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Aerospace — Constant displacement hydraulic motors — General specifications for 35 000 kPa systems

Aéronautique et espace — Moteurs hydrauliques à cylindrée fixe — Spécifications générales pour circuits 35 000 kPa

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12333 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

Aerospace — Constant displacement hydraulic motors — General specifications for 35 000 kPa systems

1 Scope

This International Standard establishes the general specifications for constant displacement hydraulic motors to be installed in aircraft, which transform hydraulic power into mechanical energy in the form of a rotational torque to 35 000 kPa systems.

Primary and secondary function motors (see clause 3) are covered in this International Standard; actuators with internal rotation angle limits and low-speed motors are not covered in this International Standard.

This International Standard shall be used in conjunction with the detail specification particular to each application.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2093:1986, *Electroplated coatings of tin — Specification and test methods*.

ISO 2669:1995, *Environmental tests for aircraft equipment — Steady-state acceleration*.

ISO 2671:1982, *Environmental tests for aircraft equipment — Part 3.4 : Acoustic vibration*.

ISO 2685:1998, *Aircraft — Environmental test procedure for airborne equipment — Resistance to fire in designated fire zones*.

ISO 3323:1987, *Aircraft — Hydraulic components — Marking to indicate fluid for which component is approved*.

ISO 3601-1:1988, *Fluid systems — Sealing devices — O-rings — Part 1: Inside diameters, cross-sections, tolerances and size identification code*.

ISO 3601-3:—[1], *Fluid power systems — O-rings — Part 3: Quality acceptance criteria*.

ISO 6771:1987, *Aerospace — Fluid systems and components — Pressure and temperature classifications*.

ISO 7137:1995, *Aircraft — Environmental conditions and test procedures for airborne equipment*.

ISO 7320:1992, *Aerospace — Couplings, threaded and sealed, for fluid systems — Dimensions*.

1) To be published. (Revision of ISO 3601-3:1987)

ISO 8077:1984, *Aerospace process — Anodic treatment of aluminium alloys — Chromic acid process 20 V DC, undyed coating*.

ISO 8078:1984, *Aerospace process — Anodic treatment of aluminium alloys — Sulfuric acid process, undyed coating*.

ISO 8079:1984, *Aerospace process — Anodic treatment of aluminium alloys — Sulfuric acid process, dyed coating*.

ISO 8081:1985, *Aerospace process — Chemical conversion coating for aluminium alloys — General purpose*.

ISO 8399-1:1998, Aer*ospace — Accessory drives and mounting flanges (Metric series) — Part 1: Design criteria*.

ISO 8399-2:1998, *Aerospace — Accessory drives and mounting flanges (Metric series) — Part 1: Design criteria*.

3 Classification

The hydraulic motors covered by this International Standard are classified in two categories:

— **Category A**: primary function motors, for example flight controls, slats, flaps, adjustable planes, transfer units, constant speed drives, etc.;

— **Category B**: secondary function motors, for example hoists, guns, radars, doors, etc.

The motors category shall be specified in the detail specification.

4 Functional requirements

4.1 Hydraulic fluid

The hydraulic fluid of the system on which the motor is to be installed shall be specified in the detail specification.

4.2 Pressures

4.2.1 Rated supply pressure

This rated supply pressure shall be defined as the system rated pressure.

The rated supply pressure is 35 000 kPa.

4.2.2 Rated differential pressure

The rated differential pressure shall be defined as the differential pressure measured between the motor inlet and outlet ports required to produce rated torque when the motor is at the rated supply pressure.

The rated differential pressure shall be specified in the detail specification.

4.2.3 No-load break-out pressure

The no-load break-out pressure shall be defined as the differential pressure required for starting the output shaft, without interruption, with the drain port at the rated return pressure.

The no-load break-out pressure shall be specified in the detail specification.

4.2.4 Rated case-drain port pressure

The rated case-drain port pressure shall be defined as the maximum pressure at which the motor is required to operate continuously.

The rated case-drain port pressure shall be specified in the detail specification.

4.2.5 Case and return port proof pressure

In order to take into account accidental transitory separation of the components, it is required that the case be designed to withstand, without damage, the pressure resulting from integral bypassing of the rated flow towards the outlet and drain ports. Unless otherwise specified in the detail specification, the case components shall withstand, without damage, an internal pressure at least equal to or greater than 5 000 kPa (50 bar) or 150 % of the maximum pressure specified in the detail specification, whichever is the greater of these two values.

4.2.6 Inlet port proof pressure

Unless otherwise specified in the detail specification, the motor shall statically withstand pressure equal to 52 500 kPa, i.e. 1,5 times nominal pressure, with no structural failure.

In the case of a bi-directional motor, both ports are subject to independent proof pressure surges.

4.2.7 Inlet port burst pressure

Unless otherwise specified in the detail specification, the motor shall statically withstand, once in the life time of the qualification test piece, pressure equal to 87 500 kPa, i.e. 2,5 times nominal pressure, with no structural failure.

In the case of a bi-directional motor, both ports are subject to independent burst pressure surges.

4.3 Rated temperature

The rated temperature of the motor shall be defined as the maximum fluid temperature at the inlet port of the motor; it shall be expressed in degrees Celsius.

The rated temperature is related to the maximum temperature (see ISO 6771) of the hydraulic system in which the motor is to be used and shall be one of the values given in Table 1. The rated temperature shall be specified in the detail specification.

The minimum continuous fluid temperature at the motor inlet port shall be specified in the detail specification.

Table 1 — Temperature relationship

Hydraulic system	Maximum system temperature °C	Rated temperature of motor °C
Type I	70	70
Type II	135	135
Type III	200	200

4.4 Rated displacement

The rated displacement of a motor shall be defined as the maximum theoretical volume of fluid generated by one revolution of its output shaft; it shall be expressed in cubic centimetres per revolution.

The rated displacement shall be calculated from the geometrical configuration of the motor, without allowing for the effects of:

a) permissible manufacturing tolerances;

b) distortions of the motor structure;

c) the compressibility of the hydraulic fluid;

d) internal leakage;

e) temperature.

The rated displacement is used to indicate the sizes of the motor rather than its performance.

4.5 Rated consumption

The rated consumption of a motor shall be defined as the flow rate measured at the inlet port, at rated temperature, rated speed and rated differential pressure.

The rated consumption shall be expressed in cubic decimetres per second and its value shall be specified in the detail specification (with, in parentheses, the corresponding value in cubic decimetres per minute).

4.6 Leakage

4.6.1 Case drain flow

The motor shall provide for case drain flow. The maximum drain flow rate shall be specified in the detail specification with:

a) the motor turning at rated torque and speed;

b) the motor turning at zero torque;

c) the motor stalled, shaft locked at any position.

If required, minimum case drain flow rates shall be specified in the detail specification.

4.6.2 Shaft seal leakage

The maximum shaft seal leakage shall be specified in the detail specification.

4.6.3 External leakage

No leakage from the motor case nor from any case static seal sufficient to form a drop shall be permitted.

4.7 Speed and direction of rotation

4.7.1 Direction of rotation

Unless otherwise specified in the detail specification, the hydraulic motors shall operate satisfactorily in either direction of rotation. It shall not be necessary to alter the motor to effect a change in the direction of rotation, but it should merely be necessary to reverse the direction of flow.

4.7.2 Rated speed

The rated speed of a motor shall be defined as the maximum speed at which the motor is required to operate continuously at rated temperature and at rated differential pressure. The rated speed shall be expressed as the number of revolutions per minute of the motor output shaft.

The rated speed of the motor shall be specified in the detail specification. As an indication, the maximum recommended values are given in the nomograph in Figure 1.

4.7.3 Overspeed

The overspeed value is equal to 115 % of the rated speed.

4.7.4 Maximum no-load speed

The maximum no-load speed shall be defined as the speed reached at rated conditions with no opposing torque.

The maximum no-load speed shall be specified in the detail specification.

4.8 Torque

4.8.1 Rated torque

The rated torque of the motor shall be defined as the minimum torque value at rated operating conditions.

The rated torque shall be specified in the detail specification.

4.8.2 Break-out torque

The break-out torque shall be defined as the minimum torque against which the motor will start at operating conditions specified in the detail specification. The specification shall be met at any angular position of the output shaft.

The break-out torque shall be specified in the detail specification.

4.8.3 Stalling torque

The stalling torque shall be defined as the minimum opposing torque which stops the rotation of the outlet shaft at the rated supply pressure and for outlet port and case-drain port pressures specified in the detail specification.

The stalling torque shall be specified in the detail specification.

4.8.4 Torque pulsations

The motor shall be designated to deliver continuous torque without excessive amplitude ripple (considered as being over ± 10 %) when the motor is operated within the rated speed range at any of the conditions specified in clause 9 as specified in the detail specification.

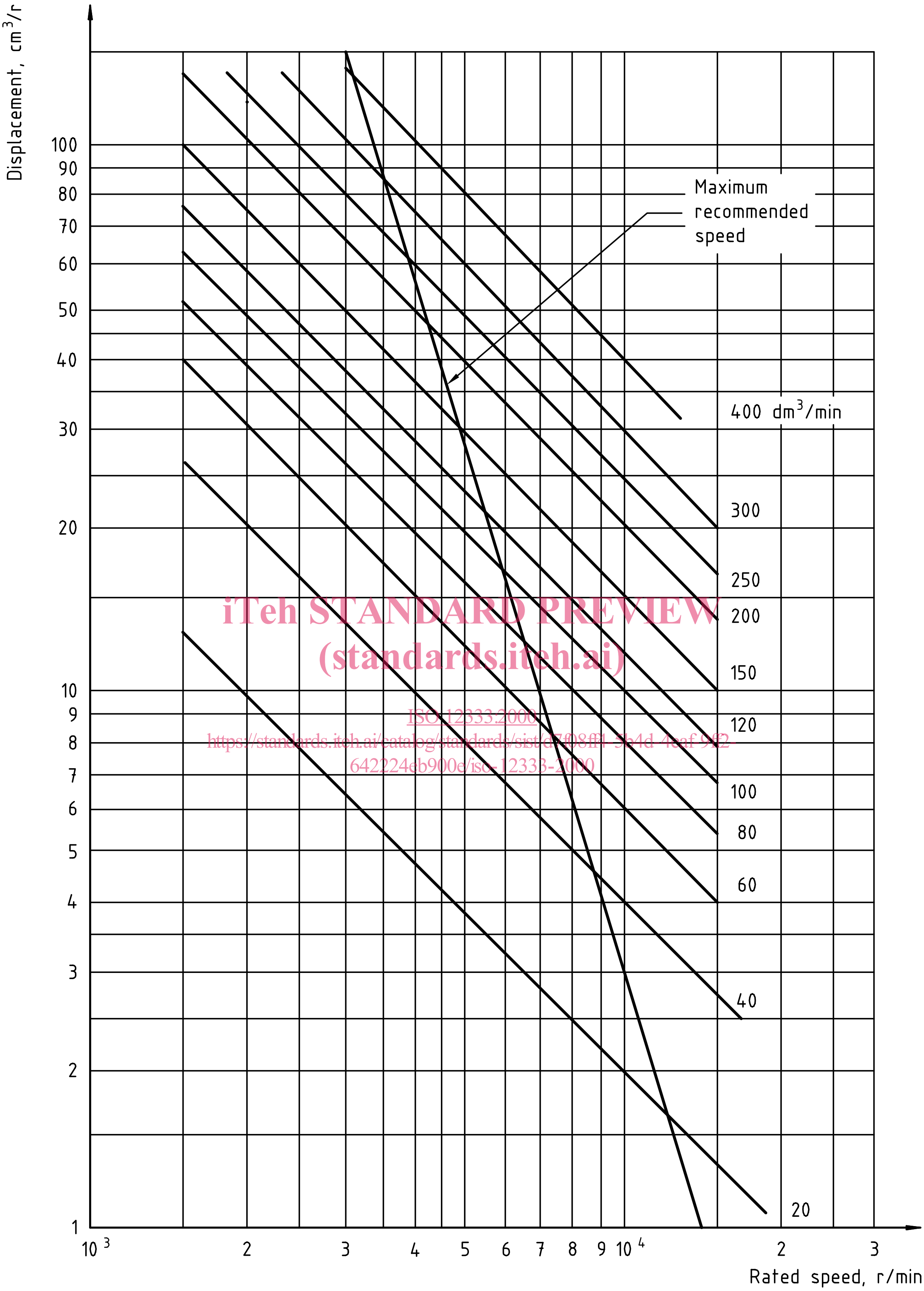

Figure 1 — Nomograph of maximum recommended values for rated speeds against displacement