

Chemical Engineering Drawing Symbols

D. G. Austin

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Foreword

Throughout all stages of the design of a chemical plant, engineers of many disciplines communicate by reference to diagrams ranging from the simple block diagram, where process alternatives are screened and developed, to the comprehensive engineering line diagrams from which the plant is planned and fabricated. The graphic symbols employed in these diagrams need to be relatively simple and versatile, so that they may be easily modified to suit the particular design requirement; also their form should be representative of the equipment they describe.

This useful reference book has collected together graphic symbols from many standard documents and other sources and these have been arranged so that the selection of the appropriate symbol for formulation or interpretation of the many different flowsheets is easily accomplished. The existence of alternative symbols for the same item emphasises the need for further standardisation in this area and it is hoped that this publication has made a valuable contribution in this respect.

This book is recommended for undergraduate chemical engineering students, especially those embarking on design project work, and it is believed that it will also be useful to draughtsmen and process engineers employed in plant design offices in the chemical industry.

*Department of Chemical Engineering
The University of Aston in Birmingham*

G. V. Jeffreys

Preface

Process flow (PFD) and engineering line (ELD) diagrams are the chemical and process engineer's basic means of communication during the development, process and project engineering of plants. However, difficulties are frequently encountered in interpreting or formulating these diagrams. Such problems are primarily associated with the layout and use of graphic symbols employed to represent plant items and ancillary equipment, including control and instrumentation features of the process.

The types of question that arise are:

What does this symbol represent?

Which type of internals is employed in this distillation column?

Does a recognised symbol exist for a plate heat exchanger?

Two symbols are available for a diaphragm valve: which is preferred, and why?

Can it be shown graphically how the valve is actuated, with the type of fittings for connection to pipelines?

Frequent reference to the various different published systems of symbols to answer these questions distracts the designer from the continuity of the flowsheet. Moreover, confusion over symbol use and interpretation, as well as being time-consuming, can lead to serious mistakes which may be costly to rectify and, if they remain undetected, can result in inefficient or even unsafe plant.

Although flowsheets fulfil diverse functions, their chief use is to communicate a process design clearly and accurately with the minimum of effort on the part of those engaged in producing and interpreting them. The principal objective in compiling this book has been to ease these tasks by providing a comprehensive list of graphic symbols with examples to illustrate the way they are used.

Birmingham
October, 1978

DGA

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Foster-Wheeler Ltd
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Pullman Kellogg
Lurgi (UK) Ltd
George Wimpey ME & C Ltd

I would also like to thank the Institution of Chemical Engineers for permission to include the process flow diagram for a plant design to produce MEK from 2-Butanol.

D.G. Austin

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Introduction

To keep this compilation within manageable size it has been necessary to restrict the sources to existing British and American standards, together with a selection of symbols used by major industrial design offices. The use of standard symbols is recommended wherever possible, but the alternatives may be used in the absence of a standard symbol or where there is a need to convey more detailed information.

Although standards are periodically revised, the continuous introduction of an increasing variety of chemical plant equipment results in a time-lag in the formulation of acceptable symbols. The British Standards-Institution has recently published BS 1553: Part 1: 1977 *Graphical symbols for general engineering: piping systems and plant*.¹ This supersedes three earlier standards,^{1,3,6} with additions to update the existing symbols together with some minor changes, and should be used wherever possible.

However, symbols derived from the superseded standards are included in this book to aid interpretation of diagrams formulated before the new standard was issued. Symbols for heating and ventilating installations are not included, since they do not feature regularly in process flow and engineering line diagrams; again, the designer is referred to BS 1553; Part 1: 1977 which provides a comprehensive listing.

Inevitably, some symbols are omitted: industrial concerns often have their own 'standard' symbols which exhibit differences depending on personal preference and on the intended function of a particular drawing. Common experience is that contractors and manor manufacturers, while in favour of standardisation, are reluctant to change their established practice. Where symbols have not been standardised for equipment of recent design, Hill⁸ presents a method of creating effective symbols which may be usefully employed.

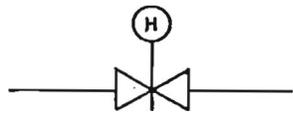
The information that a symbol should convey depends on the purpose of the drawing and it is thus an advantage if detail can be added progressively as the application commands: Figures 1 and 2 take the basic symbols for a valve and for a distillation column as they would appear in a PFO and illustrate in logical steps how the symbols may be developed for incorporation into an EIO.



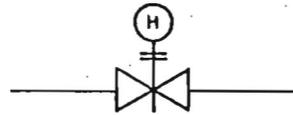
Valve - basic symbol



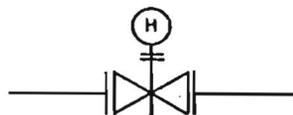
Wedge gate valve



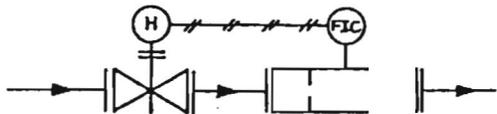
Gate valve used With an automatic actiVllllll element, with integral manual aClivllllll element



Similar valve which relains hI position on failure of the operating medium



The valve is shown connected to the pipeline by flanged/bolttld , jninlll



Th. direction O' fluid flow is shown and the llBLE valve Is incorporated into a feedback control loop consisting of an orifice plate and a flow indicator/ controller which applies corrective action to the valve via a pneumatic line

Figure 1 Example of progressive addition of detail to a basic symbol

The PFD should depict the major equipment together with the principal flow routes from raw material feed to final product. Key temperatures and pressures corresponding to anticipated normal operation are indicated throughout. Material flows and compositions, basic control systems and the design duties of major equipment may be included to give a comprehensive representation of the process in readily usable form. Figure 3 (facing page 70) provides an example of a PFD for a gas/liquid processing plant which has been drawn to the recommendations of the Institution of Chemical Engineers²¹ and the specifications of BS 5070: 1974.²² It has the following features:

- Major plant items are drawn to scale.
- Plant items are positioned in correct elevation relative to each other.
- The type of equipment is clearly indicated.
- Service headers are shown together at the top of the drawing.
- Service branch lines to items are drawn firmly but thinly, whereas all process flow lines are of the heavy type.
- Only the more important valves are shown and in this connection only the sizes of the more important pipelines need be indicated.
- The drawing is completed with an item list (of which there are several types).

ELDs are of fundamental importance in all phases of the life of the plant and serve as working documents in the engineering design and construction stage. Wells, Seagrave and Whitway²³ have listed the minimum information that an ELD should convey as follows:

1. All process equipment and piping required for start-up, shutdown, emergency and normal operation of the plant, including valves, blinds and removable spools.
2. An identification number, an identifier of the material of construction, diameter and insulation requirements for each line.
3. Direction of flow.
4. Identification of main process and start-up lines.
5. All instrumentation, control and interlock facilities with indication of action on instrument air failure.
6. Key dimensions or duties of all equipment.
7. Operating and design pressures and temperatures for vessels and reactors.
8. Equipment elevations.
9. Set pressures for relief valves.
10. Drainage requirements.
11. Special notes on piping configuration as necessary (e.g. 'no pockets', 'gravity drainage', etc.)

The designer will appreciate that the ELD is developed using the PFD as a basis drawing with subsequent addition of the necessary detail. Taking the PFD (Figure 3) for the 2-butanone (MEK) process which is described by Austin and Jeffreys,²⁴ this procedure has been adopted to produce the ELD for the solvent recovery part of the plant (Figure 4, page 73).

Abbreviations

Ace	accessory	MIN	minimum
AOV	air-operated valve	MP	medium pressure
ATM	atmosphere	NOZ	nozzle
BL	battery limit	OA	overload alarm
BW	butt weld	OS	overspeed
CL	centre line	OVHD	overhead
COMPR	compressor	PLGD	plugged
CONN	connection	RD	roof drain
CPLG	coupling	RF	raised face
CSC	car sealed closed	RO	restriction orifice
CSO	car sealed open	RTJ	ring-type joint
DIA	diameter	SCH	schedule
DIAG	diagram	<i>SID</i>	shutdown
DR	drain	SO	steam out
DWG	drawing	SP	spool piece
EL	elevation	STD	standard
EOV	electric motor operated valve	STM	steam
FLG	flanged	SW	socket weld
FF	flat faced	THD	threaded
HC	hose connection	TL	tangent line
HDR	header	TURB	turbine
HOV	hydraulic operated valve	TYP	typical
HP	high pressure	VAC	vacuum
INST	instrument	VT	vent
INT	interface	WDO	water draw-off
LC	locked closed	WN	weld neck
LO	locked open	WT	wall thickness
LP	low pressure	XS	extra strong
MAX	maximum	XXS	double extra strong

How to Use this Book

The text is divided into three arts:

- General equipment
- Piping systems
- Instrumentation and control

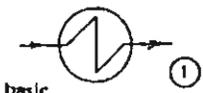
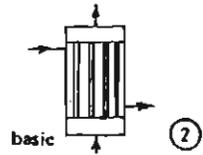
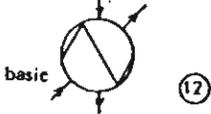
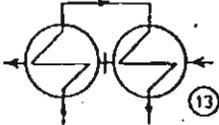
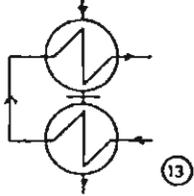
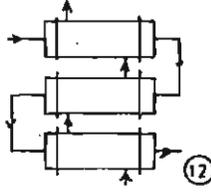
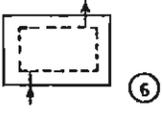
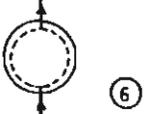
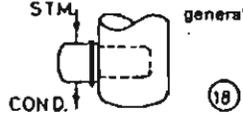
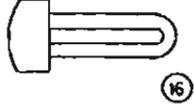
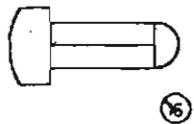
The principal categories of plant items appear as subheadings, and within each section the symbols are arranged alphabetically. Symbols in the first column are derived from British Standards and in the second from the American National Standards Institute; the last two columns list the symbols employed by selected industrial design offices.

Where the words 'basic' and 'general' appear beside symbols they have quite different implications. A *basic* symbol is one to which further graphic additions may be made to indicate the required detail, whereas a *general* symbol may be employed to represent all types of equipment in the particular category. The *source* of each symbol is given by a circled number referring to the references on page 92.

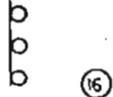
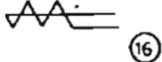
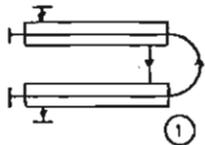
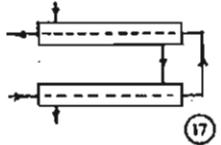
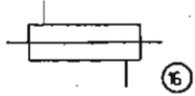
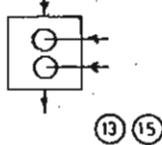
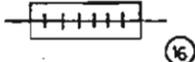
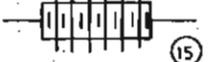
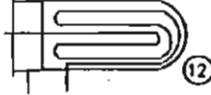
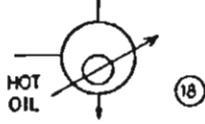
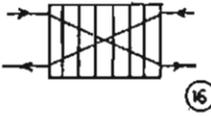
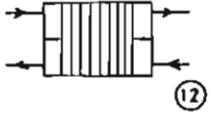
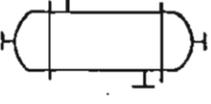
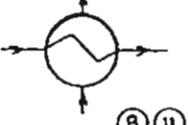
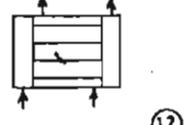
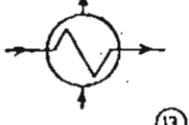
The size of symbols is not governed by standard specifications except for those relating to instrumentation diagrams. However, the main plant items in PFDs and ELDs should be drawn to convenient scale and designers should ensure that symbols are of sufficient size to avoid loss of detail if the diagrams are to be reduced.

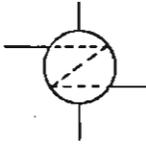
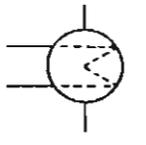
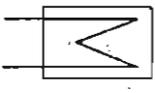
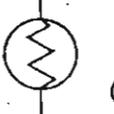
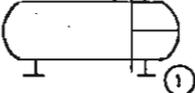
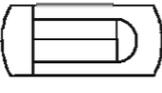
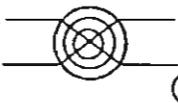
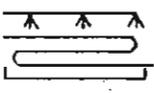
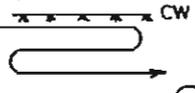
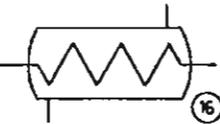
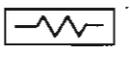
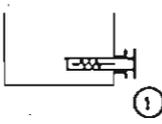
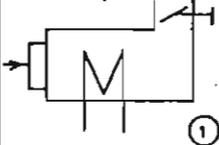
PART ONE

General Equipment

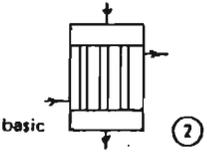
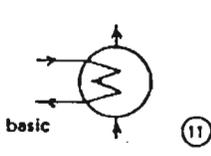
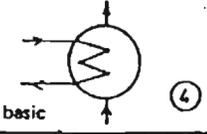
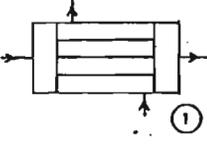
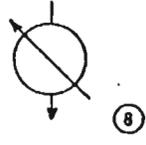
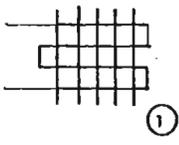
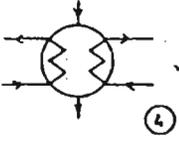
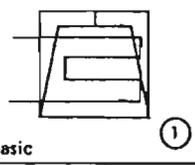
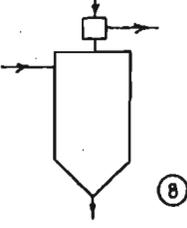
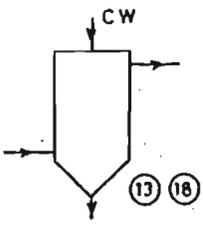
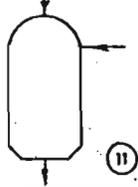
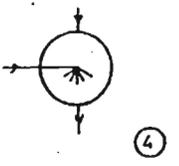
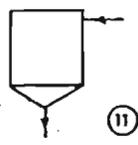
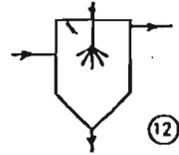
	BS	ANSI(ASA)	Alternative	Alternative
Heat exchanger	  			
Rack or bank exchanger				
horizontally stacked vertically stacked <i>Relative positions of connections to be shown.</i>				
Annular type (concentric tube)				
horizontal				
vertical				
See also Double pipe type.				
Bayonet (immersion) type				
with hairpin tubes				
with floating end plate				

4 HEAT TRANSFER
Heat exchangers (general)

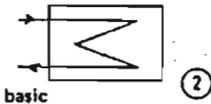
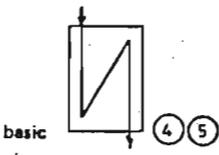
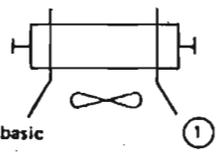
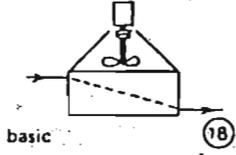
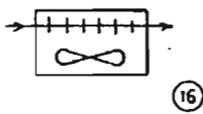
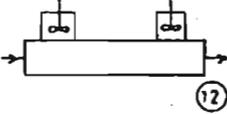
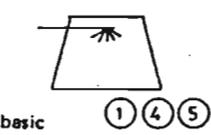
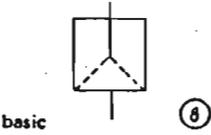
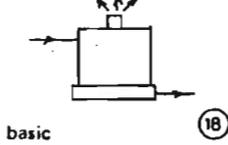
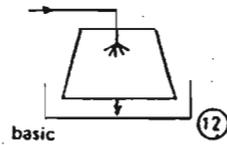
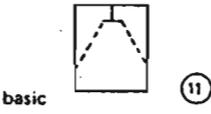
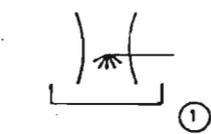
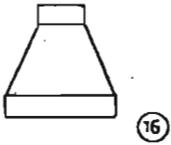
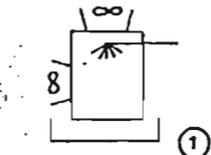
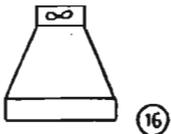
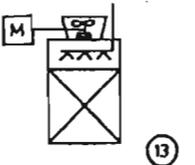
	BS	ANSI(ASA)	Alternative	Alternative
Coil (heating/cooling)	basic 			
	half pipe			
	full pipe			
	immersion coil			
Double pipe type			 	
Finned tube type			 	
Hairpin (U-tube) type <i>Relative positions of connections to be shown.</i>			 	
Kettle type				
Plate type			 	
Shell and tube fixed tube sheet			 	

	BS	ANSI(ASA)	Alternative	Alternative
<p>fixed tube sheet</p> <p><i>Baffles to be added where necessary.</i></p>			 <p>15</p>	 <p>15</p>
<p>horizontally mounted</p>	 <p>6</p>			
<p>vertically mounted</p>	 <p>6</p>			
<p>floating head (U-tube)</p>	 <p>1</p>		 <p>16</p>	
<p>Spiral type</p>			 <p>16</p>	
<p>Spray type</p> <p>See also Water-cooled exchanger.</p>			 <p>16</p>	 <p>18</p>
<p>Tube coil type</p>			 <p>16</p>	
<p>Electrical heater</p>	 <p>basic 1</p>			
<p>Tank heater</p>	 <p>1</p>			
<p>Cabin heater</p>	 <p>1</p>			

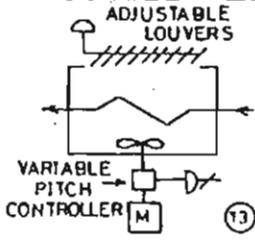
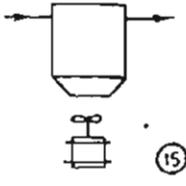
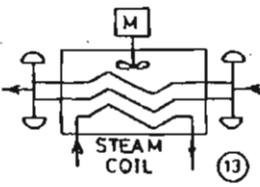
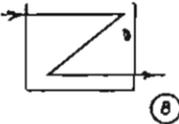
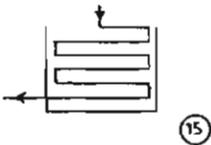
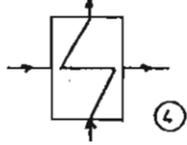
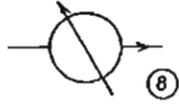
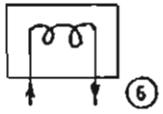
Condensers

	BS	ANSI(ASA)	Alternative	Alternative
<p>Surface condenser</p> <p>shell and tube type</p> <p>Steam flows in cross-flow arrangement over tubes.</p>				
				
<p>water-cooled</p>				
<p>air-cooled</p> <p>Natural/forced draft.</p>				
<p>water-cooled</p> <p>Divided on water side.</p>				
<p>Evaporative</p>				
<p>barometric type</p> <p>Used with steam jet ejectors for generation of vacuum.</p>				
				
<p>jet type</p> <p>Water sprayed directly into evacuated chamber.</p>				

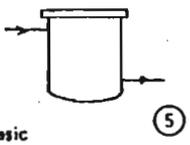
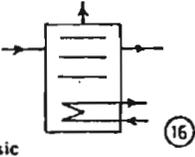
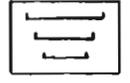
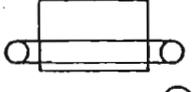
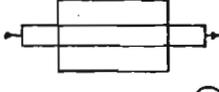
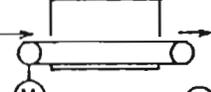
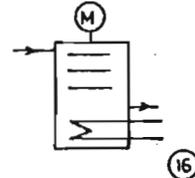
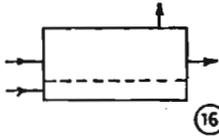
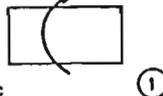
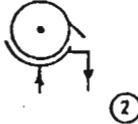
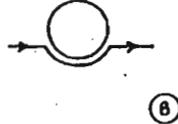
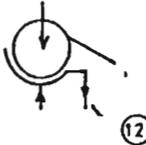
Coolers

	BS	ANSI(ASA)	Alternative	Alternative
Cooler	 basic ②			
Air-cooled exchanger	 basic ④ ⑤			
	 basic ①		 basic ⑱	
finned pipe type			 ⑯	 ⑫
			 ⑮	
Water cooler (cooling tower) Direct contact between water and air flowing countercurrently — draft may be forced, induced or natural.	 basic ① ④ ⑤	 basic ⑧	 basic ⑱	 basic ⑫
		 basic ⑪		
natural draft	 ①		 ⑯	
forced draft Show position of fan for forced draft (fan at air outlet) or induced draft (fan at air inlet).	 ①		 ⑯	 ⑬

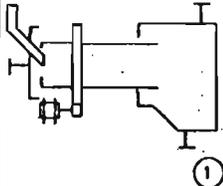
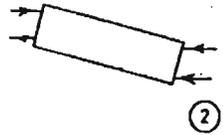
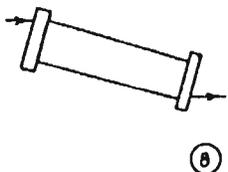
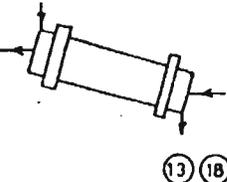
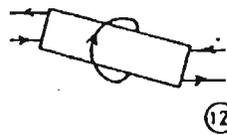
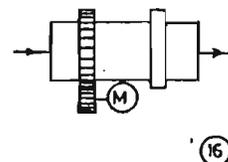
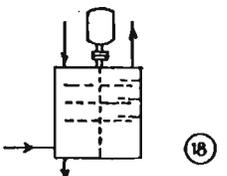
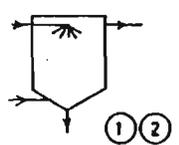
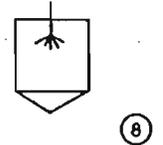
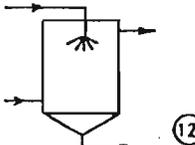
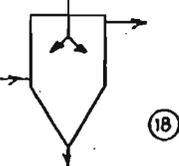
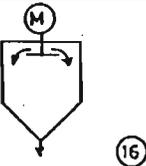
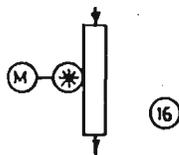
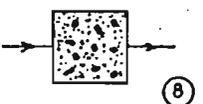
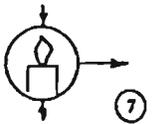
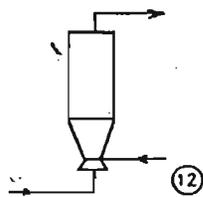
Coolers

	BS	ANSI(ASA)	Alternative	Alternative
Air cooler	forced draft		 <p>ADJUSTABLE LOUVERS VARIABLE PITCH CONTROLLER M 13</p>	 <p>15</p>
		induced draft		 <p>M STEAM COIL 13</p>
Box-type cooler		 <p>8</p>	 <p>15</p>	
Oil cooler		 <p>4</p>		
Water-cooled exchanger		 <p>8</p>		
Refrigeration exchanger		 <p>6</p>		

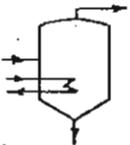
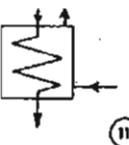
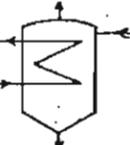
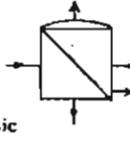
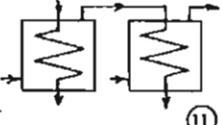
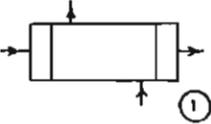
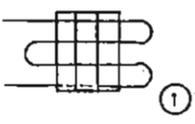
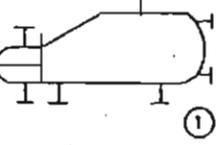
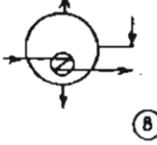
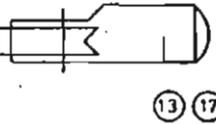
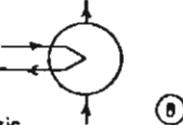
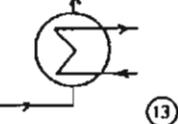
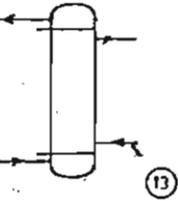
Dryers

	BS	ANSI(ASA)	Alternative	Alternative
Dryer	 basic ⑤		 basic ⑯	
Batch tray dryer Reheated, recirculated air passed over material placed on trays, which may be heated by steam coils.	 basic ① ②	 basic ⑧	 basic ⑰	 basic ⑫
drying oven	 ①			
hot gas dryer with trays	 ①			
Belt (continuous tunnel) dryer Material carried on belt or series of trays: suitable for vacuum unit.	 basic ①	 basic ⑧	 basic ⑰	
Disc dryer			 ⑰	
Fluidized bed dryer			 ⑰	
Rotary dryer	 basic ①			
rotary film dryer or flaker Used for solutions or slurries which are fed onto a steam-heated drum; dried product removed from drum using knife.	 ②	 ⑧	 ⑫	

Dryers

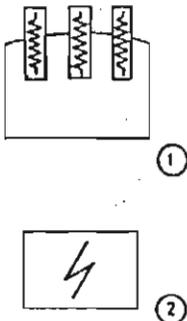
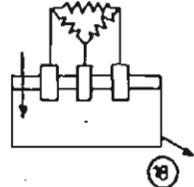
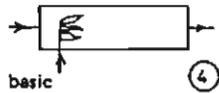
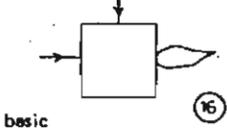
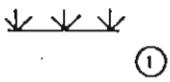
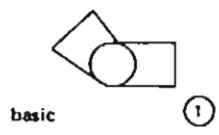
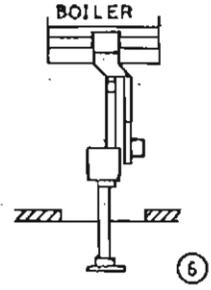
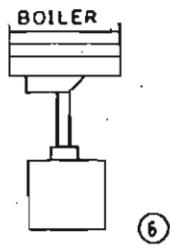
	BS	ANSI(ASA)	Alternative	Alternative
<p>rotary kiln or calciner</p> <p>Direct or indirect heating; if indirect, hot gases recirculated in an outer shell or through tubes inside the shell.</p>	 <p>①</p>  <p>②</p>	 <p>⑧</p>	 <p>⑬ ⑮</p>  <p>⑫</p>	 <p>⑯</p>
<p>rotary shelf dryer</p>			 <p>⑱</p>	
<p>Spray dryer</p> <p>Slurry atomized directly into hot gas which may flow counter-currently or concurrently; used when material degrades at high temperatures and when finely divided product is required.</p>	 <p>① ②</p>	 <p>⑧</p>	 <p>⑫</p>  <p>⑱</p>	 <p>⑯</p>
<p>Steam dryer</p>			 <p>⑱</p>	
<p>Dessicant</p> <p>Solid absorbents, e.g. silica gel or calcium chloride, in a packed bed for drying of gases; require regeneration.</p>		 <p>⑧</p>		
<p>Thermal dryer</p> <p>Directly heated.</p>	 <p>⑦</p>			
<p>Venturi dryer</p>			 <p>⑫</p>	

Evaporators

	BS	ANSI(ASA)	Alternative	Alternative
<p>Evaporator Includes natural and forced circulation units; most employ indirect steam heating with last effect operating under vacuum. See also Condensers.</p>	 <p>basic ②</p>	 <p>basic ⑪</p>	 <p>basic ⑫</p>	
	 <p>basic ④</p>			
<p>double-effect evaporator</p>		 <p>⑪</p>		
<p>water-chilling evaporator</p>	 <p>①</p>			
<p>air-cooling evaporator</p>	 <p>①</p>			
<p>Reboiler Natural or forced circulation from knock-out drum or distillation column; vaporization takes place on shell side.</p>	 <p>①</p>	 <p>⑧</p>	 <p>⑮</p>	 <p>⑬ ⑰</p>
<p>thermosyphon type</p>	 <p>basic ⑧</p>			
<p>horizontal thermosyphon</p>			 <p>⑬</p>	
<p>vertical thermosyphon Vaporization usually in tubes.</p>			 <p>⑬</p>	

Furnaces

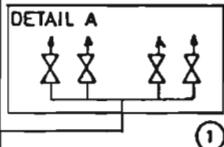
	BS	ANSI(ASA)	Alternative	Alternative
<p>Furnace or fired heater</p> <p>Show connections for fuel oil and/or fuel gas and/or steam. Add or subtract passes as required.</p> <p>CC = convection coil RC = radiant coil</p>				
<p>Solid fuel furnace (e.g. pulverized coal)</p>				
<p>Oil or gas furnace</p>				
<p>A-frame</p> <p>Inherently stiff structure used to reduce steel costs.</p>				
<p>box type</p> <p>Used for cracking hydrocarbons; flue gas recirculated.</p>				
<p>radiant type</p> <p>Single coil – other coils may be inserted and controlled independently.</p>				

	BS	ANSI(ASA)	Alternative	Alternative
Electric arc furnace	 <p>① ②</p>		 <p>⑩</p>	
Combustion chamber	 <p>basic ④</p>			
Burner			 <p>basic ⑫</p>	
oil burner	 <p>①</p>			
gas burner	 <p>①</p>			
Automatic stoker	 <p>basic ①</p>			
bunker type	 <p>⑥</p>			
hopper type	 <p>⑥</p>			

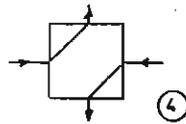
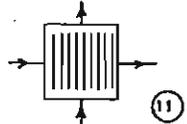
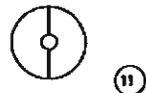
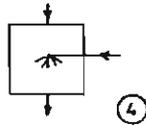
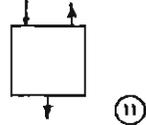
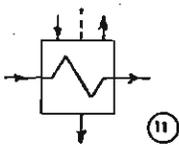
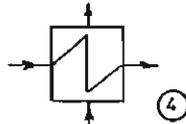
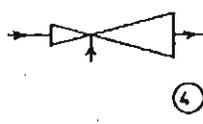
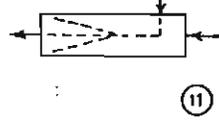
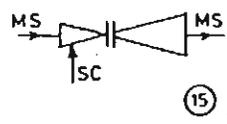
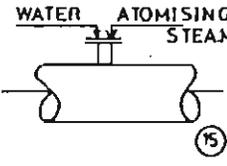
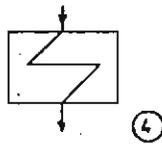
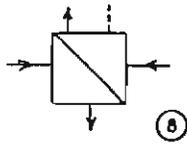
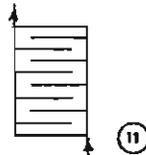
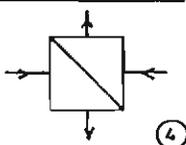
Boilers

	BS	ANSI(ASA)	Alternative	Alternative
Boiler				
boiler with economizer				
vertical boiler				
sectional-type boiler				
fire tube boiler				
Upshot heater				

Where complex burners are employed the 'burner block' may be detailed elsewhere on the drawing, thus:



Preheaters, desuperheaters, superheaters, reheaters

	BS	ANSI(ASA)	Alternative	Alternative	
Air preheater	plate or tubular type	 ④	 ⑪		
	rotating type		 ⑪		
Feed water heater	direct contact type	 ④	 ⑪		
	indirect contact type (with air outlet)		 ⑪		
Desuperheater/attenuator	surface type	 ④			
	spray type	 ④	 ⑪	 ⑮	
	'Rockwell' type			 ⑮	
Live steam superheater/reheater	<i>Additional connections may be shown as required for air, flue gas, etc.</i>	 ④	 ⑧		
	flue gas reheater (intermediate superheater)		 ⑪		
	live steam reheater	 ④			

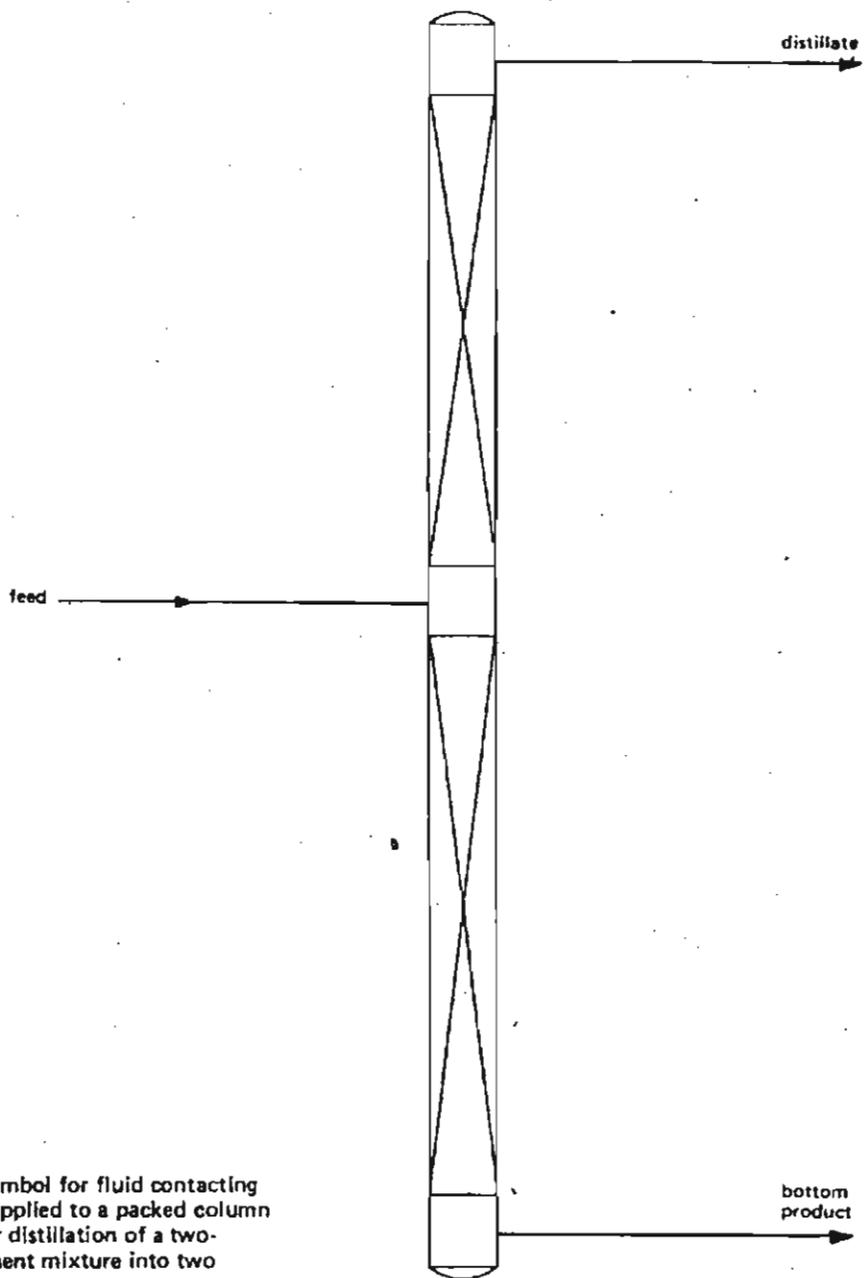
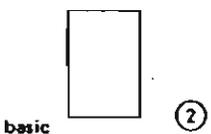
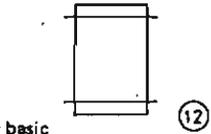
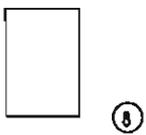
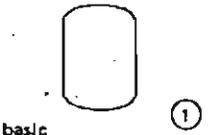
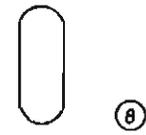
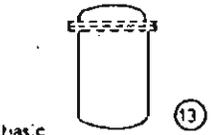
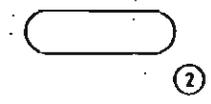
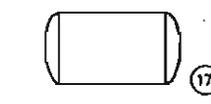
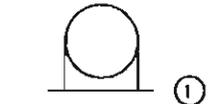
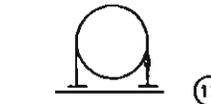
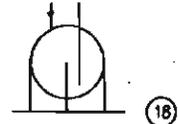
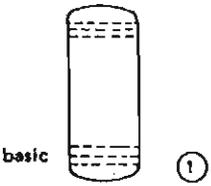
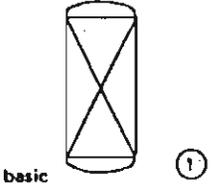
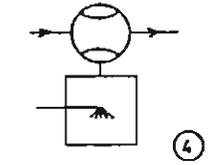
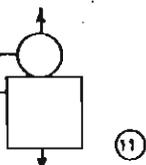
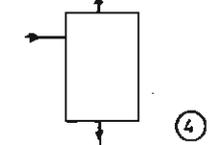
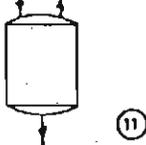
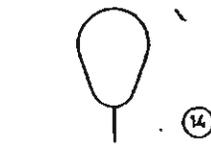


Figure 2a Basic symbol for fluid contacting device applied to a packed column used for distillation of a two-component mixture into two fractions

		BS	ANSI(ASA)	Alternative	Alternative
Vessel/unpacked column <i>Draw dished ends if vessel operates under pressure or vacuum.</i>					
Non-pressurized vessel <i>Any change in shape to be shown.</i>					
Pressure vessel <i>Outline to be representative of actual vessel shape. Add supports (saddle, skirt, etc.) if used. Show grade, level and give height of lowest part of vessel above it.</i>	vertical				
	horizontal				
	sphere				
Tray column					
Fluid contacting vessel See Figure 2.					
De-aerator					
Flash box					

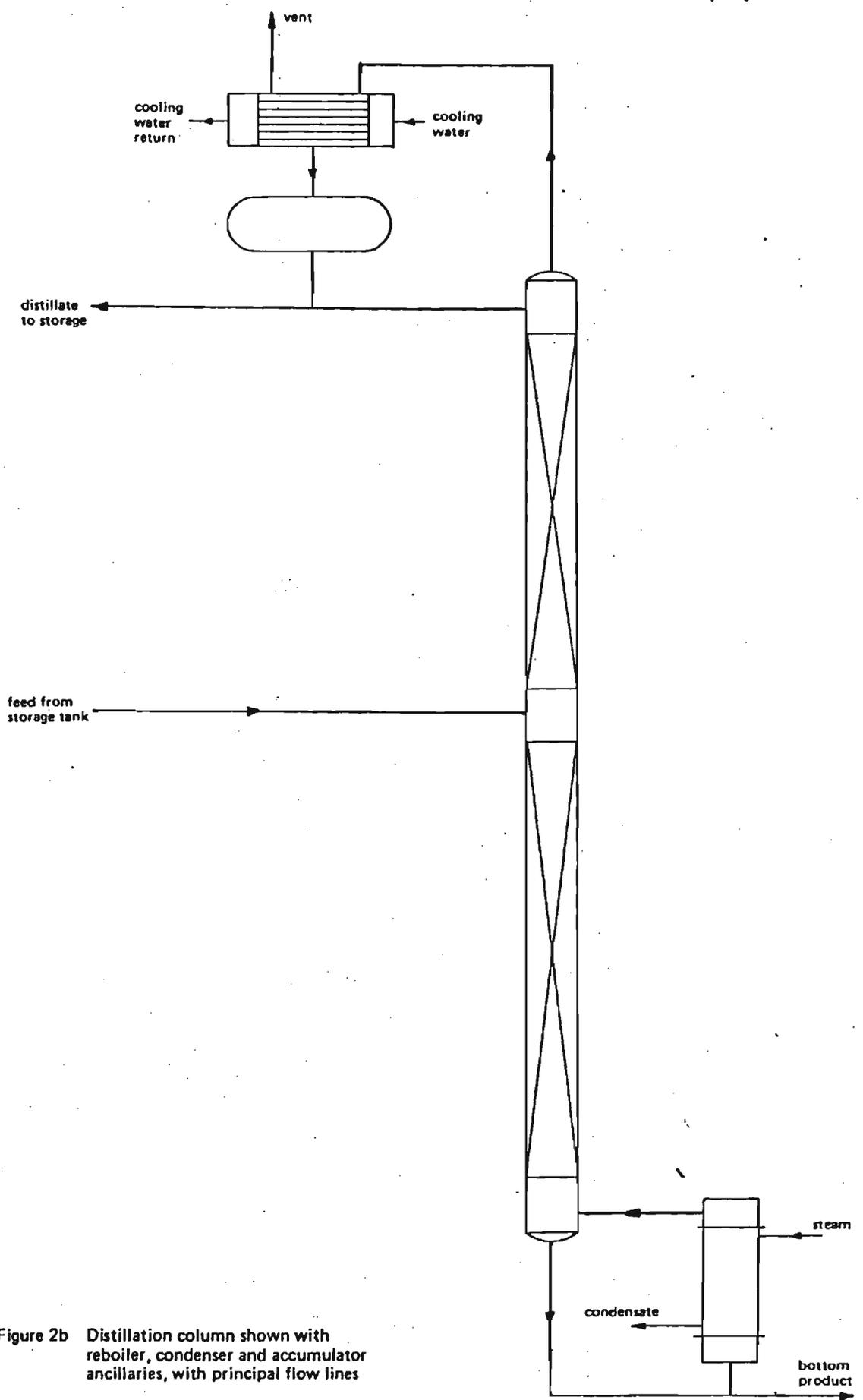


Figure 2b Distillation column shown with reboiler, condenser and accumulator ancillaries, with principal flow lines

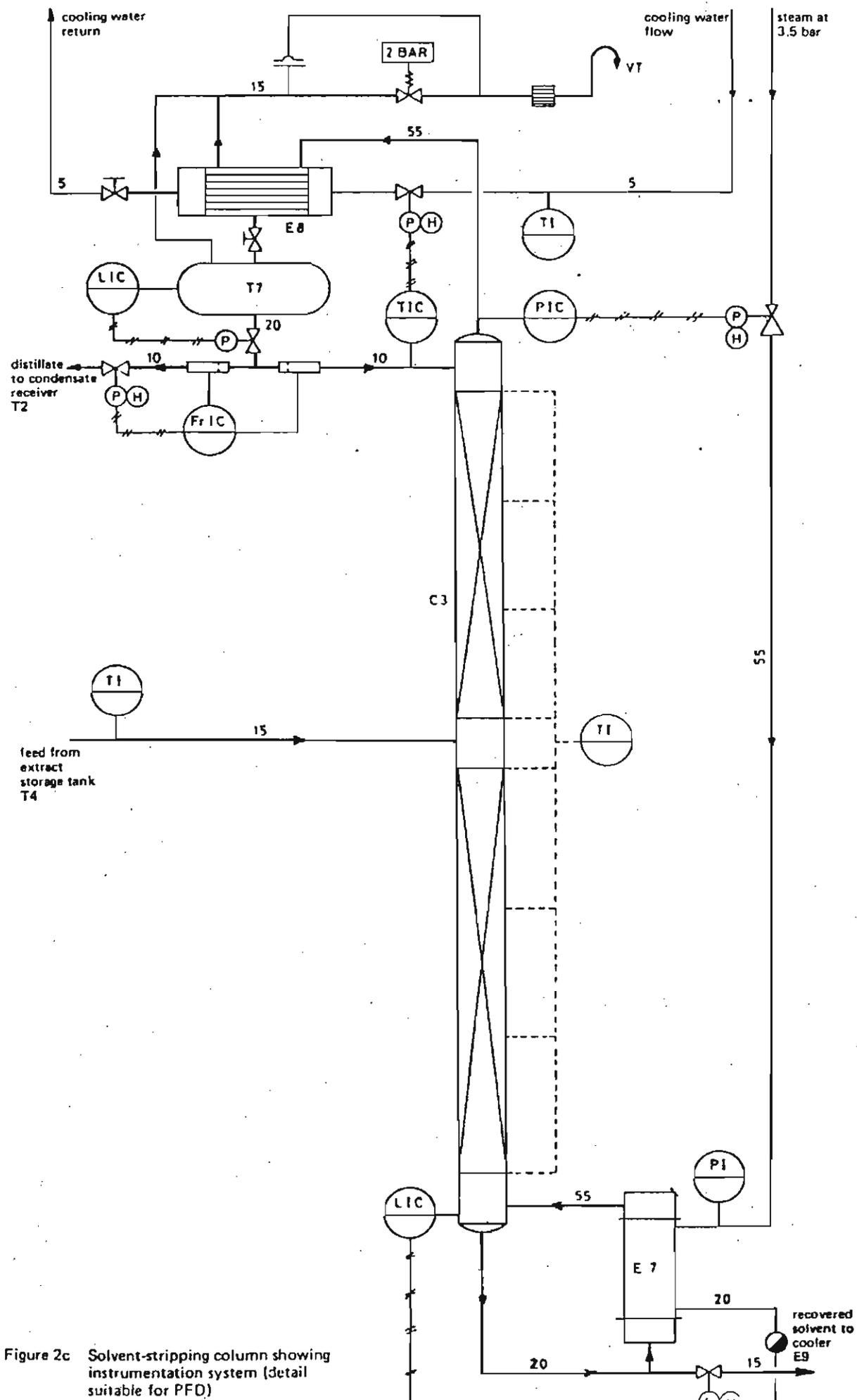
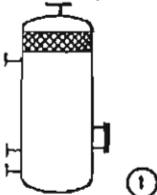
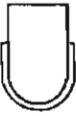
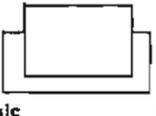
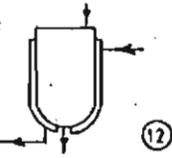
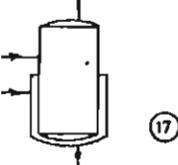
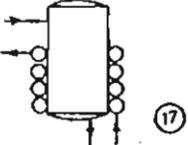
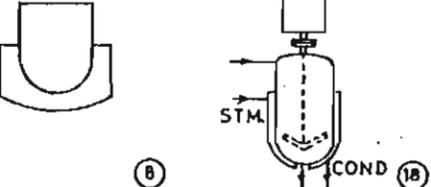
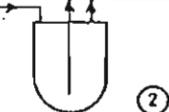
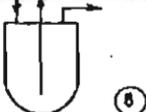
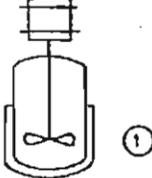
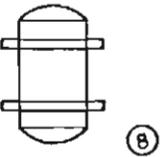
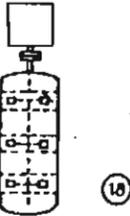
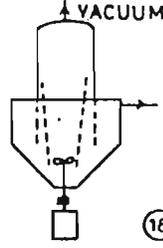
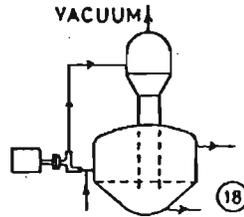
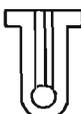
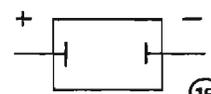
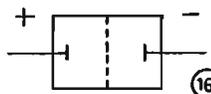
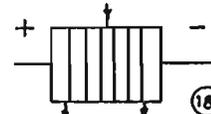
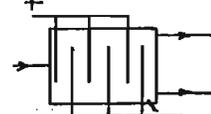


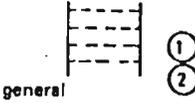
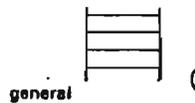
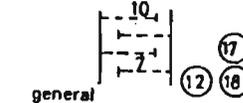
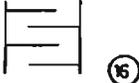
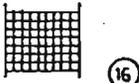
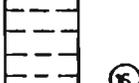
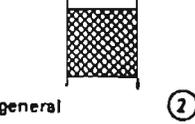
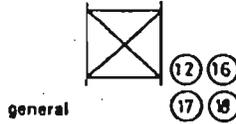
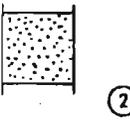
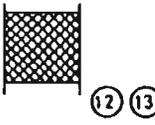
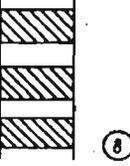
Figure 2c Solvent-stripping column showing instrumentation system (detail suitable for PFD)

Process vessels

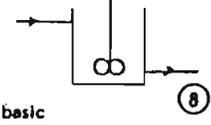
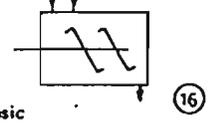
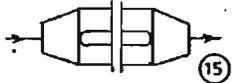
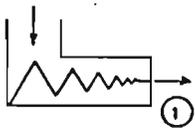
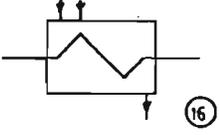
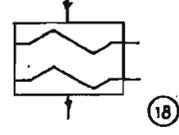
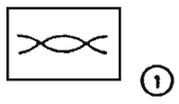
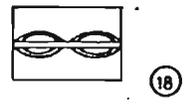
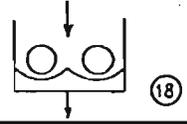
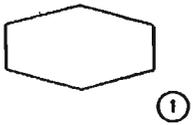
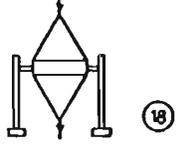
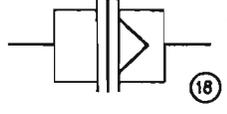
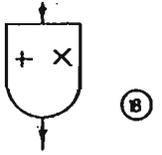
	BS	ANSI(ASA)	Alternative	Alternative	
<p>Knock-out drum See also Gas conditioning.</p>					
<p>Jacketed vessel</p> <p><i>Any change to be shown, baffle or limpet. Extent of jacket to be shown in proportion to vessel. Give diagrammatic representation of type of agitator – see Agitators.</i></p>	<p>basic</p> 	<p>basic</p> 	<p>basic</p> 		
					
	<p>annular type</p>				
	<p>limpet type</p>				
<p>Montejus or blowing egg</p>					
<p>Autoclave</p>	<p>basic</p> 	<p>basic</p> 			
<p>Extractor</p> <p><i>Symbol represents any type of liquid/liquid extraction equipment (mixer settlers, extraction columns, etc.)</i></p>					

	BS	ANSI(ASA)	Alternative	Alternative
Crystallizer				
	'Pachuca' type			(18)
				
				(18)
Reaction/absorption vessel	<p>Where it is necessary to show more than one layer of material, alternate hatching should be used.</p>			
	basic			(1)
	catalytic reactor			(8)
nuclear reactor				(8)
Electrolysis cell	without diaphragm			(16)
	with diaphragm			(16)
	series arrangement of cells			(18)
	parallel arrangement of cells			(18)

Vessel internals

	BS	ANSI(ASA)	Alternative	Alternative
<p>Separation trays</p> <p><i>Trays may be identified by numbers. Show bottom and top trays and any others to locate nozzles.</i></p>				
<p>cascade deflectors</p>				
<p>random packed tray</p>				
<p>stacked tray</p>				
<p>bubble cap tray</p>				
<p>sieve plate tray</p>				
<p>valve tray</p>				
<p>Packed bed</p>				
<p>catalyst chamber</p>				
<p>fluidized bed</p>				
<p>sectioned bed</p> <p><i>Used to represent more than one type of packing in vessel</i></p>				

Mixing vessels

	BS	ANSI(ASA)	Alternative	Alternative
Mixer				
'Durion' type mixer				
kneader				
ribbon blender				
roll blender				
double cone blender				
mixing nozzle				
pug mill				

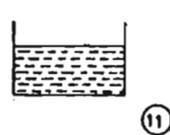
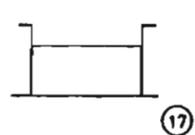
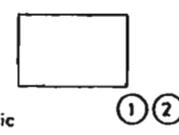
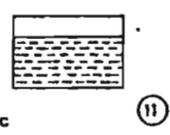
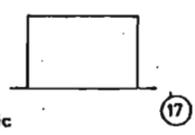
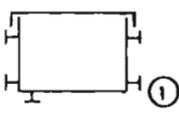
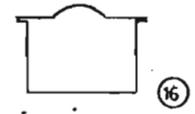
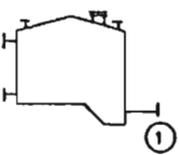
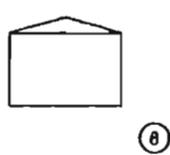
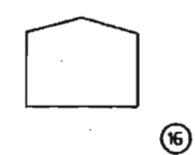
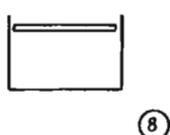
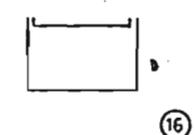
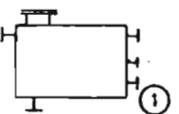
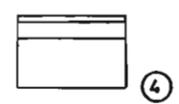
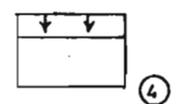
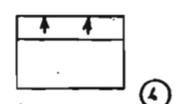
Agitators

	BS	ANSI(ASA)	Alternative	Alternative
Agitator (stirrør)				
	general  ①		general  ⑫	
anchor			 ⑫	
single blade			 ⑫	
double blade			 ⑫	
flat blade turbine			 ⑫	
finger			 ⑫	
gauge			 ⑫	
grid			 ⑫	
impeller			 ⑫	
paddle			 ⑫	
propeller			 ⑫	
scraper (for jacketed vessel)			 ⑫	
sparger			 ⑫	

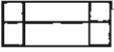
	BS	ANSI(ASA)	Alternative	Alternative
Gas holder	bell type basic ①	basic ⑧	basic ⑱	basic ⑲
	spherical/globe type ①	⑧	⑲	
	dry/piston type		⑲	
Air receiver	⑤			
Steam receiver	④			
Hopper, bunker, silo	basic ①	basic ⑧	basic ⑱	
	basic ②			
	basic ⑦			
	store/heap of material ②			
	stack of material ⑲			
bunker with vibrator ①				

See also Solid feeders.

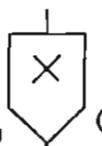
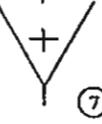
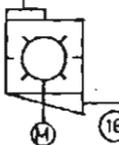
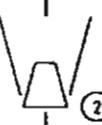
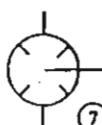
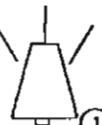
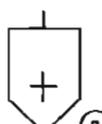
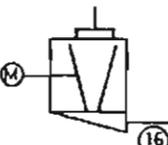
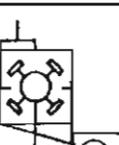
Storage vessels *Liquids*

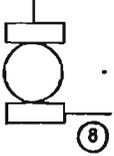
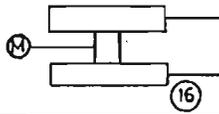
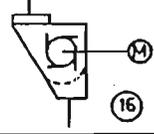
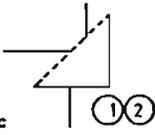
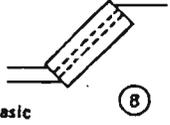
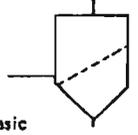
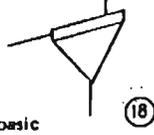
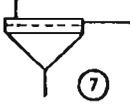
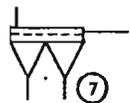
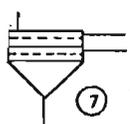
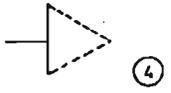
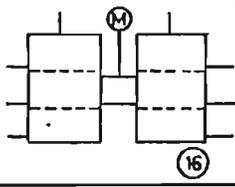
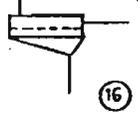
		BS	ANSI(ASA)	Alternative	Alternative
Tank	open tank				
	closed tank (flat roof)	 basic	 basic	 basic	
	covered tank				
	conical (fixed) roof				
	floating roof				
	domed roof				
	sealed tank				
	Closed tank	steam sealing type			
vacuum type					
pressure type					

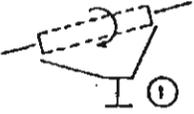
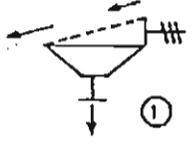
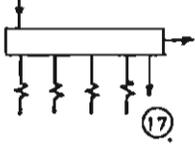
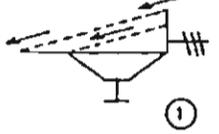
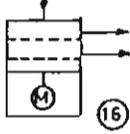
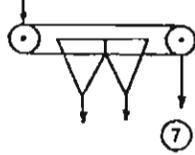
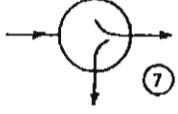
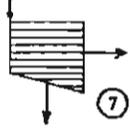
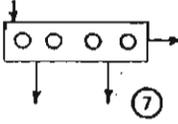
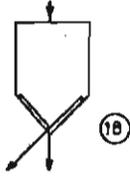
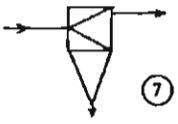
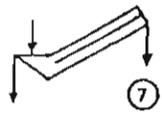
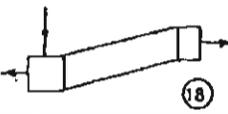
Storage vessels Low capacity

	BS	ANSI(ASA)	Alternative	Alternative
Air bottle				
Case				
Barrel/cask				
Drum				
Sack				

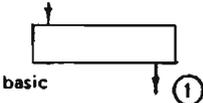
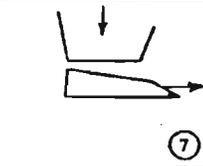
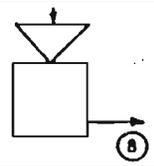
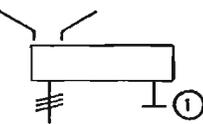
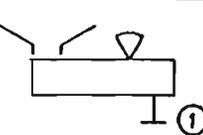
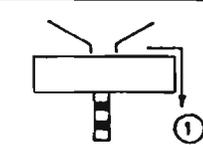
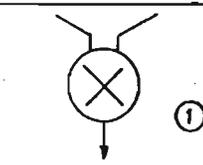
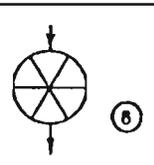
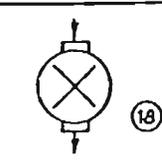
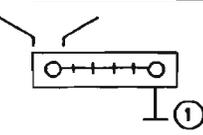
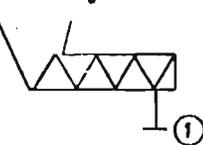
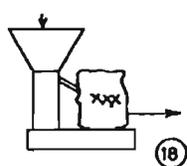
Comminution Coarse/intermediate crushers

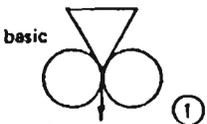
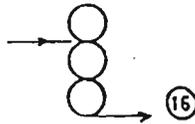
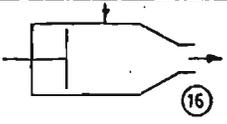
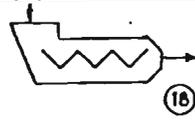
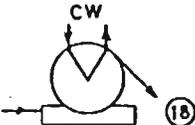
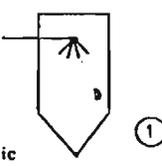
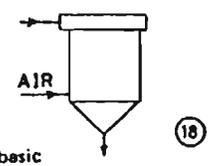
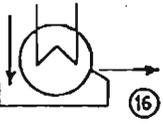
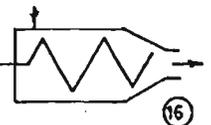
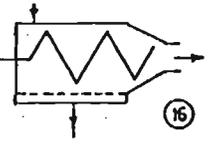
	BS	ANSI(ASA)	Alternative	Alternative
Crusher	 <p>general ①</p>		 <p>general ⑩</p>	
Coarse crusher	 <p>breaker (large material) ⑦</p>		 <p>⑩</p>	
	 <p>②</p>			
	 <p>⑦</p>			
	 <p>①</p>		 <p>⑩</p>	
Intermediate crusher	 <p>general ⑦</p>			
			 <p>⑩</p>	
	 <p>① ②</p>	 <p>⑧</p>	 <p>⑩</p>	
	 <p>① ②</p>		 <p>⑩</p>	
	 <p>① ②</p>	 <p>⑧</p>		

	BS	ANSI(ASA)	Alternative	Alternative
Fine crusher	grinder			
	pulverizer			
	rod mill			
	shredding mill			
Screen				
	one under-product			
	two under-products			
	double-deck screen			
	open-ended screen			
	classifying screen			
	reciprocating screen			

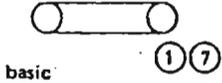
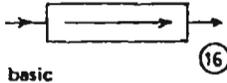
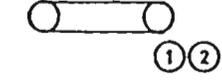
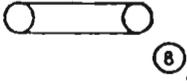
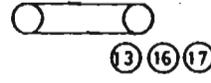
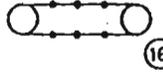
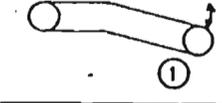
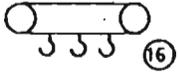
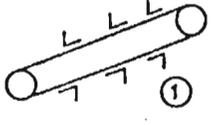
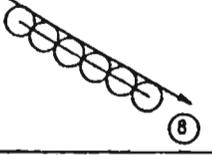
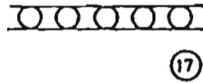
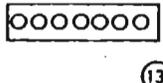
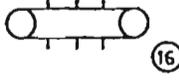
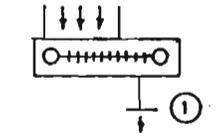
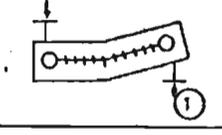
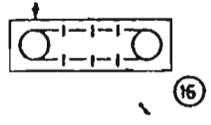
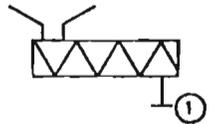
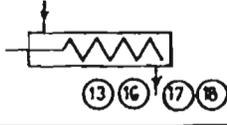
	BS	ANSI(ASA)	Alternative	Alternative
rotary screen				
vibrating screen (single-deck)				
vibrating screen (double-deck)				
Dry classifier				
picking belt				
picking table (circular)				
concentrating table				
dry cleaner				
air classifier				
cyclone classifier				
mechanical classifier				

Solid feeders

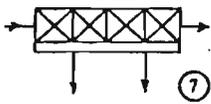
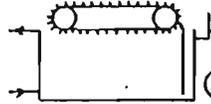
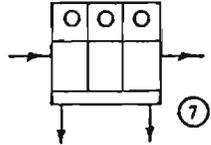
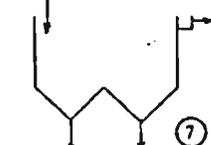
	BS	ANSI(ASA)	Alternative	Alternative
Feeder	 <p>basic ①</p>			
feeder and hopper	 <p>⑦</p>	 <p>⑧</p>		
vibrator feeder	 <p>①</p>			
weigh feeder	 <p>①</p>			
rotary table feeder	 <p>①</p>			
rotary valve feeder	 <p>①</p>	 <p>⑧</p>	 <p>⑱</p>	
scraper feeder	 <p>①</p>			
screw feeder	 <p>①</p>			
Bagger			 <p>⑱</p>	

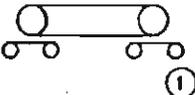
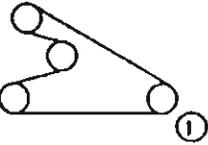
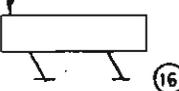
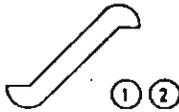
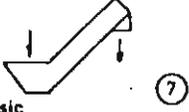
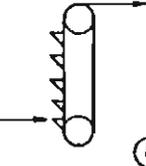
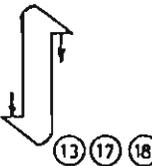
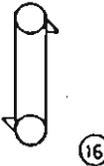
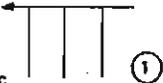
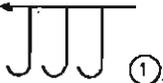
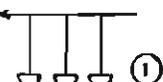
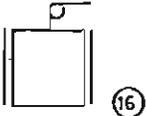
	BS	ANSI(ASA)	Alternative	Alternative
Briquetting machine	basic 			
Calender				
Extrusion press				
Flaker				
Prill tower	basic 		basic 	
Rotary cooled shredder				
Worm press	without filter			
	with filter			

Conveying, lifting

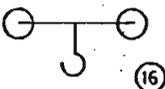
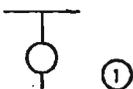
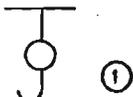
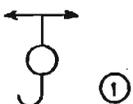
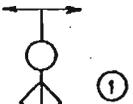
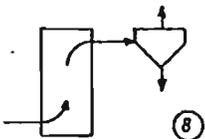
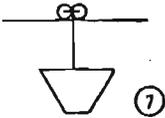
	BS	ANSI(ASA)	Alternative	Alternative
Conveyor				
belt conveyor				
link belt conveyor				
boom loader				
hook conveyor				
inclined conveyor (with chevrons)				
roller conveyor				
scraper conveyor				
scraper conveyor (en masse)				
inclined scraper conveyor				
scraper chain conveyor				
screw conveyor				

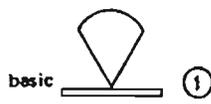
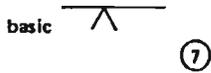
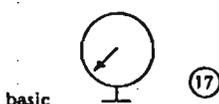
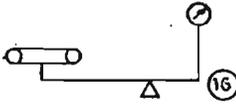
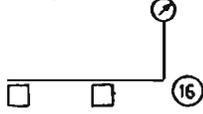
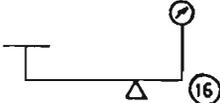
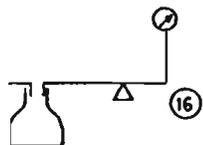
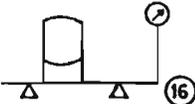
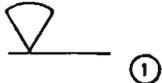
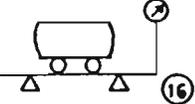
Classification *Wet medium*

	BS	ANSI(ASA)	<i>Alternative</i>	<i>Alternative</i>
<p>Wet classifier</p> <p>froth flotation cell</p> <p>jig washer</p> <p>'spitzkasten'</p> <p>trough washer</p>				
				
				
				

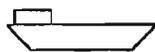
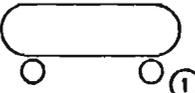
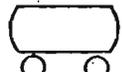
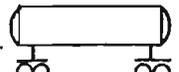
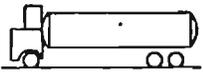
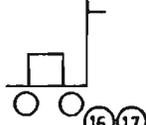
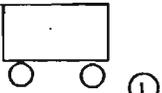
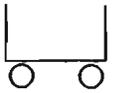
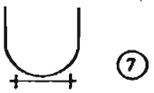
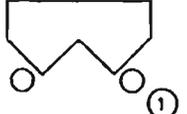
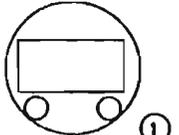
	BS	ANSI(ASA)	Alternative	Alternative
shuttle conveyor				
tripper conveyor				
vibrating conveyor				
Elevator	<p>basic</p>   <p>basic</p>			
bucket elevator				
Skip hoist	<p>basic</p> 			
Overhead conveyor	<p>basic</p> 			
with hooks				
with buckets/ carriers				
Lift				

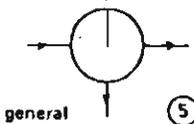
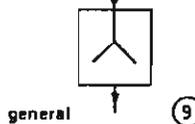
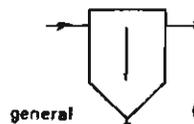
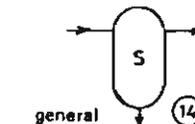
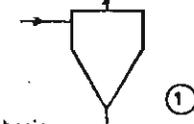
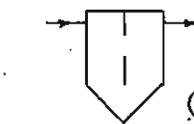
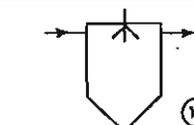
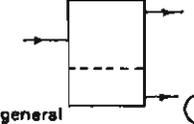
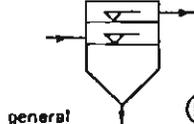
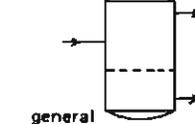
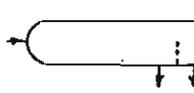
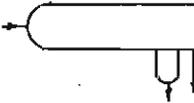
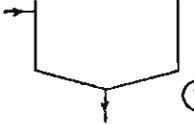
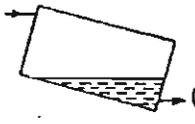
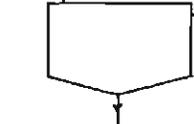
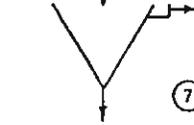
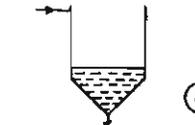
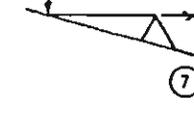
Conveying, lifting

	BS	ANSI(ASA)	Alternative	Alternative
Crane				
Hoist	basic			
	fixed hoist with hook			
	travelling hoist with hook			
	travelling hoist with grab			
Air lift				
Aerial ropeway				
	<p><i>Eduardo H. Martin Bellon</i> <i>Consulting Engineer</i> <i>C.S.A.C.</i></p>			

	BS	ANSI(ASA)	Alternative	Alternative
Weighing machine	 			
belt weigher				
electrical weigher				
platform scale				
sack weigher				
tank weigher				
weighbridge				

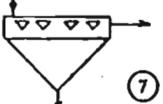
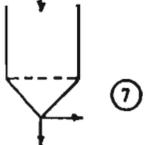
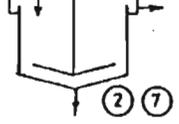
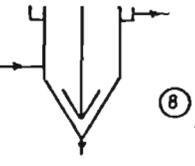
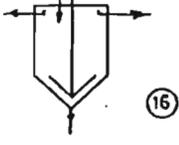
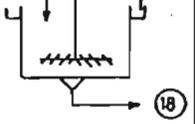
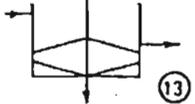
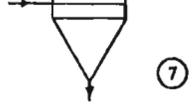
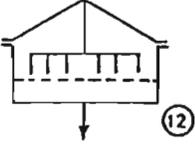
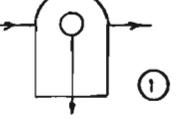
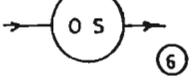
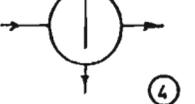
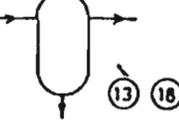
Transportation

		BS	ANSI(ASA)	Alternative	Alternative
Ship				 (16)	
Tanker	road/rail	 (1)			
	tank wagon			 (16)	 (17)
	road tanker			 (17)	
Truck	fork lift truck			 (16) (17)	
	platform truck			 (16)	
	sack truck			 (16)	
Wagon	tub/bogey	 (1)		 (16)	
	tub mine car	 (7)			
	bottom hopper wagon	 (1)			
	rotary tipper for wagons	 (1)			

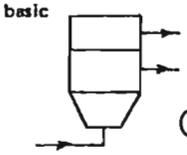
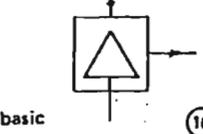
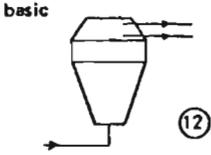
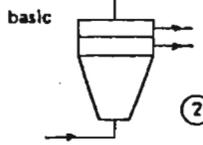
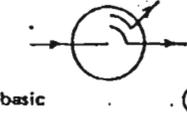
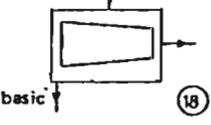
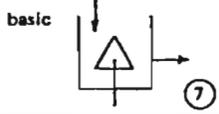
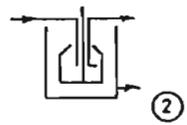
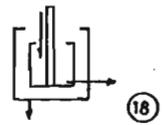
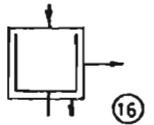
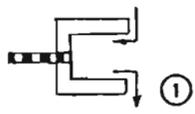
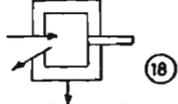
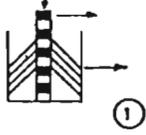
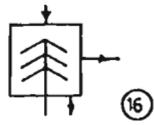
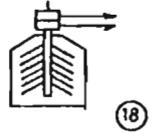
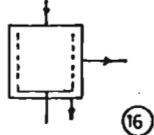
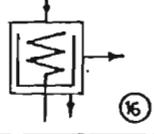
	BS	ANSI(ASA)	Alternative	Alternative
Separator				
cyclone and hydrocyclone				
baffle-type separator				
spray-type separator				
Liquid separator				
decanter (with surge chamber)				
drum (with water draw-off)				
Settling tank				
conical settling tank				
settling pond				

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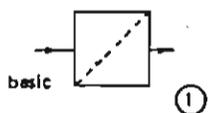
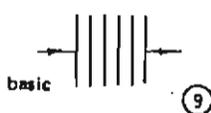
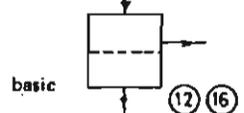
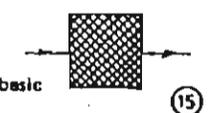
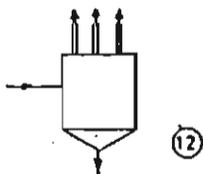
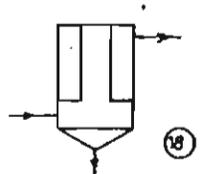
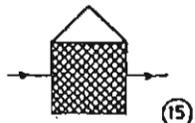
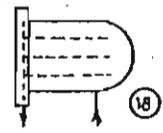
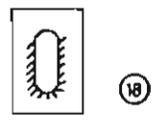
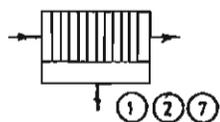
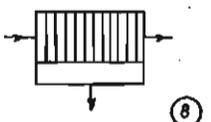
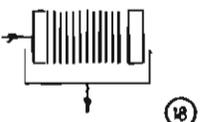
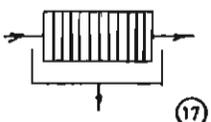
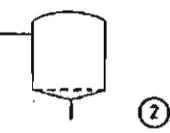
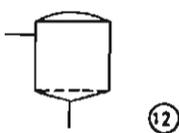
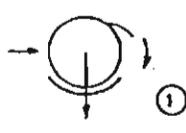
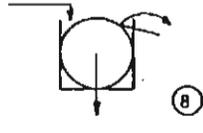
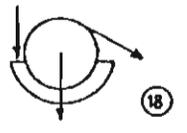
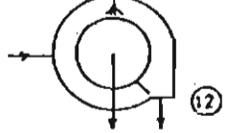
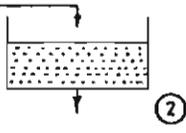
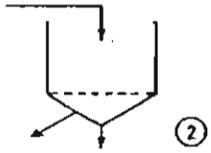
Solid/liquid separation (miscellaneous)

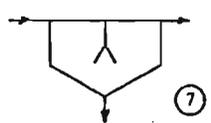
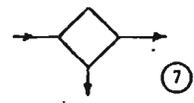
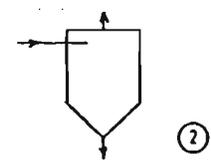
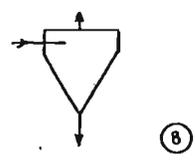
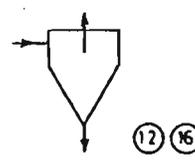
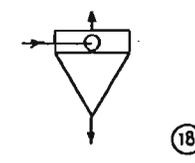
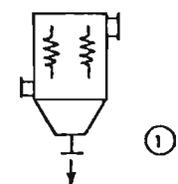
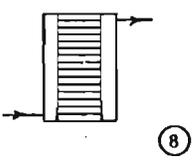
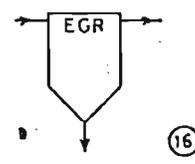
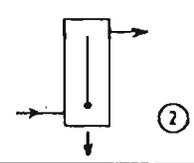
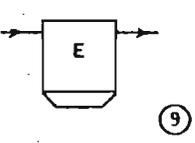
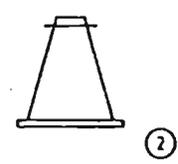
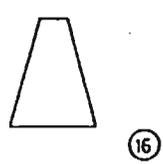
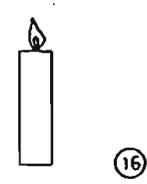
	BS	ANSI(ASA)	Alternative	Alternative	
Dewatering screen					
Drainage bunker					
Pump sump					
Thickener	rake type				
					
	cyclone thickener				
	hooded Nutsch with stirrer				
Oil separator					
					
Steam separator					
					

Centrifuge
True axis of machine to be shown.

	BS	ANSI(ASA)	Alternative	Alternative
	 <p>basic ①</p>	 <p>basic ⑧</p>	 <p>basic ⑯</p>	 <p>basic ⑫</p>
	 <p>basic ②</p>		 <p>basic ④</p>	 <p>basic ⑱</p>
	 <p>basic ⑦</p>			
basket centrifuge/hydroextractor	 <p>②</p>		 <p>⑱</p>	 <p>⑯</p>
horizontal peeler type	 <p>①</p>		 <p>⑱</p>	
disc bowl type	 <p>①</p>		 <p>⑯</p>	 <p>⑱</p>
basket type with perforated drum			 <p>⑯</p>	
scroll type			 <p>⑯</p>	

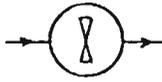
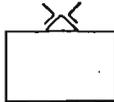
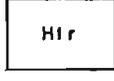
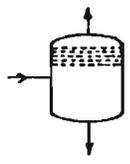
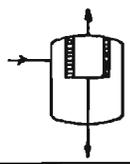
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Filtration

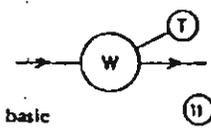
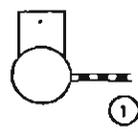
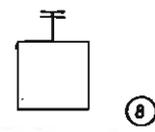
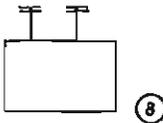
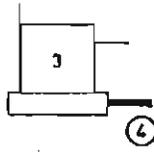
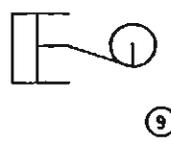
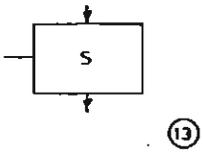
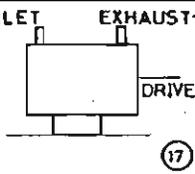
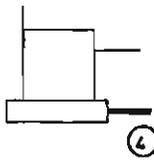
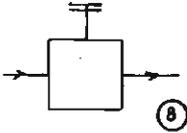
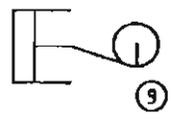
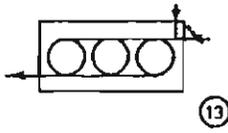
		BS	ANSI(ASA)	Alternative	Alternative
Filter	simple batch type <i>Extra connections for washing, etc., to be shown.</i>	 basic ①	 basic ⑨	 basic ⑫ ⑯	 basic ⑮
	bag type			 ⑫	 ⑱
	filter with hood (i.e. inlet to air compressor)			 ⑮	
	leaf filter			 ⑱	
	oil bath filter			 ⑱	
	filter press	 ① ② ⑦	 ⑧	 ⑱	 ⑰
	pressure filter	 ②		 ⑫	
	rotary vacuum filter	 ①	 ⑧	 ⑱	 ⑫
	sand filter	 ②			
	suction filter	 ②			

	BS	ANSI(ASA)	Alternative	Alternative
Dust collector				
De-duster				
Dust aspiration point				
Cyclone				
Electrostatic precipitator				
				
chimney				
flare stack				

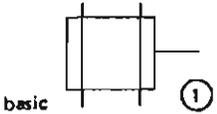
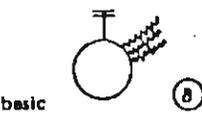
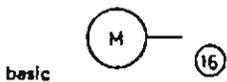
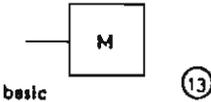
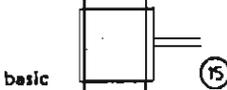
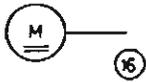
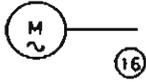
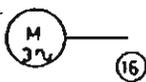
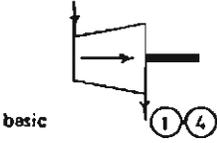
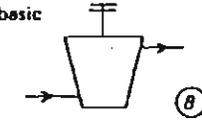
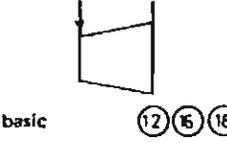
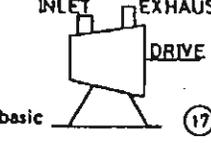
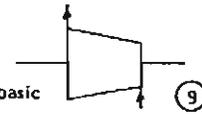
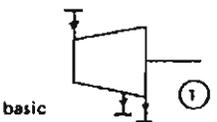
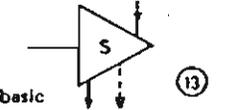
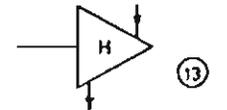
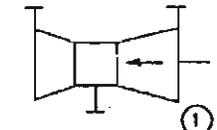
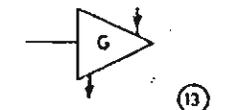
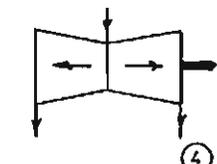
44 PHYSICAL SEPARATION

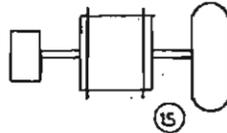
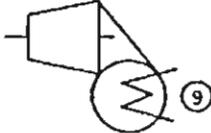
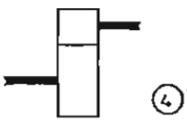
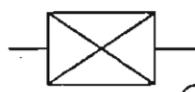
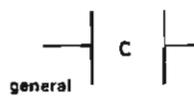
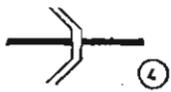
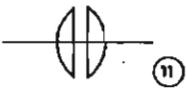
Gas conditioning

	BS	ANSI(ASA)	Alternative	Alternative
Conditioner	 7			
Humidifier/dehumidifier	 1  6			
Water spray	 1 2  6  7			
Moisture eliminator plates	 6			
Demisting pad			 14 15	
Mist eliminator	mesh type		 18	
	brink type		 18	

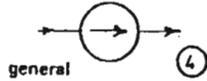
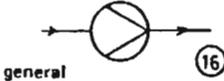
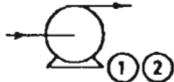
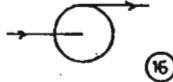
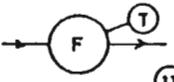
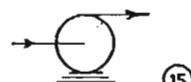
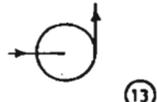
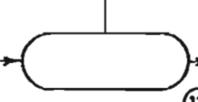
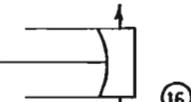
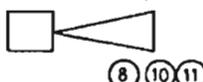
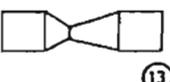
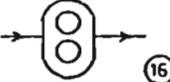
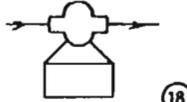
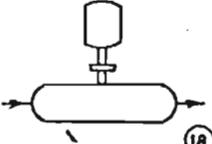
	BS	ANSI(ASA)	Alternative	Alternative
<p>Driver</p> <p>The following letters may be placed within a circle attached to the symbol for the equipment to be driven to indicate how power is supplied:</p> <p>M = motor; T = turbine; E = steam engine; G = gas engine; D = diesel engine. Illustrated: turbine-driven water pump.</p>				
<p>Engine</p> <p>single drive (reciprocating)</p>				
<p>dual drive</p>				
<p>steam engine</p> <p>Number of cylinders may be shown by a figure within the symbol.</p>				
<p>reciprocating steam engine cylinder</p> <p>Any number of these symbols may be combined to show a complete engine. Illustrated: 4-cylinder triple expansion engine.</p>				
<p>steam piston</p>				
<p>gas engine</p> <p>Letters adjacent to symbol indicate: S = supercharger; D = diesel.</p>				

Prime movers Motors, turbines, couplings

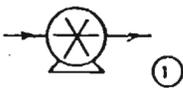
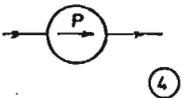
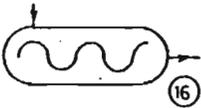
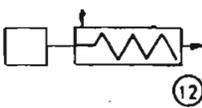
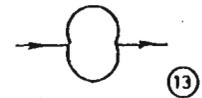
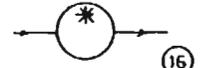
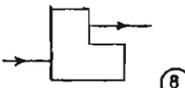
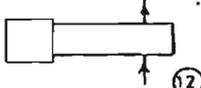
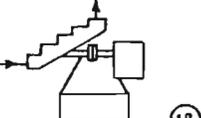
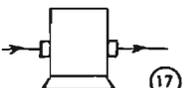
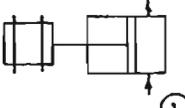
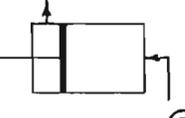
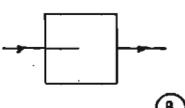
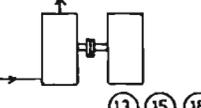
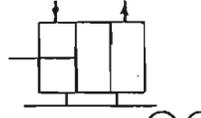
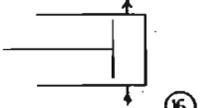
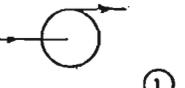
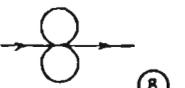
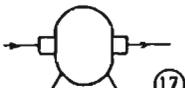
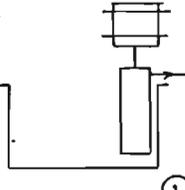
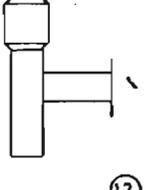
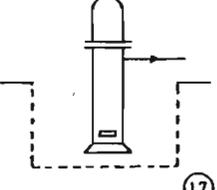
	BS	ANSI(ASA)	Alternative	Alternative
Electric motor	 basic ①	 basic ⑧	 basic ⑯	 basic ⑬
			 basic ⑮	
DC motor			 ⑯	
single-phase AC motor			 ⑯	
3-phase AC motor			 ⑯	
Turbine <i>Following letters indicate turbine fluid: S = steam; H = hydraulic; G = gas.</i>	 basic ① ④	 basic ⑧	 basic ⑫ ⑮ ⑱	 basic ⑰
	 basic ⑨			
<i>Show total number of exhaust lines.</i>	 basic ①		 basic ⑬	
hydraulic type			 ⑬	
gas turbine	 ①		 ⑬	
double flow gas turbine	 ④			

	BS	ANSI(ASA)	Alternative	Alternative
turbo-generator				(15)
condensing turbine				(9)
Gearing				(16) (13)
Coupling				(13) (15)
clutch				(4)
hydraulic coupling				(11)
mechanical coupling				(1) (4)

Pumps

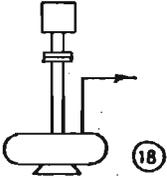
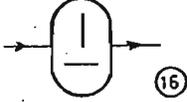
	BS	ANSI(ASA)	Alternative	Alternative
<p>Pump Conventionally, driver is shown on pump symbol only if it is not electrical.</p>				
				
<p>centrifugal pump</p> <p>Letters may be used to denote service: F = boiler feed; V = air; S = service; O = oil; D = condensate; C = circulated water.</p>				
				
horizontal mounted				
vertical mounted				
diaphragm				
ejector/injector /airlift				
gear pump				
				
in-line pump				
Metering pump: see Proportioning pump.				

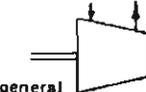
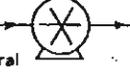
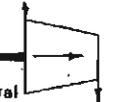
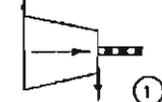
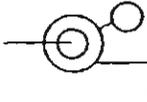
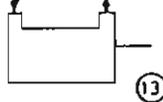
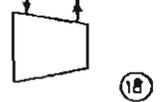
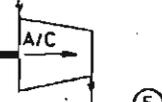
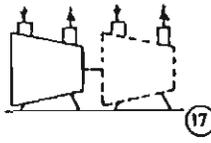
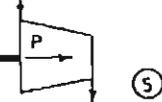
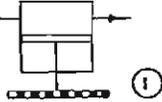
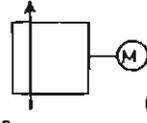
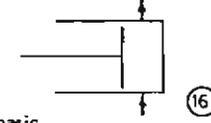
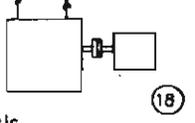
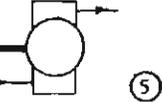
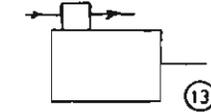
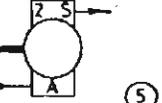
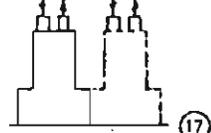
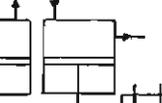
Pumps

	BS	ANSI(ASA)	Alternative	Alternative
<p>positive displacement (mono) pump (sometimes known as Screw pump)</p>	 ①  ④		 ⑯  ⑮	 ⑫  ⑬
<p>hydraulic pump</p>			 ⑯	
<p>proportioning (metering) pump</p>		 ⑧	 ⑫  ⑱	 ⑰
<p>reciprocating pump (for liquids/gases operating under pressure/vacuum)</p>	 ①  ②	 ⑧	 ⑬ ⑮ ⑱  ⑫ ⑰	 ⑯
<p>duplex type</p>			 ⑮	
<p>rotary pump</p>	 ①	 ⑧	 ⑮	 ⑰
<p>submerged suction pump</p>	 ①		 ⑫	 ⑰

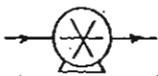
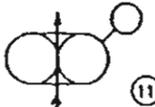
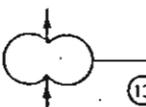
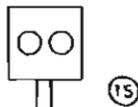
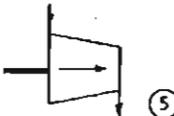
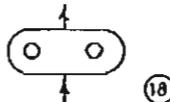
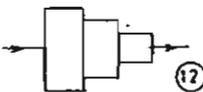
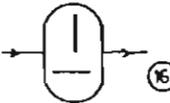
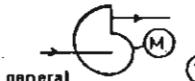
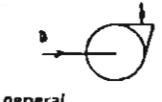
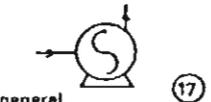
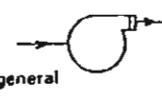
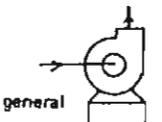
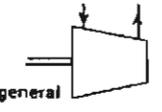
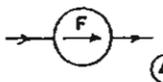
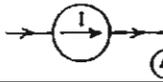
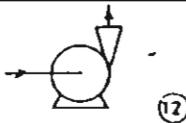
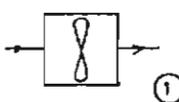
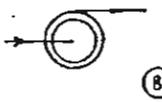
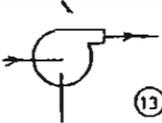
50 PRIME MOVERS, PUMPS, COMPRESSORS

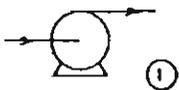
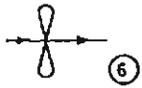
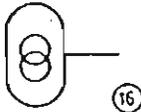
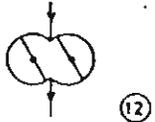
Pumps

	BS	ANSI(ASA)	<i>Alternative</i>	<i>Alternative</i>
submerged suction pump				
vane pump				

	BS	ANSI(ASA)	Alternative	Alternative
Compressor	 <p>general ①</p>		 <p>general ⑮</p>	 <p>general ⑯</p>
	 <p>general ②</p>			
	 <p>general ④</p>			
	 <p>general ⑦</p>			
axial flow/ centrifugal compressor	 <p>⑪</p>	 <p>⑪</p>	 <p>⑬</p>	 <p>⑱</p>
A - axial; C - centrifugal. Show connection to driver. Show further stages as required.	 <p>⑤</p>		 <p>⑰</p>	
positive displacement compressor	 <p>⑤</p>			
reciprocating compressor	 <p>basic ①</p>	 <p>basic ⑪</p>	 <p>basic ⑯</p>	 <p>basic ⑱</p>
In the upper rectangle the number of stages is indicated by a figure and letter S; in the lower rectangle the cooling method is indicated by A, W, O or G. Show further stages as required.	 <p>basic ⑤</p>		 <p>basic ⑬</p>	
Illustrated: 2-stage air-cooled compressor.	 <p>⑤</p>		 <p>⑰</p>	
	 <p>①</p>			

Compressors, fans, blowers

	BS	ANSI(ASA)	Alternative	Alternative
rotary compressor	 ①	 ⑪	 ⑬	 ⑮
turbine compressor	 ⑤		 ⑱	
multi-stage turbo-compressor			 ⑫	
vane compressor			 ⑯	
Fan, blower	 ②	 ⑩	 ⑰	 ⑰
	 ⑦		 ⑱	 ⑮
forced-draft fan	 ④			
induced-draft fan	 ④			
rotary fan/blower			 ⑫	
axial fan	 ①			
centrifugal fan	 ⑥	 ⑧	 ⑬	

	BS	ANSI(ASA)	Alternative	Alternative
centrifugal fan				
propeller fan				
'Rootes'-type blower				

PART TWO

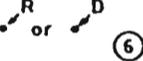
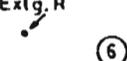
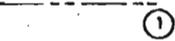
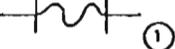
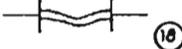
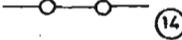
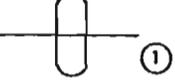
Piping Systems

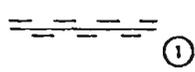
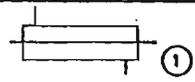
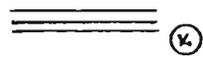
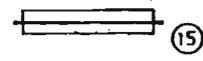
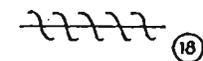
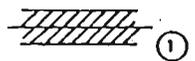
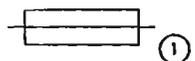
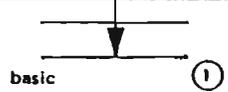
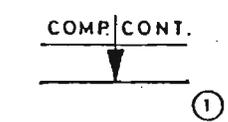
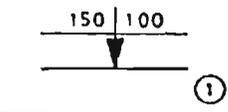
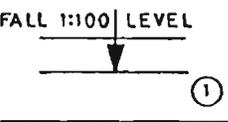
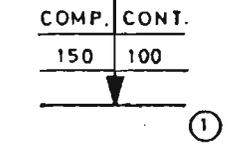
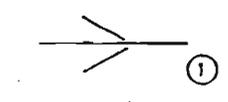
Pipelines

	BS	ANSI(ASA)	Alternative	Alternative
Pipelines major flow lines <i>Arrow on line may be used to indicate direction of flow. Process lines should be drawn thicker than service lines. Indicate nominal bore adjacent to line.</i>				
auxiliary lines				
pipeline (existing)				
pipe below floor/ground level				
pipe at skirting/dado level				
pipe in roof space				
pipe at high level				
existing pipeline to be removed				
future pipeline				
crossing (unconnected)				
junction (connected)				
indication of flow direction				
Included angle of arrow = 30°. indication of pipe size Illustrated: 150 mm diameter.				
indication of fall/rise				

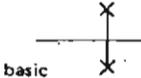
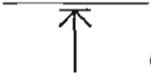
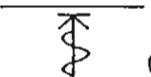
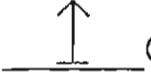
Eduardo J. Bermine & Bulnes
 Ingenieros C.A.

Pipelines

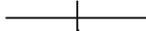
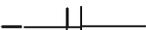
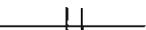
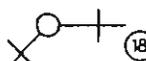
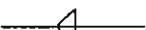
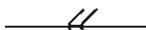
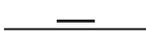
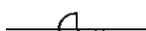
	BS	ANSI(ASA)	Alternative	Alternative
Vertical pipe				
exposed				
embedded				
in chase				
encased				
indication of flow direction R = rising; D = dropping.				
Existing vertical pipe with flow rising.				
Existing vertical pipe with flow dropping, to be removed.				
Boundary line (battery limit)				
process lines crossing battery limit				
Flexible pipe/hose				
Perforated pipe				
Special piping material				
Provision for flexibility See also Pipe joints.				

	BS	ANSI(ASA)	Alternative	Alternative
Heated/cooled pipe <i>Heating/cooling medium to be noted adjacent to symbol.</i>				
Jacketed pipe <i>Indicate type of heating/cooling medium adjacent to symbol.</i>				
steam jacket				
steam traced line				
electricity traced line				
Lagged pipe				
Sleeved pipe <i>Fluid/fill of annulus to be noted adjacent to symbol.</i>				
Point of change	basic 			
responsibility change				
pipe bore change				
change in elevation				
coincident point of change				
pipe bore change (unspecified)				

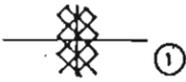
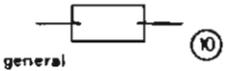
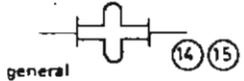
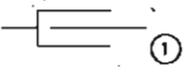
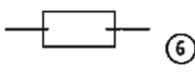
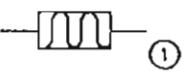
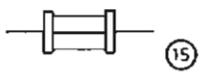
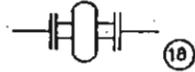
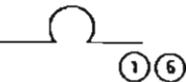
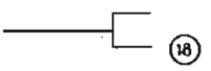
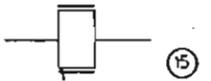
Pipe supports, hangers

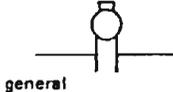
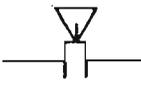
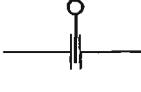
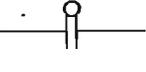
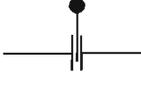
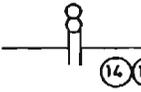
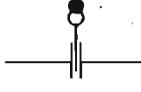
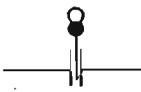
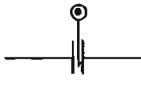
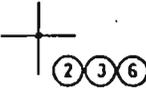
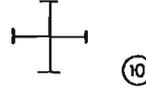
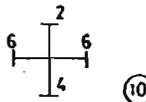
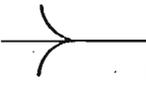
	BS	ANSI(ASA)	Alternative	Alternative
Support	basic  ①			
	simple support  ①			
	resilient support  ①			
	adjustable support  ①			
	roller support  ①			
	anchor  ①		 ⑥	
Hanger	simple hanger  ①			
	resilient hanger  ①			
	adjustable hanger  ①			
	constant-load hanger  ①			
Guide	 ①			

Pipe joints

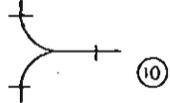
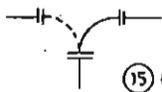
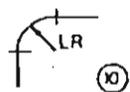
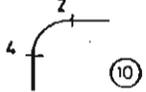
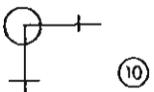
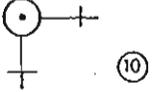
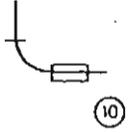
Joint	BS	ANSI(ASA)	Alternative	Alternative
general	 (3)			
butt welded	 (1)	 (10)	 (15)	 (3)
compression	 (1)			
flanged and bolted	 (1) (3)	 (10)		
flanged and bolted, flanges welded on	 (3)			
flanged and bolted, flanges screwed on	 (3)			
flanged and bolted, seal-welded	 (3)			
flexible	 (3)		 (18)	
screwed	 (1)	 (10)	 (3)	
sleeve	 (1)		 (3)	
screwed sleeve	 (3)	 (10)		
socket and spigot	 (1)	 (10)	 (3)	
socket-welded	 (1)			
soldered or solvent-welded	 (1)	 (10)	 (3)	
swivel	 (1)		 (15)	
electrically bonded	 (1)			

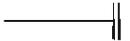
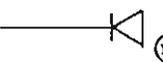
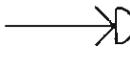
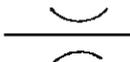
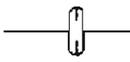
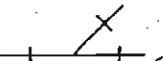
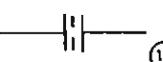
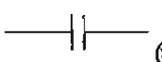
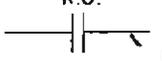
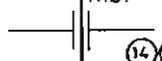
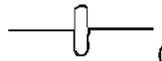
Pipe joints

	BS	ANSI(ASA)	Alternative	Alternative
electrically insulated	 ①			
Expansion joint		 ⑩ general	 ⑭ ⑮ general	
sleeve extension (sliding)	 ①		 ⑥	
bellows type	 ①		 ⑮	 ⑱
horseshoe type (expansion loop)	 ① ⑥			
Hose connection			 ⑱	
'Viking Johnson' coupling			 ⑮	

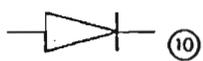
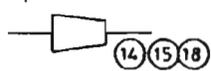
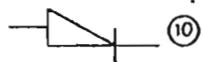
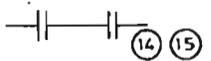
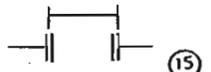
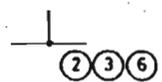
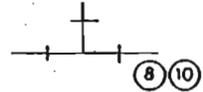
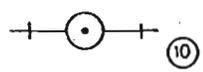
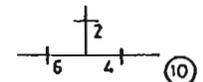
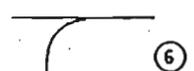
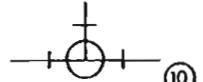
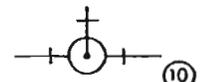
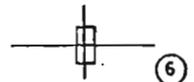
	BS	ANSI(ASA)	Alternative	Alternative
Blind			 general (18)	
	temporary blind		 (14)	
	spade type with spacer: open		 (16)	 (15)
	closed		 (16)	
	Figure-8/ spectacle plate type		 (14) (15) (18)	
	normally open		 (16)	
	normally closed		 (16)	
	hole disc		 (16)	
Bushing		 (10)		
Cross	straight size	 (2) (3) (6)	 (10)	
	reducing cross		 (10)	
	angle cross	 (6)		
	sweep cross	 (6)		

Pipe fittings

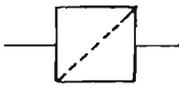
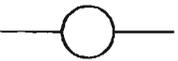
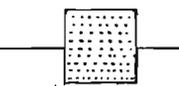
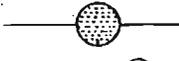
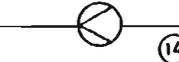
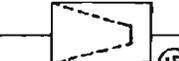
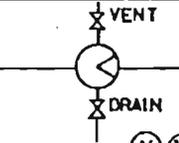
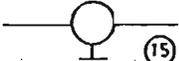
		BS	ANSI(ASA)	Alternative	Alternative
Elbow	45°	 (6)	 (10)		
	90°		 (10)		
	turned down		 (10)		
	turned up		 (10)		
	base		 (10)		
	double branch	 (6)	 (10)		
	swing/reversible			 (15) (18)	
	long radius		 (10)		
	reducing		 (10)		
	side outlet: outlet down		 (10)		
	outlet up		 (10)		
	street			 (10)	

	BS	ANSI(ASA)	Alternative	Alternative
End cap <i>Method unspecified: annotate as 'detachable' when appropriate.</i>	 general ①	 general ⑩		
butt welded	 ①			
fillet welded	 ①			
end flanged and bolted	 ①			
bull plug		 ⑩		
pipe plug		 ⑩		
quick-release end closure	 ①			
screwed	 ①			
screwed and plugged	 ①			
socket and spigot	 ①			
Flow restrictor				
fixed	 ①		 ③	
variable	 ①			
Lateral		 ⑩		
Orifice flange		 ⑩	 ⑮	
restricted orifice			 ⑮	 ⑭ ⑱
Pulsation dampener (snubber)			 ⑮	 ⑭

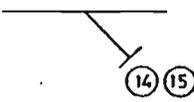
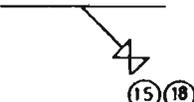
Pipe fittings

		BS	ANSI(ASA)	Alternative	Alternative
Reducing flange					
Reducer	concentric				
	eccentric				
Spool piece					
removable with blinds					
Tee	straight				
	outlet up				
	outlet down				
	double sweep				
	angle				
	reducing				
	single sweep				
	side outlet: outlet down				
	outlet up				
Union					

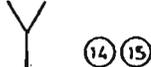
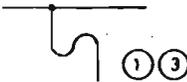
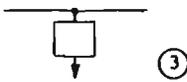
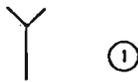
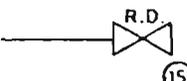
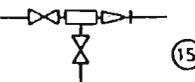
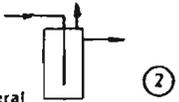
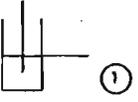
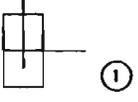
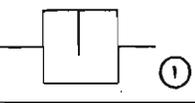
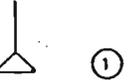
Strainers

	BS	ANSI(ASA)	Alternative	Alternative
Strainer	 <p>general (1) (3) (5)</p>  <p>general (6)</p>	 <p>general (9)</p>	 <p>general (10)</p>	
single strainer			 <p>(18)</p>	 <p>(15)</p>
basket strainer				
duplex basket strainer		 <p>(9)</p>	 <p>(14) (15) (18)</p>	 <p>(17)</p>
cone-type strainer			 <p>(14)</p>	
'Puritan-hat' strainer			 <p>(15)</p>	
slurry-type strainer			 <p>(14) (15)</p>	
sump strainer			 <p>(15)</p>	
T-type strainer: temporary			 <p>(15)</p>	
permanent			 <p>(14) (15)</p>	

Strainers

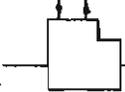
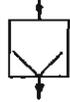
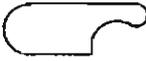
	BS	ANSI(ASA)	Alternative	Alternative
<p>Y-type strainer</p> <p>with blow-off valve</p>				
				<p style="text-align: center;"><i>Edmund H. ...</i></p>

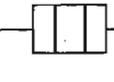
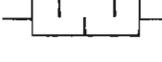
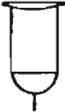
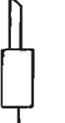
Drains, seals

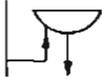
		BS	ANSI(ASA)	Alternative	Alternative
Drain open sealed syphon trap (e.g. condensate release) tundish <i>Arrow to be added when discharge is to atmosphere.</i> roof drain drain to chemical sewer drain ring <i>Symbol to be used when there is more than one drain or sewer system. A letter in the 'diamond' indicates to which drain effluent is to go.</i>					
					
					
					
					
					
					
					
Liquid seal general open liquid seal general closed liquid seal general					
					
					
Separator					
Bell mouth					

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Traps, vents

		BS	ANSI(ASA)	Alternative	Alternative
Trap	release/retention	 ①			
	grease trap	 ⑥			
	lifting trap			 ⑱	
	pumping trap			 ⑮	
	steam trap	 ⑥	 ⑨	 ⑬ ⑭	 ⑮ ⑲
Vent	open	 ①			
	intake from atmosphere	 ①			
	discharge to atmosphere	 ①			
	exhaust head	 ① ⑥		 ⑮ ⑲	
	tank breather vent			 ⑲	

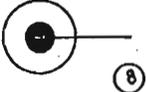
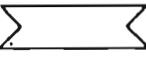
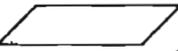
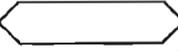
	BS	ANSI(ASA)	Alternative	Alternative		
Bursting disc	general	 ②	general	 ⑤	general	 ⑭
	in pipeline	 ①		 ⑮ ⑯	 ⑰	
	on open-ended pipe		 ⑮ ⑯	 ⑰		
	with flap		 ⑮			
Flame arrester	in pipeline	 ①		 ⑬	 ⑰	
	to atmosphere		 ⑭ ⑰	 ⑰		
			 ⑮			
Fusible plug	 ⑤					
Hydrant	 ①					
Silencer	in pipeline	 ①	 ⑰	 ⑰		
	on discharge		 ⑭	 ⑰		
		 ⑰	 ⑱			

	BS	ANSI(ASA)	Alternative	Alternative
Eyewash fountain				(18)
Safety shower				(18)
Thiefhole cover				(18)

Equipment schedule (see Figure 4)

Item No.	C3	E7	E8	T7
Description	Distillation column for solvent recovery	Vertical thermosyphon reboiler	Water-cooled condenser	Accumulator
Function	To separate MEK and 1,1,2-trichloroethane	To generate vapour for C3	To condense vapours from C3	To store condensate from E8
Size	Dia. 440 mm Height 8800 mm containing 7300 mm of 25 mm ceramic Raschig rings	2.05 m ² heat transfer area	1.45 m ² heat transfer area	2 m ³ volume
Material of construction	St. St.	St. St.	St. St.	St. St.
Operating temperature (K)	385	385	353	353
Operating pressure (bar)	1.0	2.0	1.0	1.0
Steam	—	130 kg/h at 2.0 bar	—	—
Cooling water	—	—	16.5 kg/h at 297 K	—
Lagging	yes	yes	no	no

Process fluids

	BS	ANSI(ASA)	Alternative	Alternative
Process fluid feed stock <i>Identify by name.</i>				
products <i>Identify by name.</i>				
Properties	liquid flow			
	weight flow			
	gas flow			
	pressure			
	temperature			

Fluids passing through the pipes³
 Distinction between the fluids passing through the pipes shall be made when necessary by reference letters.

Main reference

- | | |
|--------------|---------------|
| A air | O oil |
| B brine | R refrigerant |
| C condensate | S steam |
| G gas | W water |

These main references will be followed where necessary by sub-reference letters to denote the condition and purpose of the fluid indicated by the main reference.

Sub-reference

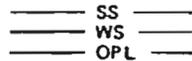
- | Condition | Purpose |
|-----------------------|--------------------------------|
| C cold | B boiler feed (discharge side) |
| D distilled | C cooling |
| H hot | E fire extinguishing |
| P fresh or filtered | F fuel |
| R raw or dirty | H heating |
| S superheated or salt | L lubricating |
| T treated chemically | S supply |
| | W waste |

Examples:

Superheated steam pipe

Salt water pipe

Filtered lubricating oil pipe



Pipeline identification

		BS	ANSI(ASA)	Alternative	Alternative	
Air conditioning	brine return		--- BR ---			
	brine supply		--- B ---			
	circulating chilled/hot water flow		--- CH ---			
	circulating chilled/hot water return		--- CHR ---			
	condenser water flow		--- C ---			
	condenser water return		--- CR ---			
	drain		--- D ---			
	humidification line		--- H ---			
	make-up water		---			
	refrigerant discharge		--- RD ---			
	refrigerant liquid		--- RL ---			
	refrigerant suction		--- RS ---			
	Heating	air relief line		---		
		boiler blow-off		---		
compressed air			--- A ---			
condensate/vacuum pump discharge			-- O -- O -- O --			
feedwater pump discharge			-- OO -- OO -- OO --			
fuel oil flow			--- FOF ---			
fuel oil return			--- FOR ---			
fuel oil tank vent			--- FOV ---			
high-pressure return			-- # -- # --			
high-pressure steam			-- # -- # -- # --			
hot-water heating return			---			
hot-water heating supply			---			

Pipeline identification

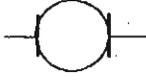
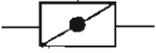
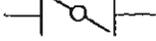
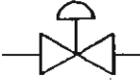
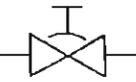
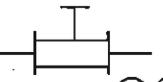
		BS	ANSI(ASA)	Alternative	Alternative
	low-pressure return		-----		
	low-pressure steam		=====		
	make-up water		-----		
	medium-pressure return		+ - - + - +		
	medium-pressure steam		+ - - + - +		
Plumbing	cold water		-----		
	compressed air		----- A -----		
	drinking-water flow		-----		
	drinking-water return		-----		
	fire line		----- F -----		
	gas line		----- G -----		
	hot water		-----		
	hot water return		-----		
	soil/waste/leader: above grade		-----		
	below grade		-----		
	vacuum cleaning		----- v -----		
	vent		-----		
Pneumatic tubes	tube run		=====		
Sprinklers	branch and head		----- ○ -----		
	drain		----- S -----		
	main supplies		----- S -----		
				(10)	

	BS	ANSI(ASA)	Alternative	Alternative
In-line valve (any type or pattern)	 basic (1) (2) (3) (6)	 basic (10)		
Straightway valve			 (16)	
Simple screwdown valve	 (1)			
Three-way valve	 (1) (2)		 (16)	
Four-way valve	 (1) (2)			
Multi-way valve <i>Show as many leads as are required, one to each side of hexagon.</i> Illustrated: 5-way valve.	 (3)			
Angle valve	 (1) (3) (6)	 (10)	 (16)	 (14) (15) (18)

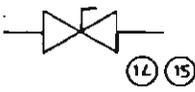
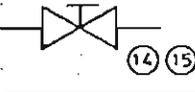
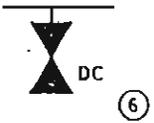
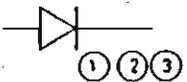
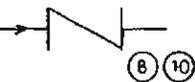
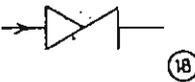
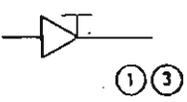
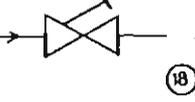
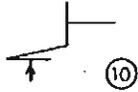
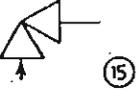
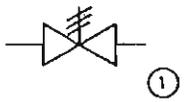
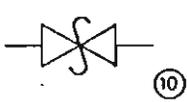
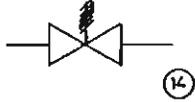
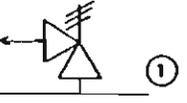
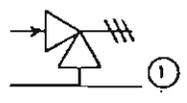
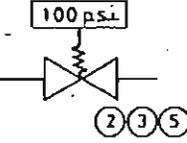
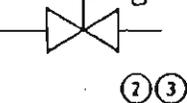
If further elucidation is required, the following reference letters may be used adjacent to the symbols to indicate valve type:

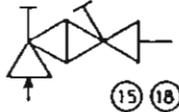
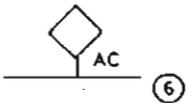
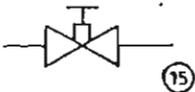
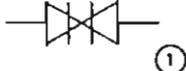
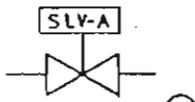
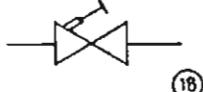
- Sluice valve, double face S
- Sluice gate/single face sluice valve W
- Parallel-side valve L
- Butterfly valve B
- Piston valve P
- Globe valve G
- Diaphragm valve D
- Fine adjustment (e.g. needle) valve F
- Streamline needle valve N
- Rotary valve R

Alternatively, the following symbols may be used to indicate a specific valve type:

	BS	ANSI(ASA)	Alternative	Alternative
Bellows seal valve				
Ball valve				
Butterfly valve				
Damper valve				
Diaphragm valve				
Flush bottom tank valve				
Gate valve				
Globe valve				
Lockshield valve				
Lubrotite valve				

	BS	ANSI(ASA)	Alternative	Alternative
Mixing valve (hand-operated)	⑥			
Needle valve	①		⑮	⑭ ⑮
Reducing valve <i>Direction of flow is from small to large triangle.</i>	② ⑥	⑩		
Reel valve			⑮	
Characterized port valve			⑮	
Plug valve <i>Note type of port adjacent to symbol: T = T-port; L = L-port.</i>	①	⑩	⑮	
	③	⑧		
	<i>straight through</i>	③	⑮	
	<i>3-way plug</i> <i>Note type of port adjacent to symbol: T = T-port; L = L-port.</i> <i>Alternatively, use specific symbols:</i>	①		⑮
<i>T-port</i>	③			
<i>L-port</i>	③			

	BS	ANSI(ASA)	Alternative	Alternative	
lubricated plug valve				(14) (15)	
non-lubricated plug valve				(14) (15)	
drain cock					
Check valve (non-return/reflux)				(1) (2) (3) (8) (10) (18) (14) (15)	
stop/screwdown				(1) (3) (18) (14) (15)	
angle					(10) (15)
Relief valve					
in-line				(1) (10) (14)	
angle (pressure)				(1)	
angle (vacuum)				(1) (14) (15) (18)	
safety/relief spring (vacuum breaker)				(2) (3) (5)	
<i>Blow-off pressure may be indicated by figures within a rectangle.</i>					
safety/relief weight valve				(2) (3)	

	BS	ANSI(ASA)	Alternative	Alternative
blow-off valve (straight/angle)				(15) (18)
automatic air release				(3) (6)
air cock				(6)
Self-draining valve				(15)
Slide valve				(15) (18)
Y-valve				(18)
Foot valve				(14)
See also Valve actuating methods. See also Figure 1, page xii.				

PART THREE

Instrumentation and Control

Sequence of additional letters denoting instrument function

Property measured

Property measured	First letter	Indicating only (I)	Recording only (R)	Indicating and Integrating (IS)	Recording and Integrating (RS)	Controlling only (C)	Indicating and Controlling (IC)	Recording and Controlling (RC)	Indicating, Controlling and Integrating (ICS)	Recording, Controlling and Integrating (RCS)
Flowrate (volumetric or gravimetric)	F	FI	FR	FIS	FRS	FC	FIC	FRC	FICS	FRCS
Level (surface height, depth, contents)	L	LI	LR			LC	LIC	LRC		
Movement, displacement or dimensions of solid elements	U	UI	UR			C	UIC	URC		
Pressure	P	PI	PR			PC	PIC	PRC		
Quality, analysis or concentration*	Q	QI	QR			QC	QIC	QRC		
Radiation	R	RI	RR	RIS	RRS	RC	RIC	RRC	RICS	RRCS
Speed (linear or rotary)	S	SI	SR	SIS	SRS	SC	SIC	SRC	SICS	SRCS
Temperature	T	TI	TR			TC	TIC	TRC		
Weight, mass or load	W	WI	WR			WC	WIC	WRC		
Any other property*	X	XI	XR			XC	XIC	XRC		
Combinations of different properties†	D	DI	DR			DC	DIC	DRC		

NOTE 1. Where applicable the following suffixes may be added to the first letter:

d denoting differential, e.g. Td, Pd.

r denoting ratio, e.g. Fr, Sr.

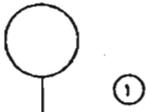
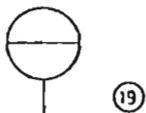
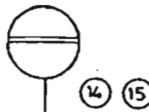
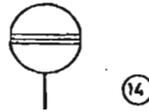
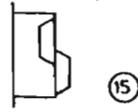
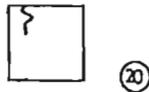
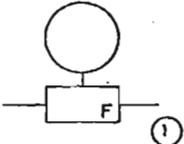
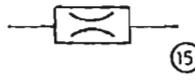
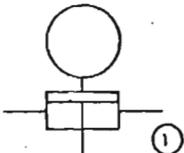
NOTE 2. The letter l and/or A may be added as suffixes to any of the above letter codes to indicate an emergency action and/or alarm function respectively.

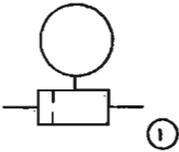
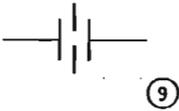
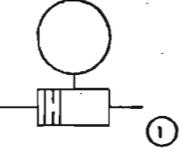
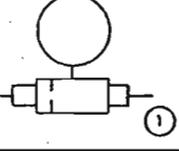
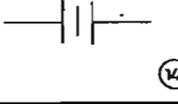
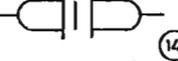
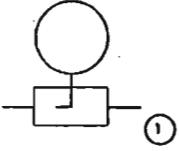
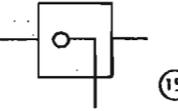
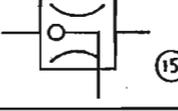
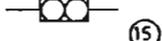
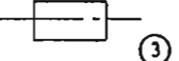
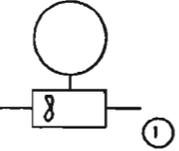
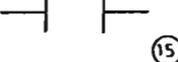
NOTE 3. If the first letter is F the suffix 'q' may be added to denote quantity transfer.

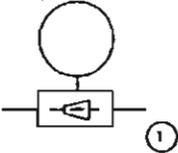
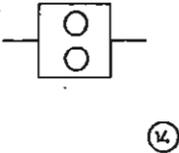
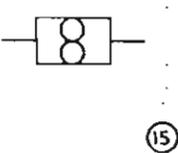
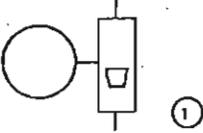
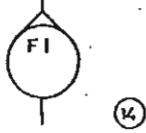
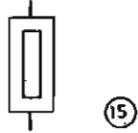
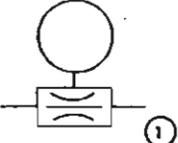
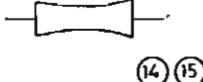
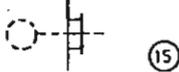
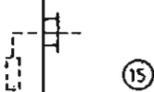
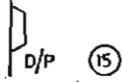
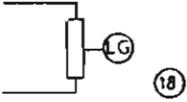
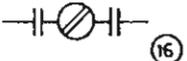
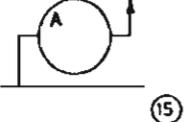
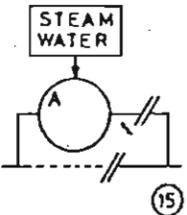
NOTE 4. If the first letter is R, the suffixes α , β , γ , n (neutrons) may be added to indicate the form of radiation followed by the suffix 'q' when radiant energy transfer is to be denoted.

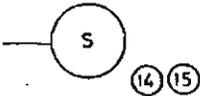
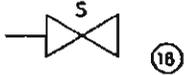
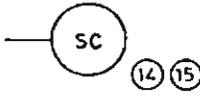
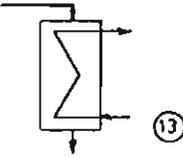
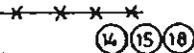
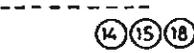
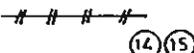
* A note shall be added to specify the property measured.

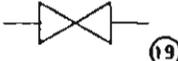
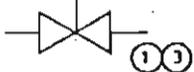
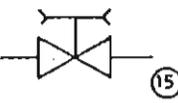
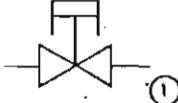
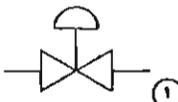
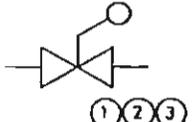
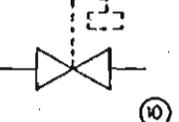
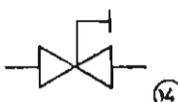
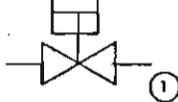
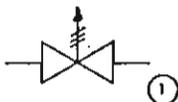
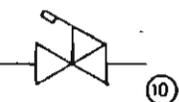
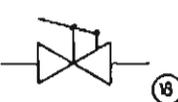
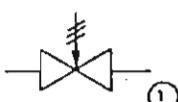
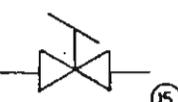
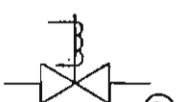
† The letter D shall only be used where measurements normally represented by different letters are being combined in one instrument (e.g. data logger). In all such cases the normal symbols for the separate measurement shall also be shown individually at the points of measurement.

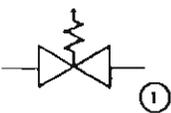
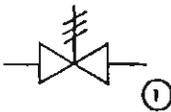
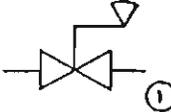
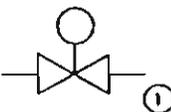
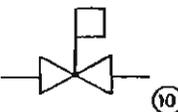
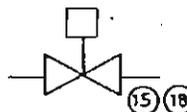
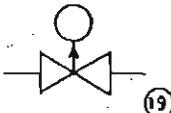
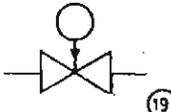
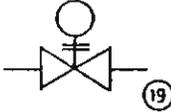
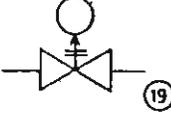
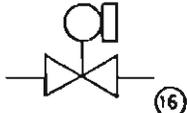
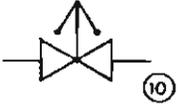
	BS	ANSI(ASA)	Alternative	Alternative
Point of measurement/ instrument* <i>Circle diameter 10 mm</i>	locally mounted 			
	control-room board mounted 			
	local board mounted 			
	control-room and local board mounted 			
Standpipe for instrument				
Recording device			general 	
<p>*The purpose of the instrument shall be defined by a letter code according to BS 1646, 1* (see table opposite). The first letter placed within the circle denotes the property named; the second denotes whether the instrument is an indicator or a recorder; the third denotes whether automatic control is employed; finally, additional letters may be used for alarm functions, emergency trip action and whether quantity is integrated.</p>				
Meter (any type) <i>Letter F indicates flow measurement.</i>				
	Dall tube 			
	diaphragm meter 			
	magnetic meter 			

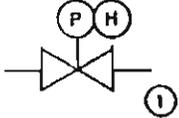
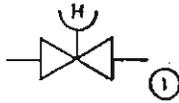
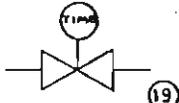
	BS	ANSI(ASA)	Alternative	Alternative
orifice plate				
orifice carrier				
calibrated pipe/ orifice run				
swaged orifice run				
Pitot tube				
Pitot venturi				
positive displacement meter				
sight flow meter				
				
rotary displac- ment meter				
target meter				

	BS	ANSI(ASA)	Alternative	Alternative
turbine meter				
variable area meter (Rotameter)				
venturi meter				
Liquid level meter	internal ball float type			
	internal displacement type			
	level gauge/ external liquid level (differential pressure type)			
	gauge glass			
	sight glass			
Analysis	sample vented			
	sample returned to process			
Illustrated: utilities required by analyser.				

	BS	ANSI(ASA)	Alternative	Alternative
sample connection				
sample connection with cooler				
sample cooler				
refrigerated sample cooler				
Instrument lines				
				
				
				

	BS	ANSI(ASA)	Alternative	Alternative
Connecting element (valve)				
manual isolation				
chain-operated				
dashpot checked				
diaphragm				
float-operated				
gear-operated				
piston				
quick-opening				
quick-closing				
solenoid				

	BS	ANSI(ASA)	Alternative	Alternative
spring-loaded				
statically-loaded				
weight-loaded				
<p>Connecting unit (control valve) <i>Symbol above connecting element may be used to represent automatic control + type of power used to actuate valve. The following letters may be placed within the circle or rectangle:</i> P = pneumatic; M = electric motor; F = hydraulic; S = electromagnetic; H = manual (override).</p>				
<p>Motor element operation</p> <p>Control valve opens on failure of operating medium.</p> <p>Control valve closes on failure of operating medium.</p> <p>Control valve retains position on failure of operating medium.</p> <p>Combination of above symbols is used to indicate safe and permitted direction of drift.</p>	   			
positioner				
governor-operated valve				

	BS	ANSI(ASA)	Alternative	Alternative
Illustrated: automatic control valve with pneumatic actuation and manual override.				
manual actuating element				
program control /time cycle actuation				

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