

PIPING AND INSTRUMENTATION DIAGRAM - P&ID

1. Pendahuluan

Untuk membantu kelancaran pekerjaan instrumentasi dilapangan teknisi-teknisi instrumentasi harus memahami beberapa dokumen yang dapat menjelaskan lokasi, fungsi, dan parameter yang diukur atau dikontrol, spesifikasi, instalasi, kalibrasi, riwayat instrumen, Selain itu untuk penggambaran instrumen dalam diagram mengikuti standar internasional juga harus dipahami.

Berikut ini adalah beberapa dokumen yang diperlukan oleh bagian instrumen

- Process flow sheet
- Piping and instrument Diagram
- Instrument index sheet
- Instrument specification sheet
- Loop wiring diagram
- Instalation detail
- Gambar-gambar khusus seperti:
 - Instrument tubing support layout
 - Schematic control diagram
 - Emergency shutdown system
 - Instrument wiring detail
 - Daftar alarm dan shutdown

Beberapa informasi yang juga diperlukan adalah:

- Process information
- Instrument specification & standarts
- Electrical specification
- Vendor Drawing

2. Piping and Instrument Diagram

Menunjukkan secara detail informasi mengenai peralatan proses dan instrumen yang terpasang pada plant.,seperti misalnya:


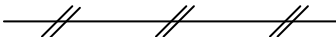
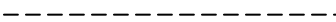
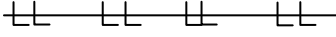
- Peralatan proses dan dan desain variabel proses
- Persambungan pipa dengan ukuran, material, dan spesifikasi fabrikasi
- Kebutuhan utilitis termasuk ukuran pipa, material
- Semua peralatan utama instrument


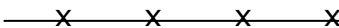
Dalam beberapa situasi secara skematis masing-maring proses dan line utilitis digambarkan dalam diagram ini, sehingga diagram ini menjadi sumber informasi teknisi instrumen dalam melakukan pekerjaan, dan perubahan-perubahan atau modifikasi sering juga dibuat pada saat pekerjaan sedang berjalan.

Pada diagam ini semua peralatan proses dan sistem instrumentasi digambarkan dalam bentuk simbol-simbol standar "Instrument Society of America" yang biasa disebut ISA Standart.

2.1 Line Instrument Symbol













Berdasarkan line simbol ini dapat dibedakan sistem instrumentasi yang terpasang apakah pneumatic, electric atau hidrolic. Berikut ini beberapa line simbol

Gambar Symbol	Keterangan
	Pipa Proses (main line)
	Pneumatic Signal
	Electric / Electronic Signal
	Hydraulic Signal


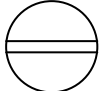


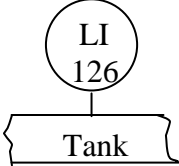
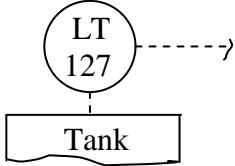
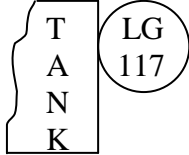
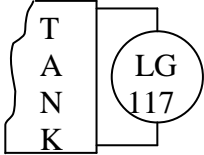
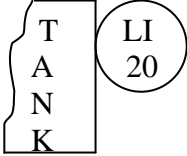
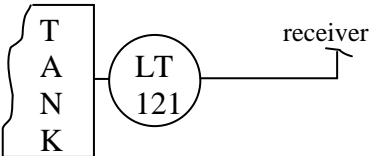
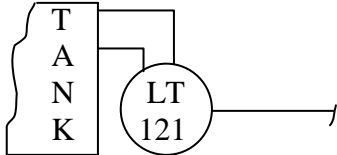
Gambar Symbol	Keterangan
	Electromagnetic atau Sonic signal
	Capillary tubing (filled system)

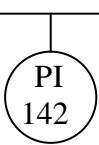
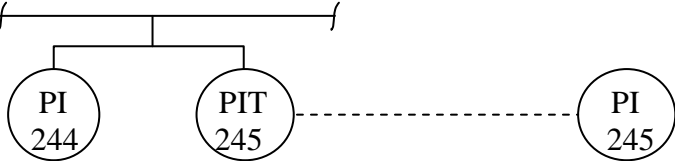


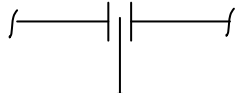
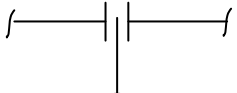
2.2 Instrument Symbol

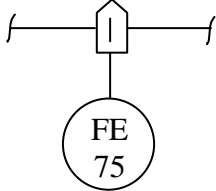
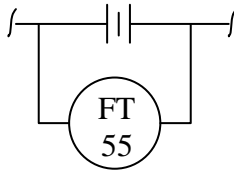
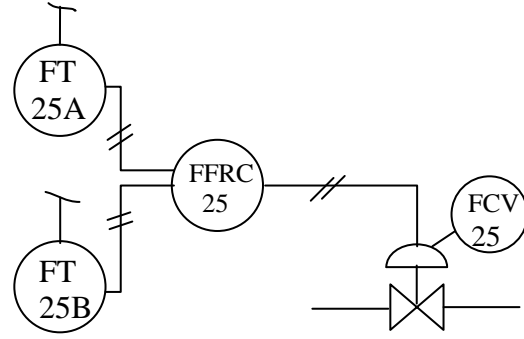
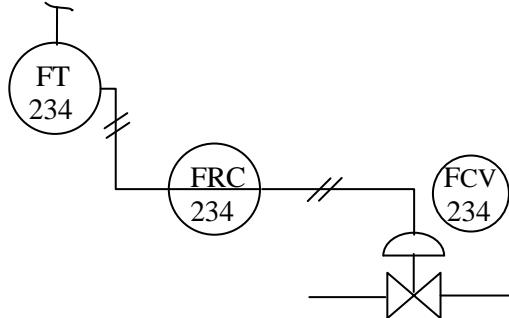
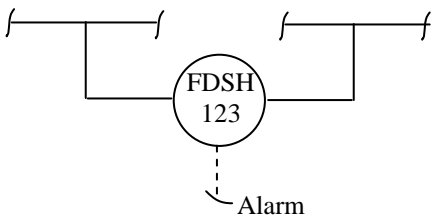
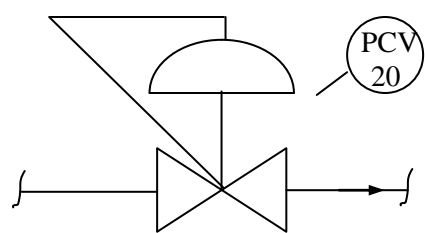
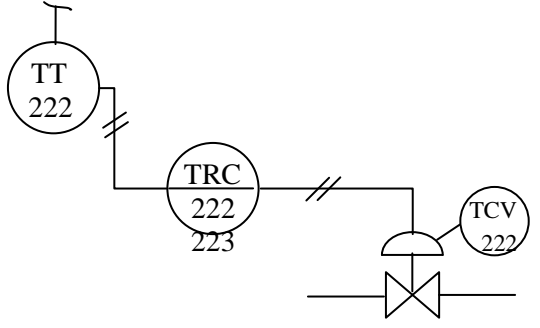
Penggambaran instrumen kedalam diagram biasanya berupa lingkaran dan diberi idektifikasi

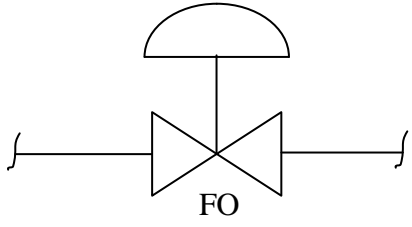
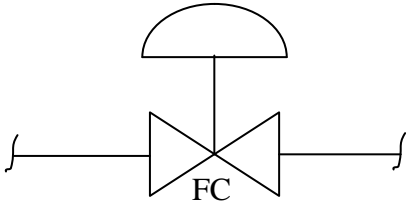
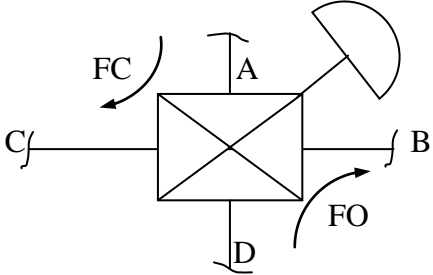
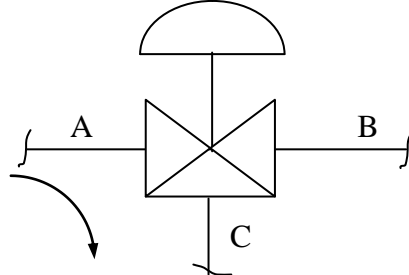
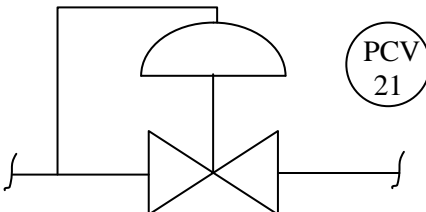
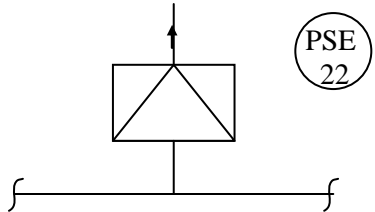
General instrument or function symbols			
	Lokasi Utama Yang Diakses/ Dimonitor Operator	Terpasang Di Lapangan	Lokasi Tambahan Yang Diakses Operator
Instrumentasi Tunggal / Individual	1 	2 	3 
Dapat Dimonitor & Digunakan Utk Kontrol Bersama	4 	5 	6 
Fungsi Perhitungan Dalam Komputer	7 	8 	9 
Programmable Logic Controller	10 	11 	12 

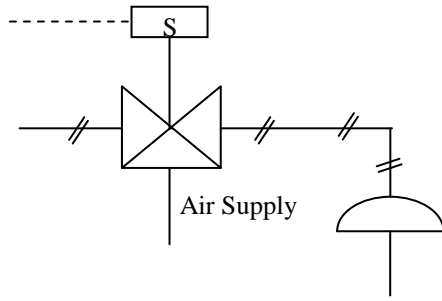
Fungsi (Lingkaran, kotak, dsb) Simbol-Simbol ini menunjukkan lokasi proses instrumentasi berlangsung. Ada terpasang di lapangan, di kontrol system atau PLC.

 <p>Locally mounted</p>	 <p>Mounted on local control panel</p>	 <p>Mounted on central control panel</p>	 <p>Mounted in rear control control panel</p>
 <p>Level Indicator Float type with gage board or tape indicator mounted above tank</p>	 <p>Capacitance or dielectric type level element connected to level transmitter (tag level element LE 127)</p>	 <p>Gage Glass integrally mounted on tank.</p>	 <p>Gage Glass externally connected</p>
 <p>Level Indicator float or displacer type</p>	 <p>Level transmitter internal float type or displacer type mounted on side oftank</p>	 <p>Level transmitter differential pressure type, externally connected with dip type</p>	

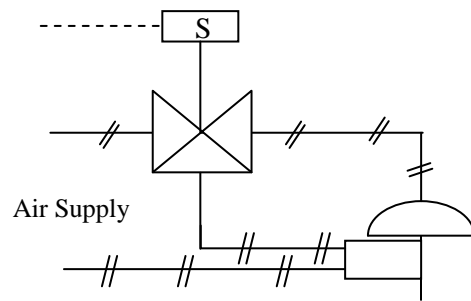
 <p>Pressure indicator direct connected</p>	 <p>Local pressure indicator and pressure indicating transmitter with common tap and board mounted pressure receiver indicator</p>		
 <p>receiver</p>	 <p>Positive displacement</p>		

<p>Unclassified primary flow element integrity transmitter</p>	<p>type flow totalizing indicator</p>	<p>Orifice plate with flange or corner taps</p>	<p>Orifice plate with flange tap connected to differential pressure type.</p>
 <p>Orifice plate in quick change fitting</p>	 <p>Orifice plate with vena contracta, radius, or pipe taps connected to differential pressure type flow transmitter</p>	 <p>Flow ratio controller with one pen record flow ratio</p>	
 <p>Recording flow control station board mounted</p>	 <p>High differential pressure switch</p>		
 <p>Back pressure regulator Self contained</p>	 <p>Recording temperature control station board mounted</p>		

 <p>Two way valve, Fail open</p>	 <p>Two way valve, Fail closed</p>
 <p>Four way valve Fail open to paths A-C and D-B</p>	 <p>Three way valve Fail open to path A-C</p>
 <p>Back pressure regulator With external pressure tap</p>	 <p>Rapture disk or safety head for vacuum relief</p>

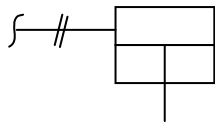


Preferred alternative

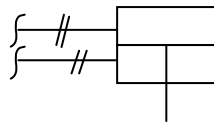


Optional alternative

Diaphragm, spring offset, with \pm and over riding pilot valve that pressurised when actuated

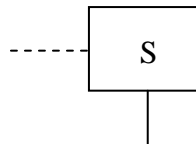


Single acting

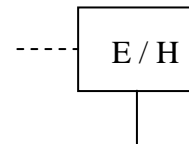


Double acting

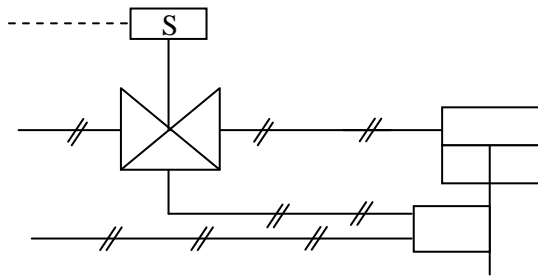
Cylinder without positioner or other pilot



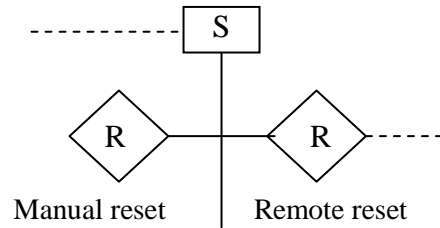
Solenoid



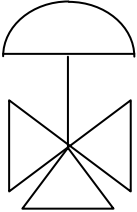
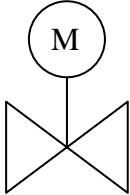
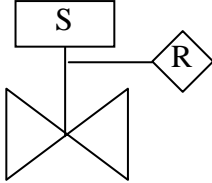
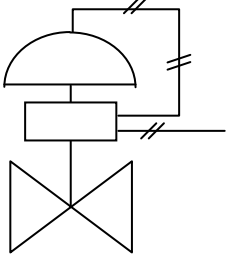
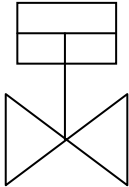
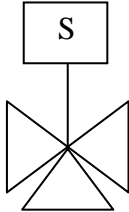
Electro Hydraulic



Single acting cylinder



Solenoid actuator and typically with electric signal for remote reset, with manual reset alternative.

 <p>Pilot valve three way or Diverter valve</p>	 <p>Motor operated valve</p>	 <p>Solenoid valve with manual reset</p>
 <p>Pneumatic control Valve With positioner</p>	 <p>Piston operated valve</p>	 <p>Solenoid valve three way</p>

3. Instrument Identification

Umumnya suatu kawasan industri atau proses produksi mempunyai unit-unit proses kecil yang satu dengan lainnya saling berkaitan. Fungsi instrumen adalah untuk memonitor, mengatur dan menjaga agar proses berjalan normal. Untuk memudahkan mengenal instrumen yang dipasang pada satu plan maka setiap instrument perlu diberi tanda pengenal (instrument identification). Dari tanda pengenal berupa "tag number" dapat diketahui Parameter yang diukur, fungsi instrumen, lokasi dipasang, dan nomor urut dari instrumen tersebut. Cara identifikasi instrumen adalah dengan huruf dan angka. Dengan adanya tag number dari masing-masing instrumen yang terpasang dan dibantu dengan gambar-gambar instrumen (piping and instrumen diagram, loop drawing, hookup drawing) seorang ahli instrumen dapat dengan mudah mencari instrumen-instrumen yang perlu mendapat perawatan

T	RC	-100	-02
Huruf pertama	Huruf kedua, ketiga	Nomor Unit	Nomor loop
Menunjukkan fungsi		Menunjukkan rangkaian /loop	
INSTRUMENT IDENTIFICATION / TAG NUMBER			

Arti dari huruf dan angka tersebut adalah:

T : Variabel yang diukur, Temperature

R : Fungsi alat ukur, Recorder

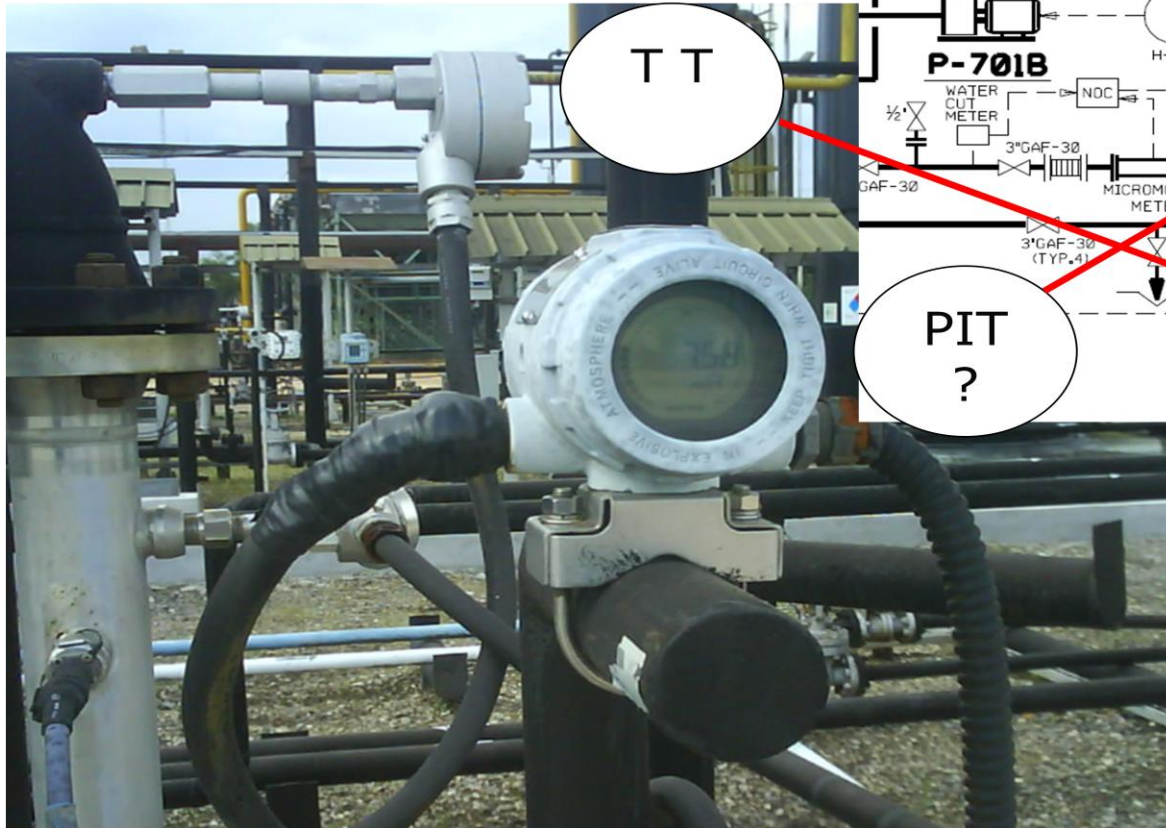
C : Fungsi Alat ukur, Kontroler

Symbol	Huruf Pertama	Huruf berikutnya	Fungsi keluaran
A	Analisis	Alarm	Control
B	Burner Flame		
C	Conductivity	Controller	

Symbol	Huruf Pertama	Huruf berikutnya	Fungsi keluaran
D	Density, SG, Differential		
E	Voltage (emf)		
F	Flow Rate, Flow Ratio	Primary Element	
G	Gaging		
H	Hand, High		
I	Current	Glass	
J	Power, Scan	High	
K	Time, Time Schedule	Indicator	
L	Level	Low, Light (pilot)	
M	Moisture, Humidity	Middle	

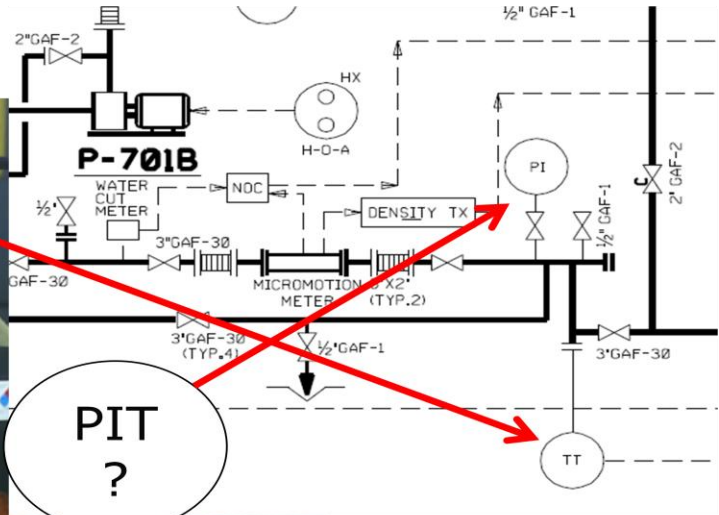
N			
O		Orifice	
P	Pressure, Vacuum	Point	
Q	Quantity, Event, Integrated Totalized		
R	Radio Activity	Recorder	
S	Speed	Safety	Switch
T	Temperature		
U			
V	Viscosity		
W	Weigh		
X			
Y			
Z	Position		

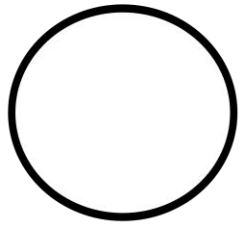
Instrument Tunggal Terpasang di Field



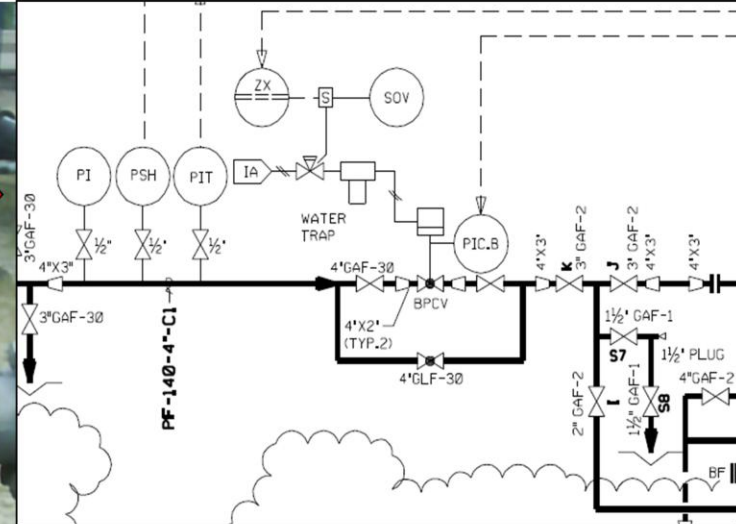
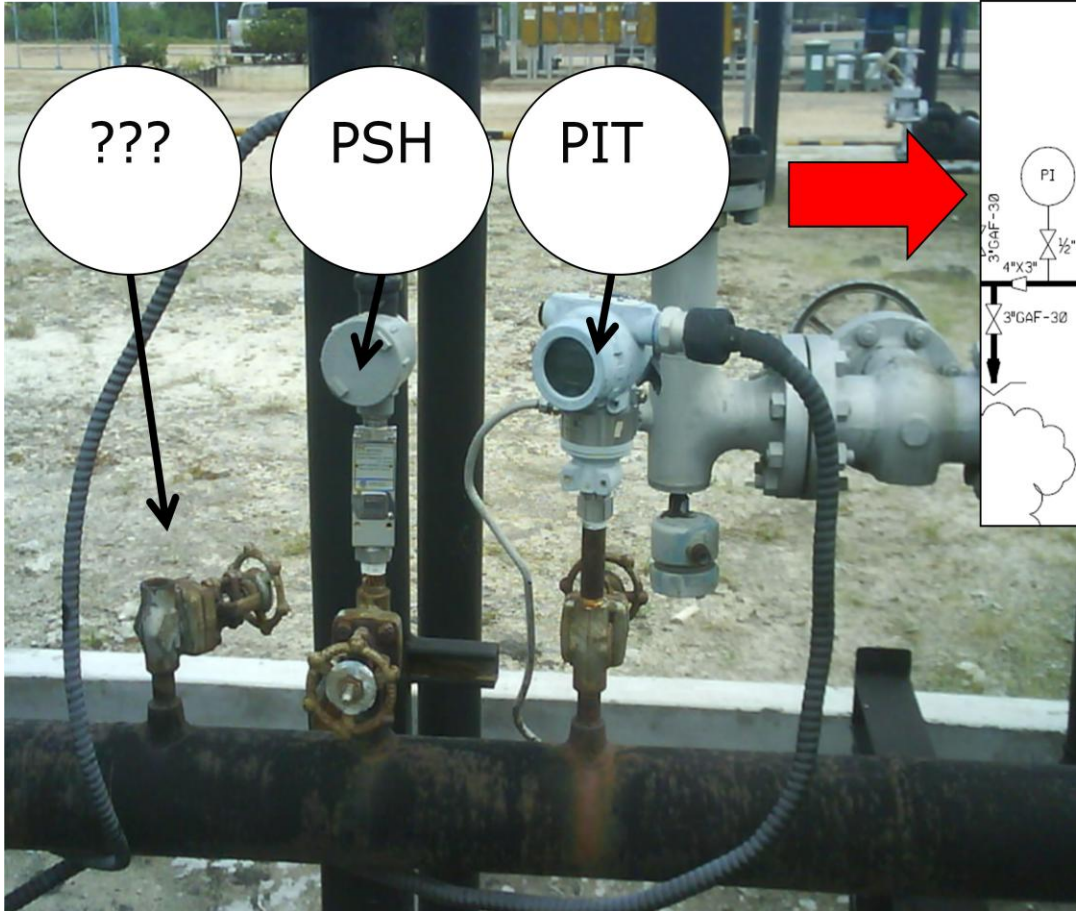
TT

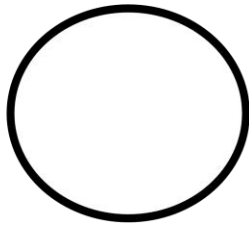
PIT ?





Instrument Tunggal Terpasang di Field



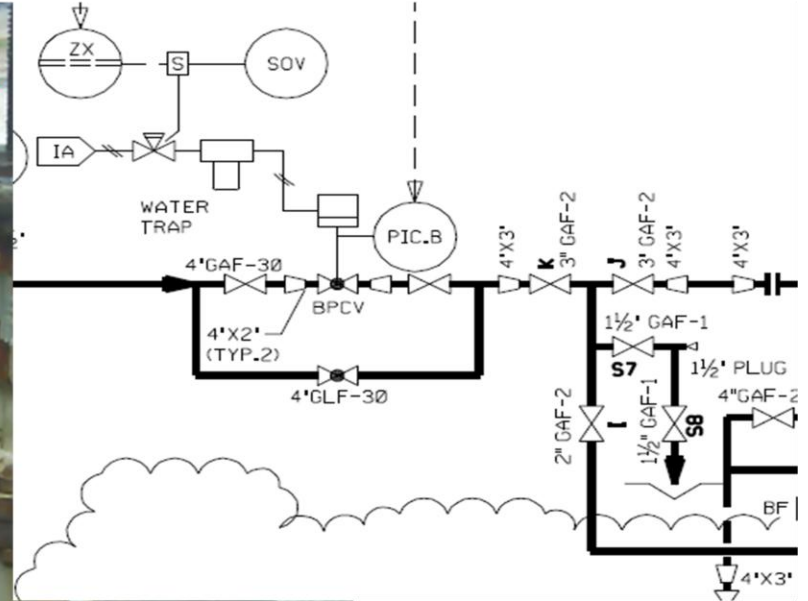
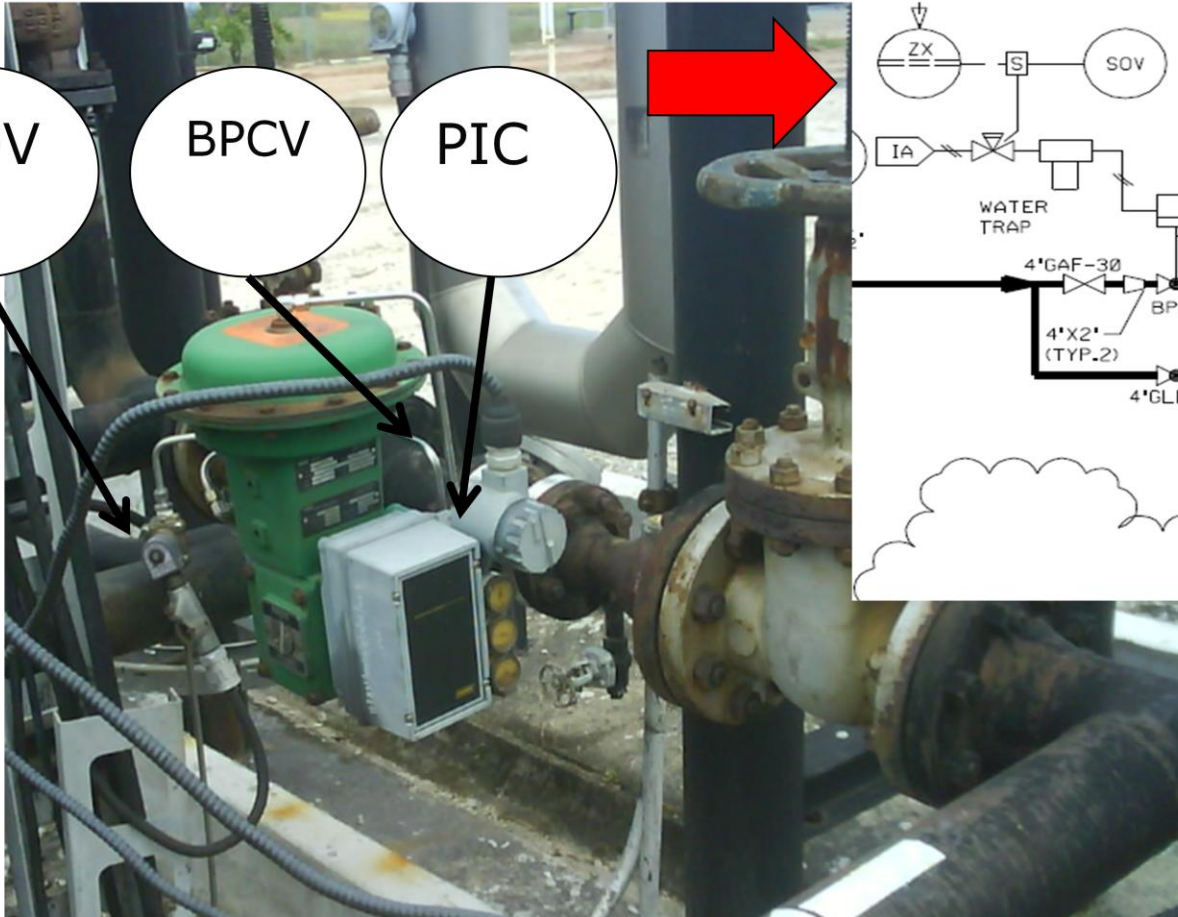


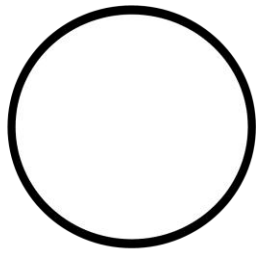
Instrument Tunggal Terpasang di Field

SOV

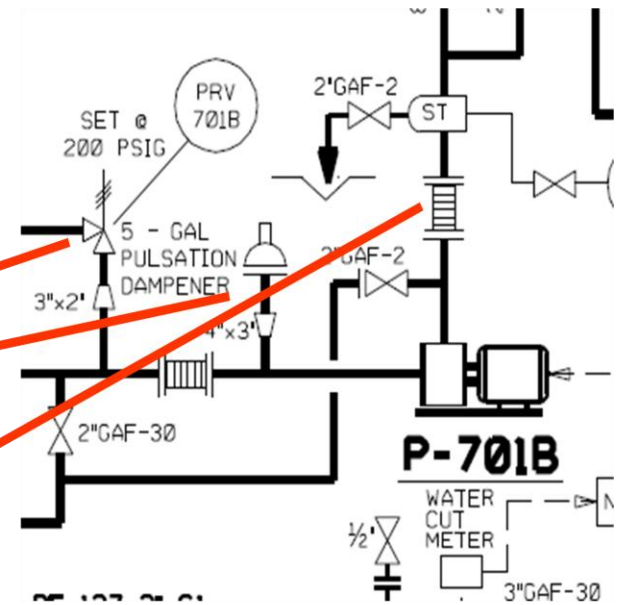
BPCV

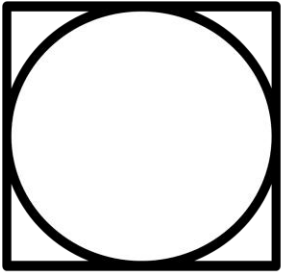
PIC





Instrument Tunggal Terpasang di Field

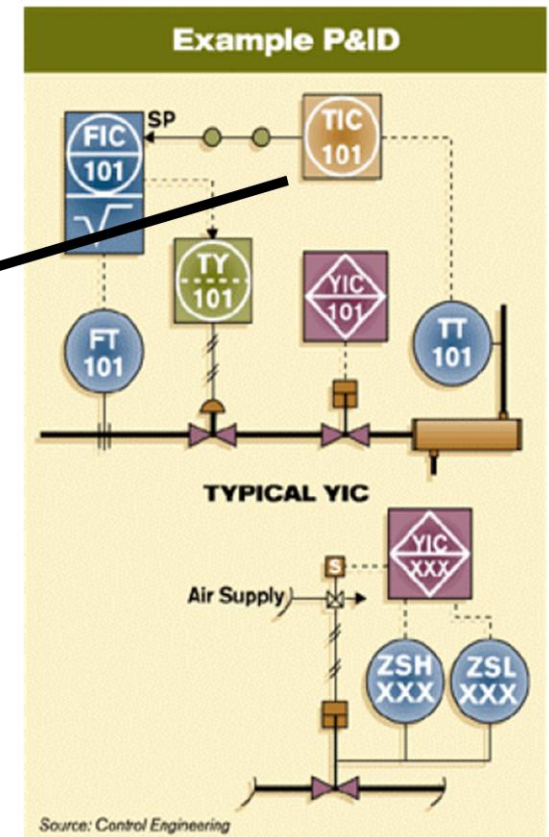


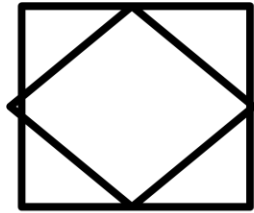


Shared Display/Shared Control Terpasang di lapangan

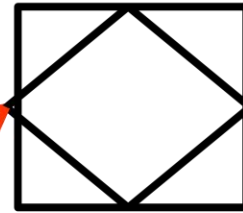


Field Mounted

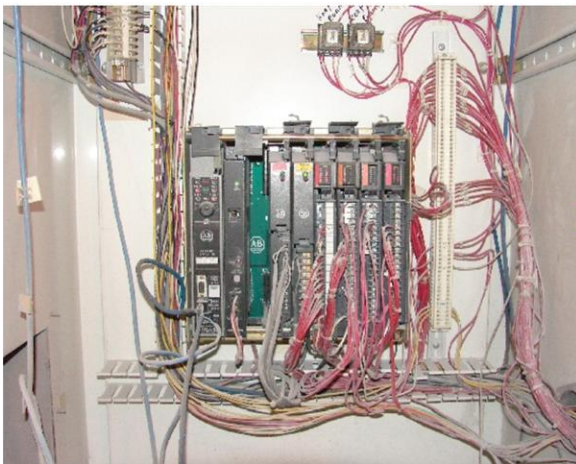


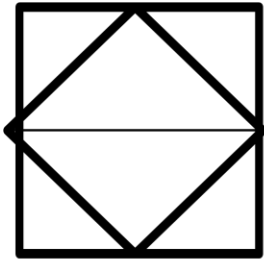


**PLC Function
Terpasang di Lapangan**

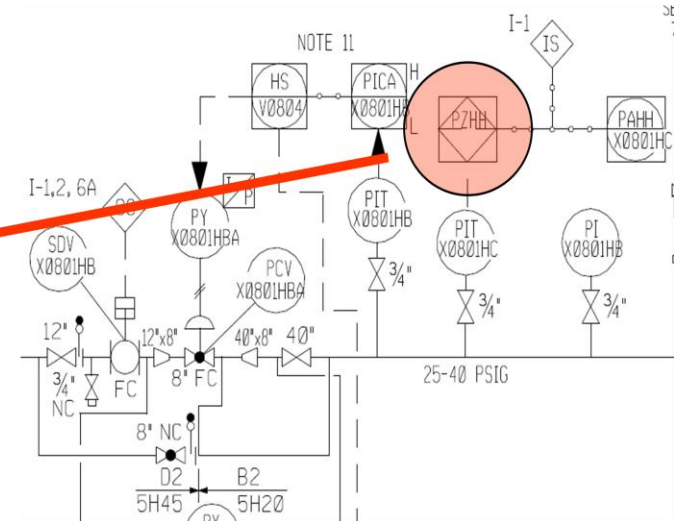


PLC Terpasang Di Lapangan

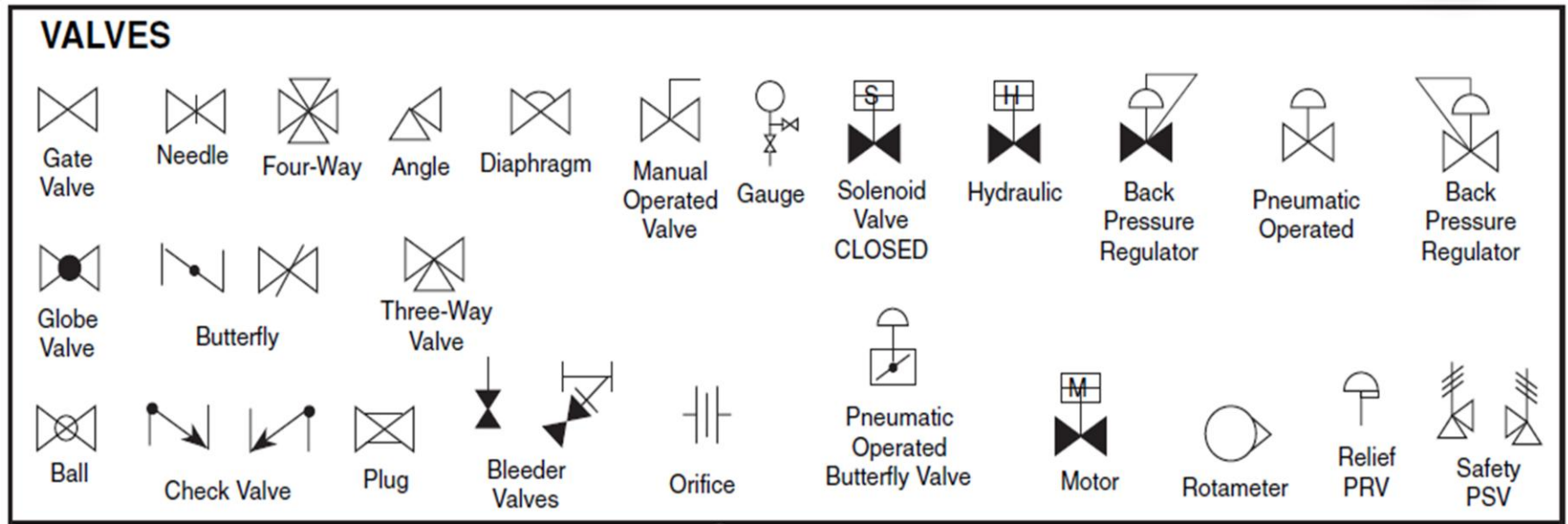




PLC Function Lokasi Utama di Akses Operator



Valves Symbol



Di dalam P&ID jenis dan tipe Valve digambarkan dengan simbol-simbol tertentu yang unik, sehingga dapat membantu menganalisa proses yang terjadi di dalam fasilitas tersebut.

Valve Symbol v.s Actual



Gate Valve



Globe Valve



Ball



Needle



Butterfly



Check Valve



Valve Symbol v.s Actual



SOV



Pneumatic Valve



MOV

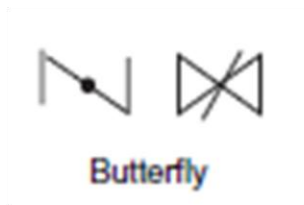


Safety PSV



Hydraulic Valve

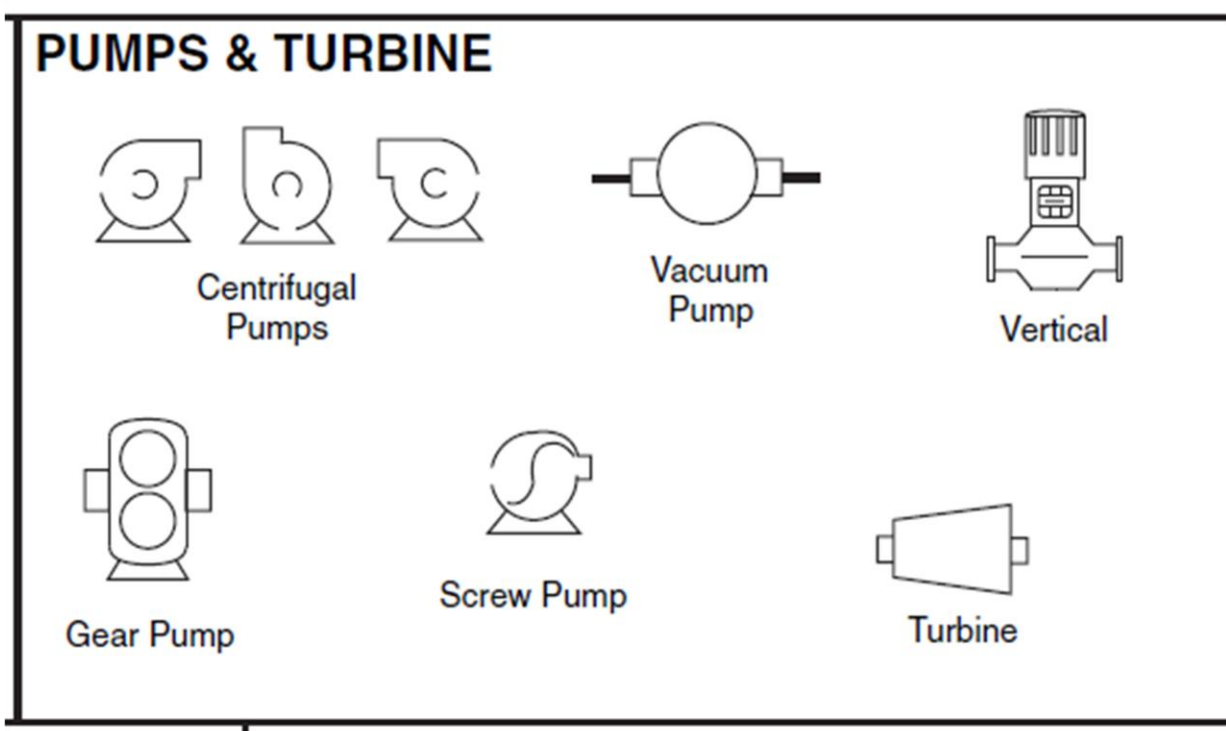
Valve Symbol v.s Actual



Butterfly Valve



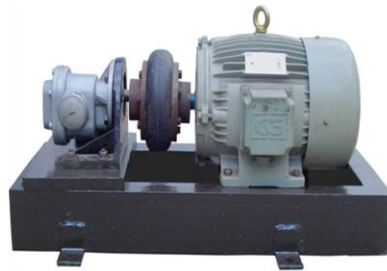
Pumps Symbol v.s Actual



Vertical



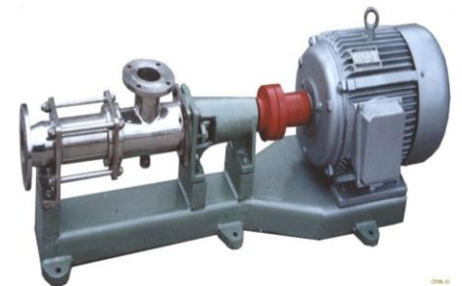
Centrifugal



Gear

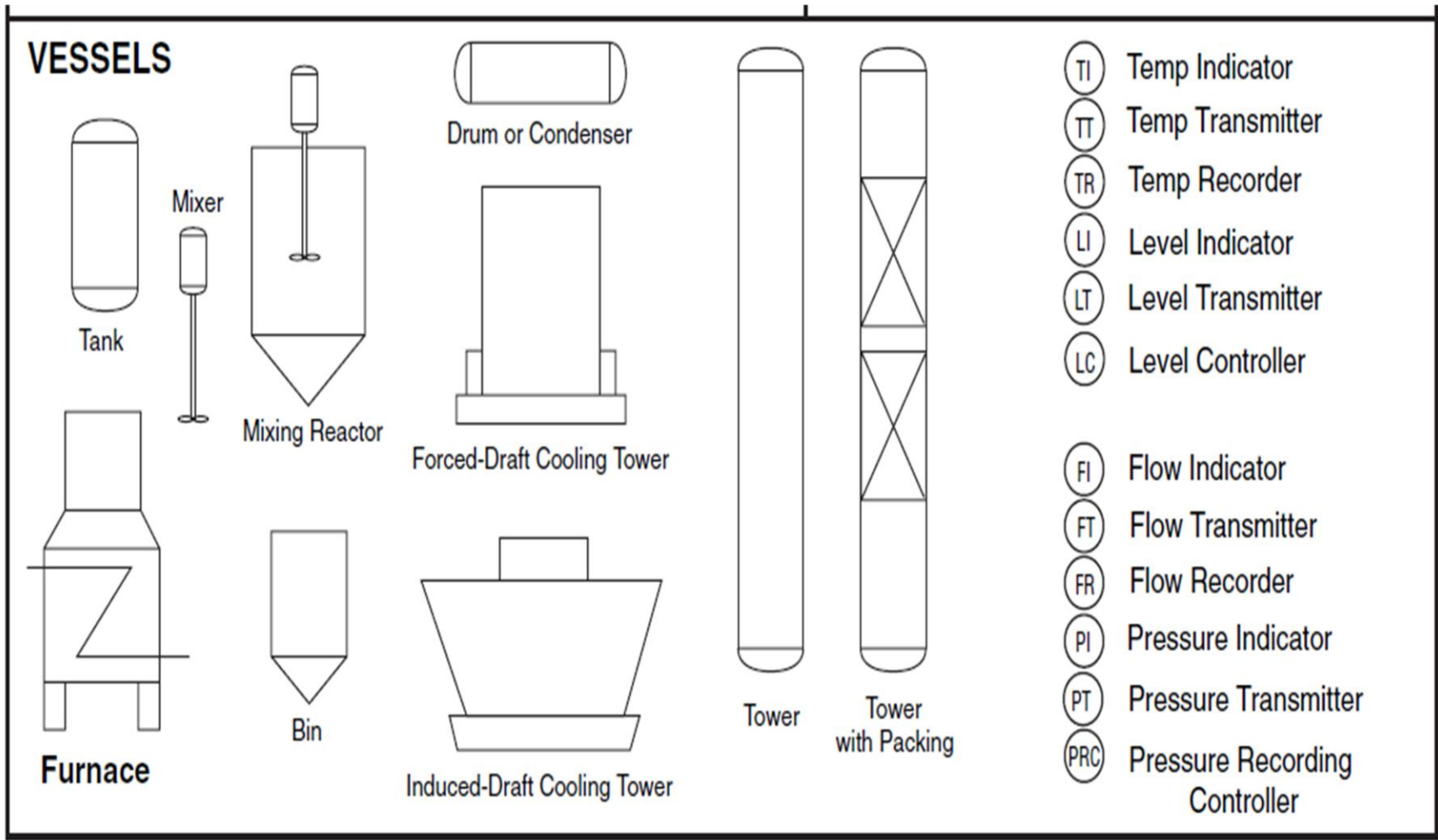


Turbine

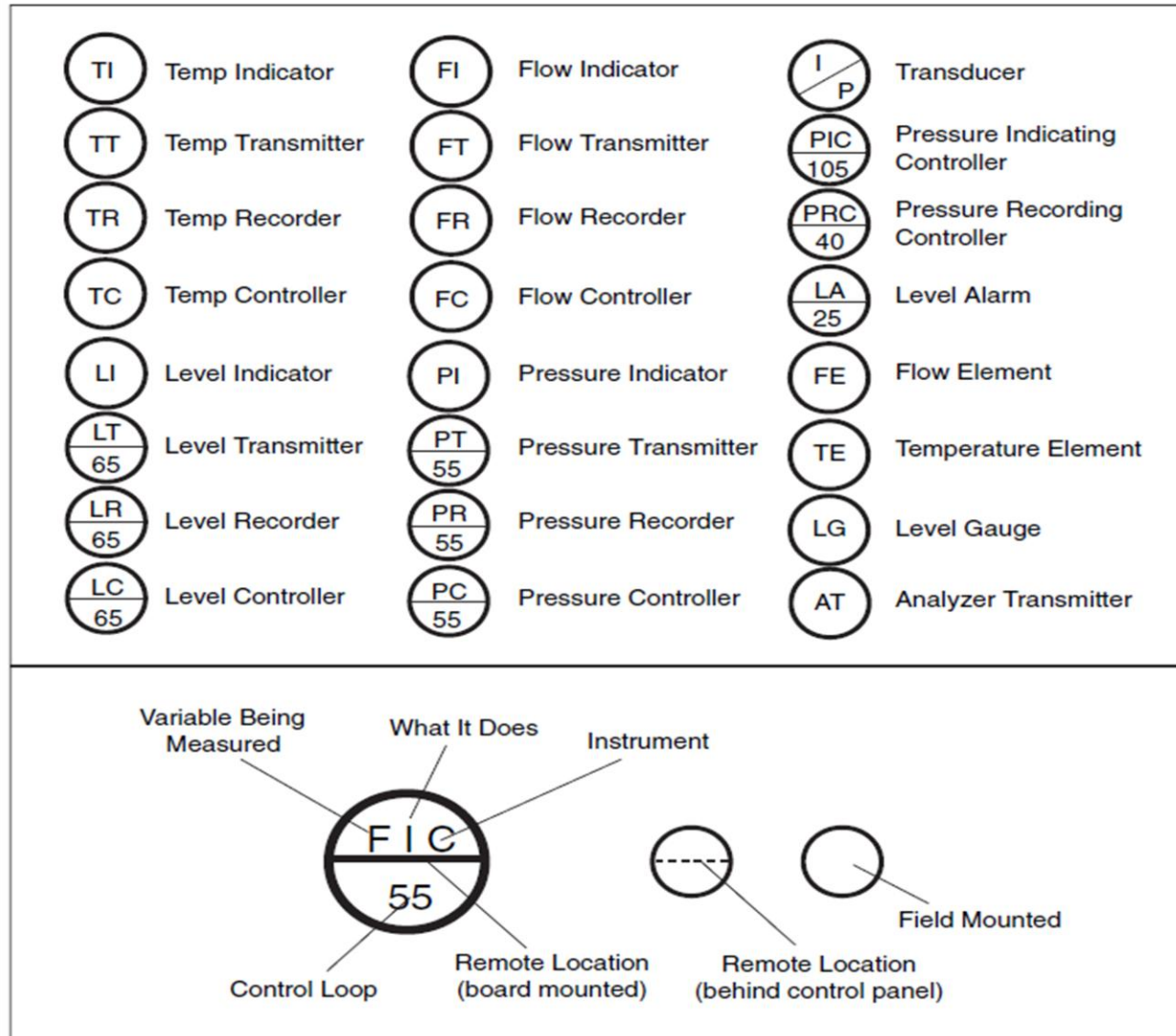


Screw

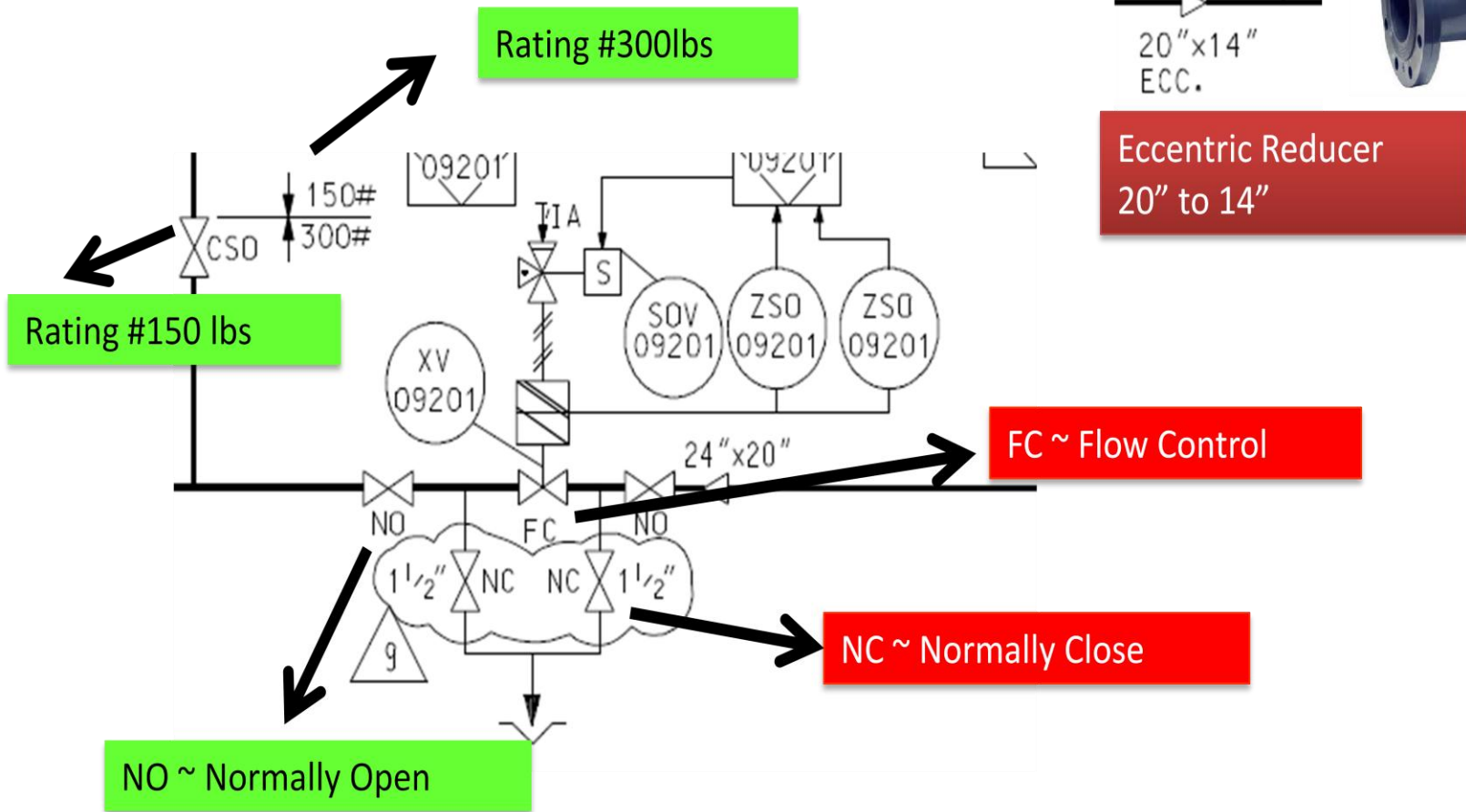
Vessel Symbol in P&ID



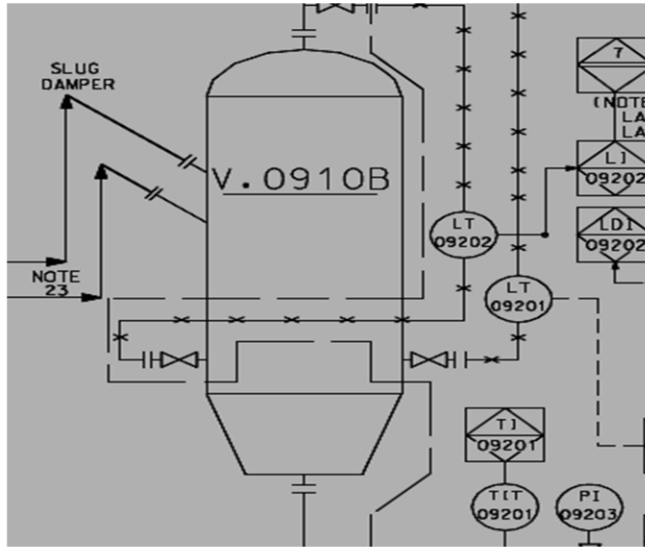
Symbol in P&ID



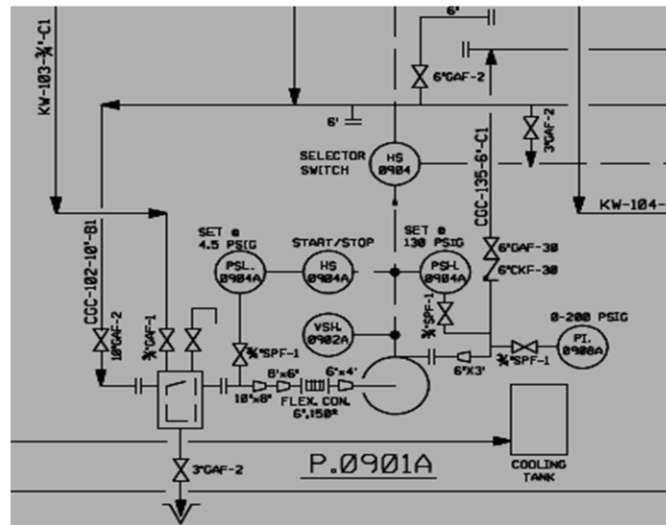
Piping & Valve Information



Equipment Information



8102.V.0910A&B		
DEGASSING SEPARATORS		
	OPERATE	DESIGN
BFPD	53125	106250
GAS MMSCFD	6.73	13.5
PRESS. (PSIG)	70	135
TEMP. (°F)	250	300
DIMENSION	DIAM = 3' HEIGHT = 30'	

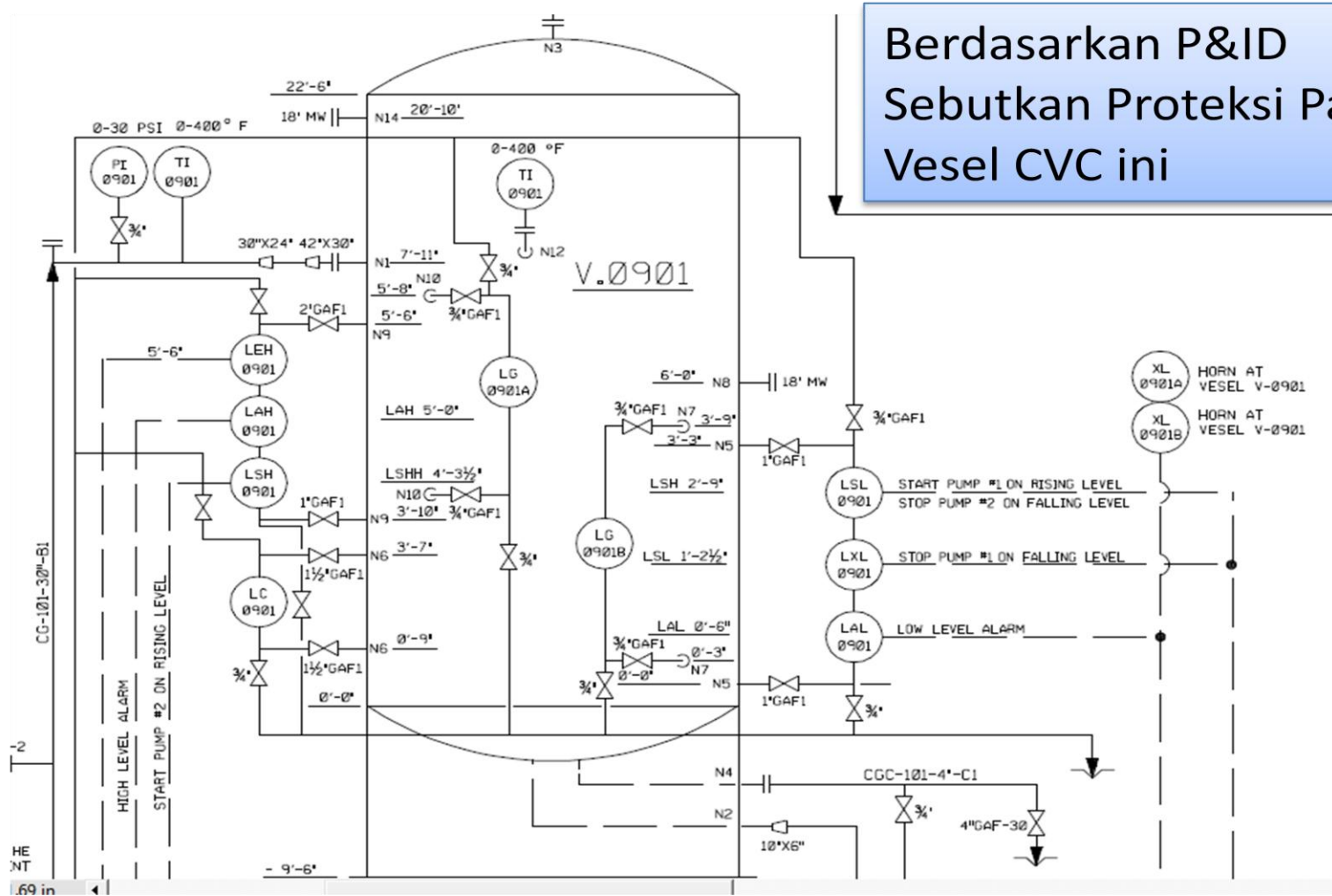


8053.P.0901 A&B

CVC TRANSFER PUMPS

DESIGN : 400 GPM @ 285 FT TDH
 MOTOR : 125 HP

Latihan..



Dirangkum dari modul instrumentasi Pusdiklat Migas Cepu, catatan dan sharing aktivitas kerja sehari hari dilapangan.