Designation: F1000 – 21

An American National Standard

Standard Practice for Piping System Drawing Symbols[1]

This standard is issued under the fixed designation F1000; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice establishes piping system drawing symbols for marine use.

1.2 This set of standard symbols is intended for use on piping system diagrammatics and arrangements for ships.

1.3 Where graphical symbols are required for an item or equipment not covered by this practice, 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.

1.4 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).

1.5 Symbols for fluid power, heating, ventilation, and air conditioning (HVAC), and Navy damage control diagrams are not included in this practice.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Significance and Use

2.1 Fig. 1 provides symbols for strainers, separators, and filters.

2.2 Fig. 2 provides symbols for valves. Valves are categorized under the following headings: globe, angle, check, ball, butterfly, gate, relief, manifolds, control, noise control, and miscellaneous.

2.3 Fig. 3 provides symbols for valve appendages such as actuators and locking devices. Symbols shown on Fig. 3 are to be combined with the appropriate symbol from Fig. 2.

2.4 Fig. 4 provides symbols for piping system–related instrumentation. These symbols are categorized under the following headings: pressure, temperature, flow, level, switches, alarms, and miscellaneous.

2.5 Fig. 5 provides symbols for fans, pumps, and turbines.

2.6 Fig. 6 provides symbols for plumbing components.

2.7 Fig. 7 provides symbols for pipe and pipe fittings.

2.8 Fig. 8 provides symbols for noise control components and designations. These symbols are generally used for submarine design.

2.9 Fig. 9 provides symbols for transitions. These symbols identify transitions such as pipe material or pipe schedule changes.

2.10 Fig. 10 provides symbols for miscellaneous components. These are components which could not be classified under the above categories. Examples include heat exchangers, flasks, and sea chests.

2.11 Fig. 11 provides symbols for grooved piping.

3. Keywords

3.1 drawing symbols; piping; piping drawings; piping symbols

[1] This practice is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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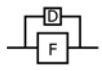
Number	Title	Symbol
1	Strainer, duplex basket type	
2	Strainer, duplex edge type	
3	Strainer, duplex magnetic	
4	Strainer, Y-type basket	
5	Strainer, Y-type edge	
6	Strainer, simplex basket type	
7	Strainer, simplex edge type	
8	Strainer, box type	
9	Strainer, basket type, steam	
10 fn. 1	Strainer, sea chest	
11	Separator, moisture	
12	Separator, cyclone	
13 fn. 2	Separator, oil-water	
14	Filter	
15	Filter with shielded container	
16	Filter with mechanical differential pressure indicator	

FIG. 1 Strainers, Separators, and Filters

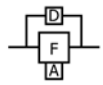
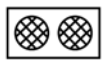
Number	Title	Symbol
17	Filter with mechanical differential pressure indicator and automatic bypass	
18	Filter, oil, cartridge type	
19	Filter, coalescing	
20	Filter, duplex	
21	Filter, charcoal	
22	Precipitator, electrostatic	
23	Centrifugal purifier	
24 fn. 3	Screen	

FIG. 1 *(continued)*

Footnotes:
1. To be combined with the symbol for sea chest (Fig 10, No. 24)
2. Parallel plate type
3. Typically used on blower intake

1. Globe		
Number	Title	Symbol
1.1	Valve, globe	
1.2	Valve, globe with flow control device	
1.3	Valve, globe, stop check	
1.4	Valve, globe, positive stop	
1.5	Valve, globe, combined spring-loaded exhaust and relief	
1.6	Valve, globe, Y-pattern	
1.7	Valve, globe, stop check, Y-pattern	
1.8	Valve, globe, reverse seated	
1.9 fn. 4	Bridgewall Note 1 Note 2	
2. Angle		
2.1	Valve, angle	
2.2	Valve, angle bellows packless	
2.3	Valve, angle, diaphragm packless	
2.4	Valve, angle, stop check	
2.5	Valve, angle, needle or throttling	

FIG. 2 Valves

2. Angle - Continued		
Number	Title	Symbol
2.6	Valve, angle, check	
2.7 fn. 5	Valve, angle, solenoid	
2.8	Valve, angle, with lock box	
2.9	Valve, angle, capped	
2.10	Valve, angle, ball	
2.11	Valve, angle, lift check	
3. Check		
3.1	Valve, swing check	
3.2	Valve, lift check	
3.3	Valve, vented swing check	
3.4 fn. 6	Valve, check, spring loaded	
3.5	Valve, swing check, Y-pattern	
3.6	Valve, check, hydraulic	
3.7	Valve, check, hydraulic with external loading	
3.8	Valve, check, in-line ball or poppet	
3.9	Valve, check, in-line ball or poppet, spring loaded	

FIG. 2 *(continued)*

Footnotes:

4. Note 1: Fluid in pipe on this side of valve is isolated from stem packing with valve shut.
   Note 2: Fluid in pipe on this side of valve is in contact with stem packing with valve shut.
5. "Solenoid valve" shown as example. See Fig. 3 for operators.
6. Include normally shut or normally open as shown on lines 11.38 or 11.39; as applicable.

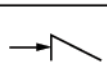
3. Check - Continued		
Number	Title	Symbol
3.10	Valve, wafer check	
3.11	Valve, check, with manual gagging provision	
3.12	Valve, check, flow limiting	
3.13	Valve, check, counterbalanced with external weights	
3.14	Valve, flapper	
3.15 fn. 7	Valve, check, swing, with integral orifice	
4. Ball		
4.1	Valve, ball	
4.2	Valve, ball, bleed port	
4.3	Valve, ball, three port	
4.4	Valve, ball, three port, normally shut	
4.5	Valve, ball, three port - showing other than normally shut	
4.6	Valve, ball, spring return	
4.7 fn. 8	Valve, ball check	
4.8	Valve, ball, four port	

FIG. 2 *(continued)*

5. Butterfly		
Number	Title	Symbol
5.1	Valve, butterfly	
5.2	Valve, butterfly, locked open	
5.3	Valve, butterfly, locked shut	
6. Gate		
6.1	Valve, gate	
6.2 fn. 9	Valve, gate, double disc with internal bypass	
6.3	Valve, gate, with three-way bypass	
7. Pressure Relief		
7.1	Valve, angle, pressure relief (self actuated)	
7.2	Valve, angle, pressure relief, differential	
7.3	Valve, angle, pilot-actuated pressure relief	
7.4	Valve, inward pressure relief, high capacity gas flow	
7.5	Valve, outward pressure relief, high capacity gas flow	
7.6	Valve, self-actuated pressure relief, globe	
7.7	Valve, pilot-actuated pressure relief, globe	
7.8	Valve, pressure relief, angle, diaphragm	

FIG. 2 *(continued)*

Footnotes:
7. This valve permits limited backflow.
8. Combination of ball and swing check.
9. Space between discs vents to side with mark.

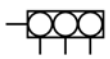
7. Pressure Relief - Continued		
Number	Title	Symbol
7.9	Valve, boiler safety	
7.10	Valve, relief, superheater safety, pilot actuated	
8. Manifolds		
8.1	Manifold, single row	
8.2	Manifold, double row	
8.3	Manifold, single row, stop check valves	
8.4	Manifold, double row, "●" locked shut	
8.5	Manifold, double row, "◒" stop check valves	
8.6	Manifold, single row, interlocked	
9. Control		
9.1	Valve, control, pilot actuated (increased actuating pressure closes valve)	
9.2	Valve, control, pilot actuated (increased actuating pressure opens valve)	
9.3	Valve, pressure reducing (increase of downstream pressure shuts valve)	
9.4	Valve, pressure regulating (increase of upstream pressure opens valve)	
9.5	Valve, priority (decrease of upstream pressure shuts valve)	
9.6	Valve, pressure reducing, diaphragm (increase of downstream pressure shuts valve)	

FIG. 2 *(continued)*

9. Control - Continued		
Number	Title	Symbol
9.7	Valve, pressure regulating, diaphragm (increase of upstream pressure opens valve)	
9.8	Valve, control, diaphragm, pilot actuated (increased actuating pressure closes valve)	
9.9	Valve, control, diaphragm, pilot actuated (increased actuating pressure opens valve)	
9.10	Valve, control, diaphragm, pilot actuated (increased actuating pressure closes valve) with check feature	
9.11	Valve, control, diaphragm, pilot actuated (increased actuating pressure opens valve) with check feature	
9.12	Valve, thermostatic expansion	
9.13	Valve, thermostatic control	
9.14	Valve, thermostatic control, three-way	
9.15	Valve, temperature control	
9.16	Valve, three-way modulating temperature control	
9.17	Valve, three-way modulating (pressure sensing)	
9.18	Valve, back pressure regulator with remote sensing	
9.19	Valve, regulator, back pressure	
9.20	Valve, feedwater regulator, motor or manual operation	

FIG. 2 *(continued)*

9. Control - Continued		
Number	Title	Symbol
9.21	Valve, boiler feedwater regulator with manual control	
9.22	Valve, compressed gas cylinder regulator	
9.23 fn. 10	Valve, proportioning, automatic	
9.24	Valve, temperature pilot control	TPC
9.25	Valve, level pilot control	LPC
9.26	Valve, pressure pilot control	PPC
9.27	Valve, manual opening automatic closing	
9.28	Valve, regulated bypass	
9.29	Valve, hydraulically operated flow control with pilot	PIH
9.30	Valve, globe, relief, adjustable or spring loaded, reducing	
9.31 fn. 11	Valve, hydraulic control, three-way	
9.32	Valve, micrometer	
9.33	Valve, unloading	
9.34	Valve, governor	
9.35	Valve, capacity control	
9.36	Valve, control, balanced pressure proportioning	

FIG. 2 *(continued)*

9. Control - Continued		
Number	Title	Symbol
9.37	Valve, typical control valve, with test fitting	
10. Noise Control (fn. 12)		
10.1	Valve, quiet throttling	
10.2	Valve, quiet vent	
10.3	Valve, vent, quiet air throttling with shroud	
10.4	Valve, quiet reducing	
10.5	Valve, quiet reducing, pilot operated	
10.6	Valve, standard, with attached quieting orifice	
10.7	Valve, quiet automatic balancing	
10.8	Valve, quiet throttling, tank mounted	
11 . Miscellaneous		
11.1	Valve, frictional throttle	
11.2	Valve, priming, float type	
11.3	Valve, needle	
11.4	Valve, three-way, two position	
11.5	Valve, gage, with test connection	
11.6	Valve, minimum volume vent with cap	V

FIG. 2 *(continued)*

Footnotes:
10. Two inlets, one outlet.
11. Water pressure actuates valve.
12. In general, symbols for quiet valves are accompanied by the quiet component symbol: QC

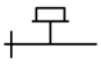
11. Miscellaneous - Continued		
Number	Title	Symbol
11.7	Valve, minimum volume drain with cap	
11.8	Valve, minimum volume vent without cap	
11.9	Valve, minimum volume drain without cap	
11.10	Valve, foot	
11.11	Valve, four way	
11.12	Valve, double ball, combination hull & backup	
11.13	Valve, combination poppet hull and ball backup	
11.14	Valve, angle, hull	
11.15	Valve, double-poppet hull and backup	
11.16	Valve, poppet, hull	
11.17	Valve, angle, ball, hull	
11.18	Valve, diaphragm, packless	
11.19	Valve, petcock	
11.20	Valve, cock stop	
11.21	Valve, cock stop, plug or cyclinder, three-way, two-port	
11.22	Valve, cock stop, plug or cylinder, four-way, two-port	

FIG. 2 *(continued)*

11. Miscellaneous - Continued		
Number	Title	Symbol
11.23	Valve, demand regulator	
11.24	Valve, angle, sentinel	
11.25	Valve, drain regulator, float-operated, with gage glass and vent	
11.26	Valve, vent/drain	
11.27	Valve, throttle trip	
11.28	Valve, pilot, four-way	
11.29	Valve, automatic shutoff	
11.30	Valve, salvage hull, with capped salvage hose connection	
11.31	Valve, ship's whistle control	
11.32	Valve, diaphragm, hand expansion	
11.33	Valve, vacuum breaker	
11.34	Valve, fueling or defueling	
11.35	Valve, manipulating, four-way three-position	
11.36	Valve, manipulating, three-way	
11.37 fn. 13	Valve, rotary, solenoid-operated with manual override	

FIG. 2 *(continued)*

Footnotes:
13. This valve is also referred to as: "Solenoid Operated Pilot Valve" (SOPV). May have two outlet ports.

11. Miscellaneous - Continued		
Number	Title	Symbol
11.38 fn. 14	Valve, normally shut	
11.39 fn. 14	Valve, normally open	
11.40 fn. 15	Valve, fails open (FO) or fails shut (FS).	
11.41	Cock, stop, plug or cylinder, four-way, three-port	
11.42	Foot valve special	

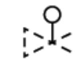
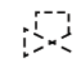
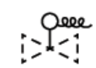
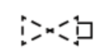
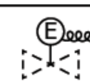
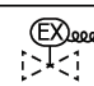
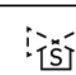
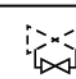
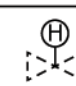
Number	Title	Symbol
1	Valve, locked open	
2	Valve, locked shut	
3	Valve, with lock shield	
4	Valve, capped	
5	Valve, with capping provision	
6	Valve, solenoid operated, spring closing	
7	Valve, solenoid operated, spring opening	
8	Valve, with hose connection	
9	Valve, quick opening	
10	Valve, quick closing	
11	Valve, electric motor operated, two positions	
12 fn. 16	Valve, electric motor operated	
13	Valve, with internal orifice	
14	Valve, with integral strainer	
15	Valve, with bypass valve	
16	Valve, hydraulically operated, two positions	

FIG. 3 Appendages

Footnotes:
14. Globe valve shown for example.
15. Control valve shown for example.
16. X-indicates number of positions if greater than two.

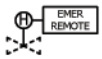
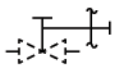
Number	Title	Symbol
17 fn. 17	Valve, hydraulically operated	
18	Valve, hydraulically operated with remote power closure	
19 fn. 18	Valve, position indicator-remote	
20	Valve, float operated	
21	Valve, remote mechanical operator	
22 fn. 19	Valve, manual override	
23	Valve, two-station operator	
24	Valve, X operated open, X is replaced with E for electric motor, H for hydraulic.	
25	Valve, X operated closed, X is replaced with E for electric motor, H for hydraulic.	
26	Valve, pneumatically closed, spring open	
27	Valve, pneumatically operated open, spring closed	
28	Valve, pneumatically operated two positions	
29 fn. 17	Valve, pneumatically operated	
30	Valve, deck operated	
31	Valve, with reachrod	
32	Valve, operated locally and from adjacent space	

FIG. 3 *(continued)*

1. Pressure		
Number	Title	Symbol
1.1	Gage, pressure, local reading	
1.2	Gage, vacuum, local reading	
1.3	Gage, differential pressure	
1.4	Gage, absolute pressure, local reading	
1.5	Gage, pressure, vacuum protected	
1.6	Gage, vacuum and pressure, local reading	
1.7	Gage, pressure (P) or vacuum (V) or absolute pressure (A), distant reading	
1.8	Gage, duplex	
1.9	Transducer, pressure	
1.10	Transducer, differential pressure	
1.11	Transmitter, pressure	
1.12	Transmitter, differential pressure	
1.13	Pressure test station	
2. Temperature		
2.1	Thermometer, local reading	
2.2	Thermometer, distant reading	

FIG. 4 Instrumentation

Footnotes:
17. X-indicates number of positions if greater than two.
18. A typical valve with an operator and position indicator is shown as: 
19. Hydraulic operator shown for example.

2. Temperature - Continued		
Number	Title	Symbol
2.3	Thermometer, resistance type	
2.4	Thermometer, resistance type, dual element	
2.5	Thermometer, resistance type, quad element	
2.6	Thermocouple	
2.7	Thermometer, liquid in glass	
2.8	Thermostat	
2.9	Thermometer, gas activated	
2.10	Heat sensing device	
3. Flow		
3.1	Flow indicator, sight type	
3.2	Flow meter, displacement type	
3.3	Flow meter, orifice	
3.4	Flow meter, venturi	
3.5	Flow meter, rotometer	
3.6	Flow meter, totalizing	
3.7	Flow meter, remote reading	
3.8	Flow meter, flow nozel	
3.9	Flow indicator, sight	
3.10	Flow meter, area type	

FIG. 4 *(continued)*

4. Level		
Number	Title	Symbol
4.1	Gage, liquid level, local reading	
4.2	Gage, liquid level, remote reading	
4.3	Gage, float-operated, liquid level	
4.4	Gage, glass	
4.5	Gage, glass, welded pad with integral valves	
4.6	Level detector, single point	
4.7	Level transducer	
5. Switch		
5.1	Switch, pressure operated	
5.2	Switch, differential pressure	
5.3	Switch, limit	
5.4	Switch, temperature operated	
5.5	Switch, liquid level	
5.6	Switch, liquid level, float operated	
5.7	Switch, flow	
6. Alarms		
6.1	Alarm, high pressure	
6.2	Alarm, low pressure	
6.3	Alarm, high level	

FIG. 4 *(continued)*

6. Alarms - Continued		
Number	Title	Symbol
6.4	Alarm, low level	LLA
6.5	Alarm, high temperature	HTA
6.6	Alarm, low temperature	LTA
7. Miscellaneous		
7.1	Monitor, dew point	DM
7.2	Salinity cell	SC
7.3 fn. 20	Indicator, liquid flow moisture	
7.4 fn. 21	Electrode, water sensing	E
7.5	Indicator, position	
7.6	Sensor, nonpenetrating	S
7.7	Sensing bulb	
7.8	Detector, oil	OD
7.9	Monitor, oil content	OCM

FIG. 4 *(continued)*

Number	Title	Symbol
1	Pump, centrifugal	
2	Pump, hand operated	
3	Pump, hand piston	
4	Pump, rotary, positive displacement	
5	Pump, sliding shoe type, positive displacement	
6	Pump, portable submersible permanently installed	
7	Pump, reciprocating, positive displacement	
8	Pump, rotary, vane type	
9	Pump, vacuum	VP
10	Compressor	
11	Fan, centrifugal	
12	Turbine, gas	GT
13 fn. 22	Turbine, steam	
14	Pump, positive displacement (non-reciprocating) (identify type)	
15	Fan, axial	

FIG. 5 Fans, Pumps, and Turbines

Footnotes:
20. Used in refrigerant systems.
21. Electrode detects presence of water.
22. This type of turbine should be clearly labeled when this symbol is used and turbine appurtenances (glands, drains, bearings) and pipe system connections appropriate to the specific diagram should be indicated on the symbol.