

		NATIONAL IRANIAN OIL COMPANY SOUTH PARS GAS FIELD DEVELOPMENT PHASE 12	 N.I.O.C. <i>Pars Oil & Gas Company</i>
DOC. NO. SP12 2Y PR DB 999 002		ONSHORE FACILITIES	Page 1 of 28

DESIGN BASIS FOR P&ID DEVELOPMENT

B3	06/11/06	For MDP Rev 7 Update, Issued for Design	RM	CM	RBJ	
B2	30/08/06	Incorporated Client Comments, Issued for Design	CM	RM	HL	
B1	10/05/06	Issued for Client Review	CM	RM	RBJ	
B0	13/4/06	Issued for Internal Review	CM	RM	RBJ	
Rev	Date	Description	Prep'd	Check'd	WP App'd	Client App'd

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1. SCOPE

This procedure outlines the design basis to be applied for P&ID elaboration of ONSHORE FACILITIES of SOUTH PARS GAS FIELD DEVELOPMENT (Phase 12) Project which is located at TOMBAK, IRAN. It defines the level of detail to be included so that it is sufficient to enable a $\pm 10\%$ cost estimate for the Project FEED Phase followed by Scope of Work to the EPC CONTRACTOR for the detailed engineering Phase. In the event of a conflict between this Basis document and Licensor P&ID's, and guidelines for P&ID's, then the Basis and guidelines shall prevail.

2. PURPOSE

The purpose of this document is:

- at the FEED stage:
 - to gather P&ID details so that they can be integrated to the process unit in a consistent and uniform manner.
- at the Detailed Engineering stage to:
 - explain and clarify the options selected for P&ID's elaboration at the FEED stage
 - Define the minimum requirements for completion by CONTRACTOR of identified items missing on FEED P&ID's.

The list of P&ID details treated by this document is not exhaustive, which means that it will be completed in order to comply with any new problem which would arise and which would be judged to be common to Engineering.

3. DESIGN BASIS

At FEED stage, the following facilities (see table below) are expected to be shown on FEED P&IDs. The extent of content at various revisions will be as per check list table.

3.1 P&ID Check Lists

The check lists are used in order to ensure the orderly development of P&IDs, and to ensure all required information is included. The check list for FEED project is shown below but not limited to

LegendE = Estimate / Preliminary

C = Completed /Confirmed by FEED Contractor

REV B0 / B1 / B2 CHECK LIST

	B0 Internal Review	B1 Client Review	B2 For HAZOP	B3 For AFD (Post HAZOP)
<u>General</u>				
Title block completed	C			
Symbols in accordance with Legend Sheet	E	C		
Sparing for equipment, pumps, relief valves	E	C		
Package unit limits	E	C		
Equipment trims	E	E	C	
<u>Vessels/Equipment</u>				
Name and equipment number (Including Conditions)	C			
Shown correctly against data sheet	E	E	C	
Relief protection provided (Shown on Instrument datasheet)	E	E	C	
Vessel vent. process vent, drain	E	C		
Utility connection, steam-out	E	E	C	
Elevation where critical	E	C		
Manways	E	C		
<u>Exchangers</u>				
Name and equipment number	C			
Short form symbol	E	C		
Reboiler elevations	E	E	C	
Vent and drain connections	E	C		
Shell / tube piping routings (s/s or t/s)	C			
<u>Air cooled exchangers</u>				
Forced / induced	E	C		
Louvres	E	C		
Fan control	E	E	C	
Tube leak detection	E	E	C	
Over-pressure protection	E	E	C	
<u>Fired Heaters</u>				

Legend E = Estimate / Preliminary

C = Completed /Confirmed by FEED Contractor

REV B0 / B1 / B2 CHECK LIST

	B0 Internal Review	B1 Client Review	B2 For HAZOP	B3 For AFD (Post HAZOP)
Name and equipment number	C			
Heater arrangements	E	E	C	
Heater type	E	E	C	
Number and arrangement of coils	E	E	E	
Fans forced draft, induced draft	E	E	C	
Stack instrumentation	E	C		
Snuffing and purging facilities	E	E	C	
Relief protection	E	E	C	
Vent / drain provision	E	E	C	
Isolation and blinding	E	E	C	
<u>Burner System</u>				
Process safety shut down			C	
<u>Combustion Air</u>				
Low pressure shut down			C	
High exhaust temperature shut down			C	
Low fluid flow shut down	E	E	C	
<u>Pumps</u>				
Title block completed	C			
Presentation and driver (if steam driven)	E	C		
Pump and driver details against Process Data sheets	E	E	C	
Insulation	E	E	C	
Seal Plan Number (API)	E	E	C	
Minimum flow protection	E	E	C	
Suction and discharge valving	C			
Casing vent, drain	E	E	E	
Start-up and warm-up requirements	E	E	E	
Discharge piping class and specification break on suction piping if required	E	C		

LegendE = Estimate / Preliminary

C = Completed /Confirmed by FEED Contractor

REV B0 / B1 / B2 CHECK LIST

	B0 Internal Review	B1 Client Review	B2 For HAZOP	B3 For AFD (Post HAZOP)
Requirement for relief valve and confirm design for shut-in	E	E	C	
Isolation requirement	C			
Pressure gauge discharge. Check valve on discharge	C			
Pump seal flush, purge or quench identification – note only	E	E	E	
<u>Compressors</u>				
Title block completed	C			
Presentation and driver representation against Process Data Sheets and Mechanical Data Sheets	E	E	C	
Control – local / remote	E	E	C	
Anti-surge controls	E	E	C	
Recycle system	E	E	C	
Suction and discharging valving	E	E	C	
Check valve, strainer	E	E	C	
Relief protection			C	
Shut in and blowdown provision			C	
Tube and seal system (note only – by EPC Contractor)			E	
Buffer gas requirements (note only – by EPC Contractor)	E	E		
Vent and drain arrangements	E	E	C	
Purging requirements	E	E	C	
Supplier interfaces by box	E	E	C	
Acoustic insulation (note only – by EPC Contractor)		E	E	
Over-pressure protection: pressure sensor	E	E	C	
: relief device	E	E	C	

Legend E = Estimate / Preliminary

C = Completed /Confirmed by FEED Contractor

REV B0 / B1 / B2 CHECK LIST

	B0 Internal Review	B1 Client Review	B2 For HAZOP	B3 For AFD (Post HAZOP)
Low suction pressure protection	C			
Backflow protection	C			
Seal system failure protection (note only – by EPC Contractor)	E	E	E	
Distance piece purge (recip. comp.) (note only – by EPC Contractor)	E	E	E	
<u>Piping</u>				
Line size	E	C		
Spec. breaks	E	C		
Line number and class		C		
Insulation type and limits	E	C		
Special instructions – note only	E	C		
Isolation arrangements	E	C		
Valve type	E	C		
Double blocks and bleeds, isolation	E	C		
Package boundaries	E	C		
Sample connections only	E	C		
Steam-out purge flushing	E	C		
Tie-ins	E	C		
Tracing	E	C		
<u>Instrumentation</u>				
Instrument numbering	E	C		
Symbols correctly shown	E	C		
Control valve type and TSO service	E	C		
Control valve action	E	C		
PSV / pressure vac. breaker installed	E	C		
For steam & gas purging systems (by EPC contractor)		E	E	
Corrosion probes	E	C		

3.2 P&ID Quality Check

The following table shows what facilities are expected to be shown on FEED P&IDs.

P&ID Item	Remarks	Shown	Not Shown
Transmitters		X	
Switches		X	
Analysers	Shown as an instrument bubble	X	
Sample coolers & Sample Connections	Details shown on legend sheet and referenced on the P&ID by special P&ID symbol	X	
Control valve set	Size of control valve	X	
	Size of bypass valve	X	
	Size of bypass line	X	
	Failure action	X	
	Hand jack required		X
	Actuator type	X	
	Valve type	X	
	Actuator action	X	
	Limit switches		X
	Hand Jack position		X
	Drain valves, swages	X	
	Instrument and bridle isolation, bleed and drain valves		X
Flushing requirements	Note only		X
Instrument signal		X	

P&ID Item	Remarks	Shown	Not Shown
On / off actuated valves	IA supply lines and regulators	X	X
	Valve type: eg ESD, EDP		
	Normal position		X
Pilot valves	Valve details		X
	eg: Solenoid valves or air operated pilot valves		X
Electrical interlocks	Shown simply only	X	

3.3 P&ID Revision Procedure

The key documents for the process systems design are the P&IDs. A procedure is followed in developing the P&IDs to FEED status in order to ensure quality.

In outline the procedure is as follows:

- Rev B0 internal review P&IDs are prepared and issued to all relevant FEED Contractor groups who may review and comment within a specified period.
- All comments are reviewed and resolved with the groups concerned and incorporated into the P&IDs. The P&IDs are then issued Rev B1 for Client review.
- An updated issue of the P&IDs at Rev B2 incorporating the Client review comments will then be issued for HAZOP.
- A full HAZOP of the P&IDs will then be carried out prior to issuing Rev B3 which will include agreed HAZOP recommendations.

At EPC stage, the following items (non exhaustive list) listed hereafter shall be developed or followed.

1. Assembly recommendations for filters at pump suction shown on table "A" SP12 2Y PR PID 999 006 have to be followed. The filters arrangement drawn on P&ID shall not be considered as an installation requirement.
2. Stand pipe has to be shown on P&ID's.
3. Material selection for piping and equipment shall be in accordance with depressurisation studies and other operational scenarios results

4. Upstream/downstream PSV line diameter has to be shown on P&ID's.
5. Upstream/downstream BDV line diameter has to be shown on P&ID's.
6. PSV size and number, control valve manifold sizing has to be shown on P&ID's
7. CONTRACTOR shall review requirements for thermal expansion relief valves installation based on piping routing and installation rules.
8. CONTRACTOR shall pay attention to BDV installation requirements for isolated part of pipe regarding the BDV installation rules.
9. At Basic / FEED stage PSV's have been located on equipment. PSV's shall be installed directly on vessels, and in case the vessel is fitted with demister, the PSV shall be taken off upstream of the demister.
10. Double block and bleed assembly (solid block assembly) shall be considered /reviewed by CONTRACTOR on high pressure service.
11. Pressurisation by-pass (location and sizing) shall be reviewed by CONTRACTOR and specified as required for plant start up

P&ID details mentioned in this Procedure shall be used as guidelines for products/developing Licensor P&ID's.

Any change made to the P&IDs given by Licensor shall be addressed to the Licensor via Petopars Ltd.

4. GENERAL CONSIDERATIONS

P&ID (PIPING AND INSTRUMENT DIAGRAM): detailed drawing used for construction and operation of the processing plant including associated off sites and utility fluids.

It contains at detailed engineering stage:

- all equipment with their reference,
- all lines (main and temporary) with their numbering (including nominal diameter, fluid service identification, piping material class, insulation and line number),
- piping class change,
- Particular line fittings (strainers, flame arrestor, reducer, cap, flanges, spacer, spectacle blind. Flame arrestors should not be considered as line fittings but as itemised pieces of equipment)
- all piping valves with their types, all actuated valves shall be itemized and their fail safe position indicated, manual valves locked position to be indicated, car seal position, if applicable, should be shown on P&ID's.
- all PSV's, rupture disks and restriction orifices with their items,
- complete instrument representation with the control loops details, numbering and location,

- insulation, tracing, slope,
- equipment elevation,
- notes for explanation and good understanding etc...

In all cases the location of main equipment symbols has to take into account the location of each equipment on the plot plan and on the fluid path.

Due to the importance of the details, it is possible to have only one main equipment represented on one sheet.

For each equipment, a reference (item/tag number) is given close to the symbolic representation.

A table also gives the item number for each equipment, the function or service and the main characteristic values.

P&ID symbols are required for a good understanding and also to give some symbolic representations on P&ID's.

4.1 P&ID Drafting Workshare

For the duration of the FEED on this project the bulk of the P&ID drafting will be done using SmartPlant P&ID (SPPID).

As each Unit is completed a Unit Wide Line List will be prepared using SPPID in the Host office for checking by the Process group prior to issue.

Rev B0 of the line list will only show line designation data and line origin / termination information.

Rev B1 of the line list will also include Process Design conditions (i.e. pressures and temperatures).

At the end of FEED stage P&IDs will be made available for use by CONTRACTOR in Autocad format.

5. EQUIPMENT

Equipment description, the basic requirements and specification shall be defined for all equipment on P&IDs.

5.1 Heat Exchangers

Notes:

1. When installed, the ¾" outlet purge, located on cooling water/sea water side, will serve as a sample connection.
2. If heat exchangers are installed at 15 m or more above ground, the addition of one vacuum breaker (or booster pump), on the cooling water side, has to be examined case by case.
3. Cleaning (for HC side):
 - A 2" nozzle with valve and blind flange for cleaning, on fouled side, shall be installed on the line. When exchangers are in line, only one nozzle will be installed (one at inlet and outlet of the group of exchangers).
 - For cleaning purpose, exchanger will be isolated and bypassed. Exchangers to be cleaned will be defined case by case.
4. As a general rule, temperature control will be installed on primary circuit (i.e. not on cooling water for example).

5.2 Air Cooler

Notes:

1. Vent

All air cooler condenser shall be equipped with 2" vent at high point used only for maintenance (infrequent).
2. Cleaning nozzle

A 2" cleaning nozzle with valve and blind flange, if needed, shall be installed on air cooler and on process line.
3. Air condenser

A self draining line shall be provided between the air condenser outlet and the reflux drum. For air condenser, the equipment shall be self draining (slope 1%)
4. Air condenser header

Header ends to be plug type. However, cover plate header type can be specified on high fouling ($> 0.0004 \text{ m}^2 \text{ }^\circ\text{C/W}$) low pressure service (rating 150#).
5. Air cooler type

Air cooler to be induced type when air cooler is installed on pipe rack. Forced draft type shall be considered

 - if air cooler is installed at grade
 - if inlet process temperature is above 175°C or air outlet over 93°C

- or for multiple purpose exchangers, several sections stacked

6. Air cooler bay isolation

Isolation of air cooler bay is required. However, air cooler shall be considered as flow limiter and therefore PSV & PCV are required on both column overhead and reflux drum.

5.3 Pumps

For installation arrangement, refer to PID's symbology sheets, "SP12 2Y PR PID 999 001 TO 012.

1. Suction filter :

Y filters will be used for pipe size up to 2", T filter for 2" and above.

2. Vent:

The following considerations shall be considered as a complement on PID symbol. Pump casing vent shall be provided if casing and flange arrangement of pump does not allow natural self venting.

A vent will be installed on pump casing and vented to a closed drain system. (This vent may be routed to atmosphere for non toxic product). Alternate to this arrangement can be considered: self priming pump.

A vent, connected to suction drum , shall be installed for pump on cold product as well (for which vapourisation temperature , at suction pressure , is less than ambient temperature).

3. Maintain temperature:

In all services specially for high temperature ($> 230^{\circ}\text{C}$), cryogenic or high pour point services, it is necessary to maintain the temperature in pump casings of standby pumps. In this regard, it is normal to install a $\frac{3}{4}$ " bypass with a valve (globe valve) across the check valves (at discharge line) to maintain the temperature in the casing. For large diameter lines ($> 12"$) the usage of check valve bypass with an appropriate size versus constant recirculation to the pump needs to be evaluated on a case by case basis.

Alternatively, during EPC phase, a 5 mm (or suitable) weep hole through check valve may be considered for maintain in temperature not for drain (in that case a specific drain connection shall be required).

4. Block valve: type and size :

If ball valves are installed at pump suction, full bore type valves shall be installed.

Diameters for valves at suction and discharge lines regarding pump nozzle diameters are as follows:

- Suction line: in all cases, valve has the same diameter as the line.
- Discharge line: if line size is one diameter greater than nozzle, check valve and block valve will have the same size as the pump nozzle. If line size is more than one diameter greater than pump nozzle, check and block valve will be in the immediately lower discharge line diameter (e.g. nozzle 4", pipe 10", check + block valves 8").

5. Automatic start:

- As base case, pump automatic start will be done generally through FSLL (if flow transmitter already exists).
- Automatic start is determined considering the following rules :
 - Personnel safety: for example flare KO drum pump will be started in order to avoid liquid in flare tips. In that case, considering the non continuous operation of flare drum pumps, the start of the spare pump can be performed by LSH or by DCS logic.
 - Equipment safety: for example BFW pump will be started in order to protect the steam drum and the steam coil.
 - Severe process upset: pump generating by its shutdown one process unit trip or generating an off spec product shall be spared and its spare pump started automatically.
 - Flaring: automatic start shall NOT be considered to minimise the flaring. For example, reflux pumps, unless a severe process upset is faced.

5.4 Vessels

- Liquid side draw-off

For side draw off lines, a vertical part of line (approx. 3 m) shall be provided just after column nozzle in order to avoid liquid vapourisation. Valve, if any, on this line shall be located in horizontal position and mounted flange to flange with the column nozzle.

- Drain and utility connections (steam out, purging):

Refer to SP12 2Y PR DB 999 003 Process sizing criteria

5.5 Compressors

As a minimum, basic compressor arrangement will show inlet/outlet valves, check valves, strainers, pressure relief valves, online condition monitors, surge valve and control. Anti-surge valve to be specified for quick opening to avoid surge on machine trip. Ideal pressure volume upto check valve to be less than 1.5 m^3 . Provisions will be made for isolating and purging the compressor.

5.6 Tanks

Two basic types' tanks are generally shown on P&IDs i.e. fixed and floating roof tanks. As a minimum, basic layout of the tanks will show the inlet / outlet connections, connections for breather valves, vents, drains, utility connections etc. A basic scheme for condition monitoring and control will also be shown.

6. INSTRUMENTS

6.1 Control Valves

Refer to typical arrangement drawing, on P&ID symbology sheets, "SP12 2Y PR PID 999 001 to 012.

Notes:

1. Control valve manifold

- *For control valve size less than or equal to 6"*

Control valves are equipped with block valves and by-pass, except control valve in non continuous service. Sizes of block valves and by pass are in accordance with API RP 550 (see tabulation hereunder).

Exception is made for flash service: the downstream block valve and piping – located between control valve and block valve - shall have the same diameter as downstream line.

When manual bypass valve is installed, it shall have a CV not higher than that of the relevant control valve fully opened. In case of having mechanical stop on control valve, CV of manual bypass valve shall not be higher than that relevant to the control valve open upto the mechanical stop.

- *For control valve size greater than 6"*

A control valve will be provided with hand wheel and no by pass with block valve unless specified case by case. For main utility control valves (fuel gas and air), by pass normally comprises a spare on line control valve. For isolation of control valves for maintenance purpose, design shall consider

the addition of block valve upstream/downstream of control valve or the use of the closest valve to minimize spill or loss of product.

2. When control valves are used as SDV and linked to the shutdowns system, by pass line will be equipped with a block valve specified as car sealed closed (C.S.C.)
3. $\frac{3}{4}$ " bleed of control valve manifolds
 - *For process line (upstream CV) greater than or equal to 6"*
IF Control valve is FO, $\frac{3}{4}$ " bleed with block valve and blind flange will be installed downstream control valve. IF Control valve is FC, two $\frac{3}{4}$ " bleed with block valve and blind flange will be installed downstream and upstream control valve.
 - *For process line (upstream CV) less than or equal to 6"*
 $\frac{3}{4}$ " bleed with block valve and blind flange will be installed downstream control valve whatever the control valve position (FO or FC) by fluid failure

TABLE OF BLOCK VALVES AND BY-PASS SIZES UP TO DIAMETER = 16"

BLOCK AND BY PASS VALVES DIAMETER REGARDING LINE DIAMETER	CONTROL VALVE SIZE													
Line	1/2"	3/4"	1"	1 1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	
Dia.														
1/2" BLOCK BY PASS	1/2" 1/2"													
3/4" BLOCK BY PASS	3/4" 3/4"	3/4" 3/4"												
1" BLOCK BY PASS	1" 1"	1" 1"	1" 1"											
1 1/2" BLOCK BY PASS	1 1/2" 1 1/2"	1 1/2" 1 1/2"	1 1/2" 1 1/2"	1 1/2" 1 1/2"										
2" BLOCK BY PASS		2" 2"	2" 2"	2" 2"	2" 2"									
3" BLOCK BY PASS			2" 2"	2" 2"	3" 2"	3" 3"								
4" BLOCK BY PASS				3" 3"	3" 3"	4" 3"	4" 4"							
6" BLOCK BY PASS					4" 4"	4" 4"	6" 4"	6" 6"						
8" BLOCK BY PASS						6" 6"	6" 6"	8" 6"	8" 8"					
10" BLOCK BY PASS							8" 8"	8" 8"	10" 8"	10" 10"				
12" BLOCK BY PASS								10" 10"	10" 10"	12" 10"	12" 12"			
14" BLOCK BY PASS										12" 10"	14" 12"	14" 14"		
16" BLOCK BY PASS											14" 12"	16" 14"	16" 16"	

Notes:

- Above table lists the maximum size of by-pass valves.

- When by-pass is installed, depending upon the actual CV of the control valve, by-pass valve size may have to be reduced (to be studied case by case).

6.2 Relief Valves

Refer to typical arrangement drawing on P&ID symbology sheet, "SP12 2Y PR PID 999 005"

1. Criteria for installation of PSV's and TSV's
Spool piece will be installed upstream PSV. However, advantage of the presence of spacer at capacity outlet can be considered. PSV bypass line diameter to be 2" whatever the vessel capacity is.
2. Spare relief valve: a spare relief valve is always installed except:
 - If the protected equipment can be isolated and de pressurized / drained without production shutdown.
 - If the installed relief valve is only used for fire case, in that case the spare relief valve is stored in warehouse (note on P&ID to be added).

For both cases, isolation with bleed is required.
3. PSV set pressure
If two or more PSV are in service, the set pressure will be staggered to avoid chattering. The difference between set points shall be less than 5 % of the design pressure. Staggering of PSV will be indicated on P&ID when applicable with respect to API considerations.
4. PSV number.
 - One PSV shown on P&ID (with one spare provided and located in warehouse) means that PSV will be designed for fire case only.
 - Two or more PSV's (n + 1spare) shown on P&ID means that safety valves are designed for other case than fire. If 3 PSV's are shown, this means that multiple PSV's in operation are expected.
5. PSV installation (Rules to be applied for P&ID's development at Basic stage) PSV

will be installed directly on vessel. PSV's shall be installed directly on vessels and in case the vessels are with demisters, PSV shall be taken off upstream of the demister.

6. Thermal expansion

- For all exchangers which can be isolated, the cold side will be equipped with a thermal expansion valve $\frac{3}{4}$ " x 1".
- A single TSV shall be provided for pipework thermal relief.
- TSV's are discarded where a PSV is already installed.

TSV's are not spared, valve with bleed to be installed upstream TSV

7. Rotative and dosing pump

- Rotative and dosing pump shall be protected by an external relief valve between discharge and suction lines.
- The internal protection - generally included in vendor's scope - can be considered as a safety device when the following parameters are reached :
 - pump capacity < 225 l/h
 - non corrosive and non toxic product
 - relief valve setting < 17.5 barg

6.3 Flow Meter

a) Rotameter

Rotameter will be installed vertically.

b) Flowmeter indication

Vapour phase to be compensated by T and P on a case by case basis depending upon operating/production needs.

c) Flowmeter type

Except otherwise required for process reasons, flow measurement, including compressor suction lines will be performed by orifice plates. Proper selection to be carried out by EPC Contractor regarding low pressure drop requirement, and applicability.

6.4 Temperature Element

Notes:

1. When two streams are mixed, the temperature element will be installed on common line at least at 10 x dia from the mixing point.
2. As general rule, temperature element on column will be installed as follows:

- tray liquid temperature element will be installed in downcomer at 100 mm from the bottom
 - tray vapour temperature element will be installed at 200 mm above the tray, the element coming inside the column by 300 mm .
3. Column top temperature element shall be installed on pipe as close as possible to column nozzle.
 4. Except for specific locations (columns for instance), all Thermowells (TW) will be fitted with local TG's which are installed for performance monitoring (on demand) and not used permanently for daily unit control or adjacent TI check.
 5. TG's required for exchangers performance check are installed. All nozzles above 2" diameter shall be equipped with Thermowells on Tubular Exchanger Manufacturer's Association (TEMA) type exchangers and air coolers. TI (Distributed Control System) shall be kept for critical parameters essential for the operator.
 6. Lines smaller than 4" will be locally enlarged to 4" if a TW or TG installation is required.

6.5 Pressure Element

Notes:

1. Pressure element will be installed preferably on vapour line and not on capacity.
2. Pressure element will be installed, at pump discharge line, upstream of check valve.
3. For split range controller, duplicated PIC at PCS (Process Control System) level made from single pressure transmitter will be considered to allow different set points on each.

6.6 Level Element

Notes:

1. Stand pipe may be installed on clean service when at least 3 level instruments have to be installed (Refer to Process sizing criteria SP2Y PR DB 999 003).
2. Minimum size for stand pipe: 3"
3. Level element used for safety action shall not be installed on stand pipe provided for level indication and control.

6.7 HIPPS

HIPPS form an acronym for Instrumented High Integrity Pressure Protection System .
HIPPS is expected to typically consist of quick closing shut-off valves, pressure sensors and a logic solver.

HIPPS shall always be applied in combination with pressure alarm.

The following minimum requirements will be considered for the components:

1. Manifold shall be installed in vertical positions. Connections and fittings shall have a nominal diameter of at least 50 mm. Provisions for in-situ internal cleaning shall be provided.
2. At least two pressure sensors (redundant or diverse) shall be installed and it shall not be possible to isolate more than one pressure sensor at one given time. Isolation of the sensor shall result in a “trip signal”.
3. Voting system shall be fail safe.
4. shut-off valve should be fail close.

7. PIPING

7.1 Sloping Requirements

1. Sloping requirements shall be indicated on P&ID's.
2. Flare header and sub-header
 - Block valves shall be avoided. However, full bore ball valve with line size diameter with position indicator are required for maintenance at each unit battery limit.
 - Flare header shall self drain towards flare drum. PSV shall self drain towards flare header.
 - All connections shall be made with no low point and preferably on the top of the header. Connection to the header should be made with a 45° angle except for smaller diameter up to 4”.
 - Flow orifice or flow meter (except annubar type or equivalent) which can be blocked by foreign matters shall not be installed.
3. Low point at compressor suction is allowed provided that low point shall be equipped with drain. Compressor anti-surge lines should preferably slope to suction and discharge drums with anti-surge valve at high point.

7.2 Utility Connection

Refer to PID typical arrangement. DWG. n° SP12 2Y PR PID 999 005.

7.3 Valve Type

The following guide line will be applied:

- Block Valve

FLUID	150 #	300 #	600 #	900 #
Stabilised liquid	$\phi \leq 8"$ ----> GATE $\phi \geq 10"$ ----> BALL	$\phi \leq 8"$ ----> GATE $\phi \geq 10"$ ----> BALL	BALL	BALL
Sour HC, non stabilised HC LPG	BALL	BALL	BALL	BALL
Lean amine	$\phi \leq 8"$ ----> GATE $\phi \geq 10"$ ----> BALL	$\phi \leq 8"$ ----> GATE $\phi \geq 10"$ ----> BALL	BALL	BALL
Rich amine	BALL	BALL	BALL	BALL
Sour gas or toxic product (mercaptans)	BALL	BALL	BALL	BALL
Sweet gas	$\phi \leq 8"$ ----> GATE $\phi \geq 10"$ ----> BALL	BALL	BALL	BALL
Steam	GATE	GATE	GATE	GATE

Notes:

1. Ball valve to be used for service where design temperature $\leq 200^{\circ}\text{C}$ orbit valve or equivalent shall be used for all relevant valves of dehydration units.
2. Ball valve to be used for isolation purposes:
 - at battery limit
 - at all spared equipment opened during operation (filters, pumps...)
3. Valve to be motorised from $\geq 24"$.
4. Butterfly to be used on cooling water service mainly for pipe diameter $\geq 2"$.
5. For PSVs :
 - gate valve to be provided upstream PSV for rating up to 150 # and for diameter lower than or equal to 8" and for non sour service or non toxic.
 - valve located downstream PSV to be gate valve type for non sour service and ball valve type for sour service or toxic.

7.4 Double Valving and Bleed

- Double valving is required on all fluids meeting one of the following conditions :
 - Operating pressure above or equal to 70 barg
 - H₂S partial pressure > 1 bara
 - very corrosive/abrasive fluid

- Therefore, double valving will be located from slug catcher area down to HP separator inlet, at export gas compressor discharge and at unit 103 inlet.
- Type of valve used: refer to § 7.3. Bleed valve is $\frac{3}{4}$ ".
- Where double valving and bleed is required, solid block assembly replacing piping valves on chemical injection and instrument tappings shall be considered. For detail refer to P&ID symbology.

7.5 Closing / Opening Of Valve

The specification of Car Seal Closed or Car Seal Open shall be preferred to Locked Closed or Locked Open except for valve on flare header.

7.6 Pressurization Valve By Pass

7.6.1 Pressurisation by manual valve by pass

a) Implementation of by-pass

By pass manual valve will be added to pressurise downstream system on the following services:

- steam line or equipment heating
- pressurisation or depressurisation of equipment / section
- balance line

Steam Network:

Bypass valve will be installed on a case by case basis.

Process Gas:

A by pass will be added on block valve isolating a group of equipment, special equipment or part of unit for 600 # and above and diameters greater than or equal to 4". For 300#, pressurisation bypass valve will be added on a case by case basis.

Liquid network:

A by pass will be added on a part of unit when the following conditions are reached:

diameter ≥ 6 " and temperature $\leq -15^{\circ}\text{C}$

diameter ≥ 6 " and pressure ≥ 50 barg

b) Type and size of by pass valve

A globe valve type will be selected.

The by pass size is determined as follows:

Line diameter	By pass diameter
Up to 8 "	1 "

10" up to 14"	1 1/2" (*)
>= 16"	2" (*)

(*) Unless greater size dictated by process constraint such as pressurization time

7.7 Isolation

7.7.1 Isolation philosophy

General basis:

The general rules for the process block isolation are the following ones:

- All equipment will be generally isolated by spacer (depending on nozzle size), installed at minimum distance from equipment and will be easily accessible.
- Double block and bleed is required for parts located from slug catcher area down to HP separator inlet, at export gas compressor discharge and at unit 103 inlet.
- For other services, single block valve with spacer (considered as a positive protection) is provided depending on nozzle diameter.
- Maintenance will be performed per train when there is no common equipment between two trains.
- ESDV's and SDV's can be used for block isolation. In that case, for maintenance purpose, SD3 / ESD2 or ESD1 can be activated provided that main equipment is already shutdown locally by operators or using remote control.
- Isolation of a single equipment does not mean that it is fitted with specific dedicated block valves; block valves of a contiguous equipment can be used. For instance the block valves of each bay of a column air condenser are used as inlet block valve for the reflux drum
- Lines with size smaller or equal to 4" shall have spectacle instead of a spacer or spade (if spacer/spade needed).

7.7.2 Spacers

Spacers to be installed using the following rule:

RATING ANSI	SPACER TO BE INSTALLED FOR
150 #	$\phi \geq 6"$
300 #	$\phi \geq 4"$
600 #	$\phi \geq 2"$
900 #	$\phi \geq 2"$

When spacers are not installed, no alternative to spacers shall be considered as lines are assumed to be flexible enough.

7.8 Sample Connection / Analyser Connection

Cooling to be provided on sample connection when operating temperature exceeds 70 °C, or for process reason. Refer to P&ID with details and types of sample connection P&ID N° SP12 2Y PR PID 999 009.

7.9 Hot and Cold Insulation

Refer to Heat Insulation in Hot & Cold Service, document numbers "SP12 12 2Y MT SP 999 011 & SP12 2Y MT SP 999 012"

7.10 Unit Battery Limit

7.10.1 Location

Battery limit valves will be located at grade only in cases of interconnection with a pipe way. When interconnecting a pipe rack to a pipe rack, battery limit valves are installed on the pipe rack and provided with platform for accessibility. Valve arrangement (horizontal or vertical) depends on site conditions. General arrangement is on a horizontal line; vertical arrangement only if horizontal arrangement is not possible.

7.10.2 Valving arrangement

- a) Drain size
 - for line diameter ≤ 4 " purge diameter (V or P) = $\frac{3}{4}$ "
 - for line diameter > 4 " purge diameter (V or P) = 2"
- b) typical arrangement for process fluid

	Double block valve	Bleed (if required by double valving)	Type of valve (1)	Drain	Valve bypass	Spacer
SOUR GAS	refer to §7.4	Connected to FA	BALL	Yes	refer to §7.6	Yes
SWEET GAS	refer to §7.4	Not connected	BALL	Yes	refer to §7.6	Yes
SOUR LIQUID HC	refer to §7.4	Connected to DR	BALL	Yes	refer to §7.6	Yes

LIGHT HC/LPG	refer to §7.4	Connected to DP	BALL	Yes	refer to §7.6	Yes
SWEET HC	refer to §7.4	Not Connected	BALL	Yes	refer to §7.6	Yes
MEG	refer to §7.4	Connected to MD (MEG)	BALL	Yes	refer to §7.6	Yes
TEG	refer to §7.4	Connected to MD (TEG)	BALL	Yes	refer to §7.6	Yes
AMINE	refer to §7.4	Connected to DA	BALL	Yes	refer to §7.6	Yes

(1) For temperature higher than 200°C, see § 7.3 note 1

c) Typical arrangement for utility fluid

	Double Block Valve + bleed	Type of Valve	Drain or Vent	Valve bypass	Spacer
Steam Condensate	No	GATE	Yes	Refer to § 7.6	Yes
HP Steam	No	GATE	Yes	Refer to § 7.6	Yes
LP Steam	No	GATE	Yes	Refer to § 7.6	Yes
Fuel Gas	No	GATE	Yes	Refer to § 7.6	Yes
Nitrogen	No	GATE	Yes	Refer to § 7.6	Yes
Inst/Utility Air	No	GATE	Yes	Refer to § 7.6	Yes
BFW	No	GATE	Yes	Refer to § 7.6	Yes
Utility Water	No	GATE	Yes	Refer to § 7.6	Yes
Cooling Water	No	BUTTERFLY	Yes	Refer to § 7.6	Yes
Potable Water	No	GATE	Yes	Refer to § 7.6	Yes
Demin. Water	No	GATE	Yes	Refer to § 7.6	Yes

7.11 Steam Trap

Steam traps shall be installed at low point or at natural drainage point. This shall have a bypass arrangement of the system does not tolerate a downtime or repair without causing a process problem.

7.12 Piping Special Items

All items are generally covered in piping classes. However those not included in any piping class would be itemised by a separate data sheet during detailed engineering phase.

8. SAFEGUARDING

Definition: all operating procedures, instruments, devices, monitoring and control systems are dedicated to plant process control and process safety in order to maintain the plant operation at margin risk.

For additional details about safeguarding, refer to Preliminary Process Description for Safety Systems document number "SP12 2Y PR DB 999 004".

9. REFERENCE

WorleyParsons Process Design Manual & Approved Standards.