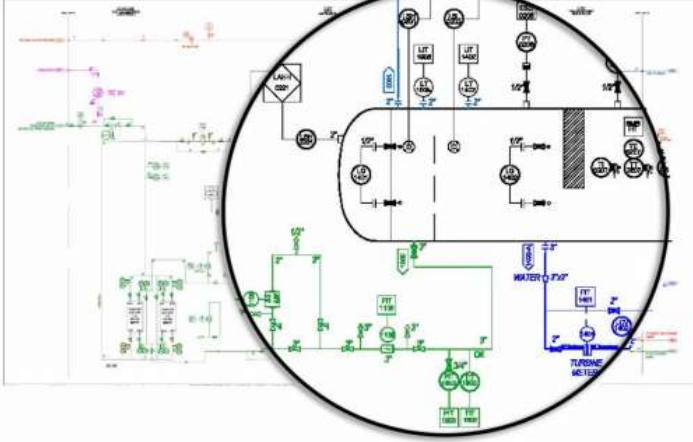


② P & ID

P&ID

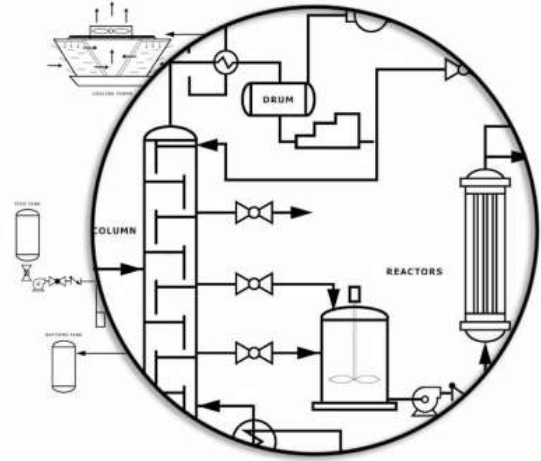
Piping & Instrumentation Diagram
PROCESS & INSTRUMENTATION DIAGRAM



Complex & Detailed

PFD

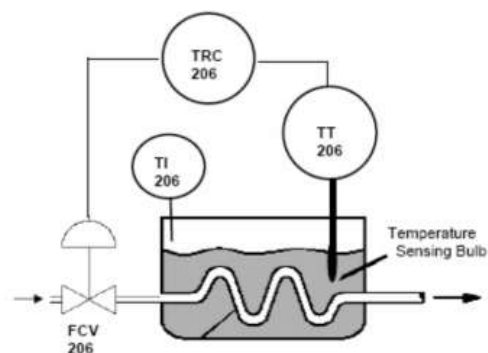
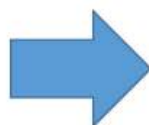
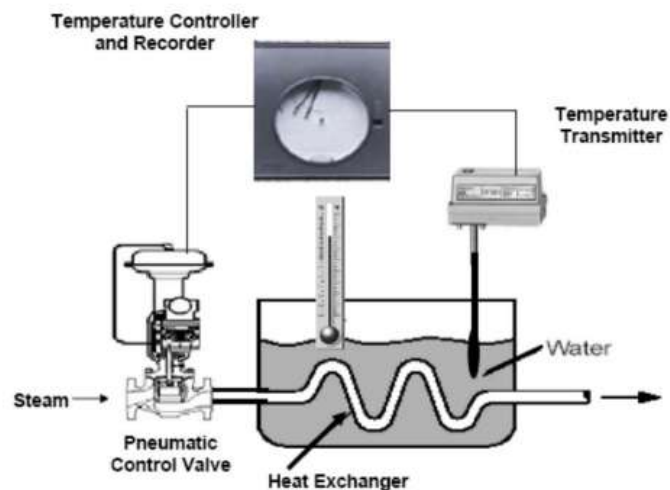
Process Flow Diagram



Simplified Overview of a Process

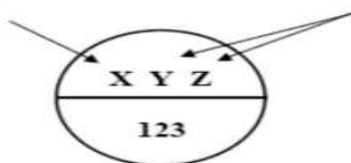
A diagram which shows the interconnection of process equipment and the instrumentation used to control the process. They usually contain the following information:

- Mechanical equipment, including:
 - Pressure vessels, columns, tanks, pumps, compressors, heat exchangers, furnaces, wellheads, fans, cooling towers, turbo-expanders
 - Bursting discs, restriction orifices, strainers and filters, steam traps, moisture traps, sight-glasses, silencers, flares and vents, flame arrestors, vortex breakers, eductors
- Process piping, sizes and identification, including:
 - Pipe classes and piping line numbers
 - Flow directions
 - Interconnections references
 - Permanent start-up, flush and bypass lines
- Process control instrumentation and designation (names, numbers, unique tag identifiers), including:
 - Valves and their types and identifications (e.g. isolation, shutoff, relief and safety valves, valve interlocks)
 - Control inputs and outputs (sensors and final elements, interlocks)
 - Miscellaneous - vents, drains, flanges, special fittings, sampling lines, reducers.



The first letter is used to designate the **measured variable**

The succeeding letter(s) are used to designate the **function** of the component, or to **modify** the meaning of the first letter.



Pressure

Level

Flow

Temperature

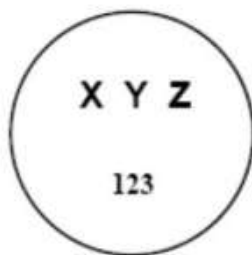
Indicator

Recorder

Controller

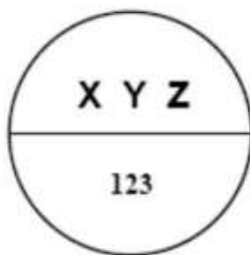
Transmitter

The presence or absence of a line determines the location of the physical device. For example **no line** means the instrument is installed in the field near the process.



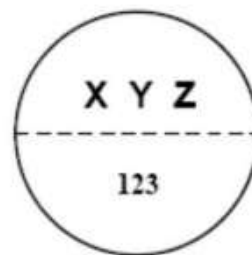
No Line

The instrument is mounted in the field near the process, (close to the operator)



Solid Line

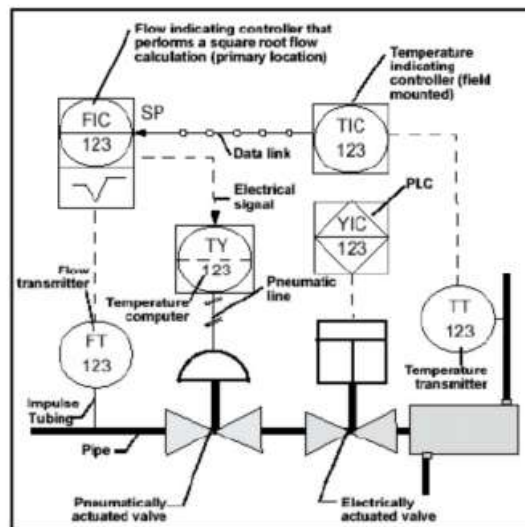
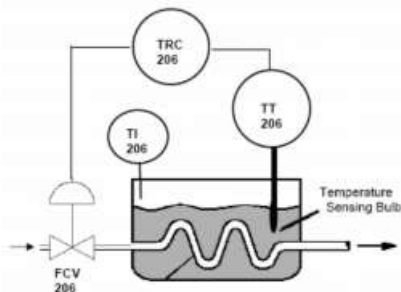
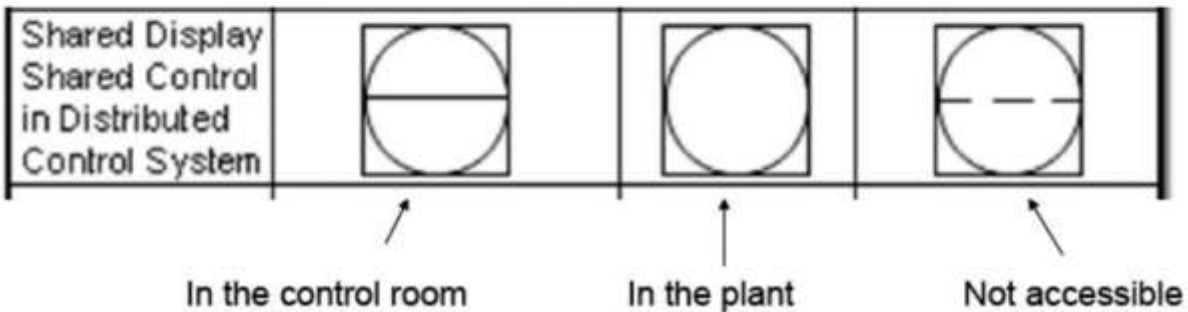
The instrument is mounted in the control room (accessible to the operator)



No Line

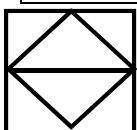
The instrument is mounted out of sight (not accessible to the operator)

Some instruments are part of a Distributed Control System (DCS) where a specific controller or indicator can be selected from many others but shown in one location (like a terminal screen)

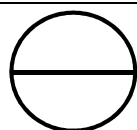


FIC – Flow Indicating Controller
TIC Temperature Indicating Cont.
YIC PLC Indicating Controller
TY Temperature Computer Output
FT Flow Transmitter
TT Temperature Transmitter

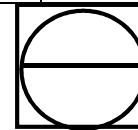
Process	Device	Device/Condition	Condition
Pressure P	Controller C	Controller C	High H
Temperature T	Transmitter T	Transmitter T	Low L
Level L	Recorder R	Recorder R	
Flow F	Indicator I	Valve V	
Analysis A	Alarm A	High H	
	Switch/Safety S	Low L	
	Gauge G		



: PLC
Symbol

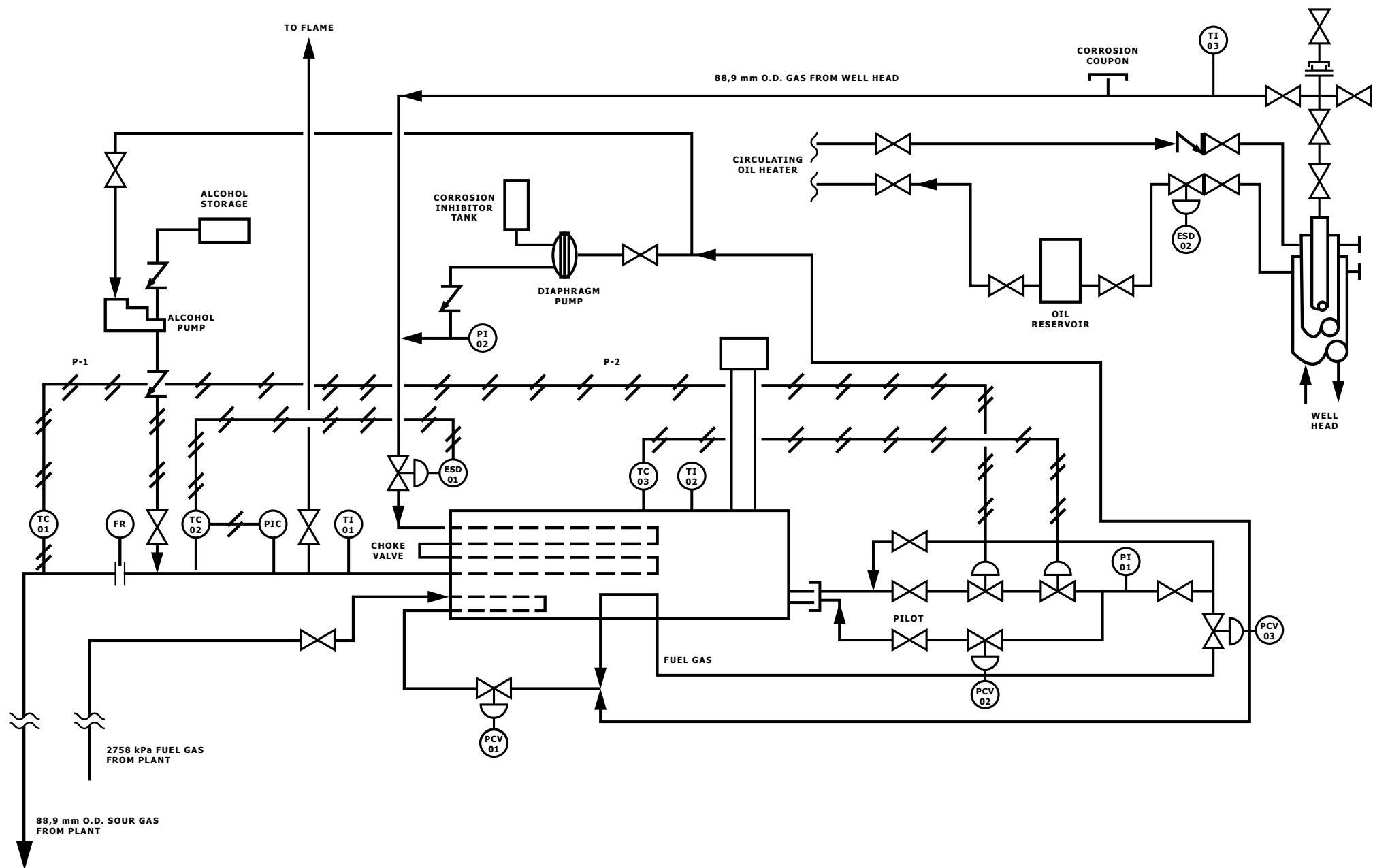


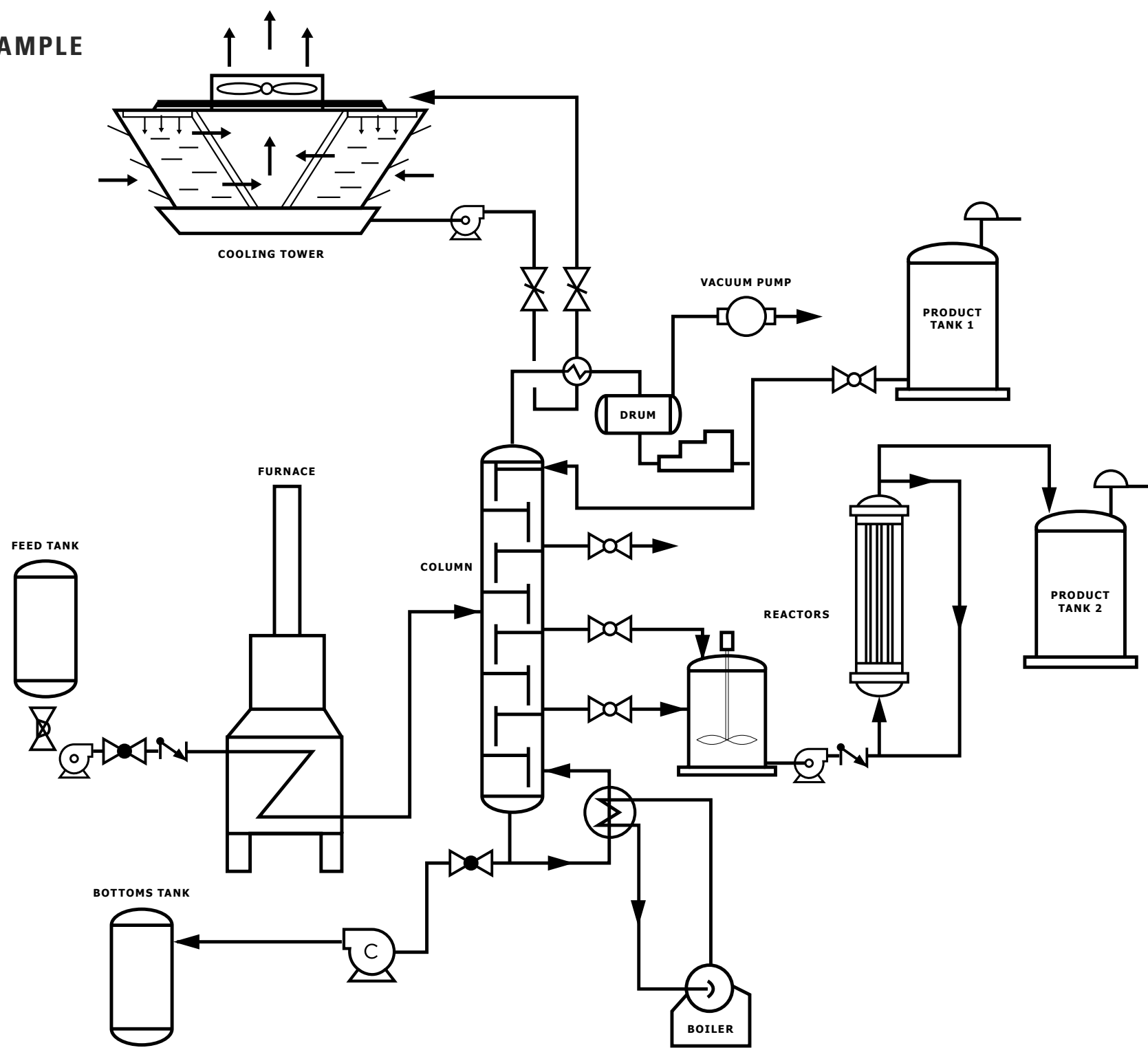
: Physical
Instrument



:DCS
Symbol

P&ID SAMPLE





TAG NUMBERS – LETTER SYMBOLS FOR DATA PROCESSING FUNCTIONS

Symbol	Measured or Initiating Variable	Modifier	Readout or Passive Function	Output Function	Modifier
A	Analysis		Alarm		
B	Burner, Combustion		User's Choice	User's Choice	User's Choice
C	User's Choice			Control	
D	User's Choice	Differential			
E	Voltage		Sensor (Primary Element)		
F	Flow Rate	Ratio (Fraction)			
G	User's Choice		Glass, Viewing Device		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time, Time Schedule	Time Rate of Change			Control Station
L	Level		Light		Low
M	User's Choice	Momentary			Middle, Intermediate
N	User's Choice		User's Choice	User's Choice	User's Choice
O	User's Choice		Orifice, Restriction		
P	Pressure, Vacuum		Point (Test) Connection		
Q	Quantity	Integrate, Totalize			
R	Radiation		Record		
S	Speed, Frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable		Multifunction	Multifunction	Multifunction
V	Vibration, Mechanical Analysis			Valve, Damper, Louver	
W	Weight, Force		Well		
X	Unclassified	X Axis	Unclassified	Unclassified	Unclassified
Y	Event, State or Presence	Y Axis		Relay, Compute, Convert	
Z	Position, Dimension	Z Axis		Driver, Actuator, Unclassified Final Control Element	

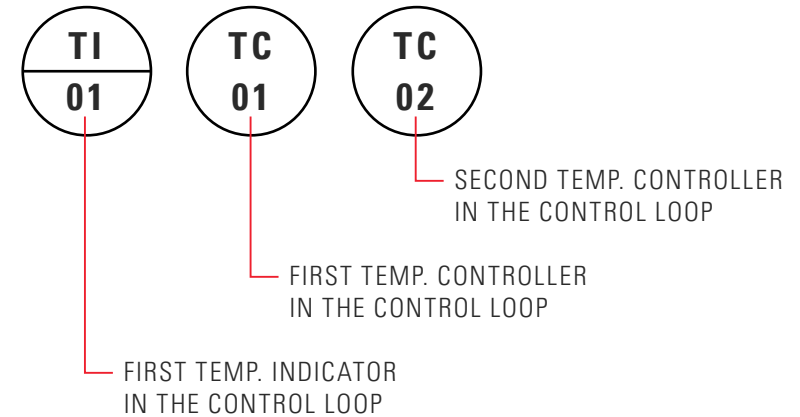
TAG NUMBERS – OIL & GAS INSTRUMENT ABBREVIATIONS *(Adapted From ISA Standard S5.1)*

A	Analog Signal	FO	Fial Open	LSLL	Level Switch Low <i>for Level Below LSL</i>	RC	Ratio Controller
AC	Analysis Controller	FQ	Flow Indicator Totaliser	LT	Level Transmitter	RTD	Resistance Temperature Detector
AAH	Analysis Alarm [High]	FQI	Flow Indicator with Total Counter	LY	I/P Converter [Level Loop]	RTU	Remote Terminal Unit
AAHL	Analysis Alarm [High/Low]	FR	Flow Recorder	LO	Lock Open	S	Solenoid
AAL	Analysis Alarm [Low]	FRC	Flow Recorder Controller	MCC	Motor Control Center	SAH	Speed Alarm [High]
AS	Air Supply	FRT	Flow Recorder Transmitter	MTU	Master Terminal Unit	SAHL	Speed Alarm [High/Low]
ASDH	Analysis Shutdown [High]	FS	Flow Switch	NC	Normally Closed	SAL	Speed Alarm [Low]
ASDL	Analysis Shutdown [Low]	FSDH	Flow Shutdown [High]	NO	Normally Open	SC	Sample Connection
ASH	Analysis Switch [High]	FSDL	Flow Shutdown [Low]	P	Pneumatic Signal	SD	Shutdown Panel
ASHL	Analysis Switch [High/Low]	FSH	Flow Switch [High]	PAH	Pressure Alarm [High]	SI	Speed Indicator
ASL	Analysis Switch [Low]	FSL	Flow Switch [Low]	PAHL	Pressure Alarm [High/Low]	SR	Speed Recorder
AT	Analysis Transmitter	FT	Flow Transmitter	PAL	Pressure Alarm [Low]	SS	Steam Supply
BC	Burner Controller	FY	Computer, Relay, Amplifier or I/P Converter in Flow Loop	PB	Pushbutton	SSH	Speed Switch [High]
BAH	Burner Alarm [High]	GS	Instrument Gas Supply	PC	Pressure Controller	SSHL	Speed Switch [High/Low]
BAHL	Burner Alarm [High/Low]	H	Hydraulic	PCV	Pressure Control Valve	SSL	Speed Switch [Low]
BAL	Burner Alarm [Low]	HMV	Hydraulic Motor Operated Valve	PD	Pulsation Dampener	TAH	Temperature Alarm [High]
BDV	Blowdown Valve	HOA	Hand/Off/Auto Switch	PdA	Pressure Differential Alarm	TAHL	Temperature Alarm [High/Low]
BPR	Back Pressure Regulator	HOA	Hand/Off/Auto Switch	PdAH	Pressure Differential Alarm [High]	TAL	Temperature Alarm [Low]
BS	Burner Switch	HS	Hand Switch	PdAL	Pressure Differential Alarm [Low]	TC	Temperature Controller
BSH	Burner Switch [High]	I	Current Signal	PdI	Pressure Differential Indicator	TCV	Temperature Control Valve
BSHL	Burner Switch [High/Low]	I/F	Interface	PdIC	Pressure Differential Indicator Controller	TD	Time Delay
BSL	Burner Switch [Low]	I/I	Current Indicator	PdS	Pressure Differential Switch	TE	Temperature [Measuring] Element/Thermocouple
BS&W	Basic Sediment and Water	I/P	Current to Pneumatic	PdSH	Pressure Differential Switch [High]	TF	Temperature Gage
CCP	Central Control Panel	I/PA	Current to Pneumatic Alarm	PdSL	Pressure Differential Switch [Low]	TH	Thermostat
CDS	Compressor Shutdown	KI	Clock/Timer	PG	Pressure Gage	TI	Temperature Indicator
CFA	Common Fault Alarm	LA	Level Alarm	P/I	Pneumatic To Current Converter	TIC	Temperature Indicator Controller
COR	Corrosimeter	LAH	Level Alarm [High]	PI	Pressure Indicator	TIT	Temperature Indicator Transmitter
CSC	Car Seal Close	LAHH	Level Alarm High <i>for Level Above LAH</i>	PIC	Pressure Indicator Controller	TJI	Multipoint Temperature Indicator/Thermocouple
CSO	Car Seal Open	LAHL	Level Alarm [High/Low]	PIT	Pressure Indicator Transmitter	TR	Temperature Recorder
CV	Control Valve	LAL	Level Alarm [Low]	PJI	Multipoint Pressure Indicator	TRC	Temperature Recorder Controller
E/I	EMF to Current Converter	LALL	Level Alarm Low <i>for Level Above LAL</i>	PJR	Multipoint Pressure Recorder	TRT	Temperature Recorder Transmitter
ES	Electrical Switch	LC	Level Controller	POV	Pneumatically Operated Valve	TSDH	Temperature Shutdown [High]
ESD	Emergency Shutdown Station	LCV	Level Control Valve	PR	Pressure Recorder	TSDL	Temperature Shutdown [Low]
ESDV	Emergency Shutdown Valve	LG	Level Gauge	PRC	Pressure Recorder Controller	TSH	Temperature Switch [High]
FAL	Flow Alarm Low	LI	Level Indicator	PRT	Pressure Recorder Transmitter	TSHL	Temperature Switch [High/Low]
FAH	Flow Alarm High	LIC	Level Indicator Controller	PRV	Pressure Regulating Valve	TSL	Temperature Switch [Low]
FAHH	Flow Alarm High <i>For Level Above FAH</i>	LIT	Level Indicator Transmitter	PSDH	Pressure Shutdown [High]	TT	Temperature Transmitter
FAHL	Flow Alarm [High/Low]	LLH	Liquid Level [High]	PSDL	Pressure Shutdown [Low]	TW	Thermowell
FALL	Flow Alarm Low <i>For Level Below FAL</i>	LLL	Liquid Level [Low]	PSE	Rupture Disk	TY	Computer, Relay, Converter, etc. in Temp. Loop
FC	Flow Controller	LLN	Liquid Level [Normal]	PSH	Pressure Switch [High]	US	Utility Station
FC	Fail Close	LQ	Lock Closed <i>When by a manual Valve</i>	PSHH	Pressure Switch High <i>for Pressure Above PSH</i>	VAH	Vibration Alarm [High]
FCV	Flow Control Valve	LR	Level Recorder	PSHL	Pressure Switch [High/Low]	VSDH	Vibration Shutdown [High]
FE	Flow Element	LS	Level Switch	PSL	Pressure Switch [Low]	VSH	Vibration Switch [High]
FFA	Flame Failure Alarm	LSDH	Level Shutdown [High]	PSLL	Pressure Switch Low <i>for Pressure Below PSL</i>	WS	Water Supply
FFSD	Flame Failure Shutdown	LSDL	Level Shutdown [Low]	PSV	Pressure Safety Valve	X	Multiply
FG	Flow Gage/Flow Sight Glass	LSH	Level Switch [High]	PT	Pressure Transmitter	ZC	Position Switch [Closed]
FI	Flow Indicator	LSHL	Level Switch [High/Low]	POS	Positioner	ZO	Position Switch [Open]
FIC	Flow Indicator Controller	LSL	Level Switch [Low]	PY	Relay, Computer, Amplifier, Converter or I/P Converter etc/ in Pressure Loop		
FIT	Flow Indicator Transmitter	LSHH	Level Switch High <i>for Level Above LSH</i>				

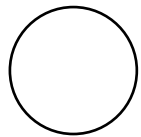
TAG NUMBERS – LOOP NUMBER

The number below these letters is the numerator to help identify a specific component on a project within the control loop. When there are multiples of the same device used in a diagram, this number helps viewers to reference that specific instrument.

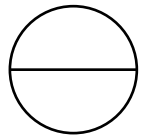
If you were looking at a list of the controls, you could look at the control loop number to find that specific device on the P&ID. Companies have different protocols for where these numbers originate.



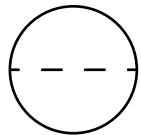
TAG NUMBERS – INSTRUMENT LOCATION



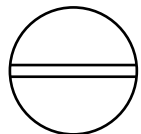
- Located in field
- Not panel, cabinet, or console mounted
- Visible at field location
- Normally operator accessible



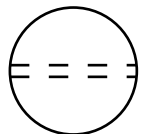
- Located in or on front of central or main panel or console
- Visible on front of panel or on video display
- Normally operator accessible at panel front or console



- Located in rear of central or main panel
- Located in cabinet behind panel
- Not visible on front of panel or on video display
- Not normally operator accessible at panel or console

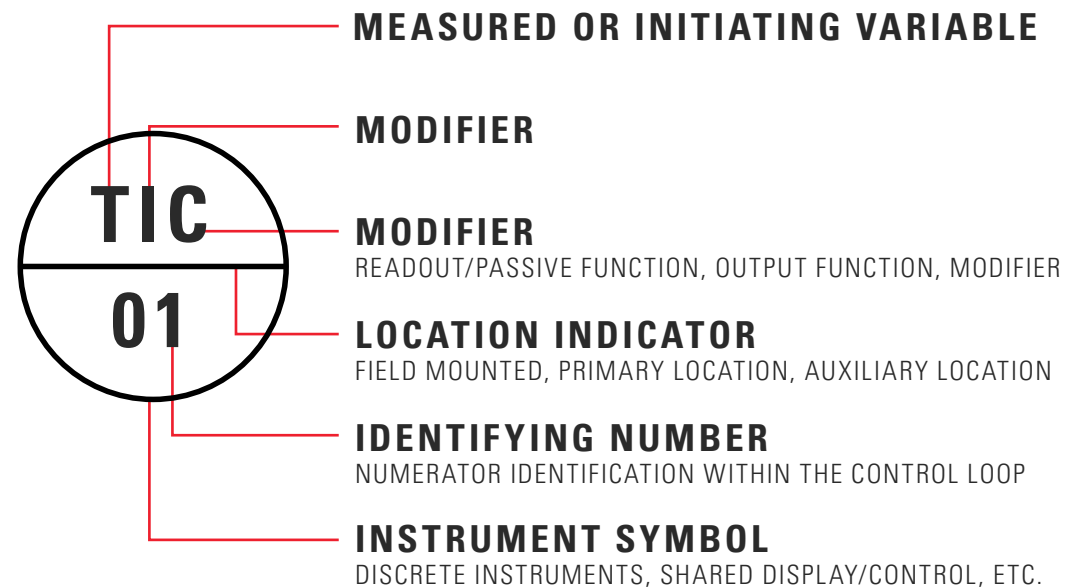


- Located in or on front of secondary or local panel or console
- Visible on front of panel or on video display
- Normally operator accessible at panel front or console

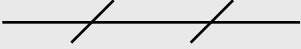
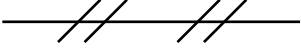
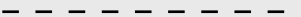
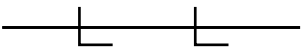
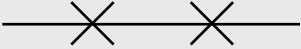
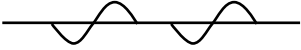
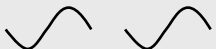
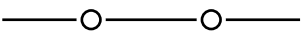
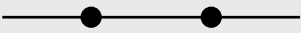
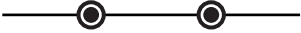


- Located in rear of secondary or local panel
- Located in field cabinet
- Not visible on front of panel or on video display
- Not normally operator accessible at panel or console

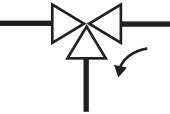
These symbols may be supplemented with information on the name of the local control room or the local control panel, just outside the symbols, for example, COMPRESSOR, i.e., the local control room or local control panel for a compressor.

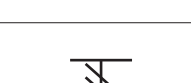
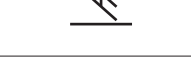
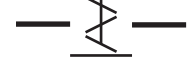
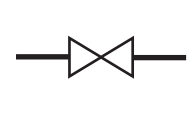


SYMBOLS – LINE TYPES

Piping (Major Process)		
Connection to Process (Minor Process)		• Functional diagram continuously variable signal. • Electrical schematic ladder diagram signal and power rails.
Undefined Signal		• Use for Process Flow Diagrams and diagrams where type of signal is not of concern
Pneumatic Signal		• Filled thermal element capillary tube. • Filled sensing line between pressure seal and instrument.
Electric Signal		• Electronic or electrical continuously variable or binary signal. • Functional diagram binary signal.
Hydraulic Signal		• Hydraulic Signal
Capillary Tube		• Filled thermal element capillary tube. • Filled sensing line between pressure seal and instrument.
Electromagnetic or Sonic Signal (Guided)		• Guided electromagnetic signal / sonic signal. • Fiber optic cable.
Electromagnetic or Sonic Signal (Not Guided)		• Unguided electromagnetic signals, light, radiation, radio, sound, wireless, etc. • Wireless instrumentation signal / communication link.
Internal System Link (Software or Data Link)		• Communication link and system bus, between devices and functions of a shared display, shared control system. (DCS, PLC, or PC communication link and system bus.)
Internal System Link (Software or Data Link)		• Communication link or bus connecting two or more independent microprocessor or computer-based systems. (DCS-to-DCS, DCS-to-PLC, PLC-to-PC, DCS-to-Fieldbus, etc.)
Mechanical Link		• Mechanical Link

SYMBOLS – CONTROL VALVES

1	a.  b. 	Generic two-way valve Straight globe valve Gate valve
2		Generic two-way angle valve Angle globe valve Safety angle valve
3		Generic three-way valve Three-way globe valve Arrow indicates failure or unactuated flow path
4		Generic four-way valve Four-way four-port plug or ball valve Arrows indicates failure or unactuated flow paths
5		Butterfly valve
6		Ball valve
7		Plug valve
8		Eccentric rotary disc valve
9	a.  b. 	Diaphragm valve
10		Pinch valve
11		Bellows sealed valve

12		Generic damper Generic louver
13		Parallel blade damper Parallel blade louver
14		Opposed blade damper Opposed blade louver
15		Two-way on-off solenoid valve
16		Angle on-off solenoid valve
17		Three-way on-off solenoid valve Arrow indicates de-energized flow path
18		Four-way plug or ball on-off solenoid valve Arrows indicates de-energized flow paths
19		Four-way five-port on-off solenoid valve Arrows indicates de-energized flow paths
20		Permanent magnet variable speed coupling
21		Electric motor Represents a motor that manipulates or controls a process variable.

Symbols 1-14, when combined with actuator symbols 1-16, represent process control valves.

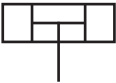
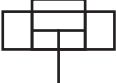
Symbol 2, when combined with actuator symbols 20 and 21, represent pressure safety valves.

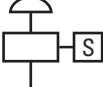
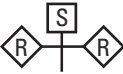
Symbols 1 and 9, users design standards will document which symbols have been selected.

Symbols 15-19, when combined with actuator symbols 13-15, represent on-off solenoid valves.

Symbol 21, when combined with actuator symbols 1-16, represents a variable speed control unit.

SYMBOLS – ACTUATORS

1		Generic actuator Spring-diaphragm actuator
2		Spring-diaphragm actuator with positioner
3		Pressure-balanced diaphragm actuator
4		Linear piston actuator Single acting spring opposed Double acting.
5		Linear piston actuator with positioner
6		Rotary piston actuator May be single acting spring opposed or double acting
7		Rotary piston actuator with positioner
8		Bellows spring opposed actuator
9		Rotary motor operated actuator Electric, pneumatic, or hydraulic Linear or rotary action
10		Modulating solenoid actuator Solenoid actuator for process on-off valve
11		Actuator with side-mounted handwheel

12		Actuator with top-mounted handwheel
13		Manual actuator Hand actuator
14		Electrohydraulic linear or rotary actuator
15		Actuator with manual actuated partial stroke test device
16		Actuator with remote actuated partial stroke test device
17		Automatic reset on-off solenoid actuator Non-latching on-off solenoid actuator
18		Manual or remote reset on-off solenoid actuator Latching on-off solenoid actuator
19		Manual and remote reset on-off solenoid actuator Latching on-off solenoid actuator
20		Spring or weight actuated relief or safety valve actuator
21		Pilot actuated relief or safety valve actuator Pilot pressure sensing line deleted if sensing is internal

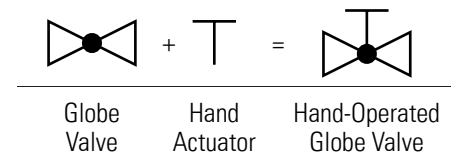
Symbols 1-16, when combined with element symbols 1-14, represent process control valves and with element symbol 21 represents a variable speed control unit.

Symbols 17-19, when combined with element symbols 15-19, represent on-off solenoid valves.

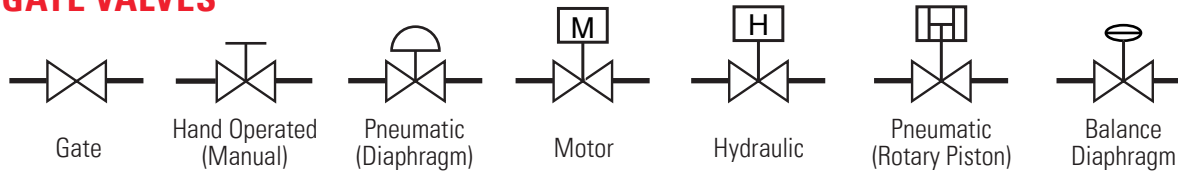
Symbols 20-21, when combined with element symbol 2, represent pressure safety valves.

SYMBOLS – COMMON VALVE SYMBOLS AND COMBINATIONS

Combining control valve symbols with actuators symbols can yield a variety of results. Below are some final control elements with actuators and a variety of other common instrument symbols.



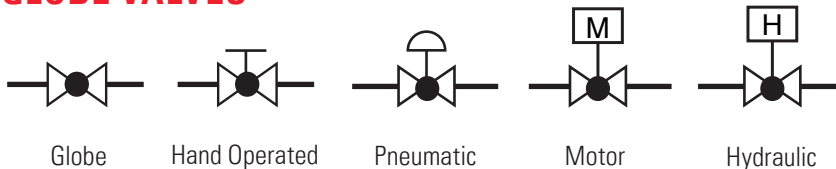
GATE VALVES



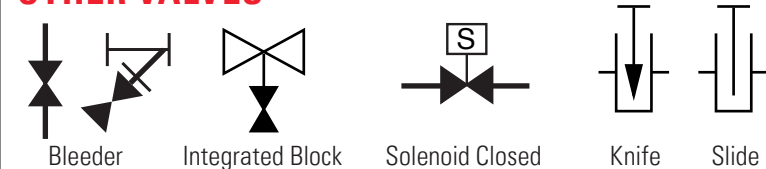
FAIL-SAFE POSITION



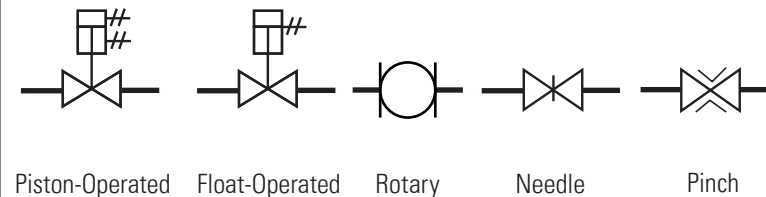
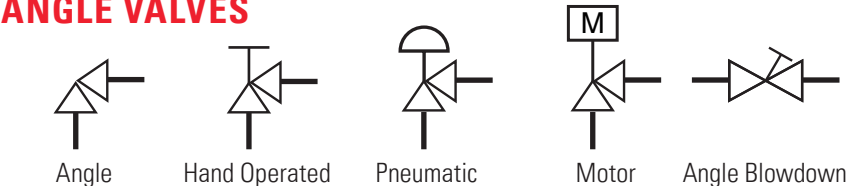
GLOBE VALVES



OTHER VALVES



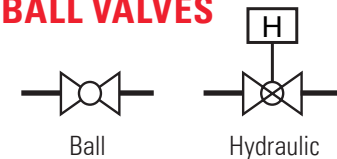
ANGLE VALVES



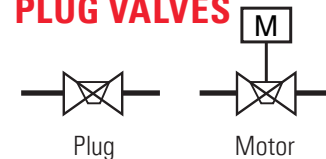
END CONNECTION



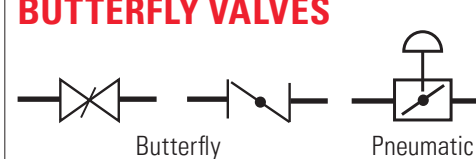
BALL VALVES



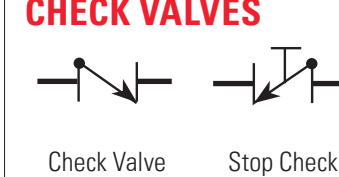
PLUG VALVES



BUTTERFLY VALVES



CHECK VALVES



DIAPHRAGM VALVES



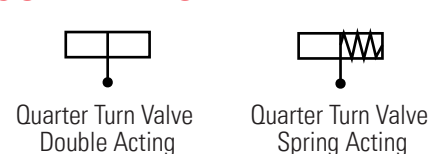
SAFETY



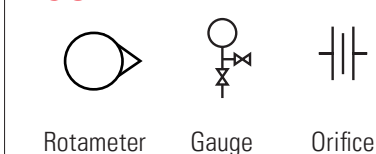
RELIEF



QUARTER TURN

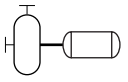
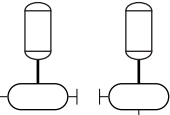


EQUIPMENT

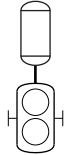
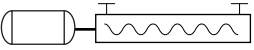
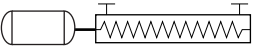
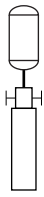
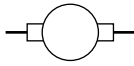


SYMBOLS – EQUIPMENT

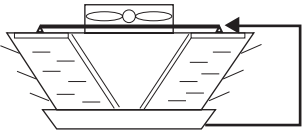
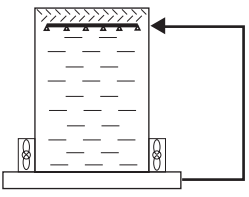
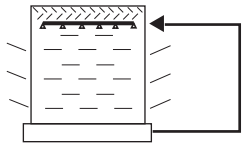
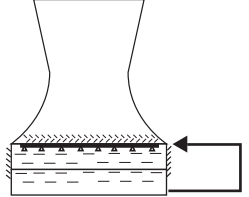
CENTRIFUGAL PUMPS

	Centrifugal Pumps
	Vertical
	Horizontal
	Vertical
	Sump Pump

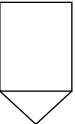
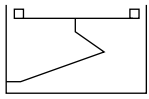
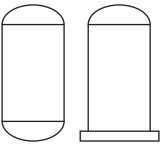
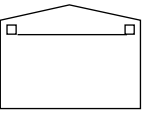
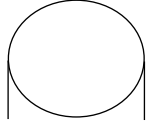
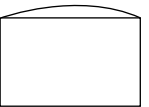
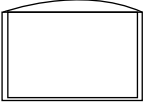
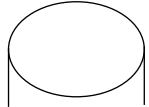
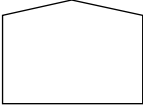
POSITIVE DISPLACEMENT PUMPS

	Positive Displacement		Positive Displacement
	Progressive Cavity		Gear Pump
	Screw Pump		
	Screw Pump		Vertical Can Pump
	Vacuum Pump		
	Reciprocating Pump		

COOLING TOWERS

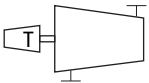
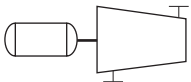
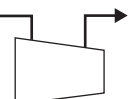
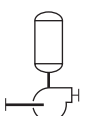
	Induced Draft Crossflow
	Forced Draft Counterflow
	Natural Draft Counterflow
	Hyperbolic Chimney Tower

STORAGE

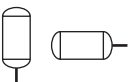
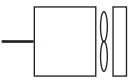
	Bin		Drum		External Floating Roof
	Tank		Internal Floating Roof Tank		Sphere
	Dome Roof Tank		Double Wall Tank		Onion Tank
	Open Top Tank		Cone Roof Tank		

SYMBOLS – EQUIPMENT

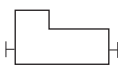
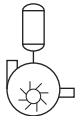
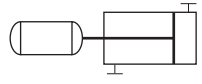
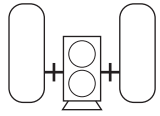
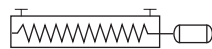
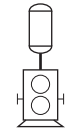
CENTRIFUGAL COMPRESSORS

	Centrifugal Compressor
	Centrifugal Compressor (Turbine Driven)
	Centrifugal Compressor
	Axial Compressor
	Centrifugal Blower

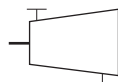
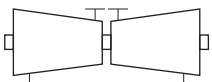
MOTORS

	Motor
	Diesel Motor
	Agitator or Mixer

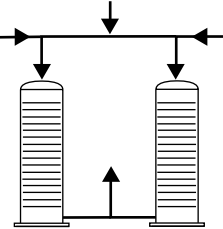
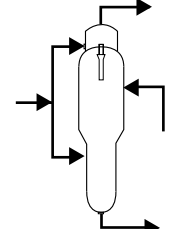
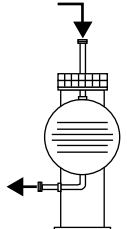
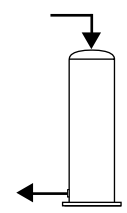
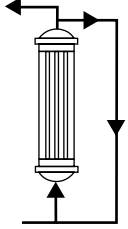
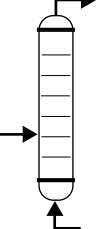
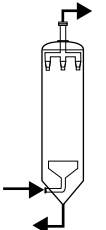
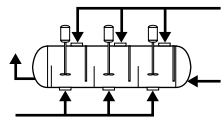
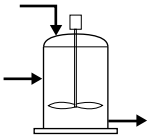
PD COMPRESSORS

	Reciprocating Compressor
	Liquid Ring Vacuum
	Reciprocating Compressor
	Rotary Compressor
	Rotary Compressor & Silencers
	Rotary Screw Compressor
	Positive Displacement Blower

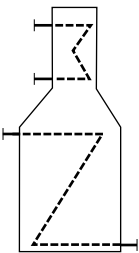
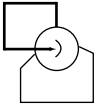
STEAM TURBINE

	Turbine Driver
	Doubleflow Turbine

REACTOR SYMBOLS

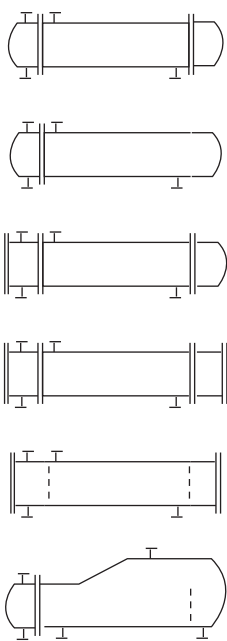
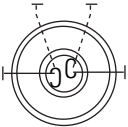
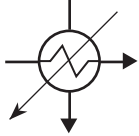
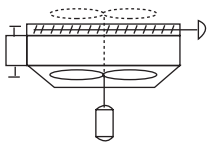
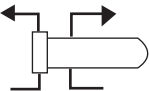
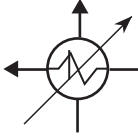
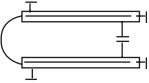
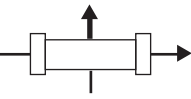
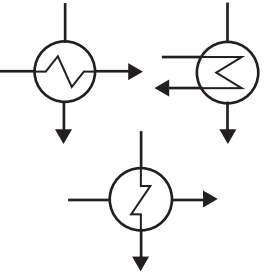
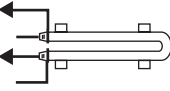
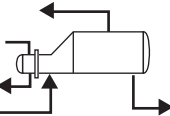
		
Hydrocracking	Fluid Coking	Reformer
		
Hydrodesulfurization	Tubular Reactor	Fluidized Reactor
		
Fluid Catalytic Cracking	Alkylation	Mixing Reactor

FURNACE AND BOILER

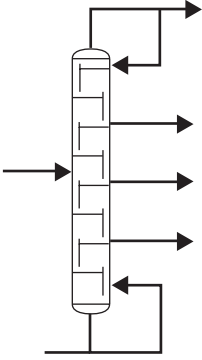
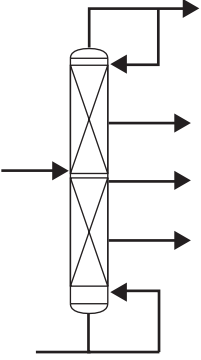
	Furnace		Boiler
---	---------	---	--------

SYMBOLS – EQUIPMENT

HEAT EXCHANGERS

		Plate and Frame Heat Exchanger		Spiral Heat Exchanger		Heater
		Air Cooled Exchanger (Louvers Optional)		U-Tube Heat Exchanger		Condenser
		Double-Pipe Heat Exchanger		Single Pass Heat Exchanger		Shell and Tube Heat Exchanger
		Hairpin Exchanger		Reboiler		

DISTILLATION SYMBOLS

	
Plate Tower Bubble-cap, Sieve, Valve	Packed Tower Saddle, Ring, Sulzer, Rosette

