



May 21, 2020

Ms. Juliana Berry
City of Aurora, Planner II
Planning & Development Services
15151 E. Alameda Parkway
Aurora, CO 80022

Subject: ACM Highpoint PHA-HAZOP: Statement of Engineer of Record

Dear Ms. Berry,

I am the Senior Facilities Engineer for Axis Exploration and the Engineer of Record, and I would like to state that for the ACM Highpoint project, the facility for that pad has gone through preliminary design but is not yet final, technological updates and equipment innovations may occur between now and time of actual facility build. The PHA-HAZOP that was provided to you was for the initial design.

When the time approaches to fine tune the ACM Highpoint facility and go to final design after OGP approval, HHS Consulting (Tim Hicks) will re-perform the PHA-HAZOP for the updated facility design. As the Senior Facility Engineer and Engineer of Record, I will take into account their recommendations and incorporate their PHA-HAZOP recommendations as appropriate to assure the safety and operability of the facility.

If you have any questions or comments regarding this letter, please feel free to email or call Chris Freeman at cfreeman@extractionog.com , (720) 354-4604.

Sincerely,

Steven Greene
Senior Facility Engineer
Design Engineer of Record
BS Chemical Engineering – Colorado School of Mines 2006

CC: Dustin Katka, Development Lead



**ACM HIGHPOINT PROJECT
HAZARDS & OPERABILITY STUDY**

433 Park Point Drive
Suite 200
Golden, Colorado 80401
888.492.8001

April 8-9, 2019

www.hhs-usa.com

Extraction Oil & Gas

Prepared for: Steve Greene, P.E.
Facility Engineer
Extraction Oil & Gas, Inc.

Author: Timothy Hicks, MSPH, CIH, CSP
Managing Director, HHS Consulting

The accuracy of this study is limited to the process safety information provided by the customer and the participation of the analysis team. As such, this study may not fully capture all or every process or hazard circumstance or issue existing at the facility.



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STUDY DESIGN

This PHA was structured to meet the requirements outlined in OSHA's PSM (29 CFR 1910.119) and EPA's RMP (40 CFR Part 68.67). The following table outlines compliance with OSHA's PSM and EPA's RMP:

OSHA / EPA PARAGRAPH	COMPLIANCE
<u>PSM: § 1910.119(e)(3)(i)</u> <u>RMP: 68.67(b) & 68.67(c)(1)</u>	The Guideword/HAZOP/Knowledge based review methodologies are utilized to address hazards associated with this facility.
<u>PSM: § 1910.119(e)(3)(ii)</u> <u>RMP: 68.67(c)(2)</u>	Team Members with expertise at similar facilities and expertise in the oil and gas industry provided potential consequences for various hazard scenarios.
<u>PSM: § 1910.119(e)(3)(iii)</u> <u>RMP: 68.67(c)(3)</u>	Existing engineering and administrative controls and safeguards were used to assess and assign a likelihood to a hazard scenario.
<u>PSM: § 1910.119(e)(3)(iv)</u> <u>RMP: 68.67(c)(4)</u>	Hazard scenarios were assigned a severity without safeguards.
<u>PSM: § 1910.119(e)(3)(v)</u> <u>RMP: 68.67(c)(5)</u>	Facility siting was evaluated to determine any potential hazard scenarios.
<u>PSM: § 1910.119(e)(3)(vi)</u> <u>RMP: 68.67(c)(6)</u>	Human factors were evaluated to determine any credible hazard scenario.
<u>PSM: § 1910.119(e)(3)(vii)</u> <u>RMP: 68.67(c)(7)</u>	Safety and environmental impacts were risk ranked with the included risk matrix. Recommendations were generated for scenarios where an acceptable level of risk with current safeguards was not adequate.
<u>PSM: § 1910.119(e)(4)</u>	Included attendance sheet(s) indicate the position of each member. The PHA Leader credentials are also included.

STUDY METHODOLOGY

The specific study methodology used for this study was the Hazards and Operability study (HAZOP), Which was completed in accordance with the Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) Standard, as outlined in 29 CFR 1910.119(e). This method is a team approach which systematically identifies hazards resulting from deviations from the process design that could lead to undesirable consequences. Guidewords were applied at specific points called nodes and combined with process parameters to identify potential deviations from the intended operation.

The HAZOP was accomplished by reviewing process variables for each node that the project affected, for deviations from normal operating conditions (e.g., High Pressure, Low/No Flow, Low Temperature, Reverse/Misdirected Flow, etc.). Each deviation was discussed and all credible causes that would create that deviation were recorded. If the project did not affect the cause or consequence of the deviation, the scenario was not discussed further, and abbreviations were recorded. If the consequences identified had no significant safety or environmental impact, the scenario was not discussed further and abbreviations were recorded. In cases where safeguards were considered inadequate, the team recommended action.

If credible, each consequence was ranked as to overall risk taking into account the reasonably likely severity of the event and the likelihood of its occurrence. The likelihood aspect of risk was ranked by the PHA team taking into account safeguards designed to prevent or limit the hazard identified. Safeguards were not considered when ranking the severity aspect of risk. Team determined that all consequences found to be "Red" according to the risk matrix must have additional safeguards. Team determined that adding safeguards to "Yellow" risk consequences is optional and that any "Yellow" risk consequences for which additional safeguards are not assigned, existing safeguards were determined to be adequate by the PHA team for that particular consequence. *That risk matrix is included in the following section.*

When assessing the effectiveness of engineering and administrative safeguards, the study team made some assumptions, unless otherwise noted in the worksheets and checklists, which are detailed below.

- "Design Integrity" or "Design Specs" as a safeguard indicates that construction according to ASME B31.8 and API 1104 provides protection against the identified cause and consequence.
- "MI Program" as a safeguard indicates the equipment involved in the cause or consequence is subject to the facility mechanical integrity program.
- Alarms and shutdowns will be fully tested as necessary to ensure reliability before facility startup and subsequently during normal operations.
- Operators will be trained in the duties of their area, both initially and annually as refresher training once procedures are written for this specific plant. Otherwise company training standards assumed.
- Vehicular traffic is controlled throughout the facility. Lines are routed and equipment is located such that the potential for vehicle impact to piping and equipment is minimized.
- Equipment is fit for intended use.
- Emergency response plans will be written and communicated to all employees, including contractors. Evacuation signals will be communicated once the plant has them installed and evacuation routes will be established. Emergency drills will be held as appropriate.
 - This assumption is used only for mitigating general employee/contractor risk when doing the risk assessment. No credit for emergency plans taken as a safeguard.
- Piping and instrumentation diagrams will reflect actual field conditions once construction is complete.
- Fire protection and mitigation equipment that will be used at the site will be appropriately located, adequately sized, functional, and tested on a suitable frequency.
- Electrical area classification is understood, followed and updated accordingly.
- Pre-Startup Safety Review will be completed before the commissioning of any equipment on-site.
- Cause and Effect will be updated as more equipment is purchased and equipment specifications are provided.

The following abbreviations were utilized while scribing HAZOP meeting:

- *NCC – No Credible Cause or Consequence*
- *SGA – Safeguards (Determined) Adequate*
- *AOI – Adverse Operational Impact*
- *NSC – No Safety Consequence*
- *NCI – No Consequence of Interest*
- *N/A – Not Applicable*

Probability of Occurrence (Frequency) Severity of Consequences	Extraordinary (1) Given current practices and procedures, incident unlikely to occur at the facility.	Rare (2) Has occurred at a similar facility and may reasonably occur at this facility within the next 30 years.	Unlikely (3) Likely to occur at this facility within the next 10 to 15 years.	Likely (4) Likely to occur at this facility within the next 5 to 10 years.	Frequent (5) Likely to occur at this facility within the next year.
Negligible (1) PERSONNEL – Minor or no injury, no lost time. COMMUNITY – No injury, hazard, or annoyance to the public. ENVIRONMENTAL – Environmentally recordable event with no Agency notification or Permit violation FACILITY - Minimal equipment damage at an estimate loss of <\$100,000. Negligible downtime.	2	3	4	5	6
Minor (2) PERSONNEL – Single injury, not severe, possible lost time. COMMUNITY – Odor or noise complaint from the public. ENVIRONMENTAL – Release which results in an Agency notification or Permit violation. FACILITY – Some equipment damage, \$100K-\$1MM, 1-10 days downtime.	3	4	5	6	7
Major (3) PERSONNEL – One or more severe injuries. COMMUNITY – One or more minor injuries. ENVIRONMENTAL – Significant release with minor or no offsite impact. FACILITY –Major damage, \$1MM- \$5MM, 10-90 days downtime.	4	5	6	7	8
Severe (4) PERSONNEL – One or more fatalities possible. COMMUNITY – One or more severe injuries. ENVIRONMENTAL – Significant release with serious offsite impact. FACILITY – Major damage, \$5MM-\$10MM, 10-90 days downtime.	5	6	7	8	9
Catastrophic (5) PERSONNEL – Multiple fatalities. COMMUNITY – One or more fatalities. ENVIRONMENTAL – Significant release with serious offsite impact likely to cause immediate or long term health effects. FACILITY - Major or total destruction, >\$10MM, downtime in excess of 90 days.	6	7	8	9	10

Legend: 1, 2, 3, 4 = Low Risk, recommendation not required; 6,7 = Medium Risk, recommendation at discretion of team; 8,9,10 = High Risk, recommendation required.

Table of Deviations

<u>Parameter</u>	<u>Guideword</u>	<u>Deviation</u>	
Flow	No	No Flow	
	More	Higher Flow Rate More Quantity Flowed	
	Less	Lower Flow Rate Less Quantity Flowed	
	As Well As		Chemical Reaction
			Polymerization
			Foaming
			Formation of Emulsion
	Reverse	Reverse Flow	
	Other Than	Misdirected Flow Boiling Freezing	
	Temperature	More	Higher Temperature
Less		Lower Temperature	
Pressure	No	Zero Pressure (Gauge)	
	More	Higher Pressure	
	Less	Lower Pressure	
Composition	No	No Material	
	More	Higher Mole Weight	
	Less	Lower Mole Weight	
	As Well As	Contaminated	
	Part Of	Missing Component	
Phase	More	Additional Phase	
		Missing Phase	
	Less	Emulsification	
	Reverse	Phase Inversion	
Level	No	Empty	
	More	Higher Level	
	Less	Lower Level	
Maintenance	No	None Performed	
	More	Performed More Frequently than Desired	
	Less	Performed Less Frequently than Desired	
	As Well As	Something Else is Done	
	Part Of	Incomplete Operation	
	Reverse	Operation Done in Opposite Order	
Other Than	Something Different is Done		

Table of Deviations

<u>Parameter</u>	<u>Guideword</u>	<u>Deviation</u>	
Instrumentation	No	None Installed	
	More	More than Needed	
	Less	Less than Needed	
	As Well As	Something Extra	
	Part Of	Something Less	
	Reverse	Installed in Reverse	
Relief	Other Than	Something Else	
	No	Relief Absent	
	More	More than Needed	
	Less	Less than Needed	
	Service	No	None Delivered
		More	Greater Quantity than Needed
Less		Lesser Quantity than Needed	
As Well As		Something Else Provided	
Part Of		Incomplete Service Provided	
Reverse		Opposite of What is Needed	
Corrosion / Erosion	Other Than	Something Different Provided	
	More	Greater Extent than Planned	
	Less	Lesser Extent than Planned	
	Safety	No	None Provided
More		More than Provided	
Less		Less than Provided	
What If	What If	Human Factors	
		- Any other Guideword and Deviation -	
		Weather	
		Buildings	
		Off Site Consequences	
		Arc Flash Exposure	
		Lightning	
		Utilities	
Operating Procedures			

HAZOP Worksheet

Printed: April 21, 2020, 1:06 PM

Company: Extraction Oil & Gas

Location:

Facility: ACM Highpoint Project

PHA Method: HAZOP

PHA Type: Initial

Process:

File Description:

Date:

Process Description:

Chemicals:

Purpose:

Complete facility hazards, and operability study, utility hazards, and operability methodology

Scope:

As indicated on Master P&IDs included in this report

Objectives:

Evaluate the potential for negative worker and public impacts (hazards) as well as for significant potential process impacts/upsets (operability) and recommend corrective actions based on risk.

Project Notes:

Vendor information not available for MR-3505, SS-3510 not reviewed
Combined Node 5 and Node 6, called Node 5 and called Flash Gas
V-6500 removed from design Node 8

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	1. More Flow	1.1. Washed out choke (sand or gas cut)	1.1.1. See High Pressure this node						
		1.2. Erosion (pipe velocity)	1.2.1. Equipment damage, loss containment, possible ignition, possible personnel injury	5	PSV-20xxA set @ 500 psig LAHH-20xx set @ XXX, shut PV-20xxA/B, SDV-10xx	2	7		1. Review erosion velocity calculations 2. Consider closing PV-10xx on LAHH-10xx
		1.3. PCV-22xxA malfunctions open	1.3.1. Overpressure V-22xx, equipment damage, loss containment, possible ignition, possible personnel injury	5	PSV-22xx set @ 125 psig LAHH-22xx set @ XXX, shut PV-20xxA/B, SDV-10xx PAHH-21xx set @ 25 psig, closes XV-21xxA/B	2	7		3. Consider closing PV-10xx on LAHH-22xx
		1.4. PV-10xx malfunctions open	1.4.1. NSC						
	2. Low Flow	2.1. Paraffin buildup, loss of production, PV-10xx malfunctions closed	2.1.1. NSC						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Temperature

Intention: MAWT= 300F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	3. Higher Temperature	3.1. External Fire	3.1.1. Equipment damage, potential loss containment, possible personnel injury, (pool fire in V-20xx)	5	PSV-20xxA set @ 500 psig TAHH-20xxA/B set @ XX, shuts SDV-10xx and PV-20xxA/B	3	8		4. Verify setpoint of TAHH-20xxA/B 5. Verify endpoint functionality of TAHH-20xxA
		3.2. TC-21xx malfunctions, XV-21xxA malfunctions open	3.2.1. Equipment damage, potential loss containment, possible ignition, possible personnel injury	5	See above	3	8		6. Consider installing HH on TIT-20xxB, to shut down TV-21xx
		3.3. Sand in V-20xx covering heating tubes, rupture in heating tube	3.3.1. Equipment damage, rupture tubes, possible ignition, possible personnel injury	5	Handheld heat cameras, operator training and intervention	4	9		7. Consider adding V-20xx to maintenance schedule for sand cleanouts 8. Consider increasing wall thickness of the fire tube 9. External coating of the fire tube
Less	4. Lower Temperature	4.1. Low ambient	4.1.1. Liquid outlet freeze, Equipment damage, potential loss containment, possible ignition, possible personnel...	5	Heated separator, catalytic heater	2	7		10. Consider installing UNI freeze proof valves on drain lines

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Temperature

Intention: MAWT= 300F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
Less (cont.)	4. Lower Temperature (cont.)	4.1. Low ambient (cont.)	...injury		Heated separator, catalytic heater (cont.)				10. Consider installing UNI freeze proof valves on drain lines (cont.)
		4.2. Loss of burner, JT effect across choke	4.2.1. Freeze blockage, equipment damage, potential loss containment, possible ignition, possible personnel injury	5	PAHH-20xxA set @ 2800 psig, shuts PV-20xxA/B, PV-10xx, SDV-10xx	2	7		11. Consider placement of choke (upstream vs downstream of coil pack)
		4.3. JT effect across FE-20xx	4.3.1. See above	5	See above	2	7		
		4.4. JT effect across PCV-22xxA	4.4.1. See above	5	Building enclosure	2	7		12. Revisit fuel gas system on separator

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Pressure

Intention: ANSI 1500 psig Well head, 500 psig Separator V-20xx

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	5. Higher Pressure	5.1. LV-20xxA, LV-20xxB malfunctions closed	5.1.1. Equipment damage, potential loss containment, possible ignition, possible personnel injury	5	LAHH-20xx set @ XX, shuts down SDV-10xx (well head valve), shuts PV-20xxA/B PAHH-20xxB set @ 425 psig, shuts SDV-10xx, shuts PV-20xxA/B PSV-20xxA set @ 500 psig, sized for XX Normally open Line 3-PG-XX05-BCCA	3	8		13. Consider closing PV-10xx on LAHH-10xx 14. Consider closing PV-10xx on PAHH-10xx
		5.2. Manual BV inadvertently closed downstream of V-20xx, PV-8050 malfunctions closed	5.2.1. See above	5	See above PAHH-8005A set @ 375 psig, facility PSD		3	8	15. Consider changing setpoint to 400 psig on PAHH-8005A
		5.3. Plugged Mist Extractor (V-20xx)	5.3.1. See above	5	LAHH-20xx set @ XX, shuts down SDV-10xx (well head valve), shuts PV-20xxA/B PAHH-20xxB set @ 425 psig, shuts SDV-10xx,...	3	8		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Pressure

Intention: ANSI 1500 psig Well head, 500 psig Separator V-20xx

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	5. Higher Pressure (cont.)	5.3. Plugged Mist Extractor (V-20xx) (cont.)	5.3.1. See above (cont.)		...shuts PV-20xxA/B PSV-20xxA set @ 500 psig, sized for XX Normally open Line 3-PG-XX05-BCCA				
		5.4. PV-20xxA/B malfunctions closed	5.4.1. See above	5	PAHH-10xxB set @ 3750 psig, shuts SDV-10xx, shuts PV-20xxA/B	2	7		
		5.5. Corrosion on preheat coil (leak)	5.5.1. See above	5	LAHH-20xx set @ XX, shuts down SDV-10xx (well head valve), shuts PV-20xxA/B PAHH-20xxB set @ 425 psig, shuts SDV-10xx, shuts PV-20xxA/B PSV-20xxA set @ 500 psig, sized for XX Normally open Line 3-PG-XX05-BCCA	2	7		16. Verify PSV-20xxA, sized for coil leak (full flow) 17. Consider closing PV-10xx on PAHH-10xx

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Pressure

Intention: ANSI 1500 psig Well head, 500 psig Separator V-20xx

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	5. Higher Pressure (cont.)	5.6. PV-10xx malfunctions closed	5.6.1. See above	5	PAHH-10xxB set @ 3750 psig, shuts SDV-10xx, shuts PV-20xxA/B	2	7		
		5.7. Washed out choke (sand or gas cut)	5.7.1. See above	5	LAHH-20xx set @ XX, shuts down SDV-10xx (well head valve), shuts PV-20xxA/B PAHH-20xxB set @ 425 psig, shuts SDV-10xx, shuts PV-20xxA/B PSV-20xxA set @ 500 psig, sized for XX Normally open Line 3-PG-XX05-BCCA	2	7		18. Consider closing PV-10xx on LAHH-10xx 19. Consider closing PV-10xx on PAHH-10xx
		5.8. Check valve malfunctions on the gas lift line	5.8.1. See above	5	Internal gas lift compressor shutdowns	3	8		20. Consider installing double check valve philosophy 21. Verify adequate pressure rating on check valves
		5.9. Frac into W-10xx	5.9.1. See above	5	PAHH-10xxB set @ 3750...	2	7		22. Consider adjusting setpoint...

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Pressure

Intention: ANSI 1500 psig Well head, 500 psig Separator V-20xx

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	5. Higher Pressure (cont.)	5.9. Frac into W-10xx (cont.)	5.9.1. See above (cont.)		...psig				...to 3200 psig on PAHH-10xxB
		5.10. Casing BV inadvertently left open	5.10.1. See above	5	LAHH-20xx set @ XX, shuts down SDV-10xx (well head valve), shuts PV-20xxA/B PAHH-20xxB set @ 425 psig, shuts SDV-10xx, shuts PV-20xxA/B PSV-20xxA set @ 500 psig, sized for XX Normally open Line 3-PG-XX05-BCCA	3	8		23. Consider closing PV-10xx on LAHH-10xx 24. Consider closing PV-10xx on PAHH-10xx 25. Verify PAHH-10xxA exists and verify endpoint functionality
		5.11. PCV-22xxB malfunctions closed	5.11.1. See above	5	PSV-22xx set @ 125 psig PSV-20xxA set @ 500 psig, sized for XX	3	8		
Less	6. Low Pressure	6.1. V-20xx shut in and blown down, maintenance with vac truck	6.1.1. Vacuum, equipment damage, potential loss containment	3	Block valve locked open on PSV-20xxA	1	4		26. Verify V-20xx is rated for vacuum

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	7. Higher Level	7.1. LV-20xxA/B malfunctions closed	7.1.1. See High Pressure this node						
		7.2. Downstream BV inadvertently closed	7.2.1. See above						
		7.3. Washed out choke (sand or gas cut)	7.3.1. See above						
		7.4. LV-22xx malfunctions closed	7.4.1. Liquid carryover to burner system, equipment damage, loss containment, potential ignition, possible personnel injury	5	LAHH-22xx set @ XXX, closes PV-20xxA/B, SDV-10xx, shuts down B-21xx	2	7		
	8. Low Level	8.1. Drain valve inadvertently open	8.1.1. Exposed fire tube, gas blowby, equipment damage, loss containment, potential ignition, possible personnel injury	5	LALL-21xxB set @ XXX	3	8		
		8.2. LV-20xxA malfunctions open	8.2.1. Gas blowby, See High Pressure Node 2						
		8.3. LV-22xx malfunctions...	8.3.1. Gas blowby, See...						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010
 IN-BRM-012-80000
 IN-BRM-012-80010
 IN-BRM-012-80015
 IN-BRM-012-94000

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	8. Low Level (cont.)	...open 8.4. LV-20xxB malfunctions open	...High Pressure Node 4 8.4.1. Gas blowby, See High Pressure Node 3						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30000
 IN-BRM-012-30005
 IN-BRM-012-35000
 IN-BRM-012-35005

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	9. More Flow	9.1. See High Level this node							
Less	10. Low Flow	10.1. See Low Level this node, See High Pressure this node							
Reverse	11. Misdirected Flow	11.1. Check valve failure on P-3025/30/35/40	11.1.1. High level in V-3000, equipment damage, potential ignition, possible personnel injury	5	LAHH-3000 set XXX, PSD facility	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30000
 IN-BRM-012-30005
 IN-BRM-012-35000
 IN-BRM-012-35005

Revision:

Parameter: Temperature

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	12. Higher Temperature	12.1. External fire	12.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-3000 set @ 250 psig	3	8		27. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility
Less	13. Low Temperature	13.1. Low ambient	13.1.1. Freeze in drain lines, equipment damage, loss containment, possible ignition, possible personnel injury	5	Heat trace and insulation on V-3000	2	7		28. Consider installing UNI freeze proof valves on drain lines

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30000
 IN-BRM-012-30005
 IN-BRM-012-35000
 IN-BRM-012-35005

Revision:

Parameter: Pressure

Intention: MAOP= 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	14. Higher Pressure	14.1. LV-20xxA malfunctions open	14.1.1. Gas blowby, Overpressure V-3000, equipment damage, potential ignition, possible personnel injury	5	PSV-3000 set @ 250 psig	3	8		29. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility
		14.2. P-3025/30/35/40 fail to start, BV inadvertently closed, plugged strainer (PDI-3000)	14.2.1. See above	5	See above LAHH-3000 set @ XXX, PSD facility	3	8		30. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility 31. Consider installing redundant strainer 32. Program logic on PI-3000 to throttle PV-20xxA
		14.3. BV downstream of P-3025/30/35/40 in advertently closed	14.3.1. Loss containment, potential ignition, possible personnel injury	5	PSV-3025/30/35/40 set @ XXX PAHH-3025B/30B/35B/40B set @ 400 psig, stop associated pump	3	8		
Less	15. Low Pressure	15.1. Manual drain valve inadvertently left open	15.1.1. See above	5	LALL-3000 set @ XXX, shuts down P-3025/30/35/40 PALL-3025A set @ XXX, shuts down all pumps P-3025/30/35/40	3	8		33. Consider installing spring loaded valve on drain lines 34. Consider adding a LL on PI-3000A set @ XXX, PSD facility
		15.2. P-3025/30/35/40 fail to stop	15.2.1. Vacuum, equipment damage, loss containment, potential ignition, possible personnel injury	5	See above	3	8		35. Verify V-3000 is rated for vacuum 36. Consider adding a LL on PI-3000A set @ XXX, PSD facility

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30000
 IN-BRM-012-30005
 IN-BRM-012-35000
 IN-BRM-012-35005

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	16. Higher Level	16.1. LIC-3000 malfunctions, P-3025/30/35/40 fails to start	16.1.1. Liquids to compression, loss containment, equipment damage, potential ignition, possible personnel injury	5	LAHH-3000 set @ XXX, PSD facility LAHH-5000 set @ XXX, PSD facility	3	8		37. Consider installing SDV on inlet of V-3000 to shut on all PSD's 38. Program logic on LIT-3000 to throttle PV-20xxA
		16.2. Loss of compression	16.2.1. See above	5	See above	3	8		39. See above
Less	17. Low Level	17.1. LIC-3000 malfunctions, P-3025/30/35/40 fails to stop	17.1.1. Pump cavitation equipment damage, loss containment, potential ignition, possible personnel injury	5	LALL-3000 set @ XXX, shuts P-3025/30/35/40 PALL-3025A set @ XXX, shuts P-3025/30/35/40	2	7		
		17.2. Manual drain valve inadvertently left open	17.2.1. See Low Pressure this node						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Drawings: IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-45000

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	18. More Flow	18.1. See High Level this node							
Less	19. Low Flow	19.1. See Low Level this node, See High Pressure this node							
Reverse	20. Misdirected Flow	20.1. Check valve failure on P-4005/10/15/20	20.1.1. High level in V-4000, equipment damage, potential ignition, possible personnel injury	5	LAHH-4000 set XXX, PSD facility	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Drawings: IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-45000

Revision:

Parameter: Temperature

Intention: MAWT = 185F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	21. Higher Temperature	21.1. External fire	21.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-4000 set @ 250 psig	3	8		40. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility 41. Consider adding TAH on FIT-4000 set @ XXX (to be done by Elevation)
Less	22. Low Temperature	22.1. Low ambient	22.1.1. Freeze in drain lines, equipment damage, loss containment, possible ignition, possible personnel injury	5	Heat trace and insulation on V-4000	2	7		42. Consider installing UNI freeze proof valves on drain lines

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Drawings: IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-45000

Revision:

Parameter: Pressure

Intention: MAOP= 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	23. Higher Pressure	23.1. LV-20xxB malfunctions open	23.1.1. Gas blowby, Overpressure V-4000, equipment damage, potential ignition, possible personnel injury	5	PSV-4000 set @ 250 psig	3	8		43. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility
		23.2. P-4005/10/15/20 fail to start, BV inadvertently closed, plugged strainer (PDI-4000)	23.2.1. See above	5	See above LAHH-4000 set @ XXX, PSD facility	3	8		44. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility 45. Consider installing redundant strainer 46. Program logic on PI-4000 to throttle PV-20xxA
		23.3. BV downstream of P-4005/10/15/20 in advertently closed	23.3.1. Loss containment, potential ignition, possible personnel injury	5	PSV-4005/10/15/20 set @ XXX PAHH-4005B/10B/15B/20B set @ 400 psig, stop associated pump	3	8		
Less	24. Low Pressure	24.1. Manual drain valve inadvertently left open	24.1.1. See above	5	LALL-4000 set @ XXX, shuts down P-4005/10/15/20 PALL-4005A set @ XXX, shuts down all pumps P-4005/10/15/20	3	8		47. Consider installing spring loaded valve on drain lines 48. Consider adding a LL on PI-4000A set @ XXX, PSD facility
		24.2. P-4005/10/15/20 fail to stop	24.2.1. Vacuum, equipment damage, loss containment, potential ignition, possible personnel injury	5	See above	3	8		49. Verify V-4000 is rated for vacuum 50. Consider adding a LL on PI-4000A set @ XXX, PSD facility

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Drawings: IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-45000

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	25. Higher Level	25.1. LIC-4000 malfunctions, P-4005/10/15/20 fails to start	25.1.1. Liquids to compression, loss containment, equipment damage, potential ignition, possible personnel injury	5	LAHH-4000 set @ XXX, PSD facility LAHH-5000 set @ XXX, PSD facility	3	8		51. Consider installing SDV on inlet of V-4000 to shut on all PSD's 52. Program logic on LIT-4000 to throttle PV-20xxA
		25.2. Loss of compression	25.2.1. See above	5	See above	3	8		53. See above
Less	26. Low Level	26.1. LIC-4000 malfunctions, P-4005/10/15/20 fails to stop	26.1.1. Pump cavitation equipment damage, loss containment, potential ignition, possible personnel injury	5	LALL-4000 set @ XXX, shuts P-4005/10/15/20 PALL-4005A set @ XXX, shuts P-4005/10/15/20	2	7		
		26.2. Manual drain valve inadvertently left open	26.2.1. See Low Pressure this node						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-80000
 IN-BRM-012-80005
 IN-BRM-012-94000
 IN-BRM-012-96000
 IN-BRM-012-96001
 IN-BRM-012-96005

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	27. More Flow	27.1. See High Level this node							
Less	28. Low Flow	28.1. See Low Level this node, See High Pressure this node							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-80000
 IN-BRM-012-80005
 IN-BRM-012-94000
 IN-BRM-012-96000
 IN-BRM-012-96001
 IN-BRM-012-96005

Revision:

Parameter: Temperature

Intention: MAWT = 200F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	29. Higher Temperature	29.1. External fire	29.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-9600 set @ 250 psig	3	8		
Less	30. Low Temperature	30.1. Low ambient	30.1.1. Freeze in drain lines, equipment damage, loss containment, possible ignition, possible personnel injury	5	Heat trace and insulation on V-9600	2	7		54. Consider installing UNI freeze proof valves on drain lines

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-80000
 IN-BRM-012-80005
 IN-BRM-012-94000
 IN-BRM-012-96000
 IN-BRM-012-96001
 IN-BRM-012-96005

Revision:

Parameter: Pressure

Intention: MAOP = 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	31. Higher Pressure	31.1. Manual BV inadvertently left open, LCV-5000 malfunctions open	31.1.1. Gas blowby, Overpressure V-9600, equipment damage, potential ignition, possible personnel injury	5	PSV-9600 set @ 250 psig PAHH-9600 set @ 75 psig, closes PV-9610	3	8		55. Consider installing a SDV-9601 on the inlet to shut when PAHH-9600, LAHH-9600, LAHH-9610 are activated and confirm all piping and valves upstream are ANSI 1500 on well head bypass 56. Consider installing a SDV-9600 on the inlet to shut when PAHH-9600, LAHH-9600, LAHH-9610 are activated and confirm all piping and valves upstream are ANSI 300 on drain lines 57. Verify CV values with burner capacity on the SDV valves 58. Confirm capacities of maintenance vessel system (well unloading)
		31.2. P-9605/10 fail to start, BV inadvertently closed, plugged strainer (PDI-9605/10)	31.2.1. See above	5	See above LAHH-9600/10 set @ XXX, shuts SDV-9600/01	3	8		59. Consider installing PCV's upstream of P-9605/10

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-80000
 IN-BRM-012-80005
 IN-BRM-012-94000
 IN-BRM-012-96000
 IN-BRM-012-96001
 IN-BRM-012-96005

Revision:

Parameter: Pressure

Intention: MAOP = 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	31. Higher Pressure (cont.)	31.3. BV downstream of P-9605/10 in advertently closed, PV-9610 malfunctions closed	31.3.1. Loss containment, potential ignition, possible personnel injury	5	See above	3	8		60. Consider installing pressure protection on P-9605/10
Less	32. Low Pressure	32.1. Desired							
Negative	33. Negative Pressure	33.1. P-9605/10 fail to stop, truck unloading	33.1.1. Vacuum, equipment damage, loss containment, potential ignition, possible personnel injury	5	Rated for half vacuum -7.5 psia	2	7		61. Verify V-9600 is rated for half vacuum

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Drawings: IN-BRM-012-20000
 IN-BRM-012-30005
 IN-BRM-012-40000
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-80000
 IN-BRM-012-80005
 IN-BRM-012-94000
 IN-BRM-012-96000
 IN-BRM-012-96001
 IN-BRM-012-96005

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	34. Higher Level	34.1. LIC-9605/10 malfunctions, P-9605/10 fails to start	34.1.1. Liquids to burner FL-9700, loss containment, equipment damage, potential ignition, possible personnel injury	5	LAHH-9600/10 set @ XXX, shuts SDV-9600/01 LAHH-9700 set @ XXX, shuts SDV-9600/01	3	8		62. Consider placement of LSHH-9600/10 to prevent parrafin build-up
		34.2. Parrafin build-up on LSHH-9600/10	34.2.1. See above	5	LAHH-9700 set @ XXX, shuts SDV-9600/01 Redundant LSH	2	7		
Less	35. Low Level	35.1. LIC-9605/10 malfunctions, P-9605/10 fails to stop	35.1.1. Pump cavitation equipment damage, loss containment, potential ignition, possible personnel injury	5	LALL-9600/10 set @ XXX, shuts P-9605/10	2	7		
		35.2. Manual drain valve inadvertently left open	35.2.1. See Negative Pressure this node						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (5) Flash Gas Compressor
 Drawings: IN-BRM-012-30005
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	36. More Flow	36.1. See High Pressure this node							
Less	37. Low Flow	37.1. Plugged Mist pad on V-5000	37.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-5000 set @ XXX PSV-3000 set @250 psig PSV-4000 set @ 250 psig PAHH-5000 set @ XXX, PSD facility PAHH-3000 set @ XXX, PSD facility PAHH-4000 set @ XXX, PSD facility	2	7		
		37.2. See High Pressure this node	37.2.1. See above		See above				
Misdirected	38. Misdirected Flow	38.1. Oxygen ingress during blowdown operations	38.1.1. Possible explosion, equipment damage, loss containment, potential ignition, possible personnel injury	5	Internal compressor shutdowns	2	7		63. Revisit blowdown procedures 64. Consider installing Oxygen Analyzer on sales gas line

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (5) Flash Gas Compressor
 Drawings: IN-BRM-012-30005
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010

Revision:

Parameter: Temperature

Intention: MAOT = 250F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	39. Higher Temperature	39.1. External Fire (V-5000/5100)	39.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-5000/5100 set @ XXX Fire Eyes, PSD facility, shuts down all compression LEL detection 10% for 60sec, 20% instant, shuts down all compression PAHH-5000 set @ XXX, PSD facility	3	8		
		39.2. External Fire (C-5000 (typical))	39.2.1. See above	5	Fire Eyes, PSD facility, shuts down all compression LEL set @ 10% 60 secs, 20% instant, PSD the facility	2	7		65. Update P&ID's to include Fire Eyes and LEL's 66. Verify temperature requirements for gas sales
Less	40. Low Temperature	40.1. Low ambient	40.1.1. Drain lines freeze, equipment damage, loss containment, potential ignition, possible personnel injury	5	Heat trace and insulation Methanol injection	2	7		67. Consider replacing drain valve with UNI freeze proof valves and on V-5000/5100
			40.1.2. Freeze in V-5000/5100, equipment damage, loss containment, potential ignition, possible personnel injury	5	Heat trace and insulation	1	6		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (5) Flash Gas Compressor
 Drawings: IN-BRM-012-30005
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010

Revision:

Parameter: Pressure

Intention: MAOP = 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	41. Higher Pressure	41.1. LV-20xxA/B (typical) malfunctions open	41.1.1. Liquid carryover, gas blowby, equipment damage, loss containment, possible ignition, possible personnel injury	5	LAHH-5000 set @ XXX, PSD facility Internal compressor shutdowns PSV-5000 set @ XXX PAHH-5000 set @ XXX, PSD facility LAHH-3000 set @ XXX, PSD facility LAHH-4000 set @ XXX, PSD facility Fire Eyes LEL detection 10% for 60sec, 20% instant	3	8		
		41.2. Discharge BV inadvertently closed, LCV-5100 malfunctions closed	41.2.1. Equipment damage, loss containment, possible ignition, possible personnel injury	5	See above	3	8		68. Consider installing PSV (typical) off of compressor discharge after double check valve, Line 2-PG-5012-BCCA
		41.3. BV downstream of V-5100 (typical) inadvertently closed, LCV-5100 malfunctions closed	41.3.1. See above	5	PSV-5100 (typical) set @ XXX PAHH-5000 set @ XXX, PSD facility PSV -5000 set @ XXX LAHH-3000 set @ XXX,...	3	8		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (5) Flash Gas Compressor
 Drawings: IN-BRM-012-30005
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010

Revision:

Parameter: Pressure

Intention: MAOP = 250 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	41. Higher Pressure (cont.)	41.3. BV downstream of V-5100 (typical) inadvertently closed, LCV-5100 malfunctions closed (cont.)	41.3.1. See above (cont.)		...PSD facility LAHH-4000 set @ XXX, PSD facility Fire Eyes LEL detection 10% for 60sec, 20% instant LAHH-5000 set @ XXX, PSD facility				
		41.4. LCV-5100 malfunctions open	41.4.1. NCC						
Less	42. Low Pressure	42.1. LCV-5100 malfunctions open	42.1.1. NCC						
		42.2. LCV-5000 malfunctions open	42.2.1. See High Pressure Node 4						
		42.3. LV-20xxA/B malfunctions closed	42.3.1. See High Level Node 1						
		42.4. C-5000 (typical) fails to stop	42.4.1. NCC		Internal shutdowns on compressors PALL-3000 set @ XXX, PSD facility PALL-4000 set @ XXX, PSD facility				69. Verify V-3000/4000 rated for vacuum 70. Consider adding PSD facility to shut XV-5000

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (5) Flash Gas Compressor
 Drawings: IN-BRM-012-30005
 IN-BRM-012-40005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	43. Higher Level	43.1. LCV-5000/5100 malfunctions closed	43.1.1. See High Pressure this node						
		43.2. BV inadvertently closed downstream of V-5000/5100	43.2.1. See above						
Less	44. Low Level	44.1. Desired Condition (V-5000/5100)							
		44.2. Drain valve inadvertently left open (V-5000/5100)	44.2.1. Gas blowby, loss containment, potential ignition, possible personnel injury	5	2" Spring valve on drain line	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (7) Drains
 Drawings: IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65005
 IN-BRM-012-65050
 IN-BRM-012-80005
 IN-BRM-012-95000

Revision:

Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	45. More What If	45.1. Manual drain valve inadvertently left open	45.1.1. Loss containment, potential ignition, possible personnel injury	5	Secondary containment Spring valves (V-5000) LAHH-6510 set @ 18" from top, PSD facility	2	7		
		45.2. Truck unloading	45.2.1. See above	5	Grounding grid Open top tank	2	7		
		45.3. Failure to empty sumps, stormwater	45.3.1. Potential H2S buildup, loss containment, potential ignition, possible personnel injury	5	LAHH-6510 set @ 18" from top, PSD facility Secondary containment	2	7		
		45.4. Plugged drain line, freeze	45.4.1. Loss containment (compressors) 45.4.2. Inability to drain, AOI	1	Secondary containment	4	5		
		45.5. Low ambient, bottom of sump freezes	45.5.1. AOI						
		45.6. Hole in the bottom of the sump	45.6.1. Loss containment	1	Double lined, external coating	2	3		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (8) Gas Lift
 Drawings: IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65006
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	46. More Flow	46.1. Desired operating condition							
Less	47. Less Flow	47.1. FX-65XX plugged, FV-65XX malfunctions closed, BV inadvertently closed	47.1.1. See High Pressure this node						
Misdirected	48. Misdirected Flow	48.1. Line rupture on gas system in facility, buy-back starts feeding facility	48.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	SDV-XXX, fail close valve, and shuts on ESD	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (8) Gas Lift
 Drawings: IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65006
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Temperature

Intention: MAOT = 250F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	49. Higher Temperature	49.1. External fire (C-6505)	49.1.1. Equipment damage, loss containment, possible personnel injury	5	Compressor PSV's on skid LEL Detection set @ 10% for 60 seconds, 20% instant, PSD facility, shuts down all compression Fire Eyes, PSD facility, shuts down all compression PSV-6505 set @ 1440 psig, sized for block flow	2	7		
		49.2. High discharge temps from C-6505	49.2.1. Loss of external coating, equipment damage, loss containment, possible personnel injury	5	Internal compressor shutdowns	3	8		
Less	50. Low Temperature	50.1. Low ambient	50.1.1. See High Pressure this node						71. Verify sales gas pipeline spec temperature
		50.2. JT effect across PV-6505	50.2.1. Freeze, equipment damage, loss containment, possible personnel injury	5	PSV-6505 set @ 1440 psig, sized for block flow Methanol injection Internal compressor shutdowns	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (8) Gas Lift
 Drawings: IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65006
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Pressure

Intention: MAOP = 1440 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	51. Higher Pressure	51.1. Discharge BV inadvertently closed C-6505	51.1.1. Overpressure, line rupture, loss containment, potential ignition, possible personnel injury	5	PSV-6505 set @ 1440 psig, sized for block flow PAHH-6505 set @ 1350 psig closes XV-6500, PSD C-6505 PIT-6505 controls PV-6505 as a let down to sales, set @ XXX Internal compressor shutdowns	2	7		
		51.2. PV-6505 (recycle valve) malfunctions open	51.2.1. See above	5	PSV-8050 set @ 740 psig PAHH-8005A/B set @ 400 psig, PSD facility	2	7		
		51.3. Downstream blockage (stuck pig, BV inadvertently closed, O2 slam valve close, Hydrate)	51.3.1. See above	5	See above	2	7		
Less	52. Low Pressure	52.1. Desired condition							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (8) Gas Lift
 Drawings: IN-BRM-012-65000
 IN-BRM-012-65005
 IN-BRM-012-65006
 IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	53. Higher Level	53.1. NSC							
Less	54. Low Level	54.1. Desired operating condition							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (9) Sales Gas
 Drawings: IN-BRM-012-80005
 IN-BRM-012-80010

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	55. More Flow	55.1. See High Pressure this node							
Less	56. Low/No Flow	56.1. Plugged mist pad on V-8000	56.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-8000 set @ 500 psig PAHH-8005A set @ XXX, PSD facility PAHH-20xxB set @ XXX, PSD separator V-20xx PSV-20xxA set @ 500 psig	3	8		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (9) Sales Gas
 Drawings: IN-BRM-012-80005
 IN-BRM-012-80010
 Parameter: Temperature

Revision:

Intention: MAOT = 200F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	57. Higher Temperature	57.1. External Fire	57.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-8000 set @ 500 psig LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression Fire Eyes, PSD facility, shuts down all compression PAHH-8005A set @ 500 psig, PSD facility	2	7		
		57.2. High discharge temps from C-8005/10	57.2.1. Loss of external coating, equipment damage, loss containment, possible personnel injury	5	Internal compressor shutdowns	3	8		
Less	58. Low Temperature	58.1. Low ambient, JT effect across orifice (FE-8005/10)	58.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-8005 set @ 740 psig, sized for block flow PSV-8010 set @ 740 psig, sized for block flow Internal compressor shutdowns FE-8005/10 to shut down C-8005/10, Close XV-8000A/B	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (9) Sales Gas
 Drawings: IN-BRM-012-80005
 IN-BRM-012-80010

Revision:

Parameter: Pressure

Intention: MAOP = 500 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	59. Higher Pressure	59.1. LV-8000 malfunctions closed, manual BV downstream of V-8000 inadvertently closed	59.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	LAHH-8000 set @ XXX, PSD facility PSV-8000 set @ 500 psig Gas outlet is normally open Internal compressor shutdowns	3	8		
		59.2. XV-8000A/B malfunctions closed	59.2.1. NCC						
		59.3. Manual BV on discharge C-8005/10 inadvertently closed	59.3.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-8005 set @ 740 psig, sized for block flow PSV-8010 set @ 740 psig, sized for block flow Internal compressor shutdowns FE-8005/10 to shut down C-8005/10, Close XV-8000A/B	2	7		
Less	60. Low Pressure	60.1. Desired operating condition							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (9) Sales Gas
 Drawings: IN-BRM-012-80005
 IN-BRM-012-80010
 Parameter: Level

Revision:

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	61. Higher Level	61.1. See High Pressure this node							
Less	62. Low Level	62.1. Desired operating condition							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	63. More Flow	63.1. See High Pressure this node							
Less	64. Low Flow	64.1. Plugged Mist pad on V-9400	64.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-9400 set @ 125 psig PAHH-9400 set @ 100 psig, shuts PV-9400	2	7		
		64.2. Plugged flame arrestors on FL-9700	64.2.1. See above	5	PSV-9700 set @ XXX PAHH-9610 set @ XXX, shuts PV-9610	3	8		
		64.3. Less gas	64.3.1. Excessive smoking combustor, equipment damage, NOV	3	PALL-9610 set @ XXX, shuts PV-9610	3	6		
		64.4. Loss of pilot / flame	64.4.1. Cold venting, equipment damage, potential ignition, possible personnel injury	5	XC-9610C (flame detection), shuts in PV-9610, shuts XV-9610/A	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: Temperature

Intention: MAOT = 200F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	65. Higher Temperature	65.1. External Fire (V-9400)	65.1.1. Equipment damage, loss containment, possible personnel injury	5	PSV-9400 set @ 125 psig PAHH-9400 set @ 100 psig, shuts PV-9400	2	7		
		65.2. External Fire (V-9700)	65.2.1. See above	5	PSV-9700 set @ XXX PAHH-9610 set @ XXX, shuts PV-9610	3	8		
Less	66. Low Temperature	66.1. Low ambient	66.1.1. Drain lines freeze, equipment damage, loss containment, potential ignition, possible personnel injury	5	Heat trace and insulation	2	7		
			66.1.2. Freeze in V-9400/9700, equipment damage, loss containment, potential ignition, possible personnel injury	5	Heat trace and insulation	1	6		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: Pressure

Intention: MAOP = 125 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	67. Higher Pressure	67.1. PV-9400 malfunctions open	67.1.1. Equipment damage, loss containment, potential ignition, possible personnel injury	5	PSV-9400 set @ 125 psig PCV-9610 set @ XXX (BMS controls) XV-9610/A set @ XXX (BMS controls) LAHH-9400 set @ XXX, shut PV-9400	3	8		73. Consider adding HH to PI-9400 set @ 100 psig, shut PV-9400
		67.2. PV-9610 malfunctions open	67.2.1. See above	5	PSV-9700 set @ XXX LAHH-9700 set @ XXX, shut in V-9600 TAHH-9610 set @ XXX, shut in V-9600	3	8		74. Verify flow barrier (tips) of FL-9700
		67.3. Discharge BV (V-9400) inadvertently closed, LV-9400 malfunctions closed	67.3.1. See above	5	PSV-9400 set @ 125 psig LAHH-9400 set @ XXX, shut PV-9400 PCV-9610 set @ XXX (BMS controls) XV-9610/A set @ XXX (BMS controls)	3	8		75. Consider adding HH to PI-9400 set @ 100 psig, shut PV-9400
		67.4. Discharge BV (V-9700) inadvertently closed	67.4.1. See above	5	PSV-9700 set @ XXX LAHH-9700 set @ XXX, shut in V-9600 TAHH-9610 set @ XXX, shut in V-9600	3	8		76. Verify flow barrier (tips) of FL-9700

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: Pressure

Intention: MAOP = 125 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	67. Higher Pressure (cont.)	67.4. Discharge BV (V-9700) inadvertently closed (cont.)	67.4.1. See above (cont.)		PAHH-9610 set @ XXX, shut PV-9610				76. Verify flow barrier (tips) of FL-9700 (cont.)
Less	68. Low Pressure	68.1. Desired operating condition							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	69. Higher Level	69.1. See High Pressure this node							
Less	70. Low Level	70.1. See Low Pressure this node							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (10) Fuel Gas
 Drawings: IN-BRM-012-94000
 IN-BRM-012-96005
 IN-BRM-012-96010

Revision:

Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If	71. What If What If	71.1. Forced air fan malfunctions	71.1.1. Incomplete combustion, NOV	3	No safeguards available	5	8		77. Verify fan shutdown shutdowns pilot flow XV-9610/A

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (11) Instrument Air
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65005
 IN-BRM-012-80005
 IN-BRM-012-95000
 IN-BRM-012-95005
 IN-BRM-012-95006
 IN-BRM-012-96010

Revision:

Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	72. What If	72.1. Manual BV inadvertently closed, PDI-9510A/15A plugged 72.2. Manual BV inadvertently closed, PDI-9510B/15B plugged 72.3. C-9500/05 fail to operate 72.4. Manual BV (drain valves) on V-9520 inadvertently closed, loss of D-9510/15 72.5. Overfilling of oil reservoir 72.6. PCV-9530 malfunctions closed	72.1.1. ESD facility, loss production, AOI 72.2.1. See above 72.3.1. See above 72.4.1. Send water into instrument air system, AOI 72.4.2. Freeze, possible SD malfunctions, equipment damage, loss containment, possible ignition, possible personnel injury 72.5.1. Oil carryover, AOI 72.6.1. ESD facility, loss production, AOI	5	Low point drain valves throughout the system Redundant SDV's Dewpoint of -40F Low point drain valves throughout the system Redundant drier systems TC-9530 set @ 90F	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (11) Instrument Air
 Drawings: IN-BRM-012-10000
 IN-BRM-012-20000
 IN-BRM-012-35005
 IN-BRM-012-50000
 IN-BRM-012-50005
 IN-BRM-012-50010
 IN-BRM-012-65005
 IN-BRM-012-80005
 IN-BRM-012-95000
 IN-BRM-012-95005
 IN-BRM-012-95006
 IN-BRM-012-96010

Revision:

Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More (cont.)	72. What If (cont.)	72.7. PCV-9530 malfunctions open	72.7.1. Line rupture, ESD facility, loss production, AOI						78. Consider adding HH on PIT-9530 set @ 125 psig, PSD facility
		72.8. H-9530 fails to start	72.8.1. Freeze in drain lines / electronics fails to operate, AOI						79. Consider adding LL on PIT-9530 set @ 40 psig, PSD facility

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Drawings: IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Flow

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	73. More Flow	73.1. FY-65xx malfunctions open, gas lift valves washout	73.1.1. AOI						
Less	74. No/Low Flow	74.1. Paraffin buildup, hydrate, FY-65xx malfunctions closed	74.1.1. See High Pressure this node						

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Drawings: IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Temperature

Intention: MAOT = 200F

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	75. Higher Temperature	75.1. Heater fails to stop	75.1.1. Equipment damage, AOI		LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression				80. Confirm building ventilation
Less	76. Low Temperature	76.1. Low Ambient	76.1.1. Hydrate, loss containment, potential ignition, possible personnel injury	5	Methanol injection	3	8		81. Consider installing knockout upstream of MR-6506
					PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500				
			PSV-6505 set @ 1440 psig						
		76.2. Heater fails to operate	76.2.1. See above	5	Methanol injection	2	7		
		76.3. JT Effect across PCV-XXX (gas to building heater), FY-65xx (control valves), orifice	76.3.1. See above	5	Methanol injection	2	7		82. Confirm building ventilation
				PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500					
					PSV-6505 set @ 1440 psig				
					Electrical rating of heater				
					LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression				

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Drawings: IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Pressure

Intention: MAOP = 1440 psig

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	77. Higher Pressure	77.1. C-6505 fails to stop	77.1.1. Overpressure, loss containment, potential ignition, possible personnel injury	5	PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500 PSV-6505 set @ 1440 psig PAHH-10xxC set @ 1300 psig, shut FY-65xx	2	7		
		77.2. Discharge BV inadvertently closed, FY-65xx malfunctions closed	77.2.1. See above	5	PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500 PSV-6505 set @ 1440 psig	2	7		
		77.3. High pressure gas to building heater for fuel, PCV-XXX malfunctions	77.3.1. See above	5	LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression Internal controller on the burner	2	7	83. Confirm internal controllers pressure rating on the burner	
Less	78. Low Pressure	78.1. C-6505 fails to operate	78.1.1. Loss of production, AOI						
		78.2. Corrosion/flange leak	78.2.1. Loss containment, potential ignition, possible personnel injury	5	LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression Internal compressor shut downs	2	7	84. Confirm building ventilation	

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (12) Gas Lift Meter Building
 Drawings: IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: Level

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
More	79. Higher Level	79.1. NSC							
Less	80. Low Level	80.1. NSC							

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Drawings: IN-BRM-012-65007
 IN-BRM-012-65008
 IN-BRM-012-65009
 IN-BRM-012-65010

Revision:

Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If	81. What If What If	81.1. Blowdown inadvertently left open	81.1.1. Gas blowby, loss containment, potential ignition, possible personnel injury	5	LEL set @ 10% 60 secs, 20% instant, PSD the facility, shuts down compression Redundant valving and plugs	2	7		85. Confirm building ventilation

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If
 Drawings:
 Parameter: What If

Revision:

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If	82. PSV's	82.1. Inaccurate sizing	82.1.1. Equipment damage, possible loss containment, potential for ignition, possible personnel injury	5	No safeguards are available	4	9		86. Verify PSV sizing and calculations
	83. Hot oiling	83.1. Parrafin build-up	83.1.1. Over pressure / over temperature, equipment damage, loss containment, potential ignition, possible personnel injury	5	See previous vessel shutdowns	2	7		87. Develop SOP for hot oiling with hot work permits
	84. PCV	84.1. Improper rating	84.1.1. Equipment damage, AOI						88. Confirm all PCV's are rated for above 125 psig
	85. Shutdowns	85.1. Inaccurate setpoints and endpoint functionality	85.1.1. See above	5	No safeguards are available	4	9		89. Confirm setpoint and endpoint functionality for all shutdowns
	86. Vendor P&ID's	86.1. See above	86.1.1. See above	5	See above	4	9		90. Update P&ID's with vendor P&ID's
	87. C&E	87.1. See above	87.1.1. See above	5	See above	4	9		91. Update C&E
	88. Composition	88.1. Oxygen contamination of inlet gas or during startup, inadequate purge	88.1.1. Equipment damage, possible loss containment, potential for ignition, possible explosion, possible personnel injury, potential downtime	5	Portable O2 analyzer	2	7		92. Consider adding an O2 analyzer on sales gas
	89. Vegetation Fire	89.1. Lightning strike, external forces	89.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	Grounding grid Vegetation Control Various LEL's & Fire eyes Equipment spacing	1	6		
	90. Excessive Piping Corrosion	90.1. CUI (corrosion under insulation)	90.1.1. Same as above	5	MI program	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If

Revision:

Drawings:
 Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If (cont.)	90. Excessive Piping Corrosion (cont.)	90.1. CUI (corrosion under insulation) (cont.)	90.1.1. Same as above (cont.)		Coated systems (vessels and water line)				
	91. Gas Buildup in Buildings	91.1. Leak in building	91.1.1. Fire, loss containment, possible personnel injury	5	Various LEL's See safeguards in other nodes	2	7		
	92. Block valve under PSV left closed	92.1. Maintenance	92.1.1. Overpressure equipment, possible loss containment, vapor cloud	5	Car seal Program Verified during PSSR	2	7		
	93. Public Impact from Worst Case Release	93.1. Overpressure of process vessels / storage tanks	93.1.1. Overpressure equipment, possible loss containment, vapor cloud	5	See Node 1	1	6		
	94. Inclement weather	94.1. Lightning	94.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	Grounding grid	2	7		
								94.2. Excessive rain/snow melt	94.2.1. Equipment damage, possible loss containment
	95. External Impact	95.1. Vehicle strike	95.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	Bollards Equipment spacing and location	2	7		
96. Manual ESD Failure	96.1. Equipment malfunction	96.1.1. Facility fails to shutdown	5	Fail closed positions ESD redundancy	1	6			

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If

Revision:

Drawings:
 Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If (cont.)	96. Manual ESD Failure (cont.)	96.1. Equipment malfunction (cont.)	96.1.1. Facility fails to shutdown (cont.)		Remote ESD capability Block and Hold Quarterly ESD testing Annual ESD PM				
	97. Inadequate Equipment Grounding	97.1. Equipment not grounded	97.1.1. Potential flash fire, shock, potential equipment damage, possible personal injury	5	Equipment grounding verified during PSSR Quarterly checks Grounding straps on buckets	1	6		
	98. Excess Air Emissions	98.1. Leaks	98.1.1. Fire, potential fire	5	LDAR program AVO program	2	7		
	99. Installation	99.1. Improperly installed isolation flange	99.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	Torque specs, logs, sheets PM program (pump skids) Verified during PSSR	1	6		
	100. High Temperature	100.1. High ambient, motor malfunctions	100.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury 100.1.2. Personnel injury from contact burn from piping	2	See safeguards in other nodes Warning labels	3	5		
101. Low Temperature	101.1. Sight glass freezes, breaks	101.1.1. Sight glass freezes, breaks	101.1.1. Equipment damage, loss containment, possible personnel injury	5	Various LL shutdowns Seat ball on sight glass Sight glass cage/guards	2	7		

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If

Revision:

Drawings:
 Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If (cont.)	102. Human Factor	102.1. Truck driver driving away while connected	102.1.1. Equipment damage, loss containment	3	No safeguards available	3	6		
		102.2. Truck driver fails to connect to vent line	102.2.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	LEL around various equipment	2	7		
	103. Arc Flash	103.1. Electrical Equipment failure/Maintenance	103.1.1. Equipment damage, potential fire, possible personnel injury	5	Quarterly PM's	2	7		
					PSSR ARC flash study Equipment warning labels				
	104. Hydrates	104.1. Hydrate Plug	104.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	See safeguards in other nodes				
	105. Chemical exposure	105.1. Employee Exposure to Hazardous substance	105.1.1. Possible personnel injury	5	PPE	2	7		
	106. Community/Employee Relations	106.1. Vandalism, Trespassing	106.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury	5	Various LEL's and Fire eyes	2	7		
					Cameras Remote ESD capability Manned 24/7				
	106.2. Cyber Attack	106.2.1. See above	5	Network security	1	6			
107. H2S inlet	107.1. Tainted well	107.1.1. Increased corrosion, personnel exposure, potential equipment damage, possible loss of containment, potential ignition, possible personal...	5	Chemical treatment program Annual flow line tests 4 Gas monitoring	1	6			

HAZOP Worksheet

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If

Revision:

Drawings:
 Parameter: What If

Intention:

GW	DEVIATION	CAUSES	CONSEQUENCES	S	SAFEGUARDS	L	R	REF#	RECOMMENDATIONS
What If (cont.)	107. H2S inlet (cont.)	107.1. Tainted well (cont.)	...injury		Internal line coating Gas Sampling program				

STATEMENT OF QUALIFICATIONS

Dawn Keeler maintains a Professional Engineering, PEng., status in Alberta, Canada and is a board-certified Certified Safety Professional, CSP. She holds a bachelors' degree in Chemical Engineering and a Masters' degree in Applied Occupational Health.

Dawn has 10 years' experience in completions and drilling, and since 2017 she has been very active in the midstream industry, including scribing and facilitating under supervision for a variety of midstream facilities.

This is to certify that

Dann Keeler

has completed a special concentrated course on

Process Hazard Analysis Leadership

May 20 - 23, 2019

This 4-day course is approved for 2.6 Continuing Education Units



Donald K. Lorenzo
Director, Training Solutions



Extraction Oil & Gas: Interchange Wellpad (tankless)

Session 1: April 8, 2019 *Greg Grande - Scribe - 12/15*

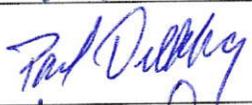
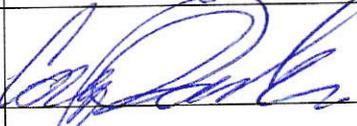
Printed Name	Signature	Role	Years Exp.
<i>Greg Grande</i>	<i>[Signature]</i>	Foreman	7
Bill Commette	<i>Bill Commette</i>	Foreman	11
Catie Nelson	<i>Catie Nelson</i>	AIR	6
Mike Mason	<i>[Signature]</i>	Foreman	25
Sam Ellis	<i>Sam Ellis</i>	Automation	11
Boyer Walker	<i>[Signature]</i>	Automation	6
<i>STEPHEN WILSON</i>	<i>[Signature]</i>	Foreman	8
BART HARTMAN	<i>[Signature]</i>	OPS MANAGER	31
Darrel Bothwell	<i>Darrel Bothwell</i>	Supervisor	21
Daren Plenzig	<i>Daren Plenzig</i>	Foreman	26
Zach Pefermann	<i>[Signature]</i>	Supervisor	14
Dean Margvart	<i>Dean Margvart</i>	Process Safety Engineer	25
Luke Kunze	<i>[Signature]</i>	Supervisor	12
Paul Dillehay	<i>Paul Dillehay</i>	LEAD	6

Steve Greene	<i>[Signature]</i>	Engineer	12
Ivan Steinke	<i>[Signature]</i>	Safety	10
Dwight Ross	<i>[Signature]</i>	Electrical	30
Todd Ochsom	<i>[Signature]</i>	Measurement	13
Stephen Anson	<i>[Signature]</i>	Measurement	19

BOND BASAMONTE		Supervisor	12
Cody Russell		Safety	5
Ken Clark		Const.	2
Keeler, Dean		Solicitor	2

Extraction Oil & Gas: Interchange Wellpad (tankless)

Session 2: April 9, 2019

Printed Name	Signature	Role	Years Exp.
Dean Marquart		Process Safety Engineer	25
Blayne Walker		Automation	6
Mike Mason		Foreman	25
Sam Ellis		Automation	11
STEPHEN WALKER		Foreman	8
Darrel Bothwell		Supervisor	21
Cody Russell		Safety	5
Todd Ochsner	Todd Ochsner	Measurement	13
Paul Dillhoff		Lead	4
Ivan Steinke		safety	10
Coop Powell		Foreman	7
Bill Comette		Foreman	11
Catie Nelson	Catie Nelson	APIR	6
Steve Greene		Engineer	12

Chris Schwappach		Engineer	41
Chris Covelli		Foreman	27
Dwight Ross		Electrical	30
Daren Plenzig		Foreman	26

Grog Grande 12 Scribe
dawn Keeler 2 Facilitator

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Parameter: Flow

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
1. More Flow	7		1. Review erosion velocity calculations			
			2. Consider closing PV-10xx on LAHH-10xx			
	7		3. Consider closing PV-10xx on LAHH-22xx			

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Parameter: Temperature

Revision:

Intention: MAWT= 300F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
3. Higher Temperature	8		4. Verify setpoint of TAHH-20xxA/B			
			5. Verify endpoint functionality of TAHH-20xxA			
	8		6. Consider installing HH on TIT-20xxB, to shut down TV-21xx			
	9		7. Consider adding V-20xx to maintenance schedule for sand cleanouts			
			8. Consider increasing wall thickness of the fire tube			
4. Lower Temperature			9. External coating of the fire tube			
	7		10. Consider installing UNI freeze proof valves on drain lines			
	7		11. Consider placement of choke (upstream vs downstream of coil pack)			
	7		12. Revisit fuel gas system on separator			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (1) Produced Gas / Liquids
 Parameter: Pressure

Revision:

Intention: ANSI 1500 psig Well head, 500 psig Separator V-20xx

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
5. Higher Pressure	8		13. Consider closing PV-10xx on LAHH-10xx			
			14. Consider closing PV-10xx on PAHH-10xx			
	8		15. Consider changing setpoint to 400 psig on PAHH-8005A			
	7		16. Verify PSV-20xxA, sized for coil leak (full flow)			
			17. Consider closing PV-10xx on PAHH-10xx			
	7		18. Consider closing PV-10xx on LAHH-10xx			
			19. Consider closing PV-10xx on PAHH-10xx			
	8		20. Consider installing double check valve philosophy			
			21. Verify adequate pressure rating on check valves			
	7		22. Consider adjusting setpoint to 3200 psig on PAHH-10xxB			
6. Low Pressure	8		23. Consider closing PV-10xx on LAHH-10xx			
			24. Consider closing PV-10xx on PAHH-10xx			
			25. Verify PAHH-10xxA exists and verify endpoint functionality			
	4		26. Verify V-20xx is rated for vacuum			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Parameter: Temperature

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
12. Higher Temperature	8		27. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility			
13. Low Temperature	7		28. Consider installing UNI freeze proof valves on drain lines			

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Parameter: Pressure

Revision:

Intention: MAOP= 250 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
14. Higher Pressure	8		29. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility			
	8		30. Consider moving PIT-3000 to V-3000 and adding HH shutdown set @ XXX psig, to PSD facility			
			31. Consider installing redundant strainer			
15. Low Pressure	8		32. Program logic on PI-3000 to throttle PV-20xxA			
	8		33. Consider installing spring loaded valve on drain lines			
	8		34. Consider adding a LL on PI-3000A set @ XXX, PSD facility			
	8		35. Verify V-3000 is rated for vacuum			
			36. Consider adding a LL on PI-3000A set @ XXX, PSD facility			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (2) Produced Oil
 Parameter: Level

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
16. Higher Level	8		37. Consider installing SDV on inlet of V-3000 to shut on all PSD's			
			38. Program logic on LIT-3000 to throttle PV-20xxA			
	8		39. See above			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Parameter: Temperature

Revision:
 Intention: MAWT = 185F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
21. Higher Temperature	8		40. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility			
			41. Consider adding TAH on FIT-4000 set @ XXX (to be done by Elevation)			
22. Low Temperature	7		42. Consider installing UNI freeze proof valves on drain lines			

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Parameter: Pressure

Revision:
 Intention: MAOP= 250 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
23. Higher Pressure	8		43. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility			
	8		44. Consider moving PIT-4000 to V-4000 and adding HH shutdown set @ XXX psig, to PSD facility			
			45. Consider installing redundant strainer			
			46. Program logic on PI-4000 to throttle PV-20xxA			
24. Low Pressure	8		47. Consider installing spring loaded valve on drain lines			
			48. Consider adding a LL on PI-4000A set @ XXX, PSD facility			
	8		49. Verify V-4000 is rated for vacuum			
			50. Consider adding a LL on PI-4000A set @ XXX, PSD facility			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (3) Produced Water
 Parameter: Level

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
25. Higher Level	8		51. Consider installing SDV on inlet of V-4000 to shut on all PSD's			
			52. Program logic on LIT-4000 to throttle PV-20xxA			
	8		53. See above			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Parameter: Temperature

Revision:
 Intention: MAWT = 200F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
30. Low Temperature	7		54. Consider installing UNI freeze proof valves on drain lines			

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Parameter: Pressure

Revision:
 Intention: MAOP = 250 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
31. Higher Pressure	8		55. Consider installing a SDV-9601 on the inlet to shut when PAHH-9600, LAHH-9600, LAHH-9610 are activated and confirm all piping and valves upstream are ANSI 1500 on well head bypass			
			56. Consider installing a SDV-9600 on the inlet to shut when PAHH-9600, LAHH-9600, LAHH-9610 are activated and confirm all piping and valves upstream are ANSI 300 on drain lines			
			57. Verify CV values with burner capacity on the SDV valves			
			58. Confirm capacities of maintenance vessel system (well unloading)			
	8		59. Consider installing PCV's upstream of P-9605/10			
	8		60. Consider installing pressure protection on P-9605/10			
33. Negative Pressure	7		61. Verify V-9600 is rated for half vacuum			

Session: (1) 4/8/2019
 Node: (4) Hydrocarbon Liquids
 Parameter: Level

Revision:
 Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
34. Higher Level	7		62. Consider placement of LSHH-9600/10 to prevent paraffin build-up			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (5) Flash Gas Compressor
 Parameter: Flow

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
38. Misdirected Flow	7		63. Revisit blowdown procedures 64. Consider installing Oxygen Analyzer on sales gas line			

Session: (1) 4/8/2019
 Node: (5) Flash Gas Compressor
 Parameter: Temperature

Revision:

Intention: MAOT = 250F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
39. Higher Temperature	7		65. Update P&ID's to include Fire Eyes and LEL's 66. Verify temperature requirements for gas sales			
40. Low Temperature	7		67. Consider replacing drain valve with UNI freeze proof valves and on V-5000/5100			

Session: (2) 4/9/2019
 Node: (5) Flash Gas Compressor
 Parameter: Pressure

Revision:

Intention: MAOP = 250 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
41. Higher Pressure	8		68. Consider installing PSV (typical) off of compressor discharge after double check valve, Line 2-PG-5012-BCCA			
42. Low Pressure			69. Verify V-3000/4000 rated for vacuum 70. Consider adding PSD facility to shut XV-5000			

HAZOP Recommendations

Company: Extraction Oil & Gas
Facility: ACM Highpoint Project

Session: (1) 4/8/2019
Node: (8) Gas Lift
Parameter: Temperature

Revision:

Intention: MAOT = 250F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
49. Higher Temperature	8		71. Verify sales gas pipeline spec temperature			

HAZOP Recommendations

Company: Extraction Oil & Gas
Facility: ACM Highpoint Project

Session: (2) 4/9/2019
Node: (9) Sales Gas
Parameter: Temperature

Revision:

Intention: MAOT = 200F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
57. Higher Temperature	8		72. Verify sales gas pipeline spec temperature			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (10) Fuel Gas
 Parameter: Pressure

Revision:
 Intention: MAOP = 125 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
67. Higher Pressure	8		73. Consider adding HH to PI-9400 set @ 100 psig, shut PV-9400			
	8		74. Verify flow barrier (tips) of FL-9700			
	8		75. Consider adding HH to PI-9400 set @ 100 psig, shut PV-9400			
	8		76. Verify flow barrier (tips) of FL-9700			

Session: (2) 4/9/2019
 Node: (10) Fuel Gas
 Parameter: What If

Revision:
 Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
71. What If What If	8		77. Verify fan shutdown shutdowns pilot flow XV-9610/A			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (1) 4/8/2019
 Node: (11) Instrument Air
 Parameter: What If

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
72. What If			78. Consider adding HH on PIT-9530 set @ 125 psig, PSD facility 79. Consider adding LL on PIT-9530 set @ 40 psig, PSD facility			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Parameter: Temperature

Revision:
 Intention: MAOT = 200F

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
75. Higher Temperature			80. Confirm building ventilation			
76. Low Temperature	8		81. Consider installing knockout upstream of MR-6506			
	7		82. Confirm building ventilation			

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Parameter: Pressure

Revision:
 Intention: MAOP = 1440 psig

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
77. Higher Pressure	7		83. Confirm internal controllers pressure rating on the burner			
78. Low Pressure	7		84. Confirm building ventilation			

Session: (2) 4/9/2019
 Node: (12) Gas Lift Meter Building
 Parameter: What If

Revision:
 Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
81. What If What If	7		85. Confirm building ventilation			

HAZOP Recommendations

Company: Extraction Oil & Gas
 Facility: ACM Highpoint Project

Session: (2) 4/9/2019
 Node: (13) Global What If
 Parameter: What If

Revision:

Intention:

DEVIATION	R	REF#	RECOMMENDATIONS	BY	END	COMMENTS
82. PSV's	9		86. Verify PSV sizing and calculations			
83. Hot oiling	7		87. Develop SOP for hot oiling with hot work permits			
84. PCV			88. Confirm all PCV's are rated for above 125 psig			
85. Shutdowns	9		89. Confirm setpoint and endpoint functionality for all shutdowns			
86. Vendor P&ID's	9		90. Update P&ID's with vendor P&ID's			
87. C&E	9		91. Update C&E			
88. Composition	7		92. Consider adding an O2 analyzer on sales gas			

EXTRACTION

Oil & Gas

How to hook up flowback

EXTRACTION INTERCHANGE WELLPAD DESIGN ISSUED FOR CONSTRUCTION

03/28/18

PROCESS DRAWINGS

DWG. NO.	DRAWING TITLE	REV
IN-BRM-012-00000	DRAWING LIST	0
IN-BRM-012-00001	VALVE AND INLINE SYMBOLS LEGEND	0
IN-BRM-012-00002	NAMING AND IDENTIFICATION SCHEDULES	0
IN-BRM-012-00003	EQUIPMENT SYMBOLS LEGEND	0
IN-BRM-012-10000	WELLHEADS (TYP.)	0
IN-BRM-012-20000	HP SEPARATOR SKID (TYP.)	0
IN-BRM-012-30000	PRODUCED OIL HEADER	0
IN-BRM-012-30005	PRODUCED OIL SURGE DRUM	0
IN-BRM-012-35000	PRODUCED OIL TO PIPELINE	0
IN-BRM-012-35005	SAMPLING AND METERING BUILDING	0
IN-BRM-012-40000	PRODUCED WATER HEADER	0
IN-BRM-012-40005	PRODUCED WATER SURGE DRUM	0
IN-BRM-012-45000	PRODUCED WATER TO PIPELINE	0
IN-BRM-012-50000	FLASH GAS COMPRESSION	0
IN-BRM-012-50005	FLASH GAS COMPRESSION	0
IN-BRM-012-50010	FLASH GAS COMPRESSION	0
IN-BRM-012-65000	GAS LIFT SUCTION SCRUBBER	0
IN-BRM-012-65005	GAS LIFT COMPRESSION	0
IN-BRM-012-65006	GAS LIFT HEADER	0
IN-BRM-012-65007	GAS LIFT METER BUILDING 01	0
IN-BRM-012-65008	GAS LIFT METER BUILDING 02	0
IN-BRM-012-65009	GAS LIFT METER BUILDING 03	0
IN-BRM-012-65010	GAS LIFT METER BUILDING 04	0
IN-BRM-012-65050	COMPRESSOR DRAIN TANK	0
IN-BRM-012-80000	SALES GAS HEADER	0
IN-BRM-012-80005	SALES GAS COMPRESSION (FUTURE)	0
IN-BRM-012-80010	SALES GAS HEADER (CONT'D)	0
IN-BRM-012-80015	SALES GAS TO PIPELINE	0
IN-BRM-012-94000	FUEL GAS SCRUBBER	0
IN-BRM-012-95000	INSTRUMENT AIR SKID	0
IN-BRM-012-95005	INSTRUMENT AIR DISTRIBUTION HEADER	0
IN-BRM-012-95006	INSTRUMENT AIR WELLHEAD DISTRIBUTION HEADER	0
IN-BRM-012-96000	MAINTENANCE HEADER (HIGH PRESSURE)	0
IN-BRM-012-96001	MAINTENANCE HEADER (MEDIUM PRESSURE)	0
IN-BRM-012-96005	MAINTENANCE VESSEL	0
IN-BRM-012-96010	EMISSION CONTROL DEVICE (ECD)	0

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NOTES:
1.

REV	DESCRIPTION	MRA BY	DATE	DMA CHK BY	DATE	GAD APR BY	DATE
0	ISSUED FOR CONSTRUCTION		03/28/18		03/28/18		03/28/18

REVISIONS				APPROVALS		
NO.	DATE	BY	DESCRIPTION	SIGNATURE	DATE	DATE

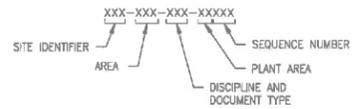
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ENGINEERING SERVICES, LLC

EXTRACTION
O&G

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
DRAWING LIST

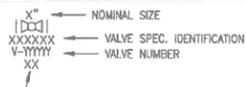
SCALE: NTS
DRAWING NO. IN-BRM-012-00000
REV. 0

DRAWING NUMBER



VALVE INFORMATION

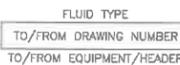
VALVE SPECIFICATION IDENTIFICATION (NON-INSTRUMENT)



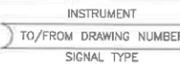
1ST	TYPE	2ND	PRESSURE CLASS	3RD	BODY MATERIAL	4TH	TRIM/SEAT MATERIAL	5TH	END CONNECTION	6TH	PORT/OPERATOR
A		A	CLASS 150	A		A		A		A	
B	FLOATING BALL	B	CLASS 300	B	IMPACT TESTED CS	B	316 SS/HF	B	BUTT WELD BOTH ENDS	B	
C	CHECK, PISTON	C	CLASS 400	C	CARBON STEEL	C		C	BUTT WELD X FLANGED RF	C	
D		D	CLASS 600	D		D		D	BUTT WELD X FLANGED RJ	D	
E	EXPANDING GATE	E	CLASS 900	E		E	NATURAL RUBBER	E		E	
F	BUTTERFLY	F	CLASS 1500	F		F	FEP	F	FLAT FACE FLANGED	F	FULL PORT, LEVER / HAND WHEEL
G	GATE	G	CLASS 2500	G		G	GRAPHITE	G		G	FULL PORT, GEAR
H	THRU CONDUIT GATE	H	API 2000	H		H	URETHANE RUBBER	H		H	FULL PORT, BARE STEM
J		J	API 3000	J		J	BUNA-N	J	RING JOINT FLANGED	J	
K	KNIFE GATE	K	API 5000	K		K	KEL-F	K	MALES SW X FEMAL TREADED	K	
L	GLOBE	L	API 10000	L	FBE LINED CS	L	ACETAL	L	FEMALES SW X FEMAL TREADED	L	
M	GAUGE, MULTI-PORT	M	API 15000	M		M	METAL/TUNG TEN CARBIDE	M	MALE TREADED BOTH ENDS	M	
N	NEEDLE	N	API 20000	N		N	NYLON	N	MALE THREADED X FEMALE TREADED	N	
P	PLUG	P	1000 PSIG CWP	P	HDPE	P	PEEK	P	MALE SW (BOTH ENDS)	P	
R		R	1500 PSIG CWP	R	RUBER LINED CS	R	REINFORCED PIPE	R	RAISED FACE FLANGED	R	REDUCED / STANDART PORT, LEVER / HAND WHEEL
S	CHECK, SWING	S	2000 PSIG CWP	S	316 SS	S		S	SOCKET WELD (BOTH ENDS)	S	REDUCED / STANDART PORT, GEAR
T	TRUNNION BALL	T	3000 PSIG CWP	T	304 SS	T	PTFE	T	FEMALE THREADED (BOTH ENDS)	T	REDUCED / STANDART PORT, BARE STEM
U		U	5000 PSIG CWP	U	316L SS	U	UHMWPE	U		U	UNIDIRECTIONAL, LEVER / HAND WHEEL
V		V	6000 PSIG CWP	V	304L SS	V	VITON	V		V	UNIDIRECTIONAL, GEAR
W	CHECK, WAFER	W	10000 PSIG CWP	W		W		W	HF/HF	W	UNIDIRECTIONAL, BARE STEM
Z	OPERATOR	Z	150 PSIG CWP						13CR/HF		
			300 PSIG CWP						316 SS		
			600 PSIG CWP								
			750 PSIG CWP								
			300 PSIG CWP								

CONTINUATION ARROWS

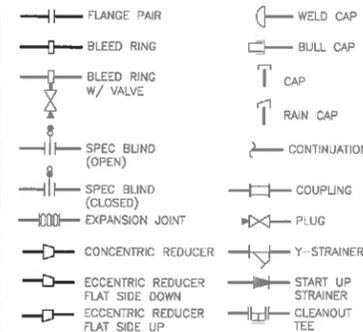
PROCESS CONTINUATION



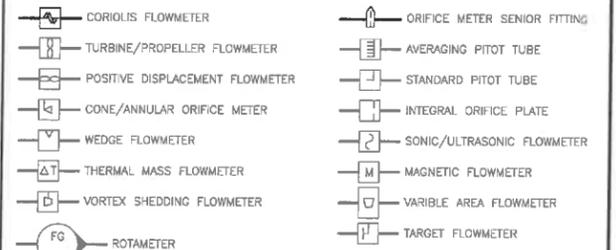
INSTRUMENTATION/ELECTRICAL CONTINUATION



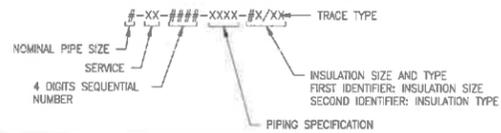
FITTING SYMBOLS



METER SYMBOLS



PROCESS LINE NUMBERING



SERVICE DESIGNATION CODES

SERVICE CODE	DESCRIPTION	SERVICE CODE	DESCRIPTION	SERVICE CODE	DESCRIPTION
AG	ACID GAS	HM	HEAT MEDIUM	PW	PRODUCED H ₂ O
AM	AMINE	IA	INSTRUMENT AIR	RA	RICH AMINE
BG	BLANKET GAS	IG	INSTRUMENT GAS	RG	REGEN GAS
CD	CLOSED DRAIN	JW	JACKET WATER	RGL	RICH GLYCOL
CO	CONDENSATE	LA	LEAN AMINE	SA	STARTING AIR
CW	COOLING WATER	LG	LEAN GLYCOL	SG	STARTING GAS
DW	DOMESTIC WATER	LO	LUBE OIL	TW	TREATED WATER
FL	FLARE	ME	METHANOL	UO	USED OIL
FG	FUEL GAS	NGL	NGL PRODUCT	VH	VENT HEADER
GL	GLYCOL	OD	OPEN DRAIN	VG	VENT GAS
HG	HYDROCARBON GAS	P	PROPANE	VL	VENT LIQUID
-	-	PF	PRODUCED FLUID	VT	VESSEL TRIM
HL	HYDROCARBON LIQUID	PG	PRODUCED GAS	WW	WASTE WATER
HO	HEAT MEDIUM OIL	PO	PRODUCED OIL	UA	UTILITY AIR

PIPING SPECIFICATION CODES

1ST	PRESSURE CLASS	2ND	MATERIAL	3RD	CORROSION ALLOWANCE	4TH	SERVICE / CODE
A	CLASS 150	A		A	0"	A	GENERAL PROCESS, SWEET, B31.3
B	CLASS 300	B	IMPACT TESTED CS	B	1/32"	B	GENERAL PROCESS, SOUR, B31.3
C	CLASS 400	C	CARBON STEEL	C	1/16"	C	GENERAL PROCESS, MECHANICAL CONNECTIONS, B31.3
D	CLASS 600	D		D	1/8"	D	HYDROCARBON LIQUID TRANSMISSION, B31.4
E	CLASS 900	E		E	1/16"	E	WATER LIQUID TRANSMISSION, B31.4
F	CLASS 1500	F		F	1/4"	F	HYDROCARBON GAS TRANSMISSION, SWEET, B31.8
G	CLASS 2500	G		G		G	HYDROCARBON GAS TRANSMISSION, SOUR, B31.8
H	API 2000	H		H		H	
I		I		I		I	
J	API 3000	J		J		J	
K	API 5000	K		K		K	AMINE, B31.3
L	API 10000	L	FBE LINED CS	L		L	LUBE OIL, B31.3
M	API 15000	M		M		M	
N	API 20000	N		N		N	
P		P	HDPE	P		P	POTABLE WATER, B31.3
Q		Q		Q		Q	
R		R	RUBER LINED CS	R		R	STEAM, PROCESS, B31.3
S		S	316 SS	S		S	STEAM, B31.1
T		T	304 SS	T		T	TUBING, B31.3
U		U	316L SS	U		U	UTILITIES, B31.3
V		V	304L SS	V		V	AIR, B31.3
W		W		W		W	WATER, B31.3

INSULATION TYPE

ABBREVIATION	DESCRIPTION
PP	PERSONAL PROTECTION
H	HEAT CONSERVATION
C	COLD CONSERVATION
FP	FREEZE PROTECTION

TRACING TYPE

ABBREVIATION	DESCRIPTION
ET	ELECTRIC TRACE
GT	GLYCOL TRACE
OT	OIL TRACE

CONTROL VALVE IDENTIFICATION

CODE	DESCRIPTION
FCV	FLOW CONTROL VALVE
PCV	PRESSURE CONTROL VALVE
TCV	TEMPERATURE CONTROL VALVE
SOV	SOLENOID OPERATED VALVE
XV	OPEN/CLOSED PROCESS VALVE
SDV	SHUTDOWN VALVE
BDV	BLOW DOWN VALVE (AUTOMATED)
KV	RIISING STEM BALL VALVE
LCV	LEVEL CONTROL VALVE

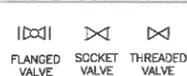
VALVE POSITION NOTATION

CODE	DESCRIPTION
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
LC	LOCKED CLOSED
LO	LOCKED OPEN
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN

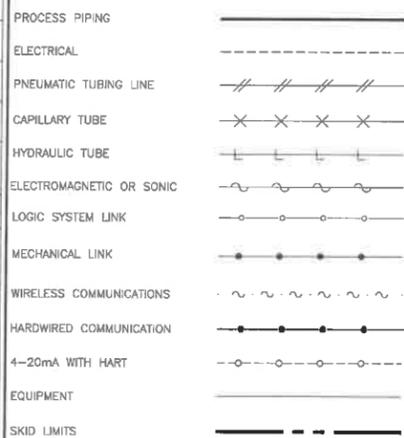
VALVE FAIL POSITION

NOTATION CODE	DESCRIPTION
FC	FAIL CLOSED
FO	FAIL OPEN
FZ	FAIL IN CURRENT POSITION

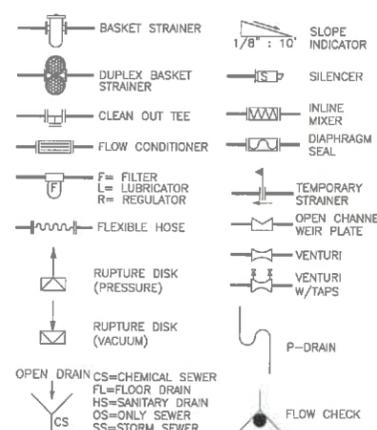
VALVE CONNECTION



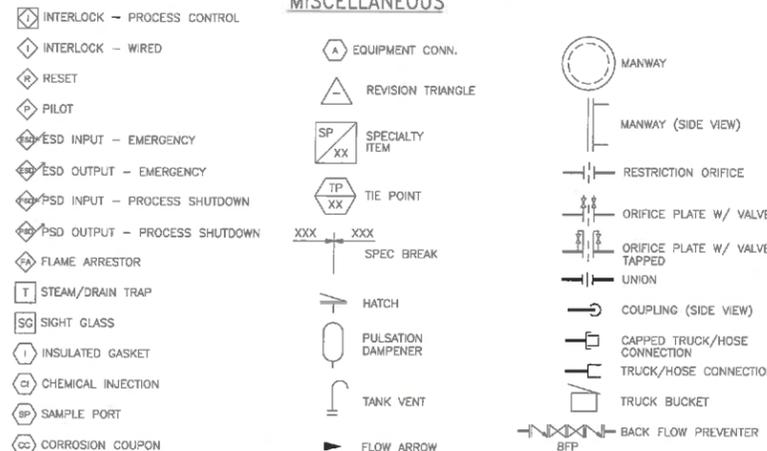
LINE TYPES



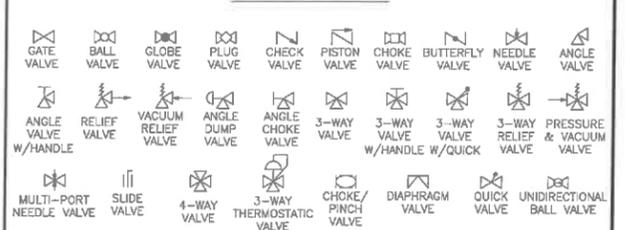
INLINE EQUIPMENT



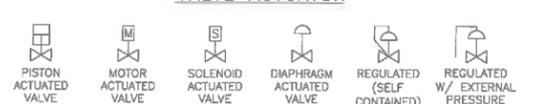
MISCELLANEOUS



VALVE SYMBOLS



VALVE ACTUATOR



NOTES:

REVISIONS

NO	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

APPROVALS

SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	



EXTRACTION

EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM VALVE AND INLINE SYMBOLS LEGEND

SCALE	DRAWING NO.	REV.
NTS	IN-BRM-012-00001	0

FILE PATH: P:\EXTRACTION 4 - XOG INTERCHANGE A & B WELLHEAD\PIPING\PAIDS\IN-SRU-012-0002.DWG BY:BRANJOCAR DATE:Mar 28, 2018 3:04pm

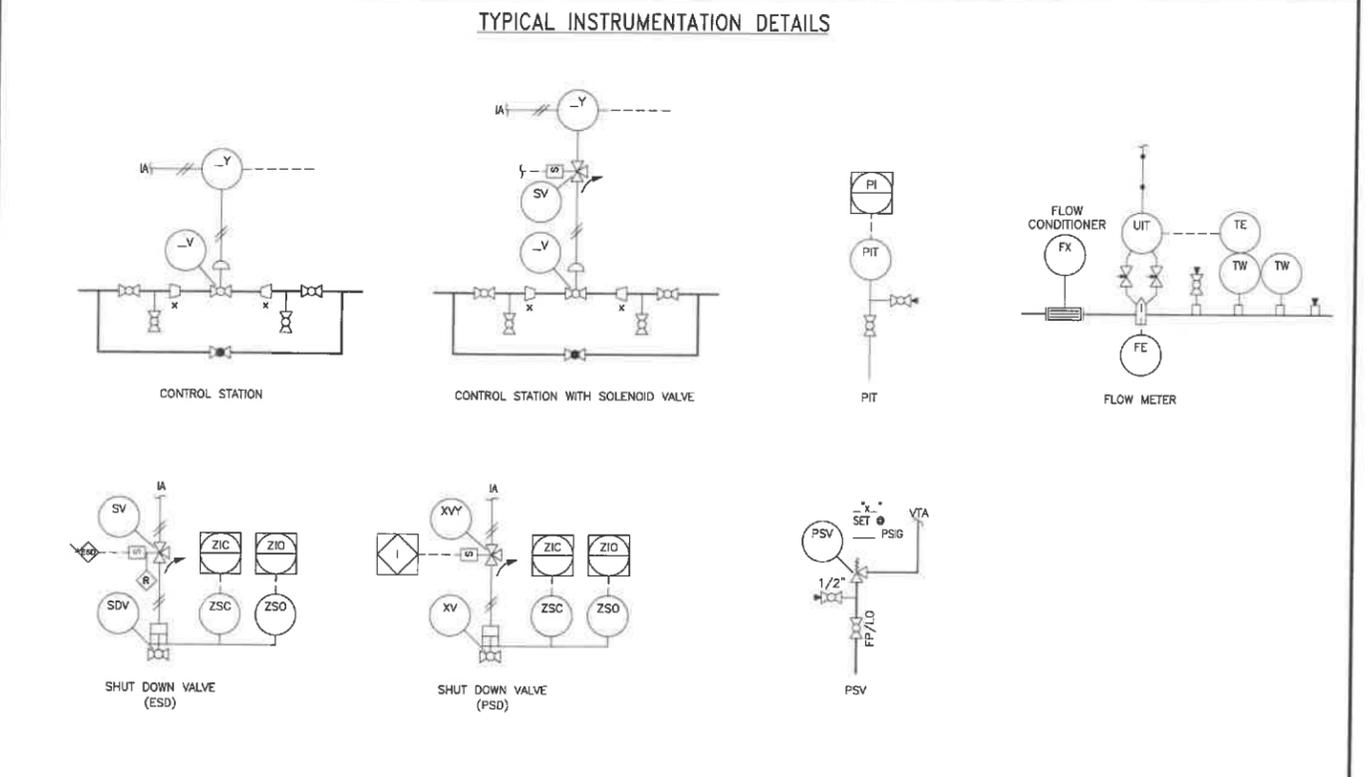
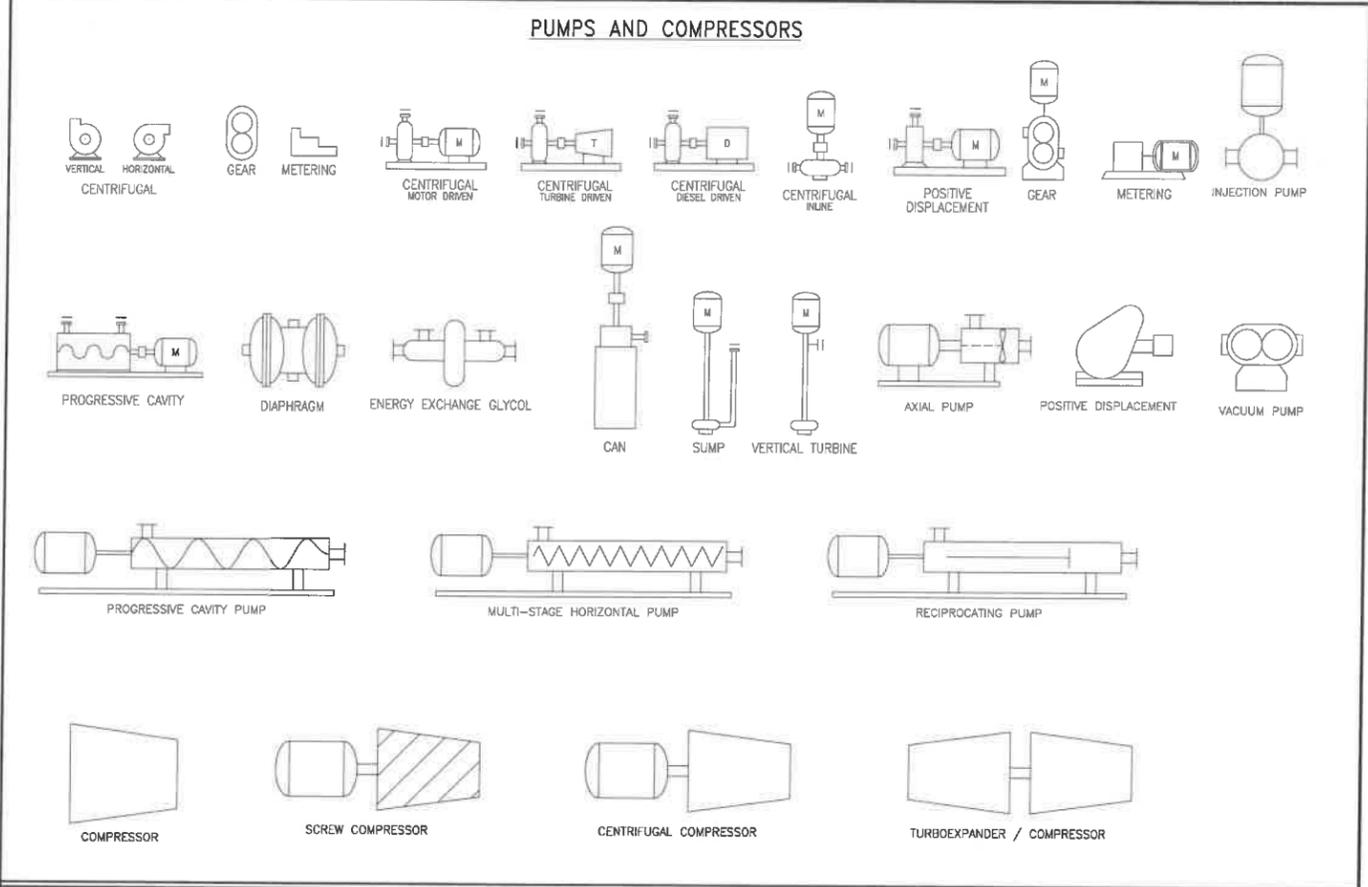
INSTRUMENT IDENTIFICATION																						
SYMBOL	FIRST LETTER	MEASURING DEVICES			CONTROLLING DEVICES			ALARMS		SWITCHES												
		I	IT	T	IC	C	CV	V	L	LL	H	HH	IS	S	SL	SLL	SH	SHH	Y	SO	SC	
	MEASURED OR INITIAL VARIABLE	READOUT (INDICATING)	TRANSMITTER (INDICATING)	TRANSMITTER (BLIND)	CONTROLLING (INDICATING)	CONTROLLERS (BLIND)	SELF CONTAIN. CONTROL VLV.	CONTROL VLV.	LOW LOW	HIGH HIGH	INDICATING	BLIND	LOW LOW	HIGH HIGH	RELAY	POSITION (OPEN)	POSITION (CLOSED)					
A	ANALYZER	AI	AIT	AT	AIC				AAL/AALL	AHH/AHHH	AIS	AS	ASL/ASLL	ASH/ASHH	AY							
B	BURNER, COMBUSTION	BI	BIT	BT	BIC	BC			BAL/BALL	BAH/BAHH	BIS	BS			BY							
D	DENSITY OR SPECIFIC GRAVITY	DI	DIT	DT	DIC	DC			DAL/DALL	DAH/DAHH	DIS	DS	DSL/DSLL	DSH/DSHH	DY							
E	ELECTRICAL VOLTAGE	EI	EIT	ET	EIC	EC			EAL/EALL	EAH/EAAHH	EIS	ES			EY							
F	FLOW	FI	FIT	FT	FIC	FC	FCV	FV	FAL/FALL	FAH/FAHH	FIS	FS	FSL/FSLL	FSH/FSHH	FY							
H	HAND INITIATED				HIC	HC		HV				HS			HY							
K	TIME OR TIME SCHEDULE	KI	KIT	KT	KIC	KC	KCV	KV	KAL/KALL	KAH/KAHH	KIS		KSL/KSLL	KSH/KSHH	KY							
L	LEVEL	LI	LIT	LT	LIC	LC	LCV	LV	LAL/LALL	LAH/LAAHH	LIS	LS	LSL/LSLL	LSH/LSHH	LY							
M	MOISTURE	MI	MIT	MT	MIC	MC			MAL/MALL	MAH/MAHH	MIS		MSL/MSLL	MSH/MSHH	MY							
P	PRESSURE OR VACUUM	PI	PIT	PT	PIC	PC	PCV	PV	PAL/PALL	PAH/PAHH	PIS		PSL/PSLL	PSH/PSHH	PY							
PD	PRESSURE DIFFERENTIAL	PDI	PDI	PDI	PDI	PDI			PDI/PDALL	PDH/PDAAHH			PDI/PDILL	PDH/PDHH								
S	SPEED OR FREQUENCY	SI	SIT	ST	SIC	SC			SAL/SALL	SAH/SAHH	SIS		SSL/SSLL	SSH/SSHH	SY							
T	TEMPERATURE	TI	TIT	TT	TIC	TC	TCV	TV	TAL/TALL	TAH/TAHH	TIS		TSL/TSLL	TSH/TSHH	TY							
U	MULTI-VARIABLE	UI	UIT	UT																		
V	VIBRATION	VI	VIT	VT	VIC	VC																
X	PROCESS SHUTDOWN*							XV														
Z	POSITION (**)	ZI, ZIO, ZIC	ZT	ZT		ZC						ZS								ZY	ZSO	ZSC

*OTHER POSSIBLE COMBINATIONS: XI: RUN INTERLOCK XS: RUN PERMISSIVE XA: RUN STATUS XY: SHUTDOWN SDV: SHUTDOWN VALVE PSV: PRESSURE SAFETY RELIEF VALVE

(**) NOTE: ZIO AND ZIC INDICATE FULLY OPEN/CLOSED

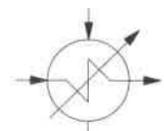
MISCELLANEOUS ABBREVIATIONS					
ABBREV	DESCRIPTION	ABBREV	DESCRIPTION	ABBREV	DESCRIPTION
AP	ABANDON IN PLACE	FP	FULL PORT	PSD	PROCESS SHUTDOWN
M	ABOVE GROUND/GRADE	FP	FREEZE PROTECTION	PP	PERSONNEL PROTECTION
ATM	ATMOSPHERE	HH	HAND HOLE	PQM	POWER QUALITY METER
AC	AIR TO CLOSE	HQA	HAND OFF AUTO	RF	RAISED FACE
AO	AIR TO OPEN	HPV	HIGH POINT VENT	RTD	RESISTANCE TAMPOR DETECTOR
BMS	BURNER MGT. SYSTEM	ID	INSIDE DIAMETER	RO	RESTRICTION ORIFICE
CC	CORROSION COUPON	LLH	LIQUID LEVEL HIGH	SDV	SHUTDOWN VALVE
CC	CORROSION COUPON	LCP	LIGHTING CONTACTOR PANEL	S/S	SEAM TO SEAM
CP	CORROSION PROBE	LLL	LIQUID LEVEL LOW	SC	SAMPLE CONNECTION
DCS	DISTRIBUTED CONTROL SYS.	LPD	LOW POINT DRAIN	SP	SET POINT
EL	ELEVATION	MCC	MOTOR CONTROL CENTER	SR	STRESS VALVE
ESD	EMERGENCY SHUTDOWN	NI	NO INSULATION	UG	UNDERGROUND
FA	FLAME ARRESTOR	NLL	NORMAL LIQUID LEVEL	UPS	UNINTERRUPTIBLE POWER SUPPLY
FE	FLOW ELEMENT	NNF	NORMALLY NO FLOW	(V)	VENDOR FURNISHED
FF	FLAT FACE	OOS	OUT OF SERVICE	VTA	VENT TO ATMOSPHERE
FL	FLAT LAST	PDC	POWER DISTRIBUTION CENTER	W/	WITH
FOT	FLAT ON TOP	PLC	PROGRAMMABLE LOGIC CONTROLLER	W/O	WITH OUT

INSTRUMENTATION SYMBOLS		
	<p>FIRST LETTER LOOP MEASURED VARIABLE</p> <p>INSTRUMENT TYPE</p> <p>INSTRUMENT SEQUENCE NUMBER</p>	<p>ALARM AND INTERLOCK INDICATORS</p> <p>HH = HIGH HIGH</p> <p>H = HIGH</p> <p>L = LOW</p> <p>LL = LOW LOW</p> <p>SUFFIX ADDITIONAL IDENTIFIERS SUCH AS A,B,C,D, IF THERE ARE MORE THAN ONE TAG OF THE SAME NUMBER.</p>
SYMBOL	DESCRIPTION	EXAMPLE
	FIELD MOUNTED INSTRUMENTS. MAY INCLUDE TRANSMITTERS, SWITCHES, ANALYZERS, INDICATORS, etc.	Ex: TI, TIT, LSI. INDICATING LOCALLY AND/OR TRANSMITTING.
	PANEL MOUNTED INSTRUMENTS LOCATED ON A LOCAL SKID PANEL. MAY INCLUDE TRANSMITTERS, SWITCHES, ANALYZERS, INDICATORS, etc.	Ex: TIT, PIT INDICATING LOCALLY AND/OR TRANSMITTING AND MOUNTED ON CENTRALIZED PANEL.
	LOCAL LOGIC NODE. LOCAL SIMPLE LOOP WITH INPUT AND DIRECT OUTPUT.	Ex: LOCAL MEASUREMENT/CONTROL LOOP. MAY BE PNEUMATIC OR ELECTRICAL.
	CENTRALIZED LOGICAL NODE. CENTRALIZED LOGIC CONTROL VIA BASIC PROCESS CONTROL SYSTEM.	Ex: TIC, PIC IN PLANT PLC WITH ALARMS AND/OR SHUTDOWNS.
	3RD PARTY INTEGRATED PACKAGED LOCAL LOGICAL NODE. SIMPLE LOOPS INCLUDED ON PACKAGED SYSTEM.	Ex: SKID MOUNTED FIRE EYE WITH DIRECT OUTPUT; SKID MOUNTED LOCAL MEASUREMENT/CONTROL LOOP.
	3RD PARTY INTEGRATED PACKAGED PANEL LOGICAL NODE. LOGIC CONTROL PERFORMED ON LOCAL SKID PANEL.	Ex: PIC ON COMPRESSOR SKID WITH IN LOGICAL CONTROL IN LOCAL PANEL.

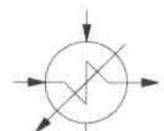


NOTES:	REVISIONS	APPROVALS		EXTRACTION EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM NAMING AND IDENTIFICATION SCHEDULES																					
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REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE																		
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SIGNATURE	DATE																								

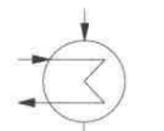
PROCESS FLOW EXCHANGERS



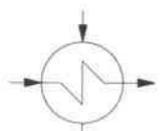
CONDENSER OR COOLER



HEATER

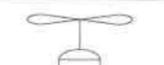


PROCESS FLOW EXCHANGER

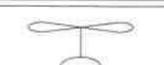


PROCESS FLOW EXCHANGER

AIR COOLERS



GENERAL AIR COOLER (SINGLE PASS)



GENERAL AIR COOLER (DOUBLE PASS)

HEAT EXCHANGERS



SHELL AND TUBE EXCHANGERS



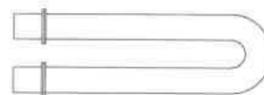
DOUBLE END KETTLE EXCHANGER



SINGLE END KETTLE EXCHANGER



DOUBLE PIPE EXCHANGER



HAIRPIN HEAT EXCHANGER

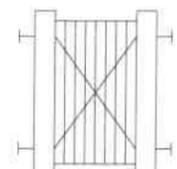
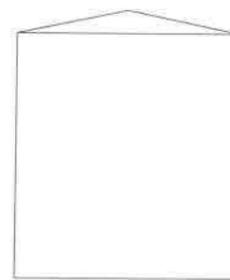
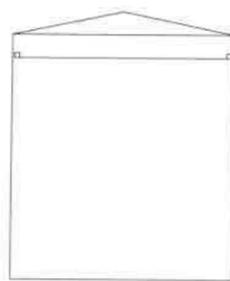


PLATE & FRAME EXCHANGER

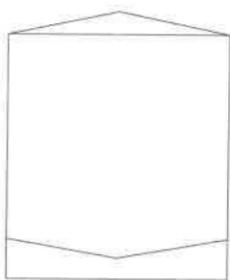
TANKS



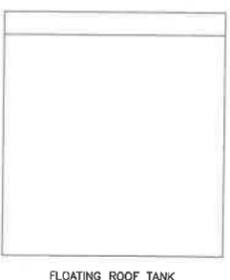
SLOPING ROOF TANK



INTERNAL FLOATING ROOF TANK



SLOPING ROOF TANK W/ SLOPED BOTTOM



FLOATING ROOF TANK

VESSELS



VERTICAL VESSEL



VERTICAL VESSEL W/ SKIRT



VERTICAL VESSEL W/ FLANGE TOP



HORIZONTAL VESSEL



HORIZONTAL VESSEL W/ WIER



HORIZONTAL VESSEL W/ SKIM BUCKET



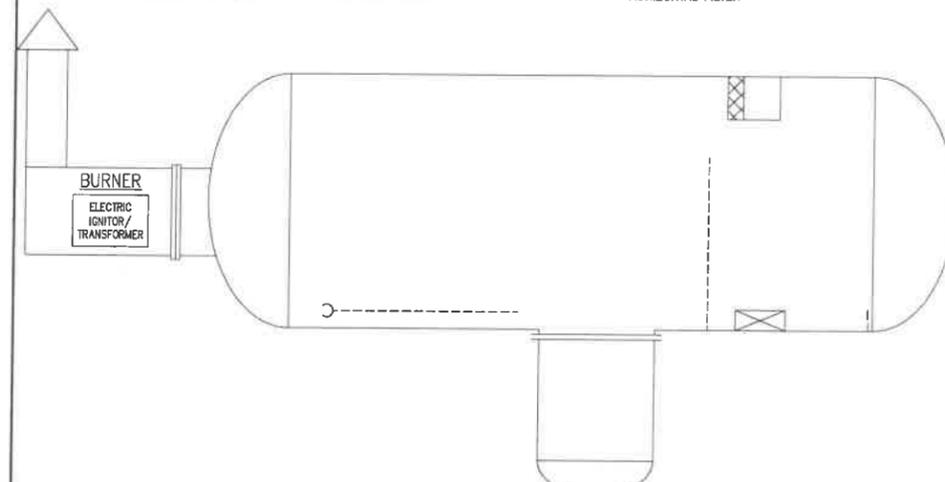
HORIZONTAL FILTER



COLUMN OR TOWER



VERTICAL FILTER



HEATER TREATER

MISCELLANEOUS



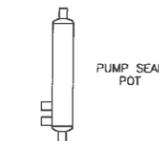
MOTOR



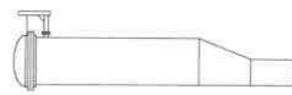
SKIRT



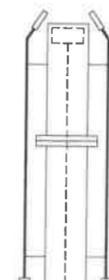
AGITATOR / MIXER



PUMP SEAL POT



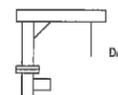
LAUNCHER / RECEIVER



FLARE



FLARE BLOWER



DAVIT



LOUVERS



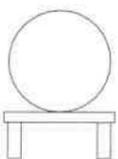
DEMISTER (W/ PAD)



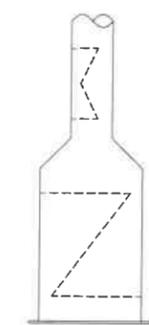
DEMISTER (W/ VANE PACK)



VORTEX BREAKER



TRUCK OR TRANSPORT



DIRECT FIRED HEATER

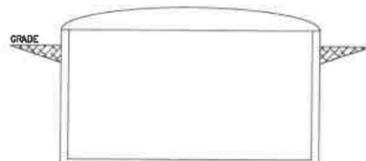


THERMAL OXIDIZER OR VOLATILE ORGANIC COMPOUND (VOC) BURNER

SUMP TANKS



FLAT ROOF SUMP



ELLIPTICAL ROOF SUMP

NOTES:

1.

REVISIONS

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

APPROVALS

SIGNATURE	DATE

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ENGINEERING SERVICES, LLC

EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
EQUIPMENT SYMBOLS LEGEND

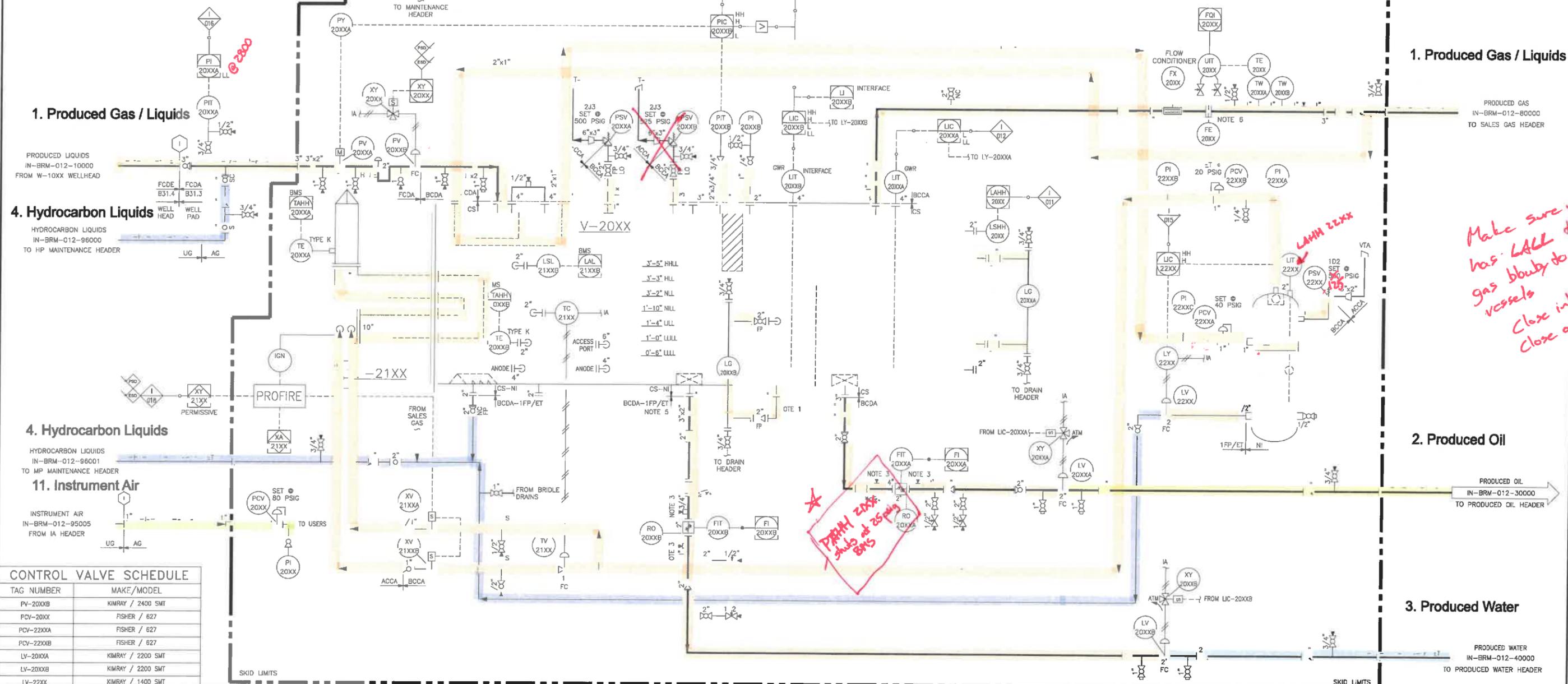
SCALE: NTS DRAWING NO. IN-BRM-012-0003 REV. 0

SEPARATOR NUMBERING		BURNER NUMBERING		FG SCRUBBER NUMBERING		SEPARATOR NUMBERING		BURNER NUMBERING		FG SCRUBBER NUMBERING	
SEPARATOR NO.	XX	BURNER NO.	XX	FG SCRUBBER NO.	XX	SEPARATOR NO.	XX	BURNER NO.	XX	FG SCRUBBER NO.	XX
V-2001	01	B-2101	01	V-2201	01	V-2020	20	B-2120	20	V-2220	20
V-2002	02	B-2102	02	V-2202	02	V-2021	21	B-2121	21	V-2221	21
V-2003	03	B-2103	03	V-2203	03	V-2022	22	B-2122	22	V-2222	22
V-2004	04	B-2104	04	V-2204	04	V-2023	23	B-2123	23	V-2223	23
V-2005	05	B-2105	05	V-2205	05	V-2024	24	B-2124	24	V-2224	24
V-2006	06	B-2106	06	V-2206	06	V-2025	25	B-2125	25	V-2225	25
V-2007	07	B-2107	07	V-2207	07	V-2026	26	B-2126	26	V-2226	26
V-2008	08	B-2108	08	V-2208	08	V-2027	27	B-2127	27	V-2227	27
V-2009	09	B-2109	09	V-2209	09	V-2028	28	B-2128	28	V-2228	28
V-2010	10	B-2110	10	V-2210	10	V-2029	29	B-2129	29	V-2229	29
V-2011	11	B-2111	11	V-2211	11	V-2030	30	B-2130	30	V-2230	30
V-2012	12	B-2112	12	V-2212	12	V-2031	31	B-2131	31	V-2231	31
V-2013	13	B-2113	13	V-2213	13	V-2032	32	B-2132	32	V-2232	32
V-2014	14	B-2114	14	V-2214	14	V-2033	33	B-2133	33	V-2233	33
V-2015	15	B-2115	15	V-2215	15						
V-2016	16	B-2116	16	V-2216	16						
V-2017	17	B-2117	17	V-2217	17						
V-2018	18	B-2118	18	V-2218	18						
V-2019	19	B-2119	19	V-2219	19						

V-20XX
HP SEPARATOR
48" ID x 16'-0" S/S
DESIGN: 500 PSIG @ -20°F/300°F

B-21XX
BURNER UNIT
DUTY: 0.5 MMBTU/H
GAS FIRED
WITH PROFIRE 2100 BMS

V-22XX
FUEL GAS SCRUBBER
10 3/4" OD x 15" S/S
DESIGN: 500 PSIG @ -20°F/200°F



TAG NUMBER	MAKE/MODEL
PV-20XXB	KIMRAY / 2400 SMT
PCV-20XX	FISHER / 627
PCV-22XXA	FISHER / 627
PCV-22XXB	FISHER / 627
LV-20XXA	KIMRAY / 2200 SMT
LV-20XXB	KIMRAY / 2200 SMT
LV-22XX	KIMRAY / 1400 SMT

- NOTES:
- BURNER MANAGEMENT PACKAGE DETAIL TO BE PROVIDED BY BURNER VENDOR.
 - ANODE PORTS (4 QUANTITY).
 - BYPASS VALVE FOR LOADING DURING START UP.

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

APPROVALS	
SIGNATURE	DATE

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ENGINEERING SERVICES, LLC

EXTRACTION
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
HP SEPARATOR SKID (TYP.)
SCALE: NTS DRAWING NO: IN-BRM-012-20000 REV: 0

1. Produced Gas / Liquids

2. Produced Oil

3. Produced Water

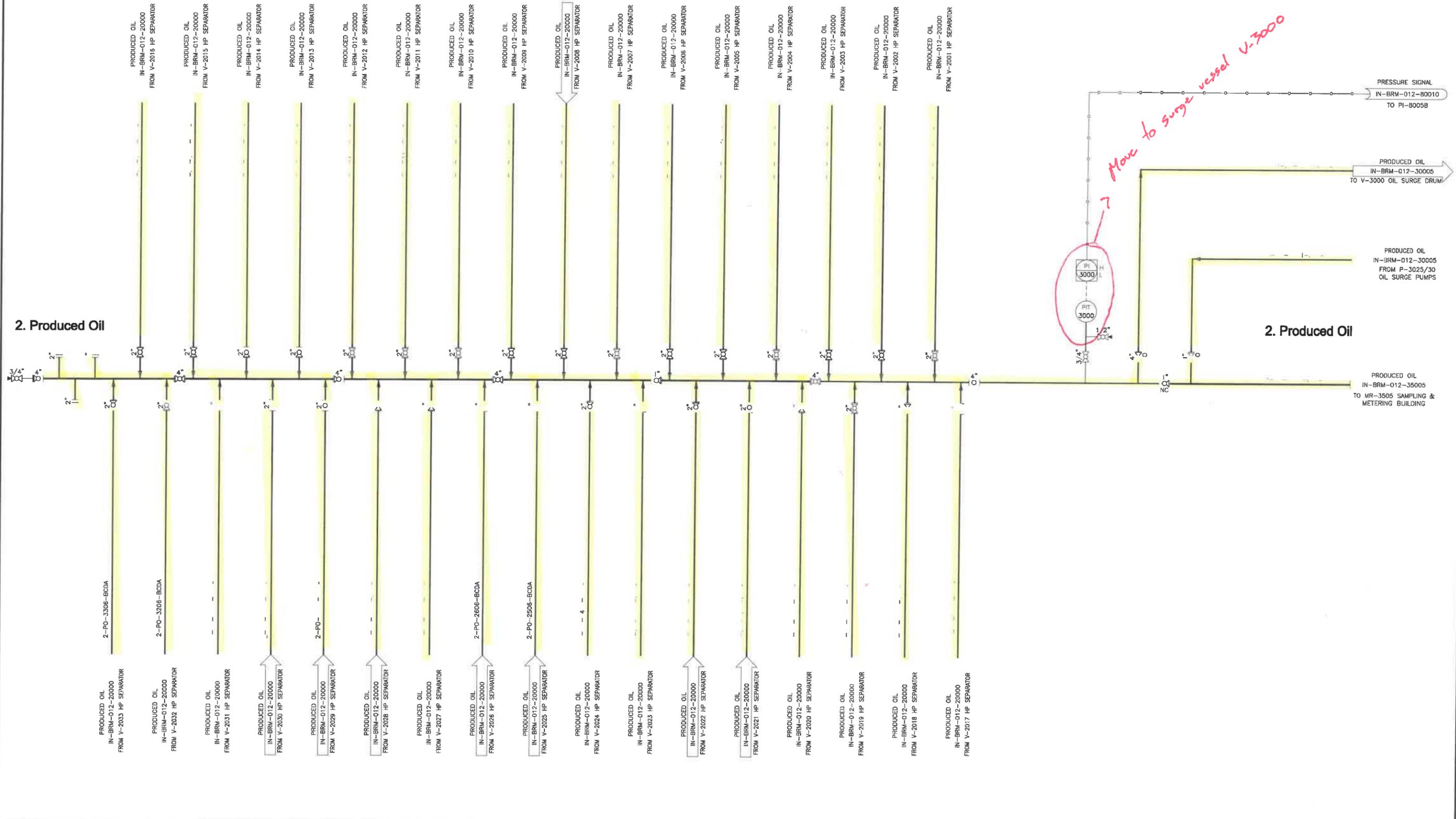
*Make sure unit has LAGB to prevent gas blowby to surge vessels
Close inlet close off water drops*

PRHH 20XX sub at 25 psig BMS

LAHH 22XX

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLPAD\PIPING\BRM-012-20000.DWG BY: BRANCO, DATE: Mar 28, 2018 3:06pm

2. Produced Oil



NOTES:

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

REVISIONS			

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

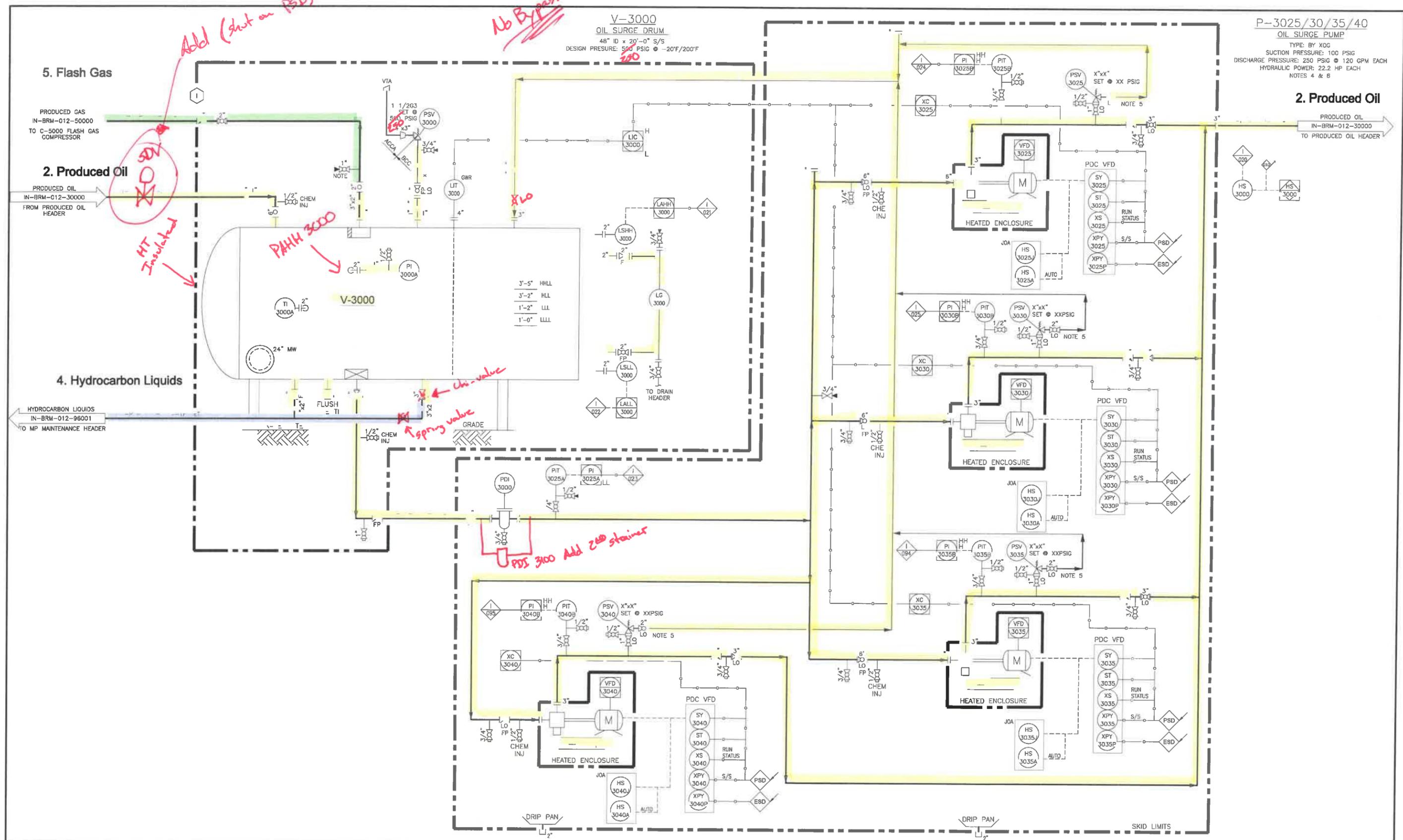


EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED OIL HEADER

SCALE: NTS DRAWING NO. IN-BRM-012-30000 REV. 0

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELHEAD\PPING\A\BDS\IN-BRM-012-30005.DWG BY:BRN/OC/LAR DATE:Mar 28, 2018 3:04pm



NOTES:

- VESSEL SHALL BE ELEVATED 8 1/2 FT. ABOVE GRADE.
- ALL CONTROL POINTS FEED PUMPS SKID PLC.
- HEAT TRACE AND INSULATE LEVEL BRIDLE.
- LISTED PUMP CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG PUMP SELECTION.
- SIZE AND REQUIREMENT OF PSV DETERMINED BY XOG PUMP SELECTION.
- HYDRAULIC HP SHOWN. MOTOR HP DETERMINED BY PUMP SPECIFIC CHARACTERISTICS.

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

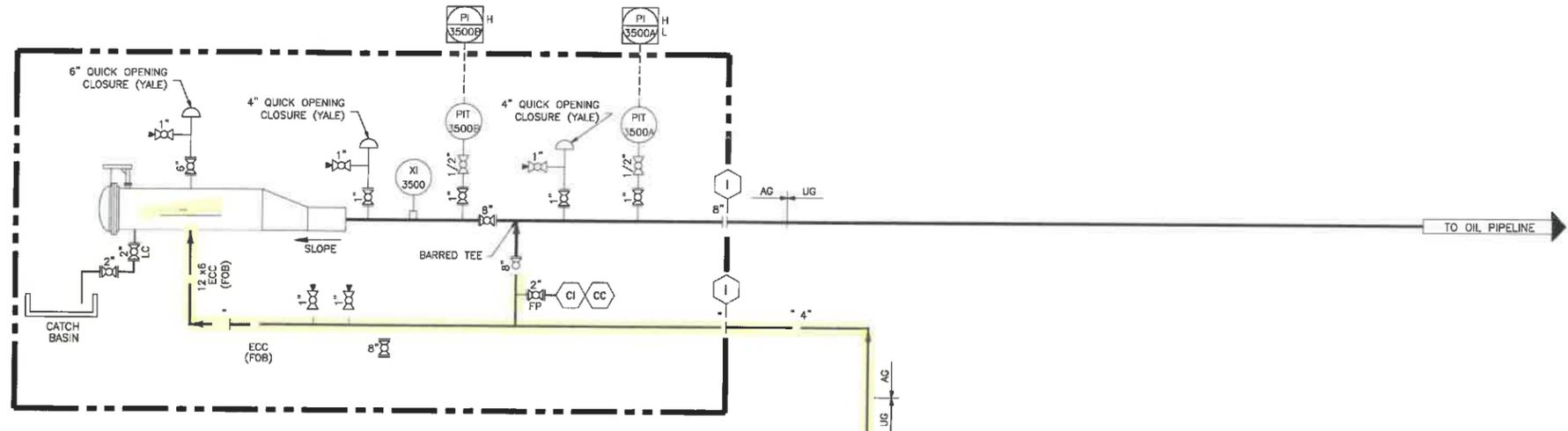
Redi
ENGINEERING SERVICES, LLC

EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED OIL SURGE DRUM

SCALE: NTS DRAWING NO: IN-BRM-012-30005 REV: 0

PL-3500
 OIL PIPELINE PIG LAUNCHER
 SIZE: 8" DIA. x 12' BARREL
 DESIGN P/T: XXX PSIG @ -XX/XXXF



2. Produced Oil

PRODUCED OIL
 IN-BRM-012-35005
 FROM MR-3505 SAMPLING
 AND METERING BUILDING

FILE PATH: P:\EXTRACTION 4 - XOG INTERCHANGE A & B WELLS\HEAD\PIPING\PIPING\IN-BRM-012-35000.DWG BY:BRANCOCLARE DATE:Mar 28, 2018 3:04pm

NOTES:

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE



EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 PRODUCED OIL TO PIPELINE

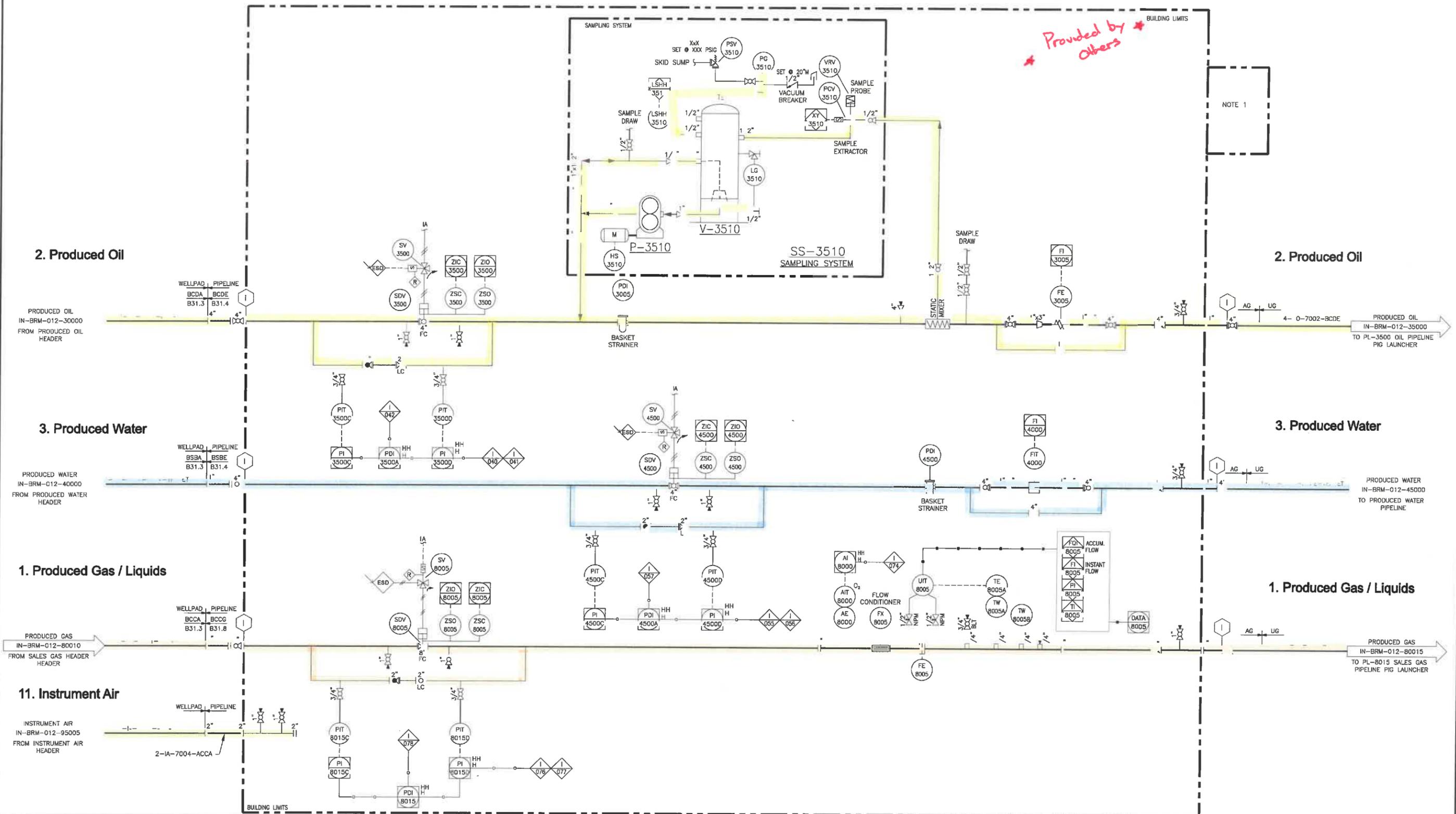
SCALE: NTS DRAWING NO.: IN-BRM-012-35000 REV. 0

SS-3510
SAMPLING SYSTEM
TYPE: XX
CAPACITY: 1-22 CC SAMPLE SIZE

MR-3505
SAMPLING & METERING BUILDING
SIZE: X'-XX" (WIDTH) x X'-XX" (LENGTH)

Provided by others

NOTE 1



NOTES:
1. PORCH SPACE FOR COMMUNICATIONS TOWER, MIN. 24" SQUARE.

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

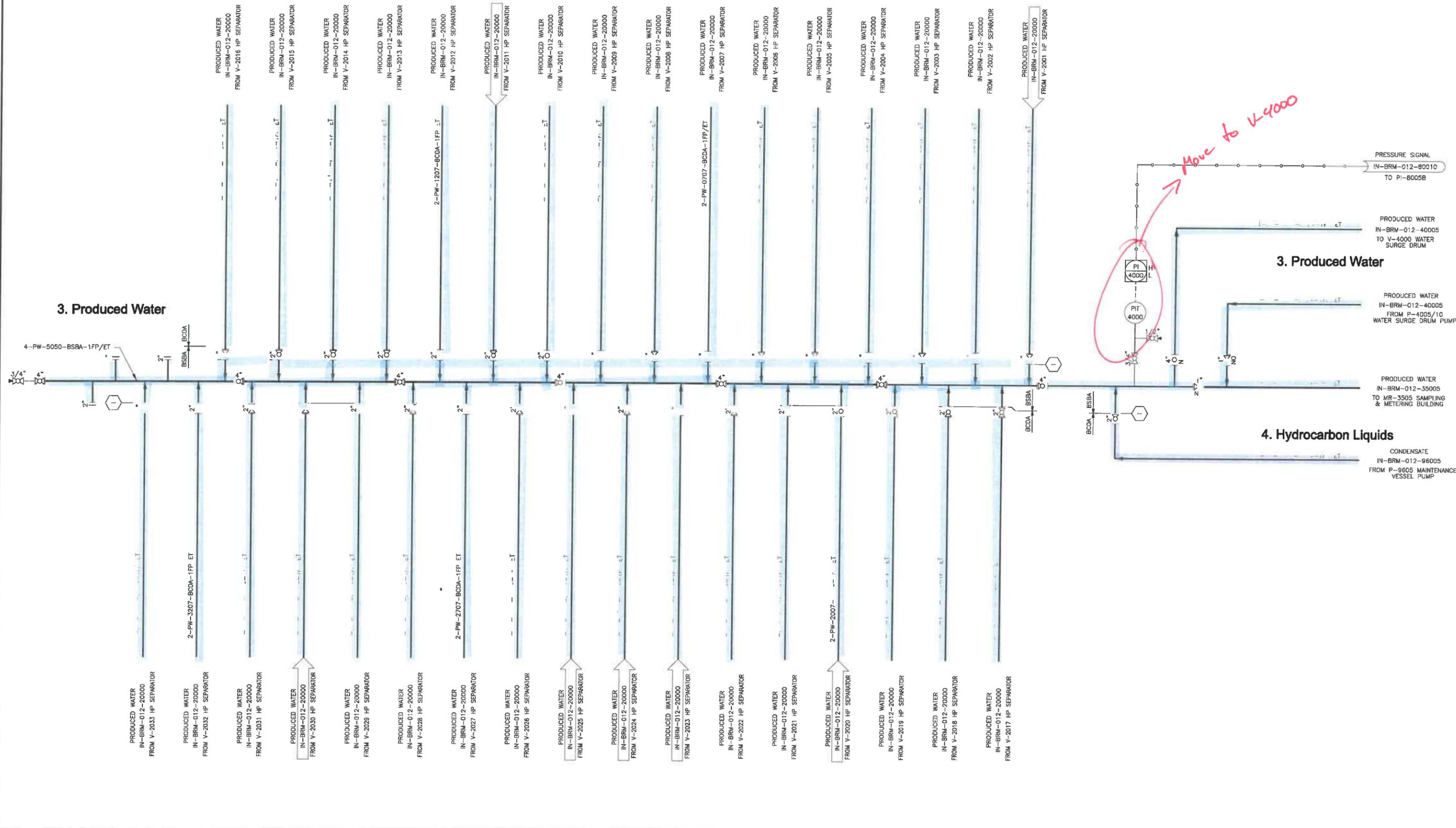
REVISIONS		APPROVALS	
NO.	DESCRIPTION	SIGNATURE	DATE

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ENGINEERING SERVICES, LLC

EXTRACTION
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
SAMPLING AND METERING BUILDING

SCALE: NTS DRAWING NO: IN-BRM-012-35005 REV: 0

FILE PATH: P:\EXTRACTION\A & B WELLPAD\PIPING\IN-BRM-012-35005.DWG BY: BERNARD, DATE: MAR 28, 2018 3:05pm



NOTES:

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
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REVISIONS			

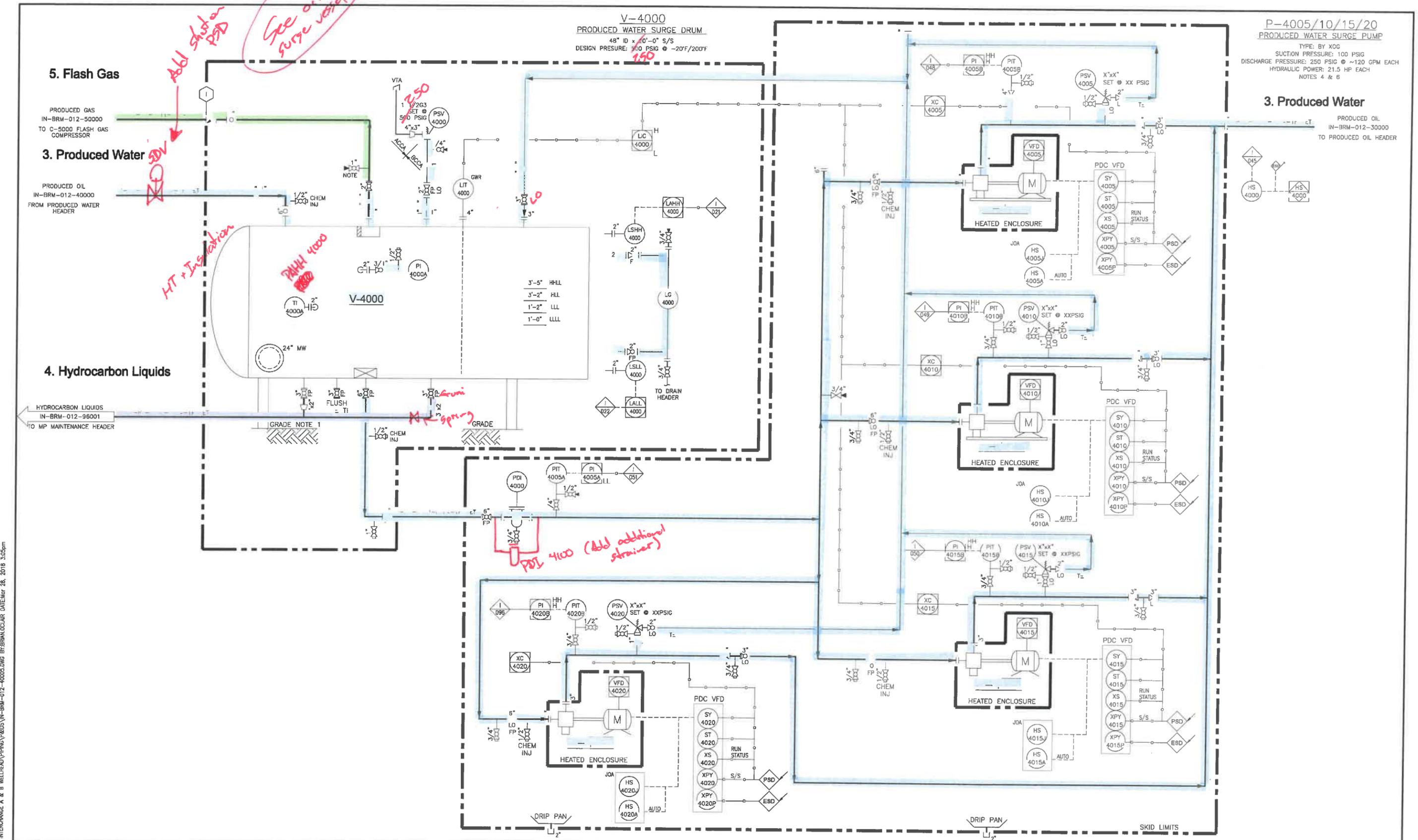
APPROVALS	
SIGNATURE	DATE
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CHECKED	
APPROVED	

Redi
ENGINEERING SERVICES, LLC

EXTRACTION
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED WATER HEADER

SCALE: NTS DRAWING NO. IN-BRM-012-40000 REV. 0

FILE PATH: P:\EXTRACTION\A & B WELLHEAD\PIPING\4005\IN-BRM-012-4005.DWG BY:BRM\LOCJLR DATE:Mar 28, 2018 3:05pm



NOTES:

1. VESSEL SHALL BE ELEVATED 8.5 FT ABOVE GRADE.
2. ALL CONTROL POINTS FEED PUMPS SKID PLC.
3. HEAT TRACE AND INSULATE LEVEL BRIDLE.
4. LISTED PUMP CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG PUMP SELECTION.
5. SIZE AND REQUIREMENT OF PSV DETERMINED BY XOG PUMP SELECTION.
6. HYDRAULIC HP SHOWN. MOTOR HP DETERMINED BY PUMP SPECIFIC CHARACTERISTICS.

REVISIONS						APPROVALS	
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	SIGNATURE	DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

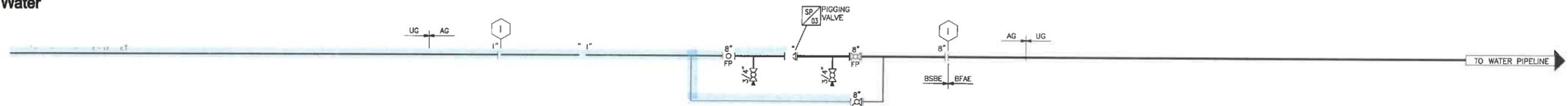
Redi
ENGINEERING SERVICES, LLC

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED WATER SURGE DRUM

SCALE: NTS	DRAWING NO. IN-BRM-012-4005	REV. 0
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3. Produced Water

PRODUCED WATER
IN-BRM-012-35005
FROM MR-3505 SAMPLING
& METERING BUILDING

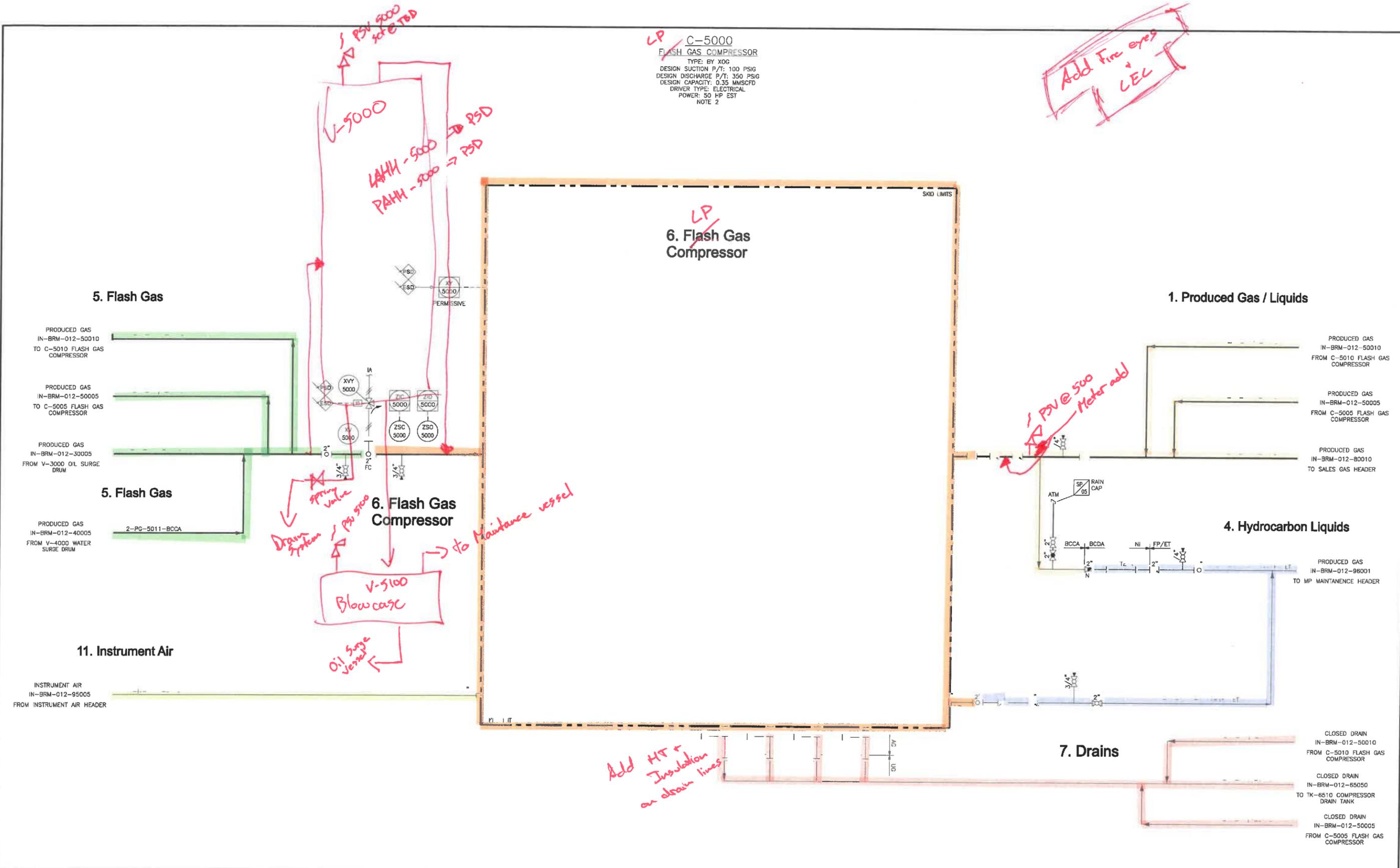


FILE PATH: P:\EXTRACTION\4 - X06 INTERCHANGE A & B WELLHEAD\PIPING\PIPING\IN-BRM-012-45000.DWG BY:BRM\OCJAP DATE:Mar 28, 2018 3:56pm

NOTES:		REVISIONS						APPROVALS				
								SIGNATURE	DATE			EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM PRODUCED WATER TO PIPELINE
										SCALE:	DRAWING NO.	
		0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18	NTS	IN-BRM-012-45000	0
		REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE			

C-5000
FLASH GAS COMPRESSOR
 TYPE: BY XOC
 DESIGN SUCTION P/T: 100 PSIG
 DESIGN DISCHARGE P/T: 350 PSIG
 DESIGN CAPACITY: 0.35 MMSCFD
 DRIVER TYPE: ELECTRICAL
 POWER: 50 HP EST
 NOTE 2

*Add Fire eyes
CEC*



FILE PATH: P:\EXTRACTION 4 - XOC INTERCHANGE A & B WELLS\HEAD\PIPING\WELLS\IN-BRM-012-50000.DWG BY: BRAN SCLAIR DATE: May 28, 2018 3:05pm

NOTES:
 1. SPOOL PIECE FOR FUTURE CHOKE NIPPLE.
 2. LISTED COMPRESSOR CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOC COMPRESSOR SELECTION.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE

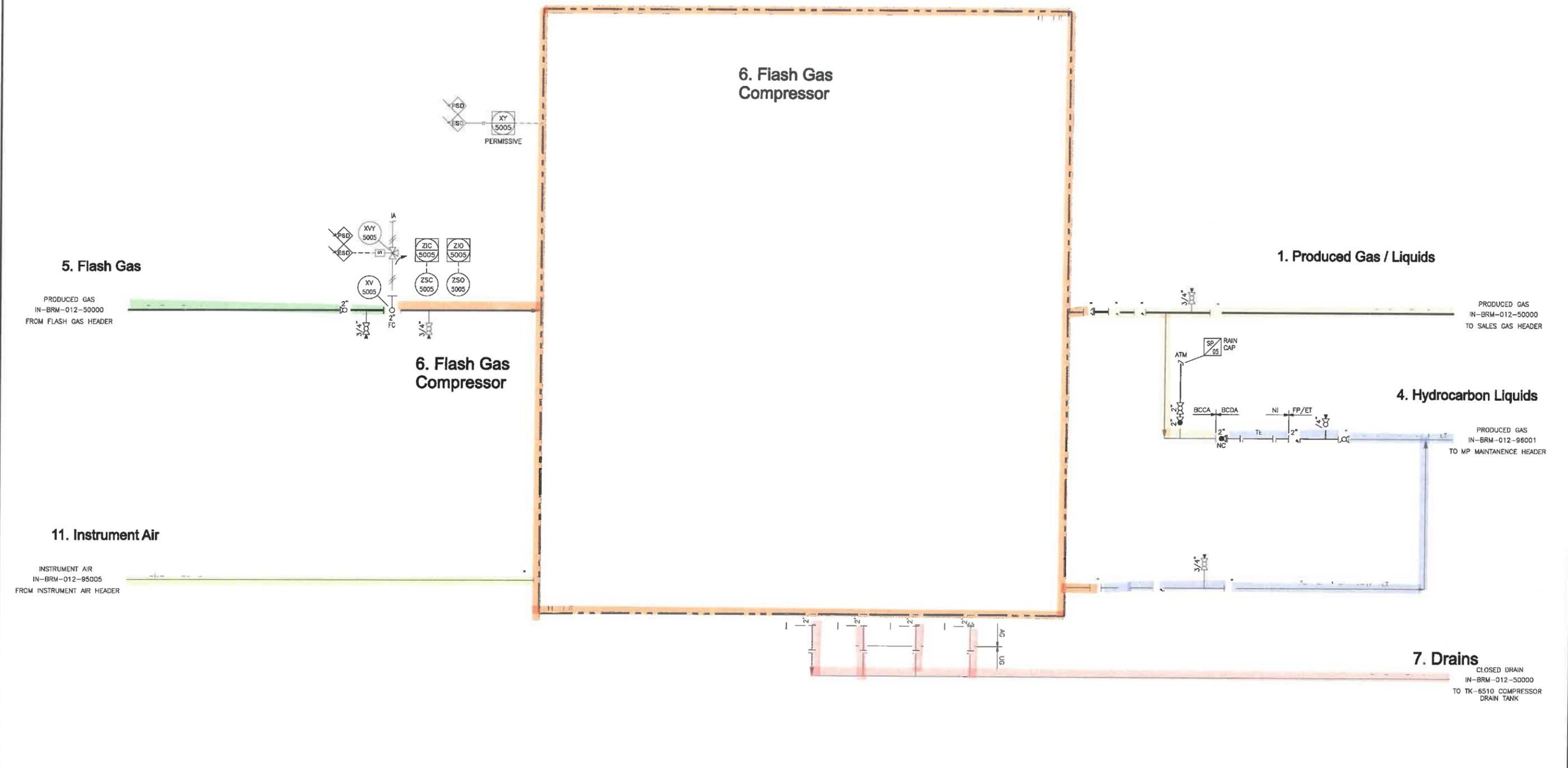
Redi
 ENGINEERING
 SERVICES, LLC

EXTRACTION
 Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 FLASH GAS COMPRESSION

SCALE: NTS DRAWING NO. IN-BRM-012-50000 REV. 0

C-5005
FLASH GAS COMPRESSOR
 TYPE: BY XOG
 DESIGN SUCTION P/T: 100 PSIG
 DESIGN DISCHARGE P/T: 350 PSIG
 DESIGN CAPACITY: 0.35 MMSCFD
 DRIVER TYPE: ELECTRICAL
 POWER: 50 HP EST
 NOTE 2



FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLPAD\PIPING\FIGURES\IN-BRM-012-50005.DWG BY:BRANDUCUARI DATE:Mar 28, 2018 3:05pm

NOTES:
 1. SPOOL PIECE FOR FUTURE CHOKE NIPPLE.
 2. LISTED COMPRESSOR CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG COMPRESSOR SELECTION.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE

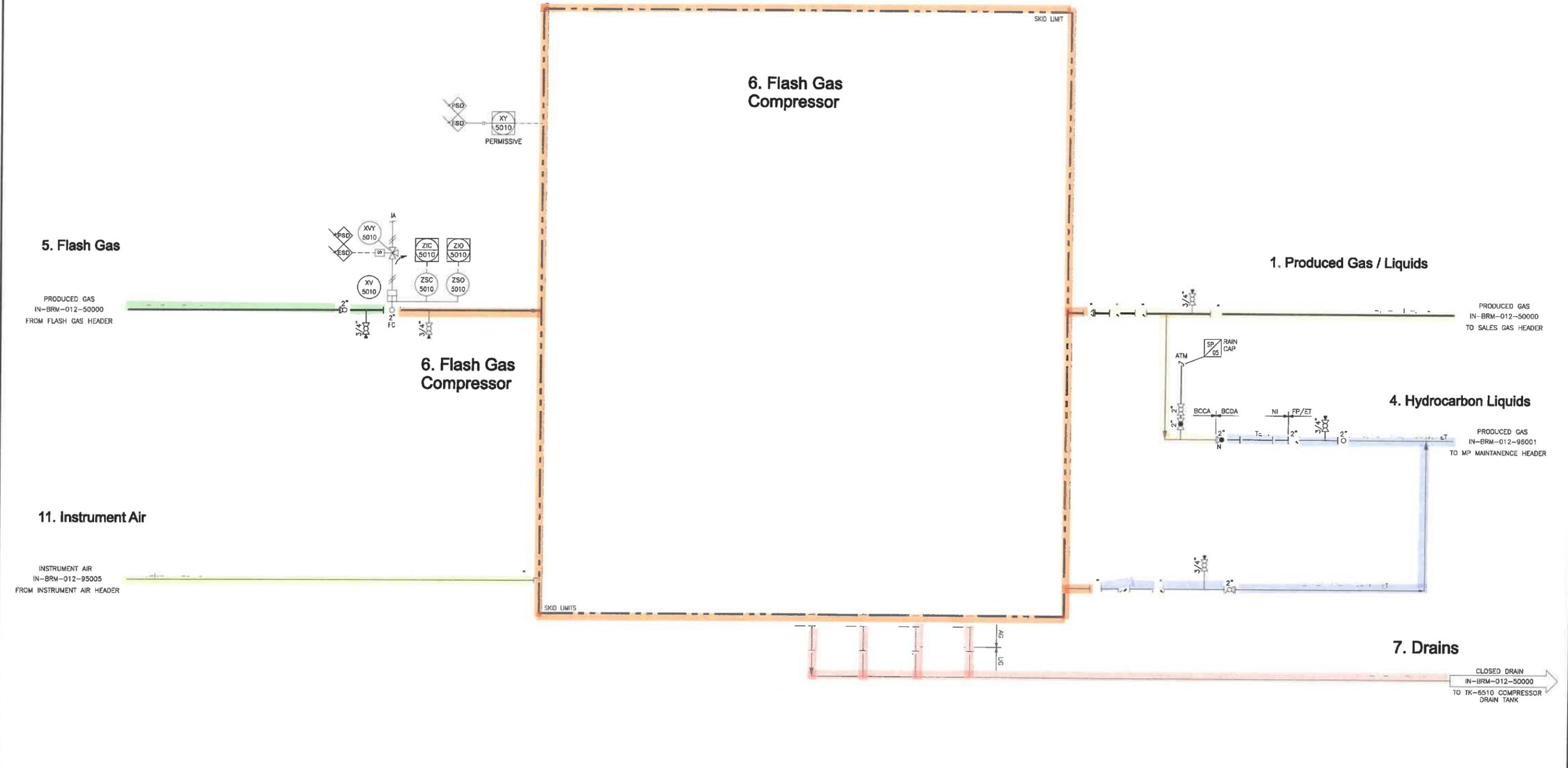
Redi
 ENGINEERING SERVICES, LLC

EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 FLASH GAS COMPRESSION

SCALE: NTS DRAWING NO: IN-BRM-012-50005 REV: 0

C-5010
 FLASH GAS COMPRESSOR
 TYPE: BY XOG
 DESIGN SUCTION P/T: 100 PSIG
 DESIGN DISCHARGE P/T: 350 PSIG
 DESIGN CAPACITY: 0.35 MMSCFD
 DRIVER TYPE: ELECTRICAL
 POWER: 50 HP EST
 NOTE 2



FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLPAD\PIPING\PIPING\IN-BRM-012-50010.DWG BY:BRM\CCUJAB DATE:Mar 28, 2018 3:05pm

NOTES:
 1. SPOOL PIECE FOR FUTURE CHOKE NIPPLE.
 2. LISTED COMPRESSOR CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG COMPRESSOR SELECTION.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE
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APPROVED	



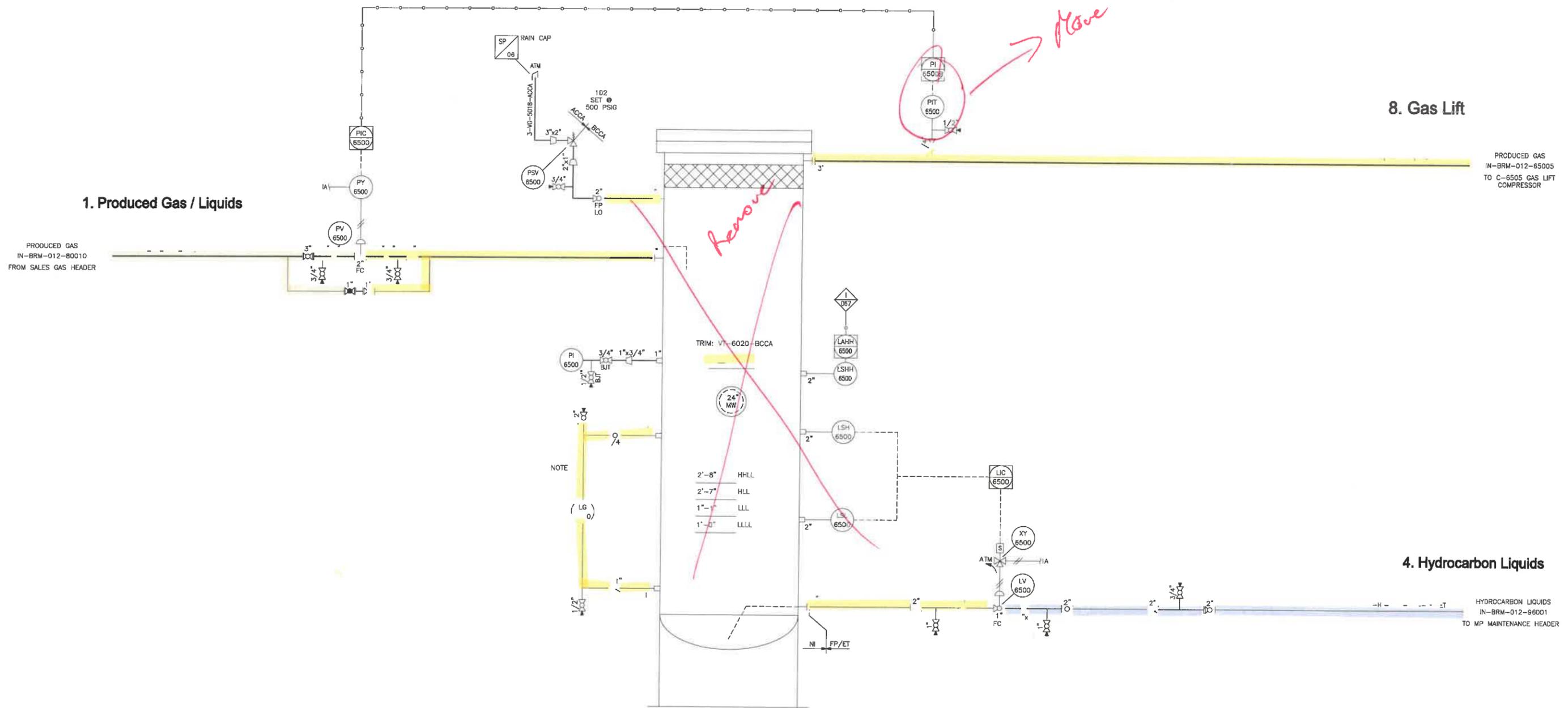
EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 FLASH GAS COMPRESSION

SCALE: NTS DRAWING NO.: IN-BRM-012-50010 REV. 0

V-6500
 GAS LIFT SUCTION SCRUBBER
 SIZE: 24" O.D. x 6'-0" S/S
 DESIGN P/T: 500 PSIG @ -20/200 °F
 MATERIAL: CS

*Move to Gas lift comp page
 G5005*



1. Produced Gas / Liquids

8. Gas Lift

4. Hydrocarbon Liquids

PRODUCED GAS
 IN-BRM-012-80010
 FROM SALES GAS HEADER

PRODUCED GAS
 IN-BRM-012-65005
 TO C-6505 GAS LIFT
 COMPRESSOR

HYDROCARBON LIQUIDS
 IN-BRM-012-96001
 TO MP MAINTENANCE HEADER

NOTE

2'-8"	HHLL
2'-7"	HLL
1'-1"	LLL
1'-0"	LLLL

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
LV-6500	KIMRAY/1400 SMT PO
PV-6500	FISHER/EZ

NOTES:
 1. HEAT TRACE & INSULATE BRIDLE - FREEZE PROTECTION

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				CAD	03/28/18

APPROVALS	
SIGNATURE	DATE

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 ENGINEERING
 SERVICES, LLC



EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 GAS LIFT SUCTION SCRUBBER

SCALE: NTS	DRAWING NO. IN-BRM-012-65000	REV. 0
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FILE PATH: P:\EXTRACTION\4 - XOC INTERCHANGE A & B WELLPAD\PIPING\PKGS\IN-BRM-012-65000.DWG BY: BRUNOCCLAR DATE: Mar 28, 2018 3:05pm

C-6505
GAS LIFT COMPRESSOR
 TYPE: RECIPROCATING COMPRESSOR
 DESIGN SUCTION P/T: 100 PSIG @ 180°F
 DESIGN DISCHARGE P/T: 1200 PSIG @ 120°F
 DESIGN CAPACITY: 1.0 MMSCFD
 DRIVER TYPE: ELECTRICAL
 POWER: 200 HP
 NOTE 3

let down to sales
RAH @ 1350 close XV-6500

1. Produced Gas / Liquids

PRODUCED GAS
 IN-BRM-012-80010
 TO SALES GAS HEADER

8. Gas Lift

PRODUCED GAS
 IN-BRM-012-65000
 FROM V-6500 GAS LIFT
 SUCTION SCRUBBER

11. Instrument Air

INSTRUMENT AIR
 IN-BRM-012-95005
 FROM INSTRUMENT AIR
 HEADER

8. Gas Lift

PRODUCED GAS
 IN-BRM-012-65006
 TO GAS LIFT HEADER

4. Hydrocarbon Liquids

PRODUCED GAS
 IN-BRM-012-96000
 TO HP MAINTENANCE HEADER

7. Drains

CONDENSATE
 IN-BRM-012-96001
 TO MP MAINTENANCE HEADER

CLOSED DRAIN
 IN-BRM-012-65050
 TO TX-6510 COMPRESSOR
 DRAIN TANK

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
PV-6505	FISHER/EZ

- NOTES:
- SPOOL PIECE FOR FUTURE CHOKE NIPPLE.
 - FUTURE GAS LIFT COMPRESSOR CONNECTION.
 - LISTED COMPRESSOR CONDITIONS ASSUMED PER DESIGN. MAY VARY FROM XOC COMPRESSOR SELECTION.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

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 ENGINEERING
 SERVICES, LLC

EXTRACTION
 Oil & Gas

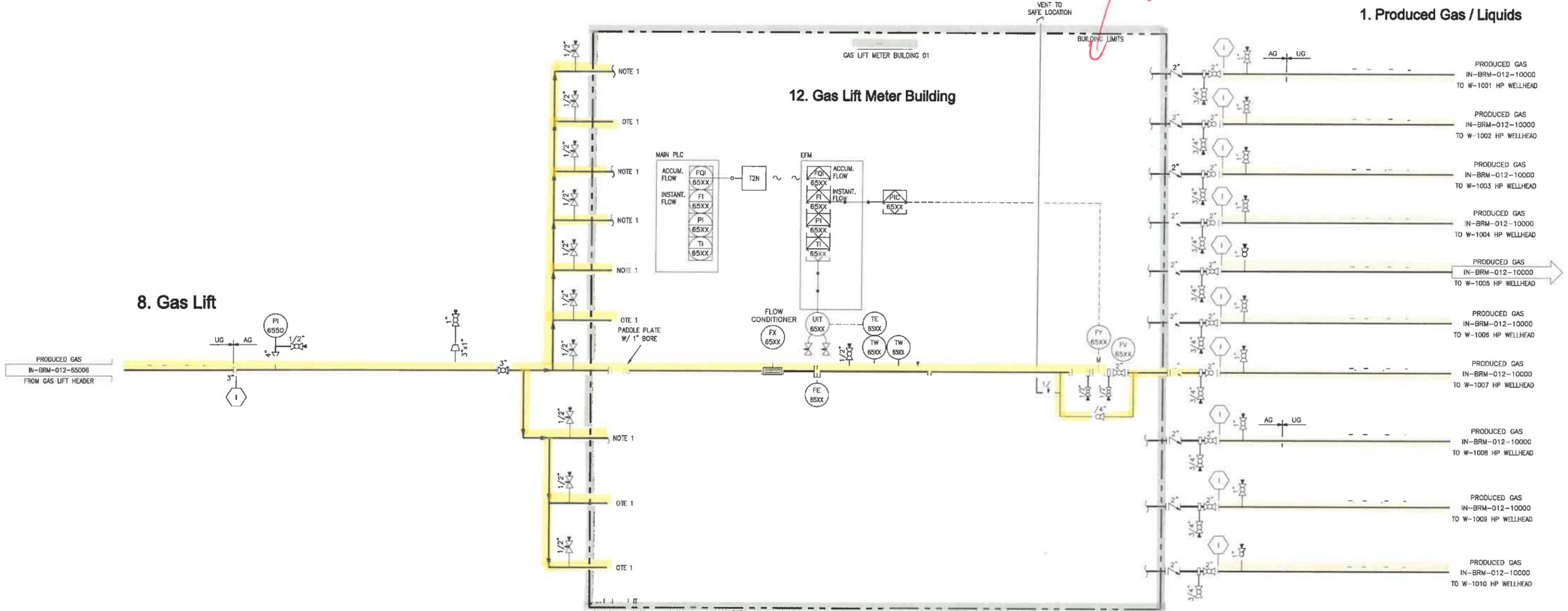
EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 GAS LIFT COMPRESSION

SCALE	DRAWING NO.	REV.
NTS	IN-BRM-012-65005	0

FILE PATH: P:\EXTRACTION\4 - XOC INTERCHANGE A & B WELLPAD\PPHNG\INSTRUMENTATION\IN-BRM-012-65005.DWG (P)BIBAN OCLAR DATE: Mar 28, 2018 3:05pm

MR-6506
GAS LIFT METER BUILDING 01

Add header and PCV for control



8. Gas Lift

12. Gas Lift Meter Building

1. Produced Gas / Liquids

1. Produced Gas / Liquids

FILE PATH: F:\EXTRACTION\4 - XGS INTERCHANGE A & B WELLPAD\PPING\PLUIDS\IN-BRM-012-65007.DWG BY:BRN\CCAR DATE:Mar 28, 2018 3:05pm

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
FV-65XX	BY X0G

NOTES:
1. METER RUN IS COMMON UP TO 10 PER BUILDING.

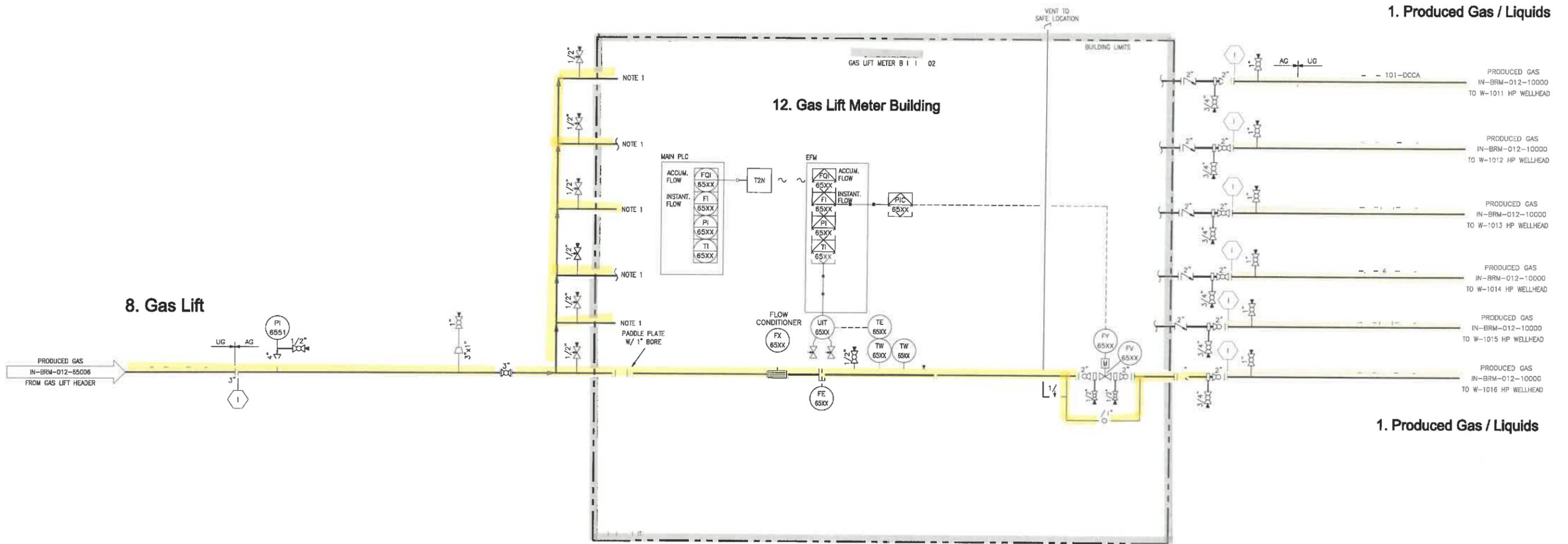
REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE



EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT METER BUILDING 01

SCALE: NTS	DRAWING NO: IN-BRM-012-65007	REV: 0
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8. Gas Lift

1. Produced Gas / Liquids

1. Produced Gas / Liquids

CONTROL VALVE SCHEDULE	
TAG NUMBER	MAKE/MODEL
FV-65XX	BY X06

NOTES:
1. METER RUN IS COMMON UP TO 10 PER BUILDING.

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

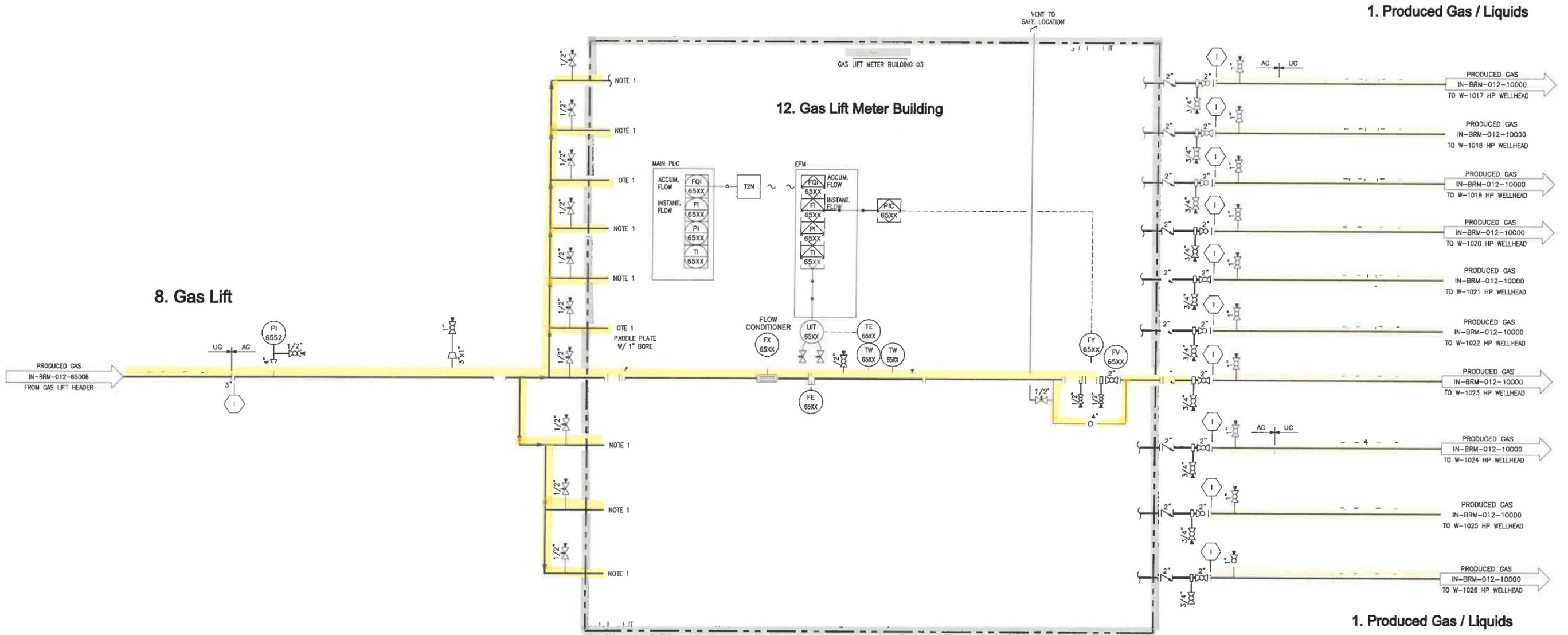


EXTRACTION

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT METER BUILDING 02

SCALE: NTS DRAWING NO. IN-BRM-012-65008 REV. 0

FILE PATH: P:\EXTRACTION\4 - X06 INTERCHANGE A & B WELLPAD\PIPING\PLMDS\IN-BRM-012-65000.DWG BY:BRN\CCJ\AR DATE:Mar 28, 2018 3:05pm



8. Gas Lift

12. Gas Lift Meter Building

1. Produced Gas / Liquids

1. Produced Gas / Liquids

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
FV-65XX	BY XOG

NOTES:
1. METER RUN IS COMMON UP TO 10 PER BUILDING.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE

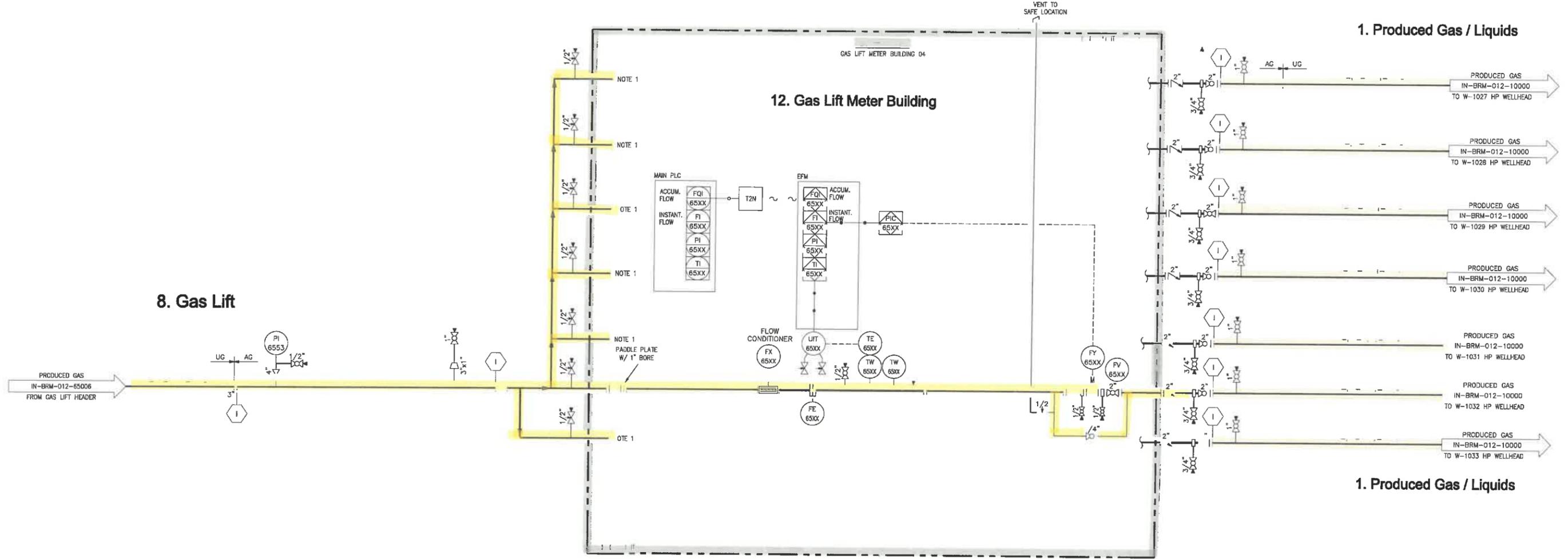
Redi
ENGINEERING
SERVICES, LLC

EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT METER BUILDING 03

SCALE:	DRAWING NO.	REV.
NTS	IN-BRM-012-65009	0

MR-6509
GAS LIFT METER BUILDING 04



8. Gas Lift

1. Produced Gas / Liquids

1. Produced Gas / Liquids

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
FV-65XX	BY XCG

NOTES:
1. METER RUN IS COMMON UP TO 10 PER BUILDING.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE



EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT METER BUILDING 04
SCALE: NTS DRAWING NO.: IN-BRM-012-65010 REV. 0

FILE PATH: P:\EXTRACTION\A & B WELLPAD\PIPING\6509\IN-BRM-012-65010\DWG\EXTRACTION\DATE: 28, 2018 3:05pm

TK-6510
 COMPRESSOR DRAIN TANK
 SIZE: 96" ID x 7'-0" OAH
 DESIGN P/T: ATM @ XXX°F
 CAPACITY: 228 GAL
 MATERIAL: PRECAST CONCRETE

update for larger size

*- Truck loadout discussions need to be had -
 - Add truck vent system connection to this pit*

7. Drains

CLOSED DRAIN
 IN-BRM-012-80005
 FROM C-8005 SALES GAS
 COMPRESSOR (FUTURE)

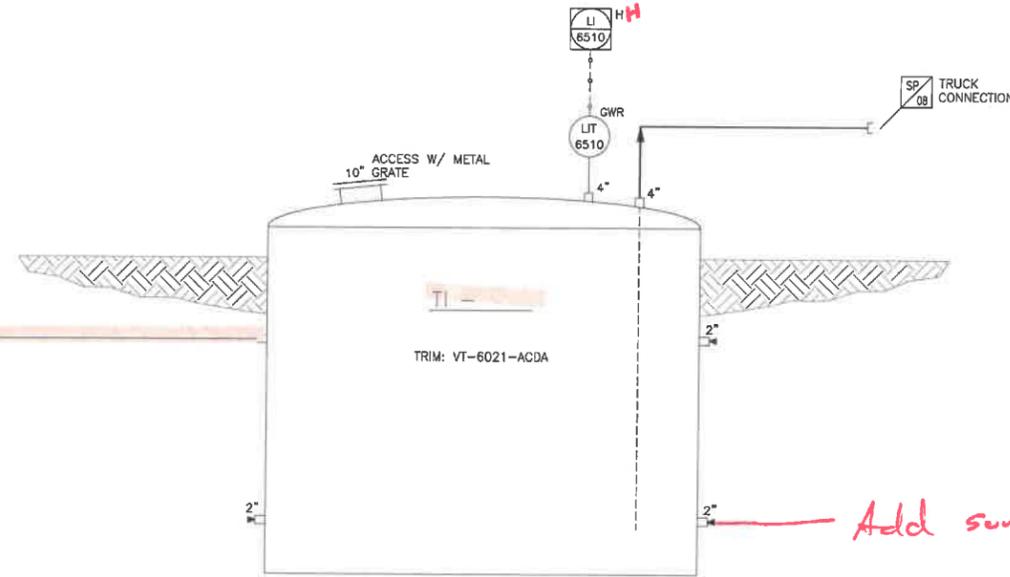
CLOSED DRAIN
 IN-BRM-012-50000
 FROM C-5000 FLASH GAS
 COMPRESSOR

7. Drains

CLOSED DRAIN
 IN-BRM-012-65005
 FROM C-6505 GAS LIFT
 COMPRESSOR

CLOSED DRAIN
 IN-BRM-012-95000
 FROM INSTRUMENT AIR SYSTEM

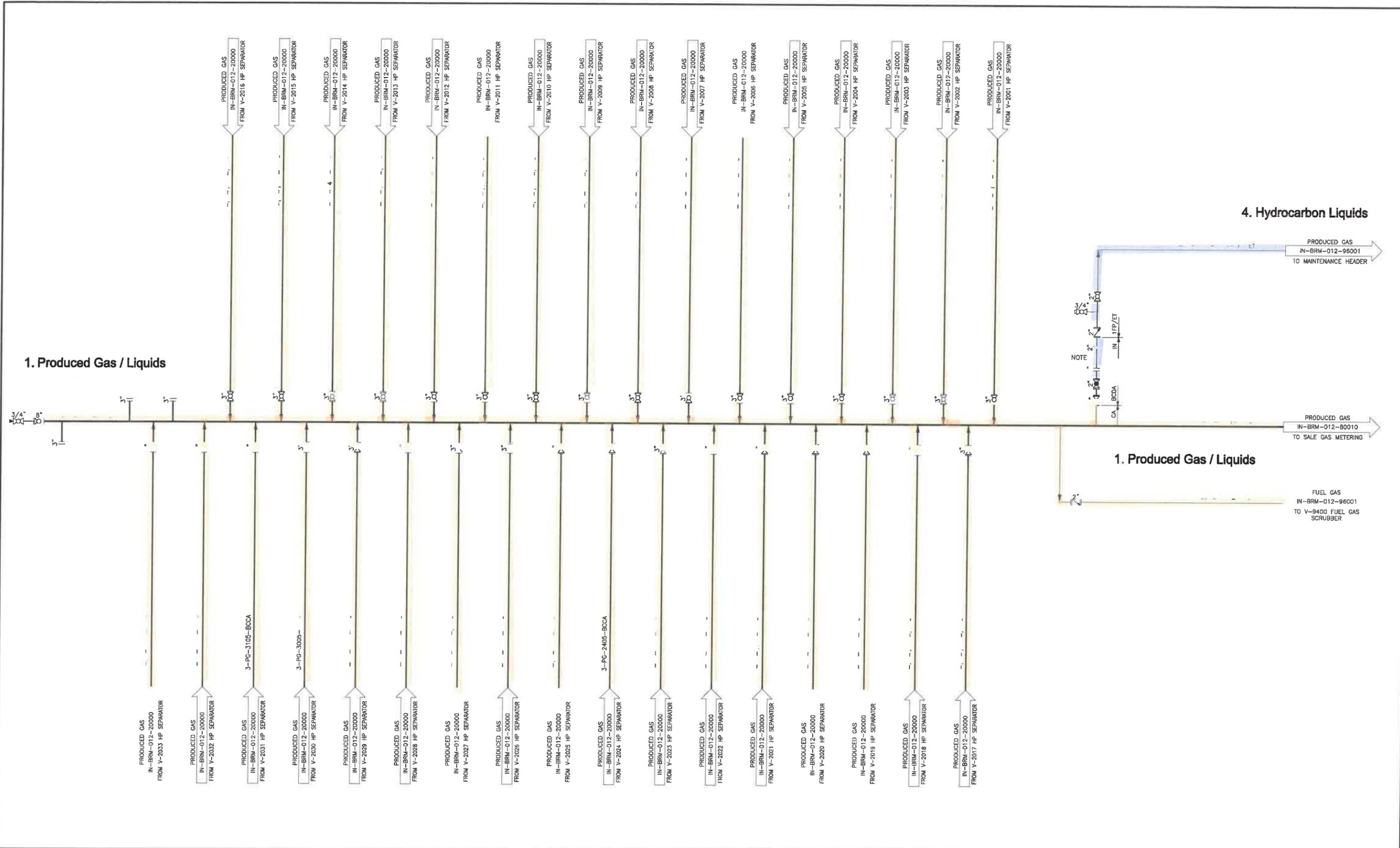
7. Drains



Add sump pump (manual) → Water Surge Vessel

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELHEAD\PIPING\PRODS\IN-BRM-012-65050.DWG BY:BRANCO,CLAR DATE:Mar 28, 2018 3:05pm

NOTES:	REVISIONS						APPROVALS				
							SIGNATURE	DATE			
							DRAWN		Redi ENGINEERING SERVICES, LLC	EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM COMPRESSOR DRAIN TANK	
							CHECKED				
							APPROVED				
	0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18	SCALE:	DRAWING NO.:	REV.:
	REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE	NTS	IN-BRM-012-65050	0



NOTES:
 1. SPOOL PIECE FOR FUTURE CHOKE NIPPLE

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	



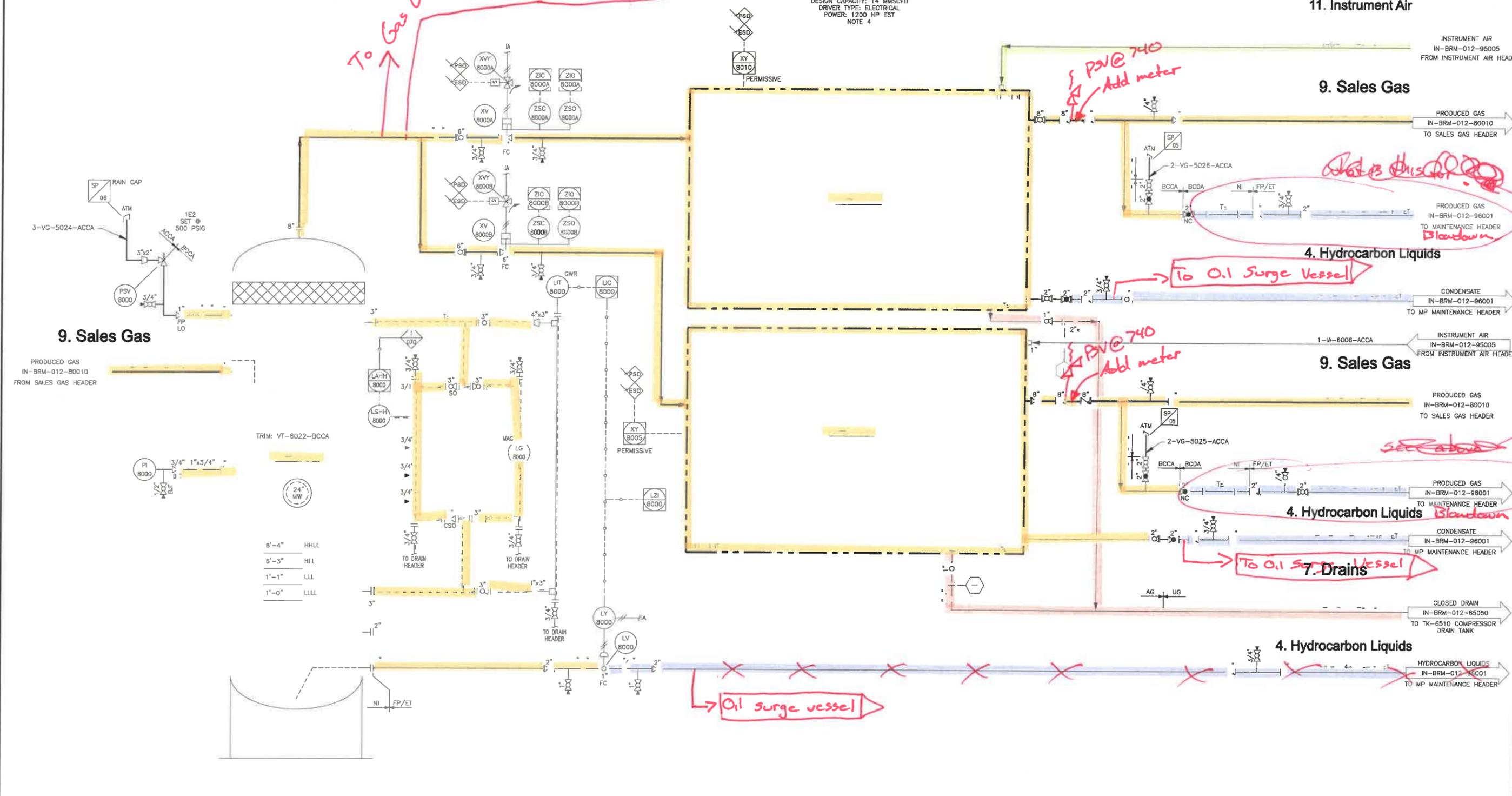
EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 SALES GAS HEADER

SCALE: NTS DRAWING NO. IN-BRM-012-80000 REV. 0

V-8000
SALES GAS SUCTION SCRUBBER
SIZE: 48" ID x 12'-0" S/S
DESIGN SUCTION P/T: 500 PSIG @ -20/200°F
MATERIAL: CS

C-8005/10
SALES GAS COMPRESSOR
DESIGN BY XOC
DESIGN SUCTION P/T: 500 PSIG
DESIGN DISCHARGE P/T: 1400 PSIG
DESIGN CAPACITY: 14 MMSCFD
DRIVER TYPE: ELECTRICAL
POWER: 1200 HP EST
NOTE 4



9. Sales Gas

11. Instrument Air

9. Sales Gas

4. Hydrocarbon Liquids

9. Sales Gas

4. Hydrocarbon Liquids

4. Hydrocarbon Liquids

7. Drains

Oil surge vessel

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
LV-8000	KIMRAY/1400 SMT PO

NOTES:

- FUTURE EQUIPMENT.
- SPOOL PIECE FOR FUTURE CHOKE NIPPLE.
- INSULATE AND HEAT TRACE BRIDLE.
- LISTED COMPRESSOR CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOC COMPRESSOR SELECTION.

REVISIONS

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

APPROVALS

SIGNATURE	DATE

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EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
SALES GAS COMPRESSION (FUTURE)

SCALE: NTS DRAWING NO. IN-BRM-012-80005 REV. 0

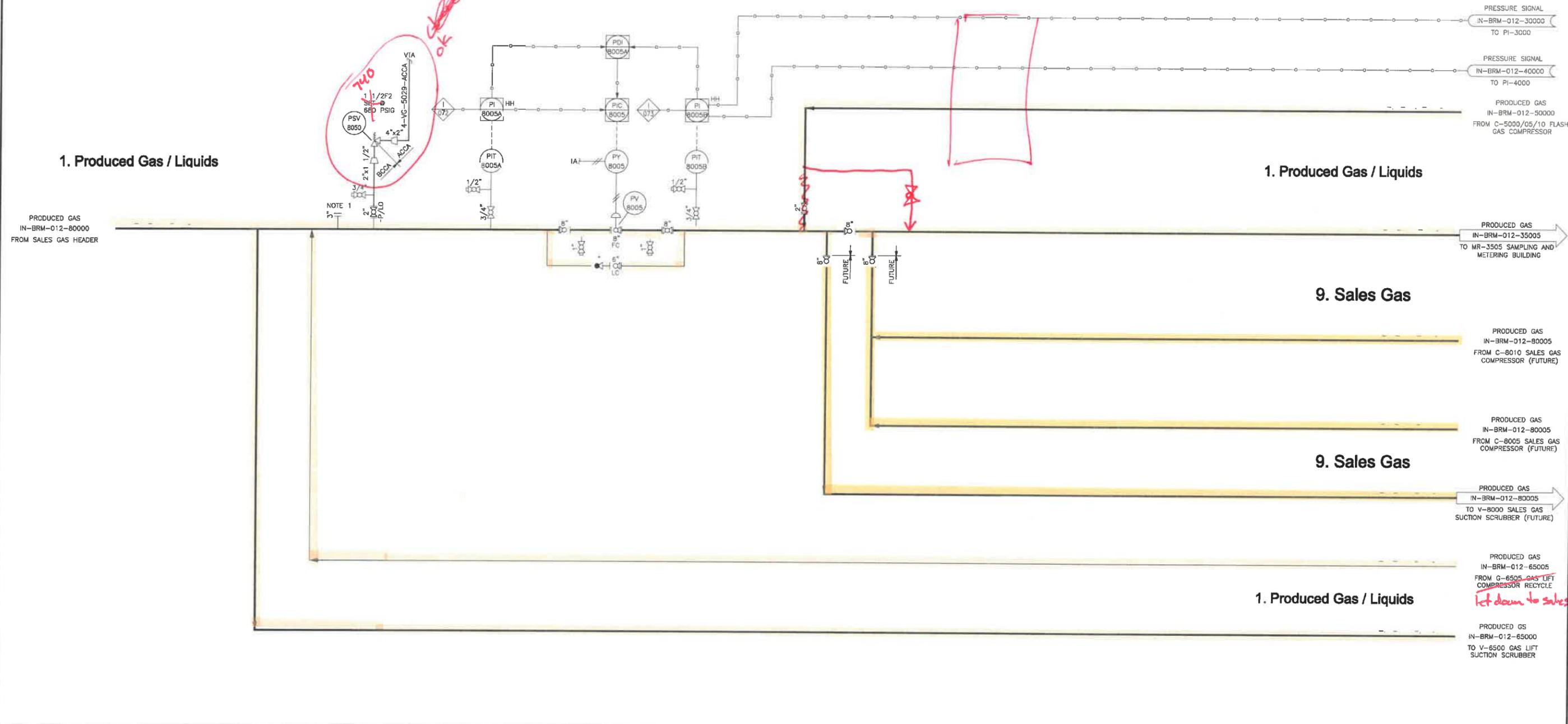
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CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
PV-8005	FISHER/V300

Flash Gas Discharge Scrubber (Part of Sales gas scrubber building)

740 OK



NOTES:
1. FUTURE GAS LIFT COMPRESSOR CONNECTION

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

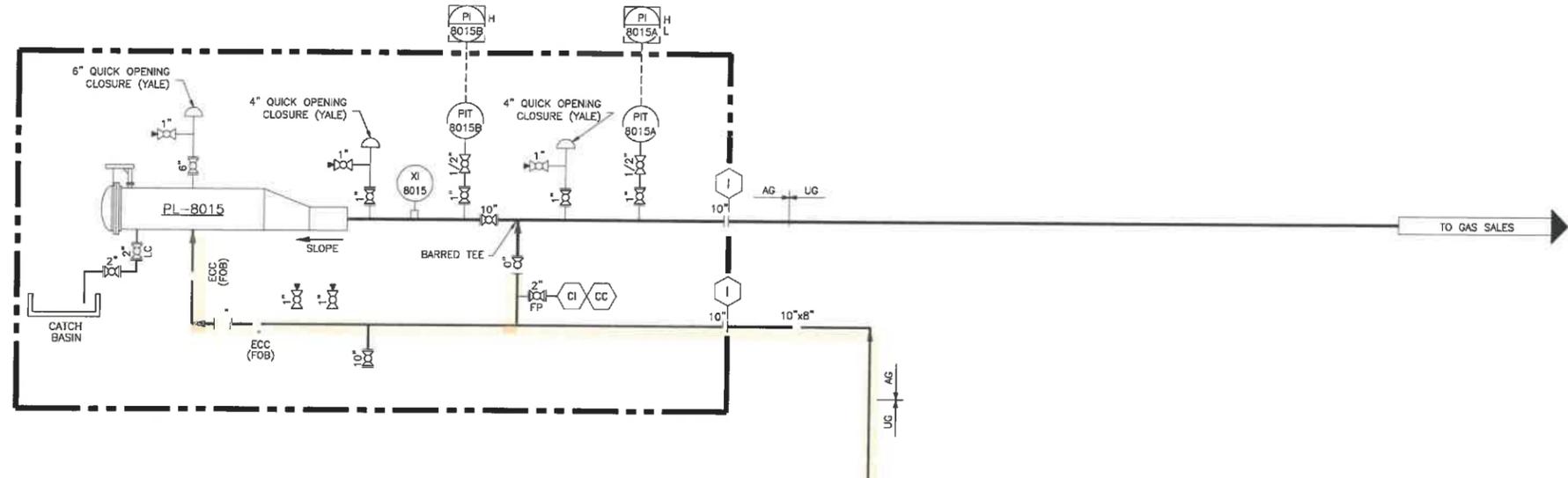
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EXTRACTION
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
SALES GAS HEADER (CONT'D)

SCALE: NTS DRAWING NO. IN-BRM-012-80010 REV. 0

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLHEAD\PIPING\SALES\IN-BRM-012-80010.DWG BY:RBAKUCUJAE DATE:Mar 28, 2018 3:05pm

PL-8015
 SALES GAS PIPELINE PIG LAUNCHER
 SIZE: 16" DIA x 12" BARREL
 DESIGN P/T: XXX PSIG @ -XX/XXX'F



1. Produced Gas / Liquids

PRODUCED GAS
 IN-BRM-012-35005
 FROM MR-3505 SAMPLING
 AND METERING BUILDING

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLPAD\PPING\PI&IDS\IN-BRM-012-80015.DWG BY:BRANCOCLAR DATE:Mar 28, 2018 3:05pm

NOTES:

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

REVISIONS		APPROVALS	
NO.	DESCRIPTION	SIGNATURE	DATE

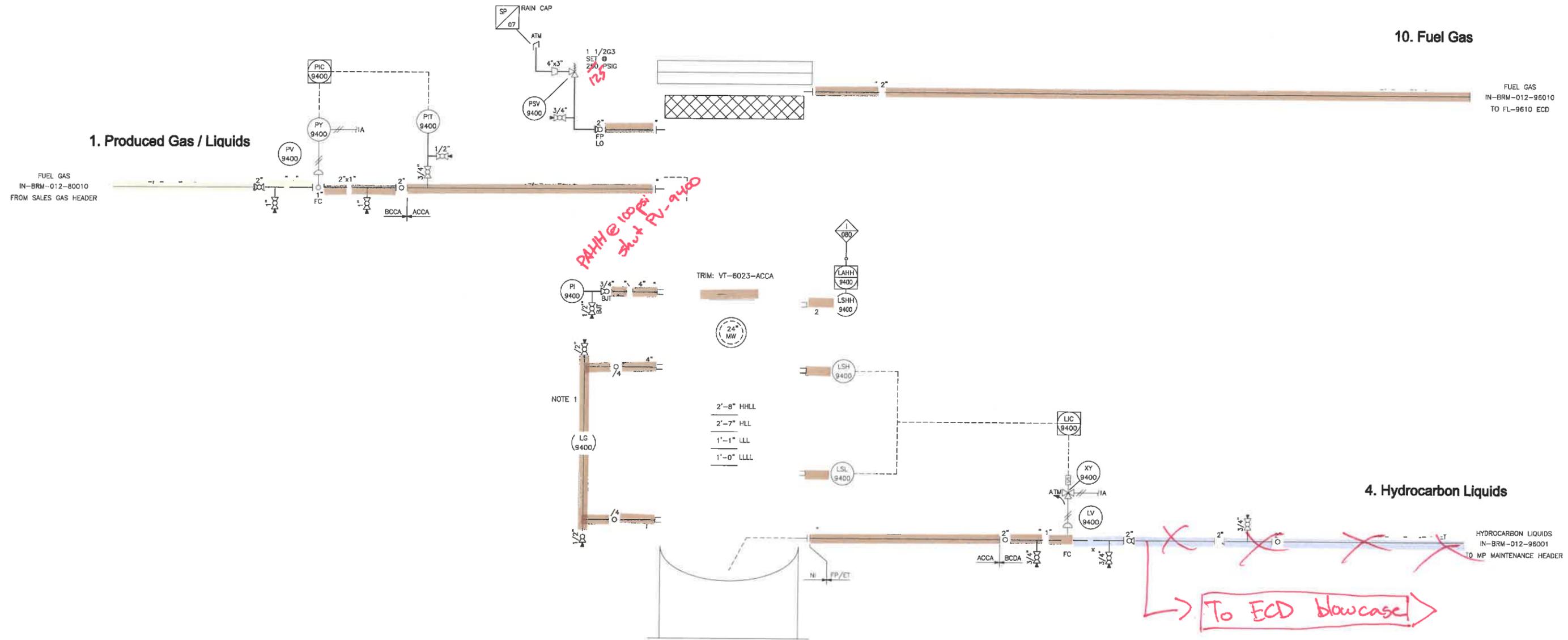
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EXTRACTION
 EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 SALES GAS TO PIPELINE

SCALE: NTS DRAWING NO. IN-BRM-012-80015 REV. 0

V-9400
 FUEL GAS SCRUBBER
 SIZE: 24" OD x 6'-0" S/S
 DESIGN P/T: 250 PSIG @ -20/200 °F
 MATERIAL: CS

125 psi



PAHHE 100 psi shut PV-9400

To ECD blowcase

CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
LV-9400	KIMRAY/1400 SMT PO
PV-9400	FISHER/EZ

NOTES:
 1. HEAT TRACE & INSULATE BRIDLE - FREEZE PROTECTION

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

APPROVALS	
SIGNATURE	DATE

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 ENGINEERING
 SERVICES, LLC

EXTRACTION
INC.

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 FUEL GAS SCRUBBER

SCALE: NTS	DRAWING NO. IN-BRM-012-94000	REV. 0
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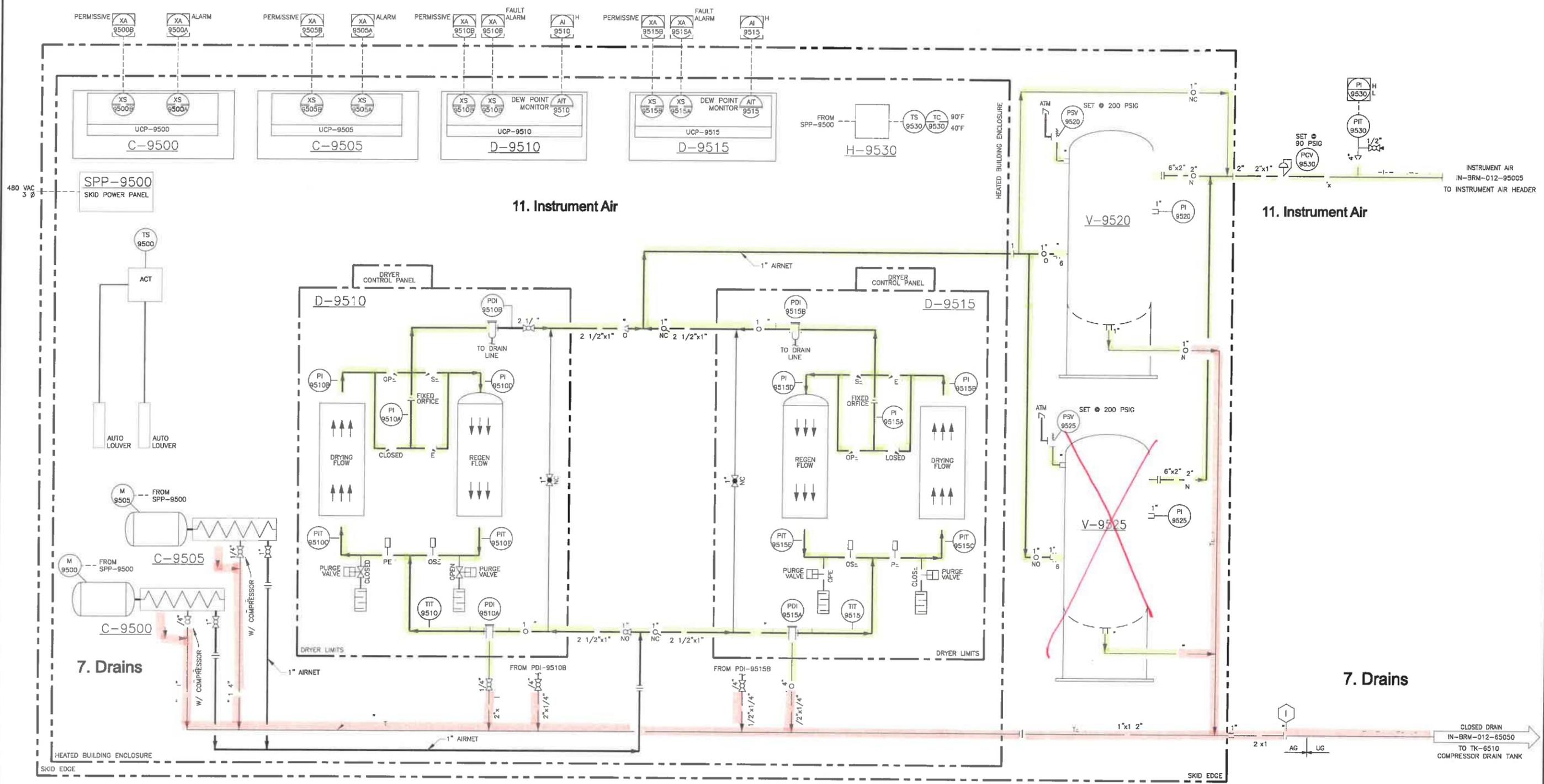
FILE PATH: P:\EXTRACTION\A & B WELLPAD\PIPING\PIPING\IN-BRM-012-94000.DWG SYSTEM: LOCAL DATE: Mar 28, 2018 3:05pm

C-9500/9505
INSTRUMENT AIR COMPRESSOR
 TYPE: GARDNER DENVER L110RS-643 1CFM
 DESIGN CAPACITY: 419 SCFM
 DESIGN DISCHARGE P/T: 138 PSIG @ 100°F
 MOTOR: 150 HP, 460/3/30 TEFC

D-9510/9515
INSTRUMENT AIR DRYER
 TYPE: GARDNER DENVER DGH-750
 CAPACITY: 750 SCFM (BOTH COMPRESSORS)
 DESIGN P/T: 250 PSIG @ 100°F
 OP: 135 PSIG @ 100°F
 OUTLET DEW POINT: -40°F

H-9530
HEATER
 TYPE:
 MODEL:
 SIZE: XKW/480/3/60

V-9520/9525
AIR RECEIVER
 48" O.D. x 12'-8" OAH
 CAPACITY: 1060 GAL.
 MAWP: 200 PSIG @ 400°F



FILE PATH: P:\EXTRACTION\4 - XOC INTERCHANGE A & B WELLHEAD PIPING\PAIDS\IN-BRM-012-95000.DWG BY:BRANCOUAR DATE:Mar 28, 2018 3:05pm

NOTES:
 1. FIELD TO INSTALL INSULATION AND HEAT TRACE ON ALL DRAINS OUTSIDE ENCLOSURE.

REVISIONS		APPROVALS			
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

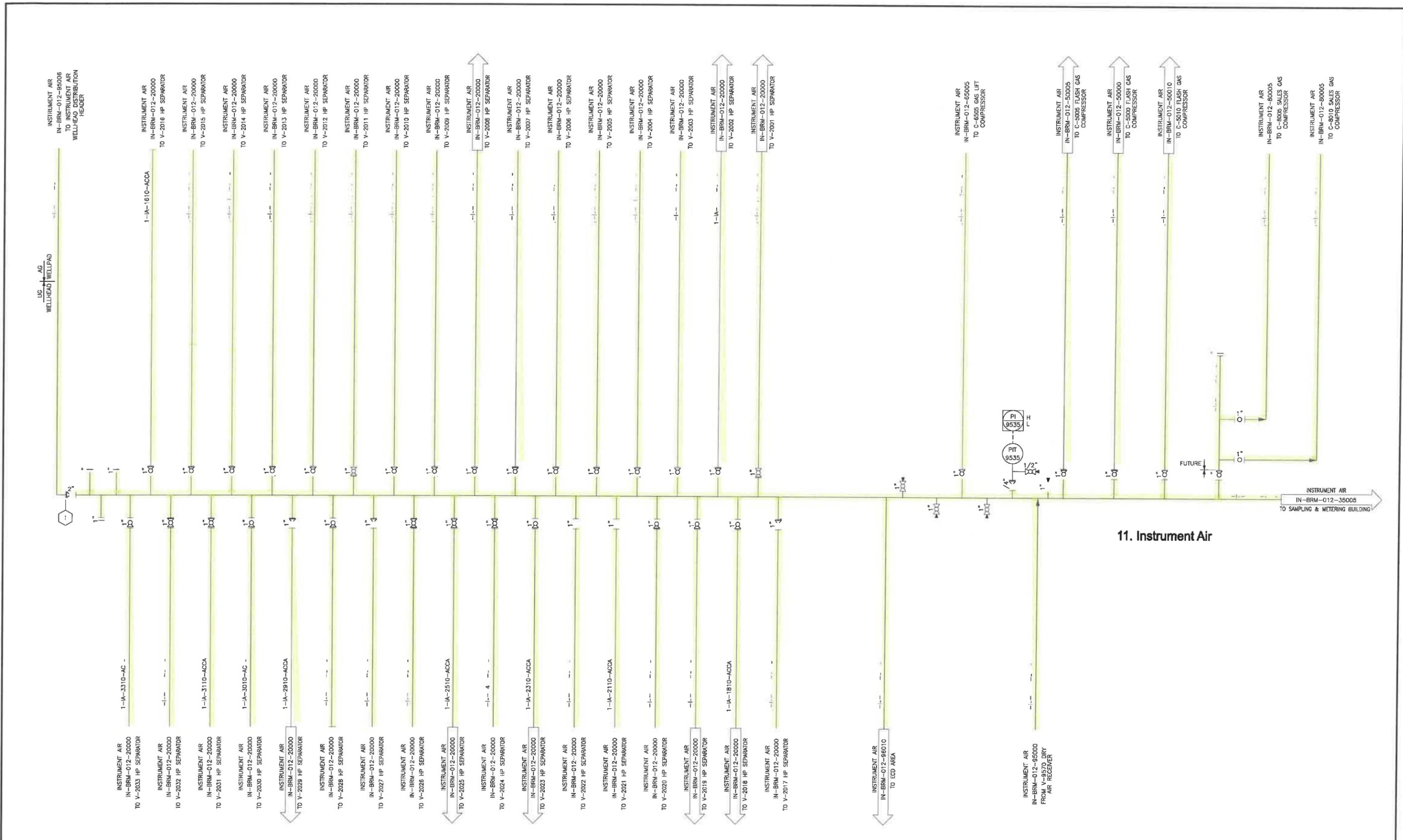
APPROVALS	
SIGNATURE	DATE



EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 INSTRUMENT AIR SKID

SCALE: NTS DRAWING NO: IN-BRM-012-95000 REV: 0



NOTES:
1.

REVISIONS						
NO	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	CAD
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR DATE

APPROVALS	
SIGNATURE	DATE

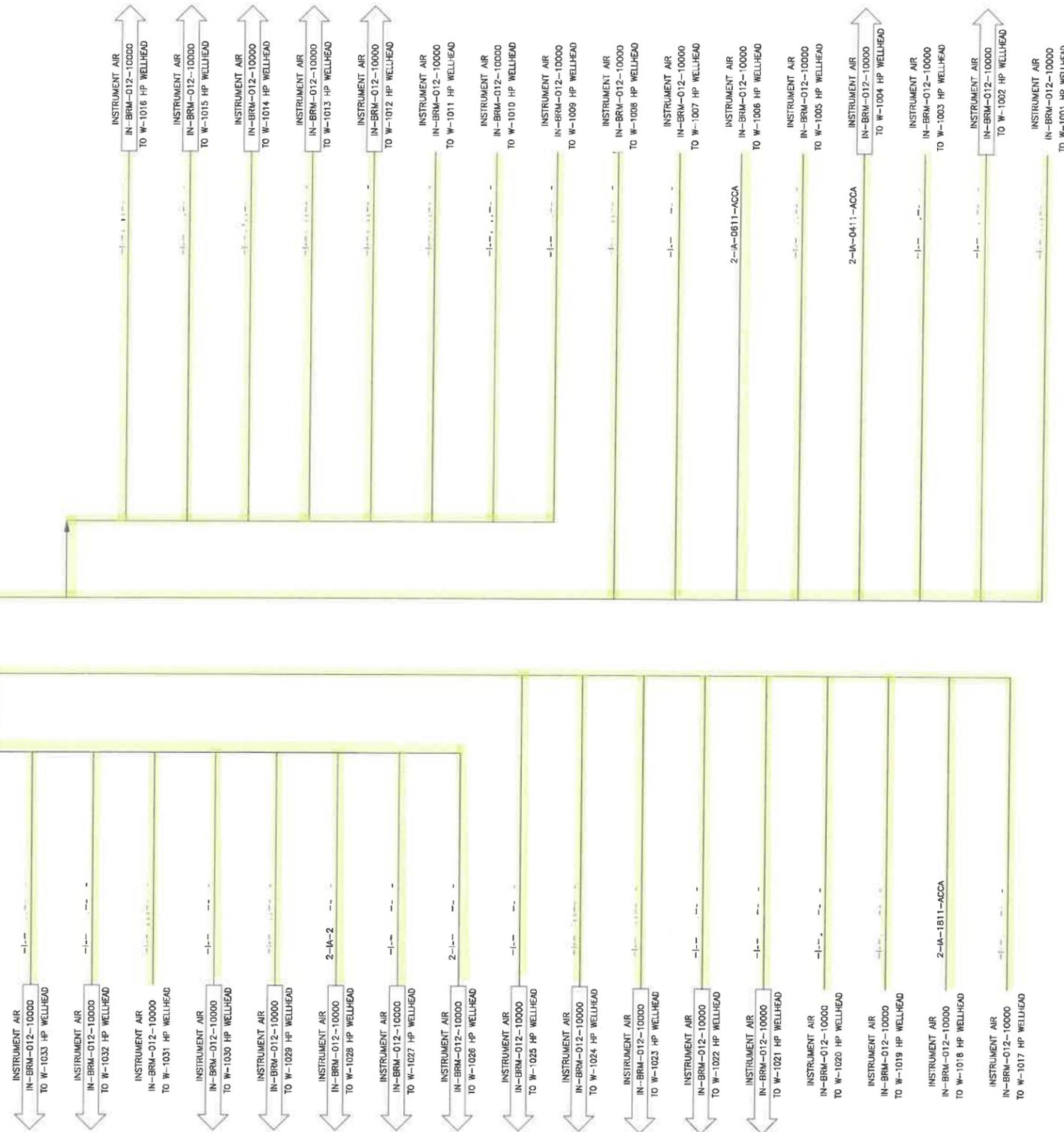


EXTRACTION
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
INSTRUMENT AIR DISTRIBUTION HEADER

SCALE: NTS DRAWING NO: IN-BRM-012-95005 REV: 0

11. Instrument Air

INSTRUMENT AIR
IN-BRM-012-95005
FROM INSTRUMENT
AIR HEADER



NOTES:

1.

REVISIONS

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

APPROVALS

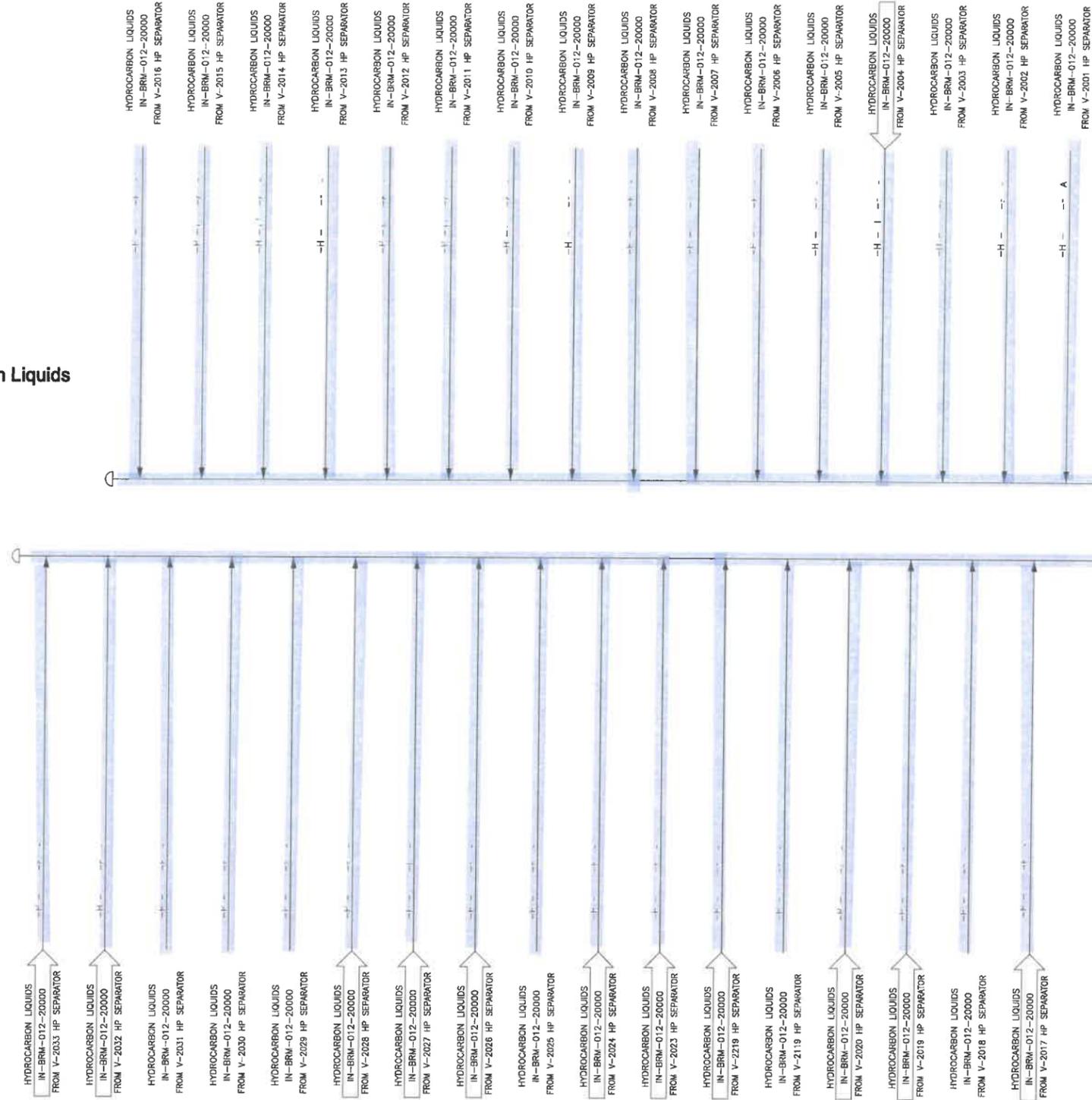
SIGNATURE	DATE



EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
INSTRUMENT AIR WELLHEAD DISTRIBUTION HEADER

SCALE: NTS	DRAWING NO. IN-BRM-012-95006	REV. 0
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4. Hydrocarbon Liquids



4. Hydrocarbon Liquids

NOTES:

1.

REVISIONS						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD 03/28/18

APPROVALS	
SIGNATURE	DATE

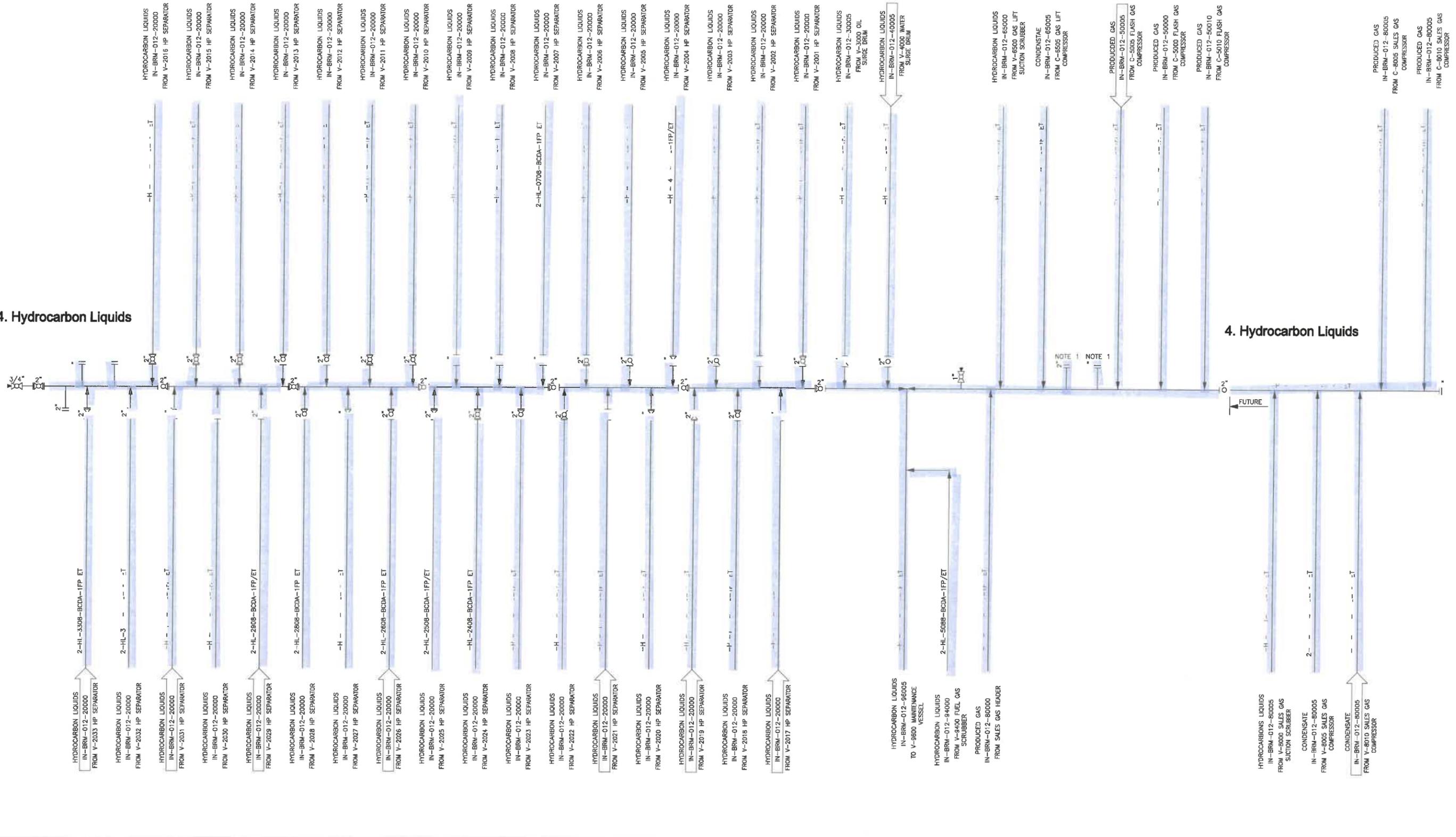


EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 MAINTENANCE HEADER (HIGH PRESSURE)

SCALE: MTS	DRAWING NO. IN-BRM-012-96000	REV. 0
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4. Hydrocarbon Liquids



4. Hydrocarbon Liquids

NOTES:
 1. FUTURE GAS LIFT SUCTION SCRUBBER AND COMPRESSOR CONNECTIONS.

REVISIONS						
NO	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS		
DRAWN	SIGNATURE	DATE
CHECKED		
APPROVED		



EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 MAINTENANCE HEADER (MEDIUM PRESSURE)

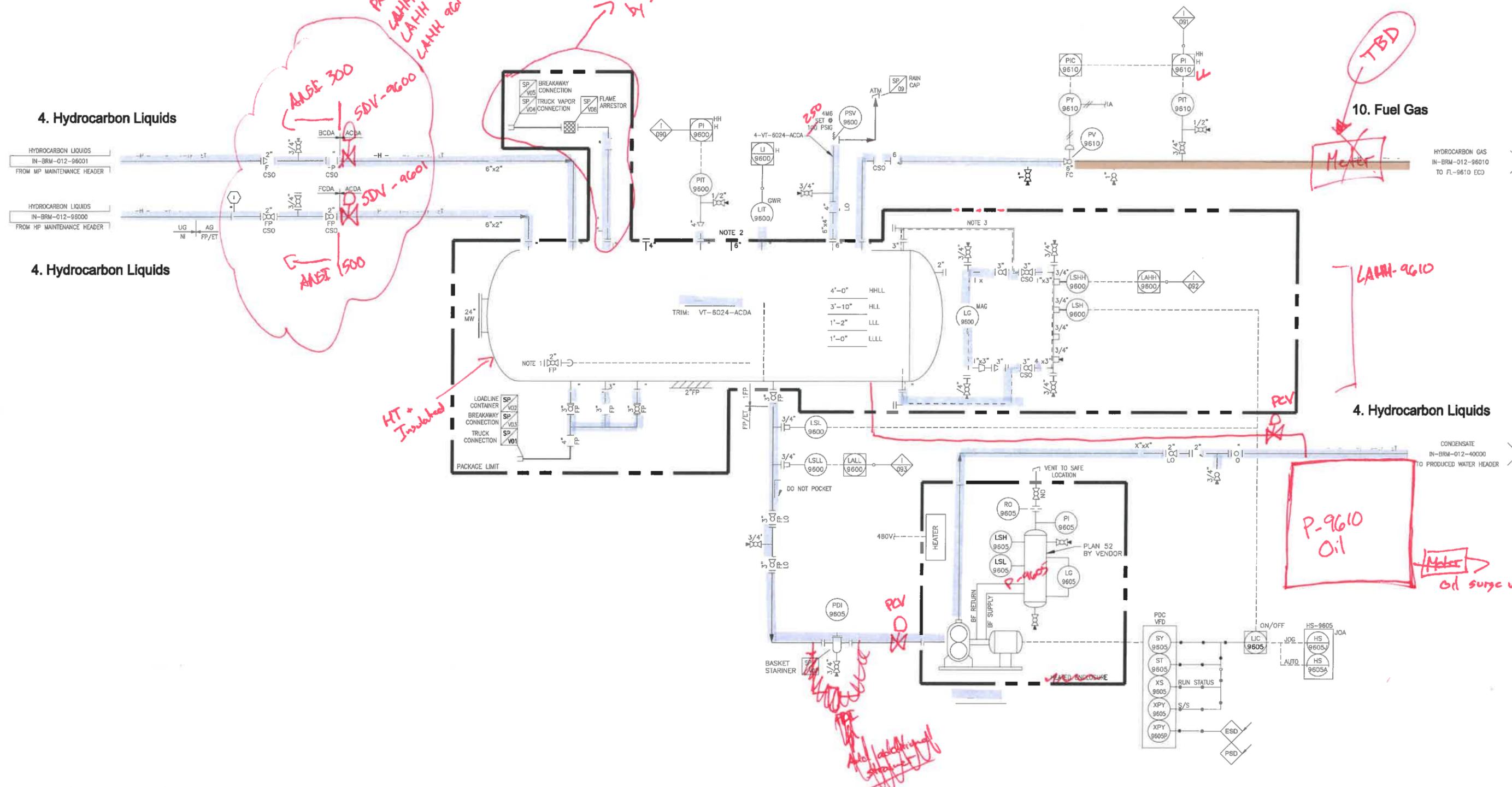
SCALE: NTS DRAWING NO. IN-BRM-012-96001 REV. 0

FILE PATH: P:\EXTRACTION\A - XOG INTERCHANGE A & B WELLHEAD\PIPING\PERMITS\IN-BRM-012-96005.DWG 6/18/2018 3:05pm

V-9600
 MAINTENANCE VESSEL
 SIZE: 72" I.D. x 30'-0" S/S
 DESIGN P/T: 150 PSIG/HALF VAL (-7.5 PSIA) @ -20/200°F
 MATERIAL: CS

P-9605
 MAINTENANCE VESSEL PUMP
 TYPE: BY XOG
 NORMAL FLOW: 20-60 GPM
 DESIGN DIFFERENTIAL PRESSURE: 145 PSIG
 DRIVER: ELECTRICAL
 NOTE 4

M-9605
 MAINTENANCE VESSEL PUMP MOTOR
 POWER: 15 HP @ 1800 RPM
 VOLTAGE: 460VAC/3HP/60HZ



CONTROL VALVE SCHEDULE

TAG NUMBER	MAKE/MODEL
PV-9610	FISHER/V150

- NOTES:
- SAND JET NOZZLE.
 - MAINTENANCE NOZZLE CONNECTION.
 - HEAT TRACE & INSULATE BRIOLE - FREEZE PROTECTION.
 - LISTED PUMP CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG PUMP SELECTION.

REVISIONS					
NO	ISSUED FOR CONSTRUCTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DNA	03/28/18
1					
2					

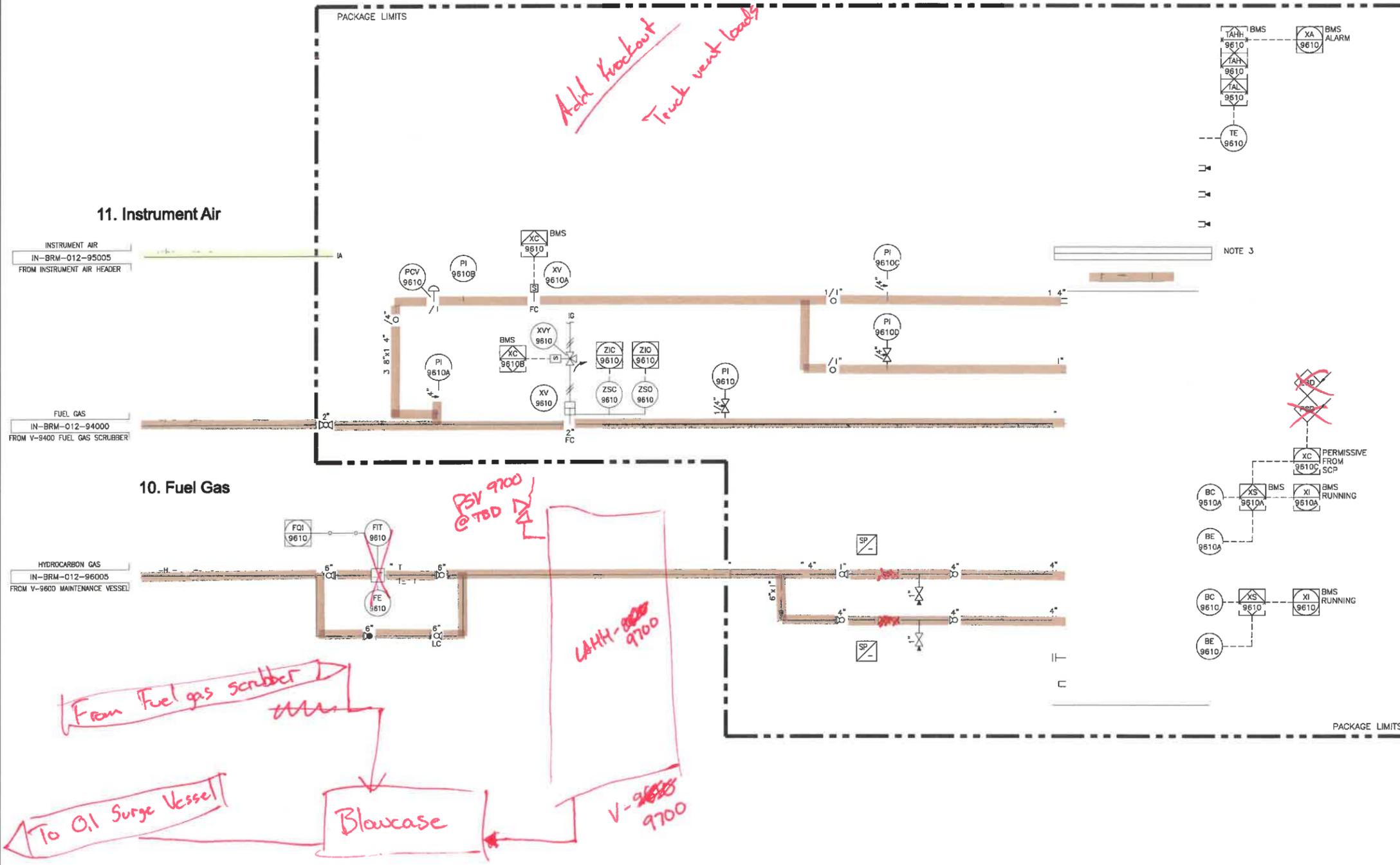
APPROVALS	
SIGNATURE	DATE



EXTRACTION
 EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 MAINTENANCE VESSEL

SCALE: NTS DRAWING NO: IN-BRM-012-96005 REV: 0

FL-9670 9700
 EMISSIONS CONTROL DEVICE (ECD)
 MANUFACTURER: BY XOG
 SIZE: 144" O.D. x 40'-0" H, NOTE 3
 CAPACITY: 150.4 MMBTU/HR
 NOTE 5



FILE PATH: P:\EXTRACTION\A & B INTERCHANGE A & B WELLHEAD\PIPING\2\DCS\IN-BRM-012-96010.DWG BY:SRM\LOCAL DATE: Mar 28, 2018 3:05pm

NOTES:
 1. BURNER CAPACITY RATED FOR METHANE EQUIVALENT.
 2. DESIGNED TO MEET CLASS 1, DIV. 2 GROUP C.D.
 3. LIMIT HEIGHT REDUCED TO 22 FT. POST-INITIAL PRODUCTION.
 4. FE-9610 STRAIGHT RUN PIPE REQUIREMENT: 15 DIAMETER UPSTREAM, 10 DIAMETER DOWNSTREAM.
 5. LISTED ECD CONDITIONS ASSUMED PER DESIGN, MAY VARY FROM XOG COMBUSTOR SELECTION.

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

REVISIONS		APPROVALS	
NO.	DESCRIPTION	SIGNATURE	DATE

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EXTRACTION
 EXTRACTION INTERCHANGE WELLPAD DESIGN
 PIPING & INSTRUMENTATION DIAGRAM
 EMISSIONS CONTROL DEVICE (ECD)

SCALE: NTS DRAWING NO. IN-BRM-012-96010 REV. 0



Cause & Effect Matrix Document Number:
IN-BRM-051-00001
 Revision: 0
 Issue for Construction
 Date: 3/5/2018

BY: RCC CHK: DT2 APPR: GD

LEGEND:
 A = ALARM
 DE = DE-ENERGIZE
 EN = ENERGIZE
 ESD = RLY PANEL
 FC = FORCE CLOSED
 FO = FORCE OPEN
 PCS = MAIN PLANT CONTROLLER
 RMT = SCADA INPUT
 SR = START (ON)
 ST = STOP (OFF)
 TD = TIME DELAY
 UCP = UNIT CONTROL PANEL

NOTES:

- 1) ALL P&ID DRAWING NUMBERS ARE PREFIXED WITH "IN-BRM-012-" UNLESS OTHERWISE NOTED.
- 2) INTERLOCKS ASSOCIATED WITH CONTROLLERS PROVIDED WITH VENDOR EQUIPMENT OR SKID PACKAGES ARE NOT INCLUDED. SEE EQUIPMENT VENDOR DOCUMENTATION FOR CAUSE AND EFFECTS.
- 3) FORCE CONTROLLER OUTPUT TO 4 MA OR 20 MA TO CLOSE MODULATING VALVE, DEPENDENT UPON THE FAIL POSITION OF THE SPECIFIC VALVE.
- 4) REQUIRES RESET AT FACILITY HMI BEFORE MANUAL RESETS IN FIELD CAN BE CLEARED.
- 5) FOR CLARITY, WHERE THERE ARE MULTIPLE IDENTICAL UNITS, ONLY ONE IS INDICATED. THERE ARE 33 HP PRODUCTION SEPARATORS AND THIS MATRIX ONLY SHOWS THE LOGIC FOR ONE. THE C&E FOR THE REMAINING UNITS IS THE SAME.
- 6) XOG TO DETERMINE EFFECTS.

Close motor valve on all SSV close @ wellhead

ROW	INTERLOCK #	NOTE	P&ID	DESCRIPTION OF INITIATING DEVICE / EVENT	DEVICE	SOFTWARE	VOTING LOGIC	SETPOINT	ALARM STATE	ACTING DEVICE (OUTPUT) CONTROL SYSTEM		INITIATING DEVICE (INPUT) CONTROL SYSTEM		RESET	DESCRIPTION OF REACTING DEVICE	P&ID	COL
										ESD	ESD	ACTING DEVICE	FAIL POSITION				
1	1		N/A	FACILITY ESD (SEE COLUMN 1)	N/A	N/A	1001	N/A	ACTIVE	N/A	ESD	X	X	(4)	FACILITY EMERGENCY SHUTDOWN ESD (SEE ROW 1)	N/A	1
2	2			REMOTE ESD VIA SCADA	HMI	CYGNET	1001	N/A	ACTIVE	RMT	ESD	X	X		ACTIVATE BEACONS AND HORNS	N/A	2
3	3			CONTROL PANEL ESD BUTTON	HS-XXXX	N/A	1001	N/A	ACTIVE	N/A	ESD	X	X		WELLHEAD ISOLATION VALVE	10000	3
4	6		N/A	PROCESS SHUTDOWN PSD (SEE COLUMN 27)	N/A	N/A	1001	N/A	ACTIVE	N/A	PCS				PRODUCED LIQUIDS SHUTDOWN VALVE TO HP SEPARATOR	20000	4
5	7	5	10000	WELLPAD ESD (QTY: TBD)	HS-10XX	HS-10XX	1001	N/A	ACTIVE	ESD	ESD	X	X		PROFIRE BMS SHUTDOWN	20000	5
6	8	5,6	10000	WELLHEAD CONTROL PRESSURE LOW-LOW	PIT-10XXA	PALL-10XXA	1001	1250 PSIG	ACTIVE	PCS	PCS				OIL SURGE PUMP SHUTDOWN	30005	6
7	9	5	10000	WELLHEAD PRODUCTION LINE PRESSURE HIGH-HIGH	PIT-10XXB	PAHH-10XXB	1001	3250 PSIG	ACTIVE	PCS	PCS				OIL SURGE PUMP SHUTDOWN	30005	7
8	10	5,6	10000	WELLHEAD PRODUCTION LINE PRESSURE LOW-LOW	PIT-10XXB	PALL-10XXB	1001	1250 PSIG	ACTIVE	PCS	PCS				OIL SURGE PUMP SHUTDOWN	30005	8
9	11	5	20000	HP PRODUCTION SEPARATOR OIL LEVEL HIGH-HIGH	LSHH-20XX	LAHH-20XX	1001	3-5"	ACTIVE	PCS	PCS				PRODUCED OIL METER RUN VALVE	35005	9
10	12	5	20000	HP PRODUCTION SEPARATOR OIL LEVEL LOW-LOW	LIT-20XXA	LALL-20XXA	1001	1-0"	ACTIVE	PCS	PCS				PRODUCED OIL METER RUN VALVE	35005	10
11	13	5	20000	HP PRODUCTION SEPARATOR LIQUID LEVEL HIGH-HIGH	LIT-20XXB	LAHH-20XXB	1001	3-5"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	11
12	14	5	20000	HP PRODUCTION SEPARATOR LIQUID LEVEL LOW-LOW	LIT-20XXB	LALL-20XXB	1001	0-6"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	12
13	15	5	20000	FUEL GAS SCRUBBER LEVEL HIGH-HIGH	LIT-22XX	LAHH-22XX	1001	1-6"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	13
14	16	5	20000	HP PRODUCTION SEPARATOR INLET PRESSURE LOW-LOW <i>N/A @ 2000 ps</i>	PIT-20XXA	PALL-20XXA	1001	100 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	14
15	17	5	20000	HP PRODUCTION SEPARATOR PRESSURE HIGH-HIGH	PIT-20XXB	PAHH-20XXB	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	15
16	18		20000	HP SEPARATOR BMS TRIP	B-21XX	XA-21XX	1001	N/A	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	16
17	20		30005	OIL SURGE DRUM ESD	HS-3000	HS-3000	1001	N/A	ACTIVE	ESD	PCS	X	X		PRODUCED GAS METER RUN VALVE	35005	17
18	21		30005	OIL SURGE DRUM LEVEL HIGH-HIGH	LSHH-3000	LAHH-3000	1001	2-11"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	18
19	22		30005	OIL SURGE DRUM LEVEL LOW-LOW	LSSL-3000	LALL-3000A	1001	1-0"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	19
20	23		30005	OIL SURGE PUMP SUCTION PRESSURE LOW-LOW	PIT-3025A	PALL-3025A	1001	100 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	20
21	24		30005	OIL SURGE PUMP DISCHARGE PRESSURE HIGH-HIGH	PIT-3025B	PAHH-3025B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	21
22	25		30005	OIL SURGE PUMP DISCHARGE PRESSURE HIGH-HIGH	PIT-3030B	PAHH-3030B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	22
23	TBD		30005	OIL SURGE PUMP DISCHARGE PRESSURE HIGH-HIGH	PIT-3035B	PAHH-3035B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	23
24	40		35005	PRODUCED OIL METER RUN PRESSURE HIGH-HIGH	PIT-3500D	PAHH-3500D	1001	450 PSIG	ACTIVE	PCS	PCS	X			PRODUCED GAS METER RUN VALVE	35005	24
25	42		35005	PRODUCED OIL METER RUN DP HIGH-HIGH	PDI-3500A	PDAH-3500A	1001	50 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	25
26	45		40005	PRODUCED WATER SKID ESD	HS-4000	HS-4000	1001	N/A	ACTIVE	ESD	PCS	X	X		PRODUCED GAS METER RUN VALVE	35005	26
27	46		40005	PRODUCED WATER SURGE DRUM LEVEL HIGH-HIGH	LSHH-4000	LAHH-4000	1001	3-5"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	27
28	47		40005	PRODUCED WATER SURGE DRUM LEVEL LOW-LOW	LSSL-4000	LALL-4000	1001	1-0"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	28
29	48		40005	PRODUCED WATER SURGE PUMP P-4005 DISCHARGE PRESSURE HIGH-HIGH	PIT-4005B	PAHH-4005B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	29
30	49		40005	PRODUCED WATER SURGE PUMP P-4010 DISCHARGE PRESSURE HIGH-HIGH	PIT-4010B	PAHH-4010B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	30
31	TBD		40005	PRODUCED WATER SURGE PUMP P-4010 DISCHARGE PRESSURE HIGH-HIGH	PIT-4015B	PAHH-4015B	1001	325 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	31
32	51		40005	PRODUCED WATER SURGE PUMP P-4005 SUCTION PRESSURE LOW-LOW	PIT-4005A	PALL-4005A	1001	100 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	32
33	55		35005	PRODUCED WATER METER RUN PRESSURE HIGH-HIGH	PIT-4500D	PAHH-4500D	1001	450 PSIG	ACTIVE	PCS	PCS	X			PRODUCED GAS METER RUN VALVE	35005	33
34	57		35005	PRODUCED WATER METER RUN DP HIGH-HIGH	PDI-4500A	PDAH-4500A	1001	50 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	34
35	67		65000	GAS LIFT SUCTION SCRUBBER LEVEL HIGH-HIGH	LSHH-6500	LAHH-6500	1001	2-8"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	35
36	70		80005	SALES GAS SUCTION SCRUBBER LEVEL HIGH-HIGH	LSHH-8000	LAHH-8000	1001	6-4"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	36
37	72		80010	SALES GAS PRESSURE HIGH-HIGH	PIT-8005A	PAHH-8005A	1001	375 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	37
38	73		80010	SALES GAS PRESSURE HIGH-HIGH	PIT-8005B	PAHH-8005B	1001	375 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	38
39	74		35005	SALES GAS O2 CONTENT HIGH-HIGH	AJT-8000	AAHH-8000	1001	10 PPM O2	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	39
40	76		35005	PRODUCED GAS METER RUN PRESSURE HIGH-HIGH	PIT-8015D	PAHH-8015D	1001	450 PSIG	ACTIVE	PCS	PCS	X			PRODUCED GAS METER RUN VALVE	35005	40
41	78		35005	PRODUCED GAS METER RUN DP HIGH-HIGH	PDI-8015	PDAH-8015	1001	50 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	41
42	80		94000	FUEL GAS SCRUBBER LEVEL HIGH-HIGH	LSHH-9400	LAHH-9400	1001	2-8"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	42
43	90		96005	MAINTENANCE VESSEL PRESSURE HIGH-HIGH	PIT-9600	PAHH-9600	1001	75 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	43
44	91		96005	MAINTENANCE VESSEL GAS OUTLET PRESSURE HIGH-HIGH	PIT-9610	PAHH-9610	1001	5 PSIG	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	44
45	92		96005	MAINTENANCE VESSEL LEVEL HIGH-HIGH	LSHH-9600	LAHH-9600	1001	4-0"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	45
46	93		96005	MAINTENANCE VESSEL LEVEL LOW-LOW	LSSL-9600	LALL-9600	1001	1-0"	ACTIVE	PCS	PCS				PRODUCED GAS METER RUN VALVE	35005	46
47															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	47
48															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	48
49															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	49
50															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	50
51															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	51
52															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	52
53															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	53
54															FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	54

close wellhead motor valve

close wellhead motor valve

close wellhead motor valve

close wellhead motor valve (on HMI)

close wellhead motor valve

X added

Add m-30v's on HV



Cause & Effect Matrix Document Number:
IN-BRM-051-00001
Revision: 0
Issue for Construction
Date: 3/5/2018

BY: RCC CHK: DT2 APPR: GD

LEGEND:
A = ALARM
DE = DE-ENERGIZE
EN = ENERGIZE
ESD = RLY PANEL
FC = FORCE CLOSED
FO = FORCE OPEN
PCS = MAIN PLANT CONTROLLER
RMT = SCADA INPUT
SR = START (ON)
ST = STOP (OFF)
TD = TIME DELAY
UCP = UNIT CONTROL PANEL

NOTES:

- 1) ALL P&ID DRAWING NUMBERS ARE PREFIXED WITH "IN-BRM-012-" UNLESS OTHERWISE NOTED.
- 2) INTERLOCKS ASSOCIATED WITH CONTROLLERS PROVIDED WITH VENDOR EQUIPMENT OR SKID PACKAGES ARE NOT INCLUDED. SEE EQUIPMENT VENDOR DOCUMENTATION FOR CAUSE AND EFFECTS.
- 3) FORCE CONTROLLER OUTPUT TO 4 MA OR 20 MA TO CLOSE MODULATING VALVE, DEPENDENT UPON THE FAIL POSITION OF THE SPECIFIC VALVE.
- 4) REQUIRES RESET AT FACILITY HMI BEFORE MANUAL RESETS IN FIELD CAN BE CLEARED.
- 5) FOR CLARITY, WHERE THERE ARE MULTIPLE IDENTICAL UNITS, ONLY ONE IS INDICATED. THERE ARE 33 HP PRODUCTION SEPARATORS AND THIS MATRIX ONLY SHOWS THE LOGIC FOR ONE. THE C&E FOR THE REMAINING UNITS IS THE SAME.
- 6) XOG TO DETERMINE EFFECTS.

ROW	INTERLOCK #	NOTE	P&ID	DESCRIPTION OF INITIATING DEVICE / EVENT	DEVICE	SOFTWARE	VOTING LOGIC	SETPOINT	ALARM STATE	INITIATING DEVICE (INPUT) CONTROL SYSTEM		INTERLOCK LOGIC CONTROL SYSTEM		REACTING DEVICE	P&ID	COL
										ACTING DEVICE	PROCESS DEVICE	FAL Position	REBET RECD			
47			96010	ECD SHUTDOWN	FL-9610	XI-9610	1oo1	N/A	ACTIVE	PCS	PCS	ESD	ESD	FACILITY EMERGENCY SHUTDOWN ESD (SEE ROW 1)	N/A	1
										ESD	ESD	ESD	ESD	ACTIVATE BEACONS AND HORNS	N/A	2
										ESD	ESD	ESD	ESD	WELLHEAD ISOLATION VALVE	10000	3
										ESD	ESD	ESD	ESD	PRODUCED LIQUIDS SHUTDOWN VALVE TO HP SEPARATOR	20000	4
										ESD	ESD	ESD	ESD	PROFIRE BMS SHUTDOWN	20000	5
										ESD	ESD	ESD	ESD	OIL SURGE PUMP SHUTDOWN	30005	6
										ESD	ESD	ESD	ESD	OIL SURGE PUMP SHUTDOWN	30005	7
										ESD	ESD	ESD	ESD	OIL SURGE PUMP SHUTDOWN	30005	8
										ESD	ESD	ESD	ESD	PRODUCED OIL METER RUN VALVE	35005	9
										ESD	ESD	ESD	ESD	PRODUCED WATER METER RUN VALVE	35005	10
										ESD	ESD	ESD	ESD	PRODUCED GAS METER RUN VALVE	35005	11
										ESD	ESD	ESD	ESD	WATER SURGE PUMP SHUTDOWN	40005	12
										ESD	ESD	ESD	ESD	WATER SURGE PUMP SHUTDOWN	40005	13
										ESD	ESD	ESD	ESD	WATER SURGE PUMP SHUTDOWN	40005	14
										ESD	ESD	ESD	ESD	FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	15
										ESD	ESD	ESD	ESD	FLASH GAS COMPRESSOR SHUTDOWN VALVE	50005	16
										ESD	ESD	ESD	ESD	FLASH GAS COMPRESSOR SHUT DOWN	50000	17
										ESD	ESD	ESD	ESD	FLASH GAS COMPRESSOR SHUT DOWN	50005	18
										ESD	ESD	ESD	ESD	GAS LIFT COMPRESSOR SHUTDOWN VALVE	65005	19
										ESD	ESD	ESD	ESD	GAS LIFT COMPRESSOR SHUT DOWN	65005	20
										ESD	ESD	ESD	ESD	SALES GAS COMPRESSOR SHUTDOWN VALVE	80005	21
										ESD	ESD	ESD	ESD	SALES GAS COMPRESSOR SHUTDOWN VALVE	80005	22
										ESD	ESD	ESD	ESD	SALES GAS COMPRESSOR SHUT DOWN	80005	23
										ESD	ESD	ESD	ESD	SALES GAS COMPRESSOR SHUT DOWN	80005	24
										ESD	ESD	ESD	ESD	MAINTENANCE VESSEL PUMP SHUTDOWN	90005	25
										ESD	ESD	ESD	ESD	EMMISSIONS CONTROL DEVICE	96010	26
										PCS	PCS	PCS	PCS	PROCESS SHUTDOWN PSD (SEE ROW 4)	N/A	27
										PCS	PCS	PCS	PCS	WELLHEAD ISOLATION VALVE	10000	28
										PCS	PCS	PCS	PCS	PRODUCED LIQUIDS SHUTDOWN VALVE TO HP SEPARATOR	20000	29
										PCS	PCS	PCS	PCS	PRODUCED LIQUIDS PRESSURE CONTROL VALVE TO HP SEPARATOR	20000	30
										PCS	PCS	PCS	PCS	PRODUCED OIL LEVEL CONTROL VALVE	20000	31
										PCS	PCS	PCS	PCS	PRODUCED WATER LEVEL CONTROL VALVE	20000	32
										PCS	PCS	PCS	PCS	FUEL GAS SCRUBBER LEVEL CONTROL VALVE	20000	33
										PCS	PCS	PCS	PCS	PROFIRE INTERLOCK / PERMISSIVE	20000	34
										PCS	PCS	PCS	PCS	OIL SURGE PUMP PERMISSIVE	30005	35
										PCS	PCS	PCS	PCS	OIL SURGE PUMP PERMISSIVE	30005	36
										PCS	PCS	PCS	PCS	OIL SURGE PUMP PERMISSIVE	30005	37
										PCS	PCS	PCS	PCS	WATER SURGE PUMP PERMISSIVE	40005	38
										PCS	PCS	PCS	PCS	WATER SURGE PUMP PERMISSIVE	40005	39
										PCS	PCS	PCS	PCS	WATER SURGE PUMP PERMISSIVE	40005	40
										PCS	PCS	PCS	PCS	FLASH GAS COMPRESSOR SHUTDOWN VALVE	50000	41
										PCS	PCS	PCS	PCS	FLASH GAS COMPRESSOR SHUTDOWN VALVE	50005	42
										PCS	PCS	PCS	PCS	FLASH GAS COMPRESSOR PERMISSIVE	50000	43
										PCS	PCS	PCS	PCS	FLASH GAS COMPRESSOR PERMISSIVE	50005	44
										PCS	PCS	PCS	PCS	GAS LIFT COMPRESSOR PERMISSIVE	65005	45
										PCS	PCS	PCS	PCS	GAS LIFT COMPRESSOR SHUTDOWN VALVE	65005	46
										PCS	PCS	PCS	PCS	GAS LIFT COMPRESSOR PERMISSIVE	65005	47
										PCS	PCS	PCS	PCS	SALES GAS COMPRESSOR SHUTDOWN VALVE	80005	48
										PCS	PCS	PCS	PCS	SALES GAS COMPRESSOR SHUTDOWN VALVE	80005	49
										PCS	PCS	PCS	PCS	SALES GAS COMPRESSOR PERMISSIVE	80005	50
										PCS	PCS	PCS	PCS	SALES GAS COMPRESSOR PERMISSIVE	80005	51
										PCS	PCS	PCS	PCS	PRODUCED GAS PRESSURE CONTROL VALVE	90010	52
										PCS	PCS	PCS	PCS	MAINTENANCE VESSEL PUMP CONTROL VALVE	96005	53
										PCS	PCS	PCS	PCS	EMMISSIONS CONTROL DEVICE	96010	54