

MIL-STD-17B-1
23 January 1963
SUPERSEDING
MIL-STD-17A
11 September 1961

MILITARY STANDARD
MECHANICAL SYMBOLS
(OTHER THAN AERONAUTICAL, AEROSPACECRAFT
AND SPACECRAFT USE)

PART-1



MIL-STD-17B-1
23 January 1963

DEPARTMENT OF DEFENSE
WASHINGTON 25, D. C.

Mechanical Symbols (Other
Than Aeronautical, Aerospacecraft
and Spacecraft Use)

MIL-STD-17B-1

1. This standard has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force, effective 23 January 1963.
2. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Defense Supply Agency, Alexandria, Virginia.

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FOREWORD

By permission of the American Standards Association and the American Society of Mechanical Engineers, the symbols contained herein have been adopted without change from the following American Standards:

ASA Z32.2.3-1949 - Graphical Symbols for Pipe Fittings, Valves
(Reaffirmed 1953) and Piping.

ASA Y32.4-1955 - Graphical Symbols for Plumbing.

ASA Z32.2.4-1949 - Graphical Symbols for Heating, Ventilating,
(Reaffirmed 1954) and Air Conditioning.

ASA Z32.2.6-1950 - Graphical Symbols for Heat-Power
(Reaffirmed 1956) Apparatus.

ASA Y32.10-1958 - Graphical Symbols for Fluid Power
Diagrams.

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Section 1, Scope.

1.1 This standard establishes an approved listing of mechanical symbols that shall be used in the preparation of drawings when graphic or symbolic representation is desired, for all items except aircraft, aerospacecraft, or spacecraft. The symbols listed are those most commonly employed on engineering drawings. They are for exterior and interior services.

1.2 Limitations. - Where graphical symbols are required for an item or equipment not covered in this standard, the form and character of the symbol will be left to the discretion of the activity concerned, provided that the symbol used does not duplicate any of those contained herein, and is clearly understandable, subject to one interpretation only, or explained by a suitable note on the drawing when necessary.

1.3 Application. - Pipe fittings, valves and piping symbols (see section 2) shall be used for all systems, except where so desired, the symbols shown for fluid power systems (see section 6) may be used for fluid power systems. All other symbols shall be used as applicable.



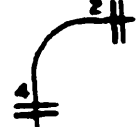
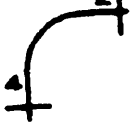
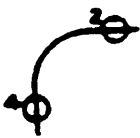

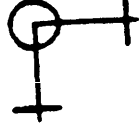
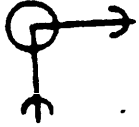
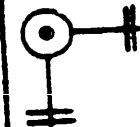
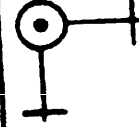
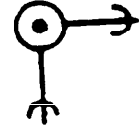

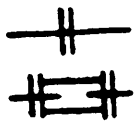
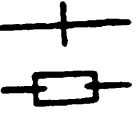
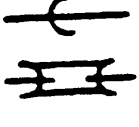
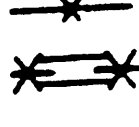
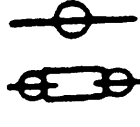

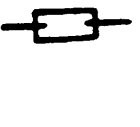
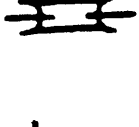
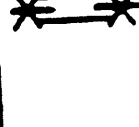


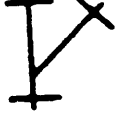

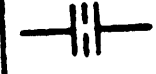

1.4 Use. - Each drawing or one sheet of each set of drawings on which symbols are used shall show a legend which shall identify the symbols. However, those symbols which are unmistakably identified on the drawing by the text or note at or near the symbols, may be omitted in the legend. In lieu of identifying each symbol, it is permissible to state that symbols used are in accordance with this Standard or the appropriate American Standards. Since symbolic representation does not usually involve exact or scale layout or the actual run or leads of piping, the same symbol may be used for all projections of the system (plan, elevations and sections) except where specific symbols for the various views are included in this standard.

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Section 2 - Graphical symbols for pipe fittings, valves, and piping
extracted from Publication ASA Z32.2.3:

Pipe fittings, valves and piping	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.1 Bushing					
2.2 Cap					
2.3 Cross					
2.3.1 Reducing					
2.3.2 Straight size					
2.4 Crossover					
2.5 Elbow					
2.5.1 45-Degree					
2.5.2 90-Degree					
2.5.3 Turned down					
2.5.4 Turned up					
2.5.5 Base					
2.5.6 Double branch					

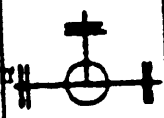
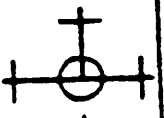
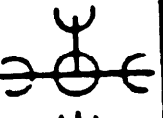
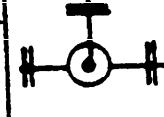
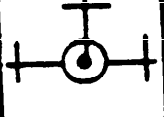
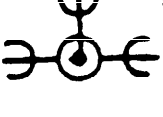









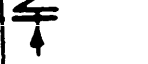












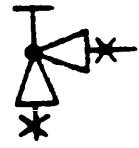





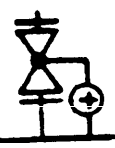

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Pipe fittings valves and piping (cont'd.)	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.5.7 Long radius					
2.5.8 Reducing					
2.5.9 Side outlet (outlet down)					
2.5.10 Side outlet (outlet up)					
2.5.11 Street					
2.6 Joint					
2.6.1 Connecting pipe					
2.6.2 Expansion					
2.7 Lateral					
2.8 Orifice flange					
2.9 Reducing flange					


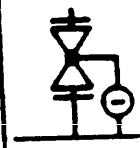












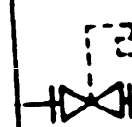
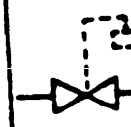
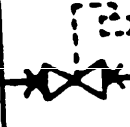
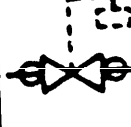
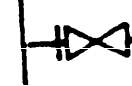
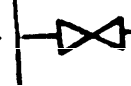



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Pipe fittings, valves and piping (cont'd.)	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.10 Plug					
2.10.1 Bull plug					
2.10.2 Pipe plug					
2.11 Reducer					
2.11.1 Concentric					
2.11.2 Eccentric					
2.12 Sleeve					
2.13 Tee					
2.13.1 (Straight size)					
2.13.2 (Outlet up)					
2.13.3 (Outlet down)					
2.13.4 (Double sweep)					
2.13.5 Reducing					
2.13.6 (Single sweep)					

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Pipe fittings, valves and piping (cont'd.)	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.13.7 Side outlet (outlet down)					
2.13.8 Side outlet (outlet up)					
2.14 Union					
2.15 Angle valve					
2.15.1 Check					
2.15.2 Gate (elevation)					
2.15.3 Gate (plan)					
2.15.4 Globe (elevation)					
2.15.5 Globe (plan)					
2.15.6 Hose angle	same as	symbol	2.23.1		
2.16 Automatic valve					
2.16.1 By-pass					

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Pipe fittings, valves and piping (cont'd.)	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.16.2 Governor-operated					
2.16.3 Reducing					
2.17 Check valve					
2.17.1 Angle check	same as	symbol	2.15.1		
2.17.2 (Straight way)					
2.18 Cock					
2.19 Diaphragm valve					
2.20 Float valve					
2.21 Gate valve					
✓ 2.21.1					
2.21.2 Angle gate	same as	symbols	2.15.2 and 2.15.3		
2.21.3 Hose gate	same as	symbol	2.23.2		

✓ Also used for general STOP VALVE symbol when amplified by specification.

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Pipe fittings, valves and piping (cont'd.)	Flanged	Screwed	Bell and spigot	Welded	Soldered
2.21.4 Motor-operated					
2.22 Globe valve					
2.22.1					
2.22.2 Angle globe	same as	symbols	2.15.4 and		
2.22.3 Hose globe	same as	symbol	2.15.5 2.23.3		
2.22.4 Motor-operated					
2.23 Hose valve					
2.23.1 Angle					
2.23.2 Gate					
2.23.3 Globe					
2.24 Lockshield valve					
2.25 Quick opening valve					
2.26 Safety valve					
2.27 Stop valve	same as	symbol	2.21.1		

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Pipe fittings, valves and piping (cont'd.) - Air Conditioning, Heating,
Plumbing, Pneumatic Tubes and Sprinklers.

(NOTE: Where line symbols on any one drawing are
duplicates of another service letter symbols may be
added.)

Air Conditioning	— — — — —
2. 28 Brine return	— — — — —
2. 29 Brine supply	— — — — —
2. 30 Circulating chilled or hot-water flow	— — — — —
2. 31 Circulating chilled or hot-water return	— — — — —
2. 32 Condenser water flow	— — — — —
2. 33 Condenser water return	— — — — —
2. 34 Drain	— — — — —
2. 35 Humidification line	— — — — —
2. 36 Make-up water	— — — — —
2. 37 Refrigerant discharge	— — — — —
2. 38 Refrigerant liquid	— — — — —
2. 39 Refrigerant suction	— — — — —
Heating	— — — — —
2. 40 Air-relief line	— — — — —
2. 41 Boiler blow off	— — — — —
2. 42 Compressed air	— — — — —
2. 43 Condensate or vacuum pump discharge	— — — — —
2. 44 Feedwater pump discharge	— — — — —
2. 45 Fuel-oil flow	— — — — —
2. 46 Fuel-oil return	— — — — —
2. 47 Fuel-oil tank vent	— — — — —
2. 48 High-pressure return	— — — — —
2. 49 High-pressure steam	— — — — —
2. 50 Hot-water heating return	— — — — —
2. 51 Hot-water heating supply	— — — — —

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Pipe fittings, valves and piping (cont'd.) - Air Conditioning, Heating
Plumbing, Pneumatic Tubes and Sprinklers.

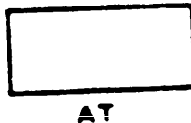
2.52 Low-pressure return	---
2.53 Low-pressure steam	---
2.54 Make-up water	---
2.55 Medium pressure return	---+---
2.56 Medium pressure steam	---+---
Plumbing	
2.57 Acid waste	---ACID---
2.58 Cold water	---
2.59 Compressed air	---A---
2.60 Drinking-water flow	---
2.61 Drinking-water return	---
2.62 Fireline	---F---
2.63 Gas	---G---
2.64 Hot water	---
2.65 Hot-water return	---
2.66 Soil, waste or leader (above grade)	---
2.67 Soil, waste or leader (below grade)	---
2.68 Vacuum	---V---
2.69 Vent	---
Pneumatic tubes	
2.70 Tube runs	==
Sprinklers	
2.71 Branch and head	---o---
2.72 Drain	---s---
2.73 Main supplies	---s---

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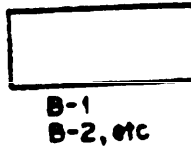
Section 3 - Graphical symbols for plumbing, extracted from
Publication ASA Y32.4:

Plumbing Symbols

3.1 Autopsy table

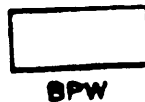


3.2 Bath



Use specification to describe

3.3 Bed pan washer



3.4 Bed pan sterilizer



3.5 Bidet



3.6 Can washer



3.7 Cleanout



3.8 Dental unit



3.9 Dish washer



3.10 Drain



3.11 Drinking fountain



Use specification to describe

3.12 Gas outlet



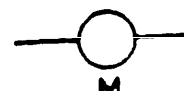
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Plumbing Symbols (cont'd.)

3.13 Range



3.20 Meter



3.14 Grease trap



3.21 Roof drain



3.15 Hose bibb



3.22 Shower
3.22.1 Head



3.16 Hose rack



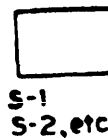
3.22.2 Stall



3.17 Hot water tank



3.23 Sink



3.18 Laundry tray



3.19 Lavatories



L-1
L-2, etc.



L-1
L-2, etc.

Use specification to describe

3.24 Wash fountain
3.24.1 Circular



Use specification to describe

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Plumbing Symbols (cont'd.)

3.24.2 Half circular



3.25 Urinal



Use specification to describe

3.26 Vacuum outlet



3.27 Water closet



Use specification to describe

3.28 Water heater



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Section 4 - Graphical symbols for heating, ventilating and air conditioning,
extracted from Publication ASA Z32.2.4:

Heating symbols for heating, ventilating and air conditioning - Heating

4.1 Air eliminator



4.2 Anchor



4.3 Expansion joint



4.4 Hanger or support



4.5 Heat exchanger



4.6 Heat transfer surface, plan
(indicate type such as convector)



4.7 Pump
(indicate type such as vacuum)



4.8 Strainer



4.9 Tank (designate type)



4.10 Thermometer



4.11 Thermostat



4.12 Traps

4.12.1 Boiler return



4.12.2 Blast thermostatic



4.12.3 Float



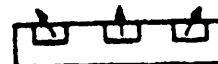
4.12.4 Float and thermostatic



4.12.5 Thermostatic



4.13 Unit heater
(centrifugal fan), plan



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Heating symbols for heating, ventilating and air conditioning (cont'd.) - Heating

4.14 Unit heater (propeller), plan



4.15 Unit ventilator, plan



4.16 valves

4.16.1 Check



4.16.2 Diaphragm



4.16.3 Gate



4.16.4 Globe



4.16.5 Lock and shield



4.16.6 Motor operated



4.16.7 Reducing pressure



4.16.8 Relief
(either pressure or vacuum)



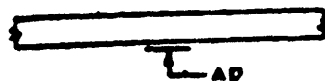
4.17 Vent point



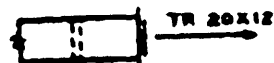
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Heating symbols for heating, ventilating and air conditioning (cont'd.) - Heating

4.18 Access door



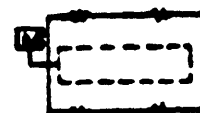
4.19 Adjustable blank off



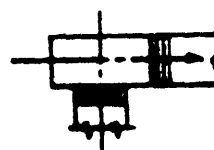
4.20 Adjustable plaque



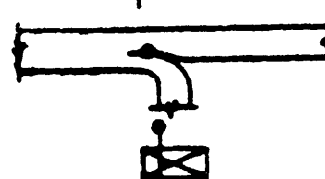
4.21 Automatic dampers



4.22 Canvas connections



4.23 Deflecting damper



4.24 Direction of flow



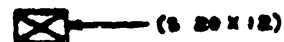
4.25 Duct (1st figure, side shown;
2nd side not shown)



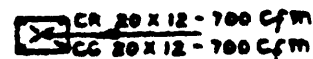
4.26 Duct section
(exhaust or return)



4.27 Duct section (supply)



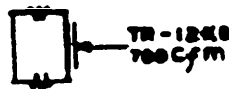
4.28 Exhaust inlet ceiling
(indicate type)



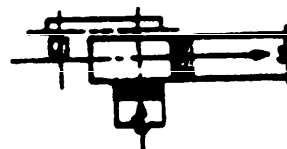
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Heating symbols for heating, ventilating and air conditioning (cont'd.) - Ventilating

* 4.29 Exhaust inlet wall
(indicate type)



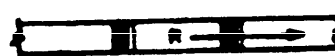
4.30 Fan and motor with
belt guard



4.31 Inclined drop in respect
to air flow



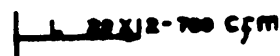
4.32 Inclined rise in respect
to air flow



4.33 Intake louvers on screen



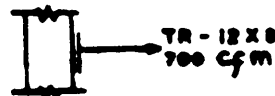
4.34 Louver opening



4.35 Supply outlet ceiling
(indicate type)



4.36 Supply outlet wall
(indicate type)



4.37 Vanes



4.38 Volume damper



* This symbol (direction of arrow) is not in accordance with
ASA Standard Z32.2.4-1949 (Reaffirmed 1954).

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Heating symbols for heating, ventilating and air conditioning (cont'd.) - Ventilating

4.39 Capillary tube



4.40 Compressor



4.41 Compressor, enclosed, crankcase, rotary, belted



4.42 Compressor, open crankcase, reciprocating, belted



4.43 Compressor, open crankcase, reciprocating, direct drive



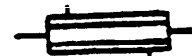
4.44 Condenser, air cooled, finned, forced air



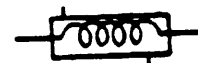
4.45 Condenser, air cooled, finned, static



4.46 Condenser, water cooled, concentric tube in a tube



4.47 Condenser, water cooled, shell and coil



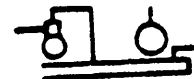
4.48 Condenser, water cooled, shell and tube



4.49 Condensing unit, air cooled



4.50 Condensing unit, water cooled



4.51 Cooling tower



4.52 Dryer



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Heating symbols for heating,
ventilating and air conditioning (cont'd.) - Air conditioning

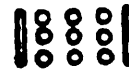
4.53 Evaporative condenser



4.54 Evaporator, circular,
ceiling type, finned



4.55 Evaporator, manifolded,
bare tube, gravity air



4.56 Evaporator, manifolded,
finned, forced air



4.57 Evaporator, manifolded,
finned, gravity air



4.58 Evaporator, plate coils,
headered or manifold



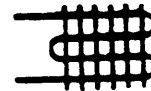
4.59 Filter, line



4.60 Filter & strainer, line



4.61 Finned type cooling unit,
natural convection



4.62 Forced convection
cooling unit



4.63 Gauge



4.64 High side float



4.65 Immersion cooling unit



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Heating symbols for heating,
ventilating and air conditioning (cont'd.) - Air conditioning

4.66 Low side float



4.67 Motor-compressor, enclosed
crankcase, reciprocating,
direct connected



4.68 Motor-compressor, enclosed
crankcase, rotary, direct
connected



4.69 Motor-compressor, sealed
crankcase, reciprocating



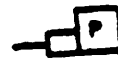
4.70 Motor-compressor, sealed
crankcase, rotary



4.71 Pressurestat



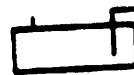
4.72 Pressure switch



4.73 Pressure switch with high
pressure cut-out



4.74 Receiver, horizontal



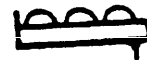
4.75 Receiver, vertical



4.76 Scale trap



4.77 Spray pond



4.78 Thermal bulb



4.79 Thermostat (remote bulb)



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**Heating symbols for heating,
ventilating and air conditioning (cont'd.) - Air conditioning**

4.80 Valves

4.80.1 Automatic expansion

4.80.2 Compressor suction pressure
limiting, throttling type
(compressor side)

4.80.3 Constant pressure, suction

4.80.4 Evaporator pressure
regulating, snap action4.80.5 Evaporator pressure
regulating, thermostatic
throttling type4.80.6 Evaporator pressure
regulating, throttling type
(evaporator side)

4.80.7 Hand expansion



4.80.8 Magnetic stop



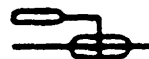
4.80.9 Snap action



4.80.10 Suction vapor regulating



4.80.11 Thermo suction



4.80.12 Thermostatic expansion



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Heating symbols for heating,
ventilating and air conditioning (cont'd.) - Air conditioning

4.80.13 Water










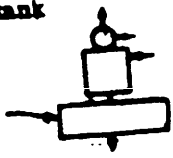


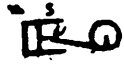



4.81 Vibration absorber, line



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Section 5 - Graphical symbols for heat power apparatus, extracted from
Publication ASA Z32.2.6:

Heat power symbols	
5.1 Compressor	
5.1.1 Rotary	
5.1.2 Reciprocating	
5.1.3 Centrifugal <i>Motor</i> <i>T. Turbine</i>	
5.2 Condenser	
5.2.1 Barometric	
5.2.2 Jet	
5.2.3 Surface	
5.3 Cooler or heat exchanger	
5.4 Cooling tower	
5.5 Deaerator	
5.5.1	
5.5.2 With surge tank	
5.6 Drainer or liquid level controller	
5.7 Engine	
5.7.1 Steam	
5.7.2 <i>S-Supercharger</i> <i>D-Diesel</i>	
5.7.3 <i>G-Gen</i>	

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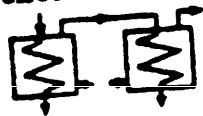
Heat power symbols (cont'd.)

5.8 Evaporator

5.8.1 Single effect



5.8.2 Double effect



5.9 Extractor



5.10 Fan-blower

W-10 per
T. Turbine



5.11 Filter



5.12 Flow nozzle



5.13 Fluid drive



5.14 Heater

5.14.1 Air (plate or tubular)



5.14.2 Air (rotating type)



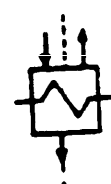
5.14.3 Desuperheater



5.14.4 Direct contact feed - water



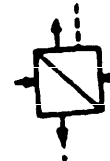
5.14.5 Feed with air outlet



5.14.6 Flue gas reheater (intermediate superheater)



5.14.7 Live steam superheater or reheater



5.15 Liquid level controller (see symbol 5.6)

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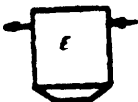
Heat power symbols (cont'd.)

5.16 Orifice



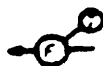
5.17 Precipitator

E-Electrostatic
M-Mechanical
M.M.F.



5.18 Pump

5.18.1 Centrifugal and rotary



Letters Denote Service

F- Boiler Feed
S- Service
D- Condensate
C- Circ. Water
W- Air
O- Oil
M- Water
T- Turbine
E- Steam Engine
G- Gas Engine
D- Diesel Engine

5.18.2 Reciprocating



5.18.3 Dynamic (air ejector or eductor)

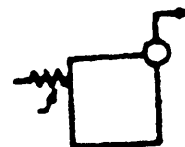


5.19 Separator



5.20 Steam generator

(boiler with economizer)



5.21 Steam trap



5.22 Strainer

5.22.1 Single



5.22.2 Double



5.23 Tank

5.23.1 Closed



5.23.2 Open



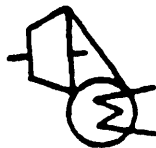
5.23.3 Flash or pressure



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Heat power symbols (cont'd.)

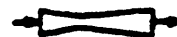
5.24 Turbine
5.24.1 Condensing



5.24.2 Steam turbine or
axial compressor



5.25 Venturi tube



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Section 6 - Graphical symbols for fluid power diagrams, extracted from
ASA Publication Y32.10:








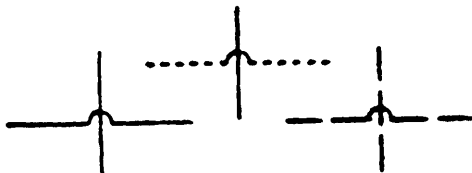


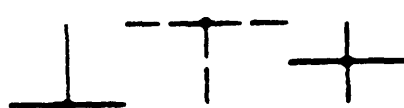








6.1 This section shows the basic symbols, describes the principles on which the symbols are based, and illustrates some representative composite symbols. Composite symbols can be devised for any fluid power component by combining basic symbols. A symbol is considered to be the lines, letters and abbreviations which identify purpose and method of operation of component represented, and symbols only are standardized in this section. Component data are added to symbols when used in circuit diagrams and consist of names of ports and control elements, notes regarding pressure and flow rate settings and other explanatory data.

6.2 Symbol rules. The following rules are applicable to graphical symbols for fluid power diagrams:

- (a) Symbols show connections, flow paths and function of component represented. They do not indicate conditions occurring during transition from one flow path arrangement to another. Further, they do not indicate construction, or values such as pressure, flow rate, and other component settings.
- (b) Symbols do not indicate location of ports, direction of shifting of spools, or position of control elements on actual component.
- (c) Symbols may be rotated or reversed without altering their meaning except in the cases of:
 - (1) Lines to reservoir, 6.3.7.1 and 6.3.7.2
 - (2) Vented manifold, 6.8.3
- (d) Line width does not alter meaning of symbols.
- (e) Symbols may be drawn any suitable size. Size may be varied for emphasis or clarity.
- (f) Letter combinations used as parts of graphical symbols are not necessarily abbreviations, provided their meaning is clearly understandable and subject to one interpretation only or explained by a suitable note or tabulated legend on the drawing when necessary.
- (g) Where flow lines cross, a loop shall be used except within a symbol envelope. Loop may be used in this case if clarity is improved.
- (h) In multiple envelope symbols, flow condition shown nearest a control symbol takes place when that control is caused or permitted to actuate.
- (i) Each symbol is drawn to show normal or neutral condition of component unless multiple circuit diagrams are furnished showing various phases of circuit operation.
- (j) Arrows shall be used within symbol envelopes to show direction of flow path in component as used in the application represented. Double-end arrow shall be used to indicate reversing flow.
- (k) External ports are where flow lines connect to basic symbol, except where component enclosure is used.
External ports are at intersections of flow lines and component enclosure symbol when enclosure is used.

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Fluid power diagram symbols

6.3 Flow Lines And Flow Line Functions 6.3.1 Lines, Working 	6.3.8 Flow, Direction of  
6.3.2 Lines, Pilot  Length of dash shall be at least 20 line widths with space approximately 5 line widths.	6.3.9 Plug or Plugged Connection 
6.3.3 Lines, Liquid Drain or Air Exhaust  Length of dash and space shall be approximately equal, each less than 5 line widths.	6.3.8.1 Testing Station 
6.3.4 Lines, Crossing 	6.3.8.2 Fluid Power Take-off Station  6.3.10 Restriction, Fixed 
6.3.5 Lines, Joining  Connector dot shall be approximately 5 widths of associated lines.	6.3.11 Quick Disconnect 6.3.11.1 Without Checks  6.3.11.2 With Checks 6.3.11.2.1 Disconnected 
6.3.6 Lines, Flexible 	6.3.11.2.2 With One Check 
6.3.7 Lines to Reservoir 6.3.7.1 Below Fluid Level 	6.3.11.2.3 With Two Checks 
6.3.7.2 Above Fluid Level 	6.4 Pumps, Compressors And Rotary Motors 6.4.1 Basic Symbol 6.4.1.1 Envelope 

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Fluid power diagram symbols (cont'd.)

6.4.1.2 Ports



Lines outside envelope are not part of symbol, but represent flow lines connected thereto.

6.4.1.3 Shafts, Rotating



Arrow indicates direction of rotation by assuming it is on near side of shaft.

6.4.1.4 Controls



*Appropriate letter combinations are shown in paragraph 7-3, page 12.

6.4.2 Pumps, Hydraulic



Appropriate symbols shall be added to indicate shafts, connecting lines, and method of control.

*Type of pump shall be indicated within basic symbol by appropriate letters listed below.

PF Fixed Displacement

PK Kinetic - Centrifugal

PV Variable Displacement

6.4.2.1 Examples

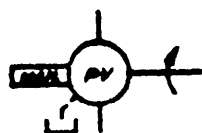
6.4.2.1.1 Pump

Single, Fixed Displacement



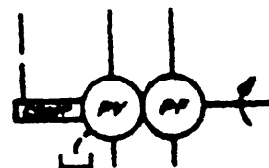
6.4.2.1.2 Pump

Single, Variable Displacement,
Manual Control, with Drain



6.4.2.1.3 Pump

Double, One Fixed Displacement,
One Variable Displacement with
Compensator Control, with Drain



6.4.3 Compressors, Air



Appropriate symbols shall be added to indicate shafts, connecting lines, and method of control.

*Type of compressor shall be indicated within basic symbol by appropriate letters listed below.

CF Fixed Displacement

CK Kinetic

6.4.3.1 Examples

6.4.3.1.1 Compressor



6.4.4 Fluid Motors, Rotary



Appropriate symbols shall be added to indicate shafts, connecting lines, and method of control.

*Type of motor shall be indicated within basic symbol by appropriate letters listed below.

MF Fixed Displacement

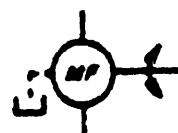
MO Oscillating

MV Variable Displacement

6.4.4.1 Examples

6.4.4.1.1 Motor

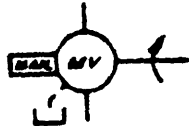
Rotary, Fixed Displacement,
with Drain



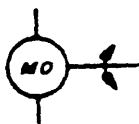
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Fluid power diagram symbols (cont'd.)

6.4.1.2 Motor Rotary, Variable Displacement, Manual Control, with Drain

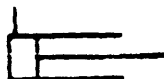


6.4.1.3 Motor Oscillating



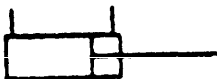
6.5 Motors, Linear Cylinders, diaphragms and other linear actuators

6.5.1 Single Acting



6.5.2 Double Acting

6.5.2.1 Single End Rod



6.5.2.2 Double End Rod



6.6 Valves

6.6.1 Basic Symbol

Basic valve symbol consists of one or more envelopes and lines within the envelopes to show flow conditions between ports. The two systems used, to show change in flow condition when valve is actuated, are:

- (a) Single Envelope
- (b) Multiple Envelopes

Single envelope symbols are used where but one flow path exists through envelope. Flow line moves to show how pressure or flow conditions are controlled as valve is actuated.

Multiple envelope symbols are used where more than one flow path exists through envelope. Envelopes move to show how flow paths change when valving element within component is shifted to its various positions.

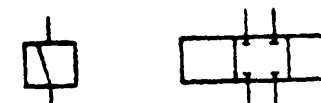
6.6.1.1 Envelopes



6.6.1.2 Ports



6.6.1.3 Ports, Internally Blocked



6.6.1.4 Flow Paths, Internal



6.6.1.5 Flow, Direction of



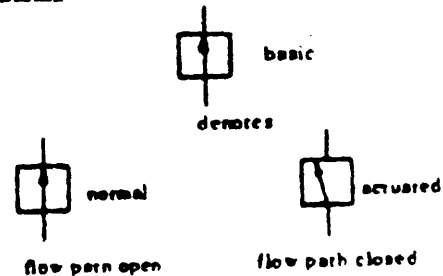
6.6.1.6 Controls

Controls for valves (see 6.7).

6.6.2 Valves, Single Envelope

6.6.2.1 Basic

6.6.2.1.1 Normally Open



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Fluid power diagram symbols (cont'd.)

6.6.2.1.2 Normally Closed



basic

denotes



normal

flow path closed



actuated

flow path open

6.6.2.1.2.1 Relief Valve, Simplified Symbol for



basic

denotes



normal

flow path closed



actuated

flow path open

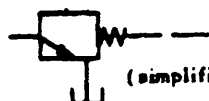
6.6.2.2 Examples

6.6.2.2.1 Relief Valve



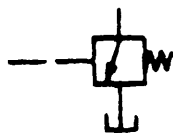
(simplified symbol)

6.6.2.2.1.1 Relief Valve, Remotely Controlled



(simplified symbol)

6.6.2.2.2 Unloading Valve, Remotely Pilot Operated



6.6.2.2.3 Deceleration Valve, Normally Open



6.6.2.2.4 Reducing Valve Pressure regulator for air or other gases



non relieving



relieving

(simplified symbols)

6.6.2.3 Valves, Other Single Envelope

6.6.2.3.1 Check



(simplified symbol)

Symbol indicates flow from left to right only.

6.6.2.3.2 Check, Orifice



6.6.2.3.3 Check, Pilot Operated, Pilot Operated



(simplified symbol)

Symbol indicates that flow can pass from right to left when pressure is introduced through control connection.

6.6.2.3.4 Shutoff, Manual



6.6.2.3.5 Valve, Flow-rate Control

6.6.2.3.5.1 Variable



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Fluid power diagram symbols (cont'd.)

6.6.2.3.5.2 Pressure Compensated



(simplified symbol)

Arrow indicates direction of controlled flow.

6.6.2.3.5.3 Variable, Pressure Compensated



(simplified symbols)

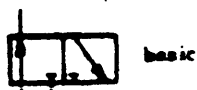
6.6.3 Valves, Multiple Envelope

6.6.3.1 Basic

Basic symbol consists of:

- Envelopes for each operating position of valve
- Internal flow paths for each valve position
- Arrows indicating flow direction through valve
- External ports in normal or neutral valve position.

6.6.3.1.1 Two Position, Three Connection



basic

denotes



normal



actuated

6.6.3.1.2 Two Position, Four Connection

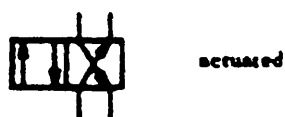


basic

denotes



normal



actuated

6.6.3.1.3 Three Position, Four Connection

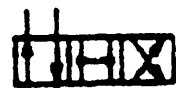


basic

denotes



normal



actuated,
envelopes
to right



actuated,
envelopes
to left

6.6.3.1.4 Four Connection Some Typical Flow Paths for Center Conditions



6.6.3.2 Directional Control, Complete Symbol Three Position, Four Connection, Spring Centered, Solenoid Control, Three Ports Inter- connected and One Port Block at Neutral.



denotes the following possible phases of operation

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Fluid power diagram symbols (cont'd)

6.6.3.2 (cont'd)



neutral, centered by springs when solenoids are de-energized



actuated, envelopes to right by energizing left solenoid



actuated, envelopes to left by energizing right solenoid

6.6.3.3 Examples, Directional Control

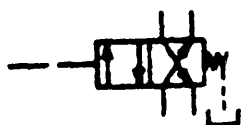
6.6.3.3.1 Two Position, Three Connection, Spring Offset, Solenoid Control



6.6.3.3.2 Two Position, Four Connection, Solenoid Control



6.6.3.3.3 Two Position, Four Connection, Spring Offset, Pilot Operated



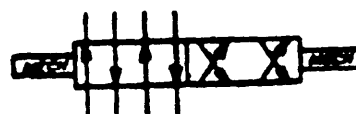
6.6.3.3.4 Three Position, Four Connection, Spring Offset, Mechanical Control, One External Port Plugged



6.6.3.5 Three Position, Five Connection, Spring Centered, Solenoid Control



6.6.3.6 Two Position, Eight Connection, Mechanical Control



6.7 Types of Control

6.7.1 Spring



6.7.2 Pilot



6.7.2.1 Pilot, Differential Area



6.7.3 Other Types of Controls



*Type of control shall be indicated by appropriate letter combination

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Fluid power diagram symbols (cont'd.)

6.7.3 (cont'd)

AIR MOT	Motor, Air Power
CENT	Centrifugal
COMP	Compressor
CYL	Cylinder (Motor, Linear)
DET	Detent (Associated with other controls)
ELEC MOT	Motor, Electric
HYD MOT	Motor, Hydraulic
MAN	Manual
MECH	Mechanical
SERV	Servo
SOL	Solenoid
SOL PLT	Solenoid Controlled, Pilot Operated
THRM	Thermal

If control other than listed above is used, its name shall be spelled out.

6.8 Miscellaneous Units

6.8.1 Reservoir for Liquid

6.8.1.1 Vented



6.8.1.2 Pressurized



6.8.2 Receiver for Air or Other Gases



6.8.3 Vented Manifold



6.8.4 Gage for Pressure or Vacuum



6.8.5 Connections, Rotating



Number of lines through circle indicates number of flow paths through component.

6.8.5.1 Example, Rotating Connection with Two Working Lines, and One Pilot Line, with Drain



6.8.6 Other Miscellaneous Units



*Type of unit shall be indicated by appropriate letter combinations as follows

ACC	Accumulator
ELEC MOT	Motor, Electric
ENG	Engine
EXM	Muffler, Exhaust
FLT	Filter
FM	Flow Meter
HE	Heat Exchanger
INT	Intensifier
LUB	Lubricator
MAN	Manual
PS	Pressure Switch
SEP	Separator
STP	Strainer
TACH	Tachometer
TURB	Turbine

✓ If unit other than listed above is used, its name shall be spelled out.

✓ Appropriate symbols shall be added to indicate shutoffs or connecting lines.

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Fluid power diagram symbols (cont'd.)

6.9 Composite Symbols

6.9.1 Component Enclosure



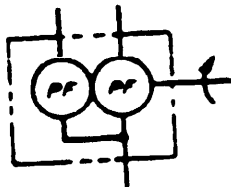
Component enclosure may surround a composite symbol or a group of symbols to represent an assembly. It is used to convey more information about component connections and functions. Enclosure indicates extremity of component or assembly. External ports are assumed to be on enclosure line and indicate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

Flow lines shall cross enclosure line without loops or dots.

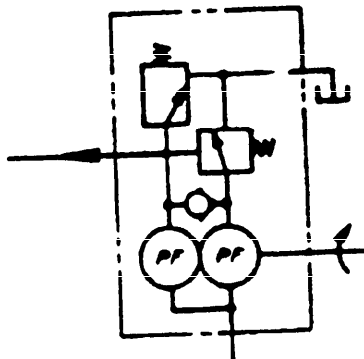
6.9.2 Examples, Typical

6.9.2.1 Pumps

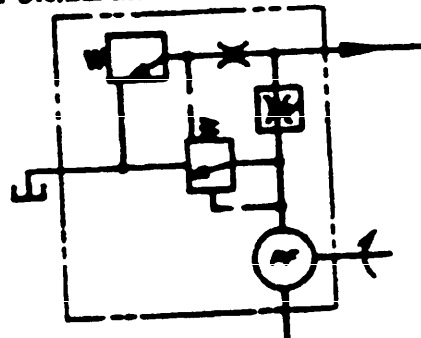
6.9.2.1.1 Double, Fixed Displacement, One Inlet, Separate Outlets



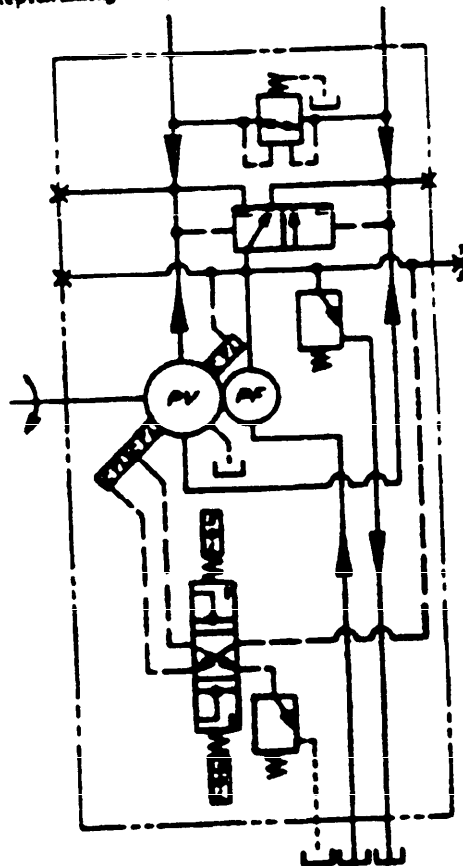
6.9.2.1.2 Double, with Integral Check, Unloading, and Relief Valves



6.9.2.1.3 Integral Variable Flow-rate Control and Overload Relief



6.9.2.1.4 Variable Displacement with Integral Replenishing Pump and Control Valves

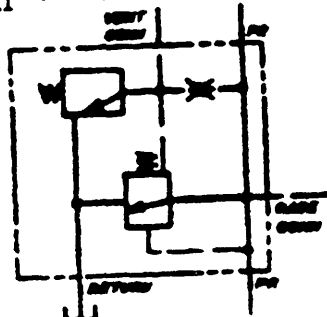


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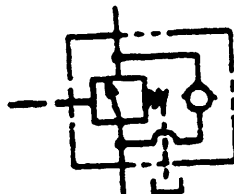
Fluid power diagram symbols (cont'd.)

6.2.2.2 Valves

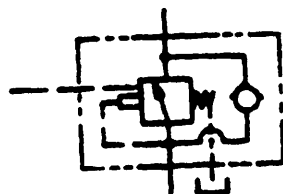
6.2.2.2.1 Relief, Balanced Type.



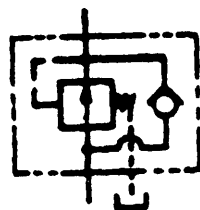
6.2.2.2.2 Remote Operated Sequence with Integral Check



6.2.2.2.3 Remote and Direct Operated Sequence with Differential Areas and Integral Check

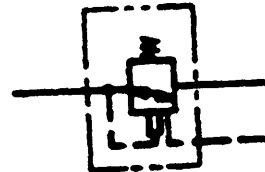


6.2.2.2.4 Pressure Reducing with Integral Check

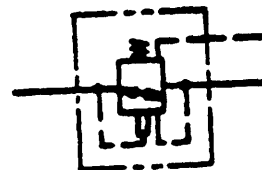


6.2.2.5 Pilot Operated Checks

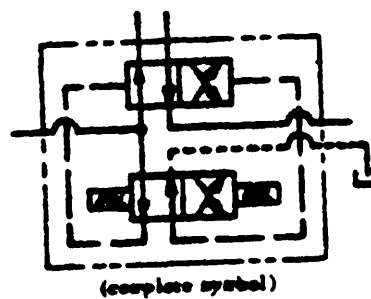
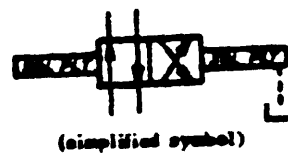
6.2.2.5.1 Differential Pilot Operated



6.2.2.5.2 Differential Pilot Operated and Closed



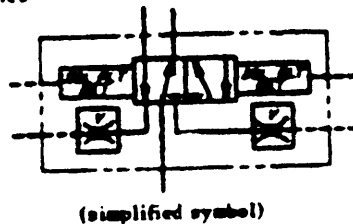
6.2.2.6 Two Position, Four Connection, Solenoid Control, Pilot Operated



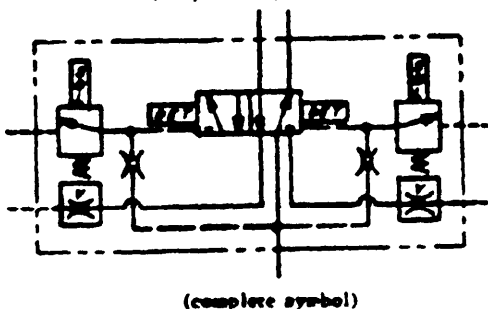
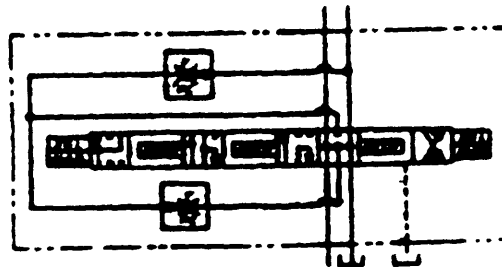
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Fluid power diagram symbols (cont'd.)

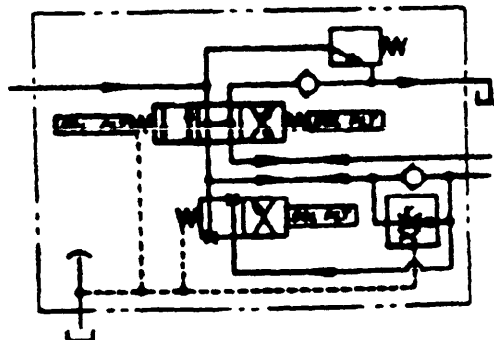
6Q227 Two Position, Five Connection, Solenoid Control, Pilot Operated with Exhaust Throttles



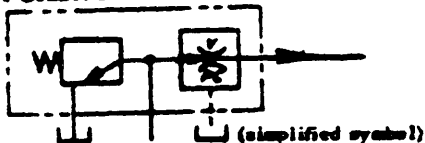
6Q2210 Cycle Control Panel, Five Position



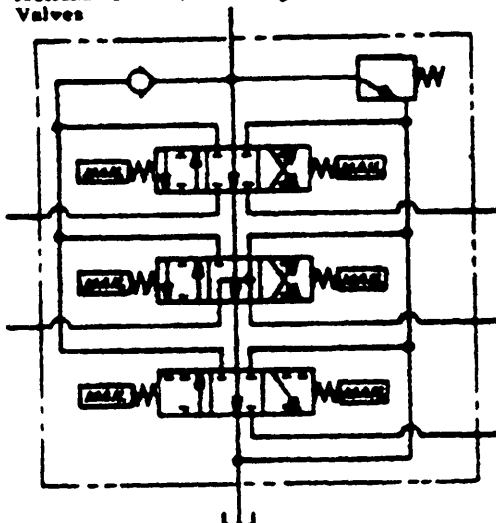
6Q2211 Panel Mounted Separate Units Furnished as a Package (Relief, Two 4-way, Two Check and Flow-rate Control Valves)



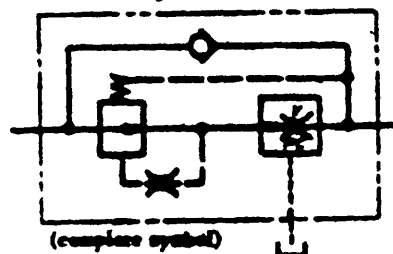
6Q228 Variable Pressure Compensated Flow-rate Control and Overload Relief



6Q229 Multiple, Three Position, Manual Directional Control, with Integral Check and Relief Valves



6Q2212 Flow Rate Control, Pressure Compensated with Integral Check



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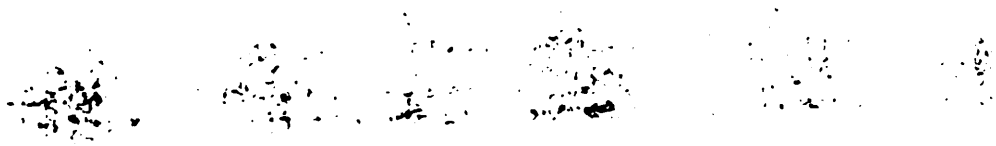
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