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Aerospace — Fixed displacement hydraulic motors — General specifications

Aéronautique et espace — Moteurs hydrauliques à cylindrée fixe — Spécifications générales

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: 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*.

This third edition of ISO 9206 cancels and replaces the second edition (ISO 9206:2016) which has been technically revised.

The main changes compared to the previous edition are as follows:

— title replaced “Constant displacement” with “Fixed displacement”;

— deletion of requirement for minimum case drain flow (6.3.2);

— update of external leakage requirements (6.3.4);

— correction of requirement for overspeed (6.4.1.2);

— coupling shaft requirements re-written (10.5);

— the test stand requirements have been revised (13.3);

— requirement to leave the case drain port unplugged in the Inlet port proof pressure test (14.3.4.3) and the Case port proof pressure test (14.3.4.4);

— update of test procedures in Operational tests at rated conditions (14.3.5);

— revision of the Sampling requirements (14.3.6.1);

— correction of flow measurement in Torque and flow rate (15.3.5.3);

— additional detail provided in the stalling torque and internal leakage test (15.3.5.7);

— endurance test representativity text added (15.3.6.1);

— revision of Endurance test alternating loads test requirements (15.3.6.1 and 15.3.6.3);

— revision of filter used for endurance testing (15.3.6.6);

— revision of Recalibration requirements (15.3.6.9);

— correction of low-temperature test requirement (15.3.7.2);

— clarification of motor operation during vibration tests (15.3.8.1.4);

— clarification of resonant frequency vibration test (15.3.8.1.4);

— ports identified for the ultimate pressure test (15.3.8.5); and

— clarification of coupling shear test (15.3.8.6).

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.

Aerospace — Fixed displacement hydraulic motors — General specifications

1 Scope

This document establishes the general requirements for constant displacement hydraulic motors, suitable for use in aircraft hydraulic systems at pressures up to 35 000 kPa (5 000 psi).

Primary and secondary function motors (see Clause 4) are covered in this document; however, actuators with internal rotation angle limits and low-speed motors are not covered.

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

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 2685, *Aircraft — Environmental test procedure for airborne equipment — Resistance to fire in designated fire zones*

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

ISO 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and designation codes*

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

ISO 7320, *Aerospace — Couplings, threaded and sealed, for fluid systems — Dimensions*

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 8081, *Aerospace process — Chemical conversion coating for aluminium alloys — General purpose*

ISO 8399-1, *Aerospace — Accessory drives and mounting flanges (Metric series) — Part 1: Design criteria*

ISO 8399-2, *Aerospace — Accessory drives and mounting flanges (Metric series) — Part 2: Dimensions*

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*

ISO 16889, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element*

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:

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

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

3.1 General

3.1.1
fixed displacement hydraulic motor
mechanical actuator that converts hydraulic pressure and flow into torque and angular velocity (rotation)

3.1.2
purchaser
organization that has the engineering responsibility for the hydraulic system that includes the motor

Note 1 to entry: Typically, the purchaser is an aircraft 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.

3.1.3
detail specification
document compiled by the *purchaser* (3.1.2) that specifies the following:

a) technical requirements;

b) acceptance and qualification test requirements;

c) reliability requirements;

d) quality requirements;

e) packaging requirements; and

f) other requirements

3.1.4
supplier
organization that provides the motor

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

3.2 Ports of the hydraulic motor

A fixed displacement hydraulic motor typically achieves bi-directional operation by reversing the differential pressure across the inlet/outlet ports, thus reversing the output torque. Table 1 below

illustrates the phasing of the motor ports in relation to the motor operation for this application, using the port identification identifiers listed below.

— port A – motor inlet/outlet port

— port B - motor inlet/outlet port

— port C – motor case drain port

— port D – motor shaft seal port

Table 1 — Phasing of the motor ports in relation to the motor operation

Motor drive coupling shaft rotation	Port A	Port B	Port C	Port D
Clockwise	Motor inlet	Motor return outlet	Case drain	Shaft seal
Counter clockwise	Motor return outlet	Motor inlet	Case drain	Shaft seal

3.2.1
motor inlet port
port that receives flow from the hydraulic system to supply the motor

3.2.2
motor outlet port
port that returns flow back to the system

3.2.3
motor case drain port
port that drains internal leakage flow to the reservoir

3.2.4
shaft seal port
port that routes any shaft seal leakage from the motor to an overboard drain, collector tank, etc.

3.3 Temperature terms

All temperatures are expressed in degrees Celsius.

3.3.1
rated temperature
maximum continuous temperature of the fluid to be supplied at the inlet port of the motor

3.3.2
minimum continuous temperature
minimum temperature of the fluid at the inlet port of the motor at which the motor is able to function

Note 1 to entry: This temperature is generally higher than the survival temperature.

3.3.3
normal operating temperature
temperature of the fluid to be supplied at the inlet port of the motor at which full motor performance is required

3.4 Pressure terms

3.4.1
design operating pressure
normal maximum steady pressure

Note 1 to entry: Excluded are reasonable tolerances, transient pressure effects such as may arise from the following:

— pressure ripple;

— reactions to system functioning; and

— demands that may affect fatigue.

3.4.2
rated supply pressure
system rated pressure, which is normally the hydraulic power generation system design operating *pressure* (3.4.1)

3.4.3
rated differential pressure
differential pressure measured between the motor inlet and outlet ports required to produce *rated torque* (3.8.1)

3.4.4
no-load break-out pressure
differential pressure required for starting the output shaft, without interruption, with the case drain port at the rated case drain pressure and the outlet port at the rated return pressure

3.4.5 Motor return pressure

3.4.5.1
nominal motor return pressure
pressure generated at the outlet port as the motor returns flow back to the system

3.4.5.2
rated motor return pressure
maximum pressure at the outlet port

Note 1 to entry: This is applicable to uni-directional motors only.

Note 2 to entry: This is a stressing term only as the nominal motor pressure is generally considerably less than the rated motor return pressure.

3.4.6 Case drain pressure

3.4.6.1
rated case drain pressure
nominal pressure at which the motor case is required to operate continuously in the system

3.4.6.2
maximum case pressure
maximum of either

— the maximum pressure peak that may be imposed by the hydraulic system on the *motor case drain port* (3.2.3); or

— the pressure resulting from integral bypassing of the rated flow towards the outlet and drain ports in order to take into account the accidental transitory separation of the components

3.5
rated consumption
flow rate measured at the *motor inlet port* (3.2.1) under conditions of the following:

— rated fluid temperature;

— *rated differential pressure* (3.4.3);

— *rated speed* (3.7.1); and

— using the hydraulic fluid specified in the *detail specification* (3.1.3)

Note 1 to entry: This is typically specified as the maximum flow rate.

3.6
rated displacement
maximum theoretical volume of fluid consumed by one revolution of its output shaft

Note 1 to entry: It shall be expressed in cubic centimetres per revolution (cubic inches per revolution).

Note 2 to entry: The rated displacement shall be calculated from the geometrical configuration of the motor, without allowing for the effects of the following:

— permissible manufacturing tolerances;

— distortions of the motor structure;

— the compressibility of the hydraulic fluid;

— internal leakage;

— temperature.

Note 3 to entry: The rated displacement is used to indicate the size of the motor rather than its performance.

3.7 Speed terms

3.7.1
rated speed
maximum speed at which the motor is required to operate continuously at *rated temperature* (3.3.1) and at *rated differential pressure* (3.4.3)

Note 1 to entry: The rated speed shall be expressed as the number of revolutions of the motor output shaft per minute.

3.7.2
maximum no-load speed
speed reached at rated conditions with no opposing torque

3.8 Torque terms

3.8.1
rated torque
minimum torque value at rated operating conditions

3.8.2
break-out torque
minimum torque against which the motor will start at operating conditions specified in the *detail specification* (3.1.3)

Note 1 to entry: The specification shall be met at any angular position of the output shaft.