



AEROSPACE RECOMMENDED PRACTICE

ARP5936™

Issued 2005-04
Reaffirmed 2021-04

Landing Gear Storage

RATIONALE

ARP5936 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This document categorizes the different types of storage requirements, either on the aircraft or new unused or overhauled on the shelf, for aircraft landing gears/components.

Recommendations and examples of proper landing gear storage are outlined.

Reclamation recommendations are provided for aircraft landing gear returning from long-term storage.

2. 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 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AIR1364A Age Control of Age Sensitive Elastomeric Materials

ARP5316B Storage of Elastomeric Seals and Seal Assemblies

AS5778 Aircraft Component Covers

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SAE WEB ADDRESS:

Full document details: SAE ARP5936

For more information on this standard, visit
<https://www.sae.org/standards/content/ARP5936/>

Documents
Document Sharing Hub

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 1417 Standard Practice for Fluorescent Penetrant Examination

ASTM E 1444 Standard Practice for Magnetic Particle Examination

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or <http://assist.daps.dla.mil/quicksearch>.

MIL-PRF-680 Degreasing Solvent, Solvent Cutback

MIL-PRF-16173 Corrosion Preventive Compound, Solvent Cutback, Cold-Application

MIL-PRF-32014 Grease, Water Resistant, High Speed, Aircraft and Missile

MIL-PRF-32033 Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)

MIL-PRF-81322 Grease, Aircraft, General Purpose, Wide Temperature Range, NATO Code G-395

MIL-PRF-83282 Hydraulic Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537

VV-L-800 Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)

2.4 U.S. Government Technical Manuals:

Request for this document shall be referred to WR-ALC/LKC, Robins AFB, GA 31098.

T.O. 1-1-686 Desert Storage Preservation and Process Manual For Aircraft

Request for this document shall be referred to OO-ALC/LGVT, Hill AFB, UT 84056.

T.O. 4T-1-3 General Aircraft Tire Technical Order

3. DEFINITIONS:

ACTUATOR: A device (mechanical, hydraulic, electrical, or otherwise) that supplies energy and force for the operation of other mechanisms or systems.

BRAKE: A device (mechanical, hydraulic, or electrical) that converts aircraft energy into heat via friction linings that are forced together with either pneumatic, hydraulic or electric brake piston actuation.

BRAKE CONTROL SYSTEM: The total system for the control of a brake or brakes. May be a mechanical, hydraulic, or electrical system, but generally includes a combination of types i.e., mechanical pilot input to brake pedals, electrical system to metering valves, and to the hydraulic brake actuators which are controlled via an electronic/mechanical antiskid system.

CLEANING AND PROTECTING CHROME FOR STORAGE: Cleaning of chrome surfaces for storage consists of wiping with a lint free cloth saturated with dry cleaning solvent followed by a lint free cloth wetted with hydraulic fluid.

CLEANING AND PROTECTING LANDING GEAR FOR STORAGE: Cleaning of landing gear surfaces for storage consists of wiping with a lint free cloth wetted with dry cleaning solvent followed by lint free cloth wetted with preservative oil or a corrosion preventative compound.

FLUORESCENT PENETRANT INSPECTION (FPI): Non-destructive inspection method to identify surface defects in non-ferrous components.

MAGNETIC PARTICLE INSPECTION (PMPI): Non-destructive inspection method to identify surface defects in ferrous components.

HYDRAULIC LEAKAGE: Unacceptable hydraulic fluid leakage from shock struts, actuators, or brakes across the static or dynamic seals. Leakage after short-term and long-term storage is expected for the first few cycles until the seals are energized.

GAS CHARGING VALVE: A valve installed on the shock strut, wheel and tire assemblies, and accumulators (brake, alternate extension, etc.) to allow for dry nitrogen gas servicing to the prescribed pressure.

LANDING GEAR: The apparatus comprising those components of an aircraft or spacecraft that support and provided mobility for the craft on land, water, or other surfaces. The landing gear consists of wheels, floats, skids, bogies, and tires, or other devices, together with struts, bracing, shock absorbers, etc. Landing gear includes all supporting components, such as the tail wheel and tire or tail skid, outrigger wheels and tires or pontoons, etc., but the term is often misconstrued to apply only to the principal components or systems such as nose and main landing gear structure (shock struts, actuators, and associated bracing and structures), wheels, brakes, tires, nose wheel steering systems, brake control or antiskid systems, and catapulting/arresting gear systems.

3. (Continued):

LANDING GEAR FUNCTIONAL CHECK: Procedure performed on landing gear systems after maintenance or extended storage to ensure proper system function.

LUBRICATION: Process in which grease is forced into joints via lube fittings (or butter lubing prior to assembly) prior to entering storage, periodically during long term storage, or before returning to service.

SERVICE PRESSURE: The pressure in a shock strut or wheel and tire assembly at the time of servicing. The shock strut dry nitrogen inflation pressure is a function of aircraft weight and is related to piston stroke, however all struts can be pressurized in the fully extended stroke and in this event the pressure does not vary with weight. The wheel and tire assembly dry nitrogen service inflation pressure is adjusted to support the maximum operating load of the wheel and tire assembly for the wheel position in the landing gear configuration and is measured with the wheel and tire assembly under load (wheel and tire assemblies may be initially serviced unloaded).

NOSE WHEEL STEERING SYSTEM: The system, apparatus, and/or controls for maneuvering the aircraft on the ground by directing the nose wheels about the shock strut centerline.

SHOCK STRUT: A structural strut that embodies a shock absorbing element which utilizes the principle of forcing hydraulic fluid through an orifice for absorption of energy, and also provides a chamber with dry nitrogen gas under pressure for the purpose of supporting the static load on the unit and extending the shock strut when the load is removed.

SHOCK STRUT SERVICING: A procedure to ensure the right amounts of dry nitrogen gas and hydraulic fluid are present in a shock strut.

STRIPPABLE PLASTIC COATING: Coating used for long-term desert storage to protect aircraft surfaces from ultraviolet or corrosive attack. Such coatings are not compatible with aircraft brakes and wiring and must not be applied to these components.

TIRE PERIOD INSPECTION AND PRESSURE CHECK: A procedure to ensure the tire condition due to ultraviolet attack is satisfactory for continued storage and the correct amount of dry nitrogen gas is present in each wheel and tire assembly.

TIRE: A solid or pneumatic covering for a wheel, typically rubber and/or fabric, fitted around the wheel rim to absorb shock, support load, and provide traction.

TIRE SERVICING: A procedure to ensure the proper amount of dry nitrogen gas is present in a wheel and tire assembly.

WHEEL: Solid disc or rigid circular ring connected by spokes, designed to turn about an axle and support the aircraft load via the tire for ground operations.

4. WARNINGS:

- Safety precautions: Deflating or inflating a shock strut or wheel and tire assembly can be a dangerous operation unless servicing personnel are thoroughly familiar with high pressure air valves. Proper deflating or inflating techniques should always be referenced.
- Proper equipment: It is important to avoid the use of improvised servicing equipment. Improper servicing under an aircraft could cause injuries to personnel and damage to the aircraft. The use of properly calibrated equipment having the proper range is essential when servicing a strut or wheel and tire assembly.
- Hydraulic fluid: Only hydraulic fluid as specified on the servicing placard or applicable maintenance manual should be used for servicing. Mixing of hydraulic fluid could have a detrimental effect on static and dynamic seals, as well as on shock strut or actuator characteristics/performance.
- Dry nitrogen: Gas servicing usually means nitrogen servicing. The use of air instead of nitrogen could be a cause of corrosion inside the shock strut or wheel and tire assembly as well as auto-ignition inside the gas chamber (dieseling).
- Temperature effects: A change of temperature could have an effect on the pressures in a shock strut. Temperature variation should be considered when servicing a shock strut.
- Over-pressurization: Excessive inflation of a shock strut with dry nitrogen can cause damage to the out stops of the shock strut if the aircraft is jacked clear of the ground.

5. CLASSIFICATION OF LANDING GEAR STORAGE TYPES:

5.1 Type I Aircraft Functional or Flyable Hold Status:

5.1.1 Short Term (Less than 90 days):

- Aircraft/landing gear system is maintained in functional/flyable status awaiting disposition
- Duration in storage is 90 days
- The procedures are written for landing gear in the extended position and the aircraft is on the ground. These procedures are also applicable to aircraft stored in a suitable container with the landing gear retracted.

5.1.2 Long Term (More than 90 days):

- Aircraft/landing gear system is maintained in functional/flyable status awaiting disposition
- Duration in storage is 90 day intervals, extensions for additional 90 day periods are granted pending acceptable inspection
- The procedures are written for landing gear in the extended position and the aircraft is on the ground. These procedures are also applicable to aircraft stored in a suitable container with the landing gear retracted.

5.2 Type II Aircraft Long Term Desert Storage:

- Landing gear system coatings and fluid integrity is maintained
- Landing gear system is preserved every 180 days
- Landing gear system components are available for reclamation
- Landing gear system requires full functional check every 4 years

5.3 Type III Aircraft Disposal Storage:

- Aircraft are awaiting disposal
- Landing gear system/components are available for reclamation
- Landing gear system is preserved every 270 days

5.4 Type IV Component Shelf Storage:

- Components are preserved and packaged to provide serviceable use after shelf storage
- Components with age limited elastomerics shall be marked to indicate recommended usage date
- Components requiring special storage considerations
 - Tires
 - Struts and actuators with elasomeric seals
 - Carbon brakes
 - Electrical wiring (harnesses)

6. LANDING GEAR STORAGE PRESERVATION REQUIREMENTS:

6.1 Type 1 Aircraft Functional or Flyable Hold Status Storage Preservation:

6.1.1 Short Term (Less than 90 days):

- a. Secure aircraft and install safety locks in landing gear. Empty fuel tanks to reduce sustained loads on the landing gear.

CAUTION: INSURE LANDING GEAR SAFETY LOCKS ARE INSTALLED.

- b. Clean landing gear using a lint free cloth wetted with:

Dry cleaning solvent followed by hydraulic fluid for the exposed chromed surfaces.

Preservative lubricating oil for all other surfaces.

- c. Lubricate all joints with grease.

WARNING: DO NOT PRESSURE WASH LANDING GEAR.

6.1.1 (Continued):

- d. Jack aircraft from aircraft jacking points, check and record tire pressure.

CAUTION: Carbon brakes are susceptible to accelerated heatstack carbon oxidation and degraded torque performance from exposure to contaminants such as cleaning agents, deicers, and hydraulic fluid, etc. Carbon oxidation reduces the strength of the carbon discs, and once the oxidation inhibitor has been sacrificed they will continue to rapidly oxidize with repeated continued heat exposure. Exposure to these contaminants is not easily identifiable visually and may permanently adversely affect torque performance of carbon brakes.

- e. Protect wheels, tires and brakes (especially carbon brakes) from any contaminants such as hydraulic fluid, cleaning agents, etc. and ultraviolet exposure from the sunlight.
- f. Make entries in aircraft log book that aircraft and landing gear have been preserved for short-term flyable hold status storage.

6.1.2 Long Term (More than 90 days):

- a. Secure aircraft and install safety locks in landing gear. Empty fuel tanks to reduce sustained loads on the landing gear.

CAUTION: INSURE LANDING GEAR SAFETY LOCKS ARE INSTALLED.

- b. Clean landing gear using lint free cloth wetted with:

Dry cleaning solvent followed by hydraulic fluid for the exposed chromed surfaces.

Preservative lubricating oil for all other surfaces.

WARNING: DO NOT PRESSURE WASH LANDING GEAR

- c. Lubricate all joints with grease.
- d. Remove wheels and clean wheel bearings and bearing cups with dry cleaning solvent. Thoroughly dry bearings and cups before lubrication. Never rotate an unlubricated bearing. Immediately re-grease bearings after drying.
- e. Lubricate wheel bearings and bearing cups with wheel bearing grease. Pack bearing cones full and coat all exposed surfaces of bearings. Immediately install bearing cones into bearing cups to prevent grease contamination.