APD ID: 10400013827 **Submission Date:** 05/05/2017

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT **Well Number:** 56H

Well Type: OIL WELL **Well Work Type:** Drill

Highlighted data reflects the most recent changes

Show Final Text

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical Depth	Measured Depth	Lithologies	Mineral Resources	Producing Formation
17697	---	3662	0	0	OTHER : Quaternary	USEABLE WATER	No
15330	RUSTLER ANHYDRITE	1982	1680	1680	ANHYDRITE	NONE	No
17718	TOP SALT	1942	1720	1720	SALT	NONE	No
17723	BOTTOM SALT	512	3150	3150	SALT	NONE	No
17740	CAPITAN REEF	512	3150	3150		USEABLE WATER	No
15314	SAN ANDRES	-1048	4710	4710	LIMESTONE	NATURAL GAS,CO2,OIL	No
17760	DELAWARE SAND	-2004	5666	5666	SANDSTONE	NATURAL GAS,CO2,OIL	No
17721	BONE SPRING LIME	-4543	8205	8205	LIMESTONE	NATURAL GAS,CO2,OIL	No
17769	AVALON SAND	-5098	8760	8760	SHALE	NATURAL GAS,CO2,OIL	No
15338	BONE SPRING 1ST	-5828	9490	9501		NATURAL GAS,CO2,OIL	No
17737	BONE SPRING 2ND	-6138	9800	16993		NATURAL GAS,CO2,OIL	Yes

Section 2 - Blowout Prevention

Pressure Rating (PSI): 5M **Rating Depth:** 11000

Equipment: Legacy Reserves plans to use a 13-5/8" 5000-psi working pressure BOP system consisting of a double ram BOP with one ram being pipe and one ram being blind, a 5000-psi annular type preventer, a 5000-psi choke manifold and 80 gallon accumulator with floor, five remote operating stations and an auxiliary power system. A rotating head will be utilized as needed. A drill string safety valve in the open position will be available on the rig floor. A mud gas separator will be available for use if needed. A 3M BOP will be used to drill from the surface casing shoe (~1800') to the intermediate casing shoe (~5600'). The BOP will be a 5M system, however the "A" section wellhead will be a 3M wellhead (see attached BOP Diagram). The BOP unit will be hydraulically operated. The BOP will be operated at least once per day while drilling and the blind rams will be operated when out of hole during trips. No abnormal pressure or temperature is expected while drilling.
Requesting Variance? NO

Variance request:

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT   Well Number: 56H

Testing Procedure: The BOPs will be tested by an independent service company to 250 psi low and 5000 psi high.

Choke Diagram Attachment:

McVay_4_Choke_Manifold_Diagram_20170829142635.pdf

BOP Diagram Attachment:

Lea_56H_BOP_05-01-2017.pdf

Section 3 - Casing

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing length MD	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
1	SURFACE	17.5	13.375	NEW	API	N	0	1800	0	1800	-6138	-7938	1800	J-55	54.5	STC	1.42	3.86	DRY	5.66	DRY	2.59
2	INTERMEDIATE	12.25	9.625	NEW	API	N	0	4000	0	4000	-6138	-10138	4000	J-55	40	LTC	1.25	2.56	DRY	1.6	DRY	1.6
3	INTERMEDIATE	12.25	9.625	NEW	API	N	4000	5600	4000	5600	-10138	-11738	1600	HCK-55	40	LTC	1.45	2.54	DRY	4.23	DRY	4.23
4	PRODUCTION	8.75	5.5	NEW	API	N	0	17000	0	9800	-6138	-15938	17000	P-110	20	OTHER - BTC	4.98	1.26	DRY	1.63	DRY	1.63

Casing Attachments

Casing ID: 1   **String Type:** SURFACE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_56H_casing_assumptions_05-01-2017.pdf

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT **Well Number:** 56H

Casing Attachments

Casing ID: 2 **String Type:** INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_56H_casing_assumptions_sub_05-01-2017.pdf

Casing ID: 3 **String Type:** INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_56H_casing_assumptions_sub_05-01-2017.pdf

Casing ID: 4 **String Type:** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_56H_casing_assumptions_sub_05-01-2017.pdf

Section 4 - Cement

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT **Well Number:** 56H

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
SURFACE	Lead		0	1800	1100	1.93	13.5	2123		Class C cement	4% bwoc bentonite II + 2% bwoc Calcium Chloride + 0.25 lbs/sack Cello Flake + 0.005% bwoc Static Free + 0.005 gps FP-6L
SURFACE	Tail				200	1.34	14.8	268		C cement	1.5% bwoc Calcium Chloride + 0.005 lbs/sack Static Free + 0.005 gps FP-6L
INTERMEDIATE	Lead		0	3901	1400	1.33	14.8	2982		Class C cement	4% bwoc bentonite II + 5% bwoc MPA-5 + 0.25% bwoc FL- 52 + 5 lbs/sack LCM-1 +0.125 lbs/sk cello flake + 0.005 lbs/sk defoamer + 0.005 gpsFP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride
INTERMEDIATE	Tail				200	1.33	14.8	266		Class C cement	none
INTERMEDIATE	Lead		3950	5600	1400	1.33	14.8	266		Poz (fly ash) Class C cement	4% bwoc bentonite II + 5% bwoc MPA-5 + 0.25% bwoc FL- 52 + 5 lbs/sack LCM-1 +0.125 lbs/sk cello flake+ 0.005 lbs/sk defoamer + 0.005 gpsFP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride
INTERMEDIATE	Tail				200	1.33	14.8	266		Class C cement	none
PRODUCTION	Lead		0	16993	1600	2.38	11.9	3808		Poz (fly ash) Class H cement	10% bwoc bentonite II + 5% bwow sodium chloride + 5 pps LCM-1 + 0.005 lbs/sk Static Free + 0.005 gps FP-6L
PRODUCTION	Tail				1700	1.62	13.2	2754		Class H	CSE-2 + 4% bwow sodium chloride + 3 pps LCM- 1 + 0.6% bwoc FL-25 + 0.005 gps FP-6L + 0.005% bwoc Static Free

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT **Well Number:** 56H

Section 5 - Circulating Medium

Mud System Type: Closed

Will an air or gas system be Used? NO

Description of the equipment for the circulating system in accordance with Onshore Order #2:

Diagram of the equipment for the circulating system in accordance with Onshore Order #2:

Describe what will be on location to control well or mitigate other conditions: Sufficient mud materials will be kept on location at all times in order to combat lost circulation or unexpected kicks. Mud logging program: 2 man unit from approximately after setting intermediate casing. No open hole logs, DSTs, or cores are planned.

Describe the mud monitoring system utilized: A Pason PVT system will be rigged up prior to spudding this well. A volume monitoring system that measures, calculates and displays readings from the mud system on the rig to alert the rig crew of impending gas kicks and lost circulation. In order to effectively run open hole logs and casing, the mud viscosity and fluid loss properties may be adjusted.

Circulating Medium Table

Top Depth	Bottom Depth	Mud Type	Min Weight (lbs/gal)	Max Weight (lbs/gal)	Density (lbs/cu ft)	Gel Strength (lbs/100 sqft)	PH	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
5600	9800	OTHER : Fresh water/brine	8.4	8.6							
1800	5600	OTHER : Brine water	9.8	10							
0	1800	SPUD MUD	8.4	8.9							
9800	16993	OTHER : Fresh water/brine	8.9	9.1							

Section 6 - Test, Logging, Coring

List of production tests including testing procedures, equipment and safety measures:

Mud logging, H2S plan, BOP and choke plans all in place for testing, equipment, safety

List of open and cased hole logs run in the well:

MUDLOG

Coring operation description for the well:

No coring planned

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 4312 **Anticipated Surface Pressure:** 2156

Anticipated Bottom Hole Temperature(F): 162

Anticipated abnormal pressures, temperatures, or potential geologic hazards? NO

Describe:

Contingency Plans geoharzards description:

Contingency Plans geohazards attachment:

Hydrogen Sulfide drilling operations plan required? YES

Hydrogen sulfide drilling operations plan:

Lea_56H_H2S_plan_05-03-2017.pdf

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

Lea_56H_horizontal_drilling_plan_05-03-2017.pdf

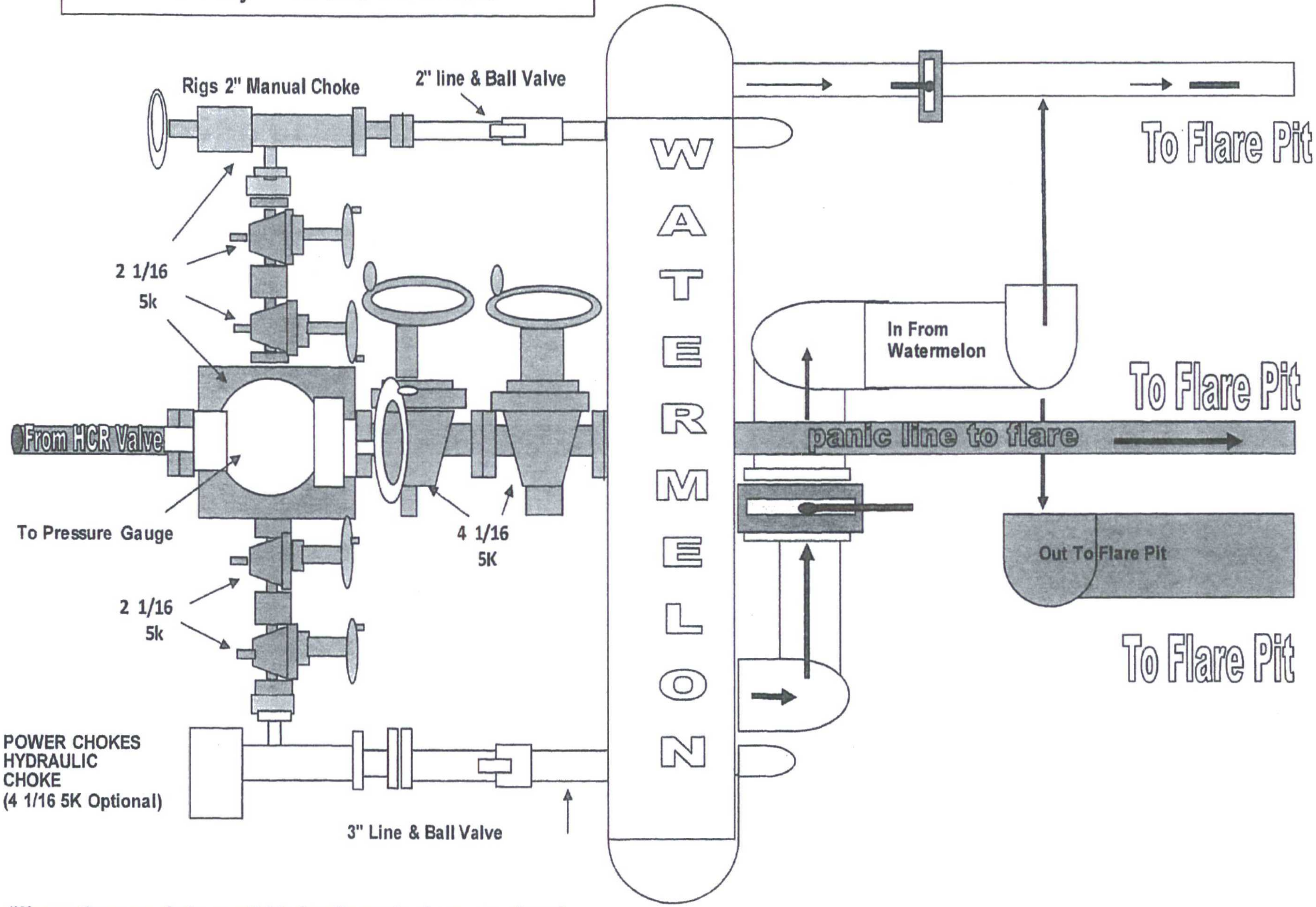
Other proposed operations facets description:

Other proposed operations facets attachment:

Lea_Unit_56H_Drilling_Plan_06_28_2017_20170829144004.pdf

Other Variance attachment:

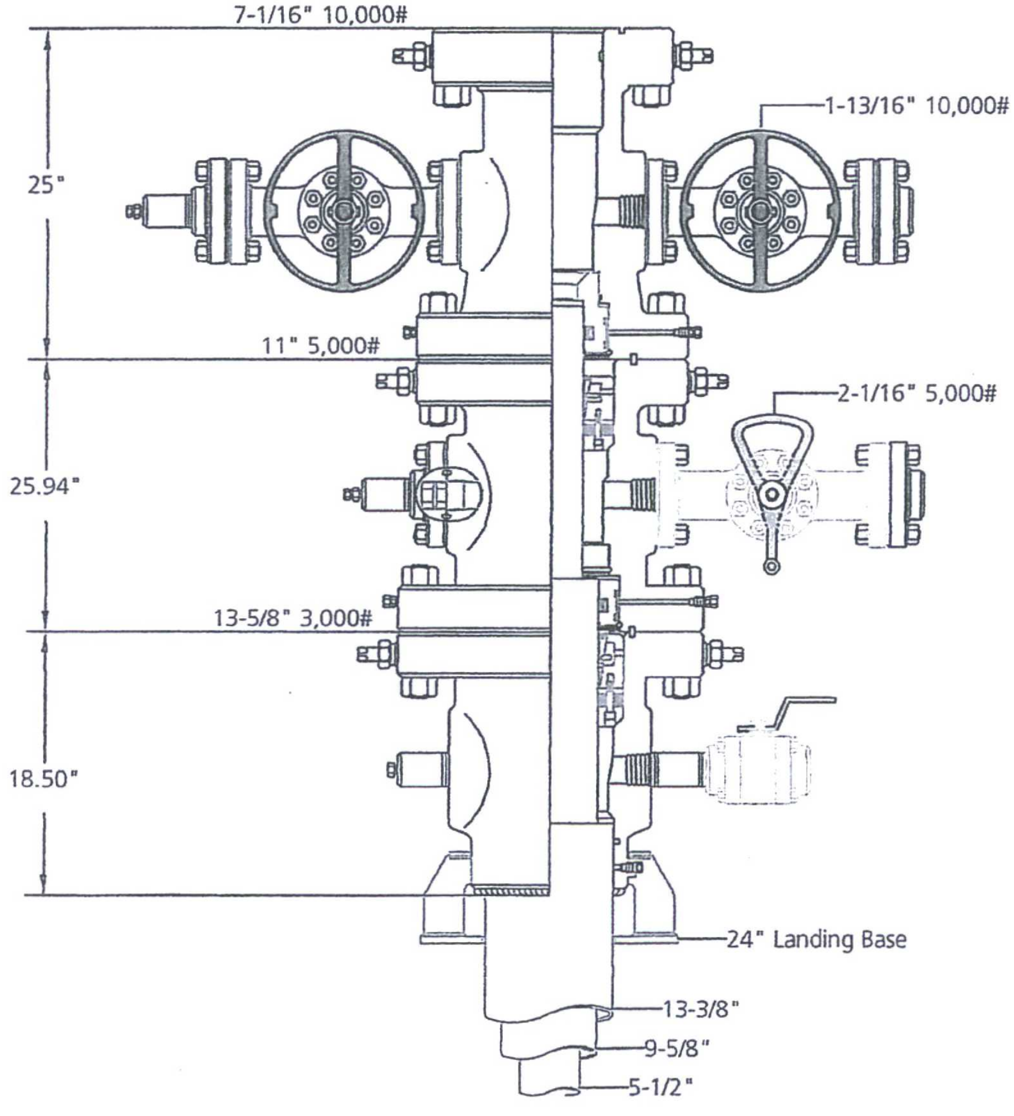
McVay 4 Choke Manifold



*We use the same choke manifolds for all aspects of our operations & all are rated to 10K;

* All connections downstream from BOP thru chokes Are Flanged, All connections downstream from chokes are Flanged .

Note: Dimensional information reflected on this drawing are estimated measurements only.

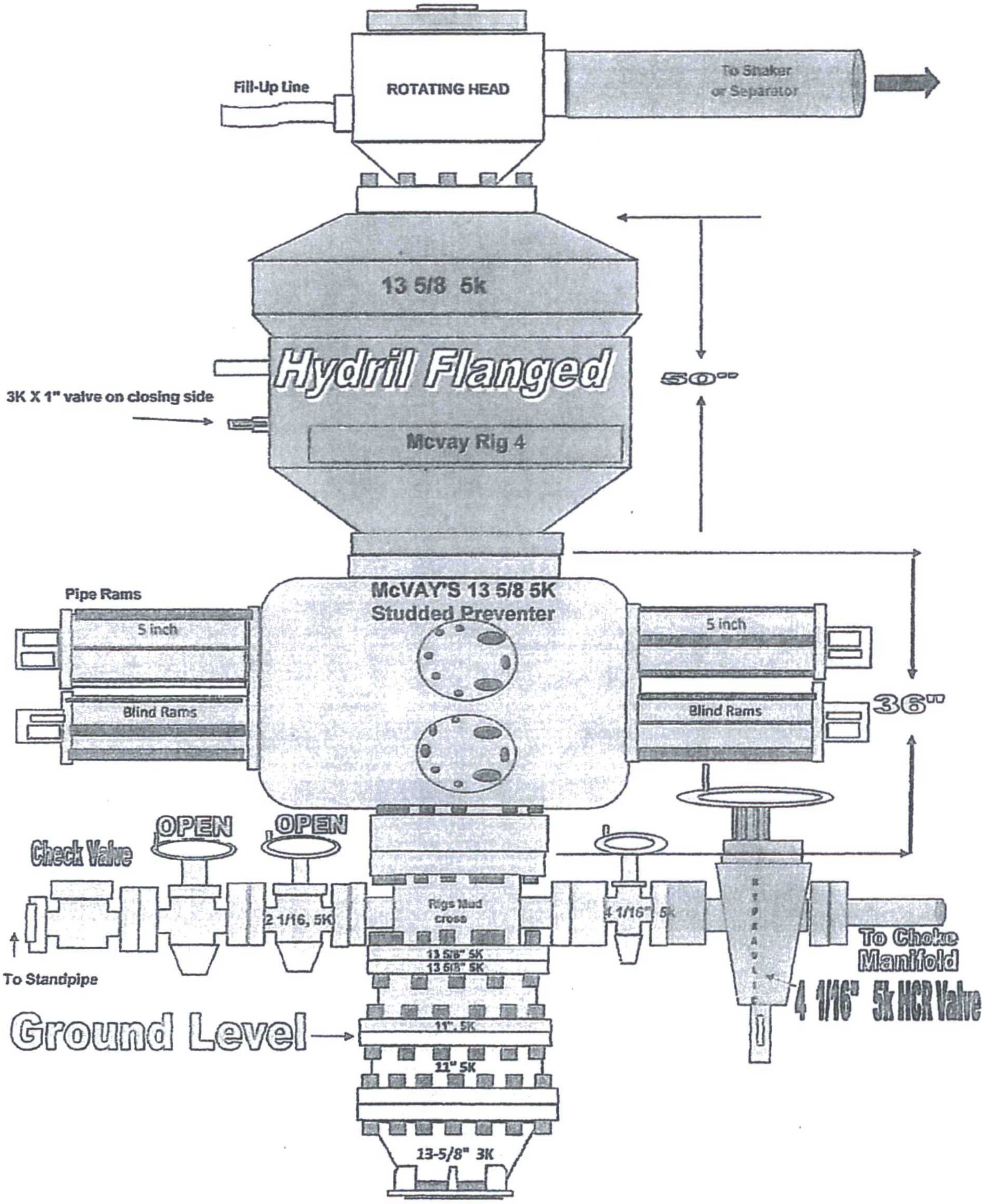


Legacy Reserves
Conventional 3- String

CAMERON

Name: Jeanette	Date: 7-15-15	Working Pressure: #	1274616

McVay Rig 4



Fill-Up Line
ROTATING HEAD
To Shaker or Separator
13 5/8 5k
Hydril Flanged
50"
3K X 1" valve on closing side
Mcvay Rig 4
McVAY'S 13 5/8 5K Studded Preventer
Pipe Rams
5 inch
5 inch
Blind Rams
Blind Rams
36"
OPEN
OPEN
Check Valve
2 1/16, 5K
Rigs Mud cross
4 1/16" 5K
To Choke Manifold
To Standpipe
13 5/8" 5K
13 5/8" 5K
4 1/16" 5k HCR Valve
Ground Level
11" 5K
11" 5K
13-5/8" 3K

Surface Casing

Size	Grade	#/ft	Collapse	Burst (Internal Yield)	Tensile	Coupling	Length	Dry Weight	Mud Weight
13.375"	*J-55*	*54.5*	*1130 psi*	*2730 psi*	*514 kips*	*STC*	*1800'*	*98,100 lbs*	*8.5 ppg*

Collapse: $DF_C = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation:
1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations:
1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test:
2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

- A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull:
514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

Size	Grade	#/ft	Collapse	Burst (Internal Yield)	Tensile	Coupling	Length	Dry Weight	Mud Weight
9.625"	*J-55*	*40*	*2570 psi*	*3950 psi*	*520 kips*	*LTC*	*4000'*	*160,000 lb*	*10.0 ppg*
9.625"	*HCK-55*	*40*	*4230 psi*	*3950 psi*	*694 kips*	*LTC*	*1600'*	*64,000 lb*	*10.0 ppg*

Collapse: $DF_C = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation:
J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25**
HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations:
J-55: 2570psi / [(0.77psi/ft – 0.433psi/ft)(4000')] = **1.91**
HCK-55: 4230psi / [(0.77psi/ft – 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

Casing Pressure Test:
J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = **2.56**
HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = **2.54**

Gas Kick:
J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = **1.41**
HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = **1.27**

Production Casing

Size	Grade	#/ft	Collapse	Burst (Internal Yield)	Tensile	Coupling	Length	Dry Weight	Mud Weight
5.5"	*P-110*	*20*	*11080 psi*	*12360 psi*	*641 kips*	*BTC*	*17,000'*	*340,000 lb*	*9.1 ppg*

Collapse: $DF_C = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations:
11,080psi / [(0.66psi/ft-0.433 psi/ft)(9,800'TVD)] = **4.98**

Production Operations:
11080psi / (9,800' TVD)(0.52psi/ft) = **2.17**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure:
12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(9,800'TVD)] = **1.26**

Production Operations:
12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(9,800'TVD)] = **4.2**

Tensile: $DF_T = 1.6$

Base Assumption

- A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull:
641,000 lbs /[(100,000 lbs.) + (340,000 lbs.)(0.86)] = **1.63**

Tensile: $DF_T = 1.6$

Base Assumption

- A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull:

J-55: 520 kips / (100,000 lbs. + 224,00 lbs.) = **1.6**

HCK-55: 694 kips / (100,000 lbs. + 64,100 lbs.) = **4.23**

Please see previous attachment for Casing Design Assumptions for

Legacy Lea 56H

Please see previous attachment for Casing Design Assumptions for

Legacy Lea 56H

Please see previous attachment for Casing Design Assumptions for

Legacy Lea 56H