The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

ARP780

Issued 5-15-63
Revised 11-1-89

REV. A

ENVIRONMENTAL SYSTEMS SCHEMATIC SYMBOLS

TABLE OF CONTENTS

1. PURPOSE:

This Aerospace Recommended Practice (ARP) establishes graphical symbols for use on schematic flow diagrams of aerospace vehicle environmental systems. Use of this ARP is recommended for systems integration purposes. It is not intended to show detailed component functional information.

2. SCOPE:

This ARP provides symbols to schematically represent aerospace vehicle environmental system components on functional flow schematic drawings and graphical computerized output. The symbols are for use on simplified diagrams that provide basic information about an environmental system.

Symbols are provided to represent basic types of components used in environmental systems. Simple variations of basic symbol types are provided. Words on the schematic diagram, special symbol codes, or symbols that combine basic symbol types (Section 5) can be used to augment the basic symbols when appropriate. Special or combined symbols not contained in this document should be defined on the schematic diagram.

An example of a complete schematic is given in Section 6.

A bibliography of other documents on environmental system symbols is found in Section 7.

3. SYMBOLS USE:

Environmental system symbols are used on a schematic diagram to indicate functional relationships between actual parts of the system. The schematic diagram facilitates tracing the operation of the system. The diagram does not indicate actual physical size, shape, or location of a system component, device, or part. The symbols are a shorthand method to relate graphically the function of a part of the system.

3.1 General Schematic Organization: Recommendations for organizing component symbols on a schematic diagram, and general recommendations on schematic symbols for system plumbing and lines are provided.

3.1.1 Symbols should be located on the schematic diagram so that components located towards the forward part of the vehicle are located on the left side of a schematic diagram, and symbols for components located towards the aft part of the vehicle are on the right side of a schematic diagram. This does not apply if general component location in a vehicle is unknown.

3.1.2 Heavy, medium, and light lines may be used on a schematic diagram to emphasize elements of the system diagram.

3.1.3 Fluid flow directions should be indicated with arrowheads on the schematic flow diagram.

3.1.4 Fluid types should be written near symbols for ducting or plumbing lines, particularly if several different fluids are used.

3.2 General Symbol Features: Several general features applicable to all symbols are recommended.

3.2.1 Circles, rectangles, squares, triangles, and lines (curved and straight) are basic symbol shapes. Rotation of a symbol shape on a schematic diagram does not change the meaning of the symbol.

3.2.2 Alphabetical (letter) codes, related to the component name, are used to identify symbols having the same or similar shape. Complete component names or identifications on a schematic diagram should be located in approximately the same location relative to the symbol to which they apply.

3.2.3 The inlet and outlet flow locations should be indicated clearly for each symbol. Flow lines through a symbol should be used to prevent confusion if two or more different fluids enter or exit a component at two different locations (e.g., heat exchanger flow lines).

3.2.4 Lines representing sensor signals or intelligence data for controls should be drawn lightly. The number of wires or lines actually used does not need to be indicated - a single line can be used. The type of sensor signal or intelligence data should be identified by words or alphanumeric codes.

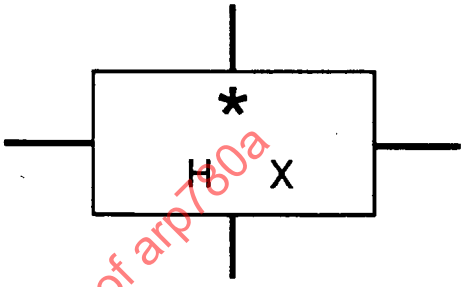
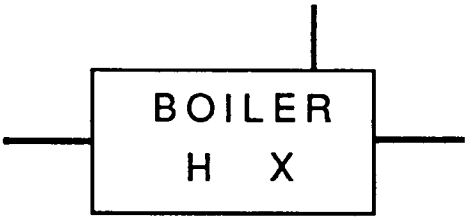
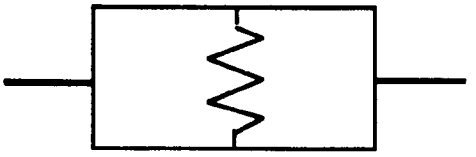
4. SYMBOLS:

Symbols are presented in five general groupings, plus miscellaneous. The five groups are Heat Exchangers, Rotating Components, Plumbing and Lines, Valves, and Controls and Sensors. Generally, symbol types are alphabetized within each group.

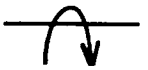
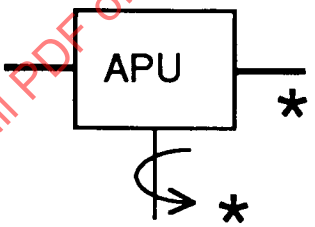
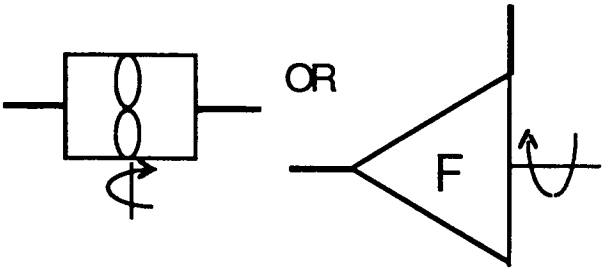
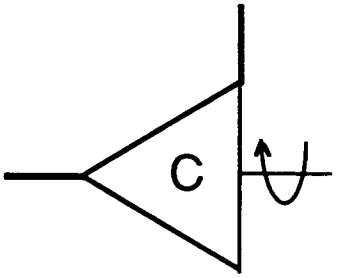
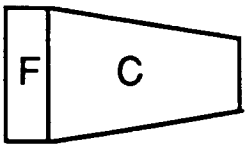
Asterisks are used on some symbols in this report, but are not intended for actual use. Instead, an identifier or code letter or letters should be used, as noted on the following pages. The asterisk can be omitted when appropriate.

Arrowheads are not included on most symbols in this report. They should be used on the schematic flow diagrams to indicate fluid flow direction between component symbols. Arrowheads are found on some symbols in this report for clarity.

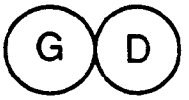
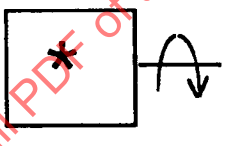
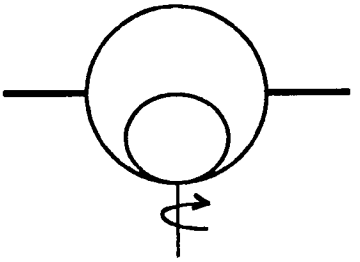
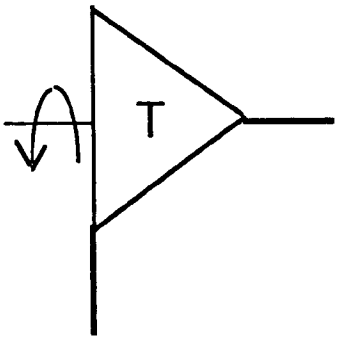
4.1 Heat Exchangers:

NAME	SYMBOL
BASIC HEAT EXCHANGER * [IDENTIFIER NAME] BOILER CONDENSER or COND DEFOG EVAPORATOR or EVAP INTERCOOLER LOAD PRECOOLER or PRE PRIMARY or PRI REGENERATIVE or REGEN REHEATER SECONDARY or SEC SUBCOOLER or SUBC	
HEAT EXCHANGER VARIATIONS	
BOILER	
ELECTRIC HEATER	

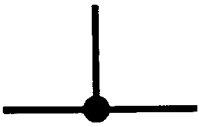
4.2 Rotating Components:

NAME	SYMBOL
SHAFT	
AIR CYCLE MACHINE (ACM)	(See COMPRESSOR, FAN, and TURBINE)
AUXILIARY POWER UNIT (APU) * Power Extraction Shaft, or Bleed, or Both, as appropriate	
BLOWER, or FAN with EXTERNAL POWER	
COMPRESSOR	
ENGINE	

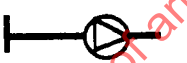
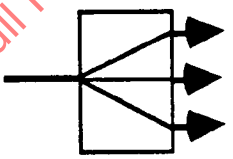
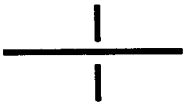
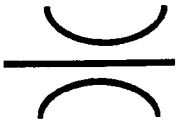
4.2 Rotating Components (Continued):

NAME	SYMBOL
GEAR DRIVE	
POWER DRIVE (MOTOR) * [IDENTIFIER CODE] AIR MOTOR . . . . . P (OR SEE TURBINE) AC MOTOR . . . . . AC DC MOTOR . . . . . DC HYDRAULIC MOTOR . . . H	
PUMP	
TURBINE	

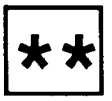
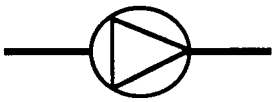
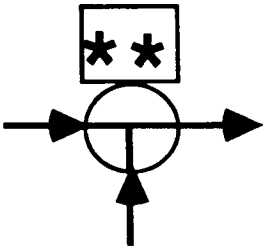
4.3 Plumbing and Lines:

NAME	SYMBOL
LINES	
AIR	
REFRIGERANT	
LIQUID COOLANT	
ELECTRIC	
CONTROL or SENSE	
CONNECTION or JUNCTION	
DISCONNECT, QUICK	
(without CHECK VALVE)	
CONNECTED	
DISCONNECTED	
(with CHECK VALVE)	
CONNECTED	
DISCONNECTED	

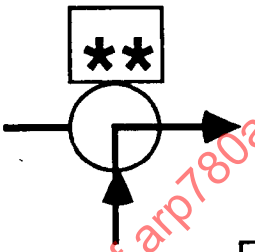
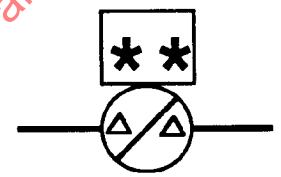
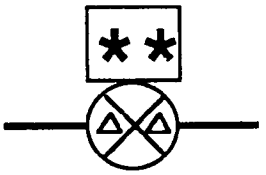
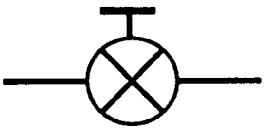
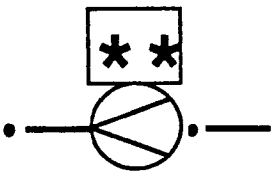
4.3 Plumbing and Lines (Continued):

NAME	SYMBOL
EXPANSION JOINT	
GROUND SERVICING	
MANIFOLD	
NOZZLE	
ORIFICE	
OUTLET	
VENTURI	

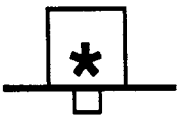
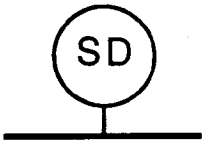
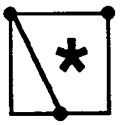
4.4 Valves:

NAME	SYMBOL
ACTUATION AND CONTROL ** [TWO LETTER CODE: 1st: ACTUATION METHOD 2nd: CONTROL METHOD] ELECTRICAL . . . . . E FLUID . . . . . F HYDRAULIC . . . . . H MECHANICAL . . . . M PNEUMATIC . . . . . P SQUIB . . . . . S THERMAL . . . . . T	
BILEVEL	
CHECK	
COMPARTMENT PRESSURE REGULATOR	
COMPARTMENT SAFETY VALVE	
FLOW MIXING	

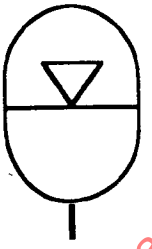
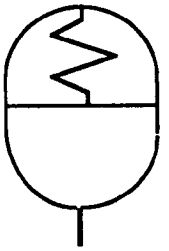
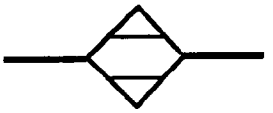
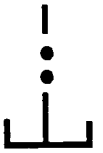
4.4 Valves (Continued):

NAME	SYMBOL
FLOW SELECTOR	
MODULATING ΔΔ [TWO LETTER CODE] SPRING LOADED CLOSED . . NC SPRING LOADED OPEN . . . . NO	
PRESSURE RELIEF	
SHUTOFF SPRING LOADED CLOSED . . NC SPRING LOADED OPEN . . . . NO	
SHUTOFF, MANUAL	
THERMAL EXPANSION	

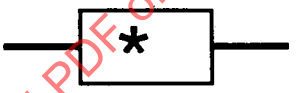
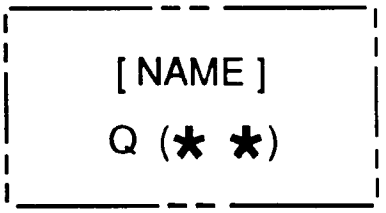
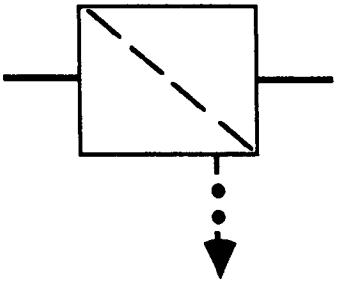
4.5 Controls and Sensors:

NAME	SYMBOL
COCKPIT SWITCH	SW
CONTROLLER	
SENSOR * [TYPE CODE] COOLING EFFECT . . . . . CE FLOW RATE . . . . . F PRESSURE (ABSOLUTE) . AP PRESSURE(DIFFERENTIAL . DP PRESSURE (GAGE) . . . . . P TEMPERATURE . . . . . T	
SMOKE DETECTOR	
SWITCH * [TYPE CODE] ALTITUDE . . . . . A PRESSURE (ABSOLUTE) . . AP PRESSURE(DIFFERENTIAL . DP PRESSURE (GAGE) . . . . . P TEMPERATURE . . . . . T	

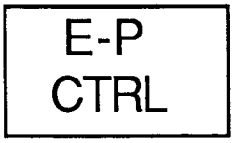
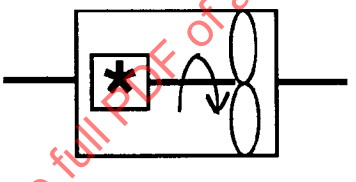
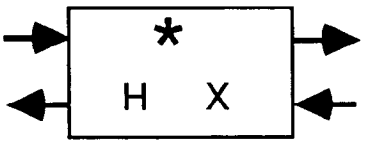
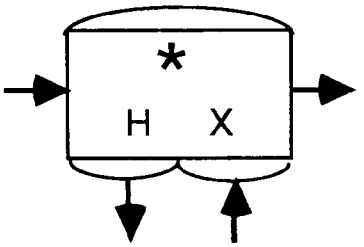
4.6 Miscellaneous:

NAME	SYMBOL
ACCUMULATOR HYDROPNEUMATIC	
SPRING-LOADED	
DESICCANT	
DRAIN (LIQUID) OVERBOARD	
TO RESERVOIR	
DUST SEPARATOR	

4.6 Miscellaneous (Continued):

NAME	SYMBOL
EJECTOR	
FILTER *[IDENTIFIER CODE] NUCLEAR, BIOLOGICAL, CHEMICAL . . . . . NBC PARTICULATE . . . . . DUST	
MUFFLER	
RAM SCOOP	RAM 
THERMAL LOAD (COMPARTMENT) ** HEAT LOAD, KW	
WATER COLLECTOR or SEPARATOR (or OTHER LIQUIDS)	

5. COMBINED OR SPECIAL SYMBOLS:

NAME	SYMBOL
CONTROLLER, ELECTRO-PNEUMATIC	
FAN * AIR MOTOR . . . . . P AC MOTOR . . . . . AC DC MOTOR . . . . . DC HYDRAULIC MOTOR . . H	
HEAT EXCHANGER, (* - see HEAT EXCHANGERS, p.4) COUNTERFLOW	
MULTI-PASS	
MULTIPLE