SAE Aerospace
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# AEROSPACE STANDARD

SAE AS1290 | REV. B

Issued 1975-07
Revised 2011-12

Superseding AS1290A

# (R) Graphic Symbols for Aircraft Hydraulic and Pneumatic Systems

## RATIONALE

AS1290 has been updated to Revision B for the following reasons:

(a) The emphasis of the document has changed from being based on producing schematic diagrams using paper drawings to those being produced using a computer drawing program

(b) New symbols and technical information have been introduced

(c) The references called up in the document have been updated

(d) The entire document has been retyped and reformatted; editorial changes have also been made to improve its readability

(e) The Foreword has been revised

## FOREWORD

The documents from which these symbols are derived are ANSI Y32.100 and ISO1219-1. The symbols that have been selected from these documents were chosen for the following reasons:

1. They represented those items that are in common usage in aerospace hydraulic and pneumatic systems

2. They were judged to provide a good basis for generating new symbols



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## 1. SCOPE

This Aerospace Standard (AS) presents a system of graphic symbols intended primarily for usage in hydraulic and pneumatic system schematic diagrams for all types of aircraft. It is also considered suitable for marine vehicles and other applications and for ancillary documents where schematics are required. Individual graphic symbols shown herein are also considered suitable for use in conjunction with other types of symbols.

This AS is intended to promote industry-wide acceptance and understanding of uniform standards and employs, where possible, symbols which are internationally recognized.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP4386 Terminology and Definitions for Aerospace Fluid Power, Actuation and Control Technologies

#### 2.1.2 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ANSI Y32.10 Graphic Symbols for Fluid Power Diagrams

#### 2.1.3 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO1219-1 Fluid power systems and components - Graphic symbols and circuit diagrams - Part 1: Graphic symbols for conventional use and data-processing applications

## 3. GENERAL SYMBOL RULES

### 3.1 Description and Method

Elementary forms of symbols are:

- Circles
- Squares
- Rectangles
- Triangles
- Arcs
- Arrows
- Lines
- Dots
- Crosses

Some symbols (such as selector valves) appear as logic configurations, with no resemblance to components; others (such as actuators and accumulators) are shape-oriented for symbolic representation. In all cases, the component function is emphasized by the symbol.

Symbols show connections, flow paths, functions and the methods of operation of the components that they represent. They can indicate the condition occurring during transition from one flow path to another. They may be rotated or reversed without altering their meaning except in the case of reservoirs or similar as specified. They distinguish between modular and non-modular components, liquid and gaseous fluid media and fluid line functions.

Symbols do not indicate construction, location or identification of ports as on the component, direction of shifting spools or positions of actuators on actual components. They do not indicate values such as pressure, flow rate or other component settings and do not indicate actual liquid levels or system conditions by symbolic instrument needle positions.

External ports are indicated where the flow lines connect to the basic symbol except where a component enclosure symbol is used, in which case the port is at the intersection of the flow line and enclosure. Flow lines shall cross enclosure lines without loops or dots and usually without change in line thickness.

Although some symbols using words are as noted herein, symbols without words or letters predominate to facilitate a symbol system capable of crossing language barriers.

Complete graphic symbols are those that give symbolic representation of the component and all of its features which are pertinent to the circuit diagram. They are often included herein to clarify simplified symbols and to act as models for new variants.

Simplified graphic symbols are stylized versions of complete symbols and are the most frequently used in system schematics.

Composite graphic symbols are an organization of simplified or complete symbols. They usually represent a complex component and may be distinguished by the enclosure as modular or non-modular type.

General graphic symbols are usually simplified symbols where only the basic function is represented and accessory functions are not included, or where controls or loadings are generalized or incomplete. They are useful in circuits where more specified detail is not relevant and maximum flexibility or simplicity is desired such as preliminary diagrams or manuals.

In multiple envelope symbols, the flow condition shown nearest a control (or operator) takes place when that control is caused or permitted to actuate, except in some cases as otherwise noted.

Each symbol is drawn to show the normal, at rest, or neutral condition of the component when the main system is unpressurized, unless otherwise noted. For complete symbols and all selector valves, a control symbol is to be shown for each flow path condition possessed by the component.

3.2 Sub-circuits

Where single page sub-circuits are used, electrical practice shall be followed in that the forward end of the aircraft is at the left side of the page for the main supply and return line runs. In addition, location of components and lines shall be laid out as to minimize line bends and crossings (without regard to actual relative positions) to promote simplicity and to facilitate functional understanding.

3.3 Nomenclature and Degree of Symbolic Representation

It is common practice for component nomenclature to express the purpose the component serves in the circuit. Such nomenclature often varies considerably for components serving the same purpose due to local usage conventions. ARP4386 provides the nomenclature for most of the common components referenced herein. In some cases, the nomenclature may differ from that used in the basic documents.

Functionally identical components often serve more than one purpose in system circuits and, consequently, may have varying nomenclature aligned with that purpose. The symbols, pictorially representing the internal action (i.e., function), will not vary and the only distinguishing difference may be in the external flow lines. There are, however, some significant areas of overlapping symbology where an alternate symbol can represent an internal action. The symbol system herein, where possible, provides such variants to identify with particular nomenclature as an aid in component identification.

Component configuration and function are so widely varied that there is often an inherent problem in the degree that such can, or should be symbolically represented consistent with pictorial simplicity. The symbol system herein has an adequate range of symbols from simplistic general symbols to complex composite symbols to provide the designer with choices to identify the components of the circuit to suit his purpose. Where new symbols are required, or new functional elements added to established symbols, there is also guidance and examples to generate such consistent with the overall concept and symbol rules.

3.4 Line Thickness, Color and Relative Symbol Envelope Size

The purpose of varying line thickness or color is to facilitate identification of components and tubing runs in complex circuits. Enclosure thicknesses are recommended maximums to give the desired degree of emphasis to suit the schematic.

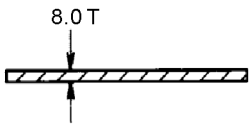
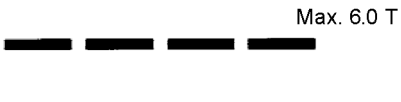
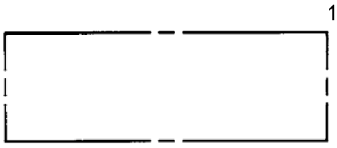
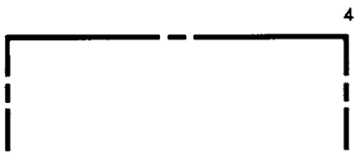
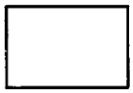
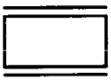
A minimum line thickness, designated as "T" shall be used primarily for low pressure lines, flow lines within valve envelopes, small valve enclosures and directional arrows. In principle, the actual line thickness should be determined by the user of this standard or by any computer drawing package that uses these symbols. However, for guidance, the minimum line thickness is suggested to be 0.010 in (0.25 mm).

In the sections following on from Basic Symbols, the relative line thickness as a multiple of "T" is designated in the upper right hand portion in the graphic section. This use is recommended for optimum clarity of diagrams.

Symbol envelope relative sizes and color can be used to differentiate various component types to offset symbol uniformity as a general aid in identification, particularly in complex circuits.

## 4. BASIC SYMBOLS

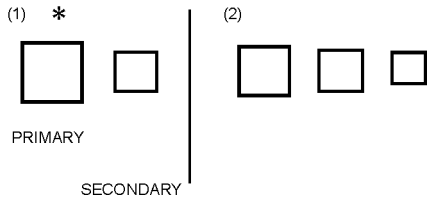
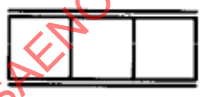
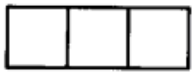
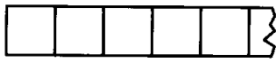
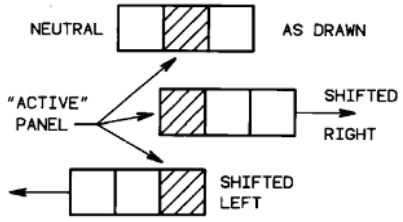
### 4.1 Boundaries, Enclosures and Envelopes

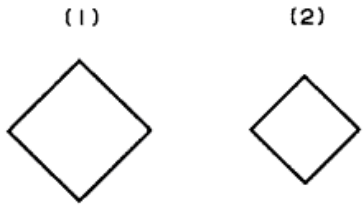
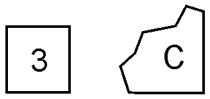
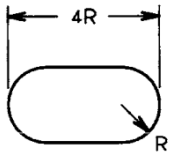
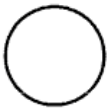
| | | |
|---|---|---|
| 4.1.1 |  | Aircraft Partitions<br>Major divisional partition in aircraft, generally separating large groups of components, for example, cargo area, wheel well area, etc. |
| 4.1.2 |  | Boundary Grouping of Components<br>Boundary grouping of components on a panel, door, maintenance station, etc. |
| 4.1.3 |  | Enclosure for an Assembly<br>Enclosure for an assembly, used to border a group of symbols where the component extremity is not obvious by the connecting symbology<br>Elements are not removable in situ |
| 4.1.3.1 |  | Enclosure representing a manifold for either modular or bolt on components that are removable in situ<br>May be used to border a modular component in a non-modular assembly |
| 4.1.4 |  | Enclosure for Small Valve Assemblies<br>Enclosure for small valve assemblies consisting of more than one functional element and for some types of flow control valve |
| 4.1.5 |  | Enclosure for Common Flow Control Valves |
| 4.1.5.1 |  | Infinite positioning due to flow characteristics |

4.1.6 Envelopes – Valves

All lines 1.5 T

* Envelope 4.1.6.1 (1) as used as infinite positioning is similar in function to 4.1.6.4 and 4.1.6.5. These alternatives widen the scope of symbolic representation.

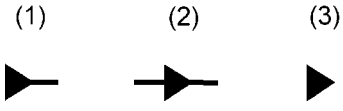
| | | |
|---|---|---|
| 4.1.6.1 |  | Single envelope<br>(1) Infinite position for control of and operated by pressure and may have two or three flow path options. See 4.1.6.4<br>(2) Used for other types of valves and components but not generally for selector valves |
| 4.1.6.2 |  | Multiple envelope two positions each envelope representing one finite flow path option<br>Commonly applicable to selector valves<br>Elongated envelope applicable to multiple port valves |
| 4.1.6.3 |  | Multiple envelope two positions representing two finite flow paths with an "in-transit" position specified in the center element |
| 4.1.6.4 |  | Multiple envelope valve<br>Infinite positioning with two flow paths<br>Applicable to valves where there is no transition zone between options |
| 4.1.6.5 |  | Multiple envelope valve<br>Infinite positioning with two flow options<br>Applicable to three or more port valves where there is a transition zone between the two flow path options where all ports are throttled to closure except for leakage flow |
| 4.1.6.6 |  | Same as 4.1.6.5 except that the transition zone is more significant to system operation and may be considered a third flow path or neutral position<br>Commonly applicable to servo valves |
| 4.1.6.7 |  | Multiple envelope valve indicating three finite flow path options<br>Used for selector valves |
| 4.1.6.8 |  | Multiple envelope valve indicating more than three flow path options or valves joined together with one set of controls |
| 4.1.6.9 |  | Valve Positions<br>In all of the above valves, the envelope is imagined to move to illustrate how pressure and flow conditions are controlled as the valve is operated |

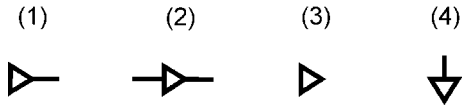
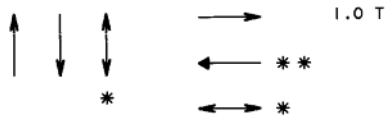
| | | |
|---|---|---|
| 4.1.7 |  | Envelope for Primary Conditioning Devices<br>Envelope for primary conditioning devices, which control the physical characteristics of the fluid.<br>(1) Heat exchangers.<br>(2) Filters and separators |
| 4.1.8 |  | Use of Numbers or Letters Inside an Envelope or Enclosure<br>A number (or letter) inside an envelope or enclosure indicates that full details are shown elsewhere. |
| 4.1.9 |  | Air Reservoirs, Accumulators, Gas Bottles |
| 4.1.10 |  | Primary Envelope of Rotative Energy Conversion Devices<br>For pumps and motors; also hand pumps, manual brake valves. |
| 4.1.10.1 |  | Envelopes for auxiliary devices, rotative devices, replaceable filter elements, simplified check valves, rollers, pivots, etc. |
| 4.1.10.2 |  | Oscillating devices |
| 4.1.11 |  | Transition Portion of Envelope<br>See 4.1.6.3 or 4.1.6.4<br>Filter element; see 6.1.1<br>Dimensions S and L to suit. |



4.2 Fluid Flow Lines – General

4.2.1 Flow – Sources and Direction

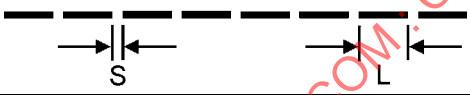
| | | |
|---|---|---|
| 4.2.1.1 |  | Hydraulic Pressure Source<br>(1) Indication of hydraulic pressure source<br>(2) Direction of hydraulic flow<br>(3) Internal hydraulic pilot valve: pump or motor element |

| | | |
|---|---|---|
| 4.2.1.2 |  | Pneumatic Pressure Source<br>(1) Indication of pneumatic pressure source<br>(2) Direction of pneumatic flow<br>(3) Internal pneumatic pilot valve, pump or motor element, gas pressure<br>(4) Pneumatic exhaust port, or atmospheric termination of fluid drain line |
| 4.2.1.3 |  | Normal direction of flow in lines or valves<br>* Flow in either direction is possible<br>**Alternate arrowhead configuration |
| 4.2.1.4 |  | Direction of free flow: usually placed under a symbol envelope<br>To indicate a free-flow arrow marked on component body |

4.2.2 High Pressure Lines

All pressure levels higher than return pressure

All lines 3.0 T

| | | |
|---|---|---|
| 4.2.2.1 |  | High Pressure Lines |
| 4.2.2.2 |  | High Pressure Pilot Lines<br>Dimensions S and L to suit |

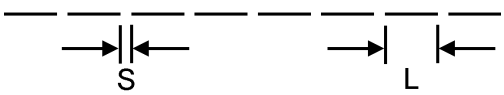
4.2.3 Low Pressure Lines

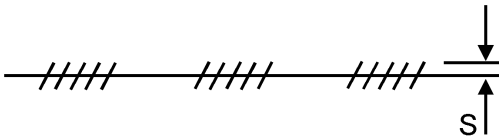
All lines 1.0 T

For line terminations, see 4.1.5.

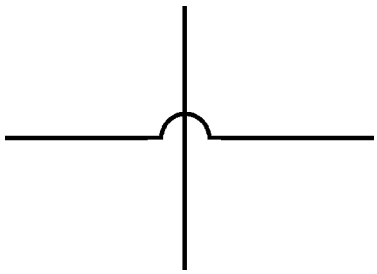
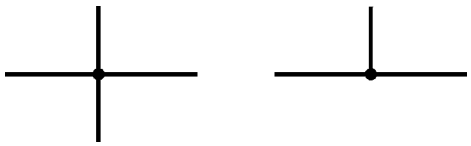
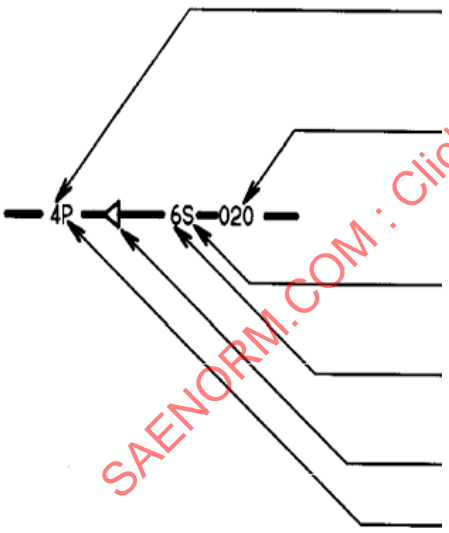
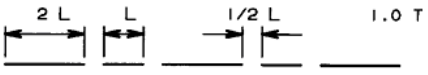
Also 4.2.3.1 (1.0 T) lines are used within small valve enclosures (4.1.4, 4.1.5, 4.1.5.1) and valve envelopes (4.1.6).

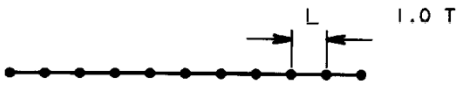
In some cases, pilot lines drawn as 4.2.2.1 or 4.2.3.1 may be desirable, for example, for fluid interfaces.

| | | |
|---|---|---|
| 4.2.3.1 |  | Return Lines<br>All flow and drain lines connected to the reservoir |
| 4.2.3.2 |  | Low Pressure Pilot Lines, And Drain Lines Venting To Atmosphere<br>Dimensions S and L to suit |

| | | |
|---|---|---|
| 4.2.3.3 |  | Suction Lines<br>Lines connecting the reservoir to the pump inlet port<br>Dimension S to suit |

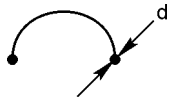
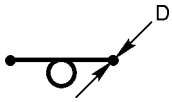
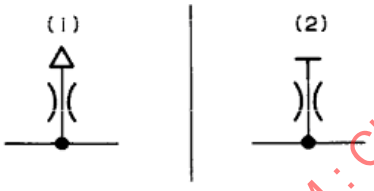
4.2.4 Crossing/Joining

| | | |
|---|---|---|
| 4.2.4.1 |  | Lines Crossing |
| 4.2.4.2 |  | Lines Joining |
| 4.2.5 |  | Line Coding<br>Fluid system no, 1, 2, 3, 4, etc. (or A, B, C, D, etc.)<br>Tube outside diameter in standard tube size (multiples of 1/16 inch) or in mm<br>A – Aluminum alloy<br>Tube material - S – Steel (corrosion resisting)<br>T– Titanium<br>Tube outside diameter in standard tube size (as shown) or in mm<br>Primary flow direction and fluid (gas or liquid)<br>Line function<br>P – Pressure R – Return S – Suction, etc.<br>Other lines (up, down, etc.) may be designated as required |
| 4.2.6 |  | Fuel Line<br>To complete oil – fuel heat exchanger symbol where no other fuel line standard exists<br>Dimension L to suit |

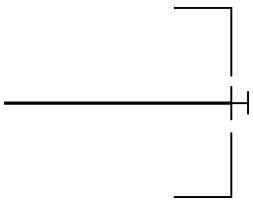
| | | |
|---|---|---|
| 4.2.7 |  | Capillary Line<br>Dimension L to suit |

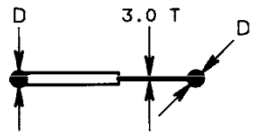
4.3 Connections, Flexible Lines

4.3.1 Flexible Line

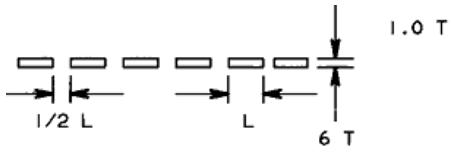
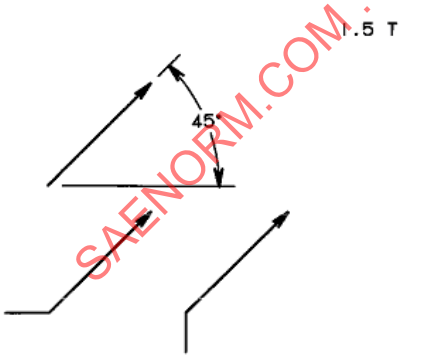
| | | |
|---|---|---|
| 4.3.1.1 |  | General symbol<br>Lines 1.5 T |
| 4.3.1.2 |  | Flexible hose<br>Lines 4.0 T |
| 4.3.1.3 |  | Coiled tubing, or tubing designed for torsion or flexure<br>Lines 3.0 T |
| 4.3.2 |  | Rotary or Swivel Connector, or Joint<br>(1) Single flow line<br>(2) More than one flow line represents concentric, but separate, flow paths in rotary connector |
| 4.3.3 |  | Bleeder Fitting<br>(1) Continuous<br>(2) Temporary |

4.3.4 Joints

| | | |
|---|---|---|
| 4.3.4.1 |  | Permanent Joint<br>Need only be shown at important points |
| 4.3.4.2 |  | Reconnectable joint<br>Need only be shown at important points |
| 4.3.4.3 |  | Plugged port, fill port, pressure cap, dust cap |
| 4.3.4.4 |  | Capped line |

| | | |
|---|---|---|
| 4.3.5 |  | Extension Fitting<br>Simplified symbol (pressure and volume balanced) |

4.4 Mechanical, Electrical and Functional

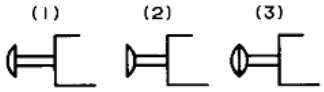
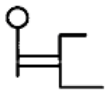
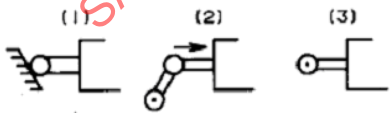
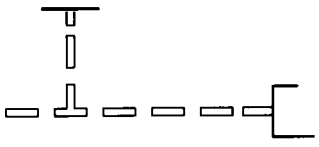
| | | |
|---|---|---|
| 4.4.1 |  | Mechanical Linkage |
| 4.4.2 |  | Shaft or Piston Rod<br>Use single line for valve shafts. |
| 4.4.3 |  | Electrical Line |
| 4.4.4 |  | Direction of Rotation<br>For shafts, the arrow is considered to be on the near side |
| 4.4.5 |  | Facility for Variable Control<br>For example, used in pump, spring, solenoid, etc.<br>General symbol<br>The arrow may be bent, as shown, to add the method of variability<br>For aircraft applications, the most likely common usage is in the symbol for a variable delivery pump. Where the added pressure compensation symbol indicated automatic variation between wide limits of flow with a narrow variation in pressure<br>Adjustability for factory setting of relief valves, etc., is not symbolized |
| 4.4.6 |  | Spring Used as a Mechanical Link<br>For example, cylinder internal return spring, etc. |

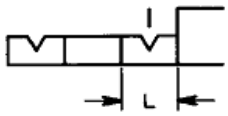
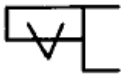
| | | |
|---|---|---|
| 4.4.7 |   | Pivoting Device With Fixed Fulcrum<br>For example, ground or earthing point<br>To indicate, in moving body components, which part is fixed to structure |
| 4.4.8 |   | Pressure Compensation, Gauge Needle, or Transducer Arm |

4.5 Controls

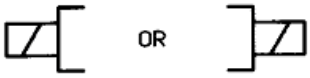
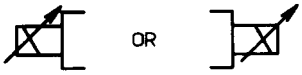
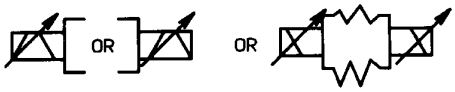
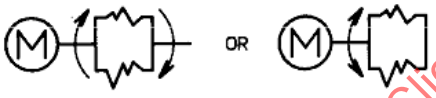
All lines 1.5 T, except as noted

4.5.1 Mechanical or Muscular

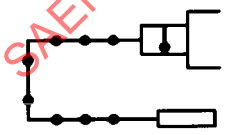
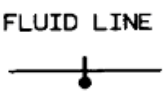
| | | |
|---|---|---|
| 4.5.1.1 |   | Spring for valve control |
| 4.5.1.2 |  | Manual control – general symbol |
| 4.5.1.3 |   | (1) Push button<br>(2) Pull button<br>(3) Push-pull button |
| 4.5.1.4 |  | Lever |
| 4.5.1.5 |   | (1) Pedal<br>(2) Treadle |
| 4.5.1.6 |   | (1) Mechanical – general symbol<br>(2) Plunger |
| 4.5.1.7 |   | (1) Mechanical – roller<br>(2) Mechanical – roller – one direction<br>(3) Mechanical - roller – two directions |
| 4.5.1.8 |   | Remote manual or mechanical, or a mechanical relationship between units or elements. (See 4.4.1) |

| | | |
|---|---|---|
| 4.5.1.9 |  | Detent<br>Show a notch for each detent in the actual component being symbolized<br>A short line indicates which detent is in use<br>Detent may, for convenience, be positioned on either end of the symbol<br>Notch used in actuators indicates an internal lock |
| 4.5.1.10 |  | Prevents stopping in dead center |

4.5.2 Electrical

| | | |
|---|---|---|
| 4.5.2.1 |  | Solenoid, single winding, finite current input |
| 4.5.2.2 |  | Torque motor, single coil – variable current input |
| 4.5.2.3 |  | Torque motor, dual coil |
| 4.5.2.4 |  | Reversing motor |

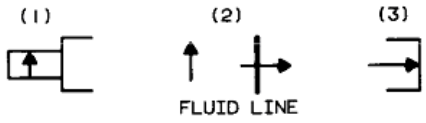
4.5.3 Temperature

| | | |
|---|---|---|
| 4.5.3.1 |  | Temperature (or thermal) – local sensing |
| 4.5.3.2 |  | Remote sensing |
| 4.5.3.3 |  | Temperature compensated (when appearing within a component enclosure) |

4.5.4 Pressure

See also 9.6.1 and 9.6.2.

NOTE For all examples shown below, the ► (hydraulic) or ▷ (pneumatic) pilot elements were randomly selected, and are interchangeable within the control symbol.

| | | |
|---|---|---|
| 4.5.4.1 |  | (1) Pressure compensated (complete symbol)<br>(2) Same as (1) (simplified symbol within component enclosure)<br>(3) Alternate for flow regulators |

4.5.4.2 Pilot Operation

The term “Pilot” can mean:

(1) A valve spool end as a piston for shifting the spool (not usually symbolized, see 4.1.6.9).

(2) A separate piston mechanically connected to a spool (not usually symbolized)

3) A miniature 2-, 3-, or 4-port valve used to direct pressure to the spool end(s) of the main selector valve (see 9.1.7.1, 9.2.1.1, 9.2.2.1, for complete symbols).

(4) A miniature spring loaded poppet acting as a pressure limiter to create a pressure unbalance for unseating a main poppet.

(5) A flapper-nozzle or similar portion of the first stage of an electrohydraulic servovalve.

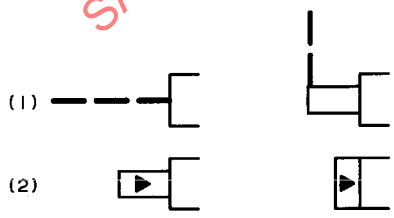
4.5.4.3 Differential Pilot

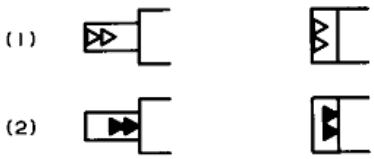
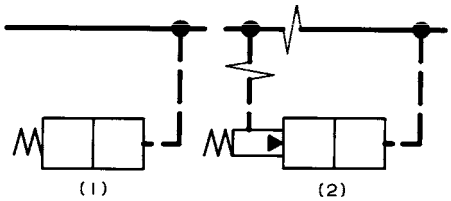
The term “Differential Pilot” can mean –

(1) An unequal area piston mechanically connected to a spool, poppet, etc., with constant pressure on the smaller.

(2) A sensing piston of greater area than and mechanically in series with a pilot poppet as 4.5.4.2 (4) but providing a wider differential between opening and closing.



| | | |
|---|---|---|
| 4.5.4.4 |  | (1) Operated from one remote pressure source, or from elsewhere within the component<br>(2) Termination of (1) for two pilots in series (same as 4.5.5.1)<br>General pilot symbol where direction of pressure is unspecified |
| 4.5.4.5 |  | Pilot supplied internally, operated by pressure application when activated by another control<br>Applicable to 4.5.4.2 (2); and when normally closed (3) |
| 4.5.4.6 |  | Pilot supplied internally, operated by pressure release when activated by another control<br>Applicable to 4.5.4.2 (2), except when normally open (3) |

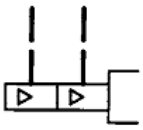
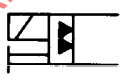
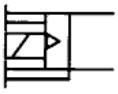
| | | |
|---|---|---|
| 4.5.4.7 |  | (1) Operating in two successive pilot pressure application stages (one pilot causes second pilot operation)<br>(2) Operating in two successive pilot pressure release or limit stages. Applicable as 4.5.4.6 with 4.5.4.2 (2) where the latter is for spool centering or to 4.5.4.3 (2) |
| 4.5.4.8 |  | Differential Pilot<br>Applicable to 4.5.4.3 (1) and similar |
| 4.5.4.9 |  | Direct pilot and compound pilot operation.<br>In both (1) and (2), when pressure exceeds spring force. RH Panel operates<br>(2) Applicable to 4.5.4.2 (4) (Pressure Limiter) |

4.5.5 Composite Controls

(AND, OR, AND/OR)

NOTE For all examples shown below, the ► (hydraulic) or ▷ (pneumatic) pilot elements were randomly selected, and are interchangeable within the control symbol.

See 4.2.3.1 (3) and 4.2.3.2 (3)

| | | |
|---|---|---|
| 4.5.5.1 |  | AND<br>One signal, and a second signal, both cause the device to operate |
| 4.5.5.2 |  | OR<br>One signal, or the other signal, causes the device to operate |
| 4.5.5.3 |  | AND/OR<br>The solenoid and the pilot, or the manual override alone, causes the device to operate |
| 4.5.5.4 |  | AND/OR<br>The solenoid and the pilots, or the manual override and the pilots, cause the device to operate (pressure centered) |
| 4.5.5.5 |  | AND/OR<br>The solenoid and the pilot, or the manual override and the pilot, or a manual override alone, causes the device to operate |
| 4.5.5.6 |  | AND<br>General symbol for solenoid-operated pilot (4.5.2.1 integrated with 4.5.4.4 (2)) |

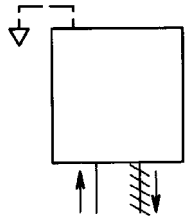
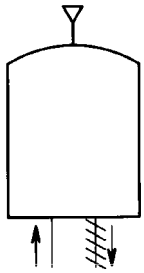
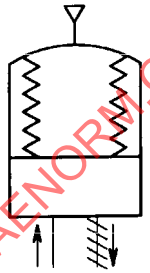
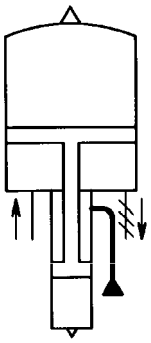
## 5. RESERVOIRS, ACCUMULATORS, GAS BOTTLES

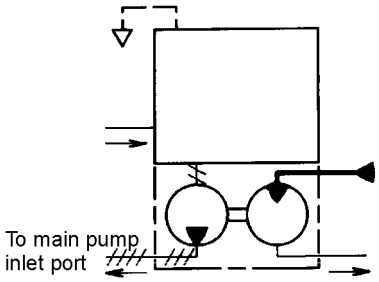
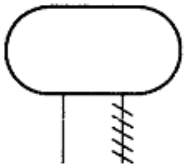
### 5.1 Reservoirs

The following are basic symbols for various types of reservoirs showing the essential features. The basic connecting lines are as shown. However, other items such as level indicators, relief valves, drain valves, filler caps, bleed valves, etc., may be added as applicable. Other types and variants shall show similar symbols, compatible with the design.

On installation schematics, reservoirs shall be oriented as in the aircraft.

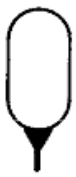
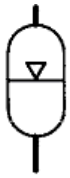
All envelopes - 1.5 T.

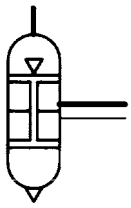
| | | |
|---|---|---|
| 5.1.1 |  | Reservoir Open to Atmosphere |
| 5.1.2 |  | Pressurized (Air-Oil Interface) |
| 5.1.3 |  | Bellows Type (Air and Oil Separated) |
| 5.1.4 |  | Pressure Operated (or Bootstrap Type) Reservoir |

| | | |
|---|---|---|
| 5.1.5 |  | Open Reservoir With Attached Hydraulic Motor-Driven Booster Pump<br>(See Section 8) |
| 5.1.6 |  | Open Reservoir – General Symbol<br>Overflow reservoir, or reservoir in a component |
| 5.1.7 |  | Pressurized Reservoir – General Symbol<br>Show in horizontal position<br>Envelope per 4.1.9 |
| 5.1.8 |  | Air Receiver<br>For pneumatic systems<br>Show in horizontal position<br>Envelope per 4.1.9 |

5.2 Accumulators

All 1.5 T. Envelope per 4.1.9, except as noted.

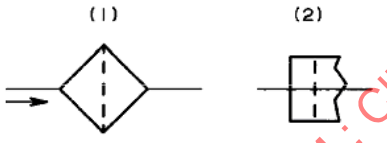
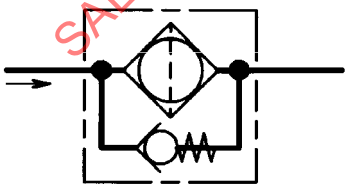
| | | |
|---|---|---|
| 5.2.1 |  | Accumulator – General Symbol<br>Without indication of energizing device |
| 5.2.2 |  | Hydro-Pneumatic Accumulator<br>The symbol applies to flexible diaphragm (sometimes spherical), piston and welded bellows, factory pre-charged types |

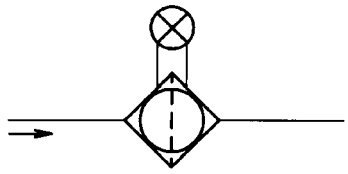
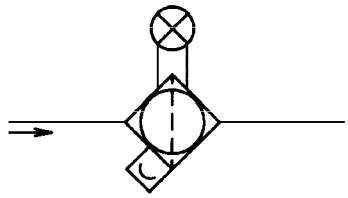
| | | |
|---|---|---|
| 5.2.3 |  | Self-Displacing Accumulator |
| 5.2.4 |  | Spring Energized Accumulator<br>For application, see 11.2 |
| 5.2.5 |  | Gas Storage Bottle<br>The symbol applies to both spherical and cylindrical types |

6. FLUID CONDITIONERS

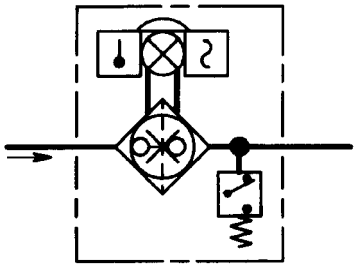
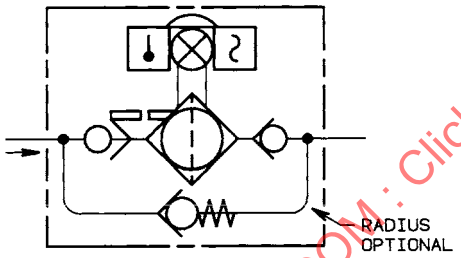
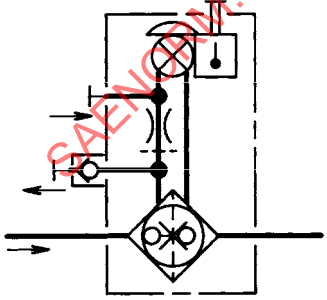
6.1 Filters

Envelope – 4.1.7 and 10.17.

| | | |
|---|---|---|
| 6.1.1 |  | Filter – General Symbol<br>(1) Filter or screen with element not removable in situ or where this is not significant to circuit function. May be used as general symbol<br>(2) Simplified symbol for screen in restrictor valves, etc. |
| 6.1.2 |  | Filter With Element Removable In Situ<br>Regardless of enclosure type |
| 6.1.3 |  | Filter With Removable Element and With By-Pass<br>See 9.6.2.2 (B) |

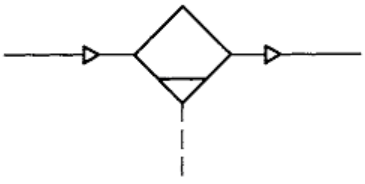
| | | |
|---|---|---|
| 6.1.4 |  | Filter With Removable Element and With ΔP Indicator |
| 6.1.4.1 |  | Same as 6.1.4, with added chip detector |

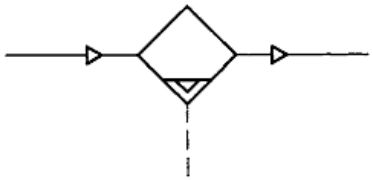
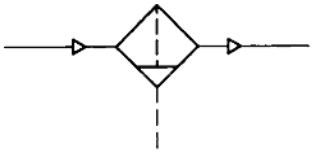
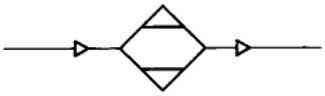
6.1.5 Filter Assemblies

| | | |
|---|---|---|
| 6.1.5.1 |  | Filter with:<br>• Removable element<br>• Automatic line shut-off on bowl removal<br>• Δp indicator having thermal lockout, surge arrestor, manual re-set button<br>• Integral pressure switch |
| 6.1.5.2 |  | Filter with:<br>• Removable element<br>• Automatic line shut-off on bowl removal (shown as complete symbol, as alternative to 10.17.5)<br>• By-pass relief valve<br>• ΔP indicator having thermal lockout, surge arrestor, and manual reset button |
| 6.1.5.3 |  | Filter with removable element and with:<br>• Automatic line shut-off on bowl removal<br>• ΔP indicator having manual re-set button and thermal lockout having manual override<br>• In situ functional test port (shown normally plugged<br>• Sampling port (shown normally plugged) |



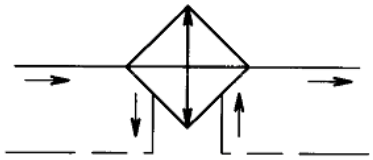
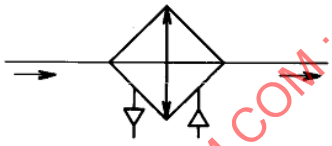
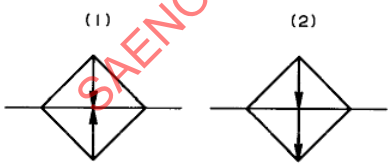
6.2 Water Separators and Filter-Separators

| | | |
|---|---|---|
| 6.2.1 |  | Water Separator With Manual Drain |

| | | |
|---|---|---|
| 6.2.2 |  | Water Separator With Automatic Drain |
| 6.2.3 |  | Filter-Separator With Manual Drain |
| 6.2.4 |  | Chemical Drier |

6.3 Heat Exchangers

These are drawn with a larger envelope than filters as an aid in identification. (See 4.1.7)

| | | |
|---|---|---|
| 6.3.1 |  | Hydraulic Fluid-to-Fuel Heat Exchanger<br>Outside lines indicate liquid cooling medium<br>See 4.2.6 |
| 6.3.2 |  | Hydraulic Fluid-to-Air Heat Exchanger<br>Outside triangles indicate that air is the cooling medium |
| 6.3.3 |  | Heaters and Temperature Controllers<br>Units represented are (1) heaters and (2) temperature controllers<br>External media not shown<br>Although not commonly in aircraft circuits, units are included for symbolic representation of heat inflow and outflow. |

## 7. ENERGY CONVERSION - ACTUATING CYLINDERS, ACTUATORS

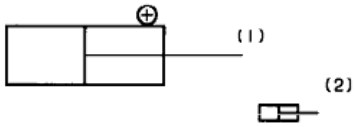
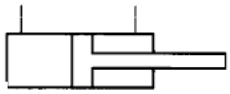
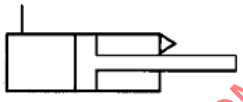
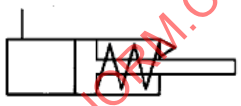
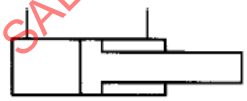
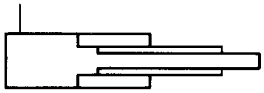
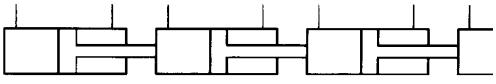
The actuating cylinders shown are some typical variants and are not intended as a complete reference.

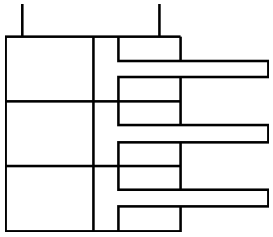
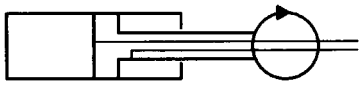
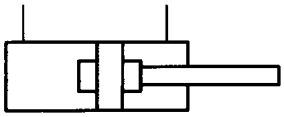
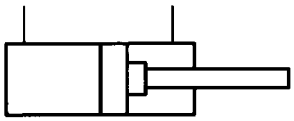
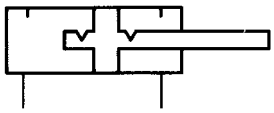
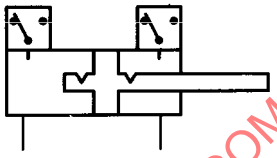
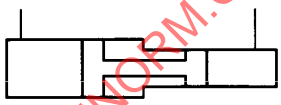
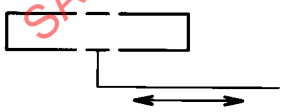
NOTES

1. The double line for pistons and rods is commonly used in aircraft circuits to emphasize it as an important interface between fixed and moving structure.
2. Single acting cylinders are also shown closed off at the rod end with a vent port
3. All fluid lines are low pressure to demonstrate position only.

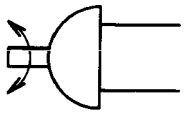
### 7.1 Linear Actuators (Cylinders)

All 1.5 T.

| | | |
|---|---|---|
| 7.1.1 |  | Linear Actuator General Symbol<br>(1) Actuating cylinders general symbol for use in preliminary circuits: optional<br>(2) Small cylinders as component elements<br>Both above are exceptions to Notes 1 and 2 |
| 7.1.2 |  | Double Acting Linear Actuator |
| 7.1.3 |  | Single Acting Linear Actuator<br>Alternatively, pressure may enter at rod end with head end vented |
| 7.1.4 |  | Single Acting Linear Actuator With Spring Return |
| 7.1.5 |  | Linear Actuator With Rod/Bore Definition<br>Diameter of rod compared to diameter of bore is significant to circuit function |
| 7.1.6 |  | Double Ended Linear Actuator<br>Piston rods may be equal (shown) or unequal diameters |
| 7.1.7 |  | Telescopic Cylinder-Single Acting |
| 7.1.8 |  | Positioning Cylinders |

| | | |
|---|---|---|
| 7.1.9 |  | Side-by-Side Cylinders With Common Body at Portings |
| 7.1.10 |  | Swivel-End Cylinder, Double Port Swivel at Rod End |
| 7.1.11 |  | Cylinder With Snubbing Facility at Both Ends |
| 7.1.12 |  | Cylinder With Snubbing Facility At One End<br>Rod end shown |
| 7.1.13 |  | Cylinder With Locks at Head and Rod Ends<br>General lock symbol<br>Symbol applies to either piston or collet (rod) type locks |
| 7.1.14 |  | Cylinder With Locks And Lock Indicators At Head And Rod Ends<br>Indicator detailed in 10.3 |
| 7.1.15 |  | Pressure Intensifier |
| 7.1.16 |  | Brake Actuator<br>Simplified symbol |

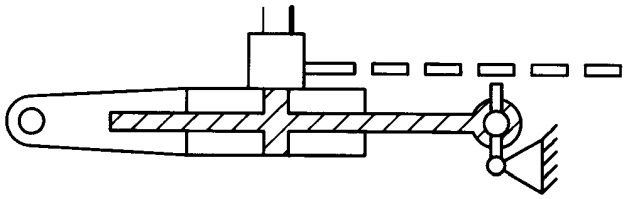
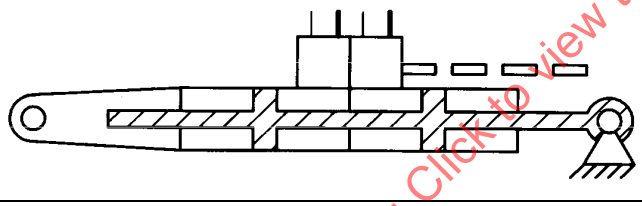
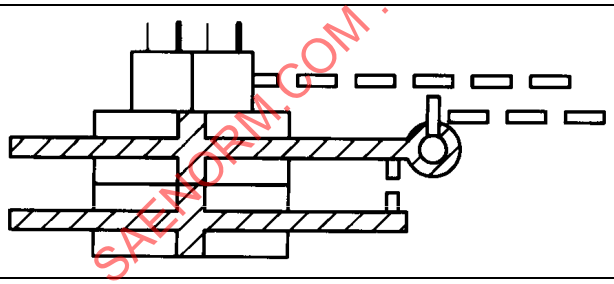
## 7.2 Other-Than-Linear Actuators

| | | |
|---|---|---|
| 7.2.1 |  | Rotary Or Oscillating Actuator |

## 7.3 Flight Control Cylinders

Flight control cylinders are made distinctive by cross-hatching of cylinder rod and piston, inclusion of end bearings, and usually having attached valve (detailed in Section 9) as an actuator package. Ground-Point symbol shows attachment to fixed structure for Moving-Body cylinders.

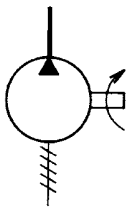
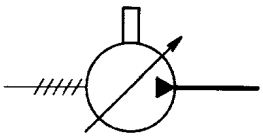
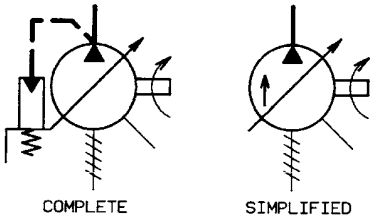
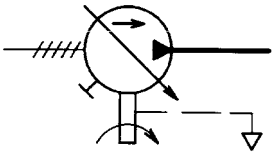
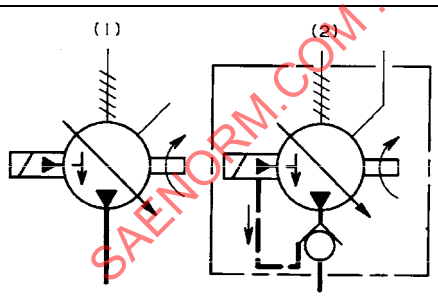
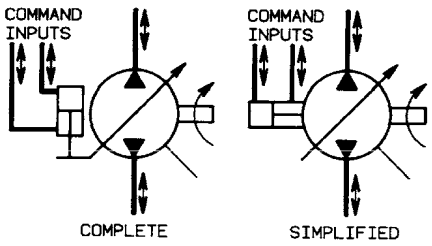
Mechanical linkages are stylized representations of usually complex systems.

| | | |
|---|---|---|
| 7.3.1 |  | Moving Body Boost Actuator<br>Ground point, connected to input. Provides proportional-load feedback |
| 7.3.2 |  | Moving Body, Full Power, Tandem Actuator |
| 7.3.3 |  | Fixed Body, Full Power, Side-By-Side, Dual Actuator |

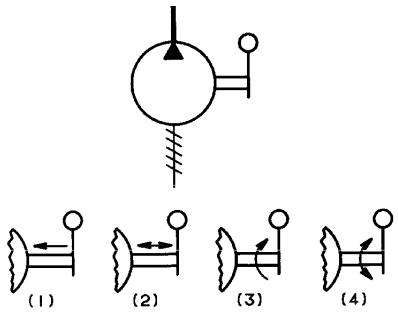
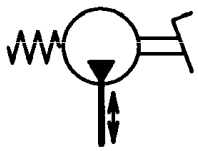
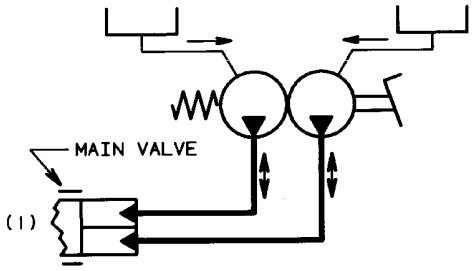
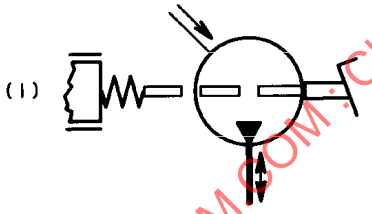
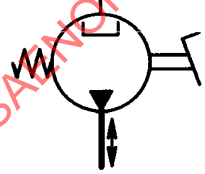
8. ENERGY CONVERSION - PUMPS, MOTORS, ENGINES

8.1 Pumps – Hydraulic

8.1.1 Pumps – Hydraulic – Power Driven

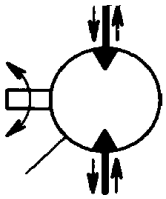
| | | |
|---|---|---|
| 8.1.1.1 |  | Fixed-displacement pump, with one direction of flow, and with case drain internally connected to pump inlet |
| 8.1.1.2 |  | General symbol for variable-displacement pump, with one direction of flow, where it is not important to specify variability control<br>Case drain and rotation optional |
| 8.1.1.3 |  | Variable-displacement, pressure-compensated pump, with one direction of flow, and case drain line connection |
| 8.1.1.4 |  | Same as 8.1.1.3, except with case drain port blocked, and with shaft-seal leakage vented to atmosphere |
| 8.1.1.5 |  | (1) Same as 8.1.1.3, except with added solenoid-operated depressurization valve<br>(2) Same as (1), except with added blocking valve; see 9.5.1.2 |
| 8.1.1.6 |  | Basic variable-displacement servo pump, with bi-directional flow (over-center pump)<br>Single direction of rotation, and with case drain |

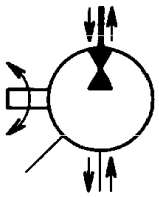
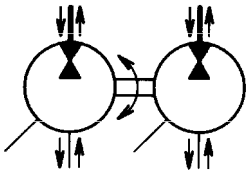
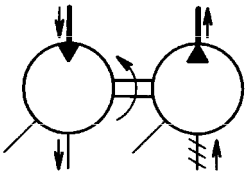
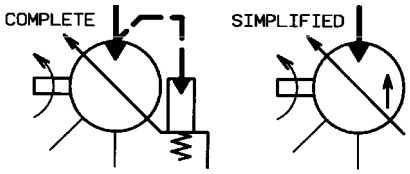
8.1.2 Pumps – Hydraulic, Muscular Energy Driven

| | | |
|---|---|---|
| 8.1.2.1 |  | Hand pump – general symbol<br>(1) Linear – single acting<br>(2) Linear – double acting<br>(3) Rotary – single acting<br>(4) Rotary – double acting |
| 8.1.2.2 |  | Foot-operated pump (or control, or master cylinder) of master/slave unit<br>Pushing on pedal causes outward flow to slave unit, and release of pedal permits recharge through the same line |
| 8.1.2.3 |  | Dual-control cylinders with remote reservoirs, and with slave units as operators of Main Valve (1)<br>Either master/slave unit will operate the Main Valve |
| 8.1.2.4 |  | Emergency-backup brake master cylinder<br>Foot control through mechanical linkage to Main Valve (1)<br>Foot muscular control for master cylinder operation<br>Added return line port for unit replenishment by system return |
| 8.1.2.5 |  | Master brake cylinder (or unit) with return flow to internal reservoir, and with external fill port |

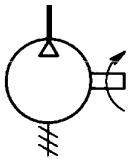
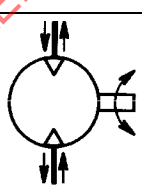


8.2 Motors, Pump-Motors, Power Transfer Units

| | | |
|---|---|---|
| 8.2.1 |  | Fixed-Displacement, Bi-Directional Hydraulic Motor, With Case Drain |

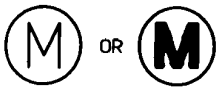
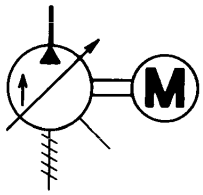
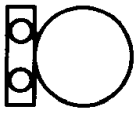
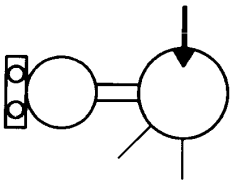
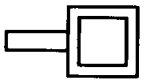
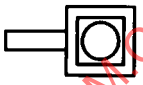
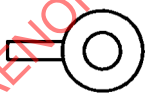
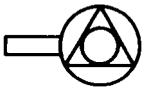
| | | |
|---|---|---|
| 8.2.2 |  | Pump Motor<br>Operates in one direction as a pump, and in other direction as a motor |
| 8.2.3 |  | Power Transfer Unit |
| 8.2.3.1 |  | Power transfer unit - Single direction of power transfer and single direction of rotation |
| 8.2.4 |  | Variable-Delivery Pressure-Compensated Motor, With One Direction of Flow, and Case Drain |

8.3 Pneumatic Pumps, Compressors, Motors

| | | |
|---|---|---|
| 8.3.1 |  | Fixed-Displacement Air Compressor |
| 8.3.2 |  | Vacuum Pump |
| 8.3.3 |  | Pneumatic Motor, Bi-Directional |

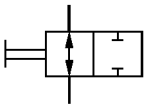
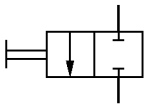
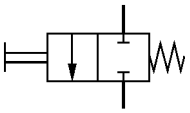
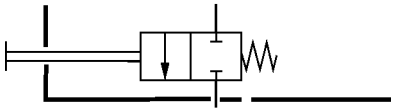
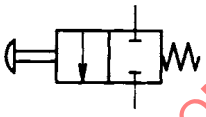
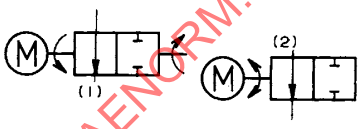
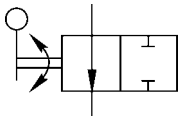
8.4 Driving and Driven Units

For example, Electric Motors, Generators, Engines, Air Turbines

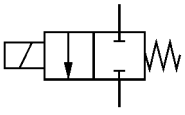
| | | |
|---|---|---|
| 8.4.1 |   | Electric Motor |
| 8.4.1.1 |  | Motor Pump<br>Electric motor-driven variable-displacement pump |
| 8.4.2 |  | Generator |
| 8.4.2.1 |  | Hydraulic Motor-Driven Generator |
| 8.4.3 |  | Heat Engine, Piston Type |
| 8.4.4 |  | Heat Engine, Gas-Turbine Type |
| 8.4.5 |  | Air Turbine |
| 8.4.6 |  | Ram Air Turbine |

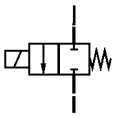
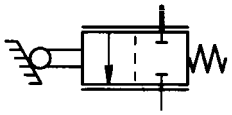
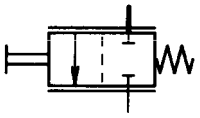
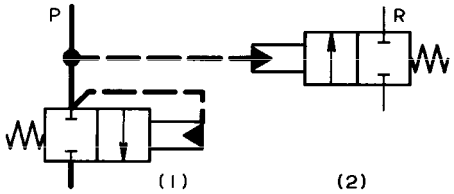
## 9. VALVES – CONTROL

### 9.1 Two-Port Selector

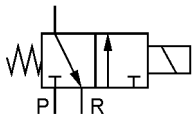
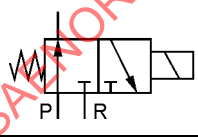
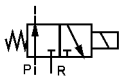
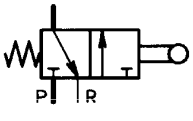
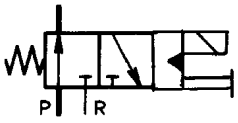
| | | |
|---|---|---|
| 9.1.1 |  | Shut-Off Valve, Manually Operated, General Symbol<br>Symbol used when the valve type, or the indication of normal flow option, is not significant to circuit function |
| 9.1.1.1 |  | Shut-off valve, reversible (operated with pressure at either port), manually operated, shown open (see Note)<br>NOTE: Only one manual control need be shown. |
| 9.1.1.2 |  | Shut-off valve, non-reversible (normally pressurized at only one port), manually operated, shown closed (see Note)<br>NOTE: Only one manual control need be shown. |
| 9.1.2 |  | Air-Charging Valve for Accumulator<br>Shown with cap |
| 9.1.3 |  | Shut-off Valve, Manually Operated, Spring Return, Normally Closed |
| 9.1.3.1 |  | Manual symbol may be extended to outside manifold of composite symbol |
| 9.1.4 |  | Push-Button Valve, Spring Return, Normally Closed |
| 9.1.5 |  | Motor Operated Shut-Off Valve<br>(1) Shown open with full counterclockwise shaft rotation, and closed with full clockwise rotation<br>(2) Related direction of rotation not significant |
| 9.1.6 |  | Lever Operated Shut-Off Valve<br>Related direction of rotation not significant |

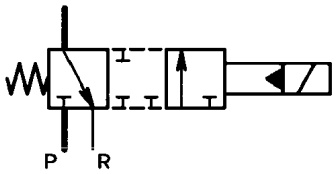
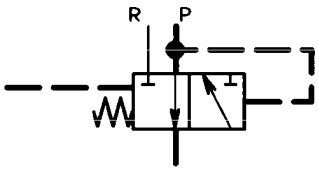
### 9.1.7 Solenoid-Operated Shut-Off Valve

| | | |
|---|---|---|
| 9.1.7.1 |  | Direct-operating solenoid valve. Normally closed |

| | | |
|---|---|---|
| 9.1.7.2 |  | Pilot valve (complete symbol) used in complete valve symbols.<br>Particularly for modular assemblies, where it may be removed in situ from the main valve it serves |
| 9.1.8 |  | Mechanically-Operated Valve, Infinitely-Variable Position, Normally Closed<br>Tracer valve<br>Flow is analogous to operator position |
| 9.1.9 |  | Needle Valve<br>Flow is analogous to operator position<br>Only one manual control need be shown |
| 9.1.10 |  | Pressure-Operated Valves<br>See 4.5.6.2 (2)<br>(1) Internally operated<br>(2) Externally operated |

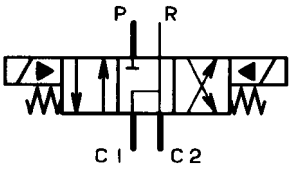
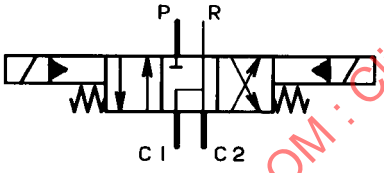
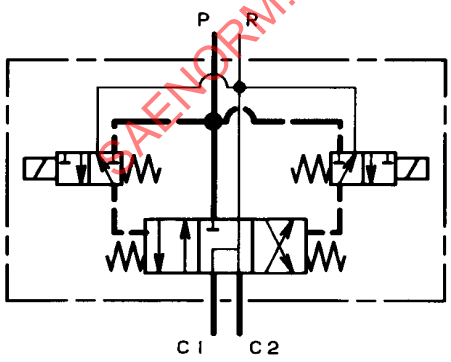
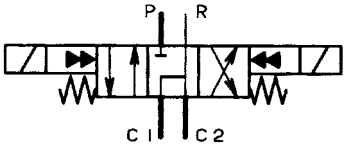
9.2 Three-Way Selector

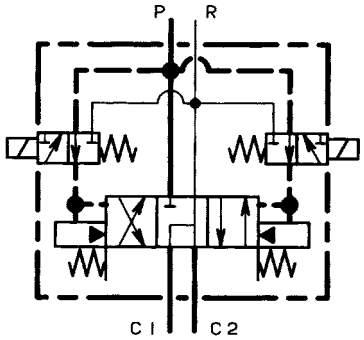
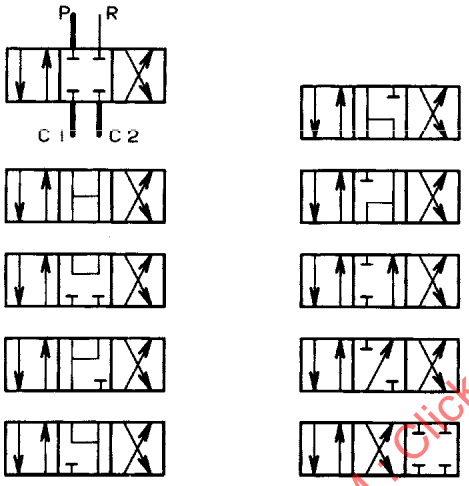
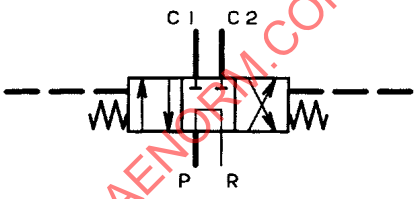
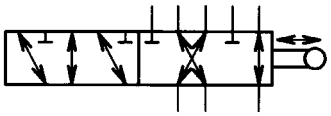
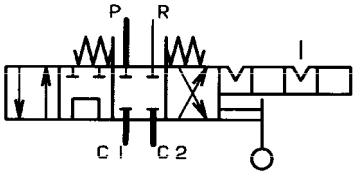
| | | |
|---|---|---|
| 9.2.1 |  | Direct-Acting Solenoid Valve, Normally Closed |
| 9.2.1.1 |  | Pilot valve (complete symbol) used in complete valve symbols, particularly for modular assemblies, where it may be removed in situ from the main valve it serves |
| 9.2.2 |  | Direct-Acting Solenoid Valve, Normally Open |
| 9.2.2.1 |  | Pilot valve (complete symbol) used in complete valve symbols, particularly for modular assemblies where it may be removed in situ from the main valve it serves |
| 9.2.3 |  | Mechanically-Operated Valve, Normally Closed |
| 9.2.4 |  | Solenoid or Manually-Operated Valve, Plus Pilot, Normally Open |

| | | |
|---|---|---|
| 9.2.5 |  | Solenoid or Manually-Operated Valve, Plus Pilot, Normally Closed<br>Operator – solenoid plus pilot.<br>Center square indicates all ports closed, during transit from open to close (non-interflow). See 4.1.6.3.<br>Operators 4.5.4.5, 4.5.2.1 shown<br>Alternative operator 4.5.5.6 |
| 9.2.6 |  | Pilot Operated Valve, Normally Open<br>Operator – external pilot to open. Internal pilot to close<br>Applicable to direct control modular valves |

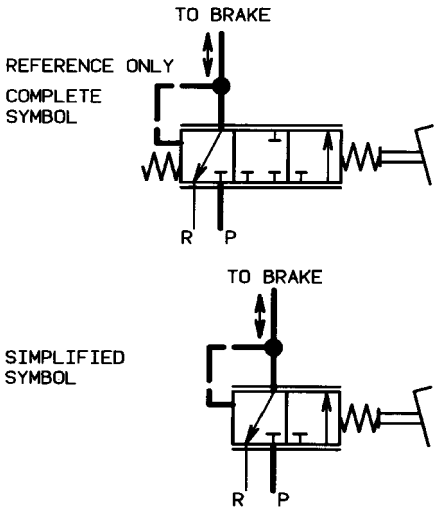
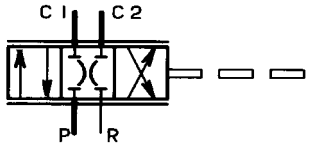
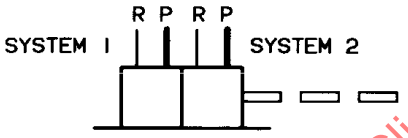
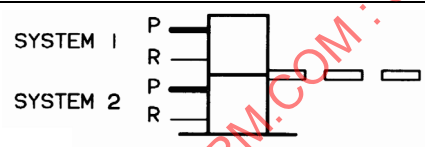
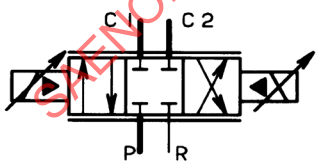
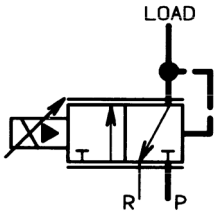
9.3 Four-Way Selector, Multi-Port Selector, and Multi-Panel Selector

9.3.1 Solenoid/Pilot Operated Valves

| | | |
|---|---|---|
| 9.3.1.1 |  | Solenoid/Pilot Operated, With Open Neutral<br>The general symbol for the operator (4.5.5.6). Indicates that it is not significant to circuit function to specify operation by applied or released pressure |
| 9.3.1.2 |  | Solenoid Plus Internal Pilot Operated, Only Spring Centered With Open Neutral<br>Actuation by applied pressure<br>Simplified symbol<br>Operator 4.5.4.5 in conjunction with 4.5.2.1 to emphasize importance of spring only centering |
| 9.3.1.2.1 |  | Solenoid Plus Internal Pilot Operated, Only Spring Centered With Open Neutral, Non-Modular Valve<br>Functionally same as 9.3.1.2<br>Complete symbol<br>See 9.2.1.1<br>Operator 4.5.4.4(1) |
| 9.3.1.3 |  | Solenoid plus internal pilot operated, and spring plus pressure centered (actuation by release pressure), with open neutral<br>Simplified symbol<br>Operator 4.5.4.7 (2), in conjunction with 4.5.2.1 to emphasize importance of spring and pressure centering |

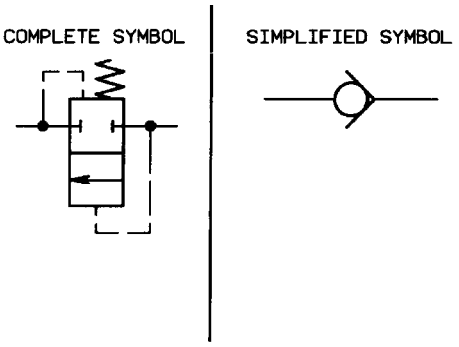
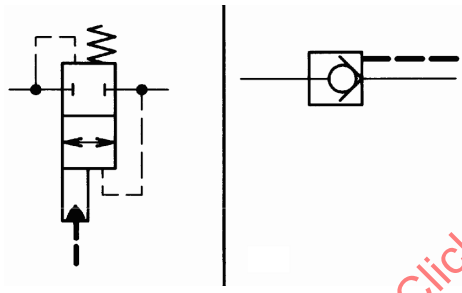
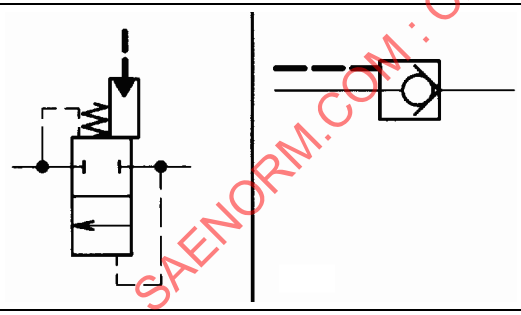
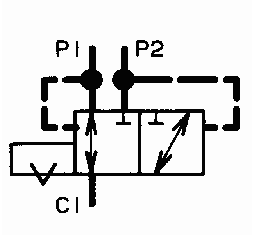
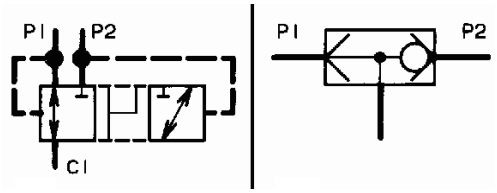
| | | |
|---|---|---|
| 9.3.1.4 |  | Modular valve with solenoid pilot valve and main valve separate and removable separately from module<br>See 9.2.2.1<br>Functionally same as 9.3.3<br>Solenoids shown optionally outside of envelope<br>Contains centering pistons, and operators 4.5.4.4 (1) and 4.5.4.6<br>Complete symbol<br>NOTE: The apparent reversal of main valve flow path compared to that of simplified symbol is due to the left-hand solenoid valve operation directing high pressure flow to port C1 (and right hand solenoid valve to port C2) |
| 9.3.2 |  | Flow Direction Options<br>Showing varieties of flow direction control, which may be obtained with four-way valves<br>These symbols do not illustrate complete four-point valves, as operators are not shown |
| 9.3.3 |  | Selector Valve<br>Four-way, three-position, pilot-operated, open-center |
| 9.3.4 |  | Phase-Control Valve<br>Only one control symbol required<br>Example of a multi-port valve |
| 9.3.5 |  | Multi-Panel Valve<br>The valve is detented in the first panel position, and detented and spring-centered in the third panel position which is the normal stand-by position<br>Only a single control is required |

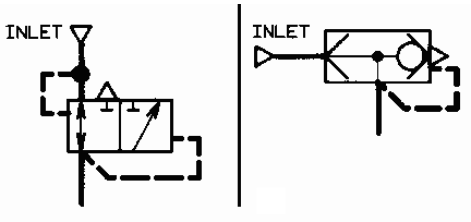
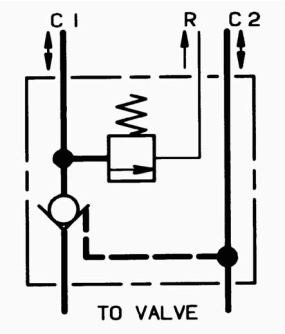
9.4 Infinite-Position selector – Power-Brake Valves, Servovalves, Servo Packages

| | | |
|---|---|---|
| 9.4.1 |  | Power-Brake Valve<br>Brakes off – L.H. Panel<br>Brakes on – R.H. Panel<br>Brakes hold – Transition zone where brake pressure, via pilot line, balances pedal load, closing all ports, ref. 4.1.6.5 |
| 9.4.2 |  | Mechanical Servovalve<br>Where neutral has defined pressure gain and leakage requirements, as might be used in flight control systems |
| 9.4.2.1 |  | Simplified Symbol For Mechanical Tandem-Control Servovalve<br>With dual system inlets and outlets<br>As might be mounted on flight control cylinders |
| 9.4.2.2 |  | Simplified symbol for side-by-side valve<br>With dual system inlets and outlets, as might be mounted on flight control cylinders |
| 9.4.3 |  | Electrohydraulic Pilot-Controlled Flow-Control Servovalve<br>Simplified symbol<br>Operators 4.5.2.3 combined with 4.5.4.4 |
| 9.4.3.1 |  | Simplified symbol, for electro-hydraulic pilot-controlled pressure-control servovalve<br>Operators 4.5.2.2 combined with 4.5.4.4 (2) |

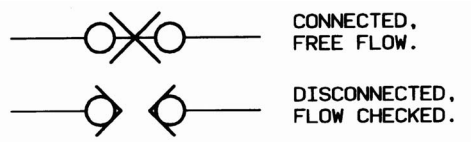
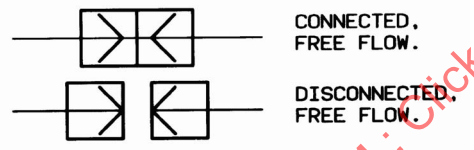
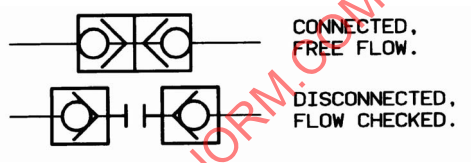
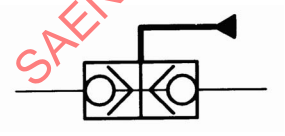
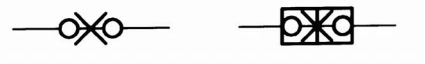
| | | |
|---|---|---|
| 9.4.4 |  | Simplified Symbol For Complex Servo-Package<br>As might be mounted on flight control cylinder |

9.5 Automatic and Semi-Automatic Check-Type

| | | |
|---|---|---|
| 9.5.1 |  | Check Valves<br>The spring is usually light, and is omitted from simplified symbols<br>NOTE: Spring-loaded check valves are considered to be relief valves. See 9.6.2.2 (B)<br>For line-mounted symbols for check valves, the free flow arrow (4.2.1.4) should always be shown to avoid possible confusion of the free flow arrow on the actual component body, with the simplified valve seat symbol which resembles an arrow head |
| 9.5.1.1 |  | Pilot-Operated Check Valve, Pilot Operated to Open<br>In the simplified symbol, the pilot pressure operates the valve in the same manner as the adjacent flow line |
| 9.5.1.2 |  | Pilot-Operated Check Valve, Pilot Operated to Close<br>In the simplified symbol, the pilot pressure operates the valve in the same manner as the adjacent flow line |
| 9.5.2 |  | Shuttle Valve<br>Shown as prevented from stopping in dead center |
| 9.5.2.1 |  | Shuttle Valve, Interflow Type, Two-Way Flow<br>General (simplified) symbol, where interflow is not significant to circuit function |

| | | |
|---|---|---|
| 9.5.2.2 |  | Rapid Exhaust Valve<br>When inlet is unloaded, outlet is freely exhausted |
| 9.5.3 |  | Cylinder Lock Valve, Single, With Thermal Relief<br>When C2 is pressurized, the check valve is held open, permitting C1 flow (then at low pressure) to the valve.<br>See 9.5.2 and 9.6.2.3 |

9.5.4 Disconnects

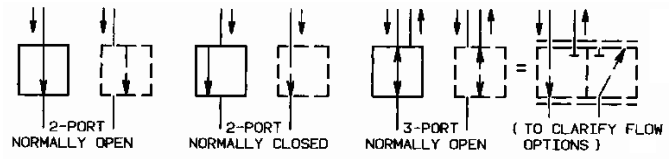
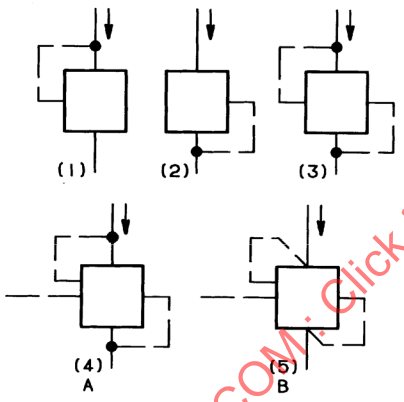
| | | |
|---|---|---|
| 9.5.4.1 |  | The coupling halves are joined by some type of standard connection, or are integrated as part of a detachable larger unit |
| 9.5.4.2 |  | The coupling halves are joined by a connection specially designed for rapid or frequent disconnection (quick disconnect) |
| 9.5.4.3 |  | Quick Disconnect Coupling<br>Disconnected unit shown with added dust caps |
| 9.5.4.4 |  | Remotely-operated disconnect<br>Hydraulically actuated version shown<br>May alternately have mechanical, electrical, etc. operator |
| 9.5.4.5 |  | For applications other than ground-support connections<br>For example brake quick disconnect couplings, 9.5.4.1 etc.<br>May be as shown, but to a smaller scale |

9.6 Automatic and Semi-Automatic Valves – Pressure Control

9.6.1 Single Envelope Valves for Pressure Control

In infinite-position, single-envelope valves, the envelope is imagined to move to illustrate how pressure and flow conditions are controlled as the valve is actuated. The term “infinite position”, as applies here, means the range between full-flow and re-seat conditions for automatic valves (controlled entirely by the fluid pressure it is subjected to). However, in semi-automatic valves (automatic operation subject to external control), the external condition may modify the “infinite position” condition to the extent that there is also full “on” or full “off” options. The following symbols do not represent complete valves, and all fluid lines are low pressure for demonstration purposes.

NOTE: Various types of pressure control valves having unique nomenclature (i.e., “relief”, “reducer”, “unloading”, “counterbalance”) have constructional and functional similarities such that for industrial valves, minor changes can transpose one to the other. Thus, pictorial differences in symbology may sometimes be more subtle than implied by the nomenclature. Also, the controls noted in 9.6.1.2 are applicable to other types of valves.

| | | |
|---|---|---|
| 9.6.1.1 |  | Dashed lined symbols represent imaginary operated positions |
| 9.6.1.2 |  | (1) Affected internally by upstream pressure<br>(2) Affected internally by downstream pressure<br>(3) Affected internally by upstream and downstream pressures; i.e., differential pressure<br>(4) Same as (3) plus external pilot (semi-automatic valve), and also applies to (1) and (2)<br>NOTE: All of the above are general symbols indicating either direct-acting or pilot-operated valves<br>(5) Alternatives to (4) to indicate direct-acting only valves, i.e., no pilot, or the pilot is shown separately |



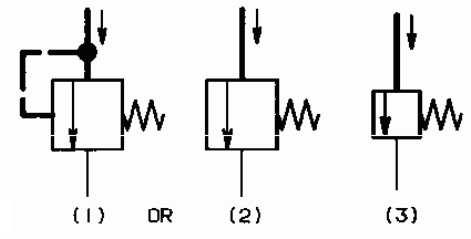
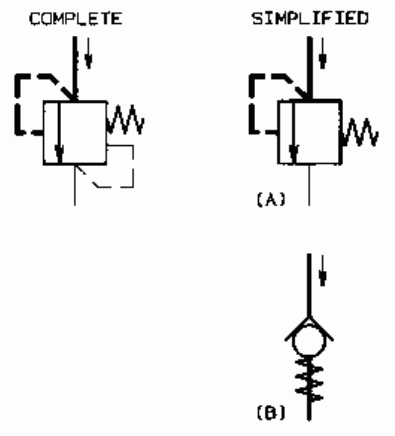
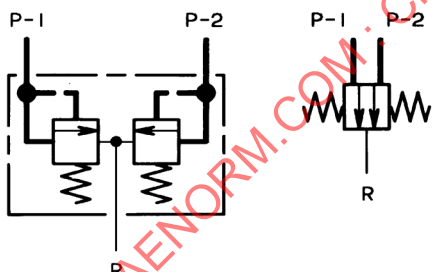
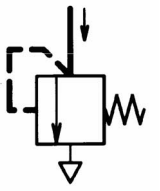
9.6.2 Relief Valves

There are various common types of relief valve construction, including:

- Direct-acting,
- Two-stage (or compound, or
- Pilot-operated) valves, such as balanced-piston or differential-area-piston types (the latter having the piston area reduced to achieve a smaller spring size).

The valves perform the same basic functions although there may be significant differences in dynamic performance. All the above are differential pressure valves, where the setting is affected (and such amplified by the differential-piston type valve) by inherent and relieving flow back-pressure caused by the length and/or diameter of return lines in closed circuits.

Where code (A) is used, for example 9.6.2.2, the simplified symbol is construed to mean any of the above types, and the downstream pilot line is omitted since the small tank symbol implies close proximity such that back-pressure effects are not significant. In aircraft circuits, although this pilot line is also omitted from simplified symbols, the presence of back-pressure is implied by the continuous line from the outlet port. A balanced relief valve, where inlet pressure is unaffected by downstream pressure, is also used in aircraft circuits, and is symbolically shown herein.

| | | |
|---|---|---|
| 9.6.2.1 |  | Relief Valve<br>General symbol for direct or compound (pilot-operated) differential pressure, etc. types<br>(1) Primary<br>(2) Primary<br>(3) Secondary |
| 9.6.2.2 |  | Relief-Type Valves<br>- Differential pressure<br>- Direct acting<br>The complete symbol, or simplified symbol (A), is recommended for circuit protection valves where the constantly closed position represents the normal system condition, and relieves pressure from a high-pressure to a low-pressure line<br>The simplified symbol (B) is recommended for valves where the open position represents a frequent system condition, or for a local by-pass valve within a component symbol (representing spasmodic operation) and pressure relief is usually to a line of similar pressure level |
| 9.6.2.3 |  | Dual Thermal Relief Valve |
| 9.6.2.4 |  | Relief Valve – Vented to Atmosphere (blow-off valve)<br>Direct acting |