INSPECTION PERFORMANCE STANDARDS

The inspection of an aircraft to determine its airworthiness requires a great amount of skill and judgment. For the most part, the items to be inspected are usually listed in a checklist provided by the manufacturer of the aircraft. But how well an item is inspected or in what order, is up to the inspector. The determination of the airworthiness of an item is sometimes easy to ascertain using guidance material provided by the manufacturer, while at other times it is left up to the judgment of the individual. Component parts of an aircraft must also be checked to determine that they meet FAA standards, as well as being legal for installation on the aircraft. These factors, combined together, make it necessary for the inspector to develop a structured system or procedure that can be used to effectively inspect an aircraft.

It is essential that inspectors develop a set of standards for themselves so they may effectively determine if an item is airworthy. These standards must be high enough to guarantee the airworthiness of the aircraft, but yet not so high as to cause needless expense for the aircraft owner. The inspector must also withstand the pressures that may be applied by others to lower those standards and represent items airworthy when they are not. Once these standards are compromised, it is very difficult for an inspector to restore his or her integrity.

Aircraft owners and operators should also understand the role and responsibilities of the inspector. While the inspector primarily determines that an aircraft is in a safe condition for continued operation, they also provide services that help maintain the value of the aircraft. As such, the inspector requires all unairworthy items to be corrected, but also recommends or performs other maintenance that, while not required, improves the aircraft’s appearance or helps to avert future problems.

INSPECTION PERFORMANCE RULES

Each person performing a 100-hour, annual, or progressive inspection shall perform those inspections in such a manner as to determine whether the aircraft concerned meets all applicable airworthiness requirements. This statement is a part of 14 CFR Part 43.15 and means that the aircraft must be physically airworthy. It must conform to its type certificate and manufacturer’s specifications, comply with all applicable airworthiness directives, and be in condition for safe flight. [Figure 4-1]

Federal Aviation Regulations

PART 43
Maintenance, Preventive Maintenance, Rebuilding, and Alteration
Effective July 6, 1964
CURRENT THROUGH CHANGE 14
(Revised September 10, 1990)

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Figure 4-1. 14 CFR Part 43 is the primary reference publication for the performance rules for conducting maintenance, including inspections.

All aircraft being maintained under an approved inspection program must also meet the requirements of 14 CFR Part 43.13. This regulation states that each person maintaining, altering, or performing preventive maintenance, shall use methods, techniques, and practices acceptable to the FAA. They shall use the tools, equipment, and test apparatus necessary to ensure completion of the work in accordance with accepted industry practices. If special equipment or test apparatus is recommended by the manufacturer involved, they must use that equipment or its equivalent acceptable to the FAA.

CHECKLIST REQUIREMENTS

Each person performing an annual or 100-hour inspection must use a checklist while performing an inspection. This checklist may be of the person’s own design, one provided by the manufacturer of the
equipment being inspected, or one obtained from another source. This checklist must include the scope and detail of the items listed in Appendix D of 14 CFR Part 43. If it is a rotorcraft, the items are listed in Paragraph b of 14 CFR Part 43.15.

FUNCTIONAL CHECKS REQUIRED
When a 100-hour or annual inspection is completed and before the aircraft can be approved for return to service, the engines must be run and checked for the following: [Figure 4-2]

1. Static (stationary aircraft) power check.
2. Idle RPM.
3. Magnetos and ignition system.
4. Fuel pressure, if equipped with a fuel pressure gage.
5. Oil pressure.
6. Oil temperature.
7. Cylinder temperature if equipped with a cylinder temperature gage.
8. All other operating systems for meeting the manufacturers’ specifications.

Figure 4-2. After a 100-hour or an annual inspection, functional checks are required before approving an aircraft for return to service.

INSPECTION PROCEDURES
The inspection of an aircraft requires that the person performing the inspection organizes their work so that the inspection can be performed in a logical and orderly sequence. This ensures that the aircraft is properly inspected with little chance that any item will be overlooked or forgotten. The accepted method of performing an inspection used by the aircraft maintenance industry also includes the service and repair activities necessary to return the aircraft to service. Including these activities into a procedure requires that the inspector follow an organized plan in completing the inspection.

The inspection of the aircraft is divided into basically five identifiable phases, as follows:

PRE-INSPECTION PHASE
The pre-inspection phase begins when the owner of the aircraft requests the services of a shop or an individual to perform an inspection on the aircraft. This phase includes the completion of a work order. The work order serves as an agreement between the maintenance facility and the aircraft owner. If problems arise during or after the maintenance operation, the work order serves as a legal document to indicate the work that was authorized and performed. Throughout the inspection process, the work order should be amended to indicate any changes in the scope of the original agreement. For example, an initial work order agreement will usually indicate that the owner has agreed that an inspection is to be performed. Before any repairs are done, however, the additional costs and time factors should be discussed with the owner, and the work order amended and signed to indicate acceptance of the additional operations and costs.
While initially filling out the work order, the technician should interview the owner to determine if there are any obvious items that the owner wants corrected or checked. Since the technician is seldom able to analyze in-flight discrepancies first-hand, it is important that owners effectively communicate all indications associated with the discrepancy. If the aircraft is legal for flight, however, it may be advantageous for the owner to duplicate the discrepancy during flight with the technician aboard.

Once the work order has been filled out and the owner interview has been completed, maintenance record research should be done. This includes a check for past work performed, any performance trends as indicated through items such as engine compression checks, landing gear problems and service history, and other prominent indicators of historical problem areas.

Airworthiness Directive and service bulletin status should be checked next. This includes research into any recurring ADs, as well as determining if there are any new ADs that require action. Remember that AD research includes the airframe, powerplant, propeller (if applicable) and all installed appliances. Before the aircraft is disassembled for inspection, it is best to organize a work plan that includes AD actions that should be taken while the aircraft is open. If AD actions become apparent during this phase, the owner should also be advised and the work order amended accordingly.

A functional check should then be performed to confirm the powerplant operation. During the run-up, record engine indication values for maximum static- and idle-RPM, manifold pressure, oil pressure and temperature, cylinder head temperature, etc.

The technician should then perform a preliminary visual inspection to determine if there are any obvious discrepancies. This includes removing the cowling and looking for fuel and oil stains. These items should be noted on a discrepancy reporting form to be further checked during the inspection. [Figure 4-4]

From this point, inspection plates, interior seats, carpet, and upholstery should be removed as required to gain suitable access to perform a thorough visual inspection. Most manufacturers' maintenance manuals provide charts or tables to indicate which inspection panels to remove.

14 CFR Part 43 Appendix D also specifies that the aircraft must be thoroughly cleaned before conducting an inspection. Many shops and technicians will perform an initial cleaning before starting an inspection, but in most cases an aircraft requires further cleaning before each area is inspected.

At this point, tools and equipment are made ready, and any known parts that will be needed are ordered.

Figure 4-4. During the "pre-inspection phase", removal of aircraft cowling is necessary. Before cleaning, note any fluid or exhaust stains on the inside of the cowling and note their location for later inspection.

**LOOK PHASE**

The look phase is the actual inspection of the aircraft. It consists of looking, feeling, checking, measuring, operating, moving, testing, and whatever else is needed to determine the condition of the aircraft and its components. The checklist should be used with a planned sequence or order in which the various items of the aircraft are inspected.

Discrepancies and needed service that become apparent are recorded during this phase of the inspection. Interrupting the inspection to perform repairs and service should be avoided as much as possible at this point. The necessary repair and service items should be accomplished after the complete aircraft and engine has been inspected, or assigned to other individuals to perform, allowing the inspector or inspection team to remain focused on completing the inspection phase.

The primary purpose of the look phase is to determine the physical airworthiness of the aircraft and its components. All of the other activities included in the inspection of the aircraft are dependent upon, and in support of, the look phase of the inspection. [Figure 4-5]
SERVICE AND REPAIR PHASE
The service and repair phase of the inspection is the necessary maintenance that is required to return the aircraft to service and keep it in airworthy condition until the next inspection. This service consists of many items such as lubricating wheel bearings, moving parts and control surface hinge bearings, as well as replacing and cleaning filters and screens, adding fluids in the brake and hydraulic reservoirs, and servicing the battery. The repair phase includes replacement, repair, and overhaul of the aircraft components and systems that are determined to be in an unairworthy condition.

FUNCTIONAL CHECK PHASE
Before an aircraft can be approved for return to service after any maintenance, a technician should conduct functional or operational checks on the aircraft or systems that have been serviced or repaired. Before a 100-hour or annual inspection can be approved for return to service, the person that approves the aircraft for return to service must run the aircraft engine(s) to determine that they will perform in accordance with the manufacturer’s recommendations of power output (static and idle RPM), magnetos, fuel and oil pressure, and cylinder and oil temperatures. This is a requirement that is directed by 14 CFR Part 43.15 which is a minimum functional check required on most engine installations. Additional checks are usually recommended to ensure that all of the systems installed in a particular aircraft or engine are in airworthy condition according to the manufacturers’ specifications. [Figure 4-6]

A typical return to service entry for a 100-hour inspection consists of the date, aircraft total time in service, a brief description of the maintenance and service performed on the aircraft, and a record of compliance with any Airworthiness Directives or service bulletins performed during the inspection. This would be followed by the statement “I certify that this aircraft has been inspected in accordance with a 100-hour inspection and was determined to be in airworthy condition”. This would be followed by the signature and certificate number of the person that performed the inspection, indicating that the aircraft meets regulatory requirements and is approved for return to service. It should be noted, however, that part of the inspection requirements also includes researching and updating a cumulative status list of ADs. This record must be thoroughly researched and signed by the inspector. While the cumulative list is generally kept separate from the inspection sign-off, it is still a vital component of the airworthiness inspection, and must be retained with the aircraft’s maintenance records for at least one year, or until the work is superseded by another inspection.

PARTS APPROVALS
Throughout the inspection process, the inspector must diligently look for unapproved parts. In addition, the inspector must identify and replace parts and components that while being FAA approved, are incorrect for that particular aircraft. The wrong part may have been installed by a certificated mechanic that made an improper substitution or possibly by a person that was not properly certificated to perform the installation.

The parts used, from the smallest nuts and bolts, to major subassemblies such as landing gear, electric motors, lights, and all other components must meet specific standards established by the FAA. Replacement parts are often procured through vendors that perform the “middle man” functions of distribution to the end user. Their parts come from a variety of sources including the original equipment manufacturer (OEM), a company authorized to make replacement parts through an FAA Parts Manufacturer Approval (PMA), the manufacturer of a part that meets FAA Technical Standard Orders (TSO), surplus parts supply companies, and many others. When a technician obtains replacement parts, it is up to that individual, or a person within an organization assigned to the task, to determine that all parts received are procured from a reputable vendor. These vendors often provide support documentation that discloses the source of where the part was manufactured or distributed. At present there is no requirement for a set method of tracking this information, but there are a number of industry accepted practices that vendors take to help control the migration of unapproved or bogus parts into the supply network.

RETURN TO SERVICE PHASE
After an inspection and/or maintenance and before an aircraft can be legally flown, certain statements or notations must be made in the maintenance records and signed by an appropriately rated mechanic. The approved for return to service statement, along with the inspector’s signature and certificate number serves the approval process.
All persons involved in aircraft maintenance should be aware of the serious consequences that may occur when illegal parts enter aviation commerce. Obviously, the main reason bogus parts must be identified and isolated is to retain safety. Ultimately though, it should be realized that the business of manufacturing and disseminating bogus parts is propelled by greed, and is only controlled by the integrity of people that strive to maintain high ethical standards.

**HARDWARE STANDARDS**

All hardware used in aircraft construction must meet certain quality standards established by the manufacturer, which ultimately must meet FAA requirements. Screws, nuts, bolts, and rivets are only a small portion of the types of hardware used. Each item must be manufactured using the proper materials, machined to the correct tolerances and dimensions, and checked for quality before being approved for aircraft use. To maintain quality, the FAA requires all hardware to be manufactured to established standards. Some of the more common standards include Air Force-Navy Standards (AN), Military Standards (MS), Military Specifications (Mil-Spec), and National Aerospace Standards (NAS), among many others.

In most cases, a technician or repair facility procures a part from a vendor of their choosing. At other times, the aircraft owner may locate and obtain parts for use on their aircraft. Aircraft owners however, should understand that the technician or repair facility can be held liable if bogus parts are installed on an aircraft. When a part is provided through a source other than from the organization doing the work, tracking documentation should be retained to support that the part is FAA-approved. This may be shown by a maintenance release document, such as a serviceable tag, or another form that indicates the condition of the part as being airworthy and approved for use.

**PARTS MANUFACTURER APPROVAL**

A PMA authorizes a manufacturer, other than the original manufacturer, to produce replacement parts. These parts include items such as brake pads and disks, spark plugs, oil filters, and a wide assortment of others. In obtaining a PMA, the manufacturer of the part must show that the item meets the same standards specified for the original part. In addition, the part manufacturer must have in place, a method of assuring quality and tracking the manufacturing process. Tracking is required in the event a discrepancy is discovered wherein parts must be identified in order to inform end users of corrective actions that must be taken.

When a part is PMA approved, the manufacturer must indicate that it has met FAA PMA approval. This is usually done on a tag or label that is affixed to the product. If the tag becomes illegible or missing, the part cannot be assumed to be approved.

**TECHNICAL STANDARD ORDERS**

The FAA also prescribes a set of standards that various aircraft appliance and component manufacturers must meet to satisfy regulations specifying minimum performance and quality requirements. These standards are presented in Technical Standard Orders (TSO). A TSO is a minimum performance standard for specifying materials, parts, and appliances used on civil aircraft. When authorized to manufacture a material, part, or appliance to a TSO standard, this is referred to as TSO authorization. Receiving a TSO authorization is both design and production approval.

One example of a TSO authorized appliance applies to newer emergency locator transmitters that broadcast on 406 MHz. In order for a new ELT to be installed in an aircraft after June 21, 1995 the ELT must meet the requirements of TSO C-126. Before that date, an ELT had to meet the requirements of TSO C-91a. The older ELTs are authorized to remain in aircraft if they were originally installed in the aircraft before that date.

TSO C-126 provides many specifications including the manufacturing minima, performance requirements, activation system reliability, as well as many others.

A small sample of other common TSOs includes the following:

- **TSO-C3d Turn and Slip Instruments**
- **TSO-C5e Direction Instrument, Non-Magnetic (Gyroscopically Stabilized)**
- **TSO-C9c Automatic Pilots**
- **TSO-C22g Safety Belts**
- **TSO-C74c Airborne Transponder Equipment**
- **TSO-C145 Global Positioning Systems**

Other TSO authorizations can be obtained on the internet from the FAA's web site at WWW.FAA.GOV.

**SURPLUS/SALVAGE PARTS**

Surplus and salvaged parts are sometimes obtained for use on civil aircraft. While this is not necessarily illegal, it presents some problems that aviation personnel must be aware of. For example, many times these parts are obtained without support documentation showing where the part was originally manufactured or obtained. Without this information it's difficult to determine the authenticity of the part, it's time in service, useful life, status of Airworthiness Directive compliance, as well as many other factors. In fact, in many cases where a part is a component, the only way to determine if it meets airworthiness standards is to perform an overhaul, but even then it may be difficult to determine if all parts used in the component were obtained from a legitimate source. If there is any doubt, it is necessary to reject the component for use on civil aircraft.
In an effort to reduce the risk of unauthorized salvage parts from entering the supply network, whenever a part or component is initially determined to be unserviceable, it should be permanently damaged or destroyed to the extent that it would not be economically feasible to repair and reuse the part.

As an additional consideration, many surplus parts are manufactured for military aircraft use and therefore are not approved for civil aircraft. The military part may appear to be equivalent to a part used on civil aircraft, but often these parts are only manufactured to the military’s specifications, which may or may not be sufficient for civil aircraft requirements. On the other hand, regardless of the quality, the part has not been evaluated to establish FAA approval. For example, spark plugs for reciprocating-engine aircraft are manufactured to FAA standards and must be FAA-approved for use in civil aircraft. Military contracts, however, may have been awarded to a manufacturer to produce a number of the same type of spark plugs. While the parts may be identical in material and workmanship, the military part is still not suitable for use in civil aircraft since it has not been monitored by the FAA through the design and manufacturing process.

It should be noted that in some situations, a part that has been manufactured for the military may be subsequently evaluated by the FAA for civil aircraft use. In most cases, if the part has been determined to meet FAA requirements, the individual or organization that requested the evaluation may be granted a Supplemental Type Certificate designating that the parts are approved for civil aircraft use. If an aircraft has these types of parts installed, the purchaser must be able to provide the certifying documentation to support that the part has been granted the proper authorization. In addition, installation of parts approved by an STC requires an FAA Form 337, Major Alteration and Repair, detailing the use of the part on a specific aircraft.

**STUDY QUESTIONS**

1. List three possible sources where a checklist may be acquired or designed for performing an inspection.

2. What does the term static RPM mean in performing a functional check?

3. List the functional checks that are required on an engine when completing a 100-hour inspection.

4. List the five phases that make up an inspection program on an aircraft.

5. The actual physical inspection of the aircraft is called which phase of the inspection program?

6. How is an aircraft approved for return to service?

7. When is it required to use a part that has been issued a TSO authorization?