P&ID
Reference Guide

Based on information from ANSI/ISA-5.1-2009 Instrumentation Symbols and Identification

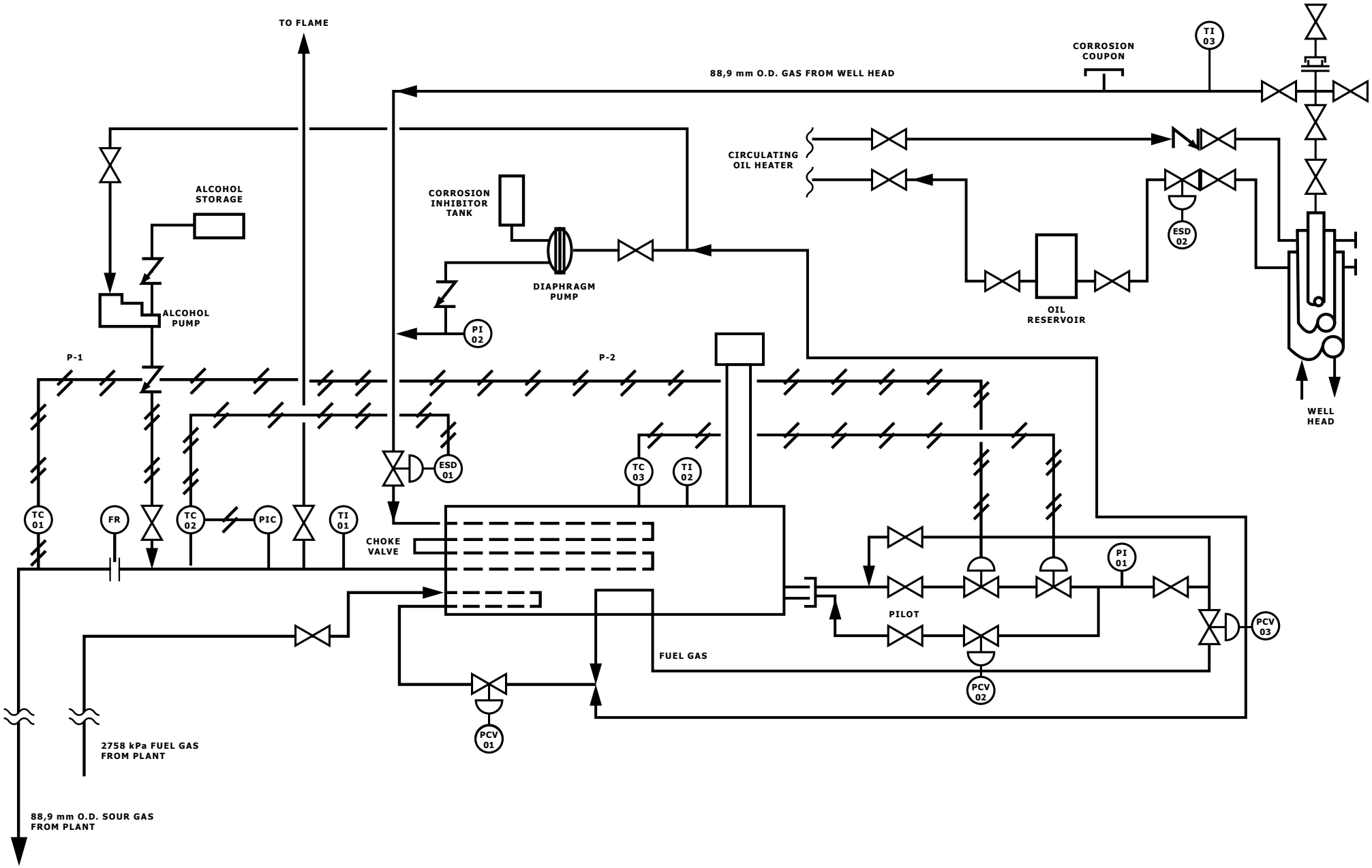
YouTube

Watch the companion video on YouTube.com/KimrayInc

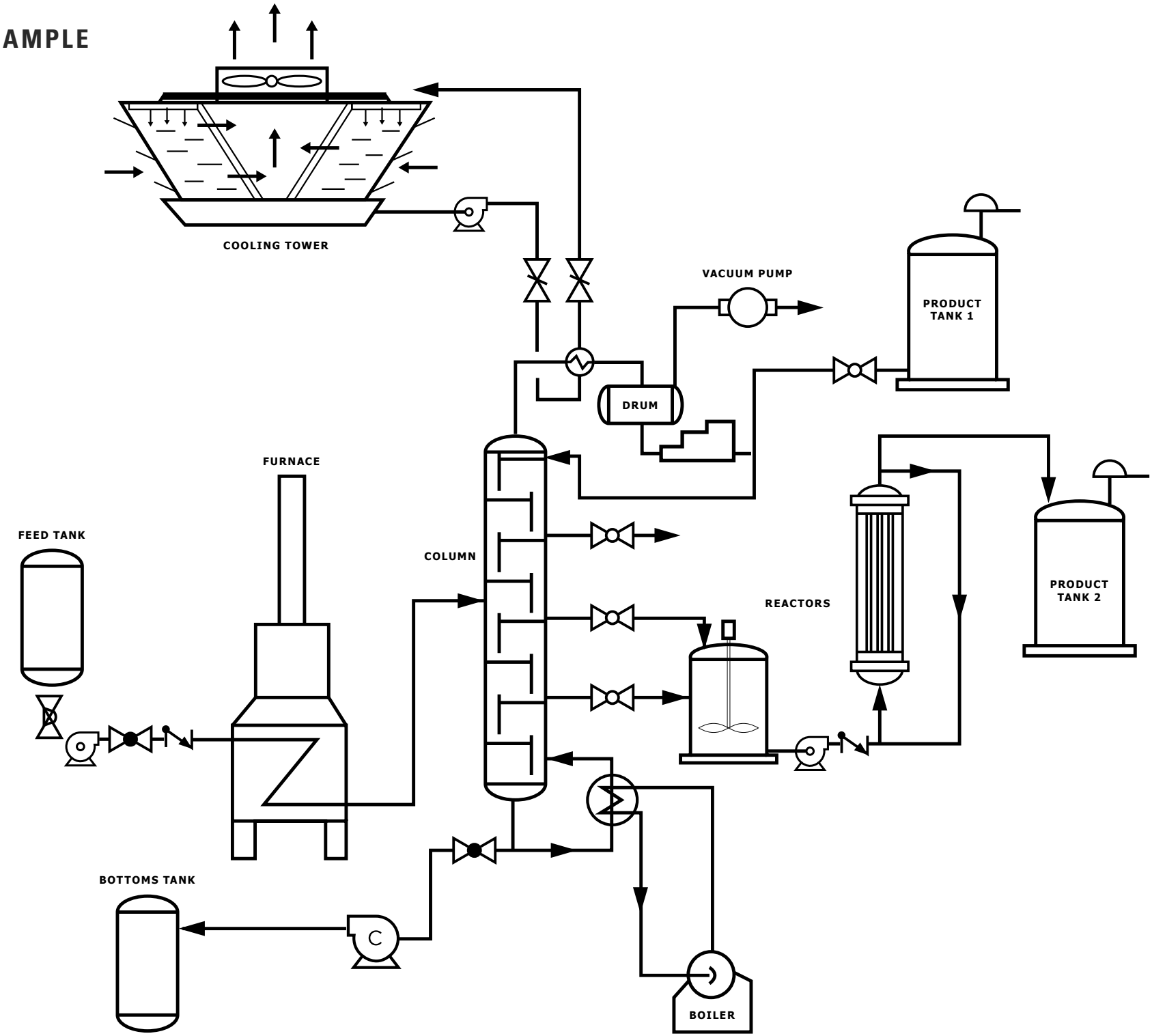
Rev. 01/2021

KIMRAY INC.

P&ID SAMPLE


TO FLAME
88,9 mm O.D. GAS FROM WELL HEAD
CORROSION COUPON
TI 03
CIRCULATING OIL HEATER
ALCOHOL STORAGE
CORROSION INHIBITOR TANK
DIAPHRAGM PUMP
ESD 02
OIL RESERVOIR
ALCOHOL PUMP
PI 02
P-1
P-2
WELL HEAD
ESD 01
TC 03
TI 02
TC 01
FR
TC 02
PIC
TI 01
CHOKE VALVE
PI 01
PILOT
PCV 03
FUEL GAS
PCV 02
PCV 01
2758 kPa FUEL GAS FROM PLANT
88,9 mm O.D. SOUR GAS FROM PLANT

PFD SAMPLE


COOLING TOWER
VACUUM PUMP
PRODUCT TANK 1
DRUM
FURNACE
FEED TANK
COLUMN
REACTORS
PRODUCT TANK 2
BOTTOMS TANK
C
BOILER

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	

A "User's choice" letter is used for unlisted meanings used repetitively in a project and will be explained on the diagram or supporting document.

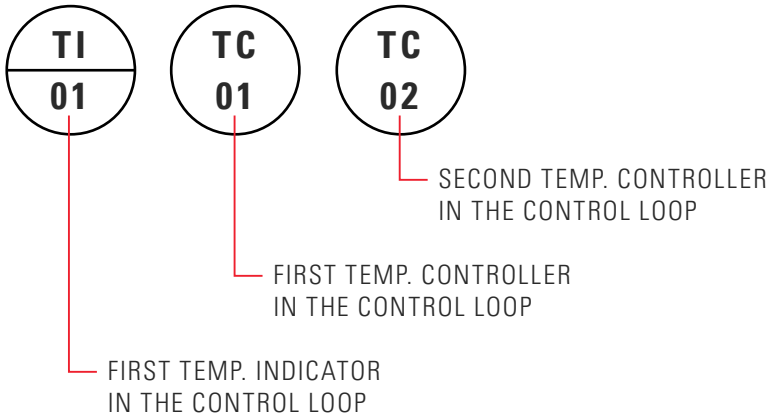
TAG NUMBERS – OIL & GAS INSTRUMENT ABBREVIATIONS *(Adapted From ISA Standard S5.1)*

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

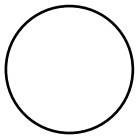
TAG NUMBERS – LOOP NUMBER

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.

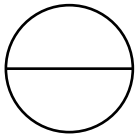
If you were looking at a list of the controls, you could look at the control loop number to find that specific device on the P&ID. Companies have different protocols for where these numbers originate.



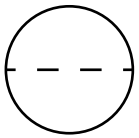
TAG NUMBERS – INSTRUMENT LOCATION



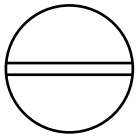
- Located in field
- Not panel, cabinet, or console mounted
- Visible at field location
- Normally operator accessible



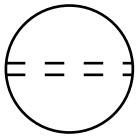
- Located in or on front of central or main panel or console
- Visible on front of panel or on video display
- Normally operator accessible at panel front or console



- 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

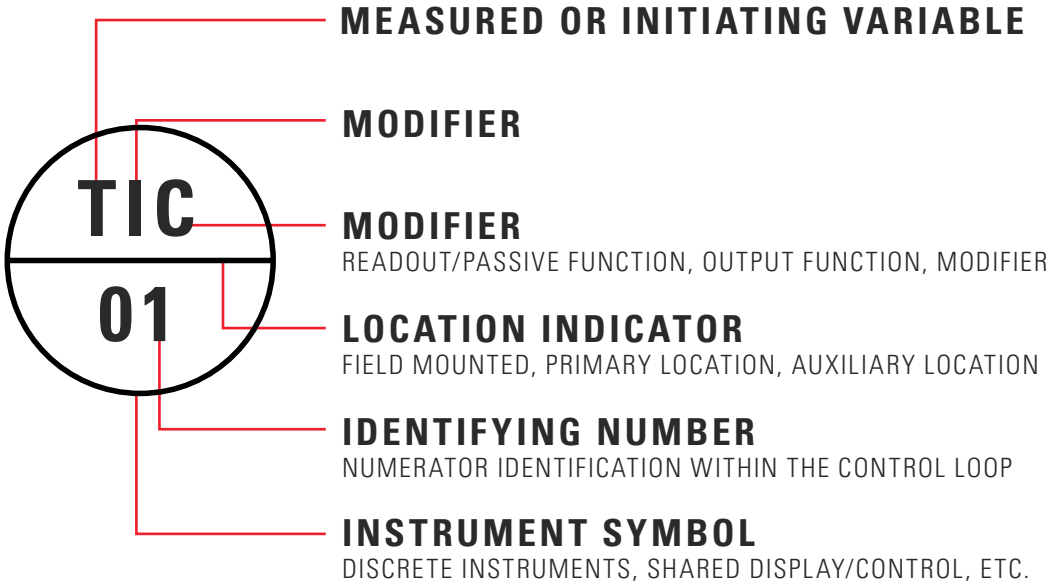


- Located in or on front of secondary or local panel or console
- Visible on front of panel or on video display
- Normally operator accessible at panel front or console



- 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 Projcess)		
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-ported 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-ported 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	M	Rotary motor operated actuator Electric, pneumatic, or hydraulic Linear or rotary action
10	S	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	E H	Electrohydraulic linear or rotary actuator
15		Actuator with manual actuated partial stroke test device
16	S	Actuator with remote actuated partial stroke test device
17	S	Automatic reset on-off solenoid actuator Non-latching on-off solenoid actuator
18	S R	Manual or remote reset on-off solenoid actuator Latching on-off solenoid actuator
19	S R R	Manual and remote reset on-off solenoid actuator Latching on-off solenoid actuator
20		Spring or weight actuated relief or safety valve actuator
21	P	Pilot actuated relief or safety valve actuator Pilot pressure sensing line deleted if sensing is internal

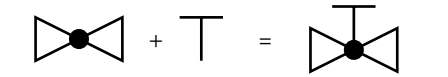
Symbols 1-16, when combined with element symbols 1-14, represent process control valves and with element symbol 21 represents a variable speed control unit.

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.

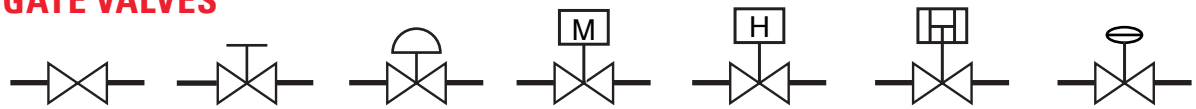
SYMBOLS – COMMON VALVE SYMBOLS AND COMBINATIONS

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.



Globe Valve | Hand Actuator | Hand-Operated Globe Valve

GATE VALVES



Gate | Hand Operated (Manual) | Pneumatic (Diaphragm) | Motor | Hydraulic | Pneumatic (Rotary Piston) | Balance Diaphragm

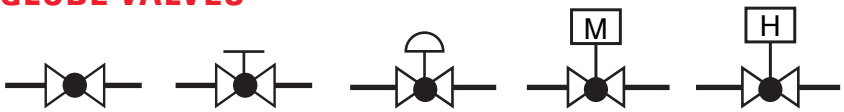
Pressure Regulator | Back Pressure Regulator

FAIL-SAFE POSITION

Fail Closed

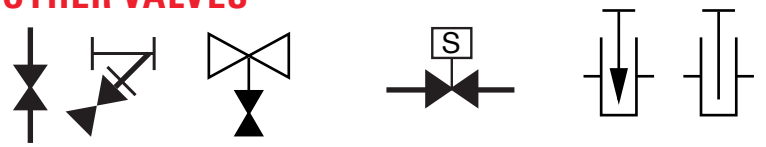
Fail Open

GLOBE VALVES

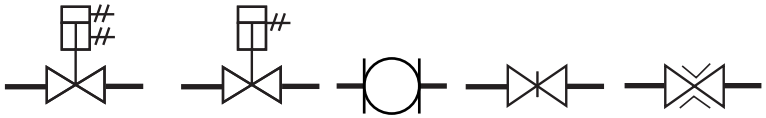


Globe | Hand Operated | Pneumatic | Motor | Hydraulic

OTHER VALVES

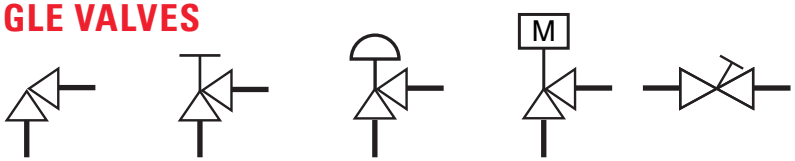


Bleeder | Integrated Block | Solenoid Closed | Knife | Slide



Piston-Operated | Float-Operated | Rotary | Needle | Pinch

ANGLE VALVES



Angle | Hand Operated | Pneumatic | Motor | Angle Blowdown

END CONNECTION

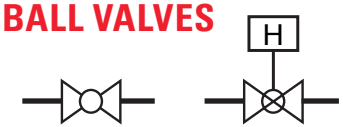
Flanged

Treaded

Welded

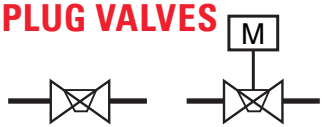
Socket Weld

BALL VALVES



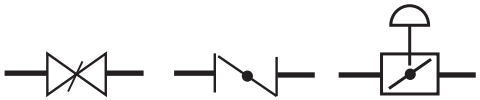
Ball | Hydraulic

PLUG VALVES



Plug | Motor

BUTTERFLY VALVES



Butterfly | Pneumatic

CHECK VALVES

Check Valve | Stop Check

DIAPHRAGM VALVES

Diaphragm | Motor

SAFETY

PSV

RELIEF

PRV

QUARTER TURN

Quarter Turn Valve Double Acting | Quarter Turn Valve Spring Acting

EQUIPMENT

Rotameter | Gauge | Orifice

SYMBOLS – EQUIPMENT

CENTRIFUGAL PUMPS

	Centrifugal Pumps
	Vertical
	Horizontal
	Vertical
	Sump Pump

POSITIVE DISPLACEMENT PUMPS

	Positive Displacement
	Progressive Cavity
	Screw Pump
	Screw Pump
	Vacuum Pump
	Reciprocating Pump

	Positive Displacement
	Gear Pump
	Vertical Can Pump

COOLING TOWERS

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

STORAGE

	Bin
	Tank
	Dome Roof Tank
	Open Top Tank

	Drum
	Internal Floating Roof Tank
	Double Wall Tank
	Cone Roof Tank

	External Floating Roof
	Sphere
	Onion Tank

SYMBOLS – EQUIPMENT

CENTRIFUGAL COMPRESSORS

	Centrifugal Compressor
T	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
	Rotory 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

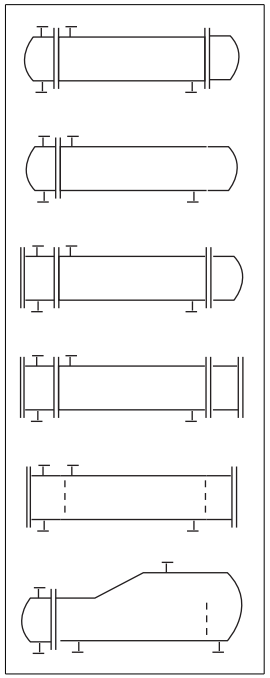
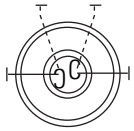
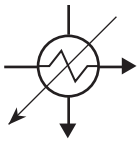
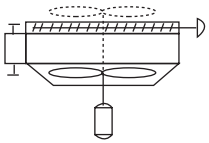
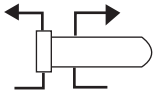
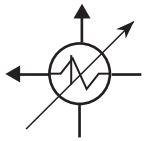
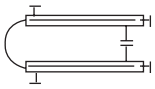
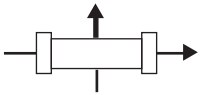
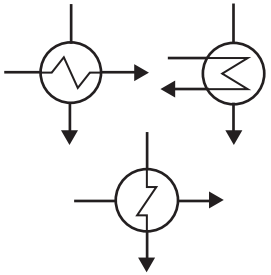
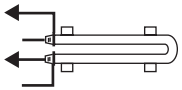
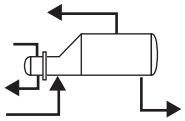


	Plate and Frame Heat Exchanger		Spiral Heat Exchanger		Heater
	Air Cooled Exchanger (Louvers Optional)		U-Tube Heat Exchanger		Condenser
	Double-Pipe Heat Exchanger		Single Pass Heat Exchanger		Shell and Tube Heat Exchanger
	Hairpin Exchanger		Reboiler		

DISTILLATION SYMBOLS

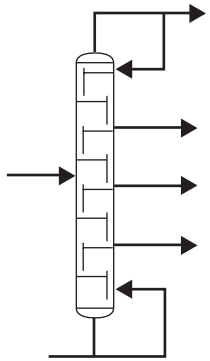
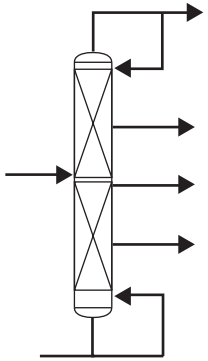


Plate Tower
Bubble-cap, Sieve, Valve



Packed Tower
Saddle, Ring, Sulzer, Rosette