INTERNATIONAL STANDARD

ISO 10770-3

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Hydraulic fluid power — Electrically modulated hydraulic control valves —

Part 3: Test methods for pressure control valves

Transmissions hydrauliques — Distributeurs hydrauliques à modulation électrique —

Partie 3: Méthodes d'essai pour distributeurs de commande de pression

Reference number
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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10770-3 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 8, *Product testing*.

ISO 10770 consists of the following parts, under the general title *Hydraulic fluid power — Electrically modulated hydraulic control valves*:

— *Part 1: Test methods for four-way directional flow control valves*

— *Part 2: Test methods for three-way directional flow control valves*

— *Part 3: Test methods for pressure control valves*

Introduction

This part of ISO 10770 describes methods of testing electrohydraulic pressure relief and pressure reducing valves. These types of electrohydraulic valves prevent the pressure in a hydraulic system rising above a level defined or set by an electrical input signal.

Relief valves are used to control the pressure in a closed volume by increasing the flow out of the volume if the pressure exceeds the set pressure level. The excess flow is dumped directly to a tank.

Reducing valves are used to control the pressure in a closed volume by restricting the flow into the volume if the pressure exceeds the set pressure level.

The design of the system and the position of the valve within the system dictates which type of valve is appropriate to use.

This part of ISO 10770 has been prepared with the intention of improving the uniformity of valve testing and hence the consistency of recorded valve performance data so that these data can be used for system design, regardless of the data source.

Hydraulic fluid power — Electrically modulated hydraulic control valves —

Part 3: Test methods for pressure control valves

1 Scope

This part of ISO 10770 describes test methods for determining the performance characteristics of electrically modulated hydraulic pressure control valves.

2 Normative references

The following referenced documents are indispensable for the application 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 1219-1, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding level of contamination by solid particles*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 6743-4, *Lubricants, industrial oils and related products (Class L) — Classification — Part 4: Family H (Hydraulic systems)*

ISO 9110-1:1990, *Hydraulic fluid power — Measurement techniques — Part 1: General measurement principles*

ISO 10771-1, *Hydraulic fluid power — Fatigue pressure testing of metal pressure-containing envelopes — Part 1: Test method*

IEC 60617-DB, *Graphical symbols for diagrams*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

3.1.1
electrically modulated pressure control valve
valve that limits the pressure in a hydraulic system to a level that is continuously variable and proportional to an electrical input signal

3.1.2
electrically modulated relief valve
valve that limits the pressure at the inlet port by dumping excess flow to the tank port

3.1.3
electrically modulated reducing valve
electrically modulated pressure control valve that limits the pressure at the outlet port by reducing the flow taken from the inlet port

3.1.4
controlled pressure
pressure difference between inlet and outlet of the relief valve under test or the pressure at the outlet of the reducing valve under test

3.1.5
controlled pressure volume
total volume of fluid in a test rig directly connected to the inlet to a relief valve under test, or the outlet of the reducing valve under test

3.1.6
headloss
minimum pressure drop through a valve

NOTE The headloss is usually plotted as pressure versus flow.

3.1.7
reference pressure
controlled pressure measured at 10 % of rated flow

3.2 Symbols

For the purposes of this document, the symbols given in Table 1 apply.

Table 1 — Symbols

Parameter	Symbol	Unit
Inductance	L_C	H
Insulation resistance	R_i	Ω
Resistance	R_C	Ω
External test resistance	R	Ω
Dither amplitude	—	% (of max. input signal)
Dither frequency	—	Hz
Input signal	I or U	A or V
Rated signal	I_N or U_N	A or V
Current readout	I_{READ}	A
Output flow	q	l/min
Rated flow	q_N	l/min
Pressure gain	$K_P = (\Delta p/\Delta I$ or $\Delta p/\Delta U)$	bar (per input signal unit)
Hysteresis	—	% (of max. output)
Internal leakage	q_l	l/min
Supply pressure	p_P	MPa (bar)
Return pressure	p_T	MPa (bar)
Controlled pressure	p_C	MPa (bar)
Valve pressure drop	$p_V = p_P - p_T$	MPa (bar)
Rated pressure	p_N	MPa (bar)
Threshold	—	% (of maximum input)
Amplitude (ratio)	—	dB
Phase lag	—	°
Temperature	—	°C
Frequency	f	Hz
Time	t	s
Time constant	t_C	s

3.3 Graphic symbols

The graphic symbols in this part of ISO 10770 conform to ISO 1219-1 and IEC 60617-DB.

4 Standard test conditions

Unless otherwise specified, tests shall be carried out using the standard conditions given in Table 2.

Table 2 — Standard test conditions

Parameter	Condition
Ambient temperature	20 °C ± 5 °C
Filtration	Solid contaminant code number shall be stated in accordance with ISO 4406.
Fluid type	Commercially available mineral based hydraulic fluid (i.e., L - HL in accordance with ISO 6743-4 or other fluid with which the valve is able to operate)
Fluid viscosity	32 cSt ± 8 cSt at valve inlet
Viscosity grade	Grade VG32 or VG46 in accordance with ISO 3448:1992
Supply pressure	Test requirement ± 2,5 %
Return pressure	Return pressure shall conform to the manufacturer's recommendations.

5 Test installation

A test installation conforming to the requirements of Figures 1, 2 or 3 shall be used for testing all valves.

SAFETY PRECAUTIONS — It is essential that consideration is given to the safety of personnel and equipment during the tests.

Figures 1 to 3 show the minimum items required to carry out the tests without any safety devices to protect against damage in the event of component failure. For tests using the test circuits shown in Figures 1 to 3, the following apply.

a) Guidance on carrying out the tests is given in Annex A.

b) A separate circuit may be constructed for each type of test. This can improve the accuracy of test results as it eliminates the possibility of leakage through the shut-off valves.

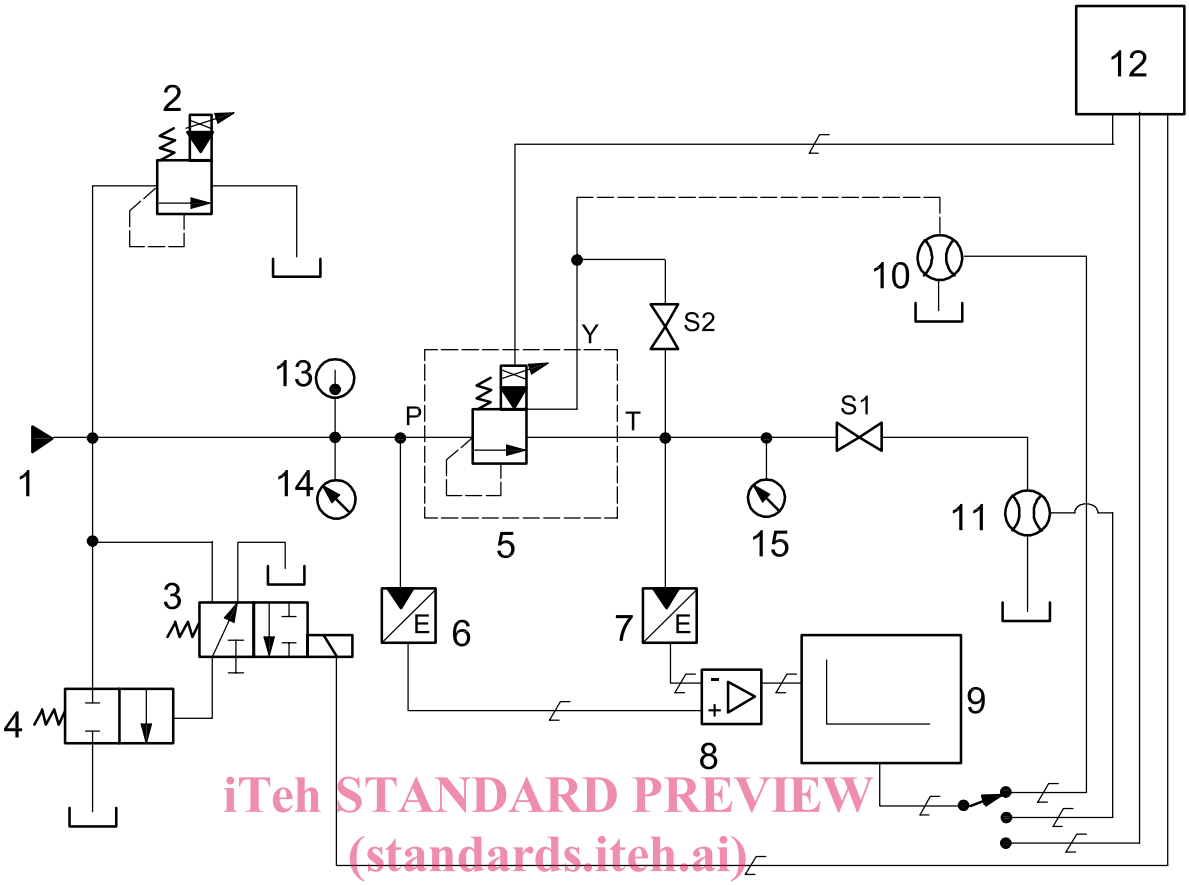
c) Hydraulic performance tests are carried out on a combination of valve and amplifier. Input signals are applied to the amplifier and not directly to the valve. For electrical tests, the signals are applied directly to the valve.

d) If possible, hydraulic tests should be conducted using an amplifier recommended by the valve manufacturer. If not, the type of amplifier used should be recorded, with the operating details (i.e. pulse width modulation frequency, dither frequency and amplitude).

e) The amplifier supply voltage and magnitude and sign of the voltage applied to the valve during the on and off periods of the pulse-width modulation should be recorded.

f) Electronic test equipment and transducers should have a bandwidth or natural frequency at least ten times greater than the maximum test frequency.

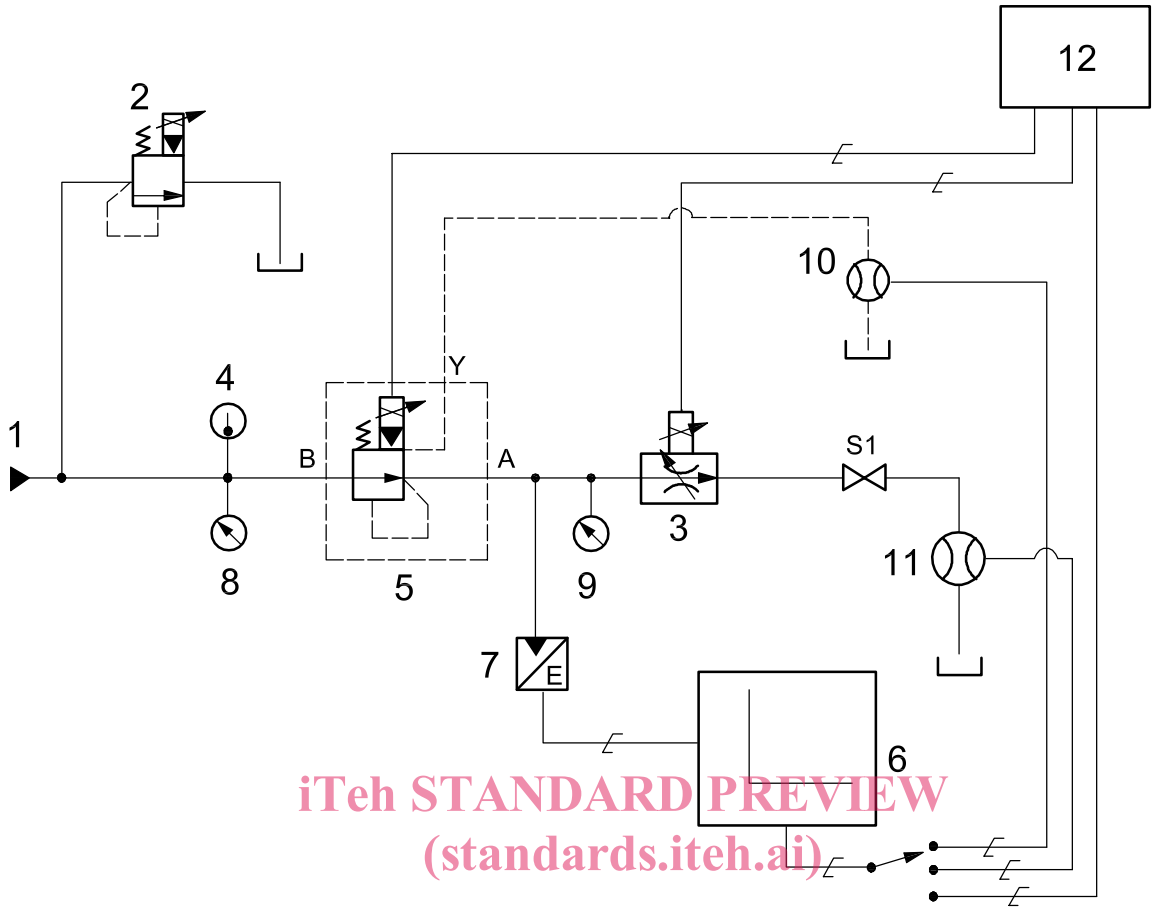
g) Flow transducer 10 shall be selected so as to have negligible effect on the pressure at port Y.



Key

1 flow source
2 system relief valve
3 pilot valve for unloading valve
4 unloading valve
5 unit under test
6 pressure transducer
7 pressure transducer
8 differential amplifier
9 data acquisition
10 flow transducer
11 flow transducer
12 signal generator
13 temperature indicator
14 pressure gauge
15 pressure gauge
S1 shut-off valve
S2 shut-off valve
P supply port
T return port
Y pilot-drain port

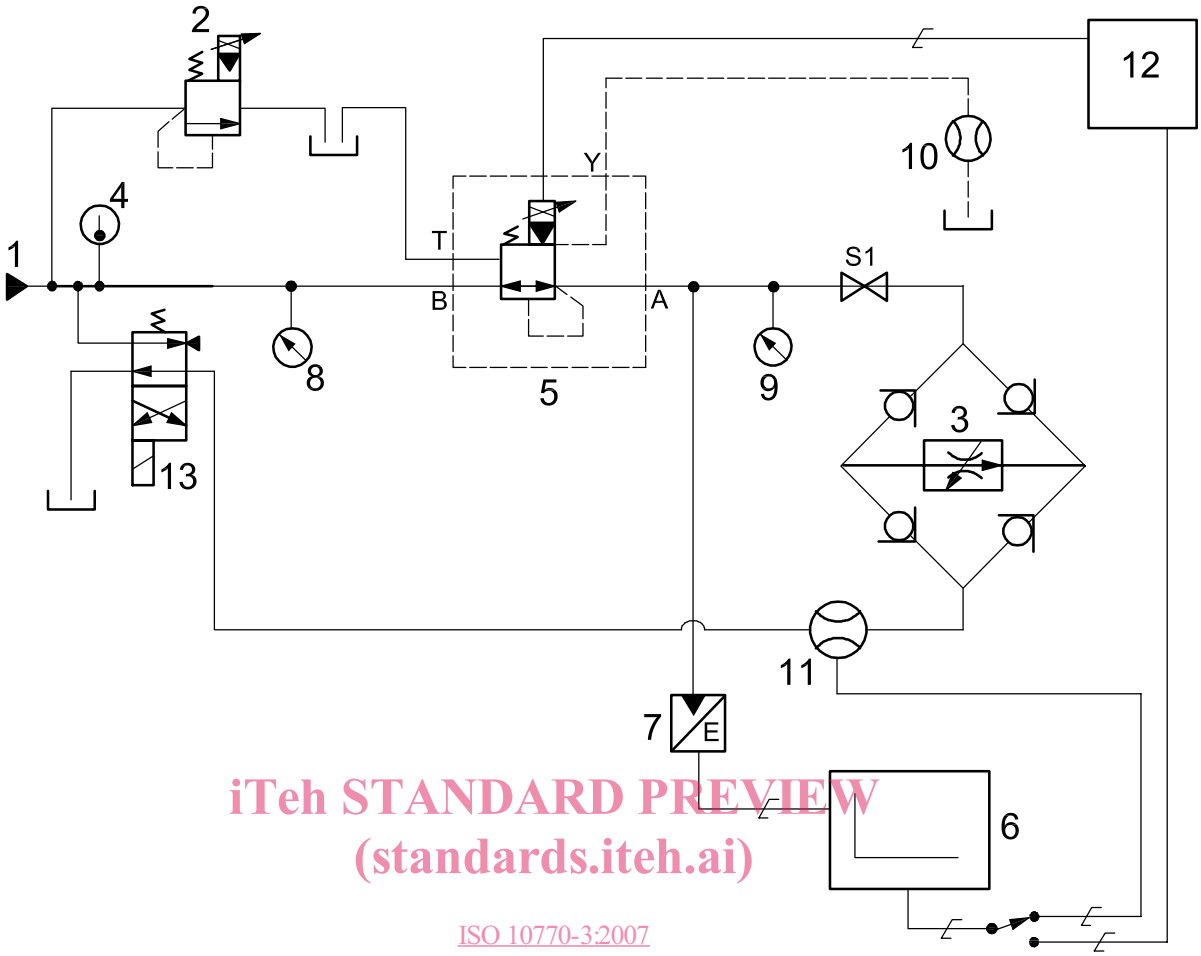
Figure 1 — Relief-valve test circuit



Key

1 flow source
2 system relief valve
3 flow control valve
4 temperature indicator
5 unit under test
6 data acquisition
7 pressure transducer
8 pressure gauge
9 pressure gauge
10 flow transducer
11 flow transducer
12 signal generator
A control-pressure port
B inlet-pressure port
S1 shut-off valve
Y pilot-drain port

Figure 2 — Reducing valve test circuit



Key

1 flow source
2 system relief valve
3 flow control valve
4 temperature indicator
5 unit under test
6 data acquisition
7 pressure transducer
8 pressure gauge
9 pressure gauge
10 flow transducer
11 flow transducer
12 signal generator
13 directional valve
A control pressure port
B inlet pressure port
S1 shut off valve
T return pressure port
Y pilot drain port

Figure 3 — Reducing valve with reverse flow test circuit