IS 7513-2 (2002): Fluid Power Systems and Components -- Graphic Symbols and Circuit Diagrams, Part 2: Circuit Diagrams [PGD 16: Fluid Power]

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भारतीय मानक

द्रव्य शक्ति तंत्र व घटक — ग्राफीय सूचक व सर्किट आरेख

भाग 2 सर्किट आरेख

Indian Standard

FLUID POWER SYSTEMS AND COMPONENTS — GRAPHIC SYMBOLS AND CIRCUIT DIAGRAMS

PART 2 CIRCUIT DIAGRAMS

ICS 01.080.30; 23.100.01

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Price Group 7

NATIONAL FOREWORD

This Indian Standard (Part 2) which is identical with ISO 1219-2 : 1995 'Fluid power systems and components — Graphic symbols and circuit diagrams — Part 2: Circuit diagrams' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Basic Fluid Power Sectional Committee and approval of the Basic and Production Engineering Division Council.

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within a circuit. Circuit diagrams are an aid to facilitate the understanding of the design and description of installations so that, by a unified representation of them, confusion and error can be avoided during planning, manufacturing, installation and maintenance.

The text of the ISO Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

c) Only the English language text in the International Standard has been retained while adopting it in this Indian Standard.

In the adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 1219-1 : 1991[1)] Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols	IS 7513 : 1974 Graphical symbols for fluid power systems	Identical with ISO 1219:1976
ISO 3098-1 : 1974 Technical drawings — Lettering — Part 1: Currently used characters	IS 9609 (Part 1) : 1989 Lettering on technical drawings: Part 1 English lettering (*first revision*)	Identical
ISO 3448:1992 Industrial liquid lubricants — ISO viscosity classification	IS 9466 : 1980 Viscosity classification of industrial liquid lubricants	Modified
ISO 5457 : 1980[2)] Technical drawings — Sizes and layout of drawing sheets	IS 10711 : 1983 Sizes of drawing sheets	Identical
ISO 5598 : 1985 Fluid power systems and components — Vocabulary	IS 10416 : 1992 Fluid power systems and components — Vocabulary (*first revision*)	do

The technical committee responsible for the preparation of this standard has reviewed the provisions of the following ISO Standards and has decided that they are acceptable for use in conjunction with this standard:

ISO 6743-4:1982 Lubricants, industrial oils and related products (class L) – Classification – Part 4: Family H (Hydraulic systems)

IEC 848:1988 Preparation of function charts for control systems

Annexes A to C of this standard are for information only.

[1)] Under revision and may be adopted on revision as decided by the Sectional Committee.

[2)] Since revised as ISO 5457:1999 Technical product documentation — Sizes and layout of drawing sheets.

Indian Standard

FLUID POWER SYSTEMS AND COMPONENTS — GRAPHIC SYMBOLS AND CIRCUIT DIAGRAMS

PART 2 CIRCUIT DIAGRAMS

1 Scope

This part of ISO 1219 establishes the main rules for drawing hydraulic and pneumatic diagrams using symbols from ISO 1219-1.

It also includes examples of circuit diagrams.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1219. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1219 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1219-1:1991, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols.*

ISO 3098-1:1974, *Technical drawings — Lettering — Part 1: Currently used characters.*

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

ISO 5457:1980, *Technical drawings — Sizes and layout of drawing sheets.*

ISO 5598:1985, *Fluid power systems and components — Vocabulary.*

ISO 6743-4:1982, *Lubricants, industrial oils and related products (class L) — Classification — Part 4: Family H (Hydraulic systems).*

IEC 848:1988, *Preparation of function charts for control systems.*

3 Definitions

For the purposes of this part of ISO 1219, the definitions given in ISO 5598 and the following definitions apply.

3.1 actuator: Component (for example, motor, cylinder) that transforms fluid energy into mechanical energy.

3.2 component: Individual unit (for example, cylinder, motor, valve, filter), comprising one or more parts designed to be a functional part of a fluid power system.

3.3 piping: Any combination of fittings, couplings or connectors with pipes, hoses or tubes which allows fluid flow between components.

3.4 system: Arrangement of interconnected components which transmits and controls fluid power energy.

4 General rules

4.1 Presentation

The diagrams shall be clear and shall make it possible to follow the circuits for all the movements and commands throughout the various sequences of the operating cycle.

All the hydraulic and pneumatic equipment, as well as their connections, shall be represented.

The diagrams need not take account of the physical arrangement of the equipment in an installation. Circuit information which includes diagrams and other related details should form a complete series of documents. This group of documents shall be identified by a common reference.

4.2 Format

Presentation in A4 or A3 formats as described in ISO 5457 is preferred. If formats other than A4 are required, the drawings shall be folded to A4 size following the method given in that standard. The use of other kinds of data media shall be agreed between the supplier and purchaser. Any references used shall be in accordance with ISO 3098-1.

4.3 Layout

4.3.1 Lines or connections between the different pieces of equipment should be drawn with minimum crossing points. Where they do cross, the representation specified in ISO 1219-1 shall be used.

4.3.2 The position of codes and indices should not overlap the space reserved for equipment and lines.

4.3.3 Dependent on the complexity of the system, a division into groupings, having related control functions, should be made.

A complete control function, including related actuators, should be represented on a single sheet, wherever possible. Provisions shall be made to identify

connections of lines between sheets (see annex B, pages 1/3 and 2/3, for examples of coding for the identification of piping between consecutive sheets of the diagram).

The limits of a sub-assembly shall be defined by a dot-dash line.

4.3.4 Devices such as limit switches or limit valves activated by actuators should be shown at their place of action, for example at the cylinder, by a marking line and their identification code.

Where the direction of actuation is unidirectional, an arrow (→) shall be added to the marking line.

4.3.5 Hydraulic and pneumatic symbols of equipment should in principle be arranged from the bottom to top and from left to right in the following order:

— energy sources: bottom left;

— control components in sequential order: upwards from left to right;

— actuators: at the top from left to right.

4.4 Equipment

4.4.1 Symbols representing fluid power equipment shall be drawn in accordance with ISO 1219-1.

If there is a detailed and a simplified symbol, only one representation shall be used on the same diagram.

4.4.2 Symbols shall be drawn as follows:

for hydraulics: unless otherwise indicated, representing components in the ready to start position;

for pneumatics: unless otherwise indicated, representing components in the ready to start position with pressure applied.

5 Rules for identification of equipment in fluid power circuits

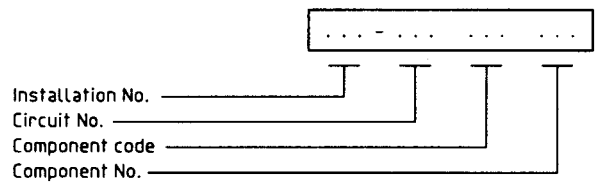
5.1 General

An identification code for the equipment shall be provided on the circuit diagram next to the respective symbol. It shall be used in all related documents.

5.2 Identification code of components (excluding piping)

The following identification code for components shall be used if no other code is stipulated.

The identification code shall contain the following elements and should be enclosed in a box:



NOTE 1 See annex A for information.

5.2.1 Installation number

This code consists of numbers beginning with 1. This installation number shall be used if the whole circuit consists of more than one installation.

5.2.2 Circuit number

This code consists of numbers. Preferably start with 0 for all accessories fitted on the power unit or supply. Continue with sequential numbers for the different fluid power circuits.

5.2.3 Component code

Each component shall be clearly identified by a code in accordance with the following list:

Pumps and compressors:	P
Actuators:	A
Prime movers:	M
Sensors:	S
Valves:	V
All other equipment:	Z, or another letter, but not those shown above

5.2.4 Component number

This code consists of numbers beginning with 1 and each component in a given circuit is numbered consecutively.

5.3 Function identification for piping

The function shall be identified as follows:

P for pressure supply lines;
T for tank return lines (hydraulics);
L for leakage drain lines (hydraulics).

All lines transmitting different pressures shall be additionally identified by numbers beginning with 1.

5.4 Port and piping connection identification

Ports shall be identified on the circuit diagram by the characters indicated on the components, on the sub-plates or on the manifolds.

Piping connections between sub-assemblies shall also be identified.

6 Technical information

At least the following information shall be included on the diagram next to the appropriate symbol.

The use of different units for the same parameter within a document should be avoided.

NOTE 2 A complete list of required technical information is given in ISO 4413 and ISO 4414.

6.1 Reservoirs

For hydraulic reservoirs, indicate

— recommended maximum fluid capacity, in litres;

— recommended minimum fluid capacity, in litres;

— type, category and viscosity class of the fluid in accordance with ISO 3448 and ISO 6743-4.

For pneumatic reservoirs, indicate

— capacity, in litres;

— maximum allowable pressure, in megapascals (or bars[1]).

6.2 Air supply

The following data shall be indicated:

— rated flowrate, in litres per minute, and/or displacement, in cubic centimetres;

— supply pressure range, in megapascals (or bars).

6.3 Pumps

For fixed displacement pumps, indicate

— rated flowrate, in litres per minute, and/or displacement, in cubic centimetres.

For variable displacement pumps, indicate

— minimum and maximum flowrate, in litres per minute, and/or maximum displacement, in cubic centimetres;

— setting points of control.

6.4 Prime movers

The rated power, in kilowatts, and speed of rotation, in revolutions per minute, shall be indicated.

6.5 Pressure control valves and pressure switches

The setting pressure(s), in megapascals (or bars), shall be indicated.

6.6 Cylinders

The cylinder bore, rod diameter (not necessary for pneumatic cylinders) and maximum stroke, in millimetres (for example, Ø 100/56 x 50) shall be indicated, and the function (for example, clamping, lifting, advance) shall be specified.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 Pa = 1 N/m^2

6.7 Semirotary actuators

The following data shall be indicated:

— displacement per movement, in cubic centimetres;

— angle in degrees,

and the function (for example, swivelling, turning over) shall be specified.

6.8 Motors

For fixed displacement motors, indicate the displacement, in cubic centimetres, and specify the function (for example, drilling, driving).

For variable displacement motors, indicate:

— maximum and minimum displacement, in cubic centimetres;

— torque, in newton metres;

— speed of rotation, in revolutions per minute;

— direction of rotation,

and specify the function (for example, drilling, driving).

6.9 Accumulators

The following data shall be indicated:

— total shell volume, in litres;

— precharge pressure (p_0), in megapascals (or bars), at a specified temperature range, in degrees Celsius (for gas-loaded accumulators only);

— maximum working pressure (p_2) and minimum working pressure (p_1) (for gas-loaded accumulators only), in megapascals (or bars);

— type of gas (for gas-loaded accumulators only).

6.10 Filters

In hydraulic circuits, indicate the filtration ratio.

In pneumatic circuits, indicate the micrometre rating.

6.11 Piping

For pipes and tubes, indicate the nominal outside diameter and wall thickness, in millimetres (for example Ø 38 x 5).

For hoses, indicate the nominal inside diameter, in millimetres (for example Ø 16).

6.12 Thermostats

The regulated temperature setting, in degrees Celsius, shall be indicated.

6.13 Timers

The delay time or timing range, in seconds, shall be indicated.

6.14 Gauges

The pressure range, in megapascals (or bars), shall be indicated.

7 Supplementary information

Supplementary information should be provided, such as parts list, sequence description, arrangement of equipment, function chart (in accordance with IEC 848).

8 Examples of circuit diagrams

Examples are given in annexes B and C of circuit diagrams in accordance with this part of ISO 1219.

9 Identification statement (Reference to this part of ISO 1219)

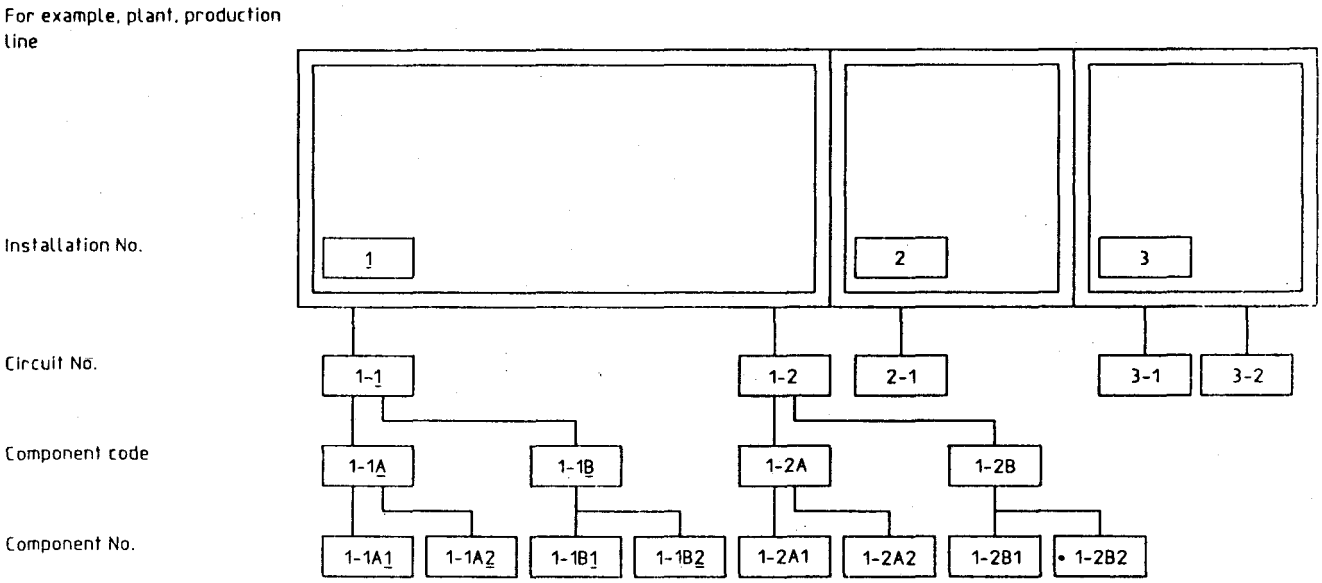
Use the following statement in test reports, catalogues and sales literature when electing to comply with this part of ISO 1219:

> "Circuit diagrams are in accordance with ISO 1219-2:1995, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 2: Circuit diagrams.*"

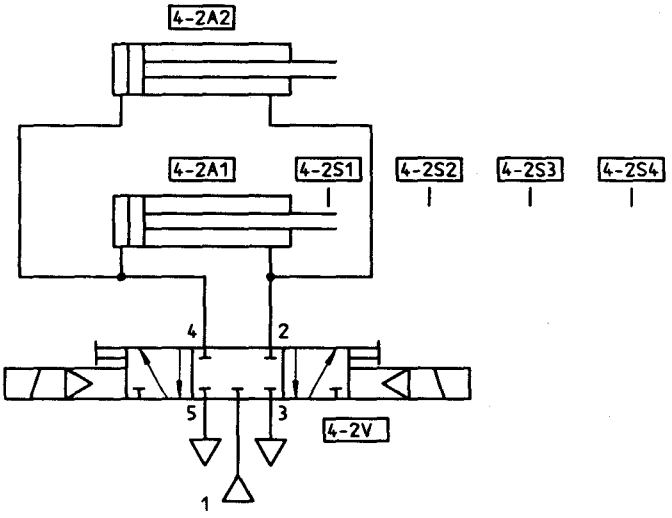
Annex A
(informative)

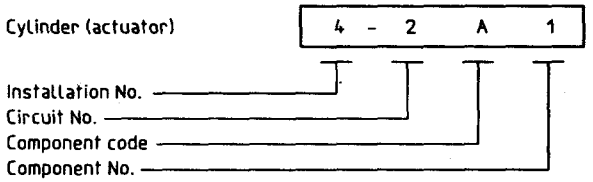
Identification of equipment in fluid power circuits

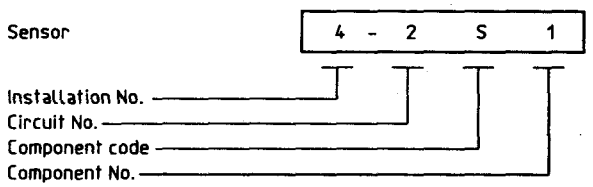
A.1 Relationships between the individual parts of the identification code for components

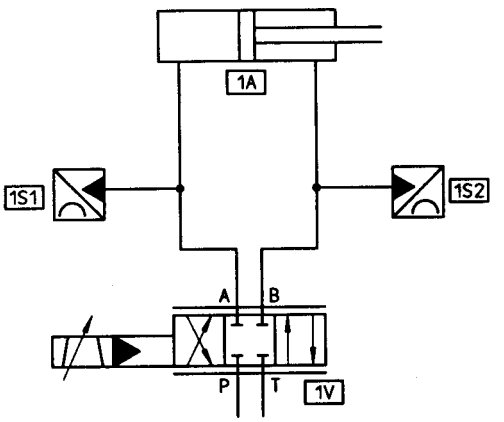


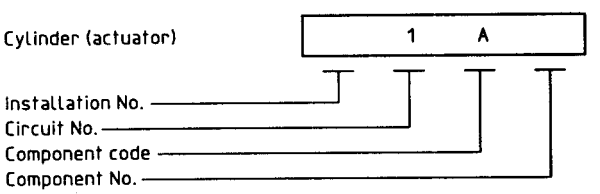
A.2 Examples of identification of components

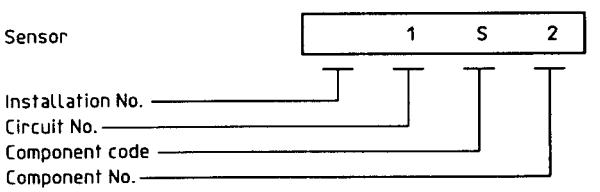






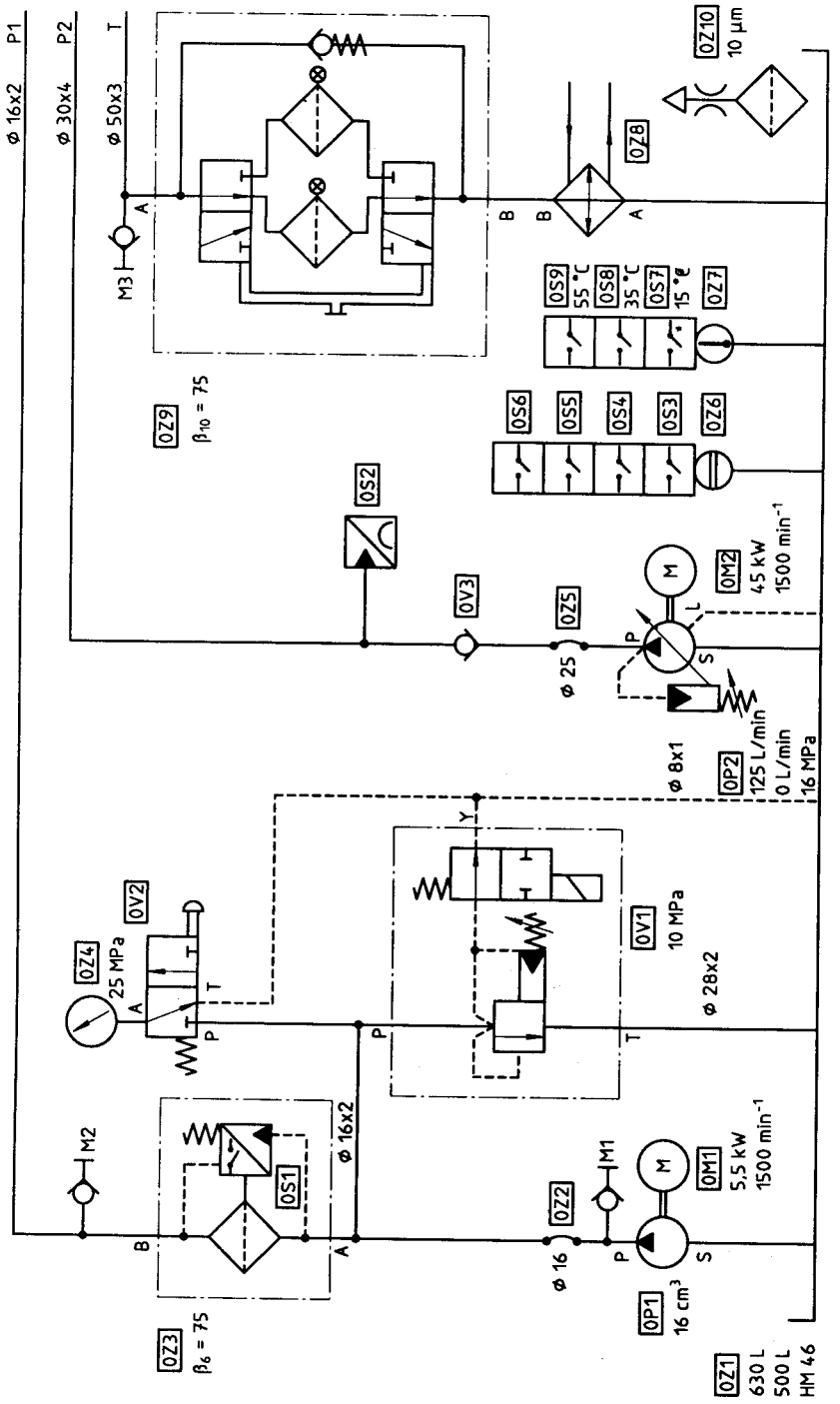

1A
1S1
1S2
A
B
P
T
1V

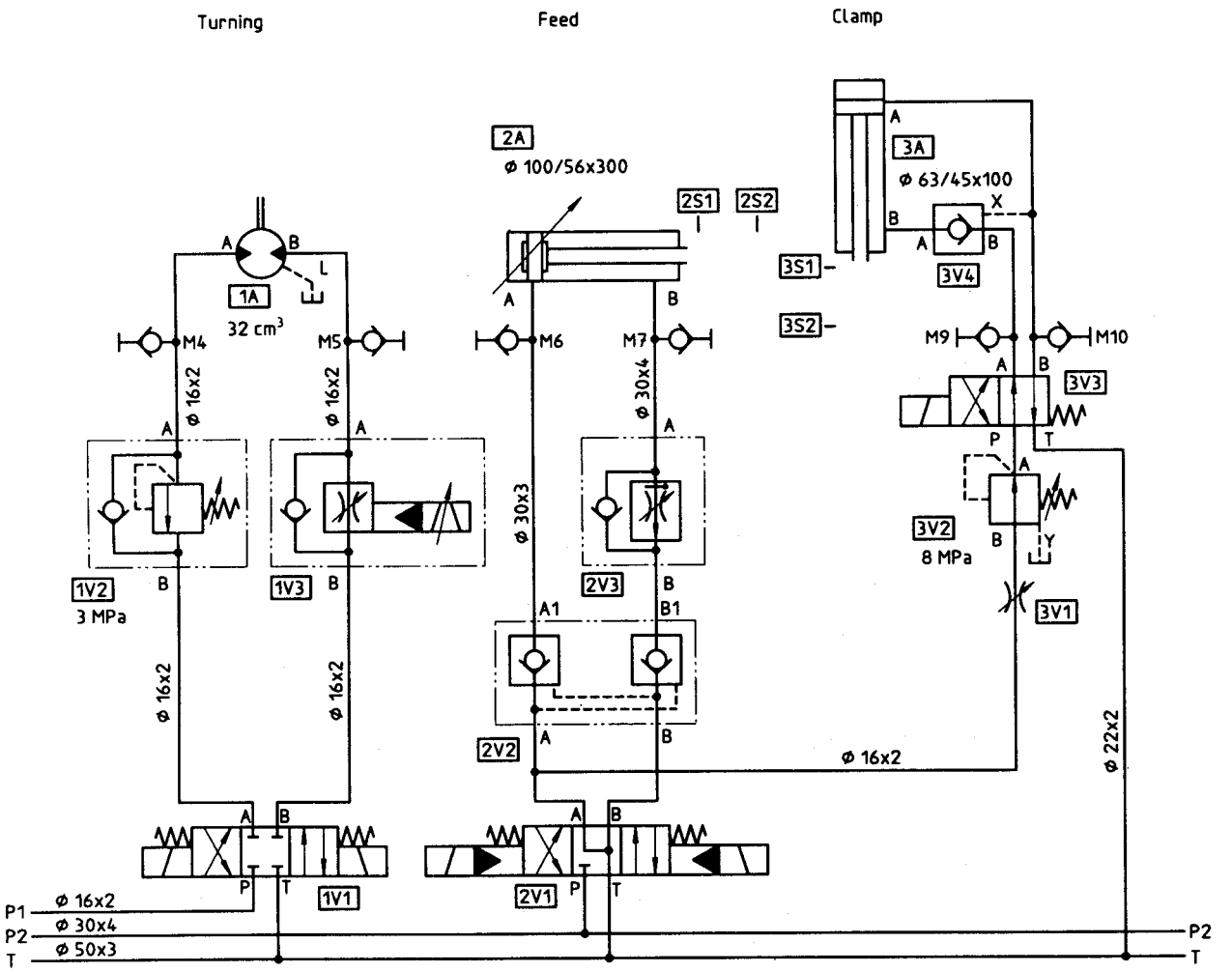

Cylinder (actuator)
1
A
Installation No.
Circuit No.
Component code
Component No.


Sensor
1
S
2
Installation No.
Circuit No.
Component code
Component No.

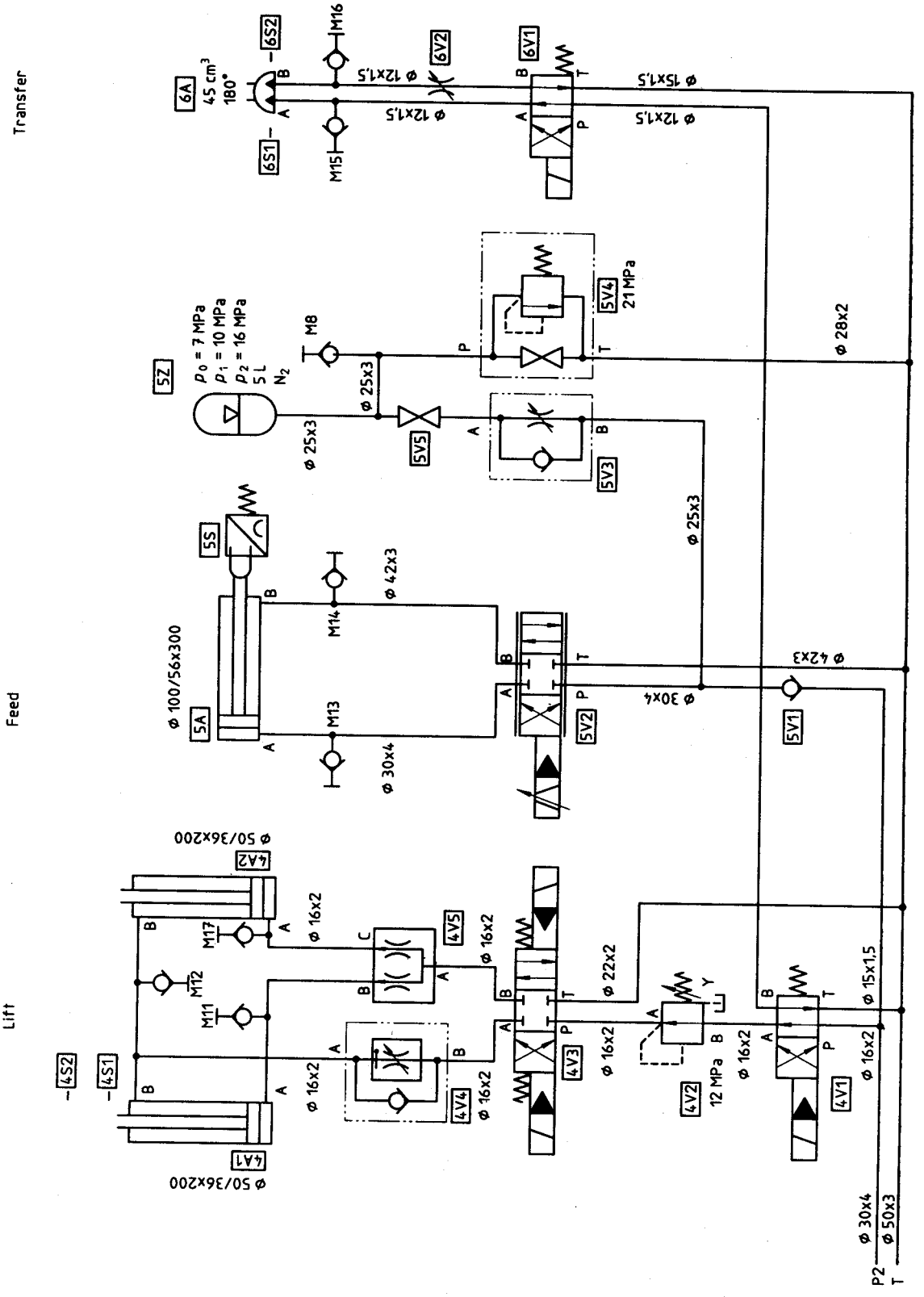
Annex B
(informative)

Example of a hydraulic circuit diagram




Turning
Feed
Clamp
2A
ø 100/56x300
2S1
2S2
3A
ø 63/45x100
3S1
3S2
1A
32 cm³
M4
M5
M6
M7
M9
M10
ø 16x2
ø 30x4
ø 30x3
1V2
3 MPa
1V3
2V3
3V3
3V4
3V2
8 MPa
3V1
2V2
1V1
2V1
ø 22x2
P1
P2
T
ø 16x2
ø 30x4
ø 50x3

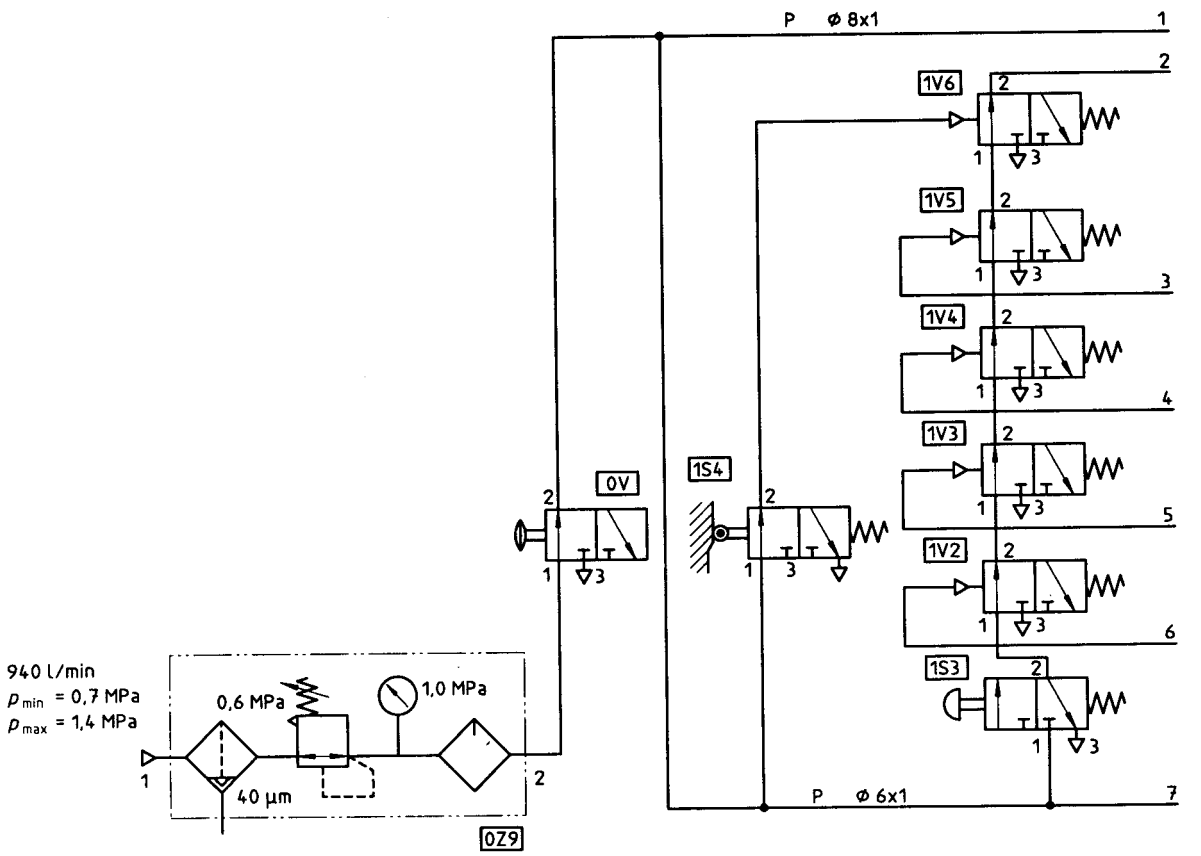
Page 2/3


Transfer
Feed
Lift
6A
45 cm³
180°
6S2
6S1
M16
M15
6V2
6V1
ø 12x1,5
ø 15x1,5
5V4
21 MPa
5Z
p0 = 7 MPa
p1 = 10 MPa
p2 = 16 MPa
5 L
N2
M8
ø 25x3
5V5
5V3
ø 28x2
5S
5A
ø 100/56x300
M14
M13
ø 42x3
ø 30x4
5V2
5V1
4A2
4A1
ø 50/36x200
M17
M12
M11
ø 16x2
4V5
4V4
4V3
4V2
4V1
ø 22x2
ø 15x1,5
12 MPa
P2
T
ø 50x3

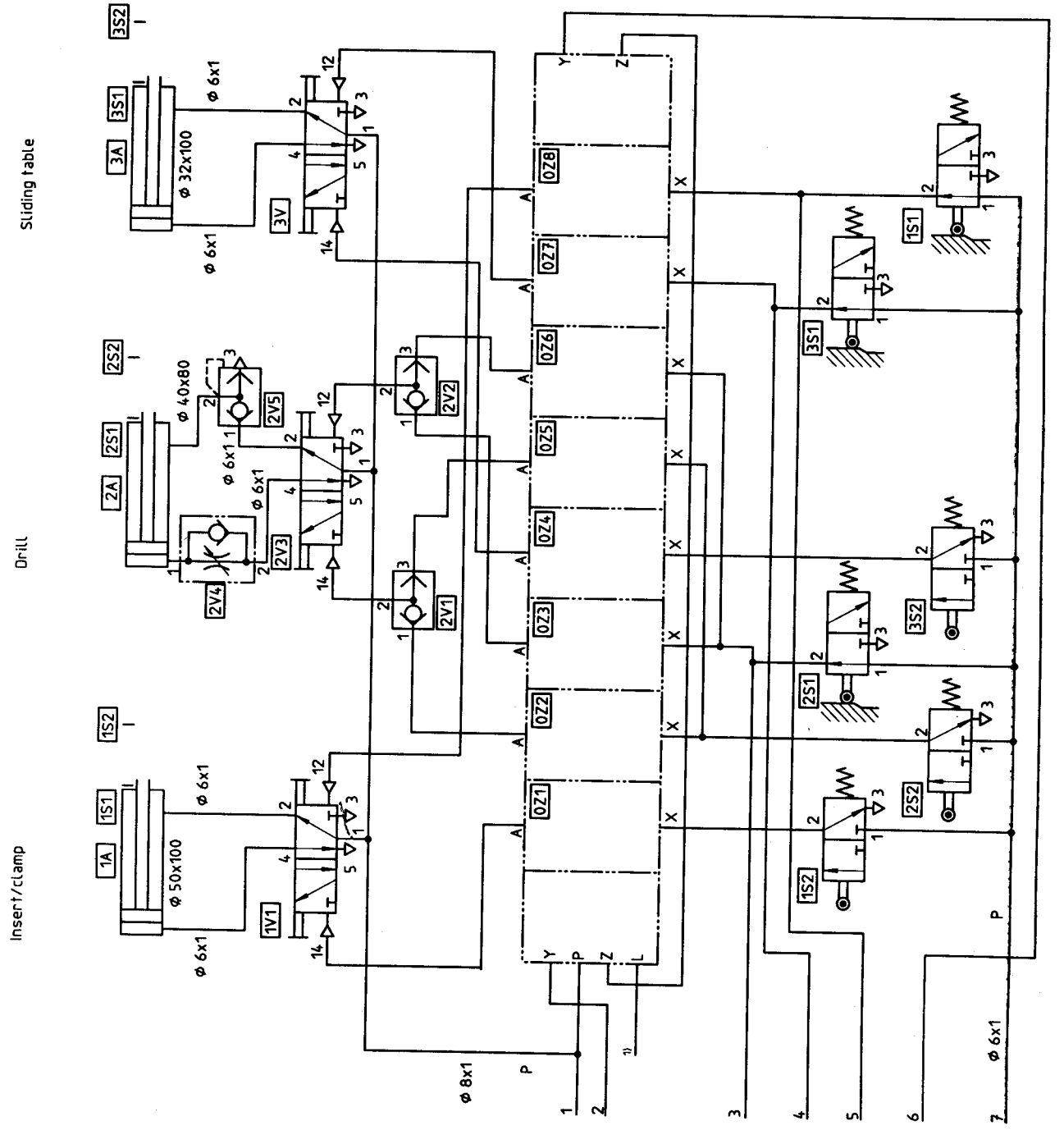
Annex C
(informative)

Examples of pneumatic and electropneumatic circuit diagrams

C.1 Example of a pneumatic circuit diagram

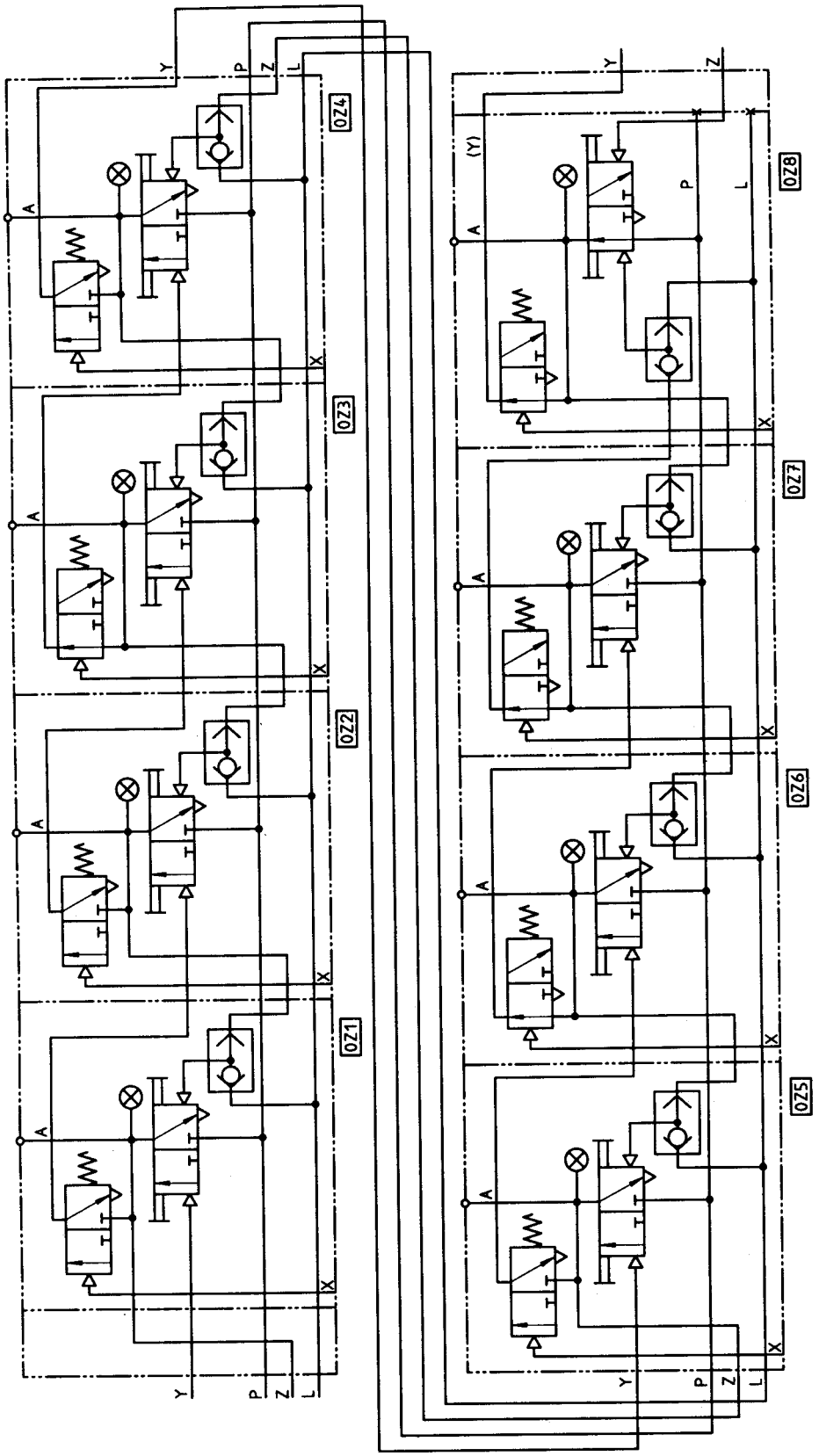


Any flowline without designation: Ø 4 × 1



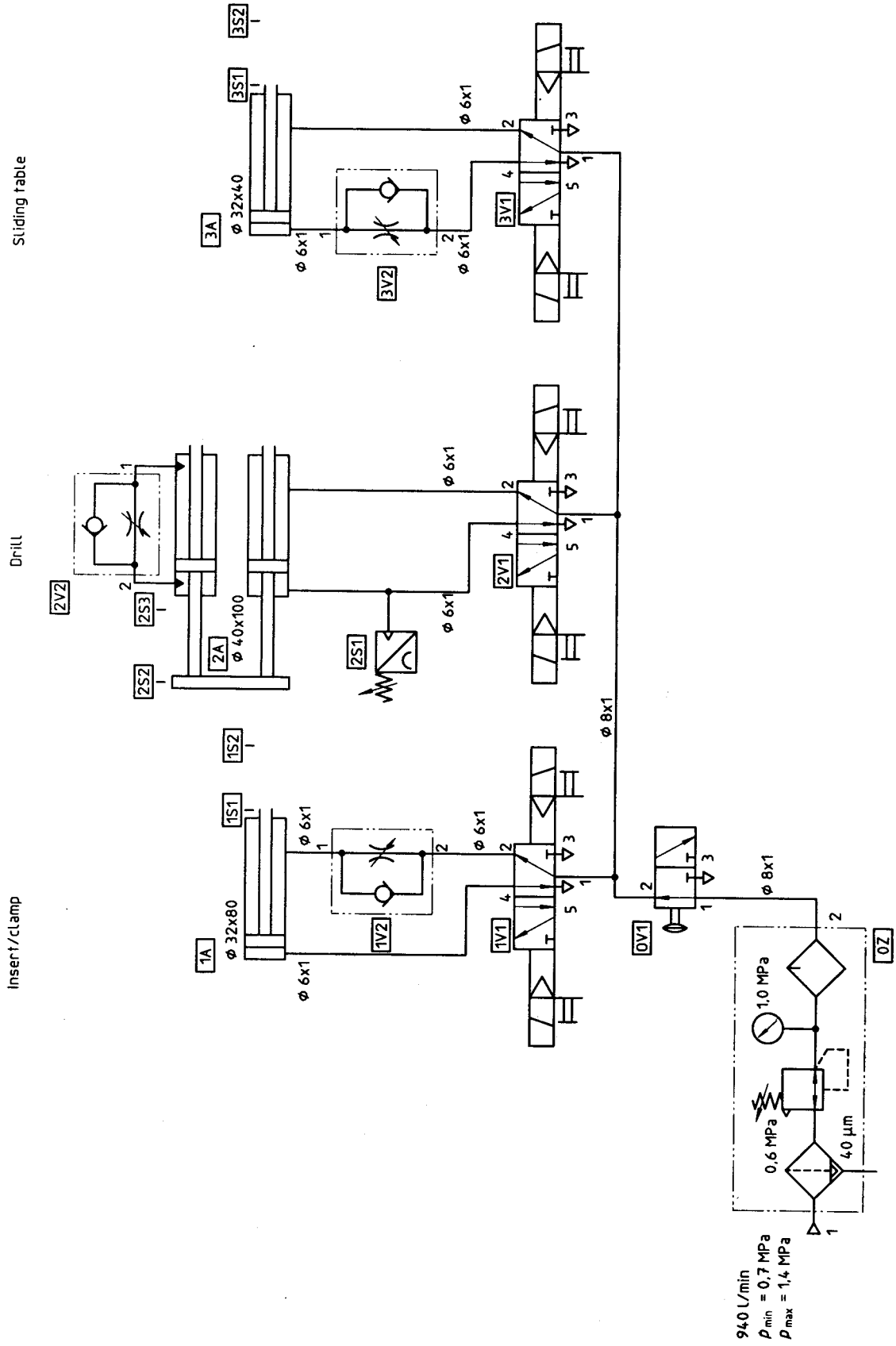
1) Port for initializing pulse

Any flowline without designation: Ø 4 x 1



This detailed representation of the stepping circuit is drawn according to clause 4.4.2 in the ready to start position with pressure applied.

C.2 Example of an electropneumatic circuit diagram



Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. BP 14 (0169).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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