SYSTEM PROCESS DESIGN CRITERIA

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TABLE OF CONTENTS

1. GENERAL

1.1 CRITERIA

All units shall be designed according to CEC Standards.

SYSTEM Process Engineering and Design shall be according to this Design Criteria.

SYSTEM Process Engineering shall be based on Client supplied Process Flow Diagrams.

1.2 RESPONSIBILITIES

The SYSTEM Process Engineering Section work consists of the following :

Process, Utility, and Interconnecting P&ID to be designed by CEC.

Pump and Compressor Head Calculations.

Establish design pressure and temperature for equipment and piping.

Hydraulic Studies.

Establish process data for control valves, orifices, and meter runs.

Line summaries.

Utility summary.

Verify relief loads.

1.3 CODES AND STANDARDS

Unless otherwise amended by CEC specifications, System Process Engineering and Design shall be in accordance with the latest edition for the following, unless otherwise shown below

Item	Regulation
Piping	
Process Piping	ANSI, B31.3
Boiler Piping	ANSI, B31.3
Flanges	ANSI, B16.5
Pressure Vessels	
Unfired	ASME, Sect. VIII, Div.1 & ASME, Sect. I
Unfired Steam Boilers	ASME, Sect. I
Fired Steam Boilers	ASME, Sect. I
Safety Relief Systems	
Safety Valves	API RP520 and API RP521
Header	ASME, Sect. I and VIII
Pumps	
Centrifugal	API 610
Reciprocating	API 674
Compressors	
Centrifugal	API 617
Reciprocating	API 618
Air Compressor (centrifugal)	API 672
Steam Turbines	API Std 611 & 612
Exchangers	ASME Section VIII & TEMA
Flammable and Combustible Liquid Storage	NFPA Volume 1
Foam Extinguishing Systems	NFPA Volume 7
Storage Tanks	
Atmospheric Pressure	API Stds 620, 650, 2000

The design shall be in accordance with the formal contract, the Basis of Design documents, CEC Engineering Standards and Specifications, Piping Specifications and Valve Data Sheets, and/or any deviation subsequently agreed upon, in writing, between Client and CEC.

2. SYSTEM PROCESS ENGINEERING

2.1 ENGINEERING UNITS

Units to be used on deliverable documents are to be MKS

Units to be used on data sheets involving mass, energy, flows, etc., shall be as follows.

Vacuum Pressure	= mm water or mmHg
Pressure	= Kg/cm2 gage or absolute
Pump and compressor head	= m
Pump flow	= m3/hr
Metering Pump flow	= L/hr
Length	= m or mm
Heat Rate	= kcal/hr
Temperature	= Degrees
Steam Rate	= kg/hr
HC Vapor	= kg/hr
HC Liquid	= kg/hr
Water	= kg/hr
Chemicals	= kg/day
Line/Valve size	= inch

2.2 LINE SIZING CRITERIA

For lines sized by CEC, line sizing criteria will be in accordance with CEC Design Guide.

Calculations for mixed phase lines will be made using CEC line sizing PC computer program.

Minimum line size in pipe racks will be 2 inches. Minimum line size will be 3/4 inch, except for vents, drains, and instrument connections.

The flows shown on the material balances are to be treated as “normal” for line sizing.

Maximum process rates are 110% of normal. Minimum rates are 50% unless shown otherwise on PFDs or in process specifications.

2.3 PUMP AND COMPRESSOR HEAD CALCULATIONS

Pump head calculations will be in accordance with this design criteria.

Work sheet will be used to summarize the calculated pressure drops for each system. For gas blanketed vessels, assume saturated fluid conditions.

Compressor head calculations will be in accordance with CEC Design guide.

2.4 MINIMUM FLOW BYPASS

Minimum continuous flow requirements will be specified by the pump vendor. The rated flow shall not normally be increased for minimum flow requirements. The minimum flow bypass shall be taken from the pump discharge before the check valve and will return to the suction vessel.

Manual valves in the minimum flow line shall be locked open.

2.5 PIPE WALL THICKNESS CALCULATIONS

Pipe wall thickness will be determined by CEC's Piping Material Specification Group.

2.6 PROCESS DATA FOR CONTROL VALVES, ORIFICES, AND METER RUNS

The System Process Engineer shall provide to the Project Instrument Engineer all the process data for sizing control valves, orifices, and meter runs. The control valve data shall be transmitted on Instrument Process Data Sheet.

2.7 RELIEF EQUIPMENT SIZING CRITERIA

The selection and, sizing of relief valves or rupture disks for CEC designed process units and relieving systems shall be in accordance with API recommended practices RP520 and RP521, ASME Codes Sections I and VIII, and CEC Design Guides.

2.8 LINE LIST

A line List will be issued with the design issue of the P&ID. Use CEC PC Computer line summary program.

3. EQUIPMENT DESIGN

3.1 PRESSURE VESSELS

Complete systems within a process must be checked in addition to the following minimum design pressure and temperature requirements of vessels :

3.1.1. Operating Pressure - OP	Min, Design Press - DP (1)
Vacuum vessels	1.05 kg/cm2g and full vacuum(2)
0 to .35 kg/cm2g	1.05 kg/cm2g (2)
35 to 10.5 kg/cm2g	OP + 1.05 kg/cm2 (3)
10.5 to 70.3 kg/cm2g	1.1 x OP
70.3 to 141 kg/cm2g	OP + 7.03 kg/cm2
Above 141 kg/cm2g	1.06 x OP

NOTES :

1) Do not include liquid head. Design pressure is for the top of the vessel. The vessels engineer designs the bottom of the vessel for any liquid head.
2) Maximum DP for vessels without ASME code stamping.
3) or at least the maximum allowable working pressure.

For vessels with a pressure-relieving system to flare, consider 3.5 kg/cm2g minimum design pressure to reduce flare size requirements.

Suction drums on reciprocating compressors are to be designed for vacuum conditions in addition to operating conditions. Mis-operation during steamout of vessels is not to be considered.

For liquified gas controlled under Korea High Pressure Gas Law, design pressure is saturation pressure at design temperature.

Furnace and reactor sections may be subject to special considerations.

3.1.2. Operating Temperature - OT	Design Temperature - DT
Below -28 degrees C	Lowest OT
-28 to 537 degrees C	OT + 14 degrees C
Above 537 degrees C	OT + 12 degrees C
Boiling water service	Saturation temperature at design pressure

3.2 TANKS

The following shall be the minimum design pressure and temperature requirements of tanks :

3.2.1 Operating Pressure - OP Min. | Design Press - DP (1)

Cone roof	
up to design pressure	.02 kg/cm2g
Dome roof	
up to design pressure	.035 kg/cm2g
up to design pressure	1.05 kg/cm2g

Notes :

Do not include liquid head. Design pressure is for the top of the tank.

Misopertion during steamout is not to be considered.

3.3 EXCHANGERS

Design pressure and temperature of exchangers are as follows :

3.3.1 Operating pressure - OP Min. | Design press - DP

Vacuum Exchangers	Full vacuum
0 to 3.5 kg/cm2g	5.3 kg/cm2g
3.6 to 17.5 kg/cm2g	OP + 1.76 kg/cm2
17.6 to 69.9 kg/cm2g	1.1 x OP
70.0 and above	1.075 x OP

3.3.2 Operating Temperature - OT | Design Temperature - DT

-28 to 343 degrees C	OT + 28 degrees C
Above 343 degrees C	OT + 14 degrees C
Boiling water service	Saturation temperature at design pressure

For air-cooled heat exchangers, the design temperature shall be the maximum fluid temperature specified on the Process Equipment Specification or the Process Flow Diagram. If no maximum fluid temperature is specified by Process, the design temperature shall be the normal operating temperature plus the applicable factor specified above. An upset condition may set the design temperature of certain exchanger.

3.4 EQUIPMENT IN PUMP DISCHARGE CIRCUIT

Equipment in a pump discharge circuit with a downstream block valve and no relief valve shall have a design pressure at least as high as the shutoff or minimum flow pressure of the pump at the maximum operating suction pressure. This is to be checked after equipment design, per Paragraphs above.

For shutoff pressure estimates on motor-driven centrifugal pumps, use the maximum suction pressure plus 125% of the rated differential pressure of the pump. For steam turbine-driven pumps, use 1.38 x maximum differential pump pressure at rated flow.

When pump-performance curves are obtained from pump vendors, the maximum pressure for the purchased impeller shall be compared with the equipment design pressure.

Equipment design pressures must be increased if the pump shutoff discharge head is greater than estimated.

For turbine-driven pumps, the certified shutoff head must multipled by the square of the ratio (turbine trip speed/pump rated speed).

4. PIPING DESIGN

4.1 NORMAL OPERATING CONDITIONS

The process conditions of the greatest severity expected during normal operation. Conditions such as turndown, startup, dual-cycle, and regeneration shall be included, when appropriate, as separate entries.

4.2 DESIGN TEMPERATURE AND PRESSURE

The conditions listed shall be set by consideration of the normal operating conditions, shortterm variations, and the applicable code requirements. The piping system shall be designed for the most severe coincident temperature and pressure for the condition requiring the greatest pipewall thickness and the highest flange rating. Usually, the piping design pressure is equal to the design pressure of the equipment to which the piping is attached.

4.3 CODE ALLOWANCE

The ANSI B31.3 allowances for variation from normal operating conditions given in 302.2.4 shall not be permitted.

5. P&ID DESIGN PRACTICES

5.1 FORMAT

The P&IDs shall be CAD drafted on size A1 sheets with drawing area of 23″ x 33″

5.2 TITLE BLOCK, LEGEND, AND FLOWSHEET SYMBOLS

A title block shall be used on each P&ID. A legend drawing shall have instrumentation and flowsheet symbols, and a drawing index. CEC flowsheet symbols will be used for P&ID designed by CEC.

5.3 P&ID REVISIONS

P&IDs shall be issued as follows :

Rev. No.	Purpose
A	Client Approval
B	Design
O	Construction

5.4 EQUIPMENT DESCRIPTIONS

The P&ID shall contain information from the equipment list for each piece of equipment as shown below :

Tag number

Equipment name as on the equipment list

DP:in kg/cm2g;DT:in Deg C (two values for shell and tube exchangers)

Exchanger of heater absorbed duty in kcal/h

Pump rated capacity in m^3/hr or L/hr and differential pressure in kg/cm^2

Pump rated power in KW

Vessel dimensions tangent to tangent and diameter

Insulated (when required)

Equipment with spares will be described once unless the spare is on a separate drawing.

5.5 VENDOR PACKAGE DETAILS

The level of detail shown for vendor furnished packages will depend on the amount of information available and will generally be less than the amount shown for CEC designed equipment. It should be adequate to support the specifications, instrumentation development, piping layout and Client review of the package.

5.6 LINE NUMBER

5.6.1 The line number shall be CEC Standard as follows :

Example - 6″ -A1A1-12-10-I-SR

Where - 6 = nominal line size (inches)

A1A1 = Piping material specification code

12 = unit number

10 = sequential line number (see appendix III)

I = insulation code

SR = stress relief of piping

5.6.2 Line Size

Line, valve and nozzle sizes shall be in inches. When a single line sequential number is used for a line which changes sizes, each size shall be listed in the summary to provide hydrotest pressure and heat tracing requirement.

5.6.3 Unit Number

The unit number shall be the unit from which line originates. Utility lines originating from the unit battery limit and the branch up to the distribution header shall be numbered as if originating from the unit.

5.6.4 Sequential Line Number

The sequential line number shall be CEC's standard as follows :

The same sequential number may be used in more than one unit. Duplicated numbers are differentiated by unit number. The complete line number, including unit number shall be retained from the start of the line to it's termination, regardless of the number of units it passes through or changes in header size. A new line number will be required when pipe specifications change except for spec breaks to insert out-of-spec piping components.

A line shall be defined as the connecting pipe serving a common process function between two or more pieces of equipment(e.g., spare); between a header(e.g., main distribution or collection) and a piece of equipment ; or between two lines.

A header shall be considered the same numbered line throughout its entire length even though its nominal size may change. Small takeoff piping such as vents or drains (except to closed systems), or to instruments, hose stations, safety showers, and eyewash stations shall be included as part of the designated line.

Line numbers shall be assigned in blocks as described in Appendix 2.

5.6.5 Insulation Type

The purpose for insulation, including any external heating requirements, is designated by a letter symbol as listed below. The holding temperature for external heating shall be listed in the remarks column of the line summary.

P - Personnel Protection

I - Heat Conservation

Heat tracing, when required, shall be indicated by a dashed line adjacent to the process line. the temperature to be maintained shall be shown.

For freeze protection electric tracing will be used and indicated by (ET) shown after the temperature in ℃.

For process reasons, steam tracing will be used and indicated by (ST) shown after the temperature in ℃.

5.7 INSTRUMENTATION

5.7.1 Symbols and identification letters

Instrument symbols and identification letters will be in accordance with the instrument society of American Standard ISA-S 5.1 “Instrumentation symbols and Identification”, latest edition.

5.7.2 General instrumentation philosophy

Transmission to or from the control board in the control room is to be via distributive control system.

Instrumentation and controls are to be compatible with computer control system to be implemented in the future.

An emergency shutdown system is to be defined.

Safety related interlocks are to be hardwired and fail safe.

Motor status lights will not be shown on P&ID.

Local control loops are to be pneumatic. Control valves shall have pneumatic operators.

5.7.3 Primary valving for instruments

Indicate level instrument valving on the P&IDs. For multiple level instruments on a vessel, use bridles or pipe columns. For level gages requiring more than one glass, only one baloon will be shown on the P&ID. Primary block valves for other instruments will not be shown on the P&ID.

5.8 VESSEL AND HEAT EXCHANGER NOZZLE SIZES

Vessel nozzle sizes shall be the same as the connecting pipe size except as follows :

5.8.1 Nozzles set by Process

If the nozzle size has been set by process and is larger than the pipe attached to it, it shall remain larger as per Process requirements. If the nozzle size set by Process is smaller than the pipe attached to it, the nozzle size shall be increased to match the pipe size, provided that a special condition does not exist to justify the smaller nozzle. (In both cases, the System Process Engineer should review nozzle size with Process)

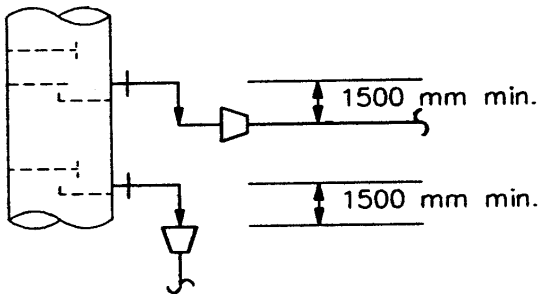
5.8.2 For liquid drawoff from column, use the following :

Minimum nozzle size in inches for total draws :

dia = 1.36 $(L/m)^{0.4}$ where L/m is flow in liters/min.

Before reducing diameter or making a horizontal run, a minimum drop of 1500 mm in elevation is required, after the piping elbow is attached to the drawoff nozzle.

The following detail will be shown on the P&ID. :



5.8.3 Nozzles for Exchangers

Size to limit dv^2 = 5965 kg/m sec^2 (where “v” is the linear velocity of the fluid in meters per second and “d” is the density in kg/m^3 for single or two phase flows)

Where exchanger shell are connected in series, maintain the larger line size.

and bypass valve sizes for performance and capacity. The line should also be checked to see if it can be reduced in size.

5.9 CONTROL VALVE MANIFOLD

5.9.1 Manifold sizes

The control Valve Manifold Design Table, Appendix 1, shall be used for selecting block and bypass valve sizes. Where the control valve is two or more sizes smaller than the line size, the project instrument engineer shall carefully analyze the block

5.9.2 Exceptions

Full-line size block and bypass valves are required for the following :

Vaporization or volume increase requires full-line capacity. Use downstream line size to size downstream block valve from table.

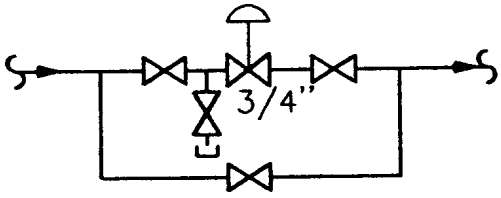
Gravity flow with small control valve differential.

Requirement for future expansion.

High pressure drop where cavitation could occur. Expansion will be used immediately at the control valve outlet.

5.9.3 Bleed valves

A 3/4 in. bleed valve shall be shown upstream of the control valve.



5.9.4 Valves without manifolds

A control valve with a handwheel and without block an bypass valves can be used in a clean, nonabrasive service where a line can be taken out of service without requiring unit shutdown.

5.10 PUMP AND COMPRESSOR MANIFOLDS

5.10.1 If valve takeoff is made before the pump nozzle sizes are known, both pump suction and discharge valves shall be line size.

5.10.2 If valve takeoff is made after the pump nozzle sizes are known, valves in suction and discharge lines shall be sized as follows:

5.10.2.1 If there is one size difference between pump nozzle and pipe.
Pump suction valve shall be line size or suction nozzle size, whichever is greater.
The valves on the discharge of a pump shall be the same size as the pump nozzle or the piping, whichever is smaller.

5.10.2.2 If pump suction or discharge nozzle differs more than one size from the line size, valves shall be one size smaller than the line size.
Where pump nozzles are smaller than the line size by two sizes or more, Check the line size for proper sizing and consider, from economic standpoint, a line-size

valve and a single swage versus two swages and a one size smaller valve. Check line size if pump nozzles are two sizes larger than line size. Both discharge check and block valves shall be the same size.

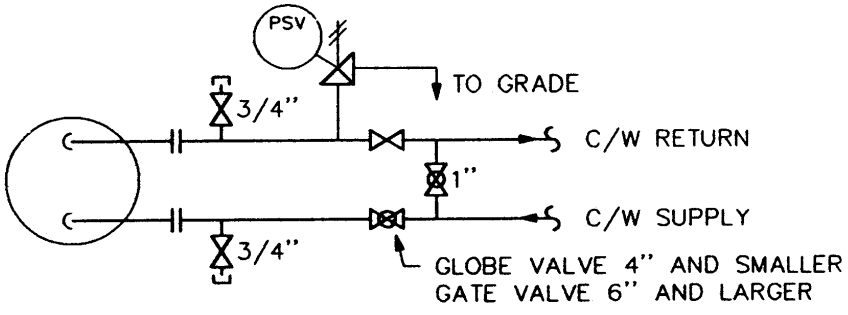
5.10.3 Pumps and compressors shall be provided with permanent strainers.

5.10.4 A minimum of three diameters of straight run of pipe shall be shown on compressor suction piping.
Instrumentation or rotating equipment may have additional requirements.

5.10.5 Install spectacle blinds on suction and discharge of reciprocating compressors.

5.10.6 Install TWs on inlet and outlet of all heat exchangers.

5.10.7 Piping and valving around water cooled heat exchangers shall be shown as in sketch below :



5.11 VENTS, DRAINS, STEAMOUT AND PURGES

5.11.1 Vertical vessel drain shall be located in the bottom outlet line.

5.11.2 Steamout connections are located at minimum distance above the bottom head steam of vertical vessels and the side or head of horizontal drums. If vendor designed vessels do not have steamout connection and client request the connection, they will be located on connecting pipeline.

5.11.3 Purge connections follow the same rules as steamout connections, but differ in that they are used when steam or water could be detrimental to the equipment or process material. Nitrogen or some other inert gas is therefore used to purge these systems.

5.11.4 Steamout or nitrogen purge shall be permanently piped for sizes 2 inches and larger. A double block, check, blind, and bleed in the purge piping shall be provided for the connection to a process line. When piping purges into a vessel, a double block, removable spool, and vent shall be provided in the purge line.

5.11.5 Vents are located on the top head of towers and vertical vessels. They are located on the top of horizontal drums at the same end as the drain and at the end opposite from the steamout or purge connection. All vents are valved and blinded or capped.

5.11.6 Vents, drains, and steamout and purge connection for columns and vessel shall be sized as follows :

Equipment Volume Cubic Meters	Vent Size inches	Drain size inches	S.O or Purge Size inches
Up to 5.6	1-1/2	1-1/2	1-1/2
5.6 to 17	1-1/2	2	1-1/2
17 to 71	2	3	1-1/2
over 71	3	4	1-1/2

NOTE : Minimum size vents for vessels having only one personnel access way will be 4 in, for horizontal vessels and 2 in, for vertical vessels.
Access ways will be shown on P&IDs.

5.11.7 All drains from towers containing toxic fluid shall have some arrangement for being double blocked.

5.11.8 Operating vents and drains for piping systems shall be sized as follows :

Pipe Size, inches	Vent size, inches	Drain Size, inches
3 / 4 - 4	3 / 4	3 / 4
6 - 10	3 / 4	1
12 and over	1	1 - 1 / 2

Non-operating and hydrotest vents and drains will not be shown on the P&IDs.

5.11.9 All vents and drains smaller than 3 in. shall be capped. All vents and drains 3 in. and larger shall be blinded.

5.11.10 Atmospheric tank overpressure protection

Atmospheric tanks shall have vent, overflow, two independent high level alarms or shutdowns, and API overpressure protection.

5.12 INSULATION

Lines and equipment surfaces normally operating at 65 degrees C and above, not insulated for heat conservation, shall be insulated for personnel protections.

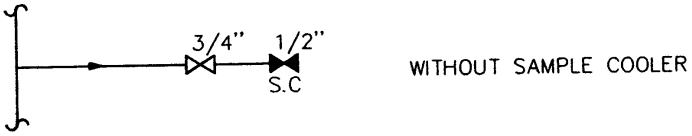
Insulation thickness shall be as specified in the insulation specifications.

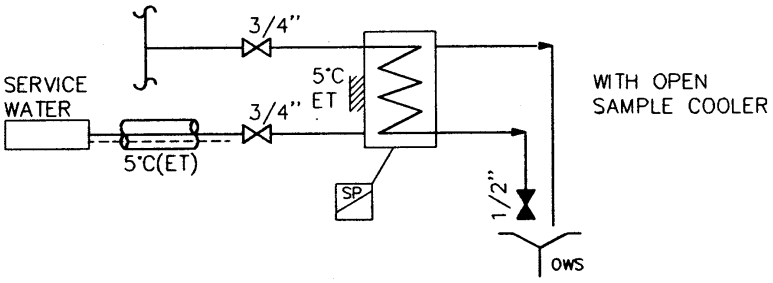
5.13 TRACING

Tracing shall be provided to maintain liquid viscosity at required levels, to keep lines from freezing, and to prevent condensation. Select temperatures at least 6 degrees C above the liquid pour or freezing points, making sure it is below the bubble point. The temperature to be maintained shall be shown in the Remarks columns of the line summary. Electric tracing will be used for freeze protection, and steam tracing will be used for process reasons. Where operating temperature may exceed 215 ℃ electric tracing shall not be used.

5.14 SAMPLE CONNECTIONS

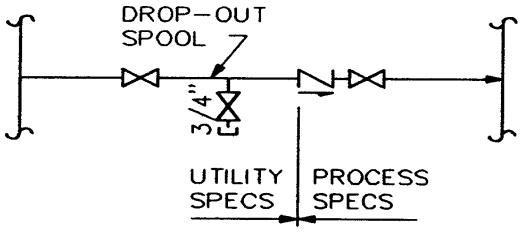
Sample connections shall be shown as follows.





5.15 PIPING SPECIFICATION BREAKS

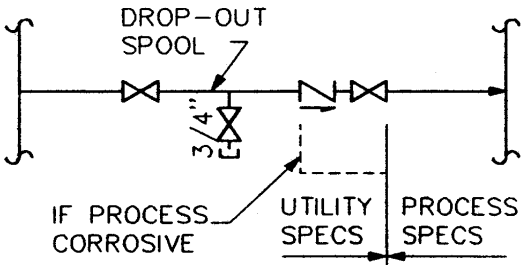
5.15.1 Process pressure greater than steam or utility pressure or hazardous process leakage.



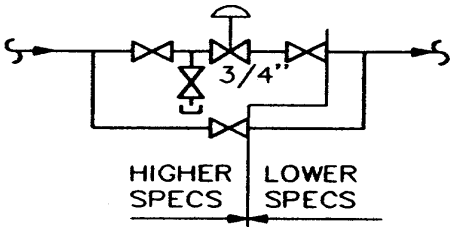
Permanent tie-ins of utility services to process equipment are not allowed. Install all piping and connect drop-out spool each time.

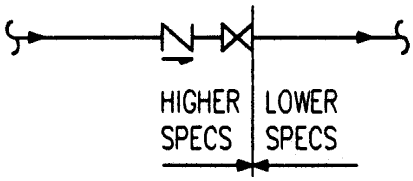
Snuffing steam, steam out, and nitrogen purge may be excluded. (See above).

5.15.2 Steam or utility pressure greater than process pressure.



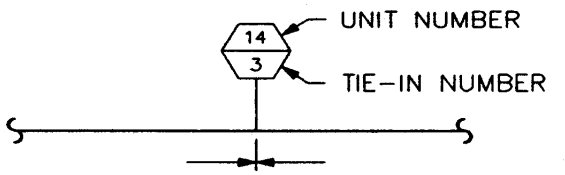
5.15.3 General break with or without check valves.





5.16 TIE-IN CONNECTIONS

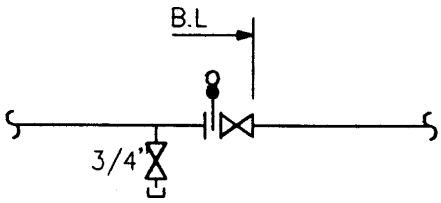
Tie-in connections will be denoted by a hexagon containing the tie-in number and the unit number and will be shown on the P&ID as :



Tie-ins will be shown at plant battery limit.

5.17 BATTERY LIMIT AND HEADER-BLOCK VALVES

5.17.1 Plant battery limit lines will generally require it battery limit block valve with spectacle blind. A 3/4-in. bleed valve shall be located inside the battery limit.



5.17.2 The following shall be the criteria for header blocks for utilities (other than unit header blocks) :

5.17.2.1 Steam

Provide block valves at header for all supply and user branches.

A turbine inlet and exhaust valve shall be located at the turbine and not at the header.

5.17.2.2 Condensate

Provide header blocks.

5.17.2.3 Cooling Water

No header block valves shall be provided for cooling water.

Block valves shall be provided at each piece of user equipment.

5.17.2.4 Nitrogen

Provide header blocks.

5.17.2.5 Instrument Air, Utility Air

Provide header blocks.

5.17.2.6 Service Water

Provide header blocks.

5.17.2.7 All Services

Provide header blocks for branch lines 2 inches and smaller.

5.18 REDUCERS

Reducers will be shown where it is not obvious where a line has changed size. Where pump, vessel, control valve or other equipment have sizes other than line size, the flange or valve sizes shall be shown but the reducers will not.

5.19 DISTRIBUTION DRAWINGS

Drawings for the distribution of utilities including flare and above ground drains will be grouped showing approximate pipe rack and equipment layout. Drawing will be split by plant areas as required. Interconnecting process lines and unit blocks will be shown directly on process P&IDs. Where process lines interface with battery limit and flare facilities, these lines may be shown on a process interconnecting drawing.

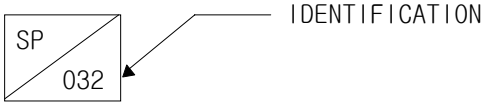
5.20 LINE CONTINUATION FLAGS

Lines continuing from one drawing to another shall be as per relevant legend drawings.

5.21 SPECIALTY ITEMS

If a special type of valve or some other piping item is required that is not included in the piping material specification, the valve or item shall be shown on the P&ID as a specialty item.

The symbol to be used is as follows :



The System Process Engineering Section shall issue to the Piping Material Section all information necessary for the purchase of these specialty items.

5.22 CHEMICAL OR MECHANICAL CLEANING

Special line treatments such as cleaning, pickling, etc., shall be indicated by notes on the P&ID. The extent of the cleaning operation and the type of cleaning shall be indicated by reference to the cleaning specification.

5.23 RELIEF VALVE ISOLATION

Upstream and downstream block valves are required for each relief valve in hydrocarbon gas service operating above 10 kg/cm2g or in LPG liquid service.

These valves shall be locked open.

3/4-in. capped bleed valves shall be shown between the upstream and downstream block valves and the relief valve.

All block valves in relief valves service shall be full port, unless the pressure drop through the inlet piping including the block valve does not exceed 3% of set pressure and the valve bore is larger than the relief valve inlet nozzle.

The relief valve shall be located at a high point and drain both to the vessel and to the relief header.

5.24 LOCKING VALVES

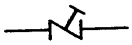
Valves that must be open or closed for reasons of safety shall be marked locked open or closed (not car sealed). Such valve that must be opened or closed in an emergency shall be car-sealed (not locked).

5.25 VALVE APPLICATION

The following is a guide for selecting the proper type of block valve for a specific application. Applications involving special services, such as high pressure drop and erosive fluids, shall be evaluated individually.

VALVE SELECTION GUIDE

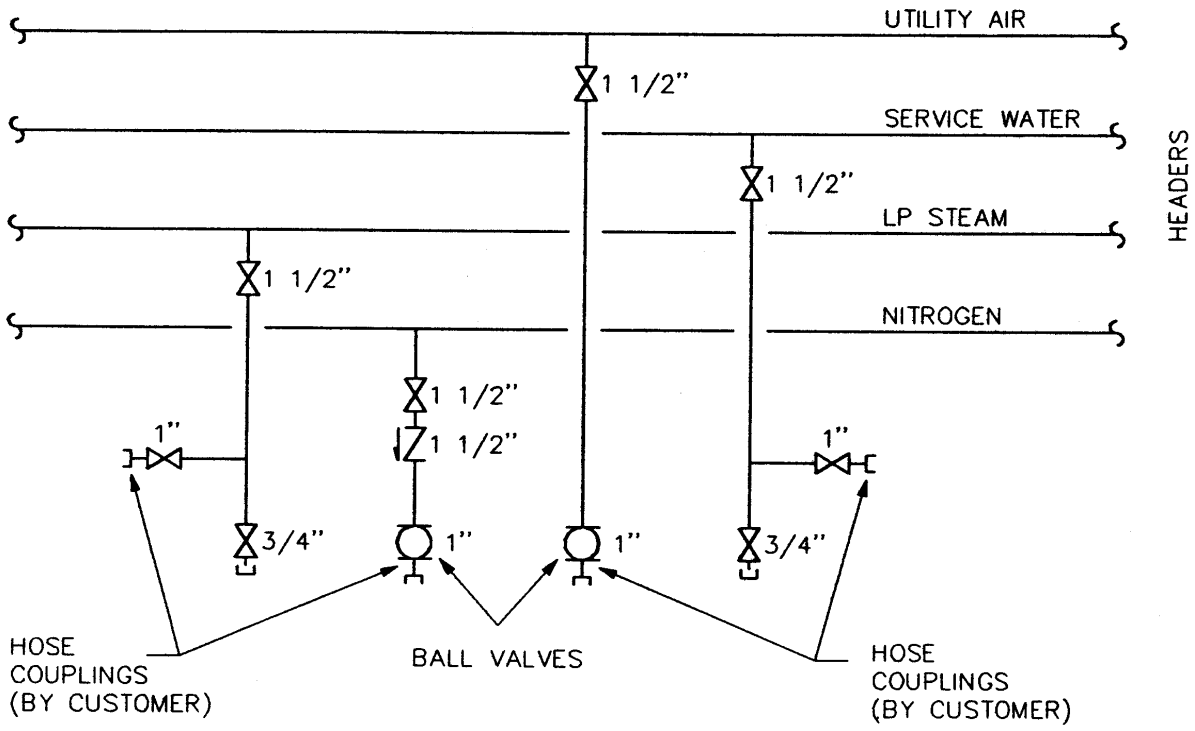
VALVE	SYMBOL	NOTE
BASIC SELECTION		
These are the basic valves to be selected.		
GATE		
GLOBE		Globe Valves normally limited to 1/2 in. to 6 in. size.
CHECK		
NEEDLE		Needle valves are used at sample connections, in line classes specified in piping material specs
BALL		Use for air and nitrogen service at utility stations and for fuel gas service
BUTTERFLY		Use for water service as shown below : Cooling water 6 in. to 30 in.

VALVE	SYMBOL	NOTE
STOP CHECK ANGLE		These valves require special sizing procedures
STOP CHECK STRAIGHT		(ditto)
INTERMITTENT BLOWDOWN		Use plunger type blowoff valve
CONTINUOUS BLOWDOWN		Angle needle type.

6. UTILITIES

6.1 UTILITY STATIONS

Utility stations for steam, service water, and air shall be provided at convenient locations throughout the plant. At certain stations, as defined on the utility P&ID, nitrogen shall be provided.



6.2 SNUFFING STEAM

All snuffing steam shall be taken from the LP steam supply header.

APPENDIX 1 BLOCK AND BYPASS VALVE SIZES

Valves at control valve manifolds shall be sized in accordance with the following table, unless otherwise shown on the piping and instrument diagrams : (All dimensions are in inches)

Control Vavle Size	Line Size	Block valve Size	By-Pass Valve Size
3/4	3/4	3/4	3/4
3/4	1	1	1
3/4	1-1/2	1-1/2	1
3/4	2,3,4	2	1
1	1	1	1
1	1-1/2	1-1/2	1-1/2
1	2,3,4	2	1-1/2
1-1/2	1-1/2	1-1/2	1-1/2
1-1/2	2,3,4	2	2
2	2	2	2
2	3,4,6	3	3
2-1/2	3,4,6	3	3
3	3	3	3
3	4,6,8	4	4
4	4	4	4
4	6,8,10	6	6
5(6” flgs)	6,8,10,12	6	6
6	6	6	6
6	8,10,12	8	8
8	8	8	8
8	10,12	10	10
10	10	10	10
10	12,14	12	12

Where piping is expanded after a control valve assembly for flashing conditions, the block valve downstream of the control valve shall be equal to or one size smaller than the expanded downstream piping.

Where reducers are used, the maximum reduction shall not be greater than two nominal line sizes per reducer.

APPENDIX 2 LINE NUMBER BLOCKS

Process Line Numbering

001 through 999

Utility Line Numbering

Steam and boiler Feedwater	
LP Steam	1000 Through 1199
MP Steam	1200 Through 1399
HP Steam	1400 Through 1599
HP Steam Superheated	1600 Through 1799
HP Steam Boiler Feedwater	1800 Through 1999
Water (above ground lines only)	
CW Supply	2000 Through 2199
CW Return	2200 Through 2399
Service Water	2400 Through 2599
Potable Water	2600 Through 2799
	2800 Through 2999
Air, Nitrogen, etc	
Plant Air	3000 Through 3199
Instrument Air	3200 Through 3399
Nitrogen	3400 Through 3599
	3600 Through 3799
Fuel Gas and Fuel Oil	
Fuel Gas	4000 Through 4199
Fuel Oil	4200 Through 4399
	4400 Through 4599
	4600 Through 4799

Vents and Reliefs	
Vent to Atmoshphere	5000 Through 5299
Vent to Flare	5300 Through 5599
Vent Reliefs	5600 Through 5899
Liquid Reliefs	5900 Through 5999
Pump-Out Blowdown, oils	
Pump-Out	6000 Through 6190
Blowdown	6200 Through 6399
Flushing Oil	6400 Through 6599
Seal Oil	6600 Through 6699
Recovered Oil	6700 Through 6799
Drains and condensate	
Closed Drains	7000 Through 7199
LP Condensate	7200 Through 7399
MP Condensate	7400 Through 7599
Other Condensate and	7600 Through 7799
Oily Water Sewer Drains	
Miscellaneous	
Miscellaneous Water	8000 Through 8199
	8200 Through 8399
Process Water	8400 Through 8599
Demineralized Water	8600 Through 8799
	8800 through 8899
	8900 Through 8999
Chemicals, Waste, Etc.	
Caustic	9000 Through 9099
Sulfuric Acid	9100 Through 9199
Nitric Acid	9200 Through 9299
Hydrochloric Acid	9300 Through 9399
	9400 Through 9499
Misc. Chemicals	9600 Through 9699