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Aircrew Egress Systems Journeyman

Volume 2. Egress Maintenance Fundamentals

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THIS VOLUME OF CAREER DEVELOPMENT COURSE (CDC) 2A653, Aircrew Egress Journeyman, is the second and final volume in your 5-skill level CDCs.

This volume consists of three units. Unit 1 covers aircraft hardware and plumbing, electrical principles, foreign object damage, and corrosion control. Unit 2 deals with the fun stuff like the fundamentals of the time change program, maintenance data collection through paper forms and maintenance information systems such as the Integrated Maintenance Data System (IMDS). Unit 3 explores the Air Force inspection system so you can better understand what drives some of the maintenance you are already performing. Then you will learn about the components of the advanced concept ejection seat (ACES) II and Martin Baker ejection seat and how everything works together to save a pilot's life when that critical moment is called upon.

A glossary for this course is included at the end of this volume

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For Guard and Reserve personnel, this volume is valued at 16 hours and 4 points.

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 Maintenance

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THIS UNIT INTRODUCES YOU to the various types of hardware with which you will work as an egress maintainer. In the previous volume, you learned about tools; now, you will learn on what those tools will be used. The hardware used for the egress system is mostly general in nature, but the ballistic system is unique and will also be covered. Then we discuss electricity. Lastly, you will learn about the never-ending battle we have with foreign object damage (FOD) and corrosion. Both are constant issues that cause the majority of unscheduled maintenance for egress maintainers.

1–1. Aircraft Hardware and Plumbing

Remember the tool lesson from the previous volume, now we cover on what you will use those tools. Fastening devices (nuts, bolts, washers, screws) that are used in an egress system are considered aircraft hardware. In addition to hardware, we also cover tubing, hoses, and seals. You need to become familiar with these items. You will use them on virtually every task—and if used improperly, they can cause serious problems. In the egress system, it is vital that the smallest component function as designed. Remember, this is the one system on the whole aircraft that does not get an ops check prior to use, and being the most important system, every item must be able to serve its purpose flawlessly.

201. Using different types of hardware

Because of the small size of most hardware, its importance is often overlooked. However, the safe and efficient operation of any aerospace vehicle depends greatly upon its correct selection and use. In this lesson, we provide a general knowledge of some hardware items you will use in your day-to-day duties. Screws and bolts have some differences. One thing about bolts that makes them different from screws is that bolts are always used with nuts and screws are used by themselves. Since just about everything in the egress system uses a nut or nut-plate, this discussion discusses bolts only.

Bolts

Bolts are used extensively in aircraft construction. Most are general-purpose, internal wrenching, or close-tolerance Air Force-Navy (AN), National Aircraft Standard (NAS), or Military Standard (MS) bolts. In certain cases, aircraft manufacturers are required to make bolts with different dimensions or greater strength than the standard types. You may identify these bolts by the letter “S” stamped on the head. It is very important to use the right bolt when replacing any bolt; you cannot just run to the nearest hardware store and grab one off the shelf, even if the size and threads are the same.

To prevent installing an incorrect bolt, always order the bolt by the type of material, shape of the head, length, diameter, and threads per inch. Installing a bolt that does not meet even one of these criteria will likely result in corrosion, bolt failure, or structure failure. Aircraft bolts are usually made of cadmium or zinc-plated, corrosion-resistant steel, or anodized aluminum alloy.

The markings on the head indicate the type of material from which the bolt was made. If the bolt is damaged so the markings or the dimensions cannot be determined, you can sometimes check the markings of another bolt that is installed in the general area. However, the maintainers who installed those bolts may have used the wrong bolts or—worse—the manufacturers may have used the wrong hardware at the factory. In this situation, it is always best to check the illustrated parts breakdown (IPB) in the appropriate aircraft technical order.

Bolt size

Bolts are made up of two parts—the head and the shank (fig. 1–1). The size of a bolt is stated in terms of length, diameter, and threads per inch. A bolt 2 inches in length, ¼ inch in diameter, and having 28 threads per inch is called a 2-inch bolt, ¼ by 28. Bolts ¼ inch in diameter or greater are specified by actual diameter measurement in inches or fractions of an inch. Bolts less than ¼ inch in diameter are specified by a number (e.g., size 12 is the next size smaller than ¼ inch; then follow sizes 10, 8, 6, 4, and 2, respectively).

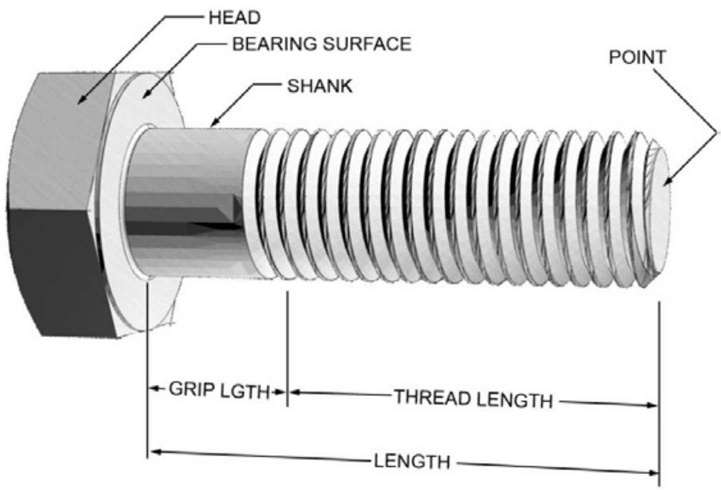


Figure 1–1. Parts of a bolt.

Generally, when a bolt is installed, the grip length (unthreaded portion) should be a few thousands of an inch shorter than the actual grip to avoid bottoming the nut. Because it is not always possible to observe this rule, certain variations are allowed. For bolt installations that involve self-locking or plain nuts, at least two complete threads must protrude through the nut. These two threads include the chamfered end of the bolt. In instances where one piece of material is thicker than the other, you may use bolts of slightly greater grip length if you use washers underneath the nut or bolt head. To prevent corrosion, use steel washers on steel parts and aluminum alloy washers with steel bolts on aluminum alloy parts, except in the case of high-torque values.

Bolt holes must not be oversized or elongated. Loose bolts may actually cause failure of the other bolts, because the other bolts are forced to carry a load greater than intended.

Grip length

One important factor to consider when selecting the correct bolt is the grip length—the unthreaded portion of the bolt from the under-head surface to the start of the thread. The thickness of the material held together by the bolt is called the grip. In an ideal installation, the bolt's grip length is a few thousands of an inch shorter than the actual grip in order to avoid bottoming. Generally, bolt installations that involve self-locking or plain nuts must have at least two complete threads protruding through the nut.

Bolt head identification

You can normally identify bolts by the type of head they have. The five standard bolt types you will most likely work with are the hex head, internal wrenching, twelve-point external wrenching, clevis bolt, and eyebolt. The following table describes each of these in more detail and includes an illustration to help you identify them.

Type	Description
 **Figure 1–1a. Hex head.**	The hex head is probably the most common type of bolt used on an aircraft (fig. 1–1a). Standard hex head bolts are all-purpose structural bolts used for general applications involving tension (stretching) or shear (sidewise) loads. They are either cadmium- or zinc-plated, corrosion-resistant steel or anodized aluminum alloy. Some hex head bolts have a deeper head that is drilled for safety wire in order to prevent the bolt from loosening due to vibrations.
 **Figure 1–1b. Internal wrenching.**	The internal wrenching bolt is a high strength steel bolt used primarily in tension applications (fig. 1–1b). The head is recessed and is installed or removed by an internal wrenching tool (Allen wrench). Never substitute a standard hex head bolt for an internal wrenching bolt. Also, never use a standard nut or washer with this type of bolt. Instead, use special nuts and heat-treated washers.
 **Figure 1–1c. Twelve-point external wrenching.**	The twelve-point, external wrenching bolt is a high-strength steel bolt used primarily in high-tensile, high-fatigue strength applications (fig. 1–1e). A hole is drilled or formed in the head in order to lighten the bolt. Standard hex head bolts cannot be substituted for these bolts.
 **Figure 1–1d. Clevis.**	The clevis bolt is a special-purpose bolt used where shearing, or sidewise stress, occurs (fig. 1–1d). Clevis bolts are *never* used under tension, but they are often used as pins in control systems. Clevis bolts come with either slotted or recessed heads. A hole drilled through the threaded end allows for installing a castellated nut and cotter pin when required.
 **Figure 1–1e. Eyebolt.**	The eyebolt is a special-purpose bolt used to carry external tension loads (fig. 1–1e). Devices such as a turnbuckle fork, clevis, shackle, or tie-down rope, are attached to the eye.

Nuts

Nuts, like bolts, come in a wide variety of shapes and sizes. They do not come with bolts, nor do they have identifying markings or lettering. Nuts can be identified by the characteristic color of metal, brass, or fiber, and by their construction and thread size. Except for a few very special types, nearly all are AN standard, and can be divided into two general groups: non-self-locking and self-locking.

Nut Types	
Type	**Description**
Non-self-locking	Non-self-locking nuts (e.g., plain, castellated, and wing nuts) must be secured by external locking devices such as lock washers, cotter pins, or lock wire.
Self-locking	Self-locking nuts, as the name implies, lock themselves. The locking feature is built into the nut. They are designed to withstand severe vibration and are used to attach anti-friction bearings, pulleys, accessories, and anchor nuts around inspection holes, etc. Self-locking nuts are not used at joints in egress systems where the movement of the joint would cause the nut to rotate against the surface on which the nut is bearing. Metallic lock nuts are used on bolts without cotter pin holes. At least two threads must extend through the lock nut for maximum locking effect.

During the past few years the government has increased the use of lightweight self-locking nuts because of the increase in strength/weight ratio requirements of modern high-performance aircraft. However, because of their wide variety these self-locking fasteners are often misidentified and misused. Most of the nuts do not have identification markings; therefore, double-check the IPB to make sure you are using the right nuts (part numbers need to match exactly). Lightweight self-locking nuts are thinner than regular self-locking nuts. Therefore, at a location where a lightweight nut was to be placed originally, the bolt or stud may be shorter. Never use a regular nut in place of a lightweight nut unless the bolt is long enough to extend at least two threads through the nut. On the other hand, usually a lightweight nut may replace a regular nut.

Castellated nuts

Castellated nuts provide an extra fail-safe feature for critical uses. They are commonly used in joints, bearings, bushings, cranks, linkages, and in locations where the bolt serves as an axle or axis for the rotation of another part. For the fail-safe measure to be effective, a cotter pin or safety wire is required for them to be secured. (**NOTE:** Even self-locking castellated nuts need to have a cotter pin.) Figure 1–2 shows the methods for installing a cotter pin as described in Technical Order (TO) 1–1A–8, *Structural Hardware*. Never reuse a cotter pin, no matter how neatly you removed the old one.

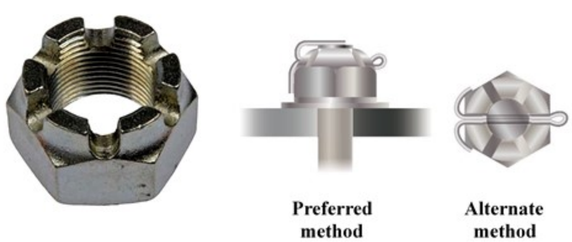


Figure 1–2. Castellated nut and cotter pin methods.

Plate-nuts

We commonly call these “nut-plates” but their official nomenclature is “plate-nut.” These types of nuts are used in areas that are inaccessible to maintainers (e.g., behind a panel or in tight fit areas where using a wrench is not practical). Nut-plates can be either self-locking or plain; on egress systems they are usually self-locking. Figure 1–3 shows a couple of examples of nut-plates with which you may already be familiar.

Figure 1–3. Example of nut-plates.

Self-locking nuts

These types of nuts are either all metal or made with a non-metallic insert that provides a positive lock (fig. 1–4). Do not reuse self-locking nuts for ejection seats and other critical applications. This applies to self-locking nuts of all types of construction. Eliminating the reuse of self-locking nuts in critical applications or flight critical applications reduces the potential for locking performance degradation and loss of corrosion preventative coatings.

Figure 1–4. Example of self-locking nuts.

Washers

Like other hardware, there are many kinds of washers. Although there are many kinds of special-purpose washers, normally, plain washers are used under hex-nuts to provide a smooth bearing surface, and to line up the slots of castellated nuts. The main purpose of washers is to help prevent corrosion by insulating steel screws from aluminum surfaces and they are necessary to distribute the load under the bolt head and/or nut face. They provide a smooth uniformed bearing surface for the gripping force of the nut or bolt.

Lock washers are used when the self-locking, or castellated type nut is not used. The spring action of the lock washer provides friction that prevents the nut loosening from vibration. Special washers are used for various purposes, such as when a bolt is installed at an angle to the surface, or where perfect alignment with the surface is required. One common special washer you will frequently use is the spring washer installed on the advanced concept ejection seat (ACES) II seat rollers (fig. 1–5).

Figure 1–5. Example of spring washer.

Lock wire

Certain areas that are subjected to extreme vibrations or movement must be lock wired to ensure they will not work loose. Zinc coated, soft, steel lock wire is used in these areas.

Methods

There are two methods of lock wiring: the double-twist method—most commonly used—and the single-wire method. Figure 1–6 shows some examples of both methods. The single-wire method is used on screws, bolts, and/or nuts in a closely spaced or closed geometrical pattern such as a triangle, square, rectangle, or circle. Single wire may be used in electrical systems also and in places that are difficult to reach such as the frangible bolts on the F–16 canopy jettison system. Most other applications require the double-twist method because of the increased tensile strength it offers.

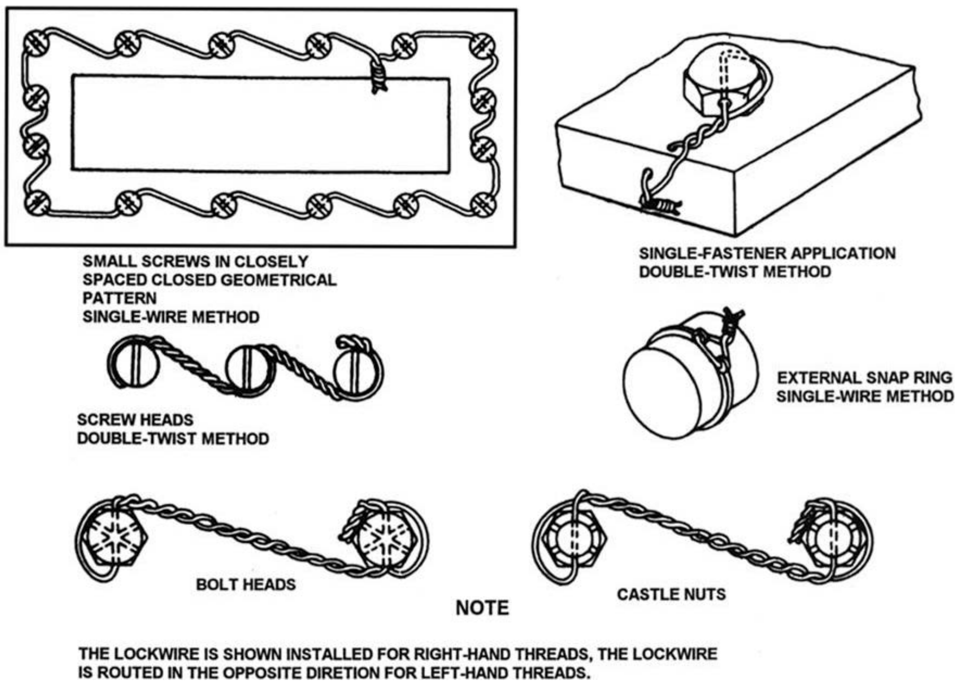


Figure 1–6. Lock wiring.

Although there are many combinations of lock wiring, there are certain basic rules that are common to all applications. Some of these rules are as follows:

- When drilled head bolts, screws, or other parts are closely grouped it is convenient to lock wire them in series to each other. The number of bolts, nuts, screws, and so forth, that may be wired together depends on the application. *When securing widely spaced bolts by the double-twist method, the maximum number of bolts that can be wired together is three.* When securing closely spaced bolts, wire no more in a series than you can secure with a 24-inch length of wire. Widely spaced multiple groups must not be secured together when the fasteners are from 4 to 6 inches apart. Do not lock wire fasteners or fittings that are spaced more than 6 inches apart, unless there are tie points on adjacent parts to shorten the span of the lock wire to less than 6 inches.
- Drilled head bolts and screws need not be lock wired if installed with self-locking nuts or lock washers.
- To prevent failure from rubbing or vibration, lock wire must be tight after installation.
- Install lock wire so it tends to tighten and keep a part locked in place, thus counteracting the natural tendency of the part to loosen.

- Lock wire must never be over-stressed. It should be pulled tightly when being twisted, but it should have a minimum of tension, if any, when secured. It will break under vibration if twisted too tightly.
- Bend lock wire ends *into* the part to avoid sharp or projecting ends that might present a safety hazard.
- Never over-torque or loosen units to align the safety wire holes. It should be possible to align the holes when the units are torqued to the specified limits.
  - Lock wire must not be nicked, kinked, or mutilated. When using pliers, grasp the wires at the ends so that you do not mutilate the twisted section of wire. Never twist the wire ends off with pliers and, when cutting off ends, leave at least four to six complete turns ($^1/_2$ to $^5/_8$ inches long) after the loop. This is known as the "pigtail." The strength of the lock wire hole is marginal. Therefore, never twist lock wire off with pliers. Cut the wire close to the hole to prevent wear and tear of the component.
  - When practical, install lock wire with the wire positioned around the head of the fastener and twisted so that the loop of the wire fits closely to the contour of the unit being safetied.

SAFETY NOTE: Safety wire is one of the little tasks you will perform that comes with big hazards and could cause serious injuries. Always wear the proper personal protective equipment when performing a simple safety wire task. Do not be like the Airman in this picture; otherwise, you could be the winner of the next Darwin award (fig. 1–7).

Figure 1–7. Example of what NOT to do when performing a safety wire task.

Lockwire sizes

When using the double-twist method of lockwiring, use 0.032-inch *minimum* diameter wire on parts that have a hole with a diameter larger than 0.045 inch. Lockwire of 0.020-inch diameter (double strand) may be used on parts having a hole with a diameter of 0.045 inch or less; or on parts having a nominal hole diameter between 0.045 and 0.062 inches with a spacing between parts of less than 2 inches. With the single wire method, use the largest size wire that the hole will accommodate.

202. Inspecting the ballistic system

Just as the plumbing in your home is used to route water or gas to various areas, escape system plumbing is used to route air and gases to different egress components. As an egress journeyman, you will be working with ballistic system hoses and plumbing of various types, shapes, and sizes. It is important to understand how to inspect these components because they are an integral part of an aircrew member's last chance for survival.

Tubing

Tubing is manufactured in accordance with military, commercial, or federal specifications. The most common types of tubing are titanium alloy, corrosion-resistant steel alloys, and aluminum. Tubing is available in a wide range of nominal outside diameter and wall thickness combinations. When sending work orders to your hydraulic shop to rebuild ballistic tubes, be extremely specific about specifications for the tube in compliance with the technical data. Appropriate material, nominal outside diameter and wall thickness combination are crucial to the success of the escape system.

Perform a tubing assembly inspection before accepting a tube from the hydraulics shop. Perform these inspections before and after installation and visually any time you are exposed to an egress ballistic tube. When visually inspecting for damage of ballistic tubes and ballistic tube assemblies, inspect for the following:

Visual Inspection for Ballistic Tube/Ballistic Tube Assembly Damage	
Inspect For	**Description**
Chafing	Damage caused by another object coming in contact with the tube.
Galling	Damage caused by friction between the tube and another object.
Fretting	Damage from chafing or galling that has actually worn away part of the tube.

Damage such as chafing, galling, or fretting produces mechanical property changes in metal tubing material that greatly reduces the ability to withstand internal pressure and vibration. Any visible penetration of the tube wall surface by these conditions is cause for the following:

- Correcting the conditions that originated the damage.
- Replacing the tube assembly or damaged section, regardless of the type of metal or pressure ranges involved.

Before installing ballistic tubes, inspect for these conditions:

- Visually or flow check fitting passage or passages are free from obstructions in accordance with technical data.
- Inspect for dents, nicks, and scratches.
- Ensure the correct nuts and sleeves are installed.
- Look for proper fit when a fitting is flared.
- Inspect cleanliness of assemblies.

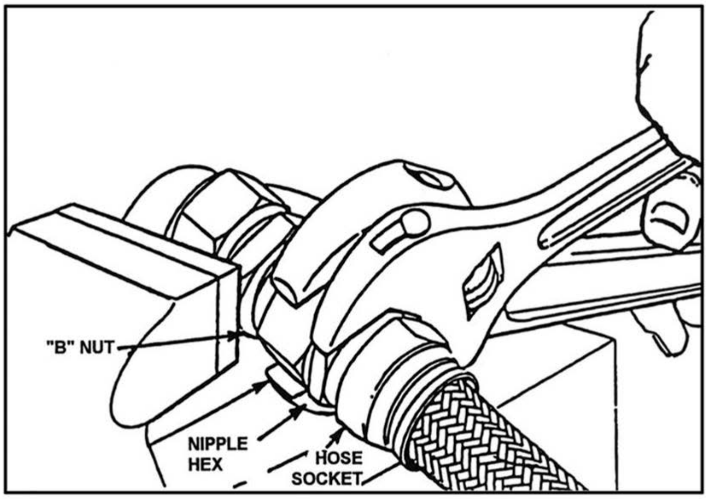
Most escape system ballistic tubes must be pressure tested after manufacture and, sometimes, even prior to every installation. Do so in accordance with TO 42E1–1–1, *Aviation Hose and Tube Manual.* You may have to coordinate with other agencies in order to accomplish this task.

Ballistic hose

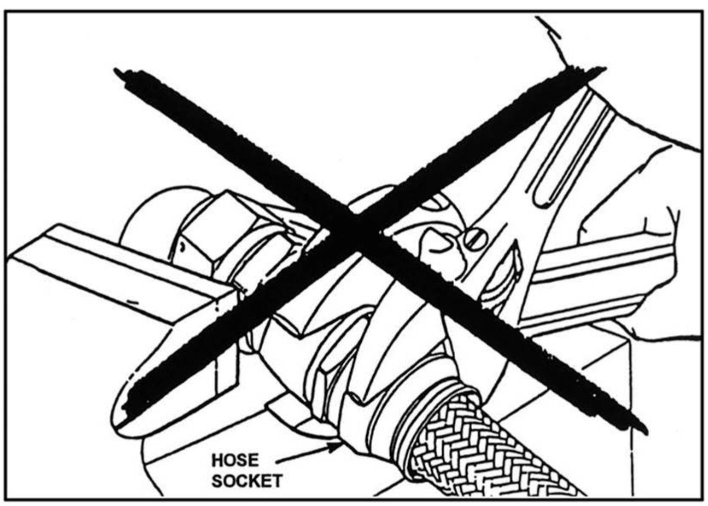
Hoses are used where a great amount of flexibility is needed. Sometimes, several types of hoses may be suitable for the same purpose. As a rule, egress systems use medium pressure, high-temperature Teflon hose. Pressure test a locally manufactured hose to 6,000 pounds per square inch (psi) and purge it before installation. TO 42E1–1–1 gives instructions on testing, installation, and inspection.

Hose installation

Because of their flexibility, install hoses so they are not subject to twisting. This prevents the tendency for fittings to loosen. Hoses should have support clamps at least every 24 inches; however, closer support is preferred. Support clamps must not restrict travel or subject the hose to tension, compression, or shear stress during flexing cycles. Additionally, the clamp must fit so it does not reduce the diameter of the hose. Bends must have a 2-inch minimum inside radius at all points. Larger inside radius bends are preferred. Finally, do not place a wrench on the socket of the hose fitting to install or remove the hose assembly (fig. 1–8).



DO----Place wrench on nipple hex to hold line while loosening "B" nut.



DON'T---Place wrench on socket flat to hold line while loosening swivel nut.

Figure 1–8. Hose installation.

Hose inspections

The following table covers the types of visible defects most commonly found on installed hoses:

Visible Defects Most Commonly Found on Installed Hoses	
Defect	**Description**
Abrasion	Abrasion is caused by rubbing or vibrating against another hose or fixture. Normally, this is seen as fraying or chaffing of the outer hose cover. Hoses may be repaired if the damage is limited to the outer covering and there is no damage to the wire braid. An acceptable repair is to cover the affected area with a Teflon spiral chafe guard, secured to the hose by tie straps.

Visible Defects Most Commonly Found on Installed Hoses	
Defect	**Description**
Broken wires	Abrasion, flexing, and stress fatigue normally causes broken wires. You must replace hoses that operate at or above 1,500 psi in the following or similar cases: • Two or more broken wires in a single plait. • Three or more broken wires adjacent to each other. • One or more broken wires in a suspected kink. • Ten or more broken wires per assembly, or per lineal foot, for assemblies over 12 inches in length. **CAUTION FOR INSPECTING BROKEN WIRES:** Never use your hands to feel for broken wires. Broken wires can injure you. Instead, run a rag along the hose length. Broken wires will snag the rag.
Corrosion	Hose corrosion is evident by a discoloration of the hose cover or reinforcement. Causes for corrosion attack include extreme heat, chemical, weathering and oxidation. Replace discolored hoses.
Kinking	Kinking is a temporary or permanent distortion of a hose. It can be induced by the hose being stepped on or folded upon itself. Kinking is often the direct result of exceeding the minimum bend radius. Teflon hoses tend to conform to the shape of installed positions. Be careful not to kink them during removal. Straightening or placing a hose in its other than natural lay can cause kinking. Kinked hoses should be replaced.
Twisting	A hose that is installed improperly so that each end of the hose turns awkwardly in opposing directions causes twisting. Correction is simply to observe the natural lay of the hose when installing.

Plumbing fittings and connectors

Fittings used in an egress system connect pieces of tubing together and connect tubing or hoses to the units within each system. Some fittings are stamped with their size number—2, 4, 6, 8, and so forth. A fitting size cannot be determined by measuring the fitting, but it can be determined by measuring the tubing or hose to which it fits. For example, when the fitting and tubing are connected, and the outside diameter of the tubing is $^1/_2$ inch, you say the fitting size is 8. Tubing is measured by its *outside diameter* to the nearest $^1/_{16}$ inch. Since $^1/_2$ inch equals $^8/_{16}$ inch, you will drop the 16 to determine the fitting size and use the upper part of the fraction. A size 6 fitting matches $^6/_{16}$– or $^3/_8$–inch tubing; size 4 fits $^4/_{16}$– or $^1/_4$–inch tubing, and so on. Measure the *inside diameter* to determine hose size.

The principal types of plumbing connectors used to attach tubing to other tubing or to system units are the flared-type, the bead-and-clamp type, the sleeve-type, and the swage-type. Because the bead-and-clamp type is only allowed to be used in low-pressure systems, this type of joint is seldom used in egress systems. The flared-sleeve type is the most common and may be used in all systems regardless of the pressure.

Refer to figure 1–9 as we discuss some of the inspection requirements for fittings. Inspect the flange for warping. Warped flanges look out-of-round. On tubing, look for damage or warping in the area where the sleeve meets the flange. Check the mating surface of the flange and the nipple. Any damage, such as nicks, scratches, and ridges that can be detected by your fingernail, may be reason to replace the fitting. Inspect the nuts for damaged threads and evidence of over tightening. Over tightening shows up as a belled or pulled condition on flared connections and may result in a frozen or seized "B" nut. Also, check the wrench pads. Pads should not have excessive damage. If you find any of these conditions, consult TO 42E1–1–1 regarding repair or replacement.

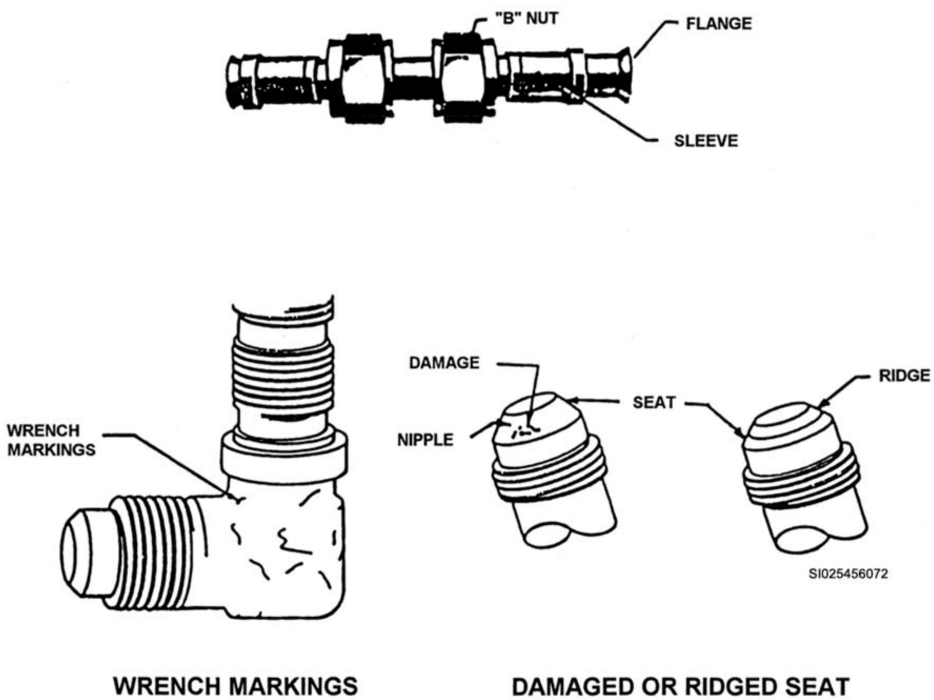


Figure 1–9. Damaged fittings.

Seals

Many egress system units use seals. There are two general classifications: packings and gaskets. Packing provides a seal between two parts of a unit that move with respect to each other. A gasket, on the other hand, seals two stationary parts of a unit. Its use in a system determines the material from which a seal is made. The shape of a seal is usually its most distinguishing feature. The most common types of seals are O-ring (doughnut) and V-ring (chevron). Figure 1–10 illustrates several standard seal shapes.

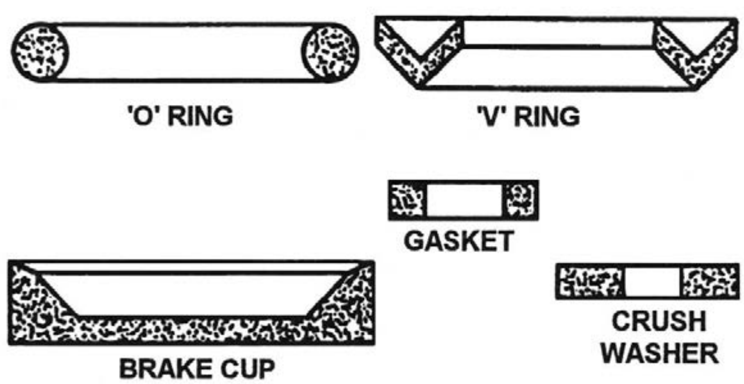


Figure 1–10. Cutaway view of common types of seals.

O-ring seal

The most common seal you will use in maintaining egress systems is the O-ring. A typical O-ring seals in both directions; therefore, only one seal is required on a piston head that moves in both directions. Figure 1–11 shows a typical O-ring seal installation. Inspect the O-ring seal for cuts, nicks, or flaws before installation. Discard the seal if you note any evidence of these defects.

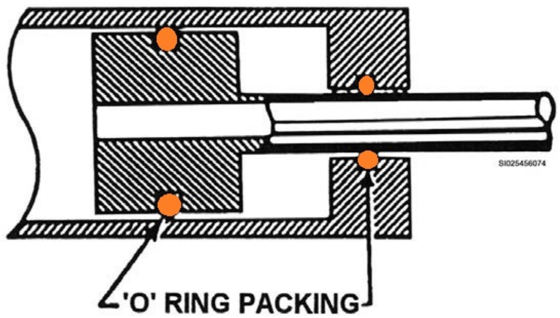


Figure 1–11. Typical O-ring installation.

For installation in pneumatic systems, lubricate the O-ring groove with pneumatic grease. Seals must be lubricated thoroughly to function properly. Lack of lubrication will increase friction that can quickly ruin the seal.

Remove and install O-rings using a small tool made from soft iron, aluminum, or brass rod. Be careful not to scratch or mar the groove surface. This is especially critical when assembling the pitch stabilization control assembly (STAPAC) on an ACES II. Many of the O-rings are difficult to install and you may be tempted to use a sharp scribe that could damage the O-ring and cause it to fail the 1000 psi pressure test. Save yourself the hassle of rebuilding it again, and use the right tool for the job.

Storage

Seals on bench stock should be rotated so that the oldest items are used first. Store them in a dark, cool, dry place, protected from excessive heat and from exposure to strong air currents, dampness, and dirt. Also, store them away from electric motors and other equipment that give off heat and ozone.

Self-Test Questions

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

201. Using different types of hardware

1. How do you identify that a bolt is made of greater strength than a standard type bolt?

2. What is the unthreaded portion of a bolt from the under-head surface to the start of the thread called?

3. Match the bolt type in column B with its description in column A by writing the correct letter in the blank space provided. Descriptions in column B may be used only once.

Column A	*Column B*
____(1) Used for shear loads.	a. Hex head.
____(2) Includes a hole drilled through the threaded end.	b. Internal wrenching.
____(3) Used to carry external tension loads.	c. Twelve-point external wrenching.
____(4) Used in high-tensile, high fatigue strength applications.	d. Clevis.
____(5) Removed by an internal wrenching tool.	e. Eyebolt.

4. When using a non-self-locking nut during aircraft maintenance, how must it be secured?

5. To ensure you are using the right nuts, what would you check?

6. When can you lock wire fasteners or fittings that are spaced more than 6 inches apart?

202. Inspecting the ballistic system

1. For what conditions do you inspect prior to installing a ballistic tube?

2. When installing hoses, where should you place support clamps?

3. If you discover a damaged hose where the damage is limited to the outer covering and there is no damage to the wire braid, what is an acceptable hose repair?

4. What is the repair procedure for kinked hoses?

5. How do you measure a tube to determine its proper fitting size?

6. How do you measure a hose to determine its proper fitting size?

7. How can you determine if a "B" nut has been over tightened?

8. When inspecting an O-ring prior to installation, what are you checking for?

9. How should seals be removed for use from bench stock?

1–2. Electrical Principles

Egress journeymen do not need to be electricians. In fact, you will call electro-environmental for most of your wiring problems. However, you do need a basic knowledge of the fundamentals of electricity in order to understand the electronic explosive devices (EED) that you are removing, installing, and replacing on egress systems.

203. Electrical terms

In the egress career field, you will be exposed to explosive components that are electrically activated. Accidental activation (by static electricity) can be disastrous. Also, you will use equipment that tests egress components and electrical circuits. As an egress journeyman, you must be able to discern when items should be exposed to electricity and when they should not. You have, from time to time, heard various terms associated with electricity. However, do you have a thorough understanding of these terms and how they apply to the job you are doing? Let's discuss some of these terms and their application to electrical theory.

Voltage

Voltage is force or pressure that causes free electrons to flow through a conductor. This force develops when one point of a circuit charges with an excess of electrons (negative potential) and a different point is charged with too few electrons (positive potential). One example of this potential energy is a battery; a battery has both a negative and positive terminal. Placing a voltmeter properly across these terminals indicates the electron charge (stored energy). This stored energy is required to move or attract the negative charge to the positive charge once an electrical circuit is complete. The negative charge—the electron—imparts its energy to the circuit in the form of electromagnetic force or heat. We call this force electromotive force (EMF), potential difference, or voltage. Remember that voltage does not flow. It is present in circuits to set the conditions for current flow in the circuit.

Current

Current is the flow of electrons through a conductor. With voltage applied across a circuit, the negative potential of the power source repels the electrons toward the positive potential while the positive potential attracts the electron. Therefore, current flows from negative to positive. This difference in potential must be present in order to establish current flow in a circuit. As the current flows through a circuit, energy in the form of heat and electromagnetic energy is imparted to the circuit to do work. When current flows through a coil of wire, a magnetic field is produced. This magnetic field operates solenoid valves, electric motors, or relays. The rate of current flow is measured in amperes. One ampere is the number of electrons that flow past a given point in one second, with a resistance of one ohm, and a potential of one volt applied.

Resistance

Resistance is the opposition to current flow in an electrical circuit. It is the product of the circuit voltage/current ratio. For example, when a fixed 12-ohm resistor is placed in a 12 voltage direct current (VDC) circuit the current draw will be 1-ampere. However, when voltage is allowed to increase or decrease (as we see in battery charging circuits) there is a proportional increase or decrease in current flow. All circuits offer some resistance through their conductors and components. Resistance controls current flow. The unit of measure is "ohms" or Omega. The ohm is equal to the amount of resistance required to allow one ampere of current flow with a pressure of one volt applied.

Ohms Law

Ohms Law expresses the relationship of voltage, current, and resistance in a circuit. This law tells how resistance and voltage affects current, and how resistance and current affect voltage. Ohms Law states that current is directly proportional to voltage and inversely proportional to resistance. In other words, if you increase the voltage through a circuit whose resistance is fixed, the current goes up. If you decrease the voltage, the current goes down (fig. 1–12).

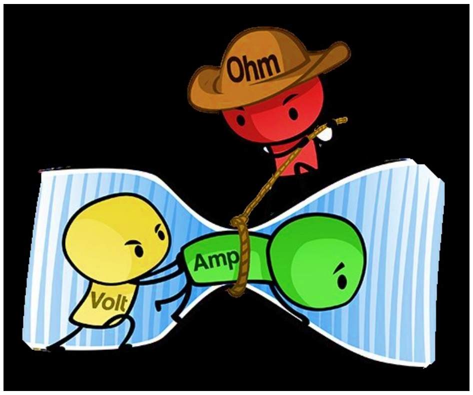


Figure 1–12. Ohm's Law.

Circuit

Voltage, current, and resistance all come together in the form of a circuit. A circuit is the complete path of an electric current from a power source through the conductors to a load device. A *load device* is the device that will use the electricity, such as a light bulb. A *conductor* is a material or object that permits an electric current to flow easily. In the case of electric circuits, it is usually wire or cable. An example of a *power source* is a battery. Figure 1–13 shows a basic circuit with a power source (the battery) and a load device (the light bulb). The power source has two terminals: one positive and one negative. As long as the connection is not broken, electrons will be pushed from the negative terminal of the power source through the load device and then back to the positive terminal of the source. The arrows show the flow of electrons through the circuit. A more complex circuit is composed of individual components connected by conductive wires through which electric current can flow. Those components may be switches or transformers (which change currents). Many escape systems use circuits to complete sequences in an ejection.

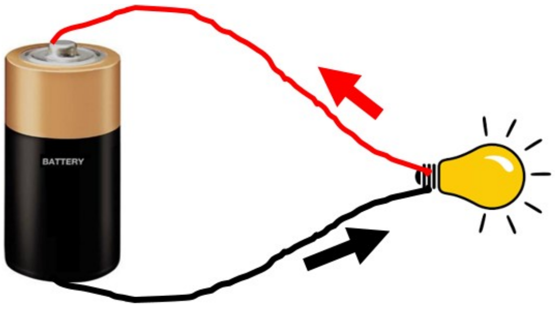


Figure 1–13. Basic circuit.

To understand circuits and how to troubleshoot them, think about the toy racecar track that you played with when you were a kid. Sometimes, you would sit the racecar on the track, pull the trigger and nothing would happen. So, you would have to troubleshoot to get your car to work. Sometimes, the problem was that pieces of the track were not connected properly, causing a break in the circuit. You would reconnect the track and away the car would go. Other times, you simply forgot to plug the power cord into the wall outlet, which in this case is the circuit's power source. Or, the electrical contacts on the bottom of the racecar were dirty and you cleaned them so the metal rails in the track would have clear contact—in this case, your problem was with the load device, the racecar itself. Remember this example when troubleshooting egress electrical systems; some circuits will be more complex than a toy racetrack, but the basic principles are the same.

Conductance factors

A good conductor is any material that contains a large number of free electrons. A few of the good conductors are hydrogen, sodium, potassium, copper, gold, and silver. The use of hydrogen, of course, would be quite impractical. As a gas, it would be all but impossible to contain as a conductor. Sodium is also highly explosive in the open atmosphere and potassium is too corrosive. The best *usable* conductor is silver, but it is too expensive to use in large applications. Gold is an excellent conducting material, but like silver, it is expensive. Although copper has less conductivity, it is a suitable conductor because it is cheaper than gold or silver, readily available, very malleable, and quite flexible. For these reasons, and others, copper is the most widely used conducting material. Although it is not as good a conductor as copper, aluminum is used often in circuits and components that require less weight, such as aircraft and missiles. A disadvantage of using aluminum as a conductor, is that it expands a lot when exposed to heat.

There are four factors that affect the ability of a material to pass electrons (conductance):

1. The *type of material* (discussed already).
2. The *length of the conductor.* (The conductance varies at a rate inversely proportional to the length or distance. That is, if you double the length, you halve the conductance.)
3. The *cross-sectional diameter* (or size). The greater the diameter (in circular mils), the greater the conductance—because of the increase in the number of electrons available in the larger diameter conductor. More free electrons result in better conductivity. Conductor sizes are given in sizes from #0000 up to #40 for general-purpose conductors. It is important to note that the *larger the numbers, the smaller the wire*.
4. The *temperature*. As the temperature of a copper conductor increases, the material expands and the atoms move farther apart. This results in a greater difficulty for the electrons to move through the conductor. Heat also causes thermal agitation within the conductor. Electrons collide and the velocity of electron drift is reduced. This reduced flow reduces conductivity.

Conductors

Conductors used to pass free electrons from one point to another are known as wires or cables. Aluminum is satisfactory as a lightweight conductor, but it offers less conductivity than copper. To overcome this, usually the aluminum wire used is larger in diameter and, whenever possible, shorter.

Insulators

Insulators are materials, or a combination of materials, having an atomic structure with very few free electrons. Sometimes the term "dielectric" is used to denote insulating material. Examples of common insulating materials are porcelain, glass, air, oil, and rubber. Certain types of plastics are used to insulate wires. In components that provide high power to a system, oil is used because it is not only a good insulator—it also dissipates heat being generated in the device.

There is no such thing as a perfect insulator. With sufficient voltage, any material can be made to conduct, so the best protection against electrical shock when working on electrical circuits or components is keep power off whenever possible. Keep this in mind when you work on or around electrical circuits.

Opens

An open is a break in the path for current flow. It is one of the most common electrical malfunctions. We no longer have continuity, or a continuous path for current flow. How will you know if you have an open? The first sign is if the circuit or part of the circuit fails to operate. A switch in the OFF position opens the circuit. As you start checking the circuit, you will find a higher than normal total resistance. In fact, the open part of the circuit will have no continuity, and will give a zero load (0.L.) reading on an ohmmeter. There is no longer a complete path for current to flow. There will be no current flow at all. You now know an open causes resistance to go up and current to go down, but what happens to the voltage, or force, that was trying to move the current? Does it just give up? What happens is the opposite of giving up; it will apply all of the force possible. In other words, we will have maximum voltage development across the open component.

If you find higher than normal resistance while doing a continuity check on a recovery sequencer—if resistance exceeds 0.010 ohm—disconnect shell from receptacle. Assure that the threads of the receptacle and connector are clean and unobstructed. Clean with shop air and a dry cloth, then reconnect and retest. If resistance still exceeds 0.010 ohm, confirm the accuracy of multimeter used. If you still find higher than normal resistance, you may need to replace the sequencer.

Shorts

A short is a loss of resistance in a component. It, too, is one of the most common electrical malfunctions. How many times have we said, "Oh, the cord must be shorted?" Wrong. Actually light cords and extension cords are wires, which mean they are conductors. Conductors are paths of low resistance for current flow. You *cannot* short a conductor. Please keep that in mind when you are troubleshooting. Only components can be shorted. Look again at the definition. You can tell you have a short if a circuit breaker trips or a fuse blows. Both of these components are protective devices that guard against excessive current flow. A second symptom of a short is excessive current flow through the shorted component. Since a short is a loss of resistance in a component, if there is a shorted component anywhere in a circuit, the total resistance of the circuit will also drop. When there is a short in a circuit, current will increase and resistance will decrease, so what happens to voltage? Think how much easier it is for you to open a well-balanced door compared to opening a 3-inch thick rusted cellar door. It is the same for voltage. If there is no resistance through a component, it will take no force to get current through. Therefore, there is no voltage development through a shorted component.

204. Electricity production

In the last lesson, you learned about voltage, current, and resistance. Now that you understand the basic composition of electricity, let's discuss some of the ways EMF is produced.

For the free electrons in a material to move (establishing a current flow), there must be a difference in potential between two points. One point must have an excess of electrons (negative); the second point must have a deficiency or lack of electrons (positive). This difference in potential is commonly known as electromotive force. The unit of measurement for EMF is the volt. A more common term for this difference in potential is voltage. A volt is defined as the force required to push 1 coulomb of electrons past a given point in one second. An EMF may be produced in any of six ways—by static electricity, photoelectricity, piezoelectricity, chemical electricity, electromechanical generation, and thermoelectricity. Our discussion will center on static, chemical, and thermoelectricity.

Static electricity

The most common natural method of producing EMF is static electricity. Electrons are transferred when certain materials are brought into contact with each other and a rubbing motion (friction) is present. One material gains electrons (becomes negatively charged) and the other material loses electrons (becomes positively charged). This potential difference can be measured by sensitive test equipment. The most common manifestation of static electricity is lightning. Friction between opposing masses of air builds up a charge that may be either negative or positive. When the charge becomes high enough (several million volts), electrons are forced to jump the air-gap to or from the ground. The result is a tremendous flash of light and a rapid expansion of air due to heat. The resulting noise is commonly known as "thunder."

While lightning is not a common danger inside an egress shop, static electricity can be. Since there are many different explosive items in an egress system, we must always be on guard to prevent the discharge of static electricity around egress components. It is possible to activate explosives with small impulses. Even small impulses of static electricity, though of small amperage, can generate thousands of volts.

SAFETY NOTE: ALWAYS ground yourself before handling electronic explosive devices.

Chemical electricity

Electrochemical voltage is produced by the interaction of two or more chemicals. Combining atoms into different structures causes chemical action. Many times the quantity of electrons that are moving is sufficient to do a certain amount of work.

The device that produces voltage through chemical action is known as a *voltaic cell*. This simple cell consists of two electrodes placed in an electrolyte. A car battery is an example of an electrochemical device.

Thermoelectricity

Thermoelectric generation is the last method for producing an EMF that we will discuss. Thermoelectricity is very useful in firing egress ballistic components. A thermocouple is formed by joining two dissimilar metals. Two metals such as iron and constantan (an alloy of nickel and copper) are bonded together and heated. Because of the different expansion rates of the two metals, a stress is placed on the bonding point. This stress distorts the valence bands of the electrons and causes electrons to break out of their orbits and move through an external circuit. It is interesting to note that the amount of voltage produced is in direct proportion to the amount of heat generated.

Thermal batteries, such as the ACES II's back-up emergency power supply, generate enough electricity to fire certain cartridge actuated devices/propellant actuated devices (CAD/PAD). These batteries sequence post-ejection events, provide redundant safety measures, and in newer systems, execute many other functions.

Self-Test Questions

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

203. Electrical terms

1. Why is it important for an egress journeyman to learn electrical principles?

2. What makes a material a good conductor?

3. How does the cross-sectional diameter of a conductor increase conductance?

4. Match the electrical term in column A with its description in column B by writing the correct letter in the blank space provided. Descriptions in column B may be used once, more than once or not at all.

Column A

___ (1) Current is directly proportional to voltage and inversely proportional to resistance.
___ (2) Includes two terminals, one positive and one negative.
___ (3) The flow of electrons through a conductor.
___ (4) A break in the path for current flow.
___ (5) Uses electricity.
___ (6) The opposition to current flow in an electrical circuit.
___ (7) Complete path of an electric current from a source of power through the conductors to a load device.
___ (8) Force or pressure that will cause free electrons to flow through a conductor.
___ (9) Permits an electric current to flow easily.
___ (10) A loss of resistance in a component.
___ (11) Material with very few electrons.

Column B

a. Voltage.
b. Current.
c. Resistance.
d. Ohm's law.
e. Circuit.
f. Load device.
g. Conductor.
h. Power source.
i. Insulator.
j. Open.
k. Short.

204. Electricity production

1. What is the difference in electron potential between the negative and positive points in a material?

2. How is this difference measured?

3. What can produce this difference in electron potential?

4. How many volts can static electricity produce?

5. What must you ALWAYS do before handling electronic explosive devices?

6. What type of voltage is produced by the interaction of two or more chemicals?

7. How does a thermocouple work?

1–3. Foreign Object Damage

All flightline personnel, especially egress journeymen who work in aircraft cockpits, must be thoroughly familiar with FOD hazards and how to eliminate them. This section will help you deal with the ever-present FOD problem.

205. Applying foreign object damage control

A foreign object is an object that is alien to an area or system. FOD is defined as any damage to aircraft, support equipment, engines, or components caused by a foreign object left on, in, or near an aircraft that could render the aircraft unsafe for use. Some examples include engine damage caused by ingestion of loose hardware, flight controls jammed by hardware or tools, and tires damaged by foreign objects on the ramp or taxiways.

Causes of FOD

There are many causes of FOD, but two major contributors are poor housekeeping and poor work habits. They include not accounting for hardware, safety wire, tools, and so forth, during operations and maintenance. All loose objects, regardless of their origin, can cause catastrophic and costly damage. Keep loose hardware in parts bags and not in your pockets. Have you ever seen someone drop a piece of safety wire onto the hangar floor? This wire may end up in an aircraft engine and cause thousands of dollars' worth of damage. How could a tiny piece of metal or stone cause so much damage? When one small piece of metal comes in contact with the hardened metal of an engine blade spinning at high speed, it can knock a chip off the blade. Then, there are two pieces of foreign objects—the original piece and the knocked off chip. As those two pieces pass to the second set of blades, they impact other blades causing more damage. With at least 13 sets of blades, and sometimes as many as 27, coupled with extreme compression and high speed, hundreds of thousands of dollars in damage can occur in seconds. Figure 1–14 shows a cutaway of a multistage turbine. If you follow the direction of the arrows and imagine them as the path of a foreign object, you can understand just how much damage one tiny piece of foreign object can cause.

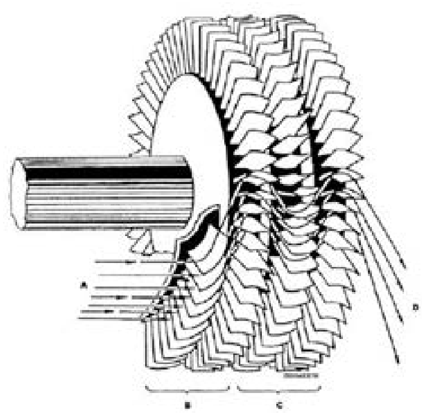


Figure 1–14. Multistage turbine.

Other causes of FOD include natural phenomena, such as high winds or heavy rainfall. FOD occurs all too often when loose objects (i.e., stone, paper, trash) are blown or washed onto taxiways or runways. Gravel and stone easily make their way into jet engines, cut aircraft tires, or cause other serious damage.

As an egress maintainer, the majority of your un-scheduled maintenance will come from FOD in the cockpit. Most of our unscheduled maintenance is raising or removing seats to facilitate a FOD search. Any type of FOD in the cockpit of a fighter jet could have catastrophic consequences.

Classes of FOD

There are three general classes of FOD: (1) metal, (2) stone, and (3) miscellaneous. To make it easier to understand, we will discuss each class separately.

Metal

Hardware can cause metal FOD. All too often, journeymen fail to account for and properly dispose of nuts, bolts, clamps, bits of safety wire, and clippings during removal, repair, or installation of aircraft parts. *Never leave these items in or around the cockpit or near the engine.* Another metal that causes FOD are the tools that you use. Wrenches, screwdrivers, pliers, or even test equipment can find their way into the flight controls or the inlet ducts of operating jet engines. Failure to account for tools and hardware properly can result in destroyed engines or aircraft crashes. Other objects classified as metal FOD include items that you are all familiar with—pens, pencils, coins, and even security badges.

Stone

There are two classes of stone—natural and man-made. The most plentiful is natural stone. It is found in all countries and on all bases. At your base, the immediate edge of runways and taxiways are probably the greatest source of natural stone. Normally, wind or rain do not blow or wash gravel, pebbles, and stone onto the surface of the operating area. However, if the edges of the flight line are disturbed, the loosened material can be blown or washed onto parking areas or runways. The border may be disturbed by overlapping sweeping machines, engine exhaust blasts, aircraft landing gears, or even flightline vehicle traffic.

Man-made stone—concrete and asphalt material—which covers most aircraft runways and taxiways, releases small stones and particles. Adverse weather conditions aggravate this process by causing cracks or breaks in concrete and asphalt surfaces.

It is worth noting that stone, in either its natural or man-made state, is the most difficult of all foreign material to control; for this reason, you must police the areas where jet engines operate continually.

Miscellaneous

As you have probably already guessed, this third class of foreign object covers anything that does not fit the metal or stone classes. Miscellaneous items include wood, rubber, cloth, plastic, and organic matter (birds).

206. Preventing and controlling foreign object damage

The vice wing commander or vice center commander (depending on the structure of your base) is responsible for ensuring that an effective FOD prevention program is established. All personnel (military, civilian, and contractors) working in, on, around, or traveling through areas near aircraft, munitions, aerospace ground equipment (AGE), engines, or components thereof will comply with FOD prevention. In short—FOD prevention is everyone’s responsibility.

Tool inventories

Inventory your tools before and after each job. Most composite tool kits (CTK) are silhouetted to identify each tool. This helps eliminate many “forgotten tools.” However, there is still the possibility of human error. This is why it is so important to inventory your tools when you arrive at the job site and before you leave. In addition to checking the CTK, you must account for tech data, bench stock, special tools, and so on, that you brought with you. No one wants to explain to the commander why they left a scribe, flashlight, mirror, diagonal cutters, and duckbills under a canopy remover panel on an F–16 and only find them missing a hour before the jet is about to fly; it HAS happened! (**BOTTOM LINE:** Perform a proper tool check.)

Foreign object removal

Personal items contribute their share to the FOD problem. Jet engines are like big vacuum cleaners. Hats, restricted area badges, glasses, ear protectors, and so on, can be sucked into the intakes with disastrous results. Loose items, such as pencils, pens, wallets, cigarette lighters, and coins can fall out of your pockets when you lean over or crawl into work areas. If you do not remove these items from your pockets or secure them before working around aircraft, they can cause FOD.

If you drop an item while you are working in the cockpit and do not immediately locate it, search the cockpit. Borescopes and X-rays can help locate foreign objects in inaccessible areas. If you cannot locate the lost item, you must take action to prevent the aircraft from flying. A detailed entry in the aircraft forms is often necessary. The more details the better because this helps the search crew identify the object. Each base develops local guidelines for finding lost objects and impounding aircraft. Remember, you have a responsibility to the aircrew to never conceal or overlook an object lost in the aircraft. For the sake of the aircrew you support, you must be willing to admit a human error. It is easier to deal with the consequences of dropping an object and causing a search than it is to deal with the consequences from dropping an object that caused an aircraft crash.

FOD control

Items lying loose on the flight line, where aircraft are parked or required to taxi, are potential causes of FOD. FOD walks (organized police-up details) are very common on most flight lines. Mechanical sweepers sweep the flightline areas on a regular schedule. Another way to control foreign objects is to use FOD bags. FOD bags are a type of pouch worn by an individual or attached to a CTK to collect bits of safety wire, cotter pins, and other foreign objects you find lying around. Empty the FOD bag after each job and never place the bag in a position where the contents may spill into the cockpit. Empting the FOD bag is often an overlooked task and is sure to excite any quality assurance inspector performing an inspection on the CTK. If the contents spill, it is almost impossible to determine if every piece of FOD lost from a bag was recovered.

Air Force Instruction (AFI) 21–101, *Aircraft and Equipment Maintenance Management*, contains detailed information on FOD prevention and responsibility. Also, make sure you familiarize yourself with any local publications as most group commanders have specific localized requirements.

Self-Test Questions

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

205. Applying foreign object damage control

1. Engine damage caused by ingestion of loose hardware, flight controls jammed by hardware, or tools and tires damaged by a nail on the flight line are all examples of what?

2. Why do foreign objects cause so much damage when ingested into aircraft engines?

3. What are the three classes of FOD?

4. Tools are classified as what class of FOD?

206. Preventing and controlling foreign object damage

1. Who is responsible for FOD prevention?

2. At what point during an egress final would you inventory your tools?

3. What tools can help locate foreign objects in inaccessible areas?

4. What do you call a pouch worn by an individual or attached to a CTK used to collect bits of safety wire, cotter pins and other debris you find lying around?

1–4. Corrosion Control

Iron has been our basic construction metal since the beginning of the Iron Age. This metal is soft, has little strength, and corrodes rapidly in certain environments. It was discovered that, when milk was poured over the metal surface, particles of butterfat would form a passive film; thus isolating the metal from the corrosive environment. As we progressed from the Iron Age into what may be called the Alloy Age, iron was replaced as the basic construction metal. We found that we could combine metallic elements into metals that were stronger than iron. Then the problems of corrosion control became even more acute because the metals were exposed to new and varied environments. Simply placing butterfat on the surfaces no longer sufficed, so more corrosion-resistant surface protections had to be developed. Modern-day research has provided many corrosion-resistant materials, such as organic coatings, chemical films, and corrosion-preventive compounds.

207. Identifying corrosion

One of the many responsibilities of aircraft maintenance personnel is to identify corrosion on an aircraft surface. Depending on the situation at your particular unit, you may also have to treat mild corrosion. Because egress personnel are the only ones inspecting the emergency escape systems on most aircraft, they are in the best position to detect corrosion in these areas. This lesson concentrates on the types of corrosion, because knowing the type will enable you to better eliminate corrosion, which we cover in the next lesson.

Definition

Corrosion is the electrochemical deterioration of a metal as a result of its chemical reaction with the surrounding environment. This reaction occurs because of the tendency of metals to return to their natural states, usually oxide or sulfide ores. For example, iron in the presence of moisture and air will return to its natural state— iron oxide or rust. Aluminum and magnesium form white oxides or hydroxides. When a water solution containing soluble salts is present, corrosion of many alloys can occur easily at ambient temperatures. You can effectively treat this type of corrosion.

Corrosion can also occur in the absence of water but only at high temperatures, such as those found in gas turbine engines. However, the most common type of corrosion (and the one you can most effectively treat) is electrochemical corrosion.

Theory of corrosion

Corrosion is the tendency of all things to return to their natural state. The natural state of a metal is an ore. When metal corrodes, the metal atoms lose electrons and become metal ions in the electrolyte. In solutions, the positively-charged metal ions can combine with negatively-charged ions to form corrosion products, such as metallic chlorides, oxides, and hydroxides.

Four conditions must exist for corrosion to occur:

1. A metal (the anode) that has a tendency to corrode must be present.
2. A dissimilar conductive material (the cathode), which has less tendency to corrode than the anode, must be present (such as a different metal, a protected part of the same metal, or conductive plastics).
3. A conductive liquid (electrolyte) must connect the anode and the cathode so that ions can carry electric current between them.
4. Electrical contact between the anode and cathode (usually in the form of metal-to-metal contact) must exist to allow electrons to move from the anode, where they are released, to the cathode.

Eliminating any of these four conditions, illustrated in figure 1–15, will stop corrosion. For example, a paint film on a metal surface will prevent the conducting liquid (electrolyte) from connecting the anode and cathode, stopping the electric current (fig. 1–16).

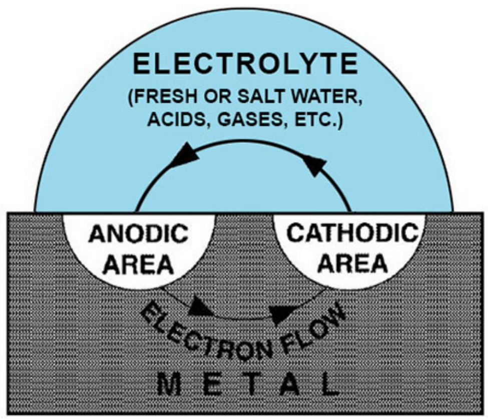


Figure 1–15. Simplified corrosion cell.

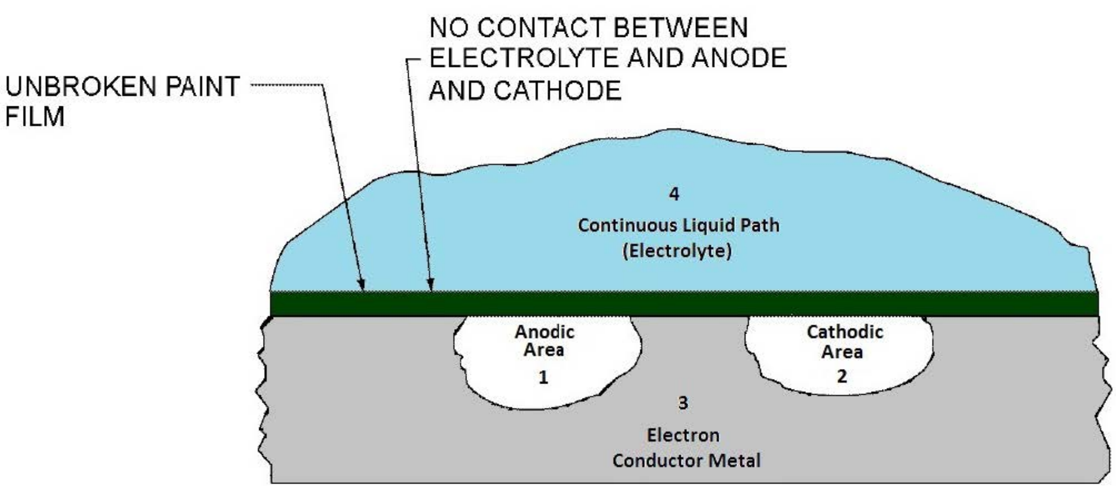


Figure 1–16. Elimination of corrosion.

Development of corrosion

Corrosion begins on a metal's surface. If allowed to progress, it can penetrate deeper into the metal. If corrosion begins on an inside surface of a component (such as the inner wall of a metal tube), it may go undetected until perforation occurs. Corrosion products often appear on the surface as a powdery deposit. This film may reduce the rate of corrosion—if the film acts like a barrier to electrolyte.

Some metals (i.e., stainless steel and titanium), under the right conditions, produce corrosion products so tightly bound to the metal that they form an invisible oxide film (called a passive film), which prevents further corrosion. However, when the film of corrosion products is loose and porous (such as those of aluminum and magnesium), electrolyte can easily penetrate and continue the corrosion process, producing more extensive damage than surface appearance would show.

Paint coatings can hide the initial stages of corrosion. Since corrosion products occupy more volume than the original metal, paint surfaces should be inspected often for irregularities such as blisters, flakes, chips, and lumps, which may be indications of corrosion beginning under the paint.

Types of corrosion

Corrosion is grouped and typed in many ways. Occasionally, different names are used for the same type of corrosion. In the following paragraphs, we define corrosion according to the most commonly used names.

Uniform etch corrosion

Uniform etch corrosion is usually caused by direct chemical attacks (for example, by an acid) and involves only the metal surface (fig. 1–17). On a polished surface, uniform etch corrosion is first seen as a general dulling or etching of the surface. If allowed to continue, the surface becomes rough and sometimes frosted in appearance. This type of corrosion appears uniform because the anodes and cathodes are very small and constantly shift from one area of the surface to another.

Figure 1–17. Uniform etch corrosion.

Pitting corrosion

Pitting corrosion is most commonly associated with aluminum and magnesium alloys, although it may also occur in other types of metal (fig. 1–18). It is first noticeable as a white or gray powdery deposit, similar to dust, which blotches the surface. When you clean the deposit away, tiny pits or holes can be seen in the surface. You need to become very familiar with early identification of this type of corrosion, since most ejection seat structures are made of aluminum alloy.

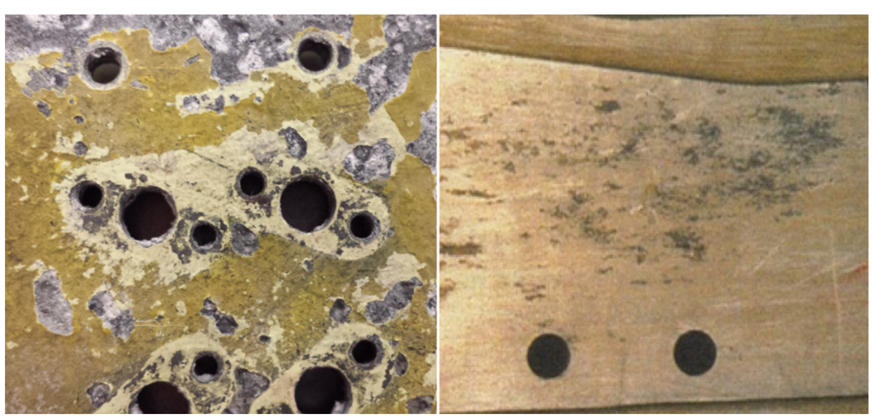


Figure 1–18. Pitting corrosion.

Intergranular corrosion

Intergranular corrosion is an attack on the grain boundaries of the metal (fig. 1–19). It is caused by a chemical difference between the boundary material and the core material of the metal grains. Intergranular corrosion resembles the pitting that remains after the powdery deposits have been removed from pitting corrosion. However, the grains of intergranular corrosion are much smaller and more clearly defined than are the pits of pitting corrosion. Figure 1–19 shows a highly magnified section of alloyed metal with intergranular corrosion.

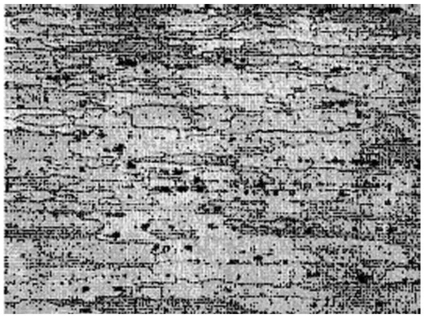


Figure 1–19. Intergranular corrosion.

Figure 1–20. Exfoliation corrosion.

Exfoliation corrosion

Exfoliation corrosion is an advanced form of intergranular corrosion that “lifts up” the surface grains of a metal (fig. 1–20). The force of the expanding corrosion that occurs at the grain boundaries causes this lifting. Exfoliation corrosion is seen most often on extruded sections such as structural angles and channels. You can recognize it by the “puffed up” appearance of the metal grains.

Galvanic corrosion

Galvanic corrosion is recognizable by a build-up at the joints between metals (fig. 1–21). It is found commonly where screws fasten panels down. Galvanic corrosion occurs when dissimilar metals contact each other in the presence of moisture. It results from the electric currents that flow between the metals.

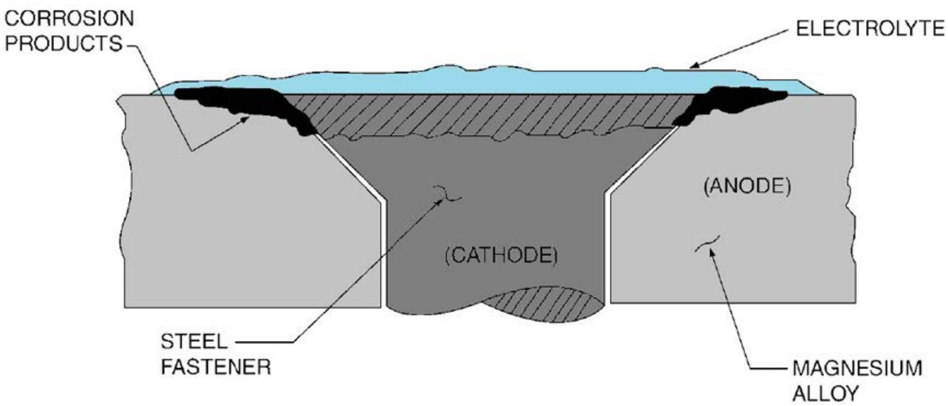


Figure 1–21. Galvanic corrosion.

Crevice/concentration cell corrosion

Crevice corrosion occurs when the electrolyte has a different concentration from one area to another. Electrolytes inside the crevice contain less oxygen and more metal ions than electrolytes just outside the crevice. As a result, the metal surfaces, even though they may be part of the same metal, have different activities, and corrosion occurs inside the crevice. This kind of corrosion also occurs when foreign material covers a surface.

Stress corrosion

Stress corrosion is the intergranular or transgranular cracking of a metal caused by the combined effects of constant tensile stress (internal or applied) and corrosion (fig. 1–22). Cold working, forming, and heat treatment operations produce internal (residual) stresses during manufacture of a part; they remain concealed in the part unless stress release operations are used. These stresses add to those caused by applying normal loads to parts in operation. Metals have threshold stresses below which stress corrosion cracking will not occur. This threshold stress varies from metal to metal, and is different for each of the three directions in which stress can be applied.

Stress corrosion cracking is an extremely dangerous type of failure because it can occur at stress levels far below the rated strength of a metal, starting from what is thought to be a minor corrosion pit. Parts can completely sever in a split second or they can crack slowly, and the rate of cracking is very unpredictable.

Specific environments cause stress corrosion cracking of certain alloys. Salt solutions, seawater, and moist air containing salt may cause stress corrosion cracking in heat treatable aluminum alloys. Magnesium alloys may stress-corrode in moist air. Placing an insulating barrier of protective coatings and water-displacing, corrosion-preventive compounds between the metal and the corrosive environment may prevent stress corrosion.

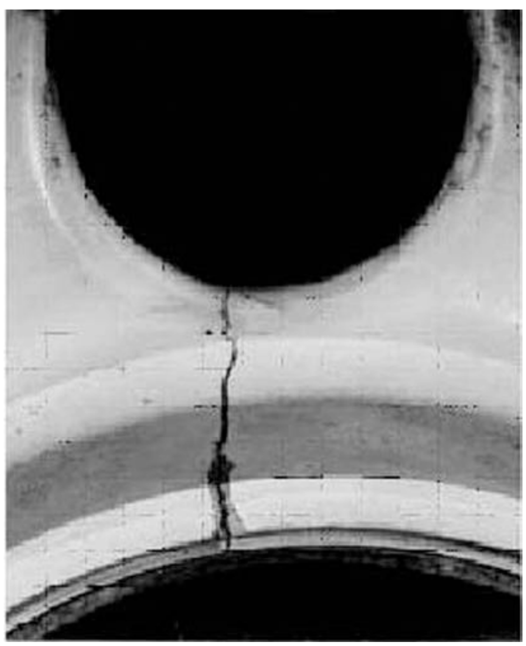


Figure 1–22. Stress corrosion.

Corrosion fatigue

Corrosion fatigue is the cracking of metals caused by the combined effects of cyclic stress and corrosion. It is very similar to stress corrosion cracking. No metal in a corrosive environment is immune to some reduction in its resistance to cyclic stressing. Damage from fatigue corrosion is greater than the sum of the damage from both cyclic stresses and corrosion. In this type of corrosion, stress is caused by a rapid reversal of force or vibration. Once corrosion develops and causes the formation of a tiny crack, vibration will eventually cause failure of the part, even if the corrosion has been removed completely. Thus, protecting parts subject to vibrations is particularly important, even when corrosion does not seem likely to occur. Preventive measures are the same as those given for stress corrosion cracking.

208. Controlling corrosion

Now that you know what corrosion is, what causes it, and the different types that exist, let's discuss some ways in which you can prevent it, and thereby reduce maintenance and replacement costs. You will learn about degrees of corrosion, corrosion inspections, corrosion removal, removal tools, surface finishing, and finally, we will wrap up the lesson with preventive maintenance.

Degrees of corrosion

Although it may be difficult to draw a distinct line between the degrees of corrosion, there are three categories: light, moderate, and severe. The following table gives an in-depth description of each type.

Degrees of Corrosion	
Degree	**Description**
Light	At this degree, the protective coating is scarred or etched and the condition of the metal is characterized by discoloration and pitting to a depth of approximately one millimeter (0.001 inch). This type of damage may be removed by light hand sanding. As an egress systems journeyman, you will likely treat only light corrosion. Any worse corrosion must be reported to and treated by corrosion control specialists.
Moderate	Moderate corrosion looks similar to light corrosion except that there may be some blisters or scaling and flaking of the coating or paint; and the pitting depths may be as deep as 0.010 inch. Normally, this type of damage is removed by extensive hand sanding or light mechanical sanding.
Severe	The general appearance of severe corrosion is similar to moderate corrosion, with severe intergranular corrosion, blistering, exfoliation, scaling, or flaking. The pitting depths are deeper than 10 millimeters. Corrosion control personnel must remove the damage by extensive mechanical sanding or grinding.

Inspection

Corrosion inspections ensure the detection, removal, and prevention of corrosion. Detection, removal, and prevention are your major responsibilities in the corrosion control program. Without proper and systematically performed inspections, corrosion can seriously damage equipment. Aircraft inspections are performed at regular intervals to ensure that areas susceptible to corrosion remain undamaged or are treated during the early stages. You must also inspect shop equipment at regular intervals. The extent and frequency of corrosion inspections depend on such factors as humidity, temperature, air pollution, and geographic location.

While corrosion can occur anywhere, some areas and materials are more susceptible than others. This may be due to the location, shape, or materials used. In any case, these areas and materials should receive special attention during corrosion inspections.

Aluminum surfaces

As already stated, aluminum corrosion produces a white or gray powder, except for exfoliation. Exfoliation is noted by soft, easily crumbled pieces or flakes of corroded metal. When you inspect egress systems, look for exfoliation, especially around the heads of countersunk fasteners. Treatment must include removing all layers of exfoliated metal, blending and polishing the damaged area, applying a chromate primer coating, and restoring protective finishes. Scratches and breaks in paint and other protective coatings can result in rapid corrosion in the metal under the break.

Magnesium surfaces

Magnesium and its alloys corrode very easily. The corrosion products are white or gray and form in large amounts, especially where dissimilar metals are in contact. Because of the rapid rate of corrosion, inspection is critical. During your inspection, pay particular attention to edges, areas around fasteners, and cracked, chipped, and missing paint surfaces.

Steel surfaces

Rust is the indication of corrosion on ordinary steels. If the steel is cadmium plated (common on egress explosive components), the cadmium will show a white residue. When the plating is corroded through, typical red or brown rust will appear. Chromium plating will have localized rust spots, blistering, or flaking as evidence of corrosion. Since chromium is cathodic to steel, steel will rapidly corrode once the plating has ruptured. Cadmium is anodic to steel, so a break in the plating is not as significant. Stainless steel is highly resistant to corrosion and requires only periodic cleaning.

Rust discoloration and/or cracking are likely due to such conditions as improper protection, exposure to excessive heat, concentration cells, or exposure to salt water or salt. Concentration cells can occur under soil buildup, fastener heads, washers, and other unsealed overlying surfaces. Typical surface rust is not in itself detrimental to high strength, heat treatable steels. However, such areas develop into pits that provide stress concentration sites. Rusted areas should be inspected carefully since rust tends to hold moisture that provides the electrolyte for additional corrosion. Metal in or near areas that have been heated are also subject to corrosion. A welded area is one example.

Spot welds

Spot-welded assemblies are particularly prone to corrosion. Corrosion is the result of the entrapment of corrosive agents between the parts of the assemblies. The corrosive attack causes skin buckling or spot-weld bulging and eventual spot-weld fracture. Skin and spot-weld bulging can be detected in its early stages by sighting or feeling along a spot-weld seam. The only way to prevent this condition is to treat potential moisture entry points with a sealant or a suitable preservative compound. These entry points may be gaps, seams, or holes created by broken spot welds.

Corrosion removal

Once corrosion is discovered, it must be removed. However, you cannot just grab a piece of sandpaper and start removing it. There are certain factors to consider first. The most important is that the corrosion must be removed completely without causing additional damage during the process. The first step is to remove corrosion that is visible through a 10X magnifying glass, then removing an additional 2 mils (0.0020 inch), to ensure that all deposits are gone. Failure to remove all the corrosion may allow the corrosion to continue after the affected surfaces are refinished. Other factors to consider are as follow:

1. Strip the paint and clean the surface before attempting to remove corrosion products. Surface contaminants will interfere with removing the corrosion and will increase the difficulty of your job.
2. Protect adjacent components from corrosion residue during the removal operation. Corrosion residue can cause additional corrosion and damage the surface finish of the surrounding area. An accidental slip of a corrosion removal tool can do additional damage.
3. Before you begin to remove corrosion, check the allowable limits specified in the technical orders. When structural repairs are not authorized by tech data, coordinate with the system manager to learn what to do next.

You have a choice of methods for mechanically removing corrosion. The method used will depend on the type of metal, the location and accessibility of the corroded area, the degree of damage, and the type of corrosion. These factors determine the types of tools and equipment you will use. It is very important that the removal method, the tools, and the equipment selected be compatible with the metal surface. Compatibility involves: (1) the mechanical effect on the surface and (2) the compatibility of metallic particles that are torn or worn off the removal equipment that might be trapped in the metal surface.

Mechanical compatibility

Mechanical compatibility refers to selecting the right tools and equipment for the job to prevent additional damage during the removal process. You often must use a series of removal techniques to remove corrosion. Using first a rapid and coarse method, followed by a slower and finer method will produce a smooth finish—for example, beginning with a wire brush, and once the surface is exposed, switching to a fine abrasive such as emery cloth.

Material compatibility

Material compatibility refers to using a cleaning medium that will not cause additional corrosion. Material compatibility is ensured by using *like metals* during corrosion removal operations (for example, an aluminum brush for aluminum surfaces and a steel brush for steel surfaces), or by using *compatible materials* such as stainless steel and aluminum oxides. Never use dissimilar metals in removing corrosion. For example, never use steel wool to remove corrosion from aluminum.

Removal tools

As an egress journeyman, you are not expected to handle extensive corrosion damage or to use sophisticated corrosion removal tools. However, you will use standard tools such as abrasive cloth, abrasive paper, metallic wools, and wire brushes to remove minor corrosion.

Abrasive cloth

Aluminum oxide grit bonded to cloth is used to dry sand light to moderate corrosion. It is available in sheets (9" × 11") and rolls (2" or 3" wide) in 240–grit (fine) and 320–grit (very-fine) grades. Aluminum oxide performs better on softer metals such as aluminum and magnesium.

Abrasive paper

Silicon carbide grit bonded to heavy paper is used to wet or dry sand light-to-moderate corrosion. It is also available in sheets in 240–grit and 320–grit grades. Silicon carbide is usually more effective on harder metals such as ferrous alloys. Other abrasives are available on paper or cloth (such as emery and flint) but suffer from poor efficiency and short working life.

Metallic wool

Metallic wool is an abrasive used to remove corrosion that is not bonded tightly to a metal surface. Metallic wool has a variety of uses and in many areas it is better than abrasive mats/cloth or paper. The four major types of metallic wools are aluminum, copper, stainless steel, and steel. Metallic wools come in six grades, ranging from number 3 (coarse) to number 000 (very fine).

You must know the type of corroded metal before using metallic wool. Steel wool is used on ferrous metals; aluminum wool on aluminum, aluminum alloys, magnesium and magnesium alloys. Copper wool is used on copper alloys, bronze and brass; and, stainless steel wool is used on stainless steel.

These materials are very good for corrosion removal on tubing or extruded parts. After using metallic wools, remove residue from the metal surface with a vacuum cleaner. Metallic wool particles can create galvanic cells if left on the metal surface causing galvanic corrosion.

Wire brushes

Wire brushes can be used to remove heavy corrosion deposits or paint that is not tightly adhered to the metal surface. They are available with aluminum, steel, stainless steel, brass, and copper bristles. The bristles vary in length, thickness, and stiffness. Thick, short, and/or stiff bristles are more effective for rapid removal. Use the finer bristles (long, thin, and flexible) for finer work. The brushes must be compatible with the metal surface in order to prevent galvanic corrosion. Stainless steel is neutral and can be used on all aviation equipment. However, only a stainless steel brush can be used on stainless steel. Do not use a brush with a wire diameter greater than 0.010, as the surface may be gouged. Move the brush in a straight, back-and-forth motion; do not cross-hatch or the surface may be damaged. After wire brushing soft metal such as aluminum or magnesium, polish the surface with fine abrasive paper.

Surface finishing

The final step in corrosion removal—and one of the most important steps from a corrosion-prevention view point—is to apply an effective protective coating. A good, intact coating is one of the most effective corrosion prevention tools available to maintenance personnel. Maintaining the coating in good condition will eliminate many general corrosion problems. In addition to the equipment's specific technical orders, refer to TO 1–1A–8 for application procedures for the various coatings.

Preventive maintenance

The two most important factors in preventing corrosion are removing electrolyte and applying protective coatings. These are also the only factors field personnel can control. Since the extent of corrosion depends on the length of time electrolytes are in contact with metals, you can minimize corrosion by frequent washing. The more frequently a surface in a corrosive environment is cleaned with non-corrosive cleaners, the less the possibility of corrosive attack. Also, maintaining chemical treatments and paint finishes in good condition can minimize corrosion. You can minimize the degradation of nonmetallic materials by only using authorized maintenance chemicals and procedures. In addition, use only approved materials to repair or replace nonmetallic materials. Dedication to proper preventive maintenance practices will maximize equipment reliability.

Self-Test Questions

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

207. Identifying corrosion

1. What is the definition of corrosion?

2. Match the type of corrosion in column A with its description in column B by writing the correct letter in the blank space provided. Descriptions in column B may be used once, more than once or not at all.

Column A

____ (1) Commonly found where screws fasten panels down.
____ (2) Most often seen on structural angles and channels.
____ (3) Caused by direct chemical attacks.
____ (4) Caused by cyclic stress and corrosion.
____ (5) Mostly associated with aluminum and magnesium alloys.
____ (6) Cracking of metal caused by combined effects of constant tensile stress and corrosion.
____ (7) Attack on the grain boundaries of the metal.
____ (8) Occurs when the electrolyte has a different concentration from one area to another.

Column B

a. Uniform etch corrosion.
b. Pitting corrosion.
c. Intergranular corrosion.
d. Exfoliation corrosion.
e. Galvanic corrosion.
f. Crevice/concentration cell corrosion.
g. Stress corrosion.
h. Corrosion fatigue.

208. Controlling corrosion

1. If you discover the protective coating of a part is scarred and the metal is discolored but the pitting is less than 0.001 inch, what degree of corrosion would you need to treat?

2. How would you treat the corrosion described in question one?

3. What factors determine the frequency of corrosion inspections at your egress shop?

4. What should you pay close attention to when inspecting magnesium surfaces on ejection seats?

5. How can you prevent corrosion to spot welds?

6. What is the first step in removing corrosion?

7. When removing corrosion, what type of compatibility deals with using a cleaning medium that will not cause additional corrosion?

8. What type of metallic wool would you use to clean corrosion from an aluminum alloy?

9. What type of wire brush can be used on all aviation equipment?

10. What is the final step in corrosion prevention?

Answers to Self-Test Questions

201

1. The letter "S" will be stamped on the head.
2. Grip length.
3. (1) a.
   (2) d.
   (3) e.
   (4) c.
   (5) b.
4. They must be secured by external locking devices such as lock washers, cotter pins, or lock wire.
5. The IPB.
6. If there are tie points on adjacent parts to shorten the span of the lock wire to less than 6 inches.

202

1. Visually or flow check fitting passage or passages are free from obstructions in accordance with technical data. Inspect for dents, nicks, and scratches. Ensure the correct nuts and sleeves are installed. Look for proper fit when fitting is flared. Inspect cleanliness of assemblies.
2. At least every 24 inches, however closer support is preferred.
3. Cover the affected area with a Teflon spiral chafe guard secured to the hose by tie straps.
4. Replace, do not repair.
5. By the outside diameter.
6. By the inside diameter.
7. It will show as a belled or pulled condition on flared connections.
8. Cuts, nicks, or flaws.
9. Rotate seals so the oldest seals are used first.

203

1. Accidental activation (by static electricity) can be disastrous. Also, you use equipment that tests egress components and electrical circuits. Finally, you must be able to discern when items should be exposed to electricity and when they should not be.
2. A large number of free electrons.
3. Increases the number of electrons.
4. (1) d.
   (2) h.
   (3) b.
   (4) j.
   (5) f.
   (6) c.
   (7) e.
   (8) a.
   (9) g.
   (10) k.
   (11) i.

204

1. EMF.
2. In volts.
3. Static electricity, photoelectricity, piezoelectricity, chemical electricity, electromechanical generation and thermoelectricity.

4. Thousands.
5. Ground yourself.
6. Electrochemical voltage.
7. A thermocouple is formed by joining two dissimilar metals, which are bonded and heated. Because of the different expansion rates of the two metals, a stress is placed on the bonding point. This stress distorts the valence bands of the electrons and causes electrons to break out of their orbits and move through an external circuit.

205

1. FOD.
2. When one small object comes into contact with the hardened metal of an engine blade spinning at high speed, it can knock a chip off a blade, causing another piece of debris which can damage other blades.
3. Metal, stone, and miscellaneous.
4. Metal.

206

1. Everyone.
2. When you arrive at the job site and before leaving.
3. Borescopes and X-rays.
4. FOD bag.

207

1. The electrochemical deterioration of a metal as a result of its chemical reaction with the surrounding environment.
2. (1) e.
   (2) d.
   (3) a.
   (4) h.
   (5) b.
   (6) g.
   (7) c.
   (8) f.

208

1. Light corrosion.
2. Light hand sanding.
3. Humidity, temperature, air pollution, and geographic location.
4. Edges, areas around fasteners and cracked, chipped and missing paint surfaces.
5. Treat potential moisture entry points with a sealant or a suitable preservative compound.
6. Remove corrosion that is visible through a 10X magnifying glass, and then remove an additional 2 mils, to ensure all deposits are gone.
7. Material compatibility.
8. Aluminum metallic wool.
9. Stainless steel.
10. Apply an effective protective coating.

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. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to Air Force Career Development Academy (AFCDA).

1. (201) What is the *best* way to ensure you are using the right bolt?
   a. Check the illustrated parts breakdown.
   b. Use the same type of bolt that you removed.
   c. Consult with aircraft sheet metal technicians.
   d. Look at other, similar components and see what they have installed.

2. (201) The size of a bolt is stated in terms of
   a. length, diameter, and threads per inch.
   b. length of shank, and gap between threads.
   c. diameter of the head and threads per inch.
   d. diameter of the threads and length of the shank.

3. (201) Which bolt would you use where shearing or sidewise stress occurs?
   a. Clevis.
   b. Hex-head.
   c. Internal wrenching.
   d. Twelve-point external wrenching.

4. (201) On egress systems, which type of self-locking nut may be reused?
   a. Those with a non-metallic insert.
   b. Those with all metal construction.
   c. Either type, as long as they hold a firm grip on the bolt.
   d. Neither type; all self-locking nuts are good for one time use only.

5. (201) When lock wiring, how many complete turns should you leave in the pigtail?
   a. 2 to 4.
   b. 4 to 6.
   c. 6 to 8.
   d. 7 to 9.

6. (202) Locally manufactured hoses must be tested to
   a. 3,000 pounds per square inch (psi).
   b. 4,000 psi.
   c. 5,000 psi.
   d. 6,000 psi.

7. (202) Which condition requires replacing a hose that operates at or above 1,500 pounds per square inch (psi)?
   a. One broken wire in a single plait.
   b. Two broken wires adjacent to each other.
   c. One or more broken wires in a suspected kink.
   d. Five broken wires per assembly for assemblies over 12 inches in length.

8. (203) Which is one of the best useable conductors of electricity *and* also the most widely used in aviation?
   a. Gold.
   b. Silver.
   c. Copper.
   d. Lithium.

9. (203) A tripped circuit breaker indicates
   a. a short.
   b. a break.
   c. a circuit.
   d. an open.

10. (204) For the free electrons in a material to move, there must be a difference in the potential between two points. That difference is that one point must have an excess of
    a. protons; the second point must have a lack of protons.
    b. protons; the second point must have a lack of neutrons.
    c. neutrons; the second point must have a lack of neutrons.
    d. electrons; the second point must have a lack of electrons.

11. (204) Which device produces voltage through chemical action?
    a. Voltaic cell.
    b. Thermocouple.
    c. Thermal battery.
    d. Electro-explosive device.

12. (205) Why is foreign object damage (FOD) so dangerous to aircraft engines?
    a. It can cause your shop to have to remove an ejection seat for a foreign object search of the cockpit.
    b. Modern aircraft engines are impervious to FOD, making FOD danger negligible.
    c. The cost of maintaining an FOD program is more expensive than the loss of aircraft engines.
    d. When one small piece of metal comes in contact with a spinning engine blade, it can knock a chip off the blade, making two foreign objects which may knock off more chips.

13. (205) Which foreign material is the *most difficult* to control?
    a. Cloth.
    b. Stone.
    c. Metal.
    d. Wood.

14. (206) When should you inventory all of the tools you brought to a job site, including technical orders, bench stock, and special tools?
    a. Once you have them back inside your shop step van.
    b. When you get back to the egress shop.
    c. Only after you complete the job.
    d. Before and after each job.

15. (206) If you have exhausted every effort to find a dropped piece of small safety wire in a cockpit, including using a borescope, the *next step* is to
    a. turn the search over to the next shift.
    b. place a detailed entry in the aircraft forms.
    c. forget about it; it’s too small to cause any damage.
    d. immediately perform a seat raise before doing anything else.

16. (206) Empty foreign object damage (FOD) bags after each job and
    a. keep the bag in the engine inlet while working so that it's in plain sight.
    b. when your bag is full during a job, dump the foreign objects in your tool box.
    c. always carry them in the cockpit so that you can dispose of foreign objects easily.
    d. never place the bag in a position where the contents may be spilled into the cockpit.

17. (207) Which condition must exist for corrosion to occur?
    a. A metal that has a tendency to corrode must be present.
    b. A similar conductive material to the anode must be present.
    c. Electrical contact between the anode and cathode must not exist.
    d. A conductive solid must connect the anode and the cathode so that ions can carry electrical current between them.

18. (207) Which type of corrosion is an advanced form of intergranular corrosion that "lifts up" the surface grains of a metal?
    a. Galvanic.
    b. Exfoliation.
    c. Intergranular.
    d. Uniform etch.

19. (208) Which degree of corrosion may include blisters or scaling and flaking of the coating or paint, with pitting depths as deep as 0.010 inch?
    a. Light.
    b. Severe.
    c. Galvanic.
    d. Moderate.

20. (208) Which is an indication of corrosion on ordinary steel surfaces?
    a. Rust.
    b. Bulging.
    c. White residue.
    d. White or gray corrosion powder.

21. (208) You need to vacuum residue from surfaces after removing corrosion with metallic wool because metallic wool particles can create
    a. pitting corrosion.
    b. stress corrosion due to friction.
    c. corrosion fatigue due to friction.
    d. galvanic cells, creating galvanic corrosion.

Please read the unit menu for unit 2 and continue ➔

Student Notes

Unit 2. Maintenance Data Collection

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THE MISSION OF EVERY AIRCRAFT ORGANIZATION is to keep systems and equipment ready to perform their missions at the least cost to the government. In order to process and control parts and equipment costs effectively, we use a data processing system and a maintenance recording procedure called equipment accountability.

In addition to the manual system of maintenance data collection (MDC), the Air Force (AF) currently uses a number of automated data collection systems. Integrated Maintenance Data System (IMDS) is one of those systems, and is the one you will use most. IMDS is the heart of the maintenance organization. The objective is to provide maintenance managers (including your supervisor) with information about the jobs performed by the personnel assigned to their organizations or work centers. In addition to the information on what was done, these systems provide data about how long repairs take, the kind of repair required, when malfunctions were discovered, and who did the work. With the systems the organization can plan, project, schedule, and control manpower, parts, and equipment as needed. Most of the data needed for statistical studies comes from IMDS. By analyzing this data, problem areas and poor trends can be identified. Managers can then make effective decisions on how to meet and support flying and maintenance requirements.

Inventory of AF materiel must be maintained and controlled. Equipment accountability applies to all AF units that have aircraft and all equipment used in support of those aircraft. This accounting procedure does not link equipment to any individual aircraft. However, it does provide methods for ensuring supply discipline. Usually, the maintenance function that is the primary user of equipment is also responsible for the accountability, storage, and up-keep of the equipment.

Collectively, the maintenance data documentation (MDD) systems and the equipment accountability procedure work together. Equipment accountability controls the assignment of AF equipment (aircraft, support and special equipment), and the MDD systems control the maintenance actions performed on the equipment. This unit is devoted to these two areas of processing and controlling materiel.

2–1. Time Change Fundamentals

The bulk of egress maintenance comes from scheduled maintenance; probably, the most critical program in your duty section is time change management. Keeping track of the explosive components assigned to your base is a tedious task and must be accomplished without error. Attention to detail is necessary on this program; a simple typo could have catastrophic results if a dud component did not perform as designed when needed. In this section, you will learn how to determine due dates, record time change information, and monitor time changes. Then, you will learn how to order new components in the supply system.

209. Understanding egress component shelf and service life

Turning a wrench on the aircraft replacing time change components is the easy part of being an egress journeyman, the behind the scenes part where your skills may be tested. You need to understand how egress component shelf and service life works.

Egress time change items and their shelf and service lives are listed in the applicable aircraft –6 and 11P-series technical orders. To determine the service life of these items, let's first look at some of the terms you will be using. You will primarily use the applicable 11P-series technical order, but there is another resource to help you determine the service life of a component. You can check the components lot number against the Global Ammunition Control Point (GACP) Website, to determine the component's status in real time if technical data is not up to date. GACP can be access at this link via the AF Portal: https://www.my.af.mil/wm/Login.aspx

Lot number

The lot number identifies a group of components manufactured at the same time. If a defect is found in a component, the lot number can be used to trace the locations of other components, with the same lot number, that may also be defective. Military contracted manufacturing of munitions since 1976 require compliance with a special lot numbering system. This system eliminates the need for separate date of manufacture (DOM) markings. The DOM need not be marked on items and containers that comply with this lot numbering system (fig. 2–1).

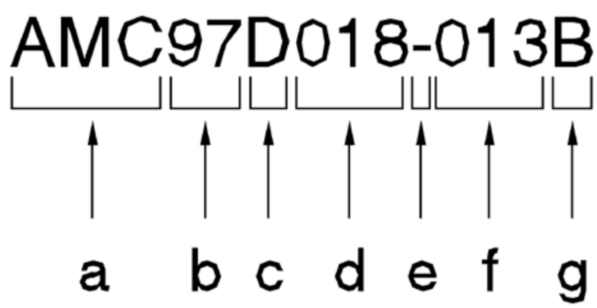

Figure 2–1. Lot numbering system.

The manufacturer's identification symbol is the first three characters of the lot number (fig. 2–1, view a). If a two-character manufacturer's identification code is used, the remaining position will be filled with a dash. The fourth and fifth characters are the two-digit numeric code identifying the year of production, regrouping, or local lot assignment (fig. 2–1, view b). The sixth character is a single alpha code signifying the month of production (fig. 2–1, view c). The months are assigned alpha codes as shown in the following table:

A	January	E	May	J	September
B	February	F	June	K	October
C	March	G	July	L	November
D	April	H	August	M	December

As you can see, there is no letter "I" in the alpha codes. This is to avoid confusing the letter "I" with the number "1." Following the alpha code are three digits known as the lot interfix number (fig. 2–1, view d). This number is used to identify like items manufactured by the same process for the same purpose. The next three digits, separated from the lot interfix number by a hyphen, are the lot sequence number (fig. 2–1; view e and f). It is a three-digit number used to identify each lot within the interfix series based on the sequence of production or assembly. Finally, you may or may not find an alpha character at the end of the lot number used to identify a rework affecting the original lot (fig. 2–1, view g).

The most important elements of the lot number for you as an egress journeyman are the two-digit code identifying the year of production and the alpha character signifying the month of production. You will use these characters to determine DOM. For example, if your explosive item has lot number OEA18G004–048, then you know that the explosive item was manufactured in July of 2018. When entering this information in IMDS, you use the last date of that month's Julian date to record the DOM. A Julian date is the numerical date of the year starting at one for January 1 and going all the way to 365 for December 31. Leap years change the Julian calendar, so be careful when estimating Julian dates for leap years, you could mistakenly schedule a time change item (TCI) to be due a month late.

Storage and shelf life

Storage life, also known as shelf life, is the length of time an item can remain in storage under prescribed conditions. The storage shelf life starts at the DOM and expires on the last day of the designated month. You obtain the DOM from the lot number off the item's data plate as shown in figure 2–2. Never exceed the storage and shelf life of an item.

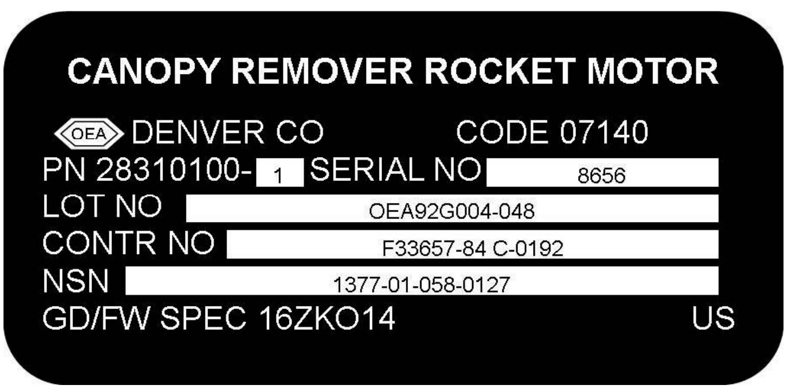

Figure 2–2. Canopy remover rocket motor data plate.

Service life

Service life is the maximum length of time an item can remain in an operating configuration or in actual use. Service life begins on the date of installation (DOI). It does not end if the item is removed and placed back in storage. Rollout dates establish explosive component service life on newly purchased aircraft. In other words, the service life of time change items starts on the date the aircraft rolled out of the factory. This date is found on the Department of Defense (DD) Form 250, Material Inspection and Receiving Report, and this date establishes the initial time change cycle.

NOTE: This form is not on the AF e-Publishing website; however, it may be found at https://www.acq.osd.mil/dpap/ccap/cc/jcchb/Files/FormsPubsRegs/Forms/DD250.pdf.

To establish the service life of an egress component, you must first check the lot number status. Next, turn to the applicable –6 aircraft inspection manual to determine the time change interval. On egress explosive components, also check the applicable 11P-series technical order for conflicts in the time change interval. Always notify your supervisor of conflicting directives. Once you have established the time change interval, your next step is to find the DOM and DOI.

The DOM is stamped on the component itself and normally is expressed by a month and year date (e.g., 02 94). The DOM may be stamped elsewhere, such as on the box the component was stored in. Never use the dates on the box since they may differ from the number on the component. The DOI is the date you install the component and is expressed as a month and year date too. Mark this date on the component with a permanent marker.

To compute the due date of a time change item, first determine the shelf and service life. To do this, add the shelf life listed in the technical order to the DOM. Then, add the service life listed to the DOI. Of these two dates, the earliest date establishes the next time change due date.

For example, on 20 February 2009, an egress journeyman is notified that the canopy removers on an F–16 aircraft are due. A review of the –6 reveals that the canopy remover rockets will be replaced at their maximum shelf or service life listed in TO 11P4–13–7, *Specialized Storage and Maintenance Procedures, Canopy Remover Rocket Assembly*, as 108 months, or nine years for both shelf and service life. The egress journeyman examines the rocket and finds the DOM to be October 2008. By adding the maximum shelf life of nine years to the DOM (October 2008) he or she determines that the shelf life due date is October 2017. The service life begins on the date the remover rockets are installed on the aircraft. If the rockets are installed in February of 2009 and the service life of nine years is added to that date, the maximum service life will be 28 February 2018. The egress journeyman now knows that the remover rockets will be due time change on 31 October 2017, which is the earlier of the two dates.

Monitoring egress time change items

Your involvement as an egress journeyman in the actual monitoring of time changes is limited. However, the role you play is critical since you will be the one to perform the maintenance and to document the forms. Documentation is an essential link in the monitoring of time change items. As such, your documents must be legible and correct. The accuracy and neatness of entries on maintenance forms is your responsibility.

When you receive a work order for a time change, the documentation section will have already supplied you with certain information: part number; serial number; lot number; and the location of the old item to be changed. You must supply the information for the new item you are installing. It is at this point breakdowns occur in the monitoring of time changes. Listed are some common practices to help you avoid this breakdown:

- Before you remove the old item, verify it is the correct component by checking the part number, lot number, serial number, and location against the information on the work order.
- If you are doing several time changes, complete the documentation on each component and install it before starting the next. This avoids confusion and prevents the item from installation in the wrong location.
- Copy the information from the new item before you install it.
- When using mirrors, remember that some characters may look like others. For example, 6s look like 9s, 2s look like 5s, and a “w” can look like an “m.”

- Check the applicable technical orders to ensure the item is actually due. Do not rely solely on a cheat sheet, as a technical order change might have been published since that cheat sheet was created.
- Use good location identification, such as aircraft station numbers or a technical order figure and index rather than a verbal location, such as FWDCP, L/H (forward cockpit, left hand) rudder pedal. Verbal locations can be very confusing and inaccurate, especially when several components are in the same location.

If you encounter problems with time change items, inform your shop supervisor; otherwise, the next time the error is found, years may have passed and by then it could be too late.

210. Time change documentation procedures

Most often parts are ordered using the Standard Base Supply System (SBSS). However, some munition and aircraft maintenance units have strict rules on ordering parts for their aircraft; everything must be ordered by their specific supply section. If that is the case, you more than likely will have to fill out an AF Form 2005, Issue/Turn-in Request, and hand-carry, email or fax it to the respective supply section in order to have the part requirement filled. This lesson covers the procedures for filling out an AF Form 2005.

AF Form 2005 to request parts

You may use any medium available (radio, telephone, intercom, teletype, mail, in person, etc.) to request expendable supplies. However, use of the computerized SBSS or a paper requisition form (when physically ordering supplies) is preferred. For a paper form, use AF Form 2005 to order supplies or turn in excess or unserviceable property. We will list some of the information that is required on the 2005. Keep in mind this form has the dual purpose of issue as well as turn-in of equipment and supplies. Turn-in is appropriate for excess and unserviceable property. Your unit supply custodian indicates which action is requested.

Normally, the customer uses an AF Form 2005 for requesting supplies. When a request is called in, base supply personnel prepare the input and provide the customer with the Julian date and serial number. The customer enters this information in the applicable block of the suspense AF Form 2005, or any other control register being used pending receipt of the D04, Daily Document Register. When the customer takes AF Form 2005 to base supply or the applicable processing point, base supply personnel manually enter the Julian date and serial number for the supply document number and return one copy to the customer for suspense. Whether the request is called in or hand-carried, the customer must provide certain information (refer to fig. 2–3 as a general reference). The information in the following table goes on the form:

AF Form 2005 Issue Request	
Block	**Entry Description**
Block A	Enter the name of requesting individual and telephone number. In the REQUEST, TIME & DATE issue (ISU) field, enter the time and date.
Blocks 1–3	Enter the transaction identification code (TRIC). For expedite and routine issue requests, the TRIC is an ISU. For issues from a supply point, the TRIC is a mission support issue (MSI). The MSI and ISU transactions require the same input data elements.
Blocks 4–6	Enter the delivery destination.
Block 7	Enter the issue exception (IEX) code on the issue requests if one exists on the input stock number. The IEX code identifies issue condition peculiar to an item. Some of the following conditions may contain an IEX code: health hazardous, photographic, or random length. Chapter 11 of AF Handbook (AFH) 23–123, Volume 2, Part 1, *Integrated Logistics System-Supply (ILS-S) Materiel Management Operations,* Chapter 5, Table 5.16, has a complete listing of authorized IEX codes.

AF Form 2005 Issue Request	
Block	**Entry Description**
Blocks 8–22	Enter the national stock number (NSN). If NSN is not available, then provide a DD Form 1348–6, DOD Single Line Item Requisition System Document (Manual-Long Form). You also see some fields below this one that say PART NUMBER. This is where you enter the item's part number, if applicable.
Blocks 23–24	Enter the unit of issue.
Blocks 25–29	Enter the quantity required.
Block 30	Enter the activity code. Use activity code "X" to expedite the request, code "R" for a routine request and code "J" for IMDS. Leave this blank if you are not sure and the supply activity personnel will assist in determining the correct activity code.
Block 31–35	Enter the organization and shop code.
Blocks 36–43	Enter the date and serial number that applies to remainder of the supply document number. Supply fills in these blocks.
Block 44	Enter the demand code. You are responsible for providing the demand code during issue requests process. You use the following demand codes for your requests: • **Code "I" (Initial Issue).** Use on issue requests submitted to satisfy an original shortage or installation or to replace an item that was installed originally but was later lost. Examples are requests for items to be installed in bench test sets or mockups, or items lost in flight, fire, or crash. No turn-in of an unserviceable item is involved; nor is a due-in from maintenance (DIFM) control established. Submit a letter of initial issue when requesting the initial issue of a repair cycle item. • **Code "N" (Non-recurring).** Use this code for one-time requests for items for which no future need is expected. Nonrecurring requests include items issued to perform modification or retrofit, or to replace items in a kit with a newer item. DIFM control is established on repair cycle assets. It should be used when requesting unusually large one-time requirements that are out-of-phase with normal needs. • **Code "R" (Recurring).** This is the most commonly used code. It applies to day-to-day issues to an organization for normal operations when it is anticipated the item will continue to be required in the future. This code establishes DIFM control on repair cycle assets. Normally, it is used when replacing a like item that is suspected to be or actually is unserviceable or one that is condemned.
Block D	Enter the part number and the commercial and government entity (CAGE) code.
Block E	Enter the technical order, figure, and index.
Block 45–50	Enter the work order number, if applicable.
Block 51	Enter the transaction exception (TEX) code, if applicable.
Block 53	This block is for the force activity designator (FAD) and you normally leave it blank. Supply has already assigned you the FAD you are authorized, so the retail supply system automatically assigns the FAD to your issue request and the subsequent requisition. If the required item is in direct support of another organization with a higher FAD, enter that organization's FAD as an override on that individual issue request. Do not use FAD override procedures for routine administrative or janitorial support.
Blocks 57–59	Enter the project code. Project codes are 3-digit characters assigned by the Joint Chief of Staff, the Department of Defense (DOD) and the Military Services for identifying special projects. Project codes also allow logisticians to identify supply transactions associated with the project.
Blocks 60–61	Enter the supply response priority maintenance code. See the table following figure 2–3 for a list of standard reporting designator (SRD) codes and definitions.
Blocks 62–64	Enter the required delivery date, if applicable.

AF Form 2005 Issue Request	
Block	**Entry Description**
Blocks 67–73	Use the MARK FOR field to identify the end item on which the requested item will be used. For instance, if the item is required for an aircraft, enter the aircraft serial number. This is the full serial number, including the model year, not just the aircraft identification (ID). Notice above blocks 67–80, you see the words "DOCUMENT NUMBER" and "POST/POST." Ignore these words, as you will not be entering that information unless required by supply.
Blocks 74–76	Enter the SRD to identify the specific end item, weapon system, or equipment that is inoperable.
Blocks 77–78	Enter the first two positions of the work unit code (WUC) that correlates to an end item, weapons system, or equipment.
Blocks 79–80	Enter the specific major command (MAJCOM) code.
Blocks F through I	These blocks are for supply, so leave blank.
Block J	Enter the nomenclature in this field.

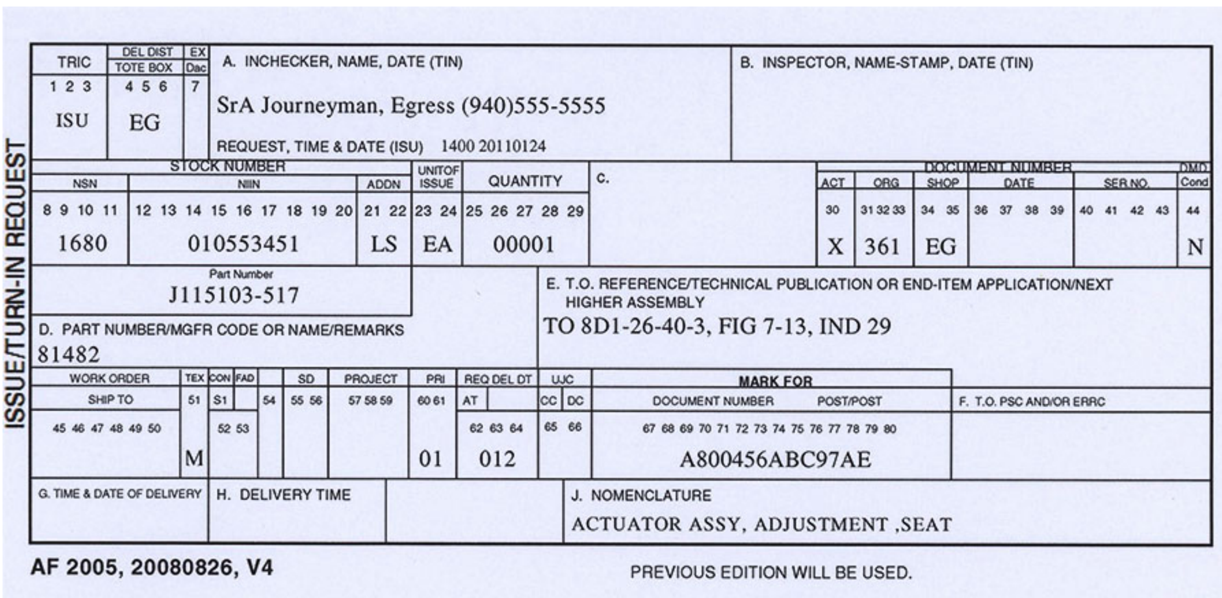
ISSUE/TURN-IN REQUEST
TRIC 1 2 3 ISU
DEL DIST / TOTE BOX 4 5 6 EG
EX Dac 7
A. INCHECKER, NAME, DATE (TIN)
SrA Journeyman, Egress (940)555-5555
REQUEST, TIME & DATE (ISU) 1400 20110124
B. INSPECTOR, NAME-STAMP, DATE (TIN)
STOCK NUMBER: NSN 8 9 10 11 1680; NIIN 12 13 14 15 16 17 18 19 20 010553451; ADDN 21 22 LS
UNIT OF ISSUE 23 24 EA
QUANTITY 25 26 27 28 29 00001
C.
DOCUMENT NUMBER: ACT 30 X; ORG 31 32 33 361; SHOP 34 35 EG; DATE 36 37 38 39; SER NO. 40 41 42 43
DMD Cond 44 N
Part Number J115103-517
D. PART NUMBER/MGFR CODE OR NAME/REMARKS 81482
E. T.O. REFERENCE/TECHNICAL PUBLICATION OR END-ITEM APPLICATION/NEXT HIGHER ASSEMBLY
TO 8D1-26-40-3, FIG 7-13, IND 29
WORK ORDER / SHIP TO 45 46 47 48 49 50
TEX 51 M
CON FAD S1 52 53
54
SD 55 56
PROJECT 57 58 59
PRI 60 61 01
REQ DEL DT AT 62 63 64 012
UJC CC DC 65 66
MARK FOR DOCUMENT NUMBER POST/POST 67 68 69 70 71 72 73 74 75 76 77 78 79 80
A800456ABC97AE
F. T.O. PSC AND/OR ERRC
G. TIME & DATE OF DELIVERY
H. DELIVERY TIME
J. NOMENCLATURE
ACTUATOR ASSY, ADJUSTMENT ,SEAT
AF 2005, 20080826, V4
PREVIOUS EDITION WILL BE USED.

Figure 2–3. Issue AF Form 2005.

The following table provides a list of SRD codes and definitions.

SRD Codes and Definitions	
Designator	**Definition**
1	Aerospace vehicles on alert status, war plan or national emergency missions, including related AGE, munitions equipment, and combined effects munitions (CEM) equipment. CEM systems or equipment including associated AGE supporting alerts, war plans, or national emergency requirements.

SRD Codes and Definitions	
Designator	**Definition**
2	Primary mission air vehicles, mission support aircraft, air launched missiles, and related AGE, munitions, munitions equipment, and CEM equipment for the first eight hours after landing or start of recovery or within six hours of a scheduled launch, alert, or test flight, and during simulated generations. Air evacuation, rescue, and weather mission aerospace vehicles and related AGE, munitions, munitions equipment and CEM equipment. All transient tactical and tactical support aircraft. Primary mission CEM systems or equipment included associated AGE, when repair is impacting mission accomplishment. Flight or missile crew training simulator or other training equipment related AGE requiring repair, which is impacting the mission by preventing or delaying student training.
3	Primary mission air vehicles, missile support aircraft, engines, air launched missiles and related AGE munitions, munitions equipment, and CEM equipment undergoing scheduled or unscheduled maintenance. Transient air vehicles not otherwise listed. Administrative aircraft within eight hours of scheduled flight or on alert status with standby crews. Time change requirements for nuclear weapons. Scheduled and unscheduled maintenance of munitions that would prevent or delay mission accomplishment, if not performed. Precision measurement equipment (PME) requiring emergency repair or calibration, the lack of which will prevent or delay mission accomplishment. Spares not available in the Logistics Readiness Squadron/supply activity. (Applies to selection of maintenance repair priority designator only.) Critical end-item and repairable spares or supply designated “priority repair” spares. Routine maintenance of aircrew or missile training simulators, other training devices, or related AGE sites. Overdue scheduled maintenance to include periodic inspections, delinquent routing time compliance technical order (TCTO) and maintenance capability letters (MCL), and other TCIs. Primary mission CEM systems or equipment including associated AGE when repair will not affect mission accomplishment. Alternate equipment provided to ensure uninterrupted operation of primary mission equipment. AGE requiring emergency repair or calibration, the lack of which will delay or prevent mission accomplishment. Repairable spares when like serviceable spares are not available in supply. All base emergency vehicles, aircraft fuels servicing vehicles, alert vehicles, 463L-loading vehicles, and crash or fire vehicles deadlined for parts the condition of their parts.
4	Routine or extensive repair of primary air mission and related AGE and repair cycle assets. Administrative aircraft undergoing scheduled or unscheduled maintenance. Routine maintenance of AGE, not otherwise listed above. War reserve materiel (WRM) items due maintenance or inspection. Inspection, maintenance, and TCTO compliance of mission support kits (MSK) or mobility readiness spares package materiel. Extensive repair of aircrew or missile training simulators, other training devices, or related AGE. Inspection, maintenance, and TCTO compliance of munitions and munitions equipment, excluding spares excess to base requirements not listed above. Scheduled calibration and unscheduled repairs on PME not listed above. Scheduled maintenance to include periodic inspections, routine TCTO, MCL, and TCIs. Primary mission CEM systems or equipment including associated AGE undergoing extensive repair or modification. Repair or other CEM systems or equipment including associated AGE. Repair of CEM repair cycle assets. WRM items due maintenance or inspection. Repair and calibration of AGE not included above. Routine or extensive repair or modification of training equipment and related AGE not scheduled for instructional use within the next eight hours. Scheduled calibration and unscheduled repairs on PME not listed above. All base vehicles deadlined for the condition of their parts except for ambulances, crash and fire trucks, and aircraft refueling vehicles.
5	Non-tactical or non-primary-mission aircraft undergoing extensive repair. Fabrication and repair of aeronautical items not carrying a higher priority. Bench stock requirements. Extensive repair of aircrew training devices. Time change requirements not listed above. Routine repair of missiles, AGE, and real property installed equipment, including repair cycle assets. Alternate and other CEM systems or equipment, including associated AGE undergoing extensive repair or modification. Clearing routing delayed discrepancies on training equipment or AGE, and routing maintenance that will not impair or affect mission accomplishment.
6	Fabrication and repair of non-aeronautical items.
7	Spares excess to base requirements.

Issue requests for supplies, bench stock, supply point items, equipment, and so forth are sent to the following base supply elements:

Requests for	Sent to
Supplies	Demand Processing Element
Replenishment bench stock fills	Bench Stock Support Element
Issues of supply point items	Repair Cycle Support Element
Equipment items	Equipment Management Element

Most likely, you will use AF Form 2005 to request explosive items as well, depending on your base's munitions request procedures.

AF Form 2005 to turn in parts

In addition to using the AF Form 2005 to request parts, you can also use the AF Form 2005 to turn in parts and equipment. You will use the AF Form 2005 for turning in DIFM items after you have removed them for replacement, so they can enter the repair cycle. Depending on your base's munitions turn-in procedures, you may use them to turn in explosives. In addition, you will use the AF Form 2005 to turn parts in if you have excess stock or if your base has changed aircraft, such as from an F–15 to an F–22. At that time, your shop will get rid of all its F–15 parts and equipment. Speaking of equipment, you will also use the AF Form 2005 to turn in equipment once your shop no longer needs it.

Part turn-in procedures

On turn-in requests, you will leave most of the blocks blank, but you do need to provide the following information on the AF Form 2005 (fig. 2–4):

Block	Entry Description
Block A	Enter custodian's name, telephone number and request number. Custodian signature is not required.
Blocks 1–3	Enter TIN for turn-in in the TRIC block.
Blocks 8–22	Enter the NSN.
Blocks 23–24	Enter the unit of issue.
Blocks 25–29	Enter the quantity.
Blocks 30–43	Non-equipment accountability identification (EAID) (NF1) activity code "P," organization/shop code, Julian date and detail number blank (Equipment Accountable Element [EAE] assigned). EAID (ND/NF 2, 3, 4, 5) activity code "E", organization/shop code, Julian date blank (EAE assigned) and detail number from the custodian authorization/custody receipt listing (CA/CRL).
Block 44	Enter the condition code (A, F or H): • **Code A – Serviceable (issuable without qualification)**. New, used, repaired, reconditioned materiel serviceable and issuable to all customers without limitations or restrictions. Includes materiel with more than six months of shelf life remaining. • **Code F – Unserviceable (repairable).** Economically repairable items that require repair, reconditioning, or overhaul. • **Code H – Unserviceable (condemned).** Materiel that has been determined to be unserviceable and does not meet repair criteria; condemned items which are radioactivity contaminated; Type I shelf-life materiel that has passed the expiration date and Type II shelf-life materiel that has passed expiration date and cannot be extended. Must contain any components or assemblies to be reclaimed.

Block	Entry Description
Block D	Enter the prime NSN when it is other than the requested NSN. This only applies to EAID items.
Block E	Provide a simple statement to replace or reduce and delete authorizations as applicable for equipment items. Also, state the condition of the item, such as serviceable or unserviceable.
Block F	Enter the expendability, recoverability, reparability, category designator (ERRCD) code. You can obtain this information from federal logistics (FEDLOG) data.
Block I	Enter date available for pick up.
Block J	Nomenclature.

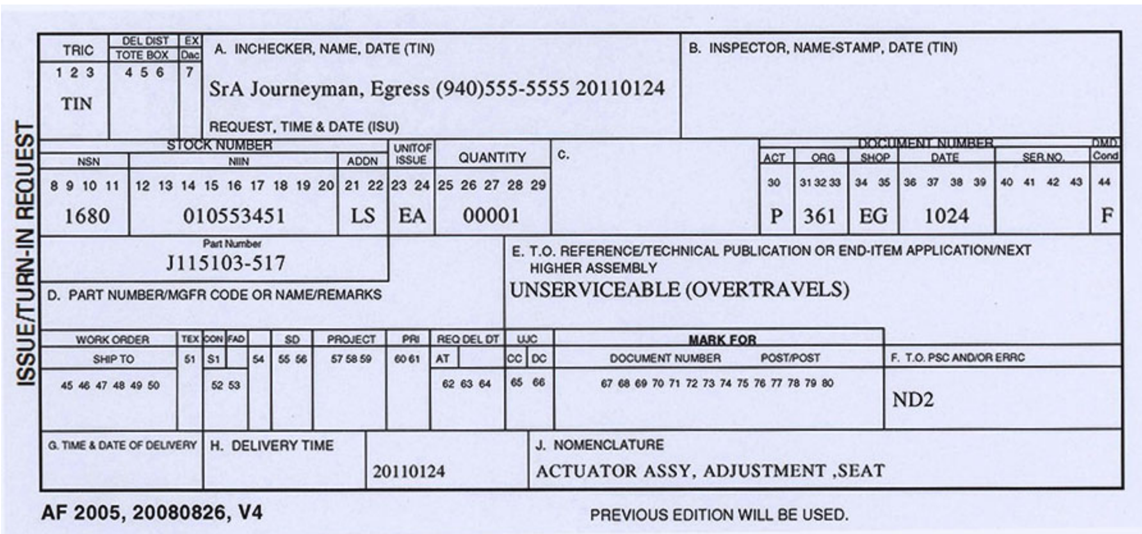
ISSUE/TURN-IN REQUEST
TRIC 1 2 3 TIN
DEL DIST TOTE BOX 4 5 6
EX Dac 7
A. INCHECKER, NAME, DATE (TIN)
SrA Journeyman, Egress (940)555-5555 20110124
REQUEST, TIME & DATE (ISU)
B. INSPECTOR, NAME-STAMP, DATE (TIN)
STOCK NUMBER
NSN 8 9 10 11 1680
NIIN 12 13 14 15 16 17 18 19 20 010553451
ADDN 21 22 LS
UNIT OF ISSUE 23 24 EA
QUANTITY 25 26 27 28 29 00001
C.
DOCUMENT NUMBER
ACT 30 P
ORG 31 32 33 361
SHOP 34 35 EG
DATE 36 37 38 39 1024
SER NO. 40 41 42 43
DMD Cond 44 F
Part Number J115103-517
D. PART NUMBER/MGFR CODE OR NAME/REMARKS
E. T.O. REFERENCE/TECHNICAL PUBLICATION OR END-ITEM APPLICATION/NEXT HIGHER ASSEMBLY
UNSERVICEABLE (OVERTRAVELS)
WORK ORDER
SHIP TO 45 46 47 48 49 50
TEX 51
CON FAD S1 52 53
54
SD 55 56
PROJECT 57 58 59
PRI 60 61
REQ DEL DT AT 62 63 64
UJC CC DC 65 66
MARK FOR
DOCUMENT NUMBER POST/POST 67 68 69 70 71 72 73 74 75 76 77 78 79 80
F. T.O. PSC AND/OR ERRC
ND2
G. TIME & DATE OF DELIVERY
H. DELIVERY TIME
20110124
J. NOMENCLATURE
ACTUATOR ASSY, ADJUSTMENT ,SEAT
AF 2005, 20080826, V4
PREVIOUS EDITION WILL BE USED.

Figure 2–4. Turn-in AF Form 2005.

You also have to attach a condition status tag and an Air Force Technical Order (AFTO) Form 350, Reparable Item Processing Tag, to the part. We have already discussed both of these.

Equipment turn-in procedures

The CA/CRL is a computer-produced list that shows all authorizations, assets, and due-outs for each equipment custodian by organization code and shop code. If a custodian has more than one organizational code assigned, a separate CA/CRL is printed for each code. Items on this list are in authorized, preferred stock number sequence, with all substitutes listed immediately after the preferred number. These substitute items must always have the same in-use detail document number, as the authorized preferred stock number. The custodian should check the CA/CRL to make sure that all substitutions are valid. If an item is not a good substitute, the custodian notifies supply in writing and then turns in the item or has supply code it as an unsatisfactory substitute (U). This enables supply to order the authorized stock number. When the authorized stock number is received, the unsatisfactory substitute must be turned in by sending AF Form 601, Equipment Action Request, or AF Form 2005 (whichever is applicable) to the EME. The phrase “out-of-balance” is printed after each group of records that has an imbalanced condition. The custodian should take prompt action to correct these conditions.

Turn-in of serviceable equipment items not on the custodial CRL are also called in to the EME.

AFTO Form 350

The AFTO Form 350 is a two-part form required on items removed for maintenance shop processing. These items include removed engines, removed end items, components removed from end items, and subassemblies removed from assemblies. The completed form serves to identify the origin of an item and contains key data elements needed to document shop actions.

Part I of the form is the repair cycle processing tag. Part II serves as the production scheduling document.

Often, you will have to remove equipment or components to facilitate other maintenance (FOM) and no repairs are needed. This completed tag is attached to the item just as if it were going into the shop for repairs, except the only blocks that need to be filled are blocks 1 (JCN [job control number]), 2 (SER. NO.), and 14 (DISCREPANCY). In the DISCREPANCY block, instead of an actual discrepancy (since there is not one), the letters "FOM" are required. This allows the part to remain in the shop without a document number on the tag, since a document number is only required when a demand is placed on the supply system. This tag, of course, must be attached to the component always.

For removed munitions or explosive type items, AFTO Form 350 may be used to indicate the reason for removal until the status of the item is determined by the munitions activity or the munitions supply activity.

The individual initiating the form completes blocks 1 through 14 and 15A. Entries for blocks 1 through 12, 14, and 15A will be completed at the time of the removal action. When a demand is made for a replacement item, the supply activity will supply the supply document number (block 13).

Front side, Part I

Using figure 2–5 as a reference, review the block entries provided in the following table:

Block, Title	Entry Description
Block 1, JCN	Enter the JCN, as documented in IMDS that reflects the JCN for the applicable reparable item. If more than one repairable component requiring an AFTO Form 350 is removed under the same JCN, each AFTO Form 350 that is initiated will have the same JCN entered in block 1.
Block 2, ID/SERIAL NO	Enter the serial number of the end item or weapon system.
Block 3,TM	Enter the type maintenance code, which you fin by cross-referencing the WUC manual.
Block 3A, SRD	Enter the SRD or the applicable code obtained from the Reliability and Maintainability Information System (REMIS) SRD table in IMDS and REMIS.
Block 4, WHEN DISC	Enter the when discovered code, which you find by cross-referencing the WUC manual.
Block 5, HOW MAL	Enter the how malfunctioned code, which you find by cross-referencing the WUC manual.
Block 6, MDS	Enter the mission design series (MDS). For example, if the item were from an F–16, you would write "F–16."
Block 7, WORK UNIT CODE	Enter the WUC of the item to which the form is to be attached. If the item is a repairable subassembly, which does not have a WUC, enter the WUC of the assembly from which the item (subassembly) was removed. You will hear this commonly referred to as the "next higher assembly."

Block, Title	Entry Description
Block 8, ITEM OPER TIME	If the item is a tracked item in the WUC table for which time records are maintained, enter the calendar time or accrued operating time of the item. Calendar time is entered to the nearest whole month and operating time is entered to the nearest whole hour. For egress items, you usually print “N/A.”
Block 9, QTY	Enter the number or quantity of like items being forwarded for shop processing.
NOTE: The AFTO Form 350 prepared for components may have a quantity of more than one only if the JCN, WUC, federal stock class (FSC), and part number are the same and the components can be packaged or transported together for shop processing. Items identified by a tracked indicator in the WUC table require an individual AFTO Form 350.	
Block 11, PART/LOT NUMBER	Enter the part number of the removed item, including dashes and slashes. First preference is the part number or complete identification as it appears on the data plate. For items that do not have a part number, enter the national item identification number (NIIN), including the dashes. The NIIN is the last nine characters of the NSN. If available, also enter the lot number of the item in this block.
Block 10, FSC	Enter the FSC, code (first four of the NSN) of the removed item.
Block 12, SERIAL NUMBER	For time change, serially controlled items, and warranty-tracked items identified by T, W, and S in the WUC table, enter the serial number of the removed item. If the serial number exceeds 10 characters, enter only the last 10 characters.
Block 13, SUPPLY DOCUMENT NUMBER	When a demand has been placed on the supply system, enter the supply document number for the replacement item.
Block 14, DISCREPANCY	Enter a brief but specific description of the malfunction that caused the removal or the reason for removal. If the item was removed for off-equipment TCTO compliance, enter the TCTO number. For electronic items that have sequential test procedures, also enter the technical order reference step, and sequence number where the item failed to pass the test. For FSC 1377, (escape system devices only) and for warranty items enter the DOI and the date of removal. The installation date of the item is obtained from the applicable equipment document. For items removed from equipment involved in accidents, enter the words “INVOLVED IN ACCIDENT.” Place the geographic location of the base originating the AFTO Form 350, in the lower right corner of this block.
Block 15, SHOP USE ONLY	If the item was made serviceable, enter a brief description of the work accomplished. An entry will not be made if the entry would reveal classified information. When shelf-life inspection requirements are accomplished, include in the description the applicable technical order number, technical order date, the last inspection due date, and the inspecting activity identification. The date entered in block 26 when the item is made serviceable establishes the due date of the next inspection. When a warranty item that is identified by a warranty sticker, decal, stencil, or tag is determined to be unserviceable, the following entries will be made in this block: “warranty item - warranty expires, contract number, accumulated operating hours and/or time” (as applicable).

Block, Title	Entry Description
Block 15A, DMC/ACT ID	If no ID number is entered in block 2, for cryptologic equipment removed from an aircraft for shop processing, enter the owning command code (two positions).
Block 15B, SHOP ACTION TAKEN	The shop technician enters the final action taken code (ATC) in block 15B prior to returning the item to the scheduler when the work is completed, or when the item is declared not repairable this station (NRTS) or condemned.

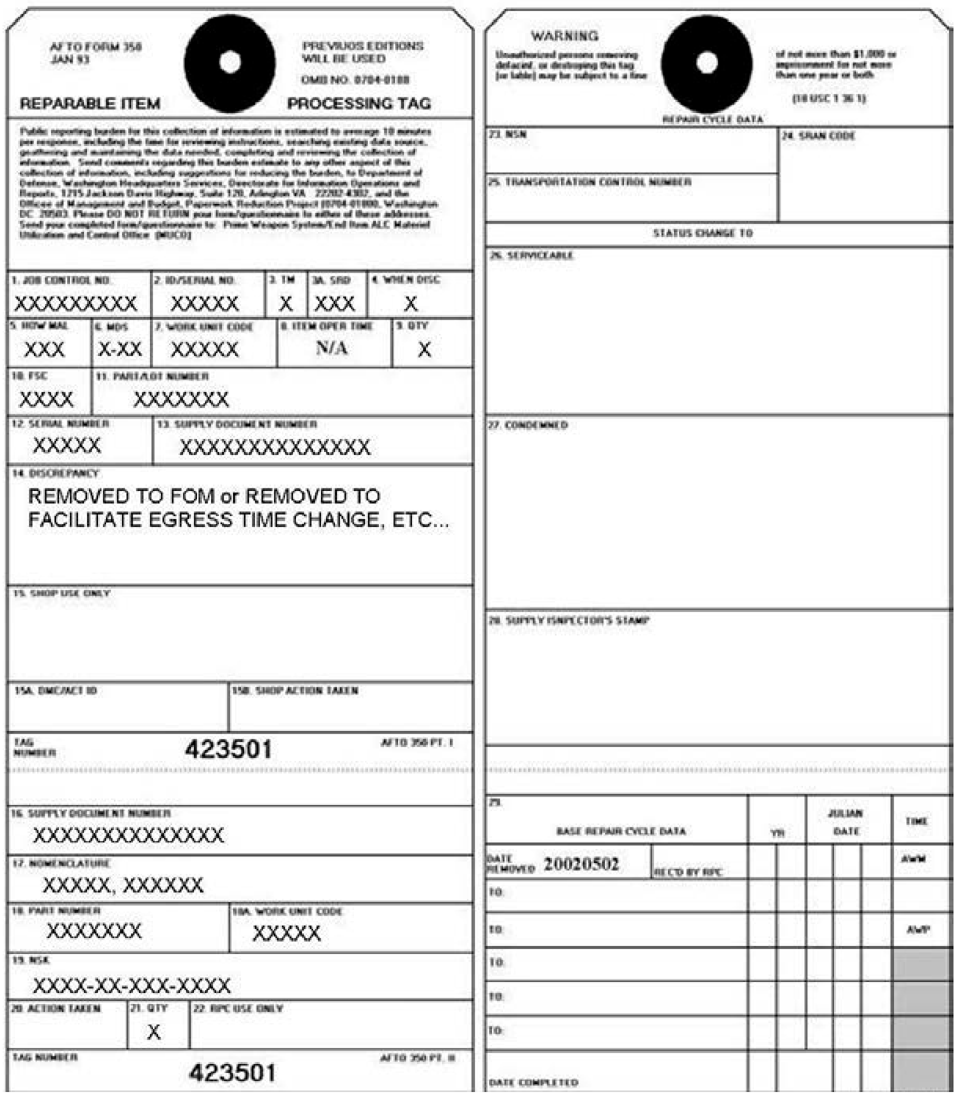

Figure 2–5. AFTO Form 350, for shop processing.

Front side, Part II

The production scheduler completes the front side (Part II), then, detaches it, and retains it as a suspense document until the item is returned from the shop or is made serviceable. When an item is not sent to the reparable processing activity because of size or other reasons, the originator completes blocks 16, 17, and 18, detaches Part II and forwards to the production scheduler.

The following table shows the block entries for the front side, Part II:

Block, Title	Entry Description
Block 16, SUPPLY DOCUMENT NUMBER	Enter the supply document number from block 13 of Part I.
Block 17 NOMENCLATURE	Enter the nomenclature of the item.
Block 18, PART NUMBER	Enter the identification of the item from block 11 of part I.
Block 18A, WORK UNIT CODE	Enter the WUC of the item when the item is declared NRTS or condemned (ATCs 0 through 9).
Block 19, NSK	This block is labeled "NSK" but is most likely a misprint. The intended information required for this block is the NSN, so enter the NSN of the item.
Block 20, ACTION TAKEN	Transcribe the ATC from block 15B of the AFTO Form 350, Part I, that is forwarded with the item when the work is completed or when the item is declared NRTS or condemned. In figure 2–3, ACTION TAKEN is left blank because this figure only illustrates how to fill out the tag before you send it off.
Block 21, QTY	Enter the quantity from block 9 of Part I.
Block 22, RPC USE ONLY	The reparable processing center (RPC) may use this block, as necessary.

Reverse side, Part I

Entries on the reverse side of the form are made by the RPC, base supply, or by the activity responsible for determining the status of the equipment, as applicable.

Self-Test Questions

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

209. Understanding egress component shelf and service life

1. What number printed on an item's data plate identifies a group of components manufactured at the same time?

2. What month was an item with a lot number of OEA11M001–030 manufactured?

3. What is the length of time an item can remain in storage under prescribed conditions?

4. What is the maximum length of time an item can remain in an operating configuration or in actual use?

5. When is the service life of an explosive component determined for a newly purchased aircraft?

6. After looking in the appropriate –6 aircraft inspection manual, where would you look to determine if there are conflicts in an explosive item's time change interval?

7. What should you verify on a time change explosive component before you replace it?

210. Time change documentation procedures

1. Who enters the document number on AF Form 2005?

2. On AF Form 2005, what TRIC would you enter if you were requesting an issue from a supply point?

3. On AF Form 2005, what activity code would you enter in block 30 to expedite the supply request?

4. On AF Form 2005, what demand code would you enter in block 44 to request unusually large one-time requirements that are out-of-phase with normal needs?

5. On AF Form 2005, what demand code would you enter in block 44 to request a replacement item for an item suspected to be or actually is unserviceable or condemned?

6. Where would you turn your AF Form 2005 in to request equipment items?

7. On AF Form 2005 what condition code would you use to turn in serviceable materiel with more than six months of shelf life remaining?

8. On AF Form 2005, what condition code would you use to turn in economically repairable items that require repair, reconditioning, or overhaul?

9. On AF Form 2005, what do you enter in block E when processing a turn-in request?

10. On AF Form 2005, when processing a turn-in, where would you find the ERRCD code to put in block F?

11. What is a computer-produced list that shows all authorizations, assets, and due-outs for each equipment custodian by organization code and shop code?

12. Where are substitute items listed on this computer-produced list?

13. If an item that is not a good substitute is on the list, what must the equipment custodian do?

14. How is part II of the AFTO Form 350 used?

15. What is printed in the DISCREPANCY block of AFTO Form 350 when a part is removed to allow other maintenance?

16. What is printed in block 13 of AFTO Form 350?

17. If more than one repairable component is removed under the same JCN, how do you annotate block 1 on each AFTO Form 350?

18. What goes in the QTY block on AFTO Form 350?

19. For escape system devices, what extra information is required in the DISCREPANCY block of AFTO Form 350?

20. Why is part II of AFTO Form 350 retained by the production scheduler?

21. Who makes entries on the reverse side of AFTO Form 350?

2–2. The Maintenance Data Documentation Process

The objective of the MDD process is to provide a vehicle for collecting, storing, and retrieving base level, depot-level, and contractor-type maintenance data. The data is used in support of the United States Air Force (USAF) equipment maintenance program, reliability and maintainability improvement program, and maintenance management system procedures.

211. System processes

MDD has a collection process, a storage process, and a retrieval process. Each of the three processes has its own place of importance. To ensure that one process does not overshadow another, the MDD system has rules and procedures that govern the operations of each process. These rules and procedures are contained in TO 00–20–2, *Maintenance Data Documentation*, and the AF Computer Systems Manual (AFCSM) 21 series.

Collection, storage and retrieval

Base-level maintenance data is collected using automated MDD systems, and verified for accuracy. This process allows for short- and long-term (historical) storage of data and on-line data retrieval. When automated systems are unavailable or offline, manual methods (i.e., AF Technical Order (AFTO) Forms 349, Maintenance Data Collection Record) are used.

Accuracy of data

Regardless of how data is stored, for MDD to be useful to its many users, the data must be accurate. It is the workcenter and shift supervisors' responsibility to review daily the data entered into the system. Every unit in the maintenance complex establishes a data integrity team (DIT) to evaluate/isolate/eliminate documentation problems in the IMDS. Anyone with at least a 5-skill level may be appointed as a DIT member to represent his or her system.

Benefits of maintenance data documentation system

Information provided through the MDD process is used in managers' decision-making processes that result in many tangible benefits to the AF. A large portion of the cost required to operate the MDD system is returned to the AF through improved reliability, maintainability, and availability of equipment.

212. Uses of maintenance data documentation information

MDD data is intended for use at the site where data is collected and off site by the AF Management and Engineering Agency, MAJCOM, and DOD. It allows maintenance actions to be recorded as they are completed. The recorded information is entered into a computer and processed in report form for management.

Base level

At base level, the intended use of the MDD system is to provide information feedback to base managers and supervisors for controlling the maintenance operation. The MDD system is a key source of information for determining maintenance requirements. More specifically, at base level, the MDD system provides the following:

- Information regarding the type of work completed, the work centers that did the work, and the equipment on which the work was done.
- Equipment maintenance schedules and inventory information for maintenance requirements established on a calendar basis.
- Materiel failures and equipment discrepancies in composite form by type and model of equipment.

A by-product of MDD is the maintenance of the actual configuration as it pertains to serial tracked and TCIs. In other words, an accurate picture of the actual components installed on the aircraft is maintained.

Off base

The intended use of the MDD system at off-base level is to provide information to manage various programs established by the AF and MAJCOM regulations and manuals. The AF Materiel Command (AFMC) is the materiel manager for AF systems and equipment. As such, this management requires all levels of maintenance production data.

Maintenance information is used for many purposes and its accuracy is vital. Some of its uses are to provide production credit information according to work center, type of work completed, and work hours spent. In addition, it is used to assure TCTOs are completed, to manage equipment resources, and to schedule and budget for future maintenance. MDD serves as a mechanized historical record of work completed.

Effectiveness

If MDD is to be an effective way to manage maintenance, it must be accurate and reliable. Various levels of management are responsible for ensuring 100 percent accuracy of the information reported. As the specialist, you provide data about the work you do. The more careful you are in filling out the forms, the closer to 100 percent accuracy they will be. Your element chief checks the entries before the analysis section reviews them. If any errors are found, analysis sends an MDD error listing back to the shop to be corrected and returned. Another agency that gets involved with MDD is quality assurance (QA). QA performs spot checks of the MDD reports and forms, and relays its findings to the maintenance group (MXG).

213. Characteristics of the maintenance data documentation concept

Aircraft maintenance personnel must have a clear understanding of how to document maintenance data. That requires knowledge of the four characteristics of the documentation concept:

1. Categories of documentation.
2. Data entry.
3. Data codes.
4. Documentation rules.

Categories of documentation

All MDD data falls within one of two categories: on-equipment or off-equipment.

Categories of MDD Documentation		
Category of Maintenance	**Description**	**Example**
On-equipment	Documents data describing maintenance performed on end items of equipment. Documentation classified as productive direct labor expenditures.	Installing an ejection seat in an aircraft.
Off-equipment	Documents data describing maintenance performed on assemblies, subassemblies, or components apart from an end item. Documentation classified as productive direct labor expenditures.	Installing an inertia reel on a seat that had been removed and taken to the shop.

Data entry

Generally, one of the following four modes of operation accomplishes job discovery and entry into the database:

- A discrepancy may be found during scheduled maintenance event.
- Unscheduled events may be discovered and input as individual maintenance discrepancies as they occur.
- Unscheduled events may be the result of a debriefing and be associated with specific aircraft flight with a manual debriefing.
- Discovery by an on-board recording device and would be input electronically.

All four modes of discovery/data entry are accomplished at the base level. The MDD process uses standard codes to minimize the computer space required to store the data, streamline data entry, and allow computer processing in the analysis of the data. These codes are in the manual, and tables used are in IMDS also.

The manual forms you use to document maintenance data entries are AFTO Form 349 and AFTO Form 350. When using the manual method in a maintenance organization, all maintenance specialists and technicians must record the amount of time spent directly and indirectly toward their assigned duties on the AFTO Form 349. The AFTO Form 349 is processed, and the data is entered into the MDD system. Additionally, this form can be used for non-MDD purposes such as scheduling specialists to the aircraft.

AFTO Form 350 is vital because it provides a link between on-equipment and off-equipment maintenance actions. It is used to process items through maintenance shops and to ensure proper identification of the items. As soon as repair is finished, this form provides information to complete AFTO Form 349. Never use AFTO Form 350 as a source document to enter data into the MDD system. You will read more about AFTO Forms 349 and 350 as well as how to use them in a later lesson.

Data codes

Use standard data codes in documenting maintenance actions on MDC forms. You will find these codes in the 00–20 series TOs and the appropriate -06 TOs (WUC manuals). Data codes are used to do the following:

- Minimize space required for data storage.
- Simplify computer analysis of the data (it is much simpler for a computer to interpret codes than your English is).
- Provide standardization in documentation.
- Reduce the maintenance technician’s time needed for documentation.

After maintenance data is documented and entered, it is stored and grouped into one of seven categories by the type of labor being recorded (i.e., on-equipment and off-equipment). These groups are called records, and each record has its own name, number, and identification.

This data may be retrieved in the form of a report to give element chiefs the information they need to identify problem areas and excessive labor expenditures within their work center. With this information, they can establish labor standards, predict the failure rate of aircraft components, and project either short-range or long-range requirements. Failure rate data also serves as a means of estimating the degree of success when implementing new ideas into the organization. This is done by comparing data on the old procedure against data on the new procedure to see if production has increased. These are only a few of the many uses of the MDD system.

Documentation rules

Support of this documentation concept requires rules to ensure that documentation is done consistently. These rules specify when to use which form, which blocks and columns to use for each category of documentation, and when to use which codes. The rules for documenting data are contained in TO 00–20–2 and AFCSM 21–556, Volume 2, *Introduction to Integrated Maintenance Data System, Central Database*.

214. Key data elements

There are three key data elements used to authorize and control maintenance and to provide production credit information for work completed. These are the JCN, workcenter code, and ID number. When used in conjunction with other data elements in MDD systems, the JCN, ID numbers, and workcenter codes play a vital part in identifying, controlling, and analyzing maintenance actions.

Job control number

The JCN is made of nine characters and used to report, control, and identify maintenance actions. Only authorized maintenance tasks are assigned a JCN; and maintenance is not authorized without a JCN or the knowledge that a JCN will be assigned. Locally, this number provides a means to tie together all on- and off-equipment actions, expended employee hours, and failed parts replaced in satisfying a maintenance requirement, whether it be the correction of a discrepancy, or the completion of an inspection, TCTO, or time change.

Workcenter code

The workcenter code (or workcenter mnemonic) consists of five characters. It identifies shops to which maintenance personnel are assigned. All organizations engaged in maintenance functions use standard workcenter codes. The four types of work centers include (1) owning, (2) performing, (3) reporting, and (4) non-reporting.

Owning work center

The owning workcenter is the workcenter that has the basic custodial and maintenance responsibility for an item of equipment.

Performing work center

This work center performs a maintenance action or contributes labor towards a maintenance requirement. When owning workcenter personnel perform maintenance on their own equipment, they represent both the owning and performing work centers.

Reporting work center

A reporting work center is any work center to which maintenance personnel are assigned.

Non-reporting work center

A non-reporting work center is a work center where maintenance personnel may expend man-hours, but to which no maintenance personnel are assigned. Examples of non-reporting work centers are those for maintenance contractors who provide maintenance data or for training equipment not assigned to maintenance but requires maintenance support.

Normally, you will need to report only the owning and performing work center. A common egress workcenter code is MXMCG. The MX stands for maintenance group, the M stands for maintenance squadron, the C stands for accessories flight, and the G stands for egress.

Identification number

The ID number consists of five characters and identifies equipment on which maintenance was performed or from which an item was removed. The first character of the ID number is normally the type equipment code, such as “A” for aircraft. The last four characters of the ID number are normally the same as the last four positions of the equipment serial number. In figure 2–6, you see an F–16 tail for Edwards AF Base F–16 “120.” In this instance, the aircraft tail does not show a four-digit serial number. You commonly see the first digit left off the ID number if it is a “0”; this is only done for looks. The actual serial number would be “0120,” with the full serial number being “83–0120” to show the year. However, for the purposes of data documentation, the ID number is “A0120.”

Figure 2–6. Aircraft tail number.

Self-Test Questions

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

211. System processes

1. Where are the rules and procedures for MDD contained?

2. How is a large portion of the cost required to operate the MDD system returned to the AF?

212. Uses of maintenance data documentation information

1. What information does the MDD system provide at base level?

2. What is the intended use of the MDD system at off-base level?

3. Who is the materiel manager for AF systems and equipment?

4. What happens when analysis discovers an error in the MDD system?

213. Characteristics of the maintenance data documentation concept

1. What type of maintenance describes maintenance performed on end items of equipment?

2. What are the four modes of job discovery and entry into maintenance documentation system databases?

3. How are standard data codes used?

4. What is a beneficial use of failure rate data?

214. Key data elements

1. What key data element provides a means to tie together all on- and off-equipment maintenance actions, expended employee hours, and failed parts replaced in satisfying a maintenance requirement?

2. How would you classify the work center when maintenance is performed by owning workcenter personnel on their own equipment?

3. What work center is a work center where maintenance personnel may expend man-hours, but to which no maintenance personnel are assigned?

4. What are the last four characters of an aircraft's ID number?

2–3. Maintenance Forms and Reports

Imagine a situation where you are rushed to install a seat in an aircraft located in the phase dock. In haste, you go into the bomb room and remove a seat marked for the aircraft that the production supervisor is in a hurry to get back together because avionics has four days of operational checks to start, and the only hold up is getting the seat installed. You install the seat and canopy then go back to the shop, check in all the tools and equipment, and go to lunch. When you get back, you notice a seat sitting in the maintenance bay that has a stencil mark of the aircraft tail number matching the one you just installed. The AFTO Form 350 tags were mistakenly filled out! That is not an easy mistake to explain to the production supervisor that you need to remove the seat and install the right one—it has happened!

Filling out maintenance forms and reports properly will save you many headaches; you just have to make sure the tags stay where they belong. In this section, we talk about using MDC forms like the AFTO Forms 349 and 350, condition tags, JCNs, scheduled and unscheduled maintenance, and 781 series aircraft forms.

215. Job control numbers

The first five characters of the JCN represent the sequential day, such as 08276 for 2 October 2008. The last four characters identify jobs and normally consist of a daily or monthly job sequence number such as 0001 for the first job of the day or month. Using the cited example, the JCN would be 082760001. Each individual job has a JCN assigned. Every action taken related to a job, regardless of work center, time, or place, carries the same JCN that was assigned to the job originally. This procedure permits identification of all related actions and provides the capability to tie information together to identify the total job.

As stated earlier, JCNs provide a means to tie together all on- and off-equipment actions taken. Therefore, when you find discrepancies, it is critical that you be able to determine when you may or may not need additional job numbers. JCNs are assigned to identify work situations. These work situations may be grouped as follows:

- Equipment discrepancies.
- TCTO and time change requirements.
- Inspections.
- General work other than inspections.

Equipment discrepancies

Equipment discrepancies pertain to those parts or end items of equipment that require corrective maintenance due to failures, defects, damage, or similar conditions. The JCN is important in the control and analysis of such discrepancies. Equipment discrepancies frequently involve unscheduled maintenance.

With the exception of major inspections, each unrelated discrepancy will have a separate JCN assigned. That particular JCN must be used for all subsequent maintenance actions to correct the discrepancy on that item. Two different JCNs are used, when an individual or a team corrects two unrelated discrepancies on the same equipment.

An item or a group of like items received from supply and require a bench check or inspection for serviceability must have a single JCN assigned. Normally, any discrepancies discovered through this process will be recorded using the same JCN. An item that is installed after being withdrawn from supply stock is recorded by using the original JCN assigned to that job. If an item is withdrawn from supply for installation and is determined to be unserviceable, a new JCN will be assigned for the discrepancy on that item.

Time compliance technical orders and time change requirements

Completing TCTOs, removing, and replacing items due to time change requirements must have JCNs assigned in accordance with the following:

- Each individual on-equipment TCTO must have a JCN assigned for the end item of equipment being modified.
- Each commodity series TCTO must have a single JCN assigned, which must be used for recording compliance on all spares. Accomplishment of commodity series TCTOs while the item is installed on an end item of equipment requires a separate JCN for each end item to be modified.
- Each replacement of a TCI due to the expiration of its time or number of events has a JCN assigned. Removal of TCIs before expiration criteria are met must have a JCN assigned.
- Completed TCTOs during an inspection are recorded by using the JCNs assigned to the TCTO.

Inspections

Discrepancies discovered during major inspections are considered part of the inspection. They are recorded by using the JCN for the inspection. However, discrepancies discovered before an inspection, but corrected during an inspection, are recorded by using the original JCN for the discrepancy. For minor inspections a JCN must be assigned for the look phase of daily, preflight, and basic postflight inspections. Each discrepancy discovered during these inspections must have a separate JCN assigned.

General work other than inspections

Support of general work other than inspections is accounted for by using a JCN assigned each day to cover categories of work on all equipment with the same end-item identification. Work that continues into the next day must retain the same JCN. An alternate method is to assign a JCN to each serially numbered end item for each day.

216. Scheduled and unscheduled maintenance

Of all the entries to be made in IMDS, perhaps the most difficult to understand is the type maintenance. Can you answer the questions: What is scheduled maintenance? What is unscheduled maintenance? The answers are complicated by many factors.

There is often a fine line between what scheduled and unscheduled maintenance is. The decision is usually determined by what is necessary for that particular organization to meet the standards set by higher headquarters.

Some discrepancies exist between TO 00–20–1, *Aerospce Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, and the applicable –6, *Inspection Manual*, in the definitions of scheduled and unscheduled maintenance. Naturally, the –06, *Work Unit Code Manual*, and the –6 are very compatible on their definitions. Since you use the –06 to record scheduled and unscheduled maintenance actions in IMDS, adhere to the definitions listed in the –06.

Scheduled maintenance actions

Scheduled maintenance is all known or predictable requirements that can be planned or programmed to be completed on a long- or short-range schedule. This includes completing recurring scheduled maintenance, inspections and servicing, complying with TCTOs (other than immediate action), completing scheduled time change replacements, and correcting delayed or deferred discrepancies. It also includes modification and renovation projects that are programmed for depot accomplishment.

Unscheduled maintenance actions

Unscheduled maintenance actions are unpredictable maintenance requirements that were not previously planned or programmed, but require prompt attention and must be added to, integrated with, or substituted for previously scheduled workloads. This includes compliance with immediate action TCTOs, correction of discrepancies discovered during flight or operation of equipment, and performance of repairs because of accidents or incidents. Work that necessitates special depot scheduling is also classed as unscheduled maintenance.

217. Air Force technical order form series 781

The flight line would be a chaotic place if we did not have a means of informing each specialist of the aircraft status he or she is assigned to work. Without a means of recording the status of each aircraft, we would never know how the aircraft was configured nor would we know what inspections, servicing, or maintenance were due or had been done. In fact, we probably would not have a job, because all the aircraft would have ceased to fly or crashed long ago.

NOTE: For this lesson, the F–22 and F–35 aircraft are exempt from using AFTO Form 781, as they utilize embedded forms incorporated into the Integrated Maintenance Information System and Autonomic Logistics Information System.

Purpose of form series

To prevent this chaos from happening, years ago the AF developed the AFTO 781 series of forms. Collectively, these forms provide a complete status and flight record for AF weapon systems.

Reporting equipment status

Use AFTO 781 series forms to report the status of a particular weapon system or support system. In this regard, they provide records of the status of the following:

- Maintenance.
- Inspection.
- Servicing.
- Configuration.
- Flight.

As an egress journeyman, it is your responsibility to review the AFTO 781 series forms prior to any maintenance activity. Reviewing these forms ensures you are aware of the status of the aircraft and all the safety hazards.

Aircraft forms

The 781 series forms are kept in a clear plastic binder with the aircraft. Never perform any maintenance until the aircraft forms have been reviewed. The same applies for the F–22 and F–35; always review the respective information system for status and hazards. Substitute binders are permitted as long as they are standardized at unit level. Supervisors ensure that current forms are being used, and entries on these forms are accurate and current.

The following table lists eight mandatory AFTO forms for aircraft. These forms are maintained in the aircraft forms binder:

Mandatory AFTO Forms for Aircraft	
Form	**Title**
AFTO Form 781	ARMS Aircrew/Mission Flight Data Document.
AFTO Form 781A	Maintenance Discrepancy and Work Document.
AFTO Form 781F	Aerospace Vehicle Identification Document.
AFTO Form 781G	General Mission Classifications-Mission Symbols.
AFTO Form 781H	Aerospace Vehicle Flight Status and Maintenance.
AFTO Form 781J	Aerospace Vehicle-Engine Flight Document.
AFTO Form 781L	Record of Removal/Installation of Controlled Cryptographic Items (CCI).
AFTO Form 781M	Status Symbols and Functional System Codes.

In addition to these eight forms, the following lists other AFTO Form 781 series forms that are often used. Uses of these forms are a MAJCOM option.

MAJCOM Optional AFTO Forms 781	
Form	**Title**
AFTO Form 781C	Avionics Configuration and Load Status Document.
AFTO Form 781D	Calendar and Hourly Item Inspection Document.
AFTO Form 781E	Accessory Replacement Document.
AFTO Form 781K	Aerospace Vehicle Inspection, Engine Data, Calendar Inspection and Delayed Discrepancy Document.

We will concentrate on only the following four AFTO Forms: 781, 781A, 781H and 781K. As egress journeymen, you must become familiar with these forms.

AFTO Form 781

The AFTO Form 781, ARMS Aircrew/Mission Flight Data Document, is the source document for logging flight activity for individuals who are authorized to take part in a mission. Maintenance personnel and the aircraft commander are jointly responsible for completing this form. All pertinent information regarding the airworthiness and maintenance status of the aircraft are kept in the 781 forms binder. You can consider this the "health chart" of the aircraft. As an egress technician, you are responsible for annotating any maintenance you perform on the aircraft in the 781 binder.

AFTO Form 781A

The AFTO Form 781A (fig. 2–7) is used to document each discrepancy discovered by aircrew or maintenance personnel (except for discrepancies resulting from battle damage). Each time a maintainer is called to address a reported maintenance discrepancy, whether or not the discrepancy corrects itself, that discrepancy is documented in the aircraft forms (do not document operator error discrepancies). This documentation is performed regardless of the timing of the action in the generation, launching or recovering of the aircraft.

A crew chief is responsible for the following:

- Ensuring sufficient copies of the AFTO Form 781A are available for the entire mission.
- Transcribing open discrepancies to a new AFTO Form 781A or 781K, removing the old 781A forms from the binder, and forwarding removed forms to the workcenter office.
- Completing the heading entries for the 781A.

It is important to maintain the 781A as neatly as possible and ensure that write-ups or discrepancies are entered properly. You will need to know the requirements for the 781A form thoroughly, so we will discuss it in its entirety in the next lesson.

If your shop receives a part with two different types of tags attached, such as a yellow and a green tag, take no chances—have the unit bench-checked before it is used. If you need to fill out a status tag, fill out two copies. Always attach one tag to the item; attach the other to the outside of the container used for shipping.

AFTO Form 781H

The AFTO Form 781H is shown in figures 2–9 and 2–10. Even though the reverse side of AFTO 781H (fig. 2–8) is not used by egress personnel (and for this reason is not filled out), it is still important to recognize it since it contains information concerning maintenance status, servicing, and the number of engine over-temperature encounters. This is why we have included it here for your reference. As such, the 781H serves as a ready-reference of the status of an aircraft or an air-launched missile. In addition, it indicates the status and history of inspections pertinent to the day's flying.

A crew chief prepares and updates the form whenever the aircraft is flown or as required to show status. Section 6, block one (fig. 2–9) should reflect the highest symbol in the 781A. Prior to flight, the crew chief ensures the service quantities and the entries on the form correspond. Maintenance supervisors and the aircraft commander make other entries.

FROM 20140320	TO	MDS F-16C	SERIAL NUMBER 88-0205	PAGE 3 OF PAGES

SYM	JCN	DATE DISC	DOC NO.	CF 781A	XF 781K	DATE CORRECTED
R	140830123	20140324				20140324

WUC/REF	FAULT CODE	STA CODE	CORRECTIVE ACTION
			Ejection Seat Installed IAW TO 1F-16C-2-95JG-10-1 (95-10-01)

DISCREPANCY	CORRECTED BY	EMPLOYEE NO.
Ejection Seat Removed for Time Changes	K. Heflin	01235

DISCOVERED BY (Print)	EMPLOYEE NO.	INSPECTED BY	EMPLOYEE NO.
D. Raxter	01234	D. Raxter	01234

SYM	JCN	DATE DISC	DOC NO.	CF 781A	XF 781K	DATE CORRECTED
R	140830124	20140324	X361EG40830101			20140324

WUC/REF	FAULT CODE	STA CODE	CORRECTIVE ACTION
			Backrest Pad Removed and Replaced

DISCREPANCY	CORRECTED BY	EMPLOYEE NO.
Backrest Pad Worn	D. Raxter	01234

DISCOVERED BY (Print)	EMPLOYEE NO.	INSPECTED BY	EMPLOYEE NO.
D. Raxter	01234		

SYM	JCN	DATE DISC	DOC NO.	CF 781A	XF 781K	DATE CORRECTED

WUC/REF	FAULT CODE	STA CODE	CORRECTIVE ACTION

DISCREPANCY	CORRECTED BY	EMPLOYEE NO.

DISCOVERED BY (Print)	EMPLOYEE NO.	INSPECTED BY	EMPLOYEE NO.

AFTO FORM 781A, 20130711 MAINTENANCE DISCREPANCY AND WORK DOCUMENT

Figure 2–7. AFTO Form 781A.

1. FROM	2. TO	3. MDS	4. SERIAL NUMBER
20140320		F-16C	88-0205

5. Certification of PR, PR/BPO, PR/TH, TH, BPO, QT, ICT, WAI, PLI

TYPE	ACCOMPLISHED BY	COMPLETED DATE	COMPLETED TIME	TYPE	ACCOMPLISHED BY	COMPLETED DATE	COMPLETED TIME

6. STATUS DATA

SEE AFTO FORMS 781A AND 781K FOR EXPLANATION OF THE STATUS SYMBOLS

STATUS TODAY		BOX NO	EXCEPTIONAL RELEASE (Enter Box No)	STATUS TODAY		BOX NO	EXCEPTIONAL RELEASE (Enter Box No)
1	13			25	37		
2	14			26	38		
3	15			27	39		
4	16			28	40		
5	17			29	41		
6	18			30	42		
7	19			31	43		
8	20			32	44		
9	21			33	45		
10	22			34	46		
11	23			35	47		
12	24			36	48		

7.		AIRFRAME TIME	8. LANDINGS FULL STOP	TOTAL	9. CART/JFS STARTS NO	ENG	NO	ENG	10. ENGINE CYCLE DOCUMENTATION NO 1 ENG	NO 2 ENG	NO 3 ENG	NO 4 ENG	NO 5 ENG	NO 6 ENG	NO 7 ENG	NO 8 ENG
PREVIOUS																
FLIGHTS	1															
	2															
	3															
	4															
	5															
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	TOTAL															

AFTO FORM 781H, 20100915 — PREVIOUS EDITION IS OBSOLETE — AEROSPACE VEHICLE FLIGHT STATUS AND MAINTENANCE

1

Figure 2–8. AFTO Form 781H (front).

11.	SERVICING DATA																					
	FUEL (Pounds, Gallons or Liters)			OIL (Half pints, pints, quarts, gallons or liters)																OXY PRESS OR QTY	NITROGEN	WATER
	OCTANE OR GRADE	QTY SRVCD	TOTAL IN TANKS	1		2		3		4		5		6		7		8				
				SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN	SER	IN			
PRE TOT																						
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						
13																						
14																						
15																						
16																						
17																						
18																						

12.	SERVICING CERTIFICATION *(Signature, Employee Number, and Station at Which Servicing is Accompished)*								
1	BY		7	BY		13	BY		
	AT	DATE		AT	DATE		AT	DATE	
2	BY		8	BY		14	BY		
	AT	DATE		AT	DATE		AT	DATE	
3	BY		9	BY		15	BY		
	AT	DATE		AT	DATE		AT	DATE	
4	BY		10	BY		16	BY		
	AT	DATE		AT	DATE		AT	DATE	
5	BY		11	BY		17	BY		
	AT	DATE		AT	DATE		AT	DATE	
6	BY		12	BY		18	BY		
	AT	DATE		AT	DATE		AT	DATE	

AFTO Form 781H, 20161215 Page 2 of 2

Figure 2–9. AFTO Form 781H (reverse).

This 781H is removed from the binder and a new one initiated prior to the next flying period. If the aircraft is off-station, the form is left in the binder until the aircraft returns home.

AFTO Form 781K

The AFTO Form 781K is used (among other things) to document delayed discrepancies and is shown in figures 2–10 and 2–11.

FORM COMPLETION INSTRUCTIONS DEFINED IN TO 00-20-1, PARA 5.14

FROM	TO	MDS	SERIAL NUMBER
20140320		F-16C	88-0205

A. AEROSPACE INSPECTION STATUS										
NEXT PERIODIC, MAJOR, OR PHASED INSPECTION DUE NO.										
TYPE	COMPL	NEXT DUE	COMPL	NEXT DUE						

B. ENGINE DATA					
PSN	ENG SER NO	ENG CHANGE DUE TIME	PSN	ENG SER NO	ENG CHANGE DUE TIME
1			5		
2			6		
3			7		
4			8		

C. CALENDAR AND HOURLY INSPECTION SCHEDULE

INSPECTION ITEM	FREQUENCY	NEXT DUE	NEXT DUE	NEXT DUE	NEXT DUE
Egress Final	30 days	~~20140324~~	20140423		
Recovery Parachute 365 day repack	365 days	20140620			
Survival Kit Annual Inspection	365 days	20140620			

AFTO FORM 781K, 20130724 PREVIOUS EDITION IS OBSOLETE AEROSPACE VEHICLE INSPECTION, ENGINE DATA, CALENDAR INSPECTION AND DELAYED DISCREPANCY DOCUMENT

Figure 2–10. AFTO Form 781K (front).

D.	DELAYED DISCREPANCIES, URGENT ACTION, AND OUTSTANDING ROUTINE ACTION TCTOs				
SYM	JOB CONTROL NUMBER	DELAYED DISCREPANCIES OR TCTO NUMBER AND PUBLICATION DATE	DOCUMENT NUMBER	GROUND DATE/TIME	TRANSFER BY EMPLOYEE NUMBER
/	~~140830124~~	~~Backrest Pad Worn~~	~~X361EG40830101~~		01234

OPEN ITEMS CARRIED FORWARDED TO NEW AFTO FORM 781K	SIGNATURE	EMPLOYEE NO.

AFTO FORM 781K, 20130724

Figure 2–11. AFTO Form 781K (reverse).

Documentation blocks

AFTO Form 781K has the following four blocks for documentation:

1. Block A - Aerospace Inspection Status.
2. Block B - Engine Data.
3. Block C - Calendar and Hourly Inspection Schedule.
4. Block D - Delayed Discrepancies, Urgent Action, and Outstanding Routine Action TCTOs.

Symbol entries

The AFTO Form 781K has the following three rules concerning symbol entries:

1. Never enter red X items on the AFTO Form 781K; only red diagonal and dash entries are placed on the 781K. Once entered, do not erase or initial over symbols.
2. When the symbol for a TCTO or a discrepancy entered on the AFTO Form 781K is to be upgraded, transfer that TCTO or discrepancy to the AFTO Form 781A. Enter the upgraded symbol in the AFTO Form 781A SYM block.
3. If a symbol is entered in error, the person making the entry enters the following statement in the DELAYED DISCREPANCY OR TCTO NUMBER AND PUBLICATION DATE block, “Symbol entered in error, discrepancy and correct symbol reentered on page ___, item ___.” The person enters his or her employee number in the appropriate block, and then reenters the discrepancy with the correct symbol on the next open line.

Automated forms

When IMDS is used, the automated forms module is used. Manual forms produced by a computer program such as PerForm Pro, Jet Form Flow, or Pure Edge Viewer does not meet the intent of the automated forms module. Neither do previously QA-approved “pre-prints,” which are mass-produced forms with pre-printed discrepancies used for speed and convenient forms documentation for repetitive or standardized maintenance tasks.

218. Completing 781A entries

As an egress journeyman, you must understand how to enter data on the AFTO Forms 781A of the aircraft on which you are performing maintenance. The properly documented forms communicate to everyone who touches that aircraft the impact of the discrepancies you are repairing and any corrective actions you have taken. A thorough understanding and proper use of the forms also prevents you from receiving QA write-ups. Refer back to figure 2–7 to see where everything is properly documented. Automated 781A forms can be accessed through IMDS.

Minimum heading requirements

Minimum heading requirements for double-sided AFTO Forms 781A will be as follows:

- From.
- MDS.
- Serial number (on page one and all odd numbered pages).
- Page number (on all pages).

When using single-sided forms, the minimum heading requirements are as follows:

- From.
- MDS.
- Serial number (on all pages).
- Page number (on all pages).

Discrepancies

When entering a discrepancy in the 781A, use the following blocks as appropriate:

- SYMBOL (SYM).
- JCN.
- DATE DISCOVERED (DATE DISC).
- DOCUMENT NUMBER (DOC NUMBER).
- CF/781A.

- XF/781K.
- DATE CORRECTED.
- WORK UNIT CODE/REFERENCE (WUC/REF).
- FAULT CODE.
- STATION CODE (STA CODE).
- DISCREPANCY.
- DISCOVERED BY.
- EMPLOYEE NO.
- CORRECTIVE ACTION.
- CORRECTED BY/EMPLOYEE NUMBER.
- INSPECTED BY/EMPLOYEE NUMBER.

SYM block

Enter the proper symbol of each discrepancy documented in the SYM block. The symbol must be entered in red ink. If the symbol is from a preprinted form, write over the symbol in red. The symbols are as follows:

- Red X.
- Red dash.
- Red diagonal.

Red X

A red X represents the most serious possible condition (major malfunction/discrepancy). It indicates the weapon system, support system, or equipment is considered unsafe or unfit for flight or use and that these items will not be flown or used until the unsatisfactory condition is corrected or the symbol is cleared. No one will authorize or direct an aircraft to be flown, a missile to be launched, or equipment to be used until the red X has been properly cleared in accordance with applicable technical data.

Red dash

A red dash indicates that a required special inspection, accessory replacement, operational check, or functional check flight is due. The red dash also indicates that a scheduled inspection, such as a preflight, postflight, basic postflight or home station check, is overdue (time or other factors will not allow accomplishment of the inspection before flight). For additional guidance, refer to the applicable weapon system technical order. The red dash may also be used for in-progress inspections when conditions (work stoppage, crew change, etc.) necessitate an entry in the AFTO Form 781A, as determined locally. The presence of the symbol indicates that the condition must be corrected as soon as possible by performing the required inspections, accessory replacement, operational check, functional check flight, and/or any necessary maintenance.

Red diagonal

A red diagonal indicates that an unsatisfactory condition exists on an aircraft or equipment, but is not sufficiently urgent or dangerous to warrant grounding the aircraft or discontinuing the use of the equipment. The red diagonal is a straight line from the lower left to the upper right corner of the SYM block. When a maintenance technician discovers an unsatisfactory condition that warrants a red diagonal, the technician writes a description of the condition on the appropriate forms. The documentation is necessary to record a complete history of the work accomplished and required to keep the weapon system, support system, and equipment in an operational condition.

Clearing symbols

When clearing red symbol entries, a black last name initial is entered over the symbol. This indicates a technician has corrected the discrepancy and the aircraft or equipment is in a satisfactory condition. When the initial is entered, you can consider the discrepancy indicated by the symbol to be cleared. Any individual who signs off a red symbol for a specific maintenance task must be qualified/certified with the task and knowledgeable of the technical orders required to accomplish the task.

JCN block

Enter the job control number in this section.

DATE DISCOVERED block

Enter the date the discrepancy was discovered.

DOCUMENT NUMBER block

Use this block only if parts are required to correct the discrepancy. If so, enter the supply document for the part on order in this block.

CF/781A and XF/781K blocks

When a new AFTO Form 781A is initiated, uncorrected discrepancies are carried forward (CF) to a new AFTO Form 781A and discrepancies other than red X items may be transferred to the AFTO Form 781K. When an individual transcribes a discrepancy to the AFTO Form 781K or a new AFTO Form 781A, in addition to checking the appropriate block, he or she also signs the CORRECTED BY block with his or her minimum signature. Never transfer downgraded red Xs to the AFTO Form 781K.

When a discrepancy is carried forward to a new AFTO Form 781A, the individual transcribing the discrepancy places a check mark in the CF 781A box. Transcribe the SYM, JCN, original date discovered, discrepancy and, if applicable, the supply document number. The individual transcribing the discrepancy will print the name and employee number of the individual who made the initial entry.

If the discrepancy is to be transferred to the AFTO Form 781K, place a check mark in the transferred (XF) 781K box. Transcribe the SYM, JCN, original discrepancy and, if applicable, the supply document number. Do not place an initial over the symbol for the discrepancies that are carried forward or transferred to another form, since this only represents a transcribing action and does not correct the reported condition.

DATE CORRECTED block

Enter the date the discrepancy is corrected in the YYYYMMDD format. For example, September 7, 2019 is entered as 20190907.

WUC/REF block

This block may or may not be required by the maintenance group commander (MXG/CC). If it is applicable, use this block to document WUC information or the appropriate reference designator.

STA CODE block

Use the STA CODE block when any corrective action is accomplished away from the home station and when maintenance is performed by other than home station personnel. Enter the four-letter geographic location (GEOLOC) indicator for the location where the repair was accomplished. The GEOLOC is entered at the time the discrepancy is corrected. GEOLOC codes are located in IMDS.

EXCEPTION: Do not include the GEOLOC or station code information for aerospace vehicles on classified missions.

DISCREPANCY block

Prior to entering new discrepancies, review the forms to prevent duplication. Print a thorough description of the discrepancy in the next open DISCREPANCY block. More than one block may be used for a discrepancy, if required. Enter all defects noted before, during, and after each flight. Do not enter more than one defect in each block. Required aircraft servicing discovered and completed during preflight/launch inspections does not require separate AFTO Form 781A documentation; however, if the servicing is not completed before the inspection is signed off, the servicing discrepancy must be documented. Identify repeat/recurring discrepancies by entering "Repeat/Recurring" in the DISCREPANCY block.

Rules for panels and doors

Quick access panels/doors/plugs/caps opened or removed for servicing and inspection as specified in servicing and inspection technical orders do not need to be documented if closed/reinstalled upon servicing or inspection completion. Lead commands supplement this guidance by providing documentation guidance per MDS, addressing the leaving of these quick access panels/doors open/removed for next launch. Panels/doors removed/opened for other reasons are entered as a separate individual discrepancy or grouped into one discrepancy. If removed to FOM, reference the original discrepancy by using the "see page __, item __" format. If grouped, list all panels/doors removed individually within the DISCREPANCY and CORRECTIVE ACTION blocks. Panels/doors requiring in-process inspections (IPI) cannot be grouped and must be documented individually, unless the MXG/CC has developed local panel sheets to record the removal of panels required by a scheduled inspection. If so, a red X entry must be made in the AFTO Form 781A, reflecting its use. This precludes a separate red X entry for each panel/IPI.

Hazardous discrepancies

Whenever a discrepancy is of a nature that operation of the affected system could be hazardous or result in further damage or injury to personnel, include a warning note following the discrepancy statement. For example: "NOTE — DO NOT APPLY ELECTRICAL POWER TO FUEL SYSTEM - FIRE HAZARD" or "NOTE — DO NOT APPLY ELECTRICAL POWER TO SEAT ACTUATOR - FIRE HAZARD." Line through the warning/note when the condition that created the note no longer exists.

IPI

An IPI is an additional inspection or verification step at a critical point in the installation, assembly, or reassembly of a system, subsystem, or component. These inspections are either tech order, lead command, or locally directed and are accomplished by IPI certified personnel. An IPI inspector other than the technician performing the task accomplishes an IPI. The technician performing the task notifies an IPI inspector at the appropriate step. The technician who ultimately clears the original discrepancy ensures all applicable IPIs were completed. Some digital technical orders include IPIs displayed as a step in the task. The IPI executes as a process within the technical order. Once executed, a workcenter event (WCE) is created automatically in the digital aircraft forms detailing the IPI task description. In this case, the IPI requirement is fulfilled and the following procedures do not apply.

The IPI inspector who completes the IPI indicates completion of the IPI(s) in the CORRECTIVE ACTION block of the original discrepancy by stating, "Required IPI (insert IPI task title or IPI description or IPI step number) complied with" and enter minimum signature in the CORRECTIVE ACTION block. If more than one IPI is required to complete the task, IPI inspector must identify the number of IPIs in CORRECTIVE ACTION block such as, "Three required IPIs (insert IPI task title or IPI description or IPI step number of three IPIs) complied with." If there is no room in the CORRECTIVE ACTION block, the IPI inspector documents the IPI as a separate entry in the AFTO Form 781A or appropriate work package. Place the IPI(s) on a red X and reference the page and item number of each original discrepancy. In the event an IPI inspector not actively assisting in the completion of the maintenance task performs an IPI, the IPI will be documented in the CORRECTIVE ACTION block as “Required IPI (insert IPI task title or IPI description or IPI step number) complied with” and the IPI inspector’s minimum signature. Document completion of IPI(s) before leaving the job site.

Procedures to follow when interrupting maintenance

No, we are not talking about bathroom breaks. The following documentation is done whenever a maintenance action is stopped prior to completion or a change of maintenance technician occurs (e.g., job awaiting parts, technician reassigned to another job, end of shift, etc.):

1. The technician(s) documents and signs off the technical order steps accomplished prior to the maintenance action(s) being stopped. For example, “Lt MLG Strut repack steps 1 thru 25 complied with (C/W) in accordance with (IAW) 1C–5B–5–5JG–2, Sec 5–2” and then add “page __, item __” of original entry.
2. The technician creates a subsequent entry in the AFTO Form 781A detailing the remaining open technical order steps or tasks. For example, “Lt MLG Strut requires repack IAW 1C–5B–5- 5JG–2, Sect 5–2, steps 26 thru 30 not complied with” and then reference the original entry.

Keep the original discrepancy and JCN open until the entire maintenance action is completed, since subsequent discrepancy corrective actions only document partial completion. Do not transcribe aerospace vehicle forms until all tasks associated with the original discrepancy are completed. When all steps or tasks of the maintenance action are complete, a qualified technician clears the discrepancy and reviews all pertinent discrepancies to determine if all steps were accomplished in accordance with the applicable technical data.

Record discrepancies discovered during scheduled inspections directly in IMDS, locally developed/approved lists, or work control documents (WCD). Enter all red X entries in both the AFTO Form 781A and maintenance information systems (MIS). All other discrepancies tracked on locally developed lists and or WCDs that cannot be corrected by the allotted scheduled inspection time must be transcribed to IMDS and the documents routed with the 781 series forms package and filed with the inspection historical documents. When accomplishing paperless scheduled inspections, all discrepancies are entered directly into IMDS.

Facilitating other maintenance

Sometimes, you may have to remove egress components so other technicians can get to their components or for a foreign object search. Any component removed to FOM is documented as a separate discrepancy with the appropriate red symbol entry. This applies even if the item is immediately reinstalled. Refer to the original discrepancy by using the “see page ____, item ____” format.

EXCEPTION: Procedures that require removal of a component as a step of the task and contain all of the steps for component removal/installation within the same procedure do not need to be documented separately.

DISCOVERED BY and EMPLOYEE NUMBER blocks

In the DISCOVERED BY block, print the first name initial and the last name for each discrepancy recorded in the DISCREPANCY block. However, a discovered by entry is not required for IMDS generated jobs that are part of a job package. Maintenance personnel enter their employee/USERID/Federal Aviation Administration (FAA) certification number or equivalent in the EMPLOYEE NO. block.

CORRECTIVE ACTION block

When a discrepancy on the AFTO Form 781A is completed, document the corrective action taken. For red X discrepancies, include a complete technical order reference to determine the work performed, (e.g., technical order number and paragraph/figure number for conventional technical orders, function number/fault code for Maintenance Integrated Data Access System- (MIDAS-) based technical orders, SSSN [system/sub-system/subject number] or equivalent reference), in the CORRECTIVE ACTION block.

When a temporary/partial repair is accomplished that warrants changing the symbol entered for the discrepancy, and the final repair action is deferred, enter the temporary/partial repair corrective action. Close out the original discrepancy and enter a new discrepancy, with the appropriate symbol and description of the work to be accomplished in the next open block of the AFTO Form 781A. The original entry CORRECTIVE ACTION block and new entry DISCREPANCY block must refer to each other by using the entries “see page __, item __,” format.

AFTO Form 781A entries for the unscheduled replacement of a TCI accomplished away from the home station includes the old and new item’s serial number and aircraft operating time at time of replacement in the CORRECTIVE ACTION block. To clear a previously complied with (PCW) discrepancy, print “PCW,” then “see forms dated FROM___, TO___” (from the old forms), “Page ___, Item ___,” in the CORRECTIVE ACTION block of the new set of forms. Then print your minimum signature in the CORRECTED BY block and initial over the symbol in the SYM block. A red X PCW discrepancy does not require a red X qualified individual since there is no maintenance action.

Duplicate discrepancies occur when two or more write-ups are entered and remain open for the same discrepancy. The initial entry should remain open and duplicate entries closed by referencing the original discrepancy. If the entries share the same JCN, do not close the job in IMDS when clearing the duplicate entries.

CORRECTED BY, INSPECTED BY and EMPLOYEE NUMBER

When a red diagonal entry has been corrected, the maintenance technician enters the minimum signature in the CORRECTED BY block and employee number in the EMPLOYEE NUMBER block. Leave the INSPECTED BY block blank.

When a red dash entry has been corrected, the maintenance technician enters the minimum signature in the INSPECTED BY block and employee number in the EMPLOYEE NUMBER block. The CORRECTED BY block will be left blank.

When a red X entry has been corrected, the maintenance technician correcting the discrepancy enters the minimum signature in the CORRECTED BY block and employee number in the EMPLOYEE NUMBER block. The inspector then enters the minimum signature in the INSPECTED BY block and employee number in the EMPLOYEE NUMBER block.

Cannot duplicate discrepancies

Make every effort to duplicate the circumstances that created a reported discrepancy. When a discrepancy cannot be duplicated, document “Cannot Duplicate Malfunction” or “CND (cannot duplicate discrepancy)” in the CORRECTIVE ACTION block, and ensure the symbol is cleared.

Self-Test Questions

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

215. Job control numbers

1. How are actions related to a job assigned JCNs?

2. With the exception of major inspections, how are unrelated discrepancies for the same piece of equipment assigned JCNs?

3. How are JCNs assigned to commodity TCTOs?

4. How are JCNs assigned to discrepancies discovered during preflight inspections?

216. Scheduled and unscheduled maintenance

1. Since discrepancies exist between TO 00–20–1 and the applicable –6 inspection manual, what publication would you use to decide whether you were performing scheduled or unscheduled maintenance?

2. What type of maintenance is complying with TCTOs other than immediate action?

3. What type of maintenance is completing scheduled time change replacements?

4. What type of maintenance is complying with immediate action TCTOs?

217. Air Force technical order form series 781

1. What status records do AFTO 781 series forms provide?

2. Concerning AFTO 781 series forms, what should you do before you perform aircraft maintenance?

3. What AFTO 781 series form contains information concerning maintenance status, servicing, and the number of engine over-temperature encounters?

4. What AFTO 781 series form contains the calendar and hourly inspection schedule?

5. How is the AFTO 781K documented when a symbol for a TCTO or a discrepancy is upgraded?

6. When a symbol is entered in error on the AFTO 781K, how is the entry corrected?

218. Completing 781A entries

1. What are the minimum heading requirements for double-sided AFTO Forms 781A?

2. What are the minimum heading requirements for single-sided AFTO Forms 781A?

3. What aircraft forms symbol indicates the weapon system, support system, or equipment is considered unsafe or unfit for flight or use and that these items will not be flown or used until the unsatisfactory condition is corrected or the symbol is cleared?

4. What aircraft forms symbol indicates a scheduled inspection, such as a preflight, is overdue?

5. What aircraft forms symbol indicates an unsatisfactory condition exists on an aircraft or equipment, but is not sufficiently urgent or dangerous to warrant grounding the aircraft or discontinuing the use of the equipment?

6. When you are looking at an aircraft forms discrepancy, what does a black initial over a red symbol indicate?

7. What does a document number entered with a discrepancy on AFTO Form 781A indicate?

8. How do you transfer a discrepancy from AFTO Form 781A to the AFTO Form 781K?

9. What should you do prior to entering new discrepancies on AFTO Form 781A?

10. How do you document panels removed to facilitate other maintenance in the DISCREPANCY block on the AFTO Form 781A?

11. What is an additional inspection or verification step at a critical point in the installation, assembly, or reassembly of a system, subsystem, or component?

12. How do IPI inspectors document completion of IPIs on AFTO Form 781A?

13. If you must interrupt maintenance, how do you document the interruption on AFTO Form 781A?

14. On AFTO Form 781A, how do you fill out the DISCOVERED BY block?

15. When an aircraft time change is performed away from the home station, what additional information is required on AFTO Form 781A?

16. How do you clear a previously complied with discrepancy on AFTO Form 781A?

17. How are the CORRECTED BY and INSPECTED BY blocks filled in when correcting red X discrepancies on AFTO Form 781A?

2–4. Integrated Maintenance Data System

Today's maintenance shop is equipped with the technology to improve the efficiency and effectiveness of maintaining egress systems. This section presents a description of the IMDS and describes some of its many subsystems.

IMDS is the standard AF base-level automated maintenance information management system. It is vital for effective and efficient management of weapon systems worldwide. The system is designed to support aircraft communications-electronics, and equipment maintenance activities at worldwide operating bases. For B-1B units, the system provides the capability to communicate with the Configuration Status Accounting System. IMDS has many interactive subsystems, such as the maintenance events subsystem, job data documentation (JDD) subsystem, time change subsystem, the SBSS subsystem, and the egress configuration management (ECM) subsystem.

IMDS subsystems are task-oriented and menu-driven (laid out in a more logical and intuitive order) to make them more readily understandable to the user. This means that IMDS subsystems are navigated easily, as long as you know what you intend to do. The main menu screen provides a link to a single subsystem menu for each area of IMDS. The main menu eliminates the need to go through multiple menus to find the information or task you want. With these changes and others, IMDS reduces reject messages, improves data integrity, and makes IMDS user-friendly.

As part of your upgrade training for egress journeyman, you are required to complete an IMDS web-based course; so, this section only covers reviewing WCE listings, clearing WCEs, completing WCEs for time change management, and reviewing time change data entries. We discuss performing inquiries and ordering components by interfacing IMDS with the SBSS and discuss ECM, time change management, and the time change verification audit.

219. Reviewing and clearing workcenter events

The JDD subsystem has a menu from which you may select the function to do the job you need to do to document maintenance in IMDS. Here you may opt to perform various inquiries, create reports, document maintenance, amend entries, schedule a job, add a WCE to an existing JCN, or change, defer, and even cancel an existing job.

Workcenter event listing

Essentially, a WCE is made of an additional three numbers and is attached to the end of a JCN for a specific action required to fix the discrepancy.

If you think about removing an ejection seat on the aircraft you work, you realize there are many more tasks involved in removing the seat than just removing the seat. You may have to remove a canopy or a hatch in order to facilitate the removal of the ejection seat. You may also have to pull breakers and open panels. All of these actions will have the same JCN, but different WCEs, and some of them may not even be performed by the same work center. For example, consider the possibility of other work centers that must perform follow-on maintenance, such as built-in tests (BIT) on electrical components, after the seat is installed.

The WCE numbers are sequential, starting with 001 and can go all the way up to 999. Let us say that a JCN assigned to an F–16 seat removal might be 122760023. The WCE assigned to the seat removal would be "001," so the full JCN including the WCE would be 122760023001; however, the WCE assigned to the canopy removal might be "002," resulting in a full JCN of 122760023002.

The WCE listing is a report that lists all jobs still open that belong to the work center requesting the report. This report is requested using screen 380, Documented Maintenance List. This screen is used to search the database, retrieve open maintenance event information for an equipment ID, work center, part/serial number, or location, and provide an enormous amount of information for open events. The amount of information should be limited by selecting specific formats and options. For example, a listing can be requested against the egress shop, or against a particular aircraft, or even against a specific part (like an ejection seat) to see which jobs have not been completed. Filling in the workcenter field on screen 380 only produces the WCE listing.

The information included in the report includes the following:

- JCN and all assigned WCEs.
- Maintenance symbol.
- WUC.
- Narratives for each WCE.
- Supply data, including document number, for parts on order.

Access screen 380 by entering "380" in the entry field. While using this screen, you may perform the following:

- Select information based on any of 10 formats.
- Display supply data for events that have parts on order.
- Display a variety of information based on the options selected.
- Provide detailed or summary information.
- Select information for a single day or up to current date.
- Select information peculiar to the precision measurement equipment laboratory (PMEL) "K" data.
- Exclude Air Expeditionary Force (AEF) information.
- Choose AEF only information.

- Choose to display output information from screen 122, Maintenance Snapshot Inquiry.

To look up the maintenance events for your entire work center, enter your workcenter mnemonic (for example, “AEGRS”) on the 380 screen. In addition, to look up maintenance events for a specific part number, serial number, location, or equipment-ID, you would also enter that information on the 380 screen. This allows you to narrow down your search extensively.

Clearing a workcenter event

How do you complete a WCE in the IMDS-computer database? Users need to know the type of work order being completed, “job-followed,” or “non-job followed.” Is it an inspection with the first three positions of the WUC equal to 033, 034, or 037? Could it be a TCTO?

NOTE: This information is displayed in the work order, or found on screen 122, Maintenance Snapshot Inquiry.

Upon determining the type of work order, the user decides the steps needed to close the job. Closing most non-job followed work orders takes a unit produced equaling “1” (or greater) on each existing WCE. This also applies to those jobs created and documented after the fact.

NOTE: Users must follow these rules to close WCEs. If the work center has more than one WCE for an event, close each independently of the other.

If the JCN is for a phase inspection, WCE 001 takes a unit produced equaling “1.” All other WCEs for that job take “0” units. Egress sections are not in charge of phase dock, so we never take a unit produced of “1” for a phase-related discrepancy. In other words, even if our maintenance performed clears our portion of the discrepancy found in a phase inspection, we still take “0” units against that discrepancy. For a TCTO, the prime workcenter documents the unit of work. The rule to follow is if unit produced equals “1,” then the job closes; however, if unit produced equals “0,” the job remains open.

Use screen 146, Maintenance Start/Completion, when closing a job-following job. Listed as follows are the correct procedures for using screen 146.

- Start the JCN before the technician is dispatched. This decision made by the maintenance unit depends on the concept of operation under which the unit is operating.
- Stop the JCN once the work center has completed its maintenance documentation (filling out the 781 series aircraft forms).
- Close the job when the last WCE is finished. Screen 146 is sent to the controlling agency with the correct status prefilled automatically. The controlling agency is responsible for acknowledging the completed job, and processing screen 146. This terminates the job-following status on the JCN and eliminates any future notices.

When the work order is a job-followed WCE, remember that both actions must be completed to close the job, the JDD, and screen 146. If any WCE is job-followed, then the event is job-followed. While there can be a mixture of job-followed and non-job followed WCEs for an event, it only takes one job-followed WCE to make the event job-followed. Until the user completes the required steps to clear a job-followed event, the event or WCE remains active, and not placed into history.

Job data documentation

Speaking of JDD, let us discuss how that particular screen works. The JDD module is known as screen 907, Job Data Documentation Menu.

No JCN

If a new job does not have a JCN, proceed to screen 907 and select “1” through “5” or “8” through “11.” Leave all other fields blank. Press ENTER or <XMIT> to process. One of the JDD screens will appear. Enter maintenance data and complete required entries. Process the transaction. A

JCN should return at the top of screen 929 for all options except “5,” “10,” and “11.” These appear on the documentation screen itself. At this time, you may input the discrepancy and corrective action narratives, and select an option at the bottom of the screen.

New WCE

To document work with an event-ID, but no WCE assigned, enter the ID and select options “1” through “4” or “8” through “11.” A “JDD after the fact” screen appears with data prefilled for the event. You must enter the data and then select <XMIT> to process. A JCN is returned to you that reflects a new WCE has been created for the event-ID that you originally input, and the JDD has been documented against the new WCE.

JCN and WCE assigned

If JCNs and WCEs are already assigned to the job, enter the 9-position event number in the year/event-ID block of screen 907 and select the appropriate action “1,” “2,” “3,” or “4.” A JDD screen appears and prompts you to fill out the necessary blocks. Press <XMIT> to complete the work order. The information is processed and a JCN returns at the top of screen 929.

On-equipment or off-equipment

Depending on your choices on the 907 screen, the screens you will use to document your work on various jobs will be screen 914, On-Equipment Maintenance, and screen 917, Off-Equipment Maintenance. To ensure good database management, keep this in mind when processing IMDS transactions.

Screen 929

After all the codes and required data are entered, the system takes the user to the narrative page. On screen 929, Create/Correct Narratives, the maintainer has the opportunity to write, in narrative form, exactly what took place on the job. A brief, accurate, and thorough description of the maintenance performed is best. Leaving the narrative blank results in a data integrity error. When you have completed your narrative, press <XMIT>. Once the job has been documented, complete a Maintenance Snapshot Inquiry from screen 122 to make certain the work order has been closed out.

Clearing a time change workcenter event

Before you process a time change WCE, it is best to create the new TCI in IMDS. You can create it later while processing the WCE, but creating it early saves time, and you can even generate TCIs on the screen 42, Individual Equipment Load, as soon as you receive them from munitions.

To create a TCI, go to screen 854, Egress Configuration Menu. From there, select option “1,” for Individual Equipment Load, or screen 42. You can also go directly to screen 42 by typing it directly into the open field at the bottom of your screen. Screen 42 loads, changes, inquires, deletes, or regains the basic equipment identification information for part/serial numbered items. As mentioned before, preloading the TCI on screen 42 before completing the WCE is fast; what makes it so fast is that you can run an inquiry on the old part and then build your new part by entering your new data on top of the old part’s data. Check with your supervisor before loading TCIs this way to determine if this method is accepted in your shop. To load a TCI, the following information must be entered:

- Enter transaction type “L.”
- Enter part number.
- Enter serial number.
- Enter lot number (this *must* be entered for egress TCIs).
- Do not use the “enter new lot number” option when loading a TCI into IMDS; this is used when changing existing information only.
- Enter the SRD.

- Enter CAGE code from data plate of item.
- Enter the egress indicator "E" or "B." "E" represents a non- CAD/PAD egress component which may or may not have a lot number; "B" represents a component that is *both* egress and CAD/PAD (the lot number must be provided).
- Enter WUC/logistics control number.
- Enter "Y" if item is warranty tracked. An "*" will delete previous information.
- Enter "1" to show that the item is managed under the Advanced Configuration Management System (ACMS).
- Enter configuration-ID for configuration-managed aircraft.
- Enter the FSC (for egress explosive items, this is normally 1377).
- Enter a "Y" to establish automated history for the part.
- Enter the manufacturer.
- Enter the DOM.
- Enter your workcenter's mnemonic.
- Enter workcenter indicator.
- Enter program element code.
- Enter remote-ID of the controlling agency for the part.
- Enter maintenance type interval.
- Enter configuration position for B–1 and B–2 aircraft.

With a good understanding of the information from this lesson, you should now be able to process your maintenance documentation easily, including time change requirements, using the screens described. However, one final detail remains when ensuring documentation is accurate and complete: reviewing time change data entries.

Reviewing time change data entries

Egress configuration management within IMDS is of utmost importance for the safety of aircrew members. Ensure that you always review the jobs you entered using a screen 122 after completion to ensure that everything you entered was accurate. We do this because the egress section is responsible for overall management and control of the egress configuration management.

220. Integrated Maintenance Data System egress configuration management

The IMDS ECM subsystem provides access to a database containing equipment and configuration records. The user can update the database as events occur which affect assigned equipment configuration records.

The inputs you make into this subsystem will be of two general types. The first type of transaction updates the database for maintenance events, and the second type requests information from the database. This process allows you to load equipment, WUCs, and next-higher-assembly WUC relationships. You can also load, track, and review F–16 canopy transparency coefficients. You can forecast time change requirements for egress equipment, establish, and maintain job standards for inspection and TCIs. If you input codes that fail to pass input edits, a reject code with a narrative displays on your IMDS screen. However, it is possible to input data incorrectly and thereby compromise the integrity of the database. The usefulness of the system is degraded when incorrect data is entered, and in egress, aircrew lives are in danger.

Reject messages

Each entry you make in IMDS is edited for validity, structure, and accuracy. A reject message displays if you enter incorrect or incomplete information. The cursor blinks (or the field is highlighted), and an error number displays at the bottom of the screen. You must correct any errors before you can continue.

Egress configuration menu

Screen 854, Egress Configuration Menu, allows you to enter egress configuration management data while documenting job data. Because follow-on pages pre-fill subsequent screens, the system reduces the number of entries you have to make. Screen 854 enables access to the following options:

- Individual equipment load.
- WUC/logistics control number table.
- Establish job standards.
- Individual equipment installation.
- Individual equipment removal.
- Inspection/time change.
- Automated history entry.
- Time compliance technical order.
- Canopy transparency coefficient.
- JDD menu.
- Egress inquiries/reports menu.

Job standards

IMDS allows plans, scheduling & documentation (PS&D) and other authorized personnel the power to create job flow packages, called job standards (JST), which are customized to fit each of the tasks most common to an egress shop. For example, to remove the seat from an F–16C, the seat removal is only a small part of the job. The crew has to remove the canopy and seat, which requires electrical/environmental specialists, a BIT on the seat's flight data recorder, and an egress final inspection to accomplish a canopy inflatable seal check (as well as all the aircraft panels that need to be removed).

The JST is convenient because it takes you from screen to screen automatically, so the whole job can be documented without the burdensome returns to the main JDD menu to add a WCE for every discrepancy. JSTs are also composed for individual TCIs.

Time change items

When a TCI is replaced, the job is documented the same as any other job. There are just a few extra steps to create a serially controlled item in the database as discussed previously, and establish DOMs and DOIs, and a due date. Some of this can be done automatically by assigning the correct JST to the item. From JDD Utilities, the user selects Documenting an Existing Event option. After entering the JCN and WCE and transmitting the screen, the user fills in either On- or Off-Equipment Maintenance (screens 914 or 917) the same as usual. It is here that a time change differs from other removal/replacement actions.

The JST should forward you on to Part/Serial Number Record Update (screen 42). Once that function is complete and the item is created in the database, and the JST is assigned via the Update Inspections/Time Changes (screen 372) page, the rest of the job can be completed. Now, this is one way to work time changes, but we discussed a faster way in the last lesson. Many JSTs are built to include all the IMDS functions needed to complete documentation of a time change, but some do not. Either way, it is the egress technician's responsibility to ensure that it all is done.

Once the job is documented and verified, you must delete the old part from the system. Having old, turned-in components in the database only encumbers the system, and is technically incorrect. Keep your database clean and correct by deleting old parts from the system. This can be done with the same function used to establish a part/serial number, screen 42, Individual Equipment Load. After the part has been deleted from the system, it will not show up when an inquiry is performed with the Serial Number Inquiry by Part Number (screen 412) function.

Egress configuration list

You can find out what items are installed on an ejection seat, or even what egress system items are installed on an aircraft by using the Egress Configuration List on screen 257. Entering the aircraft serial number and using the drop-down to select option A (B- and E-type egress items); the user can transmit and receive a list of all egress components installed on the aircraft (fig. 2–12). If you needed to know information on the parachute or survival kit (ACES II), you would select the option for all (B, C, and E).

```
INPUT ITEM: EQP-ID/PN: A0354           SN:           LN:                OPT:
     ** INPUT ITEM IS NOT INSTALLED ON ANY OTHER ITEM **
  ** INSTALLATION HIERARCHY **
 1:A0354
      64 ITEMS INSTALLED ON INPUT ITEM
PART              SERIAL                          MFG.  INSTL  DUE INT      FREQ     EGR
NUMBER            NUMBER      LOT NUMBER          DATE  DATE  DT/TM        DOM/DOI   IND

315E100-5         72121C0177                      83090 98327  NO TCH RECORD LOADED  E
JCN:NO EVT RC WUC/LCN:12CCA           NAR:ACTUATOR ASSEMBLY               JST:NO JST

2650100           0000019479 OAC97F001-015   97181 99110 11181 M  000168/          B
JCN:NO EVT RC WUC/LCN:97AN0           NAR:INIT MAN ACT DTA 2650100/6 JST:T80601

2650100           0000019511 OAC97F001-015   97181 99110 11181 M  000168/          B
JCN:NO EVT RC WUC/LCN:97AN0           NAR:INIT MAN ACT DTA 2650100/6 JST:T80601

2650100           0000019598 OAC97F001-015   97181 99110 11181 M  000168/          B
JCN:NO EVT RC WUC/LCN:97AN0           NAR:INIT MAN ACT DTA 2650100/6 JST:T80601

2651100           0000013183 OAC96E001-004   96152 99110 10151 M  000168/          B
JCN:NO EVT RC WUC/LCN:97AP0           NAR:INIT GAS ACT DTA 2651100   JST:T80603

2651100           0000013320 OAC96E001-004   96152 99110 10151 M  000168/          B
JCN:NO EVT RC WUC/LCN:97AP0           NAR:INIT GAS ACT DTA 2651100   JST:T80603

51281-725         0001201556 OAC95C001-005   95090 99116 14120 M          /000180 B
JCN:NO EVT RC WUC/LCN:97AB0           NAR:DET TRNS 16K0341-18/51282- JST:T80580

10520619          0000000259 IH-99L016-001   99334 00143 17151 M          /000204 B
JCN:NO EVT RC WUC/LCN:97AK0           NAR:INIT M53 10520619          JST:T80511
```

Figure 2–12. IMDS Egress Configuration List (screen 257).

If the seat is not installed in the aircraft (and the removal is documented in IMDS), only the system components still installed will show up on the report generated from screen 257 (fig. 2–13). To verify components installed on the ejection seat in this case, enter the part and serial number of the ejection seat itself instead of the aircraft number. The resulting report will include information such as part number, serial number, lot number (where applicable), WUC, DOM, DOI, date due replacement, and more. Overall, this is a valuable tool for managing the configuration of egress systems.

```
INPUT ITEM: EQP-ID/PN: J114936-539     SN: 000F6A1755 LN:                 OPT:

  ** INSTALLATION HIERARCHY **

 1:A0354
 2:J114936-539     000F6A1755 12E00                          EJECT ST ACE II E

     26 ITEMS INSTALLED ON INPUT ITEM

PART            SERIAL                     MFG.  INSTL  DUE INT      FREQ     EGR
NUMBER          NUMBER     LOT NUMBER      DATE  DATE   DT/TM        DOM/DOI  IND

50436-11        0000004226 TAC96K001-020   96305 98293 08305 M  000144/        B
JCN:NO EVT RC WUC/LCN:97EAA           NAR:RKT MTR SEAT STABN         JST:T80697

CAP-12115C      0000003339 16              99243 00140 08335 M       /000102 E
JCN:NO EVT RC WUC/LCN:12EGH           NAR:EM PW SP,B/U PARA D        JST:T80530

1003-24         0000020697 UPC98H001-078   98243 01213 09240 M  000132/        B
JCN:NO EVT RC WUC/LCN:97EAG           NAR:CARTRIDGE DROGUE           JST:T80709

811-00112       0000011555 411-7380-4      02151 02274 11151 M  000108/        E
JCN:NO EVT RC WUC/LCN:12EHB           NAR:SENSOR ENVIRONMENTL        JST:T80400

9392046-2       0000016515 HST02G001-007   02212 04075 10212 M  000096/        B
JCN:NO EVT RC WUC/LCN:97EAC           NAR:CARTRDG HRNSS RLSE         JST:T80701

J114712-505     0000064930                 97365 04350 10365 M  000156/        E
JCN:NO EVT RC WUC/LCN:12EHA           NAR:PARACHUTE DROG SBSY        JST:T80504

J115140-505     000CCE3523 REFURB-SEP05    05273 05298 23273 M  000216/        E
JCN:NO EVT RC WUC/LCN:12EE0           NAR:CONTROL PITCH STAB         JST:T80529

6066100-02      0000018210 SCN04C002-047   04091 05298 11090 M  000084/        B
JCN:NO EVT RC WUC/LCN:97EAE           NAR:GAS GENERTOR STAPAC        JST:T80705
```

Figure 2–13. IMDS Egress Configuration Output (screen 257).

221. Time change audit

We cannot overstate how critical it is to ensure the TCI database is accurate. PS&D is responsible for managing the TCI program, but the egress section is responsible for establishing procedures to ensure TCI data accuracy as items are replaced.

PS&D performs a quarterly review of all inspections, special inspections, and TCIs. They ensure the accuracy of all due dates and times for TCIs and verify the DOMs and DOIs. However, egress personnel may also perform an audit of the TCI database themselves. The planning requirements document (PRA) and IMDS are necessary for this endeavor.

The PRA is a report generated by wing PS&D with information from the current database, including the same information found on the Egress Configuration Listing. But it also shows the number of days left until the due date of each item, has a more extensive narrative, and component position on the aircraft. This official product should be used to verify the accurate configuration of each aircraft's egress system.

Part number inquiry

IMDS functions are indispensable in performing an audit. Using screen 412, Part Number/Serial Number, enter a part number, and the resulting report lists all components in the database with that part number. Listed in serial number order first and lot number order second, the lot numbers should fall into blocks, and the DOMs should line up sequentially as well (fig. 2–14). This is because most components purchased by the USAF are required to have unique serial numbers, so they will not be duplicated, even in different lots. Therefore, the later the item is manufactured, the larger the serial number will be.

PART NUMBER/SERIAL NUMBER INQUIRY 28/DEC/07 15:11:02
FOR P/N: 1143-3 FOR W/C: (ALL UNITS) OPTION: EGRESS

LOT NBR/ENG IDF	SERIAL NUM	W/C	SRD	FSC	WUC/LCN	NARRATIVE	EI	DOM
UPC02L001-084	0000015192	AMCCG	AKJ	1377	97EAJ	ROCKET TRJCT	B	02334
UPC02L001-084	0000015193	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	02334
UPC02L001-084	0000015194	AMCCG	AKJ	1377	97EAJ	ROCKET TRJCT	B	02334
UPC02L001-084	0000015195	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	02334
UPC02L001-084	0000015200	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	02334
UPC05C001-090	0000015658	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015659	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015682	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015686	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015688	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015694	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015702	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015704	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015705	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015709	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015773	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015785	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC05C001-090	0000015821	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	05090
UPC89B001-038	0000007496	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	89059
UPC89B001-038	0000007625	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	89059
UPC89B001-038	0000007715	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	89059
UPC89E001-040	0000008016	AMCCG	AKD	1377	97EAJ	ROCKET TRJCT	B	89151
UPC89E001-040	0000008099	AMCCG	AKJ	1377	97EAJ	ROCKET TRJCT	B	89151

Figure 2–14. IMDS part number inquiry output.

The value of screen 412 is that when you see all serial numbers of one part number listed together, one lot number out of place (because of an incorrectly entered lot number or part number) or DOM that does not match those adjacent, is obviously apparent. Any discrepancies should be corrected as soon as possible, and ensure that the discrepancy has not caused an item to go overdue.

Job flow package inquiry

The next function to use is screen 469, Job Flow Package Inquiry. For every part number, you should have at least one JST, and a screen 469 inquiry produces a listing of all part/serial numbers assigned to that JST. The numbers should line up on this list, too (fig. 2–15).

UNIT: A JOB FLOW PACKAGE INQUIRY 12/12/07 7:02:30L
JOB STANDARD: 80701 FREQUENCY: 000096 INTERVAL: M WUC/LCN: 97EAC
NARR: HARNESS RELEASE CART..PN 1002-41/9392046-2 96M DOM

EQUIPMENT IDENTIFICATION - PART / SERIAL	NUMBER -	LOT NUMBER	DUE DATE (SORTED)	NEXT HIGHER ASSEMBLE	
9392046-2	0000092321	HST99H001-006	31 AUG 07	NOT INSTALLED	
9392046-2	0000092360	HST99H001-006	31 AUG 07	NOT INSTALLED	
1002-41	0000022781	UPC00K001-089	31 OCT 08	J114936-515	000F6A1851
1002-41	0000022789	UPC00K001-089	31 OCT 08	J114936-539	00006SU160
1002-41	0000022838	UPC00K001-089	31 OCT 08	J114936-515	000F6A1912
1002-41	0000022843	UPC00K001-089	31 OCT 08	J114936-539	00006SU210
1002-41	0000022849	UPC00K001-089	31 OCT 08	J114936-515	00006SU201
1002-41	0000023208	UPC00K001-089	31 OCT 08	J114936-539	00006SF499
1002-41	0000023212	UPC00K001-089	31 OCT 08	J114936-515	000F6A1939
1002-41	0000023822	UPC00K001-091	31 OCT 08	J114936-515	000F6A1646
1002-41	0000023755	UPC00L001-090	30 NOV 08	J114936-515	000F6A2039
1002-41	0000023970	UPC00M001-076	31 DEC 08	J114936-515	000F6A146
1002-41	0000023974	UPC00M001-091	31 DEC 08	J114936-539	000F6A1905
1002-41	0000024145	UPC00M001-091	31 DEC 08	J114936-539	00006SF479
1002-41	0000024290	UPC00M001-091	31 DEC 08	J114936-515	00006SF475
1002-41	0000024291	UPC00M001-091	31 DEC 08	J114936-539	00006SF522
1002-41	0000024293	UPC00M001-091	31 DEC 08	J114936-539	00006SU122
1002-41	0000024294	UPC00M001-091	31 DEC 08	J114936-515	00006SF459
1002-41	0000024318	UPC00M001-091	31 DEC 08	J114936-539	000F6A1826
1002-41	0000024873	UPC01L001-093	30 NOV 09	J114936-515	000F6A1865
1002-41	0000024875	UPC01L001-093	30 NOV 09	J114936-515	00006SF449
1002-41	0000024880	UPC01L001-093	30 NOV 09	J114936-539	00006SU131
1002-41	0000024881	UPC01L001-093	30 NOV 09	J114936-517	00006SA460
1002-41	0000024885	UPC01L001-093	30 NOV 09	J114936-541	00006SA463
1002-41	0000024886	UPC01L001-093	30 NOV 09	J114936-539	000F6A2012

Figure 2–15. IMDS job standard inquiry.

If the shelf life and service life are the same, only one JST is necessary for that item. This is because for this special case, the due date will be measured from the DOM always. If, however, they are different, that type of component requires two JSTs—one for a due date by shelf life, and one for a due date by service life. If you print screen 469 for each JST assigned to a particular part number, then add them together and print screen 412 for that same part number, the total number of items on the 469s should match the total on the 412. Also, the 469 shows any item not installed on a higher assembly.

An entire audit may be performed by cross-checking screen 412 against screen 469s for each part number in your database. Then, any errors can be corrected. It can certainly be a tedious and time-consuming job; however, what is important is completed, you can be sure your section will not endanger any aircrew member's life through faulty documentation of a TCI.

Planning requirements

The PRA can be broken into the following two sub-reports:

- Inspection requirements.
- Time change.

Part 1 shows inspections coming due. Part 2 checks TCIs installed on the aircraft against the report to ensure all information is accurate. Each sub-report also has two divisions: events that are overdue, and events that are coming due. Refer to figure 2–16 as we discuss the information on the PRA report.

```
PREPARED 07 OCT 10  08:15                           PLANNING REQUIREMENTS                         PCN SG105-
18P  ELC 5811

INPUT IMAGE:  PRAA1  0000000000000000000     Y           F016C A       F016D A
INCLUSIVE DATES:  N/A                               INSPECTION AND TIME CHANGE FORECAST
                                                       INSPECTION REQUIREMENTS                   FOR EGRESS
EQUIPMENT
EQUIPMENT     EQUIP ID     CURR TIME    CURR DATE                PART 1
  F016C A       A0354         6391.7    07 OCT 10          INSPECTIONS COMING DUE
PART NUMBER   /SERIAL NBR/REFITEM    TIME  EST DUE      CURR  DOI/    EVENT/  JST#     JOB STANDARD NARRATIVE
 LOT NUMBER     /POS LOC            REMAIN  DATE        TIME  DOM     FREQ    WUC/LCN
J114509-535     0269301651              99 08JAN17  - - - -  07073            34749 REPACK PARACHUTE ASSEMBLY PN
J114509-523
                 SEAT                                    MN 01025       12  09311            (SCHED PROFILE #34750)
J114712-505     0000064930             670 09AUG10  - - - -  04350            82495 C/W 36 MONTH REPACK ACES II DROGUE
PARACHUTE
                                                         MN 97365       36  09311
J114936-539     000F6A1755             691 09AUG31  - - - -  07184            80031 C/W 36 MONTH SEAT INSPECTION.
                                                         MN 87001       36  0412G            IAW 1F-16CG-6-11 PAGE 2-23
PAR 41, B,H,
                                                       TIME CHANGE REQUIREMENTS
EQUIPMENT     EQUIP ID     CURR TIME    CURR DATE                PART 2
  F016C A       A0354         6391.7    07 OCT 10          OVERDUE TIME CHANGES
PART NUMBER   /SERIAL NBR/REFITEM    TIME  EST DUE      CURR  DOI/    EVENT/  JST#     JOB STANDARD NARRATIVE
 LOT NUMBER     /POS LOC            REMAIN  DATE        TIME  DOM     FREQ    WUC/LCN
6610113         0000006363            -132 07MAY31  - - - -  03076 071400001 80717 ROCKET CATAPULT.......PN 6610113
 IHM01L558-026                                           MN 01334       48  97EAM            48M DOM
50436-11        0000004226             387 08OCT31  - - - -  98293            80697 SEAT STAB ROCKET.......PN 50436-5/-
11      144M DO
 TAC96K001-020   SEAT                                    MN 96305      144  97EAA
CAP-12115C      0000003339             417 08NOV30  - - - -  00140            80530 EMER POWER SUPPLY...PN CAP12115B OR
CAP12115C DOI
 16                                                      MN 99243      102  12EGH            102M      (OLD PN A115932-
1)
1517-001        0000003047             568 09APR30  - - - -  00028            80730 CANOPY ROCKET REM PN 1517-001  120M
DOM
 UPC99D001-020                                           MN 99120      120  97CG0
1517-002        0000003597             568 09APR30  - - - -  00028            80732 CANOPY ROCKET REM  PN 1517-002
120M D
 UPC99D001-020                                           MN 99120      120  97CH0            OM
1003-24         0000020697             691 09AUG31  - - - -  01213            80709 DROGUE GUN CART..............PN
1003-24 132M DOM
```

Figure 2–16. Planning requirements report.

Part 1 – Inspections coming due

The inspections portion of the PRA displays the inspections loaded in IMDS against the ejection seat. Inspection information includes the following:

- Part number – of the part against which the inspection is loaded.
- Serial number.
- Time remaining – until the inspection is due.
- Estimated due date.
- DOI/DOM – date the component was last installed, and when it was manufactured.
- Event/frequency – event-ID and how often the inspection is accomplished.
- JST – number identifying the job flow package.
- Job standard narrative – a brief explanation of the work to be accomplished.

Part 2 – Overdue time changes/time changes coming due

The time change requirements section is almost identical to the inspections portion of the PRA, except the information pertains to time changes. As a result, it is slightly different. Time change requirements are those for which the items have a measured service life expectancy and that display an age-related failure pattern. This means the parts will probably fail after a certain length of time. Listed here are the items that differ.

- Part number – of the component to be changed.
- Lot number – same as above.
- Position location – (if used) shows the location of the component; typically used when more than one of a like item is installed.
- Time remaining – until the time change is due.
- Estimated due date – when the time change is due.
- DOI/DOM – when the component was installed/manufactured (in Julian calendar format).
- Event/frequency – event-ID/tied to the JST, this is the shelf or service life, depending on which one is used.
- WUC – the WUC used in IMDS to identify the type of component.
- Job standard narrative – tells the type of component and additional helpful information.

Notice on the first item in part 2 of the PRA in figure 2–16 that the time remaining is a negative number. This signifies that the part is overdue time change. In this case, the rocket catapult is overdue by 132 days (rocket catapults were in a shortage and the item manager had issued an extension for that aircraft). Note an event-ID is listed. This means there is already a job loaded in IMDS against that component for a time change.

Any changes to the data on the PRA due to compliance with an inspection or a TCI replacement should be annotated on the hard copy, if kept in the section. It should always match the Egress Configuration Listing for that aircraft. Reports are management tools for you and your supervisor. If you feel that a report is not providing the information you need for effective resources management, ask the people in the PS&D section to produce reports with the kind of information you do need.

Self-Test Questions

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

219. Reviewing and clearing workcenter events

1. What additional three numbers are attached to the end of a JCN in order to specify what action is required to fix a discrepancy?

2. How would you request a WCE listing for your work center when using IMDS?

3. What actions can you perform using screen 380 in IMDS?

4. What happens when you enter “0” units produced on a job using IMDS?

5. When using screen 146 within the IMDS, when does the JCN need to be stopped?

6. If a new job does not have a JCN in IMDS, how do you process it?

7. When a JCN and a WCE are already assigned to a job, how do you process them in IMDS?

8. On what screen in IMDS will you write in narrative form exactly what took place on a job?

9. What egress indicator covers items that are both egress and CAD/PAD?

10. What is normally the FSC for egress explosive items?

11. What screen in IMDS will you always use to review your time change jobs for accuracy?

220. Integrated Maintenance Data System egress configuration management

1. What subsystem in the IMDS provides access to a database containing equipment and configuration records?

2. What airframe’s canopy transparency coefficients are tracked within the IMDS ECM subsystem?

3. What happens in IMDS if you enter incorrect or incomplete information?

4. What options are available in IMDS using screen 854?

5. In IMDS, why are job standards convenient?

6. In IMDS, how can you automatically establish DOMs and DOIs, and a due date for an item?

7. Once a time change job is completed in IMDS, what must you do with the old part?

8. On what screen would you accomplish your response to STQ 7 above?

9. In the IMDS, what screen would you use to find out what egress items are installed on an aircraft?

10. If items are removed from the aircraft and documented in the IMDS correctly, what items will show up on that screen’s report?

221. Time change audit

1. Who is responsible for ensuring that TCI data is accurate?

2. How often does PS&D perform reviews of all inspections, special inspections, and TCIs?

3. In the IMDS, why do DOMs normally line up in sequence on the report generated from screen 412?

4. What should you do if you find discrepancies on the report generated from screen 412?

5. In the IMDS, how many job standards should be assigned to TCIs that have a different shelf and service life?

6. How can you perform a time change audit using the IMDS?

7. PRA is broken into what two sub-reports?

8. What are the two divisions of those sub-reports?

9. What document should the PRA always match?

Answers to Self-Test Questions

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

209

1. Lot number.
2. December.
3. Storage life, also known as shelf life.
4. Service life.
5. The aircraft roll-out date.
6. The 11P-series technical order.
7. That it is the correct component by checking the part number, lot number, serial number, and location against the information on the work order.

210

1. Base supply personnel.
2. MSI.
3. X.
4. N (non-recurring).
5. R (recurring).
6. Equipment management element.
7. Code A—Serviceable (issuable without qualification).
8. Code F—Unserviceable (repairable).
9. A simple statement to replace or reduce and delete authorizations as applicable. Also, the condition of the item, such as serviceable or unserviceable.
10. Fed Log.
11. The CA/CRL.
12. Immediately after the preferred number.

13. The custodian notifies supply in writing and then turns in the item or has supply code it as an unsatisfactory substitute (U).
14. It serves as the production scheduling document.
15. FOM.
16. The supply document number.
17. With the same JCN.
18. The number of like items being forwarded for shop processing.
19. The DOI and the date of removal.
20. It is retained as a suspense document until the item is returned from the shop or is made serviceable.
21. The RPC, base supply, or the activity responsible for determining the status of the equipment, as applicable.

211

1. TO 00–20–2 and AFCSM 21 series.
2. Through improved reliability, maintainability, and availability of equipment.

212

1. Information regarding the type of work completed, the work centers that did the work, and the equipment on which the work was done. Equipment maintenance schedules and inventory information for maintenance requirements established on a calendar basis. Materiel failures and equipment discrepancies in composite form by type and model of equipment.
2. To provide information to manage various programs established by the AF and MAJCOM regulations and manuals.
3. AFMC.
4. They send an MDD error listing back to the shop to be corrected and returned.

213

1. On-equipment maintenance.
2. A discrepancy may be found during scheduled maintenance event. Unscheduled events may be discovered and input as individual maintenance discrepancies as they occur. Unscheduled events may be the result of a debriefing and be associated with specific aircraft flight with a manual debriefing. Discovery by an on-board recording device and would be input electronically.
3. To minimize space required for data storage; to simplify computer analysis of the data (it is much simpler for a computer to interpret codes than your English); to provide standardization in documentation; and to reduce the maintenance technician’s time needed for documentation.
4. It serves as a means of estimating the degree of success when implementing new ideas into the organization.

214

1. JCN.
2. Owning work center and performing work center.
3. Non-reporting work center.
4. Normally, the last four positions of the equipment serial number.

215

1. They carry the same JCN originally assigned to the job.
2. They are assigned separate JCNs.
3. Each must have a single JCN assigned that must be used for recording compliance on all spares. Accomplishment of commodity series TCTOs while the item is installed on an end item of equipment requires a separate JCN for each end item to be modified.
4. Each discrepancy must have a separate JCN assigned.

216

1. The applicable –06.

2. Scheduled maintenance.
3. Scheduled maintenance.
4. Unscheduled maintenance.

217

1. Maintenance, inspection, servicing, configuration, and flight.
2. Review the aircraft forms.
3. AFTO Form 781H.
4. AFTO Form 781K.
5. Transfer that TCTO or discrepancy to AFTO Form 781A, and then enter the upgraded symbol in the AFTO Form 781A SYM block.
6. The person making the entry enters the following statement in the DELAYED DISCREPANCY OR TCTO NUMBER AND PUBLICATION DATE block, "Symbol entered in error, discrepancy and correct symbol reentered on page ___, item ___." The person enters his or her employee number in the appropriate block, and then reenters the discrepancy with the correct symbol on the next open line.

218

1. From, MDS, serial number (on page one and all odd numbered pages), and page number (on all pages).
2. From, MDS, serial number (on all pages), and page number (on all pages).
3. Red X.
4. Red dash.
5. Red diagonal.
6. The discrepancy is cleared.
7. Parts are required to correct the discrepancy.
8. Place a check mark in the XF 781K box. Transcribe the SYM, JCN, original discrepancy and, if applicable, the supply document number. Do not place an initial over the symbol for the discrepancies that are carried forward or transferred to another form, since this only represents a transcribing action and does not correct the reported condition.
9. Review the forms to prevent duplication.
10. Panels/doors removed/opened for other reasons are entered as a separate individual discrepancy or grouped into one discrepancy. Reference the original discrepancy by using the "see page __, item __" format. If grouped, list all panels/doors removed individually within the DISCREPANCY and CORRECTIVE ACTION blocks.
11. IPI.
12. Enter in the CORRECTIVE ACTION block of the original discrepancy "Required IPI (insert IPI task title or IPI description or IPI step number) complied with" and enter minimum signature in the CORRECTIVE ACTION block. If more than one IPI is required to complete the task, IPI inspector must identify number of IPIs in CORRECTIVE ACTION block such as, "Three required IPIs (insert IPI task title or IPI description or IPI step number of three IPIs) complied with." If there is no room in the CORRECTIVE ACTION block, the IPI inspector documents IPI as a separate entry in the AFTO Form 781A or appropriate work package. Place the IPI(s) on a red X and reference the page and item number of each original discrepancy. In the event an IPI is performed by an IPI inspector not actively assisting in the completion of the maintenance task, the IPI will be documented in the CORRECTIVE ACTION block as "Required IPI (insert IPI task title or IPI description or IPI step number) complied with" and IPI inspector's minimum signature.
13. Document and sign off the technical order steps accomplished prior to the maintenance action(s) being stopped. Then create a subsequent entry in the AFTO Form 781A detailing the remaining open technical order steps or tasks.
14. Print first name initial and last name for each discrepancy.
15. The old and new item's serial number and aircraft operating time at time of replacement in the CORRECTIVE ACTION block.
16. Print "PCW", then "see forms dated FROM___, TO___" (from the old forms), "Page ___, Item ___," in the CORRECTIVE ACTION block of the new set of forms. Then print your minimum signature in the

CORRECTED BY block and initial over the symbol in the SYM block. A red X PCW discrepancy does not require a red X qualified individual since there is no maintenance action.

17. The maintenance technician correcting the discrepancy enters the minimum signature in the CORRECTED BY block and employee number in the EMPLOYEE NUMBER block. The inspector then enters the minimum signature in the INSPECTED BY block and employee number in the EMPLOYEE NUMBER block.

219

1. A WCE.
2. By filling in only the workcenter field on screen 380.
3. Select information based on any of 10 formats; display supply data for events that have parts on order. Display a variety of information based on the options selected; provide detailed or summary information. Select information for a single day or up to current date; select information peculiar to the PMEL “K” data. Exclude AEF information; choose AEF only information; receive screen 122 information from output.
4. The job remains open.
5. Once the work center has completed its maintenance documentation (filling out the 781 series aircraft forms).
6. Proceed to screen 907 and select “1 through 5” or “8 through 11.” Leave all other fields blank. Press ENTER or <XMIT> to process. One of the JDD screens will appear. Enter maintenance data and complete required entries. Process the transaction. A JCN should return at the top of screen 929 for all options except “5,” “10,” and “11.” These appear on the documentation screen itself. At this time, you may input the discrepancy and corrective action narratives, and select an option at the bottom of the screen.
7. Enter the 9-position event number in the year/event-ID block of screen 907 and select the appropriate action “1,” “2,” “3,” or “4.” A JDD screen appears and prompts you to fill out the necessary blocks. Press <XMIT> to complete the work order. The information is processed and a JCN returns at the top of screen 929.
8. Screen 929.
9. Egress indicator B.
10. 1377.
11. Screen 122.

220

1. The IMDS ECM subsystem.
2. F–16.
3. The cursor blinks (or the field is highlighted), and an error number displays at the bottom of the screen.
4. Individual equipment load; WUC/logistics control number table; establish job standards; individual equipment installation; Individual equipment removal; Inspection/time change; automated history entry; TCTO; canopy transparency coefficient; JDD menu; egress inquiries/reports menu.
5. They are built to take you from screen to screen automatically, so the whole job can be documented without the burdensome returns to the main JDD menu to add a workcenter event for every discrepancy.
6. By assigning the correct JST to the item.
7. Delete it from the system.
8. Screen 42.
9. Screen 257.
10. Only the installed items.

221

1. The egress section.
2. Quarterly.
3. Most components purchased by the USAF are required to have unique serial numbers, so they will not be duplicated, even in different lots.
4. Correct them as soon as possible, and ensure the discrepancies have not caused any items to go overdue.

5. Two.
6. Cross-check screen 412 against screen 469 for each part number in your database.
7. Inspection requirements and time change.
8. Events that are overdue and events that are coming due.
9. The Egress Configuration Listing.

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.

Do not return your answer sheet to AFCDA.

22. (209) You are tasked to install an F–16 canopy remover rocket motor with a lot number of OEA11J004–048. What month was this item produced?
   a. June.
   b. July.
   c. August.
   d. September.

23. (209) The effect a leap year could have on the due date of a time change item is that it may mistakenly schedule it a
   a. year late.
   b. month late.
   c. year early.
   d. month early.

24. (209) You are tasked to install an item with a date of manufacture of October 2012. The 11P-series technical order states that the shelf life for the item is 108 months. When does the item's shelf life expire?
   a. 1 October 2021.
   b. 31 October 2021.
   c. 1 September 2021.
   d. 31 September 2021.

25. (209) When should you copy the information from a new egress explosive component?
   a. Before you install the component.
   b. Before you pick the component up from munitions.
   c. After you install the component, obtain the information with a mirror.
   d. After you return to the shop, copy the information from the component's box.

26. (210) When filling out an AF Form 2005, Issue/Turn-in Request, for an issue request, if an item's national stock number (NSN) is *not* available, what must you provide in addition to the AF Form 2005?
   a. AF Form 2413, Supply Control Log.
   b. DD Form 1574, Serviceable Tag-Material.
   c. DD Form 1348–6, DOD Single Line Item Requisition System Document (Manual-Long Form).
   d. AFTO Form 350, Reparable Item Processing Tag.

27. (210) In addition to the AF Form 2005, Issue/Turn-in Request, and the condition status tag, which other form must be attached to parts turned in to supply?
   a. AF Form 2413, Supply Control Log.
   b. AF Form 601, Equipment Action Request.
   c. AFTO Form 350, Reparable Item Processing Tag.
   d. AFTO Form 349, Maintenance Data Collection Record.

28. (210) On the Air Force Technical Order (AFTO) Form 350, Reparable Item Processing Tag, a shop technician would enter the final action taken code by the area labeled
    a. DISCREPANCY, in Block 14.
    b. SHOP USE ONLY, in Block 15.
    c. HOW MALFUNCTION, in Block 5.
    d. SHOP ACTION TAKEN, in Block 15B.

29. (211) The three processes of maintenance data documentation (MDD) are collection,
    a. saving, and renewal.
    b. storage, and retrieval.
    c. processing, and retrieval.
    d. documentation, and protection.

30. (211) Which of the following is responsible for reviewing data entered into a maintenance data documentation (MDD) system on a daily basis?
    a. Workcenter and shift supervisors.
    b. Flight commanders and flight chiefs.
    c. Maintenance officers and maintenance superintendents.
    d. Production superintendents and squadron commanders.

31. (211) To evaluate/isolate/eliminate documentation problems in the Integrated Maintenance Data System (IMDS), every unit must establish a
    a. data integrity team.
    b. maintenance documentation group.
    c. maintenance accuracy integrity team.
    d. quality assurance maintenance data documentation system inspector.

32. (212) What is the intended use of the maintenance data documentation (MDD) system at base level?
    a. Provide information feedback to base managers and supervisors for controlling the maintenance operation.
    b. Provide information to manage various programs established by the Air Force and major command regulations and manuals.
    c. Minimize the computer space required to store the data, streamline data entry and allow computer processing in the analysis of the data.
    d. Tie together all on- and off- equipment actions, expended employee hours, and failed parts replaced in satisfying a maintenance requirement.

33. (212) Which is a specific use of the maintenance data documentation (MDD) system at *off-base* level?
    a. Operational schedule information for operations requirements established on a calendar basis.
    b. Maintenance of the actual configuration as it pertains to serial tracked and time change items.
    c. Provide information to manage various programs established by the Air Force and major command regulations and manuals.
    d. Equipment maintenance schedules and inventory information for maintenance requirements established on a calendar basis.

34. (213) Which is an example of off-equipment maintenance?
    a. Removing an ejection seat from an aircraft.
    b. Installing a parachute on a seat installed in an aircraft.
    c. Removing a parachute from an ejection seat installed in an aircraft.
    d. Installing an inertia reel on a seat that has been removed from an aircraft and taken to a shop.

35. (214) The three key data elements used to authorize and control maintenance and provide production credit information for work completed are
    a. job control number (JCN), workcenter code, and document number.
    b. document number, workcenter code, and identification (ID) number.
    c. JCN, workcenter code, and ID number.
    d. document number, JCN, and ID number.

36. (214) A work center with training equipment *not* assigned to maintenance but requiring maintenance support would be
    a. an owning work center.
    b. a reporting work center.
    c. a performing work center.
    d. a non-reporting work center.

37. (214) What consists of five characters and is used to identify equipment on which maintenance was performed or from which an item was removed?
    a. Workcenter code.
    b. Document number.
    c. Job control number.
    d. Identification number.

38. (215) The part of a job control number (JCN) representing the sequential day is the
    a. last four characters.
    b. last five characters.
    c. first four characters.
    d. first five characters.

39. (215) If you find two unrelated discrepancies on the same piece of equipment, what is the best way to use a job control number (JCN)?
    a. Each discrepancy will have its own JCN.
    b. Different work centers will be assigned to the same JCN.
    c. Use the same JCN, but with no sub-workcenter events assigned.
    d. Different workcenter events will be assigned to the same JCN.

40. (215) During which inspection would you use the same job control number (JCN) as the inspection to document a discrepancy?
    a. Daily inspection.
    b. Major inspection.
    c. Preflight inspection.
    d. Basic postflight inspection.

41. (216) Which maintenance includes all of the known or predictable requirements that can be planned or programmed to be completed on a long- or short-range schedule?
    a. Scheduled.
    b. Discrepancy.
    c. Unscheduled.
    d. Immediate action.

42. (217) In order to provide records of maintenance, inspection, service, configuration, and flight records, we use the Air Force Technical Order (AFTO) form series
    a. 349.
    b. 350.
    c. 780.
    d. 781.

43. (218) The individual responsible for ensuring all applicable in-process inspections (IPI) were completed for a task is the
    a. shift supervisor.
    b. flightline expediter.
    c. quality assurance inspector.
    d. technician who clears the original discrepancy.

44. (218) On the Air Force Technical Order (AFTO) Form 781A, Maintenance Discrepancy and Work Document, how are facilitate other maintenance (FOM) discrepancies documented?
    a. In the discrepancy block of the original discrepancy.
    b. As separate entries and with the appropriate red symbol.
    c. In the AFTO Form 781E, Accessory Replacement Document.
    d. There is no need because they are included in the steps in the technical order.

45. (219) In the Integrated Maintenance Data System (IMDS), how many units would an egress journeyman take to clear a *phase* inspection discrepancy?
    a. 0.
    b. 1.
    c. 2.
    d. 3.

46. (219) In the Integrated Maintenance Data System (IMDS), what should you do after you hit <XMIT> on Screen 929, Create/Correct Narrative?
    a. Process a Screen 914, On-Equipment Maintenance, to take one unit of labor.
    b. Process a Screen 917, Off-Equipment Maintenance, to take one unit of labor.
    c. Write a brief, thorough description of the maintenance performed in the narrative field.
    d. Complete a maintenance snapshot inquiry on screen 122 to ensure work order has closed out.

47. (220) Within the Integrated Maintenance Data System (IMDS), to find out what egress system items are installed on a canopy, you use screen
    a. 225, Egress Inquiry/Reports Menu.
    b. 257, Egress Configuration List.
    c. 259, Canopy Transparency Coefficient List.
    d. 842, Egress Time Change Forecast Inquiry.

48. (221) In the Integrated Maintenance Data System (IMDS), you can enter a part number to generate a report that lists all components in the database with that part number by using screen
    a. 412, Part Number/Serial Number Inquiry.
    b. 352, ILS-S Parts Turn-around Transaction.
    c. 347, ILS-S Inquiry by Stock Number, Document Number or Part Number.
    d. 42, Part/Serial Number Load/Change/Inquiry/Delete.

49. (221) In the Integrated Maintenance Data System (IMDS), you can produce a listing of all part/ serial numbers assigned to a particular job standard (JST) using screen
    a. 625, Job Qualification Standard Screen.
    b. 469, Job Flow Package Inquiry.
    c. 466, Job Flow Package Load.
    d. 412, Part Number/Serial Number.

50. (221) On the planning requirements document (PRA), you would find overdue time changes on part
    a. 1.
    b. 2.
    c. 3.
    d. 4.

Please read the unit menu for unit 3 and continue ➔

Student Notes

Unit 3. Inspections, Ejection Seat Components, and Seat Theory of Operations

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MANY OF US have had the unfortunate experience of having our car break down on the highway. Beyond the inconvenience of being stranded short of our destination, we have found that car troubles on the road are often costly as they say roadside mechanics have “cash register eyes.”

Usually, you can avoid costly repairs and the resulting inconvenience by taking care of your car. If you perform routine maintenance, or take your car to a good garage for regular checkups, you can avoid most breakdowns on the road. However, if a breakdown does occur, you can get out and walk.

If an aircraft “breaks down” while in the air, it can be hazardous and perhaps fatal for its occupants. Failure of aircraft parts and equipment can be very costly, in terms of both human life and dollars. A modern aircraft truly flies much like a brick when it has total engine failure during flight. Parachutes can often save pilots and passengers, but not an aircraft. Therefore, let’s prevent malfunctions before they happen. If certain parts are known to wear out after so much use, why not replace them at scheduled times before they have a chance to fail. This is precisely what the Air Force system of inspection and preventive maintenance does.

Sometimes malfunctions occur on the end item or component regardless of how effective your inspection program may be. Malfunctions that occur because of faulty workmanship during manufacture, repair, modification, or maintenance are termed quality deficiencies. Report these quality deficiencies in a timely manner so appropriate action can be taken. This ensures high standards are maintained on end items or components. How well these systems work depends almost entirely on how well you fulfill your duties.

To become familiar with the aircraft inspection methods and materiel deficiency reporting procedures, you need to understand the objectives and breakdown of the maintenance and inspection system.

3–1. Inspections

The Air Force has used and refined three basic inspection concepts since the 1960s. In 1978, a fourth concept, programmed depot maintenance (PDM), was added. Today, there are currently five authorized inspection concepts used for aerospace vehicles:

- Periodic.
- Phase.
- Isochronal (ISO).
- Aerospace vehicle manufacturer.
- PDM.

The MXG/CC establishes the necessary controls to assure that the periodic, phase, or ISO inspections are accomplished at or near the scheduled due time. The single manager (SM) will, in coordination with the using agency, schedule the PDM inspection at, or prior to, the scheduled due time. The –6 inspection workcards may include varying calendar inspection periods (7-day, 14-day, etc.) as determined by the weapon system SM and MAJCOM. Inspections for support and training equipment include servicing, operator, special, periodic, acceptance, transfer, and WRM/mobility inspections.

The Air Mobility Command (AMC) predominantly uses the ISO concept to better accommodate aircraft scheduling. The Air Combat Command (ACC) inspects most of its assigned aircraft under the phase and periodic concept. The phase concept keeps an aircraft out of commission for the shortest period. Regardless of the inspection concept used at your base, all aircraft fall under the PDM concept.

There will be times, when you find yourself extremely knowledgeable on what to inspect for each type of inspection. Complacency is probably the number one reason for many of the mishaps you will encounter as an egress maintainer. Remember to follow technical data no matter how well you know a task. When you sign off an inspection, you are claiming responsibility that the system will perform as designed. In the unfortunate event the egress system is needed and fails, because you decided to skip a few steps that could be considered criminal negligence and you would most likely end up like the inspector in the following photograph (fig. 3–1). Not following guidance will not only put other lives as risk but it will also put your way of life at risk.

Figure 3–1. An egress 7-level inspector facing possible negligent homicide charges.

222. Inspection concepts

As mentioned previously, the Air Force has five authorized inspection concepts: periodic, phase, ISO, aerospace vehicle manufacturer, and PDM. These inspections are listed in detail in TO 00–20–1. Each SM determines minimum scheduled inspection requirements for each type of aircraft, and the requirements are published in the applicable –06 technical order. This section lists the basic sub-elements for the periodic, phase, ISO, and PDM.

Periodic

Periodic inspections are due upon accrual of the number of flying hours, operating hours, or at the expiration of a calendar period specified in the applicable MDS –6 technical order. The basic sub-elements for the periodic inspection concept are as follows:

- Preflight.
- End of runway (EOR).
- Thru-flight.
- Basic postflight (BPO).
- Hourly postflight (HPO).
- Combined preflight/BPO or preflight/thru-flight.
- Periodic.

Phase

Phase inspections are cumulative for the life of an aerospace vehicle. The number of the next due phase inspection should be the same as the number obtained by dividing the aerospace vehicle hours at which the next phase inspection is due by the hourly inspection interval. The number obtained may vary from the actual phase number due because of transfers and premature or overdue flying hour inspections. Phase inspections are accomplished upon accrual of the number of flying hours specified in the applicable MDS specific –6 technical order and maintenance manual. Sometimes phases are accomplished in advance to cover periods of upcoming missions. The basic sub-elements for the phase inspection concept are as follows:

- Preflight.
- EOR.
- Thru-flight.
- BPO.
- Combined preflight/BPO or preflight/thru-flight.
- HPO.
- Phase.

Isochronal

The ISO inspection concept translates flying hour utilization rates into calendar periods, usually expressed in days. The AFMC SM ensures the calendar period is properly established to meet maintenance and engineering requirements. In the event programmed flying hours are changed, the inspection interval is adjusted as specified in the MDS specific –6 technical order. The basic sub-elements for the ISO inspection concept are as follows:

- Preflight.
- EOR.
- Thru-flight.
- BPO.
- Combined preflight/BPO or preflight/thru-flight.

- Home station check (HSC).
- Minor.
- Major.

Programmed depot maintenance

The PDM is an inspection requiring skills, equipment, and facilities beyond your normal duties. Individual areas, components, and systems are inspected to a degree beyond the –6 requirements. It applies to all aircraft regardless of whether they are under the periodic, phase, or ISO concept.

223. Basic scheduled inspections

Preflight, EOR, thru-flight, and BPO are the basic scheduled inspections common to the periodic, phase, and ISO concepts. The main purpose for all four of these inspections is flight stability, suitability, and preparedness. Each inspection examines certain systems, subsystems, and components to ensure that defects or hazards do not exist that would interfere with the safe operation of the aircraft.

Preflight inspection

The preflight inspection, as the name implies, is a flight preparedness check. It is required before the first flight of a specified flying period, which is determined by the MAJCOM. The inspection consists of a visual inspection and an operational check of certain systems and components to ensure that no defects exist that could abort missions or cause accidents. A preflight inspection is mandatory at the following times:

- Prior to the first flight of a specified flying period.
- When the preflight validity period has expired.
- When the preflight validity period is 72 hours and the aircraft has not flown within 48 consecutive hours.

MAJCOMs, in conjunction with the aircraft SM, have the option of selecting a 24-, 48-, or 72-hour preflight validity period.

End of runway inspection

The EOR inspection is a final visual inspection and/or operational check on some aircraft systems and components just before takeoff. The purpose of the inspection is to detect critical defects, which might have developed or become apparent during ground operation of the aircraft. The inspection normally includes such items as the following:

- Cuts in tires.
- Leak in fluid system.
- Landing gear downlocks.
- FOD covers, removal of safety pins.
- Any last minute security checks of aircraft panels and closed doors.

Thru-flight inspection

The thru-flight inspection is designed for use on cargo aircraft used for regular airline-type operations. It is, however, applicable to any aircraft for which an immediate turnaround or a continuation flight is scheduled. This inspection is performed prior to takeoff at intermediate stops for refueling or other normal requirements. The aircraft is checked visually to determine if there are defects that could impair flight safety. The scope of the thru-flight is governed by the inspection concept under which the aircraft is maintained.

Basic postflight inspection

The BPO inspection is performed after the last flight of a specified flying period. This inspection consists of checking the aircraft to determine whether it is suitable for another flight. A visual examination of certain systems and components is made to ensure that no defects exist which would be detrimental to flight safety.

Maintenance is not obligated to perform the BPO until operations releases the aircraft. Since operations has not released the aircraft, if an aircraft lands to change pilots or other crewmembers, or if an aircraft makes a brief stop with the crew staying in the immediate area of the aircraft, the BPO is not necessary. The BPO inspection is a more thorough check than the preflight or the thru-flight inspections.

224. Scheduled inspection characteristics

Of all the inspection concepts, only two concepts have inspections based on the accrual of a number of flying or operating hours specified in the –6 technical order. These inspections are the HPO inspection and periodic inspection from the periodic concept and the phase inspection from the phase concept. As an egress journeyman, most of your scheduled maintenance will be performed during the periodic and phase inspection.

Hourly postflight inspection

The HPO is performed after a specified number of flying hours have accumulated. It consists of checking certain component areas and systems of the aircraft to make sure that no conditions exist that could result in failure of the part before the next scheduled inspection. This inspection augments the BPO. In fact, often the BPO is done at the same time. The due time for all HPO inspections is determined at the completion of each periodic inspection. Egress journeymen are sometimes required to perform certain parts of these inspections. Compared to a periodic inspection, in an HPO inspection your role is minor. Normally, in the hourly inspection, ejection seats are not removed, but you will inspect such items as the following:

- Inertia reels and lap belts for wear and proper operation.
- Seats and components for cleanliness and corrosion.
- Ejection controls for proper identification.
- Explosive items for time changes coming due.

Periodic inspection

The periodic inspection is a more extensive inspection than the HPO or BPO inspections. In addition to the same inspection items required during the HPO and BPO, the periodic inspection includes certain other parts, areas, and systems of the aircraft. Because of each of their functions, these parts, areas, and systems require inspection less frequently than the HPO or the BPO are performed. A good example is the egress system. Normally, egress components such as seats and jettison systems are given a complete check during a periodic inspection. Seats are removed from the aircraft, disassembled, cleaned, and painted. Each component is inspected carefully using applicable technical data. Items failing to meet technical order criteria are repaired or replaced, and the new or repaired items are again checked against technical order procedures. Nothing is left to chance. This is a very thorough inspection, and the entire aircraft is examined in much the same way as the egress system. The periodic inspection is due when the specified number of flying hours or calendar time has expired.

Phase inspection

The phase inspection is a combination of parts of the BPO, HPO, and periodic inspection requirements. These packages have approximately the same work content and clock hours. Lumping these three inspections into one would make an inspection that requires an extremely long time to complete. Therefore, this inspection is broken into parts or phases. The amount of flying time accrued between phases depends on the aircraft and its use. For example, in a phase inspection cycle having a 50-hour inspection interval, 12 inspections are done during the 600-hour cycle. Phase 1 is due at 50 hours, phase 2 at 100 hours, phase 3 at 150 hours, and so on until the cycle is complete at 600 hours with phase 12; then the cycle starts all over at 650 hours with phase 1.

When aircraft are required for extended missions and are under the phase inspection concept, the required number of phase packages may be performed in advance to cover the period of the extended mission. One of the main objectives of the phase inspection is to reduce the time the aircraft is out of commission for any given inspection. The phases are arranged in such a manner that each requires approximately the same number of man-hours. This arrangement permits all inspection requirements to be met with a short out-of-commission time for any one phase.

If you happen to be the time change monitor for your section, it would be a good idea to get as much egress maintenance scheduled as possible during the phase inspection. Chances are good that egress will have to remove the seat for other maintenance sections to perform their cockpit maintenance that could take several days.

225. Isochronal inspection concept

Unlike the phase and periodic inspection concepts, which use flying time as the basis for scheduling inspections, the ISO system uses specified calendar intervals on which to build a schedule for inspections expressed in days. The three inspections included in the ISO inspection system are the following:

- Major inspection.
- Minor inspection.
- Home station check.

Major inspection

The major inspection is due on the accrual of the number of calendar days as specified in the applicable –6 scheduled inspection and maintenance requirements manual. This date is computed from the programmed start date of the last major inspection. It is a thorough "look, see, and fix" of the weapon system, and each of the requirements may be more extensive in scope than for past inspection items. The inspection consists of checking certain parts, areas, and aircraft systems, which, because of their roles, require less frequent inspection than that required by other inspections; therefore, it is far more in-depth than the minor inspection. It is performed to determine if a condition exists that, if not corrected, could result in failure of a part, or cause a system malfunction before the next scheduled inspection. The major inspection is performed at the end of the mission during which the specified number of days have accrued.

Minor inspection

The minor inspection is due upon the accrual of the number of calendar days specified in the applicable –6 inspection manual. It consists of checking certain components, areas, or systems of the aircraft to ensure that no conditions exist that could result in failure or malfunction before the next scheduled inspection. The minor inspection is performed when the specified calendar days are accrued and computed from the post dock of the last ISO inspection.

Home station check

The HSC is an inspection arranged and designed for accomplishment upon expiration of a specified short-term calendar interval. The HSC is a combination inspection of former BPO and HPO items. This inspection is due at the calendar interval specified in the MDS specific –6 technical order. Send HSC schedule deviation requests to the lead command functional manager. Units will not request an HSC deviation unless the deviation exceeds the overfly authorized by the MDS specific –6 technical order (if applicable). Since the HSC is an integral part of the ISO concept, the due date is computed from the completion of the last HSC/ISO inspection. This inspection is accomplished in conjunction with minor and major inspections.

226. Other inspections

Other inspections that do not fall under the previously mentioned concepts include the following:

- Calendar.
- Transfer.

- Acceptance.
- Special.
- Time replacement item inspections.

Calendar inspections

Calendar inspections consist of 30-day and 90-day inspections. If an aircraft does not fly or is out of commission for longer than these calendar periods, maintenance personnel must still perform the specified inspections required. Aircraft in PDM do not require the 90-day inspection if all the 90-day requirements have been accomplished as part of the PDM contract, and 90 days has not elapsed since they were done. For aircraft that have not flown for at least 30 days, they become “hanger queens.”

Transfer inspections

The losing unit—prior to transfer of an aircraft from one USAF unit to another— performs transfer inspections. Transfer inspections do not apply to aircraft on loan. The transfer inspection may be performed by PDM if the aircraft is to be transferred while in depot.

Acceptance inspections

Maintenance personnel from the gaining unit perform these inspections on all newly assigned aircraft and sometimes when received from undergoing depot level maintenance. During these inspections, they examine the aircraft thoroughly to determine whether it is mechanically fit for flight, if its –21 equipment set (FOD covers, etc.) is complete, and if the supporting documents are complete. During an acceptance inspection, depending on guidance listed in TO 00–20–1, egress technicians ensure all parts of the egress system are serviceable and accounted for by correct part number, serial number, and lot number as applicable.

Special inspections

The –6 technical order contains a section dedicated to special inspections. These differ in that only one part of the aircraft requires the inspection. ACES II and some components found on other egress systems require inspections that fall into this category. Maintenance personnel perform special inspections on the following occasions:

- On the accrual of a specific number of flying hours of operation.
- Following the lapse of a specific calendar time.
- After the occurrence of a specific or unusual condition. For example, on the F–16, if the recovery parachute is wet or even suspected of being wet, aircrew flight equipment (AFE) must repack the chute**.**

Normally, maintenance personnel perform hourly or calendar requirements of the special inspections along with the next BPO or phase inspection, such as HPO or periodic (if the periodic system is used), whichever is appropriate.

Replacement schedule

The –6 technical order also contains a section entitled “Replacement Schedule.” This section lists equipment that must be replaced when a specified limit is reached (e.g., a certain number of flying hours or calendar days, and/or following the occurrence of a specific condition). The hourly and calendar requirements, when due, are added to the nearest phase, HPO, or periodic inspection. Good management dictates they be changed at the closest scheduled inspection so they do not go overdue. However, when an egress item is due, it must be changed and is never left until the next scheduled inspection.

227. Special inspections

In this lesson, you will study a few other types of inspections, or special inspections such as on the ACES II, that you will undoubtedly perform. Whether you are inspecting or assisting, knowing what to look for can make the difference between success and failure in an ejection, and consequently, life or death.

ACES II seat visual inspection

A seat visual inspection is performed anytime an ACES II or Martin Baker seat is removed from an aircraft (fig. 3–2). For most ACES II seats, it is often referred to as a "5–8 inspection" since the procedures are located in paragraph 5–8 of TO 13A5–56–11, *Operation and Maintenance Instructions with Illustrated Parts Breakdown - Escape System Assemblies*. This inspection is designed to catch defects in the ejection seat that have developed due to wear and tear, or other damage, since the last inspection. The visual inspection is a thorough, searching, *nondestructive* inspection of the seat and all of its components. In other words, you inspect every visible area of the seat, but you are not expected to disassemble the seat to perform the inspection. Items failing to meet minimum acceptable standards must be repaired or be replaced. This inspection is not intended to cover every situation or possible discrepancy you could find. However, if you are familiar with the correct configuration of the seat, proper use of hardware, and effective general maintenance techniques, the technical order will help you produce a high-quality product every time.

Figure 3–2. Airman performing a visual inspection on the ejection seat.

If you are assigned to an area with high humidity or other conditions that could contribute to corrosion, your unit may elect to perform a more in-depth inspection. Likewise, if you are assigned to an area, which has frequent high winds, you may be required to perform a more in-depth inspection to ensure windblown debris will not cause a component to malfunction.

Martin Baker seat visual inspection

Just like the 5–8 inspection for the ACES II seat, the inspection on a Martin Baker seat like those used in T–38s and F–35s receives a visual inspection every time the seat is removed and again prior to installation. You will inspect all metal parts for corrosion and foreign objects, nicks, cracks, scratches, and other damage that might cause failure or malfunction of a component.

Pay particular attention to the magnesium components on the seat. This metal is highly susceptible to corrosion because of the electrochemical activity. If the protective coating exposes the alloy, corrosion will most likely occur due to the exposure. The magnesium parts of the seat include the headrest, handgrip handles and triggers, seat leg brace and covers, and the seat back.

Another thing critical thing to remember about the Martin Baker seat is that any time a ballistic hose is removed for other maintenance, inspect it for deterioration, chafing, cuts, damage to braids, and end fittings. If any of these defects are found, the hose should be replaced. Unlike an ACES II seat, there is no recovery sequencer with P-leads branching out to all the components.

F–16 canopy inspection

The F–16 canopy inspection is a complete and thorough inspection that requires minor disassembly of the canopy. To perform this inspection, you must remove panels to gain access to various components. It is performed every 36 months and as directed by local operating instructions. The purpose of this inspection is to verify the integrity and proper installation of canopy components, and ensure that explosive items have not exceeded their service/shelf life. While performing the inspection, ensure that components, hardware, links, and cables are not corroded or damaged and are adjusted properly. You must also use a prism to check for cracks around bolt holes, which would otherwise not be visible. Even though the –6 technical order directs this inspection be performed every 36 months, it is good preventative maintenance discipline to perform a canopy inspection whenever the canopy is removed from the aircraft; the same could be said for F–22 canopies. Last thing supervision wants to hear, is that while installing a canopy you just found something broken after the canopy was sitting in your shop for a week. It is best to find all discrepancies on day one.

Sometimes egress personnel are called to the flight line if the pilot has visibility issues with the transparency. When evaluating the transparency, always follow guidance in TO 16W2–5–2, *Canopy Assembly*. Polish objectionable scratches and abrasions in an attempt to make them more acceptable. However, if polishing does not make the transparency acceptable to the pilot, he or she has the final word and it usually results in replacement.

Cartridge actuated device/propellant actuated device inspection

The CAD/PAD is an inspection of the explosives installed in the aircraft’s egress system. This inspection is designed to verify the serial number, part number, lot number, and location of the explosives. The inspection determines if the components recorded in the IMDS and the supporting documentation (in the case of an acceptance inspection) are actually installed in the aircraft. It also verifies whether any explosives are “overdue time change.” Normally, the CAD/PAD inspection is performed when an aircraft returns from depot, on newly assigned aircraft, during major inspections, and whenever the egress system’s integrity is in question. Normally, 100 percent verification is required on newly assigned aircraft, and those returning from depot. Some aircraft, such as the B–1 and B–2, may receive only 25 percent verification as determined by the MAJCOM.

36-month inspection

For most ACES II airframes, the ejection seat scheduled inspection interval is 36 months. It must be completed no later than 36 months after the last inspection; that means before the first day of the 37th month. Scheduled inspections on the seat include a visual inspection and functional tests of certain components. As with the visual inspection, items failing to meet visual inspection and functional testing criteria must be repaired or replaced.

To avoid firing the ejection initiators, ensure the safety pin assembly is installed properly and the ejection control lever is up in the locked (safe) position before performing any maintenance on the seat. Also, to prevent accidental firing of other ballistic components, verify the seat is grounded at one of the authorized grounding points. The only authorized seat grounding points are the interdictor striker and the restraint release bellcrank. The following is a list of components that require functional testing during the 36-month inspection:

- SEQUENCE START switch.
- Emergency manual parachute deployment handle.
- Environmental sensor.
- Firing control handle(s).
- Ejection control safety lever.

In addition to testing the previous items, several tests must be performed on the pitch stabilization control assembly. This includes a visual inspection, a magnification inspection (to inspect for potential cracks), and a dye penetrant inspection (if cracks are suspected). The drogue parachute also requires a repack, so make sure you coordinate with aircrew flight equipment early in the inspection to make sure you do not interrupt the maintenance schedule

The 36-month seat inspection takes time to perform correctly. You may be tempted to “cut corners” or skip certain steps outlined in the technical data. However, you must remember that the aircrew depends on your integrity. In fact, they literally trust you with their lives. It is up to you to make sure that the seat will function as designed. To do this, you must know your job, strictly adhere to technical data, and ensure your coworkers do the same.

In-process inspection

An IPI is an additional inspection or verification step at a critical point in the installation, assembly, or reassembly of a system, subsystem, or component. The key phrase in that statement is “critical point.” This phrase indicates the technician is at a point in the maintenance process that requires paying particular attention to what is being done. This is usually because a task is performed that cannot be inspected after completion, such as when a panel or door is being closed, which will prevent inspection of the work done inside.

These inspections are directed locally, by the technical order, or by your MAJCOM. The special certification roster identifies the qualified personnel who must accomplish these inspections. The lead command for that aircraft determines minimum IPI requirements and incorporates these requirements into applicable technical orders. Maintenance supervision compiles a list of squadron tasks requiring IPIs not identified by technical data. The list includes:

- WUC.
- Nomenclature.
- Specific technical order, paragraph, and step number within the technical order task where the IPI will be called.

When the squadron develops the IPI list, QA is consulted to determine if there are problem areas that continually warrant extra supervisory attention. Squadrons submit their on- and off-equipment lists to QA. If the MXG/CC approves the recommendations, then they are published as an official IPI listing. IPIs are reviewed annually; the list may have items added to it, or if an item is no longer a concern, it may be deleted.

NOTE: Some IPIs are directed by applicable tech data already and not required to be included in the local listing.

The IPI due is documented in the discrepancy block of the original discrepancy or as a separate entry in the AFTO Form 781A, Maintenance Discrepancy and Work Document, AFTO Form 244, Industrial/Support Equipment Record, or appropriate work document and in IMDS. If the IPI is a separate entry in the AFTO Form 781A or AFTO Form 244, the IPI is placed on a red X. When an IPI is a separate entry, the compliance is documented in the CORRECTIVE ACTION block of the AFTO Form 781A and signed in the INSPECTED BY block. The original discrepancy must reference the page and item numbers of the IPI entries. The person performing the task enters the required IPI step and notifies a qualified IPI certifier at the appropriate step. The certifier complies with the IPI and enters his or her signature and employee number next to the IPI statement in the corrective action block. The qualified technician who ultimately clears the discrepancy ensures the IPI was completed and properly documented. For maintenance actions where a different work center is required to perform an IPI, the shop that entered the IPI in the forms creates a WCE or job for the IPI for the different work center in IMDS. The individual who signs the red X does not have to be the same as the person who signs off the IPI.

One-time inspection

As an egress journeyman, you may be tasked to perform an inspection on an explosive component or critical piece of equipment that has been damaged or improperly installed. You must understand the importance of establishing whether the damage or condition was the result of maintenance practices, abnormal wear, or a manufacturing defect.

When the same components on multiple aircraft are found to be unacceptable, it will lead a supervisor to believe there may be a trend. In order to find out whether or not there really is a trend, the MXG/CC may authorize a local one-time inspection (OTI). OTIs normally are *look-only* actions to verify the existence of suspected equipment conditions or malfunctions. If a trend is confirmed, the MXG/CC determines if there is value in sending cross-tell to the lead command for that type of aircraft. The lead command decides whether to alert the rest of the Air Force. If so, every unit that maintains that type of aircraft or equipment must be notified of the findings so they can inspect their equipment.

OTIs are processed and managed by MAJCOM, numbered Air Force (NAF), and local organizations using the same procedures as a TCTO issued from the air logistics complex (ALC). Headquarters, NAF, or MXG/CCs may initiate OTIs. They are identified by a data code consisting of a unique alpha prefix (“J” for MAJCOM, “N” for NAF, and “L” for local) and a six-digit sequence number. For local OTIs, the six remaining characters identify the originating wing, year issued, and a sequence number (e.g., L181401, L for local OTI, 181 for 181FW, 4 for the year 2004 and 01 for the first in the sequence). For MAJCOM and NAF OTIs, the six remaining characters identify the year, month of issue, and a sequence number (e.g., J/N 812010 equates to the 10th MAJCOM/NAF OTI issued during December 1998). The data code is used to report and control OTI compliance.

Minimum contents include statements of the following:

- Title.
- Applicable equipment.
- Date OTI was issued.
- Data code.
- Type or category (i.e., immediate, urgent, routine action).
- Background, purpose, or reason.
- Compliance period.
- Remove from service date.
- Rescission date.
- By whom to be accomplished (Air Force specialty code [AFSC] and man-hours required).
- Tools required.
- How work is to be accomplished (gives detailed and specific step-by-step instructions).
- Operational checks (technical order references listed if required to verify operational status).
- Record actions.

- Compliance reporting (MAJCOM may require periodic status).
- Office of primary responsibility (who drafted the OTI, including name and telephone number).

228. Inspection management

The procedures that follow provide a common approach to inspection management. Personnel, facilities, and equipment adequate to carry out the programmed workload to support the inspection must be in place before the inspection begins.

Personnel

The skill and teamwork of personnel performing the inspection determine the quality of the inspection and maintenance. To aid in developing efficient teams, individual training and inspection team proficiency must be considered.

Individual personnel must be skilled in inspection procedures and techniques. In this regard, on-the-job training of 3-skill level Airmen as additional team members provides a valuable means for upgrading inspection skills and techniques. The more skillful team members are the fewer of them will be needed to complete the inspection.

Inspection team proficiency must be maintained. Initially, an individual must be trained to inspect a specific area. After individuals have developed proficiency in a particular area, they must be trained in other areas until they are qualified in all areas of the aircraft. With multiple personnel skilled in inspecting multiple areas of the aircraft, the team will work efficiently and smoothly.

Facilities

The facilities available to the inspection unit depend on the location of the unit and the type of aircraft assigned. Selected facilities should have adequate heat, illumination, ventilation, and communications.

Equipment

To perform inspections efficiently, you must have the required tools and equipment. To minimize delays, each inspection section should have access to the following items:

- Applicable –6 inspection workcards and technical orders (including WUC manuals).
- Adequate hand tools and special tools, including grease guns.
- Bench stock and petroleum products required for servicing.
- A card bin for controlling inspection workcards.

Inspection phases

Carry out an inspection according to a basic plan broken into four phases. Most aircraft maintenance (especially inspections) is performed in these four phases:

1. Pre-inspection phase.
2. Look phase.
3. Fix phase.
4. Post inspection phase.

Pre-inspection phase

The pre-inspection phase consists of a pre-inspection (or pre-dock) meeting, aircraft preparation, and inspection area preparation. Personnel from PS&D, maintenance supply liaison (MSL), and representatives from the aircraft maintenance squadron (AMXS) maintenance flight attend the pre-inspection meeting. The discussions focus on what can be accomplished reasonably within the time allotted. The requirements for performing maintenance (e.g., TCTOs, TCIs, and delayed discrepancies), as well as supply support, are also discussed. The aircraft should be washed in preparation for inspection. The inspection area must be clean, and the necessary equipment and tools must be available.

Look phase

The look phase follows the pre-inspection phase and consists of an inspection of the aircraft according to the applicable –6 inspection manual and workcards. All write-ups found are documented and given to the supervisor or coordinator for preplanning the work to be done.

Fix phase

The fix phase may be started before the look phase is completed, but should not interfere with the look phase. The fix phase consists of maintenance actions to correct write-ups found on the look phase and to close out the preplanned maintenance identified and scheduled during the pre-inspection phase.

Post-inspection phase

The post-inspection phase starts when the fix phase is completed; however, it may be started earlier if so directed by maintenance control. This phase consists of the following:

- Performing operational checks according to the applicable –6 inspection workcards and technical orders.
- Preparing the aircraft for functional check flight (FCF), when applicable.
- Correcting write-ups found on post-inspection checks and those found after the FCF.

The inspection phases you have studied apply to the aircraft inspection section. Implement these procedures into how you accomplish your major seat inspections.

Self-Test Questions

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

222. Inspection concepts

1. What publication covers the Air Force’s inspection concepts?

2. Match the type of inspection concept listed in column B with its description in column A by writing the correct letter in the blank space provided. Descriptions in column B may each be used once.

Column A	*Column B*
____ (1) Translates flying hour utilization rates into calendar periods, usually expressed in days.	a. Phase.
____ (2) Due upon accrual of number of flying hours, operating hours, or expiration of calendar period.	b. Periodic.
____ (3) Requires skills, equipment, and facilities beyond your normal duties.	c. Isochronal.
____ (4) Accomplished upon accrual of flying hours.	d. Programmed depot maintenance.

223. Basic scheduled inspections

1. What are the main purposes of basic scheduled inspections?

2. Match the type of inspection listed in column B with its description in column A by writing the correct letter in the blank space provided. Descriptions in column B may each be used only once.

Column A	*Column B*
____(1) Applicable to any aircraft for which an immediate turnaround or continuation flight is scheduled.	a. Preflight inspection.
____(2) Final visual inspection just before takeoff.	b. Thru-flight inspection.
____(3) Performed after the last flight of a specified flying period.	c. End of runway inspection.
____(4) Flight preparedness check.	d. Basic postflight inspection.

3. When are preflight inspections mandatory?

4. Under what circumstances is a BPO inspection not required?

224. Scheduled inspection characteristics

1. What two inspection concepts have inspections based on the accrual of a number of flying or operating hours specified in the –6 technical order?

2. What are the three inspections under those two concepts?

3. What inspection does the HPO inspection augment?

4. What would an egress journeyman inspect during an HPO inspection?

5. During what type of inspection would an egress system be given a complete check?

6. When aircraft are required for extended missions and are under the phase inspection concept, how can phase requirements be met?

225. Isochronal inspection concept

1. When are major inspections performed?

2. When is the minor inspection date computed from?

3. When can units request an HSC deviation?

4. HSCs are accomplished in conjunction with what inspections?

226. Other inspections

1. When are calendar inspections *not* required?

2. Who performs transfer inspections?

3. What are egress technicians responsible for ensuring during an acceptance inspection?

4. Under what conditions would maintenance personnel perform a special inspection?

5. When an egress item is due time change and a scheduled inspection does not overlap with the time change due date, should the time change be held off until the next scheduled inspection?

227. Special inspections

1. Under what circumstances might you perform a more in-depth inspection on an ejection seat than the seat visual inspection prescribed by technical orders?

2. How often are F–16 canopy inspections performed?

3. When are CAD/PAD inspections accomplished?

4. What aircraft are subject to only a 25 percent CAD/PAD inspection verification as determined by the MAJCOM?

5. What components require functional testing during an ACES II 36-month inspection?

6. What tests must be performed on the pitch stabilization control assembly during an ACES II 36-month inspection?

7. Who is authorized to accomplish IPIs?

8. How often are IPI lists reviewed?

9. For maintenance actions where a different work center is required to perform an IPI, what are the responsibilities for the shop that entered the IPI in the aircraft forms?

10. Who may initiate OTIs?

228. Inspection management

1. Why is it important to include 3-skill level Airmen as additional team members on an inspection team?

2. To what equipment should inspection sections have access?

3. Match the phase of inspection listed in column A with its description in column B by writing the correct letter in the blank space provided. Descriptions in column B may be used once.

Column A	*Column B*
____ (1) Consists of aircraft preparation.	a. Fix phase.
____ (2) Consists of an inspection of an aircraft.	b. Look phase.
____ (3) Corrects write-ups found during inspection.	c. Pre-inspection phase.
____ (4) Corrects write-ups found after the functional check flight.	d. Post-inspection phase.

3–2. ACES II Ejection Seat

In this section, we discuss the ACES II system. This is the primary egress system used on most modern fighter and bomber aircraft in the Air Force inventory. Currently, there are approximately 5,000 ACES II seats being used in A–10, F–15, F–16, F–22, B–1B, and B–2 aircraft.

We first look at the major components of the typical ACES II system. We also cover the methods for ACES II theory of operation. Then, we turn our attention to three maintenance procedures you perform on the ACES II system. They are operational checkouts, cleaning and lubricating, and troubleshooting.

The ACES II is designed to provide safe escape at aircraft speeds from 0 to 600 knots and from ground level to 50,000 feet. Safe escape is achieved through special features and controlled event timing. The ACES II seat provides three modes of operation that are required to get the correct elapsed time from the start of the ejection to the recovery of the crewmember under all escape conditions. The increased performance capability of this system has greatly improved the survivability of aircrews during escape from an aircraft under adverse conditions throughout the flight envelope.

The ACES II seat system uses both conventional and advanced technology to recover the ejecting crewmember. The heart of this system lies in post-ejection, and it is at this point that all events are electronically controlled. To give you a better understanding of the ACES II system, we discuss each major component individually. After you understand what the components do, it will be easier to understand how they all work together when we discuss the theory of operation.

229. ACES II major components

Imagine you are flying an F–15 aircraft on a dark rainy night—you are 500 feet above the ground—traveling at over 10 miles per minute. Suddenly, an emergency develops—you know you must get out of that plane immediately. In a situation like this, you have to rely on the ACES II aircraft escape system for your survival. The success or failure of your ejection depends upon the reliability of the ejection equipment and on how well the egress maintainers have done their work. The failure of even one critical component could result in your death. Putting yourself in the aircrew's shoes details the importance of the work you perform as an egress journeyman. Keep this in mind as we discuss the individual major components that make up the ACES II system. In no particular order, we will get started by looking at the environmental sensor.

Environmental sensor

Figure 3–3 shows an illustration of the environmental sensor. The purpose of this device is to sense seat airspeed and altitude and supply this information to the digital recovery sequencer (DRS). Once the canopy jettisons, the environmental sensor receives airspeed input through the pitot tubes mounted on either side of the headrest.

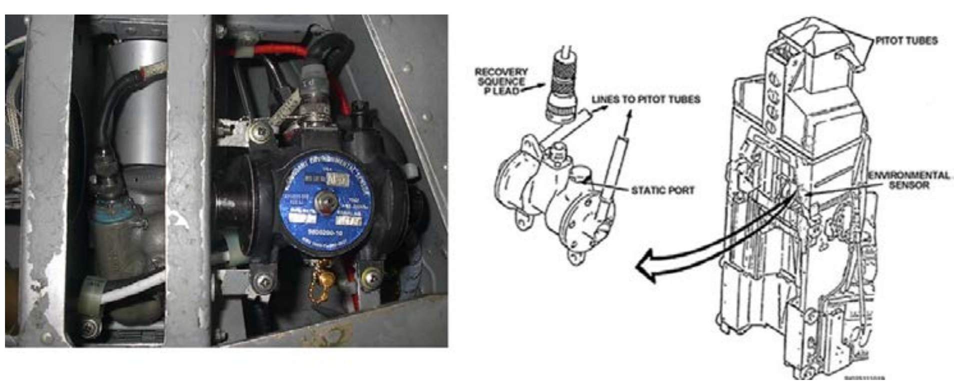

Figure 3–3. ACES II environmental sensor.

As pitot tubes sample airspeed, air pressure is sent down the flexible hoses to apply pressure to bellows on each side of the sensor unit. As pressure is applied, the bellows inflate, activating a micro-switch. The bellows activate the switch when the pressure indicates that the seat is traveling at a rate of 250 or more knots. As the switch activates, it opens a circuit.

A static port located on top of the sensor receives altitude inputs. Two sealed bellows are mounted inside the sensor unit, collocated next to micro-switches. The open static port exposes the bellows to the environment. As the seat's altitude increases, the air pressure outside the sensor decreases, and the bellows expand. The sensor is designed to activate the switches when the seat is above 15,000 feet. Activating the switch opens a circuit.

The DRS sends an electrical signal to the environmental sensor, and it interprets whatever replies it receives back. If the airspeed and altitude circuits are both closed, the DRS selects ejection Mode 1. If the airspeed circuit is open, but the altitude circuit is closed, the DRS selects Mode 2. If the altitude circuit is open, the DRS will select Mode 3. It is critical the pitot tubes and static port are kept free of obstructions so the DRS can select the proper mode of ejection.

Velocity sensor

In addition to the environmental sensor, the B–1B aircraft also uses a velocity sensor on the aft seats to prevent yaw-divergence rocket operation when aircraft speed exceeds 370 knots. The velocity sensor is located near the environmental sensor and uses the same inputs from the pitot tubes as the environmental sensor.

Digital recovery sequencer

The ACES II seats contain a DRS and it works as the brain of the ejection system (fig. 3–4). The DRS is programmable, which allows for continual improvement of its ejection sequencing and usefulness. It is also capable of recording ejection events, sort of like a "black box."

The battery, or power module, is replaceable for time changes so that egress technicians do not have to replace the entire unit, saving both time and money. It even includes mounting locations for solid-state sensors to replace the environmental sensor, should the Air Force decide to do so in the future.

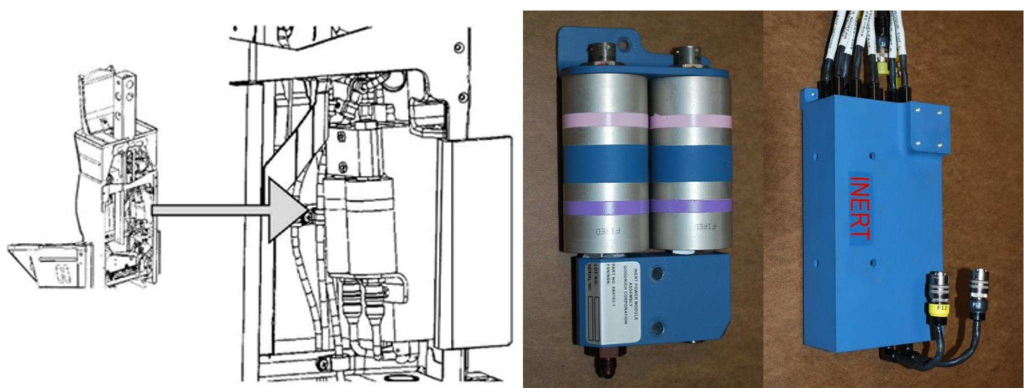

Figure 3–4. ACES II digital recovery sequencer.

The DRS contains triple redundant microcontroller circuits to interrogate and interpret pitot and static inputs that the environmental sensor sends. The inputs allow the DRS to select an ejection sequence that provides the best recovery means for the full range of escape conditions. Three modes of operation are available. The specific mode of operation picked depends on aircraft height and speed at the start of the ejection sequence. The parameters for each mode are listed:

- Mode 1 – low altitude/low speed.
- Mode 2 – low altitude/high speed.
- Mode 3 – high altitude/low or high speed.

The Electronic Module receives power from thermal batteries in the Power Module. The batteries remain dormant until turned on by ballistics pressure from the rocket catapult. The Electronic Module uses the power from the batteries to operate the timing circuits. The Electronic Module also uses the power from the batteries to provide electric initiation signals that actuate subsystem ballistic devices. The signals are applied to the subsystem devices through individual cables. The cables are part of the Electronic Module. The thermal batteries have a heat-sensitive paint stripe to indicate if the battery has been fired. The heat-sensitive paint is colored pink prior to firing the battery. The heat-sensitive paint is colored purple after firing the battery.

Initiators

The JAU–8/A25 initiators provide ballistic pressure to start the ejection sequencing system. The seat system and canopy sequencing system provide a time delay for the canopy to jettison before firing the rocket catapult. The delay between canopy jettison and firing of the rocket catapult and inertia reel initiator varies. The delay varies with speed on F–15 and F–16 aircraft (a shorter delay at higher speeds). The delay also varies between single seat and two-seat aircraft. The delay is shorter with single seat aircraft.

SEQUENCE START switch

This switch is located near the right-hand bottom of the seat and activates the time-delay circuits (fig. 3–5). As the seat moves up the rails, a striker on the rails makes contact with the switch actuating the bellcrank and briefly closes the switch activating the timing circuits, which enact one of the three modes of pre-programmed time-delays.

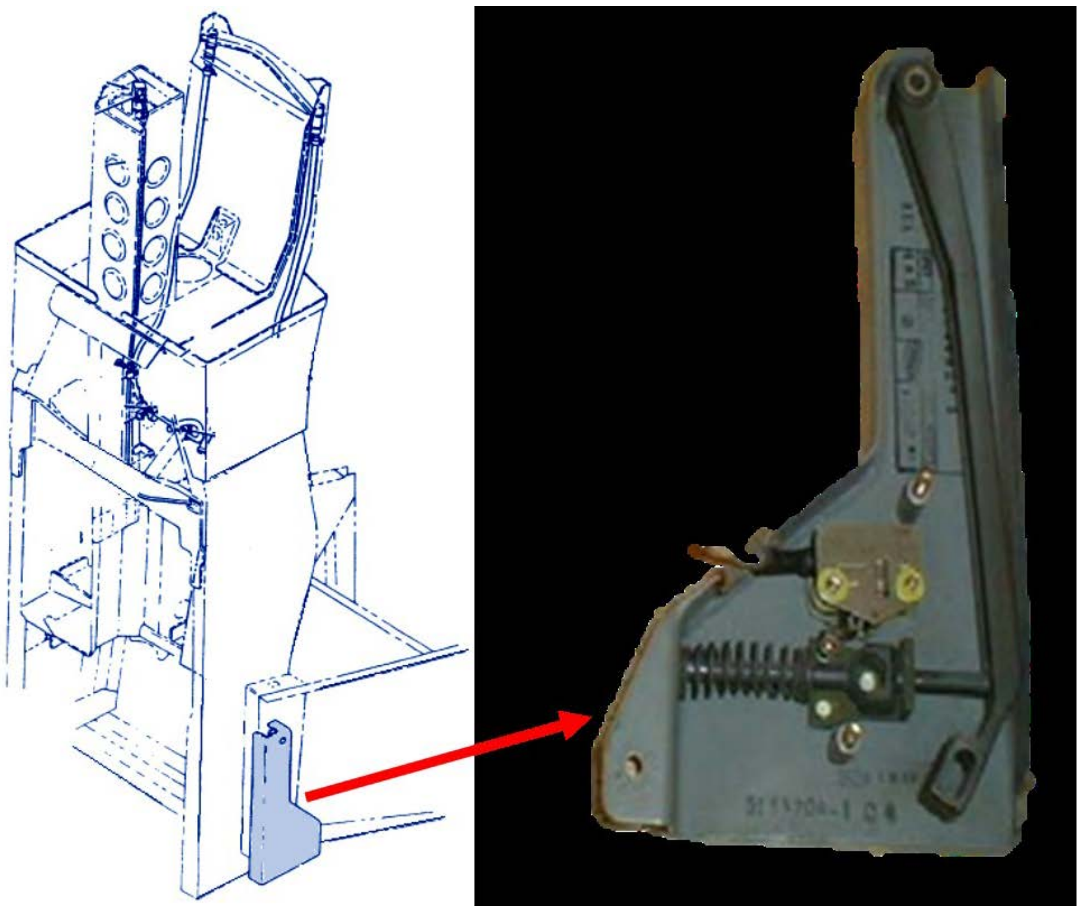

Figure 3–5. ACES II SEQUENCE START switch.

Pitch stabilization control assembly

The purpose of the STAPAC is to maintain the crewmember’s trajectory, or ejection angle, as much as possible, to prevent tumbling and becoming entangled during parachute deployment. The gyro-controlled Vernier rocket system accomplishes this (fig. 3–6). The STAPAC, mounted beneath the seat, consists of a gyroscope spin-up gas generator, a piston and rack assembly, a gyro rotor assembly, a Vernier rocket, and the Vernier rocket control pulley assemblies.

The gyroscope spin-up gas generator is fired electrically by the DRS. It serves two purposes. First, it spins up the gyro by use of a rack piston. As the rack piston retracts, a secondary piston then operates to fire the Vernier rocket mechanically. Once the system is in operation, the gyro's rotation, through a pulley system, adjusts the angle of the Vernier rocket as needed to correct seat pitch and maintain the crewmember's trajectory.

Drogue system

The ACES II uses an electrically fired drogue gun, which fires a slug to deploy a two-foot wide extraction chute (fig. 3–7). The extraction chute deploys the drogue parachute, five feet in diameter, from its stowage cavity in the back of the seat. The drogue parachute slows down and stabilizes the seat during Mode 2 and 3 ejection sequences. Because of the extra time it takes to deploy the drogue parachute, it is not used during Mode 1 ejection sequences when the aircrew member exits the aircraft moving less than 250 knots at altitudes under 15,000 feet. Therefore, the drogue gun will not fire in this mode.

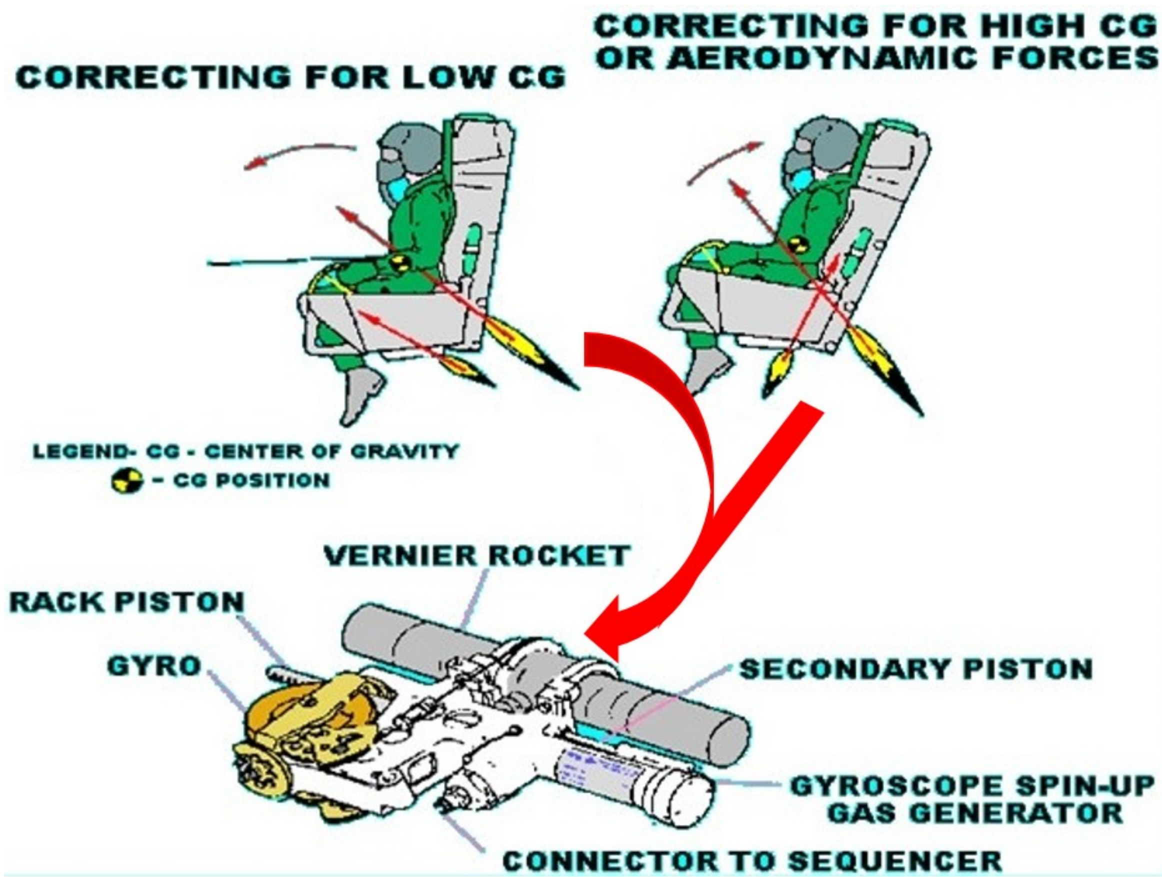

Figure 3–6. ACES II pitch stabilization control assembly.

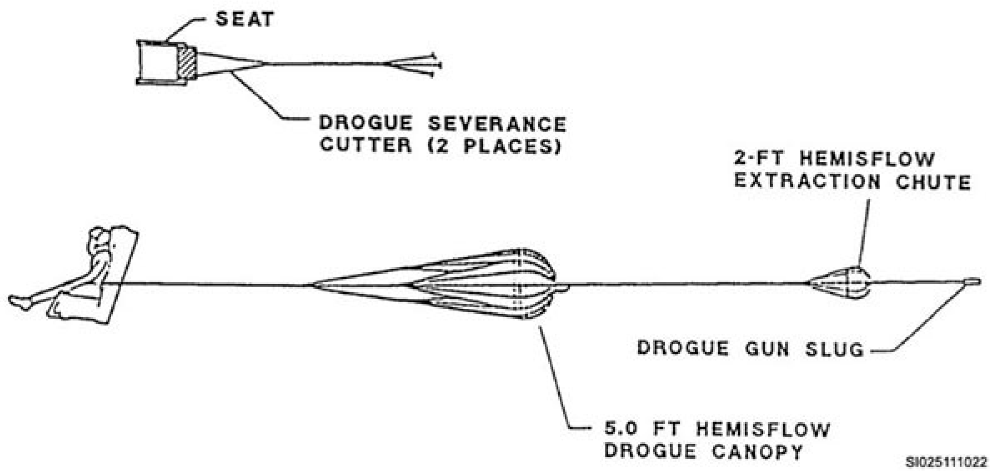

Figure 3–7. ACES II drogue system.

Drogue severance cutters

The job of drogue severance cutters are to release the drogue system after it has deployed and stabilized the seat; however, the two drogue severance cutters will fire regardless of the mode of ejection. The cutters are fired by the DRS electrically and are unique in that they use a flexible linear shaped charge (FLSC) to cut the drogue chute bridle lines. FLSC is designed to produce a metal jet that exerts a pressure of several million psi and has a detonation velocity of 20,000 to 25,000 feet per second.

Parachute mortar assembly

The purpose of the mortar assembly is to deploy the recovery parachute forcibly. The mortar assembly is a telescoping device consisting of an inner and an outer tube. The outer tube is attached to the recovery parachute canister. The inner tube is locked into the mortar disconnect assembly by a locking pin connected to the restraint release bellcrank and the secondary locking pin in the mortar disconnect assembly. When one of the mortar cartridges is fired by the DRS or by pulling the emergency manual parachute deployment handle, it explosively propels the outer tube upward, deploying the recovery parachute.

Pilot chute and recovery parachute

The pilot chute is packaged in a fabric enclosure at the top of the recovery parachute metal canister. The pilot chute deploys immediately to an inflated condition, except at zero speed condition. As the pilot chute deploys, the canister containing the recovery parachute is pulled to deploy the parachute. The suspension lines deploy first, and then the canopy deploys skirt-first as the canister separates. The reefed 28-foot diameter canopy of the recovery parachute contains dual reefing line cutters. The *reefing line* is a nylon cord that encircles the parachute, holding it to a smaller diameter than it would be if it were deployed fully. The reefed condition reduces the shock a pilot would normally experience if ejecting at a high speed and then having the recovery parachute open normally. The container and outer tube fall away from the parachute as it deploys.

During mortar extension, two lanyards attached to the parachute mortar assembly inner tube are pulled, activating two delayed *reefing line cutters*. These lanyards are visible from the back of the seat and inspected by egress during the seat incoming inspection. Figure 3–8 shows a diagram of the cutters as they are buried in the folds of the recovery chute. After approximately 1.15 seconds, the reefing line cutters cut the reefing line, allowing the recovery parachute to deploy fully. Backup lanyards to the cutters are attached to the recovery parachute. These lanyards provide an alternate means of activating the reefing line cutters in the event mortar extension fails to activate the cutters.

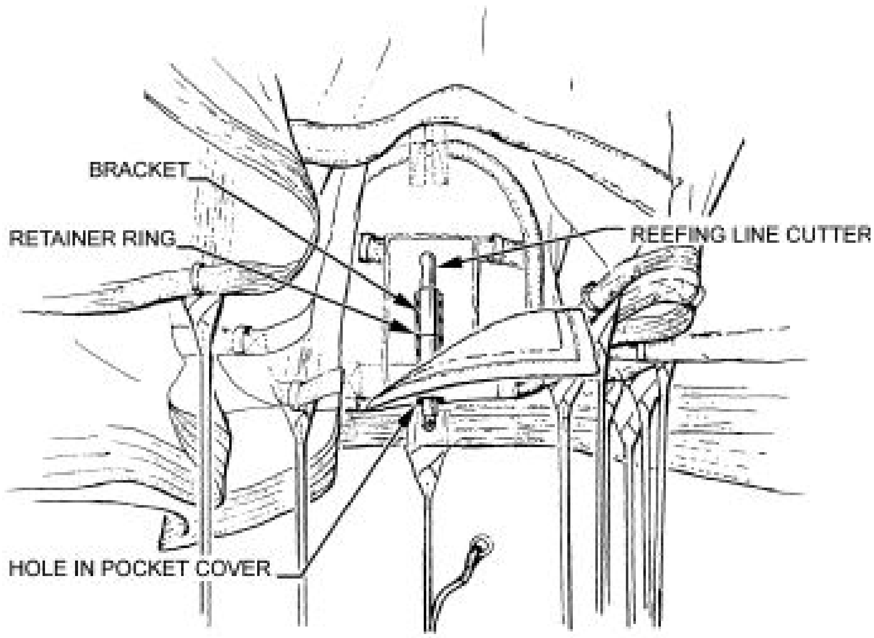

Figure 3–8. Reefing line cutter.

Restraint system

The restraint system consists of lap belts, inertia reel straps, and parachute risers. The B–1B, F–22, and other modified ACES II seats also incorporate limb (arm and leg) restraints actuated by the seat's movement up the rails after ejection is initiated. These items work together to keep the crewmember's arms and legs from flailing in the windblast when entering the environment after ejecting from the aircraft. Since many injuries to aircrew members during ejections at higher speeds have been due to limb flailing injuries with the high windblast forces, newer seats have incorporated arm and leg restraints, and some older seats have been modified. The arm restraints are nets made of nylon bands that surround and tighten around the crewmember's elbows, preventing the arms from being drawn out into the airstream.

The F–22 leg restraints are cords that are attached to the underside of the front of the seat and to the floorboards, held in place by hook-and-pile fasteners (Velcro®) at multiple points around the edge of the entrance to the rudder wells where the pilot's legs rest during flight. Before the point where they attach to the floor, they are looped through snubbers, which hold the cord in place to prevent it from releasing once it has retracted. As the seat travels up the rails, the cords pull tight from the hook-and-pile fasteners around the pilot's legs, holding them securely to front of the ejection seat, preventing the legs from flailing. The hardware securing the cords to the cockpit floor is designed to break, freeing them from the aircraft. When the aircrew member releases from the seat, the snubbers and cords are also released automatically. The arm restraints do not actually hold the arms; they only prevent them from moving laterally into the wind stream.

Restraint release system

The restraint release system is used to release the crewmember from the seat. The system consists of a bellcrank, four lock pins, and a seat pan latch. When the bellcrank is rotated, the seat pan unlatches, and two lock pins are withdrawn from the lap belts, one from the inertia reel straps, and one from the mortar disconnect assembly. You may also manually rotate the bellcrank by pulling the ground servicing cable (also called the equipment release cable) during maintenance.

Restraint release thruster

The DRS fires the restraint release thruster electrically. Once a signal from the DRS fires the thruster, the thruster piston extends 2 inches and mechanically rotates the restraint release bellcrank assembly to a locked/open position. When the bellcrank reaches this position, it retracts the mortar disconnect assembly lock pin, lap belts, and inertia reel strap lock pins unlatches the seat pan. As the lock pins are retracted and the seat pan unlatches, seat and person separation is accomplished.

Emergency power supply

The emergency power supply contains a thermal battery, which generates an electrical voltage after a firing pin strikes the thermal battery primer. This voltage is supplied to the back-up mortar cartridge from the emergency power supply when the emergency manual chute deployment handle is pulled. Ballistic pressure from the cartridge propels the recovery parachute canister from the seat. This action deploys the recovery parachute ballistically and actuates the parachute reefing line cutters.

Survival kit

During seat and person separation, the seat pan pivots up and forward to allow withdrawal of the survival kit. The survival kit consists of a fabric case that houses the life raft, rucksack, and an auxiliary kit container. Survival kits used on the B–1B aircraft are similar to those used on other aircraft, except they contain a sleeping bag instead of the auxiliary kit container. Figure 3–9 shows how the life raft and rucksack are attached to the survival kit case by a drop line. The auxiliary kit container is secured inside the survival kit and stores additional survival items needed to be retained by the crewmember. In addition, the radio beacon transmitter is attached to the survival kit and stays with the crewmember.

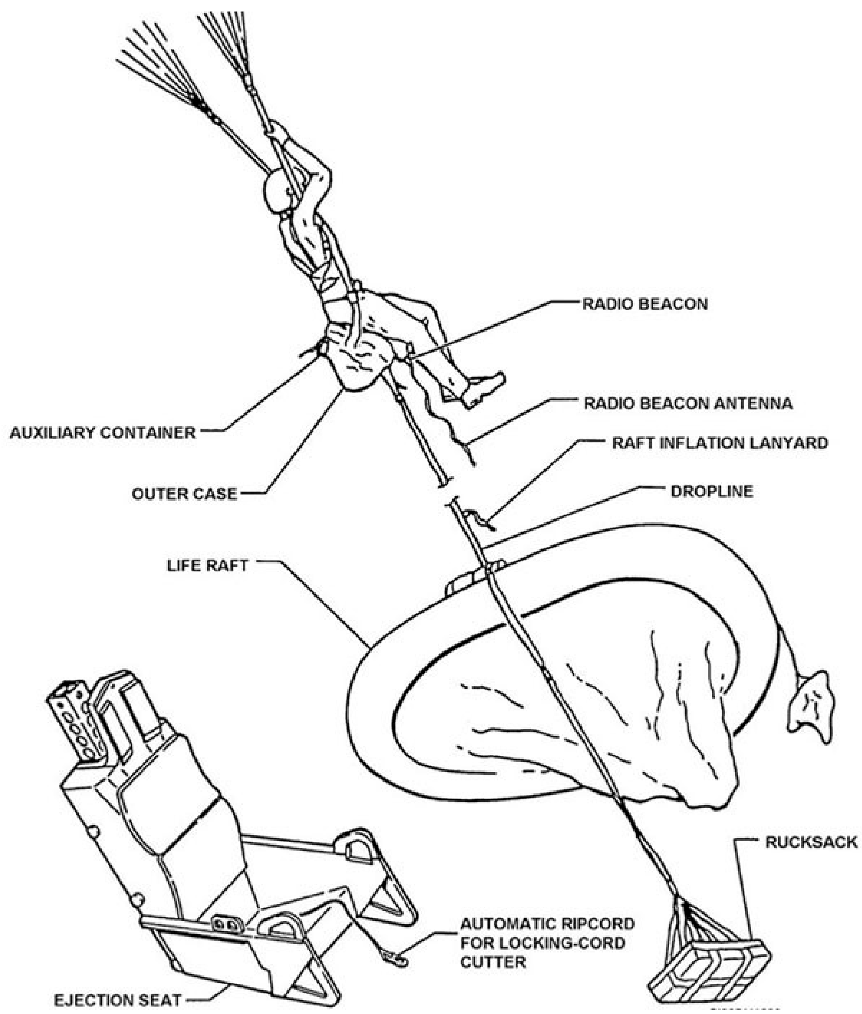

Figure 3–9. Survival kit deployment.

A control lever located on the front edge of the seat pan allows the crewmember to select automatic or manual deployment of the kit. Automatic deployment is initiated upon seat-person separation when the fitting on the end of the automatic ripcord remains attached to the seat, and the kit leaves with the aircrew member. The ripcord activates the cutter, and four seconds later the kit locking cord is severed, allowing the contents to deploy. Selection of the manual mode allows the automatic ripcord to disconnect from the seat during seat-person separation, giving the crewmember the option to keep the kit intact after separation. If desired, deployment of the contents can be accomplished after separation by pulling the manual ripcord handle located on the rear, right-hand corner of the kit.

Emergency oxygen system

The emergency oxygen system consists of a cylinder, an oxygen hose, and a starting lanyard. The hose is routed from the cylinder to a connector. The connector is on the right hand side of the torso harness. The emergency oxygen lanyard, attached to the floor on one end and to the seat's left-hand side on the other end, is pulled taut during ejection. On B–1 left side seats, the oxygen lanyard and bottle are on the right side of the seat; additionally, the B–1's auto lanyard does not attach to the floorboards, it is pulled when the seat oxygen connector disconnects from the seat. Either action activates the oxygen bottle to provide the crewmember with 50 cubic centimeters of oxygen, which comes in handy during high altitude descent. In addition, an emergency oxygen ring is provided for manual operation of the oxygen system should the automatic system fail during ejection or if the normal aircraft oxygen system fails during flight if the aircraft supply is depleted or contaminated.

Trajectory divergence rocket

You will find trajectory divergence rockets (TDR) only on B–1Bs, dual seat F–15s and F–16s (fig. 3–10). The TDR consists of a dual bridgewire initiator and an internal squib. The TDR is fired by a signal from the DRS. Thrust from the rocket rolls the seat about its horizontal axis. The rolling of the seat about its horizontal axis imparts a horizontal vector to its trajectory. In layperson's terms, the job of the TDR is to get the seats out of the way of each other and in the case of the F–16, out of the way of the vertical stabilizer (tail fin).

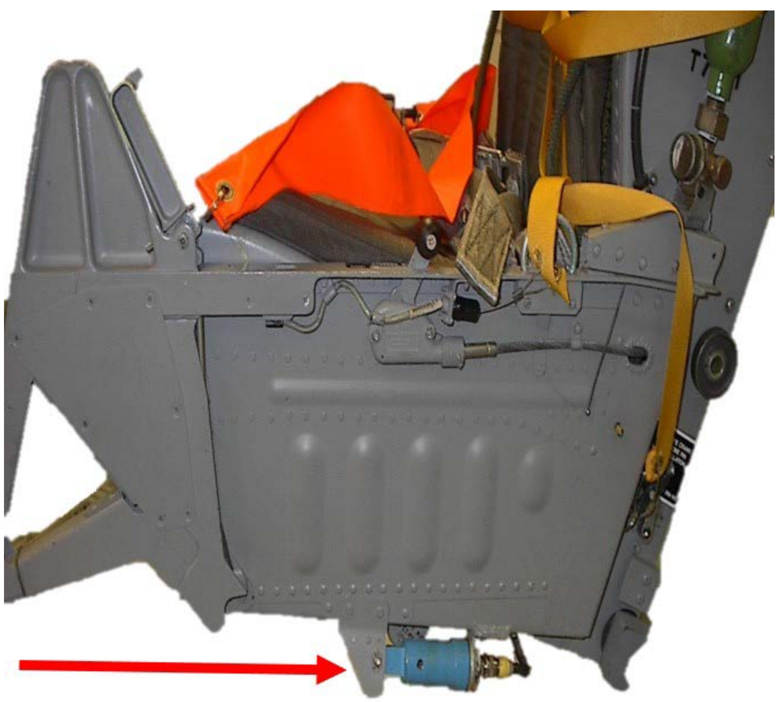

Figure 3–10. Trajectory divergence rocket.

230. ACES II theory of operation

Now that you are familiar with the major components of the ACES II, let us look at how they all work together.

The ejection seat

The seat provides an automatic ejection sequence for the aircraft crewmember. The sequence starts when the crewmember pulls the firing control handle. The mode of operation is selected and controlled by the DRS. The DRS provides the best recovery means for the full range of escape conditions. Three modes of operation are available. The mode selected depends on aircraft speed and altitude at the time of ejection.

Initiation

Ejection initiation varies depending on which airframe the ejection seat is installed. There are two types of firing control handles—dual handled and single.

Dual handled firing control handles

A–10s, B–1Bs, B–2s, and F–15s all have fire control handles on the forward right and left hand sides of the ejection seat. For the purposes of this lesson, we will only focus on A–10 and F–15 ejection seat theories of operation, although the other two systems are similar. Pulling either or both firing control handles on F–15 seats and A–10 seats fires two ejection initiators.

Single firing control handles

F–16s and F–22s both have single firing control handles. For the purpose of this lesson, we will focus on the F–16 ejection seat theory of operation. On the F–16 aircraft, dual initiators are mounted on the forward surface of the seat. The dual ejection initiators are fired by pulling the single firing control handle on the F–16 aircraft seat.

Rocket catapult

As the rocket catapult fires, pressure from the catapult is applied to a firing mechanism in the Power Module. The firing mechanism initiates the thermal batteries in the Power Module. The batteries do not provide electrical power to operate the Electronic Module until fired.

Up the rails

As the lower part of the seat nears the top of the guide rails, pitot tubes located on both sides of the headrest are exposed to the airstream. The ejection seats that you maintain may have flip-up pitot tubes, which will mechanically “flip-up” once the parachute portion of the seat clears the rails. A static port on the environmental sensor monitors the pressure. The speed and altitude transducers in the sensor sense pitot and static pressure inputs. The transducer outputs are, in turn, applied to the DRS. The outputs are applied to the DRS for selection of the proper recovery mode of operation. A lanyard connected between the oxygen cylinder and the cockpit starts the emergency oxygen supply.

SEQUENCE START switch activates

A SEQUENCE START switch on the seat turns to the ON position as the lower part of the seat nears the top of the guide rails. The switch turns on when the switch actuating bellcrank contacts a striker on the right-hand guide rail. The contacts of the switch are momentarily closed. The closed contacts of the switch start timing circuits in the DRS. A delay in the DRS start circuit provides filtering action against switch chatter. This delay also delays the sequence start by 0.003 second.

It is important to note that turning the switch on during maintenance of the seat has no effect on DRS operation. The batteries that provide power for the timing circuit operation are turned on only after firing of the rocket catapult.

STAPAC actuates

After a 0.018-second time delay, the DRS provides an electrical signal that fires the gyro spin-up gas generator. The generator develops enough pressure to shear a retaining pin. After the pin shears, the geared piston and rack are fired across the geared surface of the gyro rotor. Firing the geared piston and rack across the geared surface of the gyro rotor enables it to attain a speed of 10,500 rotations per minute. Pressure continues through the piston and rack chamber to move a second piston. The second piston pulls a sear from the Vernier rocket firing device, firing the rocket. The rotations per minute of the gyro rotor develop enough torque as the seat pitches forward or backward to direct the thrust. The thrust of the STAPAC's Vernier rocket is directed by means of a pulley system, in a direction that allows the seat to maintain proper pitch attitude.

Trajectory divergence rocket fires

After a 0.040 second delay, the DRS provides a signal that fires the TDR on dual seat F–15s and all models of F–16s. The A–10 does not have a TDR.

Modes of operation

Once the seat leaves the rails and the STAPAC and TDR have fired, sequential start of all other seat ballistic devices depends on the mode of operation. The DRS selects the mode of operation with respect to speed with information from the pitot tubes and altitude from a static pressure sensor within the environmental sensor. The three modes of operation are shown in figures 3–11 and 3–12.

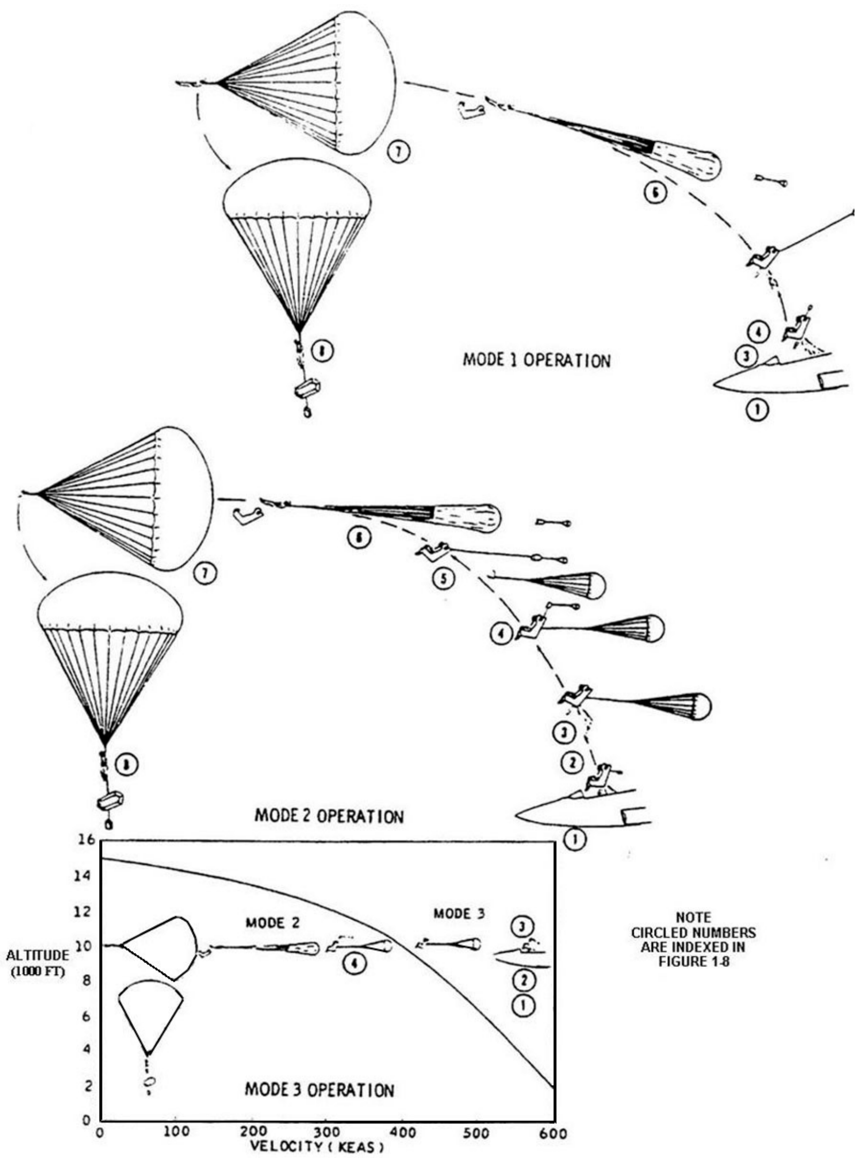

Figure 3–11. Escape system operating modes.

		TIME (SECONDS)			
		MODE 1	MODE 2 (A-10)	MODE 2 (F-15, F-16)	MODE 3
①	ROCKET CATAPULT FIRES	0.0	0.0	0.0	0.0
②	DROGUE DEPLOYS	N/A	0.17	0.17	0.17
③	STAPAC IGNITES	0.18	0.18	0.18	0.18
④	PARACHUTE DEPLOYS	0.20	0.97	1.17	*
⑤	DROGUE RELEASES FROM SEAT	N/A	1.12	1.32	*
⑥	SEAT RELEASES FROM CREWMAN	0.45	1.22	1.42	*
⑦	PARACHUTE INFLATES	1.8	2.6	2.8	*
⑧	SURVIVAL EQUIPMENT DEPLOYS	5.5	6.1	6.3	*
* SEQUENCE IS INTERRUPTED UNTIL SEAT CROSSES MODE 3 BOUNDARY, THEN DEPLOYS PARACHUTE AFTER 0.80-SECOND DELAY (A-10) OR 1.0 SECOND DELAY (F-15, F-16)					

Figure 3–12. Event-time sequence.

Mode 1 operation

Mode 1 operation is selected for speeds of less than 250 knots at sea level and for altitudes of 0 to 15,000 feet. Mode 1 operates minus deployment of the extraction chute or drogue parachute through drogue gun actuation. During Mode 1 operation, the mortar is fired 0.032 seconds after sequence start detection. As the mortar propels the pilot chute and recovery parachute from the seat, the pilot chute deploys. A 1.15-second time delay in each parachute reefing line cutter starts as the pilot chute deploys. Even though the drogue parachute has not been deployed, the primary and secondary drogue severance cutters are fired 0.182 seconds and 0.192 seconds, respectively, after SEQUENCE START switch detection. After a time interval of 0.282 seconds from SEQUENCE START switch detection, the restraint release thruster is fired. The thruster is fired to turn the bellcrank assembly. The bellcrank pulls locking pins that secure the lap belt and inertia reel straps. As the recovery parachute deploys, the crewmember and survival kit are separated from the seat. At seat and person separation, the RADIO BEACON REMOTE switch turns on. In Mode 1 deployment, when the parachute reefing line cutters fire 1.15 seconds after the mortar, the recovery parachute fully inflates. If automatic survival kit deployment has been selected, the kit will open four seconds after seat and person separation. The survival kit opening allows the life raft and rucksack to deploy.

Mode 2 operation

Mode 2 operation is selected for speeds in excess of 250 knots at sea level and for altitudes of 0 to 15,000 feet. During Mode 2 operation, extraction chute and drogue parachute deployment begins at SEQUENCE START switch detection. A signal from the DRS fires the drogue gun cartridge. Firing of the cartridge propels a slug from the gun. Projection of the slug deploys the extraction parachute, which in turn, deploys the drogue parachute. A signal from the DRS fires the parachute mortar 1.000 second after SEQUENCE START switch detection. The primary and secondary drogue severance cutters are fired 0.182 seconds and 0.192 seconds, respectively, after SEQUENCE START switch detection. Recovery parachute deployment and seat and person separation then occurs as described for Mode 1.

Mode 3 operation

Mode 3 operation occurs at altitudes over 15,000 feet, regardless of speed. This mode is known as high altitude/low or high speed. During Mode 3 operation, the sequence of events occur as described for Mode 2, but deployment of the pilot chute and recovery parachute, seat and person separation and firing of the drogue severance cutters is delayed until Mode 2 speed and altitude conditions are met.

Back-up system

If the primary mortar cartridge does not initiate automatic firing of the parachute mortar, a back-up mortar cartridge can initiate the parachute mortar. The crewmember initiates the manual mode by pulling up on the emergency manual chute handle. This action activates a thermal battery via a cable assembly that releases a firing pin. The firing pin strikes a primer in the emergency power supply battery. The resultant electrical pulse from the battery ignites the back-up mortar cartridge ballistically deploying the parachute.

Self-Test Questions

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

229. Major components

1. Match the ACES II component listed in column B with its description in column A by writing the correct letter in the blank space provided. Descriptions in column B may be used once, more than once or not at all.

Column A	*Column B*
____(1) Releases the drogue system.	a. Environmental sensor.
____(2) Activates time-delay circuits.	b. Velocity sensor.
____(3) Houses a life raft.	c. Digital recovery sequencer.
____(4) Rolls the seat about its horizontal axis.	d. JAU–8/A25 initiator.
____(5) Extends 2 inches to rotate the restraint release bellcrank mechanically.	e. SEQUENCE START switch.
	f. Pitch stabilization control assembly.
____(6) Senses airspeed and altitude.	g. Drogue system.
____(7) Prevents yaw-divergence rocket operation.	h. Drogue severance cutter.
____(8) Maintains crewmember's trajectory.	i. Parachute mortar assembly.
____(9) Allows the recovery parachute to deploy fully.	j. Reefing line cutter.
____(10) Contains a replaceable power module.	k. Restraint system.
____(11) Use for breathing during high-altitude ejection.	l. Restraint release system.
____(12) Generates an electrical voltage.	m. Restraint release thruster.
____(13) May include nets to protect crewmember's arms.	n. Emergency power supply.
____(14) Slows down the seat.	o. Survival kit.
____(15) Forcibly deploys the recovery parachute.	p. Emergency oxygen system.
____(16) Starts the ejection sequence.	q. Trajectory divergence rocket.
____(17) Releases the crewmember from the seat.	

2. What are the three modes of operation for the ACES II?

230. ACES II theory of operation

1. What ACES II component selects and controls the modes of operation?

2. Which aircraft have ACES II seats with dual firing control handles?

3. Which aircraft have ACES II seats with single firing control handles?

4. When does the SEQUENCE START switch turn to the ON position?

5. What directs the thrust of the STAPAC's Vernier rocket?

6. When are the primary and secondary drogue severance cutters fired during a Mode 1 and Mode 2 ejection?

7. When do the primary and secondary drogue severance cutters fire during a Mode 3 ejection?

3–3. ACES II Maintenance

In this section, we discuss the operational checks, cleaning and lubrication, and troubleshooting that apply to the ACES II ejection system. Because of constantly changing information, you should *always* consult the proper technical orders when performing any inspection or operational check of an ACES II system. *Do not* substitute the information in this section for technical data!

231. Performing operational checkouts

Operational checkouts are performed on the ACES II as part of a scheduled inspection at the specified calendar interval of 36 months. The 36-month scheduled inspection must be accomplished prior to the first day of the 37th month since the previous one. These tests are much more thorough than visual inspections. In this lesson, you learn procedures for the following operational checkouts:

1. SEQUENCE START switch.
2. Emergency manual parachute deployment handle.
3. Firing control handles.
4. Ejection control safety lever.
5. STAPAC inspection.
6. Emergency oxygen hose inline disconnect.

All these procedures are outlined in the applicable 13A5–series technical order, *Escape System Assemblies.*

SEQUENCE START switch

Checking the SEQUENCE START switch consists of tests for both continuity and resistance. With multimeter (set to continuity setting) leads connected to pins *A* and *B*, and the switch bellcrank arm depressed (closing the circuit) there should be continuity. The same is then done with pins *C* and *D*. Repeat the test with the switch bellcrank arm released. There should be no continuity between pins A and B and between pins C and D when the switch is released. Some shops may have a locally manufactured tool to make this test easier. In fact, your shop 13A5–series technical order should include a drawing of a SEQUENCE START switch test lead in the special tools and test equipment section that shows how the test lead can be manufactured locally.

The resistance check is done between the P-lead connector shell and receptacle, after the P-lead is connected, but before the safety wire is installed. The resistance must be 0.010 ohms or less. Of course, this excludes the resistance of the meter leads. This resistance check is also required on all electrically actuated explosives when they are installed.

If the SEQUENCE START switch bellcrank is twisted, cracked, or otherwise damaged beyond limits specified in the technical order, it must be replaced. A Go/No-Go gauge is used on a flat surface to determine the serviceability of the bellcrank. See figure 3–13 for a description of this test.

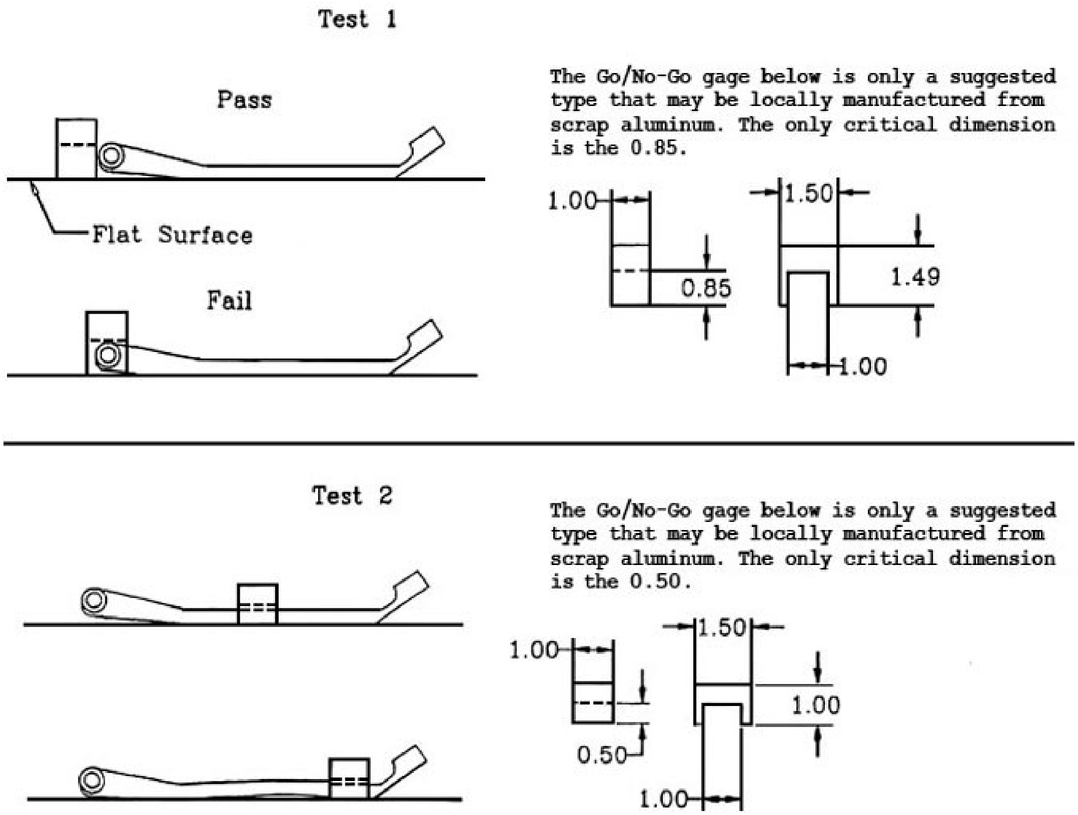

Figure 3–13. Bellcrank inspection.

Emergency manual parachute deployment handle

The emergency manual parachute deployment handle test is another check you will do during your 36-month inspection. Before you begin, make sure that the striker stop pin is installed on the seat. If the striker stop pin is removed, you may inadvertently actuate the power supply, which could cause death or injury to personnel.

After ensuring the striker stop pin is installed, remove the safety wire from P-lead P–11, and disconnect it from the emergency power supply and disconnect the power supply’s firing linkage by removing the cotter pin, washer, and clevis pin. Following tech data, next, remove the recovery parachute. Then remove the ejection seat pin assembly from the emergency backup parachute deployment handle. Once that is done, pull the ground servicing cable.

When you pull the ground servicing cable, the following events should happen:

1. The bellcrank should rotate to the down position.
2. The lever assembly should drop into place and contact the first bellcrank notch.
3. The mortar disconnect pins should retract.
4. The shoulder restraint retaining pins and lap belt pins should fully retract.

5. The lap belt end fittings should release.
6. The pulley assembly should not rotate.
7. The seat pan latch should disengage from the seat pan.

Check the retraction of the mortar disconnect pin by inserting a 3/32 inch diameter drill rod into the second inspection hole, which is closest to the cable assembly nut of the mortar disconnect housing. The minimum penetration of the drill rod into the mortar disconnect housing should be 0.45-inch (fig. 3–14).

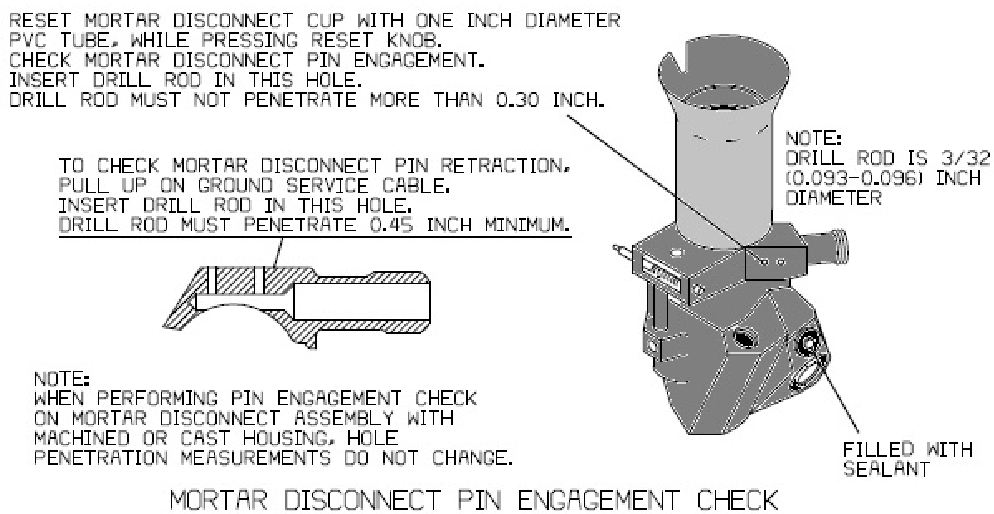

Figure 3–14. Mortar disconnect pin engagement check.

If any condition is not met, consult the troubleshooting section in your 13A5–series technical order. If all the conditions are met, reset the mortar disconnect cup by inserting a one-inch diameter polyvinyl chloride tube into the mortar while pressing the reset knob. It is easiest to do this task with two personnel. The required result of the reset is for the mortar disconnect cup to rest below and against the mortar disconnect pin. In addition, the following should occur:

1. The bellcrank should return rapidly and freely to the original position.
2. The shoulder restraint retaining pin and lap belt pins should protrude through their respective fittings.
3. The mortar disconnect pin engages.

Again, check the retraction of the mortar disconnect pin by inserting a 3/32 inch diameter drill, but this time insert it into the first inspection hole. This time, penetration should not exceed 0.30 inch.

After resetting the mortar disconnect cup, squeeze the emergency manual chute handle and pull up on the handle only until it is released from the handle receptacle. Then attach a force gage to the handle and pull upward (fig. 3–15) until the lever assembly drops into place. Here's what you should see:

1. The force should not exceed 45 pounds.
2. The bellcrank should rotate to the down position.
3. The lever assembly should drop into place and the lever should contact the first bellcrank notch.
4. The mortar disconnect pin should retract.
5. The shoulder restraint retaining pins and lap belt pins should fully retract.
6. The lap belt end fittings (if installed) should release.
7. The seat pan should disengage from the seat pan.

Figure 3–15. Emergency manual parachute deployment handle test.

Again, check the retraction of the mortar disconnect pin by inserting a $^{3}/_{32}$ inch diameter drill rod into the second inspection hole, which is closest to the cable assembly nut of the mortar disconnect housing. The minimum penetration of the drill rod into the mortar disconnect housing should be 0.045-inch. The mortar disconnect cup should also be resting below and against the mortar disconnect pin.

Now, reinstall the emergency manual chute handle and reset the mortar with the polyvinyl chloride tube while depressing the reset knob. During this procedure the following conditions should be present:

1. The bellcrank should return rapidly and freely to the original position.
2. The shoulder restraint retaining pin and lap belt pins should protrude through their respective fittings.
3. The mortar disconnect pin should engage.

You check the mortar disconnect engagement by inserting the drill rod into the first inspection hole. Then, engage the ball end of the emergency power supply’s cable back into the pulley assembly. Check that the striker stop pin is installed, and then reinstall the emergency manual chute handle pin.

You rotate the pulley and install the emergency manual chute cable in the pulley detent, after which reconnect the firing linkage cotter pin, washer, and clevis pin. Then rotate the pulley and install the emergency manual chute cable in the pulley detent and reconnect the P-lead P–11 to the power supply, install the lock wire and perform the connector shell and receptacle resistance check. Finally, reinstall the recovery parachute.

Firing control handles

Now we discuss how to test ACES II firing control handles by covering the fundamentals of the F–15 type handles and the F–16’s D-ring handle.

F–15 handles

The F–15 has two ejection control handles, one on each forward side of the seat. Of course, the first step is to perform all safety procedures like making sure the seat is grounded. Next, remove the ejection initiators and remove the survival kit. Next, suspend 15-pound weights from the left- and right-hand adjustment links. Remove the ejection seat pin assembly from the left ejection control handle and place ejection control safety lever in the ejection control ARMED (down) position. Now, test the handles in two positions: initial and fired.

Initial position

Connect a force gage to the left-hand side handle and pull along a line until the handle rotates between 0.5 inch and 1.0-inch distance along the forward edge of the handle guide. Find the line by looking for scribe lines on the handle. Make sure to avoid side pull on handles. Side pulls could significantly affect force readings and make the test results invalid. Record the force required to rotate each handle and then repeat the test with the right hand handle. For each handle, the pull forces should be 42.5 pounds minimum. If the pull forces are outside those parameters, consult TO 13A5–56–11 for troubleshooting procedures.

Fired position

For the fired position, install a wedge in the 23-degree position on the left-hand side. With the wedge installed, the handle is approximately at the fired position. Repeat the same steps for the initial position test on both sides and record your results when the handle is rotated 0.12 to 0.25 inches from the forward top corner of the wedge. Again, the pull forces should be 42.5 pounds minimum. If the pull forces are outside those parameters, consult TO 13A5–56–11 for troubleshooting procedures.

30-pound check

Remove the 15-pound weights, reset the handles, and install 30-pound weights. Perform the initial position and fired position tests again, recording your results. The handle must rotate without any binding or hesitation. Compare the higher of the two force readings on the right-hand side handle to the higher of the two force readings on the left-hand side handle. If the highest of these four force pulls exceeds 57.5 pounds, then you will have to troubleshoot using the procedures in TO 13A5–56–11 to fix the problem. Remove the 30-pound weights and the wedge and reset the handles, place the ejection control safety lever in the up/ejection controls LOCKED position and install the ejection seat pin assembly. Install the ejection initiators and the survival kit.

F–16 handles

During the 36-month inspection, remove the F–16 seat's firing control handle assembly and send it to the nondestructive inspection shop so they can perform a dye penetrant or eddy current check on the socket and pivot to inspect for evidence of cracks. If assemblies are cracked, they will need to be replaced. If they are not cracked, reinstall the assembly and perform the function test, which includes a rotation check, a pulley bellcrank test, and a friction check. Before you start on this or any other seat maintenance, perform a safe for maintenance check to ensure the seat is safe.

Rotation check

The point of the rotation check is to make sure the D-ring can rotate forward and aft without requiring too much force, but also without it being so loose that it flops forward and is not available in an emergency. The important factor is reliability, while maintaining ease of use and convenience for the aircrew member.

Remove the ejection initiators if they are installed. Attach a force gage to the firing control handle assembly top center prong, pulling it forward and then aft. The force required to rotate the firing control handle backward and forward should be a minimum of 3 pounds and a maximum of 7 pounds.

If the specified force is less than 3 pounds, adjust the torque on the bolt in the grip assembly pivot attachment to obtain the specified force. If the specified force is more than 7 pounds, or if torqueing the bolt in the grip assembly pivot attachment did not obtain the specified force, you will need to remove the washers and sand them with medium grit sandpaper. Then reinstall the washers and adjust the torque on the bolt in the grip assembly pivot to obtain the specified force.

Pulley bellcrank test

Testing of the ejection initiators consists of checking the movement of the adjustment links and the pulley bellcrank for binding. These items are part of the initiator firing mechanism. Remove the cover to do this test. Also, disconnect the initiators by disconnecting the adjustment links; however, according to the technical order, the initiators do not have to be removed. Of course, since you will also be doing this test in conjunction with the rotation and friction checks, the initiators will probably be removed already.

First, remove the ejection seat pin assembly from the ejection control safety lever. Place ejection control safety lever in the ejection controls ARMED (down) position. Verify that both adjustment links have freedom of movement in the barrel nuts and in the pulley bellcrank by moving the links within the limits allowed by the pulley housing. Then verify the ends of both adjustment links are at least flush or protruding through the barrel nuts, ensuring no preloading on the ejection initiators occurs. Now, verify that the pulley bellcrank can turn without binding. Do this by pulling up on the firing control handle until the handle is extended 1 ½ to 2 inches. Finally, hold the firing control handle in the extended position (1 ½ to 2 inches). Verify that both adjustment links have freedom of movement in the barrel nuts in the pulley bellcrank by moving the links within the limits allowed by the pulley housing.

If there is no binding in the movement of the adjustment links and the pulley bellcrank, the initiator firing mechanism is working properly. You can return the firing control handle to the stowed position, place the ejection control safety lever in ejection controls LOCKED (safe) position, and install the ejection seat pin assembly. Since you are moving on with the 36-month inspection, proceed to the friction check.

If there is binding in the movement of the adjustment links and pulley bellcrank, follow procedures within TO 13A5–56–11 to correct the conditions.

Friction check

Attach two pulley assemblies to the seat structure (fig. 3–16). Route the cable assemblies through the pulleys and attach to initiator adjustment links. Suspend a 15-pound weight from each cable. Using the hook, attach a force gage to the firing control handle. Place the ejection control safety lever in the ARMED (down) position.

Pull the firing control handle with the force gage to the over-center position of the initiator firing pulley-bellcrank. The force required to pull the handle should be a minimum of 40 and a maximum of 50 pounds.

While holding the firing control handle, move the initiator firing pulley bellcrank from the over-center position and allow the handle to return to the stowed position slowly. Remove the 15-pound weights and attach 30-pound weights to each cable assembly.

Again, pull the firing control handle with the force gage to the over-center position of initiator firing pulley-bellcrank. This time, there is no minimum force, but the maximum force should be 50 pounds. While holding the firing control handle, move the initiator firing pulley-bellcrank from the over-center position and allow the handle to return to the stowed position slowly.

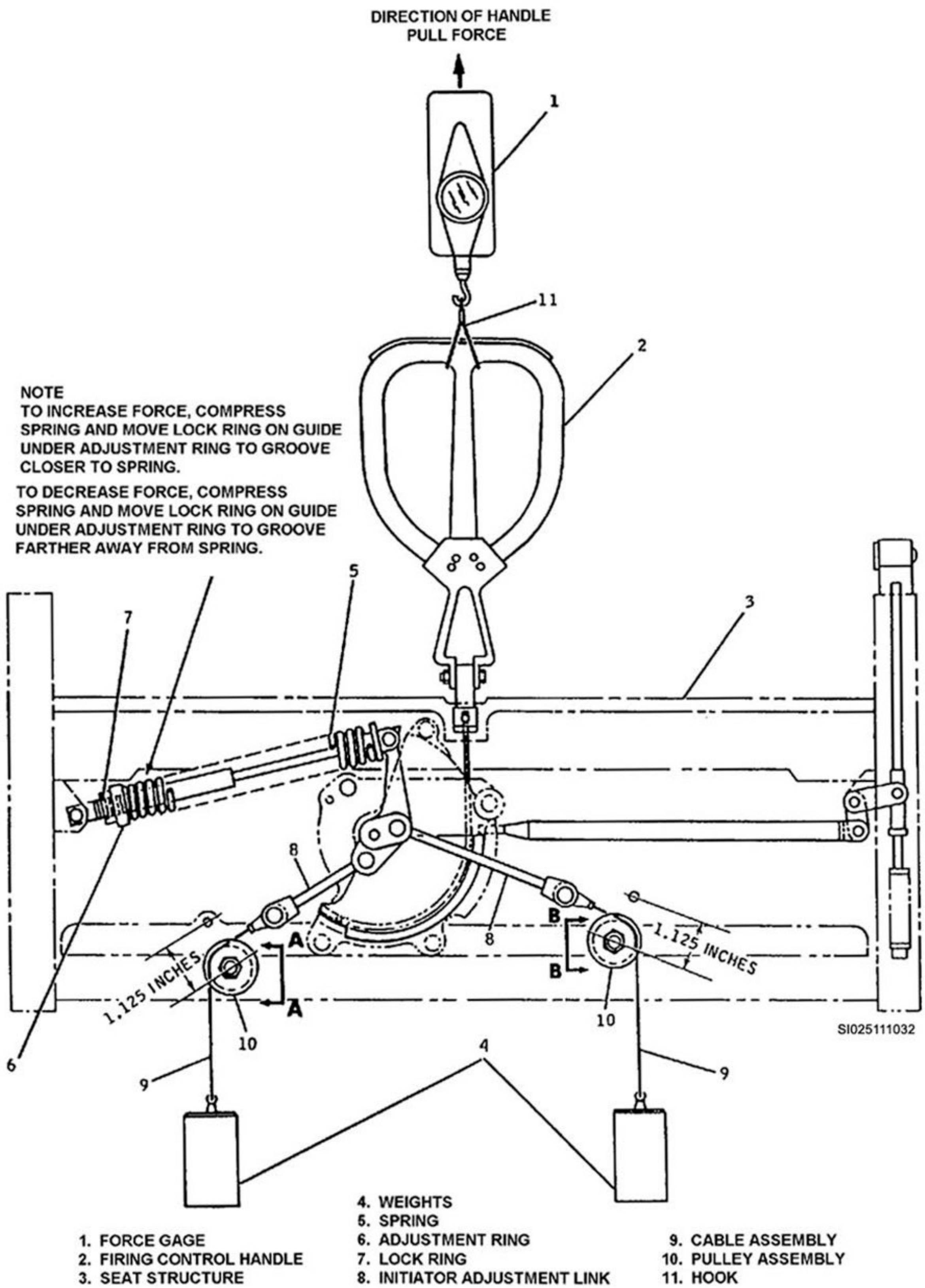

Figure 3–16. F–16 friction check.

If the operating forces are not within the specified limits, perform the following steps to increase or decrease force.

1. To *increase* force, compress the spring and move the lock ring on the guide under the adjustment ring to a groove *closer to* the spring. Then repeat the adjustments as required to obtain readings within the specified limits.
2. To *decrease* force, compress the spring and move the lock ring on the guide under adjustment ring to a groove *farther away* from the spring. Then repeat the adjustments as required to obtain readings within the specified limits.

Once the bellcrank operates properly, or if it passed the check with no problems, remove the force gage, weights, cable assemblies, and pulley assemblies. Place the ejection control safety lever in the SAFE (up) position and install the safety pin. Finally, reinstall the ejection initiators and button everything back up.

Ejection control safety lever

Like the ejection control handle test, there are separate test procedures for the F–15 seats and the F–16 seats. Like all seat maintenance, make sure the seat is safe for maintenance before proceeding.

F–15 seat

To ensure the ejection controls will not fire when the ejection control safety level is in the LOCKED (safe) position, disconnect the initiator firing rod and terminal from the ejection initiator. Disconnect both the left-hand and right-hand initiator firing rods and terminals from the ejection initiators. Then remove the ejection seat pin assembly from the firing control handle assembly. Place the ejection control safety lever in the ejection controls LOCKED (safe) position.

Next, apply an actuation force of 42.5 to 57.5 pounds using a force gage on the firing control handle. See figure 3–15 for the attaching point on the firing control handle. The firing control handle should not actuate. However, up to .50 inches of handle travel is permissible for the left side handle and .80 inches of travel is permissible for the right side handle measured at the forward end.

Using a force gage, apply an actuation force of 2 to 12 pounds, between 3.38 and 3.62 inches from the pivot point on the ejection control safety lever until first motion occurs. The force required to move the ejection control safety lever should be between 2 and 12 pounds.

Then place the ejection control safety lever in the ARMED (down) position and use the force gage to apply an actuation force of 2 to 12 pounds, between 3.38 and 3.62 inches from the pivot point on the ejection control safety lever until the first motion occurs. The force required to move the ejection control safety lever should be between 2 and 12 pounds. Place the ejection control safety lever to the LOCKED (safe) position and install ejection seat pin assembly in the firing control handle assembly (fig. 3–17). Reconnect the initiator firing rod and terminal to the ejection initiator. Reconnect both the left-hand and right-hand initiator firing rods and terminals from the ejection initiators.

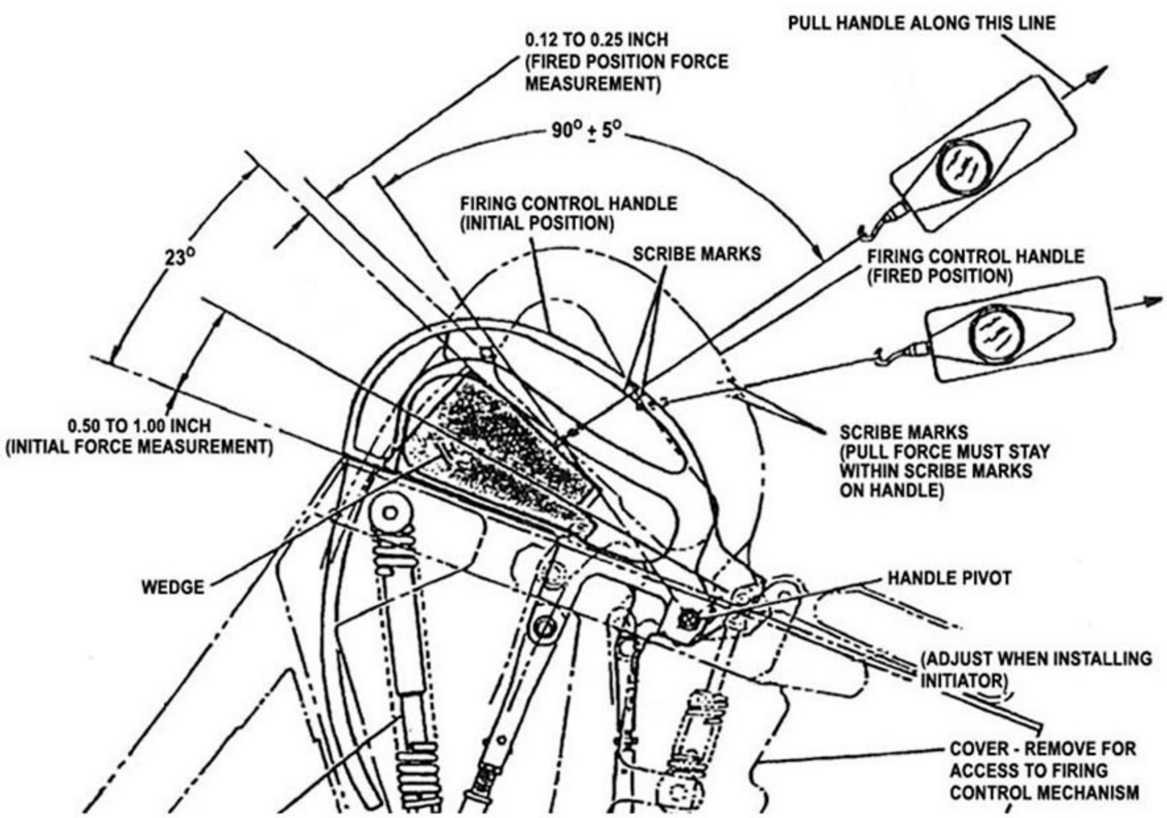

Figure 3–17. F–15 ejection control safety lever test.

F–16 seats

To prepare for this test, disconnect the clevis from both ejection initiators. Remove the ejection seat pin assembly from the firing control handle assembly. Place the ejection control safety lever in ejection controls LOCKED (safe) position.

First, using a force gage, apply an actuation of 40 to 50 pounds on firing control handle. The firing control handle should not actuate.

Then, use a force gage to apply an actuation force of 2 to 12 pounds, 3.38 to 3.62 inches from the pivot point on the ejection control safety lever until the first motion occurs. The force required to move the ejection control safety lever should be between 2 and 12 pounds.

Next, place the ejection control safety lever in the ARMED (down) position and use a force gage to apply an actuation force of 2 to 12 pounds, 3.38 to 3.62 inches from the pivot point on the ejection control safety lever until the first motion occurs. Again, the force required to move the ejection control safety lever should be between 2 and 12 pounds.

If the firing control handle actuates when the safety lever is in the ejection controls LOCKED (safe) position and the force of 40 to 50 pounds is applied, the cause is most likely due to a worn surface on the ejection control safety lock pin where it engages the bellcrank. The fix is to replace the safety lock pin.

If the ejection control safety lever can be moved out of the ejection controls LOCKED (safe) position with less than 2 pounds or more than 12 pounds of pull force, the safety lever spring is most likely faulty. To correct this condition, replace the spring. After successfully completing the test, place the ejection control safety lever in the LOCKED (safe) position and install the ejection seat pin assembly in the firing control handles. Reconnect the clevis to both of the ejection initiators.

STAPAC inspection

Inspection of the STAPAC consists of a visual inspection, a magnification inspection, and a dye penetrant inspection. You are qualified to perform only the visual and magnification inspections. The nondestructive inspection performs the dye penetrant inspection.

Visual inspection

First, inspect cable assemblies for damage or broken strands of wire; for loose, damaged, or missing swaged balls; and for damaged threads on cable tension adjustment bolts and nuts. No damage is allowed to the cables. Then inspect the cable retainer pins for worn or damaged surface that would affect security of cable assembly when pins are installed in the rocket motor. Next, if the Vernier rocket was previously removed, inspect support assemblies for worn or damaged bearing surfaces that would affect correct rotation of the Vernier rocket. Then inspect the sector assemblies and the gimbal sector for cracks. Finally, if the piston/rack has been disassembled, inspect piston/rack assembly for worn or otherwise damaged packings that would affect pressure retention capabilities of housing assembly pressure chamber when gas generator is actuated.

Magnification inspection

For this inspection, you will need a 5 to 10X commercial magnifying glass. Using an angled light source to highlight potential cracks and the magnifying glass, carefully inspect the mounting lugs for evidence of cracks. If a crack is suspected, the presence of the crack must be verified by dye penetrant inspection. For the dye penetrant inspection, you will send the two STAPAC bearings to nondestructive inspection for completion. Some shops may require this inspection regardless if cracks are suspected or not. If this is the case in your shop, it is good practice to have a set of pre-inspected bearings ready for install as the estimated time of completion for the 36-month inspection is usually only a few days. In addition, the bearings may not be returned from nondestructive inspection in time to reassemble the STAPAC and return the seat to service by the deadline.

Emergency oxygen hose inline disconnect

This check ensures that the emergency oxygen hose will disconnect at the correct force during seat-person separation. For this check, take two pieces of cord, tie one end of each cord around the groove between the nut and the emergency oxygen hose on each side of the inline disconnect. Attach a force gage to one cord and use the cord, which is not attached to the force gage to apply force with a slow, steady pull. Observe the amount of force required to disconnect the connector on the force gage. The force required should be between 16 to 32 pounds. If everything goes smoothly, reconnect the inline disconnect and remove the two cords from the assembly.

WARNING: Keep work area clean and free of oil, grease, dust, and dirt. Oil and oxygen form an explosive mixture and may cause severe injury or death to personnel.

232. Clean and lubricate

You probably had a bike as a child, that is, if you ever learned how to ride a bike. Do you remember how the chain worked? You pushed the pedals, which turned a sprocket attached to the bike chain, which met up with another sprocket attached to the back tire that drove the bike forward. Remember what would happen if the chain was dirty? Sometimes, mud and dirt would cause the chain to bind and in some cases, come completely off the sprocket. How about if the chain had not been oiled for a while? That condition, too, would cause the chain to bind and possibly slip off. After several months of not being oiled, the chain and sprockets would become rusty, which rendered your bike useless.

Similarly, if an ejection seat is not cleaned and lubricated properly, the moving parts may bind up, and if the moving parts on an ejection seat bind, the ejection sequence may fail, costing a crewmember's life. In this lesson, we discuss how to properly clean and lubricate the ACES II.

Cleaning

Cleaning is a necessary procedure performed prior to inspections and/or operational checks. Compressed air can be used to remove accumulated moisture, dust, and dirt from an ACES II system. When you are using compressed air, make sure it is clean, filtered, and moisture free. Do not use air pressures over 30 psi.

During the cleaning operation, wipe off heavy accumulations of dirt and grease with a clean, lint-free, or nap-free, dry cloth moistened in dry-cleaning solvent PD–680 Type II or III. Remember, PD–680 gives off toxic fumes and is flammable; therefore, always use it in a well-ventilated area away from open flames. In addition, use only approved personal protective equipment since you will want to avoid skin contact with the chemicals.

Do not use cotton or paper waste materials to remove dirt and grease because of the possible residue. Once the seat is clean, it is ready for inspection, preventive maintenance, and repair or replacement of parts. It is even possible that during cleaning you will have found a discrepancy or two, if you are familiar with the seat's inspection criteria. On an outgoing inspection, it is also a good idea to recheck the seat for general cleanliness.

Corrosion control

Corrosion control consists of the prevention, recognition, and elimination of corrosion. Prevention of corrosion on the ACES II is done by cleaning, paint touch-up, and use of protective materials to remove or prevent contact of foreign substances that cause corrosion. Corrosion inhibitors, named in your applicable 13A5 series technical order, are approved for use, provided they are applied in accordance with authorized procedures, and used on equipment for which they were designed. Recognition of corrosion is necessary for correct removal and treatment procedures when corrosion occurs. Elimination of corrosion requires detailed instructions for methods of removal, chemical treatment, and applying paint. For materials and procedures required for corrosion control, refer to the applicable technical orders and corrosion control specialists.

Lubrication

There are a few areas of the seat that you lubricate. The areas we will discuss are packings, seat rollers, and the SEQUENCE START switch bellcrank.

Packings

You will have to install packings on the seat's explosive cartridges. Apply only a thin film of grease to the packings before installing them on the cartridges. Lubricating the packings helps to extend their life by protecting them from drying and cracking.

In addition, you will grease the packing that is inserted into the parachute mortar tube and the packings, which are installed in the seat pitot receptacles prior to parachute installation. The same grease is used to lubricate the output ends of the recovery parachute pitot tubes, again with only a thin film.

Never lubricate oxygen system packings with grease as this can cause a fire when the oxygen system is activated. Oxygen system packings are colored orange so they are not mixed with other packings for this reason.

Seat rollers

Check the seat rollers for presence of lubrication when the seats are removed from the aircraft. Properly lubricated rollers ensure the seat moves freely up and down the seat rails during day-to-day operation of the seat actuator, and removal and installation, or in the case of an ejection. In addition, it may be your shop's policy to clean and relubricate the rollers during the 36-month inspection. To lubricate the rollers, apply dry film lubricant in accordance with the manufacturer's instruction as required.

SEQUENCE START switch bellcrank

Probably the only time you will be able to inspect the SEQUENCE START switch bellcrank is when you remove it while performing the SEQUENCE START switch test during the 36-month inspection. Thus, it may be the policy in your shop to clean and relubricate the bellcrank during the 36-month inspection. Also, you will want to clean and lubricate the bellcrank if corrosion is discovered. In this case, after cleaning away the corrosion, use a corrosion inhibitor, and then apply dry film lubricant.

233. Troubleshooting

You are about to become an egress journeyman. As an egress journeyman, your supervisors rely on you to be able to quickly troubleshoot and solve mechanical problems with the ACES II. Becoming an expert troubleshooter comes with time, but some troubleshooting procedures are laid out in your applicable 13A5-series technical order so that you can easily troubleshoot some of the seat's known problems. Remember from Volume 1, if you find any problems on the seats that are not easily resolved, then you should submit a request for engineering assistance. We will cover a few, but not all of the troubleshooting procedures prescribed by TO 13A5–56–11. Remember, *do not* use this career development course (CDC) as a guide to work on any ejection system; only use the applicable technical orders. The component troubleshooting procedures we will discuss are as follows:

1. P-leads.
2. Inertia reel.
3. Inertia reel control assembly.
4. Restraint release lever and knob.

P-leads

If during the resistance check on P-leads the resistance exceeds 0.010 ohm, disconnect the shell from the receptacle. Make sure the threads of the receptacle and connector are clean and unobstructed. Clean them with shop air and a dry cloth, then reconnect and retest.

If resistance still exceeds 0.010 ohm, confirm the accuracy of the multimeter used in the test. You may have to replace the multimeter's batteries. Consult your supervisor if that does not work.

Inertia reel

These are probably the most important troubleshooting procedures to know as you will often be called to the flight line to correct locked inertia reels, usually due to operator error.

If the inertia reel straps extend more than two inches with the inertia reel control handle in the LOCKED position, the inertia reel is faulty. Replace the inertia reel. If the inertia reel straps extend less than 36 inches when pulled with the control handle in the UNLOCKED position, then this also means the inertia reel is faulty and needs to be replaced. If the inertia reel straps do not retract freely into the inertia reel when released in the UNLOCKED position or the inertia reel straps do not retract back into inertia reel and lock in retracted position when the straps are released from the extended position with the control handle in the LOCKED position, then the probable causes are the same:

- Faulty inertia reel.
- Straps binding on seat structure.
- Frayed, twisted, or crossed-over straps.
- Incorrect adjustment of reel control assembly terminal.

Faulty inertia reel

If during troubleshooting the inertia reel is found to be faulty, replace it.

Straps binding on seat structure

Check the strap routing and clearance between rollers and structure. Straps must be routed forward of lower roller and aft of upper rollers. Check the strap widths and replace the straps if the width does not meet 0.69 to 0.75 inches.

Frayed, twisted or crossed over straps

If the straps are twisted or crossed over, reroute the straps. If the straps are frayed, replace the inertia reel straps.

Incorrect adjustment of reel control assembly terminal

Remove the cotter pin and washer, loosen the locknut, and remove the terminal from the inertia reel cam lever. Make sure the inertia reel cam lever is against the stop in the "A" position and control handle is in the UNLOCKED position. Adjust the terminal until the hole lines up with the inertia reel cam lever. Preload the terminal by rotating the terminal one-half turn clockwise and install the terminal on the cam lever, secure the locknut, install the washer and the cotter pin.

If that does not work, check that the inertia reel cam lever is in the "A" UNLOCKED position and is slightly preloaded to the full travel position by the control detent spring force. If necessary, readjust the terminal one-half turn for required preload.

Inertia reel control assembly

Look at figure 3–18 for an illustration of the inertia reel assembly while we discuss its troubleshooting procedures. If the inertia reel control assembly is binding, first check for lack of lubricant inside the handle slot.

Lubricate the control assembly with solid film lubricant in the handle slot and see if the binding has been corrected. If that does not work, the control assembly may be defective and should be replaced. If the inertia reel does not lock automatically preventing the further extension of straps with inertia reel control in the UNLOCKED position and the straps are extended rapidly in one motion, the adjustment of the reel control assembly terminal may be incorrect. Remove the cotter pin and washer and loosen the locknut. After that, remove the terminal from the inertia reel cam lever. Ensure the inertia reel cam lever is against the stop in the "A" position and control handle is in the UNLOCKED position. Adjust the terminal until the hole lines up with the inertia reel cam lever. Preload the terminal by rotating it one-half turn clockwise and install the terminal on the cam lever, secure the locknut, install the washer and the pin.

If that does not fix the problem, check to ensure that the inertia reel cam lever is in the "A" UNLOCKED position and is slightly preloaded to the full travel position by the control detent spring force. If necessary, readjust the terminal one-half turn for required preload.

If neither of those conditions fix the problem, then the inertia reel is likely faulty and should be replaced.

Restraint release lever and knob

If the reset lever does not operate smoothly or fails to reset, check for proper installation of components and replace defective spring, the reset lever, or the reset knob.

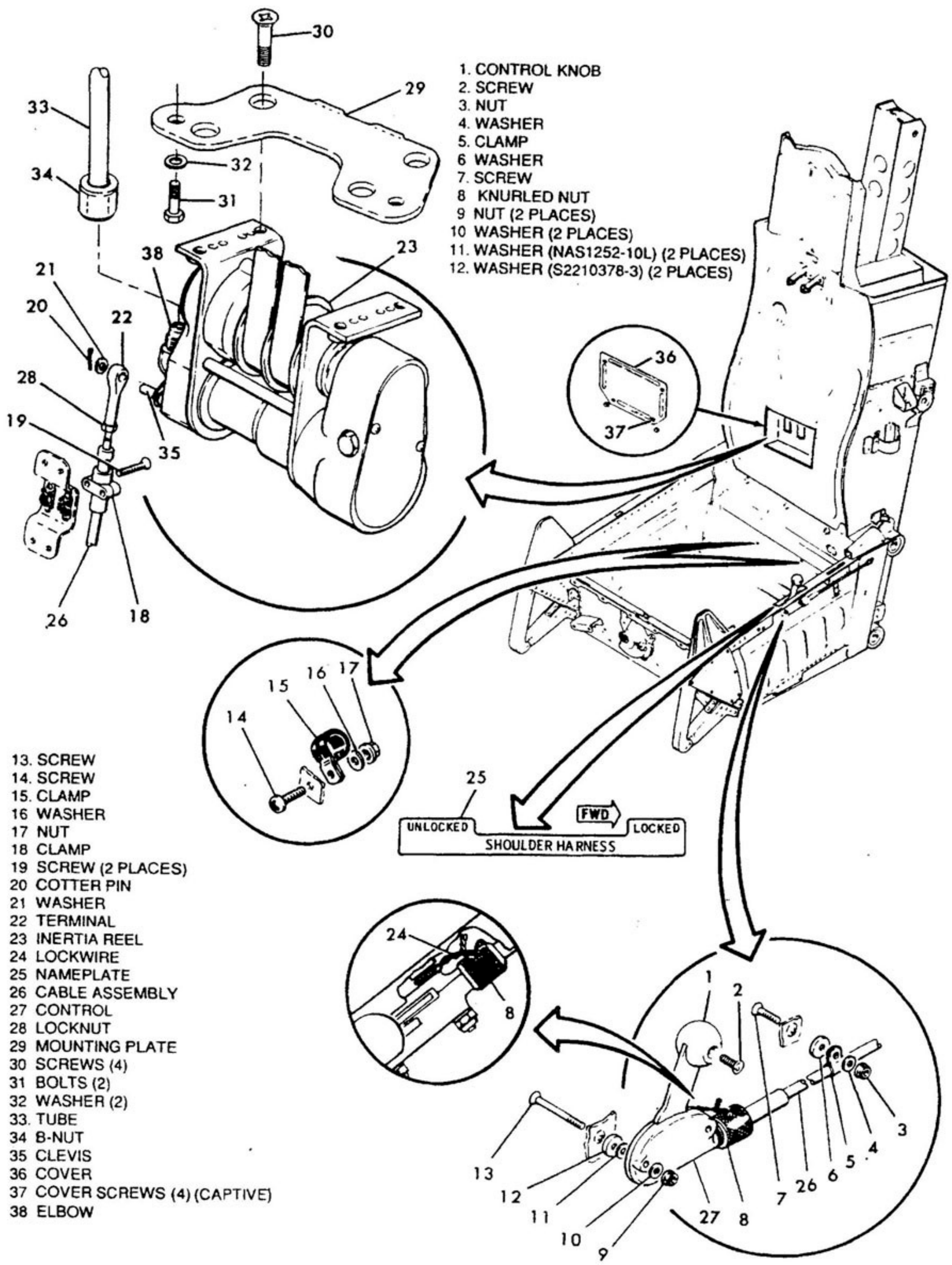

Figure 3–18. Inertia reel control assembly.

234. Using escape system schematics

As an egress journeyman, you will use escape system schematics on a regular basis to troubleshoot the ejection systems. Reading escape system schematics is a very handy skill to pick up, not only for troubleshooting, but also for explaining ejection systems to outside agencies like the production supervisor in order to justify egress maintenance.

Symbols

Since schematics are graphic representations of how a system works, symbols are necessary to depict components, actions, and sequences. There are so many different types of components that it would be impractical to list them all in this CDC. Therefore, we will discuss only the more common ones. For each escape system schematic, read the legend to determine how the graphical symbols relate to the system. Figure 3–19 shows a schematic for the F–16 escape system schematic.

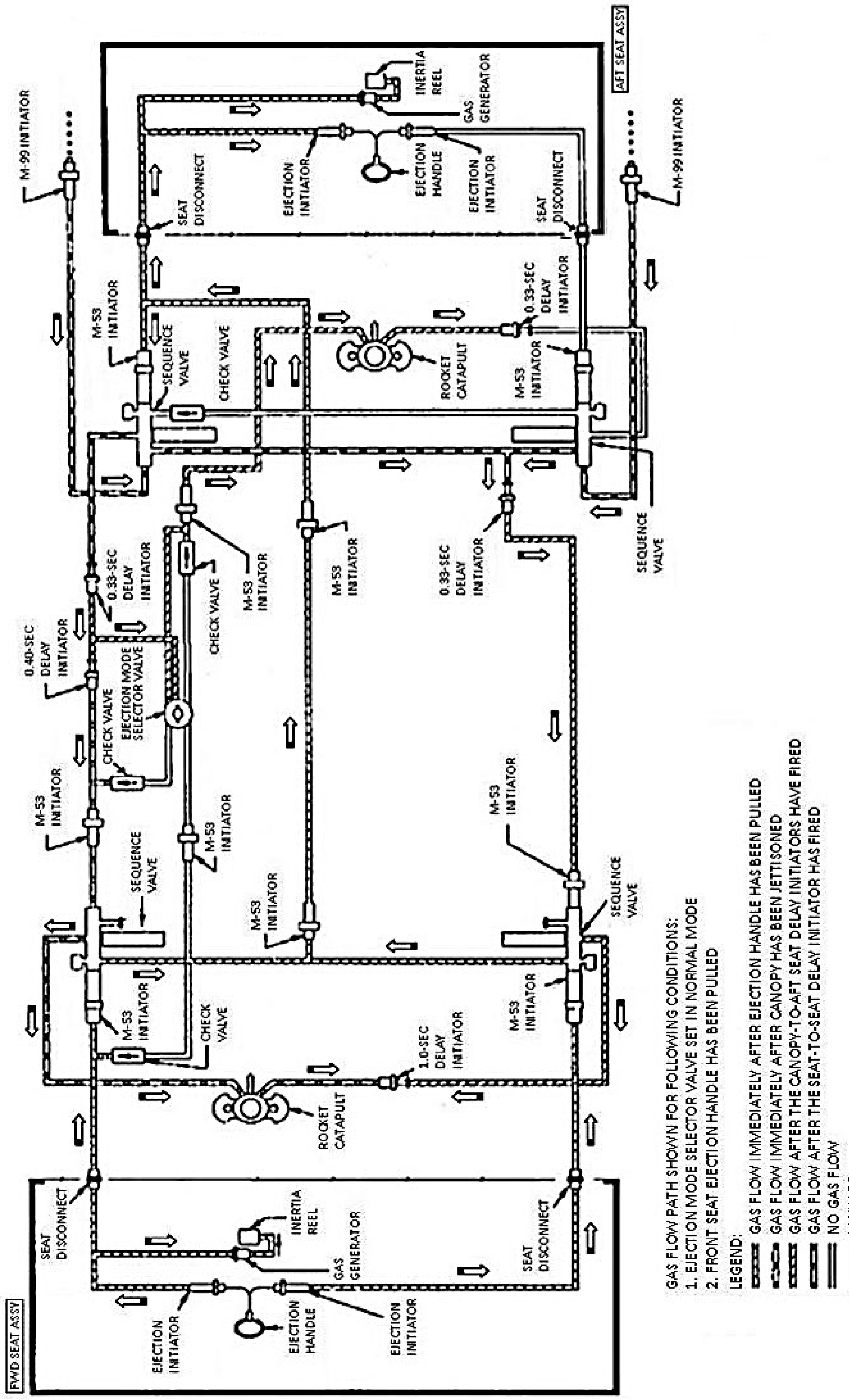

Figure 3–19. F–16 escape system schematic.

Hoses and tubes

Usually, hoses and tubes are shown as two parallel lines. Ballistic gas may be represented with a pattern, such as alternating black and white lines, or as gray shading. Whatever the pattern, it will remain constant throughout the schematic. Hoses and tubes are a means of transferring ballistic gas (in most cases) from one component to another. They are direction-neutral, meaning gas can travel in either direction unless controlled by another component, such as a valve. If the direction of travel of the gas in the tube or hose is one-way, it is indicated by an arrow, either in-between the two lines, or alongside them. Hoses are secured at each end by B-nuts.

Energy transfer lines

Many types of energy transfer lines are used to transfer detonation energy to ballistically fired components. These may be represented by a solid line, bold line, or two parallel lines, and are not generally unidirectional. Again, no matter how they are represented, the representation remains constant throughout the schematic. Though engineers from different aircraft manufacturers may choose different ways to depict an energy transfer line, the most important thing to remember is the function of the line. What does it do? Where does it receive its detonation energy, and what component does it fire? Usually, the engineer will use arrows to show the direction of transfer when the system functions normally.

Valves, gates, sequencers, and linkages

Valves, gates, sequencers, and linkages control and sequence the functions of other components by directing or redirecting force in preplanned order. They are depicted with small, graphic representations of the actual items. Each component that performs a directing or redirecting function is labeled appropriately. The explosive components that assist in transferring detonation energy from one place to another, such as booster initiators, are shown as accurately as possible too. Finally, the components that actually eject and recover the aircrew member are drawn as large as possible for the schematic. Remember to refer to the legend if you are uncertain as to what you are looking at.

Reading schematics

Escape system schematics are almost self-explanatory, as long as you know what they mean. Because the systems vary from airframe to airframe, and symbols vary between manufacturers, your ability to read and decipher technical data is paramount. Usually, escape system schematics are found in general system technical orders. After you have located the correct technical order, then make sure that you select the correct schematic for the egress system on which you are working. Most general system technical orders cover both single seat and dual seat aircraft. If you choose the incorrect schematic, you could be troubleshooting the wrong components. In addition, some schematics are broken down by what mode of ejection is selected by the crewmembers. Always check that you are reading the correct schematic for the item you are researching. This could further add to your mistake if the wrong schematic is chosen; choose wisely. Along with a pictorial representation of the system is a section of text to give a verbal explanation. The text will refer to the picture, and act as a legend, in reverse.

This system knowledge, coupled with the ability to read a schematic, will enable you to troubleshoot problems in your system. With an in-depth understanding of the operation of the many various parts and functions of the egress system, you will be able to pinpoint problems, and prescribe proper repair procedures based on technical data.

Your expert knowledge will not only be used in maintenance and troubleshooting, but it may also be used to assist in an accident investigation. With the proper training, you should be able to tell whether each part of your system, from the canopy to the smallest piece of safety wire, worked as it was designed. If any part did fail, for whatever reason, you may be called upon to decide whether it contributed to the outcome of the accident. Take this advice: know your system!

Self-Test Questions

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

231. Performing operational checkouts

1. When must the ACES II 36-month scheduled inspection be performed?

2. When checking the resistance between the SEQUENCE START switch P-lead connector and receptacle, what should the resistance measure?

3. What events should happen when you pull the ground servicing cable during the emergency manual parachute deployment handle test?

4. What events should happen when you attach a force gage to the emergency manual chute handle and pull up on the handle until the lever assembly drops into place during the emergency manual parachute deployment handle test?

5. When performing a firing control handle test on the F–15 or A–10, what should the minimum pull force be when using 15-pound weights from the initial position?

6. During the F–16 firing control handle rotation check, how can you achieve the required force if the force required to rotate the firing control handle backward and forward is over 7 pounds?

7. How can you increase the force required to rotate the initiator firing pulley-bellcrank if an F–16 ACES II fails the friction check?

8. During the A–10 and F–15 ejection control safety lever test, how do you make sure the ejection controls will not fire when the ejection control safety lever is in the ejection controls LOCKED (safe) position?

9. If the F–16 ejection control safety lever can be moved out of the ejection controls LOCKED (safe) position with less than 2 pounds or more than 12 pounds of pull force, how do you correct the defect?

10. When inspecting the STAPAC, what do you look for when inspecting the retainer pins?

11. How do you perform the emergency oxygen hose inline disconnect check on ACES II?

232. Clean and lubricate

1. How should you clean off heavy accumulations of dirt and grease on the ACES II?

2. On the ACES II, how is corrosion prevention accomplished?

3. Why do we lubricate explosive cartridge packings?

4. How do you lubricate seat rollers?

233. Troubleshooting

1. What is your next step when an ACES II P-lead fails a multimeter resistance check after you have disconnected the shell, ensured the threads of the receptacle and the connector are clean and unobstructed, and cleaned them with shop air and a dry cloth?

2. When troubleshooting an ACES II inertia reel, how do you correct adjustment of the reel control assembly terminal?

3. What is the first step when troubleshooting a binding ACES II inertia reel control assembly?

4. How do you troubleshoot an ACES II restraint release reset lever if it does not operate smoothly or fails to reset?

234. Using escape system schematics

1. On escape system schematics, what depicts components, actions, and sequences?

2. Using the schematic from figure 3–19, determine what F–16 egress component fires the 0.40-second delay initiator.

3. Using the schematic from figure 3–19, determine what F–16 egress component fires the aft seat's rocket catapult.

4. Concerning the schematic from figure 3–19, what does a series of five dots represent?

5. On escape system schematics, how would you determine the location of ballistic gas?

6. What is the most important thing to remember about energy transfer lines when reading escape system schematics?

7. How would you find valves, gates, sequencers, and linkages on an escape system schematic?

3–4. Martin Baker Ejection Seat

The Martin Baker seat is an original pioneer of ejection seat development and approximately 17,000 seats are being used currently by 84 different air forces around the world. Since the first Martin Baker seat live ejection in 1946, there have been more than 7,545 lives saved by this seat. The seat offers a state-of-the-art, lifesaving performance, which interfaces with the existing canopy jettison system and the contents of the Personal Survival Pack matches operator's requirements to suit the aircraft role. The seat also offers maximum possible pilot size and weight range accommodation (without airframe changes), with a simple seat installation and reduced life cycle costs.

The following two lessons cover the Martin Baker ejection seats installed in T–38C aircraft. The Martin Baker seats discussed in this lesson are almost identical to the ones used in the F–35 egress system. Let's first discuss the major components and then look at the theory of operation.

235. Martin Baker major components

The part number for the forward seat is MK US16T–1 and the aft seat, MK US16T–2. These are dual catapult, lightweight seats operated by cartridges with the aid of a rocket motor. A gas-operated interseat sequencing system (ISS) controls which of the two aircrew members starts the ejection sequence. Time-delay cartridges ensure that the *rear seat always ejects first*, with an automatic time interval before the front seat ejects. A solo mode can be selected. This gives the shortest possible time for front seat ejection.

The front and rear cockpit ejection seats are each mounted in tracks attached to the aircraft structure. Four pairs of side slippers are installed on each seat, keep the seat positioned between the tracks, and allow the seat to slide upward and out of the aircraft during ejection. Each seat contains the following components:

- Two ejection rocket catapults.
- Ballistic powered inertia reel.
- Ground safety pin.
- Seat adjusting unit and toggle switch.
- Automatic safety belt release.
- Headrest.
- Drogue parachute.
- Drogue gun.
- Ballistic initiators.
- Lap belts.
- Leg restraints.
- Garters.

The right and left sides of the seat are shown in figures 3–20 and 3–21. Each seat is equipped with a canopy piercer and will eject through the canopy should the canopy jettison system malfunction.

The ejection seats have the following five main components:

- Guide rails assembly.
- Catapult and cross beams assembly.
- Seat bucket assembly.
- Parachute assembly.
- Seat survival kit.

Guide rails assembly

Two guide rails for the ejection seat are attached to the aircraft structure in the cockpit. The ejection seat is attached to the guide rails by top latches in left and right catapults. The ejection sequence releases the top latches, causing the seat to rise up the guide rails on four pairs of slippers (attached to the catapults) which are engaged in slots in the guide rails.

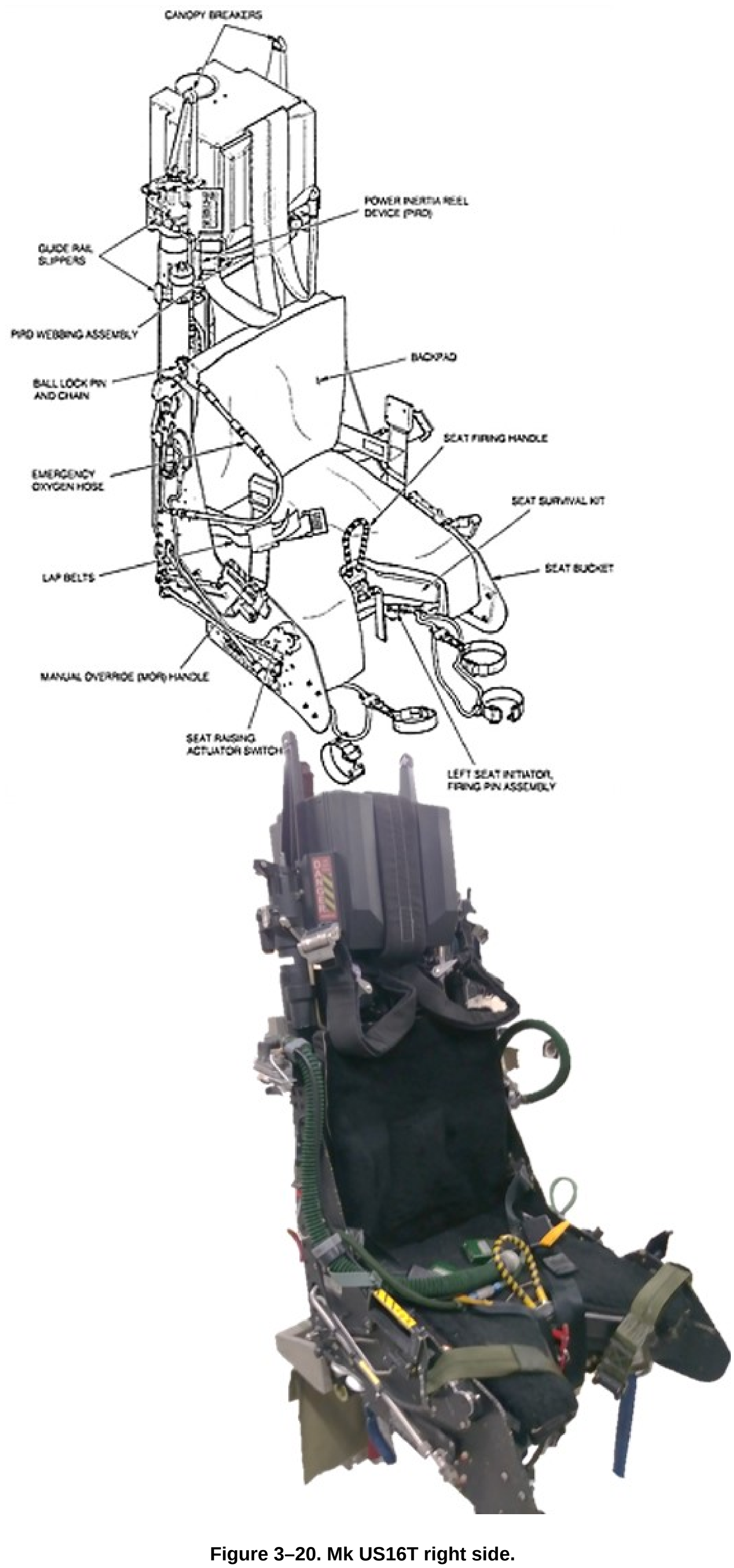

Figure 3–20. Mk US16T right side.

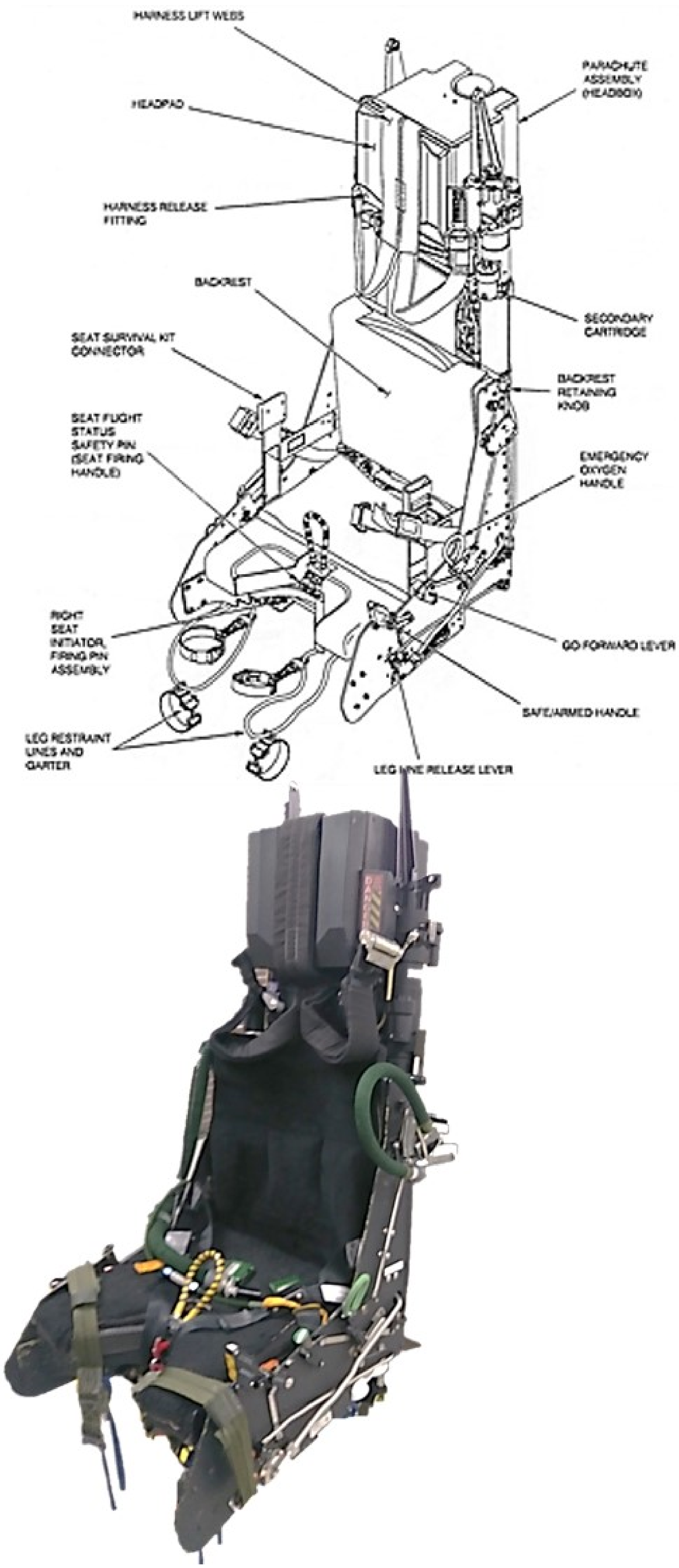

Figure 3–21. Mk US16T left side.

Catapult and cross beams assembly

Left and right rocket catapults are attached at each side of the top and bottom cross beams. Each catapult has an outer tube and inner piston tube. A head pad is attached between the top caps of the left and right catapults in front of the parachute container (headbox). The catapult and cross beams are the primary location for the ejection seat components and the catapults are primary components in the initial ejection sequence.

Seat bucket assembly

The seat bucket is attached to sliding collars on the left and right catapults. The seat-firing handle safety pin is on the seat bucket, which is also the primary location of the operating controls. The yellow-and-black striped seat-firing handle is on the front of the seat bucket. The ejection sequence is started when the aircrew member pulls the seat-firing handle. In figure 3–22, you can see a safety pin is attached to a red streamer and is put through the handle to make the ejection seat SAFE. The safety pin cannot be installed in the seat-firing handle when the SAFE/ARMED handle is in the ARMED position.

Figure 3–22. Seat bucket and firing handle.

Initiators

Left and right seat initiators are attached to the bottom front of the seat bucket. Sear pins fire both seat initiators that are connected to the seat-firing handle (attached to the front of the seat bucket) by a linkage (fig. 3–23). The SAFE/ARMED handle on the left side of the seat bucket locks the seat-firing handle when the safety pin is removed (fig. 3–24). When in the SAFE position, the handle is white and has SAFE written on it in black letters. When in the ARMED position, the handle has black-and-yellow stripes and has ARMED written on it in black letters. When the seat- firing handle safety pin is installed, the SAFE/ARMED handle cannot be placed in the ARMED position without using excessive force.

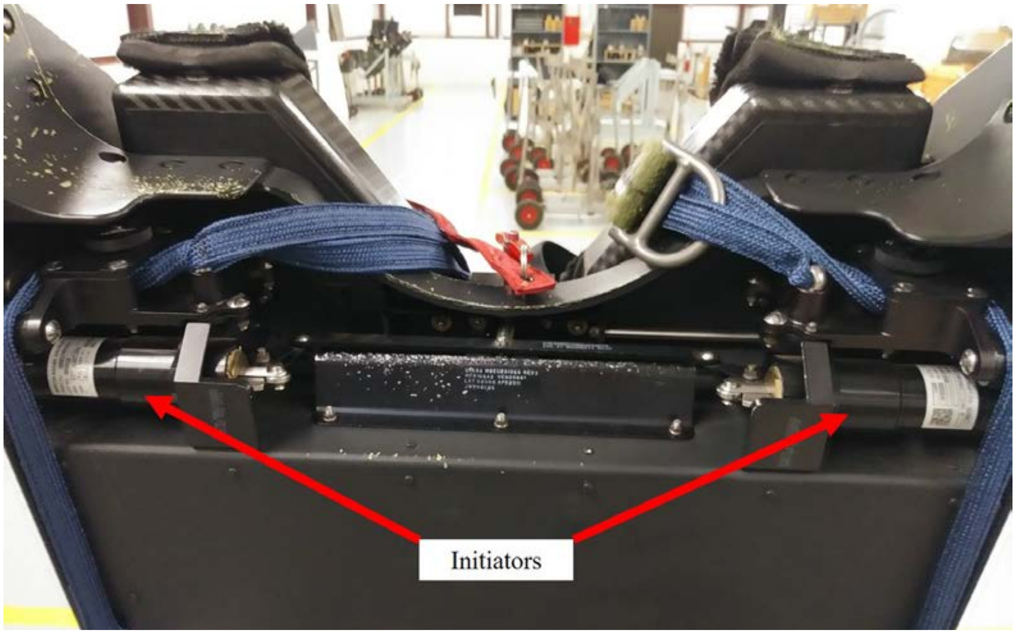

Figure 3–23. Initiators.

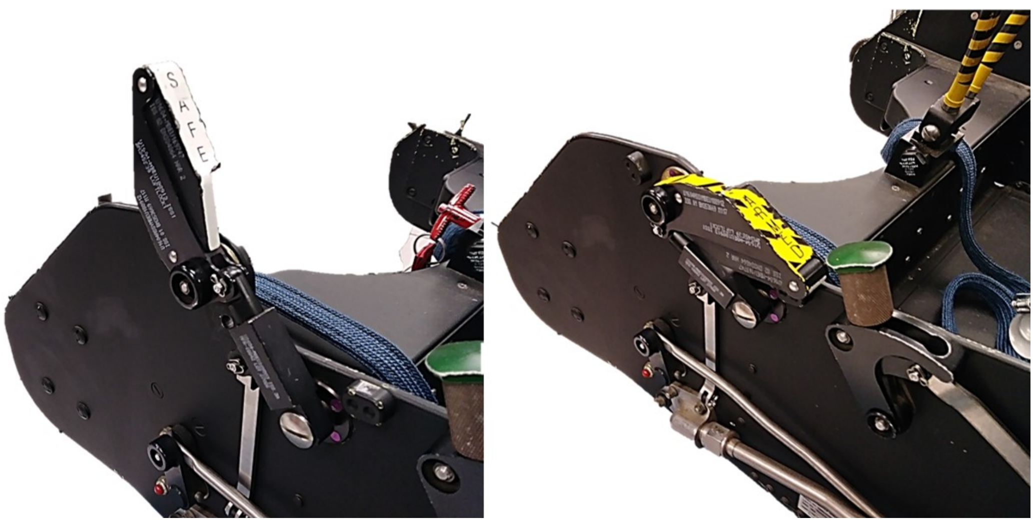

Figure 3–24. Safe/armed lever.

Seat actuator

The seat height can be adjusted by operating a seat raising actuator attached to the top cross beam of the seat bucket. The screw jack of the seat raising actuator is attached to the bottom of the body of the powered inertia reel device (PIRD). A switch on the right front of the seat bucket operates the seat raising actuator. The backrest can be adjusted forward or rearward for different aircrew personnel.

Go-forward lever

The PIRD go-forward lever is on the left side skin of the seat bucket. When the lever is in the rear position, the PIRD is locked, preventing all forward movement. When the lever is in the forward position, the aircrew can move freely forward and back.

Under seat rocket motor

The under seat rocket motor (USRM) is attached to the bottom rear of the seat bucket (fig. 3–25). When fired by gas from the left or right multi-purpose initiator (MPI), gas pressure from USRM propellant goes through two exhaust nozzles in each of the two end caps. This gives the thrust necessary to continue the seat's acceleration and achieve the velocity required for proper seat trajectory.

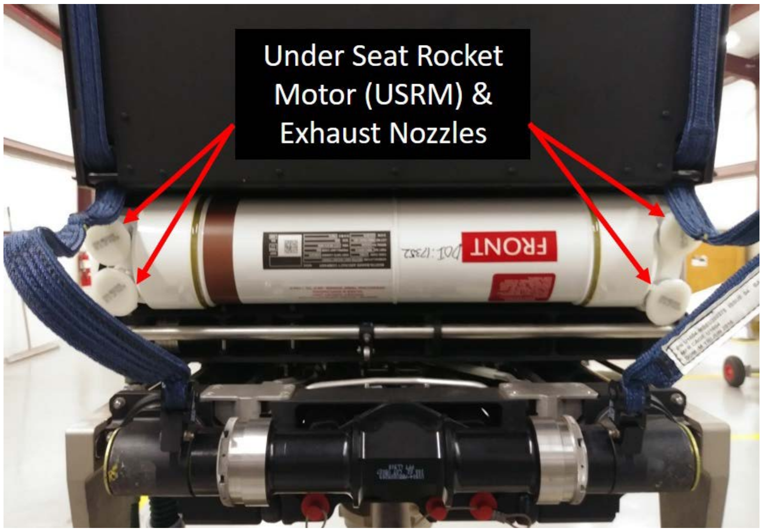

Figure 3–25. Under seat rocket motor.

Emergency oxygen cylinder

The emergency oxygen cylinder (which has a contents gauge) is installed on the left inner seat bucket and connects with the emergency oxygen rigid hose (fig. 3–26). The other end of the emergency oxygen rigid hose (which has a connector for connection of the aircrew emergency oxygen hose) is on the right of the seat bucket. The system automatically supplies the aircrew with oxygen for a short period during ejection. It can be used manually when the main oxygen supply cannot operate. Gas from the left or right MPI cartridge moves a piston to operate the emergency oxygen control handle. The handle operates a linkage (on the left side skin of the seat bucket) connected to the operating head of the emergency oxygen cylinder, to turn on the emergency oxygen supply.

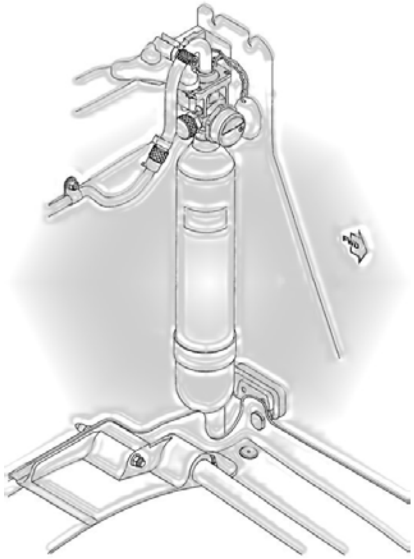

Figure 3–26. Emergency oxygen cylinder.

Manual override handle

The manual override (MOR) handle is on the right side of the seat bucket. It has yellow-and-black stripes. It is connected by a linkage to a firing unit in the lower right side at the rear of the seat bucket. Gas from the left or right MPI cartridge moves a piston to release the MOR handle. If the automatic seat separation sequence does not operate, the aircrew can operate the MOR handle as a backup (after ejection). This will fire a cartridge to operate the upper and lower harness locks, leg restraint line locks, the upper and lower bridle locks, and the headbox deployment unit (HBDU).

Leg restraint system

The leg restraint system is attached to the bottom front of the seat bucket. This system keeps the legs of the aircrew near to the seat bucket during ejection, reducing the possibility of leg injuries to a minimum. The system has two leg restraint line locks, two snubbers, two lower leg garters (one on the lower calf of each of the aircrew's legs, immediately above the boot) and two upper leg garters (one on the thigh of each of the aircrew's legs, immediately above the knee). The garters are illustrated in figure 3–27. The snubbers are used to adjust the length of the left hand and right hand leg restraint lines. The leg line release lever is on the left outside face of the seat bucket. If the leg line release lever is operated, the leg restraint lines release from the leg restraint locks, allowing the garters to be removed.

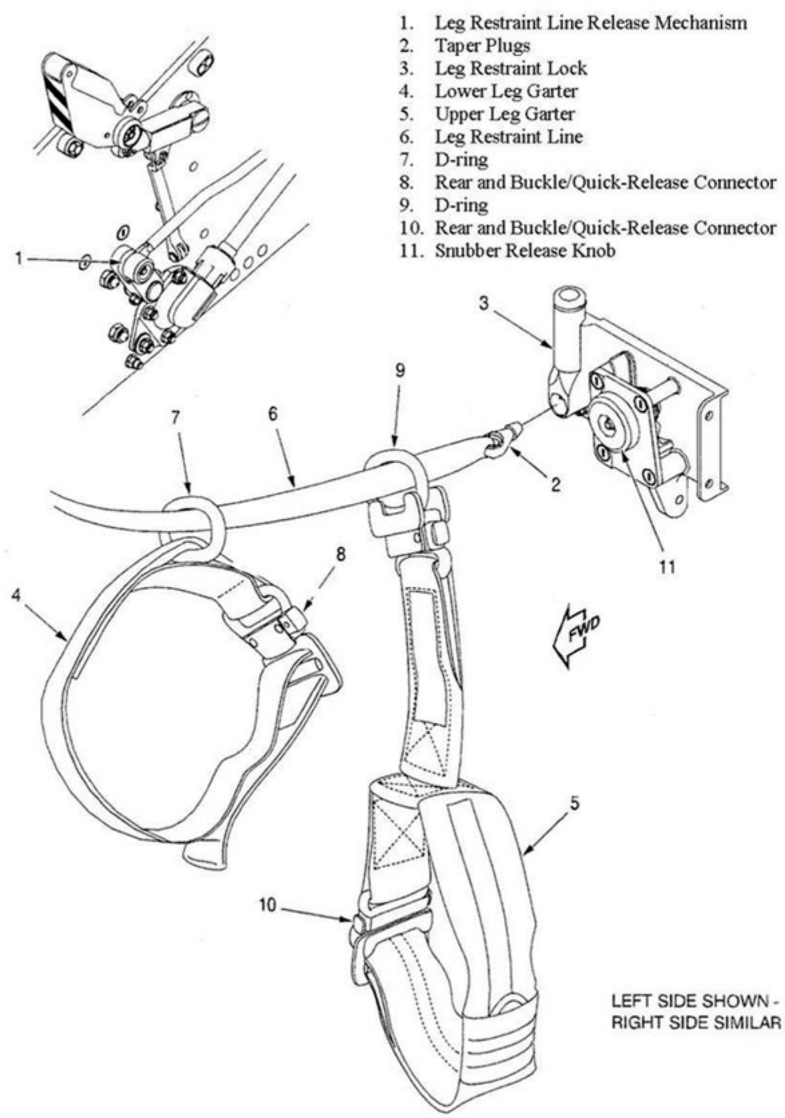

Figure 3–27. Garters/leg restraint system.

Parachute assembly

The parachute container contains a GQ Type 5000 parachute. During the ejection sequence, the HDBU deploys the parachute container. Then the parachute rigging lines, followed by the canopy, are pulled from the bottom of the parachute container. The parachute canopy is connected to the parachute lift webs. The parachute lift webs have upper harness release fittings for attachment to the upper torso harness and the underwater automatic release system (UWARS).

Seat survival kit

The seat survival kit (SSK) is installed in the seat bucket. The seat cushion is attached to the top of the sitting platform, which is designed and given a shape to give maximum support and comfort to the aircrew. The SSK has a fabric container for survival aids. The automatic deployment unit (ADU) is attached on the right side of the SSK as seen in figure 3–28 and 3–29. The ADU (metallic orange in the following figure) has an AUTO/MANUAL selector knob. A static line connects the sear of the ADU to the seat. As the aircrew is pulled from the seat, the static line pulls the sear out of the ADU. The sear releases the firing pin, which, if the ADU is set to AUTO, fires a four-second delay cartridge. After the four-second delay, the cartridge generates gas pressure, which retracts a piston to release the strap attaching the SSK to the lower harness. This lets the SSK fall to the end of the lowering line. If the ADU is set to MANUAL, a mechanism prevents the firing pin from firing the cartridge.

Figure 3–28. Seat survival kit.

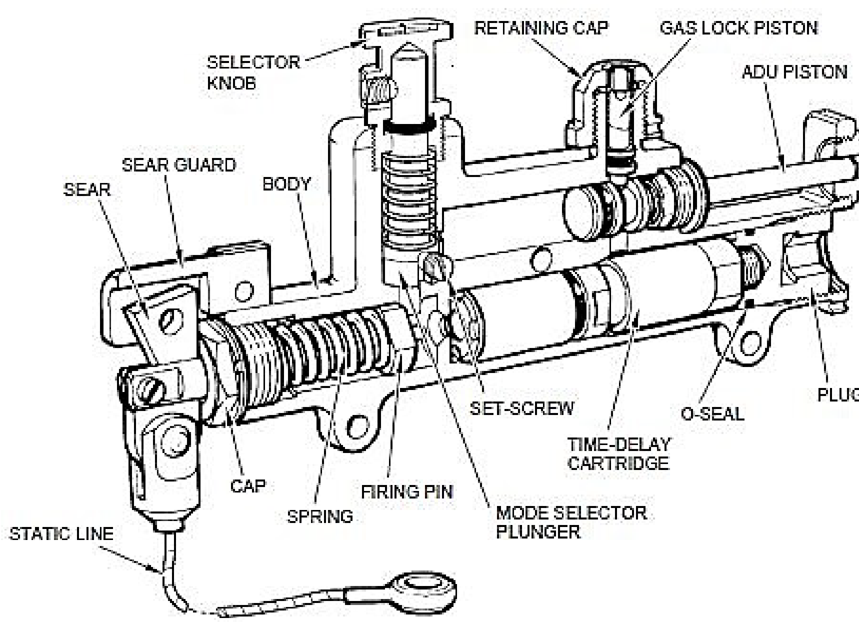

Figure 3–29. Inside view of automatic deployment unit.

236. Martin Baker theory of operation

This unit will explain the theory of operation as it relates to the T–38C aircraft. While the seat has many of the same components of the F–35, how it all relates to the cockpit components is obviously completely different.

An ISS gives the aircrew the ability to control the order in which the two seats eject (fig. 3–30). Time-delay cartridges make sure that the *rear ejection seat always ejects first* with a time interval before the front ejection seat ejects. The ISS mode selector is located in the rear cockpit and can be set to one of three modes:

- SOLO.
- CMD FWD (command forward).
- BOTH.

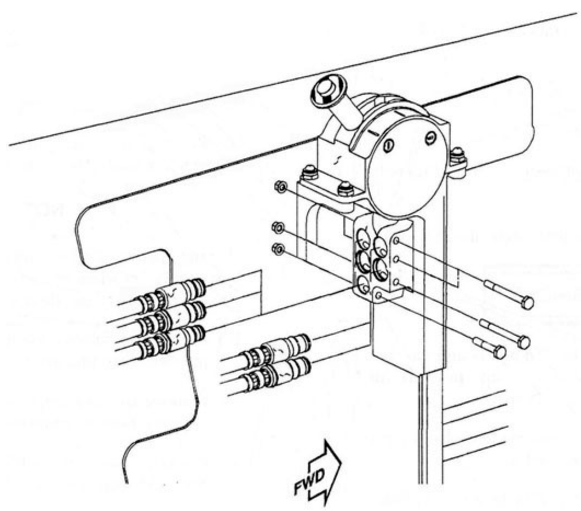

Figure 3–30. ISS selector valve.

When the aircrew has set the mode selector to the applicable position, the interseat ejection sequence occurs as described in the following table.

Interseat Ejection Sequence Mode Selection Settings	
Mode	**Description**
SOLO	When SOLO mode is selected, the front seat ejects with a *reduced time-delay*. When the front seat-firing handle is pulled, *only* the front seat ejection sequence is started. If the rear seat-firing handle is pulled, only the rear seat ejection sequence is started. The SOLO mode is only applicable when the aircraft is to fly with one crewmember.
CMD FWD	When the front seat-firing handle is pulled in the CMD FWD mode, the ejection sequence is started for *both the front and rear* seats. If the rear seat-firing handle is pulled, only the ejection sequence for the rear seat is started.
BOTH	In the BOTH mode, the ejection sequence is started for both seats when *either the front or the rear* seat-firing handle is pulled. When the mode is set to CMD FWD or BOTH, the rear seat *always* ejects first, with an interval of time before the front seat ejects.

Ejection is started when the crewmember pulls the seat-firing handle on the front of the seat bucket. Gas pressure travels to time-delay cartridges attached to a manifold on top of the bottom cross beam. When the ejection sequence is started, gas pressure from the left seat initiator (on the seat bucket) is supplied through hoses to operate the ISS and the related left time-delay cartridge. Gas pressure from the right seat initiator is supplied through hoses to operate ISS and the related right time-delay cartridge. After the related time-delay, time-delay cartridges initiate the catapult primary cartridge.

The gas inlets of the catapult primary cartridge are connected to the bottom of the manifold on the bottom cross beam. The two gas outlets of the primary cartridge are attached to catapult collars on each catapult inner piston tube. Gas pressure in the catapults cause the left and right catapult top latches to release. Gas pressure in the catapults also causes bottom latches to engage in the two guide rails. With the catapult top latches released, increased gas pressure causes catapult outer tubes, with seat attached, to rise up the guide rails. The inner piston tubes stay in the cockpit, locked by the bottom latch pistons to the guide rails. When the outer tube has risen enough, the firing unit of the secondary cartridge in each catapult becomes open to, and is fired by, gas from the primary cartridge. This added pressure from the secondary cartridges increases the seat's upward acceleration and velocity. Gas from the right seat initiator is supplied through a hose to initiate the cartridge of the PIRD. The PIRD is installed horizontally on the front face of the top crossbeam. The upper harness is attached to it. The PIRD pulls and locks the aircrew in the correct posture for ejection before the time-delay cartridges initiate the catapult primary cartridge.

Left and right MPIs are attached to the bottom cross beam for each side of the time-delay cartridges. Each MPI has a static line attached to the cable attachment plate, which remains with the aircraft during ejection. When the seat rises, the static lines are pulled tight and each releases a firing pin to fire an MPI cartridge.

The length of the left MPI static line causes the USRM to fire after the end of the catapult stroke. Gas from the left MPI cartridge is supplied through hoses to the USRM (attached to the seat bucket). Gas from the left MPI cartridge is also supplied through hoses to the MOR lock housing, the emergency oxygen/USRM manifold (both attached to the seat bucket). The barostatic time-release unit (BTRU) is attached to a flange on the inside face of the left catapult and the drogue deployment unit (DDU) tilt mechanism.

The length of the right MPI static line causes gas from the right MPI cartridge to be supplied through hoses to the DDU attached to the rear face of the top crossbeam. The gas fires the DDU cartridge after the end of the catapult stroke. The gas from this cartridge operates a two-stage piston assembly, which deploys the drogue canister (attached to the top of the DDU). The momentum of deployment causes the canister to separate from the drogue, which inflates to decrease velocity and stabilize the seat.

Gas from the right MPI cartridge is also supplied through hoses to the BTRU and the automatic backup unit (ABU). The BTRU mechanism prevents parachute deployment until altitude and forces caused by ejection at high velocity reach appropriate levels. The ABU time-delay mechanism delays parachute deployment for 3.3 seconds. In the event of BTRU failure, the ABU time-delay mechanism delays parachute deployment until a safe altitude is reached.

The BTRU cartridge fires when conditions are satisfactory. Gas from the BTRU cartridge is supplied through hoses to the HBDU attached to the top crossbeam. The HBDU piston deploys the parachute container attached to the top caps of left and right catapults. The momentum generated by deployment causes the parachute container to separate from the personnel parachute, which then inflates to pull the aircrew from the seat.

Gas from the BTRU cartridge is supplied through hoses to the four drogue bridle locks to release them and discard the bridle and drogue.

The BTRU cartridge also supplies gas pressure to the time delay unit (TDU) attached to the left face of the BTRU. Gas from the TDU cartridge is supplied through hoses to release the upper and lower harness locks and leg restraint lines. The short delay before the TDU cartridge fires keeps the aircrew in the seat against the reaction force of the HBDU, but releases the locks before the parachute inflates.

As the parachute inflates, it pulls the aircrew out of the seat (when the inflation load is sufficient to separate the SSK sticker straps from the sticker clips, which attach it to the seat). The load necessary to separate the SSK sticker straps from the sticker clips makes sure that when the aircrew does separate from the seat, the risk of contact with the seat is at a minimum.

Gas from the ABU cartridge fires the HBDU cartridge to deploy the parachute and release the upper and lower bridle locks, upper and lower harness locks, and the leg restrain lines in case of a BTRU and TDU failure.

Self-Test Questions

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

235. Major components

1. Match the Martin Baker T–38 escape system component/term listed in column B with its description in column A by writing the correct letter in the blank space provided. Descriptions in column B may be each be used only once.

Column A	*Column B*
____(1) Attaches to the seat by top latches in catapults.	a. Mk US16T–1.
____(2) Installed on left inner seat bucket.	b. Mk US16T–2.
____(3) Locks the seat-firing handle.	c. Guide rails assembly.
____(4) AUTO mode releases SSK after four seconds.	d. Catapult and cross beams assembly.
____(5) Primary location of operating controls	e. Seat bucket assembly.
____(6) Attached to bottom rear of seat bucket.	f. Seat-firing handle.
____(7) Forward seat.	g. SAFE/ARMED handle.
____(8) Turns the handle black with yellow stripes.	h. SAFE position.
____(9) Includes snubbers and garters.	i. ARMED position.
____(10) Turns the handle white.	j. Seat actuator.
____(11) Aft seat.	k. Go-forward lever.
____(12) Contains survival aids.	l. URSM.
____(13) Attached to the bottom of the PIRD body.	m. Emergency oxygen cylinder.
____(14) Includes the headbox.	n. MOR handle.
____(15) Deploys the parachute container.	o. Leg restraint system.
____(16) Connected to two seat initiators by a linkage.	p. HDBU.
____(17) Deploys the parachute container.	q. SSK.
____(18) Operates the PIRD.	r. ADU.

236. Martin Baker theory of operation

1. What controls which of the aircrew starts the ejection sequence?

2. What seats eject when the rear seat-firing handle is pulled in CMD FWD mode?

3. What seat initiator sends gas pressure to the ISS?

4. How do the left and right catapult top latches release?

5. What seat initiator fires the PIRD?

6. How are the MPIs fired?

7. The right MPI cartridge sends gas pressure to fire which components?

8. What component fires the HBDU cartridge in case of BTRU and TDU failure?

Answers to Self-Test Questions

222

1. TO 00–20–1.
2. (1) c.
   (2) b.
   (3) d.
   (4) a.

223

1. Flight stability, suitability, and preparedness.
2. (1) b.
   (2) c.
   (3) d.
   (4) a.
3. Prior to the first flight of a specified flying period, when the preflight validity period has expired, and when the preflight validity period is 72 hours and the aircraft has not flown within 48 consecutive hours.
4. If an aircraft lands to change pilots or other crewmembers, or if an aircraft makes a brief stop with the crew staying in the immediate area of the aircraft the BPO is not required since the aircraft has not been released by operations.

224

1. Periodic and phase.
2. Hourly postflight and periodic inspections (from the periodic concept) and phase inspection (from the phase concept).
3. BPO inspection.

4. Inertia reels and lapbelts for wear and proper operation; seats and components for cleanliness and corrosion; ejection controls for proper identification; and explosive items for time changes coming due.
5. Periodic inspection.
6. They may be performed in advance to cover the period of the extended mission.

225

1. At the end of the mission during which the specified number of days have accrued.
2. The post dock of the last ISO inspection.
3. Only when the deviation exceeds the overfly authorized by the MDS specific –6 technical order (if applicable).
4. Major and minor inspections.

226

1. Aircraft in PDM do not require the 90-day inspection to be accomplished if all the 90-day requirements have been accomplished as part of the PDM contract, and 90 days has not elapsed since they were done.
2. The losing unit.
3. All parts of the egress system are serviceable and accounted for by correct part number, serial number and lot number as applicable.
4. On the accrual of a specific number of flying hours of operation; following the lapse of a specific calendar time; or after the occurrence of a specific or unusual condition.
5. It must be changed and is never left until the next scheduled inspection.

227

1. If you are assigned to an area with high humidity or other conditions which could contribute to corrosion, or if you are assigned to an area with frequent high winds causing windblown debris.
2. Every 36 months and as directed by local operating instructions.
3. Normally, they are performed when an aircraft returns from depot, on newly assigned aircraft, during major inspections, and whenever the egress system’s integrity is in question.
4. B–1 and B–2.
5. SEQUENCE START switch, emergency manual parachute deployment handle, environmental sensor, firing control handle(s), and the ejection control safety lever.
6. A visual inspection, a magnification inspection, and a dye penetrant inspection if cracks are suspected.
7. Qualified personnel as identified in the special certification roster.
8. Annually.
9. That shop must create a WCE or job for the IPI for the different work center in IMDS.
10. Headquarters, NAF, or MXG/CCs.

228

1. It provides a valuable means for upgrading inspection skills and techniques.
2. Applicable –6 inspection workcards, technical orders including WUC manuals; adequate hand tools and special tools; bench stock and petroleum products required for servicing; and a card bin for controlling inspection workcards.
3. (1) c.
   (2) b.
   (3) a.
   (4) d.

229

1. (1) h.
   (2) e.
   (3) o.
   (4) q.

(5) m.
(6) a.
(7) b.
(8) f.
(9) j.
(10) c.
(11) p.
(12) n.
(13) k.
(14) g.
(15) i.
(16) d.
(17) l.

2. Mode 1 - low altitude/low speed. Mode 2 - low altitude/high speed. Mode 3 - high altitude/low or high speed.

230

1. The DRS.
2. A–10s, B–1Bs, B–2s, and F–15s.
3. F–16s and F–22s.
4. The switch is turned ON when the switch actuating bellcrank contacts a striker on the right-hand guide rail.
5. It is directed by means of a pulley system, in a direction that allows the seat to maintain proper pitch attitude.
6. 0.182 seconds and 0.192 seconds, respectively, after SEQUENCE START switch detection.
7. Once Mode 2 speed and altitude conditions are met.

231

1. Do it prior to the first day of the 37th month since the previous inspection.
2. The resistance must be 0.010 ohms or less.
3. The bellcrank should rotate to the down position. The lever assembly should drop into place and contact the first bellcrank notch. The mortar disconnect pins should retract. The shoulder restraint retaining pins and lap belt pins should fully retract. The lap belt end fittings should release. The pulley assembly should not rotate. The seat pan latch should disengage from the seat pan.
4. The force should not exceed 45 pounds. The bellcrank should rotate to the down position. The lever assembly should drop into place and the lever should contact the first bellcrank notch. The mortar disconnect pin should retract. The shoulder restraint retaining pins and lap belt pins should fully retract. The lap belt end fittings (if installed) should release. The seat pan should disengage from the seat pan.
5. 42.5 pounds minimum.
6. If the specified force is more than 7 pounds, or if torqueing the bolt in the grip assembly pivot attachment did not work the specified force, you'll need to remove the washers, sand them with medium grit sandpaper. Then reinstall the washers and adjust the torque on the bolt in the grip assembly pivot to obtain the specified force.
7. Compress the spring and move the lock ring on the guide under the adjustment ring to a groove closer to the spring. Then repeat the adjustments as required to obtain readings within the specified limits.
8. Disconnect the initiator firing rod and terminal from the ejection initiator. Disconnect both the left-hand and right-hand initiator firing rods and terminals from the ejection initiators. Then remove the ejection seat pin assembly from the firing control handle assembly. Place the ejection control safety lever in the EJECTION CONTROLS LOCKED (safe) position. Next, apply an actuation force of 42.5 to 57.5 pounds using a force gage on the firing control handle. The firing control handle should not actuate. However, up to .50 inch of handle travel is permissible for the left-side handle and .80 inch of travel is permissible for the right-side handle measured at the forward end.
9. Replace the ejection control safety lever spring.

10. Worn or damaged surface that would affect security of cable assembly when pins are installed in the rocket motor.
11. Take two pieces of cord, tie one end of each cord around the groove between the nut and the emergency oxygen hose on each side of the inline disconnect. Attach a force gage to one cord and use the cord which is not attached to the force gage to apply force with a slow, steady pull. Observe the amount of force required to disconnect the connector on the force gage. The force required should be between 16 to 32 pounds.

232

1. Wipe off heavy accumulations of dirt and grease with a clean, lint-free or nap-free dry cloth moistened in dry-cleaning solvent PD–680 Type II or III.
2. Cleaning, paint touch-up, and use of protective materials to remove or prevent contact of foreign substances that cause corrosion.
3. It helps to extend their life by protecting them from drying and cracking.
4. Apply dry film lubricant in accordance with the manufacturer's instruction as required.

233

1. If resistance still exceeds 0.010 ohm, confirm the accuracy of the multimeter used in the test. You may have to replace the multimeter's batteries.
2. Remove the cotter pin and washer, loosen the locknut, and remove the terminal from the inertia reel cam lever. Ensure the inertia reel cam lever is against the stop in the "A" position and control handle is in the UNLOCKED position. Adjust the terminal until the hole lines up with the inertia reel cam lever. Preload the terminal by rotating the terminal one-half turn clockwise and install the terminal on the cam lever, secure the locknut, install the washer and the cotter pin. If that does not work, check to ensure that the inertia reel cam lever is in the "A" UNLOCKED position and is slightly preloaded to the full travel position by the control detent spring force. If necessary, readjust the terminal one-half turn for required preload.
3. If the inertia reel control assembly is binding, first check for lack of lubricant inside the handle slot. Lubricate the control assembly with solid film lubricant in the handle slot and see if the binding has been corrected. If that does not work, the control assembly may be defective and should be replaced.
4. Check for proper installation of components and replace defective spring, the reset lever, or the reset knob.

234

1. Symbols.
2. A 0.33-second delay initiator.
3. An M–99 initiator.
4. Lanyard.
5. It may be represented with a pattern, such as alternating black and white lines or as gray shading.
6. The function of the line.
7. They are depicted with small, graphic representations of the actual items.

235

1. (1) c.
   (2) m.
   (3) g.
   (4) r.
   (5) e.
   (6) l.
   (7) a.
   (8) i.
   (9) o.
   (10) h.
   (11) b.
   (12) q.

(13) j.
(14) d.
(15) p.
(16) f.
(17) n.
(18) k.

236

1. The ISS.
2. Only the rear seat.
3. The right seat initiator.
4. Gas pressure from the catapults.
5. The right seat initiator.
6. When the seat rises, the static lines are pulled tight and each releases a firing pin to fire the MPI cartridge.
7. The DDU, BTRU, and ABU.
8. ABU.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to AFCDA.

51. (222) Which inspection requires skills, equipment, and facilities beyond your normal duties?
    a. Phase inspection.
    b. Isochronal inspection.
    c. Programmed depot maintenance.
    d. Aerospace vehicle manufacturer A or B check.

52. (223) During which aircraft inspection are safety pins removed to prepare for flight?
    a. Periodic.
    b. Thru-flight.
    c. Postflight.
    d. End of runway.

53. (223) Which aircraft inspection is performed prior to takeoff at intermediate stops for refueling or other normal requirements?
    a. Preflight.
    b. Thru-flight.
    c. Postflight.
    d. End of runway.

54. (224) What would an egress journeyman inspect during an hourly postflight inspection?
    a. The condition of ballistic hose O-rings.
    b. The contents of ejection seat survival kits.
    c. Corrosion on ejection seats and components.
    d. The integrity of safety wire on components inside access panels.

55. (224) During which aircraft inspection would ejection seats be removed from the aircraft, disassembled, cleaned, and painted?
    a. Phase inspection.
    b. Periodic inspection.
    c. Preflight inspection.
    d. Hourly postflight inspection.

56. (225) What interval does the *isochronal* inspection concept use for scheduling inspections?
    a. Shelf life.
    b. Service life.
    c. Flying hours.
    d. Calendar intervals.

57. (225) A *major* inspection is computed from the programmed
    a. start date of the last minor inspection.
    b. start date of the last major inspection.
    c. end date of the last minor inspection.
    d. end date of the last major inspection.

58. (225) Which *isochronal* inspection is a combination inspection of former basic postflight and hourly postflight inspections?
    a. Major inspection.
    b. Minor inspection.
    c. Phase inspection.
    d. Home station check.

59. (225) Who can approve home station check schedule deviations?
    a. Operational wing commander.
    b. Operations group commander.
    c. Maintenance group commander.
    d. Lead command functional manager.

60. (226) Who performs *acceptance* inspections?
    a. Maintenance personnel from the depot.
    b. Maintenance personnel from the losing unit.
    c. Maintenance personnel from the gaining unit.
    d. Major command headquarters functional managers.

61. (227) On the Martin Baker seat, components made from which type of metal are highly susceptible to corrosion?
    a. Steel.
    b. Tungsten.
    c. Aluminum.
    d. Magnesium.

62. (227) During an F–16 canopy inspection, what would you use to check for cracks around bolt holes which would otherwise not be visible?
    a. Magnifying glass.
    b. Borescope.
    c. Mirror.
    d. Prism.

63. (227) Which advanced concept ejection seat (ACES) II component would you *functionally* check during a 36-month inspection?
    a. Seat sidecap.
    b. Survival kit radio.
    c. SEQUENCE START switch.
    d. Pitch stabilization control assembly.

64. (227) Who decides to alert the rest of the Air Force to the results of a one-time inspection (OTI)?
    a. Supervisors.
    b. Quality assurance.
    c. The lead command.
    d. The maintenance group commander.

65. (228) During which inspection phase would personnel discuss what can reasonably be accomplished during the time allotted?
    a. Fix phase.
    b. Look phase.
    c. Pre-inspection phase.
    d. Post-inspection phase.

66. (228) Which inspection phase prepares the aircraft for a functional check flight?
    a. Fix phase.
    b. Look phase.
    c. Pre-inspection phase.
    d. Post-inspection phase.

67. (229) On the advanced concept ejection seat (ACES) II, which explosive component rolls the seat about its horizontal axis to impart a horizontal vector to its trajectory?
    a. Drogue parachute.
    b. Restraint release thruster.
    c. Trajectory divergence rocket.
    d. Pitch stabilization control assembly.

68. (230) On the advanced concept ejection seat (ACES) II, which type of aircraft seats have *single* firing control handles?
    a. A–10 and F–15.
    b. B–1B and B–2.
    c. B–52 and T–38.
    d. F–16 and F–22.

69. (230) During advanced concept ejection seat (ACES) II ejection, the flip-up pitot tubes actuate when the
    a. ejection control handle(s) is/are pulled.
    b. parachute portion of the seat clears the rails.
    c. pitot inputs are sensed by the speed transducers in the sensor.
    d. static pressure inputs are sensed by altitude transducers in the sensor.

70. (230) Which explosive component(s) do/does *not* fire during an advanced concept ejection seat (ACES) II ejection, if the digital recovery sequencer (DRS) selects Mode 1 ejection?
    a. Drogue gun.
    b. Restraint release thruster.
    c. Drogue severance cutters.
    d. Trajectory divergence rocket.

71. (230) During advanced concept ejection seat (ACES) II ejection, if the digital recovery sequencer (DRS) selects Mode 3 ejection, when will the pilot chute and recovery parachute deploy?
    a. 0.032 seconds after sequence start switch detection.
    b. 0.192 seconds after sequence start switch detection.
    c. When Mode 1 speed and altitude conditions are met.
    d. When Mode 2 speed and altitude conditions are met.

72. (231) During the advanced concept ejection seat (ACES) II SEQUENCE START switch checkout, when checking pins with the switch bellcrank arm depressed, there should be continuity at pins
    a. A and B.
    b. A and C.
    c. A and D.
    d. B and C.

73. (231) If the SEQUENCE START switch bellcrank is discovered twisted, what would be the correct action to take?
a. Gently bend/flex the bellcrank into tolerable limits.
b. Replace the bellcrank and test new one with the Go/No-Go gauge.
c. Place bellcrank in a vice and straighten to pass the Go/No-Go test.
d. Place bellcrank on a hard, flat, level surface and use a soft-faced hammer to straighten into tolerable limits that will pass the Go/No-Go test.

74. (231) What are you required to do after making sure the striker stop pin is installed during the emergency manual parachute deployment handle test?
a. Pull the ground servicing cable.
b. Remove the recovery parachute.
c. Remove the ejection seat pin assembly.
d. Disconnect the P-lead P–11 from the emergency power supply.

75. (231) What is the *first thing* to happen after pulling the ground servicing cable during the emergency manual parachute deployment handle test?
a. Lap belt end fittings should release.
b. Mortar disconnect pins should retract.
c. Bellcrank should rotate to the down position.
d. Shoulder restraint retaining pins and lap belt pins should fully retract.

76. (231) During the advanced concept ejection seat (ACES) II firing control handle test for the F–15 seat, how many force readings do you record and what is the maximum pull force?
a. Two force readings and 42.5 pounds.
b. Four force readings and 42.5 pounds.
c. Two force readings and 57.5 pounds.
d. Four force readings and 57.5 pounds.

77. (232) What advanced concept ejection seat (ACES) II components should be checked for presence of lubrication when the seat is removed from the aircraft?
a. Packings.
b. Seat rollers.
c. Pulley bellcranks.
d. Canopy actuator release bolts.

78. (233) If your shop *cannot* resolve a technical problem with the advanced concept ejection seat (ACES) II, where should you seek assistance?
a. Engineering.
b. The item manager at the air logistics complex.
c. The system manager at the air logistics complex.
d. Air Force Materiel Command depot engineers.

79. (233) When troubleshooting an advanced concept ejection seat (ACES) II inertia reel, if the strap width does not meet 0.69 to 0.75 inches, correct it by
a. replacing the inertia reel straps.
b. rerouting the inertia reel straps.
c. readjusting the control assembly terminal.
d. replacing the inertia reel because it is probably faulty.

80. (233) If an advanced concept ejection seat (ACES) II inertia reel control assembly is binding, the *first* thing you should check is if
    a. the inertia reel cam lever is against the stop in the "A" position.
    b. the terminal holes inside the inertia reel cam lever are lined up.
    c. the inertia reel cam lever is slightly preloaded to the full travel position.
    d. there is presence of lubricant inside the inertia reel control assembly handle slot.

81. (234) On a schematic, if you are uncertain as to what you are looking at, then refer to the
    a. legend.
    b. previous schematic.
    c. theory of operation.
    d. illustrated parts breakdown.

82. (234) In which technical order would you *usually* find escape system schematics?
    a. Abbreviated.
    b. Fault isolation.
    c. General system.
    d. Troubleshooting.

83. (234) After you choose the correct technical order for an ejection system schematic, make sure you choose the correct schematic
    a. for the correct item and/or mode of ejection.
    b. from the company that engineered the aircraft.
    c. that illustrates direction of travel for ballistic gasses.
    d. for location of valves, gates, sequencers, and linkages.

84. (235) On the T–38 Martin Baker seat, what controls which of the two aircrew members starts the ejection sequence?
    a. AND gates.
    b. Check valves.
    c. Input cartridges.
    d. Interseat sequencing system.

85. (235) The T–38 Martin Baker seats have five main assemblies, including the seat survival kit, the parachute assembly, the seat bucket assembly, the catapult and cross beams assembly, and the
    a. intermediate rails assembly.
    b. guide rails assembly.
    c. seat back assembly.
    d. headrest assembly.

86. (235) On the T–38 Martin Baker seat, if the automatic seat separation sequence does *not operate*, the aircrew can
    a. pull the emergency manual chute deployment handle.
    b. cut the restraints and leap from the seat.
    c. pull the manual parachute release cord.
    d. pull the manual override handle.

87. (236) On the T–38 Martin Baker seat, which component starts the ejection sequence?
    a. Firing handle.
    b. Main rocket catapult.
    c. SEQUENCE START switch.
    d. Analog recovery sequencer.

88. (236) On the T–38 Martin Baker seat, what fires the under seat rocket motor (USRM) after the end of the catapult stroke?
a. Bleed-off gas pressure from the secondary cartridges.
b. The length of the *left* multi-purpose initiator static line.
c. The length of the *right* multi-purpose initiator static line.
d. Bleed-off gas pressure from the powered inertia reel device.

Student Notes

Glossary of Abbreviations and Acronyms

0.L.	zero load
ABU	automatic backup unit
ACC	Air Combat Command
ACES	advanced concept ejection seat
ACMS	Advanced Configuration Management System
ADU	automatic deployment unit
AEF	Air Expeditionary Force
AF	Air Force
AFCSM	Air Force computer systems manual
AFE	aircrew flight equipment
AFH	Air Force handbook
AFI	Air Force instruction
AFMC	Air Force Materiel Command
AFSC	Air Force specialty code
AFTO	Air Force technical order
AGE	aerospace ground equipment
ALC	air logistics complex
AMC	Air Mobility Command
AMXS	aircraft maintenance squadron
AN	Air Force-Navy
ARMS	Aviation Resource Management Systems
ATC	action taken code
BIT	built-in test
BPO	basic postflight
BTRU	barostatic time-release unit
CA/CRL	custodian authorization/custody receipt listing
CAD/PAD	cartridge actuated device/propellant actuated device
CAGE	commercial and government entity
CCI	controlled cryptographic item
CDC	career development course
CEM	combined effects munition
CF	carried forward
CND	cannot duplicate discrepancy

CTK	composite tool kit
C/W	complied with
DD	Department of Defense (form)
DDU	drogue deployment unit
DIFM	due-in from maintenance
DIT	data integrity team
DOD	Department of Defense
DOI	date of installation
DOM	date of manufacture
DRS	digital recovery sequencer
EAE	equipment accountable element
EAID	equipment accountability identification
ECM	egress configuration management
EED	electronic explosive device
EMF	electromotive force
EOR	end of runway
ERRCD	expendability, recoverability, reparability, category designator
FAA	Federal Aviation Administration
FAD	force activity designator
FCF	functional check flight
FEDLOG	federal logistics
FLSC	flexible linear shaped charge
FOD	foreign object damage
FOM	facilitate other maintenance
FSC	federal stock class
GACP	Global Ammunition Control Point
GEOLOC	geographic location
HBDU	headbox deployment unit
HPO	hourly postflight
HSC	home station check
IAW	in accordance with
ID	identification
ILS-S	Integrated Logistics System-Supply
IEX	issue exception
IMDS	Integrated Maintenance Data System
IPB	illustrated parts breakdown

IPI	in-process inspection
ISO	isochronal
ISS	interseat sequencing system
ISU	issue
JCN	job control number
JDD	job data documentation
JST	job standard
MAJCOM	major command
MCL	maintenance capability letter
MDC	maintenance data collection
MDD	maintenance data documentation
MDS	mission design series
MIDAS	Maintenance Integrated Data Access System
MIS	maintenance information system
MOR	manual override
MPI	multi-purpose initiator
MS	Military Standard
MSI	mission support issue
MSL	maintenance supply liaison
MSK	mission support kit
MXG	maintenance group
MXG/CC	maintenance group commander
NAF	numbered Air Force
NAS	National Aircraft Standard
NIIN	national item identification number
NRTS	not repairable this station
NSN	national stock number
OTI	one-time inspection
PCW	previously complied with
PDM	programmed depot maintenance
PIRD	powered inertia reel device
PME	precision measurement equipment
PMEL	precision measurement equipment laboratory
PRA	planning requirements document
PS&D	plans, scheduling & documentation
psi	pounds per square inch

QA	quality assurance
REMIS	Reliability and Maintainability Information System
RPC	reparable processing center
SBSS	Standard Base Supply System
SM	single manager
SRD	standard reporting designator
SSK	seat survival kit
STAPAC	pitch stabilization control assembly
TCI	time change item
TCTO	time compliance technical order
TDR	trajectory divergence rocket
TDU	time delay unit
TEX	transaction exception
TIN	turn-in
TO	technical order
TRIC	transaction identification code
U	unsatisfactory
USAF	United States Air Force
USRM	under seat rocket motor
UWARS	underwater automatic release system
VDC	volts direct current
WCD	work control document
WCE	workcenter event
WRM	war reserve materiel
WUC	work unit code
XF	transferred

Student Notes

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