

## ISA-5.5-1985

Formerly ISA-S5.5-1985



# Graphic Symbols for Process Displays

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**Cartagena99**

Automation Society

ISA-5.5-1985, Graphic Symbols for Process Displays

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## Preface

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This preface is included for informational purposes and is not a part of ISA-5.5-1985.

This Standard has been prepared as a part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static, but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board, ISA, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, North Carolina 27709, Telephone (919) 549-8411, e-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to U.S.A. users of ISA Standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide*, which has been published by the Institute of Electrical and Electronics Engineers as ANSI/IEEE Std. 268-1982, and future revisions will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA Standards. Participation in the ISA Standards-making process by an individual in no way constitutes endorsement by the employer of that individual of ISA or any of the standards which ISA develops.

The information contained in this preface, in the footnotes, and in the appendices is included for information only and is not part of the standard.

The original draft of this document resulted from the committee work of the International Purdue Workshop on Industrial Computer Systems, the Man/ Machine Communication Committee TC-6.

The use of graphic symbols representing entities and characteristics of processes has evolved rapidly during the course of the last decade. Technology has allowed the presentation of a physical process to be represented and controlled by the use of computers and advanced electronic systems. These systems use video-display technologies such as CRTs, plasma screens, and other media to present to the user a graphic representation of his process. It is through these devices and the symbology used to represent the process in question that the user monitors and controls the particular operation.

Process displays convey information to the user in the form of both text and graphic symbols. Text information is based on the use of numeric data and the alphabet to construct the words

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must become familiar with the graphic symbology of several different systems, although they may represent common elements.

It is the intent of this document that both the manufacturers and users of process displays use these graphic symbols in their systems whenever applicable. It is recognized that technology is rapidly changing in the types of devices available for process display use. The graphic symbols suggested in this standard should provide a foundation for all display systems that are used to display and control processes. The graphic symbols that are represented in this standard are divided into 13 major groups. Attributes associated with the various types of symbols such as color usage, blink, orientation, etc., are addressed in the document.

The symbols defined in ISA-S5.5 are intended to supplement those of ISA-S5.1 and ISA-S5.3 to provide a cohesive integration of graphic symbology and common industry usage of flow diagrams. ISA-S5.1 and ISA-S5.3 are drafting standards which govern the depiction of process and instrumentation symbols for drawings and other printed documents. The ISA-S5.5 symbols were developed for use on video devices that represent both character display and pixel addressable displays. Use of the symbols also applies to both color and monochromatic video displays as well as other media. Therefore, the symbols that are represented in this standard may differ from those in the other standards because of the nature of the physical devices used to display the symbols. The principal users of these symbols are operators and other personnel who use information concerning process operations.

The main intent of the graphic symbols is to provide to the user an easily understandable representation of his process on a display device. Computers, distributed control systems, stand-alone microprocessor-based systems, etc., can appear to be similar or to perform similar functions; however, they are diverse in philosophy and graphic presentation. Therefore, it is essential that a common set of symbols be used to convey process information to the users of such devices.

The symbols presented in this standard are by no means all that were suggested or that may be required; however, by adopting these as a standard, the majority of present processes may be adequately represented. When it becomes necessary to develop special symbols for equipment not included in the standard, simplicity of form is considered of paramount importance.

The ISA Standards Committee on Graphic Symbols for Process Displays SP5.5 operates within the ISA Standards and Practices Department, Norman Conger, Vice President. The persons listed below served as members of ISA Committee SP5.5, which prepared this standard:

<b>NAME</b>	<b>COMPANY</b>
D. G. Kempfer, Chairman 1982-85	Standard Oil Company of Ohio
A. T. Bonina	Industrial Data Terminals
R. F. Carroll, Chairman 1981	Setpoint, Inc.
A. S. Fortunak	Inland Steel Company
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The persons listed below served as members of ISA Committee SP5, which approved this standard:

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This standard was approved for publication by the ISA Standards and Practices Board in December 1985.

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The logo for Cartagena99 features the text 'Cartagena99' in a stylized, teal-colored font. The '99' is significantly larger and more prominent than the rest of the text. The logo is set against a light blue background with a white, stylized arrow pointing to the right, and a yellow-orange shadow effect at the bottom.

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## 1 Purpose

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The purpose of this standard is to establish a system of graphic symbols for process displays that are used by plant operators, engineers, etc., for process monitoring and control. The system is intended to facilitate rapid comprehension by the users of the information that is conveyed through displays, and to establish uniformity of practice throughout the process industries.

Resulting benefits are intended to be as follows:

- a) A decrease in operator errors
- b) A shortening of operator training
- c) Better communication of the intent of the control system designer to the system users

An objective of the standard is to insure maximum compatibility of symbols on process visual display units (VDUs) with related symbols used in other disciplines.

The symbols in this standard are intended to depict processes and process equipment. The symbols are suitable for use on Visual Display Units (VDUs), such as Cathode Ray Tubes (CRTs).

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## 2 Scope

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The standard is suitable for use in the chemical, petroleum, power generation, air conditioning, metal refining, and numerous other industries.

Though the standard may make use of standard symbols now used for piping and instrument diagrams, logic diagrams, loop diagrams, and other documents, the symbols of the standard are generally expected to be used in ways complementing existing types of engineering documents.

The symbolism is intended to be independent of type or brand of hardware or computer software.

### 2.1 Application to work activities

This standard is suitable for use whenever any reference to process equipment on VDUs is required. Such references may be required for the following uses as well as others:

- a) Process displays on CRTs
- b) Process displays on other visual media such as plasma displays, liquid crystal displays, etc.

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## 2.3 Relationship to other symbol standards

This document complements the ANSI Standard for process flow sheets, ANSI Y32.11M — "Graphic Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries" and ANSI/NEMA Standard ICS 1-1978 "General Standards for Industrial Control and Systems" whenever possible and practical.

## 2.4 Definitions

**Aspect ratio:** The ratio of a symbol's height to its width.

**Background:** The field that information is displayed upon for contrast.

**Blinking:** A periodic change of hue, saturation, or intensity of a video display unit pixel, character, or graphic symbol.

**Character:** A term used to refer to a predefined group of pixels.

**Chromaticity:** The color quality of light, which is characterized by its dominant wavelength and purity.

**Color coding:** The use of different background and foreground colors to symbolically represent processes and process equipment attributes, such as status, quality, magnitude, identification, configuration, etc.

**Foreground:** The information element on a background field.

**Graphic symbol:** An easily recognized pictorial representation.

**Highlighting:** A term encompassing various attention-getting techniques, such as blinking, intensifying, underscoring, and color coding.

**Intensity:** The lumination level (i.e., brightness) of the pixels of a VDU.

**Pixel:** The smallest controllable display element on a VDU. Also referred to as picture element (PEL).

**Process visual display:** A dynamic display intended for operators and others engaged in process monitoring and control.

**Reverse Video:** The interchange of foreground and background attributes, such as intensity, color, etc.

**Task/Surround lumination ratio:** The luminance ratio between the keyboard and screen (TASK) and workplace (SURROUND) within the operator's field of view.

**Visual Display Unit (VDU):** A generic term used for display units based on technologies such as Cathode Ray Tubes (CRTs), Plasma Discharge Panels (PDPs), Electroluminescent Devices (ELs), Liquid Crystal Displays (LCDs), etc.

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## 3 Symbols

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### 3.1 Symbol usage

#### 3.1.1 General

- 1) The graphic symbols in this standard are intended for use on VDUs.
- 2) Because size variations of symbols representing the various pieces of equipment are anticipated, no scale is indicated on the graphic symbol sketches. The integrity of the defined symbols should be preserved by maintaining the aspect ratio depicted.
- 3) Color coding to improve the perception of information and ease of interpretation of the displayed image is anticipated.
- 4) Graphic symbols should be arranged to depict spatial relationships, energy, material and data flows in a consistent manner (e.g., left to right, top to bottom, etc.). Equipment outlines and piping lines may be differentiated by color, intensity, or width.
- 5) Symbols may be rotated in any orientation on a VDU in order to represent the process in the most effective manner.
- 6) Arrows may be used on process lines to indicate direction of flow.
- 7) Symbols should be shown only when they are important to understanding the operation or are an integral part of the process depicted. Symbol qualities, such as luminance, size, color, fill, and contrast should be considered collectively and judiciously in order to avoid any psychophysiological masking of adjacent display targets, such as measurement values, alarm messages, labels, etc.
- 8) Numeric values and text may be included to enhance comprehension. The values may be either static or dynamic.
- 9) Graphic displays may contain both static and dynamic symbols and data. The symbol set, while intended for color displays, is also usable on monochromatic displays.
- 10) Special characteristics of displays should be used to enhance the understanding of process symbols. These characteristics may be used to indicate the status of process devices:
  - Reverse video
  - Blinking
  - Intensity variation

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by use of some of certain terms are particularly applicable to the

Rotating Equipment and Valves and Actuators groups of symbols. Prudence in judgment should be used when adhering to this practice as some symbols should not change from their outline form. In depicting valve position, use solid to show open (material flowing or active) and outline to show closed (material stopped or nonactive). Another usage is solid/outline to represent a pump running/stopped as the generally accepted practice. Some industries, such as the power industry, use solid/outline to show closed (active or unit energized)/open (nonactive or unit deenergized). In these special cases, the explicit uses of these conventions are to be made clear to the operator and noted in operation manuals.

- 12) A symbol may be partially filled or shaded to represent the characteristic of the contents of a vessel, e.g., level, temperature, etc.
- 13) Properties of physical or chemical states, as measured by primary elements or instruments, can be represented on a VDU by symbolic characters. It is not normal to display these characters on a process display, but they are available if required. Appendix B contains the recommended designated characters and an example of their usage. This list has been derived from character designations based on the ISA Standard S5.1, "Instrumentation Symbols and Identification." It has been modified for use on VDU displays. An excerpt of the S5.1 document explaining the identification-letter usage is also included in Appendix B.

### 3.1.2 Color

Color is an effective coding technique used either singularly or redundantly with symbol, shape, and alphanumeric coding. Although this standard pertains exclusively to the definition and configuration of display symbols, certain color application guidelines have, nevertheless, been included for the convenience of the display designer. They are as follows:

- 1) Information-bearing color schemes should be simple, consistent, and unambiguous.
- 2) The most common color technology is the CRT using the raster display scheme and an additive color generation technique based on the three primaries: red, blue, and green. The number of selectable colors can range from six plus black and white to the thousands. The number of colors in one display should be limited to the minimum necessary to satisfy the process interface objectives of the display. Color is an effective coding technique for dynamic identification and classification of display elements. Used judiciously, it can improve operator performance, e.g., reduce search time, improve element identification, etc. Conversely, irrelevant color can act as visual noise and negate the positive effects of color coding. Typically, four colors can accommodate the dynamic coding requirements of process displays.
- 3) Large background areas should be black. In situations where the black background results in a high task/surround lumination ratio, a brighter background may be used, preferably blue or brown.
- 4) Compatible color combinations, i.e., those with high chromaticity contrast, should be

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- 5) Use color as a redundant indicator along with text, symbol, shape, size, reverse video, blinking, and intensity coding to preserve communications of critical process state and quality information with individuals having limited color perception.
- 6) To insure fast operator response, use highly saturated colors such as red or yellow.
- 7) Colors should not be used to indicate quantitative value.
- 8) The display designer should establish a project-related set of generic color meanings before developing a list of specific color-to-display-element associations. This generic set should be based on applicable plant, industry, and agency (OSHA, NRC, ANSI, etc.) conventions. Each project may have its unique set of generic definitions; e.g., Project A uses red to indicate closed or inactive states, while Project B uses green. In some special cases, such as the power industry, red may indicate closed and active or unit energized. This is suitable as long as the color meanings are defined as such for the particular project. Listed below is an example of a unique project-related color plan:

### Color plan example

Color	Generic meaning	Element association
Black	Background	
Red	Emergency	A) Stop B) Highest Priority Alarm C) Closed D) Off
Yellow	Caution	A) Abnormal Condition B) Second Priority Alarm
Green	Safe	A) Normal Operation B) Start C) Open D) On
Cyan (Light Blue)	Static & Significant	A) Process Equipment in Service B) Major Labels
Blue	Nonessential	A) Standby Process Equipment B) Labels, Tags, etc.
Magenta (Purple)	Radiation	A) Radiation Alarms B) Questionable Values

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## 3.2 Grouping of symbols

The graphic symbols for process displays have been divided into related groups. There are 13 groups and their contents are as follows:

Group	Symbol	Section
Connectors		3.3.1
Containers and Vessels		3.3.2
Process	Distillation Tower	3.3.2
	Jacketed Vessel	3.3.2
	Reactor	3.3.2
	Vessel	3.3.2
Storage	Atmospheric Tank	3.3.2
	Bin	3.3.2
	Floating Roof Tank	3.3.2
	Gas Holder	3.3.2
	Pressure Storage Vessel	3.3.2
	Weigh Hopper	3.3.2
Electrical	Circuit Breaker	3.3.3
	Manual Contactor	3.3.3
	Delta Connection	3.3.3
	Fuse	3.3.3
	Motor	3.3.3
	State Indicator	3.3.3
	Transformer	3.3.3
Wye Connection	3.3.3	
Filters	Liquid Filter	3.3.4
	Vacuum Filter	3.3.4
Heat Transfer Devices	Exchanger	3.3.5
	Forced Air Exchanger	3.3.5
	Furnace	3.3.5
	Rotary Kiln	3.3.5
HVAC (Heating Ventilating and Air Conditioning)	Cooling Tower	3.3.6

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Group	Symbol	Section
Mixing	Agitator	3.3.8
	Inline Mixer	3.3.8
Reciprocating Equipment	Reciprocating Compressor or Pump	3.3.9
Rotating Equipment	Blower	3.3.10
	Compressor	3.3.10
	Pump	3.3.10
	Turbine	3.3.10
Scrubbers and Precipitators	Electrostatic Precipitator	3.3.11
	Scrubber	3.3.11
Separators	Cyclone Separator	3.3.12
	Rotary Separator	3.3.12
	Spray Dryer	3.3.12
Valves and Actuators		3.3.13
Actuators	Actuator	3.3.13
	Throttling Actuator	3.3.13
	Manual Actuator	3.3.13
Valves	Valve	3.3.13
	3-Way Valve	3.3.13
	Butterfly Valve	3.3.13
	Check Valve	3.3.13
	Relief Valve	3.3.13

The symbols are presented in Section 3.3, Structure of Symbols. The symbols are categorized into their respective groups and are presented in alphabetical order. Each symbol is described with the following information:

Group	An associated classification of similar symbols
Subgroup	Represents further division within a group
Symbol Name	The name of the process symbol
Symbol Mnemonic	A four-character name given to the symbol to be used as its reference name in a computer system
Description	A brief description of what the symbol represents
Symbol Drawing	The actual drawing of the symbol itself. Although no specific aspect ratio is given, the shape that is drawn should be depicted as closely as possible. Process connections and flow directions

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### 3.3 Structure of symbols

#### 3.3.1 Group: Connectors

**Subgroup:** N/A

**Symbol Name:** N/A

**Symbol Mnemonic:** N/A

**Description:** For the purpose of this document, the various possible connectors have been excluded. In the majority of cases, pipe connections are not required to be detailed. A recommended practice to avoid any confusion on the video display is to use line breaks to indicate that the lines do not join. The most important lines should be kept solid with the secondary lines being broken. If all lines are of equal importance, a usual convention is to break the vertical line.

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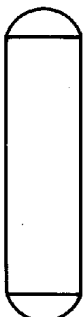
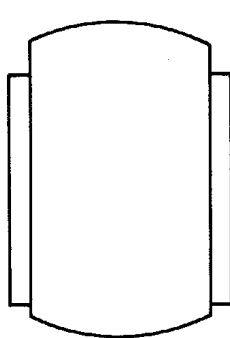
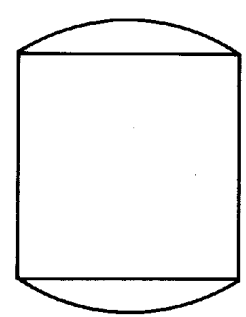
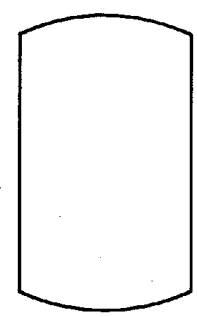
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### 3.3 Structure of symbols

#### 3.3.2 Group: Containers and vessels

<p><b>Subgroup:</b> Process <b>Symbol Name:</b> Distillation Tower <b>Symbol Mnemonic:</b> DTWR</p> <p><b>Description:</b> A packed or trayed distillation tower used for separation. Packing or trays may be shown to indicate type of distillation tower.</p> 	<p><b>Subgroup:</b> Process <b>Symbol Name:</b> Jacketed Vessel <b>Symbol Mnemonic:</b> JVSL</p> <p><b>Description:</b> A vessel with a heating or cooling jacket. Jacket may be on straight shell, on bottom head, on top head, or any combination, as required to match the actual process vessel.</p> 
<p><b>Subgroup:</b> Process <b>Symbol Name:</b> Reactor <b>Symbol Mnemonic:</b> RCTR</p> <p><b>Description:</b> A chemical reactor. Internal details may be shown to indicate type of reactor.</p> 	<p><b>Subgroup:</b> Process <b>Symbol Name:</b> Vessel <b>Symbol Mnemonic:</b> VSSL</p> <p><b>Description:</b> A vessel or separator. Internal details may be shown to indicate type of vessel. Can also be used as a pressurized vessel in either a vertical or horizontal arrangement.</p> 

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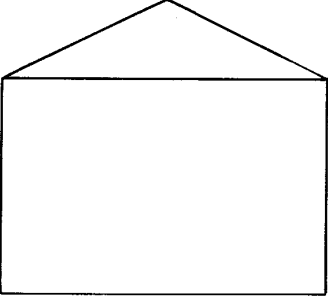
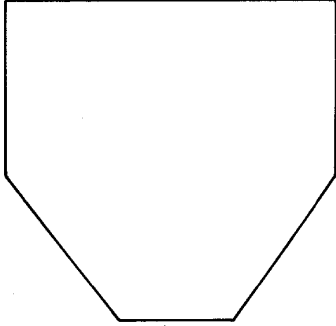
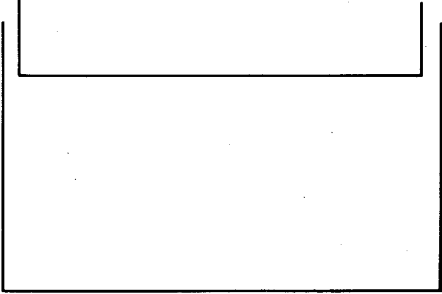
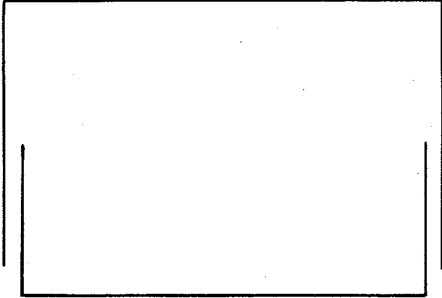
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### 3.3 Structure of symbols

#### 3.3.2 Group: Containers and vessels (cont'd)

<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Atmospheric Tank <b>Symbol Mnemonic:</b> ATNK</p> <p><b>Description:</b> A tank for material stored under atmospheric pressure.</p> 	<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Bin <b>Symbol Mnemonic:</b> BINN</p> <p><b>Description:</b> A container used to store solid or granular material that is discharged from the bottom.</p> 
<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Floating Roof Tank <b>Symbol Mnemonic:</b> FTNK</p> <p><b>Description:</b> A tank for liquids with roof of vessel moving up and down with a change in stored volume.</p> 	<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Gas Holder <b>Symbol Mnemonic:</b> GHDR</p> <p><b>Description:</b> A tank for gases with roof of vessel moving up and down with a change in stored volume.</p> 

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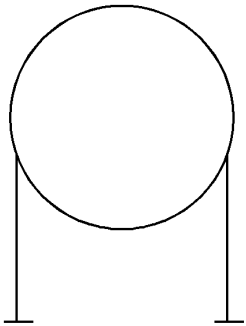
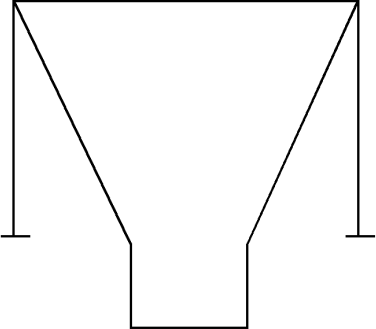
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### 3.3 Structure of symbols

#### 3.3.2 Group: Containers and vessels (cont'd)

<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Pressure Storage Vessel <b>Symbol Mnemonic:</b> PVSL <b>Description:</b> A pressurized spherical vessel for storage of gases and liquids.</p> 	<p><b>Subgroup:</b> Storage <b>Symbol Name:</b> Weigh Hopper <b>Symbol Mnemonic:</b> WHPR <b>Description:</b> A vessel used for weighing material.</p> 
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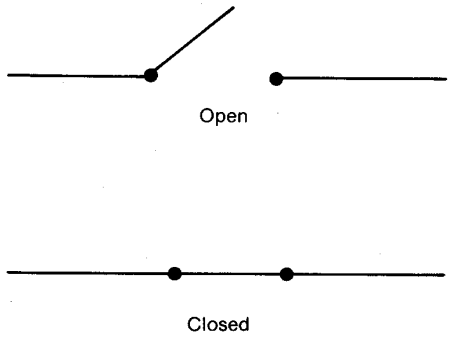
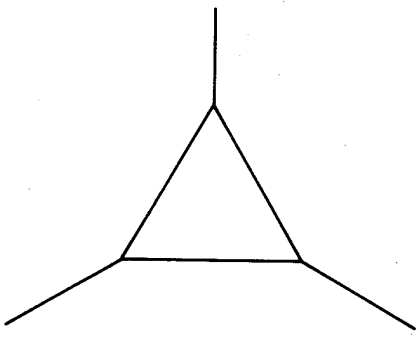
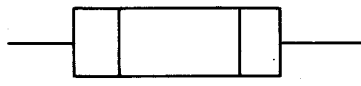
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### 3.3 Structure of symbols

#### 3.3.3 Group: Electrical

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Circuit Breaker <b>Symbol Mnemonic:</b> CBRK</p> <p><b>Description:</b> Representation of a circuit breaker for electrical systems. See STATE INDICATOR symbol for alternative use.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Manual Contactor <b>Symbol Mnemonic:</b> MCTR</p> <p><b>Description:</b> A power distribution switch used for device isolation.</p> 
<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Delta Connection <b>Symbol Mnemonic:</b> DLTA</p> <p><b>Description:</b> Representation of a 3-phase delta connection.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Fuse <b>Symbol Mnemonic:</b> FUSE</p> <p><b>Description:</b> Representation of a fuse as an over-current protection device.</p> 

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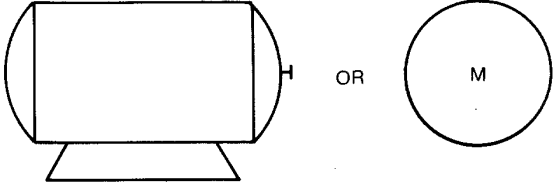
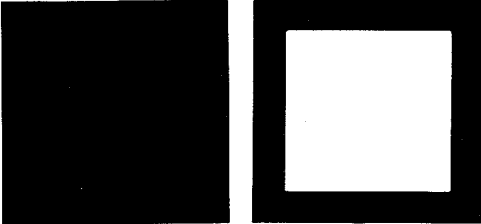
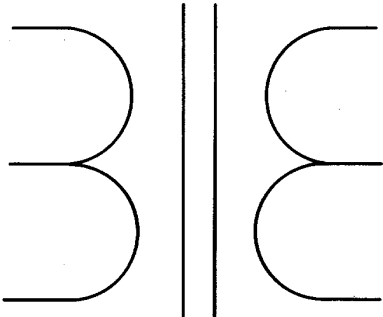
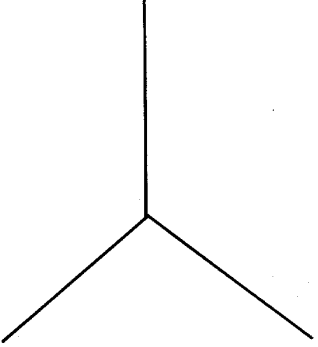
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### 3.3 Structure of symbols

#### 3.3 Group: Electrical (cont'd)

<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Motor  <b>Symbol Mnemonic:</b> MOTR  <b>Description:</b> An ac or dc motor.</p>  <p>This is the preferred symbol for process diagrams (base optional).</p> <p>This is the preferred symbol for electrical diagrams.</p>	<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> State Indicator  <b>Symbol Mnemonic:</b> STAT  <b>Description:</b> Used to represent binary states. For example: Circuit Closed/Circuit Open, etc.</p>  <p>Circuit Closed      Circuit Open</p>
<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Transformer  <b>Symbol Mnemonic:</b> XFMR  <b>Description:</b> A universal transformer.</p> 	<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> WYE Connection  <b>Symbol Mnemonic:</b> WYEC  <b>Description:</b> Representation of a 3-phase wye (star) connection.</p> 

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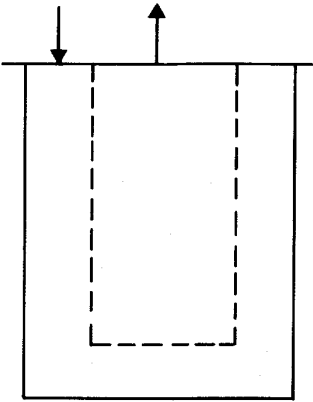
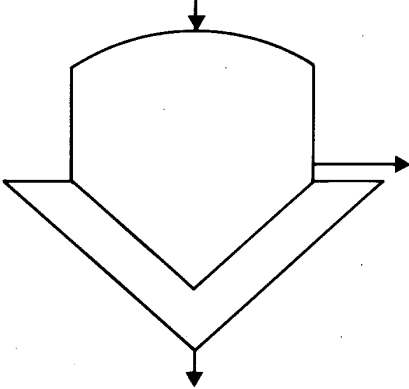
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### 3.3 Structure of symbols

#### 3.3.4 Group: Filters

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Liquid Filter <b>Symbol Mnemonic:</b> LFLT <b>Description:</b> A liquid filter.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Vacuum Filter <b>Symbol Mnemonic:</b> VFLT <b>Description:</b> A vacuum-assisted filtration device.</p> 
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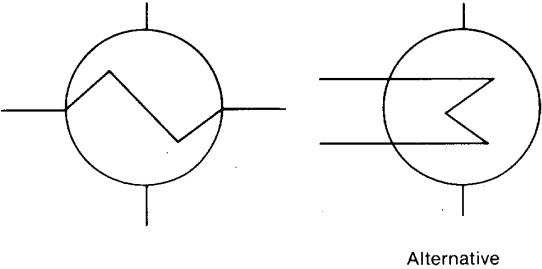
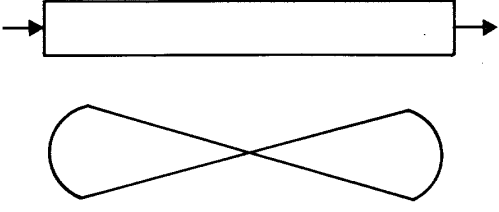
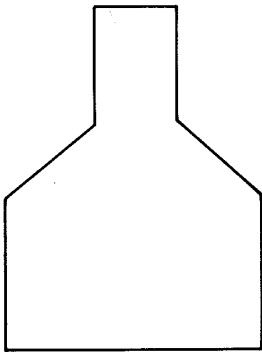
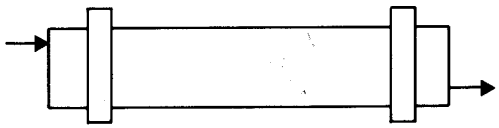
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### 3.3 Structure of symbols

#### 3.3.5 Group: Heat transfer devices

<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Exchanger  <b>Symbol Mnemonic:</b> XCHG</p> <p><b>Description:</b> Heat transferral equipment. An alternative symbol is depicted.</p>  <p style="text-align: center;">Alternative</p>	<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Forced Air Exchanger  <b>Symbol Mnemonic:</b> FAXR</p> <p><b>Description:</b> A forced-air heat exchanger.</p> 
<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Furnace  <b>Symbol Mnemonic:</b> FURN</p> <p><b>Description:</b> Process heater or furnace. Internal details may be shown as needed.</p> 	<p><b>Subgroup:</b> N/A  <b>Symbol Name:</b> Rotary Kiln  <b>Symbol Mnemonic:</b> KILN</p> <p><b>Description:</b> Typical gas, oil, coal or coke-fired kiln.</p> 

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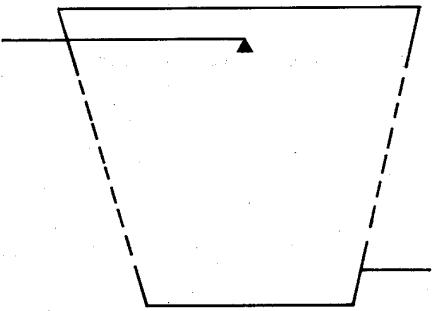
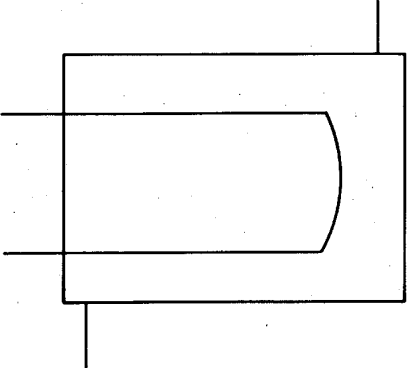
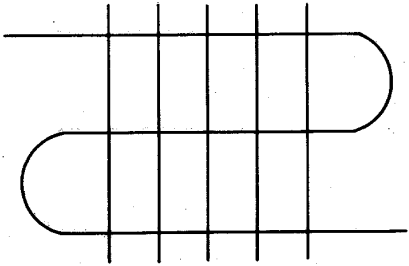
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### 3.3 Structure of symbols

#### 3.3.6 Group: HVAC (heating ventilation & air conditioning)

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Cooling Tower <b>Symbol Mnemonic:</b> CTWR</p> <p><b>Description:</b> A device for use in HVAC or other processes indicating the atmospheric cooling of water by forced evaporation.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Evaporator <b>Symbol Mnemonic:</b> EVPR</p> <p><b>Description:</b> An HVAC device used to represent the exchange of heat between a liquid or gas and a refrigerant.</p> 
<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Finned Exchanger <b>Symbol Mnemonic:</b> FNXR</p> <p><b>Description:</b> A high surface transfer device used to exchange heat between a liquid or gas and air.</p> 	

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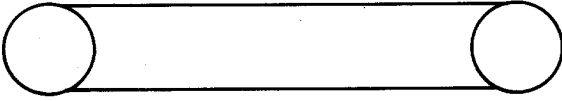
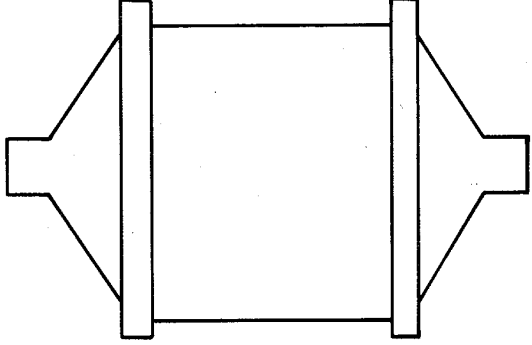
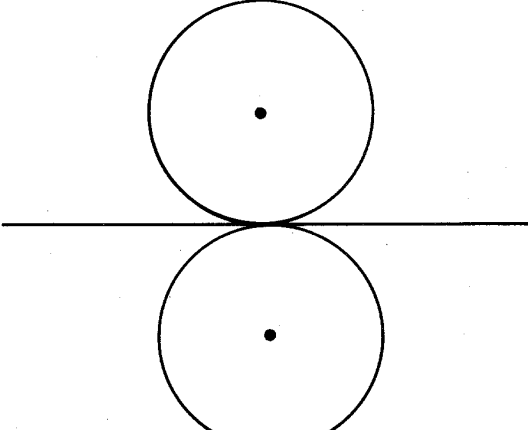
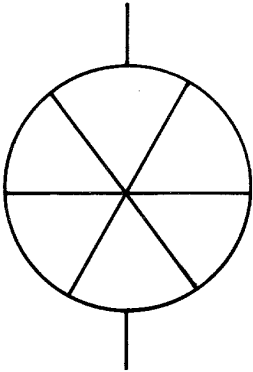
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### 3.3 Structure of symbols

#### 3.3.7 Group: Material handling

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Conveyor <b>Symbol Mnemonic:</b> CNVR</p> <p><b>Description:</b> Belt conveyors, chain conveyors, and roller conveyors used in association with other symbols to represent more complex equipment such as a paper machine.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Mill <b>Symbol Mnemonic:</b> MILL</p> <p><b>Description:</b> Rotating rod, ball, autogenous, or semiautogenous mill used for size reduction of solids.</p> 
<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Roll Stand <b>Symbol Mnemonic:</b> RSTD</p> <p><b>Description:</b> Roll stand used in metal, paper, rubber, plastic, and glass industries.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Rotary Feeder <b>Symbol Mnemonic:</b> RFDR</p> <p><b>Description:</b> A rotary feeder used to convey material in dry powder form from one location to another.</p> 

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### 3.3 Structure of symbols

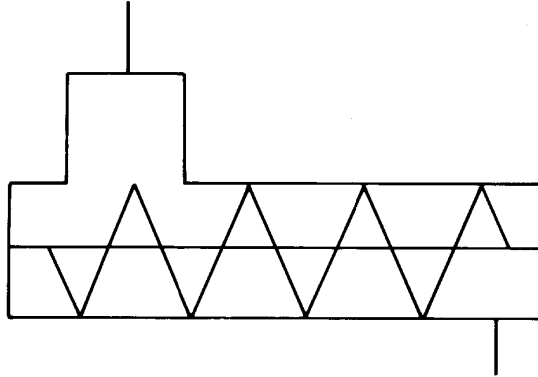
#### 3.3.7 Group: Material handling (cont'd)

**Subgroup:** N/A

**Symbol Name:** Screw Conveyor

**Symbol Mnemonic:** SCNV

**Description:** A typical screw conveyor or screw pump.



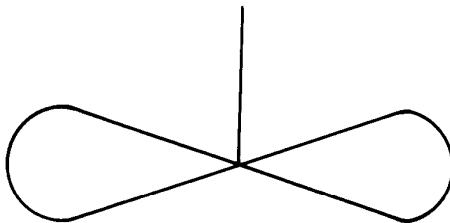
#### 3.3.8 Mixing

**Subgroup:** N/A

**Symbol Name:** Agitator

**Symbol Mnemonic:** AGIT

**Description:** A blade, propeller, or paddle-type agitator.

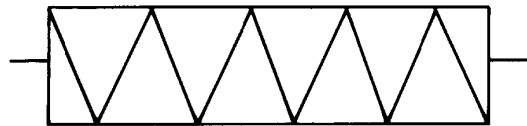


**Subgroup:** N/A

**Symbol Name:** Inline Mixer

**Symbol Mnemonic:** IMIX

**Description:** A mixing device used to continuously blend materials.



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### 3.3 Structure of symbols

#### 3.3.9 Group: Reciprocating equipment

**Subgroup:** N/A

**Symbol Name:** Reciprocating Compressor

**Symbol Mnemonic:** RECP

**Description:** A reciprocating compressor or pump represents that class of equipment used to transport slurries or liquids by reciprocating action. Examples are pistons, diaphragms, plungers, etc.



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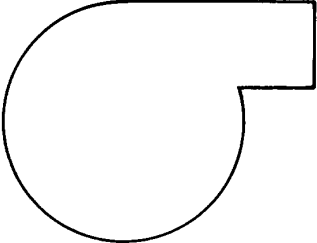
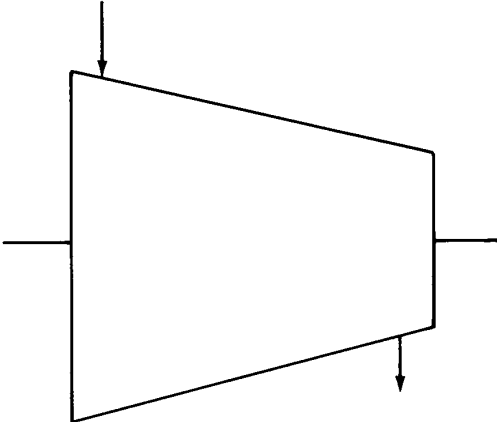
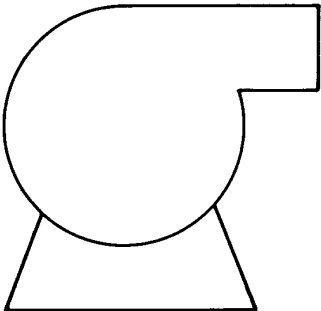
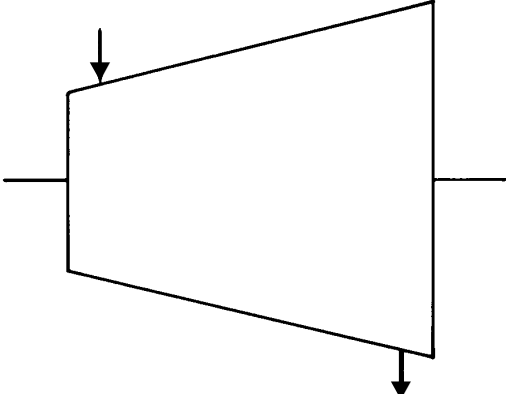
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### 3.3 Structure of symbols

#### 3.3.10 Group: Rotating equipment

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Blower <b>Symbol Mnemonic:</b> BLWR</p> <p><b>Description:</b> A device used to convey a gas under slight pressure.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Compressor <b>Symbol Mnemonic:</b> CMPR</p> <p><b>Description:</b> A device used to convey a gas under high pressure.</p> 
<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Pump <b>Symbol Mnemonic:</b> PUMP</p> <p><b>Description:</b> Represents that class of equipment used to transport slurries or liquids by internal rotary action. Examples are centrifugal, gear, lobe, etc.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Turbine <b>Symbol Mnemonic:</b> TURB</p> <p><b>Description:</b> A device using the force of expanding gas to propel rotating equipment.</p> 

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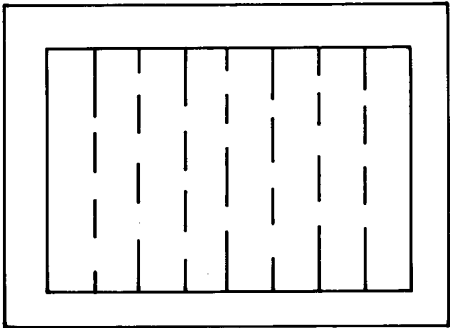
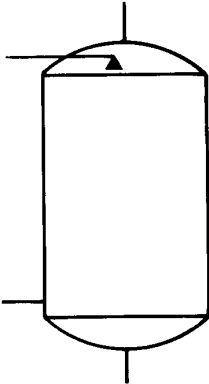
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### 3.3 Structure of symbols

#### 3.3.11 Group: Scrubber and precipitators

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Electrostatic Precipitator <b>Symbol Mnemonic:</b> EPCP</p> <p><b>Description:</b> A device used to separate solid particles from a gas (e.g., in a smoke stack) by means of an electrostatically charged grid.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Scrubber <b>Symbol Mnemonic:</b> SCBR</p> <p><b>Description:</b> A device that uses a liquid spray to scrub gas.</p> 
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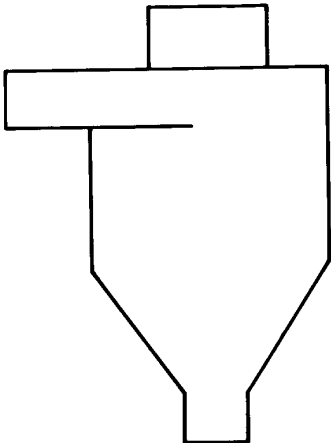
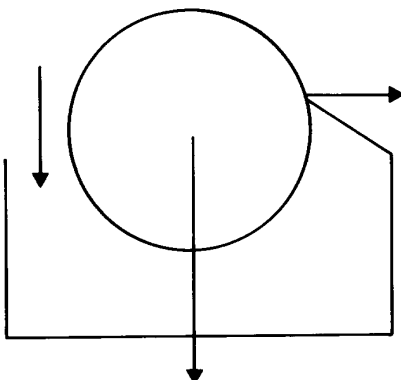
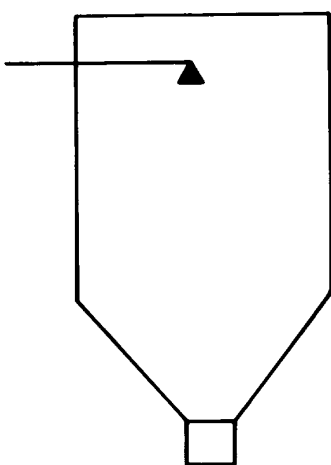
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### 3.3 Structure of symbols

#### 3.3.12 Group: Separators

<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Cyclone Separator <b>Symbol Mnemonic:</b> CSEP</p> <p><b>Description:</b> A device used for solid, liquid, or vapor separation.</p> 	<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Rotary Separator <b>Symbol Mnemonic:</b> RSEP</p> <p><b>Description:</b> A rotary device for separating solids from liquids.</p> 
<p><b>Subgroup:</b> N/A <b>Symbol Name:</b> Spray Dryer <b>Symbol Mnemonic:</b> SDRY</p> <p><b>Description:</b> A device used for evaporation of liquids from mixtures of solids and liquids.</p> 	

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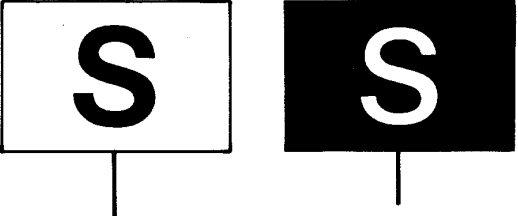
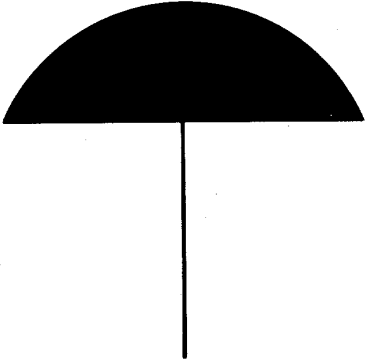
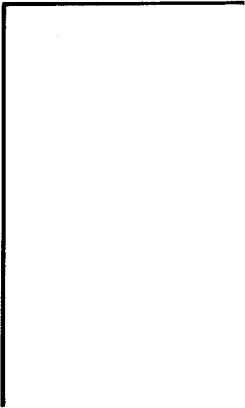
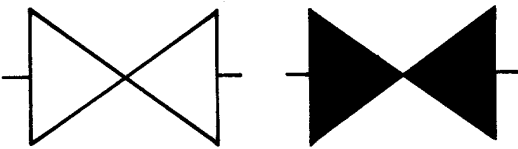
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### 3.3 Structure of symbols

#### 3.3.13 Group: Valves and actuators

<p><b>Subgroup:</b> Actuators  <b>Symbol Name:</b> Actuator  <b>Symbol Mnemonic:</b> ACTR</p> <p><b>Description:</b> Represents the final control element that determines the state of a two-state device.</p> <p>Desired Device State is CLOSED      Desired Device State is OPEN</p>  <p>The use of a letter in the symbol to designate the type of actuator is optional. Other choices include:</p> <p><u>Character Designation</u></p> <p>M = Electrical Motor  S = Solenoid  H = Hydraulic  A = Air Motor</p>	<p><b>Subgroup:</b> Actuators  <b>Symbol Name:</b> Throttling Actuator  <b>Symbol Mnemonic:</b> TACT</p> <p><b>Description:</b> Represents a diaphragm actuator that can affect multiple positions of the controlled device.</p> 
<p><b>Subgroup:</b> Actuators  <b>Symbol Name:</b> Manual Actuator  <b>Symbol Mnemonic:</b> MATR</p> <p><b>Description:</b> Represents a manually-operated valve actuator.</p> 	<p><b>Subgroup:</b> Valves  <b>Symbol Name:</b> Valve  <b>Symbol Mnemonic:</b> VLVE</p> <p><b>Description:</b> Represents GLOBE, GATE, BALL, and NEEDLE valves used to regulate fluid flow through piping systems. Can be used with various combinations of actuators to convey multiple manipulation schemes.</p> <p>Actual State is CLOSED      Actual State is OPEN</p> 

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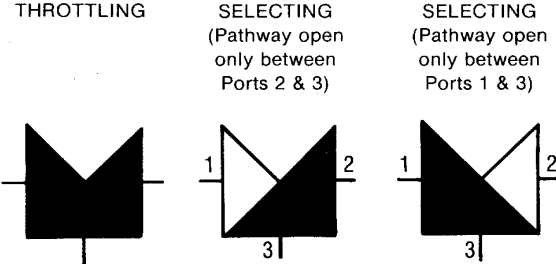
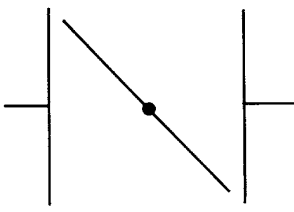
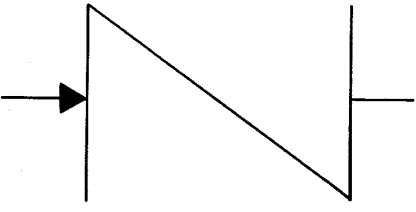
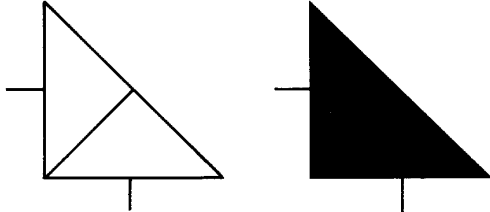
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### 3.3 Structure of symbols

#### 3.3.13 Group: Valves and actuators (cont'd)

<p><b>Subgroup:</b> Valves  <b>Symbol Name:</b> 3-Way Valve  <b>Symbol Mnemonic:</b> VLV3</p> <p><b>Description:</b> Represents a valve used in piping systems to select flow paths or regulate between flow paths. Can be used with various combinations of actuators to convey multiple manipulation schemes.</p> <p>THROTTLING      SELECTING (Pathway open only between Ports 2 &amp; 3)      SELECTING (Pathway open only between Ports 1 &amp; 3)</p>  <p><b>Note:</b> Port numbers are not part of symbol.</p>	<p><b>Subgroup:</b> Valves  <b>Symbol Name:</b> Butterfly Valve  <b>Symbol Mnemonic:</b> BVLV</p> <p><b>Description:</b> Represents a butterfly valve, damper, or vane used to throttle (modulate) fluid flow through a pipe, duct, or stack.</p> 
<p><b>Subgroup:</b> Valves  <b>Symbol Name:</b> Check Valve  <b>Symbol Mnemonic:</b> CVLV</p> <p><b>Description:</b> Represents a device that mechanically limits fluid flow to only one direction in a piping system — typically a check valve or back-draft damper.</p>  <p>Arrow shows direction of allowable flow and is part of the symbol.</p>	<p><b>Subgroup:</b> Valves  <b>Symbol Name:</b> Relief Valve  <b>Symbol Mnemonic:</b> RVLV</p> <p><b>Description:</b> Represents a one-way mechanically actuated pressure relief valve. While these valves are normally closed, two symbols are shown to accommodate those situations where feedback signals are provided to indicate actual status.</p> <p>Normally closed valve that is actually CLOSED      Normally closed valve that is actually OPEN</p> 

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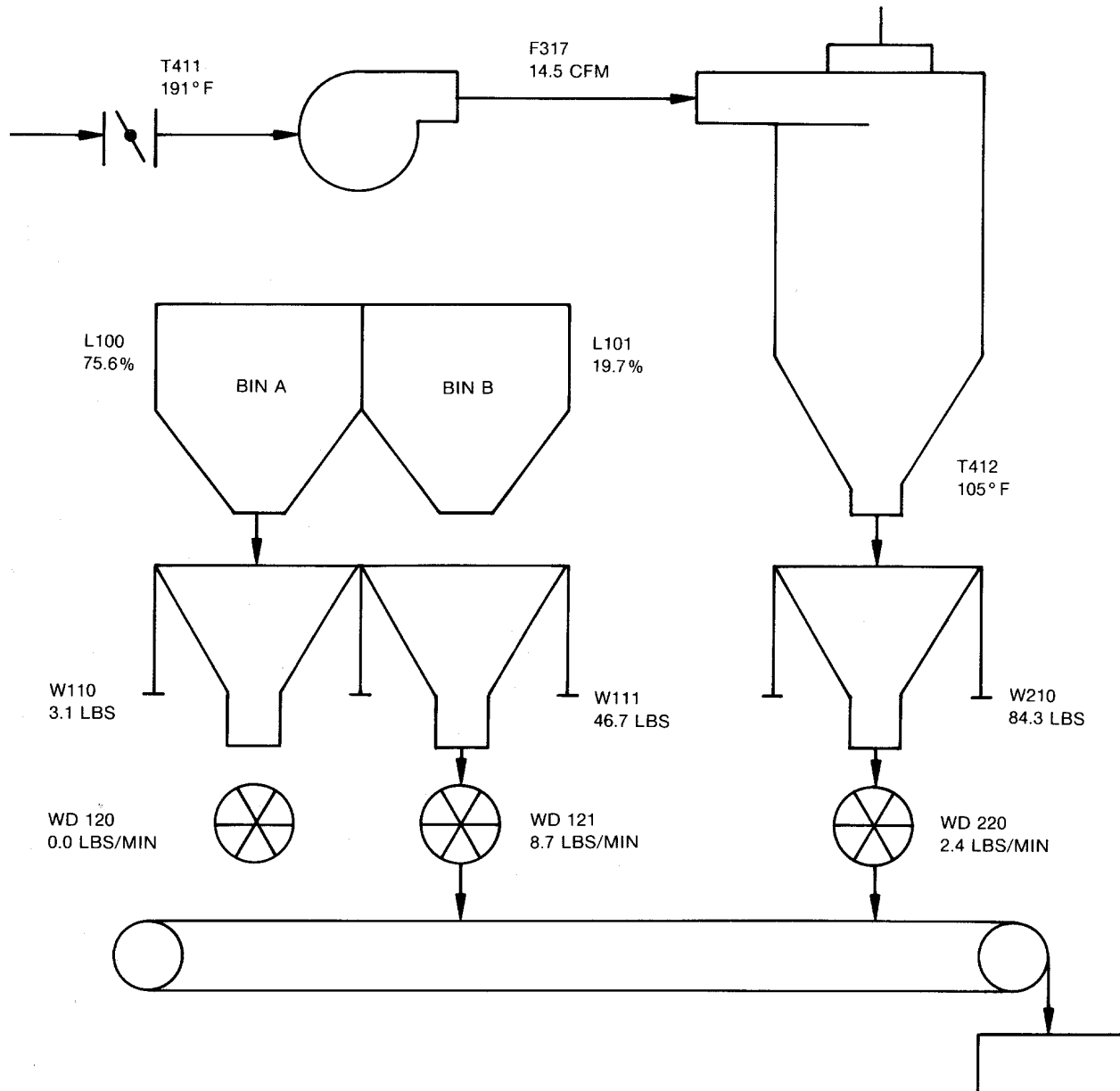
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## Appendix A — Examples of use



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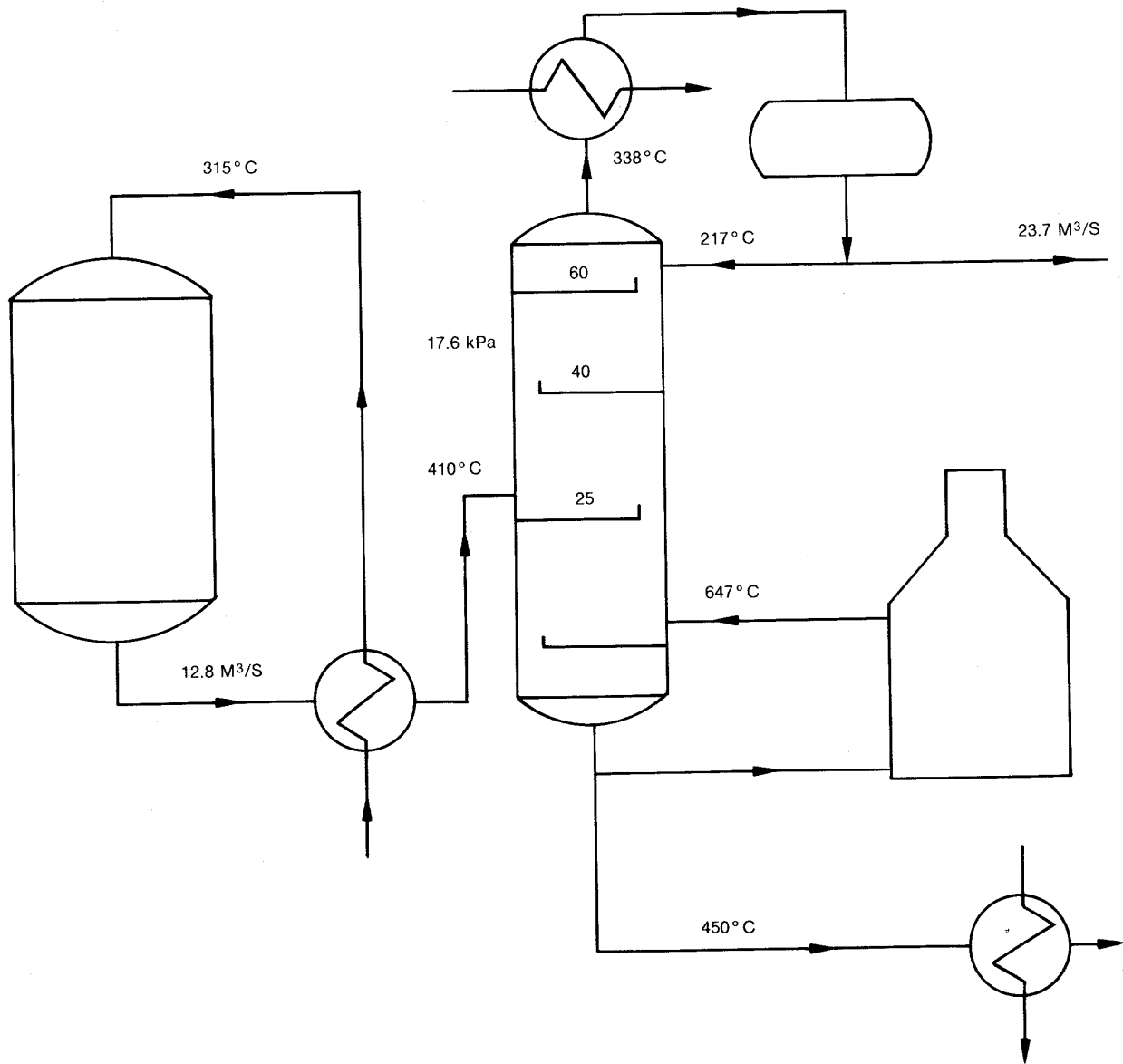


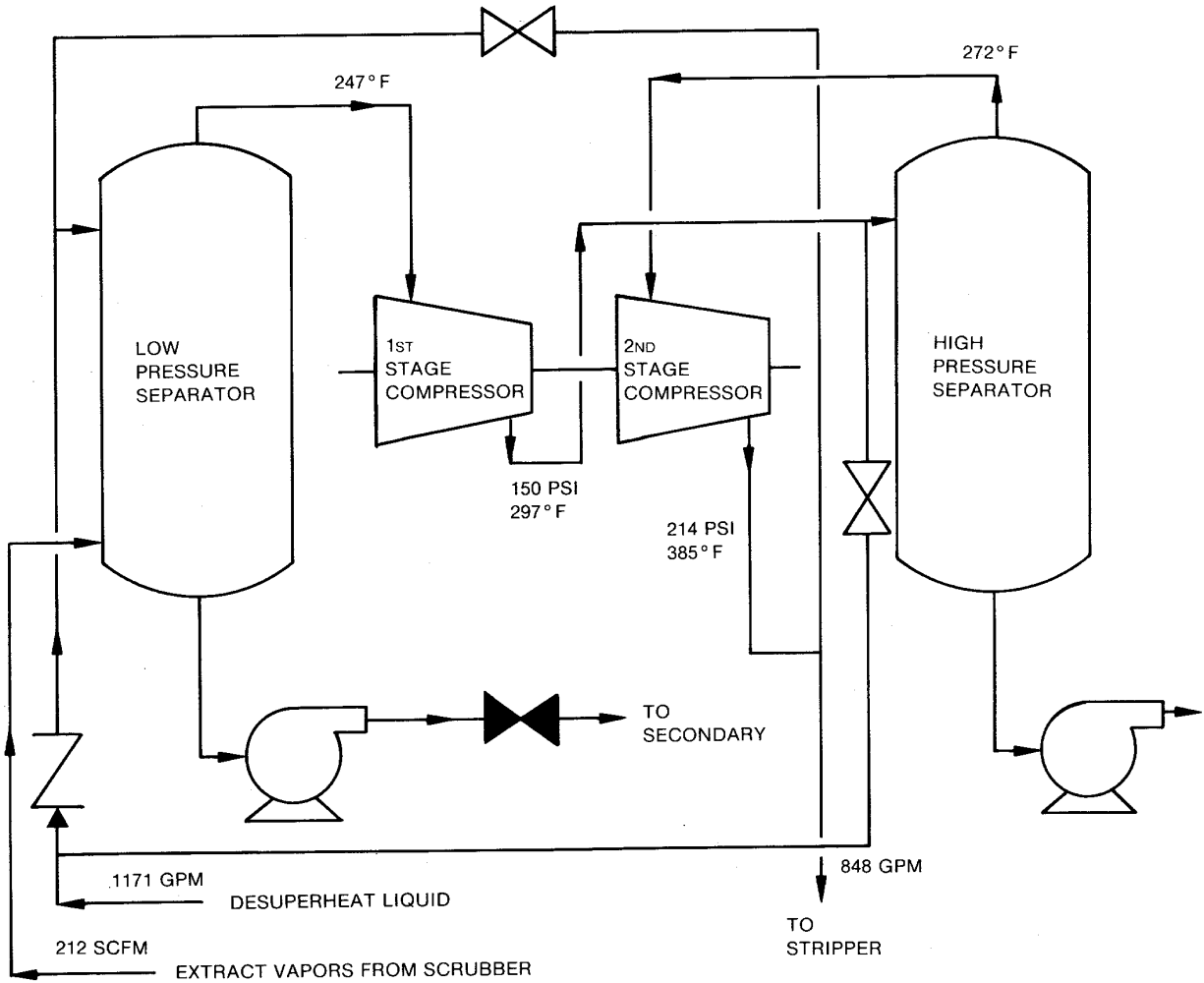
Figure A-2 — Chemical process

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**Figure A-3 — Heat pump system**

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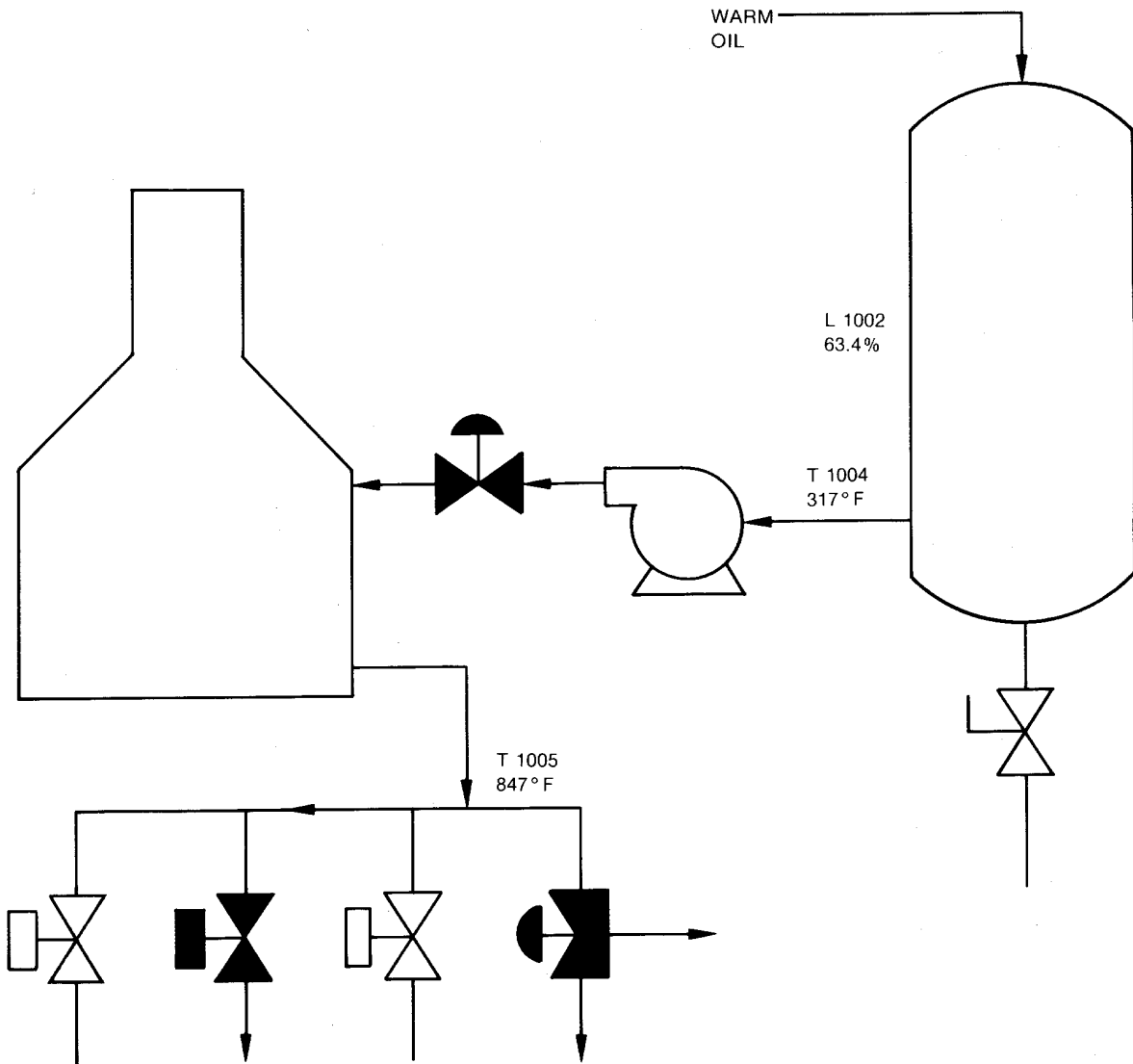


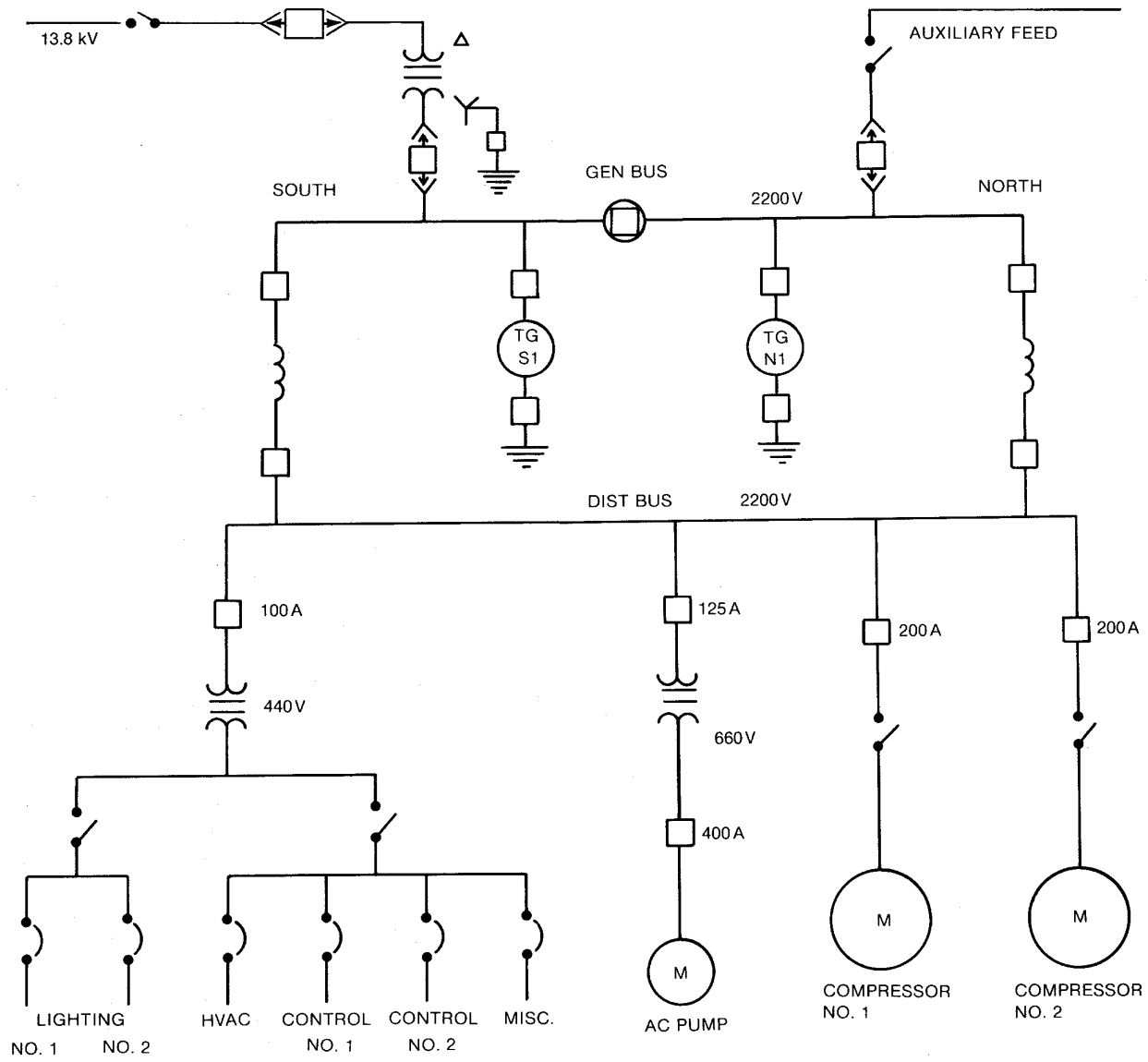
Figure A-4 — Hot oil system

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**Figure A-5 — Electrical power system**

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## Appendix B — Primary measurement recommended usage

Primary elements or instruments can be depicted on a VDU by a character(s). The characters that are recommended for use are:

First character	Type of measurement	Notes
A	Analysis	4
B	Burner, Combustion	
C	User's Choice	1
D	User's Choice	1
E	Voltage (EMF)	
F	Flow Rate	
G	User's Choice	1
H	Hand (Manual)	
I	Current (Electric)	
J	Power	
K	Time	
L	Level	
M	User's Choice	1
N	User's Choice	1
O	User's Choice	1
P	Pressure/Vacuum	
Q	Quantity	
R	Radiation	
S	Speed, Frequency	
T	Temperature	
U	Multivariable	5
V	Vibration, Mechanical Analysis	6
W	Weight, Force	
X	Unclassified	2
Y	Event, State or Presence	7
Z	Position, Dimension	
First modifier*	Type of measurement	Notes
D	Differential	

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**NOTE 1:** A "USER'S CHOICE" letter is intended to cover unlisted meanings for primary measurements that will be used repetitively in a particular project. If used, the letter will have one meaning as a first letter and a different meaning for the second letter. The meanings need be defined only once in the beginning of the project. For example, the letter 'M' may be defined as "MOISTURE" in one project, but as "MASS" in another.

**NOTE 2:** The unclassified letter 'X' is intended to cover unlisted meanings that will be used only once or to a limited extent. If used, the letter may have any number of meanings as a first letter and any number of meanings as a succeeding letter.

Except for its use with distinctive measurements, it is expected that the meaning will be defined outside the symbol. For example, 'X' may be a stress measurement at one point and a volume measurement at another point.

The units of the quantity measured will assist in determining the actual usage of the letter 'X'.

**NOTE 3:** Any first letter, if used in combination with modifying letters 'D' (differential), 'F' (ratio), 'K' (time rate of change), or 'Q' (integrate or totalize), or any combination of them, shall be construed to represent a new and separate measured variable, and the combination shall be treated as a first-letter entity. Thus, instrument measurements 'T' and 'TD' measure two different variables, namely, temperature and differential temperature. These modifying letters shall be used when applicable.

**NOTE 4:** First letter 'A' for analysis covers all analyses not described by a "USER'S CHOICE" letter. It is expected that the type of analysis will be defined outside the symbol. The units of the quantity measured will assist in determining the actual type of analysis occurring. Additional information can be added as text to the Visual Display Unit.

**NOTE 5:** Use of the first letter 'U' for "Multivariable" in lieu of a combination of first letters is optional. It is recommended that nonspecific designators such as 'U' be used sparingly.

**NOTE 6:** First letter 'V,' "Vibration or Mechanical Analysis," is intended to perform the duties in machinery monitoring that the letter 'A' performs in more general analyses. Except for vibration, it is expected that the variable of interest will be defined outside the actual symbol. This definition can occur as a result of units of the quantity measured or as additional text shown on the visual display unit.

**NOTE 7:** First letter 'Y' is intended for use when control or monitoring responses are event-driven as opposed to time or time-schedule driven. It can also signify presence or state.

**NOTE 8:** Second letter 'K,' in combination with a first letter such as 'L,' 'T,' or 'W,' signifies a time rate of change of the primary measurement. As an example, 'WK' may represent "Rate of Weight Loss or Gain."

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The following are Identification Letters and their usage from ISA Standard S5.1, "Instrumentation Symbols and Identification," Revision 4.

**Table B-1: Identification letters**

First letter (4)		Succeeding letters (3)			
Measured or initiating variable	Modifier	Readout or passive function	Output function	Modifier	
A	Analysis (5, 19)	Alarm			
B	Burner, Combustion	User's Choice (1)	User's Choice (1)	User's Choice (1)	
C	User's Choice (1)		Control (13)		
D	User's Choice (1)	Differential (4)			
E	Voltage	Sensor (Primary Element)			
F	Flow Rate	Ratio (Fraction) (4)			
G	User's Choice (1)	Glass, Viewing Device (9)			
H	Hand			High (7, 15, 16)	
I	Current (Electrical)	Indicate (10)			
J	Power	Scan (7)			
K	Time, Time Schedule	Time Rate of Change (4, 21)		Control Station (22)	
L	Level	Light (11)		Low (7, 15, 16)	
M	User's Choice (1)	Momentary (4)		Middle, Intermediate (7, 15)	
N	User's Choice (1)	User's Choice (1)	User's Choice (1)	User's Choice (1)	
O	User's Choice (1)	Orifice, Restriction			
P	Pressure, Vacuum	Point (Test) Connection			
Q	Quantity	Integrate, Totalize (4)			
R	Radiation	Record (17)			
S	Speed, Frequency	Safety (8)		Switch (13)	
T	Temperature			Transmit (18)	
U	Multivariable (6)		Multifunction (12)	Multifunction (12)	
V	Vibration, Mechanical Analysis		Valve, Damper, Louver (13)		
W	Weight, Force	Well			
X	Unclassified (2)	X Axis	Unclassified (2)	Unclassified (2)	
Y	Event, State	Y Axis	Relay, Compute,		

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## Notes for Table B-1:

**NOTE 1:** A "USER'S CHOICE" letter is intended to cover unlisted meanings that will be used repetitively in a particular project. If used, the letter may have one meaning as a first letter and another meaning as a succeeding letter. The meanings need to be defined only once in a legend, or otherwise, for that project. For example, the letter 'N' may be defined as "MODULUS OF ELASTICITY" as a first letter and "OSCILLOSCOPE" as a succeeding letter.

**NOTE 2:** The unclassified letter 'X' is intended to cover unlisted meanings that will be used only once or to a limited extent. If used, the letter may have any number of meanings as a first letter and any number of meanings as a succeeding letter. Except for its use with distinctive symbols, it is expected that the meanings will be defined outside a tagging bubble on a flow diagram. For example, XR-2 may be a stress recorder and XX-4 may be a stress oscilloscope.

**NOTE 3:** The grammatical form of the succeeding letter meanings may be modified as required. For example, "indicate" may be applied as "indicator" or "indicating," "transmit" as "transmitter" or "transmitting," etc.

**NOTE 4:** Any first letter, if used in combination with modifying letters 'D' (differential), 'F' (ratio), 'M' (momentary), 'K' (time rate of change), 'Q' (integrate or totalize), or any combination of these is intended to represent a new and separate measured variable, and the combination is treated as a first-letter entity. Thus, instruments 'TDI' and 'TI' indicate two different variables, namely, differential temperature and temperature. Modifying letters are used when applicable.

**NOTE 5:** First letter 'A,' "Analysis," covers all analyses not described by a "USER'S CHOICE" letter. It is expected that the type of analysis will be defined outside a tagging bubble.

**NOTE 6:** Use of first letter 'U' for "Multivariable" in lieu of a combination of first letters is optional. It is recommended that nonspecific designators such as 'U' be used sparingly.

**NOTE 7:** The use of modifying terms "high," "low," "middle" or "intermediate," and "scan" is optional.

**NOTE 8:** The term "safety" applies to emergency protective primary elements and emergency protective final control elements only. Thus, a self-actuated valve that prevents operation of a fluid system at a higher than desired pressure by bleeding fluid from the system is a backpressure-type PCV, even if the valve is not intended to be used normally. However, this valve is designated as a PSV if it is intended to protect against emergency conditions, i.e., conditions that are hazardous to personnel and/or equipment and that are not expected to arise normally.

The designation 'PSV' applies to all valves intended to protect against emergency pressure conditions regardless of whether the valve construction and mode of operation place them in the category of the safety valve, relief valve, or safety relief valve. A rupture disc is designated 'PSE.'

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**NOTE 11:** A pilot light that is part of an instrument loop should be designated by a first letter followed by the succeeding letter 'L.' For example, a pilot light that indicates an expired time period should be tagged 'KQL.' If it is desired to tag a pilot light that is not part of an instrument loop, the light is designated in the same way. For example, a running light for an electric motor may be tagged 'EL,' assuming voltage to be the appropriate measured variable, or 'YL,' assuming the operating status is being monitored. The unclassified variable 'X' should be used only for applications that are limited in extent. 'XL' should not be used for motor running lights as these are commonly numerous. It is permissible to use the "USER'S CHOICE" letters 'M,' 'N,' or 'O' for a motor running light when the meaning is previously defined. If 'M' is used, it must be clear that the letter does not stand for the word "Motor," but for a monitored state.

**NOTE 12:** Use of a succeeding letter 'U' for "Multifunction" instead of a combination of other functional letters is optional. This nonspecific variable designator should be used sparingly.

**NOTE 13:** A device that connects, disconnects, or transfers one or more circuits may be either a switch, a relay, an ON-OFF controller, or a control valve, depending on the application.

If the device manipulates a fluid process stream and is not a hand-actuated ON-OFF block valve, it is designated as a control valve. It is incorrect to use the succeeding letters 'CV' for anything other than a self-actuated control valve. For all applications, other than fluid process streams, the device is designated as follows:

A *switch*, if it is actuated by hand.

A switch or an ON-OFF controller, if it is automatic and is the first such device in a loop. The term "Switch" is generally used if the device is used for alarm, pilot light, selection, interlock, or safety. The term "Controller" is generally used if the device is used for normal operating control.

A relay, if it is automatic and is not the first such device in a loop, i.e., it is actuated by a switch or an ON-OFF controller.

**NOTE 14:** It is expected that the functions associated with the use of succeeding letter 'Y' will be defined outside a bubble on a diagram when further definition is considered necessary. This definition need not be made when the function is self-evident, as for a solenoid valve in a fluid signal line.

**NOTE 15:** The modifying terms "high," "low," and "middle" or "intermediate" correspond to values of the measured variable, not of the signal, unless otherwise noted. For example, a high-level alarm derived from a reverse-acting level transmitter signal shall be an 'LAH,' even though the alarm is actuated when the signal falls to a low value. The terms may be used in combinations as appropriate (see Section 6.9A ISA-S5.1).

**NOTE 16:** The terms "high" and "low," when applied to positions of valves and other open-close devices, are defined as follows: "high" denotes that the valve is in or approaching the fully open position, and "low" denotes it is in or approaching the fully closed position.

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**NOTE 20:** First letter 'Y' is intended for use when control or monitoring responses are event-driven as opposed to time- or time-schedule-driven. 'Y,' in this position, can also signify presence or state.

**NOTE 21:** Modifying letter 'K,' in combination with a first letter, such as 'L,' 'T,' or 'W,' signifies a time rate of change of the measured or initiating variable. 'WKIC,' for instance, may represent a rate-of-weight-loss controller.

**NOTE 22:** Succeeding letter 'K' is a user's option for designating a *control station*, while the succeeding letter 'C' is used for describing automatic or manual *controllers*. See Definitions, ISA S5.1.

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**Table B-2 — Typical letter combinations**

Controllers		Readout devices		Switches and alarm devices*			Transmitters			Solenoids relays computing devices		Primary elements	Test point	Well or probe	Viewing device glass	Safety device	Element
Indicating	Blind	Self-actuated control valves	Recording	Indicating	High†	Low‡	Comb	Recording	Indicating	Blind							
AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
BIC	BC		BR	BI	BSH	BSL	BSDL	BRT	BIT	BT	BY	BE		BW	BG		BZ
EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
FIC	FC	FCV, FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQIC	FQC		FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FFIC	FFC		FFR	FFO	FFSH	FFSL						FE					PV
HIC	HC		IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					HV
IIC	IIC		JR	JJ	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					IZ
KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					JV
LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		KV
PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP				PV
PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL	PDSHL	PDRT	PDIT	PDT	PDY	PDE	PDP			PSV, PSE	PDV
QIC	QC		QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					OZ
RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW			TV
TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL	TDSHL	TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
			UR	UI	VSH	VSL	VSHL	VRT	VIT	VT	UY	VE					UV
			VR	VI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					VZ
WIC	WC	WCV	WR	WI	WDSH	WDSL	WDSHL	WDRT	WDIT	WDT	WDY	WDE					WZ
WDIC	WDC	WDCV	WDR	WDI													WDZ
			YR	YI	YSH	YSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					YZ
ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZDE					ZV
ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZDSL	ZDSHL	ZDRT	ZDIT	ZDT	ZDY						ZDV

† be used in the same fashion as S, switch, the  
the undefined case.

Other possible combinations:  
 (Restriction Orifice) PFR  
 (Control Stations) KQI  
 (Accessories) QOQ  
 (Scanning Recorder) WKIC  
 (Pilot Light) HMS  
 (Ratio) (Running Time Indicator)  
 (Rate-of-Weight Loss Controller)  
 (Hand Momentary Switch)

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