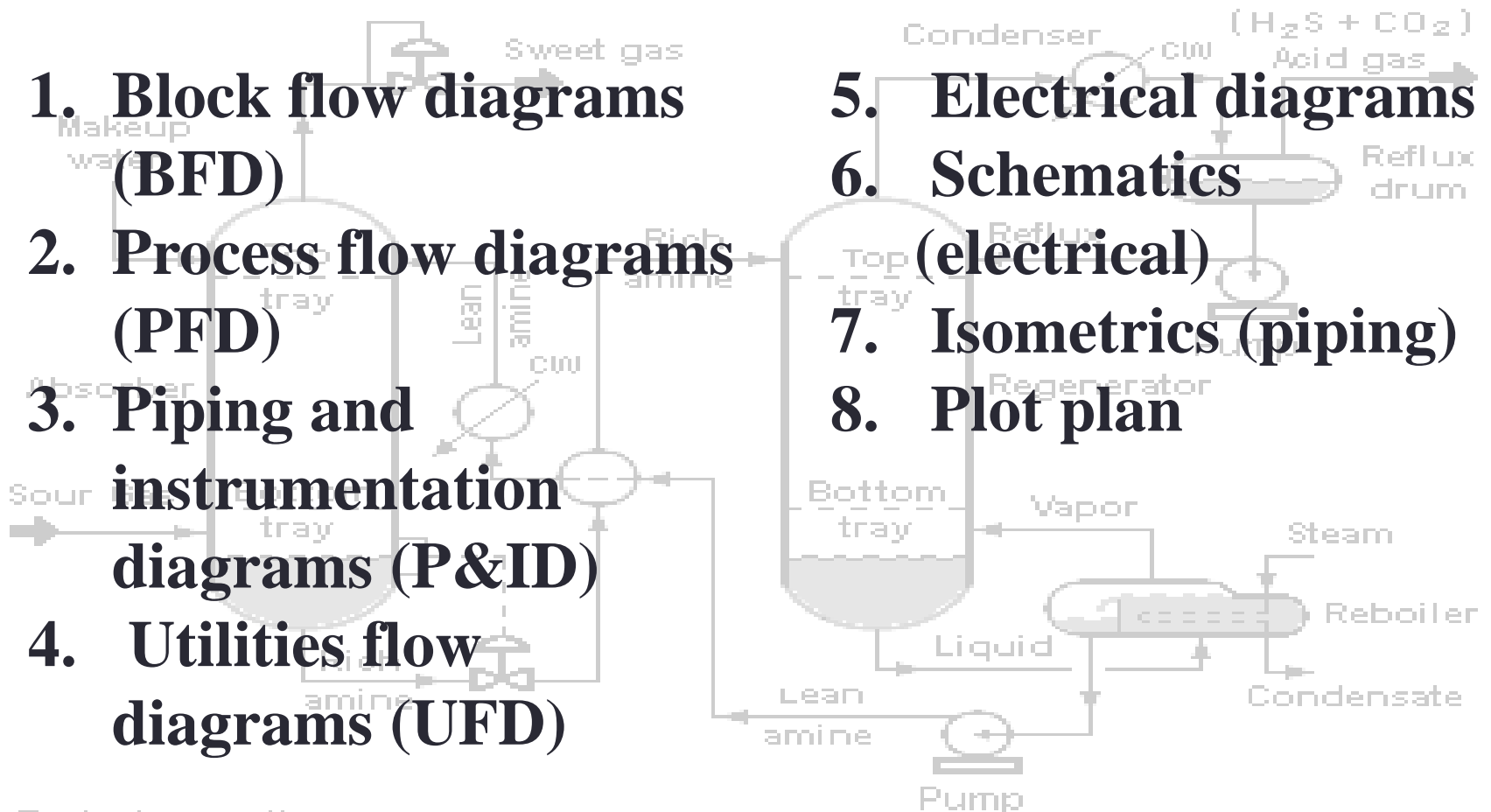


READING PROCESS DRAWINGS

Common Process Drawings



Typical operating ranges

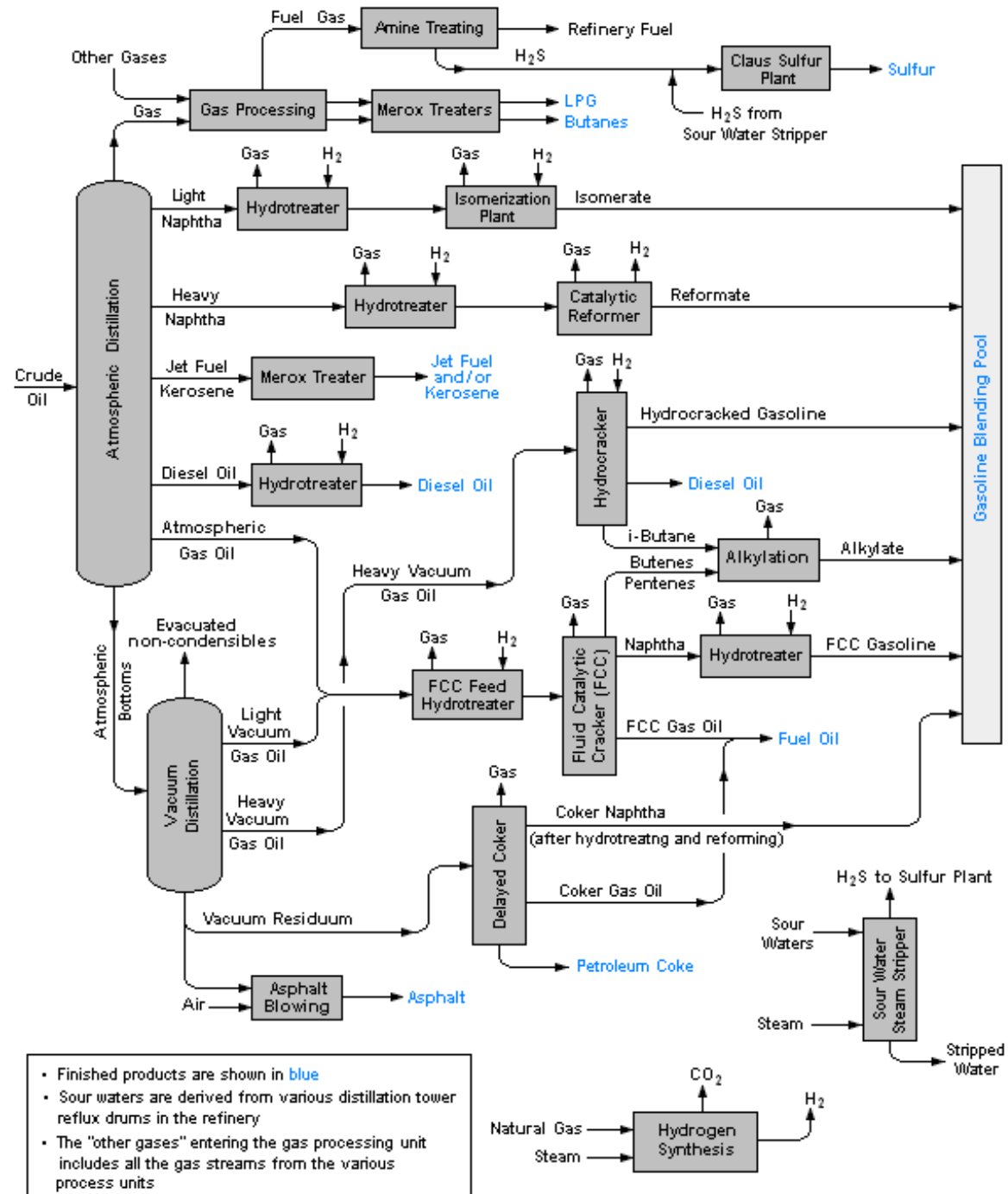
Absorber : 35 to 50 °C and 5 to 205 atm of absolute pressure

Regenerator : 115 to 126 °C and 1.4 to 1.7 atm of absolute pressure
at tower bottom

Block flow diagrams (BFD)

- Blocks connected by straight lines
- Process flow

http://en.wikipedia.org/wiki/Process_flow_diagram

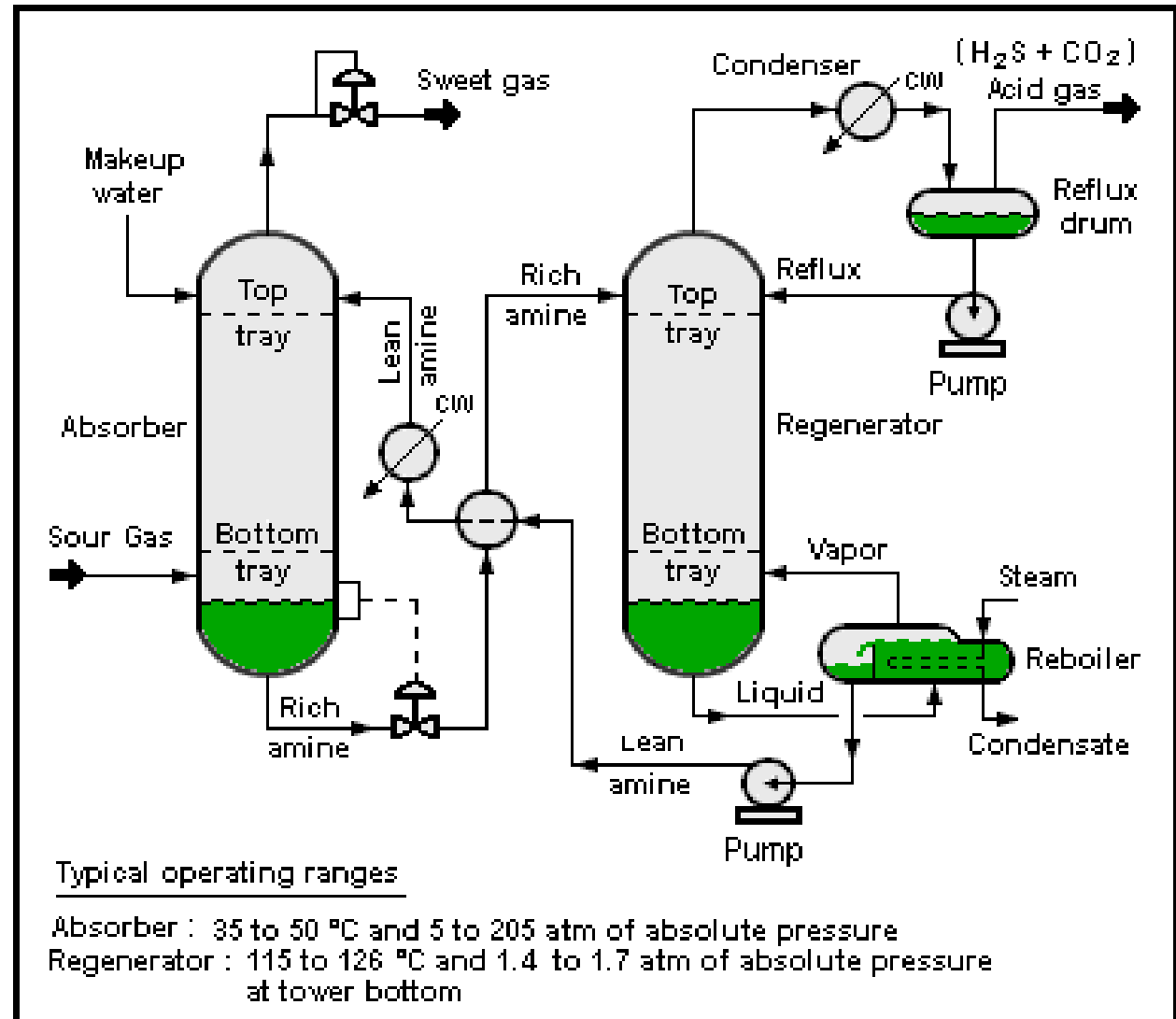


- Finished products are shown in blue
- Sour waters are derived from various distillation tower reflux drums in the refinery
- The "other gases" entering the gas processing unit includes all the gas streams from the various process units

Process flow diagrams (PFDs)

- Symbols
- Directional arrows
- Flow

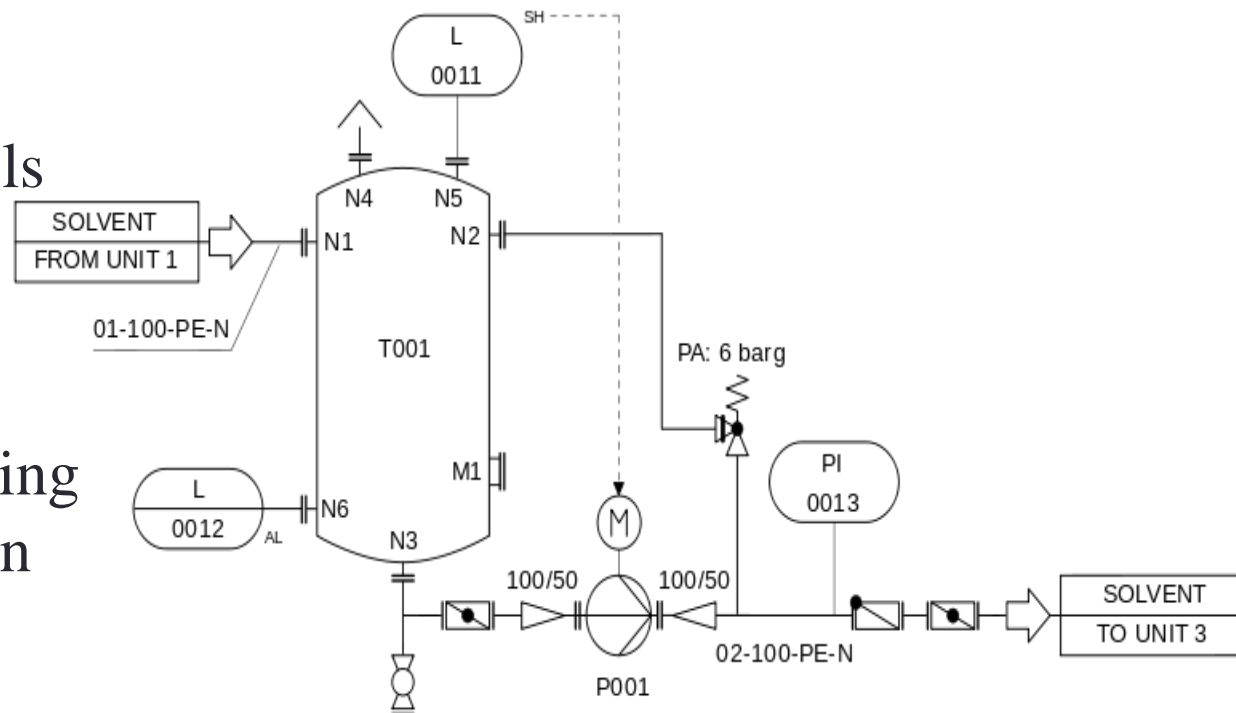
http://en.wikipedia.org/wiki/Process_flow_diagram



Piping and instrumentation diagrams (P&IDs)

- Left to right
- detail drawings
- Equipment symbols and numbers
- Equipment designations
- Major process piping
- All instrumentation
- General notes

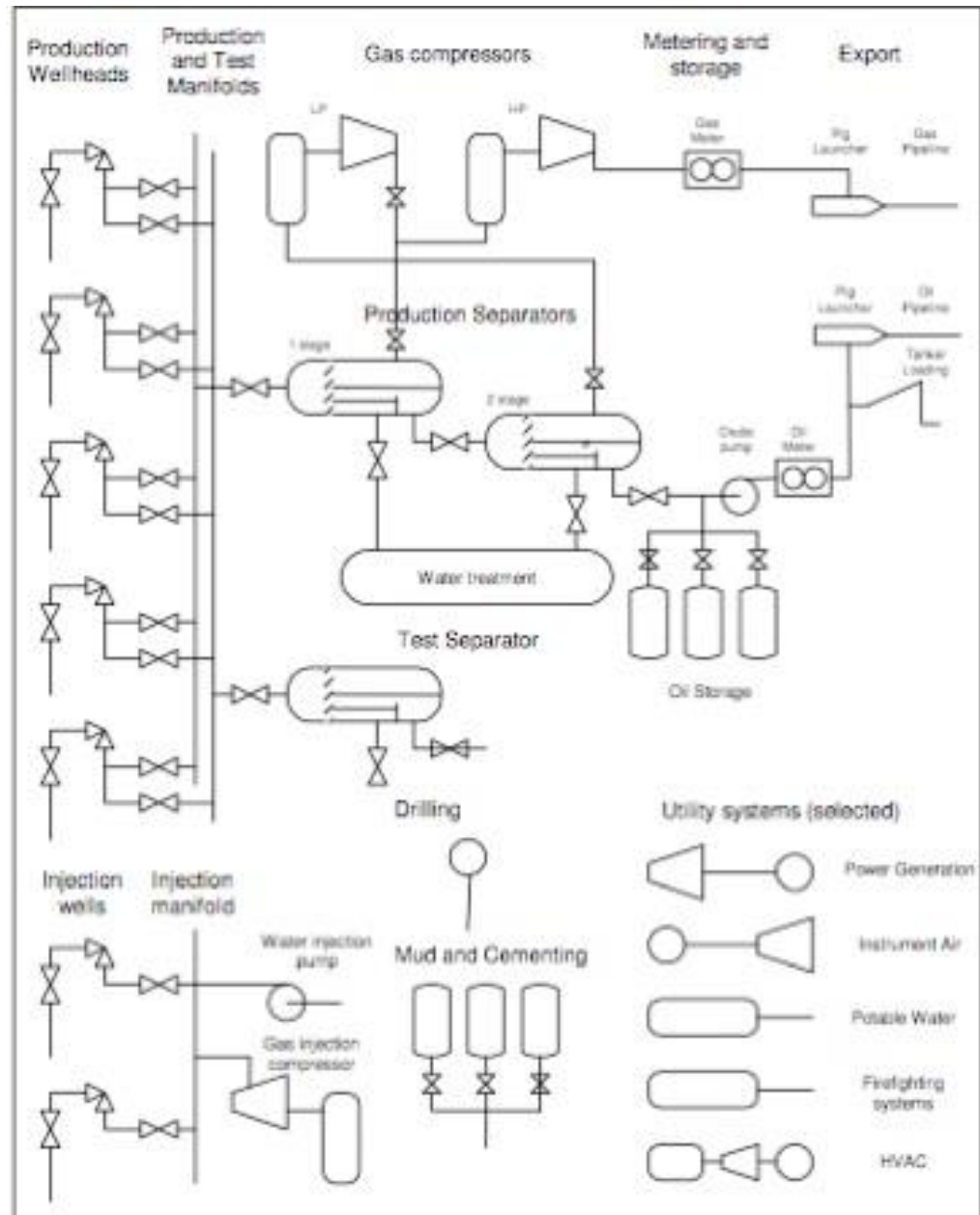
	T001	P001
SERVICE	STORAGE TANK	FEED PUMP
DATA	DIAMETER: 1000 mm HEIGHT: 3000 mm CAPACITY: 2.4 m ³	FLOW RATE: 5 m ³ /h DIFF. PRESSURE: 2.5 bar
DESIGN PRESSURE	10 barg	10 barg
DESIGN TEMP.	50 °C	50 °C



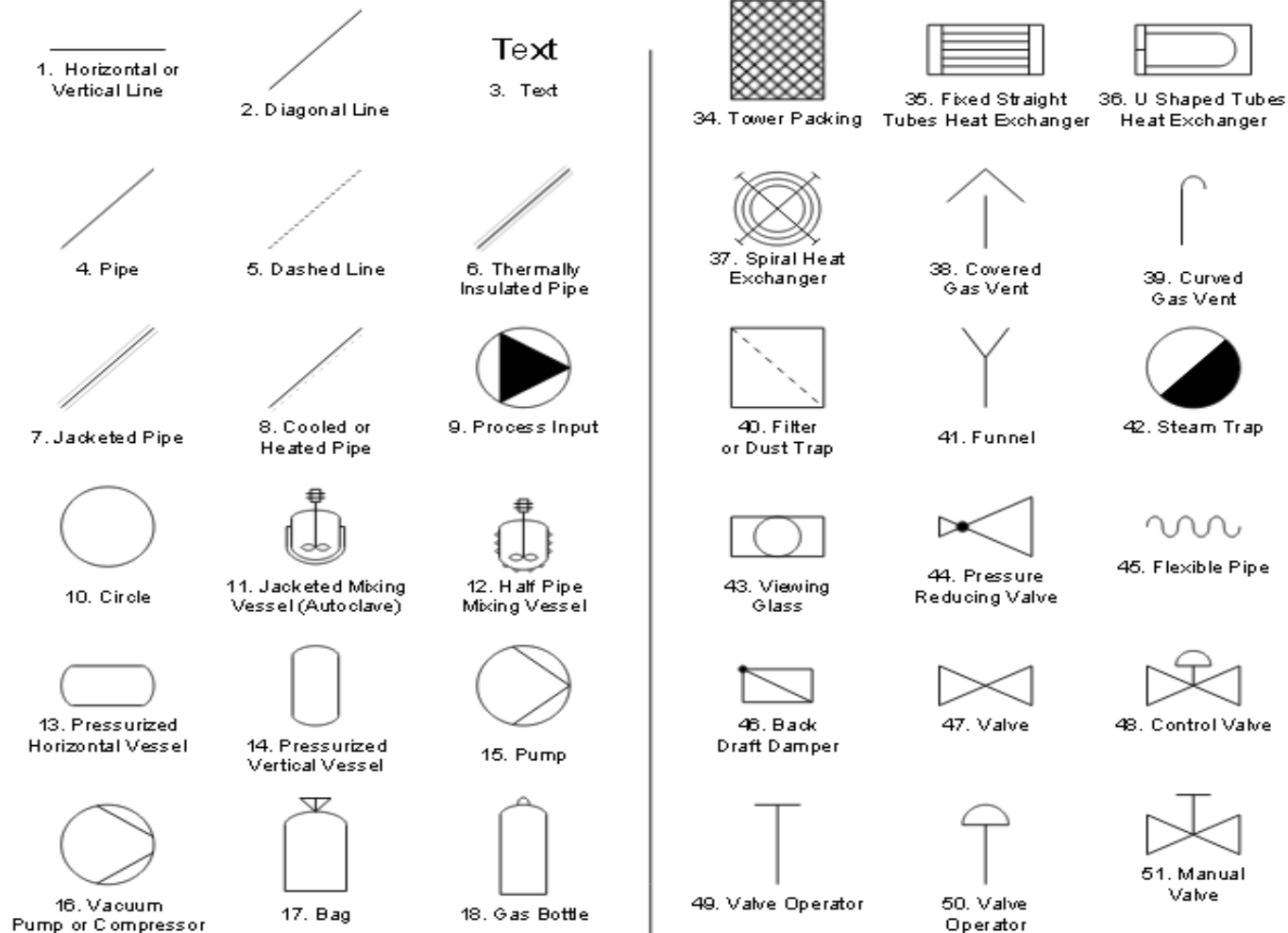
http://en.wikipedia.org/wiki/Piping_and_instrumentation_diagram

Utilities flow diagrams (UFD)

- Utility supply
- connections



Industrial Objects Piping and Instrumentation



Piping and Instrumentation Continued

<http://www.rff.com/process-flow-diagrams.htm>



22. Axial Fan



23. Radial Fan



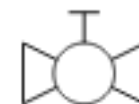
24. Dryer



55. Diaphragm Valve



56. Ball Valve



57. Globe Valve



25. Packing Column



26. Tray Column



27. Furnace



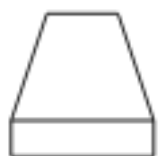
58. Ball Valve



59. Ball Valve



60. Check Valve



28. Cooling Tower



29. Heat Exchanger



30. Heat Exchanger



61. T For Piping



62. Relief Bypass Valve



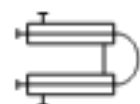
63. Motor Operated Valve



31. Cooler



32. Plate and Frame Heat Exchanger



33. Double Pipe Heat Exchanger



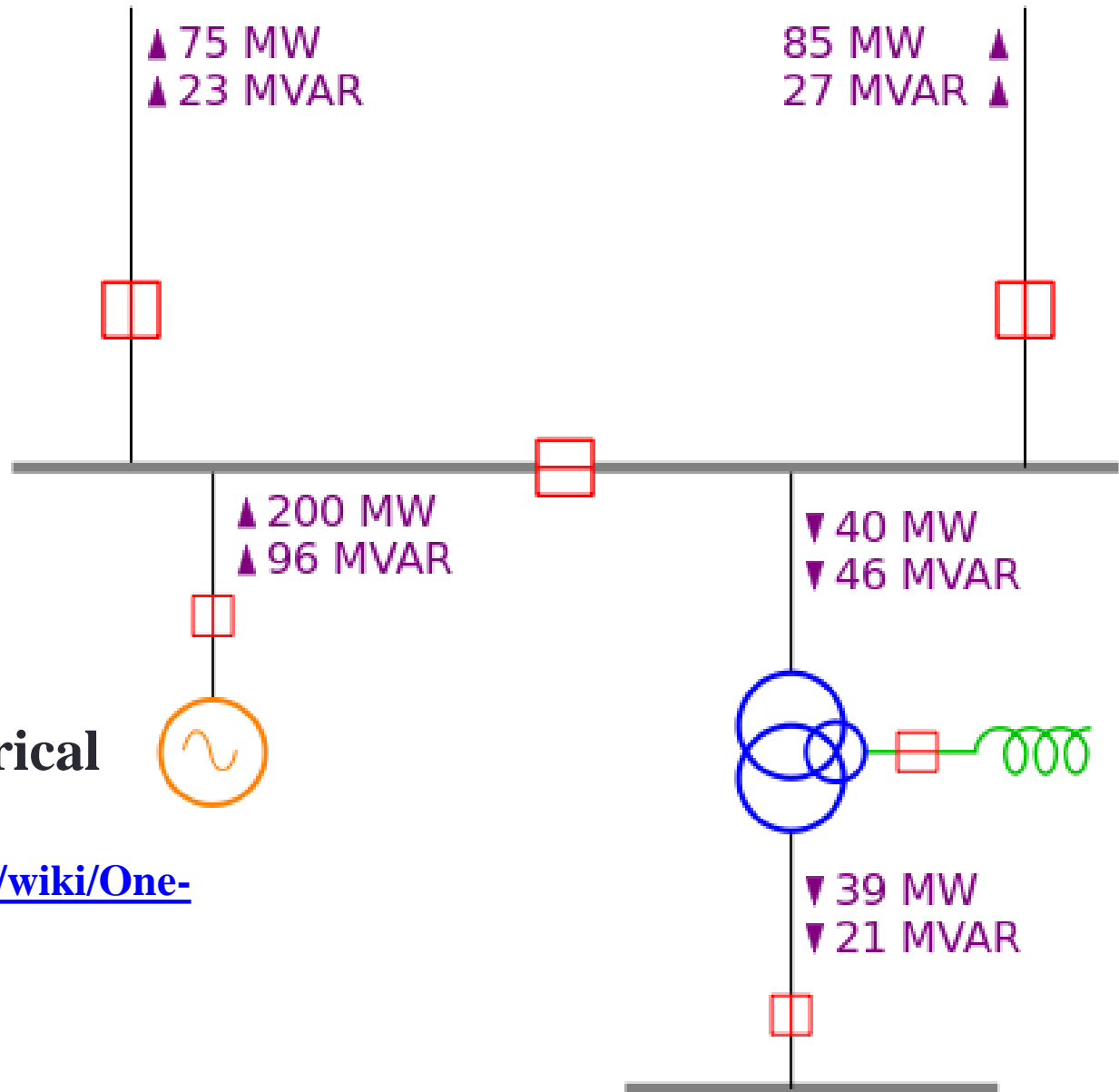
64. Heater



65. Motor



66. Diagonal Line



Single Line Electrical Diagram

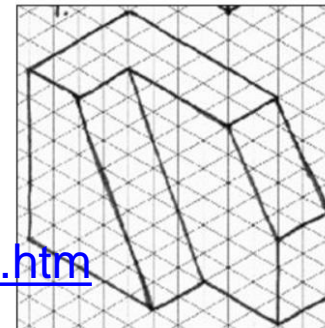
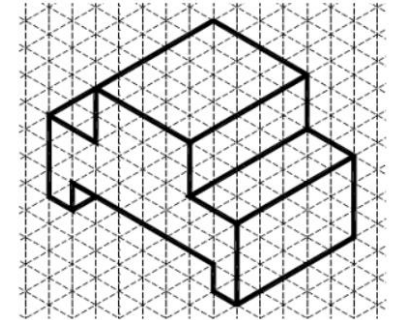
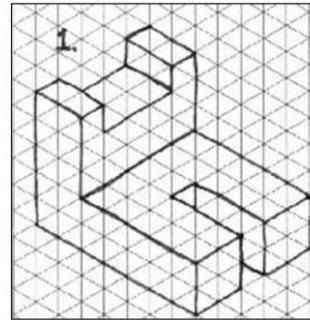
http://en.wikipedia.org/wiki/One-line_diagram

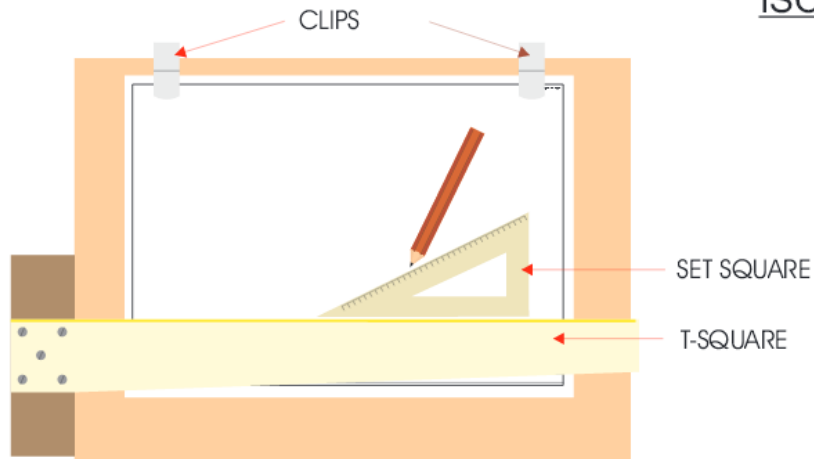
Diagram Software

- Free Download-30 day trial
- <http://www.edrawsoft.com/electrical-symbols.php>

Practice with common electric symbols, diagrams and more.

- Isometric drawings 





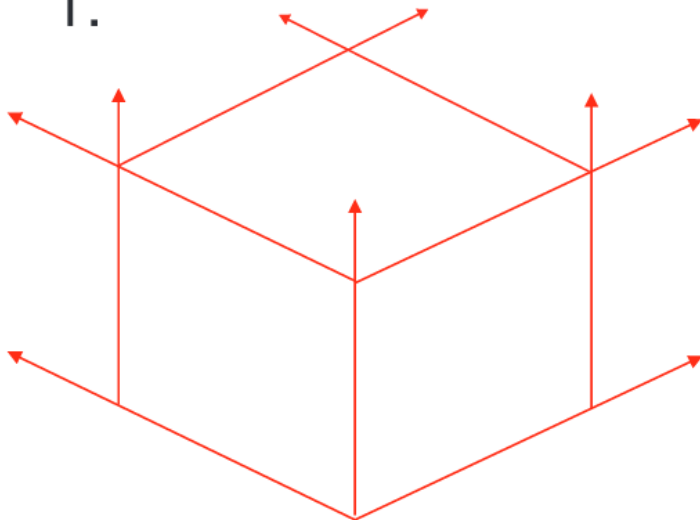
ISOMETRIC PROJECTION

The diagram to the left shows the use of a T-Square and Set Square in drawing a 3D cube (isometric cube).

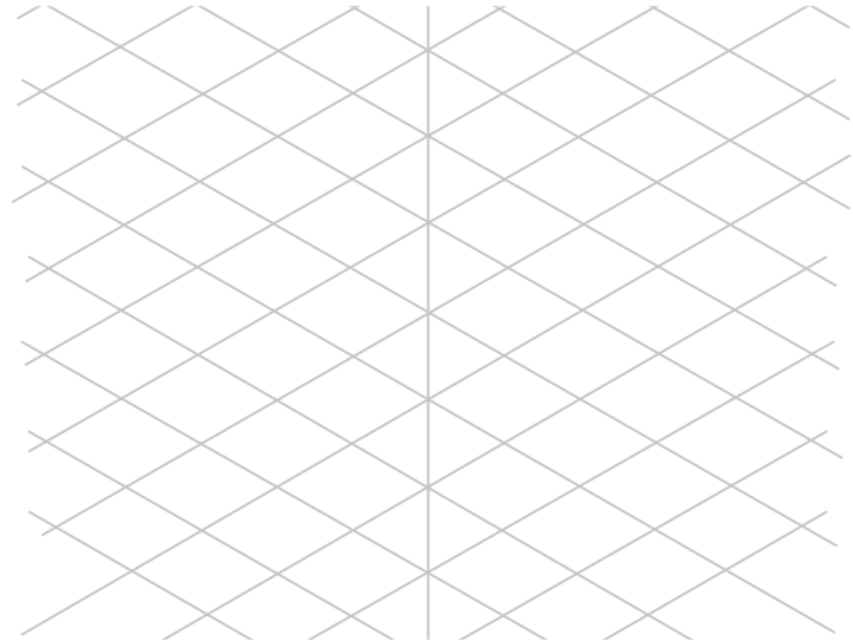
1. Complete question 1 by drawing dark lines over the top of the faint guidelines to produce an isometric cube. Remember to use a 30/60 degree set square.

2. Draw an isometric cube (all sides are the same length) using the faint isometric grid below.

1.

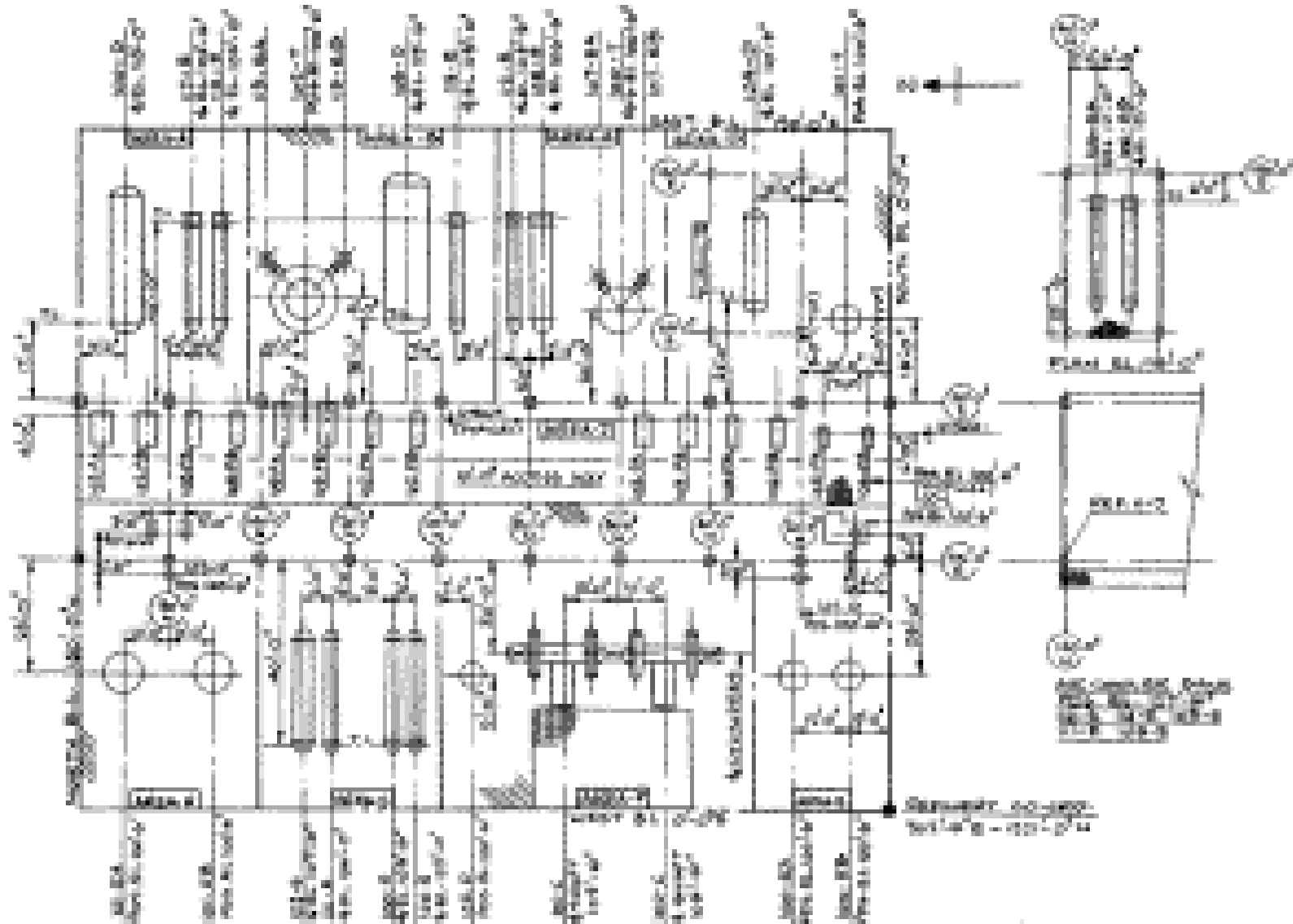


2.



http://www.technologystudent.com/despro_flsh/isomty2.html

Plot plan

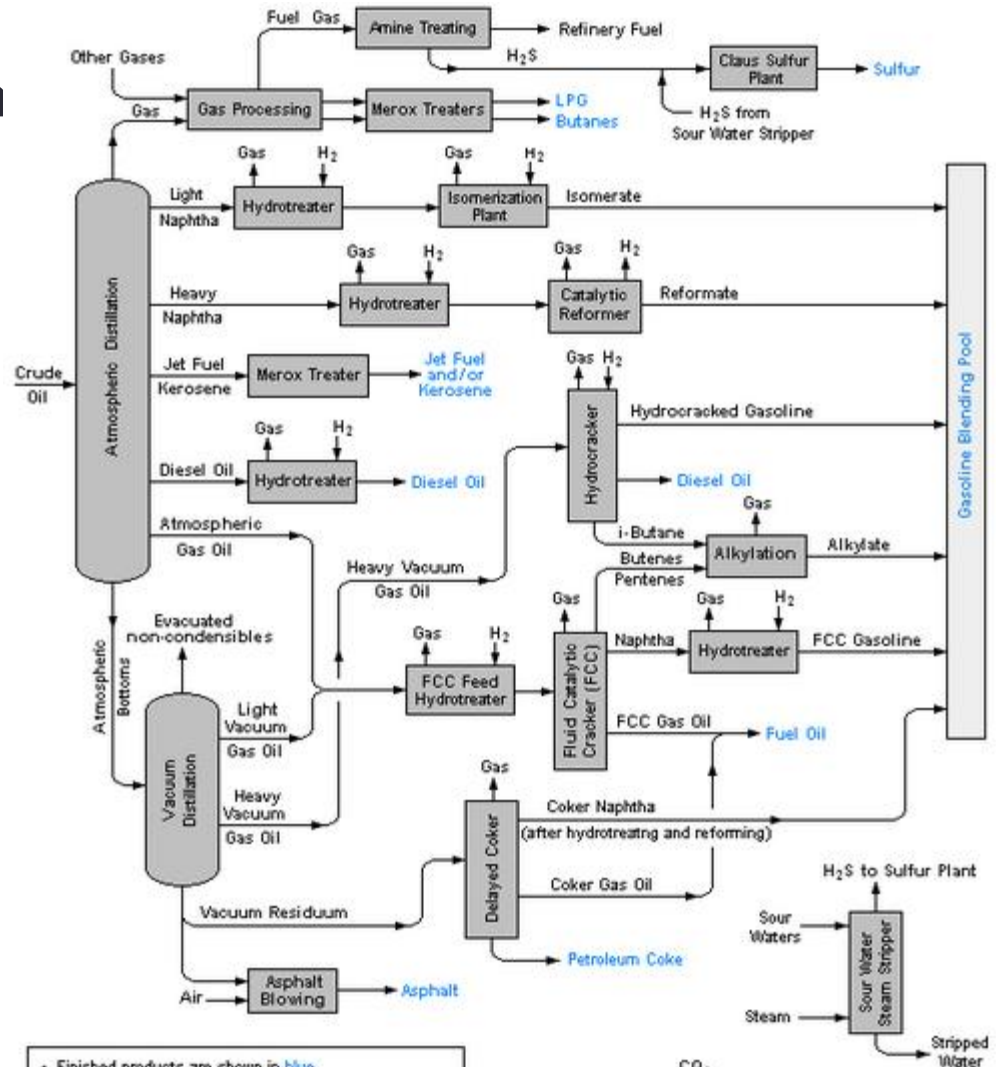


Process Drawing In

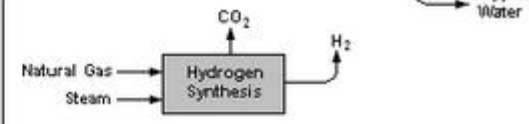
5	LONGITUDINAL FRAMING & GIRDERS	116-6200694	01-116
4	SHELL EXPANSION	111-6200891	01-111
3	WELDING TABLE	801-6201065	23-801
2	STANDARD WELDING DETAIL BOOKLET	801-6201064	22-801
1	STANDARD STRUCTURAL DETAIL BOOKLET	801-6201063	21-801
NO	TITLE	NAVSEA DWG	MMC DWG
REFERENCES			

CONTRACT NO N00024-85-C-2108		DEPARTMENT OF THE NAVY NAVAL SEA SYSTEMS COMMAND WASHINGTON, D.C. 20342	
MARINETTE MARINE CORP MARINETTE WIS. 54143		120' TORPEDO WEAPONS RETRIEVER	
BY DATE		MACHINERY S.W. & COOLING WATER SYSTEM A/D	
APPROVED <i>[Signature]</i>	8-5-87	A	
APPROVED <i>[Signature]</i>	8-22-85		
CHECKED <i>[Signature]</i>	7-31-85		
DRAWN <i>[Signature]</i>	7-25-85		
NAVSEA APPROVAL DATE		NO. FROM H 53711	NO. SHEETS 256-6200947
SCALE 1/2" = 1'-0" & AS SHOWN		SHEET 1 OF 5	
1			
*MMC DWG. NO, S291-C2-256			

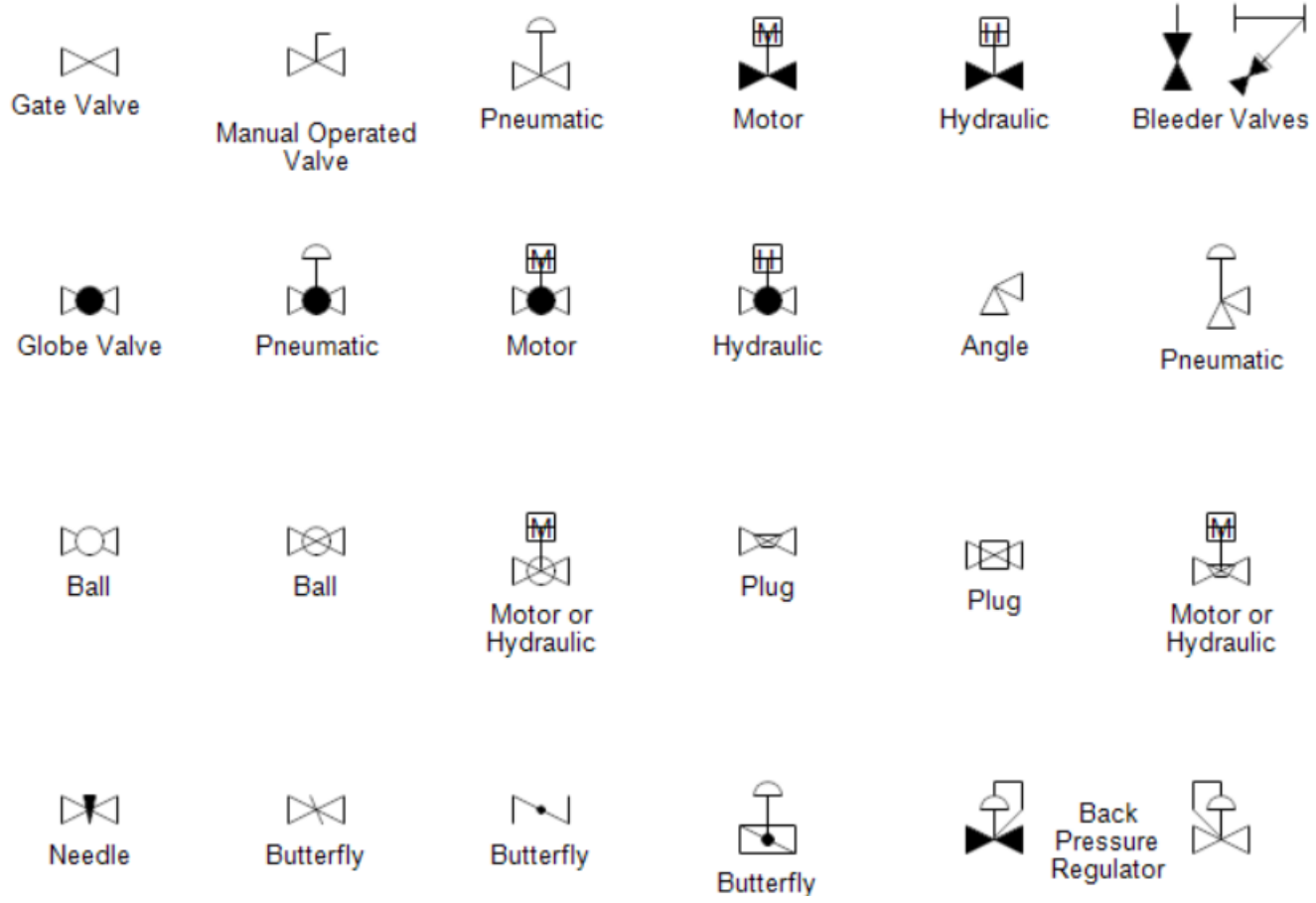
Title Block & Application Block

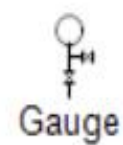
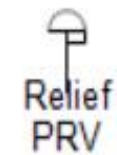
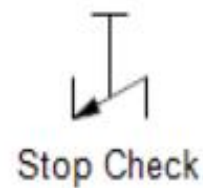
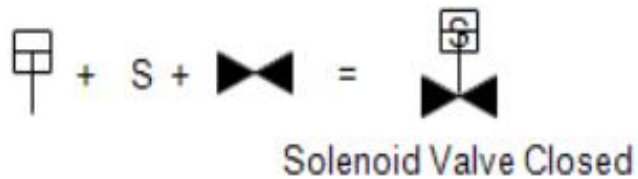


- Finished products are shown in blue
- Sour waters are derived from various distillation tower reflux drums in the refinery
- The "other gases" entering the gas processing unit includes all the gas streams from the various process units



Process Flow Valves

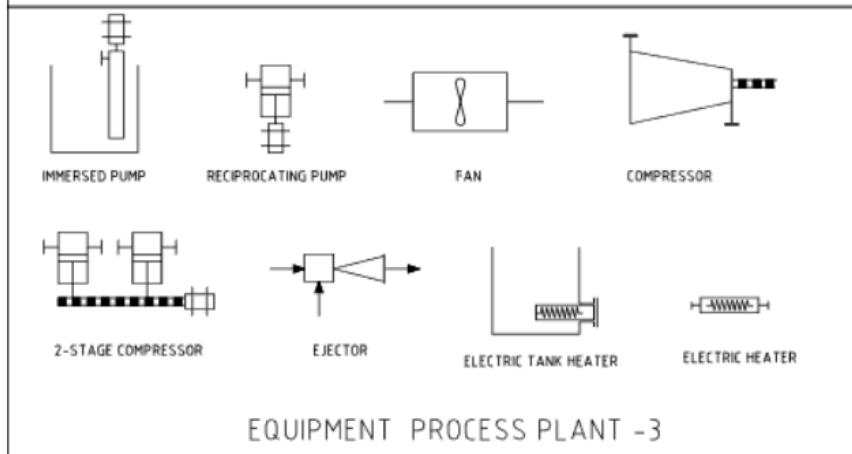
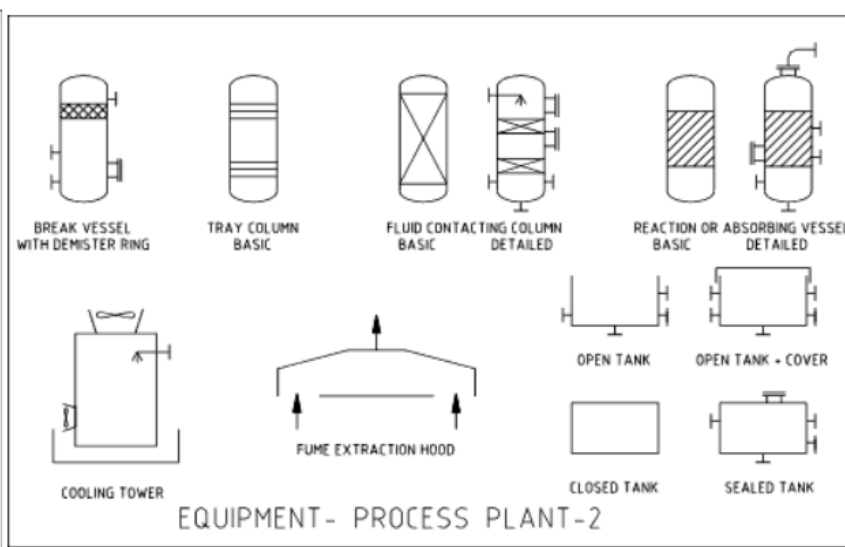
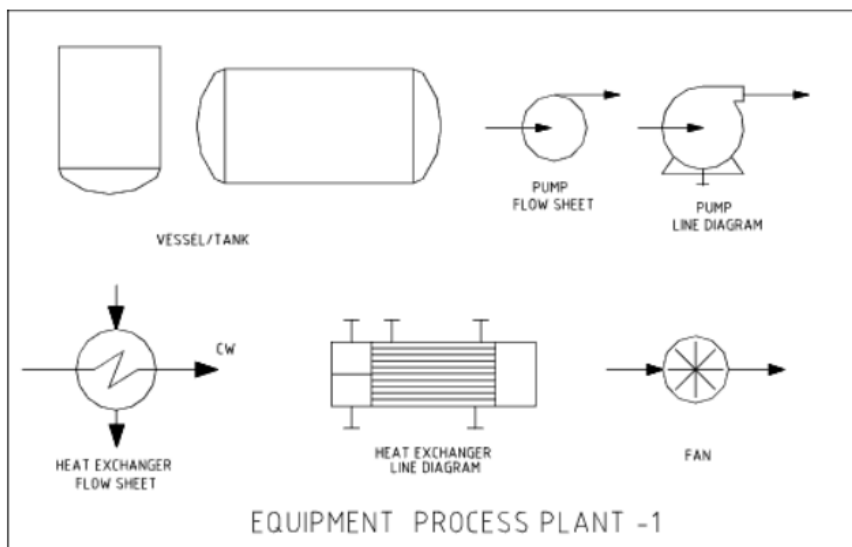




Process Flow Valves

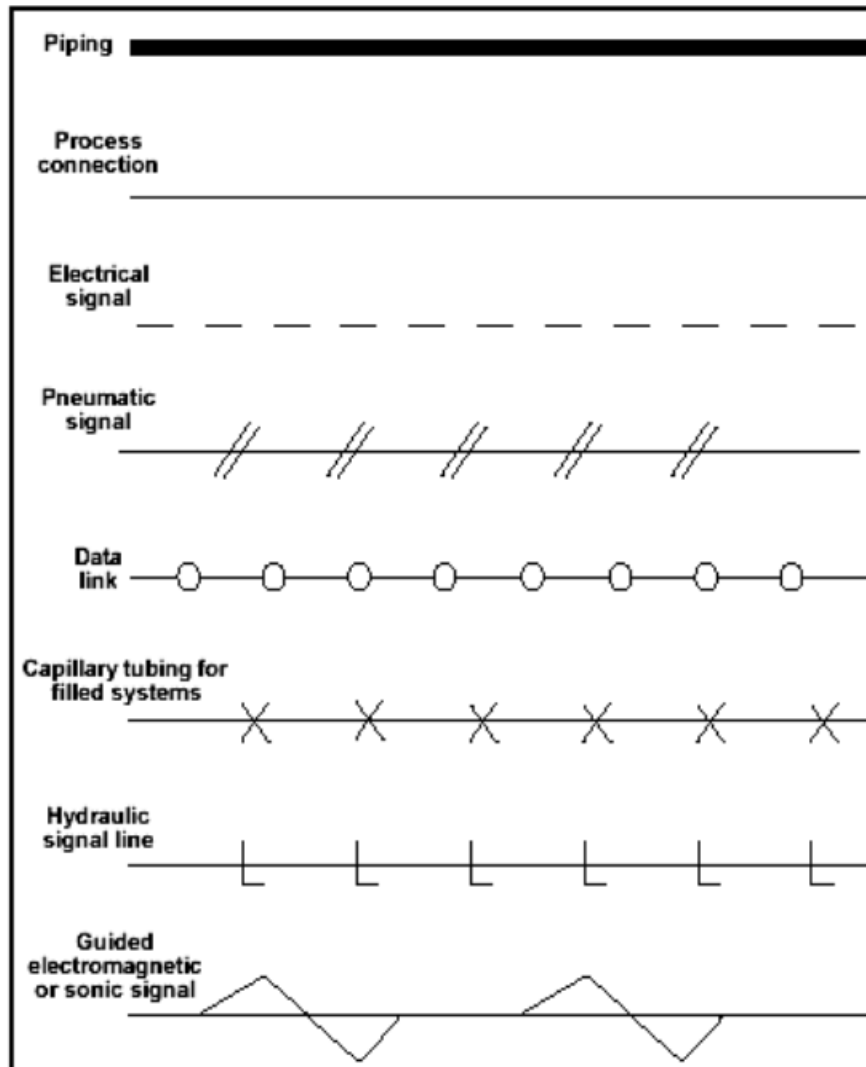
Continued

SYMBOLS



<https://controls.engin.umich.edu/wiki/index.php/PIDStandardNotation>

Piping and Connection Symbols



These symbols are used to identify how the instruments in the process connect to each other.

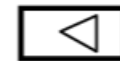
And what type of signal is being used. (electrical, pneumatic, data, etc)

Valve Actuator Symbols

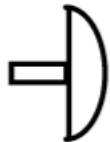


Wr

Spring



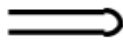
Air Pilot



Push Button



Solenoid



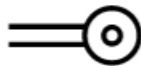
Plunger



Solenoid Air Pilot





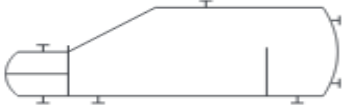




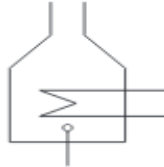


Lever



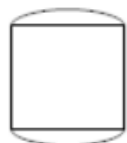
Cam Roller

Heat Transfer Equipment

Heat exchanger (basic symbols)	
Alternative:	
Shell and tube: fixed tube sheet	
Shell and tube: U tube or floating head	
Shell and tube: kettle reboiler	
Air-blown cooler	
Plate type	
Double pipe type	
Heating/cooling coil (basic symbol)	
Fired heater/boiler (basic symbol)	

<http://booksite.elsevier.com/9780080966595/content/Appendices/Appendix%20A.pdf>

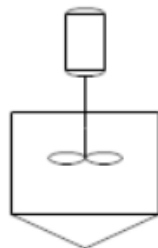
Vessels and Tanks



Tank



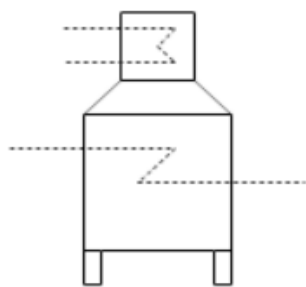
Mixer

Mixing
Reactor

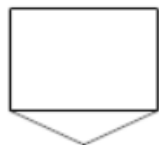
Drum or Condenser



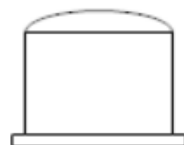
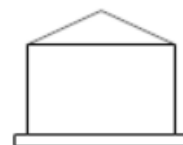
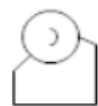
Tower

Tower
with Packing

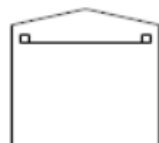
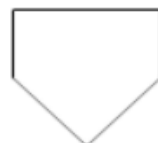
Furnace



Bin

Dome Roof
TankCone Roof
Tank

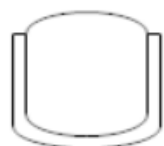
Boiler

Internal Floating
Roof Tank

Centrifuge



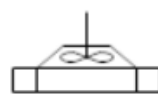
Conveyor Belt



Jacketed Tank



Stirrers



Air Cooler



Cooling Tower



Flare

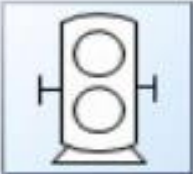



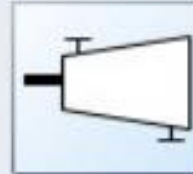
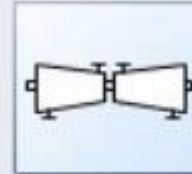


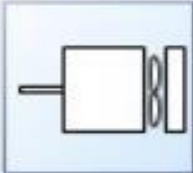
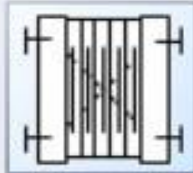

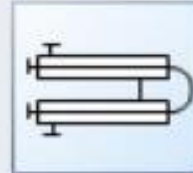



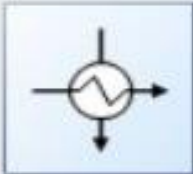


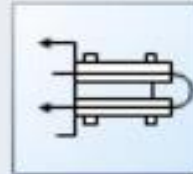
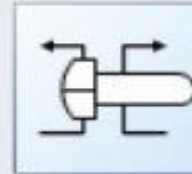
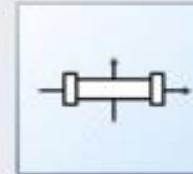
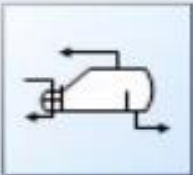



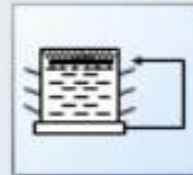




Gas Spurge



Demister

Other Symbols <http://www.edrawsoft.com/pidsymbols.php>

						
Rotary compressor	Rotary compressor	Liquid ring vacuum	Positive displacement	Turbine driver	Doubleflow turbine	Motor
						
Agitator or mixer	Diesel motor	Plate and frame heat	Air cooled exchanger	Double-pipe heat	Spiral heat exchanger	Heater
						
Condenser	Shell and tube heat	Shell and tube heat 2	Shell and tube heat 3	Hairpin exchanger	U-tube heat exchanger	Single pass heat
						
Reboiler	Crossflow induced	Counterflow forced draft	Chimney tower	Counterflow natural draft	Furnace	Boiler

Pumps and Compressors



Centrifugal Pump



Gas Blower



Compressor



Gear Pump



Gas Compressor



Feed Pump



Cavity Pump



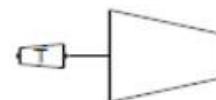
Motor



Motor



Compressor



Turbine or Centrifugal Compressor



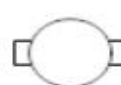
Reciprocating Compressor



Rotary Compressor



Liquid Ring Compressor



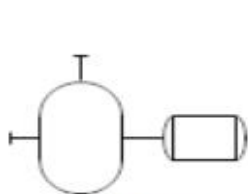
Vacuum Pump or Compressor



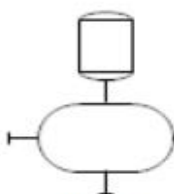
Screw Pump



Axial Compressor

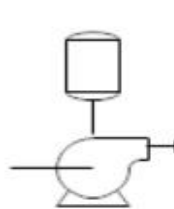


Horizontal

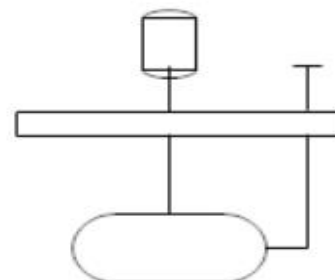


Vertical

Centrifugal Pumps



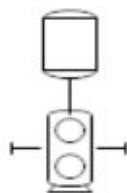
Centrifugal Blower



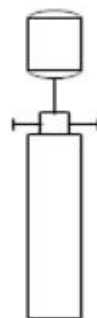
Sump Pump



Positive Displacement Pump



Positive Displacement Pump



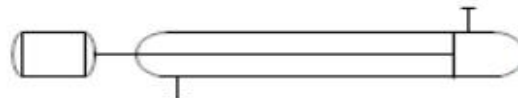
Vertical Can Pump



Progressive Cavity Pump



Screw Pump















Reciprocating Pump

ISA Symbols

Process Measurement	Element Type	Element	Transmitter	Indicator	Indicator Controller	Controller	Ratio Controller	Recorder	Hand switch	Hand Valve	Totalizer	Indicating Totalizer	Solonoid valve	Control Valve	Calculation	Ratio Calculation	Switch Low	Switch High	Alarm Low	Alarm Low-Low	Alarm High	Alarm High-High
	Code	E	T	I	IC	C	FC	R	HS	HV	Q	IQ	XV	V	Y	FY	SL	SH	AL	ALL	AH	AHH
Analysis	A	AE	AT	AI	AIC	AC	AFC	AR	AHS	AHV	AQ	AIQ	AXV	AV	AY	AFY	ASL	ASH	AAL	AALL	AAH	AAHH
Conductivity	C	CE	CT	CI	CIC	CC	CFC	CR	CHS	CHV	CQ	CIQ	CXV	CV	CY	CFY	CSL	CSH	CAL	CALL	CAH	CAHH
Density	D	DE	DT	DI	DIC	DC	DFC	DR	DHS	DHV	DQ	DIQ	DXV	DV	DY	DFY	DSL	DSH	DAL	DALL	DAH	DAHH
Voltage	E	EE	ET	EI	EIC	EC	EFC	ER	EHS	EHV	EQ	EIQ	EXV	EV	EY	EFY	ESL	ESH	EAL	EALL	EAH	EAHH
Flow	F	FE	FT	FI	FIC	FC	FFC	FR	FHS	FHV	FQ	FIQ	FXV	FV	FY	FFY	FSL	FSH	FAL	FALL	FAH	FAHH
Dimension	G	GE	GT	GI	GIC	GC	GFC	GR	GHS	GHV	GQ	GIQ	GXV	GV	GY	GFY	GSL	GSH	GAL	GALL	GAH	GAHH
Hand	H	HE	HT	HI	HIC	HC	HFC	HR	HHS	HHV	HQ	HIQ	HXV	HV	HY	HFY	HSL	HSH	HAL	HALL	HAH	HAHH
Current	I	IE	IT	II	IIC	IC	IFC	IR	IHS	IHV	IQ	IIQ	IXV	IV	IY	IFY	ISL	ISH	IAL	IALL	IAH	IAHH
Time	K	KE	KT	KI	KIC	KC	KFC	KR	KHS	KHV	KQ	KIQ	KXV	KV	KY	KFY	KSL	KSH	KAL	KALL	KAH	KAHH
Level	L	LE	LT	LI	LIC	LC	LFC	LR	LHS	LHV	LQ	LIQ	LXV	LV	LY	LFY	LSL	LSH	LAL	LALL	LAH	LAHH
Humidity	M	ME	MT	MI	MIC	MC	MFC	MR	MHS	MHV	MQ	MIQ	MXV	MV	MY	MFY	MSL	MSH	MAL	MALL	MAH	MAHH
Power	N	NE	NT	NI	NIC	NC	NFC	NR	NHS	NHV	NQ	NIQ	NXV	NV	NY	NFY	NSL	NSH	NAL	NALL	NAH	NAHH
Pressure	P	PE	PT	PI	PIC	PC	PFC	PR	PHS	PHV	PQ	PIQ	PXV	PV	PY	PFY	PSL	PSH	PAL	PALL	PAH	PAHH
Delta Pressure	dP	dPE	dPT	dPI	dPIC	dPC	dPFC	dPR	dPHS	dPHV	dPQ	dPIQ	dPXV	dPV	dPY	dPFY	dPSL	dPSH	dPAL	dPALL	dPAH	dPAHH
Quantity	Q	QE	QT	QI	QIC	QC	QFC	QR	QHS	QHV	QQ	QIQ	QXV	QV	QY	QFY	QSL	QSH	QAL	QALL	QAH	QAAH
Radioactivity	R	RE	RT	RI	RIC	RC	RFC	RR	RHS	RHV	RQ	RIQ	RXV	RV	RY	RFY	RSL	RSH	RAL	RALL	RAH	RAHH
Speed	S	SE	ST	SI	SIC	SC	SFC	SR	SHS	SHV	SQ	SIQ	SXV	SV	SY	SFY	SSL	SSH	SAL	SALL	SAH	SAHH
Temperature	T	TE	TT	TI	TIC	TC	TFC	TR	THS	THV	TQ	TIQ	TXV	TV	TY	TFY	TSL	TSH	TAL	TALL	TAH	TAHH
Delta Temperature	dT	dTE	dTT	dTI	dTIC	dTC	dTFC	dTR	dTHS	dTHV	dTQ	dTIQ	dTXV	dTV	dTY	dTFY	dTSL	dTSH	dTAL	dTALL	dTAH	dTAHH
Viscosity	V	VE	VT	VI	VIC	VC	VFC	VR	VHS	VHV	VQ	VIQ	VXV	VV	VY	VFY	VSL	VSH	VAL	VALL	VAH	VAHH
Weight	W	WE	WT	WI	WIC	WC	WFC	WR	WHS	WHV	WQ	WIQ	WXV	WV	WY	WFY	WSL	WSH	WAL	WALL	WAH	WAHH
Vibration	Y	YE	YT	YI	YIC	YC	YFC	YR	YHS	YHV	YQ	YIQ	YXV	YV	YY	YFY	YSL	YSH	YAL	YALL	YAH	YAAH
Position	Z	ZE	ZT	ZI	ZIC	ZC	ZFC	ZR	ZHS	ZHV	ZQ	ZIQ	ZXV	ZV	ZY	ZFY	ZSL	ZSH	ZAL	ZALL	ZAH	ZAAH

General instrument or function symbols

	Primary location accessible to operator	Field mounted	Auxiliary location accessible to operator
Discrete instruments	1 	2 	3 
Shared display, shared control	4 	5 	6 
Computer function	7 	8 	9 
Programmable logic control	10 	11 	12 

1. Symbol size may vary according to the user's needs and the type of document.
2. Abbreviations of the user's choice may be used when necessary to specify location.
3. Inaccessible (behind the panel) devices may be depicted using the same symbol but with a dashed horizontal bar.

Source: Control Engineering with data from ISA S5.1 standard

Equipment Standards

- ANSI (The American National Standards Institute)
- API (The American Petroleum Institute)
- ASME (The American Society of Mechanical Engineers)
- NEC (The National Electric Code)
- OSHA (The Occupational Safety and Health Administration)
- ASTM: American Society for Testing and Materials

Example:

First letter (pressure) _____ **P**

Supplementary letter (differential) _____ **D**

1st succeeding letter (indication) _____ **I**

2nd succeeding letter (control) _____ **C**

