



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



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ACM HIGHPOINT PROJECT HAZARDS & OPERABILITY STUDY

April 8-9, 2019

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:</u> § 1910.119(e)(3)(i) <u>RMP:</u> 68.67(b) & 68.67(c)(1)	The Guideword/HAZOP/Knowledge based review methodologies are utilized to address hazards associated with this facility.
<u>PSM:</u> § 1910.119(e)(3)(ii) <u>RMP:</u> 68.67(c)(2)	Team Members with expertise at similar facilities and expertise in the oil and gas industry provided potential consequences for various hazard scenarios.
<u>PSM:</u> § 1910.119(e)(3)(iii) <u>RMP:</u> 68.67(c)(3)	Existing engineering and administrative controls and safeguards were used to assess and assign a likelihood to a hazard scenario.
<u>PSM:</u> § 1910.119(e)(3)(iv) <u>RMP:</u> 68.67(c)(4)	Hazard scenarios were assigned a severity without safeguards.
<u>PSM:</u> § 1910.119(e)(3)(v) <u>RMP:</u> 68.67(c)(5)	Facility siting was evaluated to determine any potential hazard scenarios.
<u>PSM:</u> § 1910.119(e)(3)(vi) <u>RMP:</u> 68.67(c)(6)	Human factors were evaluated to determine any credible hazard scenario.
<u>PSM:</u> § 1910.119(e)(3)(vii) <u>RMP:</u> 68.67(c)(7)	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:</u> § 1910.119(e)(4)	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*

<div>Probability of Occurrence (Frequency)</div> <div>Severity of Consequences</div>	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.
<div>Negligible (1)</div> <div>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.</div>	2	3	4	5	6
<div>Minor (2)</div> <div>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.</div>	3	4	5	6	7
<div>Major (3)</div> <div>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.</div>	4	5	6	7	8
<div>Severe (4)</div> <div>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.</div>	5	6	7	8	9
<div>Catastrophic (5)</div> <div>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.</div>	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 Flow
Temperature	Reverse	Misdirected Flow
		Boiling
	Other Than	Freezing
	More	Higher Temperature
		Lower Temperature
	Less	
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
		Missing Component
	Other Than	Incorrect Material
Phase	More	Additional Phase
		Missing Phase
	Less	Emulsification
		Phase Inversion
	Reverse	
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
		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
	Other Than	Something Else
Relief	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
	Other Than	Something Different Provided
Corrosion / Erosion	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

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Session: (1) 4/8/2019

Revision:

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

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
	2. Low Flow	1.4. PV-10xx malfunctions open	1.4.1. NSC						
		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

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Session: (1) 4/8/2019

Revision:

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

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

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Session: (1) 4/8/2019

Revision:

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

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 enclosurement	2	7		12. Revisit fuel gas system on separator

HAZOP Worksheet

Company: Extraction Oil & Gas
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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

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		

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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

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

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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

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

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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

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

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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

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

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Revision:

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

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

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Session: (1) 4/8/2019

Revision:

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

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

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Session: (1) 4/8/2019

Revision:

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

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

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Company: Extraction Oil & Gas
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Session: (1) 4/8/2019

Revision:

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

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

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Facility: ACM Highpoint Project

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Revision:

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

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

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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		

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Revision:

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

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

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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

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Revision:

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

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						

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Facility: ACM Highpoint Project

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Revision:

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

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

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Revision:

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

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

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Session: (1) 4/8/2019

Revision:

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

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

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Revision:

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

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

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Facility: ACM Highpoint Project

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Revision:

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

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 paraffin 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						

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Company: Extraction Oil & Gas
Facility: ACM Highpoint Project

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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

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Facility: ACM Highpoint Project

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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

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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		

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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

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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

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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

Parameter: What If

Revision:

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

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Session: (2) 4/9/2019

Revision:

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

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

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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

Parameter: Temperature

Revision:

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		71. Verify sales gas pipeline spec temperature
		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						
		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

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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

Parameter: Pressure

Revision:

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

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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

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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

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

Revision:

Parameter: Temperature

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		72. Verify sales gas pipeline spec temperature
		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

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Session: (2) 4/9/2019

Node: (9) Sales Gas

Drawings: IN-BRM-012-80005

IN-BRM-012-80010

Parameter: Pressure

Revision:

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						
Less	60. Low Pressure	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		
		60.1. Desired operating condition							

HAZOP Worksheet

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 Facility: ACM Highpoint Project

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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

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Session: (2) 4/9/2019

Revision:

Node: (10) Fuel Gas

Drawings: IN-BRM-012-94000

IN-BRM-012-96005

IN-BRM-012-96010

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		

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Company: Extraction Oil & Gas
Facility: ACM Highpoint Project

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Session: (1) 4/8/2019

Node: (10) Fuel Gas

Drawings: IN-BRM-012-94000

IN-BRM-012-96005

IN-BRM-012-96010

Parameter: Temperature

Revision:

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

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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

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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

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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							

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Company: Extraction Oil & Gas
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Revision:

Node: (10) Fuel Gas

Drawings: IN-BRM-012-94000

IN-BRM-012-96005

IN-BRM-012-96010

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

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Session: (1) 4/8/2019

Revision:

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

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

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Session: (1) 4/8/2019

Revision:

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

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

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Facility: ACM Highpoint Project

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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

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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 PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500 PSV-6505 set @ 1440 psig Building heater	3	8		81. Consider installing knockout upstream of MR-6506
		76.2. Heater fails to operate	76.2.1. See above	5	Methanol injection PAHH-6505 set @ 1350 psig shuts down associated compressor and XV-6500 PSV-6505 set @ 1440 psig	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 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	2	7		82. Confirm building ventilation

HAZOP Worksheet

Company: Extraction Oil & Gas
Facility: ACM Highpoint Project

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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

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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

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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

Page: 50 of 54

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	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
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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	2	Berm Secondary Containment Stormwater management program Anchoring in flooding plain	2	4		
	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
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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		See safeguards in other nodes				
			100.1.2. Personnel injury from contact burn from piping	2	Warning labels	3	5		
	101. Low Temperature	101.1. 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
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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 PSSR ARC flash study Equipment warning labels	2	7		
	104. Hydrates	104.1. Hydrate Plug	104.1.1. Equipment damage, possible loss containment, potential ignition, possible personnel injury		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 Cameras Remote ESD capability Manned 24/7	2	7		
				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

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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

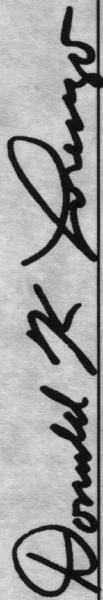
has completed a special concentrated course on

Process Hazard Analysis Leadership

May 20 - 23, 2019

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





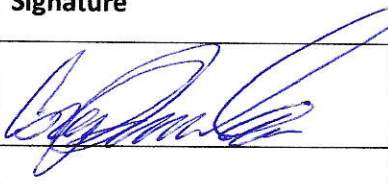
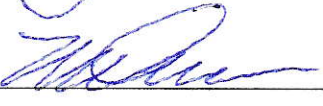
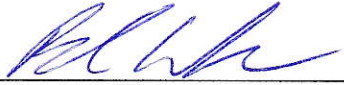




Donald K. Lorenzo
Director, Training Solutions




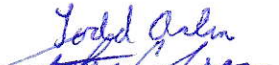







Extraction Oil & Gas: Interchange Wellpad (tankless)

Session 1: April 8, 2019

Grog Grande - Scribe - 12yrs

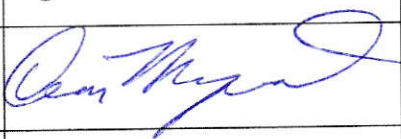







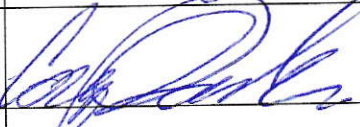


Printed Name	Signature	Role	Years Exp.
Grog Grande		Foreman	7
Bill Commette	Bill Commette	Foreman	11
Catie Nelson	Catie Nelson	AIR	6
Mike Mason		Foreman	25
Sam Ellis	Sam Ellis	Automation	11
Boyer Walker		Automation	6
STEPHAN WILSON		Foreman	8
BART HARTMAN		OPS MANAGER	31
Darrel Bothwell	Darrel Bothwell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





Steve Greene		Engineer	12
Ivan Steinke		Safety	10
Dwight Ross		Electrician	30
Todd Ochsm		Measurement	13
Stephen Anson		Measurement	19

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

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 Ochsmoer	Todd Ochsmoer	Measurement	13
Paul Dillkay	Paul Dillkay	Lead	4
Ivan Steinke		safety	10
Cody Rosch		Foreman	7
Bill Comette		Foreman	11
Catie Nelson	Catie Nelson	AIR	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

Page: 1 of 14

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 TAAH-20xxA/B			
			5. Verify endpoint functionality of TAAH-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

Page: 2 of 14

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

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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			
			32. Program logic on PI-3000 to throttle PV-20xxA			
15. Low Pressure	8		33. Consider installing spring loaded valve on drain lines			
			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

Page: 4 of 14

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

Page: 5 of 14

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

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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

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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

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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

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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

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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

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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

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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

Page: 13 of 14

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	8		80. Confirm building ventilation			
76. Low Temperature			81. Consider installing knockout upstream of MR-6506			
			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

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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			



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

NOTES:
1.

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

APPROVALS		
SIGNATURE	DATE	
DRAWN		
CHECKED		
APPROVED		



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EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
DRAWING LIST

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

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				
		READOUT (INDICATING)	TRANSMITTER (INDICATING)	TRANSMITTER (BLIND)	CONTROLLING (INDICATING)	CONTROLLERS (BLIND)	SELF CONTAIN. CONTROL VLV.	CONTROL VLV.	LOW LOW LOW	HIGH HIGH HIGH	INDICATING	BLIND	LOW LOW LOW	HIGH HIGH HIGH	RELAY	POSITION (OPEN)	POSITION (CLOSED)				
A	ANALYZER	AI	AIT	AT	AIC				AAL/AALL	AAH/AAHH	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/EAHH	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/LAHH	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	PDIT	PDT	PDIC				PDAL/PDALL	PDH/PDAAHH			PDL/PDLL	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					VIS	VS		VSH/VSHH							
X	PROCESS SHUTDOWN*							XV							XY						
Z	POSITION (*)	ZI,ZIO,ZIC	ZIT	ZT							ZIS				ZY	ZSO	ZSC				
OTHER POSSIBLE COMBINATIONS:			XI: RUN INTERLOCK	XS: RUN PERMISVE	XA: RUN STATUS	XY: SHUTDOWN	SDV: SHUTDOWN VALVE	PSV: PRESSURE SAFETY RELIEF VALVE										()1 NOTE: ZIO AND ZIC TO INDICATE FULLY OPEN/CLOSED			

MISCELLANEOUS ABBREVIATIONS					
ABBREV	DESCRIPTION	ABBREV	DESCRIPTION	ABBREV	DESCRIPTION
AIP	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 TAMPER 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	FAIL LAST	PDC	POWER DISTRIBUTION CENTER	W/	WITH
FOT	FLAT ON TOP	PLC	PROGRAMMABLE LOGIC CONTROLLER	W/O	WITH OUT

INSTRUMENT SYMBOLS

FIRST LETTER LOOP MEASURED VARIABLE
 INSTRUMENT TYPE
 ALARM AND INTERLOCK INDICATORS
 HH = HIGH HIGH L = LOW LL = LOW LOW
 H = HIGH
 SUFFIX
 ADDITIONAL IDENTIFIERS SUCH AS A,B,C,D, IF THERE ARE MORE THAN ONE TAG OF THE SAME NUMBER.

SYMBOL	DESCRIPTION	EXAMPLE
	FIELD MOUNTED INSTRUMENTS. MAY INCLUDE TRANSMITTERS, SWITCHES, ANALYZERS, INDICATORS, etc.	Ex: T1,T11,L5L INDICATING LOCALLY AND/OR TRANSMITTING.
	PANEL MOUNTED INSTRUMENTS LOCATED ON A LOCAL SKID PANEL. MAY INCLUDE TRANSMITTERS, SWITCHES, ANALYZERS, INDICATORS, etc.	Ex: T1T, 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 LOGICS 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:

VERTICAL
CENTRIFUGAL

HORIZONTAL
CENTRIFUGAL

GEAR

METERING

CENTRIFUGAL MOTOR DRIVEN

CENTRIFUGAL TURBINE DRIVEN

CENTRIFUGAL DIESEL DRIVEN

CENTRIFUGAL INLINE

POSITIVE DISPLACEMENT

GEAR

METERING

INJECTION PUMP

PROGRESSIVE CAVITY

DIAPHRAGM

ENERGY EXCHANGE GLYCOL

CAN

SUMP

VERTICAL TURBINE

AXIAL PUMP

POSITIVE DISPLACEMENT

VACUUM PUMP

PROGRESSIVE CAVITY PUMP

MULTI-STAGE HORIZONTAL PUMP

RECIPROCATING PUMP

COMPRESSOR

SCREW COMPRESSOR

CENTRIFUGAL COMPRESSOR

TURBOEXPANDER / COMPRESSOR

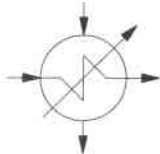
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	SIGNATURE	DATE
DRAWN		
CHECKED		
APPROVED		

EXTRACTION

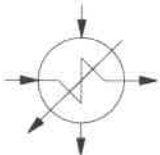
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NTS	IN-BRM-012-00002	0

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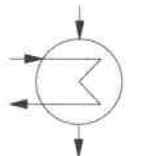
PROCESS FLOW EXCHANGERS



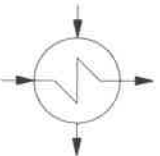
CONDENSER OR COOLER



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



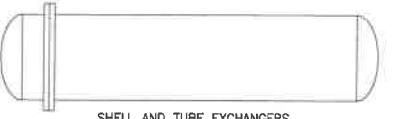
DOUBLE END KETTLE EXCHANGER



SINGLE END KETTLE EXCHANGER



DOUBLE PIPE EXCHANGER



HAIRPIN HEAT EXCHANGER

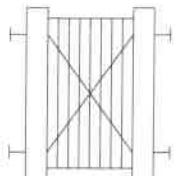
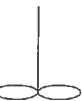


PLATE & FRAME EXCHANGER

MISCELLANEOUS



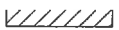
MOTOR



AGITATOR / MIXER



FLARE BLOWER



LOUVERS



DEMISTER
(W/ PAD)



DEMISTER
(W/ VANE PACK)



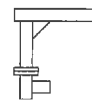
VORTEX BREAKER



SKIRT



PUMP SEAL
POT



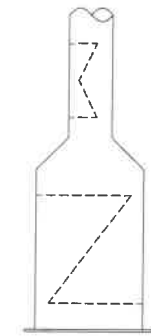
DAVIT



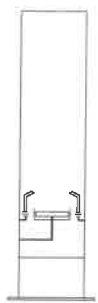
TRUCK OR
TRANSPORT



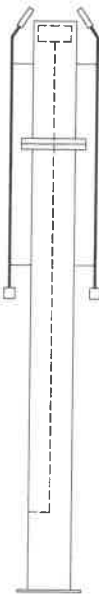
LAUNCHER / RECEIVER



DIRECT FIRED HEATER

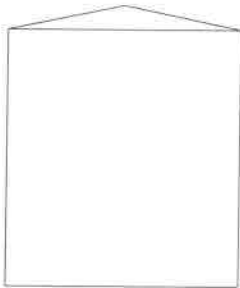


THERMAL OXIDIZER OR
VOLATILE ORGANIC
COMPOUND (VOC) BURNER

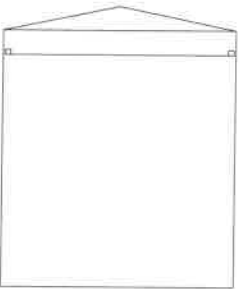


FLARE

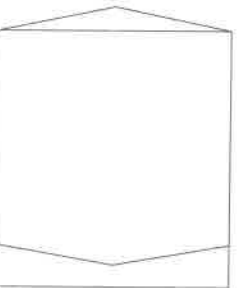
TANKS



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



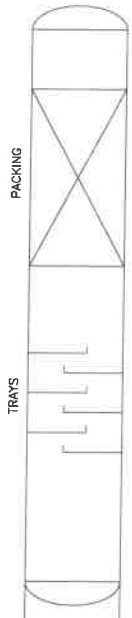
HORIZONTAL VESSEL W/ WIER



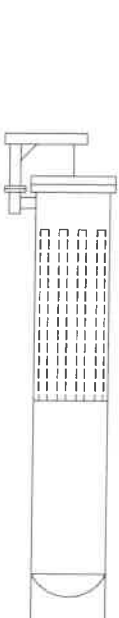
HORIZONTAL VESSEL W/ SKIM BUCKET



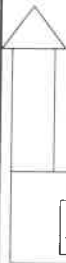
HORIZONTAL FILTER



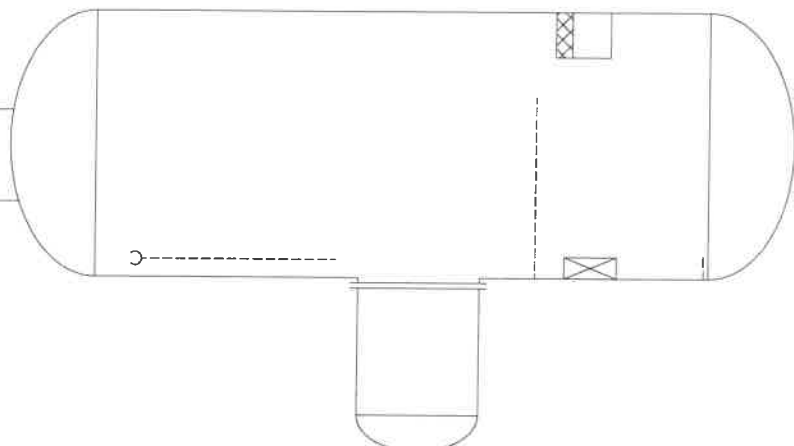
COLUMN OR TOWER



VERTICAL FILTER



BURNER
ELECTRIC
IGNITOR/
TRANSFORMER



HEATER TREATER

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
DRAWN	
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APPROVED	

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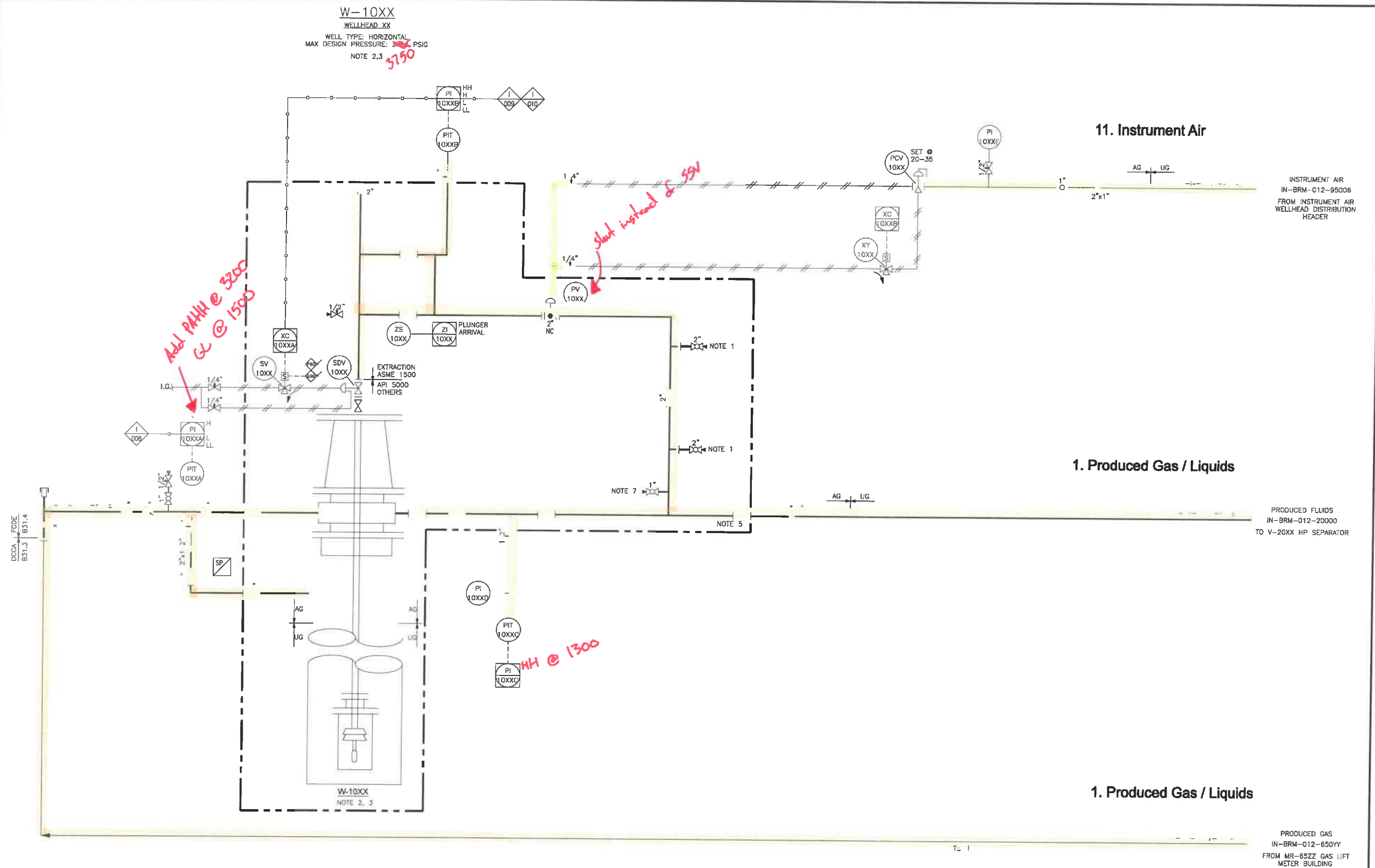
EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
EQUIPMENT SYMBOLS LEGEND

SCALE: NTS	DRAWING NO. IN-BRM-012-00003	REV. 0
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WELLHEAD SCHEDULE			
WELLHEAD NO.	XX	YY	ZZ
W-1001	01	07	06
W-1002	02	07	06
W-1003	03	07	06
W-1004	04	07	06
W-1005	05	07	06
W-1006	06	07	06
W-1007	07	07	06
W-1008	08	07	06
W-1009	09	07	06
W-1010	10	07	06
W-1011	11	08	07
W-1012	12	08	07
W-1013	13	08	07
W-1014	14	08	07
W-1015	15	08	07
W-1016	16	08	07
W-1017	17	09	08
W-1018	18	09	08
W-1019	19	09	08
W-1020	20	09	08
W-1021	21	09	08
W-1022	22	09	08
W-1023	23	09	08
W-1024	24	09	08
W-1025	25	09	08
W-1026	26	09	08
W-1027	27	10	09
W-1028	28	10	09
W-1029	29	10	09
W-1030	30	10	09
W-1031	31	10	09
W-1032	32	10	09
W-1033	33	10	09

WELLHEAD NO.	XX	YY	ZZ
W-1001	01	07	06
W-1002	02	07	06
W-1003	03	07	06
W-1004	04	07	06
W-1005	05	07	06
W-1006	06	07	06
W-1007	07	07	06
W-1008	08	07	06
W-1009	09	07	06
W-1010	10	07	06
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W-1018	18	09	08
W-1019	19	09	08
W-1020	20	09	08
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W-1024	24	09	08
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W-1027	27	10	09
W-1028	28	10	09
W-1029	29	10	09
W-1030	30	10	09
W-1031	31	10	09
W-1032	32	10	09
W-1033	33	10	09



CONTROL VALVE SCHEDULE	
TAG NUMBER	MAKE/MODEL
PCV-10XX	BY XOG

TAG NUMBER	MAKE/MODEL
PCV-10XX	BY XOG

NOTES

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	GAO	03/28/18		

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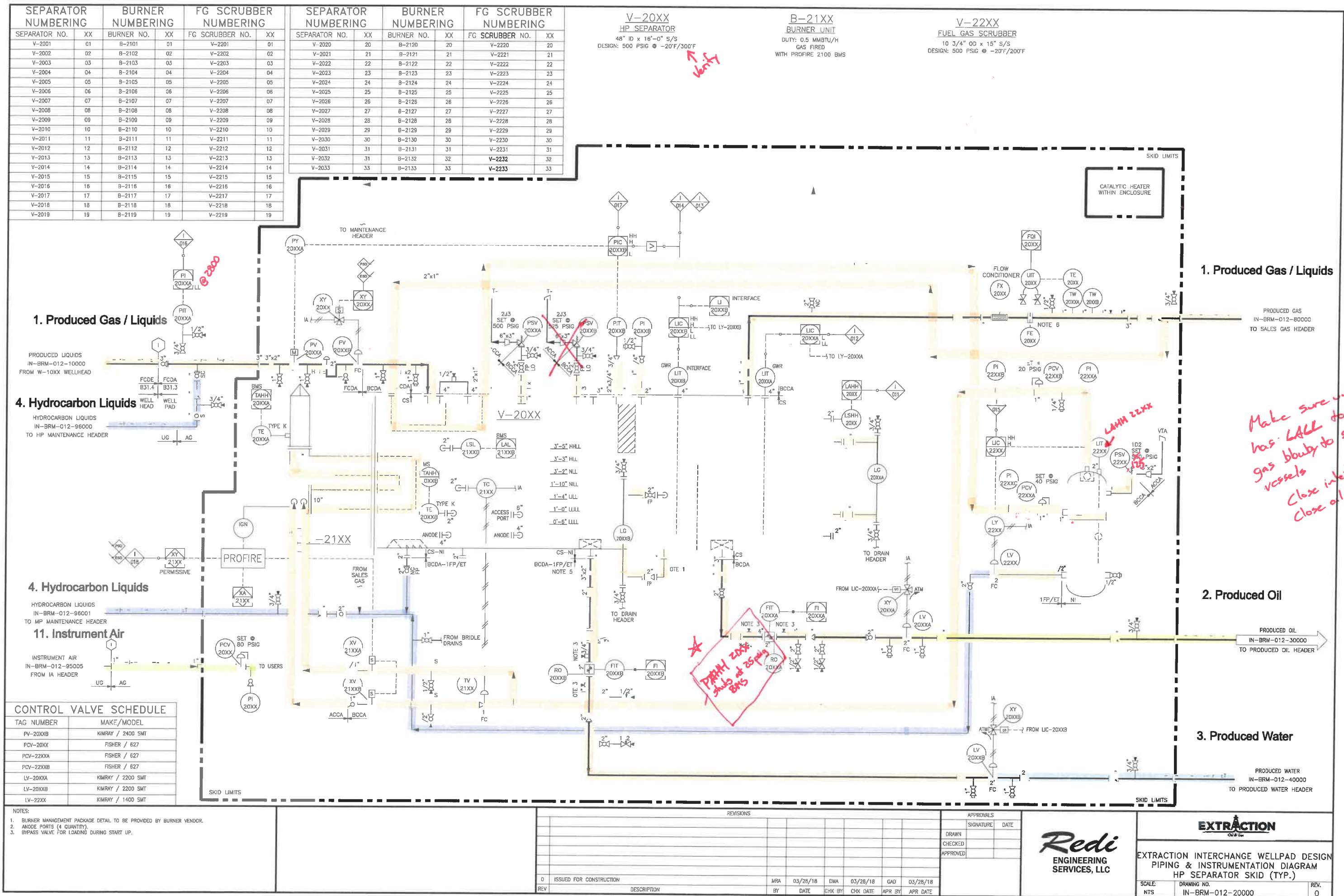
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EXTRACTION

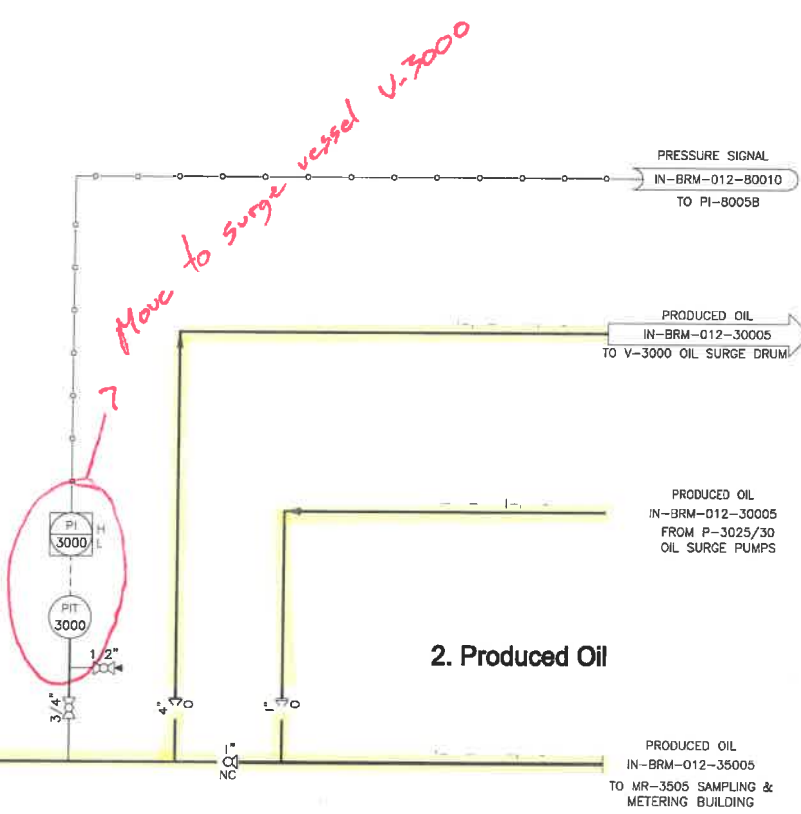
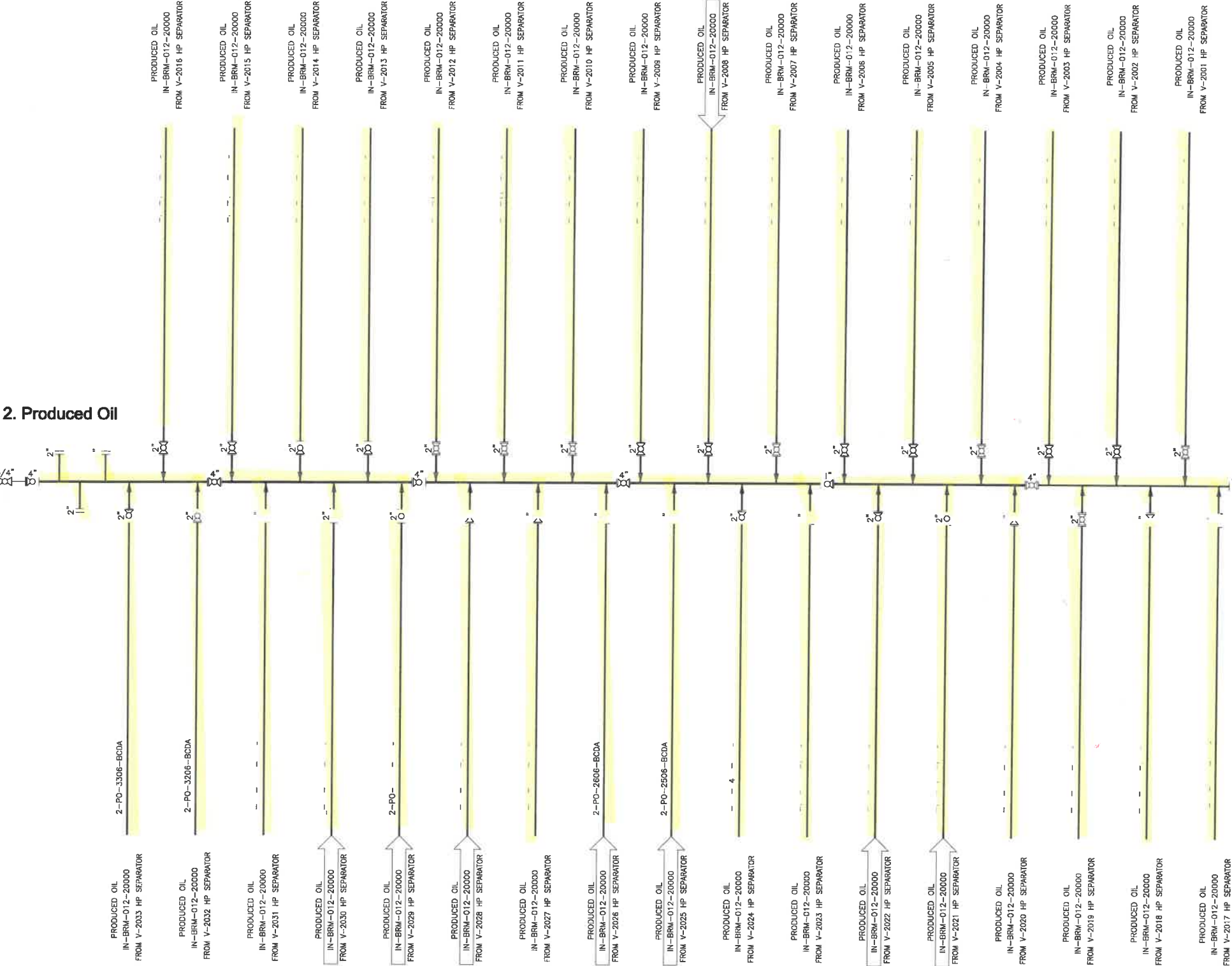
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
WELLHEAD (TYP.)

SCALE:	DRAWING NO.	REV.
NTS	IN-BPM-013-10000	0

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2. Produced Oil



2. Produced Oil

NOTES:

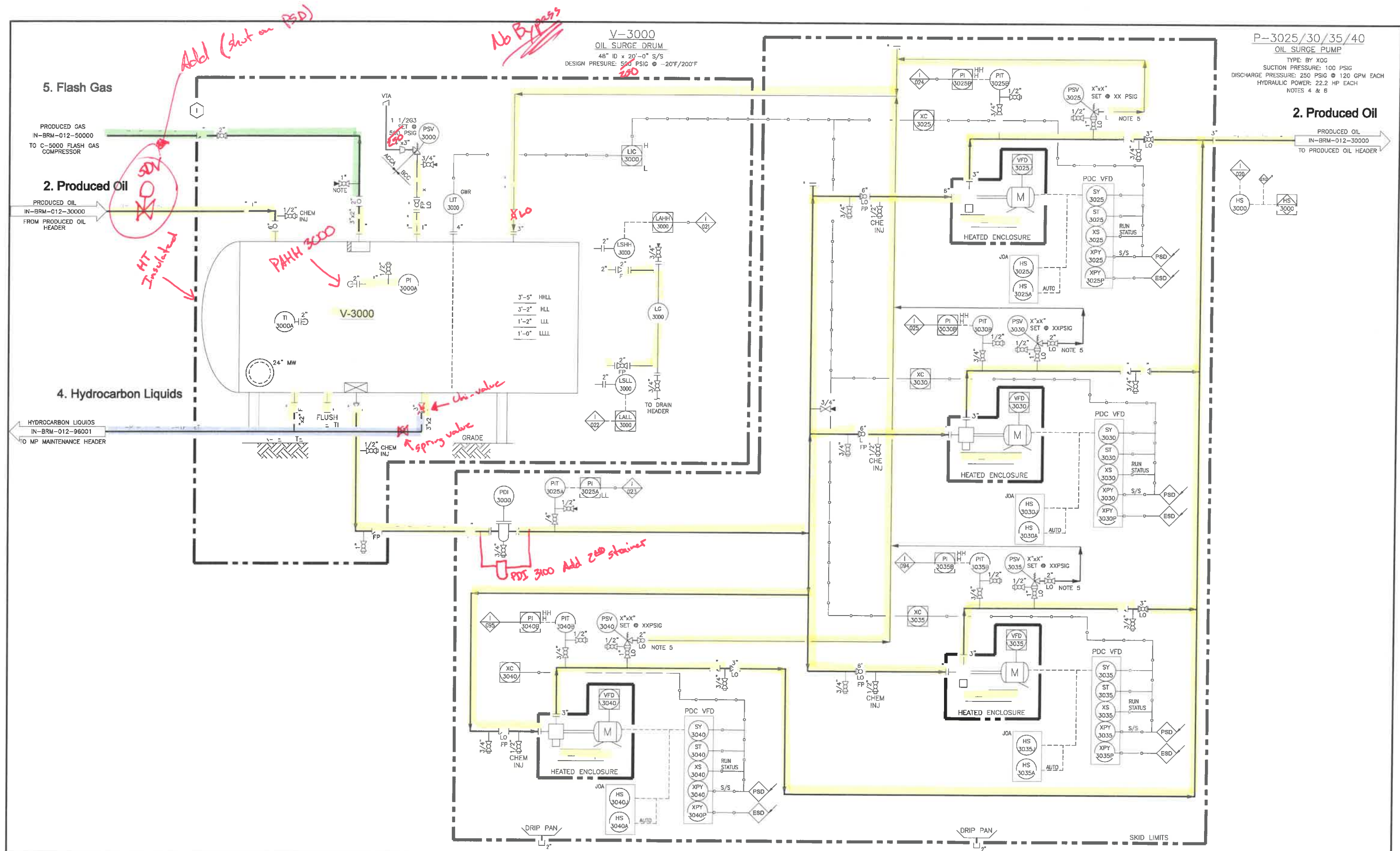
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0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD 03/28/18

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

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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 WELLPAD\PIPING\A\B\WELLPAD-012-30005.DWG BY:BRUNO OLAR DATE:Mar 28, 2018 3:04pm



- NOTES:
1. VESSEL SHALL BE ELEVATED 8 1/2 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.

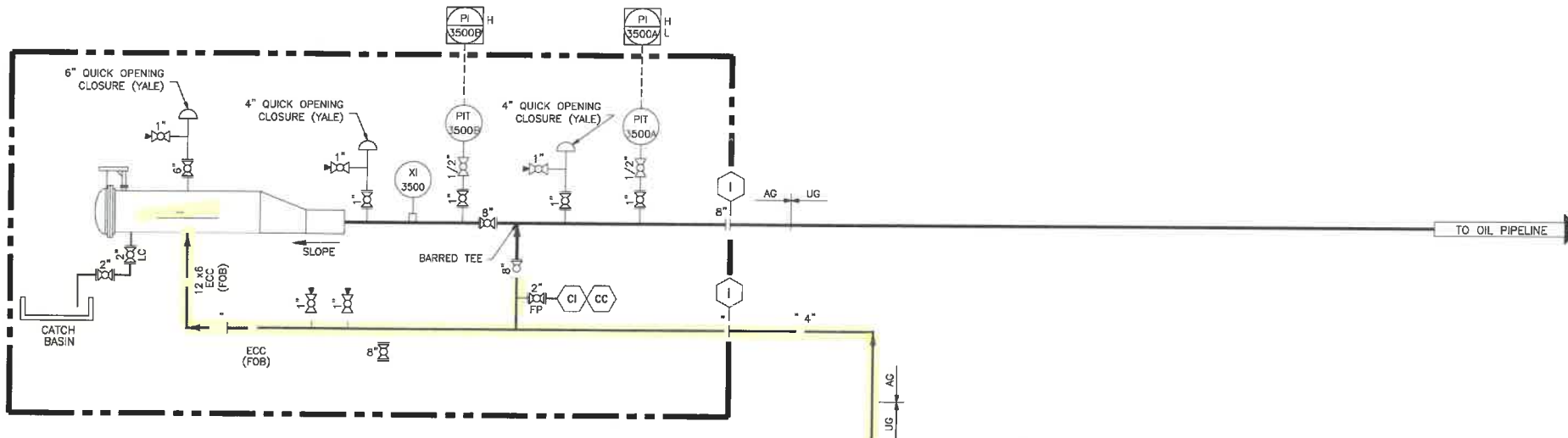
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REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
				GAD	03/28/18

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM PRODUCED OIL SURGE DRUM		
SCALE:	DRAWING NO.	REV.
NTS	IN-BRM-012-30005	0

PL-3500
OIL PIPELINE PIG LAUNCHER
SIZE: 8" DIA. x 12" BARREL
DESIGN P/T: XXX PSIG @ -XX/XXX°F



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: BRIAN O'LEARY DATE: Mar 28, 2018 3:04pm

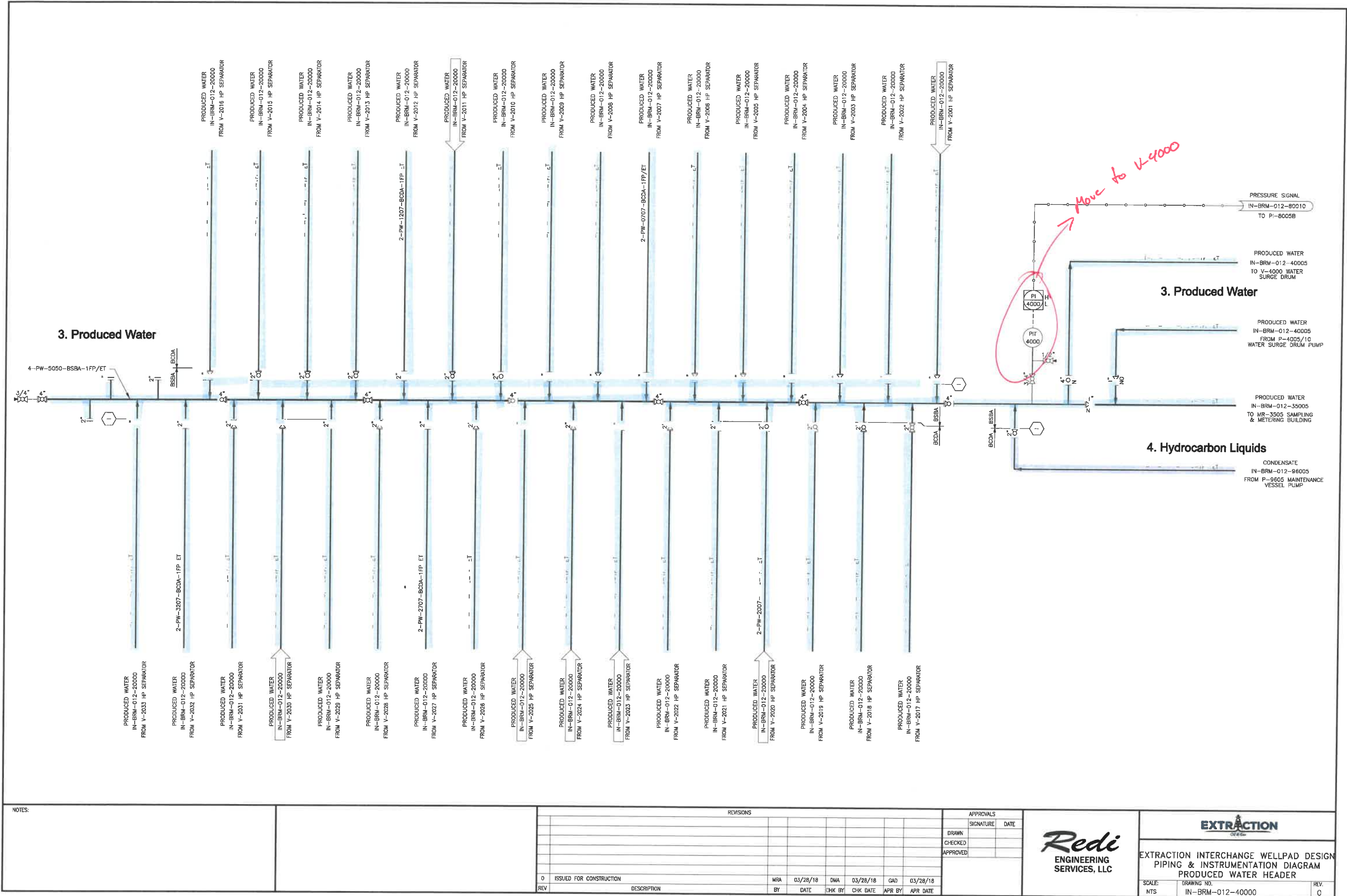
NOTES:

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0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM PRODUCED OIL TO PIPELINE		
SCALE: NTS	DRAWING NO. IN-BRM-012-35000	REV. 0



NOTES:

REVISIONS

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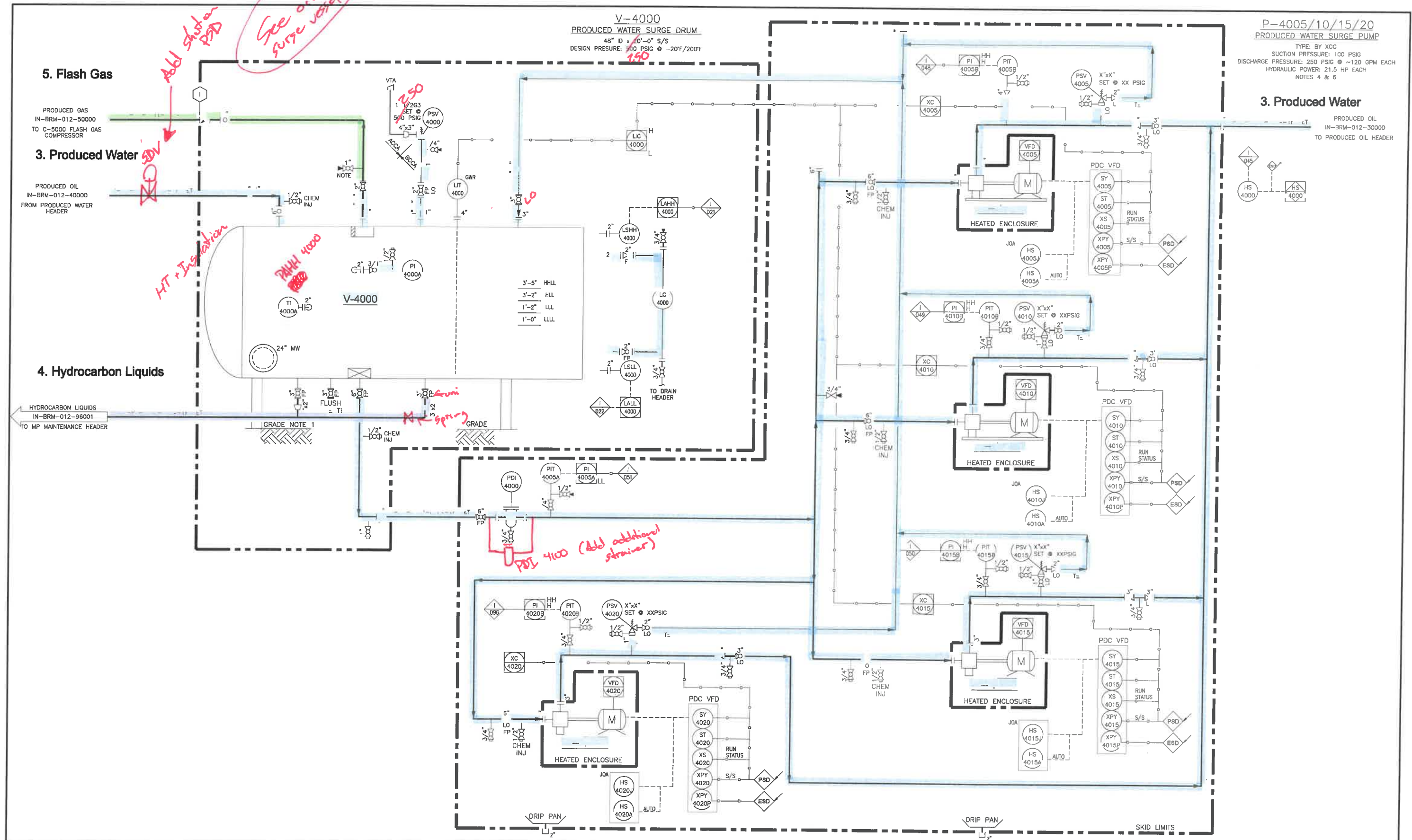
EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED WATER HEADER

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

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

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLHEAD\PIPING\4005\IN-BRM-012-40005.DWG BY:BRM/CLAUDE 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						
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD
						03/28/18

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SIGNATURE	DATE
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EXTRACTION
Oil & Gas

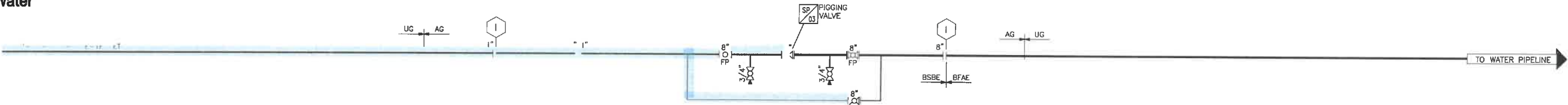
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
PRODUCED WATER SURGE DRUM

SCALE: NTS
DRAWING NO. IN-BRM-012-40005
REV. 0

FILE PATH: P:\EXTRACTION\4 - X03 INTERCHANGE A & B WELLPAD\PIPING\A&B\IN-BRM-012-45000.DWG BY:BRM,OCJ:AR DATE:Mar 28, 2018 3:05pm

3. Produced Water

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



NOTES:

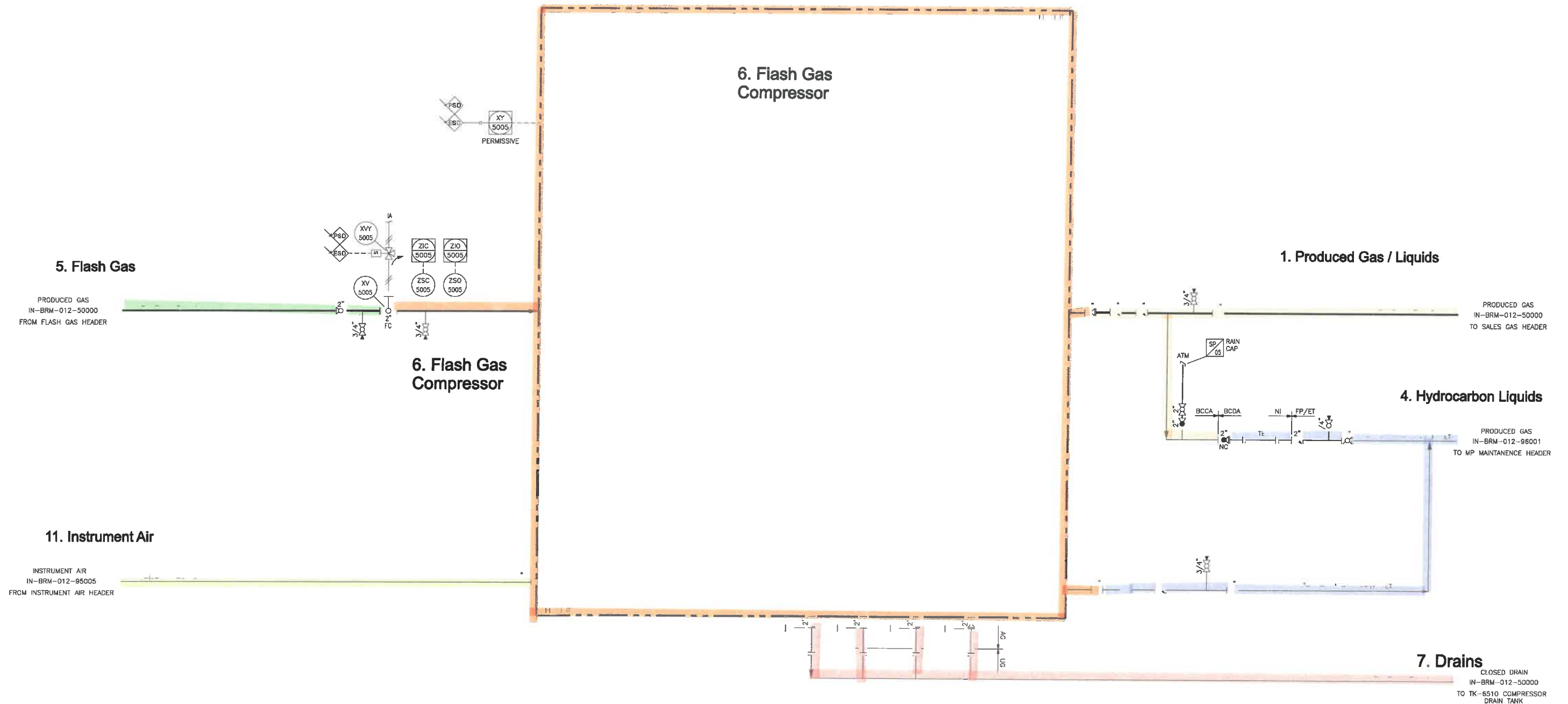
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APPROVALS	
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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM PRODUCED WATER TO PIPELINE		
SCALE: NTS	DRAWING NO. IN-BRM-012-45000	REV. 0

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



NOTES:

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

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

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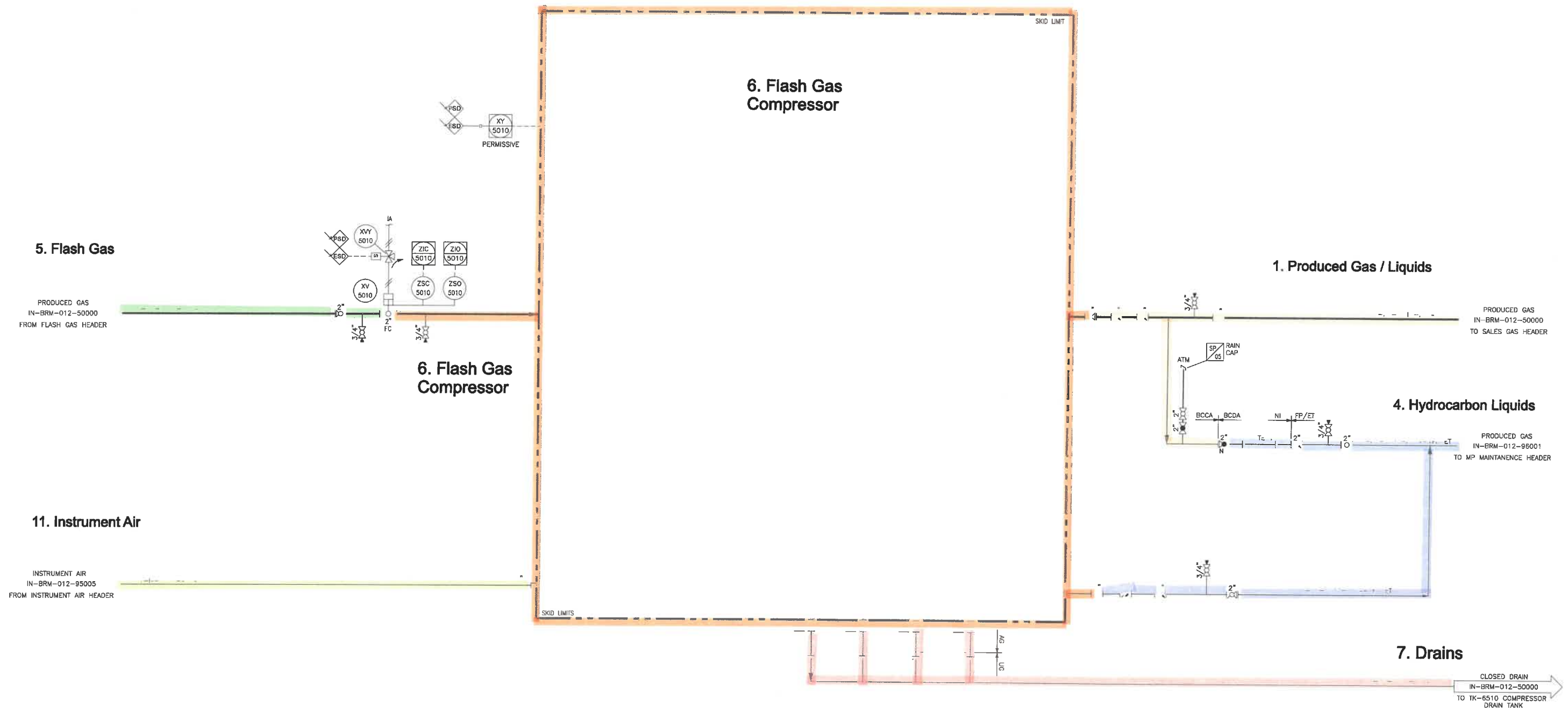
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EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
FLASH GAS COMPRESSION

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



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	APR DATE		
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APPROVALS		
	SIGNATURE	DATE
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EXTRACTION

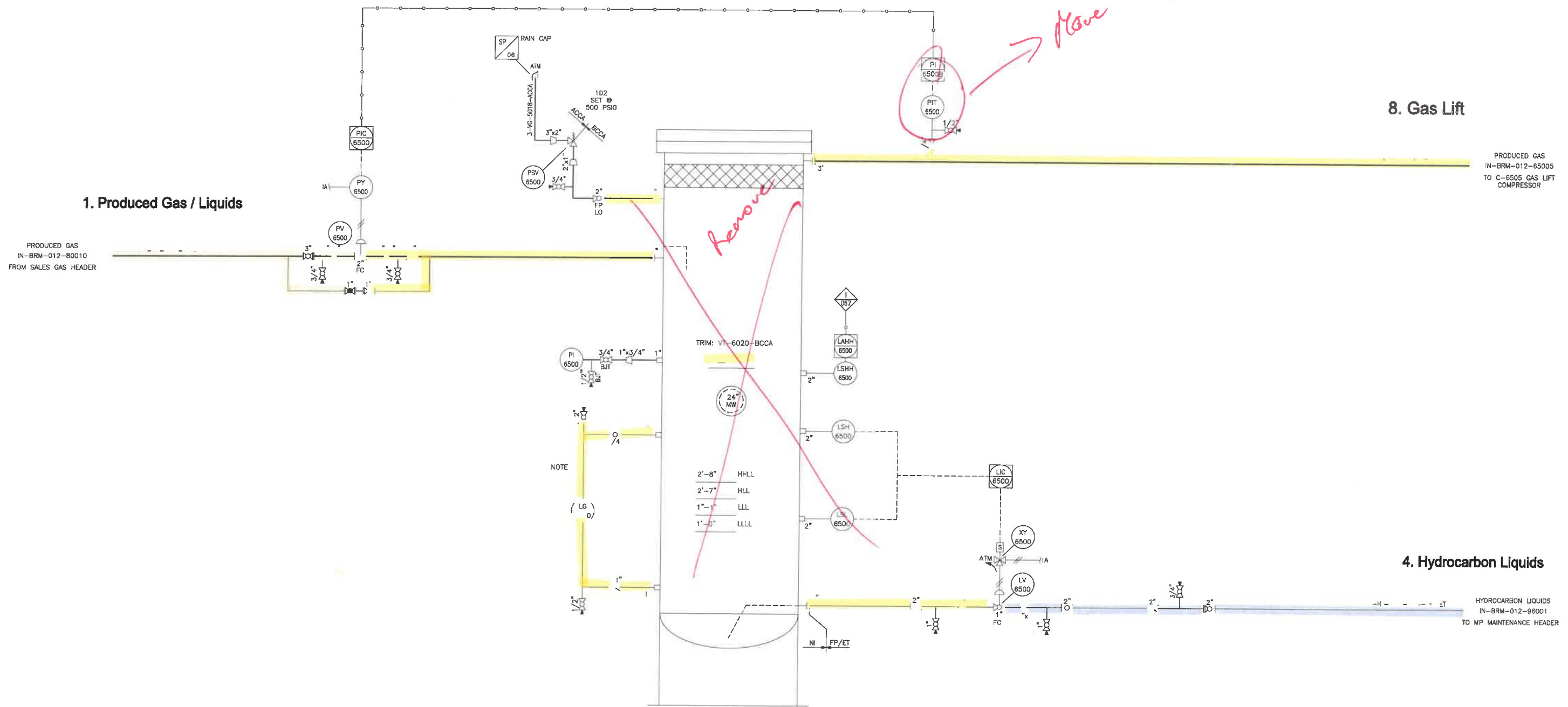
EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
FLASH GAS COMPRESSION

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

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

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
65005



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					
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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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM GAS LIFT SUCTION SCRUBBER		
SCALE: NTS	DRAWING NO. IN-BRM-012-65000	REV. 0

FILE PATH: P:\EXTRACTION\4 - XOG INTERCHANGE A & B WELLS\HEAD\PRINCIPAL\IN-BRM-012-65006.DWG BY:BRM\CCAIR DATE:Mar 28, 2018 3:05pm

8. Gas Lift

PRODUCED GAS
IN-BRM-012-65005
FROM C-8505 GAS LIFT
COMPRESSOR

PRODUCED GAS
IN-BRM-012-65008
TO MR-6507 GAS METER
BUILDING 02

PRODUCED GAS
IN-BRM-012-65007
TO MR-6506 GAS METER
BUILDING 01

8. Gas Lift

PRODUCED GAS
IN-BRM-012-65009
TO MR-6508 GAS METER
BUILDING 03

2-PG-5031-DCCA

PRODUCED GAS
IN-BRM-012-65010
TO MR-6509 GAS METER
BUILDING 04

NOTES:

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	
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EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT HEADER

SCALE: NTS	DRAWING NO. IN-BRM-012-65006	REV. 0
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FILE PATH: P:\EXTRACTION\4 - XOS INTERCHANGE A & B WELLHEAD\PPING\PLUDES\IN-BRM-012-65007.DWG BY:BRN\OCAR DATE:Mar 28, 2018 3:55pm

MR-6506
GAS LIFT METER BUILDING 01

VENT TO
SAFE LOCATION

Add header
and PCV for control

1. Produced Gas / Liquids

8. Gas Lift

12. Gas Lift Meter Building

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
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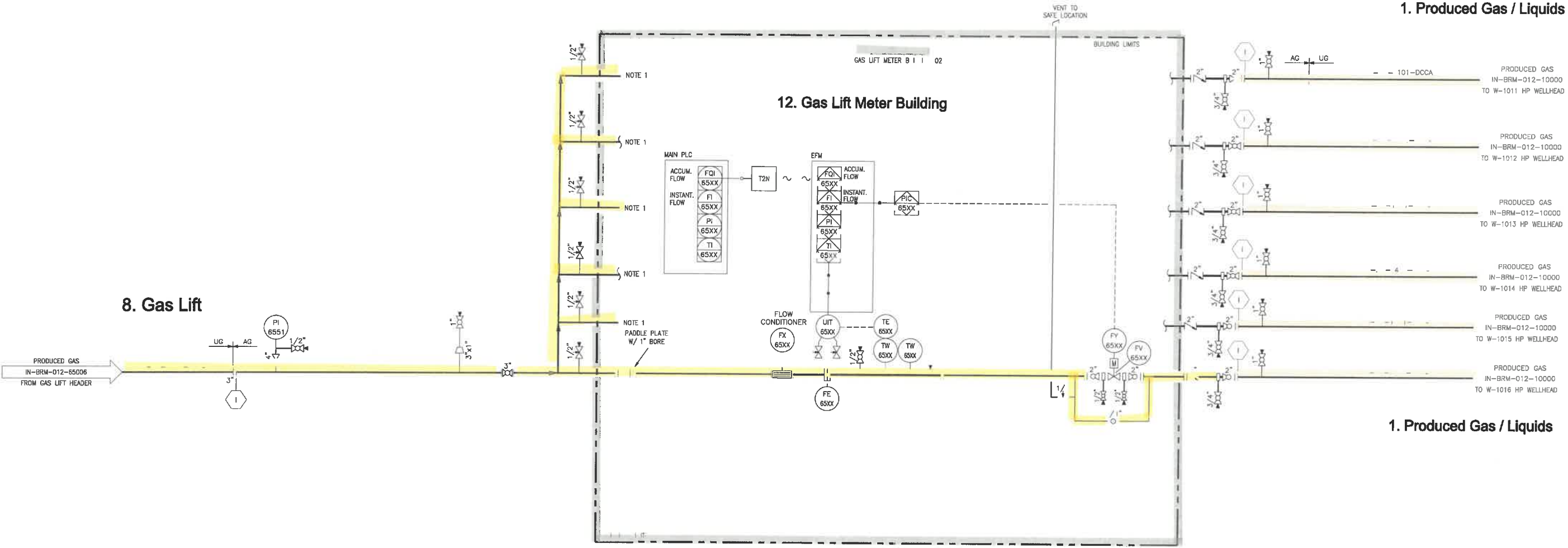
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SIGNATURE	DATE
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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM GAS LIFT METER BUILDING 01		
SCALE: NTS	DRAWING NO. IN-BRM-012-65007	REV. 0

FILE PATH: P:\EXTRACTION\4 - XOS INTERCHANGE A & B WELLHEAD\PPING\PLAIDS\IN-BRM-012-6500.DWG BY:BRUN,OCJ:AR DATE:Mar 28, 2018 3:05pm

MR-6507
GAS LIFT METER BUILDING 02



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	APR DATE
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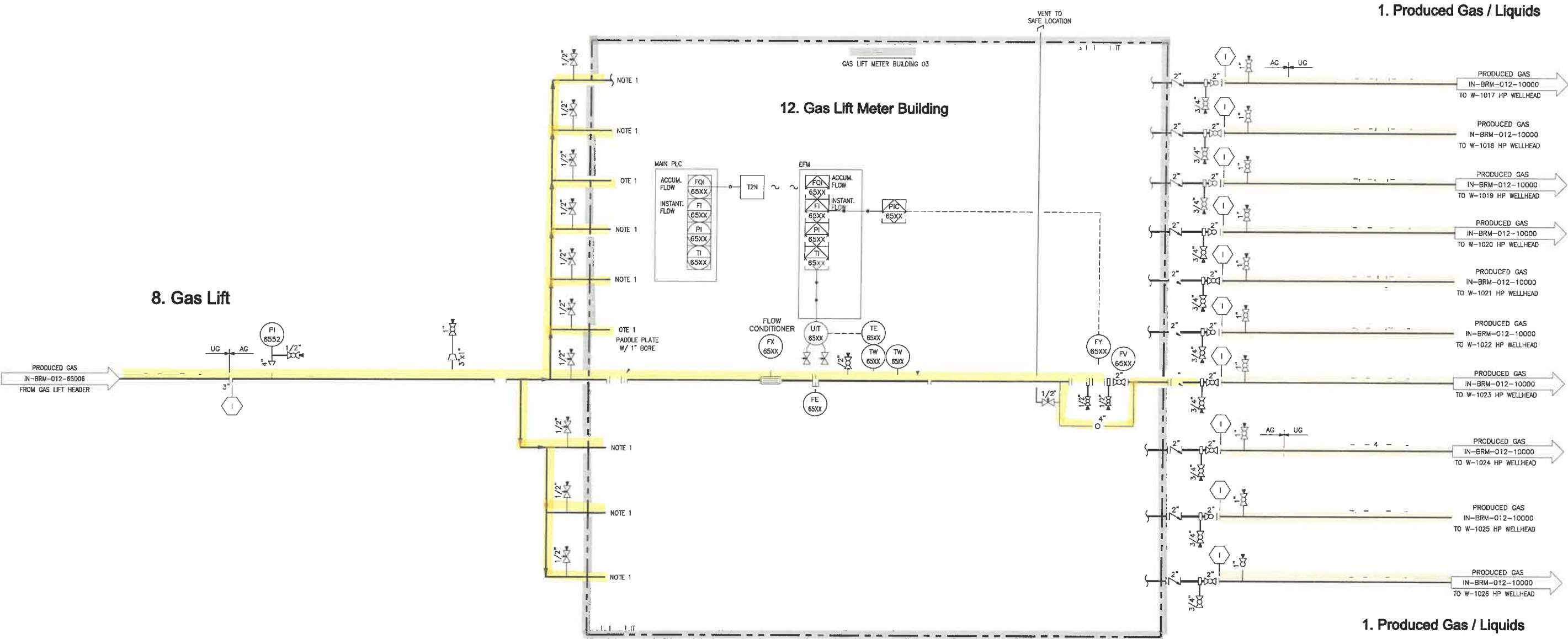
APPROVALS	
SIGNATURE	DATE
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APPROVED	

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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 - XOG INTERCHANGE A & B WELLHEAD\PPING\012-65009.DWG BY:BRUNO,CLAR DATE:Mar 28, 2018 3:05pm

MR-6508
GAS LIFT METER BUILDING 03



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

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

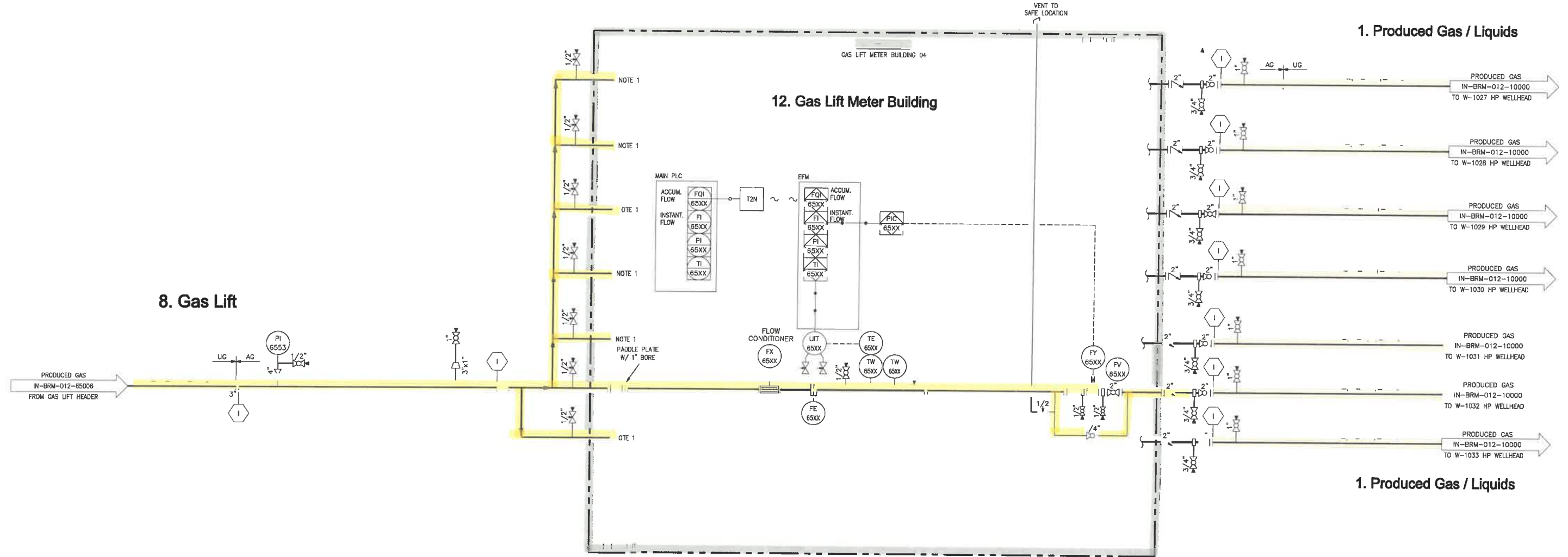
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		GAD	03/28/18		

APPROVALS	
SIGNATURE	DATE
DRAWN	
CHECKED	
APPROVED	

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EXTRACTION Oil & Gas		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM GAS LIFT METER BUILDING 03		
SCALE: NTS	DRAWING NO. IN-BRM-012-65009	REV. 0

MR-6509
GAS LIFT METER BUILDING 04



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	APR DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18	GAD	03/28/18

APPROVALS	SIGNATURE	DATE
DRAWN		
CHECKED		
APPROVED		

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EXTRACTION
Oil & Gas

EXTRACTION INTERCHANGE WELLPAD DESIGN
PIPING & INSTRUMENTATION DIAGRAM
GAS LIFT METER BUILDING 04

SCALE: NTS	DRAWING NO. IN-BRM-012-65010	REV. 0
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TK-6510
COMPRESSOR DRAIN TANK
SIZE: 96" ID x 7'-0" OAH
DESIGN P/T: ATM @ XXX°F
CAPACITY: 225 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)

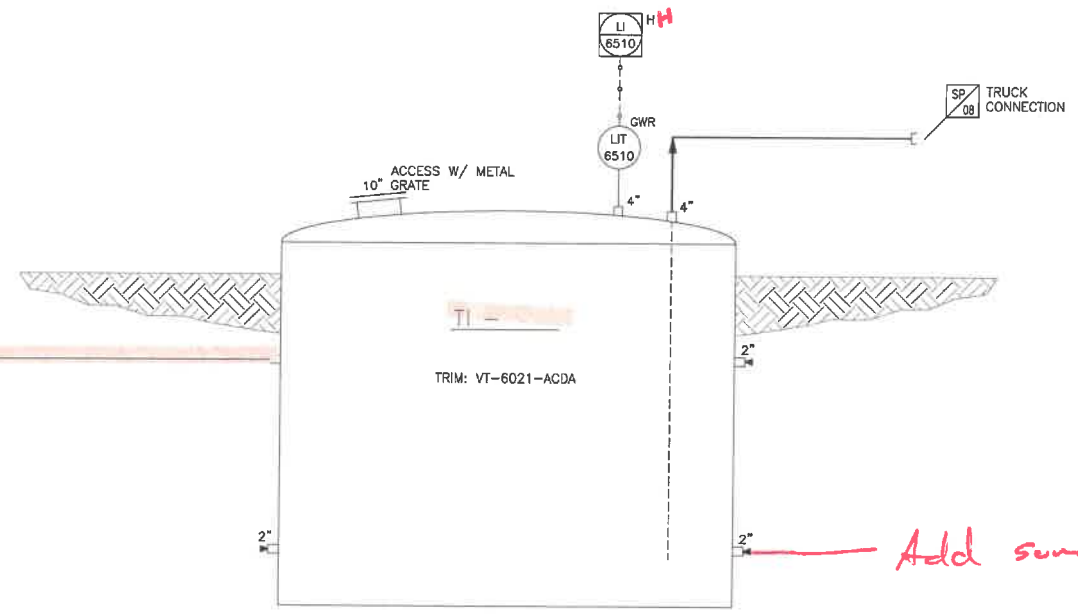
CLOSED DRAIN
IN-BRM-012-50000
FROM C-5000 FLASH GAS
COMPRESSOR

7. Drains

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

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

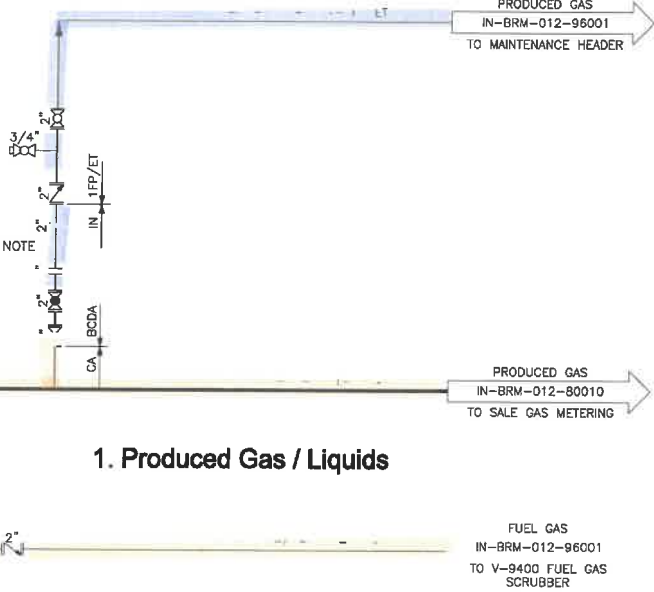
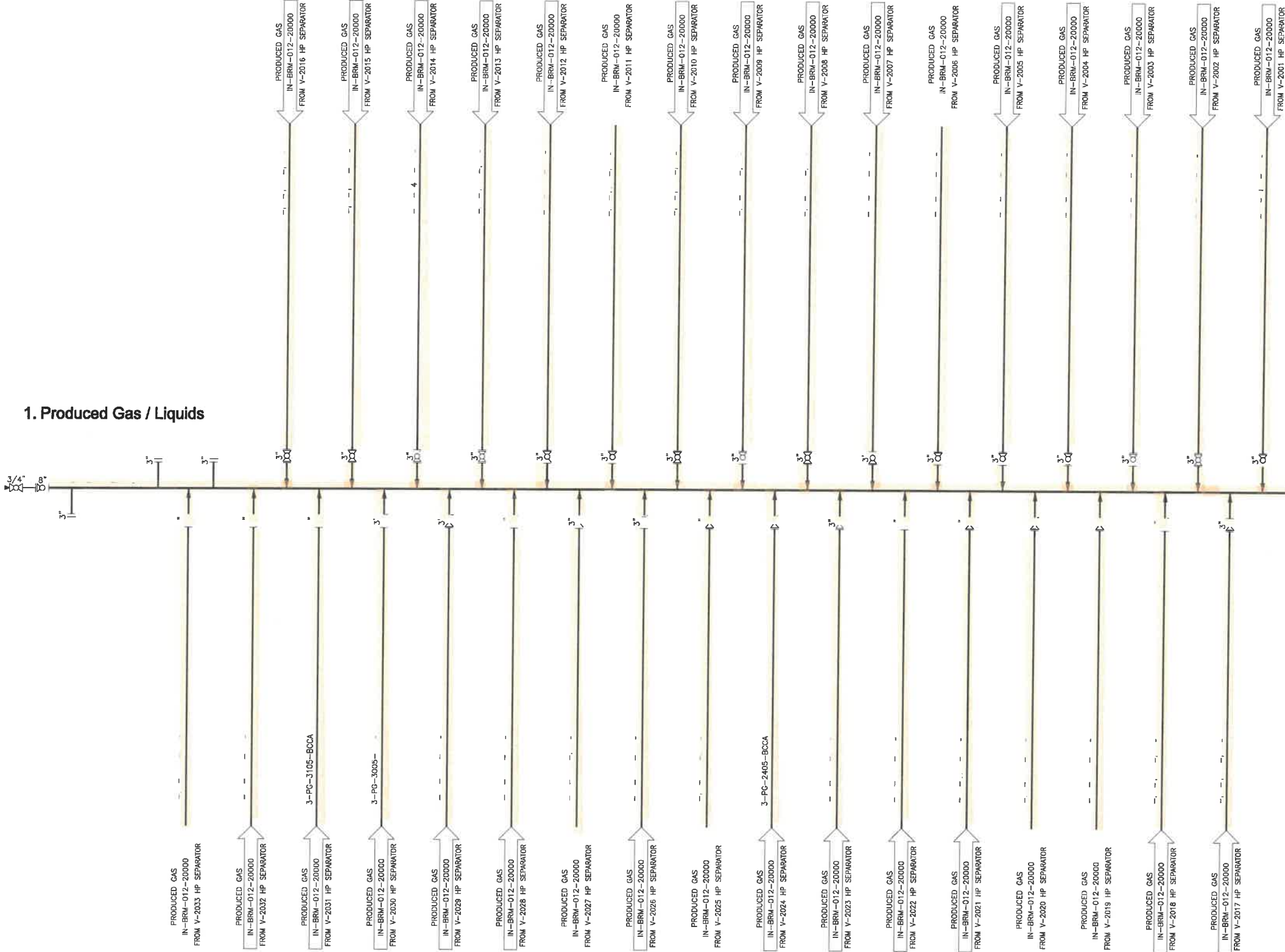
7. Drains



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:BRANCOCLAIR DATE:Mar 28, 2018 3:05pm

NOTES:		REVISIONS										APPROVALS		<div>Redi</div> <div>ENGINEERING SERVICES, LLC</div>	<div>EXTRACTION</div> <div>EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM COMPRESSOR DRAIN TANK</div>	
												SIGNATURE	DATE			
												DRAWN				
												CHECKED				
												APPROVED				
0	ISSUED FOR CONSTRUCTION	WRA	03/28/18	DMA	03/28/18	GAD	03/28/18									
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE									



4. Hydrocarbon Liquids

1. Produced Gas / Liquids

1. Produced Gas / Liquids

NOTES:
1. SPOOL PIECE FOR FUTURE CHOKE NIPPLE

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

APPROVALS	
SIGNATURE	DATE
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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: 1500 PSIG
DESIGN CAPACITY: 14 MMSCFD
DRIVER TYPE: ELECTRICAL
POWER: 1200 HP EST
NOTE 4

11. Instrument Air

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

9. Sales Gas

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

4. Hydrocarbon Liquids

PRODUCED GAS
IN-BRM-012-96001
TO MAINTENANCE HEADER
Blowdown

9. Sales Gas

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

4. Hydrocarbon Liquids

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

4. Hydrocarbon Liquids

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

9. Sales Gas

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

TRIM: VT-6022-BCCA

6"-4" HHLL
6"-3" HLL
1"-1" LLL
1"-0" LLLL

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

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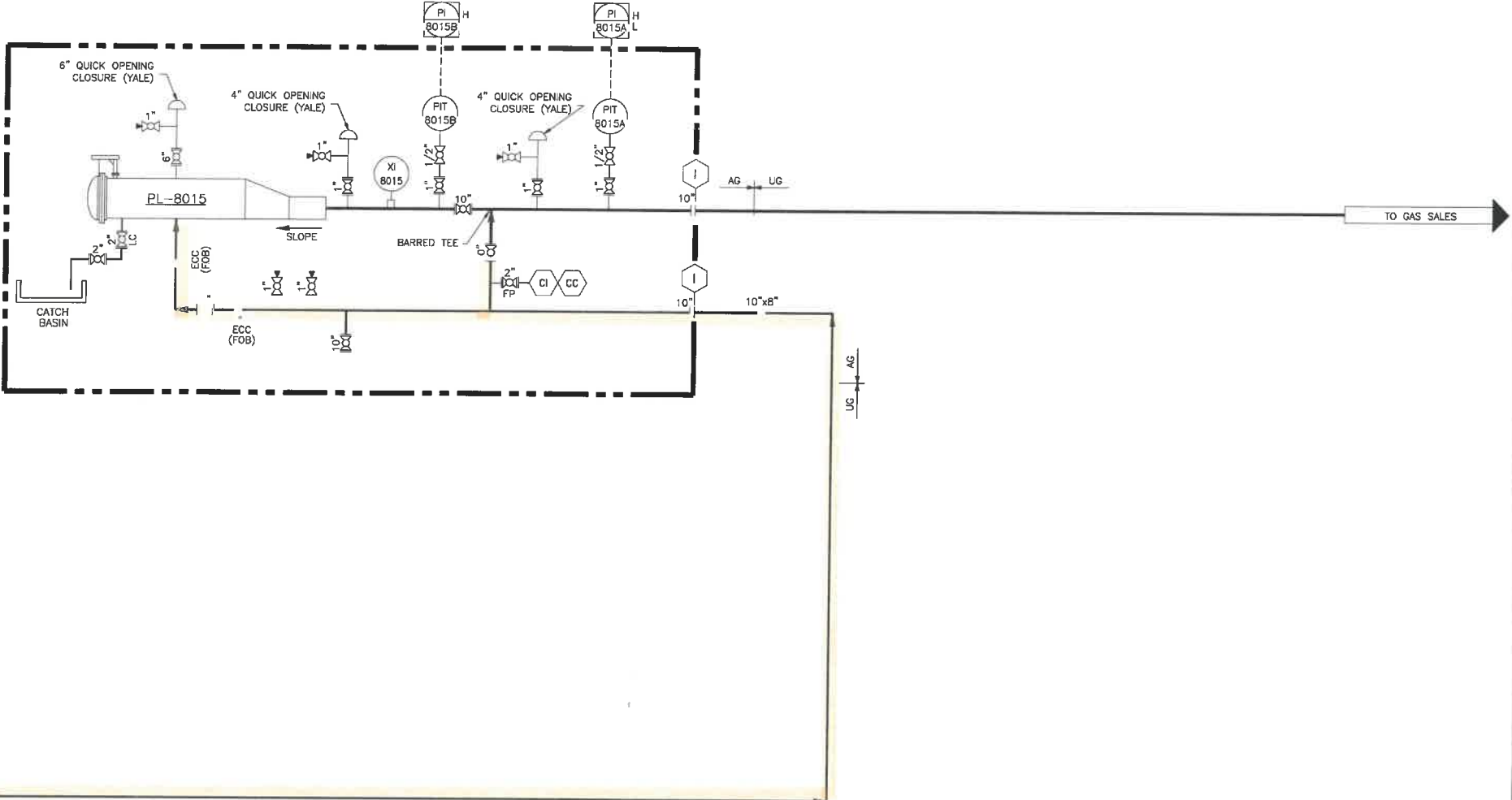
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EXTRACTION
Oil & Gas

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

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

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 WELLHEAD\PIPING\P&IDS\IN-BRM-012-80015.DWG BY: BRIAN.OCLAIR DATE: Mar 28, 2018 3:05pm

NOTES

		REVISIONS					
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	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
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NOTES:

1. HEAT TRACE & INSULATE BRIDLE - FREEZE PROTECTION

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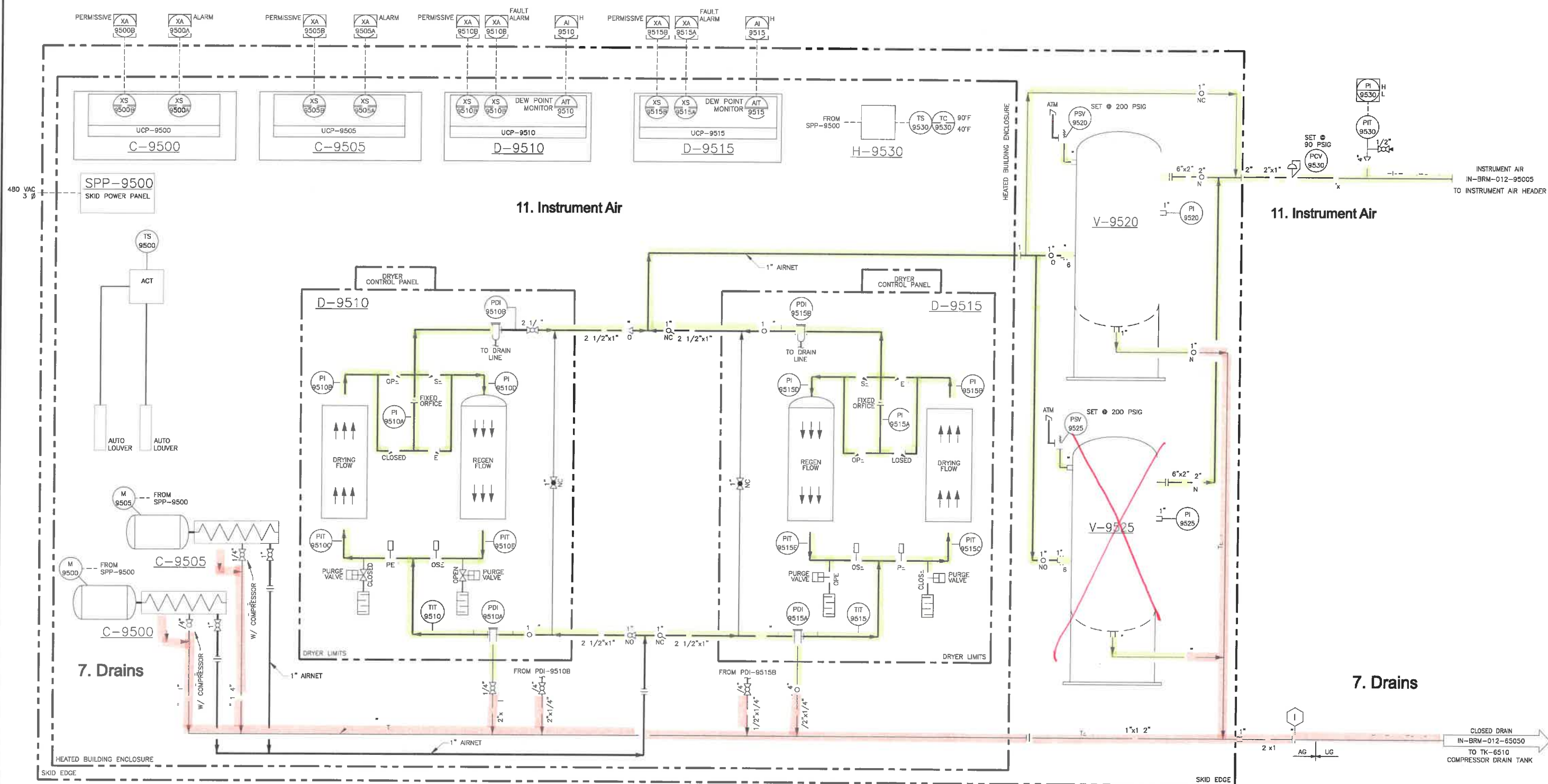
	
<p>EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM FUEL GAS SCRUBBER</p>	
SCALE: WTS.	DRAWING NO. IN. PRM. 012 04000
	REV. 0

C-9500/9505
INSTRUMENT AIR COMPRESSOR
TYPE: GARDNER DENVER L110RS-643 ICFM
DESIGN CAPACITY: 419 SCFM
DESIGN DISCHARGE P/T: 135 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



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

REVISIONS					
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
0	ISSUED FOR CONSTRUCTION	MRA	03/28/18	DMA	03/28/18
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7					
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9					

APPROVALS	
SIGNATURE	DATE
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APPROVED	

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EXTRACTION		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM INSTRUMENT AIR SKID		
SCALE: NTS	DRAWING NO. IN-BRM-012-95000	REV. 0

NOTES:
1.

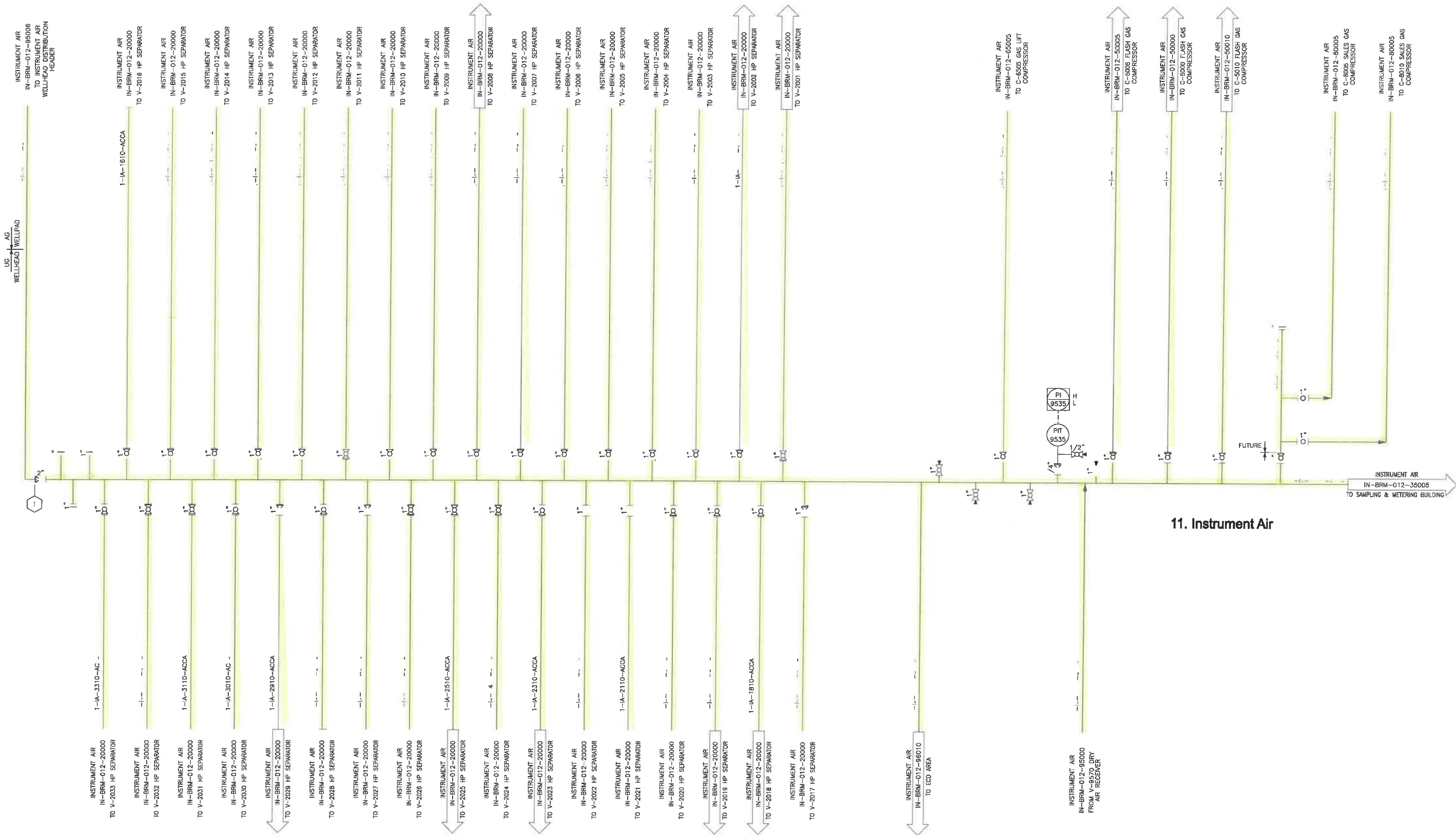
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EXTRACTION Oil & Gas		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM INSTRUMENT AIR DISTRIBUTION HEADER		
SCALE: NTS	DRAWING NO. IN-BRM-012-95005	REV. 0

11. Instrument Air



NOTES:
1.

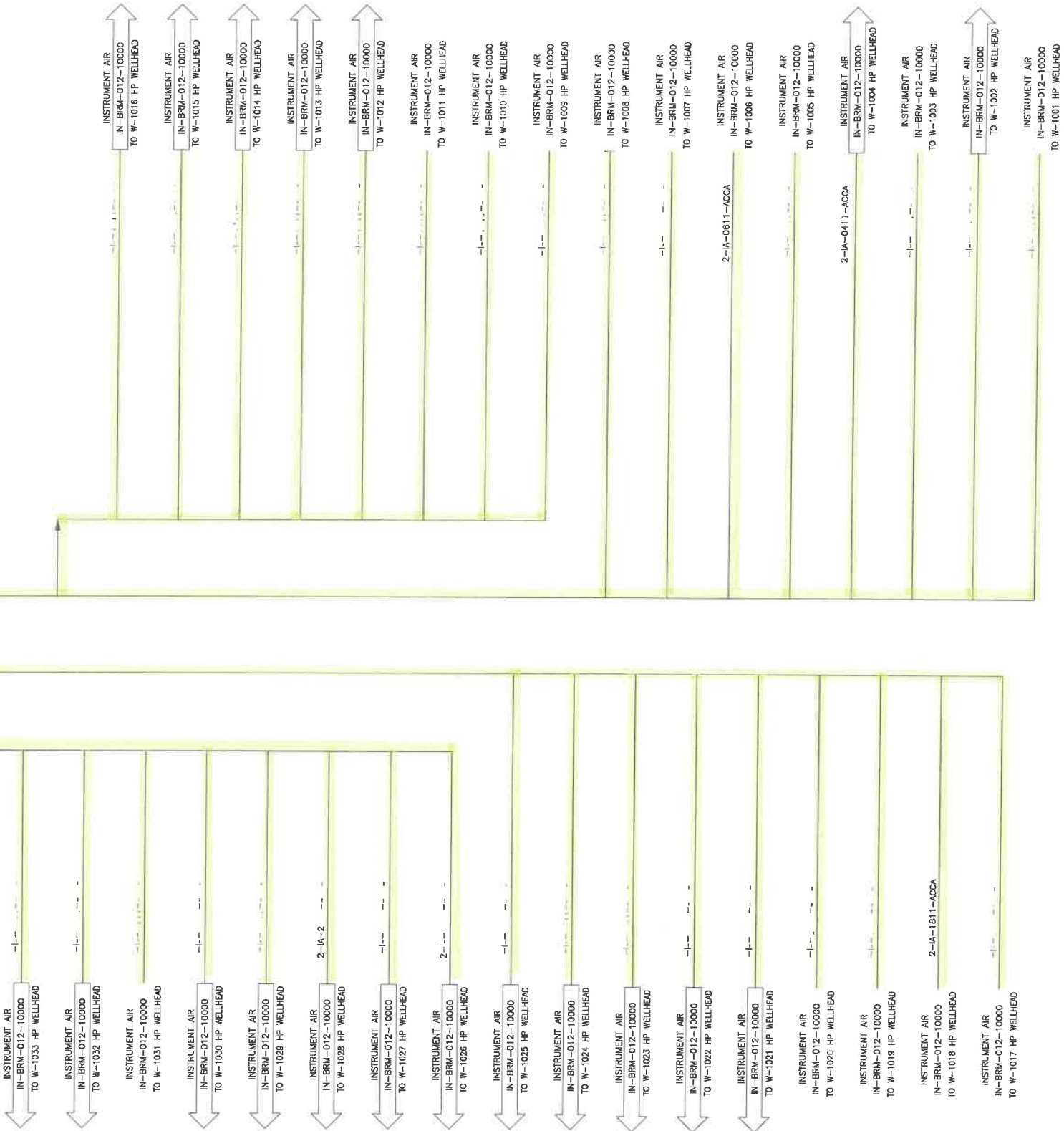
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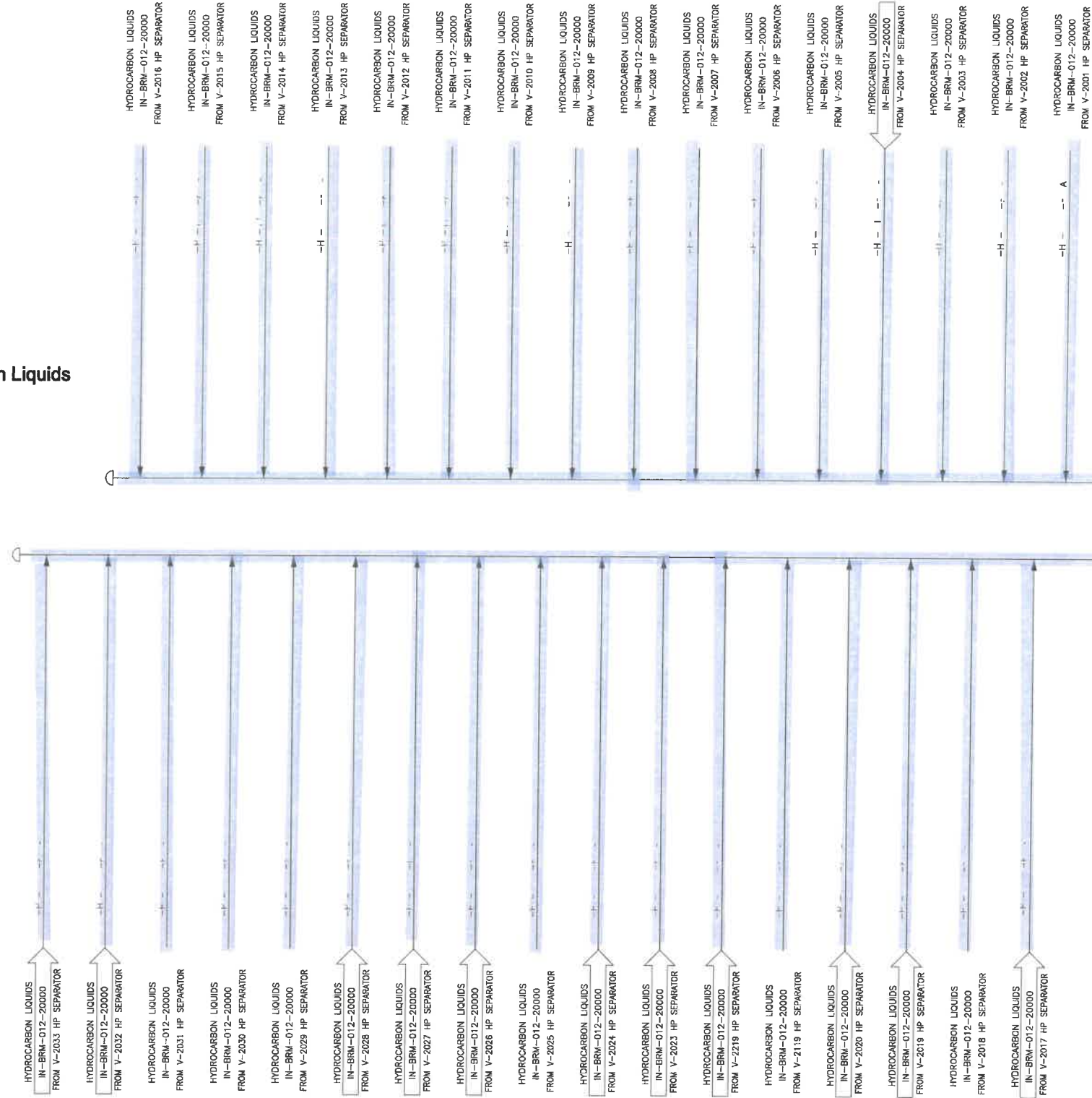
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EXTRACTION <small>Oil & Gas</small>		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM INSTRUMENT AIR WELLHEAD DISTRIBUTION HEADER		
SCALE: NTS	DRAWING NO. IN-BRM-012-95006	REV. 0

11. Instrument Air
IN-BRM-012-95005
FROM INSTRUMENT
AIR HEADER



4. Hydrocarbon Liquids



4. Hydrocarbon Liquids

HYDROCARBON LIQUIDS
IN-BRM-012-96005
TO V-9600 MAINTENANCE VESSEL

NOTES:
1.

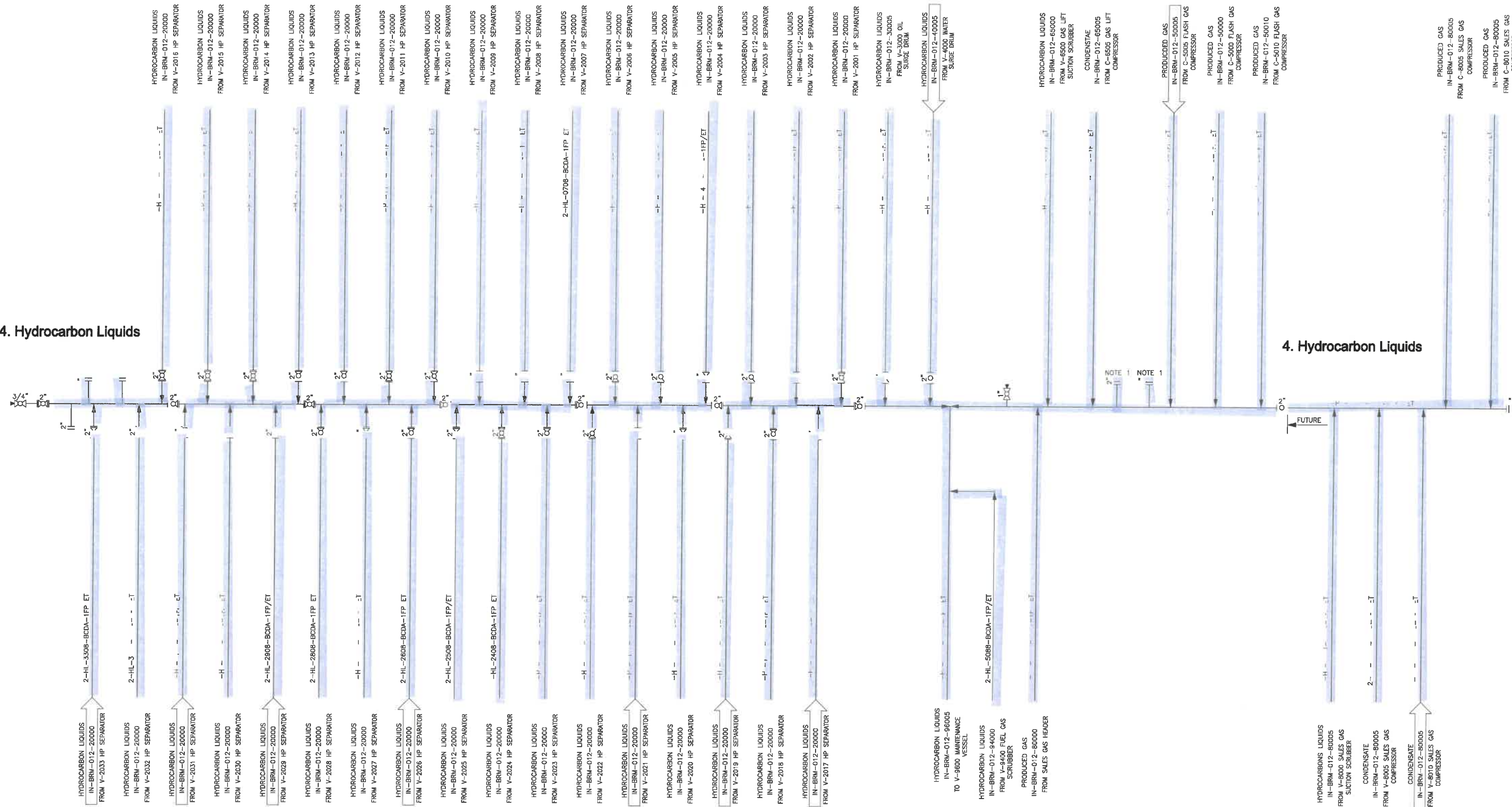
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APPROVALS	
DRAWN	SIGNATURE DATE
CHECKED	
APPROVED	

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SERVICES, LLC

EXTRACTION <small>Oil & Gas</small>		
EXTRACTION INTERCHANGE WELLPAD DESIGN PIPING & INSTRUMENTATION DIAGRAM MAINTENANCE HEADER (HIGH PRESSURE)		
SCALE: NTS	DRAWING NO. IN-BRM-012-96000	REV. 0

4. Hydrocarbon Liquids



4. Hydrocarbon Liquids

NOTES:

- ### 1. FUTURE GAS LIFT SUCTION SCRUBBER AND COMPRESSOR CONNECTIONS

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

APPROVALS		
	SIGNATURE	DATE
DRAWN		
CHECKED		
APPROVED		

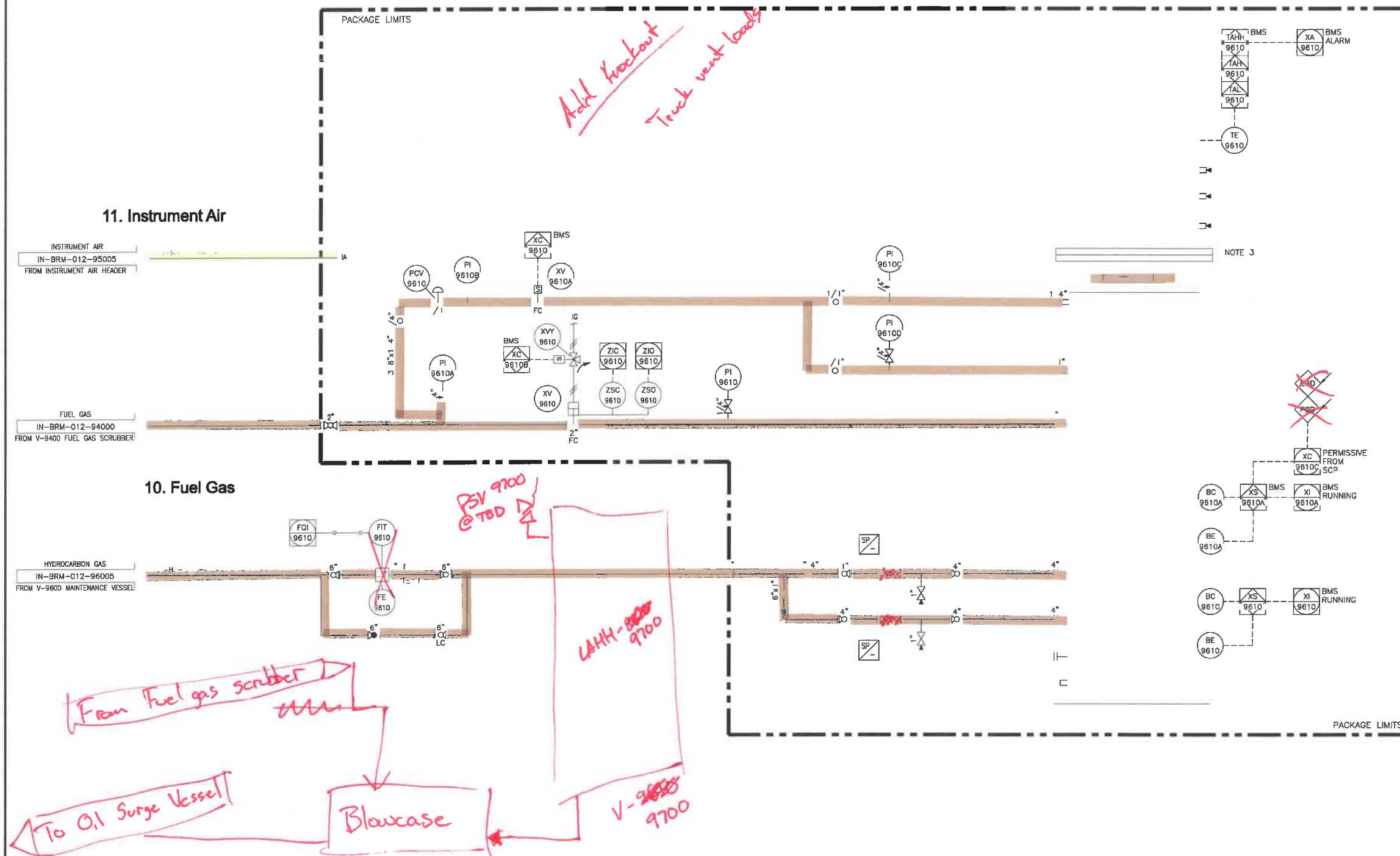
Redi
ENGINEERING
SERVICES, LLC

EXTRACTION
Oil & Gas

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

SCALE: NTS	DRAWING NO. IN-BRM-012-96001	REV. 0
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FL-~~9670~~ 9700
EMISSIONS CONTROL DEVICE (ECD)
MANUFACTURER: BY XOG
SIZE: 144" O.D. x 40'-0" H, NOTE 3
CAPACITY: 160.4 MMBTU/HR
NOTE 5



- NOTES:
1. BURNER CAPACITY RATED FOR METHANE EQUIVALENT.
 2. DESIGNED TO MEET CLASS 1, DIV. 2 GROUP C,D.
 3. UNIT 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.

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

APPROVALS			
	SIGNATURE	DATE	
DRAWN			
CHECKED			
APPROVED			

Redi
ENGINEERING
SERVICES, LLC

EXTRACTION

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

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



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

- 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





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
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NOTES:

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ROW	INTERLOCK #	NOTE	P&ID	DESCRIPTION OF INITIATING DEVICE / EVENT	DEVICE	SOFTWARE	VOTING LOGIC	SETPOINT	ALARM STATE	INITIATING DEVICE (INPUT) CONTROL SYSTEM		RESET REQD	DESCRIPTION OF REACTING DEVICE ESD (SEE ROW 1)	P&ID	COL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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47			96010	ECD SHUTDOWN	FL-9610	XI-9610	1001	N/A	ACTIVE	ACTING DEVICE (OUTPUT) CONTROL SYSTEM		(4)	FACILITY EMERGENCY SHUTDOWN ESD (SEE ROW 1)	N/A	1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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