



AEROSPACE RECOMMENDED PRACTICE

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Maintenance and Inspection Procedures for Rotary and Linear Mechanical Actuators

RATIONALE

Rotary and linear mechanical actuators are used in many critical aircraft applications. The proper function of these systems requires that the actuators be properly maintained and inspected for wear and damage. This document satisfies the need for having guidance material for developing detailed maintenance and inspection procedures as well as guidance material for use by personnel responsible for maintaining such actuators.

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Documents

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) shall provide guidelines for the maintenance, inspection, and support of rotary and linear mechanical actuators on in-service and aging aircraft.

1.1 Purpose

This document establishes guidelines and general procedures for inspection and maintenance of rotary and linear mechanical actuators. Maintenance and inspection of only the elements comprising the primary transmission path are addressed by this document.

1.2 Field of Application

The rotary and linear mechanical actuators serve as the output device for, and are part of, a mechanical actuation system. The output devices consist of, but are not confined to, gearing and gear boxes, mechanical brakes and clutches including no-backs and torque limiters, ball screws, sliding contact screws, roller screws, helical splines, rack and pinion assemblies, and skewed roller actuators. Maintenance and inspection of only the elements comprising the primary transmission path are addressed by this recommended practice. A typical actuation system may contain one or more of the following components (Although not limited to):

- a. Prime Mover (Hydraulic, Pneumatic, Electric, Manual)
- b. Connecting Members (Torque Shafts, Couplings, U-Joints)
- c. Sensors (RVTs, RVDTs, LVDTs, Tachometers, Hall Effects, Encoders, Limit Switches, Load Sensors)
- d. Miscellaneous Devices (Sequencers, Accessory Drives, etc.)

These components may be configured and specified apart from or integrated with the rotary and linear mechanical actuator assembly. Guidelines for maintaining and inspecting these items are outside the scope of this document. Follow the recommended procedures as provided by the manufacturers of these items.

2. REFERENCES

2.1 Applicable Documents

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

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP4386 Terminology and Definitions for Aerospace Fluid Power, Actuation, and Control Technologies

2.1.2 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-HDBK-838 Lubrication of Military Equipment

2.2 Definitions

Definitions used herein are compatible with terminology and definitions of ARP4386. Where new terms are used the definitions are presented below or within the lead paragraph of the topic.

2.2.1 AGING AIRCRAFT

An aircraft is considered as aging when it reaches its initial Design Service Goal (Certified at time of Type Certification). This limit can be defined in terms of Flight Hours, Flight Cycles, and/or Calendar Time.

3. REQUIREMENTS

3.1 Maintainability

3.1.1 Maintainability Characteristics

The ultimate maintainability goal of the actuator assembly design is to minimize maintenance requirements over the useful life of the program to ensure the continued airworthiness of flight hardware. The minimization of maintenance does not necessarily eliminate the need for periodic inspection. Inspection intervals should be determined during development and further tuned while in service. Factors such as complexity, accessibility, visibility, testability, simplicity and interchangeability should influence maintenance design. Maintainability requirements should be clearly documented within the appropriate Aircraft Maintenance Manual (AMM) or Component Maintenance Manual (CMM).

3.1.2 Maintenance and Inspection Concept

When an actuator assembly requires maintenance or inspection, the procedure should state the desired maintenance and level of maintenance that will apply. All attempts should be made to mitigate requirements for maintenance labor hours, Aerospace Ground Equipment (AGE), personnel skills, and technical publications/data.

The level of maintenance or inspection should be classified/defined as:

- a. Organizational Level or Flight Line (Maintenance - performed on the aircraft)
- b. Hangar and/or Depot/Repair Station (Inspection - performed on an actuator while removed from the aircraft)

3.1.3 Quantitative Maintainability

Each applicable level of maintenance should specify a detailed mean/average to repair period stated in maintenance man-hours, personnel skill level, and support equipment requirements.

To assist in determining the maintenance specific quantitative and qualitative maintainability tasks. Analyses can be performed, which can consist of:

- a. Maintainability Modeling
- b. Maintainability Allocations
- c. Maintainability Predictions
- d. Failure Mode and Effects Analysis (FMEA) - Maintainability Information
- e. Maintainability Analysis
- f. Maintainability Design Criteria

The Maintainability Analysis requirements for a procuring activity can be a combination of two or more of the analysis approaches that best meet the actuator assembly maintainability design objectives.