly across a power supply. If you do, serious damage may occur to both the ammeter and the power supply because there is very little internal resistance in an ammeter. Always verify that the power is *off* when you connect an ammeter in a circuit. This way, you run no risk of burn or shock while you are making the connection. Always try to estimate the approximate current in a circuit so you have the ammeter set to the proper scale (as high as, or higher than, the estimated current) before you turn on the power.

Voltmeter

Voltmeters measure the voltage drop across a circuit element and are connected in parallel with the load. The sensitivity of a voltmeter is its strong point. The higher the sensitivity, the less current it takes to move the indicating needle. The sensitivity of a voltmeter is expressed in ohms per V. Where high voltage is present, we recommend that you connect the voltmeter to the circuit under test before you apply power. This prevents the operator from being shocked. Many voltmeters are encased in metal boxes and have a special ground clip that is to be fastened to a chassis ground before you make voltage measurements.

Ohmmeter

You can use an ohmmeter to measure the resistance of a resistor only when the resistor is not connected to a source of voltage. A battery inside the case of the ohmmeter supplies the current required to operate the ohmmeter. External power can cause serious damage to the ohmmeter. When you place the ohmmeter terminals across a resistor, the circuit containing the ohmmeter battery is completed. When a certain amount of current flows through the meter, it causes the indicating needle to move according to the amount of current. When you measure an unknown resistor, disconnect at least one terminal of the resistor from the circuit so you can obtain an accurate measurement.

Multimeter

The multimeter is the most convenient and most used item of test equipment for measuring electrical current in AC and DC environments. When controls are properly set, it has the ability to measure amps, ohms, and voltage in different amounts through the use of different scales on the face of the meter that correspond to the different settings of the function switch. You should follow the TO procedures on how to use the multimeter to make sure you are safe and prevent damage to weapon systems and equipment.

Digital meter

There are many different types and manufacturers of digital multimeters, but they all perform the same basic functions. The most common digital multimeter in the field is produced by FLUKE. There are also many different types of FLUKE digital meters, but here we only cover the FLUKE model 8025B shown in figure 1–2.

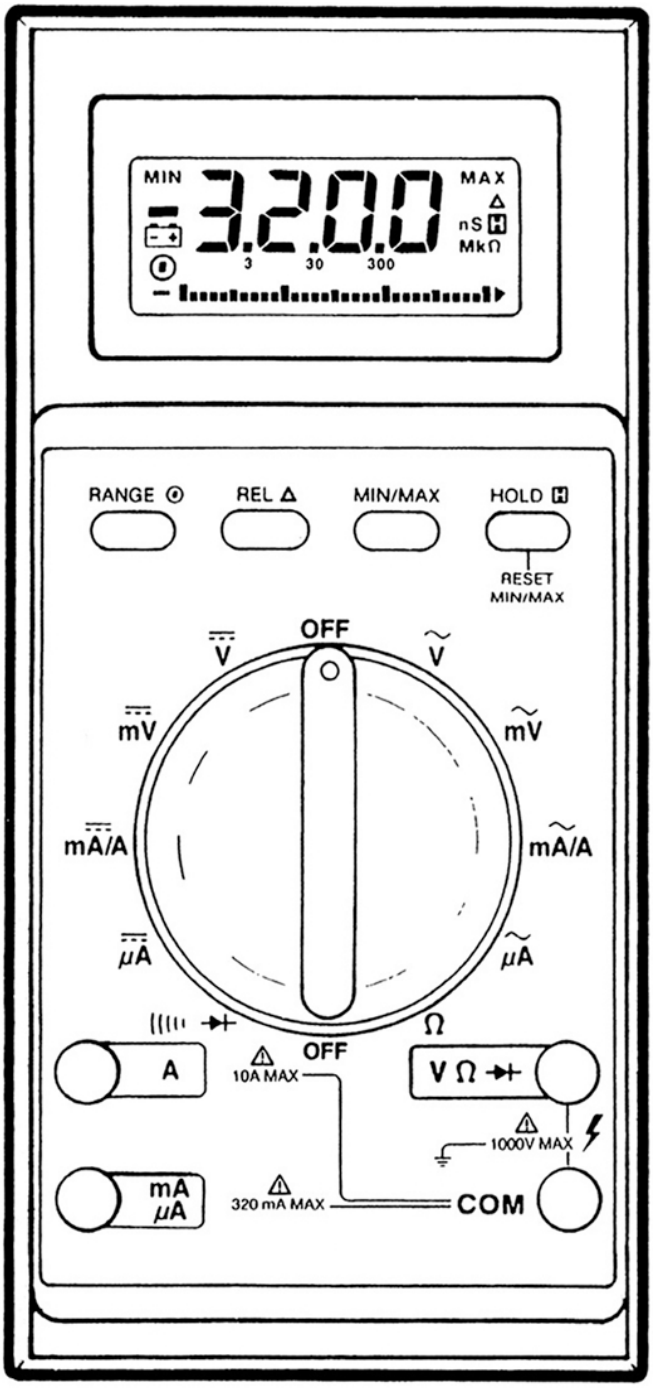


Figure 1–2. FLUKE 8025B Multimeter.

The 8025B is a rugged, water and chemical-resistant multimeter designed to use in military environments. It combines the precision of a digital meter with the speed and versatility of an analog bar graph. The components are housed in a case sealed against dirt, dust, and moisture. It is powered by a 9 V battery with a life of 1,000 hours and has overload protection via fuses. Some of the other features are as follows:

- Automatically selects the appropriate measurement range.
- Has an audible continuity indicator allowing you to test components without having to look at the display.

- Features low-power resistance measurements that allow in-circuit resistance measurements to be taken without turning on diodes or transistors.

Operation

When the function switch is moved from the OFF to any other position, the meter is powered up and performs a self-test. During the self-test, all liquid crystal display (LCD) segments are switched on for about one second, and then the meter is operational. A battery test is also performed each time the function switch is changed to a different position. If the battery voltage is low, the battery enunciator comes on and remains on until a subsequent battery test determines that the battery voltage is correct.

The meter powers up in the auto-range mode. In auto-range, the meter automatically selects the appropriate range for the measurement being taken. The decimal point position and range indicator in the display and in the ohms function indicates the operating range by the presence of the megohm (M) or kilohm (k) enunciators (fig. 1–3).

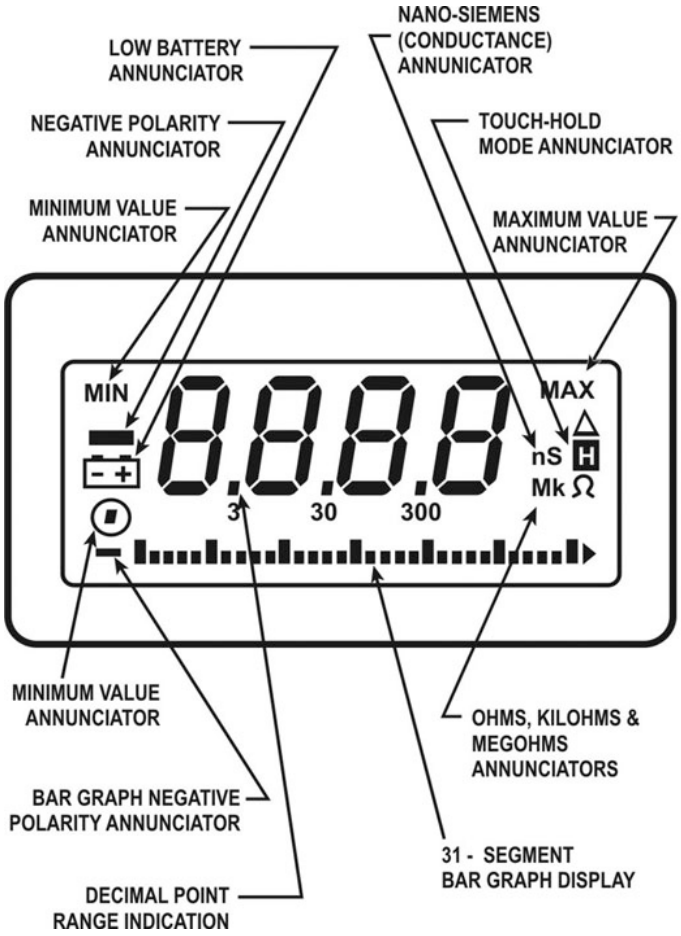


Figure 1–3. FLUKE 8025B Multimeter display.

There is no enunciator for the auto-range mode; the absence of the manual range enunciator indicates that the instrument is in the auto-range mode. Push the range button to enter the manual range mode. While in the manual range mode, pushing the range button increments the range setting. To return to the auto-range mode, press and hold the RANGE button for approximately two seconds. In addition, if you select a different function with the rotary switch (fig. 1–4) while in the manual range mode, the 8025B automatically switches to auto-range.

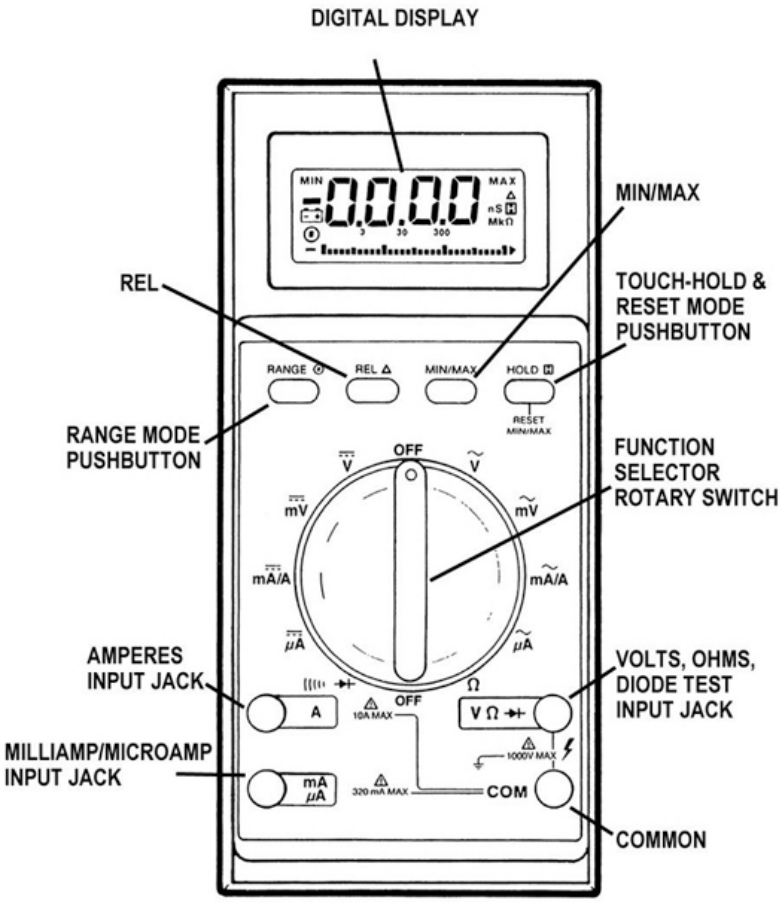


Figure 1–4. Rotary switch of FLUKE 8025B.

The 8025B functions by rotating the function selector switch to the appropriate setting. Meter functions include:

- VOLTS DC.
- MILLIVOLTS DC.
- MILLIAMPS/AMPS DC.
- MICROAMPS DC.
- VOLTS AC.
- MILLIVOLTS AC.
- MILLIAMPS/AMPS AC.
- MICROAMPS AC.
- RESISTANCE/CONDUCTANCE.
- DIODE TEST.

If the input is over-ranged, the display will indicate an overload by displaying the letters OL. OL is an acronym that stands for over load, out of limits, open line, or open loop, depending on the function selected. For further instruction on how to use the 8025B millimeter, refer to the manufacturer's manual.

605. Test equipment

This lesson contains inspection, use, and maintenance instructions for common test equipment that do not require extensive maintenance. Specialized test equipment that requires individualized attention

will be included in a lesson elsewhere. The intent of this lesson is to make sure personnel responsible for using or managing test equipment are familiar with its basic inspections, usage, and maintenance.

Inspecting

Before first use each day, test equipment must go through a physical inspection. A physical inspection consists of a series of visual checks to determine the equipment's physical condition. Make sure you perform the following procedures before using the test equipment:

1. Visually inspect for obvious physical damage.
2. Inspect electrical connectors IAW TO 11N–35–51, *General Instructions Applicable to Nuclear Weapons.*
3. Check for damaged or deteriorated insulation and protective coating (not protective surface finish), bulging surfaces, and broken and loose potting compounds.
4. Check for correct position and proper connection of component.
5. Slight abrasion or a roughened part due to normal wear is not cause for rejection if the component is not otherwise defective.
6. When necessary, apply item 323, general-purpose lubricating oil, to bearings, shafts, hinges, and other sliding surfaces. Apply lubricant sparingly to the part, and wipe off any excess lubricant.

If a physical inspection results in the equipment requiring repairs, make sure a functional test is performed following the repair action. A functional test determines the operation of a special test equipment item without actually using the equipment to its full extent. Perform a functional test after any parts are replaced or repaired that affects equipment operating characteristics or anytime there is doubt about its proper function.

A functional test of various test equipment requires the performance of current, resistance, or voltage checks. Such checks require a readily accessible supply of jumpers or other suitable connecting wires. Use caution when inserting mating connectors and making temporary connections since this might damage pins and sockets of electrical connectors. Since cable assemblies are inherent to most of the test equipment, a functional test will consist of checking for continuity and shorts using the applicable cable-wiring diagram illustrated in their respective TO. Unless otherwise specified, voltage and resistance checks of test sets can be performed using a multimeter with a sensitivity of 20,000 ohms per volt, direct current (VDC) and 1,000 ohms per volt, alternating current (VAC).

Using

Once the inspection portion is complete, you are ready to use the test equipment as intended according to the weapon-specific TO. If you encounter any unusual indications or malfunctions during operation, decide if the cause can be identified and corrected without dismantling the equipment by following the troubleshooting procedures.

Maintaining

Part of maintaining test equipment may involve troubleshooting. The troubleshooting procedures will illustrate schematic and wiring diagrams to help personnel isolate faults with little or no delay. The complexity of some wiring diagrams may require the use of a station system of ID. The large heavy numerals are station numbers; wires at a station are identified by a wire number and the number of the station at which that particular wire number can be picked up when tracing a circuit.

Keep equipment clean of dirt, dust, oil, grease, and foreign material. When procedures require cleaning, preservation, packaging, touchup, or ID marking and are not in a specific TO, refer to TO 11N–35–51 and TO 11N–35–51A, *General Instructions Applicable to Nuclear Weapons (Supplement)*. Common maintenance procedures for test equipment that reoccur frequently are

cleaning, surface preservation, and minor parts replacement. These minor parts normally are lamps, fuses, gaskets, and screws.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

603. Electrical principles

1. What should a safety observer be trained on for electrical operations?

2. What are some of the articles of clothing or items prohibited from having while working on or around electrical equipment?

3. What are the requirements for extension cords in well-traveled areas?

4. What should happen at the end of each work shift in regards to extension cords?

5. What happens in a parallel circuit if any one resistance burns out?

6. What is resistance?

7. What happens in a series circuit if any one device is disconnected?

8. List three situations that can cause a short circuit.

9. What is the name we apply to the pressure or force that produces current?

10. What are the rope requirements placed on an emergency equipment board?

604. Using digital meters

1. When can you use a volt-ohm-milliammeter to troubleshoot a weapon?

2. What is the proper scale in which to set the ammeter before turning on the power?

3. What must you do when measuring an unknown resistor with an ohmmeter?

4. When the controls are properly set, what does the multimeter have the ability to measure?

5. What occurs when the FLUKE model 8025B function switch is moved from the OFF to any other position?

6. When the FLUKE model 8025B is powered on, what does the auto-range meter automatically select?

7. While in the manual range mode, how can you return to the auto-range mode?

8. If the input into the FLUKE model 8025B is over-ranged, what will the display indicate?

605. Test equipment

1. What must test equipment go through before use each day?

2. Parts categorized as “roughened” are normally a result of what?

3. How do you apply lubricant to bearings, shafts, hinges, and other sliding surfaces?

4. What should occur following any repair of test equipment?

5. Why should technicians use caution when inserting mating connectors and making temporary connections?

6. Upon initial encounter of an unusual indication while using test equipment, what is the first action you take?

7. How are wires at a station identified?

1–3. Support Equipment Procedures

All operations you perform require certain support equipment to complete the task. Support equipment requires specific operations for its use to include preparation for storage and shipment, inspection and maintenance, lubrication, and repair and replacement of parts.

606. Handling equipment

Before starting any maintenance operations, complete a serviceability inspection on the handling equipment associated to the task. Perform this inspection to verify the item's condition, correct assembly, secured hardware, and to ensure no excessively worn components.

Inspecting

Handling equipment is to be used only according to documented purposes IAW the TO and for which the procedures are provided. Handling equipment is inspected at the following intervals:

- Inspect before the first use on the day it is intended to be used.
- Inspect if the serviceability of item is in doubt.
- Inspect when indicated by difficulties encountered during use.
- Inspect when the type and frequency of use indicates.

Once a determination is made to inspect the handling equipment on the interval stated above, personnel will inspect it for good condition as defined by the following criteria. As a note, surface cosmetic features from handling, usage, or manufacturing processes that clearly do not compromise intended design use are acceptable. Perform inspection procedures as they apply to the item in question:

- Visually sound—Item is not bent, twisted, chafed, or burned; broken or cracked; bare or frayed; dented or collapsed; torn or cut; or deteriorated.
- Correctly assembled—Parts are in normal assembled positions.
- Secure—Parts are tight.
- Serviceable—Item is not damaged beyond safe or serviceable limits and/or damage will not result from further operation.

NOTE: "Excessively worn" items are items that are worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next use.

General physical inspection

If the item is damaged, remove it from service, and repair or replace it as applicable. Inspect handling equipment as follows:

- Parts and recesses—Inspect all parts and recesses for dirt and corrosion. In high-humidity locations, look for moisture, mildew, and fungus growth.
- Surfaces—Inspect surfaces for damage, corrosion, sharp edges, and burrs.
- Moving parts—Inspect moving parts for damage. As necessary, clean shaft, hinges, sliding and threaded surfaces, and similar moving parts.
- Markings—The term “rated maximum load” and “capacity” marked on the lifting equipment are synonymous and considered load-bearing marks. Load-bearing marks are considered functional markings in addition to nomenclature, part number, and suffix. All other markings are considered nonfunctional markings. Permanent markings include engravings, etchings, or impression stamps, which are not easily removed. Nonpermanent markings, such as stencil, ink, decals, or labels, are more easily removed.

When you discover any of the conditions stated above, use TO 11N–35–51 to repair or clean the item as necessary.

Specific inspection procedures

In addition to the general physical inspection, perform the following inspection procedures as applicable. If an item is damaged, remove it from service, and repair or replace it as necessary.

- Structure—Inspect the item for cracks, bends, breaks, or twists in structural members or welds. Reject damaged parts using service procedures.
- Rivets—Inspect the item for loose or missing rivets. Do not replace or repair rivets without specific disposition instructions from the design agency.
- Shackle, shackle pins, and bolts—Inspect the shackle, shackle pins, and similar load-bearing pins or bolts for wear. Replace the shackle if the shackle pin or bolt cross-section is noticeably reduced by wear.
- Axles—In order to inspect axles, support the item on blocks with casters clear of the floor, then rotate the caster wheels and check for excessive wobble or looseness on the axles. Also, check for binding or other resistance to rotation of the wheels. Lubricate as necessary if binding is caused by lack of lubrication. In addition, check for binding or other resistance to the rotation of the swivels and lubricate as necessary. Finally, apply caster brake, when present, to ensure that the caster locks in place.
- Rubber parts—Inspect to determine that the rubber wheels, pads, gaskets, or similar rubber parts have not hardened, checked, cracked, deformed, or become excessively worn or otherwise deteriorated. Make sure that rubber parts have not separated from base.
- Pads—Inspect to determine that felt pads are present and in satisfactory condition. Make sure that felt pads have not separated from base.
- Chains—Inspect to determine that chain assemblies are securely attached at each end and are not kinked, broken, or otherwise damaged.
- Controls—Inspect to determine that all operating controls and other mechanisms are in good condition.
- Pins—Inspect quick-release pins (QRP) by operating and releasing the plunger several times and checking for normal operation of locking balls. Then release the plunger and check that the balls cannot be pushed into the holes until they are flush with the outer surface of the pin body.

Lifting equipment

Other specific inspections are related to lifting equipment such as hoisting adapters and strong backs.

- Wire ropes—Inspect the wire rope leg assembly and reject it if any of the following is found:
  - Excessive wear. Beyond serviceable limits or is likely to fail if it is not replaced.
  - Corrosion.
  - Breakage. If there are 10 or more randomly distributed, broken wires in one wire rope lay, or if there are five or more broken wires in one strand in one wire rope lay.
  - Bird Caging.
  - High Stranding. A wire rope strand is raised from its original position and permanently distorted.
  - Kinked. The rope is bent over itself or curls in a tight radius.
- Thimbles—Inspect and reject the thimbles if any of the following is found:
  - Thimble biting into wire rope.
  - Distortion or closure of thimble eye.

  NOTE: Some looseness is acceptable if the thimble cannot be manually dislodged or removed.
  - Slippage or looseness of thimble eye.
  - Rough edges, burrs, and sharp corners that may damage wire rope, damage swage sleeve/clamp, or injure user.
  - Any detectable cracks.
- Hooks—Inspect and reject the hooks if any of the following is found:
  - Hook twisted out of normal position until hook latch fails to fully close.

  NOTE: Cosmetic surface nicks and scratches in hooks are acceptable.
  - Any detectable cracks.
- Hook latches—Inspect the hook latches and reject if any of the following is found:
  - Latch twisted or bent so the hook latch fails to fully close or function properly.
  - Latch spring fails to close latch against hook tip.
  - Latch nut is loose, unsecurable, or missing.
- Swage sleeves/clamps—Inspect and reject if any of the following is found:
  - Visible slippage at the swaging/clamping joints.
  - Cracks, bends, wear, or distortion in any portion of the fitting substantially affecting sling leg strength.
- Nylon slings—Inspect the slings (straps) and replace if any of the following conditions exist:
  - Broken strands and threads, frayed and missing stitching from sling junctions, holes, brittleness, and other conditions indicating excessive wear or decomposition that may render unit unsafe for further use.
  - Damage from prolonged exposure to sunlight, acids, mildew, excessive heat, and sharp projections.

These inspection points are not all inclusive; you can find additional inspection content in TO 11N–H–61 for the specific item in question. Keep in mind; always check the Air Force Technical Order (AFTO) Form 244, Industrial/Support Equipment Record, and AFTO Form 95, Significant Historical Data, as they may contain information vital to the serviceability of the equipment.

Using

Once the handling equipment has gone through the prior-to-use inspection, the equipment is ready for use. If any DOE handling equipment is used outside its authorized procedures, it requires immediate approval from Sandia National Laboratories (SNL). In order to gain the authorization, you must submit an unsatisfactory report (UR). You can use a UR to request the one-time use or to permanently change TO 11N–H–61 for the particular usage.

Maintaining

Maintain handling equipment either in an in-package condition for storage or shipment or in an out-of-package condition for use. If you are packaging handling equipment for storage or shipment, handle it according to the general instructions for cleaning, preserving, and packaging. It requires no special preparation for shipment other than packaging IAW TO 11N–35–51. You can maintain items of handling equipment that you use infrequently in an in-package storage status to reduce inspection and maintenance requirements.

Out-of-package storage requires you protect all rubber parts from contact with oil, grease, and other petroleum products. You also need to protect nylon slings from prolonged exposure to sunlight, acids, mildew, excessive heat, and sharp projections. Additionally, use item 323, general lubricating oil to protect wire rope, threaded fasteners, and other unpainted parts. Finally, on equipment with wire ropes, you should form large coils to avoid kinks and sharp bends.

Repairing

Replacing components is preferable to repairing them. However, personnel, parts, and facilities available to the using organization limit maintenance operations. Repair information is presented for personnel who are trained in the use of standard servicing equipment, who possess basic troubleshooting skills (inspection, common-sense analysis of symptoms, and working knowledge of available information), and who use approved repair techniques using information in TO 11N–35–51.

NOTE: When forwarding equipment to another agency for maintenance, include all pertinent data regarding the malfunction or defective component.

When replacing a component, make sure the replacement part is suitable for the intended application. Before installing a replacement part, visually inspect for damage or defective conditions that may have occurred during shipment, storage, or handling. If a replacement part is damaged, perform required corrective action or reject the part.

When torque values are not indicated and doubt exists on the acceptable tightness, use the information in TO 11N–35–51 as a guide.

Before reassembling the equipment, visually inspect parts and remove any dirt, dust, excess oil or grease, chips, or foreign material. After reassembly, inspect the equipment using related specific procedures. As a note, welding repairs are not authorized without specific disposition instructions from the design agency unless specifically authorized in TO 11N–H–61.

We need to keep our equipment in the highest operational status possible. This reduces the potential for accidents and injuries to personnel. To achieve this, we employ an inspection program to judge the functional ability of our equipment. There are daily serviceability inspections, general physical inspections, and specific inspection procedures. TO 11N–H–61, contains a large portion of the special handling equipment that you use and maintain.

607. Hoists, overhead gantries, and monorails

This lesson outlines basic requirements for hoists used during nuclear handling operations. Requirements for hoists in these applications are more detailed due to the equipment’s capability for lateral movement in addition to a straight vertical lift.

Hazards

The most common hazards associated with hoists are overloading, dropping, or slipping the load from improper hitching or slinging, obstruction to load passage, and failure to stabilize the load during the movement. The severity of an injury is increased by personnel not wearing required personal protective equipment such as hardhat, gloves, safety-toed boots, and eye protection. Additional hazards are human factors such as inattention and failure to keep the load clear of people and objects.

General requirements

All materiel handling equipment used with nuclear weapons must be nuclear certified. In addition, hoists must meet the following general requirements:

- Signals—Standard operating signals understood by operators and signalers shall be used in hoist operations. See AFMAN 91–203 for approved signals. Pendant controls and all personnel shall use the compass points (North, South, East, and West) to standardize direction of hoist movements.
- Engines and motors—Hoist engines and motors shall be guarded to protect personnel.
- Brakes—Self-locking brakes capable of holding at least 125 percent of the rated capacity shall be installed on all hoists.
- Electric hoists—The conductors and switches of electric hoists shall be guarded against accidental contact.
- Loads—All loads shall be balanced on hoist carriages and secured to prevent slipping or shifting.
- Hooks—Latch-type safety hooks shall be installed on all hoists.
- Load rating—The rated capacity shall be permanently marked on the hoist or its load block, and shall be legible from the operating position.
- Warnings—Information concerning operating procedures must be posted by all hoists or displayed on a label affixed to the hoist, controls or block, and shall include cautions regarding the following:
  - Lifting more than the rated capacity.
  - Operating the hoist when the hook is not centered under the hoist.
  - Operating a damaged or malfunctioning hoist.
  - Operating a rope hoist with a rope not properly seated in its groove.
  - Lifting people or loads over people.
  - Operating the hoist with twisted, kinked, or damaged chain or rope.
  - Removing or obscuring the warning label.
- Pendants—The pendant station shall be supported by a cable, chain, or rope that will protect the electrical conductors against strain. Pendant control stations shall be constructed to prevent electrical shock and shall be clearly marked for ID of functions.

Safe operating practices

The following guidelines ensure hoists are being used safely during nuclear handling operations. This list is not all-inclusive; see AFMAN 91–203 for a complete list of precautions:

- Operators who must divert their attention while operating a hoist must stop the hoist. Suspended loads cannot be left unattended.
- The operator must be familiar with the equipment and its proper care. If adjustments or repairs are necessary or any damage is observed or suspected, the operator promptly reports the problem to the bay chief.

- Rated capacity cannot be exceeded except for properly authorized tests. If it is known or suspected that a hoist may have been overloaded (other than a required and approved test load), the team chief makes sure all frequent and periodic inspections are completed before use.
- Loads are attached by means of slings or other authorized device designed specifically for the load being lifted. Also, ensure the sling or other device is seated properly in the saddle of the hook before lifting operations begin.
- Hoists will not be operated until the hoist is centered over the load. The load cannot be moved or lifted more than a few inches until it is balanced in a sling or lifting device and center of gravity is known.
- Operators test the brakes each time a load is handled by raising the load just high enough to clear the floor or supports and checking for brake action. The lift should only be continued after making sure the braking system is operating properly.
- Loaded rope hoist drum cannot be lowered where less than two wraps of rope remain on the drum. Distinctive rope markings may be used to warn the operator the rope wrap limit is being reached.
- Upper limit device cannot be used as a normal operating control except to inch the hook into place for storage between uses. Excessive jogging or inching (rapid, repeated starts and stops) of hoist controls must be avoided since this can cause premature wear or possible uncontrolled movement could occur.
- Personal protective equipment will be worn. Safety goggles are worn when eye-injury hazards, such as work-generated dirt, dust, or other airborne particles are present. Also, gloves are worn by workers who hook, unhook, load, or handle tag lines, or when there is a potential for injury from punctures and severe cuts, lacerations, and abrasions.

Inspections

Hoists are a vital part of our job, and making sure they are serviceable is very important to the safety of the weapon and the personnel in the operation. Inspect all controls and operation mechanisms, hooks, and wire ropes for damage or wear at the beginning of each shift; include observations during operations. Carefully examine any deficiencies, and the operator and bay chief should determine if they are a safety hazard.

Prior-to-use inspection

The operator or designated person conducts a visual or prior-to-use inspection daily or before use. A daily inspection is only required if specified by a TO, manufacturer's instructions, or other governing directive. Otherwise, a prior-to-use inspection will be required before the first use of the day for any munitions handling equipment, unless your unit has a more stringent directive. First, review past inspection records (AFTO Form 95 and AFTO Form 244) for discrepancies and overdue inspection dates. Upon satisfactory results, make the checks in the following paragraphs without a load on the hoist.

All controls and operation mechanisms

On the pendant controls, inspect the electrical and support cable for the condition, and ensure all labels are present and legible. Operate the hoist in all functions of the hoist, including hoisting and lowering, all applicable compass directions, operation of brakes and all limit, locking, and safety devices. Conduct the test under the slowest possible speed before testing with increased speeds up to the maximum speed. Remember to "inch" the hoist into the limit switches. Keep multi- or variable-speed hoists running at slow speeds to prevent possible damage.

Hooks

Make sure hooks do not have any apparent bend or twist from the plane from the original measurements; does not have any wear exceeding 10 percent of the original section dimension of the

hook or its load pin; and does not have any distortion causing an increase in throat opening of five (5) percent, not to exceed ¼ inch (fig. 1–5). In addition, inspect for cracks, severe nicks, or gouges, and ensure the safety latch is present and operational (i.e., closes at hook's throat). As a note, do not paint or repair by welding or reshaping nuclear certified hoist hooks. Finally, document the inspection on the AFTO Form 244 or locally devised system, which includes the date of inspection, signature of inspector, an identifier for the hooks inspected, and the hook condition. Maintain the inspection documentation for a minimum of one year. Make sure the documentation is readily available.

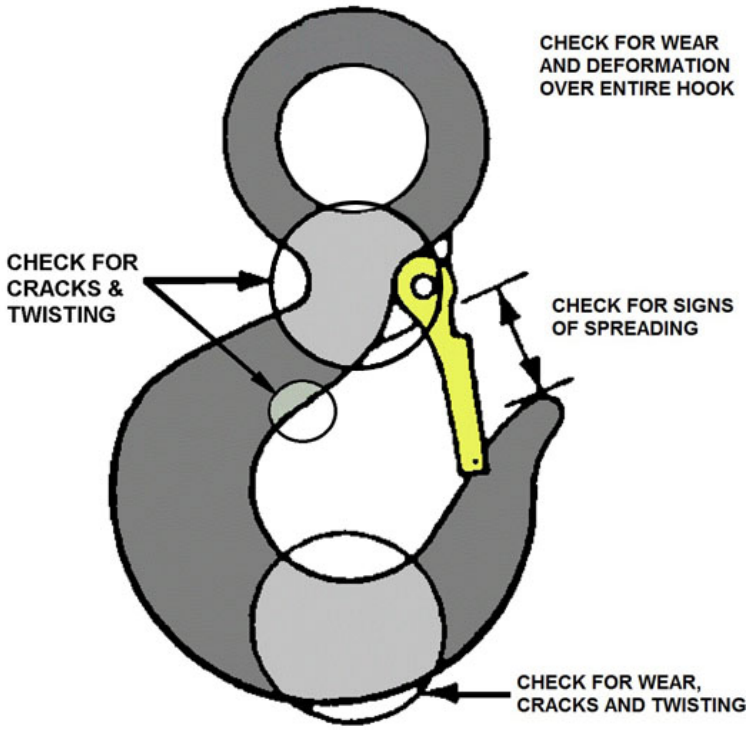


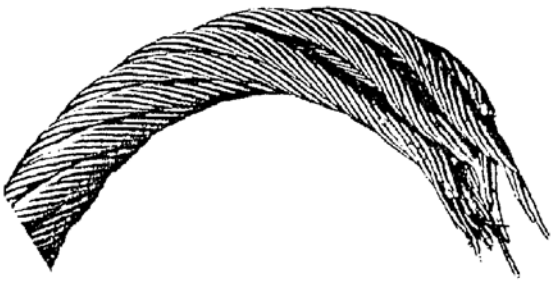
Figure 1–5. Hook inspection areas.

Wire ropes

All ropes must be visually inspected daily or prior to use inspection. Document the inspection on AFTO Form 244 or locally devised system, which includes the date of inspection, signature of the inspector, and an identifier for the ropes inspected and the rope condition. Maintain inspection documentation for a minimum of one year and made readily available. Pay close attention to sections of rope normally hidden or difficult to see during inspection as these points are most likely to fail. Inspect wire rope for reduction of rope diameter below the nominal diameter, broken or worn outside wires, and corroded or broken wires at end connections. Also, inspect for corroded, cracked, bent, worn or improperly applied end connections. Finally, inspect for severe kinking, crushing, cutting, or unstranding (fig. 1–6).

When you complete the hoist inspection, document the inspection on an AFTO Form 244 or locally devised system annotating the date, time, initials of the person performing the inspection, and any discrepancies noted during the inspection.

A "bird cage." Caused by sudden release of tension and resultant rebound of rope from overloaded condition. These strands and wires will not return to their original positions.



A wire rope which has jumped a sheave. The rope itself is deformed into a "curl" as if bent around a round shaft. Close examination of the wires show two types of breaks–normal tensile "cup and cone" breaks and shear breaks which give the appearance of having been cut on an angle with a cold chisel.

A wire rope which has been subjected to repeated bending over sheaves under normal loads. This results in "fatigue" breaks in individual wires–these breaks are square and usually in the crown of the strands.

A wire rope which has been kinked. A kink is caused by pulling down a loop in a slack line during improper handling, installation, or operation. Note the distortion of the strands and individual wires. Early rope failure will undoubtedly occur at this point.

An example of "fatigue" failure of a wire rope which has been subjected to heavy loads over small sheaves. The usual crown breaks are accompanied by breaks in the valleys of the strands–these breaks are caused by "strand nicking" resulting from the heavy loads.

An example of a wire rope that has provided maximum service and is ready for replacement.

A close-up of a rope subjected to drum crushing. Note the distortion of the individual wires and displacement from their normal position. This is usually caused by the rope scrubbing on itself.

A fatigue break in a cable tool drill line caused by a tight kink developed in the rope during operation.

Figure 1–6. Wire rope damage and wear.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

606. Handling equipment

1. What are the inspection intervals of handling equipment?

2. What is meant by handling equipment that is visually sound?

3. What is meant by handling equipment that is serviceable?

4. What term is assigned to handling equipment worn beyond serviceable limits?

5. What additional considerations are made when inspecting in high-humidity locations?

6. What are some examples of functional markings?

7. When can a technician repair loose rivets?

8. How are QRPs inspected?

9. Who must approve handling equipment used outside authorized procedures?

10. What is used to protect wire rope in out-of-package storage configuration?

11. What must occur before installing a replacement part?

12. Are welding repairs authorized on handling equipment?

607. Hoists, overhead gantries, and monorails

1. What are the common hazards associated with hoists?

2. What standardizes the direction of all hoist movements?

3. What are the brake requirements of all hoists?

4. Where should hoist warnings be posted?

5. When are hoists authorized to exceed the rated capacity?

6. How are slings or other devices positioned on the hook?

7. How often are hoist brakes checked?

8. When are upper limit switches used as normal operating controls?

9. Why are gloves required for unhooking, hooking, or unloading operations during hoisting?

10. What are the inspections for the pendant control?

11. What is the wear criterion of the original section dimension of the hoist hook or load pin?

12. How long are AFTO Form 244 maintained for wire ropes?

Answers to Self-Test Questions

601

1. AFNWC.
2. ELO–4.
3. Aircraft, ICBM, air-launched missile, facilities, non-specialized, and general guidance sections.
4. Purpose, scope, positive ID, general restrictions, and additional information.
5. Only the nameplate, label, or appropriate markings.

6. Absence of data on the nameplate, when all other identifying elements are correct, does not constitute a discrepancy.
7. Restrictions will be clearly marked in the MNCL listing under the restrictions block for that particular item and reflect individual item ID information (e.g., item serial number).

602

1. A .mil or .gov domain.
2. The disclosure and distribution page. Click the "I Agree" hyperlink to advance.
3. The MNCL search engine.
4. (1) d.
   (2) e.
   (3) g.
   (4) b.
   (5) h.
   (6) c.
   (7) a.
   (8) f.

603

1. Techniques of first aid for electrical shock and in CPR procedures.
2. Jewelry, earrings, rings, hair fasteners, bracelets, key chains, or metallic ID (dog) tags.
3. Should be properly protected by molded housing, bridges, or other covers approved for such use.
4. Should be disconnected.
5. The other paths continue to operate. The only change is that the total current is reduced.
6. The opposition that either a conductor or insulator offers to the flow of electrons.
7. The remaining devices will not function because there is no longer a complete path or circuit.
8. (1) Improper wiring.
   (2) Broken insulation.
   (3) Accidental contact between two normally insulated conductors or points.
9. Voltage.
10. 15 feet in length of natural fiber rope, preferably ½ or $^{5}/_{8}$ inch in diameter. Do not use synthetic rope since they may melt or burn quickly when exposed to an electric arc, heat, or flame.

604

1. When specifically authorized by the maintenance procedures in the applicable TOs.
2. As high as, or higher than, the estimated current.
3. Disconnect at least one terminal of the resistor from the circuit to obtain an accurate measurement.
4. Amps, ohms, and voltage in different amounts through the use of different scales on the face of the meter.
5. The meter is powered up and a self-test is performed.
6. The appropriate range for the measurement being taken.
7. Press and hold the RANGE button for approximately two seconds or select a different function with the rotary switch.
8. OL.

605

1. A physical inspection.
2. Normal wear.
3. Sparingly to the part and wipe off any excess lubricant.
4. Functional test.
5. Might damage pins and sockets of electrical connectors.

6. Decide if the cause can be identified and corrected without dismantling the equipment.
7. By a W number and the number of the station at which that particular W number can be picked up when tracing a circuit.

606

1. (1) Before first use on the day it's intended to be used.
   (2) If serviceability of item is in doubt.
   (3) When indicated by difficulties encountered during use.
   (4) When type and frequency of use indicates.
2. Item is not bent, twisted, chafed or burned, broken or cracked, bare or frayed, dented or collapsed, torn or cut, or deteriorated.
3. Item is not damaged beyond safe or serviceable limits and/or damage will not result from further operation.
4. Excessively worn.
5. Inspect for moisture, mildew, and fungus growth.
6. Nomenclature, part number, suffix, and load-bearing marks.
7. Only when disposition instructions are received from the design agency.
8. By operating and releasing the plunger several times and checking for normal operation of the locking balls. Then release plunger and check that the balls cannot be pushed into holes until flushed with outer surface of pin body.
9. SNL.
10. Use item 323, general lubricating oil.
11. Visually inspect for damage or defective conditions that may have occurred during shipment, storage, or handling.
12. Not without specific disposition instructions from the design agency unless specifically authorized in TO 11N–H–61.

607

1. Overloading, dropping, or slipping of the load from improper hitching or slinging, obstruction to load passage, and failure to stabilize the load during the movement.
2. Pendant controls labeled with and personnel using the compass points.
3. Self-locking brakes capable of holding at least 125 percent of the rated capacity shall be installed on all hoists.
4. Affixed to the hoist, controls, or block.
5. Properly authorized tests.
6. Seated properly in the saddle of the hook.
7. Each time a load is handled.
8. To inch the hook into place for storage between uses.
9. Potential for injury from punctures and severe cuts, lacerations, and abrasions.
10. Inspect the electrical and support cable for condition and ensure all labels are present and legible.
11. Wear does not exceed 10 percent of the original section dimension of the hook or its load pin.
12. Minimum of one year.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

1. (601) What are host nations authorized to use for determining the nuclear certification status of host-nation-owned support equipment?
   a. Master Nuclear Certification List (MNCL).
   b. Engineering Liaison Office (ELO)–4.
   c. North Atlantic Treaty Organization (NATO)–1.
   d. Outside the continental United States (OCONUS)–3.

2. (601) What section of the Master Nuclear Certification List (MCNL) category filter is used to find the certification status of the Secure Transportable Maintenance System (STMS)?
   a. Aircraft.
   b. Non-specialized.
   c. Intercontinental ballistic missile (ICBM) certification.
   d. Outside the continental United States (OCONUS).

3. (601) What section of the Master Nuclear Certification List (MNCL) category filter is used to find the certification status of the forklifts?
   a. Aircraft.
   b. Non-specialized.
   c. Logistics readiness squadron (LRS) certification.
   d. Intercontinental ballistic missile (ICBM).

4. (601) What reason may restrict the use of nuclear certified equipment from the Master Nuclear Certification List (MNCL)?
   a. Modification.
   b. Serviceability.
   c. Budget restraints.
   d. Suspended stock.

5. (602) Which agency manages the Web-based Master Nuclear Certification List (MNCL)?
   a. Air Force Nuclear Weapons Center (AFNWC).
   b. Defense Threat Reduction Agency (DTRA).
   c. Sandia National Laboratories (SNL).
   d. Major command (MAJCOM).

6. (602) What term is annotated in the Cert Status of the Master Nuclear Certification List (MNCL)?
   a. Nuclear or design.
   b. Certified or design.
   c. Nuclear or uncertified.
   d. Certified or uncertified.

7. (603) What is the *most* important job of the safety observer?
   a. Fulfill two-person concept requirements.
   b. Evaluate adherence to governing directives.
   c. Help carry heavy objects during electrical tasks.
   d. Immediately disconnect power if a mishap occurs.

8. (603) Which method is an approved measure when working around live electrical equipment?
   a. Wearing surgical gloves or mechanic's gloves to cover your rings.
   b. Wearing metal-framed eyeglasses secured by a band or cord.
   c. Tucking a metallic identification (ID) (i.e., military dog tag) inside your shirt.
   d. Wrapping tape around your ring(s).

9. (603) What statement applies to the use of flexible cords and extension cords?
   a. Extension cords can be used to substitute fixed wiring.
   b. Extension cords shall be rated at 10 amperes (amp) minimum above the required power draw.
   c. Extension cords used with portable tools, and equipment can have two-prong plugs.
   d. Clear tape may be used to secure cords in place in traveled areas to avoid tripping.

10. (603) What is the unit of current called?
   a. Resistance.
   b. Wattage.
   c. Voltage.
   d. Ampere.

11. (603) A circuit in which there is more than one voltage path is
   a. an open circuit.
   b. a series circuit.
   c. a parallel circuit.
   d. a grounded circuit.

12. (604) If you use an ohmmeter or multimeter with an ohmmeter to troubleshoot a nuclear weapon, they may produce enough voltage to
   a. actuate the weapons command disablement system (CDS).
   b. alter the permissive action link (PAL) coded switches.
   c. actuate the weapons active protection system.
   d. fire an electrostatic sensitive device (ESSD).

13. (604) What would happen if you connected an ammeter directly across a power supply?
   a. A normal voltage indication would be obtained.
   b. Indication of available power in the power supply is received.
   c. Serious damage to the ammeter and power supply may occur.
   d. Needle movement in accordance to the amount of current would register.

14. (604) How do you connect a voltmeter when measuring voltage drop across a circuit element?
   a. Parallel with the load.
   b. In series with the load.
   c. In the series side of a series-parallel circuit.
   d. In the parallel side of a series-parallel circuit.

15. (604) When you rotate the function switch on the FLUKE 8025B multimeter from the OFF position to any other position, the meter is powered
   a. up only.
   b. down only.
   c. up and performs a self-test.
   d. down and performs a self-test.

16. (605) Before using test equipment, what do you apply to bearings, shafts, and hinges when necessary?
    a. Nothing, bearings, shafts, and hinges must remain clean.
    b. General-purpose lubricating oil.
    c. Rust-preventative compound.
    d. Solid film lubricating oil.

17. (605) What are the multimeter requirements in order to check voltage and resistance of test sets?
    a. 10,000 ohms per volt, direct current (VDC) and 5,000 ohms per volt, alternating current (VAC).
    b. 5,000 ohms per VDC and 10,000 ohms per VAC.
    c. 20,000 ohms per VDC and 1,000 ohms per VAC.
    d. 1,000 ohms per VDC and 20,000 ohms per VAC.

18. (606) What is *not* inspected as part of the specific inspection procedures?
    a. Markings.
    b. Shackles.
    c. Structure.
    d. Rubber parts.

19. (606) What is the correct procedure for inspecting quick-release pins (QRP)?
    a. Operate the plunger several times for normal operation to make sure it operates smoothly.
    b. Operate the plunger several times and then make sure the locking balls cannot be pushed back into the holes.
    c. Operate the plunger several times and then make sure the locking balls can be pushed back into the holes.
    d. Only a visual inspection will suffice for serviceability inspection.

20. (606) While repairing handling equipment, what resource should you refer to if torque values *are not* specified?
    a. Best possible guess.
    b. Limits of the wrench.
    c. TO 32B14–3–1–101.
    d. TO 11N–35–51.

21. (607) How is the injury severity *increased* by personnel while using a hoist?
    a. Dropping or slipping of the load.
    b. Improper hitching or slinging of the load.
    c. Not wearing the required personal protective equipment.
    d. Inattention and failure to keep the load clear of people and objects.

22. (607) Which is one of the warnings that *must* be displayed or affixed to the hoist?
    a. Lifting people or loads over people.
    b. Ensuring hoist operators are fully trained and qualified.
    c. Latch-type safety hooks should be installed on all hoists.
    d. Signing off the Air Force Technical Order (AFTO) Form 244 after each inspection.

23. (607) Which statement serves as a guideline in regards to safe operating practices of hoists?
    a. The rated capacity may be exceeded at any time the hoist is used for nonnuclear operations.
    b. An upper limit device shall be used as a normal operating control to include inching.
    c. No loaded rope drum shall be lowered where less than three (3) wraps remain.
    d. Operators must test the brakes each time a load is handled.

24. (607) What Air Force technical order (AFTO) forms do you check to verify the condition of the hoist before use?
    a. 95 and 244.
    b. 95 and 349.
    c. 244 and 349.
    d. 349 and 350.

25. (607) Hoist hooks *must* be replaced when they have more than
    a. 5 percent in excess of normal throat opening not to exceed ½ inch.
    b. 10 percent in excess of normal throat opening not to exceed ½ inch.
    c. 5 percent in excess of normal throat opening not to exceed ¼ inch.
    d. 10 percent in excess of normal throat opening not to exceed ¼ inch.

26. (607) How long is the hoist wire rope inspection documentation maintained?
    a. Minimum of each month.
    b. Minimum of six months.
    c. Minimum of one year.
    d. Life of the wire rope.

Please read the unit menu for unit 2 and continue ➔

Student Notes

Unit 2. Special Test and Handling Equipment

IN THIS UNIT, we'll cover some of the special test and handling equipment used for specific operations. For instance, we cover the handling equipment used with limited-life components (LLC) and the test equipment used to backfill and leak-test the containers prior to storage and transport. Afterwards, we discuss the equipment called use control (UC) equipment, used to prevent unauthorized arming of nuclear weapons. First, we cover the procedures for the LLC containers.

2–1. Limited-Life Component Container Procedures

The H1616s are containers authorized for shipping reservoirs to and from DOE facilities. The Department of Transportation (DOT) regulates the transportation of radioactive material to eliminate hazards in case of an accident. To meet DOT regulations for shipping LLCs, H1616 containers were developed.

608. H1616 container assembly

The H1616 provides a safe environment for tritium reservoirs during normal handling and transporting. They are certified according to federal regulations for the transport of radioactive material, and they meet strict requirements pertaining to the accidental release of tritium.

General and safety precautions

You are responsible for unpacking and packaging the components in the H1616 container during LLC exchange operations; therefore, you need to understand some general operating procedures for the container. TO 11N–H1616–2, *Operation and Maintenance Instructions with Illustrated Parts Breakdown, H1616 Containers,* contains operating procedures, maintenance instructions, and the illustrated parts breakdown (IPB) for the H1616 container. You must reject the entire container if the drum overpack, containment vessel (CV) lid, or CV fails inspection. Do not mix parts from different containers. In addition, as always, refer to the proper TO when performing any maintenance procedures.

Description

There are two models of containers authorized for use: H1616–1 and H1616–2. Use the H1616–2 model *only* when specifically authorized to do so. The H1616 is comprised of two major components: an internal CV and an external drum overpack. Refer to figure 2–1 as we examine these components.

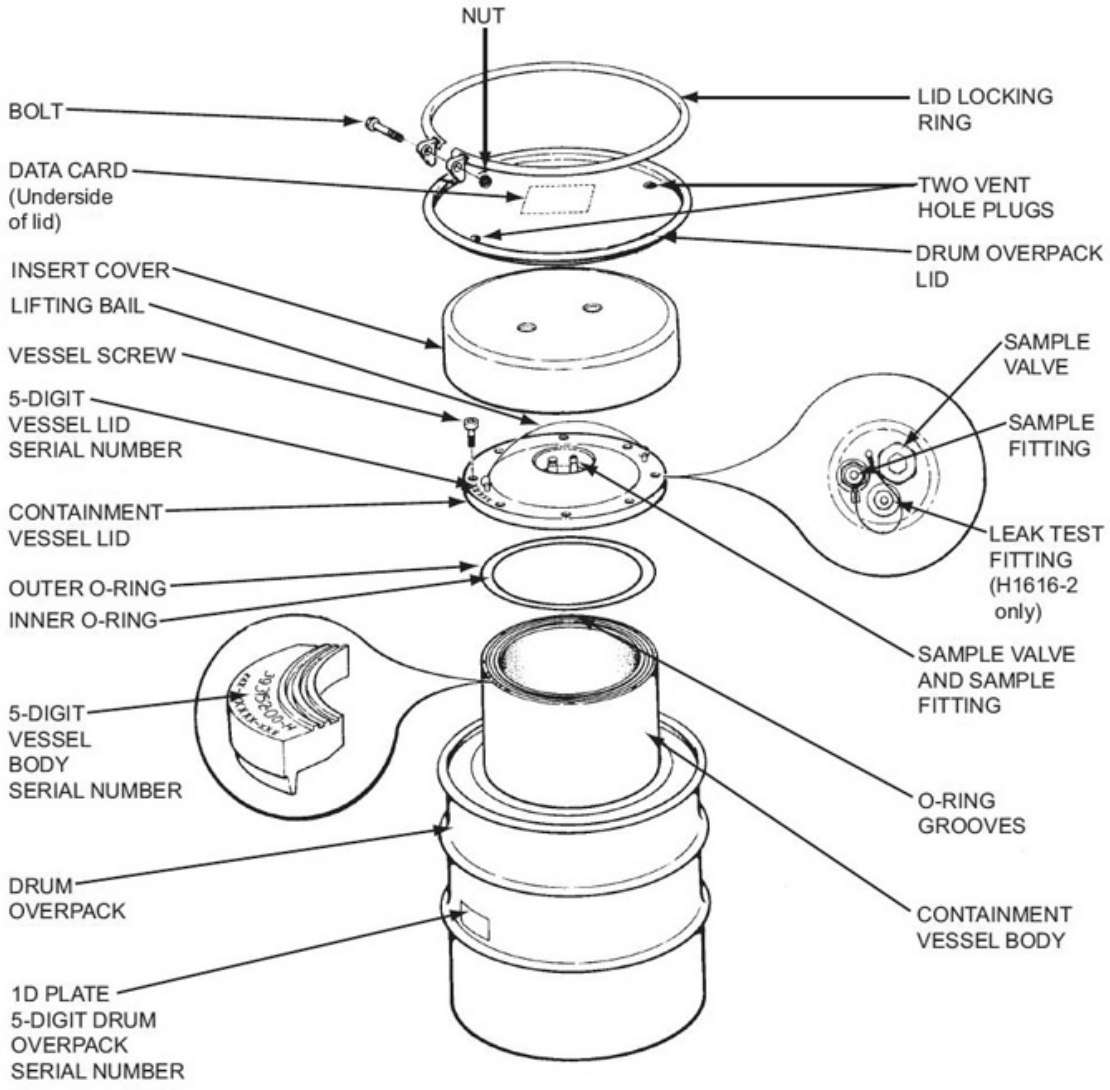


Figure 2–1. H1616 components.

Containment vessel

The CV is designed to provide tritium containment if a reservoir ruptures because of an accident. The CV is sealed when the vessel lid is secured to the vessel body. The CV is comprised of two major parts: a vessel body and vessel lid. The vessel body contains groves for installing O-rings, which seal the CV when the lid is secured to the vessel body. The CV is filled with aluminum thimble packing material to protect and draw heat away from the LLC material. It is later backfilled with nitrogen gas to provide a consistent atmosphere for shipping and storage.

H1616–1

The H1616–1 vessel lid has two major operational components: the sample valve and the sample fitting. When it is attached to the T568, the sample fitting on the H1616–1 allows the following operations:

- Evacuating the CV.
- Backfilling the CV with nitrogen.
- Testing the CV O-rings for leaks.

The sample valve provides access (through the sample fitting) to the interior volume where the reservoirs reside. When the sample valve is closed, it limits access to the volume between the O-rings only.

H1616–2

Besides the sample valve and the sample fitting, the H1616–2 vessel lid has an additional fitting, the leak-test fitting. When it is attached to the T568, the leak-test fitting verifies the integrity of the O-rings and the volume seal. The H1616–2 vessel lid also contains a groove that houses a getter assembly. The getter assembly absorbs any tritium that might leak past the inner O-ring. To verify that the H1616–2 is operational, three leak tests are required:

- Sample valve seal test—Tests sample valve seat sealing using the sample fitting.
- O-ring leak test—Tests the integrity of O-rings using the leak-test fitting.
- Test fitting leak test—Tests the integrity of the leak-test fitting cap seal.

You can see with the cutaway examples in figures 2–2a and 2–2b to provide a better representation of the differences in the two CVs.

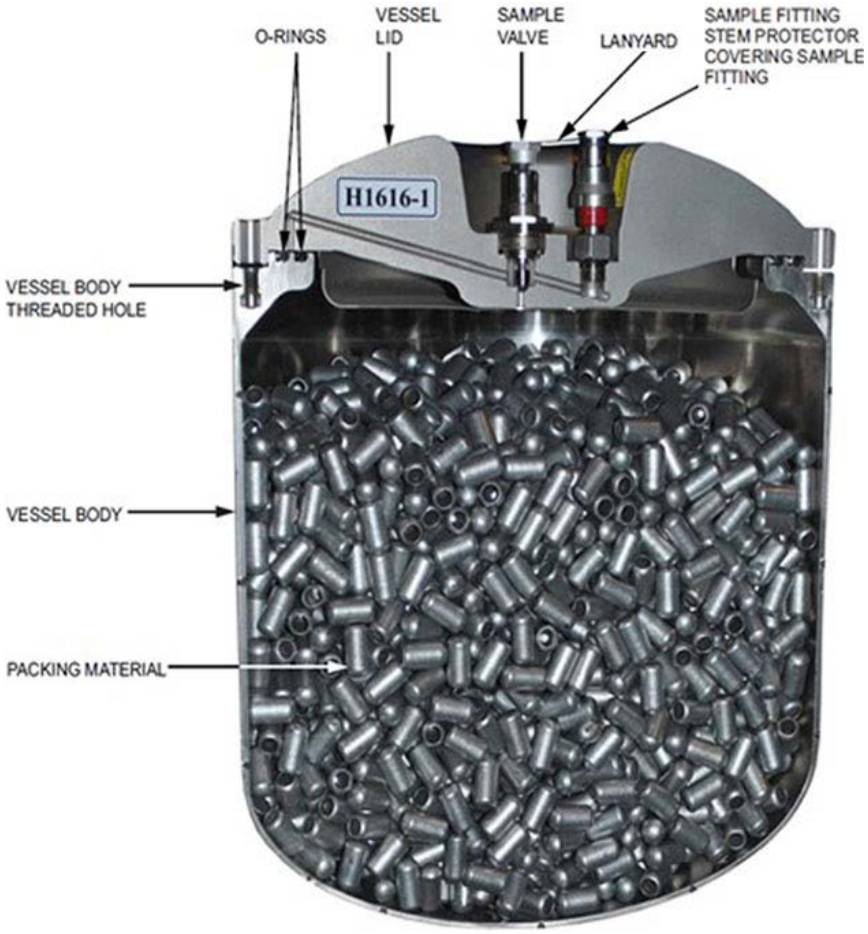


Figure 2–2a. H1616-1 cutaway.

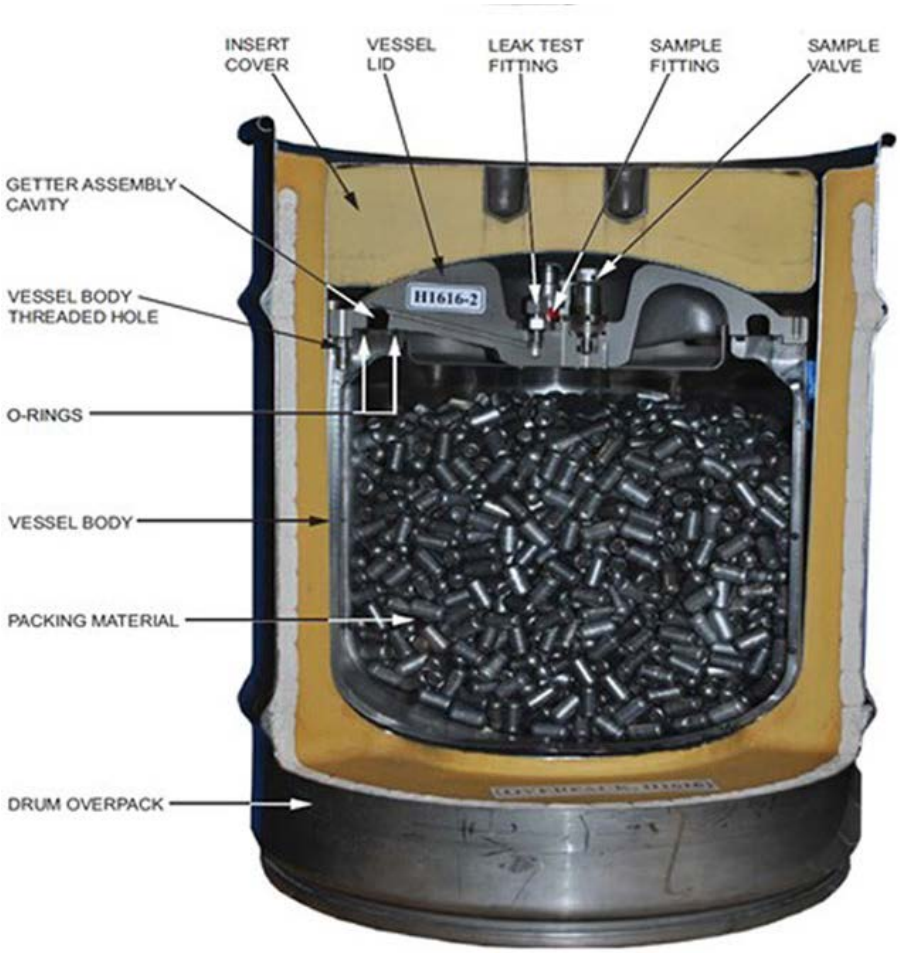


Figure 2–2b. H1616-2 cutaway.

Drum overpack

The insulated and polyurethane foam-filled, stainless-steel drum overpack provides a thermal barrier to keep the temperature of the CV O-rings below their maximum allowable service temperature, and a mechanical shock protection for the CV during handling and accident conditions. Both models of the H1616 use the same drum overpack. Vent holes (sealed with vent plugs) in the overpack prevent pressure buildup if an accident involves fire.

Handling the H1616

The H1605 clamp band (fig. 2–3) is the recommended equipment for handling the H1616. The H1605 has handles so personnel can carry the H1616 and has lugs for hoisting by overhead equipment. You can use any sling with a minimum safe working load of 200 pounds, provided the metal parts of the sling do not strike against the side of the H1616.

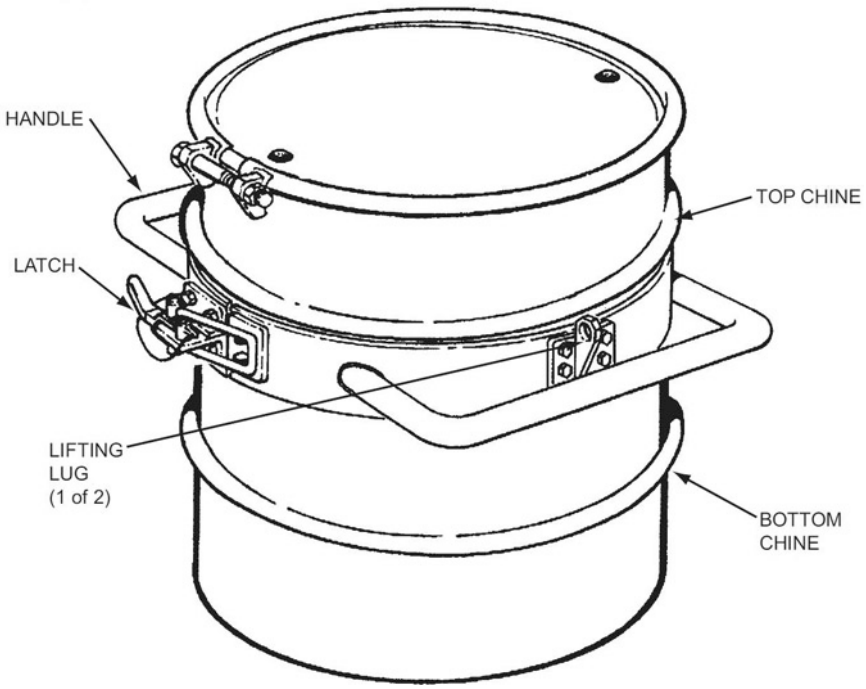


Figure 2–3. H1605 installed on the H1616.

When using the H1605 clamp band, observe the following warning and caution:

WARNING: To prevent injury to personnel, support the H1605 during tension adjustment; initial adjustment of the self-locking nuts may allow the H1605 to fall from the H1616 overpack. Failure to install the H1605 directly below the H1616 top chine may cause injury to personnel due to a high center of gravity. To prevent the inadvertent release of the H1605 latch, make sure that the T-handle lock pin is installed.

CAUTION: To prevent damage to the H1605 latching mechanism, make sure that the U-bolt is centered in the hook assembly and install the H1605 with lifting lugs upward.

Unpackage contents

Before you unpack the contents from the H1616 container, you will perform a physical inspection of the container to see if it has any damage that may reduce its effectiveness or prevent its use. If the drum overpack, CV lid, or CV fail inspection, the entire container must be rejected. Do not mix parts from different containers. Confirm that all 15 vent hole plugs are in place. If any plugs are missing, cover the area with pressure-sensitive adhesive tape and accept the H1616 for use. Punctures in excess of one-half inch and dents or flattened areas greater than one-half inch in the drum overpack are causes for rejection. Smaller punctures are acceptable and may be covered with pressure-sensitive adhesive tape, as well. Scratches and gouges are acceptable.

Make sure the expiration date found on the H1616 overpack allows adequate time for LLC removal, installation, and return of expired LLC material to DOE custody. Container verification expires on the date shown on the label. For example, a container with an expiration date of 29 May 13 may not be used on or after 30 May 13. Within the DOD, containers with expired certification are authorized for storage and shipping LLC materials. Containers with expired certification are not authorized for shipping LLC materials by DOE transportation. When preparing for shipment to DOE, if the contents are stored in an expired container, repackage the contents in a certified container that will not expire before transfer to DOE.

To unpackage the H1616, cut and remove Multi-Lok seal, remove the nut and bolt from the locking ring, remove the locking ring and lid from the drum overpack, and remove insert cover from the container. Next, equalize the CV pressure by:

1. Open the sample valve on the CV lid by turning the valve approximately one turn counterclockwise. Do not attempt to turn the valve beyond the stop or you will damage the sample valve.
2. Next, remove the sample fitting stem protector and use the backside of the fitting, or other suitable tool, to equalize the CV pressure by depressing and holding the sample fitting stem until you can no longer hear the sound of airflow.
3. Reinstall the sample fitting stem protector.

NOTE: When utilizing the H1616–2 container, only open it prior to maintenance operations that require it. After placing the component in the H1616–2 container, follow all procedures to include a leak test to ensure the H1616–2 container has not failed, and that you accomplish a successful leak check. The H1616–2 vessel lid shall not remain removed from the CV body for more than 2 hours.

Now, loosen the CV lid screws. A second person should hold the CV to prevent it from rotating while you loosen the screws. Once you remove the screws, use the wire bail to lift the lid and place it on a clean flat surface. Before unpacking, verify the serial numbers by removing the data card from the underside of the drum overpack lid. Verify that the serial numbers of the drum overpack, vessel body, and lid match the serial numbers on the data card. If they do not agree with the data card, accept the reservoirs, restrict the H1616 to storage use only, and submit a UR.

Next, you will remove the aluminum thimble packing material. Because the aluminum packing material contains trace levels of radioactive contamination, aluminum oxide, and residue left over from the manufacturing process, using gloves is recommended. If gloves are used, dispose of them as low-level radioactive waste (LLRW). Keep removing the packing material until you expose and can carefully remove the LLC from the CV.

Packaging an LLC and closing the H1616

When packaging an LLC in the H1616 for shipment or storage, perform the following procedures:

- Visually inspect the drum overpack. Record the LLC serial numbers, then bag and mark components for shipping, per applicable weapons TO.
- Remove data card and verify serial numbers of drum overpack, vessel lid, and vessel body. The vessel lid and vessel body may have different serial numbers. You can use the H1616 if the serial numbers of the vessel body, vessel lid, and drum overpack match those found on the data card. Otherwise, reject the H1616 and submit a UR.
- Make sure the “re-verify due date” on the data card and the “expiration date” on the H1616 drum overpack agree. If they do not, submit a UR. Enter the date packaged using the day-month-year format, (e.g., 1 Jan 08); location where packaged using the reporting unit ID code; and kit number according to TO 11N–100–2, *Supply Management of Limited-Life Components*.
- Make sure the CV interior is dry.
- Make sure about two to three inches of packing material remains in the bottom of the CV. Add or remove packing material as necessary.
- Place the LLC on top of the packing material approximately centered in the vessel, in a horizontal position, or as specified by the appropriate weapons manual. Fill with the remaining packing material, between two to three inches from the top of the CV flange. Ensure that the contents do not extend closer than 2 inches from top of the CV flange.
- Using your fingers, remove the O-rings. Do not use instruments of any kind when removing O-rings. Using anything other than your fingers could cause damage to the O-rings or sealing

surfaces. Inspect the O-rings for cuts, gouges, or scratches. Replace if any of these defects are present by disposing of the old O-ring as LLRW, and obtaining a new O-ring. Record the 5-digit batch number (located on the O-ring packaging) onto the data card.

- Visually inspect the CV sealing surfaces for scratches, nicks, and cosmetic flaws on the sealing surfaces. These defects are acceptable as long as the container passes the leak test (H1616–1) or O-ring test (H1616–2).
- Clean the O-rings, O-ring grooves in the vessel body, and the sealing surface on the underside of the vessel lid with isopropyl alcohol. Allow to air dry for approximately 10 minutes.
- Reinstall O-rings in the grooves.
- If utilizing the H1616–2, inspect for the presence of getter in the lid. If it is missing, submit a UR.

NOTE: To prevent leak-test failures, sealing surfaces and O-rings must be clean, dry, and free of lubricants.

- Install and align the vessel lid and tighten the screws to 20 ± 2 foot-pounds (ft-lb) using diametrically opposed, alternating sequence. Repeat the torque sequence. If the screws move significantly during the second torqueing sequence, you need to check for pinched O-rings.
- If the H1616 container needs to be transported over road before the backfill and leak check are performed, finger-tighten the sample valve and torque to 30 ± 2 inch-pound (in-lb).
- Use the T568 to evacuate, backfill with nitrogen, and conduct a leak test. (This procedure will be covered in the next section.) On the data card, record the following leak-test information: date leak tested, location tested, and test results. Place the card in the drum overpack lid.
- Install the insert cover on top of the CV and install the drum overpack lid. Install the locking ring, lug nut, and bolt. Align the lugs so that they are directly above the permanent ID plate. Tighten the lock ring lug nut to 72 ±12 in-lb. If the locking ring rotates after applying this torque, the ring is acceptable.
- Place the appropriate labels and tags on the outside of the drum overpack and install the Multi-Lok security seal. Figure 2–4 shows the placement of the security seal and red tag.

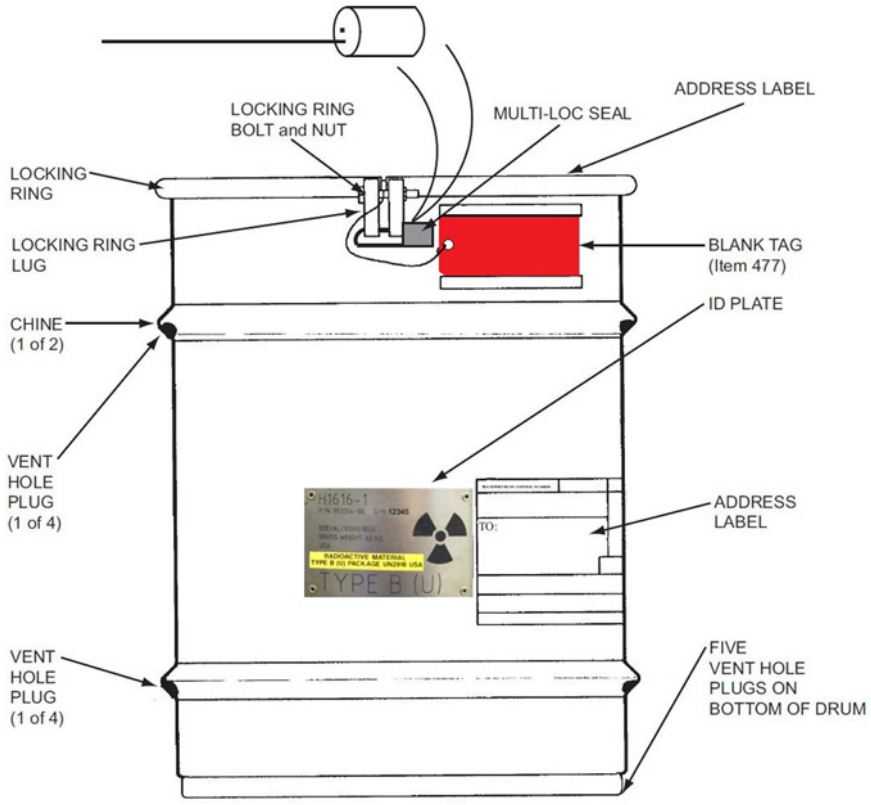


Figure 2–4. External view of the H1616.

Red tag completion

Before shipping an H1616, you must complete and attach a red tag. Red tags are required when shipping replaced (expired) or unserviceable LLC components. Information for completing the red tag is also located in TO 11N–H1616–2 and TO 11N–35–51. Obtain the kit part number from TO 11N–100–2 and the component's serial numbers that were recorded earlier.

Using waterproof ink and characters at least $^{5}/_{32}$ inch high for hand marking (use capital letters for typing), annotate or type the following data on the *red* tag:

Kit Part Number: Quantity: "1 EA"	Obtain from Table 2–1, TO 11N–100–2.
Fig. And Date Code: "A/A-1A-___"	Current date by month and year, e.g. 11/17
Serial Numbers or Assembly (as applicable):	List serial numbers of reservoirs or neutron generators. Do not list prefixes or suffixes.
Weight:	Package weight to nearest pound.
Cube: 1.8 (9-gal Drum), 3.6 (H1616-1/H1616-2)	

Insert the *red* tag into a plastic bag or plastic envelope and safety wire (double-twist method) it to the closing bolt of the can. Secure the tag to the container with filament-reinforced, pressure-sensitive adhesive tape. Apply other external labels as necessary to the yellow polyethylene tape on the drum overpack.

The H1616 container is compatible with all currently used storage facilities. The container can be shipped without restrictions on all government ground vehicles and cargo aircraft.

Principles of operation

In case of an accident, the CV provides tritium containment under maximum credible conditions that could occur in the vessel if a reservoir ruptures. The drum overpack provides a thermal barrier to keep the temperature of the CV O-rings below their maximum allowable service temperature. It also provides mechanical protection for the CV during handling and accident conditions. After you package the container, evacuate the CV, fill it with nitrogen, and verify the CV assembly. The nitrogen backfill eliminates the potential for an explosive mixture of tritium and air to form if the reservoir leaks during an accident. The nitrogen also guarantees a consistent atmosphere (primarily low humidity) for the reservoir during shipment and storage.

609. H1700 container

The H1700 container assembly (fig. 2–5) is used for shipping and storing components. It is certified IAW federal regulations for transport of radioactive material. It is used only when specifically authorized.

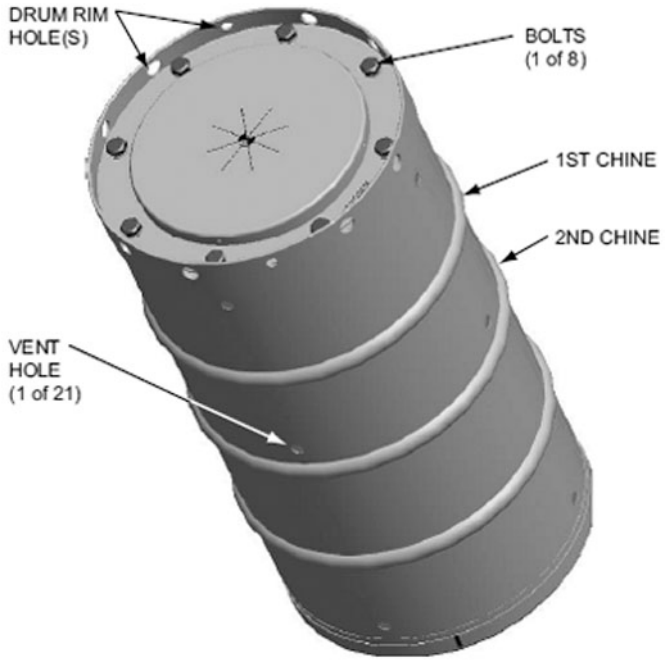


Figure 2–5. External view of the H1700.

General and safety precautions

If the drum overpack, CV lid, or CV fails inspection, you must reject the entire container. Do not mix parts from different containers unless authorized by a UR. In addition, the yellow polyethylene tape is the only tape authorized for use on the CV or drum overpack. The labels may be affixed to the yellow polyethylene tape by any suitable means identified in TO 11N–H1700–2, *Operation and Maintenance Instructions with Illustrated Parts Breakdown, H1700 Container*.

Description

The H1700 drum is approximately 36 inches high by 19 inches wide, and can weigh from approximately a minimum of 256 pounds to a maximum weight of 350 pounds. The H1700 container is composed of two parts: an internal CV and an external drum overpack.

Containment vessel

The CV (fig. 2–6) has two major parts: a vessel body and a vessel cone seal. The vessel cone seal plug contains grooves for installing O-rings, which seal the CV when the vessel cone seal is secured to the vessel body. The CV lid has a leak-test port plug and gland nut. The lead test port allows leak

testing of the CV O-rings. A test fitting leak test also verifies the integrity of the leak-test port plug. The leak-test adapter interfaces between the CV test port and the T568 by hose.

The CV protects and draws heat away from the components. It also holds the union assembly, which contains two war reserve (WR) components and two blivets. A "blivet" is a mass mockup of the WR component used for H1700 packaging operations. It is made from aluminum, colored blue for ID, and has threaded inserts, but it is missing the connector present on WR components. A blivet does not require inspection.

Figure 2–6. Containment vessel.

Drum overpack

The insulated and polyurethane foam-filled, stainless-steel drum overpack provides thermal and mechanical shock protection for the CV. Vent holes (sealed with cap plugs) in the drum overpack prevent pressure buildup in the drum overpack if an accident involves fire.

Principles of operation

The H1700 is designed to provide a safe environment for components during normal handling and transportation. Operation of the two major components (the CV and the drum overpack) are as follows:

- The CV is designed to provide containment under maximum credible conditions that could occur in the CV because of an accident. The CV is a sealed system when the vessel cone seal (lid) is secured to the vessel body.
- The drum overpack provides a thermal barrier to keep the temperature of the CV O-rings below their maximum allowable service temperature. It also provides mechanical protection for the CV during handling and accident conditions.

After components are packaged in the CV and the cone seal (lid) is installed, the CV seal is verified using the T568.

Unpackage contents

Internal pressurization of the CV may occur due to increased temperature and gas generation. The CV has a pressure-release hole in the vessel wall located adjacent to the top of the seated cone seal plug. This pressure-release hole allows trapped gas to vent after the seal is broken but before the closure threads are completely disengaged. Ensure the vent path is pointed away from personnel.

The H1700, like the H1616, must be inspected before unpacking the contents. Confirm that all 21 vent holes cap plugs (4 on the lid, 12 on the drum side, and 5 on the container bottom) are in place. If cap plugs are missing, cover the holes with yellow polyethylene tape, and accept the H1700 for use. Use Table 5–1 listed in TO 11N–H1700–2 to determine the reject criteria for punctures, dents, gouges, and other damages to the H1700 to determine its serviceability. Containers with expired certification are authorized for storage and shipment within the DOD only. This does not apply to DOE transportations of the H1700. Once the container is expired, it is restricted to storage only. In order to ship via DOE transportation, you must remove and repackage the contents in the expired container in a certified, non-expired H1700 container. Next, perform the following procedures to unpackage the H1700:

- Cut and remove the security seal or quick seals. Remove the eight bolts and washers from the lid and set aside for later reinstallation.
- Apply yellow polyethylene tape to the laser-etched markings on the drum lid to improve suction.

- Apply the vacuum cup handle (fig. 2–7) to the lid and ensure the cups are properly engaged. Manually support the underside while removing the lid. Place the lid on a clean padded surface.

Figure 2–7. Vacuum cup handle.

- Next, remove the exchange parts bag containing extra labels and set aside. Manually remove the top load distribution fixture and place on a clean padded surface.
- Attach the CV tongs (fig. 2–8) to the cone seal nut and install a QRP. The CV may weigh up to 100 pounds, so a hoist is recommended to help lift the vessel out of the H1700. Manually, or by using a hoist, lift the vessel and lower it into the CV stand ensuring the notches on the CV align with the bar in the CV stand.

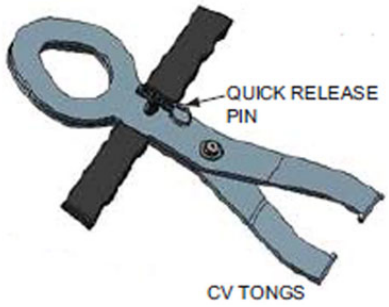


Figure 2–8. CV tongs.

- Remove the CV tongs. Check that the cone seal and CV scribe marks are within 1 inch of each other. If the marks are not within 1 inch of each other, submit a UR.
- Remove the cone seal by installing a CV socket on the cone seal nut, and while restraining the cone seal and CV stand, remove the cone seal. This is all under spring pressure, so you must be extremely careful during this portion of the operation. Set the cone seal on a clean padded surface and install the CV protector on the CV.
- Remove the upper spring, union, and lower springs from the CV. Using a hex key with a ball head or ball driver, remove the two sets of screws that secure each component and fin cup to each end of the union.
- Set the components in the tray cup with the WR components down. Remove the two screws from each fin cup, disengage one fin cup and component from the other fin cup and component, and place them in the designated tray cup. Remove the two screws from each fin cup to separate the WR components and place the fin cups aside.

Packing contents and closing container

To package components for shipment or storage, first remove the data card from the underside of the H1700 lid and verify the serial numbers of the drum, cone seal plug, cone seal nut, CV body, and drum lid. These items may have different serial numbers, but the serial numbers must match the H1700 data card. If not, reject the H1700 and submit a UR. Ensure the “leak-test expiration date” on the data card matches the expiration date on the H1700 leak-test label. If the dates don’t agree, submit

a UR. Enter the date the components were packaged in day-month-year format (e.g., 16 Jan 17 or 16/01/17) and the unit ID code. Set the data card aside for later recording of leak-test results. Next, record the serial numbers of components on a blank red tag IAW the proper format and install components as follows:

- First, ensure the WR components have connector covers.
- Place the components in tray cups with the connectors facing up.
- Carefully mate the components to the fin cups with the connector installed in the cutout, and install two screws that secure each fin cup to each WR component. Torque to 50 ± 5 in-lb.
- Place one WR component fin cup over a blivet fin cup and secure with two screws. Torque to 80 ± 6 in-lb. Repeat for the other component.
- Place one fin cup assembly into the union, ensuring the WR component side is inserted inside the union. Align the holes of the fin cup assembly with the union, and secure with two screws. Torque to 80 ± 6 in-lb. Repeat for the other end of the union. Set the union assembly into the tray.
- Inspect any exposed CV sealing surfaces and O-rings. Clean the sealing surface and O-ring as necessary with a clean cloth moistened with isopropyl alcohol, and air-dry for approximately 10 minutes. Lubricate the O-ring using a light film of fluorinated grease (Krytox 240AD).
- Ensure the interior of the CV is clear of any dirt, debris, and moisture. Clean the interior as necessary with a clean cloth moistened with isopropyl alcohol; air-dry for 10 minutes.
- If not already done, install the CV protector on the CV, and place one spring assembly into the CV with the closed end facing down.
- Manually, or with a lifting handle installed, place the union into the CV. Remove the lifting handle.
- Place the second spring assembly into the CV with the closed end up. Remove the CV protector, and install the cone seal on the CV. Hand-tighten and then torque to 110 ± 10 ft-lb ensuring the CV stand does not rotate. Check the scribe mark on cone seal nut and make sure it is within 1 inch (fig. 2–9) of either side of the CV body scribe mark.

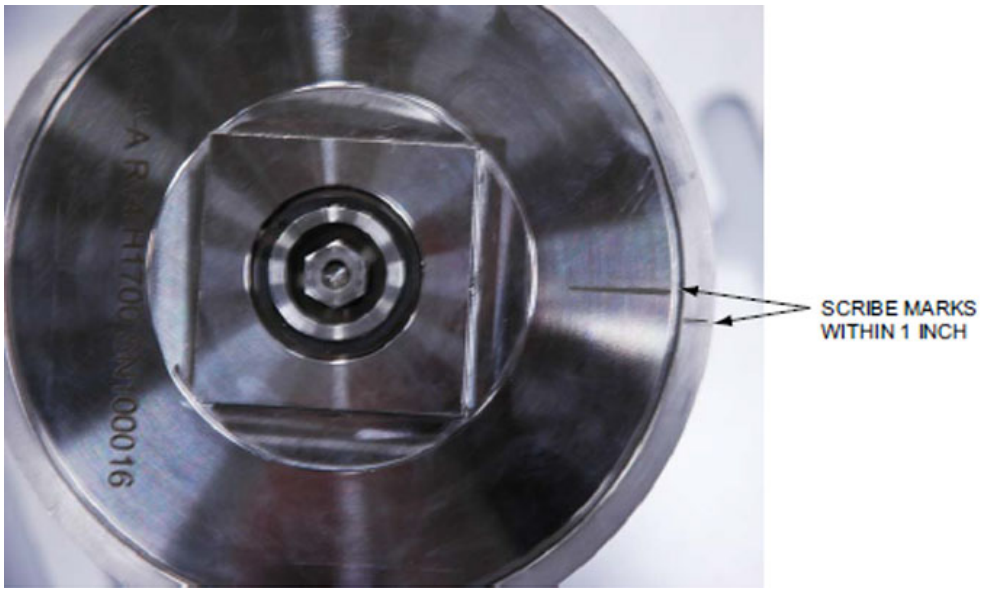


Figure 2–9. Scribe marks.

Once these procedures are completed, the H1700 is ready for the leak test to ensure the integrity of the container and a successful leak check is accomplished. We will discuss this more in the next lesson. Once the leak test is successful, continue the following procedures to close the H1700.

- Place the data card to the underside of the H1700 drum lid and then remove the bottom-load distribution fixture. Verify the drum liner surfaces are clear of dirt, debris, and moisture.
- Install the bottom-load distribution fixture open end in the drum liner, attach CV tongs to the CV cone seal nut, and then secure it with a QRP. Manually, or with a hoist since it may weigh up to 100 pounds, lift and install it into the H1700 container. Remove the CV tongs.
- Install the top-load distribution fixture on the CV. Attach the vacuum cup handle to the lid and, while supporting the underside of the lid, place the lid on H1700. Remove the vacuum cup handle and polyethylene tape.
- Align the drum lid bolt holes with the drum body threaded inserts and install eight bolts and washers. Torque to 45 ± 5 ft-lb and then re-torque to confirm all bolts are properly tightened.
- Install the security seal by inserting the free end through one bolt head, one large hole, and one small hole on the drum body flange (fig. 2–10). Pull any excess wire through until all the slack is removed.
- Wrap wire around the anchor, and close the cap and secure. Pull on the wire to ensure the seal is secured. Repeat for the second security seal.

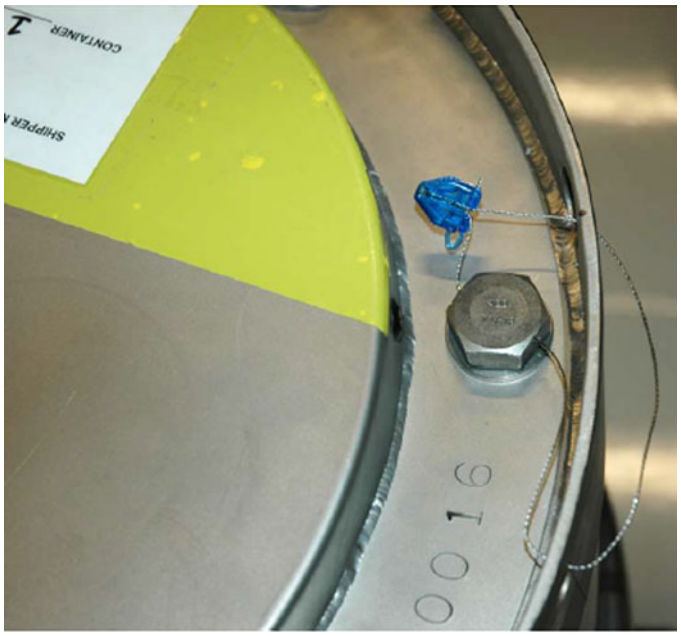


Figure 2–10. Security seal routing.

610. T568 purge, backfill, and leak-test system

The T568 is used to purge, backfill, and leak-rate tests on the H1616 and H1700 containment systems prior to shipment and to ensure the tested container does not exceed the maximum allowable leak rate. We use references to the H1616 shipping and storage container and the H1700 container assembly only as necessary to identify interfaces between them.

Description

Refer to figure 2–11 as we cover the principal components of the tester. The T568 is a portable, simple-to-use, durable tester. When using its testing function, it evacuates the volume to be tested and then measures the pressure rise in the volume over a preset time interval.

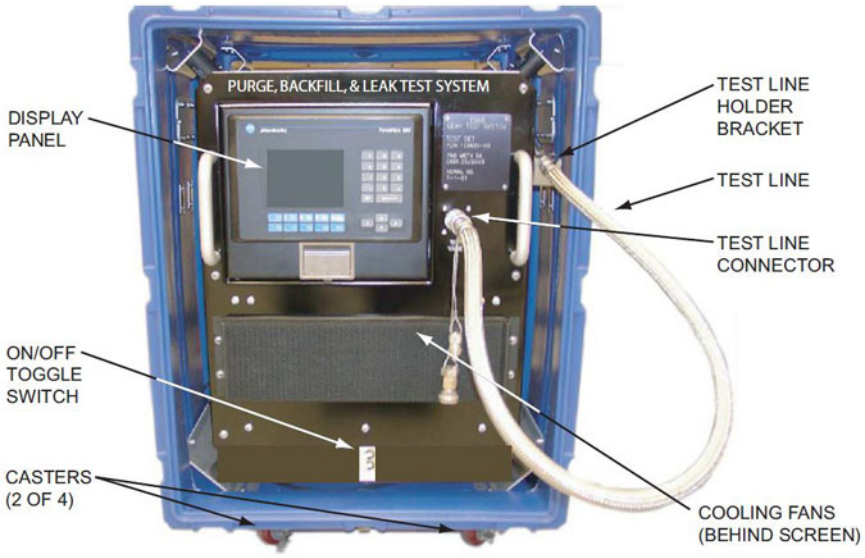


Figure 2–11. T568 Purge, backfill, and leak-test system.

The T568 calculates the measured leak rate and compares this to the maximum allowable leak rate to determine if the CV has passed or failed the leak check. The main components are as follows:

- A durable, blue, rack-mount shipping case that is weather sealed to provide environmental protection.
- Three cooling fans directed at the vacuum pump.
- Vacuum pump.
- System for purge, backfill, and leak-rate checks.
- User interface display panel.

The shipping case has front and rear covers, which protect the internal components from dust and moisture. The front cover opens to expose the operator interface display panel and test line connector. On the back of the T568 (fig. 2–12), there is the backfill gas connector, the power cord, and a storage drawer. This drawer contains the test line, H1616–2 adapters, and the backfill gas line.

Figure 2–12. Back of T568.

Principles of operation

The T568 is semi-automatic. It relies on the operator to turn on the system, conduct a self-test, and perform the leak check, by following the instructions on the user interface display panel. It purges and backfills by using pressurizing gas. The operator connects the pressurized gas source to the connector on the back and then follows the prompts on the user interface display panel. The automatic test modes occur during the purge and backfill operations. Before using the T568, you perform a daily inspection. This consists of removing the front and rear covers and installing the casters, if required.

Next, you will visually inspect the unit for serviceability. If you move the T568 from an environment below 32 degrees to an operating location, allow the T568 to stabilize at least 24 hours above 55 degrees before operating so you don't damage the equipment. If you find condensation on the unit, do not turn on the power; let the equipment sit open until the condensation clears. During operation, keep the rear of the T568 at least 12 inches away from any vertical surface to prevent damage to the backfill gas connector and to allow the air to flow.

Setting up the T568

Before plugging in the T568, make sure the switch is in the OFF position. Lift the interface display panel until it locks into position. Turn on the T568 and validate that the proper software versions are installed. Press F1 on the interface display to continue. Connect the pressurizing gas source and press F2. Next, remove the protective caps from the test line and inspect for cleanliness. The *minimum* bend diameter for the test line is 11 inches. Do not bend the test line any tighter or you may damage the bellows inside the line. Connect the test line to the T568 but not to the H1616 or H1700 container. Press F3, and the self-test will begin automatically and last approximately 15 minutes.

If all the tests pass, press F4 to display the main menu. After completing a successful self-test, you will follow the instructions on the interface display to connect the T568 to the H1616–1, H1616–2, or H1700 containers to perform a purge, backfill, and leak test. From the main menu, you can also re-run the T568 self-test or shut down the T568.

Interface display panel screens

The following are the types of screens displayed on the interface panel:

- Information: A screen that contains a blue box with white lettering. This information relates to the progress of the procedure and requires no operator action.
- Action: A screen that contains a yellow box with black lettering. You perform the displayed task and press the appropriate function key to continue.
- Results: Individual test or completed containers will either pass or fail. A "Pass" is a green screen with a black box and green letters. You must press a function key to continue. A "Fail" is a red screen with a black box and red letters. Refer to the troubleshooting procedures to determine the appropriate action.
- Error: A screen that contains a red box with white letters. Refer to the troubleshooting procedures to determine the appropriate action.
- Warning or Caution: The warning or caution is depicted in red text; some will flash.

Troubleshooting

Anytime a black screen with a red box (error screen) appears, follow the troubleshooting procedures. Troubleshooting may be needed to address errors or failures indicated by the T568. The tables in TO 11N–T568–2, *Operations and Maintenance Instructions with Illustrated Parts Breakdown, T568 Purge, Backfill, and Leak Test System*, list the errors applicable to the T568, H1616, and H1700 containers and the corrective actions you will take. Self-test errors could occur during the self-test procedures, and auto-mode errors could occur during the automatic-test mode. When you receive an error message, perform the required action(s) from the troubleshooting procedures. If, after you take all the appropriate action(s), the error repeats, you reject either the T568 and/or the container and submit a UR.

If a UR is generated on the T568, you are required to document the error number shown on the error screen. If a UR is required on an H1616 or H1700 container, you must document the serial number of the container and the T568. You will also document the clock hours from the T568 for all UR submissions. The clock is located at the rear of the case within the right-hand-side inner frame. An inspection mirror is required to access the clock visually.

Verification

The T568 requires a periodic factory maintenance cycle that is determined by the DOE. Each T568 must pass a successful self-test every 90 days. Cleanliness is important to keep it in working order. When not in use, store the T568 indoors. Minor maintenance is authorized if directed by a UR response.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

608. H1616 container assembly

1. What two major components make up the H1616 container?

2. What is the purpose of the CV?

3. What operations are performed through the sample fitting on the H1616–1 when the T568 Purge, Backfill, and Leak-Test System is attached?

4. What is the purpose of the getter assembly on the vessel lid of the H1616–2?

5. List the three leak tests required to verify that the H1616–2 is operational.

6. What function does the drum overpack serve?

7. What WARNING do you observe when installing the H1605 on the H1616?

8. During inspection of the H1616, you discover three vent plugs are missing. What action do you take?

9. What serial number verification do you perform on the container?

10. What action do you take if an O-ring has gouges or scratches?

11. How do you clean and dry O-rings?

12. What can happen if you install wet or lubricated O-rings?

13. When do you complete and attach a red tag to the H1616 container?

14. What is the purpose of the nitrogen backfill?

609. H1700 container

1. What happens to the H1700 container if *only* the CV lid fails the inspection?

2. What is the *only* tape authorized for use on the H1700 drum overpack?

3. What is the minimum and maximum weight of the H1700 container?

4. What two parts make up the H1700 container?

5. What is the purpose of the vent holes in the H1700 container?

6. What is the CV of the H1700 designed to provide?

7. What is the next step after cutting and removing the security seal, or quick seals, while unpackaging the H1700 contents?

8. What do you apply to improve vacuum-cup handle suction on the drum lid during removal?

9. Why is the hoist recommended to lift the vessel out of the H1700?

10. What serial numbers must be verified on the H1700 during the packing and closing process?

11. What action must you take if the leak-test expiration date on the data card does not agree with the date on the H1700 leak-test label?

12. What do you use to clean the CV sealing surface and O-ring?

610. T568 purge, backfill, and leak-test system

1. What is the purpose of the T568?

2. What is the purpose of the front and rear covers?

3. Although the T568 is semi-automatic, what part of the operation is automatic?

4. If you move the T568 from an environment below 32 degrees to an operating location, how long must you allow the T568 stabilize to before operating it?

5. What is displayed on the interface panel once the T568 is initially turned on?

6. What action do you take after you receive an error message, complete appropriate troubleshooting actions, and the error repeats?

7. When generating a UR on the T568, what information is required in the UR?

8. How often is a self-test performed on the T568?

9. When is minor maintenance authorized on the T568?

2–2. Use Control

Nuclear weapon UC refers to the collection of measures that facilitate rapid authorized use of nuclear weapons and protect against deliberate unauthorized use. These measures include a combination of weapon design features and operational procedures. The term UC applies to those design or procedural measures closely associated with the nuclear weapon itself that prevent unauthorized use.

We achieve nuclear weapon UC through three types of positive measures—procedures, coded controls, and use denial. We maintain UC through a series of crosschecks, two-person control, and separate storage of removable components to make sure we do not use weapons until proper authorization is received. These also include safe and key procedures. We achieve UC by designing weapons with electronic and/or mechanical features that prevent unauthorized use while allowing for use when authorized. This is where the permissive action link (PAL) comes into play. You can think of PAL with its equipment and codes as being similar to a key to a lock. The lock is the internal components inside the weapon. PAL electronically acts as a key to the lock, which either allows the weapon to receive arming and fusing signals or prevents the weapon from receiving arming and fusing signals. It also can work to change the internal codes.

Information associated with nuclear weapons operations, and especially command and control codes (including PAL codes), are a high priority for espionage efforts. This is why most PAL equipment is protected under the Verifiable Control Procedures (VCP) Program. In this section, we will introduce some PAL and UC definitions and identifiers, and we will describe equipment used to perform PAL operations. We also cover VCP handling, storing, and inspecting requirements.

611. Equipment identifiers and definitions

There are different types or categories of PAL systems used on AF weapons. Different categories of PAL use different internal weapon-coded switches to give a wide, varied range of capabilities. These categories require various types of equipment to verify and change the status of these coded switches. Learning how equipment is identified and grasping some basic terms will aid you in understanding PAL and UC procedures we discuss in the next section. Equipment identifiers also help you locate PAL and UC TOs and equipment.

Equipment identifiers

Identifiers were created because of the vast amount of equipment used in the AF. These identifiers associate related equipment items into groups, depending on each item's function. The UC equipment category provides control for all UC equipment. The first two positions in the ID number are alphanumeric followed by the specific number given to identify the equipment. The table below lists some common identifiers:

Equipment Designator Categories	
UC	Controllers, decoders, recoders, and verifiers.
UD	Disablement equipment.
UH	Headquarters equipment.
UL	UC cables and adapters.
UM	Miscellaneous equipment.
UP	Power supplies, chargers, batteries, converters, and transformers.
US	UC software.
UT	Simulators and trainers.

To help you understand the UC equipment family, we will clarify some terms.

TERM	DEFINITION
Base station	A laptop personal computer (PC) used with the code management system (CMS) that transfers files to/from headquarters CMS and to/from the field processor (FP).
Code activated processor (CAP)	An enhanced cryptographic replacement for the multiple-code coded switch (MCCS). Enhancements over the MCCS include weapon ID and state of health checks.
Code check	An operation that verifies the selected code set into the coded switch of a weapon.
Command disable (CD) signals	These are electrical signals to the Command Disable Subsystem (CDSS), normally in a sustained sequence that initiate and complete warhead disablement. CD signals may include a unique signal(s) required to enable the CDSS for disablement.
CDSS	A nuclear weapon subsystem integral to the physics package and a warhead electrical system (WES) exercised to intentionally disable the weapon.
Command Disablement System (CDS)	A system that includes the CDSS in the warhead and control hardware needed to execute command disablement.
Command disablement	The process of intentionally disabling a nuclear weapon by initiating the weapon's CDSS, thus preventing use of the weapon in its intended mode of operation.
Communication module (CM)	A DOE-designed component that executes CM and weapon operations received from the FP. Connects directly to the weapon through an interface adapter cable. Displays information through light-emitting diode (LED) characters.
Disenabling (locking)	This is an operation when the activation of the coded switch in the weapon precludes (prevents) weapon arming.
Enabling (unlocking)	This is an operation when the activation of the coded switch in the weapon permits weapon arming.
FP	A handheld PC that transfers files and data to/from the base station and the CM. It also provides display and selection of field operations.
Inhibited code	A code stored in a multiple-code switch and was once used to perform a lock operation. An attempt to perform a lock, unlock, or recode operation using an inhibited code will be unsuccessful.
Multiple code coded switch (MCCS)	A coded switch that responds to any one of several correct codes.
Multiple code coded switch encryption translator (MET)	An encryption processor designed for retrofitting older weapons currently equipped with an MCCS. The MCCS remains in the weapon; when it is used in conjunction with the MET, it provides all of the encryption capabilities of a CAP-equipped weapon.
Nonviolent command disablement	A warhead disablement process where confinement of the effects of disablement is to the weapon case and is not hazardous to nearby personnel at the time of disablement.
Recoding	The act of changing a code that was previously set into the coded switch of a weapon. This allows the weapon switch to respond when you insert a new code.
Uninhibited code	One of the codes stored in the MCCS. It is used repeatedly during an all codes recode operation.
Weapon status check	The operation performed to check the locked (disenabled) or unlocked (enabled) status of the weapon-coded switch.

612. Verifiable control procedures

The concepts of VCP enhance the accountability, verification, and control of PAL equipment used in conjunction with weapons coding, recoding, and code verification. TO 11N–50–4, *Verifiable Control Procedures (VCP) for Permissive Action Link (PAL) Equipment,* gives specific storage and handling

procedures. Remember, always refer to the TO for procedures and when questions arise. Here you receive a general overview of handling, storing, and inspecting procedures for VCP items.

Tamper-detection indicators

Tamper-detection indicators (TDI), which are approved by the National Security Agency (NSA), are used on designated coding equipment to detect attempts to modify, penetrate, bypass, or substitute the equipment. TDIs provide units with the capability to deter and detect hostile exploitation of PAL equipment. Types of TDIs used are holographic seals, epoxy screw head coatings, and holographic stickers. Figure 2–13 shows a few examples.

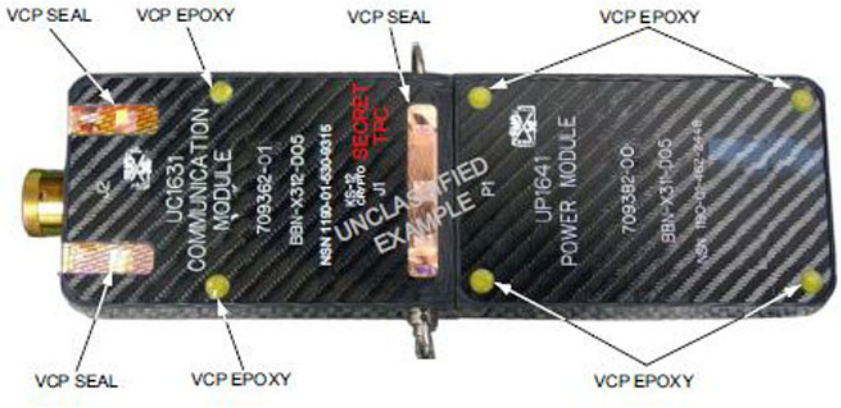


Figure 2–13. VCP examples.

Inspection requirements

At a minimum, inventory items and inspect for the integrity of TDIs. Look for signs of obvious tampering according to the appropriate equipment technical publication and procedures in TO 11N–50–4. Perform these inspection procedures after installation or before removing seals, before each day's use, or once annually (whichever comes first), and anytime tampering is suspected or a deviation is noted. Submit a UR if evidence of tampering is found or suspected.

The stringent inspection criteria for TDIs help ensure the integrity of the VCP program by indicating signs of tampering. These procedures enhance the accountability, verification, and control of PAL equipment.

Handling requirements

While this equipment is in your possession, don't let it out of your personal control for any length of time. Do not allow unauthorized personnel to handle the equipment. If you are separated from the equipment for any reason, regain control immediately, and notify your supervisors.

If evidence shows signs of tampering or a loss of control for any period of time, impound the equipment. Determine the reliability of the equipment, and report the incident to the controlling authority. Do not release this equipment to anyone who does not have a security clearance equal to the classification of the equipment being used *and* indoctrination into VCP. Protect VCP cables and adapters with the same care you provide the controller.

Storage requirements

Equipment used in PAL recoding/verification operations is divided into four basic categories or classes, Class 1, 1A, 2, and 3.

The minimum storage requirement for Class 1 PAL equipment is one of the following procedures established to control PAL equipment when not in operational use:

- A locked alarmed structure, communications security (COMSEC) vault, or area authorized for open storage of classified material.

- A General Services Administration (GSA)-approved security container with an approved combination lock that meets FF–L–2740, *Federal Specification: Locks, Combination,* standards.

Class 1A and Class 2 PAL equipment have no special storage requirement.

Class 3 equipment is stored according to Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3260 series (storage of two-person concept [TPC] materiel) in addition to the procedures required for Class 1 equipment.

613. Code management system

The CMS uses DOD commercial off-the-shelf (COTS) computer-based technology incorporated with specially designed DOE software and equipment. We use these items along with the improved functionality of weapon devices to perform UC functions. Many devices are used in the CMS system, which we will discuss further.

UC1620 with UC1630

Headquarters, United States European Command (HQ EUCOM) is the controlling authority for UC in the European theater. The common PAL equipment varies slightly from the equipment used in CONUS. Therefore, it is commonly referred to as the outside the continental United States (OCONUS) CMS. The OCONUS CMS has many pieces of equipment and designators associated with it. Some of them are listed in the following table:

CMS Component	Nomenclature
Base station laptop PC	UC1621A
OCONUS FP	UC1622
CM	UC1630
Power module	UP1640
Interface adapter	UL1650
Field tester	UT1660

Security

The OCONUS CMS UC1621A base station (fig. 2–14), UC1622 FP, and UC1630 CM have a Secret security classification. The field tester, power module, and interface adapter are unclassified. The OCONUS CMS *does not* fall under the VCP program.

Description

The OCONUS CMS is a system that provides management of weapons codes and keys and executes these weapon-coded switch operations securely. It is divided into headquarters and field functions. Headquarters CMS functions include planning, material generating, verification, and transmittal of executable files at the headquarters level. Field CMS functions include receiving files from the headquarters level as well as performing weapon code and key operations.

Here are some of the field CMS capabilities:

- Transfers files with headquarters CMS.
- Executes field operations generated by headquarters CMS.
- Performs secure recoder operations (encrypted recode, and rekey operations).
- Builds data files from weapon recoder operations for verification with headquarters CMS.
- Performs decoder operations (unlock and lock).
- Performs weapons status checks.

Figure 2–14. CMS base station.

The base station is a laptop computer that uses Microsoft Windows-based software. It performs all file transfers with headquarters CMS (secure mode) and with the FP. The base station and FP may be used with a docking station to set up all connections. The FP is a tablet that communicates between the base station and the CM. The FP uses Windows-based operating system and DOE designed software. It tells the CM what operations to perform through an infrared (IR) data port. The CM performs and records all weapons operations. It also verifies operations and codes with the field tester. The CM physically connects to the weapon or field tester by the interface adapter (cable). Examples of these items can be seen in figure 2–15.

Figure 2–15. OCONUS CMS components.

UC1620 with UC1631

The CMS used in CONUS is similar to the OCONUS CMS in that it employs code and key material provided by NSA. Some of the components used with the CONUS CMS have the same designator as the OCONUS CMS. The following table shows some of the components used with the CONUS CMS:

CMS Component	Nomenclature
Base station laptop PC	UC1621A
FP	UC1620
CM	UC1631

CMS Component	Nomenclature
Power module	UP1641/ UP1642
Interface adapters	UL1651 UL1652 UL1653 UL1654
Field tester	UT1660
Field IR Adapter	UL1661

Description

The CONUS CMS is also divided into headquarters and field functions. Headquarters CMS functions include planning, material generating, verification, and transmission of executable files to the field. Field CMS functions include receiving files from the headquarters level as well as performing weapon code and key operations.

Some of the field CMS capabilities are as follows:

- Transfers file with headquarters CMS.
- Executes field operations generated by headquarters CMS.
- Performs recoder operations on PAL-equipped weapons.
- Supports A and B team authentication procedures.
- Performs weapons status checks.
- Supports zeroization of UC1631 data under duress conditions.

Currently, the UC1621A base station and UT1660 field tester are used with both the OCONUS and CONUS CMSs. Figure 2–16 shows the various CMS components in its carrying case.

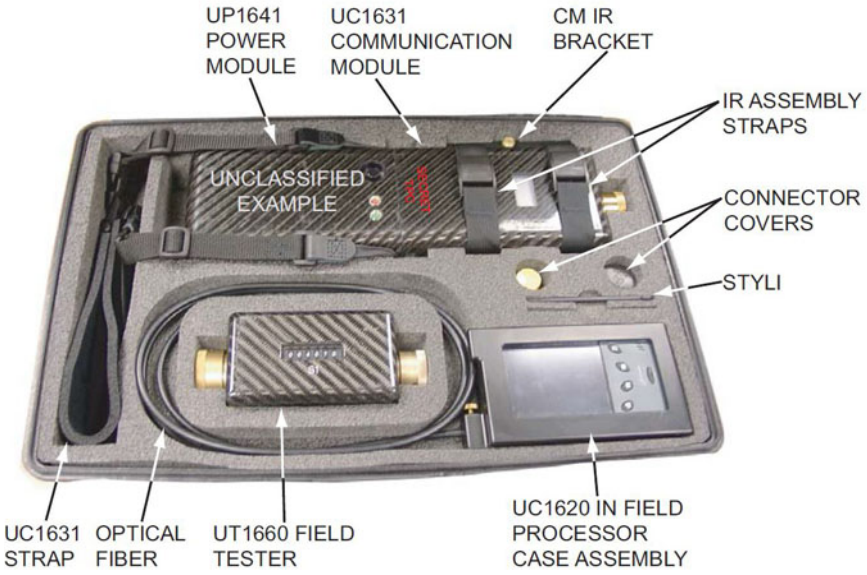


Figure 2–16. CONUS CMS components.

The UT1660 serial number determines if it is authorized for use with the UC1631. The base-station laptop computer uses Microsoft Windows-based, DOE-designed software. It performs all file transfers with headquarters CMS (secure mode) and with the FP. A docking station may be used to set up all connections.

The FP (fig. 2–17), is a handheld computer that communicates between the base station and the CM. The FP also uses Windows-based, DOE-designed software. It tells the CM what operations to perform through an IR data port.

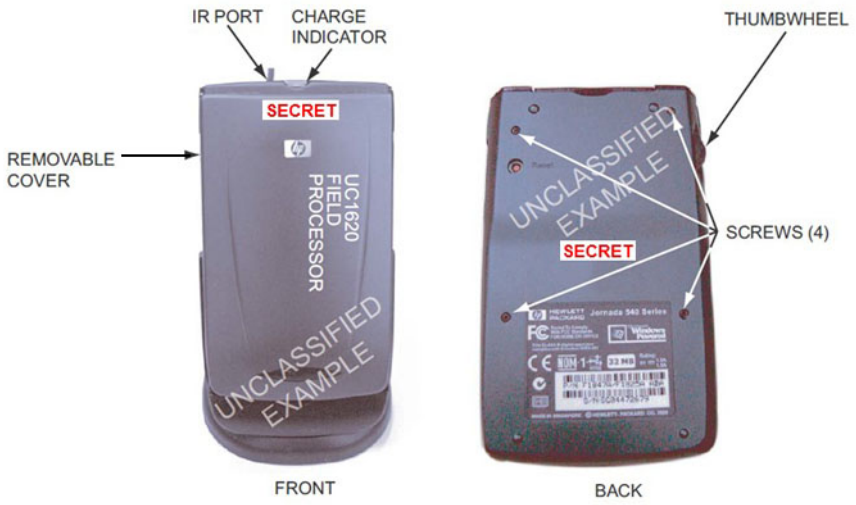


Figure 2–17. UC1620 field processor.

The UC1631 CM (fig. 2–18), is used with the CONUS CMS and interfaces with the weapon (through one of four interface adapter cables) to execute field operations and to create and store audit records from executed recorder operations. It also verifies operations and codes with the field tester.

Figure 2–18. UC1631 communication module.

The UL1661 field IR adapter (fig. 2–19) consists of the FP case assembly, an optical fiber, CM IR bracket, and IR assembly straps. It is used only with the CONUS CMS and provides shielded IR communications between the UC1620 and the UC1631. The IR port must be shielded with the UL1661 whenever the UC1631 will be powered on.

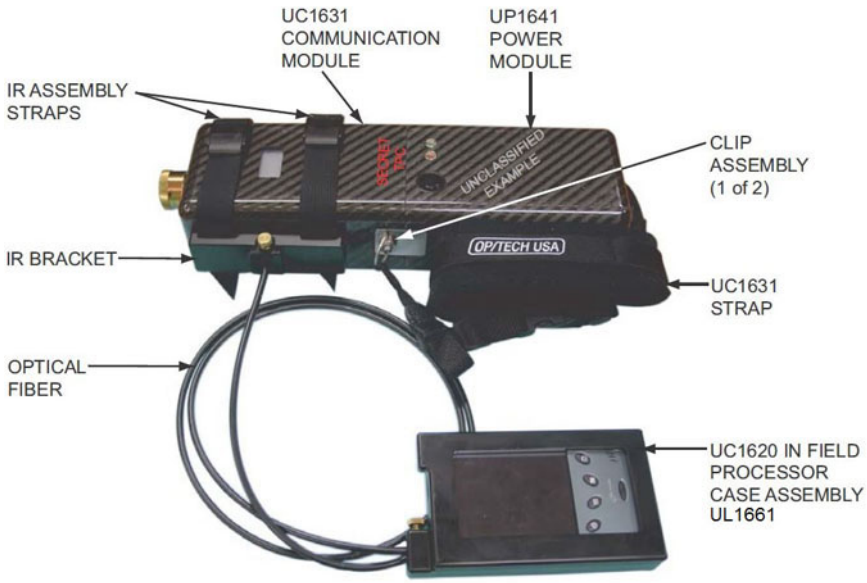


Figure 2–19. UL1661 field IR adaptor.

Security

The classification and handling of the CONUS CMS is listed in the following table:

Nomenclature	Description	Classification	Handling
UT1660	Field tester	Unclassified	VCP
UP1641 UP1642	Power modules	Unclassified	VCP
UL1651 UL1652 UL1653 UL1654	Interface adapters	Unclassified	VCP
UC1621	Base station	Secret	
UC1620	FP	Secret	
UC1631	CM	Secret	VCP, TPC

As you can see from this table, certain components of the CONUS CMS *do* fall under the VCP/TPC program.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

611. Equipment identifiers and definitions

1. Why was it necessary to establish a UC equipment category?

2. What type of item is found under the US equipment designator category?

3. Explain command disablement.

4. Explain the difference between disenabling and enabling operations.

5. What will happen if you use an inhibited code for an operation?

6. When is an uninhibited code used?

612. Verifiable control procedures

1. Why are TDIs used?

2. Name three types of TDIs used in the VCP program.

3. Where are inspection criteria found?

4. How often are TDI inspection procedures performed?

5. What course of action is required if there has been a loss of control or equipment showing evidence of tampering?

6. What type of security container is authorized for storing Class 1 PAL equipment?

613. Code management system

1. Match the UC1620 with UC1630 OCONUS CMS nomenclature in column B with the component in column A. Items in column B will be used only once.

Column A	*Column B*
____ (1) Base station laptop PC.	a. UC1622.
____ (2) CM.	b. UC1621A.
____ (3) Interface adapter.	c. UC1630.
____ (4) FP.	d. UP1640.
____ (5) Power module.	e. UL1650.
____ (6) Field tester.	f. UT1660.

2. Do the VCPs apply to the OCONUS UC1620 field CMS?

3. List some of the OCONUS CMS capabilities.

4. List some of the CONUS CMS capabilities.

5. What components are used with the OCONUS and CONUS CMS?

6. What determines if the UT1660 field tester is authorized for use with the UC1631 CM?

7. What does the UL1661 field IR adapter provide?

8. Which components of the CONUS CMS fall under the VCP program?

Answers to Self-Test Questions

608

1. An internal CV and an external drum overpack.
2. To provide tritium containment if a reservoir ruptures because of an accident.
3. Evacuating the CV, backfilling the CV with nitrogen, and leak testing the CV's O-rings.
4. To absorb any tritium that might leak past the inner O-ring.
5. Sample valve seal test, O-ring leak test and test fitting leak test.
6. Provides a thermal barrier to keep the temperature of the CV O-rings below their maximum allowable service temperature and a mechanical shock protection during handling and accident conditions.
7. To prevent injury to personnel, support the H1605 during tension adjustment, initial adjustment of the self-locking nuts may allow the H1605 to fall from the H1616 overpack. Failure to install the H1605 directly below the H1616 directly below the H1616 top chine may cause injury to personnel due to a high center of gravity. To prevent the inadvertent release of H1605 latch, make sure the T-handle lock pin is installed.
8. Cover the area with pressure-sensitive adhesive tape and accept H1616 for use.
9. Drum overpack, vessel body, and vessel lid.
10. Replace the damaged O-ring and record the new O-ring serial number on the data card.
11. Clean with isopropyl alcohol and air-dry approximately 10 minutes.
12. Leak-test failures.
13. Before shipping.
14. Eliminates the potential for an explosive mixture of tritium and air to form if the reservoir leaks during an accident, and guarantees a consistent atmosphere (primarily low humidity) for reservoir shipment and storage.

609

1. Entire container must be rejected.
2. Yellow polyethylene tape.
3. Minimum of 256 pounds to a maximum of 350 pounds.
4. Internal CV and an external drum overpack.

5. Prevent pressure buildup in the drum overpack if an accident involves fire.
6. Containment under maximum credible conditions that could occur in the CV because of an accident.
7. Remove eight bolts and washers from the lid and set aside for later reinstallation.
8. Use the yellow polyethylene tape.
9. CV may weigh up to 100 pounds.
10. Drum, cone seal plug, cone seal nut, CV body, and drum lid.
11. Submit a UR.
12. Clean cloth moistened with isopropyl alcohol and air-dry for approximately 10 minutes.

610

1. Purge, backfill, and leak-rate tests on the H1616 and H1700 containment systems prior to shipment and to ensure the tested container does not exceed their maximum allowable leak rate.
2. Help protect the internal components from dust and moisture.
3. Purge and backfill operations.
4. 24 hours.
5. Software version installed.
6. Reject either the T568 and/or the container and submit a UR.
7. The error number shown on the error screen and clock hours off the T568.
8. Every 90 days.
9. When directed by a UR response.

611

1. Give a wide, varied range of capabilities.
2. UC software.
3. It is the process of intentionally disabling a nuclear weapon by initiating the weapon's CDSS, thus preventing use of the weapon in its intended mode of operation.
4. Disenabling activates a coded switch in the weapon that prevents weapon arming. Enabling activates a coded switch in the weapon that permits weapon arming.
5. It will be unsuccessful.
6. Repeatedly during an all codes recode operation.

612

1. To detect attempts to modify, penetrate, bypass, or substitute equipment.
2. Holographic seals, epoxy screw head coatings, and holographic stickers.
3. TO 11N–50–4.
4. After installation or before removal of seals, before each day's use or once annually, whichever comes first, and anytime tampering is suspected or a deviation is noted.
5. Impound the equipment, determine the reliability of the equipment, and report the incident to the controlling authority.
6. A GSA-approved security container with an approved combination lock that meets FF–L–2740 standards.

613

1. (1) b.
   (2) c.
   (3) e.
   (4) a.
   (5) d.
   (6) f.
2. No.
3. (1) Transfers files with headquarters CMS.

(2) Executes field operations generated by headquarters CMS.
(3) Performs secure recoder operations (encrypted recode, and rekey operations).
(4) Builds data files from weapon recoder operations for verification with headquarters CMS.
(5) Performs decoder operations (unlock and lock).
(6) Performs weapons status checks.

4. (1) Transfers file with headquarters CMS.
(2) Executes field operations generated by headquarters CMS.
(3) Performs recoder operations on PAL-equipped weapons.
(4) Supports A and B team authentication procedures.
(5) Performs weapons status checks.
(6) Supports zeroization of UC1631 data under duress conditions.
5. UC1621A base station, UC1620 FP, and UT1660 field tester.
6. The serial number.
7. Shielded IR communications between the UC1620 and the UC1631.
8. The UT1660 field tester, UP1641/UP1642 power modules, UL1651/52/53/54 interface adapters, and UC1631 CM.

Complete the unit review exercises.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

27. (608) Which model of the H1616 containers has an additional fitting, and what is it?
    a. H1616–1; a sample fitting.
    b. H1616–2; a sample fitting.
    c. H1616–1; a leak-test fitting.
    d. H1616–2; a leak-test fitting.

28. (608) What is the function of the leak-test fitting on the H1616–2?
    a. Verifies the integrity of the O-rings and the volume seal.
    b. Measures the amount of tritium seepage past the inner O-ring.
    c. Measures the amount of tritium within the containment vessel.
    d. Verifies there is no pressure build-up within the containment vessel.

29. (608) To prevent injury to personnel, the H1605 *must* be installed on the H1616 directly
    a. below the bottom chine.
    b. above the bottom chine.
    c. below the top chine.
    d. above the top chine.

30. (608) What actions are required when H1616 component serial numbers do not match the data card?
    a. Accept the reservoir, restrict the H1616 for storage use only, and submit an unsatisfactory report (UR).
    b. Reject the reservoir and H1616; hold for disposition instructions.
    c. Accept the reservoir and H1616; update the data card with the correct numbers.
    d. Reject the reservoir; restrict the H1616, and ship it back to the Department of Energy (DOE).

31. (608) How many inches of packing material should remain in the bottom of the containment vessel (CV)?
    a. 2 to 3.
    b. 3 to 4.
    c. 4 to 5.
    d. 5 to 6.

32. (608) The authorized method for removing the O-ring on the H1616 is to use
    a. a tongue depressor.
    b. plastic tools only.
    c. your fingers only.
    d. a Q-tip.

33. (609) What document authorizes personnel to mix the H1700 container assembly parts from other containers?
    a. TO 11N–H1700–2, *Operation and Maintenance Instructions with Illustrated Parts Breakdown, H*1700 *Container*.
    b. Engineer technical assistance request.
    c. Maintenance assistance request.
    d. Unsatisfactory report (UR).

34. (609) What is a “blivet” as it is used with the H1700 container assembly?
    a. War reserve (WR) components used for packaging operations.
    b. Mockup of the WR component used for packaging operations.
    c. Hardware used to secure the vessel lid to the containment vessel (CV) body.
    d. Item used to provide thermal and mechanical shock protection for the CV body.

35. (609) An H1700 container with an expired certification date is
    a. scheduled for inspection and recertified with a new date by certified technicians.
    b. authorized for movement within the Department of Energy (DOE) only.
    c. authorized for movement within the Department of Defense (DOD) only.
    d. restricted to storage use only.

36. (610) If the T568 is moved from an environment below 32 degrees, how long *must* you allow the T568 to stabilize before operating the equipment?
    a. 12 hours.
    b. 24 hours.
    c. 36 hours.
    d. You need the temperature of the bay to calculate the time.

37. (610) How far, if any, *must* the back of the T568 be kept from any vertical surface during operation?
    a. 8 inches.
    b. 10 inches.
    c. 12 inches.
    d. There are no clearance requirements.

38. (610) Which screen on the T568 relates to the progress of the procedure and requires no operator action?
    a. Error.
    b. Action.
    c. Results.
    d. Information.

39. (610) If an unsatisfactory report (UR) is generated on a T568, in addition to the clock hours, what else are you required to document?
    a. Error number on the error screen.
    b. Serial number of the container.
    c. Temperature of the bay.
    d. Pump serial number.

40. (611) Which operation allows the weapons switch to respond to a new code?
    a. Enabling.
    b. Decoding.
    c. Recoding.
    d. Disenabling.

41. (611) To verify the locked or unlocked condition of the weapon-coded switch, you use what type of check?
    a. Condition.
    b. Weapon status.
    c. Enable/disenable.
    d. Lock/unlock condition.

42. (612) Which organization approves the tamper detection indicators (TDI) used on designated coding equipment?
    a. Wing command section.
    b. Department of Energy (DOE).
    c. National Security Agency (NSA).
    d. Air Force Nuclear Weapons Center (AFNWC).

43. (612) When they are *not* used regularly, when are tamper detection indicators (TDI) inspected?
    a. Only before removal.
    b. Only before use.
    c. Semiannually.
    d. Annually.

44. (612) Who is authorized to handle verifiable control procedures (VCP) controlled equipment?
    a. Personnel with at least a Secret clearance and under personnel reliability program (PRP).
    b. Any two-person team; VCP indoctrination is not required.
    c. Personnel with a security clearance equal to the classification of the equipment being used and a need-to-know.
    d. Personnel with a security clearance equal to the classification of the equipment being used; VCP indoctrination required.

45. (613) Which piece of permissive action link (PAL) equipment is commonly used in the European theater?
    a. T1616.
    b. T1563.
    c. PC1583.
    d. UC1630.

46. (613) What is the classification of the UC1621A field code management system (CMS) base station?
    a. Secret.
    b. Top Secret.
    c. Confidential.
    d. Unclassified.

47. (613) What piece of equipment of the outside the continental United States (OCONUS) field code management system (CMS) physically connects to the weapon or field tester by the interface adapter (cable)?
    a. Base station.
    b. Field processor (FP).
    c. Power module (PM).
    d. Communication module (CM).

48. (613) The field processor tells the UC1631 communication module (CM) what operation to perform through
    a. interface adapter (IA) cables.
    b. a base station.
    c. an infrared (IR) data port.
    d. a field tester.

49. (613) The UL1661 field infrared (IR) adapter is used with
    a. outside the continental United States (OCONUS) and continental United States (CONUS) code management system (CMS).
    b. all permissive action link (PAL) equipment.
    c. OCONUS CMS only.
    d. CONUS CMS only.

50. (613) One difference between the outside the continental United States (OCONUS) and continental United States (CONUS) code management system (CMS) components are
    a. certain OCONUS components do fall under the verifiable control procedures (VCP) program.
    b. all components of the OCONUS CMS fall under the VCP program.
    c. certain CONUS components do fall under the VCP program.
    d. all components of the CONUS CMS fall under the VCP program.

Glossary of Abbreviations and Acronyms

AC	alternating current
ADU	aircraft delivery unit
AED	automated external defibrillator
AF	Air Force
AFI	Air Force instruction
AFMAN	Air Force manual
AFNWC	Air Force Nuclear Weapons Center
AFSEC	Air Force Safety Center
AFTO	Air Force technical order
ALCM	air-launched cruise missile
amp	ampere
CAP	code activated processor
CD	command disable
CDS	command disablement system
CDSS	command disable subsystem
CJCSI	Chairman of the Joint Chiefs of Staff instruction
CM	communication module
CMS	code management system
COMSEC	communications security
CONUS	continental United States
COTS	commercial off-the-shelf
CPIN	computer program identification number
CPR	cardiopulmonary resuscitation
CV	containment vessel
DC	direct current
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
ELO	engineering liaison office
EMF	electromotive force
ESSD	electrostatic sensitive device
FP	field processor
ft-lb	foot-pound

GSA	General Services Administration
HQ EUCOM	Headquarters, United States European Command
IAW	in accordance with
ICBM	intercontinental ballistic missile
ID	identification
in-lb	inch-pound
IPB	illustrated parts breakdown
IR	infrared
k	kilohm
LCD	liquid crystal display
LED	light-emitting diode
LLC	limited-life component
LLRW	low-level radioactive waste
M	megohm
MAU	munitions adapter unit
MCCS	multiple code coded switch
MET	multiple code coded switch encryption translator
MMAC	materiel management aggregation code
MNCL	Master Nuclear Certification List
NEC	National Electrical Code
NIIN	national item identification number
NSA	National Security Agency
NSN	national stock number
OCONUS	outside the continental United States
OL	over load, out of limits, open line, or open loop
PAL	permissive action link
PC	personal computer
QRP	quick-release pin
SNL	Sandia National Laboratories
STMS	Secure Transportable Maintenance System
TDI	tamper-detection indicator
TO	technical order
TPC	two-person concept
UC	use control
UL	Underwriters Laboratory

UR	unsatisfactory report
V	volt
VAC	volt, alternating current
VCP	verifiable control procedure
VDC	volts, direct current
WES	warhead electrical system
WR	war reserve

Student Notes

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