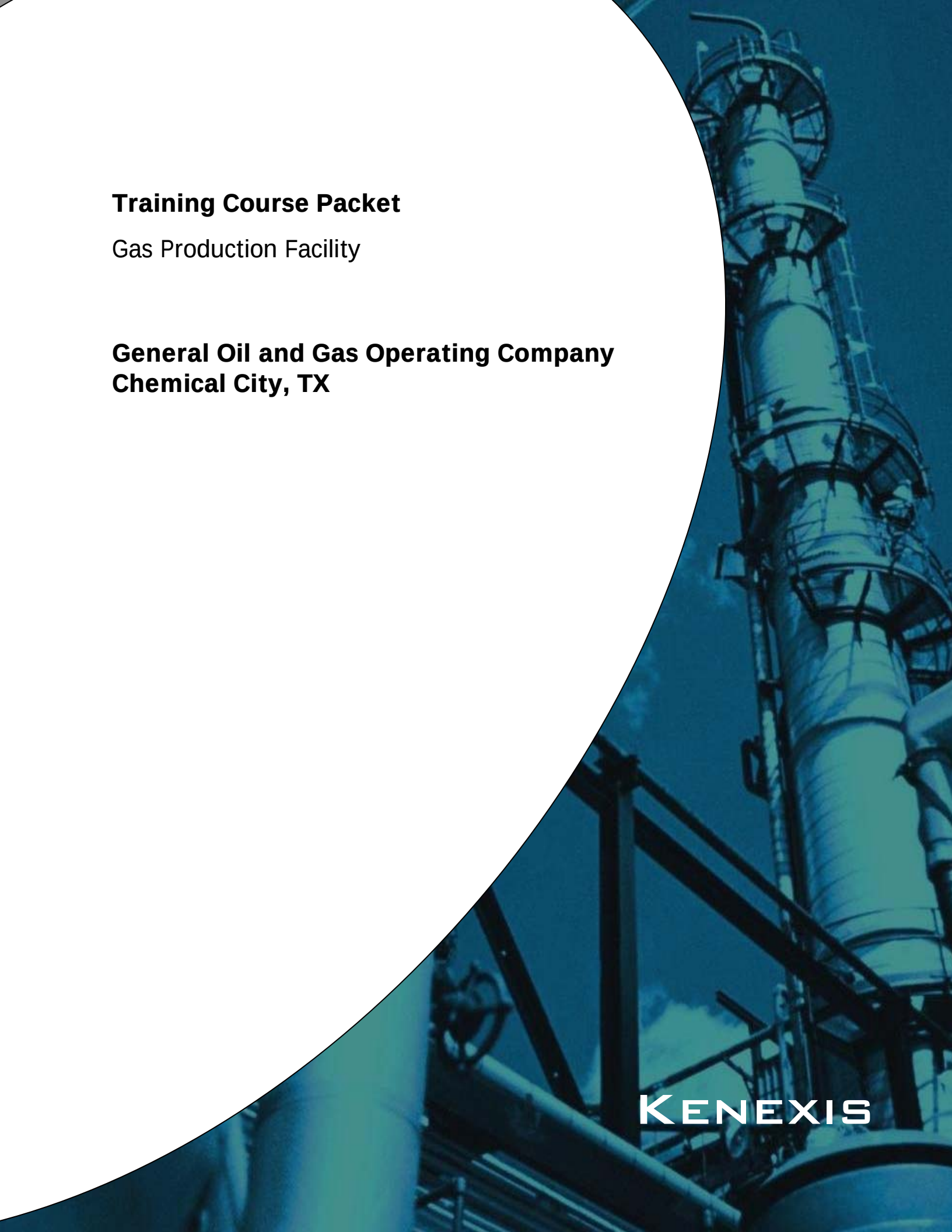


Training Course Packet

Gas Production Facility

General Oil and Gas Operating Company
Chemical City, TX

KENEXIS

KENEXIS

Client:	Consultant:
	Kenexis Consulting Corporation 3366 Riverside Drive Suite 200 Columbus, OH 43221 Ph: (614) 451-7031 Fax: (614) 451-2643 E-Mail: info@kenexis.com http://www.kenexis.com

Project Number:	Internal	Report Number:	XXX.XXX-01:0
Release Date:	June 2011		
Report Type:	Training Course Packet		
Process Area:	Gas Production Facility		

Revision History:

Revision	Release Date	Primary Author	Review	Approval
0	1 Jun 2011	SA Gray	B Buckeye	B Buckeye

Responsible Staff:	Signature	Date
Project Manager:		
B Buckeye		1 Jun 2011
Authors:		
SA Gray		1 Jun 2011

Disclaimer:

Background Information

This booklet contains background information on a sample facility that is used as a basis for discussion for seminars and training classes. The sample facility is intended to present typical equipment utilized in the process industries in order to provide a realistic training environment, while keeping the process very small in order for an entire facility to be analyzed during a single seminar or class.

The sample facility contains equipment similar to that which would be used for a natural gas production process and also a high-head pumping system that would be similar to charge systems in some high pressure refining units such as hydrotreaters and hydrocrackers.

It is important to note that this type of facility would not serve a real process purpose in isolation, and is thus not entirely genuine. It is important for attendees at the training classes and seminars that use this sample plant to focus on the principles and techniques that are being discussed, and not to dwell on perceived inconsistencies or process engineering related issues related to the sample plant. This will ensure a beneficial training experience.

Contents

1 Process Description

1.1 Overview

The General Oil & Gas Operating Company's production facility located in Chemical City, TX processes hydrocarbon fluids coming out of natural gas wells located in production platforms. The wells discharge the production fluids into a main production header, which in turn supplies the facility with feedstock. In the first stage of the separation process (high pressure stage), the production fluids enter a high pressure separator where the liquid and gas components are separated at a specific temperature and pressure. The gas leaving the high pressure separator is predominantly composed of lighter hydrocarbons and does not need any additional treatment. The gas leaves the facility via the export gas pipeline to neighboring gas processing companies. In the second stage of the separation process (low pressure stage), the liquid from the first stage enters the low pressure separator and flashes at a specific temperature and pressure. The gas stream from the low pressure separator is compressed and the compressed gas combines with the gas leaving the high pressure separator. The liquid from the low pressure separator is considered to be stabilized for processing purposes and it is pumped into the high pressure export liquid pipeline. The major equipment used in this process, includes a High Pressure Separator, Low Pressure Separator, Export Pump and Gas Compressor are described in the following sections.

1.2 High Pressure Separator (V-101)

Hydrocarbon fluids enter the high pressure separator (V-101) through a pressure reducing valve (PRV-101A) which reduces the pressure from approx.700 psig (production header pressure) to 350 psig (first stage operating pressure). The pressure in the separator is maintained by the pressure control valve PV-101B. Flashing occurs in the vessel causing separation of gas and liquid components. Reduction in flow velocity causes the liquid droplets to drop out of the gas stream. The separator vessel provides the retention time needed for effective gas-liquid separation and also provides a surge volume necessary to handle intermittent surges of liquid. The liquid level in the vessel is maintained by the level control valve LV-101A.

As the hydrocarbon fluids come into contact with the inlet diverter, most of the liquid falls into the liquid section and the gas flows over the inlet diverter. The gas stream continues to flow horizontally above the liquid section and small drops of liquid not separated by the inlet diverter are separated out by gravity. Drops of liquid that are too small to be separated by gravitational force are removed from the gas stream by a de-mister pad.

The gas leaves the high pressure separator and enters the export gas pipeline to neighboring gas processing facilities. Over pressure protection of the high pressure separator is provided by relief valve PSV-101.

1.3 Low Pressure Separator (V-102)

The liquid from the high pressure separator enters the low pressure separator through the level control valve LV-101A. The operating pressure in the low pressure separator is maintained at 50 psig to flash off the lighter hydrocarbons into the gas phase and partially stabilize the liquid phase. The vapor and liquid disengage similar to V-101. The gas is sent to compressor C-104

and the partially stabilized liquid is pumped out using pump P-103. Over pressure protection of the low pressure separator is provided by relief valve PSV-102.

1.4 Export Pump (P-103)

The partially stabilized hydrocarbon liquid from V-102 is pumped using high pressure pump P-103 to the export liquid pipeline. P-103 is a multistage pump that discharges the liquid at a pressure of 2200 psig needed to transport the hydrocarbon liquid several miles before it can be further processed. A pressure relief valve PSV-103 protects the pump from damage in case of a blocked flow in the export liquid pipeline.

1.5 Gas Compressor (C-104)

The gas stream leaving the low pressure separator V-102 at a pressure of 50 psig enters compressor C-104 where its pressure is increased to 350 psig to match the gas pressure leaving the high pressure separator. The pressure controller PIC-104A controls pressure from the compressor to the export gas pipeline. The pressure controller senses changes in separator pressure and sends a signal to either open or close the control valve PV-104A accordingly. Controller FIC-104 provides anti-surge control by "spilling back" sufficient material through FV-104 to the low pressure separator and prevents surging. Over pressure protection of the suction and discharge sides of the compressor are provided by pressure relief valves PSV-104A and PSV-104B respectively.

1.6 Support Facilities

The support efforts include:

1. A site with roads
2. Security with perimeter chain link fencing a guard house and an entry gate
3. Utilities to enable the process to work: electricity; fuel oil or diesel; instrument air and water
4. Safety systems include fire water deluge, personnel protection, and escape
5. Vent systems which discharge to a flare header and flare

2 Process Flow Diagram (PFD)

The process flow diagrams begin on the following page.

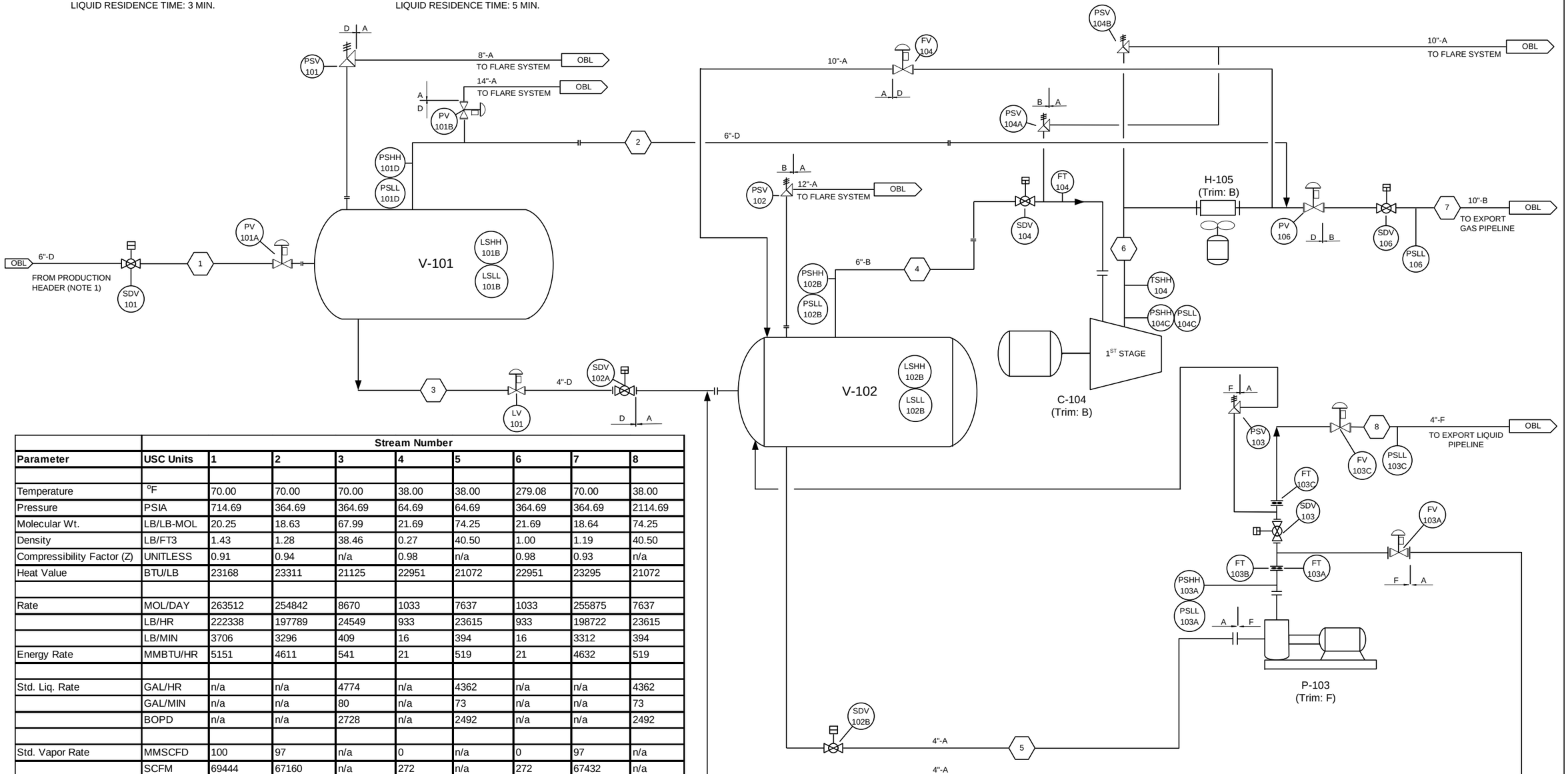
V-101
HIGH PRESSURE SEPARATOR
SIZE: 60" I.D. (1.52 M) X 18'-6" S/S (5.64 M)
DESIGN: 1200 PSIG (82.7 BAR)/FV AT 300°F (149°C)
OPERATING: 350 PSIG (24.2 BAR) AT 70°F (21°C)
LIQUID RESIDENCE TIME: 3 MIN.

V-102
LOW PRESSURE SEPARATOR
SIZE: 42" I.D. (1.07 M) X 13'-6" S/S (4.11 M)
DESIGN: 75 PSIG (5.2 BAR)/FV AT 300°F (149°C)
OPERATING: 50 PSIG (3.5 BAR) AT 38°F (3°C)
LIQUID RESIDENCE TIME: 5 MIN.

P-103
EXPORT PUMP
CAPACITY: 100 GPM (0.38 SCM) @ 2200 PSIG (151.7 BAR)
DIFFERENTIAL PRESSURE: 2100 PSIG (144.8 BAR)
MOTOR: 200 HP

C-104
GAS COMPRESSOR
CAPACITY: 0.50 MMSCFD (14160 SCMD)
SUCTION: 50 PSIG (3.4 BAR) AT 70°F (21°C)
DISCHARGE: 350 PSIG (24.1 BAR) AT 279.1°F (137.3°C)
MOTOR: 73 HP

H-105
COMPRESSOR DISCHARGE COOLER
DUTY: 0.12 MMBTU/HR (35.2 KW)
DESIGN: 500 PSIG (34.4 BAR) AT 350°F (177°C)
OPERATING: 350 PSIG (24.1 BAR) AT 279.1°F (137.3°C)



	Stream Number								
Parameter	**USC Units**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Temperature	°F	70.00	70.00	70.00	38.00	38.00	279.08	70.00	38.00
Pressure	PSIA	714.69	364.69	364.69	64.69	64.69	364.69	364.69	2114.69
Molecular Wt.	LB/LB-MOL	20.25	18.63	67.99	21.69	74.25	21.69	18.64	74.25
Density	LB/FT3	1.43	1.28	38.46	0.27	40.50	1.00	1.19	40.50
Compressibility Factor (Z)	UNITLESS	0.91	0.94	n/a	0.98	n/a	0.98	0.93	n/a
Heat Value	BTU/LB	23168	23311	21125	22951	21072	22951	23295	21072
Rate	MOL/DAY	263512	254842	8670	1033	7637	1033	255875	7637
	LB/HR	222338	197789	24549	933	23615	933	198722	23615
	LB/MIN	3706	3296	409	16	394	16	3312	394
Energy Rate	MMBTU/HR	5151	4611	541	21	519	21	4632	519
Std. Liq. Rate	GAL/HR	n/a	n/a	4774	n/a	4362	n/a	n/a	4362
	GAL/MIN	n/a	n/a	80	n/a	73	n/a	n/a	73
	BOPD	n/a	n/a	2728	n/a	2492	n/a	n/a	2492
Std. Vapor Rate	MMSCFD	100	97	n/a	0	n/a	0	97	n/a
	SCFM	69444	67160	n/a	272	n/a	272	67432	n/a

NOTES

The Design Basis for this facility is 100 MMSCFD of natural gas at a pressure of 700 psig and a temperature of 70oF. The incoming production header pressure is assumed to be 700 psig in normal operation. The molar composition of the natural gas stream is: Methane – 90%, Ethane – 2%, Propane – 2%, N-Butane – 2%, N-Pentane – 2%, and N-Hexane – 2%.

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General Oil and Gas Operating CO.

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DRAWING TITLE
Process Flow Diagram
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-01	1 OF 1	1

3 Piping & Instrumentation Diagram (P&ID)

The Piping and Instrumentation Diagrams begin on the following page.

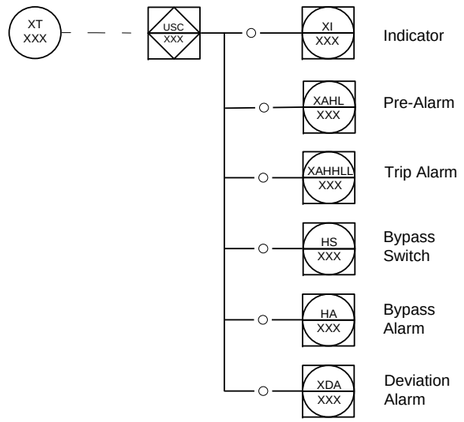
Process Legend Sheet	Instrument Function	Alarm Low, Low-Low	Alarm High, High-High	Alarm High/ Low	Element	Gauge/Glass (Direct)	Indicate	Light (Status Indication)	Transmitter (Note 1)	Controller (Note 2)	Valve, Damper, Louver	Valve, Self-Restraining	Switch Low	Switch High	Switch High/Low	Compute, Convert, Relay
Process Variable		AL(L)	AH(H)		E	G	I	L	T	CI	V	CV	SL(L)	SH(H)		Y
A	Analysis	AAL	AAH		AE		AI		AT	AIC	AV		ASL	ASH		AY
B	Burner, Combustion	BAL	BAH		BE		BI		BT	BIC	BV		BSL	BSH		BY
BD	Blowdown	BDAHH									BDV					BDY
C	Choice (Conductivity)	CAL	CAH				CI		CT	CIC			CSL	CSH		CY
D	Choice (Density)	DAL	DAH				DI		DT	DIC			DSL	DSH		DY
E	Voltage	EAL	EAH				EI		ET				ESL	ESH		EY
F	Flow/Flowrate	FAL	FAH		FE	FG	FI		FT	FIC	FV	FCV	FSL	FSH		FY
FF	Flow Ratio	FFAL	FFAH				FFI		FFT	FFIC	FFV		FFSL	FFSH		FFY
G	User's Choice															
H	Hand									HIC	HV					HY
I	Current (Electric)	IAL	IAH				II		IT	IIC			ISL	ISH		IY
J	Power	JAL	JAH				JI		JT	JIC			JSL	JSH		JY
K	Time															
L	Level	LAL	LAH	LALH		LG	LI		LT	LIC	LV	LCV	LSL	LSH	LSLH	LY
LX	Level, Safety	LXALL	LXAHH						LXT							
M	User's Choice (Moisture)															
N	User's Choice															
O	User's Choice															
P	Pressure	PAL	PAH				PI		PT	PIC	PV	PCV	PSL	PSH		PY
PD	Pressure Differential	PDAL	PDAH				PDI		PDT	PDIC	PDV	PDCV	PDSL	PDSH		PDY
PF	Pressure Ratio	PFAL	PFAH				PFI			PFIC	PFV		PFSL	PFSH		PFY
PX	Pressure, Safety	PXALL	PXAHH		PSE				PXT		PSV					
Q	Quantity															
R	Radiation															
S	Speed	SAL	SAH				SI		ST	SIC	SV		SSL	SSH		SY
SD	Shutdown										SDV					SDY
T	Temperature	TAL	TAH		TE	TG	TI		TT	TIC	TV	TCV	TSL	TSH		TY
TD	Temperature Differential	TDAL	TDAH				TDI			TDIC	TDV		TDSL	TDSH		TDY
TX	Temperature, Safety	TXALL	TXAHH						TXT							
U	Multi-Variable	UAL	UAH						UT	UIC	UV		USL	USH		UY
V	Vibration	VAL	VAH		VE		VI		VT				VSL	VSH		VY
W	Weight	WAL	WAH		WE		WI		WT	WIC			WSL	WSH		WY
X	Unclassified						XI		XT	XIC	XV	XCV	XSL	XSH		
Y	Event, State, Presence						YI	YL								YY
Z	Position	ZAL	ZAH				ZI	ZL	ZT	ZIC			ZSL	ZSH		ZY

ANSI Piping Pressure Specifications at 300°F (149°C)

Piping Class	ANSI Class Rating	Maximum Design Pressure	Material of Construction
A	150#	230 psi (15.9 bar)	Carbon Steel
B	300#	655 psi (45.2 bar)	Carbon Steel
D	600#	1315 psi (90.7 bar)	Carbon Steel
E	900#	1970 psi (135.8 bar)	Carbon Steel
F	1500#	3280 psi (226.2 bar)	Carbon Steel

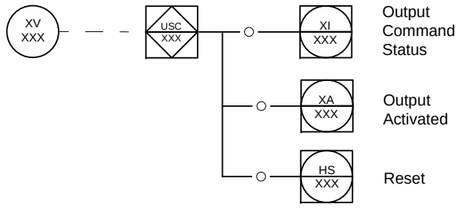
Instrument Symbols

Detail "A" - SIS Inputs



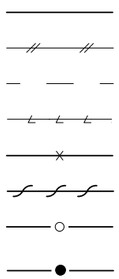
Indicator
Pre-Alarm
Trip Alarm
Bypass Switch
Bypass Alarm
Deviation Alarm

Detail "B" - SIS Outputs



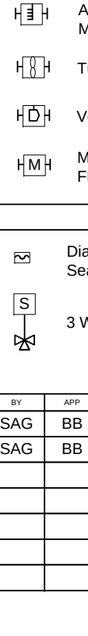
Output Command Status
Output Activated
Reset

Lines

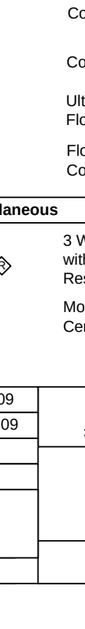


Instrument Impulse Lines from Process
Pneumatic Signal
Electrical Signal
Hydraulic Signal
Capillary Tube
Fiber Optic
"Soft Link" Communication
"Serial Link" Communication

Control Valve/Relief Device



Diaphragm Spring Return
Piston Spring Return
Self-Actuated
Motor Operated
Solenoid Operated
Buckling Pin
Relief Valve (Spring)
Pressure/Vacuum Safety Valve
Pilot Operated



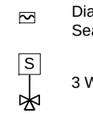
Fixed Choke
Adjustable Choke
Actuated Choke
Rupture Disk
Deluge
Diaphragm with Positioner
Piston with Positioner
Double Acting Piston with Positioner

Flow Symbols

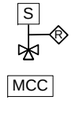
Orifice
Quick Change Orifice Meter (SR/JR Optional)
Venturi Meter
Averaging Pilot Meter
Turbine Meter
Vortex Meter
Magnetic Flowmeter

Positive Displacement Flow Meter
In-Line Flow Glass
Rotameter
Cone Meter
Coriolis Meter
Ultrasonic Flowmeter
Flow Conditioner

Miscellaneous



Diaphragm Seal
3 Way Solenoid



3 Way Solenoid with Manual Reset
Motor Control Center

NOTES:
1. All electronic transmitters are indicating transmitters.
2. If an "I" is omitted, the device is a non-indication controller.

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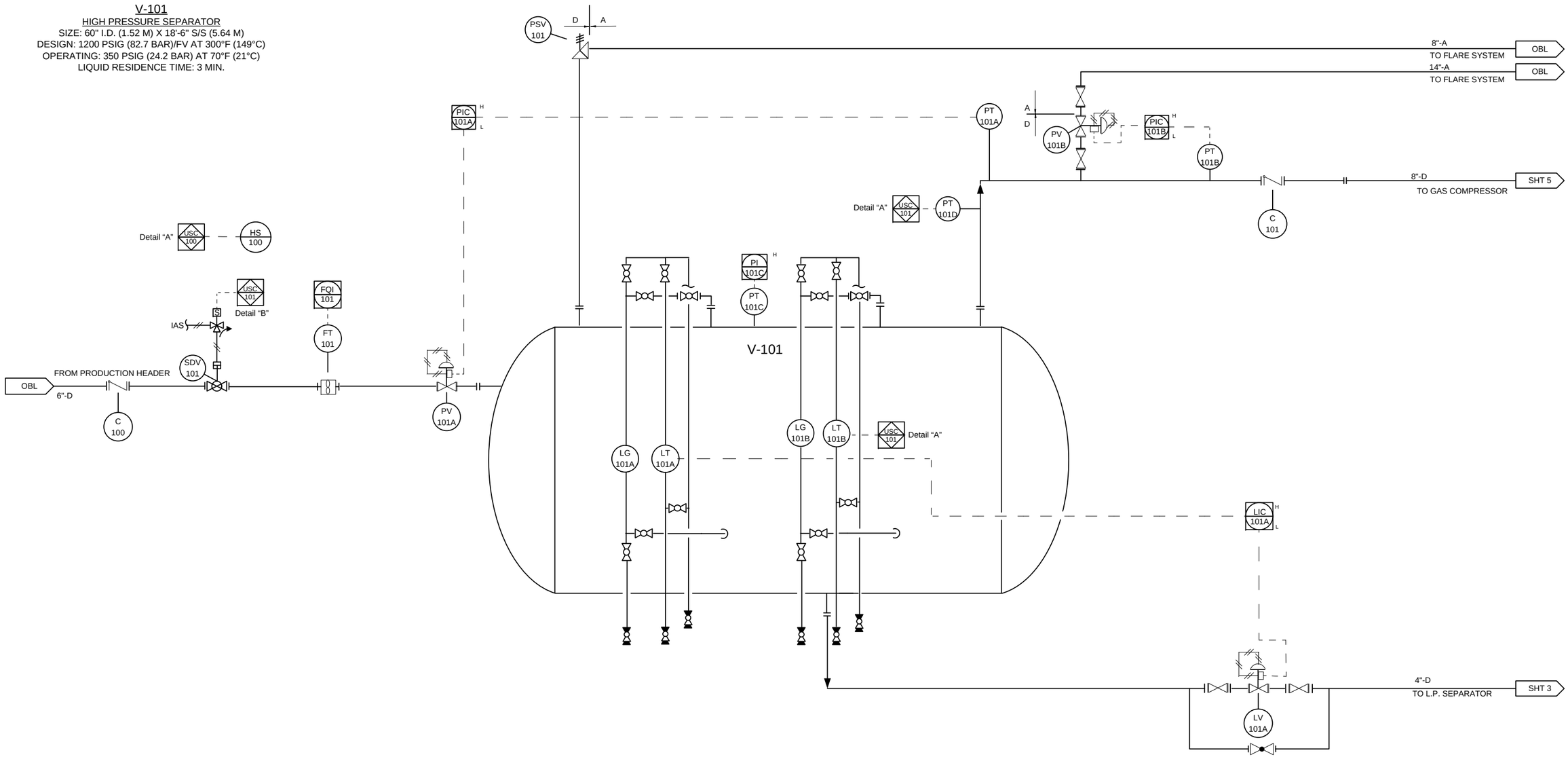
DRAWING TITLE
Legend Sheet
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-02	1 OF 6	1

V-101

HIGH PRESSURE SEPARATOR
SIZE: 60" I.D. (1.52 M) X 18'-6" S/S (5.64 M)
DESIGN: 1200 PSIG (82.7 BAR)/FV AT 300°F (149°C)
OPERATING: 350 PSIG (24.2 BAR) AT 70°F (21°C)
LIQUID RESIDENCE TIME: 3 MIN.



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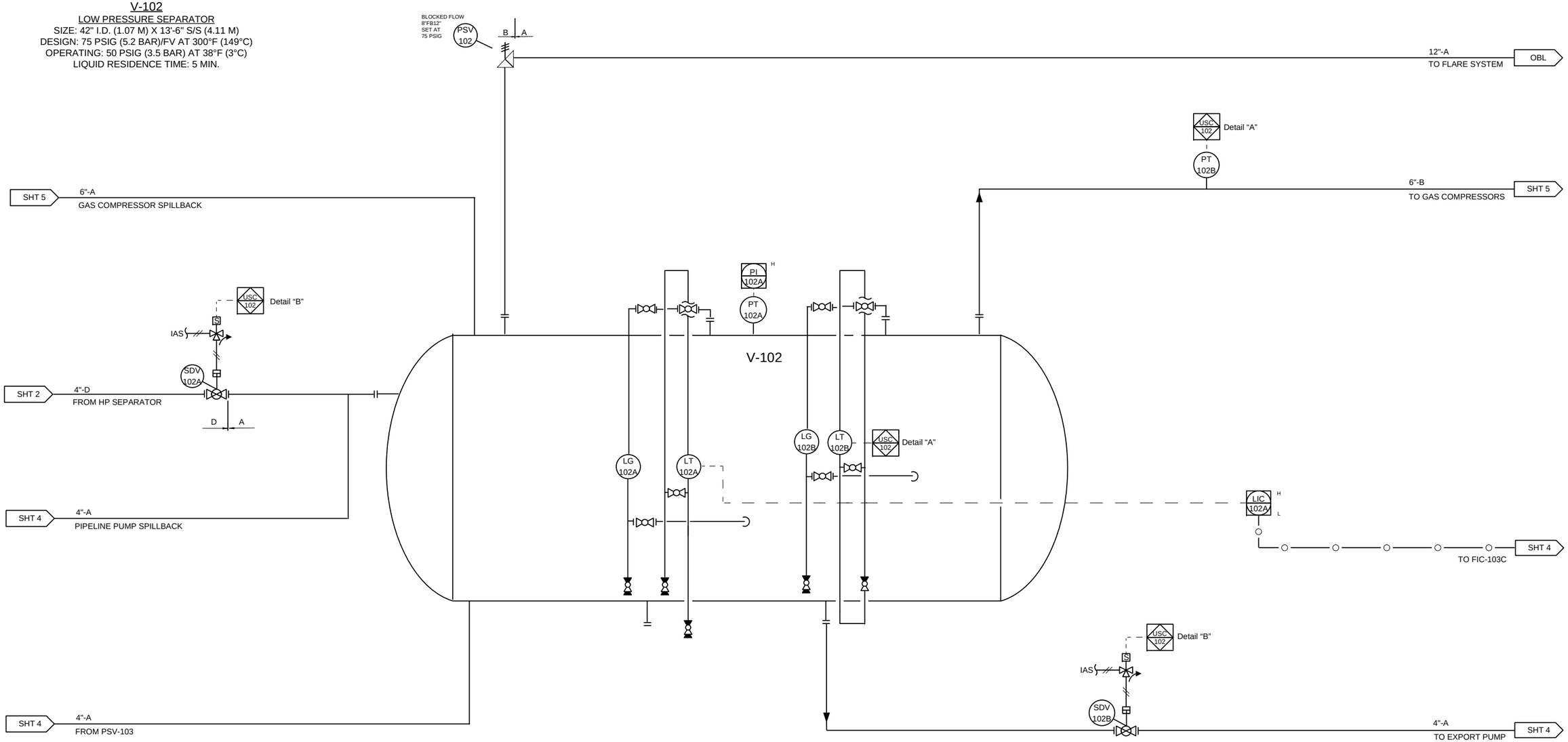
DRAWING TITLE
High Pressure Separator
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-02	2 OF 6	1

V-102
LOW PRESSURE SEPARATOR
SIZE: 42" I.D. (1.07 M) X 13'-6" S/S (4.11 M)
DESIGN: 75 PSIG (5.2 BAR)/FV AT 300°F (149°C)
OPERATING: 50 PSIG (3.5 BAR) AT 38°F (3°C)
LIQUID RESIDENCE TIME: 5 MIN.



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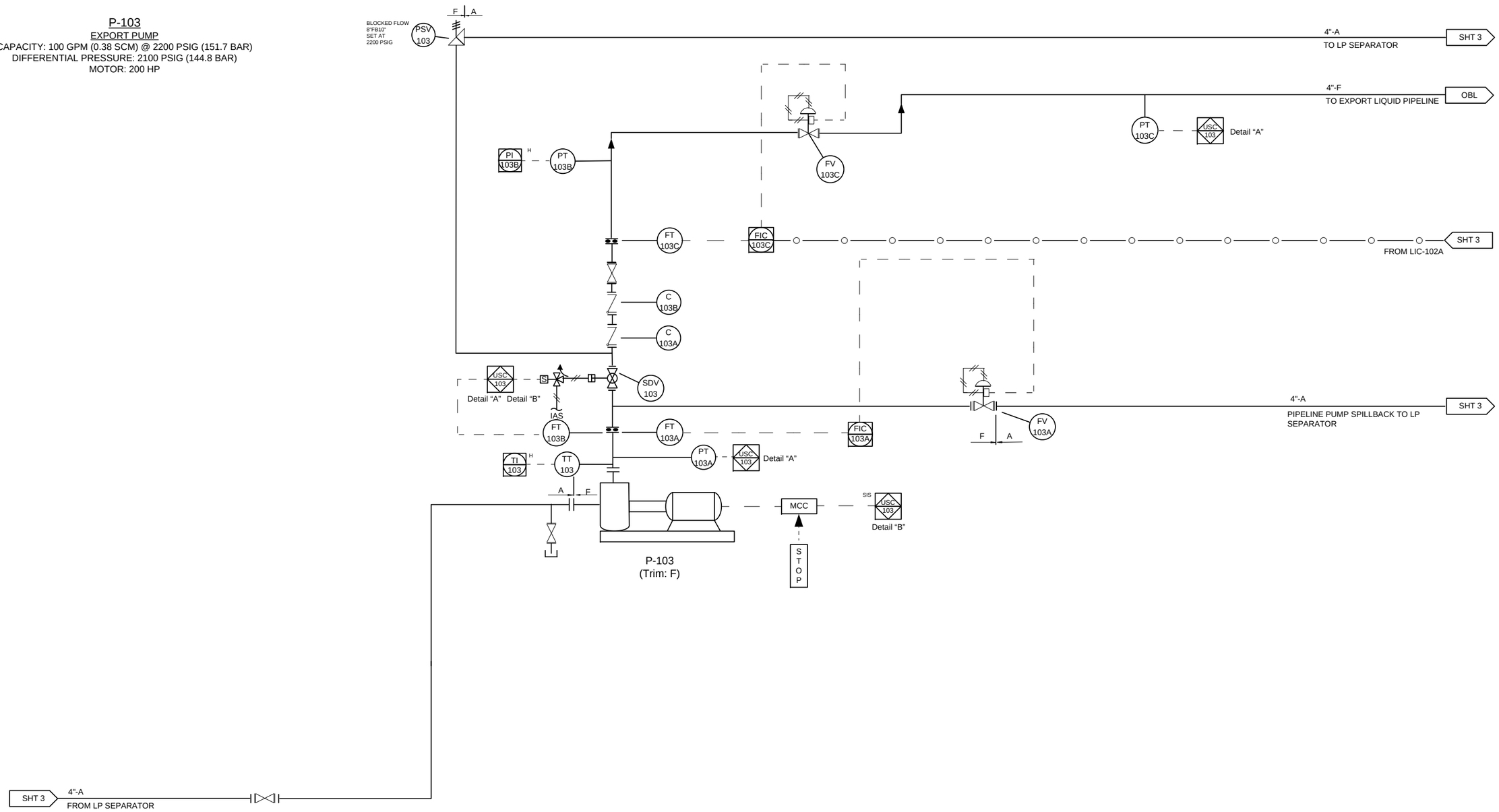
DRAWING TITLE
Low Pressure Separator
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-02	3 OF 6	1

P-103
EXPORT PUMP
CAPACITY: 100 GPM (0.38 SCM) @ 2200 PSIG (151.7 BAR)
DIFFERENTIAL PRESSURE: 2100 PSIG (144.8 BAR)
MOTOR: 200 HP



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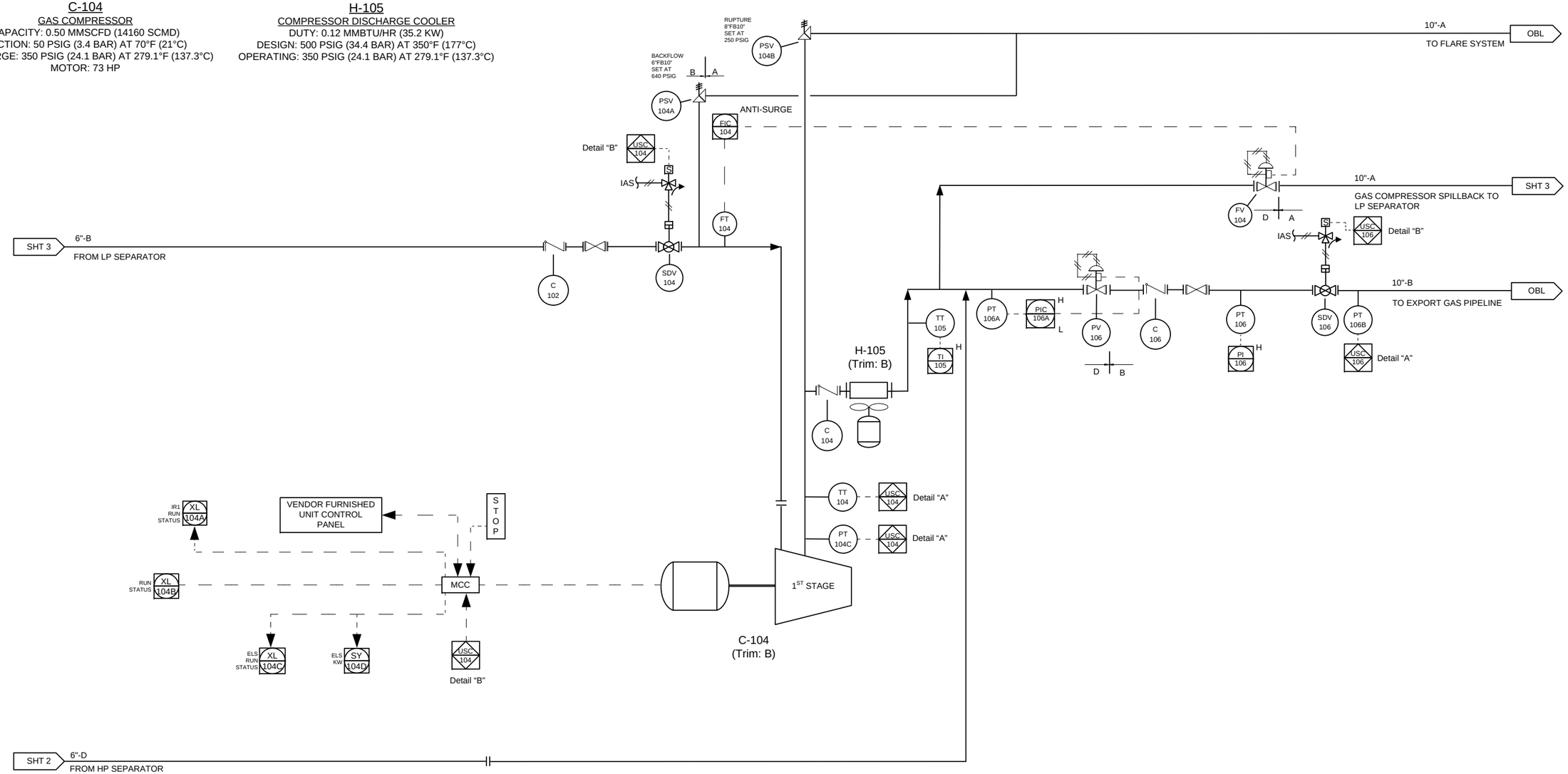
DRAWING TITLE
Pipeline Pump
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-02	4 OF 6	1

C-104
GAS COMPRESSOR
CAPACITY: 0.50 MMSCFD (14160 SCMD)
SUCTION: 50 PSIG (3.4 BAR) AT 70°F (21°C)
DISCHARGE: 350 PSIG (24.1 BAR) AT 279.1°F (137.3°C)
MOTOR: 73 HP

H-105
COMPRESSOR DISCHARGE COOLER
DUTY: 0.12 MMBTU/HR (35.2 KW)
DESIGN: 500 PSIG (34.4 BAR) AT 350°F (177°C)
OPERATING: 350 PSIG (24.1 BAR) AT 279.1°F (137.3°C)



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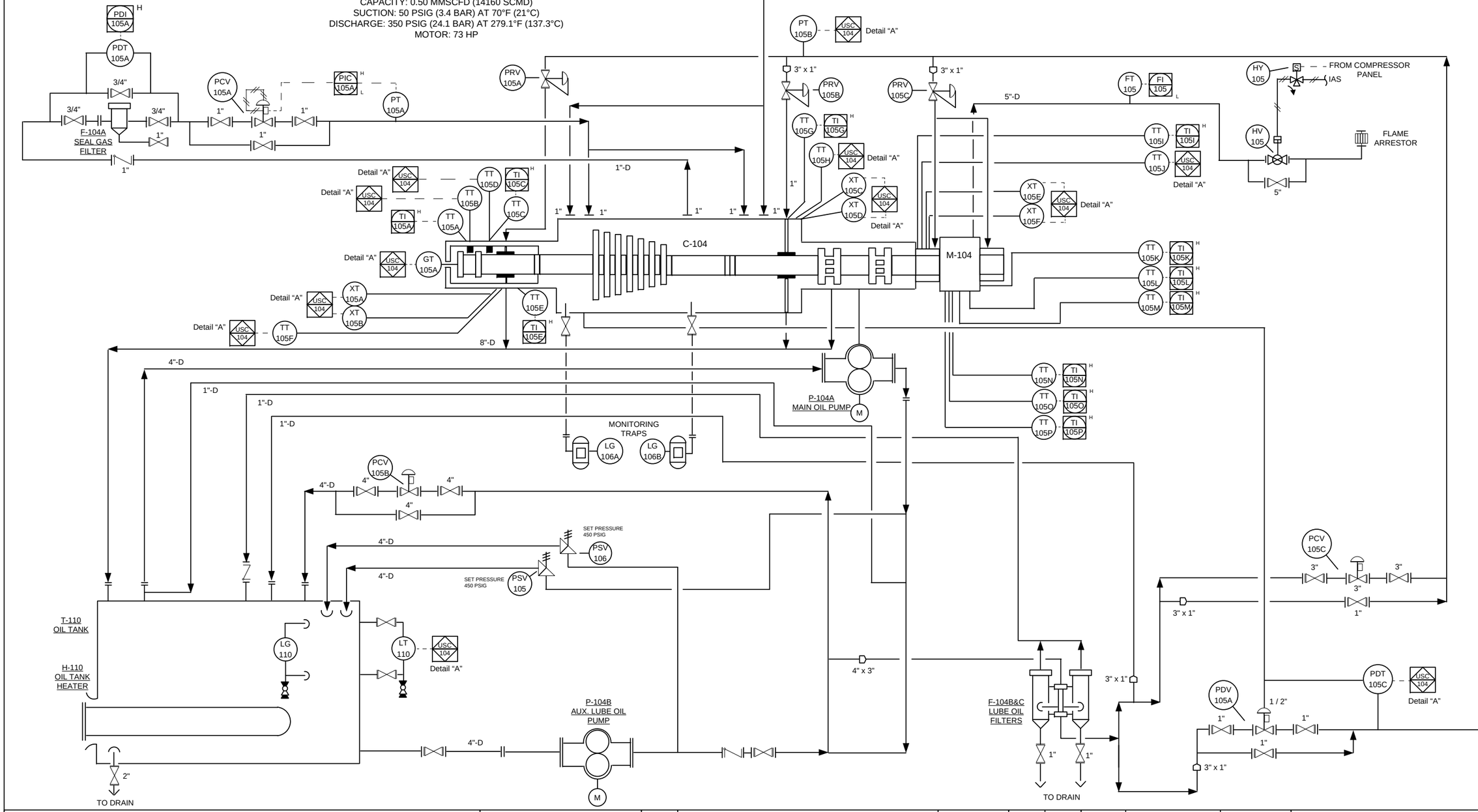
DRAWING TITLE
Gas Compressor
Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-02	5 OF 6	1

C-104

GAS COMPRESSOR

CAPACITY: 0.50 MMSCFD (14160 SCMD)
SUCTION: 50 PSIG (3.4 BAR) AT 70°F (21°C)
DISCHARGE: 350 PSIG (24.1 BAR) AT 279.1°F (137.3°C)
MOTOR: 73 HP



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DRAWING TITLE
Gas Compressor Utility Details
Gas Production Facility

DRAWING NUMBER	SHEET	REV
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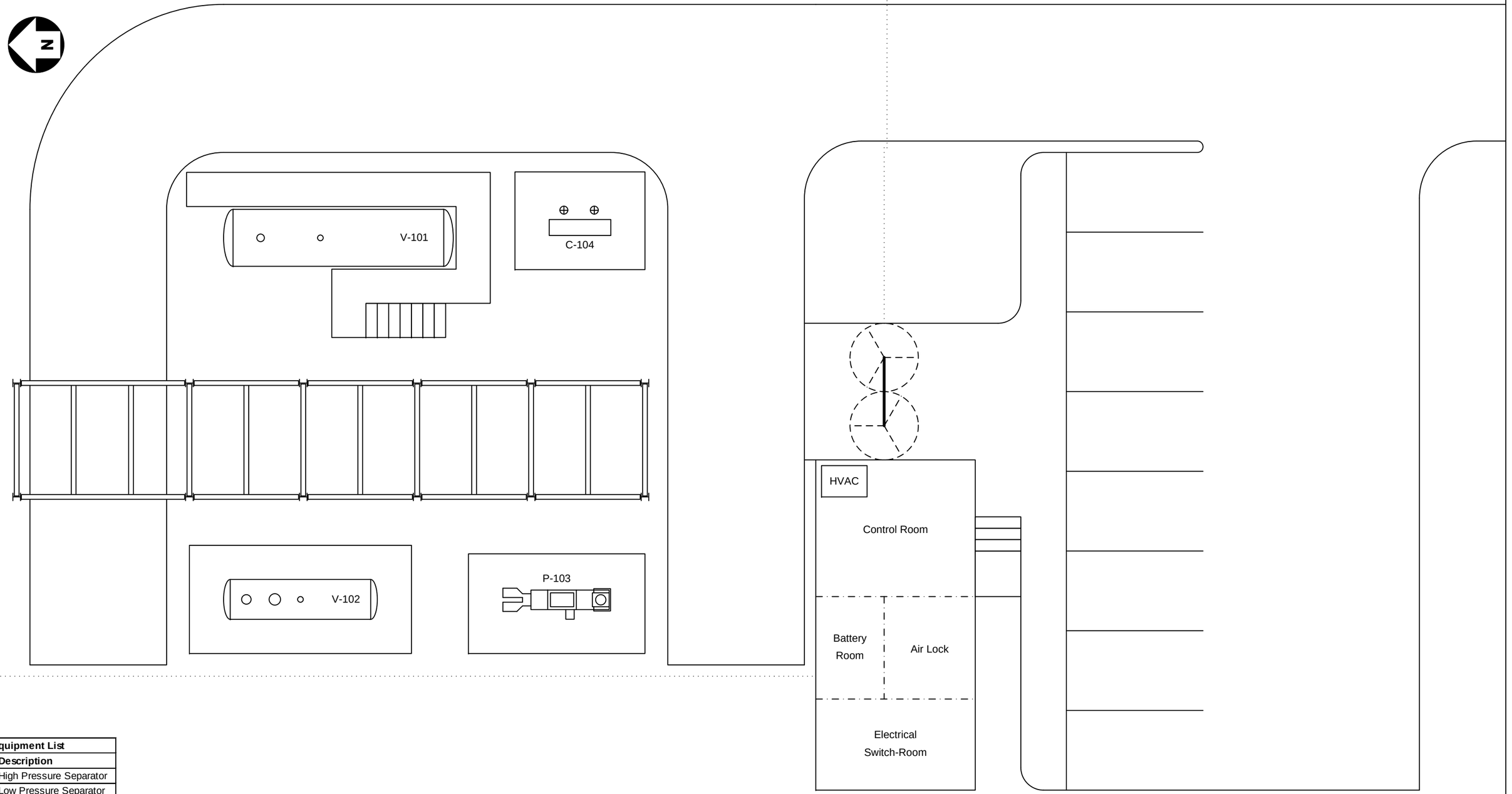
4 Plot Plan - Equipment Layout

The equipment layout plot plans begin on the following page.



Equipment List	
Tag No.	**Description**
V-101	High Pressure Separator
V-102	Low Pressure Separator
P-103	Export Pump
C-104	Gas Compressor

NOTES

1. All dimensions are in inches.

CLIENT

General Oil and Gas Operating CO.

REV	DESCRIPTION	DATE	BY	APP
0	As Built	9 Jun 09	SAG	BB
1	Revision	23 Jun 09	SAG	BB
2	Revision	7 Jan 11	SAG	BB
3	Revision	1 Jun 11	SAG	BB

DRAWN	S. A. Gray	09 Jun 09
CHECKED	B. Buck	1 Jun 11
APPROVED		
APPROVED		
FILE PATH	K:\Training Courses\Sample Process for Training\DWG-Plot Plan.vsd	
SCALE	1 in : 100 in	

KENEXIS
3366 Riverside Drive, Suite 200, Columbus OH 43221

DRAWING TITLE

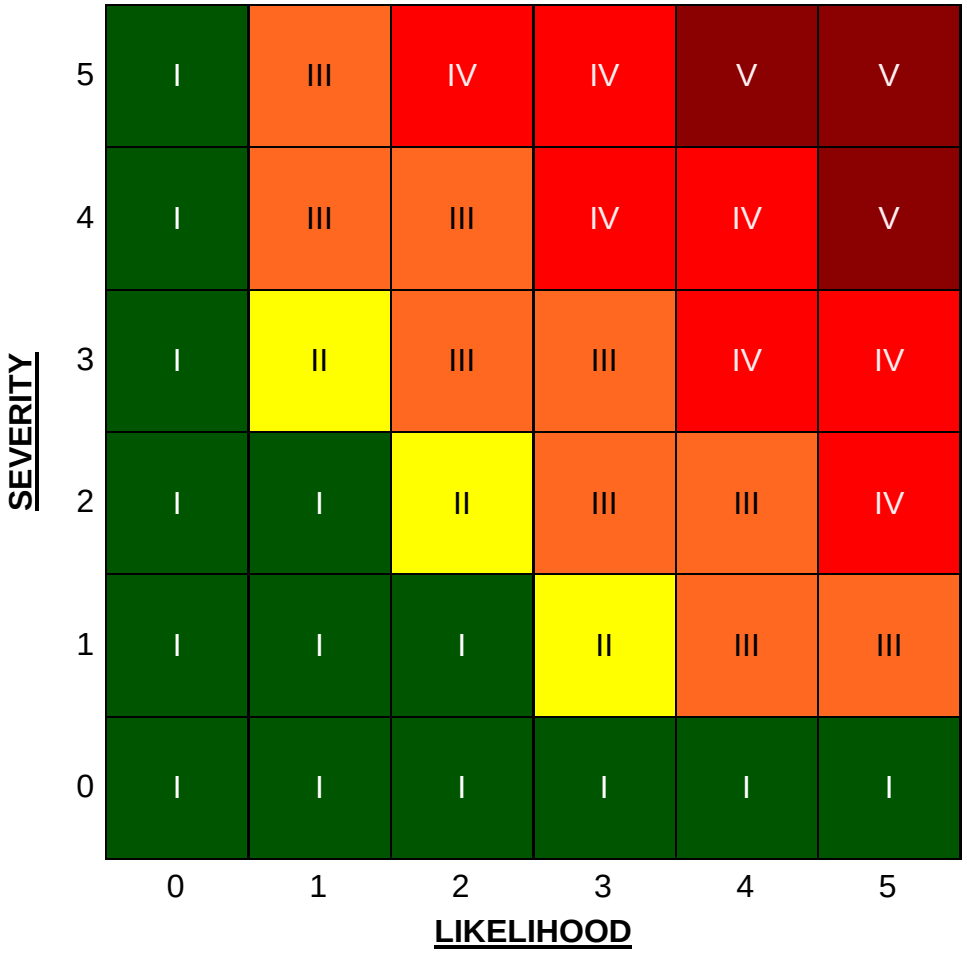
Plot Plan

Gas Production Facility

DRAWING NUMBER	SHEET	REV
DXXX.XXX-03	1 OF 1	3

5 PHA Risk Ranking Matrix and Tables

5.1 Risk Matrix



5.2 Severity

S	Category	Safety Description	Environmental Description	Commercial Description
0	None	No significant safety consequence	None	None
1	Very Low	Minor injury - first aid	Small release with minimal clean up requirements	Less than $50,000
2	Low	Lost time injury not requiring extended hospitalization	Moderate release limited to onsite damage with moedrate clean up effort	$50,000 to $500,000
3	Moderate	Severe injury (extended hospitalization, dismemberment)	Large release with limited offsite impact, requires significant onsite clean up	$500,000 to $5,000,000
4	High	Single fatality	Large release offsite with extensive clean up and damage to sensitive areas	$5,000,000 to $50,000,000
5	Very High	Multiple fatalities	Very large release offsite with extensive clean up and permanent damage to several sensitive areas	Greater than $50,000,000

5.3 Likelihood

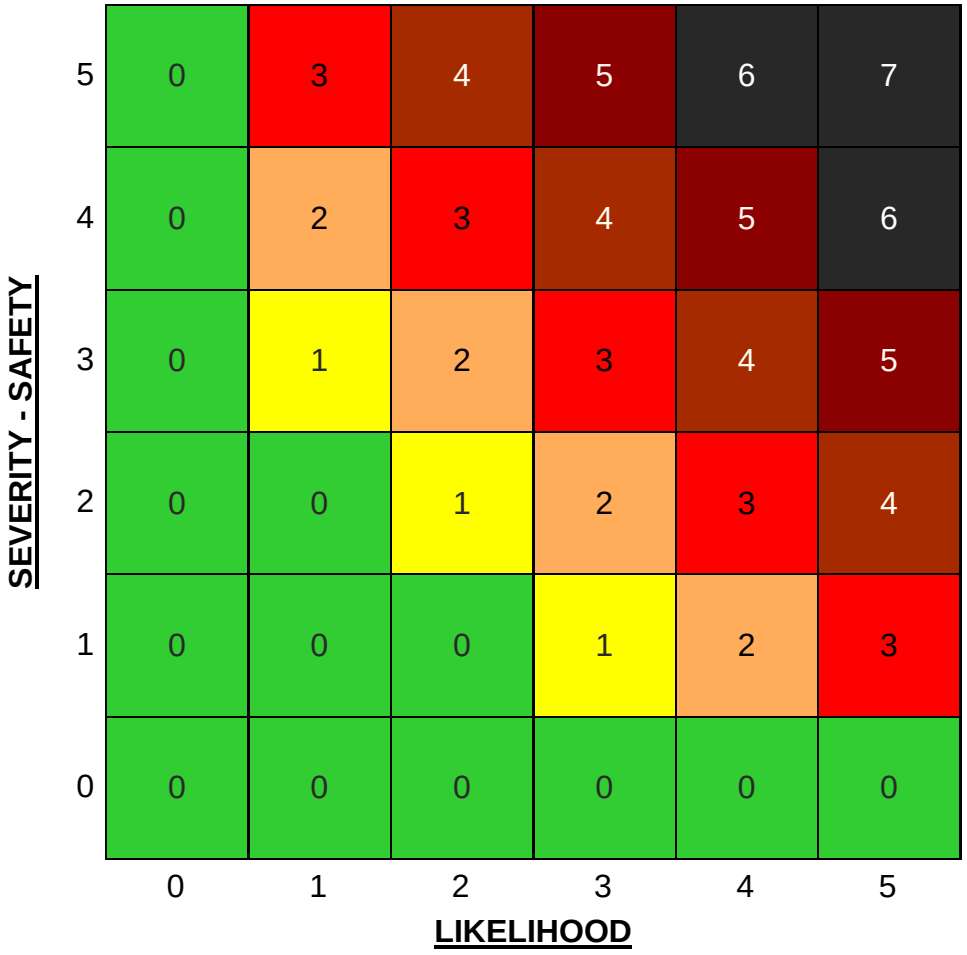
L	Category	Description	Recurrence
0	None	Not expected to occur	N/A
1	Very Low	Possible to occur, but not expected to occur in the lifetime of the plant, either at the plant or at a similar facility in industry	1,000 years
2	Low	Not expected to occur in the lifetime of the plant, but expected to occur within the lifetime of the plant at a similar facility in industry	100 years
3	Moderate	Expected to occur within the lifetime of the plant	10 years
4	High	Expected to occur about once per year	1 year
5	Very High	Expected to occur mant times per year	0.1 years

5.4 Risk Ranking

Risk Ranking	Category	Description
I	Low	Risk is low and/or sufficiently controlled - no additional risk reduction measures are required
II	Moderate	Risk is moderate - additional controls could be considered, but are not required
III	High	Risk is high and may not be sufficiently controlled - additional risk reduction measures should be considered
IV	Very High	Risk is high and is not be sufficiently controlled - additional risk reduction measures are requried and additional operations vigilance measures are required in order to operate the plant in the interim prior to implementing risk reduction measures
V	Intolerable	Risk is intolerably high - the facility cannot operate in this state. Additional risk reduction measures or process redesign to reduce risk shall be performed prior to allowing the plant to operate

6 SIL Selection Risk Ranking Matrix and Tables

6.1 Risk Matrix - Safety



6.2 Severity - Safety

Severity - S	Category	Description	TMEL-S
0	None	No significant safety consequence	
1	Very Low	Minor injury - First Aid	1E-02
2	Low	Lost time injury not requiring extended hospitalization	1E-03
3	Moderate	Severe injury (extended hospitalization, dismemberment)	1E-04
4	High	Single fatality	1E-05
5	Very High	Multiple fatalities	1E-06

6.3 Likelihood

Likelihood	Category	Description	Recurrence
0	None	Not expected to occur	N/A
1	Very Unlikely	Possible to occur, but not expected to occur in the lifetime of the plant, either at the plant or at a similar facility in industry	1,000 years
2	Unlikely	Not expected to occur in the lifetime of the plant, but expected to occur within the lifetime of the plant at a similar facility in industry	100 years
3	Occasional	Expected to occur within the lifetime of the plant	10 years
4	Frequent	Expected to occur about once per year	1 year
5	Very Frequent	Expected to occur many times per year	0.1 year

6.4 Risk Matrix - Environment

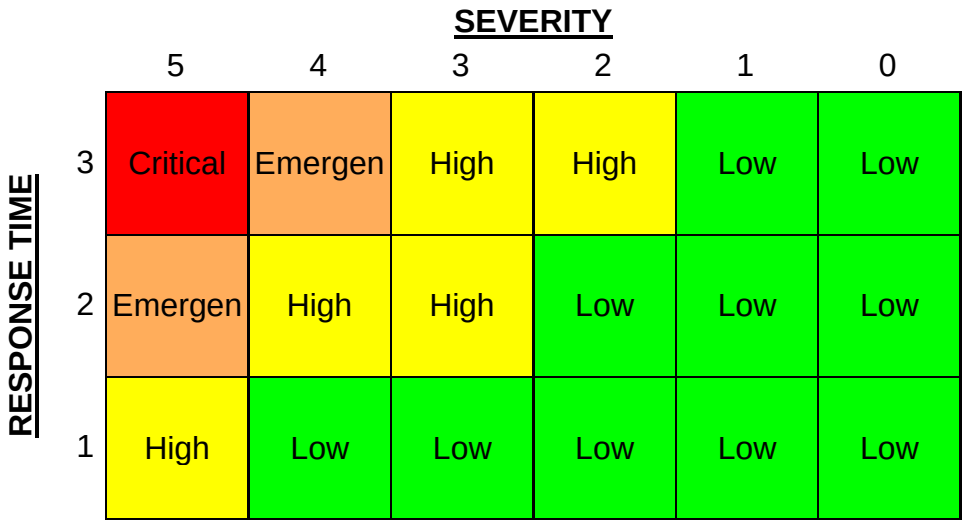
Severity - E	Category	Description	TMEL-E	Risk Matrix					
				Likelihood					
				0	1	2	3	4	5
				Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking
0	None	None	1E+00	0	0	0	0	0	0
1	Very Low	Small release with minimal clean up requirements	1E-02	0	0	0	1	2	3
2	Low	Moderate release limited to onsite damage with moderate clean up effort	1E-03	0	0	1	2	3	4
3	Moderate	Large release with limited offsite impact requires significant onsite clean up	1E-04	0	1	2	3	4	5
4	High	Large release offsite with extensive clean up and damage to sensitive areas	1E-05	0	2	3	4	5	6
5	Very High	Very large release offsite with extensive clean up and permanent damage to several sensitive areas	1E-06	0	3	4	5	6	7

6.5 Risk Matrix - Commercial

Severity - C	Category	Description	TMEL-C	Risk Matrix					
				Likelihood					
				0	1	2	3	4	5
				Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking	Risk Ranking
0	None	None		0	0	0	0	0	0
1	Very Low	Less than $50,000	1E-02	0	0	0	1	2	3
2	Low	$50,000 to $500,000	1E-03	0	0	1	2	3	4
3	Moderate	$500,000 to $5,000,000	1E-04	0	1	2	3	4	5
4	High	$5,000,000 to $50,000,000	1E-05	0	2	3	4	5	6
5	Very High	More than $50,000,000	1E-06	0	3	4	5	6	7

7 Alarm Rationalization Matrix and Tables

7.1 Risk Matrix



7.2 Severity

Code	Category	Safety Description	Environmental Description	Commercial Description
0	None	No significant safety consequence	None	None
1	Very Low	Minor Injury - first aid	Small release with minimal cleanup requirements	Less than $50,000
2	Low	Lost time injury not requiring extended hospitalization	Moderate release limited to onsite damage with moderate cleanup effort	$50,000 to $500,000
3	Moderate	Severe injury (extended hospitalization, dismemberment)	Large release with limited offsite impact, requires significant onsite cleanup	$500,000 to $5,000,000
4	High	Single Fatality	Large release offsite with extensive cleanup and damage to sensitive areas	$5,000,000 to $50,000,000
5	Very High	Multiple fatalities	Very large release offsite with extensive cleanup and permanent damage to several sensitive areas	Greater than $50,000,000

7.3 Response Time

Code	Description
1	10-30 Minutes
2	3 to 10 Minutes
3	< 3 Minutes

7.4 Priority

Code	Description
Critical	Critical
Emergency	Emergency
High	High Priority
Low	Low Priority
Journal	Journal
No Alarm	No Alarm

8 Safety Analysis Functional Evaluation (SAFE) Chart

The Safety Analysis Functional Evaluation Chart begins on the following page.

CLIENT LOGO

General Oil and Gas Operating CO.

CLIENT NAME

General Oil and Gas Operating Company

SAFETY ANALYSIS FUNCTIONAL EVALUATION CHART (SAFE)

BY

KENEXIS

	REV	3	DATE	1 Jun 2011

NUM	PID DEV ID		PROCESS COMPONENT ID		SERVICE	DEVICE ID		ALTERNATE PROTECTION: SAC REF NUM	ALT DEVICE IF APPLICABLE: DEVICE ID		ALT DEVICE IF APPLICABLE: EQUIP ID		NOTES
R1	PT	101D	M	101	High Pressure Separator	PSHH	101D						
R2	PT	101D				PSLL	101D						
R3	LI	101B				LSHH	101B						
R4	LI	101B				LSLL	101B						
R5	PSV					PSV	101						
R6	FSV				Gas Line	FSV	101						
R7	FSV				Liquid Line			A.4.f.2					
R8	PT	102D	M	102	Low Pressure Separator	PSHH	102D						
R9	PT	102D				PSLL	102D						
R10	LI	102B				LSHH	102B						
R11	LI	102B				LSLL	102B						
R12	PSV					PSV	102						
R13	FSV				Liquid Line at Pump Discharge			A.4.2.2.4	FSV	103			
R14	PT		P	103	Pipeline Pump	PSHH	103C						
R15	PT					PSLL	103C						
R16	PSV					PSV		A.7.e.2					
R17	FSV					FSV	103						
R18	PT				Gas Compressor Discharge	PSHH	104C						
R19	PT				Gas Compressor Discharge	PSLL	104C						
R20	PT				Gas Compressor Suction				PSHH	102B			
R21	PT				Gas Compressor Suction				PSLL	102B			
R22	PSV				Gas Compressor Discharge	PSV		A.8.f.3					
R23	PSV				Gas Compressor Suction	PSV	104A						
R24	FSV				Gas Compressor Suction	FSV	105						
R25	TX				Gas Compressor Discharge	TSH	104A						
R26													
R27													

NUM	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42
DWG	002		003	003					004	004																																
FUNCTION PERFORMED	Close Inlet Valve From Flowline		Close Inlet Valve From M-101	Close M-102 Outlet Valve to P-103		Compressor Shutdown	Close Compressor Isolation Valve		Export Pump Shutdown	Close Export Pump Discharge Valve		Close Departing Gas Shutoff Valve		Initiate Facility Evacuation Alarm		Alarm	Prevent Flame Emission	Prevent Spark Emission	Vacuum Relief	Pressure Relief	Minimize Backflow																						
SHUTDOWN/CNTL DEV ID	101		101	102		104			103	103																																
	M		M	M		G			P	P																																
	101		102A	102B		104	104A		103	103		104B																														
	SDV		SDV	SDV		USC	SDV		USC	SDV		SDV		ALARM		ALARM	FA	SA	VACUUM	PSV	FSV																				
SAC REF NUM	1		1	1					1	1																																
R1	●						●									●																										
R2	●		●			●	●									●																										
R3	●					●	●									●																										
R4			●													●																										
R5																				●																						
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R10			●			●	●									●																										
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R26																																										
R27																																										

DWG	DXXX.XXX-04	SHT	1	OF	3

CLIENT LOGO

General Oil and Gas Operating CO.

CLIENT NAME

General Oil and Gas Operating Company

SAFETY ANALYSIS FUNCTIONAL EVALUATION CHART (SAFE)

BY

KENEXIS

	REV	3	DATE	1 Jun 2011

NUM	PID DEV ID		PROCESS COMPONENT ID		SERVICE	DEVICE ID		ALTERNATE PROTECTION SAC REF NUM	ALT DEVICE IF APPLICABLE DEVICE ID		ALT DEVICE IF APPLICABLE EQUIP ID		NOTES
R28	PT				Incoming Gas Production Header	PSHH		A.3.a.3					
R29	PT					PSLL		A.3.b.2					
R30	PSV					PSV		A.3.c.2					
R31	PT	104D			Departing Gas Production Header	PSHH	104E						
R32	PT	104D				PSLL	104E						
R33	PSV					PSV	104C						
R34	PT	103D			Export Liquid Pipeline	PSHH	103D						
R35	PT	103D				PSLL	103D						
R36	PSV					PSV	103						
R37													
R38	PT				Compressor Discharge Cooler	PSHH	104D						
R39	PT					PSLL	104D						
R40	PSV					PSV	104B						
R41			ESD		Manual ESD Station (Typical)								
R42			TSE		Fire Det in Fire Zones 1 through X								
R43			ASH		Process Areas (50% LEL)								
R44					Comb. Gas Det. (2nd 50% LEL)								
R45					Comb. Gas Det. (20% LEL)								
R46			TSH		Control Room Fire								
R47			YSH		Control Room Fire								
R48			ASH		Control Room Gas Leak (20% LEL)								
R49					Control Room Gas Leak (50% LEL)								
R50			TSH		MCC Building 1 Fire								
R51			YSH		MCC Building 1 Fire								
R52			ASH		MCC Build. 1 Gas Leak (20% LEL)								
R53					MCC Build. 1 Gas Leak (50% LEL)								

NUM	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32	C33	C34	C35	C36	C37	C38	C39	C40	C41	C42
DWG	002		003	003					004	004																																
FUNCTION PERFORMED	Close Inlet Valve From Flowline		Close Inlet Valve From M-101	Close M-102 Outlet Valve to P-103		Compressor Shutdown	Close Compressor Isolation Valve		Export Pump Shutdown	Close Export Pump Discharge Valve		Close Departing Gas Shutoff Valve		Initiate Facility Evacuation Alarm		Alarm	Prevent Flame Emission	Prevent Spark Emission	Vacuum Relief	Pressure Relief	Minimize Backflow																						
SHUTDOWN/CNTL DEV ID	101		101	102		104			103	103																																
	M		M	M		G			P	P																																
	101		102A	102B		104	104A		103	103		104B																														
	SDV		SDV	SDV		USC	SDV		USC	SDV		SDV		ALARM		ALARM	FA	SA	VACUUM	PSV	FSV																				
	1		1	1					1	1																																
R28	●																																									
R29	●																			●																						
R30							●					●				●																											
R31	●					●	●					●				●																											
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R40																				●																						
R41	●		●	●		●	●		●	●		●				●																											
R42	●		●	●		●	●		●	●		●				●																											
R43	●		●	●		●	●		●	●		●				●																											
R44	●		●	●		●	●		●	●		●				●																											
R45																●																											
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R49	●		●	●		●	●		●	●						●																											
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R53	●		●	●		●	●		●	●						●																											

CLIENT LOGO

General Oil and Gas Operating CO.

CLIENT NAME

General Oil and Gas Operating Company

SAFETY ANALYSIS FUNCTIONAL EVALUATION CHART (SAFE) - NOTES

BY

KENEXIS

	REV	1	DATE	1 Jun 2011

NOTE	DESCRIPTION	PLACES USED
1	Drawing referrences should be prefixed with "D-254-001-".	C1, C3, C4, C9, C10