U S A S T A N D A R D

Graphic Symbols for Fluid Power Diagrams

USAS Y32.10 - 1967

REAFFIRMED 1999

FOR CURRENT COMMITTEE PERSONNEL
PLEASE SEE ASME MANUAL AS-11

American National Standard

This standard is one of approximately 6000 approved as either a USA Standard or as an American Standard. It became an American National Standard in October 1969 when the institute changed its name to American National Standards Institute, Inc.

ANSI, 1430 Broadway, New York, N. Y. 10018

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National Fluid Power Association

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The American Society of Mechanical Engineers

Published by

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Foreword

THE Joint Industry Conferences (JIC) gave the first industrial recognition to circuit diagraming by using graphic symbols. Electrical symbols led the way in 1947, and formed the patterns of diagrams to follow, such as those released with the JIC Hydraulic Standards in 1948, and the JIC Pneumatic Standards in 1950.

The Graphic symbols portion of the Hydraulic Standard found increasing acceptance. In 1954, a task group was created within the American Standards Association to develop a symbology which would permit the diagraming of both hydraulic and pneumatic circuits. This task group effort resulted in ASA Y32.10-1958. Industry acceptance was immediate. Y32.10 (and a companion work, Y14.17) was quickly made a part of the JIC Pneumatic and Hydraulic Standards.

Subsequent international interest was reflected in the British Standard 2917, the Australian Document No. 731, and in the European Oil Hydraulic Technical Commission formed in 1960. Improved continuing coordination with comparable activities of the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) is accomplished through the participation of members of the ASA task group in meetings of the IEC and ISO.

The notation IEC adjacent to symbols indicates that symbol has been recommended by the International Electrotechnical Committee.

As a result, the standard presented here is one which crosses language barriers. It is not tied specifically to the English language. It reflects the thoughtful contributions of representatives from many nationalities and from the American Industries it is intended to serve.

The symbols in this standard are the best that can be attained at this time. Standardization, however, must be dynamic, not static, and any solution of a problem should be tested through use and revised if necessary. It is anticipated therefore that the contents of this standard will be modified as future needs dictate. It is contemplated that such modifications will be made available through the issuance of approved supplements. Suggestions for improvement will be welcomed. They should be addressed to the Secretary, Task Group on Graphic Symbols for Fluid Power Diagrams, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N. Y. 10017, with a copy to the United States of America Standards Institute, 10 East 40th Street, New York, N. Y. 10016. The revised proposal was submitted to the Sponsor organization and to United States of America Standards Institute for final approval as a USA Standard. This approval was granted on February 21, 1967.

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Reference Material

1. USAS Y14.2-1957
   Line Conventions, Sectioning and Lettering

2. USAS Y14.17-1966
   Fluid Power Diagrams

3. USAS Y32.2-1962 and Supplement No. 1, 1964
   Graphic Symbols for Electrical & Electronic Diagrams

4. USAS Z32.2.3-1949
   Graphical Symbols for Pipe Fittings, Valves and Piping

5. USAS Z32.2. 4-1949
   Graphical Symbols for Heating, Ventilating, and Air Conditioning

6. USAS Z32.2. 6-1950
   Graphical Symbols for Heat Power Apparatus

7. USAS Y32.11-1962
   Graphical Symbols for Process Flow Diagrams in Petroleum, and Chemical Industries

8. USAS B93.2-1965
   Glossary of Terms for Fluid Power

9. DOCUMENTS ISO/TC 10/SC 2 (Secr. 9) 29 and ISO/TC 10 (Secr. 76) 104, March, 1965.
   Graphic Symbols for Hydraulic and Pneumatic Transmissions.

10. BRITISH STANDARD 2917:1957
    Graphic Symbols for Use in Diagrams for Fluid Power Transmissions and Control Systems

11. ISA RP5.1
    Instrumentation Flow Plan Symbols
    Proposed Revision dated 9/ 11/60
    The Instrument Society of America

12. DOCUMENT B205-1964 of the Standards Association of Australia
    Graphical Symbols for Fluid Power Transmissions and Control Systems

13. IEC 117-1, 1st Edition 1960; 117-2, 1st Edition 1960; 117-3 1st Edition 1963
    Recommended Graphical Symbols
    International Electrotechnical Commission

CONTENTS

USA STANDARD

Graphic Symbols for Fluid Power Diagrams

1. Introduction

1.1 General

Fluid power systems are those that transmit and control power through use of a pressurized fluid (liquid or gas) within an enclosed circuit.

Types of symbols commonly used in drawing circuit diagrams for fluid power systems are Pictorial, Cutaway, and Graphic. These symbols are fully explained in the USA Standard Drafting Manual (Ref. 2).

1.1.1 *Pictorial symbols* are very useful for showing the interconnection of components. They are difficult to standardize from a functional basis.

1.1.2 *Cutaway symbols* emphasize construction. These symbols are complex to draw and the functions are not readily apparent.

1.1.3 *Graphic symbols* emphasize the function and methods of operation of components. These symbols are simple to draw. Component functions and methods of operation are obvious. Graphic symbols are capable of crossing language barriers, and can promote a universal understanding of fluid power systems.

Graphic symbols for fluid power systems should be used in conjunction with the graphic symbols for other systems published by the USA Standards Institute (Ref. 3–7 inclusive).

1.1.3.1 Complete graphic symbols are those which give symbolic representation of the component and all of its features pertinent to the circuit diagram.

1.1.3.2 Simplified graphic symbols are stylized versions of the complete symbols.

1.1.3.3 Composite graphic symbols are an organization of simplified or complete symbols. Composite symbols usually represent a complex component.

1.2 Scope and Purpose

1.2.1 *Scope*

This standard presents a system of graphic symbols for fluid power diagrams.

1.2.1.1 Elementary forms of symbols are:

Circles	Triangles	Lines
Squares	Arcs	Dots
Rectangles	Arrows	Crosses

1.2.1.2 Symbols using words or their abbreviations are avoided. Symbols capable of crossing language barriers are presented herein.

1.2.1.3 Component function rather than construction is emphasized by the symbol.

1.2.1.4 The means of operating fluid power components are shown as part of the symbol (where applicable).

1.2.1.5 This standard shows the basic symbols, describes the principles on which the symbols are based, and illustrates some representative composite symbols. Composite symbols can be devised for any fluid power component by combining basic symbols.

Simplified symbols are shown for commonly used components.

1.2.1.6 This standard provides basic symbols which differentiate between hydraulic and pneumatic fluid power media.

1.2.2 *Purpose*

1.2.2.1 The purpose of this standard is to provide a system of fluid power graphic symbols for industrial and educational purposes.

1.2.2.2 The purpose of this standard is to simplify design, fabrication, analysis, and service of fluid power circuits.

1.2.2.3 The purpose of this standard is to provide fluid power graphic symbols which are internationally recognized.

1.2.2.4 The purpose of this standard is to promote universal understanding of fluid power systems.

1.3 Terms and Definitions

Terms and corresponding definitions found in this standard are listed in Ref. 8.

2. Symbol Rules (See Section 10)

2.1 Symbols show connections, flow paths, and functions of components represented. They can indicate conditions occurring during transition from one flow path arrangement to another. Symbols do not indicate construction, nor do they indicate values, such as pressure, flow rate, and other component settings.

2.2 Symbols do not indicate locations of ports, direction of shifting of spools, or positions of actuators on actual component.

2.3 Symbols may be rotated or reversed without altering their meaning except in the cases of: a.) Lines to Reservoir, 4.1.1; b.) Vented Manifold, 4.1.2.3; c.) Accumulator, 4.2.

2.4 Line Technique (See Ref. 1)
Keep line widths approximately equal. Line width does not alter meaning of symbols.

2.4.1 Solid Line

(Main line conductor, outline, and shaft)

2.4.2 Dash Line

(Pilot line for control)

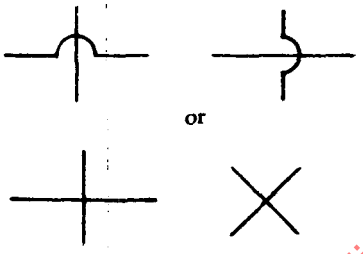
2.4.3 Dotted Line

(Exhaust or Drain Line)

2.4.4 Center Line

(Enclosure outline)

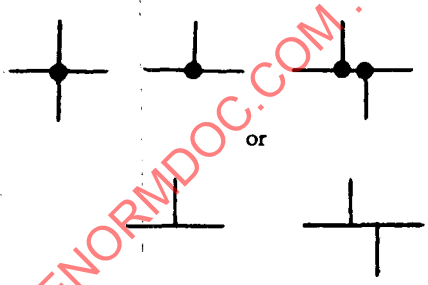
2.4.5 Lines Crossing
(The intersection is not necessarily at a 90 deg angle.)



IEC

IEC

2.4.6 Lines Joining



IEC

IEC

2.5 Basic symbols may be shown any suitable size. Size may be varied for emphasis or clarity. Relative sizes should be maintained. (As in the following example.)

2.5.1 Circle and Semi-Circle

2.5.1.1 Large and small circles may be used to signify that one component is the "main" and the other the auxiliary.

2.5.2 Triangle 

2.5.3 Arrow

2.5.4 Square

Rectangle

2.6 Letter combinations used as parts of graphic symbols are not necessarily abbreviations.

2.7 In multiple envelope symbols, the flow condition shown nearest an actuator symbol takes place when that control is caused or permitted to actuate.

2.8 Each symbol is drawn to show normal, at-rest, or neutral condition of component unless multiple diagrams are furnished showing various phases of circuit operation. Show an actuator symbol for each flow path condition possessed by the component.

2.9 An arrow through a symbol at approximately 45 degrees indicates that the component can be adjusted or varied.

2.10 An arrow parallel to the short side of a symbol, within the symbol, indicates that the component is pressure compensated.

2.11 A line terminating in a dot to represent a thermometer is the symbol for temperature cause or effect.

See Temperature Controls 7.9, Temperature Indicators and Recorders 9.1.2, and Temperature Compensation 10.16.3 and 4.

2.12 External ports are located where flow lines connect to basic symbol, except where component enclosure symbol is used.

External ports are located at intersections of flow lines and component enclosure symbol when enclosure is used, see Section 11.

2.13 Rotating shafts are symbolized by an arrow which indicates direction of rotation (assume arrow on near side of shaft).

3. Conductor, Fluid

3.1 Line, Working (main)

3.2 Line, Pilot (for control)

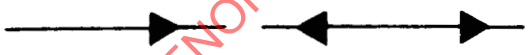
3.3 Line, Exhaust and Liquid Drain

3.4 Line, sensing, etc. such as gage lines shall be drawn the same as the line to which it connects.

3.5 Flow, Direction of

3.5.1 Pneumatic

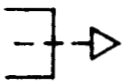
3.5.2 Hydraulic



3.6 Line, Pneumatic Outlet to Atmosphere

3.6.1 Plain orifice, unconnectable

3.6.2 Connectable orifice (e. g. Thread)



3.7 Line with Fixed Restriction

3.8 Line, Flexible

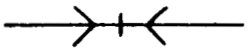
3.9 Station, Testing, measurement, or power take-off

3.9.1 Plugged port

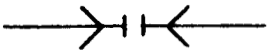
3.10 Quick Disconnect

3.10.1 Without Checks

Connected

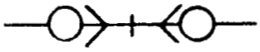


Disconnected

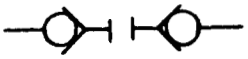


3.10.2 With Two Checks

Connected

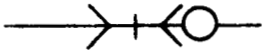


Disconnected



3.10.3 With One Check

Connected



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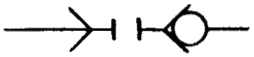
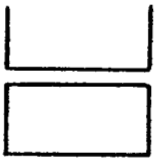


3.11 Rotating Coupling

4. Energy Storage and Fluid Storage

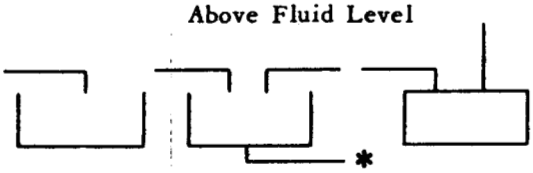
4.1 Reservoir



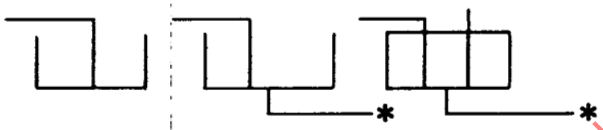
Note: Reservoirs are conventionally drawn in the horizontal plane. All lines enter and leave from above. Examples:

4.1.1 Reservoir with Connecting Lines

Above Fluid Level



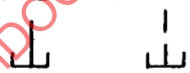
Below Fluid Level



4.1.2 Simplified symbol

The symbols are used as part of a complete circuit. They are analogous to the ground symbol of electrical diagrams.  IEC. Several such symbols  may be used in one diagram to represent the same reservoir.

4.1.2.1 Below Fluid Level



4.1.2.2 Above Fluid Level

(The return line is drawn to terminate at the upright legs of the tank symbol.)

4.1.2.3 Vented Manifold

• Show line entering or leaving below reservoir only when such bottom connection is essential to circuit function.

4.2 Accumulator

4.2.1 Accumulator, Spring Loaded

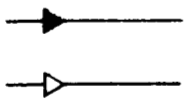
4.2.2 Accumulator, Gas Charged

4.2.3 Accumulator, Weighted

4.3 Receiver, for Air or Other Gases

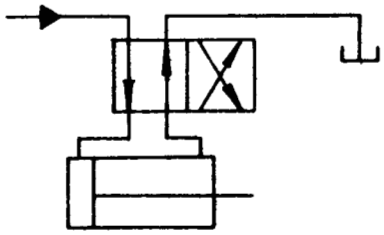
4.4 Energy Source (Pump, Compressor, Accumulator, etc.)

This symbol may be used to represent a fluid power source which may be a pump, compressor, or another associated system.

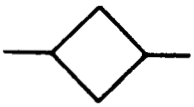


Simplified Symbol

Example:



5. Fluid Conditioners

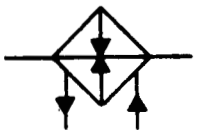


Devices which control the physical characteristics of the fluid.

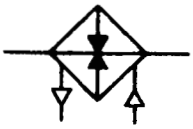
5.1 Heat Exchanger

5.1.1 Heater

Inside triangles indicate the introduction of heat.

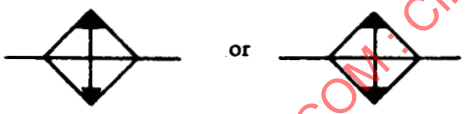


Outside triangles show the heating medium is liquid.



Outside triangles show the heating medium is gaseous.

5.1.2 Cooler

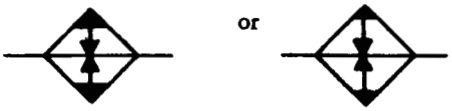


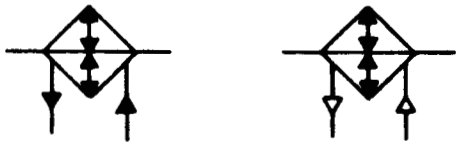
Inside triangles indicate heat dissipation

(Corners may be filled in to represent triangles.)

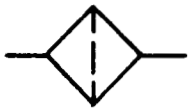
5.1.3 Temperature Controller

(The temperature is to be maintained between two predetermined limits.)





5.2 Filter – Strainer



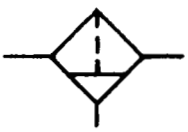
5.3 Separator

5.3.1 With Manual Drain

5.3.2 With Automatic Drain

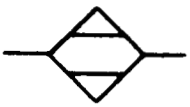
5.4 Filter – Separator

5.4.1 With Manual Drain



5.4.2 With Automatic Drain

5.5 Dessicator (Chemical Dryer)



5.6 Lubricator

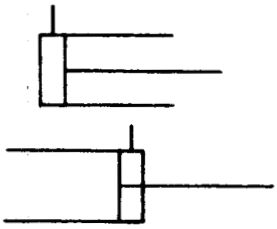
5.6.1 Less Drain

5.6.2 With Manual Drain

6. Linear Devices

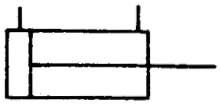
6.1 Cylinders, Hydraulic & Pneumatic

6.1.1 Single Acting

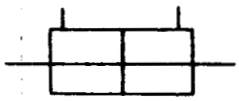


6.1.2 Double Acting

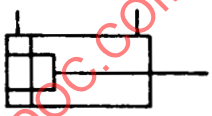
6.1.2.1 Single End Rod



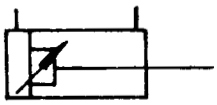
6.1.2.2 Double End Rod



6.1.2.3 Fixed Cushion, Advance & Retract

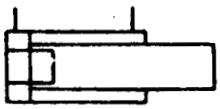


6.1.2.4 Adjustable Cushion, Advance Only



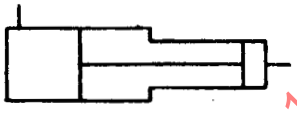
6.1.2.5 Use these symbols when diameter of rod compared to diameter of bore is significant to circuit function.

(Non-Cushion)

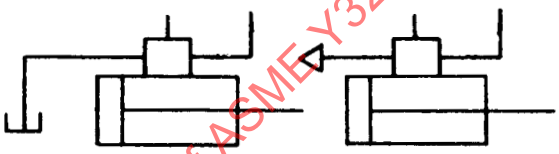


(Cushion, Advance & Retract)

6.2 Pressure Intensifier



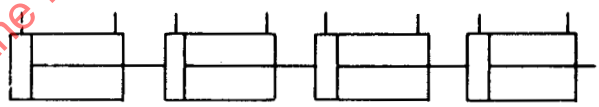
6.3 Servo Positioner (Simplified)



Hydraulic Pneumatic

6.4 Discrete Positioner

Combine two or more basic cylinder symbols.



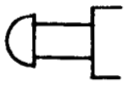
7. Actuators and Controls

7.1 Spring

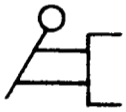
7.2 Manual

(Use as general symbol without indication of specific type; i.e., foot, hand, leg, arm)

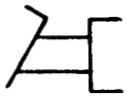
7.2.1 Push Button



7.2.2 Lever

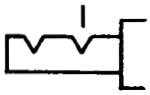


7.2.3 Pedal or Treadle



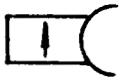
7.3 Mechanical

7.4 Detent



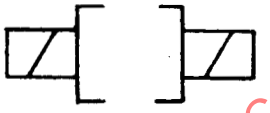
(Show a notch for each detent in the actual component being symbolized. A short line indicates which detent is in use.) Detent may, for convenience, be positioned on either end of symbol.

7.5 Pressure Compensated



7.6 Electrical

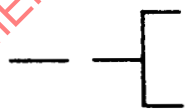
7.6.1 Solenoid (Single Winding)



7.6.2 Reversing Motor

7.7 Pilot Pressure

7.7.1

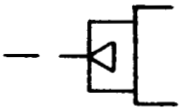


Remote Supply

7.7.2

Internal Supply

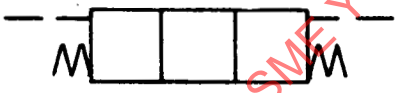
7.7.3 Actuation by Released Pressure



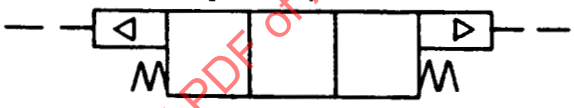
by Remote Exhaust

by Internal Return

7.7.4 Pilot Controlled, Spring Centered

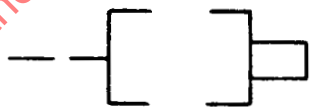


Simplified Symbol

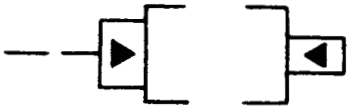


Complete Symbol

7.7.5 Pilot Differential



Simplified Symbol

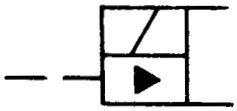


Complete Symbol

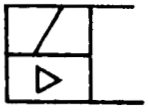
7.8 Solenoid Pilot

7.8.1 Solenoid or Pilot

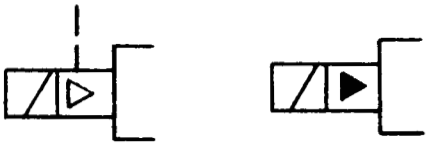
External Pilot Supply



Internal Pilot Supply and Exhaust



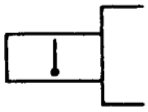
7.8.2 Solenoid and Pilot



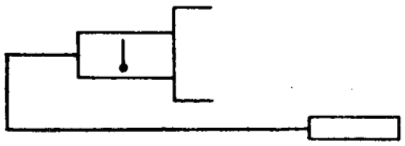
7.9 Thermal

A mechanical device responding to thermal change.

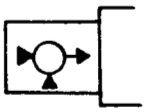
7.9.1 Local Sensing



7.9.2 With Bulb for Remote Sensing



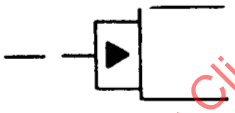
7.10 Servo



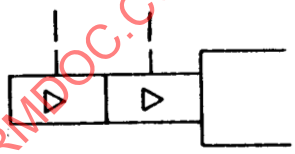
(This symbol contains representation for energy input, command input, and resultant output.)

7.11 Composite Actuators (and, or, and/or)

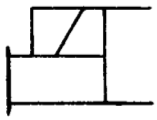
Basic One signal only causes the device to operate.



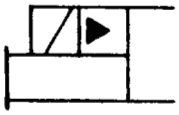
And One signal and a second signal both cause the device to operate.



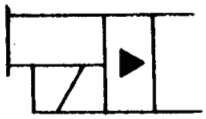
Or One signal or the other signal causes the device to operate



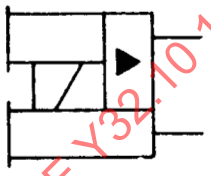
And/Or The solenoid and the pilot or the manual override alone causes the device to operate.



The solenoid and the pilot or the manual override and the pilot



The solenoid and the pilot or a manual override and the pilot or a manual override alone.

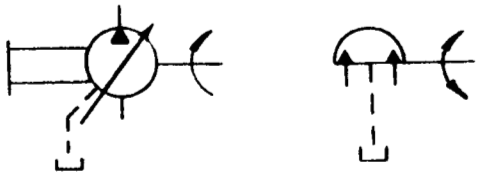


8. Rotary Devices

8.1 Basic Symbol

8.1.1 With Ports

8.1.2 With Rotating Shaft, with control, and with Drain



8.2 Hydraulic Pump

8.2.1 Fixed Displacement.

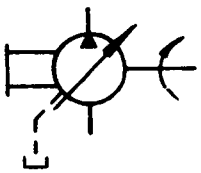
8.2.1.1 Unidirectional

8.2.1.2 Bidirectional

8.2.2 Variable Displacement, Non-Compensated

8.2.2.1 Unidirectional

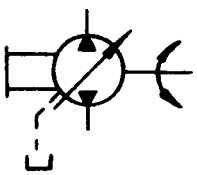
Simplified



Complete

8.2.2.2 Bidirectional

Simplified

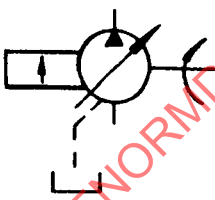


Complete

8.2.3 Variable Displacement, Pressure Compensated

8.2.3.1 Unidirectional

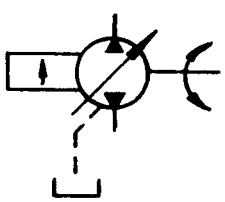
Simplified



Complete

8.2.3.2 Bidirectional

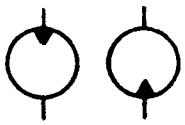
Simplified



Complete

8.3 Hydraulic Motor

8.3.1 Fixed Displacement



8.3.1.2 Bidirectional

8.3.2 Variable Displacement

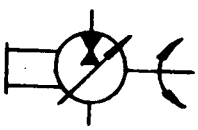
8.3.2.1 Unidirectional

8.3.2.2 Bidirectional

8.4 Pump-Motor, Hydraulic

8.4.1 Operating in one direction as a pump. Operating in the other direction as a motor.

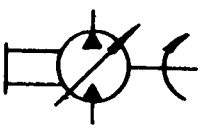
8.4.1.1 Complete Symbol



8.4.1.2 Simplified Symbol

8.4.2 Operating one direction of flow as either a pump or as a motor.

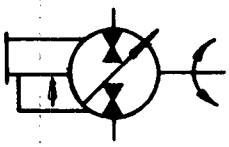
8.4.2.1 Complete Symbol



8.4.2.2 Simplified Symbol

8.4.3 Operating in both directions of flow either as a pump or as a motor.
(Variable displacement, pressure compensated shown)

8.4.3.1 Complete Symbol



8.4.3.2 Simplified Symbol

8.5 Pump, Pneumatic

8.5.1 Compressor, Fixed Displacement

8.5.2 Vacuum Pump, Fixed Displacement

8.6 Motor, Pneumatic

8.6.1 Unidirectional

8.6.2 Bidirectional

8.7 Oscillator

8.7.1 Hydraulic

8.7.2 Pneumatic

8.8 Motors, Engines

8.8.1 Electric Motor

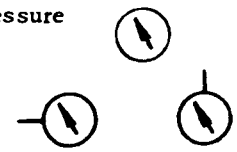
IEC

8.8.2 Heat Engine (E.G. internal combustion engine)

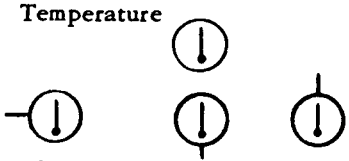
9. Instruments and Accessories

9.1 Indicating and Recording

9.1.1 Pressure

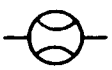


9.1.2 Temperature



9.1.3 Flow Meter

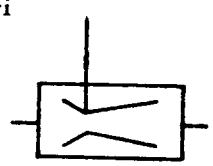
9.1.3.1 Flow Rate



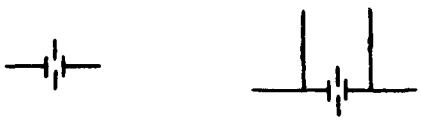
9.1.3.2 Totalizing

9.2 Sensing

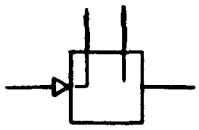
9.2.1 Venturi



9.2.2 Orifice Plate



9.2.3 Pitot Tube

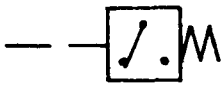


9.2.4 Nozzle

Hydraulic Pneumatic

9.3 Accessories

9.3.1 Pressure Switch



9.3.2 Muffler

10. Valves

A basic valve symbol is composed of one or more envelopes with lines inside the envelope to represent flow paths and flow conditions between ports. Three symbol systems are used to represent valve types: single envelope, both finite and infinite position; multiple envelope, finite position; and multipe envelope, infinite position.

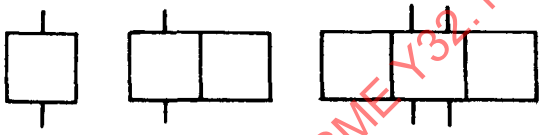
10.1 In infinite position single envelope valves, the envelope is imagined to move to illustrate how pressure or flow conditions are controlled as the valve is actuated.

10.2 Multiple envelopes symbolize valves providing more than one finite flow path option for the fluid. The multiple envelope moves to represent how flow paths change when the valving element within the component is shifted to its finite positions.

10.3 Multiple envelope valves capable of infinite positioning between certain limits are symbolized as in 10.2 above with the addition of horizontal bars which are drawn parallel to the envelope. The horizontal bars are the clues to the infinite positioning function possessed by the valve re-represented.

10.4 Envelopes

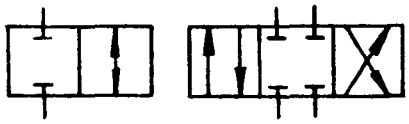
10.5 Ports



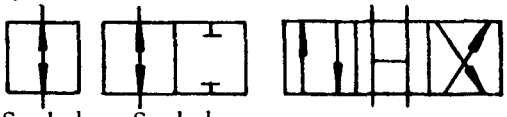
10.6 Ports, Internally Blocked

Symbol System 10.1

Symbol System 10.2

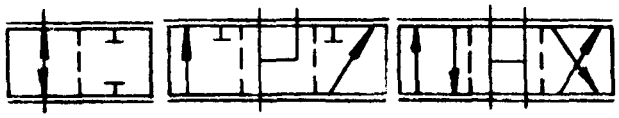


10.7 Flow Paths, Internally Open (Symbol System 10.1 and 10.2)



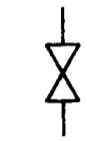
Symbol System 10.1 Symbol System 10.2

10.8 Flow Paths, Internally Open (Symbol System 10.3)

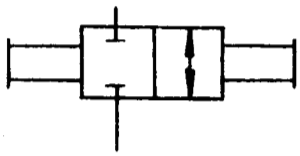


10.9 Two-Way Valves (2 Ported Valves)

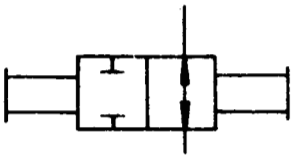
10.9.1 On-Off (Manual Shut-Off)



Simplified

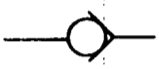


Off

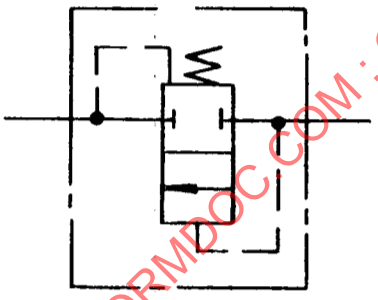


On

10.9.2 Check



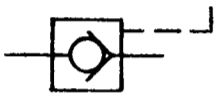
Simplified Symbol



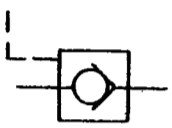
Flow to the right is blocked. Flow to the left is permitted)

(Composite Symbol)

10.9.3 Check, Pilot- Operated to Open



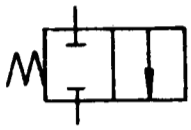
10.9.4 Check, Pilot-Operated to Close



10.9.5 Two-Way Valves

10.9.5.1 Two-Position

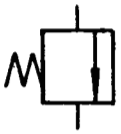
Normally Closed



Normally Open

10.9.5.2 Infinite Position

Normally Closed

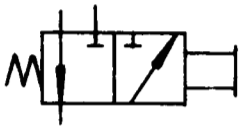


Normally Open

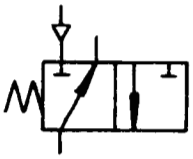
10.10 Three-Way Valves

10.10.1 Two-Position

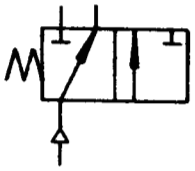
10.10.1.1 Normally Open



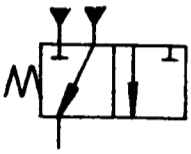
10.10.1.2 Normally Closed



10.10.1.3 Distributor (Pressure is distributed first to one port, then the other)



10.10.1.4 Two-Pressure

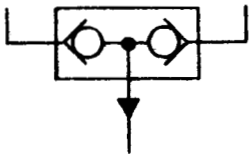


10.10.2 Double Check Valve

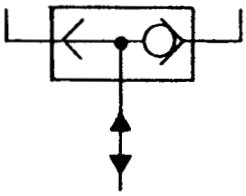
Double check valves can be built with and without "cross bleed". Such valves with two

poppets do not usually allow pressure to momentarily "cross bleed" to return during transition. Valves with one poppet may allow "cross bleed" as these symbols illustrate.

10.10.2.1 Without Cross Bleed (One Way Flow)

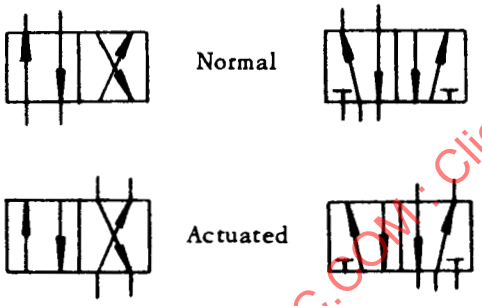


10.10.2.2 With Cross Bleed (Reverse Flow Permitted)



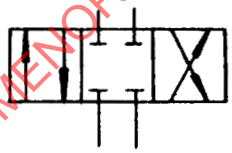
10.11 Four-Way Valves

10.11.1 Two Position

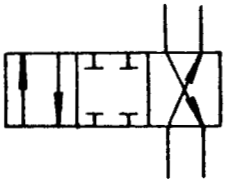


10.11.2 Three Position

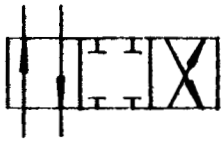
(a) Normal



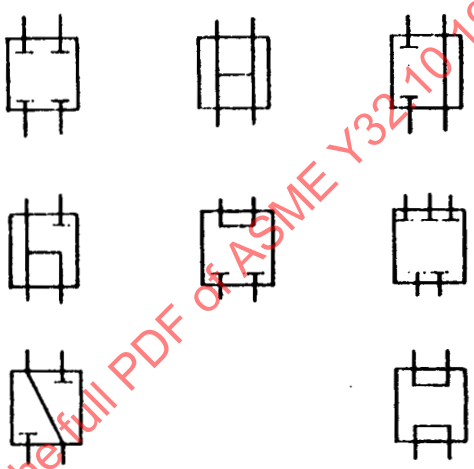
(b) Actuated Left



(c) Actuated Right



10.11.3 Typical Flow Paths for Center Condition of Three Position Valves



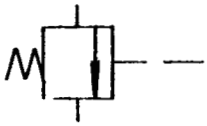
10.11.4 Two-Position, Snap Action with Transition.

As the valve element shifts from one position to the other, it passes through an intermediate position. If it is essential to circuit function to symbolize this "in transit" condition, it can be shown in the center position, enclosed by dashed lines.

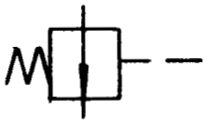
Typical Transition Symbol

10.12 Infinite Positioning (Between Open & Closed)

10.12.1 Normally Closed

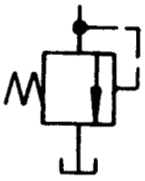


10.12.2 Normally Open

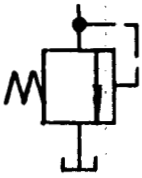


10.13 Pressure Control Valves

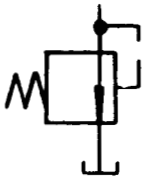
10.13.1 Pressure Relief



Simplified Symbol Denotes

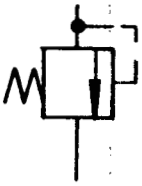


Normal

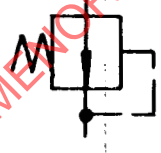


Actuated (Relieving)

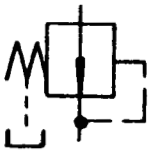
10.13.2 Sequence



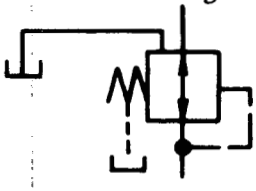
10.13.3 Pressure Reducing



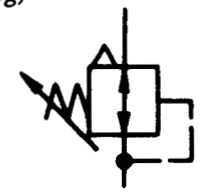
ISO



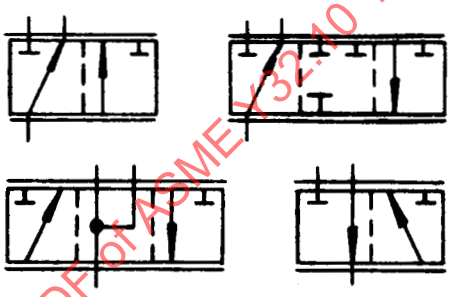
10.13.4 Pressure Reducing and Relieving



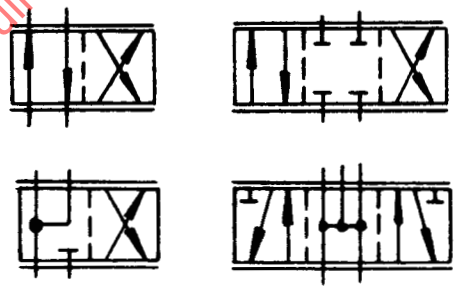
10.13.5 Airline Pressure Regulator (Adjustable, Relieving)



10.14 Infinite Positioning Three-Way Valves



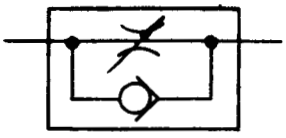
10.15 Infinite Positioning Four-Way Valves



10.16 Flow Control Valves (See 3.7)

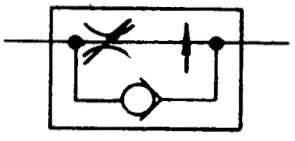
10.16.1 Adjustable, Non-Compensated (Flow control in each direction)

10.16.2 Adjustable with Bypass

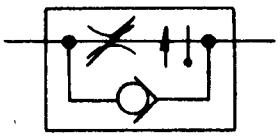


Flow is controlled to the right
Flow to the left bypasses control

10.16.3 Adjustable and Pressure Compensated With Bypass



10.16.4 Adjustable, Temperature & Pressure Compensated



11. Representative Composite Symbols

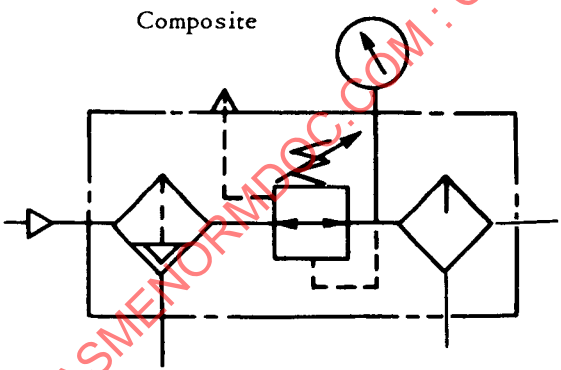
11.1 Component Enclosure

Component enclosure may surround a complete symbol or a group of symbols to represent an assembly. It is used to convey more information about component connections and functions. Enclosure indicates extremity of component or assembly. External ports are assumed to be on enclosure line and indicate connections to component.

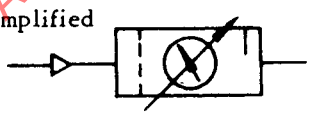
Flow lines shall cross enclosure line without loops or dots.

11.2 Airline Accessories (Filter, Regulator, and Lubricator)

Composite



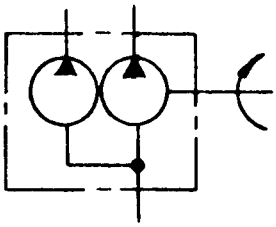
Simplified



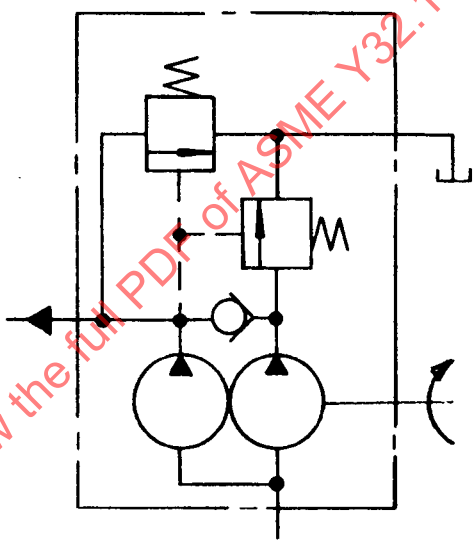
11.3 Pumps and Motors

11.3.1 Pumps

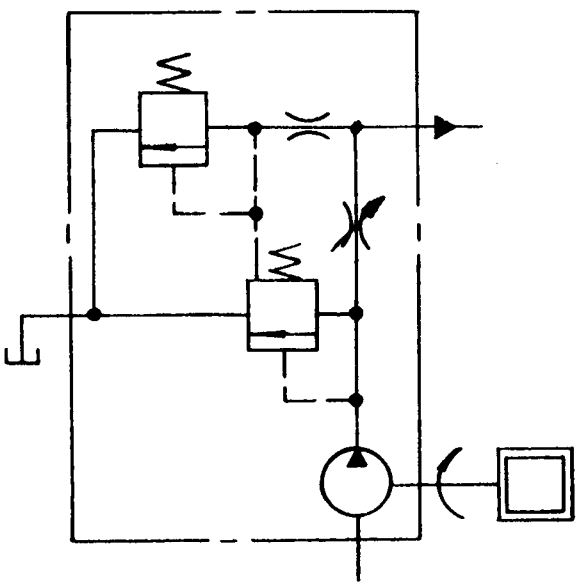
11.3.1.1 Double, Fixed Displacement, One Inlet and Two Outlets



11.3.1.2 Double, with Integral Check Unloading and Two Outlets



11.3.1.3 Integral Variable Flow Rate Control with Overload Relief



11.3.1.4 Variable Displacement with Integral Replenishing Pump and Control Valves