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Aerospace — Linear hydraulic utility actuator — General specifications

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Linear hydraulic utility actuators are designed to move structural elements of a flight vehicle from one position to another to allow the functioning of various flight vehicle systems, such as landing gear, cargo doors, in-flight refuelling probes, etc.

It is noted that, while ISO standards should normally refer only to SI units, large segments of the aerospace industry refer to other measurement systems as a matter of common working practice. All dimensions used in this document are in SI units with the non-SI units given in addition for the convenience of those users more familiar with these.

It is further noted that the standard ISO decimal symbol "," (comma) is not used as common working practice for inch dimensions. A decimal point is used in the inch dimensions in this document as in many other aerospace standards.

NOTE The use of non-SI units and the decimal point in this document does not constitute general acceptance of measurement systems other than SI within International Standards.

Aerospace — Linear hydraulic utility actuator — General specifications

1 Scope

This document establishes the general requirements for a linear hydraulic utility actuator, herein referred to as a "utility actuator", for use in flight vehicle hydraulic systems at pressures up to 35 000 kPa (5 000 psi).

These requirements include:

— design requirements;

— test requirements.

This document is intended to be used in conjunction with the detail specification that is particular to each application.

NOTE Although Brake pistons and Landing Gear Bogie (Truck) Pitch Trimmers are utility actuators, they are outside the scope of this document. This is because these devices are considered to be specialist actuator devices due to their specific duty cycles requiring a separate set of tailored requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2093, *Electroplated coatings of tin — Specification and test methods*

ISO 2669, *Environmental tests for aircraft equipment — Steady-state acceleration*

ISO 2671, *Environmental tests for aircraft equipment — Part 3.4 : Acoustic vibration*

ISO 3323, *Aircraft — Hydraulic components — Marking to indicate fluid for which component is approved*

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment*

ISO 8078, *Aerospace process — Anodic treatment of aluminium alloys — Sulfuric acid process, undyed coating*

ISO 8079, *Aerospace process — Anodic treatment of aluminium alloys — Sulfuric acid process, dyed coating*

ISO 8625-1, *Aerospace — Fluid systems — Vocabulary — Part 1: General terms and definitions related to pressure*

ISO 8625-2, *Aerospace — Fluid systems — Vocabulary — Part 2: General terms and definitions relating to flow*

ISO 8625-3, *Aerospace — Fluid systems — Vocabulary — Part 3: General terms and definitions relating to temperature*

ISO 11218, *Aerospace — Cleanliness classification for hydraulic fluids*

SAE AS4088, *Aerospace Rod Scraper Gland Design Standard*

SAE AS4716, *Gland Design, O-Ring and Other Elastomeric Seals*

SAE AS5781, *Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Scarf-Cut, For Use in AS 4716 Glands*

SAE AS5782, *Retainers (Backup Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Un-Cut, For Use in AS 4716 Glands*

SAE AS5857, *Gland Design, O-ring and Other Elastomeric Seals, Static Applications*

SAE AS5860, *Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Single Turn, Static Gland*

SAE AS5861, *Retainers, (Back-Up Rings), Hydraulic and Pneumatic, Polytetrafluoroethylene Resin, Solid, Static Gland*

MIL-STD-810, *Environmental Engineering Considerations and Laboratory Tests*

MMPDS *Metallic Materials Properties Development and Standardization Handbook*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8625-1, ISO 8625-2, ISO 8625-3 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
utility actuator
two-position hydraulic utility actuator that is controlled by an external selector valve

Note 1 to entry: The scope of this document is not limited to those utility actuator configurations shown in Figures 1 to 6, as these are only examples.

3.2
single acting hydraulic utility actuator
utility actuator (3.1) that is hydraulically powered in one direction and returned to the other by a spring or externally applied mechanical force

Note 1 to entry: A typical configuration of a single acting utility actuator is shown schematically in Figure 1.

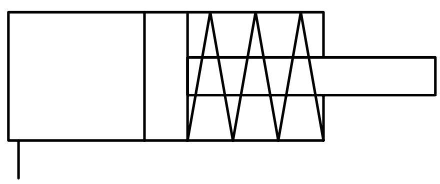

Figure 1 — Single acting utility actuator

3.3
double acting hydraulic utility actuator
utility actuator (3.1) that is hydraulically powered in both directions

Note 1 to entry: Typical configurations of double acting hydraulic utility actuators are shown schematically in Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6.

Note 2 to entry: Figure 3 shows an actuator with piston rods that are equal in diameter. However, this type of actuator may have unequal rod diameters.

Note 3 to entry: The utility actuators can incorporate restrictors to control the extension and/or the retraction time.

Note 4 to entry: The utility actuators can incorporate *end of travel snubbing* (3.5.2) at one or both ends of the actuator stroke.

Note 5 to entry: If the utility actuator is an unequal area actuator, pressure can be applied at both ports to extend the utility actuator by permitting the fluid to circulate from the annulus side to the piston side.

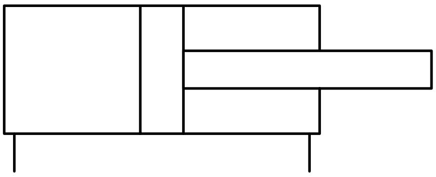

Figure 2 — Simple utility actuator with extend and retract port

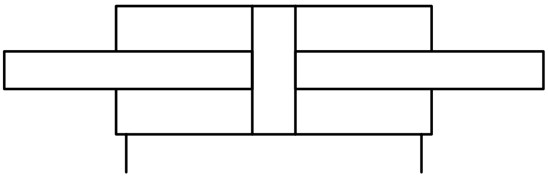

Figure 3 — Double ended utility actuator

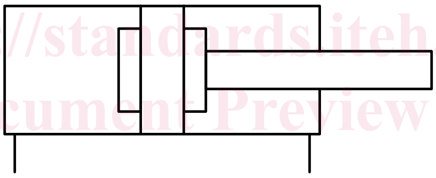

Figure 4 — Utility actuator with end of travel snubber (in extension and retraction)

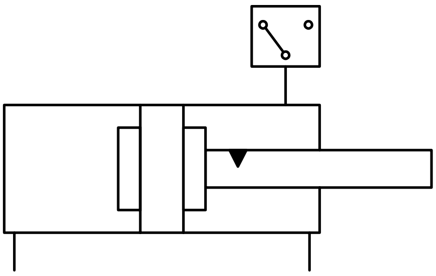

Figure 5 — Utility actuator with end of travel snubber (in extension and retraction), extend lock and lock indicator

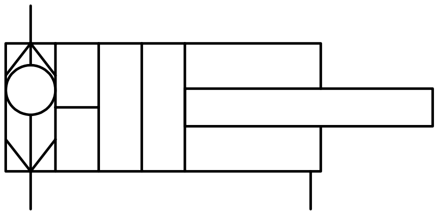

Figure 6 — Utility actuator with a shuttle valve for alternate supply power extend actuation

3.4
non-bottoming utility actuator
utility actuator (3.1) that does not rely on internal end stops for positioning as the extended and/or retracted positions of the utility actuator are dictated by external features such as mechanical stops on structure

Note 1 to entry: For non-bottoming utility actuators, the loads are generated by the internal pressures of the utility actuator only because the piston is floating.

3.5 Velocity damping and end of travel snubbing

3.5.1
velocity damping
incorporation of means to reduce the *utility actuator* (3.1) stroke velocity during extension and/or retraction

3.5.2
end of travel snubbing
incorporation of means to reduce the *utility actuator* (3.1) stroke velocity towards the extension and/or retraction end stop to reduce impact loads

3.5.3
end of travel velocity
rate of the *utility actuator* (3.1) upon reaching its mechanical end stop(s)

3.6 Design operating pressure (DOP)

3.6.1
system DOP
normal maximum steady pressure that is applied to the actuator from the hydraulic power generation system

Note 1 to entry: Excluded from this are:

— reasonable tolerances and transient pressure effects such as may arise from acceptable pump ripple, or

— reactions to system functioning or demands that may affect fatigue.

3.6.2
actuator DOP
sustained pressure that is generated within the actuator due to pressure intensification, such as end of stroke damping

3.7 Load

3.7.1
stall load
maximum load at which the external force applied to the *utility actuator* (3.1) in the opposing direction to that in which the utility actuator is operating, equals the internal hydraulic force generated by the utility actuator

Note 1 to entry: Beyond this point, the actuator may or may not be back-driven depending on the hydraulic circuit configuration.

Note 2 to entry: This load also corresponds to a static hydraulic chamber pressure (hydraulic load) that the actuator cylinder housing has to withstand.

3.7.2
limit structural load
maximum external load applied to the *utility actuator* (3.1) in either the extended or retracted position at the extent of the normal (nominal or worst case) operating conditions

Note 1 to entry: The limit structural load also takes into consideration the combined effects of both axial and bending loads, if applicable.

3.7.3
ultimate structural load
load that the *utility actuator* (3.1) withstands without buckling or structural failure, and normally associated with system single failure cases or flight outside the normal flight envelope

Note 1 to entry: The ultimate structural load also takes into consideration the combined effects of both axial and bending loads, if applicable.

3.7.4
break out seal and scraper friction load
load that the seals and the scraper(s) impose on the *utility actuator* (3.1) rod that has to be overcome before the actuator can start moving

3.8 Temperature

3.8.1 Ambient temperature

3.8.1.1
maximum rated temperature
<ambient> maximum continuous temperature of the air surrounding the *utility actuator* (3.1)

Note 1 to entry: This temperature is generally lower than the *survival temperature* (3.8.3).

Note 2 to entry: Temperatures are expressed in degrees Celsius.

3.8.1.2
minimum operating temperature
<ambient> minimum temperature of the air surrounding the *utility actuator* (3.1)

Note 1 to entry: This temperature is generally higher than the *survival temperature* (3.8.3).

Note 2 to entry: Temperatures are expressed in degrees Celsius.

3.8.2 Hydraulic fluid temperature

3.8.2.1
maximum rated temperature
<hydraulic fluid> maximum continuous temperature of the hydraulic fluid within the *utility actuator* (3.1)

Note 1 to entry: This temperature is generally lower than the *survival temperature* (3.8.3).

Note 2 to entry: Temperatures are expressed in degrees Celsius.

3.8.2.2
minimum operating temperature
<hydraulic fluid> minimum temperature of the hydraulic fluid within the *utility actuator* (3.1)

Note 1 to entry: This temperature is generally higher than the *survival temperature* (3.8.3).

Note 2 to entry: Temperatures are expressed in degrees Celsius.

3.8.3
survival temperature
minimum or maximum temperature of the fluid or air that the actuator will be exposed to without being required to function

Note 1 to entry: Temperatures are expressed in degrees Celsius.

3.9
purchaser
organization that has the engineering responsibility for the hydraulic system that includes the *utility actuator* (3.1)

Note 1 to entry: Typically, the purchaser is a flight vehicle manufacturer, an equipment manufacturer that has the actuation system responsibility or a modification centre.

Note 2 to entry: The purchaser is responsible for the compilation of the *detail specification* (3.11).

3.10
supplier
organization that provides the *utility actuator* (3.1)

Note 1 to entry: Typically, the supplier is the manufacturer of the utility actuator who will be responsible for the design, production and qualification of the utility actuator.

3.11
detail specification
document compiled by the *purchaser* (3.9) that specifies the following:

— the technical requirements;

— the acceptance and qualification test requirements;

— the reliability requirements;

— the quality requirements;

— the packaging requirements;

— any other requirements

3.12
first article inspection
FAI
process that conducts the following:

— verifies that the parts of a component comply with the drawings;

— verifies that the manufacturing processes have been compiled and are adhered to;

— verifies that the assembly processes have been compiled and are adhered to;

— verifies that the acceptance test of the component is in accordance with the test procedure, and that the results of the test are in agreement with the test requirements

3.13
service life
period from first installation of the *utility actuator* (3.1) to its last removal for scrapping

3.14
normal extension and retraction
extension and retraction of the *utility actuator* (3.1) under load conditions normally encountered by the actuator

