International Standard 5596

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Hydraulic fluid power — Gas-loaded accumulators with separators — Range of pressures and volumes, characteristic quantities and identification

Transmissions hydrauliques — Accumulateurs hydropneumatiques avec séparateur — Gammes de pressions et de volumes, grandeurs caractéristiques et identification

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Descriptors : fluid power, hydraulic fluid power, hydraulic equipment, gas loaded accumulators, separators, characteristics.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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International Standard ISO 5596 was developed by Technical Committee ISO/TC 131, *Fluid power systems and components*. It incorporates draft International Standard ISO/DIS 5595. Both documents were circulated to the member bodies in October 1979 and have been approved by the member bodies of the following countries :

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Australia	Germany, F. R.	Spain
Austria	Hungary	Sweden
Belgium	India	Switzerland
Canada	Japan	United Kingdom
China (DIS 5595 only)	Netherlands	USA
Czechoslovakia	Norway	USSR
Finland	Poland	
France	Romania	

The member body of the following country expressed disapproval of the documents on technical grounds :

South Africa, Rep. of

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Hydraulic fluid power — Gas-loaded accumulators with separators — Range of pressures and volumes, characteristic quantities and identification

0 Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit.

Gas-loaded accumulators are devices which are able to store and to return energy following the principle of the compressibility of gases.

1 Scope and field of application

1.1 This International Standard is used to specify the characteristic performance quantities required for defining, designing, and testing gas-loaded accumulators with a separator to be used in hydraulic fluid power systems.

1.2 It defines ranges of pressure and volumes for accumulators.

1.3 It also defines a code of identification of such accumulators.

2 References

ISO 3, *Preferred numbers — Series of preferred numbers.*

ISO 5598, *Fluid power systems and components — Vocabulary.* [1)]

ISO 6743/4, *Lubricants, industrial oils and related products — Class L — Classification — Part 4 : Family H (hydraulic systems).* [1)]

3 Definitions

3.1 gas-loaded accumulator : (for the purpose of this International Standard) Hydraulic accumulator with separator between liquid and gas where the liquid is pressurized using the compressibility of an inert gas (for example nitrogen). The separator may be a bladder, a diaphragm or a piston.

3.1.1 standard gas-loaded accumulator : Gas-loaded accumulator which does not include additional gas storage

3.1.2 transfer gas-loaded accumulator : Gas-loaded accumulator for use with additional gas capacity contained in one or more supplementary gas bottles connected to the gas side of the transfer accumulator by a common pipeline.

3.2 compatible fluid : Fluid which does not influence noticeably the nature and life of the components (especially elastomer products) of the accumulator.

For definitions of other terms used in this International Standard, see ISO 5598.

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4 Applications

4.1 Energy storage

The gas-loaded accumulator stores energy during a period of low energy demand from the circuit in which it is mounted.

The stored fluid is then returned to the circuit to supplement or replace the pump discharge temporarily or to ensure emergency operation.

4.2 Pulse or surge damper

The gas-loaded accumulator absorbs liquid to reduce pressure peaks and returns liquid to compensate for pressure drops.

The accumulator thus reduces the amplitude of pressure oscillations in the circuit in which it is mounted.

4.3 Loaded expansion compensating device

The gas-loaded accumulator absorbs volume changes resulting from temperature changes of the hydraulic fluid contained in an isolated part of the circuit.

1) At present at the stage of draft.

5 Characteristic quantities

Use the following quantities to define and design a gas-loaded accumulator.

5.1 Pressures

p_0 = pre-charging; the gas pressure in the accumulator when the hydraulic circuit is not under pressure (initial state) at a temperature of 20 + 5 °C[1), 2)].

$p_{0\,max}$ = the maximum p_0 pressure achieved by the accumulator under normal rise conditions.

p_1 = minimum working pressure of the hydraulic circuit.

p_2 = maximum working pressure of the hydraulic circuit.

p_3 = setting pressure of the relief valve of the hydraulic circuit. This pressure, including tolerance and any flow-induced relief valve pressure peaks, is to be greater than p_2 and less than or equal to p_4.

p_4 = maximum authorized pressure of the accumulator.

p_5 (or p_t) = hydraulic test pressure; it is 1,5 times the maximum authorized pressure p_4. Pressure p_5 is reached when testing the accumulator body under the supervision of a competent inspecting authority.

Δp = pressure drop; pressure difference between the accumulator gas pressure and the liquid pressure at the connecting port for a given liquid, at a given flow rate and at the working temperature.

NOTES

1 The pressures are expressed in bar (and in megapascals)[3)].

2 The pressure drop of a transfer accumulator is increased with respect to that of a standard accumulator by the pressure drops in the pipelines, fittings, etc., connecting the additional gas storage chambers to the accumulator.

5.2 Volumes[1)]

V = water capacity of the accumulator body.

V_0 = original volume; volume of the space in the accumulator body occupied by the gas at pressure p_0.

V_{t0}, V_{t1}, V_{t2}, V_{t3} = volumes occupied by the gas contained in the accumulator and the additional chambers, if any, at pressures p_0, p_1, p_2 and p_3 respectively (those pressures defined in 5.1).

ΔV = Volume to be restored (difference between volumes V_{t1} and V_{t2}).

NOTE — The volumes are expressed in litres (cubic decimetres).

5.3 Flow rates

q_{Vi} = instantaneous volume rate of flow.

q_{Vm} = mean volume rate of flow; the average of the instantaneous volume rates of flow during the transition from p_2 to p_1.

q_{Vl} = limiting volume rate of flow; the maximum mean volume rate of flow for which the accumulator is designed.

NOTE — Flow rates are expressed in litres per second (cubic decimetres per second).

5.4 Temperatures

5.4.1 Working temperatures

$t_{s\,min}$ = the minimum working temperature of the fluid or of the environment, whichever is the lower.

$t_{s\,max}$ = the maximum working temperature of the fluid or of the environment, whichever is the higher

NOTE — Temperatures are expressed in degrees Celsius.

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5.4.2 Storage temperatures

$t_{0\,min}$, $t_{0\,max}$ = the minimum and maximum storage temperatures.

5.5 Maximum working frequency : $f_{s\,max}$

$f_{s\,max}$ = maximum frequency in the liquid that may be withstood by the accumulator under working conditions.

NOTE — Frequencies are expressed in hertz.

6 Ranges of pressures and volumes

6.1 Pressure range

63 (6,3) — 100 (10) — 160 (16) — 200 (20) — 250 (25) — 315 (31,5) — 400 (40) — 500 (50) — 630 (63)

NOTES

1 Pressures are expressed in bar (and in megapascals).

2 For special applications which require higher pressures, use pressures corresponding to the R 10 series of preferred numbers (see ISO 3).

1) In some cases with low pressures, express the low pressures as absolute values to calculate the quantity of fluid discharged into the accumulator.

2) Use the absolute temperature to determine the correction of the pre-charging as a function of temperature.

3) 1 bar = 0,1 MPa; 1 Pa = 1 N/m^2

6.2 Volume range

0,25 — 0,4 — 0,5 — 0,63 — 1 — 1,6 — 2,5 — 4 — 6,3 — 10 — 16 — 20 — 25 — 32 — 40 — 50 — 63 — 100 — 160 — 200

NOTES

1 Volumes are expressed in litres (cubic decimetres).

2 For special applications which require larger volumes, use volumes corresponding to the R 10 series of preferred numbers (see ISO 3).

7 Identification

7.1 Identify a gas-loaded accumulator by the symbols and numerical values in the order in which they are defined below (separated by dashes), and by references to this International Standard.

7.1.1 Symbol for the accumulator category

S : standard accumulator
T : transfer accumulator

7.1.2 Symbol for the separator type

A : bladder
B : diaphragm
C : piston

7.1.3 Value of the maximum authorized pressure

The value of the maximum authorized pressure p_4, expressed in bar, and taken from the pressure range defined in 6.1

063[1] — 100 — 160 — 200 — 250 — 315 — 400 — 500 — 630.

7.1.4 Value of the initial gas volume

The value[2] of the initial gas volume (V_0), expressed in litres, and taken from the volume range defined in 6.2

000,2[3] — 000,4 — 000,5 — 000,6[3] — 001,0 — 001,6 — 002,5 — 004,0 — 006,3 — 010,0 — 016,0 — 020,0 — 025,0 — 032,0 — 040,0 — 050,0 — 063,0 — 100,0 — 160,0 — 200,0.

7.1.5 Symbol for compatible fluid[4]

H — for mineral oils, all categories

A — for fire-resistant fluids, category HFA

B — for fire-resistant fluids, category HFB

C — for fire-resistant fluids, category HFC

D — for fire-resistant fluids, category HFD

7.2 Examples of identification

7.2.1 Standard gas-loaded accumulator

Identify a standard bladder gas-loaded accumulator, operating at maximum authorized pressure p_4 of 100 bar (10 000kPa), with an initial gas volume of 6,3 l intended for use with mineral oils as follows :

ISO 5596 S — A — 100 — 006,3 — H

7.2.2 Transfer gas-loaded accumulator

Identify a transfer diaphragm gas-loaded accumulator, operating at a maximum authorized pressure p_4 of 100 bar, (10 MPa), with an initial gas volume of 20 l intended for use with fire-resistant fluids of categories HFC as follows :

ISO 5596 T — B — 100 — 020,0 — C

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8 Identification statement (Reference to this International Standard)

Use the following statement in test reports, catalogues, and sales literature when electing to comply with this International Standard :

"Characteristic quantities and identification of gas-loaded accumulators with a separator selected in accordance with ISO 5596, "Hydraulic fluid power — Gas-loaded accumulators with separators — Ranges of pressures and volumes, characteristic quantities and identification".

1) So that the code always includes the same number of characters, it was decided to write 063 in place of 63.

2) So that the code always includes the same number of characters, it was decided to use a 4-digit code (i.e. 3 digits before the point and 1 digit after it).

3) 000,2 and 000,6 instead of 000,25 and 000,63.

4) See ISO 6743/4.

Bibliography

The following document served as a reference in the preparation of ISO 5596 and will be helpful in the utilization of the standard :

ISO 2944, *Fluid power systems and components — Nominal pressures.*

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