Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☐ DRILL ☐ REENTER

1b. Type of Well: ☐ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☐ Single Zone ☐ Multiple Zone

7. If Unit or CA Agreement, Name and No.

8. Lease Name and Well No.

2. Name of Operator

9. API Well No.
30-005-64398

3a. Address

3b. Phone No. *(include area code)*

10. Field and Pool, or Exploratory

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*
At surface
At proposed prod. zone

11. Sec., T. R. M. or Blk. and Survey or Area

14. Distance in miles and direction from nearest town or post office*

12. County or Parish

13. State

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)

16. No of acres in lease

17. Spacing Unit dedicated to this well

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.

19. Proposed Depth

20. BLM/BIA Bond No. in file

21. Elevations (Show whether DF, KDB, RT, GL, etc.)

22. Approximate date work will start*

23. Estimated duration

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature | Name *(Printed/Typed)* | Date

Title

Approved by *(Signature)* | Name *(Printed/Typed)* | Date

Title | Office

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

APPROVED WITH CONDITIONS

Approval Date: 03/26/2025

(Continued on page 2)

*(Instructions on page 2)

C-102 Submit Electronically Via OCD Permitting	State of New Mexico Energy, Minerals & Natural Resources Department OIL CONSERVATION DIVISION		Revised July 9, 2024
		Submittal Type:	☑ Initial Submittal ☐ Amended Report ☐ As Drilled

WELL LOCATION INFORMATION

API Number 30-005-64398	Pool Code 19140	Pool Name Double L; San Andres	
Property Code 334750	Property Name HI BOB FEDERAL		Well Number 5H
OGRID No. 13837	Operator Name MACK ENERGY CORPORATION		Ground Level Elevation 3781.3
Surface Owner: ☐State ☐Fee ☐Tribal ☐Federal		Mineral Owner: ☐State ☐Fee ☐Tribal ☐Federal	

Surface Location

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
N	8	15 S	29 E		707 SOUTH	1650 WEST	33.0250454°N	104.0537674°W	CHAVES

Bottom Hole Location

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
N	17	15 S	29 E		1 SOUTH	1650 WEST	33.0086763°N	104.0538259°W	CHAVES

Dedicated Acres	Infill or Defining Well	Defining Well API	Overlapping Spacing Unit (Y/N)	Consolidation Code
160				
Order Numbers.			Well setbacks are under Common Ownership: ☐Yes ☐No	

Kick Off Point (KOP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
N	8	15 S	29 E		707 SOUTH	1650 WEST	33.0250454°N	104.0537674°W	CHAVES

First Take Point (FTP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
C	17	15 S	29 E		100 NORTH	1650 WEST	33.0228274°N	104.0537706°W	CHAVES

Last Take Point (LTP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
N	17	15 S	29 E		100 SOUTH	1650 WEST	33.0089483°N	104.0538249°W	CHAVES

Unitized Area or Area of Uniform Interest	Spacing Unit Type ☐Horizontal ☐Vertical	Ground Floor Elevation:

OPERATOR CERTIFICATIONS

I hereby certify that the information contained herein is true and complete to the best ofmy knowledge and belief, and, if the well is a vertical or directional well, that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of a working interest run leased mineral interest, or to a voluntary pooling agreement or a compulsory pooling order here to fore entered by the division.

If this well is a horizontal well, I further certify that this organization has received the consent of at least one lessee or owner of a working interest or unleased mineral interest in each tract (in the target pool or formation) in which any part of the well's completed interval will be located or obtained a compulsory pooling order from the division.

Deana Weaver 4/15/2025

Signature Date

Deana Weaver

Printed Name

dweaver@mec.com

Email Address

SURVEYOR CERTIFICATIONS

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

FILIMON F. JARAMILLO
NEW MEXICO
12797
REGISTERED PROFESSIONAL SURVEYOR

Signature and Seal of Professional Surveyor

FILIMON F. JARAMILLO

CertificateNumber	Dateof Survey
PLS 12797	APRIL 14, 2025

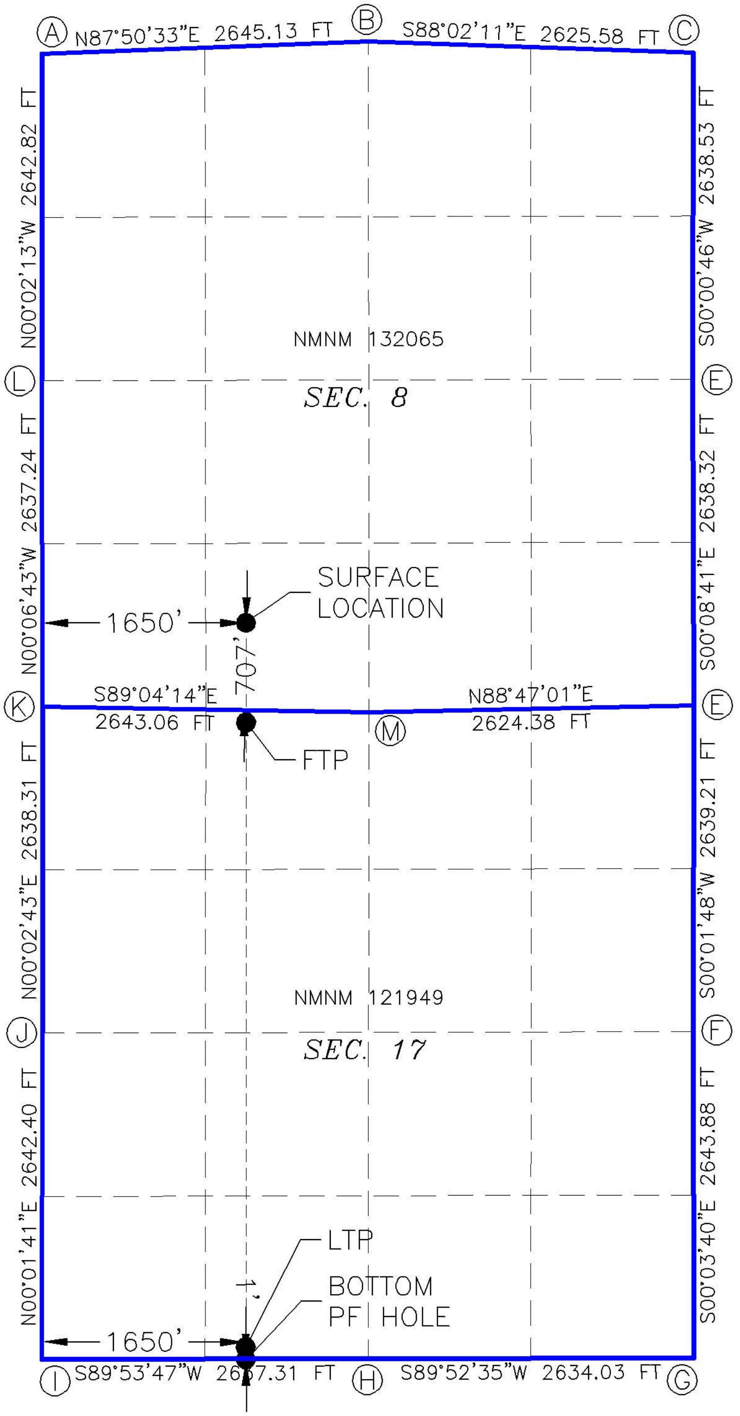
SURVEY NO. 9916

Note: No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

ACREAGE DEDICATION PLATS

This grid represents a standard section. You may superimpose a non-standard section, or larger area, over this grid. Operators must outline the dedicated acreage in a red box, clearly show the well surface location and bottom hole location, if it is directionally drilled, with the dimensions from the section lines in the cardinal directions. If this is a horizontal wellbore show on this plat the location of the First Take Point and Last Take Point, and the point within the Completed interval (other than the First Take Point or Last Take Point) that is closest to any outer boundary of the tract.

Surveyors shall use the latest United States government survey or dependent resurvey. Well locations will be in reference to the New Mexico Principal Meridian. If the land is not surveyed, contact the OCD Engineering Bureau. Independent subdivision surveys will not be acceptable.



HI BOB FEDERAL 5H
EL. = 3781.3

GEODETIC COORDINATES
NAD 83 NMSP EAST
SURFACE LOCATION
N.= 736762.57
E.= 627021.79
LAT. = 33.0250454°N
LONG. = 104.0537674°W

KICK OFF POINT
707' FSL, 1650' FWL
N.= 736762.57
E.= 627021.79
LAT. = 33.0250454°N
LONG. = 104.0537674°W

FIRST TAKE POINT (PPP 1)
100' FNL, 1650' FWL
N.= 735955.59
E.= 627022.95
LAT. = 33.0228274°N
LONG. = 104.0537706°W

LAST TAKE POINT
100' FSL, 1650' FWL
N.= 730905.95
E.= 627019.73
LAT. = 33.0089483°N
LONG. = 104.0538249°W

BOTTOM OF HOLE
1' FSL, 1650' FWL
N.= 730806.97
E.= 627019.68
LAT. = 33.0086763°N
LONG. = 104.0538259°W

CORNER COORDINATES TABLE
NAD 83 NMSP EAST

A	N.= 741361.02	E.= 625366.62
B	N.= 741460.58	E.= 628009.19
C	N.= 741370.64	E.= 630632.55
D	N.= 738732.80	E.= 630631.96
E	N.= 736095.17	E.= 630638.62
F	N.= 733456.63	E.= 630637.24
G	N.= 730813.44	E.= 630640.06
H	N.= 730807.76	E.= 628006.72
I	N.= 730802.99	E.= 625370.10
J	N.= 733444.71	E.= 625371.40
K	N.= 736082.33	E.= 625373.48
L	N.= 738718.89	E.= 625368.32
M	N.= 736039.47	E.= 628015.51

LEGEND
SECTION LINE
QUARTER LINE
LEASE LINE
WELL PATH

State of New Mexico
Energy, Minerals and Natural Resources Department

Submit Electronically
Via E-permitting

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

NATURAL GAS MANAGEMENT PLAN

This Natural Gas Management Plan must be submitted with each Application for Permit to Drill (APD) for a new or recompleted well.

Section 1 – Plan Description
Effective May 25, 2021

I. Operator: Mack Energy Corporation **OGRID:** 013837 **Date:** 12 / 19 / 2023

II. Type: ☒ Original ☐ Amendment due to ☐ 19.15.27.9.D(6)(a) NMAC ☐ 19.15.27.9.D(6)(b) NMAC ☐ Other.

If Other, please describe: ______________________

III. Well(s): Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	ULSTR	Footages	Anticipated Oil BBL/D	Anticipated Gas MCF/D	Anticipated Produced Water BBL/D
High Bob Federal #5H		N Sec 8 T15S R29E	707 FSL 1650 FWL	100	100	1,000

IV. Central Delivery Point Name: DCP Midstream Linam Ranch Proscessing Plant / Durango Midstream [See 19.15.27.9(D)(1) NMAC]

V. Anticipated Schedule: Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	Spud Date	TD Reached Date	Completion Commencement Date	Initial Flow Back Date	First Production Date
High Bob Federal #5H		6/1/2024	6/20/2024	7/31/2024	7/31/2024	8/1/2024

VI. Separation Equipment: ☒ Attach a complete description of how Operator will size separation equipment to optimize gas capture.

VII. Operational Practices: ☒ Attach a complete description of the actions Operator will take to comply with the requirements of Subsection A through F of 19.15.27.8 NMAC.

VIII. Best Management Practices: ☒ Attach a complete description of Operator's best management practices to minimize venting during active and planned maintenance.

Section 2 – Enhanced Plan
EFFECTIVE APRIL 1, 2022

Beginning April 1, 2022, an operator that is not in compliance with its statewide natural gas capture requirement for the applicable reporting area must complete this section.

☒ Operator certifies that it is not required to complete this section because Operator is in compliance with its statewide natural gas capture requirement for the applicable reporting area.

IX. Anticipated Natural Gas Production:

Well	API	Anticipated Average Natural Gas Rate MCF/D	Anticipated Volume of Natural Gas for the First Year MCF

X. Natural Gas Gathering System (NGGS):

Operator	System	ULSTR of Tie-in	Anticipated Gathering Start Date	Available Maximum Daily Capacity of System Segment Tie-in

XI. Map. ☐ Attach an accurate and legible map depicting the location of the well(s), the anticipated pipeline route(s) connecting the production operations to the existing or planned interconnect of the natural gas gathering system(s), and the maximum daily capacity of the segment or portion of the natural gas gathering system(s) to which the well(s) will be connected.

XII. Line Capacity. The natural gas gathering system ☐ will ☐ will not have capacity to gather 100% of the anticipated natural gas production volume from the well prior to the date of first production.

XIII. Line Pressure. Operator ☐ does ☐ does not anticipate that its existing well(s) connected to the same segment, or portion, of the natural gas gathering system(s) described above will continue to meet anticipated increases in line pressure caused by the new well(s).

☐ Attach Operator's plan to manage production in response to the increased line pressure.

XIV. Confidentiality: ☐ Operator asserts confidentiality pursuant to Section 71-2-8 NMSA 1978 for the information provided in Section 2 as provided in Paragraph (2) of Subsection D of 19.15.27.9 NMAC, and attaches a full description of the specific information for which confidentiality is asserted and the basis for such assertion.

Section 3 - Certifications

Effective May 25, 2021

Operator certifies that, after reasonable inquiry and based on the available information at the time of submittal:

☒ Operator will be able to connect the well(s) to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system; or

☐ Operator will not be able to connect to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system. ***If Operator checks this box, Operator will select one of the following:***

Well Shut-In. ☐ Operator will shut-in and not produce the well until it submits the certification required by Paragraph (4) of Subsection D of 19.15.27.9 NMAC; or

Venting and Flaring Plan. ☐ Operator has attached a venting and flaring plan that evaluates and selects one or more of the potential alternative beneficial uses for the natural gas until a natural gas gathering system is available, including:

- **(a)** power generation on lease;
- **(b)** power generation for grid;
- **(c)** compression on lease;
- **(d)** liquids removal on lease;
- **(e)** reinjection for underground storage;
- **(f)** reinjection for temporary storage;
- **(g)** reinjection for enhanced oil recovery;
- **(h)** fuel cell production; and
- **(i)** other alternative beneficial uses approved by the division.

Section 4 - Notices

1. If, at any time after Operator submits this Natural Gas Management Plan and before the well is spud:

(a) Operator becomes aware that the natural gas gathering system it planned to connect the well(s) to has become unavailable or will not have capacity to transport one hundred percent of the production from the well(s), no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised venting and flaring plan containing the information specified in Paragraph (5) of Subsection D of 19.15.27.9 NMAC; or

(b) Operator becomes aware that it has, cumulatively for the year, become out of compliance with its baseline natural gas capture rate or natural gas capture requirement, no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised Natural Gas Management Plan for each well it plans to spud during the next 90 days containing the information specified in Paragraph (2) of Subsection D of 19.15.27.9 NMAC, and shall file an update for each Natural Gas Management Plan until Operator is back in compliance with its baseline natural gas capture rate or natural gas capture requirement.

2. OCD may deny or conditionally approve an APD if Operator does not make a certification, fails to submit an adequate venting and flaring plan which includes alternative beneficial uses for the anticipated volume of natural gas produced, or if OCD determines that Operator will not have adequate natural gas takeaway capacity at the time a well will be spud.

I certify that, after reasonable inquiry, the statements in and attached to this Natural Gas Management Plan are true and correct to the best of my knowledge and acknowledge that a false statement may be subject to civil and criminal penalties under the Oil and Gas Act.

Signature:	Deana Weaver
Printed Name:	Deana Weaver
Title:	Regulatory Technician II
E-mail Address:	dweaver@mec.com
Date:	12/19/2023
Phone:	575-748-1288

OIL CONSERVATION DIVISION (Only applicable when submitted as a standalone form)
Approved By:
Title:
Approval Date:
Conditions of Approval:

VI. Separation Equipment:

Mack Energy Corporation(MEC) production facilities include separation equipment designed to efficiently separate gas from liquid phases to optimize gas capture based on projected and estimated volumes from the targeted pool of our completion project. MEC will utilize flowback separation equipment and production separation equipment designed and built to industry specifications after the completion to optimize gas capture and send gas to sales or flare based on analytical composition. MEC operates facilities that are typically multi-well facilities. Production separation equipment is upgraded prior to new wells being completed, if determined to be undersized or inadequate. This equipment is already on-site and tied into our sales gas lines prior to the new drill operations.

VII. Operational Practices:

1. Subsection (A) Venting and Flaring of Natural Gas. MEC understands the requirements of NMAC 19.15.27.8 which outlines that the venting and flaring of natural gas during drilling, completion or production operations that constitutes waste as defined in 19.15.2 are prohibited.
2. Subsection (B) Venting and Flaring during drilling operations. This gas capture plan isn't for a well being drilled.
3. Subsection (C) Venting and flaring during completion or recompletion. Flowlines will be routed for flowback fluids into a completion or storage tank and if feasible under well conditions, flare rather than vent and commence operation of a separator as soon as it is technically feasible for a separator to function.
    - At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.
4. Subsection (D) Venting and flaring during production operations ○ At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.
    - Monitor manual liquid unloading for wells on-site or in close proximity (<30 minutes' drive time), take reasonable actions to achieve a stabilized rate and pressure at the earliest practical time, and take reasonable actions to minimize venting to the maximum extent practicable.
    - MEC will not vent or flare except during the approved activities listed in NMAC 19.15.27.8 (D) 14.
5. Subsection (E) Performance standards ○ All tanks and separation equipment are designed for maximum throughput and pressure to minimize waste.
    - If a flare is utilized during production operations it will have a continuous pilot and is located more than 100 feet from any known well or storage tanks.
    - At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.

6. Subsection (F) Measurement or estimation of vented and flared natural gas ○ Measurement equipment is installed to measure the volume of natural gas flared from process piping.
   - When measurement isn't practicable, estimation of vented and flared natural gas will be completed as noted in 19.15.27.8 (F) 5-6.

VIII. Best Management Practices:

1. MEC has adequate storage and takeaway capacity for wells it chooses to complete as the flowlines at the sites are already in place and tied into a gathering system.
2. MEC will flare rather than vent vessel blowdown gas when technically feasible during active and/or planned maintenance to equipment on-site.
3. MEC combusts natural gas that would otherwise be vented or flared, when technically feasible.
4. MEC will shut in wells in the event of a takeaway disruption, emergency situation, or other operations where venting or flaring may occur due to equipment failures.

5. MEC has a gas gathering system in place(CTB-887)a with multiple purchaser's to limit venting or flaring, due to purchaser shut downs.

AFMSS
U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

Drilling Plan Data Report

03/26/2025

APD ID: 10400096387

Submission Date: 02/16/2024

Highlighted data reflects the most recent changes

Show Final Text

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL

Well Number: 5H

Well Type: OIL WELL

Well Work Type: Drill

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical	Measured Depth	Lithologies	Mineral Resources	Producing Formatio
15284236	RUSTLER	3781	240	240	ALLUVIUM	NONE	N
15284235	TOP OF SALT	3171	610	610	SALT	NONE	N
15284233	BASE OF SALT	3041	740	740	SALT	NONE	N
15284232	YATES	2884	897	897	ANHYDRITE, SILTSTONE	NATURAL GAS, OIL	N
15284234	SEVEN RIVERS	2621	1160	1160	ANHYDRITE, SILTSTONE	NATURAL GAS, OIL	N
15284237	QUEEN	2114	1667	1667	ANHYDRITE	NATURAL GAS, OIL	N
15284238	GRAYBURG	1716	2065	2065	ANHYDRITE, DOLOMITE, SILTSTONE	NATURAL GAS, OIL	N
15284239	SAN ANDRES	1434	2347	2386	ANHYDRITE, DOLOMITE	NATURAL GAS, OIL	Y

Section 2 - Blowout Prevention

Pressure Rating (PSI): 3M

Rating Depth: 8612

Equipment: Rotating Head, Mud Gas Separator

Requesting Variance? NO

Variance request:

Testing Procedure: The BOP/BOPE test shall include a low pressure test for 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30mins without a test plug. The estimated bottom hole at TD is 120 degrees and estimated maximum bottom hole pressure is 1414 psig (0.052*2955' TVD*9.2) less than 2900 bottom hole pressure. Well test to 2000 psi for 30 mins.

Choke Diagram Attachment:

NEW_Choke_Manifold_3M_20231218150622.pdf

BOP Diagram Attachment:

NEW_BOP_3M_20231218150632.pdf

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

NEW_Choke_Manifold_3M_20231218150622.pdf

NEW_BOP_3M_20231218150632.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	600	0	600	3781	3181	600	J-55	48	ST&C	2.471	4.625	BUOY	17.623	BUOY	4.74
2	INTERMEDIATE	12.25	9.625	NEW	API	N	0	1200	0	1200	3781	2581	1200	J-55	36	LT&C	3.237	7.04	BUOY	10.768	BUOY	7.04
3	PRODUCTION	8.75	7.0	NEW	API	N	0	2050	0	2050	3781	1731	2050	HCP-110	26	LT&C	7.03	3.317	BUOY	6.762	BUOY	3.317
4	PRODUCTION	8.75	7.0	NEW	API	N	2050	3100	2050	2884	1731	897	1050	HCP-110	26	BUTT	4.698	3.317	BUOY	8.332	BUOY	3.317
5	PRODUCTION	8.75	5.5	NEW	API	N	3100	8612	2884	2955	897	826	5512	HCP-110	17	BUTT	5.584	3.547	BUOY	7.157	BUOY	3.547

Casing Attachments

Casing ID: 1 **String** SURFACE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Surface_Csg_20231219083812.pdf

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

Casing Attachments

Casing ID: 2 **String** INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Intermediate_Csg_20231219084148.pdf

Casing ID: 3 **String** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

production_Csg_20231219084912.pdf

Casing ID: 4 **String** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

production_Csg_20231219085057.pdf

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

Casing Attachments

Casing ID: 5 **String** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

production_Csg_20231219085324.pdf

Section 4 - Cement

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
PRODUCTION	Lead		0	0	0	0	0	0		0	0
PRODUCTION	Lead		0	0	0	0	0	0		0	0
SURFACE	Lead		0	600	100	1.61	14.4	457		RFC+12% PF53+2%PF1+5ppsPF42+.125pps PF29	20bbls Gelled Water 50sx of 11# Scavenger Cement
SURFACE	Tail		0	600	550	1.34	14.8	457	100	Class C+1% PF1	20bbls Gelled Water 50sx of 11# Scavenger Cement
INTERMEDIATE	Lead		0	1200	220	1.72	13.5	417	100	Class C + 45 F20 +.4pps PF 45+ .125 PF 29	20bbls Gelled Water 50sx of 11# Scavenger Cement
INTERMEDIATE	Tail		0	1200	200	1.34	14.8	417	100	Class C + 1% PF 1	20bbls Gelled Water 50sx of 11# Scavenger Cement
PRODUCTION	Lead		0	8612	250	2.82	13.5	2176	35	Class C 4% PF 20+ 4pps PF45+125pps PF 29	20bbls Gelled Water 20bbls Chemical Wash 50sx of 11# Scavenger Cement

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
PRODUCTION	Tail		0	8612	1700	1.34	14.2	2176	35	50/50 POZ C + 5% (BWOW) PF 44+2% PF 204+.2% PF 606+.1% PF153+.4pps PF 44	20bbls Gelled Water 20bbls Chemical Wash 50sx of 11# Scavenger Cement

Section 5 - Circulating Medium

Mud System Type: Open

Will an air or gas system be Used? NO

Description of the equipment for the circulating system in accordance with 43 CFR 3172:

Diagram of the equipment for the circulating system in accordance with 43 CFR 3172:

Describe what will be on location to control well or mitigate other conditions: BOPE Brine Water

Describe the mud monitoring system utilized: Parson PVT with PVT Volume Recorder

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
0	600	SPUD MUD	8.5	10	74.8	0.1	11		12000		
600	1200	LSND/GEL	8.3	9.2	74.8	0.1	11		12000		
1200	8612	LSND/GEL	8.3	9.2	74.8	0.1	11		12000		The estimated bottom hole at TD is 120 degrees and estimated maximum bottom hole pressure is 1414 (0.052*2955'*9.2)

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

Section 6 - Test, Logging, Coring

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

None

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

CNL/FDC,COMPENSATED DENSILOG,GAMMA RAY LOG,DUAL LATERAL LOG/MICRO-SPHERICALLY FOCUSED,

Coring operation description for the well:

None

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 1414 **Anticipated Surface Pressure:** 763

Anticipated Bottom Hole Temperature(F): 95

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

Describe:

Contingency Plans geoharzards description:

Contingency Plans geohazards

Hydrogen Sulfide drilling operations plan required? NO

Hydrogen sulfide drilling operations

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

Hi_Bob_Federal__5H_Preliminary_Horizontal_Well_Plan_1_20231219091909.pdf
Gas_management_20231219093329.pdf
H2S_20240216073228.pdf
Escape_Route_20240216073235.pdf
KOP_20240216073333.pdf
Drilling_Plan_20240311071656.pdf
H2S_Contingency_Plan_20240311070856.pdf

Other proposed operations facets description:

Perforations 3387.5'-8500'
FTP- NENW Sec. 17 T15S R29E 100 FNL 1650 FWL
LTP- SESW Sec. 17 T15S R29E 110 FSL 1650 FWL

Other proposed operations facets attachment:

Other Variance attachment:

Variance_request_20231219091935.pdf

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL **Well Number:** 5H

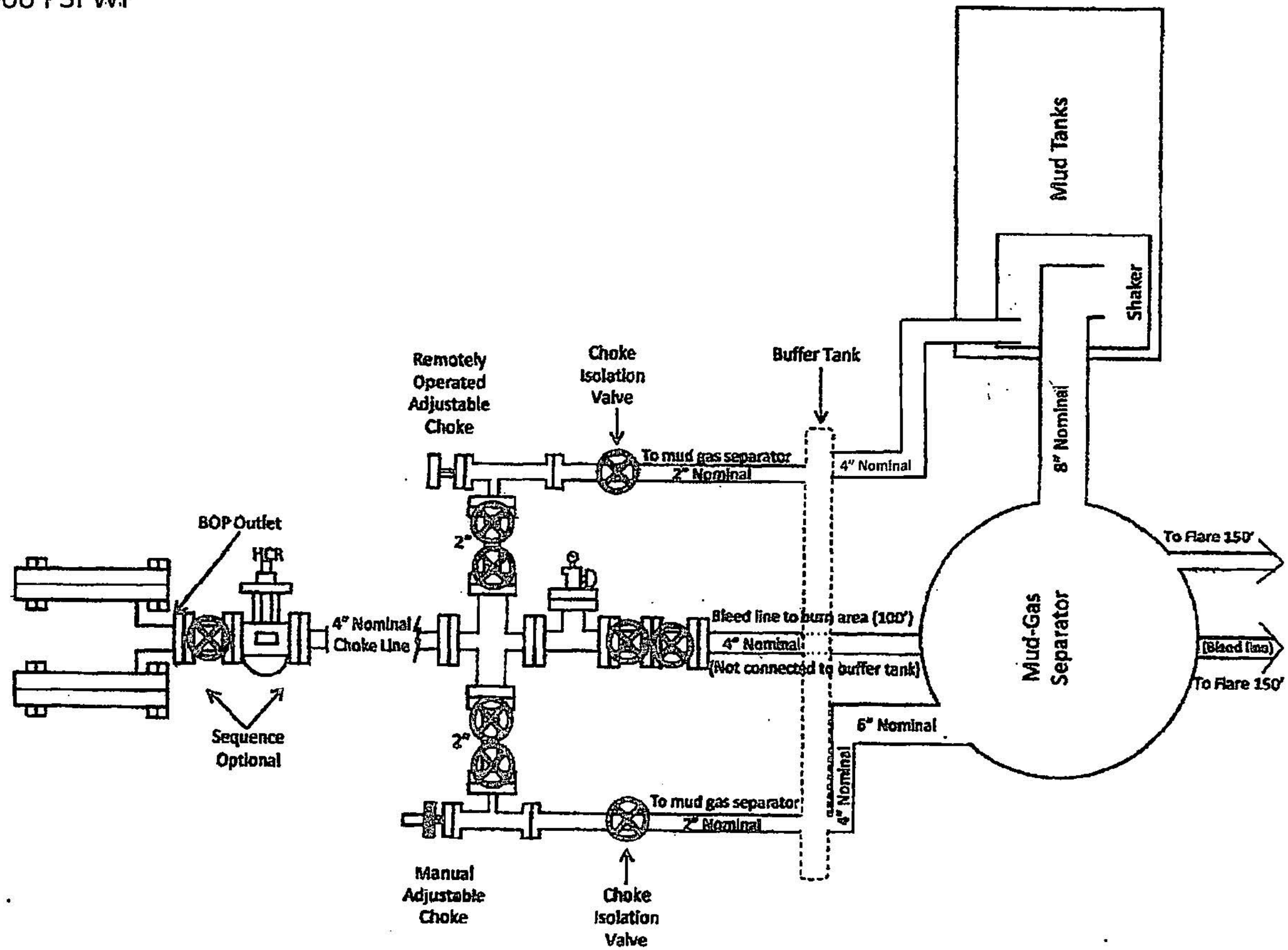
Cactus_Wellhead_installation_Procedure_20231219091944.pdf

Choke_Hose_Cert_20231219092009.pdf

Flex_Hose_Cert_20231219092025.pdf

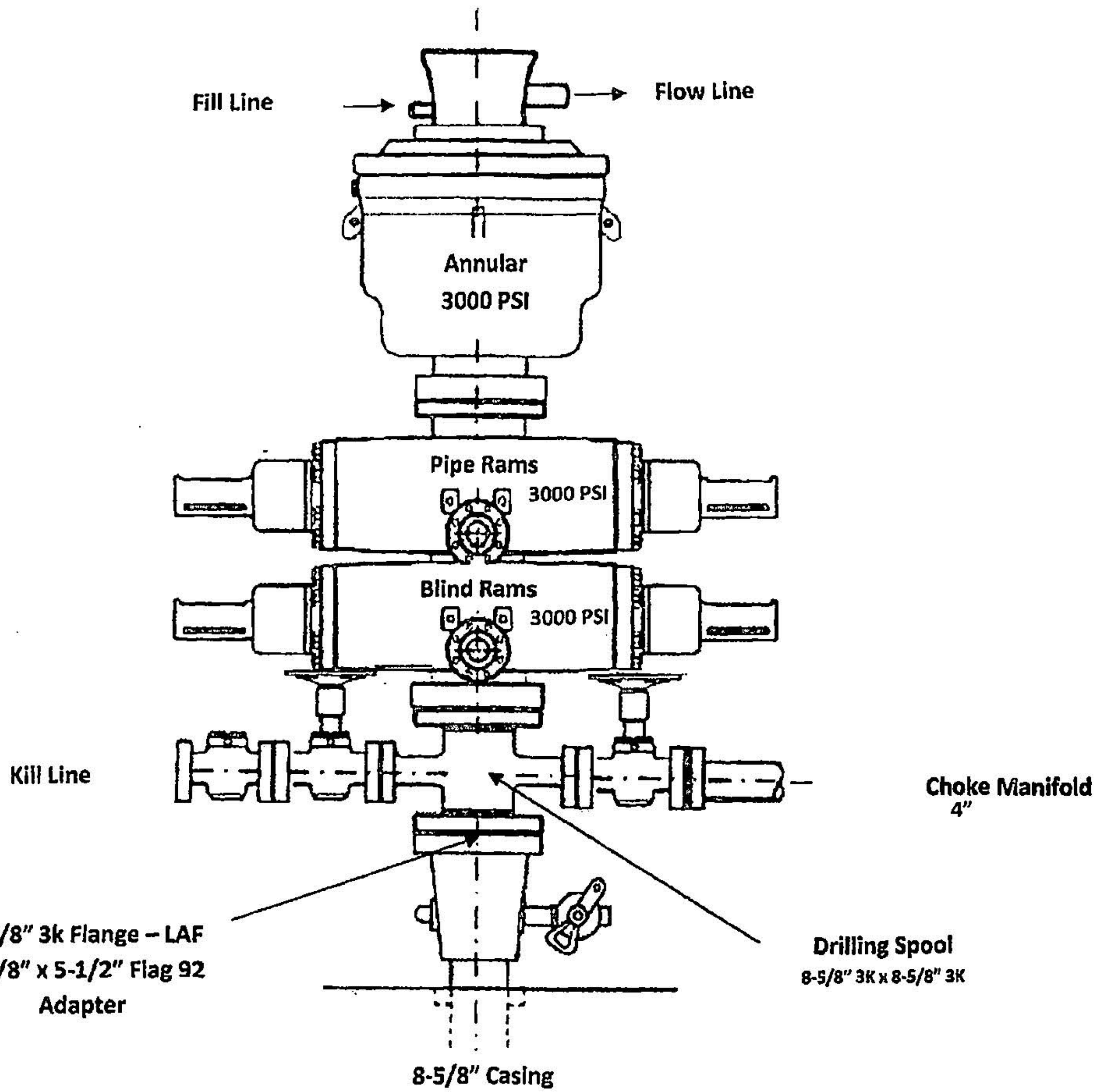
Choke Manifold

3000 PSI WP



BOP Diagram

Dual Ram BOP
3000 PSI WP



Casing Design **Well:** Hi Bob Federal #5H

String Size & Function: 13 3/8 in surface x intermediate

Total Depth: 600 ft

Pressure Gradient for Calculations **(While drilling)**

Mud weight, collapse:	9.6 #/gal	Safety Factor Collapse:	1.125
Mud weight, burst:	9.6 #/gal	Safety Factor Burst:	1.25
Mud weight for joint strength:	9.6 #/gal	Safety Factor Joint Strength	1.8

BHP @ TD for: collapse: 299.52 psi Burst: 299.52 psi, joint strength: 299.52 psi

Partially evacuated hole? Pressure gradient remaining: 10 #/gal

Max. Shut in surface pressure: 500 psi

1st segment	600 ft to	0 ft	Make up Torque ft-lbs		Total ft = 600
O.D.	Weight	Grade / Threads	opt.	min.	mx.
13.375 inches	**48** #/ft	**J-55** / **ST&C**	**3,220**	**2,420**	**4,030**
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
740	**2,370** psi	**433** ,000 #	**744** ,000 #		**12.559**

2nd segment	0 ft to	0 ft	Make up Torque ft-lbs		Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.
inches	#/ft				
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
psi	psi	,000 #	,000 #		

3rd segment	0 ft to	0 ft	Make up Torque ft-lbs		Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.
inches	#/ft				
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
psi	psi	,000 #	,000 #		

4th segment	0 ft to	0 ft	Make up Torque ft-lbs		Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.
inches	#/ft				
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
psi	psi	,000 #	,000 #		

5th segment	0 ft to	0 ft	Make up Torque ft-lbs		Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.
inches	#/ft				
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
psi	psi	,000 #	,000 #		

6th segment	0 ft to	0 ft	Make up Torque ft-lbs		Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.
inches	#/ft				
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift
psi	psi	,000 #	,000 #		

Select 1st segment bottom		600	**S.F.**	Actual		Desire
			collapse	2.47062	>=	1.125
600 ft to	0 ft		burst-b	4.624571	>=	1.25
13.375 0 J-55	ST&C		burst-t	4.74		
Top of segment 1 (ft)		0	**S.F.**	Actual		Desire
Select 2nd segment from bottom			collapse	#DIV/0!	>=	1.125
			burst-b	0	>=	1.25
0 ft to	0 ft		burst-t	0		
0 0	0 0		jnt strngth	17.62322	>=	1.8

Casing Design **Well:** Hi Bob Federal #5H

String Size & Function: 9 5/8 in surface intermediate x

Total Depth: 1200 ft **TVD:** 1200 ft

Pressure Gradient for Calculations **(While drilling)**

Mud weight, collapse:	10 #/gal	Safety Factor Collapse:	1.125
Mud weight, burst:	10 #/gal	Safety Factor Burst:	1.25
Mud weight for joint strength:	10 #/gal	Safety Factor Joint Strength	1.8

BHP @ TD for: collapse: 624 psi Burst: 624 psi, joint strength: 624 psi

Partially evacuated hole? Pressure gradient remaining: 10 #/gal

Max. Shut in surface pressure: 500 psi

1st segment	1200 ft to	0 ft		Make up Torque ft-lbs			Total ft = 1200
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
9.625 inches	**36** #/ft	**J-55**	**LT&C**	**3,940**	**2,960**	**4,930**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
2,020 psi	**3,520** psi	**394** ,000 #		**564** ,000 #		**8.765**	

2nd segment	ft to	ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

3rd segment	0 ft to	0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

4th segment	0 ft to	0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

5th segment	0 ft to	0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

6th segment	0 ft to	0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

Select 1st segment bottom		1200	**S.F.**	Actual		Desire
			collapse	3.237179	>=	1.125
1200 ft to 0 ft			burst-b	7.04	>=	1.25
9.625 0 J-55	LT&C		burst-t	7.04		
Top of segment 1 (ft)		0	**S.F.**	Actual		Desire
Select 2nd segment from bottom			collapse	#DIV/0!	>=	1.125
			burst-b	0	>=	1.25
0 ft to 0 ft			burst-t	0		
0 0 0	0		jnt strngth	10.76785	>=	1.8

Casing Design **Well:** Hi Bob Federal #5H

String Size & Function: 5 1/2"x 7" in Production x

Total Depth: 8612 ft **TVD:** 2955 ft

Pressure Gradient for Calculations **(While drilling)**

Mud weight, collapse:	10 #/gal	Safety Factor Collapse:	1.125
Mud weight, burst:	10 #/gal	Safety Factor Burst:	1.25
Mud weight for joint strength:	10 #/gal	Safety Factor Joint Strength	1.8

BHP @ TD for: collapse: 1536.6 psi Burst: 1536.6 psi, joint strength: 1536.6 psi

Partially evacuated hole? Pressure gradient remaining: 10 #/gal

Max. Shut in surface pressure: 3000 psi

1st segment	8612 ft to 3100 ft			Make up Torque ft-lbs			Total ft = 5512
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
5.5 inches	**17** #/ft	**HCP-110**	**Buttress**	**4,620**	**3,470**	**5,780**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
8,580 psi	**10,640** psi-lrcr	**568** ,000 #		**546** ,000 #		**4.767**	

2nd segment	3100 ft to 2050 ft			Make up Torque ft-lbs			Total ft = 1050
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**HCP-110**	**Buttress**	**6,930**	**5,200**	**8,660**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
7,800 psi	**9,950** psi-lrcr	**853** ,000 #		**830** ,000 #		**6.151**	

3rd segment	2050 ft to 0 ft			Make up Torque ft-lbs			Total ft = 2050
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**P-110**	**LT&C**	**6930**	**5200**	**8660**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
7,800 psi	**9,950** psi	**693** ,000 #		**830** ,000 #		**6.151**	

4th segment	0 ft to 0 ft			Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

5th segment	0 ft to 0 ft			Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

6th segment	0 ft to 0 ft			Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

Select 1st segment bottom	8612	**S.F.**	Actual		Desire
		collapse	5.583756	>=	1.125
8612 ft to 3100 ft		burst-b	3.546667	>=	1.25
5.5 0 HCP-110 Buttress		burst-t	3.546667		
Top of segment 1 (ft)	3100	**S.F.**	Actual		Desire
Select 2nd segment from bottom		collapse	4.697739	>=	1.125
		burst-b	3.316667	>=	1.25
3100 ft to 2050 ft		burst-t	3.316667		
7 26 HCP-110 Buttress		jnt strngth	7.156601	>=	1.8

			Top of segment 2 (ft)	2050	S.F.	Actual		Desire
Select	3rd segment from bottom				collapse	7.029955	>=	1.125
					burst-b	3.316667	>=	1.25
2050 ft	to	0 ft			burst-t	3.316667		
7	26 P-110	LT&C			jnt strngth	8.322732	>=	1.8
			Top of segment 3 (ft)	0	S.F.	Actual		Desire
Select	4th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	0 ft			burst-t	0		
0	0	0	0		jnt strngth	6.76161	>=	1.8
			Top of segment 4 (ft)		S.F.	Actual		Desire
Select	5th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	ft			burst-t	0		
0	0	0	0		jnt strngth	0	>=	1.8
			Top of segment 5 (ft)		S.F.	Actual		Desire
Select	6th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	ft			burst-t	0		
0	0	0	0		jnt strngth	0	>=	1.8
			Top of segment 6 (ft)		jnt strngth		>=	1.8

use in colapse calculations across different pressured formations

Three gradient pressure function

Depth of evaluation:	1,200	ft			516	psi @	1,200	ft
Top of salt:	2,400	ft	fx #1	516				
Base of salt:	3,700	ft	fx #2	900				
TD of intermediate:	4,600	ft	fx #3	540				

Pressure gradient to be used above each top to be used as a function of depth. ex. psi/ft

fx #1	fx #2	fx #3
0.43	0.75	0.45

1) Calculate neutral point for buckling with temperature affects computed also
2) Surface burst calculations & kick tolerance in surface pressure for burst
3) Do a comparison test to determine which value is lower joint strength or body yield to use in tensile strength calculations
4) Raise joint strength safety factor up to next level on page #2
5) Sour service what pipe can be used with proper degrading of strength factors and as function of temp

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	5.06873
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	795.518
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	764.706
S.F. Body yield strength top of segment:	6.87941

Collapse calculations for 1st segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	2955	ft	
hydrostatic pressure collapse - backside:	1536.6	psi	
Axial load @ bottom of section	0	lbs	previous segments
Axial load factor:	0		load/(pipe body yield strength)
Collapse strength reduction factor:	1		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8580	psi	
Actual safety factor	5.58376		adjusted casing rating / actual pressure

calculations for top of segment @	3100 ft	
hydrostatic pressure collapse - backside:	1612 psi	
Axial load @ top of section	79367.3 lbs	previous segments + (this segment x BF)
Axial load factor:	0.14536	load/(pipe body yield strength)
Collapse strength reduction factor:	0.95231	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8170.79 psi	
Actual safety factor	5.06873	adjusted casing rating / actual pressure

Burst calculations for 1st segment - Completion fracture treatment

calculations for bottom of segment @	8612 ft	
Differential burst pressure	3000 psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640 psi	
Actual safety factor	3.54667	casing rating / differential burst pressure
calculations for top of segment @	3100 ft	
Differential burst pressure	3000 psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640 psi	
Actual safety factor	3.54667	casing rating / differential burst pressure

Joint strength calculations for 1st segment

Buoyancy factor for joint strength calc.:	0.847	
calculations for bottom of segment @	8612 ft	
Axial load @ bottom of section	714 lbs	weight of previous segments
Joint Strength of segment	568000 lbs	
Body Yield Strength of segment	546000 lbs	
Actual safety factor joint strength	795.518	csg joint strength / axial load
Actual safety factor body yield	764.706	csg body yield strength / axial load
calculations for top of segment @	3100 ft	
Axial load @ top of section	79367.3 lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	568000 lbs	
Body Yield Strength of segment	546000 lbs	
Actual safety factor joint strength	7.1566	csg joint strength / axial load
Actual safety factor body yield	6.87941	csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	7.02996
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	10.7475
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	10.4577
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 2nd segment - casing evacuated

Buoyancy factor collapse:	0.847	
calculations for bottom of segment @	3100 ft	
hydrostatic pressure collapse - backside:	1612 psi	
Axial load @ bottom of section	79367.3 lbs	load @ top of last segment
Axial load factor:	0.09562	load/(pipe body yield strength)
Collapse strength reduction factor:	0.97087	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7572.75 psi	
Actual safety factor	4.69774	adjusted casing rating / actual pressure
calculations for top of segment @	2050 ft	
hydrostatic pressure collapse - backside:	1066 psi	
Axial load @ top of section	102490 lbs	previous segments + (this segment x BF)
Axial load factor:	0.12348	load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93 psi	
Actual safety factor	7.02996	adjusted casing rating / actual pressure

Burst calculations for 2nd segment - Completion fracture treatment

calculations for bottom of segment @	3100 ft	
Differential burst pressure	3000 psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950 psi	
Actual safety factor	3.31667	casing rating / differential burst pressure
calculations for top of segment @	2050 ft	

Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 2nd segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	3100	ft	
Axial load @ bottom of section	79367.3	lbs	weight of previous segments
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	10.7475		csg joint strength / axial load
Actual safety factor body yield	10.4577		csg body yield strength / axial load
calculations for top of segment @	2050	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	8.32273		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	6.76161
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	8.09832
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 3rd segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	2050	ft	
hydrostatic pressure collapse - backside:	1066	psi	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Axial load factor:	0.12348		load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93	psi	
Actual safety factor	7.02996		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	0.17787		load/(pipe body yield strength)
Collapse strength reduction factor:	0.93889		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7323.36	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 3rd segment - Completion fracture treatment

calculations for bottom of segment @	2050	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 3rd segment

Buoyancy factor for joint strength calc.:			
calculations for bottom of segment @	2050	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)

Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 4th segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 4th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 4th segment

Buoyancy factor for joint strength calc.: 0.847

calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 5th segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 5th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 5th segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 6th segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 6th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 6th segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Casing Design **Well:** Hi Bob Federal #5H

String Size & Function: 5 1/2"x 7" in Production x

Total Depth: 8612 ft **TVD:** 2955 ft

Pressure Gradient for Calculations **(While drilling)**

Mud weight, collapse:	10 #/gal	Safety Factor Collapse:	1.125
Mud weight, burst:	10 #/gal	Safety Factor Burst:	1.25
Mud weight for joint strength:	10 #/gal	Safety Factor Joint Strength	1.8

BHP @ TD for: collapse: 1536.6 psi Burst: 1536.6 psi, joint strength: 1536.6 psi

Partially evacuated hole? Pressure gradient remaining: 10 #/gal

Max. Shut in surface pressure: 3000 psi

1st segment	8612 ft	to	3100 ft	Make up Torque ft-lbs			Total ft = 5512
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
5.5 inches	**17** #/ft	**HCP-110**	**Buttress**	**4,620**	**3,470**	**5,780**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
8,580 psi	**10,640** psi-lrcr	**568** ,000 #		**546** ,000 #		**4.767**	

2nd segment	3100 ft	to	2050 ft	Make up Torque ft-lbs			Total ft = 1050
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**HCP-110**	**Buttress**	**6,930**	**5,200**	**8,660**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
7,800 psi	**9,950** psi-lrcr	**853** ,000 #		**830** ,000 #		**6.151**	

3rd segment	2050 ft	to	0 ft	Make up Torque ft-lbs			Total ft = 2050
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**P-110**	**LT&C**	**6930**	**5200**	**8660**	
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
7,800 psi	**9,950** psi	**693** ,000 #		**830** ,000 #		**6.151**	

4th segment	0 ft	to	0 ft	Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

5th segment	0 ft	to	0 ft	Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

6th segment	0 ft	to	0 ft	Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade	Threads	opt.	min.	mx.	
inches	#/ft						
Collapse Resistance	Internal Yield	Joint Strength		Body Yield		Drift	
psi	psi	,000 #		,000 #			

Select 1st segment bottom	8612	**S.F.**	Actual		Desire
		collapse	5.583756	>=	1.125
8612 ft to 3100 ft		burst-b	3.546667	>=	1.25
5.5 0 HCP-110 Buttress		burst-t	3.546667		
Top of segment 1 (ft)	3100	**S.F.**	Actual		Desire
Select 2nd segment from bottom		collapse	4.697739	>=	1.125
		burst-b	3.316667	>=	1.25
3100 ft to 2050 ft		burst-t	3.316667		
7 26 HCP-110 Buttress		jnt strngth	7.156601	>=	1.8

	Top of segment 2 (ft)				2050	S.F.	Actual		Desire
Select	3rd segment from bottom					collapse	7.029955	>=	1.125
						burst-b	3.316667	>=	1.25
2050 ft	to		0 ft			burst-t	3.316667		
7	26	P-110	LT&C			jnt strngth	8.322732	>=	1.8
	Top of segment 3 (ft)				0	S.F.	Actual		Desire
Select	4th segment from bottom					collapse	#DIV/0!	>=	1.125
						burst-b	0	>=	1.25
0 ft	to		0 ft			burst-t	0		
0	0	0	0			jnt strngth	6.76161	>=	1.8
	Top of segment 4 (ft)					S.F.	Actual		Desire
Select	5th segment from bottom					collapse	#DIV/0!	>=	1.125
						burst-b	0	>=	1.25
0 ft	to		ft			burst-t	0		
0	0	0	0			jnt strngth	0	>=	1.8
	Top of segment 5 (ft)					S.F.	Actual		Desire
Select	6th segment from bottom					collapse	#DIV/0!	>=	1.125
						burst-b	0	>=	1.25
0 ft	to		ft			burst-t	0		
0	0	0	0			jnt strngth	0	>=	1.8
	Top of segment 6 (ft)					jnt strngth		>=	1.8

use in colapse calculations across different pressured formations

Three gradient pressure function

Depth of evaluation:	1,200 ft			516	psi @	1,200 ft
Top of salt:	2,400 ft	fx #1	516			
Base of salt:	3,700 ft	fx #2	900			
TD of intermediate:	4,600 ft	fx #3	540			

Pressure gradient to be used above each top to be used as a function of depth. ex. psi/ft

fx #1	fx #2	fx #3
0.43	0.75	0.45

1) Calculate neutral point for buckling with temperature affects computed also
2) Surface burst calculations & kick tolerance in surface pressure for burst
3) Do a comparison test to determine which value is lower joint strength or body yield to use in tensile strength calculations
4) Raise joint strength safety factor up to next level on page #2
5) Sour service what pipe can be used with proper degrading of strength factors and as function of temp

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	5.06873
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	795.518
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	764.706
S.F. Body yield strength top of segment:	6.87941

Collapse calculations for 1st segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	2955	ft	
hydrostatic pressure collapse - backside:	1536.6	psi	
Axial load @ bottom of section	0	lbs	previous segments
Axial load factor:	0		load/(pipe body yield strength)
Collapse strength reduction factor:	1		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8580	psi	
Actual safety factor	5.58376		adjusted casing rating / actual pressure

calculations for top of segment @	3100	ft	
hydrostatic pressure collapse - backside:	1612	psi	
Axial load @ top of section	79367.3	lbs	previous segments + (this segment x BF)
Axial load factor:	0.14536		load/(pipe body yield strength)
Collapse strength reduction factor:	0.95231		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8170.79	psi	
Actual safety factor	5.06873		adjusted casing rating / actual pressure

Burst calculations for 1st segment - Completion fracture treatment

calculations for bottom of segment @	8612	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640	psi	
Actual safety factor	3.54667		casing rating / differential burst pressure
calculations for top of segment @	3100	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640	psi	
Actual safety factor	3.54667		casing rating / differential burst pressure

Joint strength calculations for 1st segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	8612	ft	
Axial load @ bottom of section	714	lbs	weight of previous segments
Joint Strength of segment	568000	lbs	
Body Yield Strength of segment	546000	lbs	
Actual safety factor joint strength	795.518		csg joint strength / axial load
Actual safety factor body yield	764.706		csg body yield strength / axial load
calculations for top of segment @	3100	ft	
Axial load @ top of section	79367.3	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	568000	lbs	
Body Yield Strength of segment	546000	lbs	
Actual safety factor joint strength	7.1566		csg joint strength / axial load
Actual safety factor body yield	6.87941		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	7.02996
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	10.7475
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	10.4577
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 2nd segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	3100	ft	
hydrostatic pressure collapse - backside:	1612	psi	
Axial load @ bottom of section	79367.3	lbs	load @ top of last segment
Axial load factor:	0.09562		load/(pipe body yield strength)
Collapse strength reduction factor:	0.97087		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7572.75	psi	
Actual safety factor	4.69774		adjusted casing rating / actual pressure
calculations for top of segment @	2050	ft	
hydrostatic pressure collapse - backside:	1066	psi	
Axial load @ top of section	102490	lbs	previous segments + (this segment x BF)
Axial load factor:	0.12348		load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93	psi	
Actual safety factor	7.02996		adjusted casing rating / actual pressure

Burst calculations for 2nd segment - Completion fracture treatment

calculations for bottom of segment @	3100	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure
calculations for top of segment @	2050	ft	

Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 2nd segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	3100	ft	
Axial load @ bottom of section	79367.3	lbs	weight of previous segments
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	10.7475		csg joint strength / axial load
Actual safety factor body yield	10.4577		csg body yield strength / axial load
calculations for top of segment @	2050	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	8.32273		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	6.76161
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	8.09832
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 3rd segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	2050	ft	
hydrostatic pressure collapse - backside:	1066	psi	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Axial load factor:	0.12348		load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93	psi	
Actual safety factor	7.02996		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	0.17787		load/(pipe body yield strength)
Collapse strength reduction factor:	0.93889		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7323.36	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 3rd segment - Completion fracture treatment

calculations for bottom of segment @	2050	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 3rd segment

Buoyancy factor for joint strength calc.:			
calculations for bottom of segment @	2050	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)

Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 4th segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 4th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 4th segment

Buoyancy factor for joint strength calc.: 0.847

calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 5th segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 5th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 5th segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 6th segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 6th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 6th segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Casing Design **Well:** Hi Bob Federal #5H

String Size & Function: 5 1/2"x 7" in Production x

Total Depth: 8612 ft **TVD:** 2955 ft

Pressure Gradient for Calculations **(While drilling)**

Mud weight, collapse:	10 #/gal	Safety Factor Collapse:	1.125
Mud weight, burst:	10 #/gal	Safety Factor Burst:	1.25
Mud weight for joint strength:	10 #/gal	Safety Factor Joint Strength	1.8

BHP @ TD for: collapse: 1536.6 psi Burst: 1536.6 psi, joint strength: 1536.6 psi

Partially evacuated hole? Pressure gradient remaining: 10 #/gal

Max. Shut in surface pressure: 3000 psi

1st segment	8612 ft to 3100 ft		Make up Torque ft-lbs			Total ft = 5512
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
5.5 inches	**17** #/ft	**HCP-110** / **Buttress**	**4,620**	**3,470**	**5,780**	
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
8,580 psi	**10,640** psi-lrcr	**568** ,000 #	**546** ,000 #		**4.767**	

2nd segment	3100 ft to 2050 ft		Make up Torque ft-lbs			Total ft = 1050
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**HCP-110** / **Buttress**	**6,930**	**5,200**	**8,660**	
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
7,800 psi	**9,950** psi-lrcr	**853** ,000 #	**830** ,000 #		**6.151**	

3rd segment	2050 ft to 0 ft		Make up Torque ft-lbs			Total ft = 2050
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
7 inches	**26** #/ft	**P-110** / **LT&C**	**6930**	**5200**	**8660**	
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
7,800 psi	**9,950** psi	**693** ,000 #	**830** ,000 #		**6.151**	

4th segment	0 ft to 0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
inches	#/ft					
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
psi	psi	,000 #	,000 #			

5th segment	0 ft to 0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
inches	#/ft					
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
psi	psi	,000 #	,000 #			

6th segment	0 ft to 0 ft		Make up Torque ft-lbs			Total ft = 0
O.D.	Weight	Grade / Threads	opt.	min.	mx.	
inches	#/ft					
Collapse Resistance	Internal Yield	Joint Strength	Body Yield		Drift	
psi	psi	,000 #	,000 #			

Select 1st segment bottom	8612	**S.F.**	Actual		Desire
		collapse	5.583756	>=	1.125
8612 ft to 3100 ft		burst-b	3.546667	>=	1.25
5.5 0 HCP-110 Buttress		burst-t	3.546667		
Top of segment 1 (ft)	3100	**S.F.**	Actual		Desire
Select 2nd segment from bottom		collapse	4.697739	>=	1.125
		burst-b	3.316667	>=	1.25
3100 ft to 2050 ft		burst-t	3.316667		
7 26 HCP-110 Buttress		jnt strngth	7.156601	>=	1.8

	Top of segment 2 (ft)			2050	S.F.	Actual		Desire
Select	3rd segment from bottom				collapse	7.029955	>=	1.125
					burst-b	3.316667	>=	1.25
2050 ft	to	0 ft			burst-t	3.316667		
7	26 P-110	LT&C			jnt strngth	8.322732	>=	1.8
	Top of segment 3 (ft)			0	S.F.	Actual		Desire
Select	4th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	0 ft			burst-t	0		
0	0	0	0		jnt strngth	6.76161	>=	1.8
	Top of segment 4 (ft)				S.F.	Actual		Desire
Select	5th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	ft			burst-t	0		
0	0	0	0		jnt strngth	0	>=	1.8
	Top of segment 5 (ft)				S.F.	Actual		Desire
Select	6th segment from bottom				collapse	#DIV/0!	>=	1.125
					burst-b	0	>=	1.25
0 ft	to	ft			burst-t	0		
0	0	0	0		jnt strngth	0	>=	1.8
	Top of segment 6 (ft)				jnt strngth		>=	1.8

use in colapse calculations across different pressured formations

Three gradient pressure function

Depth of evaluation:	1,200 ft			516	psi @	1,200 ft
Top of salt:	2,400 ft	fx #1	516			
Base of salt:	3,700 ft	fx #2	900			
TD of intermediate:	4,600 ft	fx #3	540			

Pressure gradient to be used above each top to be used as a function of depth. ex. psi/ft

fx #1	fx #2	fx #3
0.43	0.75	0.45

1) Calculate neutral point for buckling with temperature affects computed also
2) Surface burst calculations & kick tolerance in surface pressure for burst
3) Do a comparison test to determine which value is lower joint strength or body yield to use in tensile strength calculations
4) Raise joint strength safety factor up to next level on page #2
5) Sour service what pipe can be used with proper degrading of strength factors and as function of temp

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	5.06873
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	795.518
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	764.706
S.F. Body yield strength top of segment:	6.87941

Collapse calculations for 1st segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	2955 ft	
hydrostatic pressure collapse - backside:	1536.6 psi	
Axial load @ bottom of section	0 lbs	previous segments
Axial load factor:	0	load/(pipe body yield strength)
Collapse strength reduction factor:	1	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8580 psi	
Actual safety factor	5.58376	adjusted casing rating / actual pressure

calculations for top of segment @	3100	ft	
hydrostatic pressure collapse - backside:	1612	psi	
Axial load @ top of section	79367.3	lbs	previous segments + (this segment x BF)
Axial load factor:	0.14536		load/(pipe body yield strength)
Collapse strength reduction factor:	0.95231		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	8170.79	psi	
Actual safety factor	5.06873		adjusted casing rating / actual pressure

Burst calculations for 1st segment - Completion fracture treatment

calculations for bottom of segment @	8612	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640	psi	
Actual safety factor	3.54667		casing rating / differential burst pressure
calculations for top of segment @	3100	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	10640	psi	
Actual safety factor	3.54667		casing rating / differential burst pressure

Joint strength calculations for 1st segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	8612	ft	
Axial load @ bottom of section	714	lbs	weight of previous segments
Joint Strength of segment	568000	lbs	
Body Yield Strength of segment	546000	lbs	
Actual safety factor joint strength	795.518		csg joint strength / axial load
Actual safety factor body yield	764.706		csg body yield strength / axial load
calculations for top of segment @	3100	ft	
Axial load @ top of section	79367.3	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	568000	lbs	
Body Yield Strength of segment	546000	lbs	
Actual safety factor joint strength	7.1566		csg joint strength / axial load
Actual safety factor body yield	6.87941		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	7.02996
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	10.7475
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	10.4577
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 2nd segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	3100	ft	
hydrostatic pressure collapse - backside:	1612	psi	
Axial load @ bottom of section	79367.3	lbs	load @ top of last segment
Axial load factor:	0.09562		load/(pipe body yield strength)
Collapse strength reduction factor:	0.97087		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7572.75	psi	
Actual safety factor	4.69774		adjusted casing rating / actual pressure
calculations for top of segment @	2050	ft	
hydrostatic pressure collapse - backside:	1066	psi	
Axial load @ top of section	102490	lbs	previous segments + (this segment x BF)
Axial load factor:	0.12348		load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93	psi	
Actual safety factor	7.02996		adjusted casing rating / actual pressure

Burst calculations for 2nd segment - Completion fracture treatment

calculations for bottom of segment @	3100	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure
calculations for top of segment @	2050	ft	

Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 2nd segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	3100	ft	
Axial load @ bottom of section	79367.3	lbs	weight of previous segments
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	10.7475		csg joint strength / axial load
Actual safety factor body yield	10.4577		csg body yield strength / axial load
calculations for top of segment @	2050	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	853000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	8.32273		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	6.76161
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	8.09832
S.F. Body yield strength top of segment:	8.09832

Collapse calculations for 3rd segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	2050	ft	
hydrostatic pressure collapse - backside:	1066	psi	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Axial load factor:	0.12348		load/(pipe body yield strength)
Collapse strength reduction factor:	0.96076		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7493.93	psi	
Actual safety factor	7.02996		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	0.17787		load/(pipe body yield strength)
Collapse strength reduction factor:	0.93889		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	7323.36	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 3rd segment - Completion fracture treatment

calculations for bottom of segment @	2050	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	9950	psi	
Actual safety factor	3.31667		casing rating / differential burst pressure

Joint strength calculations for 3rd segment

Buoyancy factor for joint strength calc.:			
calculations for bottom of segment @	2050	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)

Joint Strength of segment	693000	lbs	
Body Yield Strength of segment	830000	lbs	
Actual safety factor joint strength	6.76161		csg joint strength / axial load
Actual safety factor body yield	8.09832		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 4th segment - casing evacuated

Buoyancy factor collapse: 0.847

calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 4th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 4th segment

Buoyancy factor for joint strength calc.: 0.847

calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 5th segment - casing evacuated

Buoyancy factor collapse:	0.847		
calculations for bottom of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ bottom of section	147635	lbs	load @ top of last segment
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure
calculations for top of segment @	0	ft	
hydrostatic pressure collapse - backside:	0	psi	
Axial load @ top of section	147635	lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!		load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!		Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0!	psi	
Actual safety factor	#DIV/0!		adjusted casing rating / actual pressure

Burst calculations for 5th segment - Completion fracture treatment

calculations for bottom of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure
calculations for top of segment @	0	ft	
Differential burst pressure	3000	psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0	psi	
Actual safety factor	0		casing rating / differential burst pressure

Joint strength calculations for 5th segment

Buoyancy factor for joint strength calc.:	0.847		
calculations for bottom of segment @	0	ft	
Axial load @ bottom of section	102490	lbs	load @ top of last segment
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load
calculations for top of segment @	0	ft	
Axial load @ top of section	102490	lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0	lbs	
Body Yield Strength of segment	0	lbs	
Actual safety factor joint strength	0		csg joint strength / axial load
Actual safety factor body yield	0		csg body yield strength / axial load

Adjust for best combination of safety factors

	Secondary
S.F. Collapse bottom of segment:	
S.F. Collapse top of segment:	#DIV/0!
S.F. Burst bottom of segment:	
S.F. Burst top of segment	
S.F. Joint strength bottom of segment:	0
S.F. Joint strength top of segment:	
S.F. Body yield strength bottom of segment:	0
S.F. Body yield strength top of segment:	0

Collapse calculations for 6th segment - casing evacuated

Buoyancy factor collapse:	0.847	
calculations for bottom of segment @	0 ft	
hydrostatic pressure collapse - backside:	0 psi	
Axial load @ bottom of section	147635 lbs	load @ top of last segment
Axial load factor:	#DIV/0!	load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0! psi	
Actual safety factor	#DIV/0!	adjusted casing rating / actual pressure
calculations for top of segment @	0 ft	
hydrostatic pressure collapse - backside:	0 psi	
Axial load @ top of section	147635 lbs	previous segments + (this segment x BF)
Axial load factor:	#DIV/0!	load/(pipe body yield strength)
Collapse strength reduction factor:	#DIV/0!	Messrs, Westcott, Dunlop, Kemler,1940
Adjusted collapse rating of segment:	#DIV/0! psi	
Actual safety factor	#DIV/0!	adjusted casing rating / actual pressure

Burst calculations for 6th segment - Completion fracture treatment

calculations for bottom of segment @	0 ft	
Differential burst pressure	3000 psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0 psi	
Actual safety factor	0	casing rating / differential burst pressure
calculations for top of segment @	0 ft	
Differential burst pressure	3000 psi	(frac. pres.-mud pres.) + max. surf. pres.
Burst rating of segment	0 psi	
Actual safety factor	0	casing rating / differential burst pressure

Joint strength calculations for 6th segment

Buoyancy factor for joint strength calc.:	0.847	
calculations for bottom of segment @	0 ft	
Axial load @ bottom of section	102490 lbs	load @ top of last segment
Joint Strength of segment	0 lbs	
Body Yield Strength of segment	0 lbs	
Actual safety factor joint strength	0	csg joint strength / axial load
Actual safety factor body yield	0	csg body yield strength / axial load
calculations for top of segment @	0 ft	
Axial load @ top of section	102490 lbs	weight of previous segments + (this segment x BF)
Joint Strength of segment	0 lbs	
Body Yield Strength of segment	0 lbs	
Actual safety factor joint strength	0	csg joint strength / axial load
Actual safety factor body yield	0	csg body yield strength / axial load

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft		09:53 Friday, December 15, 2023 Page 1 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E

Site				**Map Zone**	UTM	**Lat Long Ref**	
				Surface X	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD*	INC*	AZI*	TVD*	N*	E*	DLS*	V. S.*	MapE*	MapN*	SysTVD*
ft	deg	deg	ft	ft	ft	°/100ft	ft	ft	ft	ft
*** TIE (at MD = 2050.00)										
2050.00	0.00	0.0	2050.00	0.00	0.00		0.00	1930558.50	11989075.00	1748.80
2100.00	0.00	0.0	2100.00	0.00	0.00	0.00	0.00	1930558.50	11989075.00	1698.80
*** KOP 8 DEGREE (at MD = 2150.00)										
2150.00	0.00	0.0	2150.00	0.00	0.00	0.00	0.00	1930558.50	11989075.00	1648.80
2200.00	4.00	180.0	2199.96	-1.74	0.00	8.00	1.74	1930558.50	11989073.26	1598.84
2250.00	8.00	180.0	2249.68	-6.97	0.00	8.00	6.97	1930558.50	11989068.03	1549.12
2300.00	12.00	180.0	2298.91	-15.65	-0.01	8.00	15.65	1930558.49	11989059.35	1499.89
2350.00	16.00	180.0	2347.41	-27.74	-0.02	8.00	27.74	1930558.48	11989047.26	1451.39
2400.00	20.00	180.0	2394.95	-43.19	-0.03	8.00	43.19	1930558.47	11989031.81	1403.85
2450.00	24.00	180.0	2441.30	-61.92	-0.04	8.00	61.92	1930558.46	11989013.08	1357.50
2500.00	28.00	180.0	2486.23	-83.83	-0.06	8.00	83.83	1930558.44	11988991.17	1312.57
2550.00	32.00	180.0	2529.53	-108.83	-0.08	8.00	108.83	1930558.42	11988966.17	1269.27
2600.00	36.00	180.0	2570.97	-136.78	-0.10	8.00	136.78	1930558.40	11988938.22	1227.83
2650.00	40.00	180.0	2610.36	-167.56	-0.12	8.00	167.56	1930558.38	11988907.44	1188.44
2700.00	44.00	180.0	2647.51	-201.01	-0.14	8.00	201.01	1930558.36	11988873.99	1151.29
2750.00	48.00	180.0	2682.24	-236.97	-0.17	8.00	236.97	1930558.33	11988838.03	1116.56
2800.00	52.00	180.0	2714.37	-275.26	-0.19	8.00	275.26	1930558.31	11988799.74	1084.43
*** 55 DEGREE TANGENT (at MD = 2837.50)										
2837.50	55.00	180.0	2736.67	-305.40	-0.21	8.00	305.40	1930558.29	11988769.60	1062.13
2850.00	55.00	180.0	2743.84	-315.64	-0.22	0.00	315.64	1930558.28	11988759.36	1054.96
2900.00	55.00	180.0	2772.52	-356.60	-0.25	0.00	356.60	1930558.25	11988718.40	1026.28
2950.00	55.00	180.0	2801.20	-397.56	-0.28	0.00	397.56	1930558.22	11988677.44	997.60
3000.00	55.00	180.0	2829.88	-438.52	-0.31	0.00	438.52	1930558.19	11988636.48	968.92
*** 10 DEGREE BUILD (at MD = 3037.50)										
3037.50	55.00	180.0	2851.39	-469.23	-0.33	0.00	469.23	1930558.17	11988605.77	947.41
3050.00	56.25	180.0	2858.45	-479.55	-0.33	10.00	479.55	1930558.17	11988595.45	940.35
3100.00	61.25	180.0	2884.38	-522.28	-0.36	10.00	522.28	1930558.14	11988552.72	914.42
3150.00	66.25	180.0	2906.49	-567.11	-0.40	10.00	567.11	1930558.10	11988507.89	892.32
3200.00	71.25	180.0	2924.60	-613.70	-0.43	10.00	613.70	1930558.07	11988461.30	874.20
3250.00	76.25	180.0	2938.59	-661.68	-0.46	10.00	661.68	1930558.04	11988413.32	860.21
3300.00	81.25	180.0	2948.34	-710.71	-0.50	10.00	710.71	1930558.00	11988364.29	850.46
3350.00	86.25	180.0	2953.78	-760.40	-0.53	10.00	760.40	1930557.97	11988314.60	845.02
*** LANDING POINT (at MD = 3387.50)										
3387.50	90.00	180.0	2955.01	-797.87	-0.56	10.00	797.87	1930557.94	11988277.13	843.79
3400.00	90.00	180.0	2955.01	-810.37	-0.57	0.00	810.37	1930557.93	11988264.63	843.79
3450.00	90.00	180.0	2955.01	-860.37	-0.60	0.00	860.37	1930557.90	11988214.63	843.79
3500.00	90.00	180.0	2955.01	-910.37	-0.64	0.00	910.37	1930557.86	11988164.63	843.79
3550.00	90.00	180.0	2955.01	-960.37	-0.67	0.00	960.37	1930557.83	11988114.63	843.79

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft	09:53 Friday, December 15, 2023	Page 2 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location	SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E			**Map Zone**	UTM	**Lat Long Ref**	
Site				**Surface X**	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
3600.00	90.00	180.0	2955.01	-1010.37	-0.71	0.00	1010.37	1930557.79	11988064.63	843.79
3650.00	90.00	180.0	2955.01	-1060.37	-0.74	0.00	1060.37	1930557.76	11988014.63	843.79
3700.00	90.00	180.0	2955.01	-1110.37	-0.78	0.00	1110.37	1930557.72	11987964.63	843.79
3750.00	90.00	180.0	2955.01	-1160.37	-0.81	0.00	1160.37	1930557.69	11987914.63	843.79
3800.00	90.00	180.0	2955.01	-1210.37	-0.85	0.00	1210.37	1930557.66	11987864.63	843.79
3850.00	90.00	180.0	2955.01	-1260.37	-0.88	0.00	1260.37	1930557.62	11987814.63	843.79
3900.00	90.00	180.0	2955.01	-1310.37	-0.91	0.00	1310.37	1930557.59	11987764.63	843.79
3950.00	90.00	180.0	2955.01	-1360.37	-0.95	0.00	1360.37	1930557.55	11987714.63	843.79
4000.00	90.00	180.0	2955.01	-1410.37	-0.98	0.00	1410.37	1930557.52	11987664.63	843.79
4050.00	90.00	180.0	2955.01	-1460.37	-1.02	0.00	1460.37	1930557.48	11987614.63	843.79
4100.00	90.00	180.0	2955.01	-1510.37	-1.05	0.00	1510.37	1930557.45	11987564.63	843.79
4150.00	90.00	180.0	2955.01	-1560.37	-1.09	0.00	1560.37	1930557.41	11987514.63	843.79
4200.00	90.00	180.0	2955.01	-1610.37	-1.12	0.00	1610.37	1930557.38	11987464.63	843.79
4250.00	90.00	180.0	2955.01	-1660.37	-1.16	0.00	1660.37	1930557.34	11987414.63	843.79
4300.00	90.00	180.0	2955.01	-1710.37	-1.19	0.00	1710.37	1930557.31	11987364.63	843.79
4350.00	90.00	180.0	2955.01	-1760.37	-1.23	0.00	1760.37	1930557.27	11987314.63	843.79
4400.00	90.00	180.0	2955.01	-1810.37	-1.26	0.00	1810.37	1930557.24	11987264.63	843.79
4450.00	90.00	180.0	2955.01	-1860.37	-1.30	0.00	1860.37	1930557.20	11987214.63	843.79
4500.00	90.00	180.0	2955.01	-1910.37	-1.33	0.00	1910.37	1930557.17	11987164.63	843.79
4550.00	90.00	180.0	2955.01	-1960.37	-1.37	0.00	1960.37	1930557.13	11987114.63	843.79
4600.00	90.00	180.0	2955.01	-2010.37	-1.40	0.00	2010.37	1930557.10	11987064.63	843.79
4650.00	90.00	180.0	2955.01	-2060.37	-1.44	0.00	2060.37	1930557.06	11987014.63	843.79
4700.00	90.00	180.0	2955.01	-2110.37	-1.47	0.00	2110.37	1930557.03	11986964.63	843.79
4750.00	90.00	180.0	2955.01	-2160.37	-1.51	0.00	2160.37	1930556.99	11986914.63	843.79
4800.00	90.00	180.0	2955.01	-2210.37	-1.54	0.00	2210.37	1930556.96	11986864.63	843.79
4850.00	90.00	180.0	2955.01	-2260.37	-1.58	0.00	2260.37	1930556.92	11986814.63	843.79
4900.00	90.00	180.0	2955.01	-2310.37	-1.61	0.00	2310.37	1930556.89	11986764.63	843.79
4950.00	90.00	180.0	2955.01	-2360.37	-1.65	0.00	2360.37	1930556.85	11986714.63	843.79
5000.00	90.00	180.0	2955.01	-2410.37	-1.68	0.00	2410.37	1930556.82	11986664.63	843.79
5050.00	90.00	180.0	2955.01	-2460.37	-1.72	0.00	2460.37	1930556.78	11986614.63	843.79
5100.00	90.00	180.0	2955.01	-2510.37	-1.75	0.00	2510.37	1930556.75	11986564.63	843.79
5150.00	90.00	180.0	2955.01	-2560.37	-1.79	0.00	2560.37	1930556.71	11986514.63	843.79
5200.00	90.00	180.0	2955.01	-2610.37	-1.82	0.00	2610.37	1930556.68	11986464.63	843.79
5250.00	90.00	180.0	2955.01	-2660.37	-1.86	0.00	2660.37	1930556.64	11986414.63	843.79
5300.00	90.00	180.0	2955.01	-2710.37	-1.89	0.00	2710.37	1930556.61	11986364.63	843.79
5350.00	90.00	180.0	2955.01	-2760.37	-1.93	0.00	2760.37	1930556.57	11986314.63	843.79
5400.00	90.00	180.0	2955.01	-2810.37	-1.96	0.00	2810.37	1930556.54	11986264.63	843.79

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft	09:53 Friday, December 15, 2023	Page 3 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location	SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E			**Map Zone**	UTM	**Lat Long Ref**	
Site				**Surface X**	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
5450.00	90.00	180.0	2955.01	-2860.37	-2.00	0.00	2860.37	1930556.50	11986214.63	843.79
5500.00	90.00	180.0	2955.01	-2910.37	-2.03	0.00	2910.37	1930556.47	11986164.63	843.79
5550.00	90.00	180.0	2955.01	-2960.37	-2.07	0.00	2960.37	1930556.43	11986114.63	843.79
5600.00	90.00	180.0	2955.01	-3010.37	-2.10	0.00	3010.37	1930556.40	11986064.63	843.79
5650.00	90.00	180.0	2955.01	-3060.37	-2.14	0.00	3060.37	1930556.36	11986014.63	843.79
5700.00	90.00	180.0	2955.01	-3110.37	-2.17	0.00	3110.37	1930556.33	11985964.63	843.79
5750.00	90.00	180.0	2955.01	-3160.37	-2.21	0.00	3160.37	1930556.29	11985914.63	843.79
5800.00	90.00	180.0	2955.01	-3210.37	-2.24	0.00	3210.37	1930556.26	11985864.63	843.79
5850.00	90.00	180.0	2955.01	-3260.37	-2.28	0.00	3260.37	1930556.22	11985814.63	843.79
5900.00	90.00	180.0	2955.01	-3310.37	-2.31	0.00	3310.37	1930556.19	11985764.63	843.79
5950.00	90.00	180.0	2955.01	-3360.37	-2.35	0.00	3360.37	1930556.15	11985714.63	843.79
6000.00	90.00	180.0	2955.01	-3410.37	-2.38	0.00	3410.37	1930556.12	11985664.63	843.79
6050.00	90.00	180.0	2955.01	-3460.37	-2.42	0.00	3460.37	1930556.08	11985614.63	843.79
6100.00	90.00	180.0	2955.01	-3510.37	-2.45	0.00	3510.37	1930556.05	11985564.63	843.79
6150.00	90.00	180.0	2955.01	-3560.37	-2.49	0.00	3560.37	1930556.01	11985514.63	843.79
6200.00	90.00	180.0	2955.01	-3610.37	-2.52	0.00	3610.37	1930555.98	11985464.63	843.79
6250.00	90.00	180.0	2955.01	-3660.37	-2.56	0.00	3660.37	1930555.94	11985414.63	843.79
6300.00	90.00	180.0	2955.01	-3710.37	-2.59	0.00	3710.37	1930555.91	11985364.63	843.79
6350.00	90.00	180.0	2955.01	-3760.37	-2.63	0.00	3760.37	1930555.87	11985314.63	843.79
6400.00	90.00	180.0	2955.01	-3810.37	-2.66	0.00	3810.37	1930555.84	11985264.63	843.79
6450.00	90.00	180.0	2955.01	-3860.37	-2.70	0.00	3860.37	1930555.81	11985214.63	843.79
6500.00	90.00	180.0	2955.01	-3910.37	-2.73	0.00	3910.37	1930555.77	11985164.63	843.79
6550.00	90.00	180.0	2955.01	-3960.37	-2.76	0.00	3960.37	1930555.74	11985114.63	843.79
6600.00	90.00	180.0	2955.01	-4010.37	-2.80	0.00	4010.37	1930555.70	11985064.63	843.79
6650.00	90.00	180.0	2955.01	-4060.37	-2.83	0.00	4060.37	1930555.67	11985014.63	843.79
6700.00	90.00	180.0	2955.01	-4110.37	-2.87	0.00	4110.37	1930555.63	11984964.63	843.79
6750.00	90.00	180.0	2955.01	-4160.37	-2.90	0.00	4160.37	1930555.60	11984914.63	843.79
6800.00	90.00	180.0	2955.01	-4210.37	-2.94	0.00	4210.37	1930555.56	11984864.63	843.79
6850.00	90.00	180.0	2955.01	-4260.37	-2.97	0.00	4260.37	1930555.53	11984814.63	843.79
6900.00	90.00	180.0	2955.01	-4310.37	-3.01	0.00	4310.37	1930555.49	11984764.63	843.79
6950.00	90.00	180.0	2955.01	-4360.37	-3.04	0.00	4360.37	1930555.46	11984714.63	843.79
7000.00	90.00	180.0	2955.01	-4410.37	-3.08	0.00	4410.37	1930555.42	11984664.63	843.79
7050.00	90.00	180.0	2955.01	-4460.37	-3.11	0.00	4460.37	1930555.39	11984614.63	843.79
7100.00	90.00	180.0	2955.01	-4510.37	-3.15	0.00	4510.37	1930555.35	11984564.63	843.79
7150.00	90.00	180.0	2955.01	-4560.37	-3.18	0.00	4560.37	1930555.32	11984514.63	843.79
7200.00	90.00	180.0	2955.01	-4610.37	-3.22	0.00	4610.37	1930555.28	11984464.63	843.79
7250.00	90.00	180.0	2955.01	-4660.37	-3.25	0.00	4660.37	1930555.25	11984414.63	843.79

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft	09:53 Friday, December 15, 2023	Page 4 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location	SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E			**Map Zone**	UTM	**Lat Long Ref**	
Site				**Surface X**	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
7300.00	90.00	180.0	2955.01	-4710.37	-3.29	0.00	4710.37	1930555.21	11984364.63	843.79
7350.00	90.00	180.0	2955.01	-4760.37	-3.32	0.00	4760.37	1930555.18	11984314.63	843.79
7400.00	90.00	180.0	2955.01	-4810.37	-3.36	0.00	4810.37	1930555.14	11984264.63	843.79
7450.00	90.00	180.0	2955.01	-4860.37	-3.39	0.00	4860.37	1930555.11	11984214.63	843.79
7500.00	90.00	180.0	2955.01	-4910.37	-3.43	0.00	4910.37	1930555.07	11984164.63	843.79
7550.00	90.00	180.0	2955.01	-4960.37	-3.46	0.00	4960.37	1930555.04	11984114.63	843.79
7600.00	90.00	180.0	2955.01	-5010.37	-3.50	0.00	5010.37	1930555.00	11984064.63	843.79
7650.00	90.00	180.0	2955.01	-5060.37	-3.53	0.00	5060.37	1930554.97	11984014.63	843.79
7700.00	90.00	180.0	2955.01	-5110.37	-3.57	0.00	5110.37	1930554.93	11983964.63	843.79
7750.00	90.00	180.0	2955.01	-5160.37	-3.60	0.00	5160.37	1930554.90	11983914.63	843.79
7800.00	90.00	180.0	2955.01	-5210.37	-3.64	0.00	5210.37	1930554.86	11983864.63	843.79
7850.00	90.00	180.0	2955.01	-5260.37	-3.67	0.00	5260.37	1930554.83	11983814.63	843.79
7900.00	90.00	180.0	2955.01	-5310.37	-3.71	0.00	5310.37	1930554.79	11983764.63	843.79
7950.00	90.00	180.0	2955.01	-5360.37	-3.74	0.00	5360.37	1930554.76	11983714.63	843.79
8000.00	90.00	180.0	2955.01	-5410.37	-3.78	0.00	5410.37	1930554.72	11983664.63	843.79
8050.00	90.00	180.0	2955.01	-5460.37	-3.81	0.00	5460.37	1930554.69	11983614.63	843.79
8100.00	90.00	180.0	2955.01	-5510.37	-3.85	0.00	5510.37	1930554.65	11983564.63	843.79
8150.00	90.00	180.0	2955.01	-5560.37	-3.88	0.00	5560.37	1930554.62	11983514.63	843.79
8200.00	90.00	180.0	2955.01	-5610.37	-3.92	0.00	5610.37	1930554.58	11983464.63	843.79
8250.00	90.00	180.0	2955.01	-5660.37	-3.95	0.00	5660.37	1930554.55	11983414.63	843.79
8300.00	90.00	180.0	2955.01	-5710.37	-3.99	0.00	5710.37	1930554.51	11983364.63	843.79
8350.00	90.00	180.0	2955.01	-5760.37	-4.02	0.00	5760.37	1930554.48	11983314.63	843.79
8400.00	90.00	180.0	2955.01	-5810.37	-4.06	0.00	5810.37	1930554.44	11983264.63	843.79
8450.00	90.00	180.0	2955.01	-5860.37	-4.09	0.00	5860.37	1930554.41	11983214.63	843.79
8500.00	90.00	180.0	2955.01	-5910.37	-4.13	0.00	5910.37	1930554.37	11983164.63	843.79
8550.00	90.00	180.0	2955.01	-5960.37	-4.16	0.00	5960.37	1930554.34	11983114.63	843.79
8600.00	90.00	180.0	2955.01	-6010.37	-4.20	0.00	6010.37	1930554.30	11983064.63	843.79
*** TD (at MD = 8611.50)										
8611.50	90.00	180.0	2955.01	-6021.87	-4.20	0.00	6021.87	1930554.30	11983053.13	843.79

State of New Mexico
Energy, Minerals and Natural Resources Department

Submit Electronically
Via E-permitting

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

NATURAL GAS MANAGEMENT PLAN

This Natural Gas Management Plan must be submitted with each Application for Permit to Drill (APD) for a new or recompleted well.

Section 1 – Plan Description

Effective May 25, 2021

I. Operator: Mack Energy Corporation **OGRID:** 013837 **Date:** 12 / 19 / 2023

II. Type: ☒ Original ☐ Amendment due to ☐ 19.15.27.9.D(6)(a) NMAC ☐ 19.15.27.9.D(6)(b) NMAC ☐ Other.

If Other, please describe: ______

III. Well(s): Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	ULSTR	Footages	Anticipated Oil BBL/D	Anticipated Gas MCF/D	Anticipated Produced Water BBL/D
High Bob Federal #5H		N Sec 8 T15S R29E	707 FSL 1650 FWL	100	100	1,000

IV. Central Delivery Point Name: DCP Midstream Linam Ranch Proscessing Plant / Durango Midstream [See 19.15.27.9(D)(1) NMAC]

V. Anticipated Schedule: Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	Spud Date	TD Reached Date	Completion Commencement Date	Initial Flow Back Date	First Production Date
High Bob Federal #5H		6/1/2024	6/20/2024	7/31/2024	7/31/2024	8/1/2024

VI. Separation Equipment: ☒ Attach a complete description of how Operator will size separation equipment to optimize gas capture.

VII. Operational Practices: ☒ Attach a complete description of the actions Operator will take to comply with the requirements of Subsection A through F of 19.15.27.8 NMAC.

VIII. Best Management Practices: ☒ Attach a complete description of Operator's best management practices to minimize venting during active and planned maintenance.

Section 2 – Enhanced Plan

EFFECTIVE APRIL 1, 2022

Beginning April 1, 2022, an operator that is not in compliance with its statewide natural gas capture requirement for the applicable reporting area must complete this section.

☒ Operator certifies that it is not required to complete this section because Operator is in compliance with its statewide natural gas capture requirement for the applicable reporting area.

IX. Anticipated Natural Gas Production:

Well	API	Anticipated Average Natural Gas Rate MCF/D	Anticipated Volume of Natural Gas for the First Year MCF

X. Natural Gas Gathering System (NGGS):

Operator	System	ULSTR of Tie-in	Anticipated Gathering Start Date	Available Maximum Daily Capacity of System Segment Tie-in

XI. Map. ☐ Attach an accurate and legible map depicting the location of the well(s), the anticipated pipeline route(s) connecting the production operations to the existing or planned interconnect of the natural gas gathering system(s), and the maximum daily capacity of the segment or portion of the natural gas gathering system(s) to which the well(s) will be connected.

XII. Line Capacity. The natural gas gathering system ☐ will ☐ will not have capacity to gather 100% of the anticipated natural gas production volume from the well prior to the date of first production.

XIII. Line Pressure. Operator ☐ does ☐ does not anticipate that its existing well(s) connected to the same segment, or portion, of the natural gas gathering system(s) described above will continue to meet anticipated increases in line pressure caused by the new well(s).

☐ Attach Operator's plan to manage production in response to the increased line pressure.

XIV. Confidentiality: ☐ Operator asserts confidentiality pursuant to Section 71-2-8 NMSA 1978 for the information provided in Section 2 as provided in Paragraph (2) of Subsection D of 19.15.27.9 NMAC, and attaches a full description of the specific information for which confidentiality is asserted and the basis for such assertion.

Section 3 - Certifications

Effective May 25, 2021

Operator certifies that, after reasonable inquiry and based on the available information at the time of submittal:

☒ Operator will be able to connect the well(s) to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system; or

☐ Operator will not be able to connect to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system. ***If Operator checks this box, Operator will select one of the following:***

Well Shut-In. ☐ Operator will shut-in and not produce the well until it submits the certification required by Paragraph (4) of Subsection D of 19.15.27.9 NMAC; or

Venting and Flaring Plan. ☐ Operator has attached a venting and flaring plan that evaluates and selects one or more of the potential alternative beneficial uses for the natural gas until a natural gas gathering system is available, including:

(a) power generation on lease;
(b) power generation for grid;
(c) compression on lease;
(d) liquids removal on lease;
(e) reinjection for underground storage;
(f) reinjection for temporary storage;
(g) reinjection for enhanced oil recovery;
(h) fuel cell production; and
(i) other alternative beneficial uses approved by the division.

Section 4 - Notices

1. If, at any time after Operator submits this Natural Gas Management Plan and before the well is spud:

(a) Operator becomes aware that the natural gas gathering system it planned to connect the well(s) to has become unavailable or will not have capacity to transport one hundred percent of the production from the well(s), no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised venting and flaring plan containing the information specified in Paragraph (5) of Subsection D of 19.15.27.9 NMAC; or

(b) Operator becomes aware that it has, cumulatively for the year, become out of compliance with its baseline natural gas capture rate or natural gas capture requirement, no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised Natural Gas Management Plan for each well it plans to spud during the next 90 days containing the information specified in Paragraph (2) of Subsection D of 19.15.27.9 NMAC, and shall file an update for each Natural Gas Management Plan until Operator is back in compliance with its baseline natural gas capture rate or natural gas capture requirement.

2. OCD may deny or conditionally approve an APD if Operator does not make a certification, fails to submit an adequate venting and flaring plan which includes alternative beneficial uses for the anticipated volume of natural gas produced, or if OCD determines that Operator will not have adequate natural gas takeaway capacity at the time a well will be spud.

I certify that, after reasonable inquiry, the statements in and attached to this Natural Gas Management Plan are true and correct to the best of my knowledge and acknowledge that a false statement may be subject to civil and criminal penalties under the Oil and Gas Act.

Signature:	Deana Weaver
Printed Name:	Deana Weaver
Title:	Regulatory Technician II
E-mail Address:	dweaver@mec.com
Date:	12/19/2023
Phone:	575-748-1288

OIL CONSERVATION DIVISION **(Only applicable when submitted as a standalone form)**
Approved By:
Title:
Approval Date:
Conditions of Approval:

VI. Separation Equipment:

Mack Energy Corporation(MEC) production facilities include separation equipment designed to efficiently separate gas from liquid phases to optimize gas capture based on projected and estimated volumes from the targeted pool of our completion project. MEC will utilize flowback separation equipment and production separation equipment designed and built to industry specifications after the completion to optimize gas capture and send gas to sales or flare based on analytical composition. MEC operates facilities that are typically multi-well facilities. Production separation equipment is upgraded prior to new wells being completed, if determined to be undersized or inadequate. This equipment is already on-site and tied into our sales gas lines prior to the new drill operations.

VII. Operational Practices:

1. Subsection (A) Venting and Flaring of Natural Gas. MEC understands the requirements of NMAC 19.15.27.8 which outlines that the venting and flaring of natural gas during drilling, completion or production operations that constitutes waste as defined in 19.15.2 are prohibited.
2. Subsection (B) Venting and Flaring during drilling operations. This gas capture plan isn't for a well being drilled.
3. Subsection (C) Venting and flaring during completion or recompletion. Flowlines will be routed for flowback fluids into a completion or storage tank and if feasible under well conditions, flare rather than vent and commence operation of a separator as soon as it is technically feasible for a separator to function.
   - At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.
4. Subsection (D) Venting and flaring during production operations ○ At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.
   - Monitor manual liquid unloading for wells on-site or in close proximity (<30 minutes' drive time), take reasonable actions to achieve a stabilized rate and pressure at the earliest practical time, and take reasonable actions to minimize venting to the maximum extent practicable.
   - MEC will not vent or flare except during the approved activities listed in NMAC 19.15.27.8 (D) 14.
5. Subsection (E) Performance standards ○ All tanks and separation equipment are designed for maximum throughput and pressure to minimize waste.
   - If a flare is utilized during production operations it will have a continuous pilot and is located more than 100 feet from any known well or storage tanks.
   - At any point in the well life (completion, production, inactive) an audio, visual and olfactory inspection be performed at prescribed intervals (weekly or monthly) pursuant to Subsection D of 19.15.27.8 NMAC, to confirm that all production equipment is operating properly and there are no leaks or releases.

6. Subsection (F) Measurement or estimation of vented and flared natural gas ○ Measurement equipment is installed to measure the volume of natural gas flared from process piping.
   - When measurement isn't practicable, estimation of vented and flared natural gas will be completed as noted in 19.15.27.8 (F) 5-6.

VIII. Best Management Practices:

1. MEC has adequate storage and takeaway capacity for wells it chooses to complete as the flowlines at the sites are already in place and tied into a gathering system.
2. MEC will flare rather than vent vessel blowdown gas when technically feasible during active and/or planned maintenance to equipment on-site.
3. MEC combusts natural gas that would otherwise be vented or flared, when technically feasible.
4. MEC will shut in wells in the event of a takeaway disruption, emergency situation, or other operations where venting or flaring may occur due to equipment failures.
5. MEC has a gas gathering system in place(CTB-887)a with multiple purchaser's to limit venting or flaring, due to purchaser shut downs.

Mack Energy Corporation
Onshore Order #6
Hydrogen Sulfide Drilling Operation Plan

I. HYDROGEN SULFIDE TRAINING

All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, will receive training from a qualified instructor in the following areas prior to commencing drilling operations on this well:

1. The hazards an characteristics of hydrogen sulfide (H2S)
2. The proper use and maintenance of personal protective equipment and life support systems.
3. The proper use of H2S detectors alarms warning systems, briefing areas, evacuation procedures, and prevailing winds.
4. The proper techniques for first aid and rescue procedures.

In addition, supervisory personnel will be trained in the following areas:

1. The effects of H2S on metal components. If high tensile tubular are to be used, personnel well be trained in their special maintenance requirements.
2. Corrective action and shut-in procedures when drilling or reworking a well and blowout prevention and well control procedures.
3. The contents and requirements of the H2S Drilling Operations Plan and Public Protection Plan.

There will be an initial training session just prior to encountering a known or probable H2S zone (within 3 days or 500 feet) and weekly H2S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H2S Drilling Operations Plan and the Public Protection Plan. **The concentrations of H2S of wells in this area from surface to TD are low enough that a contingency plan is not required.**

II. H2S SAFETY EQUIPMENT AND SYSTEMS

Note: All H2S safety equipment and systems will be installed, tested, and operational when drilling reaches a depth of 500 feet above, or three days prior to penetrating the first zone containing or reasonable expected to contain H2S.

1. **Well Control Equipment:**

   A. Flare line.
   B. Choke manifold.
   C. Blind rams and pipe rams to accommodate all pipe sizes with properly sized closing unit.
   D. Auxiliary equipment may include if applicable: annular preventer & rotating head.

2. Protective equipment for essential personnel:

A. Mark II Survive air 30-minute units located in the doghouse and at briefing areas, as indicated on well site diagram.

3. H2S detection and monitoring equipment:

A. 1 portable H2S monitors positioned on location for best coverage and response. These units have warning lights and audible sirens when H2S levels of 20 PPM are reached.

4. Visual warning systems:

A. Wind direction indicators as shown on well site diagram (Exhibit #8).
B. Caution/Danger signs (Exhibit #7) shall be posted on roads providing direct access to location. Signs will be painted a high visibility yellow with black lettering of sufficient size to be readable at a reasonable distance from the immediate location. Bilingual signs will be used, when appropriate. See example attached.

5. Mud program:

A. The mud program has been designed to minimize the volume of H2S circulated to surface. Proper mud weight, safe drilling practices and the use of H2S scavengers will minimize hazards when penetrating H2S bearing zones.

6. Metallurgy:

A. All drill strings, casings, tubing, wellhead, blowout preventer, drilling spool, kill lines, choke manifold and lines, and valves shall be suitable for H2S service.
B. All elastomers used for packing and seals shall be H2S trim.

7. Communication:

A. Radio communications in company vehicles including cellular telephone and 2-way radio.
B. Land line (telephone) communication at Office.

8. Well testing:

A. Drill stem testing will be performed with a minimum number of personnel in the immediate vicinity, which are necessary to safely and adequately conduct the test. The drill stem testing will be conducted during daylight hours and formation fluids will not be flowed to the surface. All drill-stem-testing operations conducted in an H2S environment will use the closed chamber method of testing.

B. There will be no drill stem testing.

EXHIBIT #7

WARNING

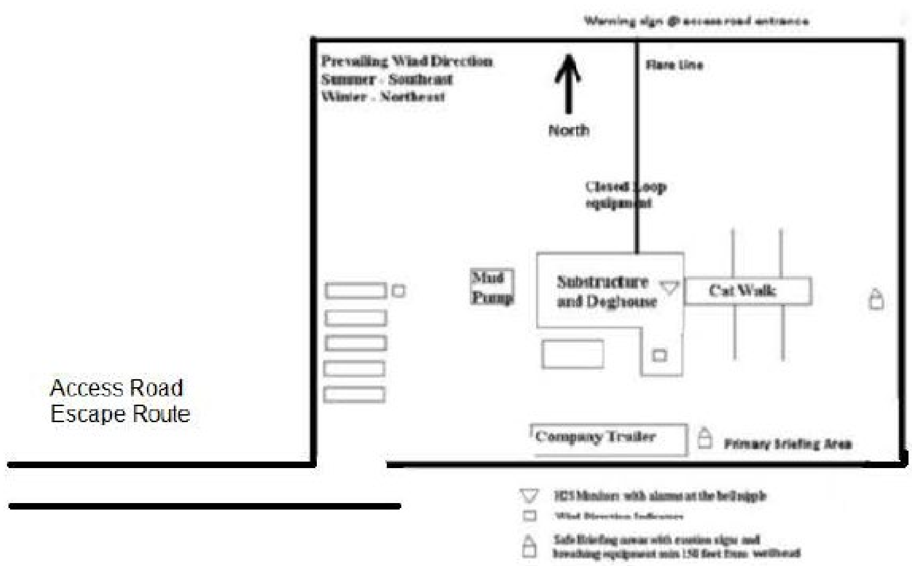
YOU ARE ENTERING AN H2S

AUTHORIZED PERSONNEL ONLY

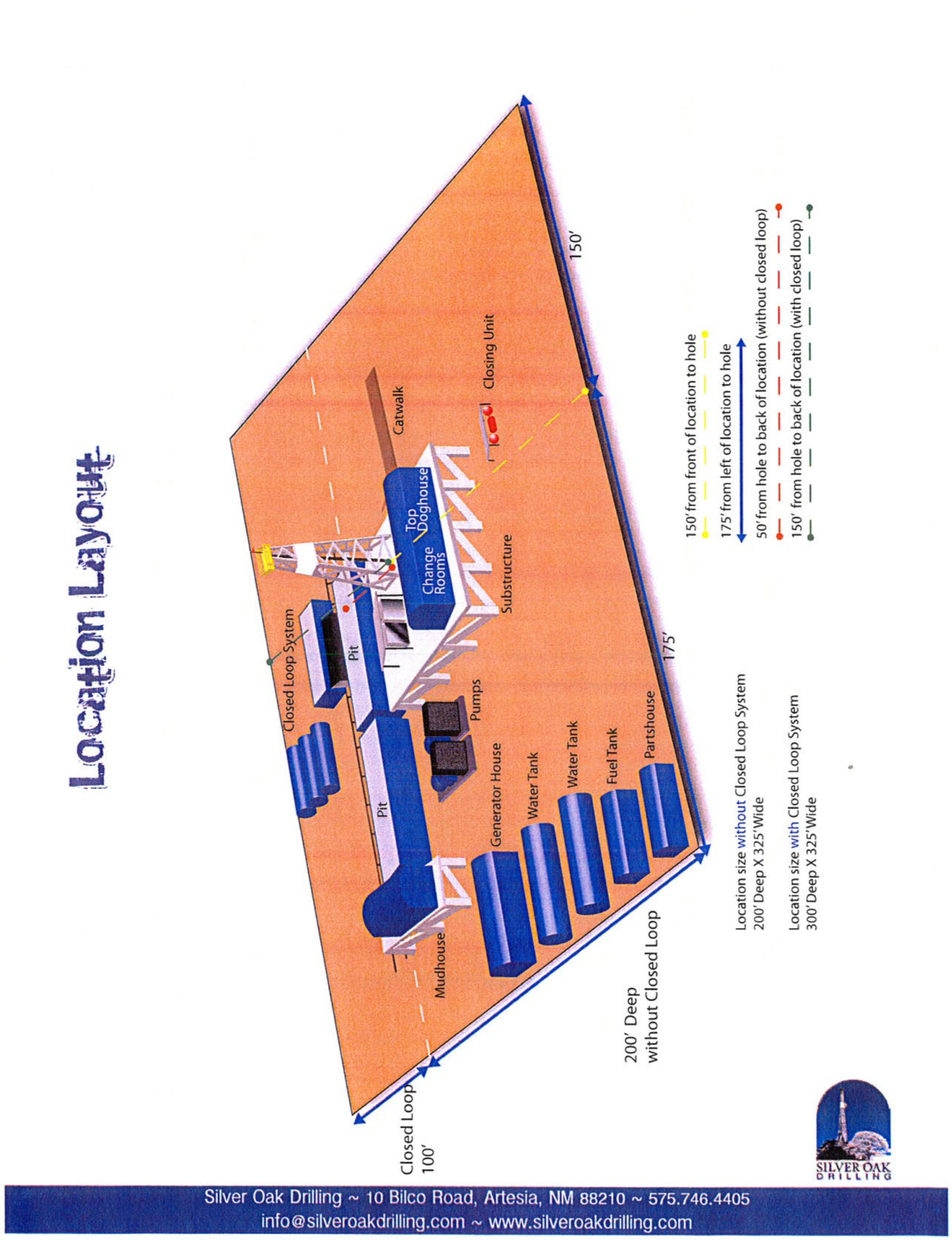
1. BEARDS OR CONTACT LENSES NOT ALLOWED
2. HARD HATS REQUIRED
3. SMOKING IN DESIGNATED AREAS ONLY
4. BE WIND CONSCIOUS AT ALL TIMES
5. CHECK WITH MACK ENERGY FOREMAN AT OFFICE

MACK ENERGY CORPORATION

1-575-748-1288



DRILLING LOCATION H2S SAFTY EQUIPMENT
Exhibit # 8



Mack Energy Corporation Call List, Chaves County

Artesia (575)	Cellular	Office
Jim Krogman	432-934-1596	748-1288
Emilio Martinez	432-934-7586	748-1288

Agency Call List (575)

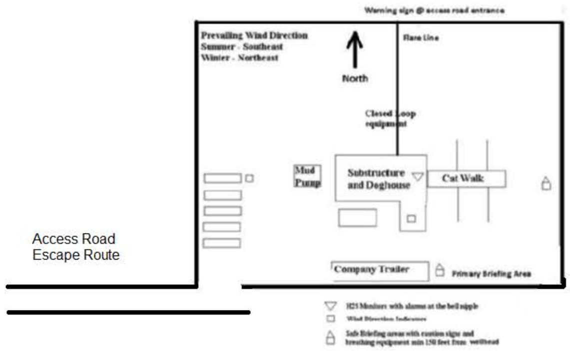
Roswell

State Police……………………………………………..622-7200
City Police……………………………………………...624-6770
Sheriff's Office…………………………………………624-7590
Ambulance……………………………………………...624-7590
Fire Department………………………………………...624-7590
LEPC (Local Emergency Planning Committee………...624-6770
NMOCD………………………………………………...748-1283
Bureau of Land Management…………………………...627-0272

Emergency Services

Boots & Coots IWC……………..…1-800-256-9688 or (281)931-8884
Cudd pressure Control……………….(915)699-0139 or (915)563-3356
Halliburton……………………………………………..746-2757
Par Five………………………………………………...748-9539

Flight For Life-Lubbock, TX…….……………………(806)743-9911
Aerocare-Lubbock, TX………………………………...(806)747-8923
Med Flight Air Amb-Albuquerque, NM……………….(505)842-4433
Lifeguard Air Med Svc. Albuquerque, NM……………(505)272-3115


Warning sign @ access road entrance
Prevailing Wind Direction
Summer - Southeast
Winter - Northeast
North
Flare Line
Closed Loop equipment
Mud Pump
Substructure and Doghouse
Cat Walk
Access Road
Escape Route
Company Trailer
Primary Briefing Area
H2S Monitors with alarms at the bell nipple
Safe Briefing areas with caution signs and breathing equipment min 150 feet from wellhead

Intent [XX] As Drilled [ ]

API #

Operator Name:	Property Name:	Well Number
MACK ENERGY CORPORATION	HI BOB FEDERAL	5H

Kick Off Point (KOP)

UL	Section	Township	Range	Lot	Feet	From N/S	Feet	From E/W	County
N	8	15S	29E		707	SOUTH	1650	WEST	CHAVES

Latitude	Longitude	NAD
33.0250454	104.0537674	83

First Take Point (FTP)

UL	Section	Township	Range	Lot	Feet	From N/S	Feet	From E/W	County
C	17	15S	29E		100	NORTH	1650	WEST	CHAVES

Latitude	Longitude	NAD
33.0228274	104.0537706	83

Last Take Point (LTP)

UL	Section	Township	Range	Lot	Feet	From N/S	Feet	From E/W	County
N	17	15S	29E		100	SOUTH	1650	WEST	CHAVES

Latitude	Longitude	NAD
33.0089483	104.0538249	83

Is this well the defining well for the Horizontal Spacing Unit? [ ]

Is this well an infill well? [ ]

If infill is yes please provide API if available, Operator Name and well number for Defining well for Horizontal Spacing Unit.

API #

Operator Name:	Property Name:	Well Number

KZ 06/29/2018

Attached to Form 3160-3
Mack Energy Corporation
High Bob Federal #5H , NMNM-121949
SHL : 707 FSL & 1650 FWL, SESW, Sec. 8 T15S R29E
BHL : 1 FSL & 1650 FWL, SESW, Sec. 17 T15S R29E
Chaves County, NM

DRILLING PROGRAM

1. **Geologic Name of Surface Formation**

   Quaternary

2. **Estimated Tops of Important Geologic Markers:**

Rustler	240’
Top Salt	610’
Base of Salt	740’
Yates	897’
Seven Rivers	1,160’
Queen	1,667’
Grayburg	2,065’
San Andres	2,386’

3. **Estimated Depths of Anticipated Fresh Water, Oil and Gas:**

Water Sand	150’	Fresh Water
Yates	897’	Oil/Gas
Seven Rivers	1,160’	Oil/Gas
Queen	1,667’	Oil/Gas
Grayburg	2,065’	Oil/Gas
San Andres	2,386’	Oil/Gas

No other formations are expected to give up oil, gas or fresh water in measurable quantities. Setting 13 3/8” casing to 600’ and circulating cement back to surface will protect the surface fresh water sand. Salt section and shallower zones above TD, which contain commercial quantities of oil and/or gas, will have cement circulated across them by cementing 5 ½” production casing, sufficient cement will be pumped to circulate back to surface.

4. **Casing Program:**

Hole Size	Interval	OD Casing	Wt, Grade, Jt, cond, collapse/burst/tension
17 1/2”	0-600’	13 3/8”	48#, J-55, ST&C, New, 2.47062/4.624571/4.74
12 ¼”	0-1200’	9 5/8”	36#, J-55, LT&C, New, 3.237179/7.04/7.04

Attached to Form 3160-3
Mack Energy Corporation
High Bob Federal #5H , NMNM-121949
SHL : 707 FSL & 1650 FWL, SESW, Sec. 8 T15S R29E
BHL : 1 FSL & 1650 FWL, SESW, Sec. 17 T15S R29E
Chaves County, NM

8 3/4"	0-2050'	7"	26#,HPC-110,LT&C,New, 7.029955/3.316667/3.316667
8 ¾"	2050-3100'	7"	26#, HCP-110, Buttress, New, 4.697739/3.316667/3.31667
8 ¾"	3100-8612'	5 ½"	17#, HCP-110 Buttress, New, 5.583756/3.546667/3.546667

***Variance request: A variance is requested to ise a Multi Bowl System and Flex Hose as the choke like from the BOP to the Choke Manifold. If this hose is used, a copy of the manufacturer's certification and pressure test will be kept on the rig*.**

5. **Cement Program:**

13 3/8" Surface Casing: Lead 100sx, RFC+12%PF53+2%PF1+5ppsPF42+.125ppsPF29, yld 1.61, wt 14.4 ppg, 7.357gals/sx. Tail: 550sx, Class C+1% PF1, yld 1.34, wt 14.8 ppg, 6.323 gals/sx, excess 100%

9 5/8" Intermediate Casing: Lead 220sx Class C + 4% PF20+.4ppsPF44+.125pps PF29, yld 1.72, wt 13.5 ppd, 9.102gal/sx, excess 100%, Slurry Top Surface. Tail: 200sx Class C+1%PF1, yld 1.34, wt 14.8 ppg, 6.323 gals/sx, excess 100%, Slurry Top Surface'

7" & 5 ½" Production Casing: Lead 250sx Class C 4% PF20 +4 pps PF45+125pps PF29, yld 2.82, wt 13.5 ppg, 16.421gals/sx, excess 35%, Slurry Top Surface. Tail 1,700sx, 50/50 POZ/C 5% PF44+2%PF20+.2%PF13+.2%PF65+.2%PF606+.4ppsPF45, yld 1.34, wt 14.2, 6.091gals/sx, 35% excess, Slurry top 2,000'.

6. **Minimum Specifications for Pressure Control:**

The blowout preventer equipment (BOP) shown in Exhibit #10 will consist of a double ram-type (3000 psi WP) minimum preventer. This unit will be hydraulically operated and the ram type preventer will be equipped with blind rams on top of 4 1/2" drill pipe rams on bottom. The 11" BOP will be nippled up on the 8 5/8" surface casing and tested by a 3rd party to 2000 psi used continuously until TD is reached. All BOP's and accessory equipment will be tested to 2000 psi before drilling out of intermediate casing. Pipe rams will be operationally checked each 24-hour period. Blind rams will be operationally checked on each trip out of the hole. These checks will be noted on the daily tour sheets. Other accessories to the BOP equipment (Exhibit #10) will include a Kelly cock and floor safety valve and choke lines and choke manifold (Exhibit #11) with a minimum 3000 psi WP rating

7. **Types and Characteristics of the Proposed Mud System:**

The well will be drilled to TD with a combination of fresh and cut brine mud system. The applicable depths and properties of this system are as follows:

DEPTH	TYPE	WEIGHT	VISCOSITY	WATERLOSS
0-600'	Fresh Water	8.5	28	N.C.
600-1200'	Cut Brine	9.1	29	N.C.
1200'-TD'	Cut Brine	9.1	29	N.C.

Perforations 3387.5'-8500'
FTP- NENW Sec. 17 T15S R29E 100 FNL 1650 FWL
LTP- SESW Sec. 17 T15S R29E 110 FSL 1650 FWL

Sufficient mud materials to maintain mud properties and meet minimum lost circulation and weight increase requirements will be kept at the well site at all times.

8. Auxiliary Well Control and Monitoring Equipment:

A. Kelly cock will be kept in the drill string at all times.
B. A full opening drill pipe-stabbing valve with proper drill pipe connections will be on the rig floor at all times.

9. Logging, Testing and Coring Program:

A. The electric logging program will consist of GR-Dual Laterolog, Spectral Density, Dual Spaced Neutron, CSNG Log from T.D. to 8 5/8 casing shoe.
B. Drill Stem test is not anticipated.
C. No conventional coring is anticipated.
D. Further testing procedures will be determined at TD.

10. Abnormal Conditions, Pressures, Temperatures and Potential Hazards:

No abnormal pressures or temperatures are anticipated. The estimated bottom hole at TD is 120 degrees and estimated maximum bottom hole pressure is 1414 psig (0.052*2955'TVD*9.2). Low levels of Hydrogen sulfide have been monitors in producing wells in the area, so H2S may be present while drilling of the well; a plan is attached to the Drilling program. No major loss of circulation zones has been reported in offsetting wells.

11. Anticipated Starting Date and Duration of Operations:

Road and location work will not begin until approval has been received from the BLM. The anticipated spud date is June 1, 2024. Once commenced, the drilling operation should be finished in approximately 20 days. If the well is productive, an additional 30 days will be required for completion and testing before a decision is made to install permanent facilities.

Attachment to Exhibit #10
NOTES REGARDING THE BLOWOUT PREVENTERS
High Bob Federal #5H
Chaves County, New Mexico

1. Drilling nipple to be so constructed that it can be removed without use of a welder through rotary table opening, with minimum I.D. equal to preventer bore.

2. Wear ring to be properly installed in head.

3. Blow out preventer and all fittings must be in good condition, 2000 psi WP minimum.

4. All fittings to be flanged.

5. Safety valve must be available on rig floor at all times with proper connections, valve to be full 2000 psi WP minimum.

6. All choke and fill lines to be securely anchored especially ends of choke lines.

7. Equipment through which bit must pass shall be at least as large as the diameter of the casing being drilled through.

8. Kelly cock on Kelly.

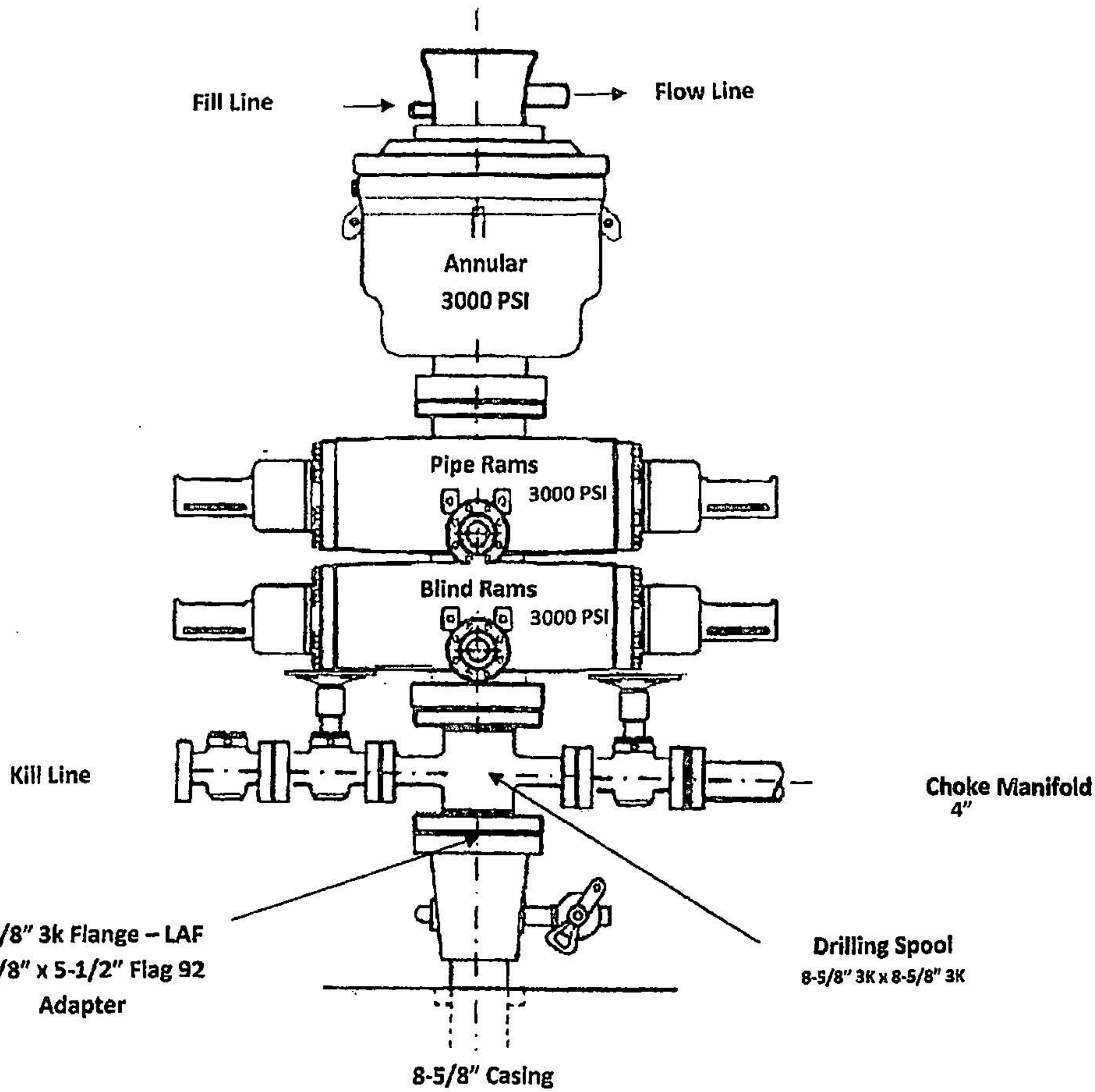
9. Extension wrenches and hands wheels to be properly installed.

10. Blow out preventer control to be located as close to driller's position as feasible.

11. Blow out preventer closing equipment to include minimum 40-gallon accumulator, two independent sources of pump power on each closing unit installation all API specifications.

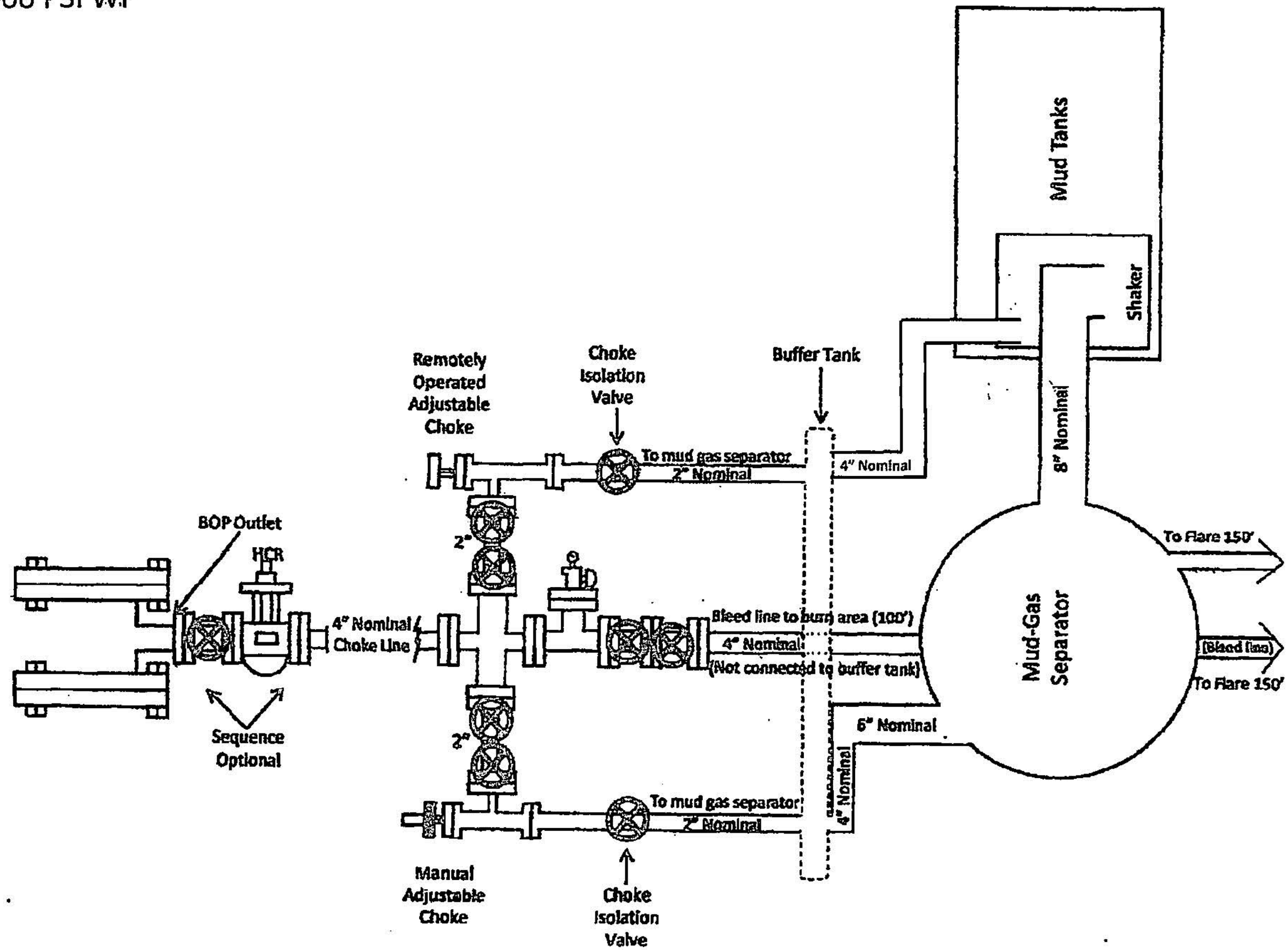
BOP Diagram

Dual Ram BOP
3000 PSI WP



Choke Manifold

3000 PSI WP



Mack Energy Corporation

Legal Description:
Mack Energy-San Andres MDP Area
Chaves Co. New Mexico
Various Sections
T-15-S, R-28-E and R-29-E

H2S

"Contingency Plan"'

1

Table of Contents

H2S CONTINGENCY PLAN SECTION

Scope:

This contingency plan provides an organized plan of action for alerting and protecting the public within an area of exposure prior to an intentional release, or following the accidental release of a potentially hazardous volume of hydrogen sulfide. The plan establishes guidelines for all personnel whose work activity may involve exposure to Hydrogen Sulfide Gas (H_2S).

Objective:

Prevent any and all accidents, and prevent the uncontrolled release of H2S into the atmosphere.

Provide proper evacuation procedures to cope with emergencies.

Provide immediate and adequate medical attention should an injury occur.

Discussion of Plan:

Suspected Problem Zones:

Implementation: This plan, with all details, is to be fully implemented 1000' before drilling into the first sour zone.

Emergency Response Procedure: This section outlines the conditions and denotes steps to be taken in the event of an emergency.

Emergency Equipment and Procedure: This section outlines the safety and emergency equipment that will be required for the drilling of this well.

Training Provisions: This section outlines the training provisions that must be adhered to 1000' before drilling into the first sour zone.

Emergency call list: Included are the telephone numbers of all persons that would need to be contacted, should an H2S emergency occur.

Briefing: This section deals with the briefing of all persons involved with the drilling of this well.

Public Safety: Public Safety Personnel will be made aware of the drilling of this well.

Check Lists: Status check lists and procedural check lists have been included to ensure adherence to the plan.

Genera/Information: A general information section has been included to supply support information.

EMERGENCY PROCEDURES SECTION

I. In the event of any evidence of H2S level above l0ppm, take the following steps immediately:

   a. Secure breathing apparatus.

   b. Order non-essential personnel out of the danger zone.

   c. Take steps to determine if the H2S level can be corrected or suppressed, and if so, proceed with normal operations.

II. If uncontrollable conditions occur, proceed with the following:

   a. Take steps to protect and/or remove any public downwind of the rig, including partial evacuation or isolation. Notify public safety personnel and the New Mexico Oil Conservation Division or Bureau of Land Management, whichever is appropriate, of the situation.

   b. Remove all personnel to the Safe Briefing Area.

   c. Notify public safety personnel for help with maintaining roadblocks and implementing evacuation.

   d. Determine and proceed with the best possible plan to regain control of the well. Maintain tight security and safety measures.

III. Responsibility:

   a. The Company Approved Supervisor shall be responsible for the total implementation of the plan.

   b. The Company Approved Supervisor shall be in complete command during any emergency.

   c. The Company Approved Supervisor shall designate a back-up Supervisor in the event that he/she is not available.

EMERGENCY PROCEDURE IMPLEMENTATION

I. Drilling or Tripping

a. *<u>All Personnel</u>*

- **i.** When alarm sounds, don escape unit and report to upwind Safe Briefing Area.
- **ii.** Check status of other personnel (buddy system).
- **iii.** Secure breathing apparatus.
- **iv.** Wait for orders from supervisor.

b. *<u>Drilling Foreman</u>*

- **i.** Report to the upwind Safe Briefing Area.
- **ii.** Don Breathing Apparatus and return to the point of release with the Tool Pusher or Driller (buddy system).
- **iii.** Determine the concentration of H_2S.
- **iv.** Assess the situation and take appropriate control measures.

c. *<u>Tool Pusher</u>*

- **i.** Report to the upwind Safe Briefing Area.
- **ii.** Don Breathing Apparatus and return to the point of release with the Drilling Foreman or the Driller (buddy system).
- **iii.** Determine the concentration of H_2S.
- **iv.** Assess the situation and take appropriate control measures.

d. *Driller*

- **i.** Check the status of other personnel (in a rescue attempt, always use the buddy system).
- **ii.** Assign the least essential person to notify the Drilling Foreman and Tool Pusher, in the event of their absence.
- **iii.** Assume the responsibility of the Drilling Foreman and the Tool Pusher until they arrive, in the event *of* their absence.

e. <u>*Derrick Man and Floor Hands*</u>

i. Remain in the upwind Safe Briefing Area until otherwise instructed by a supervisor.

f. <u>*Mud Engineer*</u>

i. Report to the upwind Safe Briefing Area.

ii. When instructed, begin check of mud for pH level and H_2S level.

g. <u>*Safety Personnel*</u>

i. Don Breathing Apparatus.

ii. Check status of personnel.

iii. Wait for instructions from Drilling Foreman or Tool Pusher.

II. Taking a Kick

a. All Personnel report to the upwind Safe Briefing Area.

b. Follow standard BOP procedures.

III. Open Hole Logging

a. All unnecessary personnel should leave the rig floor.

b. Drilling Foreman and Safety Personnel should monitor the conditions and make necessary safety equipment recommendations.

IV. Running Casing or Plugging

a. Follow "Drilling or Tripping" procedures.

b. Assure that all personnel have access to protective equipment.

SIMULATED BLOWOUT CONTROL DRILLS

All drills will be initiated by activating alarm devices (air horn). One long blast, on the air horn, for ACTUAL and SIMULATED Blowout Control Drills. This operation will be performed by the Drilling Foreman or Tool Pusher at least one time per week for each of the following conditions, with each crew:

Drill #1 Bottom Drilling

Drill #2 Tripping Drill Pipe

In each of these drills, the initial reaction time to shutting in the well shall be timed as well as the total time for the crew to complete its entire pit drill assignment. The times must be recorded on the IADC Driller's Log as "Blowout Control Drill".

Drill No.:
Reaction Time to Shut-In: minutes, seconds.
Total Time to Complete Assignment: minutes, seconds.

I. Drill Overviews

a. Drill No. 1-Bottom Drilling

i. Sound the alarm immediately.

ii. Stop the rotary and hoist Kelly joint above the rotary table.

iii. Stop the circulatory pump.

iv. Close the drill pipe rams.

v. Record casing and drill pipe shut-in pressures and pit volume increases.

b. Drill No. 2-Tripping Drill Pipe

i. Sound the alarm immediately.

ii. Position the upper tool joint just above the rotary table and set the slips.

iii. Install a full opening valve or inside blowout preventer tool in order to close the drill pipe.

iv. Close the drill pipe rams.

v. Record the shut-in annular pressure.

II. Crew Assignments

a. Drill No. 1-Bottom Drilling

i. *Driller*

1. Stop the rotary and hoist Kelly joint above the rotary table.
2. Stop the circulatory pump.
3. Check Flow.
4. If flowing, sound the alarm immediately
5. Record the shit-in drill pipe pressure
6. Determine the mud weight increase needed or other courses of action.

ii. *Derrick man*

1. Open choke line valve at BOP.
2. Signal Floor Man #1 at accumulator that choke line is open.
3. Close choke and upstream valve after pipe tam have been closed.
4. Read the shut-in annular pressure and report readings to Driller.

iii. *Floor Man #1*

1. Close the pipe rams after receiving the signal from the Derrickman.
2. Report to Driller for further instructions.

iv. *Floor Man #2*

1. Notify the Tool Pusher and Operator representative of the H_2S alarms.
2. Check for open fires and, if safe to do so, extinguish them.
3. Stop all welding operations.
4. Turn-off all non-explosions proof lights and instruments.
5. Report to Driller for further instructions.

v. *Tool Pusher*

1. Report to the rig floor.
2. Have a meeting with all crews.

3. Compile and summarize all information.

4. Calculate the proper kill weight.

5. Ensure that proper well procedures are put into action.

vi. Operator Representative

1. Notify the Drilling Superintendent.

2. Determine if an emergency exists and if so, activate the contingency plan.

b. Drill No. 2-Tripping Pipe

i. Driller

1. Sound the alarm immediately when mud volume increase has been detected.

2. Position the upper tool joint just above the rotary table and set slips.

3. Install a full opening valve or inside blowout preventer tool to close the drill pipe.

4. Check flow.

5. Record all data reported by the crew.

6. Determine the course of action.

ii. Derrick man

1. Come down out of derrick.

2. Notify Tool Pusher and Operator Representative.

3. Check for open fires and, if safe to do so, extinguish them.

4. Stop all welding operations.

5. Report to Driller for further instructions.

iii. Floor Man #1

1. Pick up full opening valve or inside blowout preventer tool and stab into tool joint above rotary table (with Floor Man #2).

2. Tighten valve with back-up tongs.

3. Close pipe rams after signal from Floor Man #2.

4. Read accumulator pressure and check for possible high pressure fluid leaks in valves or piping.

5. Report to Driller for further instructions.

iv. Floor Man #2

1. Pick-up full opening valve or inside blowout preventer tool and stab into tool joint above rotary table (with Floor Man #1).

2. Position back-up tongs on drill pipe.

3. Open choke line valve at BOP.

4. Signal Floor Man #1 at accumulator that choke line is open.

5. Close choke and upstream valve after pipe rams have been closed.

6. Check for leaks on BOP stack and choke manifold.

7. Read annular pressure.

8. Report readings to the Driller.

v. Tool Pusher

1. Report to the rig floor.

2. Have a meeting with all of the crews.

3. Compile and summarize all information.

4. See that proper well kill procedures are put into action.

vi. Operator Representative

1. Notify Drilling Superintendent

2. Determine if an emergency exists, and if so, activate the contingency plan.

IGNITION PROCEDURES

Responsibility:

The decision to ignite the well is the responsibility of the DRILLING FOREMAN in concurrence with the emergency response officials. In the event the Drilling Foreman is incapacitated, it becomes the responsibility of the RIG TOOL PUSHER. This decision should be made only as a last resort and in a situation where it is clear that:

1. Human life and property are endangered.
2. There is no hope of controlling the blowout under the prevailing conditions.

If time permits, notify the main office, but do not delay if human life is in danger. Initiate the first phase of the evacuation plan.

Instructions for Igniting the Well:

1. Two people are required for the actual igniting operation. Both men must wear self-contained breathing apparatus and must use a full body harness and attach a retrievable safety line to the D-Ring in the back. One man must monitor the atmosphere for explosive gases with the LEL monitor, while the Drilling Foreman is responsible for igniting the well.
2. The primary method to ignite is a 25mm flare gun with a range of approximately 500 feet.
3. Ignite from upwind and do not approach any closer than is warranted.
4. Select the ignition site best suited for protection and which offers an easy escape route.
5. Before igniting, check for the presence of combustible gases.
6. After igniting, continue emergency actions and procedures as before.
7. All unassigned personnel will limit their actions to those directed by the Drilling Foreman.

Note: After the well is ignited, burning Hydrogen Sulfide will convert to Sulfur Dioxide, which is also highly toxic. Do not assume the area is safe after the well is ignited.

TRAINING PROGRAM

When working in an area where Hydrogen Sulfide (H_2S) might be encountered, definite training requirements must be carried out. The Company Supervisor will ensure that all personnel, at the well site, have had adequate training in the following consistent with the requirements in ANSI/ASSE Z390.1-2006 (R2010) Accepted Practices for Hydrogen Sulfide (H2S) Training Programs:

1. Physical and Chemical Properties of Hydrogen Sulfide.
2. Sources of Hydrogen Sulfide.
3. Human Physiology and Medical Evaluation.
4. Work Procedures.
5. Personal Protective Equipment.
6. Use of Contingency Plans and Emergency Response.
7. Burning, Flaring and Venting of Hydrogen Sulfide.
8. State and Federal Regulatory Requirements.
9. Hydrogen Sulfide Release Dispersion Models
10. Rescue Techniques, First Aid and Post-Exposure Evaluation
11. Methods of Detection and Monitoring
12. Engineering Controls
13. Transportation of Hydrogen Sulfide Cargoes
14. Emerging Technology

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Service company personnel and visiting personnel must be notified if the zone contains H_2S, and each service company must provide proof of adequate training and equipment for their employees before they arrive at the well site.

EMERGENCY EQUIPMENT REQUIREMENTS

Lease Entrance Sign:

Should be located at the lease entrance with the following information:

CAUTION- POTENTIAL POISON GAS
HYDROGEN SULFIDE
NO ADMITTANCE WITHOUT AUTHORIZATION

Respiratory Equipment:

- Fresh air breathing equipment should be placed at the safe briefing areas and should include the following:
- Two SCBA's at each briefing area.
- Enough airline units to operate safely, anytime the H_2S concentration reaches the IDLH level (100 ppm).
- Cascade system with enough breathing air hose and manifolds to reach the rig floor, the derrick man and the other operation areas.

Windsocks or Wind Streamers:

- A minimum of two 10" windsocks located at strategic locations so that they may be seen from any point on location.
- Wind streamers (if preferred) should be placed at various locations on the well site to ensure wind consciousness at all times. (Corners of location).

Hydrogen Sulfide Detector and Alarms:

- 1- Four channel H_2S monitor with alarms.
- Four (4) sensors located as follows: #1- Rig Floor, #2- Bell Nipple, #3- Shale Shaker, #4- Mud Pits.
- Gastec or Draeger pump with tubes.
- Sensor test gas.

Well Condition Sign and Flags:

The Well Condition Sign w/flags should be placed a minimum of 150' before you enter the location. It should have three (3) color coded flags (green, yellow and red) that will be used to denote the following location conditions:

GREEN- Normal Operating Conditions
YELLOW- Potential Danger
RED- Danger, H_2S Gas Present

Auxiliary Rescue Equipment:

- Stretcher
- 2- 100' Rescue lines.
- First Aid Kit properly stocked.

Mud Inspection Equipment:

Garret Gas Train or Hach Tester for inspection of Hydrogen Sulfide in the drilling mud system.

Fire Extinguishers:

Adequate fire extinguishers shall be located at strategic locations.

Blowout Preventer:

- The well shall have hydraulic BOP equipment for the anticipated BHP.
- The BOP should be tested upon installation.
- BOP, Choke Line and Kill Line will be tested as specified by Operator.

Confined Space Monitor:

There should be a portable multi-gas monitor with at least 3 sensors (O_2, LEL H_2S). This instrument should be used to test the atmosphere of any confined space before entering. It should also be used for atmospheric testing for LEL gas before beginning any type of Hot Work. Proper calibration documentation will need to be provided.

Communication Equipment:

- Proper communication equipment such as cell phones or 2-way radios should be available at the rig.
- Radio communication shall be available for communication between the company man's trailer, rig floor and the tool pusher's trailer.

- Communication equipment shall be available on the vehicles.

Special Control Equipment:

- Hydraulic BOP equipment with remote control on the ground.
- Rotating head at the surface casing point.

Evacuation Plan:

- Evacuation routes should be established prior to spudding the well.
- Should be discussed with all rig personnel.

Designated Areas:

Parking and Visitor area:

- All vehicles are to be parked at a pre-determined safe distance from the wellhead.
- Designated smoking area.

Safe Briefing Areas:

- Two Safe Briefing Areas shall be designated on either side of the location at the maximum allowable distance from the well bore so they offset prevailing winds or they are at a 180 degree angle if wind directions tend to shift in the area.
- Personal protective equipment should be stored at both briefing areas or if a moveable cascade trailer is used, it should be kept upwind of existing winds. When wind is from the prevailing direction, both briefing areas should be accessible.

Note:

- Additional equipment will be available at the Alliance Safety office.
- Additional personal H_2S monitors are available for all employees on location.
- Automatic Flare Igniters are recommended for installation on the rig.

CHECK LISTS

Status Check List

Note: Date each item as they are implemented.

1. Sign at location entrance. ______
2. Two (2) wind socks (in required locations). ______
3. Wind Streamers (if required). ______
4. SCBA's on location for all rig personnel and mud loggers. ______
5. Air packs, inspected and ready for use. ______
6. Spare bottles for each air pack (if required). ______
7. Cascade system for refilling air bottles. ______
8. Cascade system and hose line hook up. ______
9. Choke manifold hooked-up and tested. (before drilling out surface casing.) ______
10. Remote Hydraulic BOP control (hooked-up and tested before drilling out surface casing). ______
11. BOP tested (before drilling out surface casing). ______
12. Mud engineer on location with equipment to test mud for H_2S. ______
13. Safe Briefing Areas set-up ______
14. Well Condition sign and flags on location and ready. ______
15. Hydrogen Sulfide detection system hooked -up & tested. ______
16. Hydrogen Sulfide alarm system hooked-up & tested. ______
17. Stretcher on location at Safe Briefing Area. ______
18. 2 -100' Life Lines on location. ______
19. 1-20# Fire Extinguisher in safety trailer. ______
20. Confined Space Monitor on location and tested. ______
21. All rig crews and supervisor trained (as required). ______

22. Access restricted for unauthorized personnel. ______________
23. Drills on H_2S and well control procedures. ______________
24. All outside service contractors advised of potential H_2S on the well. ______________
25. NO SMOKNG sign posted. ______________
26. H_2S Detector Pump w/tubes on location. ______________
27. 25mm Flare Gun on location w/flares. ______________
28. Automatic Flare Igniter installed on rig. ______________

Procedural Check List

Perform the following on each tour:

1. Check fire extinguishers to see that they have the proper charge.
2. Check breathing equipment to insure that they have not been tampered with.
3. Check pressure on the supply air bottles to make sure they are capable of recharging.
4. Make sure all of the Hydrogen Sulfide detection systems are operative.

Perform the following each week:

1. Check each piece of breathing equipment to make sure that they are fully charged and operational. This requires that the air cylinder be opened and the mask assembly be put on and tested to make sure that the regulators and masks are properly working. Negative and Positive pressure should be conducted on all masks.
2. BOP skills.
3. Check supply pressure on BOP accumulator stand-by source.
4. Check all breathing air mask assemblies to see that straps are loosened and turned back, ready for use.
5. Check pressure on cascade air cylinders to make sure they are fully charged and ready to use for refill purposes if necessary.
6. Check all cascade system regulators to make sure they work properly.
7. Perform breathing drills with on-site personnel.
8. Check the following supplies for availability:
   - Stretcher
   - Safety Belts and Ropes
   - Spare air Bottles
   - Spare Oxygen Bottles (if resuscitator required)
   - Gas Detector Pump and Tubes
   - Emergency telephone lists
9. Test the Confined Space Monitor to verify the batteries are good

EVACUATION PLAN

General Plan

The direct lines of action prepared by Mack Energy Corporation to protect the public from hazardous gas situations are as follows:

1. When the company approved supervisor (Drilling Foreman, Tool Pusher or Driller) determine that Hydrogen Sulfide gas cannot be limited to the well location, and the public will be involved, he will activate the evacuation plan. Escape routes are noted on the area map.

2. Company safety personnel or designee will notify the appropriate local government agency that a hazardous condition exists and evacuation needs to be implemented.

3. Company approved safety personnel that have been trained in the use of the proper emergency equipment will be utilized.

4. Law enforcement personnel (State Police, Local Police Department, Fire Department, and the Sheriff's Department) will be called to aid in setting up and maintaining road blocks. Also, they will aid in evacuation of the public if necessary.

NOTE: Law enforcement personnel will not be asked to come into a contaminated area. Their assistance will be limited to uncontaminated areas. Constant radio contact will be maintained with them.

5. After the discharge of gas has been controlled, "Company" safety personnel will determine when the area is safe for re-entry.

See Specific Site Safety Plan or Job Safety Analysis to be completed during drilling

Emergency Assistance Telephone List

PUBLIC SAFETY:	911 or
Pecos Valley Communication Center (Chaves County Police, Fire, EMS)	(575) 624-7590
Central Dispatch (Eddy County Police, Fire, EMS)	(575) 616-7155

Hospitals:

Roswell	(575) 622-8170
Artesia	(575) 748-3333

Dept. of Public Safety/SE New Mexico	(575) 622-7200
Highway Department	(575) 637-7200
New Mexico Oil Conservation	(575) 748-1283
Bureau of Land Management	(575) 622-5335

Mack Energy Corporation

Company Drilling Supervisor

Jim Krogman	(575) 703-7385

Drilling Foreman

Emilio Martinez	(575) 703-5231

Silver Oak Drilling

Silver Oak Drilling	(575) 746-4405

Tool Pusher:

Darren Mc Bride	(575) 703-6070
Osiel Sanchez	(575) 703-4109

Safety

Lee Hassell (Alliance Safety)
(806) 217-2950
Scott Ford (Mack Energy)
(505) 692-4976
Robbie Houghtaling (Silver Oak)
(575) 703-2122

Intentionally Blank –Space provided for Specific Site Safety Plan or Job Safety Analysis

Affected Notification List

(within a 65' radius of exposure @ IOOppm)

The geologic zones that will be encountered during drilling are known to contain hazardous quantities of H_2S. The accompanying map illustrates the affected areas of the community. The residents within this radius will be notified via a hand delivered written notice describing the activities, potential hazards, conditions of evacuation, evacuation drill siren alarms and other precautionary measures.

Evacuee Description:
Residents: **THERE ARE NO RESIDENTS WITHIN 3000' ROE.**

Notification Process:

A continuous siren audible to all residence will be activated, signaling evacuation of previously notified and informed residents.

Evacuation Plan:
All evacuees will migrate lateral to the wind direction.

The Oil Company will identify all home bound or highly susceptible individuals and make special evacuation preparations, interfacing with the local and emergency medical service as necessary.

Toxic Effects of H_2S Poisoning

Hydrogen Sulfide is extremely toxic. The acceptable ceiling concentration for eight-hour exposure is 10 PPM, which is .001% by volume. Hydrogen Sulfide is heavier than air (specific gravity -1.192) and is colorless and transparent. Hydrogen Sulfide is almost as toxic as Hydrogen Cyanide and is 5-6 times more toxic than Carbon Monoxide. Occupational exposure limits for Hydrogen Sulfide and other gases are compared below in Table 1. Toxicity table for H_2S and physical effects are shown in Table 2.

Table 1
Permissible Exposure Limits of Various Gases

Common Name	Symbol	Sp. Gravity	TLV	STEL	IDLH
Hydrogen Cyanide	HCN	.94	4.7 ppm	c	
Hydrogen Sulfide	H2S	1.192	10 ppm	15 ppm	100 ppm
Sulfide Dioxide	so2	2.21	2 ppm	5 ppm	
Chlorine	CL	2.45	.5 ppm	1 ppm	
Carbon Monoxide	co	.97	25 ppm	200 ppm	
Carbon Dioxide	C02	1.52	5000 ppm	30,000 ppm	
Methane	CH4	.55	4.7% LEL	14% UEL	

Definitions

A. TLV- Threshold Limit Value is the concentration employees may be exposed based on a TWA {time weighted average) for eight {8) hours in one day for 40 hours in one {1) week. This is set by ACGIH {American Conference of Governmental Hygienists) and regulated by OSHA.

B. STEL- Short Term Exposure Limit is the 15 minute average concentration an employee may be exposed to providing that the highest exposure never exceeds the OEL {Occupational Exposure Limit). The OEL for H_2S is 19 PPM.

C. IDLH -Immediately Dangerous to Life and Health is the concentration that has been determined by the ACGIH to cause serious health problems or death if exposed to this level. The IDLH for H_2S is 100 PPM.

D. TWA- Time Weighted Average is the average concentration of any chemical or gas for an eight {8) hour period. This is the concentration that any employee may be exposed based on an TWA.

TABLE 2

Toxicity Table of H_2S

Percent%	PPM	Physical Effects
.0001	1	Can smell less than 1ppm.
.001	10	TLV for 8 hours of exposure.
.0015	15	STEL for 15 minutes of exposure.
.01	100	Immediately Dangerous to Life & Health. Kills sense of smell in 3 to 5 minutes.
.02	200	Kills sense of smell quickly, may burn eyes and throat.
.05	500	Dizziness, cessation of breathing begins **in a few minutes.**
.07	700	Unconscious quickly, death will result if not rescued promptly.
.10	1000	Death will result unless rescued promptly. Artificial resuscitation may be necessary.

PHYSICAL PROPERTIES OF H2S

The properties of all gases are usually described in the context of seven major categories:

COLOR
ODOR
VAPOR DENSITY
EXPLOSIVE LIMITS
FLAMMABILITY
SOLUBILITY {IN WATER)
BOILING POINT

Hydrogen Sulfide is no exception. Information from these categories should be considered in order to provide a fairly complete picture of the properties of the gas.

COLOR- TRANSPARENT

Hydrogen Sulfide is colorless so it is invisible. This fact simply means that you can't rely on your eyes to detect its presence. In fact that makes this gas extremely dangerous to be around.

ODOR- ROTTEN EGGS

Hydrogen Sulfide has a distinctive offensive smell, similar to "rotten eggs". For this reason it earned its common name "sour gas". However, H_2S, even in low concentrations, is so toxic that it attacks and quickly impairs a victim's sense of smell, so it could be fatal to rely on your nose as a detection device.

VAPOR DENSITY- SPECIFIC GRAVITY OF 1.192

Hydrogen Sulfide is heavier than air so it tends to settle in low-lying areas like pits, cellars or tanks. If you find yourself in a location where H_2S is known to exist, protect yourself. Whenever possible, work in an area upwind and keep to higher ground.

EXPLOSIVE LIMITS- 4.3% TO 46%

Mixed with the right proportion of air or oxygen, H_2S will ignite and burn or explode, producing another alarming element of danger besides poisoning.

FLAMMABILITY

Hydrogen Sulfide will burn readily with a distinctive clear blue flame, producing Sulfur Dioxide ($S0_2$), another hazardous gas that irritates the eyes and lungs.

SOLUBILITY-4 TO 1 RATIO WITH WATER

Hydrogen Sulfide can be dissolved in liquids, which means that it can be present in any container or vessel used to carry or hold well fluids including oil, water, emulsion and sludge. The solubility of H_2S is dependent on temperature and pressure, but if conditions are right, simply agitating a fluid containing H_2S may release the gas into the air.

BOILING POINT- {-76 degrees Fahrenheit)

Liquefied Hydrogen Sulfide boils at a very low temperature, so it is usually found as a gas.

RESPIRATOR USE

The Occupational Safety and Health Administration (OSHA) regulate the use of respiratory protection to protect the health of employees. OSHA's requirements are written in the Code of Federal Regulations, Title 29, Part 1910, Section 134, Respiratory Protection. This regulation requires that all employees who might be required to wear respirators, shall complete a OSHA mandated medical evaluation questionnaire. The employee then should be fit tested prior to wearing any respirator while being exposed to hazardous gases.

Written procedures shall be prepared covering safe use of respirators in dangerous atmospheric situations, which might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

Respirators shall be inspected prior to and after each use to make sure that the respirator has been properly cleaned, disinfected and that the respirator works properly. The unit should be fully charged prior to being used.

Anyone who may use respirators shall be properly trained in how to properly seal the face piece. They shall wear respirators in normal air and then in a test atmosphere. (Note: Such items as facial hair (beard or sideburns) and eyeglass temple pieces will not allow a proper seal.) Anyone that may be expected to wear respirators should have these items removed before entering a toxic atmosphere. A special mask must be obtained for anyone who must wear eyeglasses. Contact lenses should not be allowed.

Respirators shall be worn during the following conditions:

A. Any employee who works near the top or on the top of any tank unless tests reveal less than 20 ppm of H2S.

B. When breaking out any line where H_2S can reasonably be expected.

C. When sampling air in areas where H_2S may be present.

D. When working in areas where the concentration of H_2S exceeds the Threshold Limit Value for H2S {10 ppm).

E. At any time where there is a doubt as to the H_2S level in the area to be entered.

EMERGENCY RESCUE PROCEDURES

DO NOT PANIC!!!

Remain Calm -Think

1. Before attempting any rescue you must first get out of the hazardous area yourself. Go to a safe briefing area.

2. Sound alarm and activate the 911 system.

3. Put on breathing apparatus. At least two persons should do this, when available use the buddy system.

4. Rescue the victim and return them to a safe briefing area.

5. Perform an initial assessment and begin proper First Aid/CPR procedures.

6. Keep victim lying down with a blanket or coat, etc.., under the shoulders to keep airway open. Conserve body heat and do not leave unattended.

7. If the eyes are affected by H_2S, wash them thoroughly with potable water. For slight irritation, cold compresses are helpful.

8. In case a person has only minor exposure and does not lose consciousness totally, it's best if he doesn't return to work until the following day.

9. Any personnel overcome by H_2S should always be examined by medical personnel. They should always be transported to a hospital or doctor.

Variance request: A variance is requested to use a Multi Bowl System and Flex Hose as the choke line from the BOP to the Choke Manifold. If this hose is used, a copy of the manufacturer's certification and pressure test will be kept on the rig.

Cactus Wellhead

Installation Procedure Prepared For:

Mack Energy Corporation
13-3/8” x 9-5/8” x 7” 10M
MBU-LR Wellhead System With
CTH-DBLHPS Tubing Head

Publication # IP0228

May, 2014

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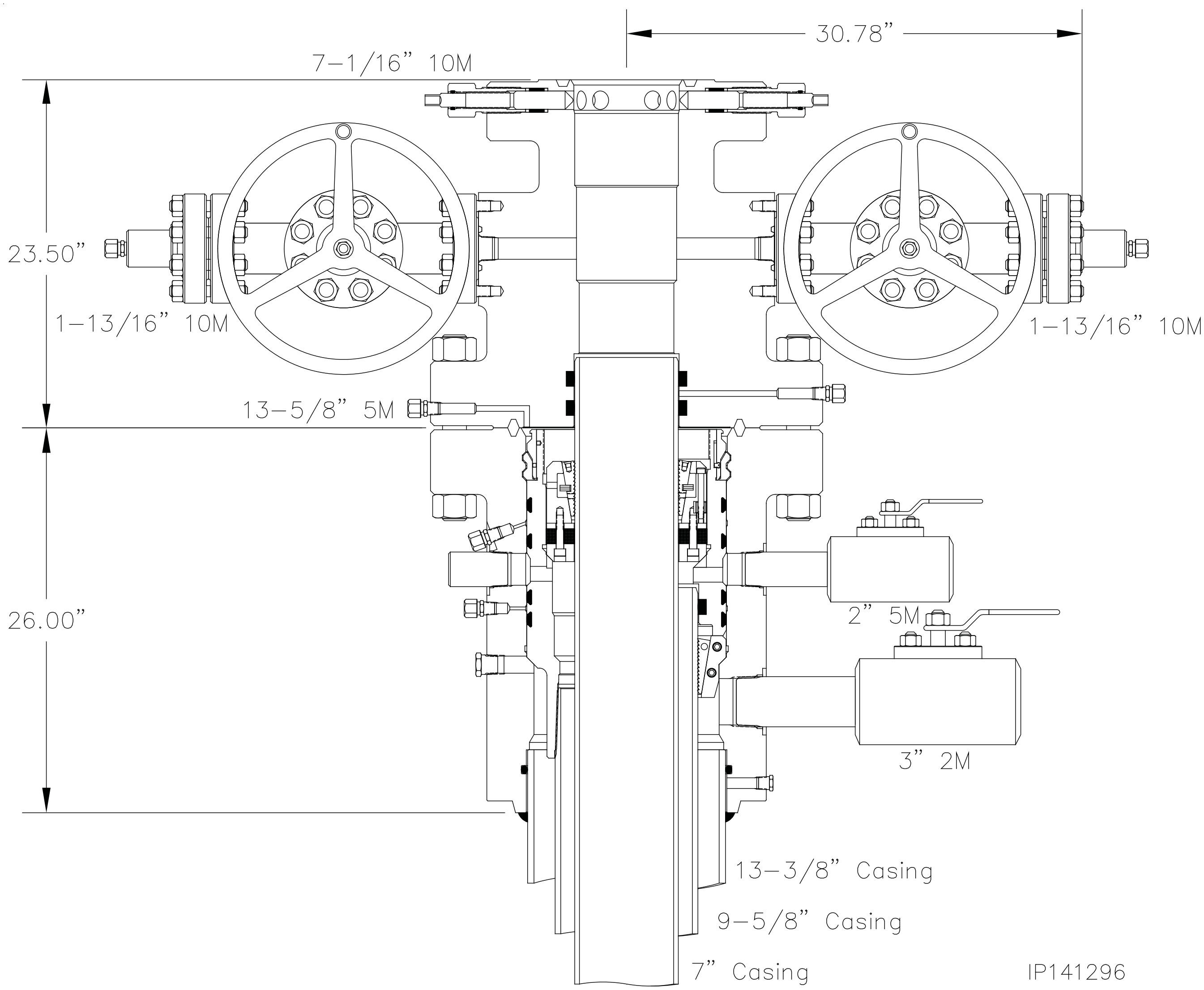
System Drawing



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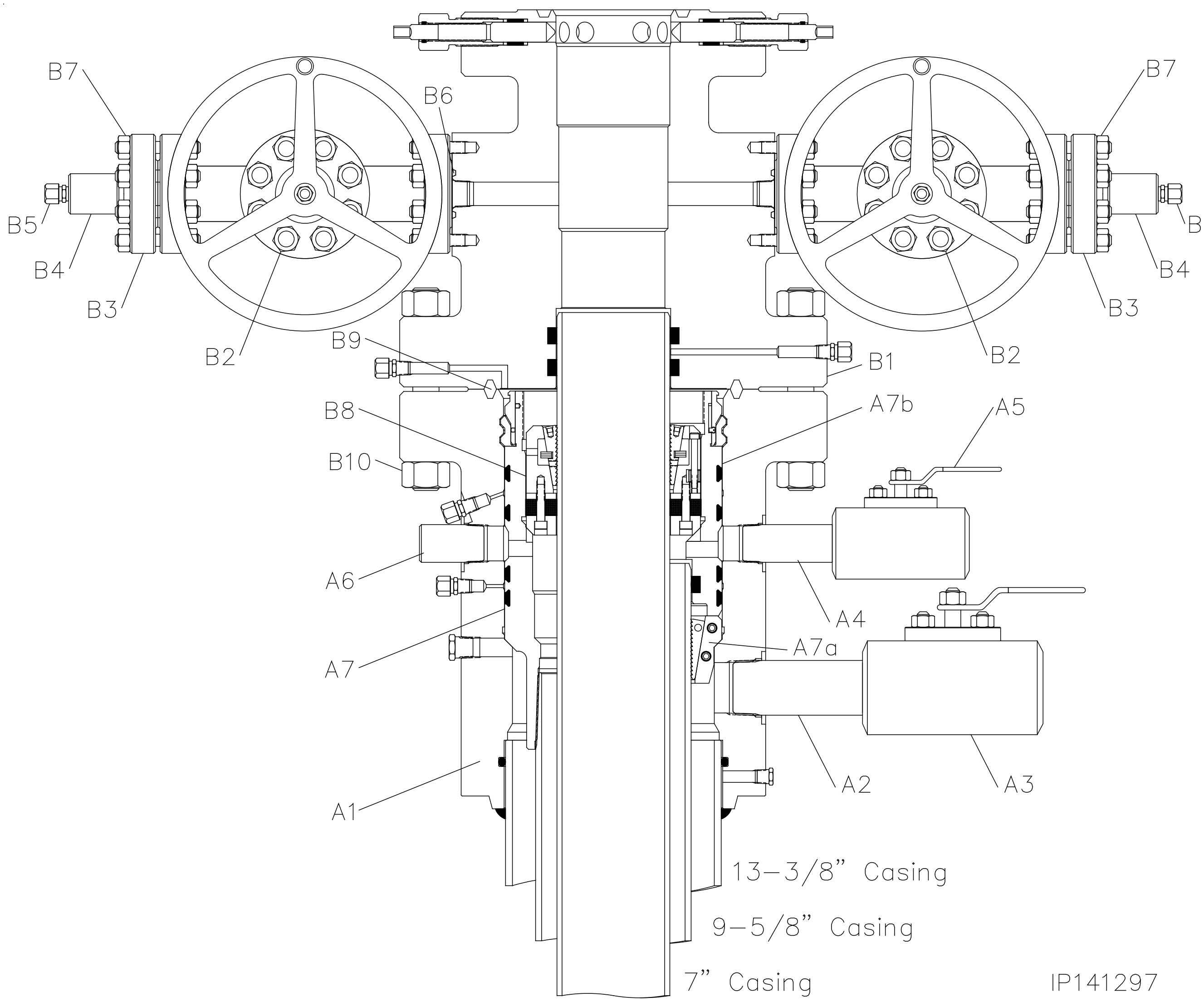


Mack Energy Corporation.
13-3/8" x 9-5/8" x 7" 10M MBU-LR Wellhead System
With CTH-DBLHPS Tubing Head

MBU-LR HOUSING ASSEMBLY

Item	Qty	Description
A1	1	Housing, CW, MBU-LR, 13-5/8" 5M x 13-3/8" SOW, with two 2" line pipe upper outlets and one 3" line pipe lower outlet, one piece, 6A-PU-AA-1-1 Part # 102513
A2	1	Nipple, 3" line pipe x 12" long, XH Part # 101610
A3	1	Ball Valve, KF, AH, 3 RP 2M LP, DI: Body, CS: Trim, nylon seats, HNBR: seals, with handle standard non-nace service Part # 100535
A4	1	Nipple, 2" line pipe x 6" long, XH Part # NP6A
A5	1	Ball Valve, 2" RP, 5M LP x 2" LP, WCB body, 304SS ball, CR13 stem, RPTFE seats, API 596 Part # 103877
A6	1	Bull Plug, 2" line pipe solid, 4130 60K Part # BP2P
A7	1	Casing Hanger, CW, MBU-LR, 13-5/8" x 9-5/8" LC box bottom x 11.250" 4 Stub Acme 2G LH box top, mandrel, 6A-U-AA-1-1 Part # 100482

EMERGENCY EQUIPMENT

Item	Qty	Description
A7a	1	Casing Hanger, CW, MBU, 13-5/8" x 9-5/8" 6A-PU-DD-3-1 Part # 100569
A7b	1	Packoff, CW, MBU-LR Emergency, 13-5/8" x 11" x 9-5/8" with 11.250" 4 Stub Acme 2G LH top, slotted for CL outlets, 6A-PU-AA-1-1 Part # 100538

TUBING HEAD ASSEMBLY

Item	Qty	Description
B1	1	Tubing Head, CW, CTH-DBLHPS, 7, 13-5/8" 5M x 7-1/16" 10M, with two 1-13/16" 10M studded outlets 6A-PU-EE-0,5-2-1 Part #
B2	2	Gate Valve, DSG-22, 1-13/16" 10M, flanged end, EE-0,5 trim, (6A-PU-EE-0,5-3-1) Part # 102284
B3	2	Companion Flange, 1-13/16" 10M x 2" line pipe (5,000 psi max WP), (6A-PU-EE-NL-1) Part # 200010
B4	2	Bull Plug, 2" line pipe x 1/2" line pipe, API 6A-DD-NL Part # BP2T
B5	2	Fitting, Grease, Vented Cap, 1/2" NPT, Alloy Non-Nace Part # FTG1
B6	4	Ring Gasket, 151, 1-13/16" 10M Part # BX151
B7	16	Studs, all thread with two nuts, black, 3/4" x 5-1/2" long, B7/2H Part # 780080
B8	1	Casing Hanger, C22, 11" x 7" Part # 50020
B9	1	Ring Gasket, 160, 13-5/8" 5M Part # BX160
B10	16	Studs, all thread with two nuts, black, 1-5/8" x 12-3/4" long, B7/2H Part # 780087

RECOMMENDED SERVICE TOOLS

Item	Qty	Description
ST1	1	Test Plug/Retrieving Tool, CW, 13-5/8" x 4-1/2" IF, 1-1/4" LP bypass and spring loaded lift dogs Part # 800002
ST2	1	Wear Bushing, CW, MBU-LR-LWR, 13-5/8" x 12.38" ID x 20.31" long Part # 100546
ST3	1	Casing Hanger Running Tool, CW, MBU-LR, 13-5/8" x 9-5/8" long casing box top x 11.250" 4 Stub Acme LH pin bottom, 4140 110K Part # 102304
ST4	1	Packoff Running Tool, CW, MBU-LR, 13-5/8" x 4-1/2" IF box bottom and top, with 11.250" 4 Stub Acme 2G LH pin bottom Part # 100556
ST5	1	Test Plug/Retrieving Tool, CW, 11" x 4-1/2" IF, 1-1/4" LP bypass and spring loaded lift dogs Part # 800001
ST6	1	Wear Bushing, MBU-LR-UPR, 13-5/8" x 11" x 9.00" I.D. x 16.0" long Part # 102789
ST7	1	Wash Tool, CW, Casing Hanger, MBU-LR/MBS2, fluted, 13-5/8" x 4-1/2" IF box top threads, fabricated Part # 102787

TA CAP ASSEMBLY

Item	Qty	Description
C1	1	Flange, Blind, 7-1/16" 10M X 1/2 LP ,With Two 3/4" Part # 101464
C2	1	Needle Valve, MFA, 1/2" Line Pipe, 10M Part # NVA
C3	12	Studs, All Thread With Two Nuts, Black, 1-1/2" X 11-3/4" Long, B7/H2 Part # 780082

Stage 1 — Install the MBU-LR Wellhead Housing

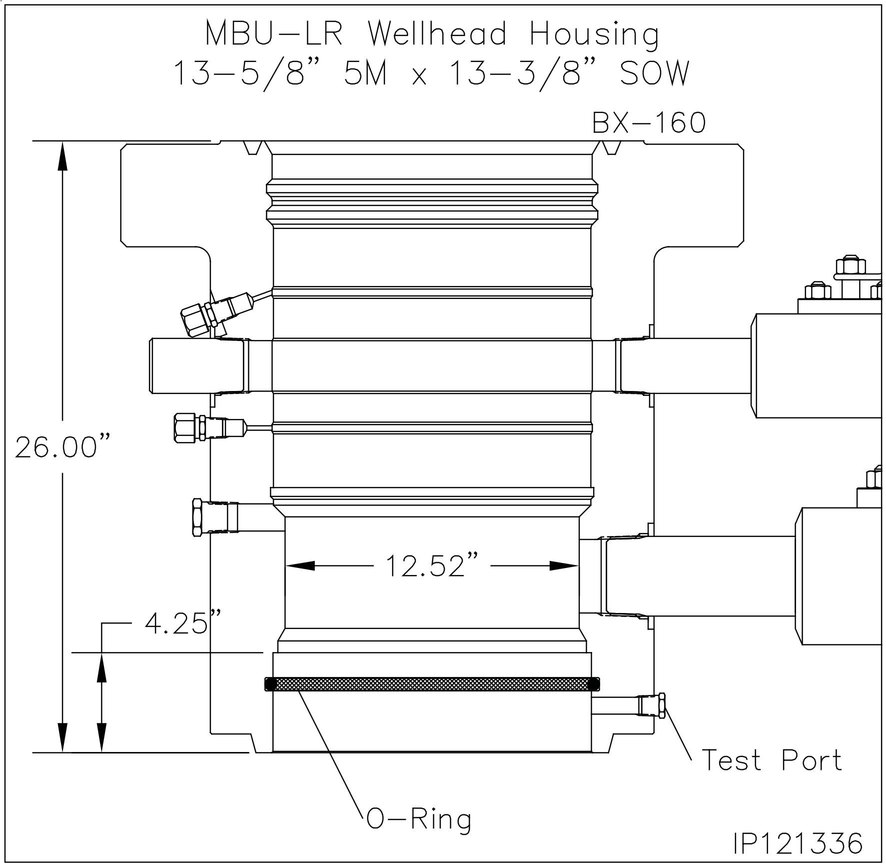
1. Run the conductor and 13-3/8" surface casing to the required depth and cement as required.

2. Determine the correct elevation for the MBU-LR Wellhead Assembly.

3. Cut the 13-3/8" at 53.5" below the cellar to accommodate the wellhead. Grind stub level with the horizon and place an 1/8" x 1/8" bevel on the OD of the stub.

Note: The slip on and weld preparation is 4.25" in depth.

4. Examine the ***13-5/8" 5M x 13-3/8" SOW MBU-LR Wellhead Assembly (Item A1)***. Verify the following:
   - bore is clean and undamaged
   - weld socket is clean and free of grease and debris and o-ring is in place and in good condition
   - all seal areas are clean and undamaged
   - valves are intact and in good condition



5. Align and level the Wellhead Assembly over the casing stub, orienting the outlets so they will be compatible with the drilling equipment.

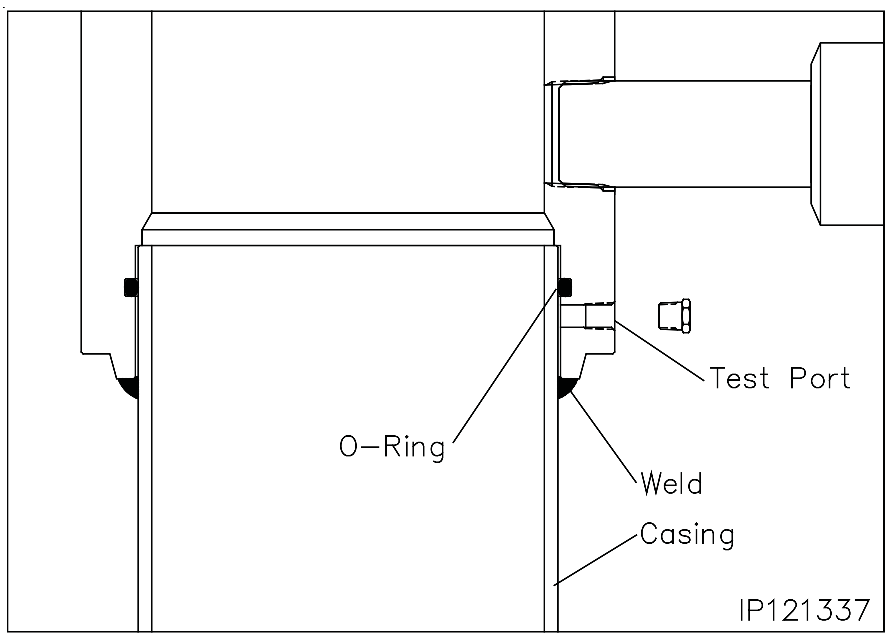
6. Remove the pipe plug from the port on the bottom of the Head.

7. Slowly and carefully lower the assembly over the casing stub, weld and test the MBU-LR housing to the surface casing.

8. Replace the pipe plug in the port on the bottom of the housing.

Note: The weld should be a fillet-type weld with legs no less than the wall thickness of the casing. Legs of 1/2" to 5/8" are adequate for most jobs.

Refer to the back of this publication for the **Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal** and for field testing of the weld connection.

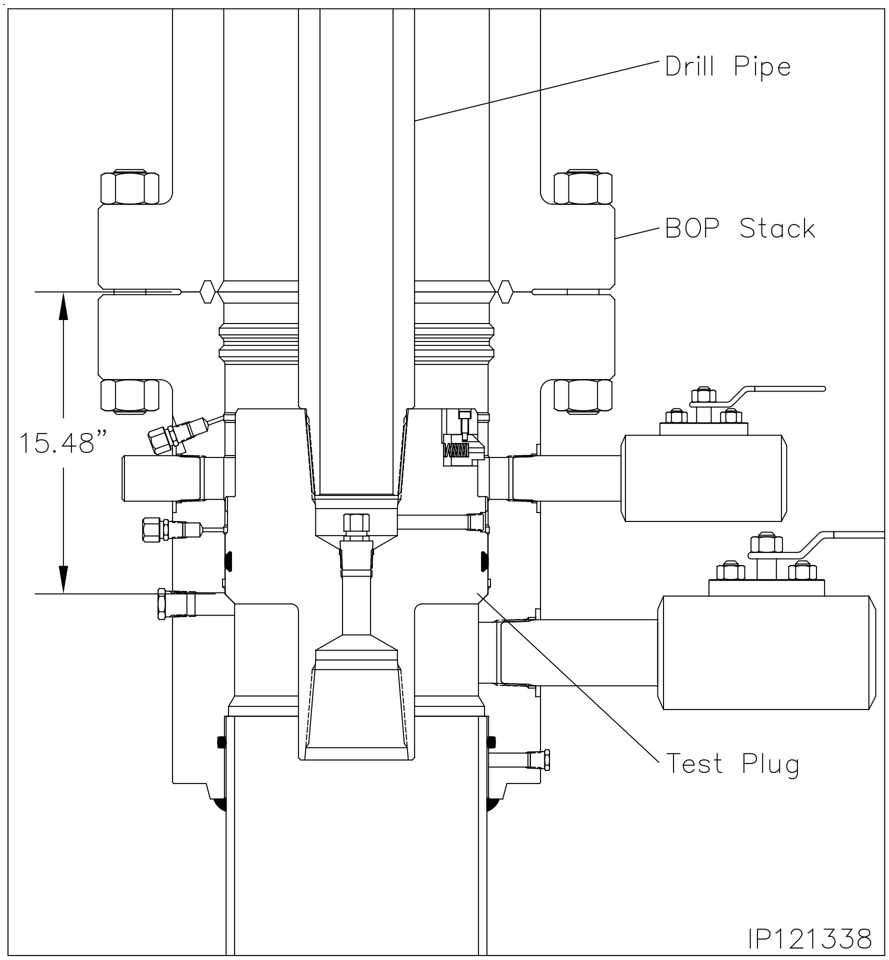


Stage 2 — Test the BOP Stack

Immediately after making up the BOP stack and periodically during the drilling of the well for the next casing string the BOP stack (connections and rams) must be tested.

1. Examine the ***13-5/8" Nominal x 4-1/2" IF CW Test Plug/ Retrieving Tool (Item ST1)***. Verify the following:
   - 1-1/4" VR plug and weep hole plug are in place and tightened securely
   - elastomer seal is in place and in good condition
   - retractable lift lugs are in place, clean, and free to move
   - drill pipe threads are clean and in good condition

Note: Prior to installing the BOP it is recommended to attain an accurate RKB dimension for future use for accurately landing test plugs and casing hangers. This dimension is attained by dropping a tape measure from the rig floor to the top of the wellhead flange. Pull tape taut and record the dimension from the wellhead to the top of the rig floor or kelly bushings. Ensure this dimension is placed on the BOP board in the dog house and on the drillers daily report sheet.



2. Position the test plug with the elastomer seal down and the lift lugs up and make up the tool to a joint of drill pipe.

WARNING: Ensure that the lift lugs are up and the elastomer seal is down

3. Remove the 1/2" NPT pipe plug from the weep hole if pressure is to be supplied through the drill pipe.

4. Open the housing side outlet valve.

5. Lightly lubricate the test plug seal with oil or light grease.

6. Carefully lower the test plug through the BOP and land it on the load shoulder in the housing, 15.48" below the top of the housing.

7. Close the BOP rams on the pipe and test the BOP to 5,000 psi.

Note: Any leakage past the test plug will be clearly visible at the open side outlet valve.

8. After a satisfactory test is achieved, release the pressure and open the rams.

9. Remove as much fluid as possible from the BOP stack and the retrieve the test plug with a straight vertical lift.

Note: When performing the BOP blind ram test it is highly recommended to suspend a stand of drill pipe below the test plug to ensure the plug stays in place while disconnecting from it with the drill pipe.

10. Repeat this procedure as required during the drilling of the hole section.

Stage 3 — Run the Lower Wear Bushing

Note: Always use a Wear Bushing while drilling to protect the load shoulders from damage by the drill bit or rotating drill pipe. The Wear Bushing **must be retrieved** prior to running the casing.

1. Examine the ***13-5/8" Nominal MBU-LR-LWR Wear Bushing (Item ST2).*** Verify the following
   - internal bore is clean and in good condition
   - o-ring is in place and in good condition
   - shear o-ring cord is in place and in good condition
   - paint anti-rotation lugs white and allow paint to dry

Run the Wear Bushing Before Drilling

2. Orient the ***13-5/8" Nominal x 4-1/2" IF CW Test Plug/Retrieving Tool (Item ST1)*** with drill pipe connection up.

3. Attach the Retrieving Tool to a joint of drill pipe.

4. Align the retractable lift lugs of the tool with the retrieval holes of the bushing and the carefully lower the tool into the Wear Bushing until the lugs snap into place.

Note: If the lugs did not align with the holes, rotate the tool in either direction until they snap into place.

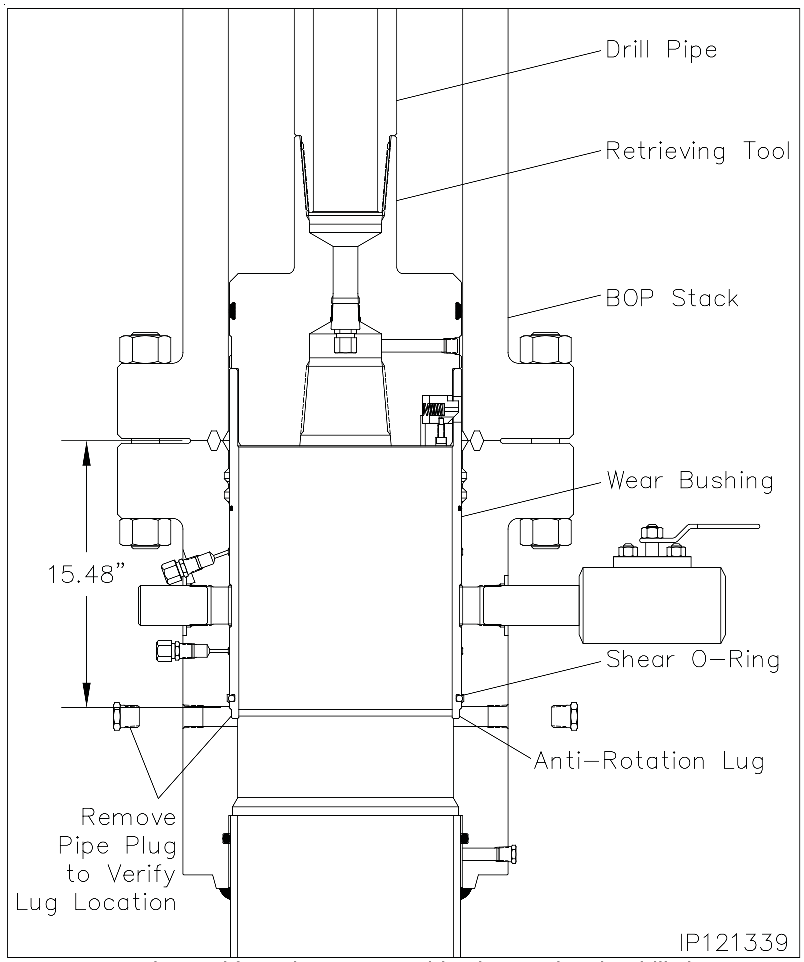
5. Apply a heavy coat of grease, not dope, to the OD of the bushing.

6. Slowly lower the Tool/Bushing Assembly through the BOP stack and land it on the load shoulder in the housing, 15.48" below the top of the housing.

7. Rotate the drill pipe clockwise (right) to locate the stop lugs in their mating notches in the head. When properly aligned the bushing will drop an additional 1/2".

8. Remove one of the 1" sight port pipe plugs from the OD of the housing and look through the hole to verify the lug has engaged the slot. The painted lug will be clearly visible through the port. Reistall the pipe plug and tighten securely.

Note: The Shear O-Ring on bottom of the bushing will locate in a groove above the load shoulder in the head to act as a retaining device for the bushing.



9. Remove the Tool from the Wear Bushing by rotating the drill pipe counter clockwise (left) 1/4 turn and lifting straight up.

10. Once set is highly recommended to inject a minimum of two full tubes of grease through the housing test ports To keep trash from accumulating behind the bushing.

11. Drill as required.

Note: It is highly recommended to retrieve, clean, inspect, grease, and reset the wear bushing each time the hole is tripped during the drilling of the hole section.

Retrieve the Wear Bushing After Drilling

12. Make up the Retrieving Tool to the drill pipe .

13. Slowly lower the Tool into the Wear Bushing.

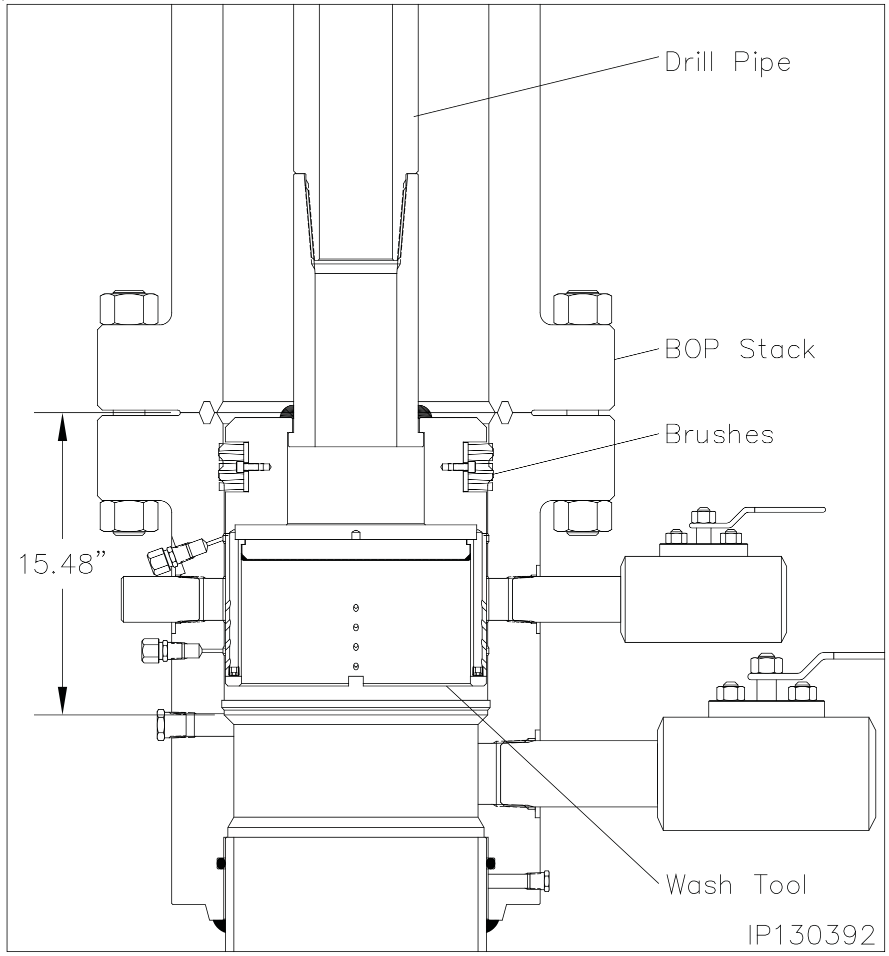
14. Pick up and balance the riser weight.

15. Rotate the Retrieving Tool clockwise until a positive stop is felt. This indicates the lugs have snapped into the holes in the bushing.

16. Retrieve the Wear Bushing, and remove it and the Retrieving Tool from the drill string.

Stage 4 — Hang Off the 9-5/8" Casing

Due to the possible build up of debris in the bore and lockring groove of the MBU-LR wellhead it is recommended to run the 13-5/8" Wash Tool prior to running the 9-5/8 casing.



Running the 13-5/8" Wash Tool

1. Examine the ***13-5/8" x 4-1/2" IF Wash Tool (Item ST7).*** Verify the following:
   - drill pipe threads and bore are clean and in good condition
   - all ports are open and free of debris
   - brushes are securely attached and in good condition

2. Orient the Wash Tool with drill pipe box up. Make up a joint of drill pipe to the tool.

3. Carefully lower the Wash Tool through the BOP and land it on top of the 9-5/8" casing hanger, 15.48" below the top flange of the housing.

4. Place a paint mark on the drill pipe level with the rig floor and then pick up on the tool approximately 1".

5. Attach a high pressure water line to the end of the drill pipe and pump water through the tool and up the Diverter stack.

6. While flushing, raise and lower the tool the full length of the wellhead and BOP stack. The drill pipe should be slowly rotate while raising and lowering to wash the inside of the housing and BOP stack to remove all caked on debris.

7. Once washing is complete, shut down pumps and then open the housing lower outlet valve and drain the BOP stack.

Note: If returns are not clean, continue flushing until they are.

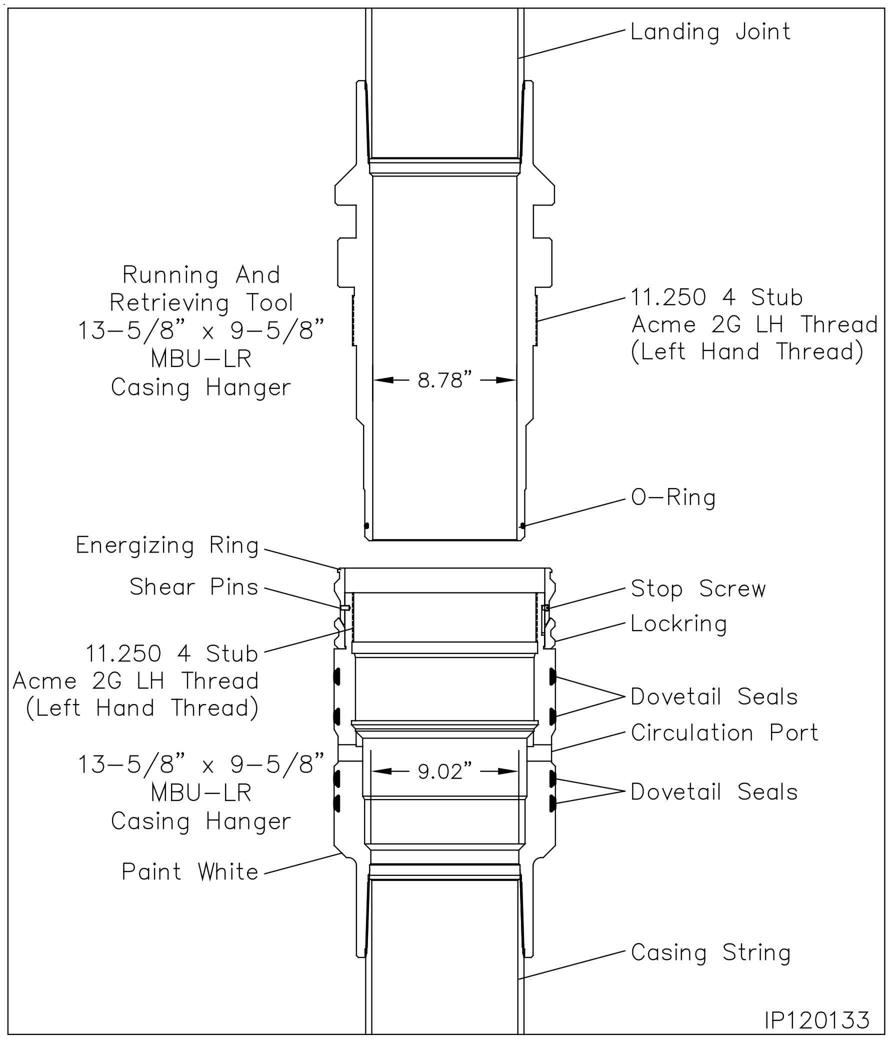
8. Once the returns are clean and free of debris, retrieve the tool to the rig floor.

Stage 4 — Hang Off the 9-5/8” Casing

The 9-5/8” MBU-LR casing hanger and running and retrieving tool should be shipped to location pre assembled as a full joint. If not, follow steps 1 through for assembling on the pipe rack.

1. Examine the ***13-5/8” x 9-5/8” LC MBU-LR Casing Hanger (Item A7)***. Verify the following:
   - bore and internal Acme threads are clean and in good condition
   - lockring is in place and free to rotate
   - energizing ring is in its upper most position and secured with shear pins
   - dovetail seals are clean and in good condition
   - pup joint is in good condition and properly made up. Thoroughly clean, inspect, and lubricate pin threads
   - paint the 45° load shoulder white as indicated

2. Examine the ***13-5/8” x 9-5/8” LC MBU-LR Casing Hanger Running and Retrieving Tool (Item ST3)***. Verify the following:
   - bore is clean and free of debris
   - O.D. Acme threads are clean and in good condition
   - o-ring is in place and in good condition
   - proper length landing joint is made up in top of the tool with thread lock compound



Cactus Wellhead

Stage 4 — Hang Off the 9-5/8" Casing

3. Thoroughly clean and lightly lubricate the mating Acme threads and seal surfaces of the hanger and running tool.

4. Carefully slide the running tool into the hanger and then rotate the tool clockwise (Right) to locate the thread start and then counter clockwise (Left) approximately 8 turns or until the tool makes contact with the top of the energizing ring.

WARNING: Do Not apply torque to the Hanger/Tool connection.

5. Run the 9-5/8" casing as required and space out appropriately for the mandrel casing hanger.

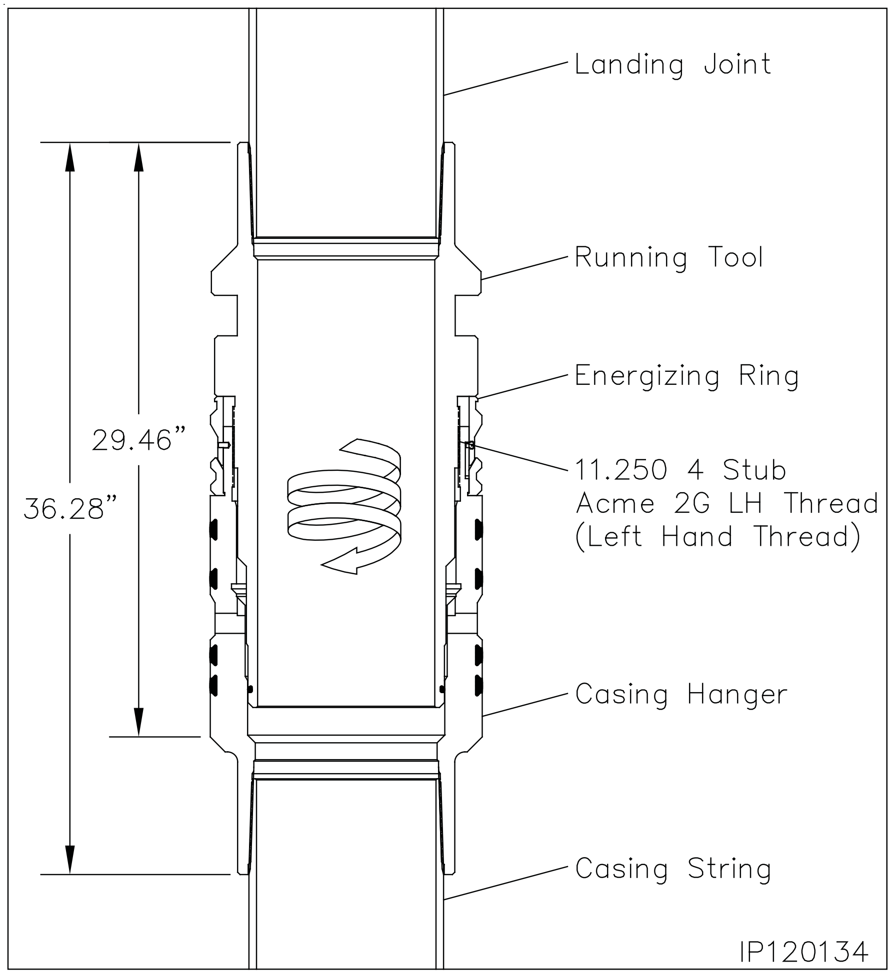
Note: If the 9-5/8" casing becomes stuck and the mandrel casing hanger can not be landed, Refer to **Stage 4A** for the emergency procedure.

6. Set the last joint of casing run in the floor slips.

7. Pick up the casing hanger/running tool assembly and make it up in the casing string. Torque connection to thread manufacturer's optimum make up torque.

8. ***Using chain tongs only***, back off the running tool with clockwise rotation (Right) one full turn to verify ease of operation and then re make the connection with counter clockwise rotation (Left) just until contact with the energizing ring is.

WARNING: Do Not apply torque to the Hanger/Tool connection.



Stage 4 — Hang Off the 9-5/8" Casing

9. Calculate the total landing dimension by adding the previously attained RKB dimension and 15.48", the depth of the wellhead.

10. Drain the BOP stack and wellhead through the 3" ball valve.

11. Starting at the top of the 45° angle load shoulder of the casing hanger measure up 5 feet and place a horizontal paint mark on the landing joint and write 5 next to the mark.

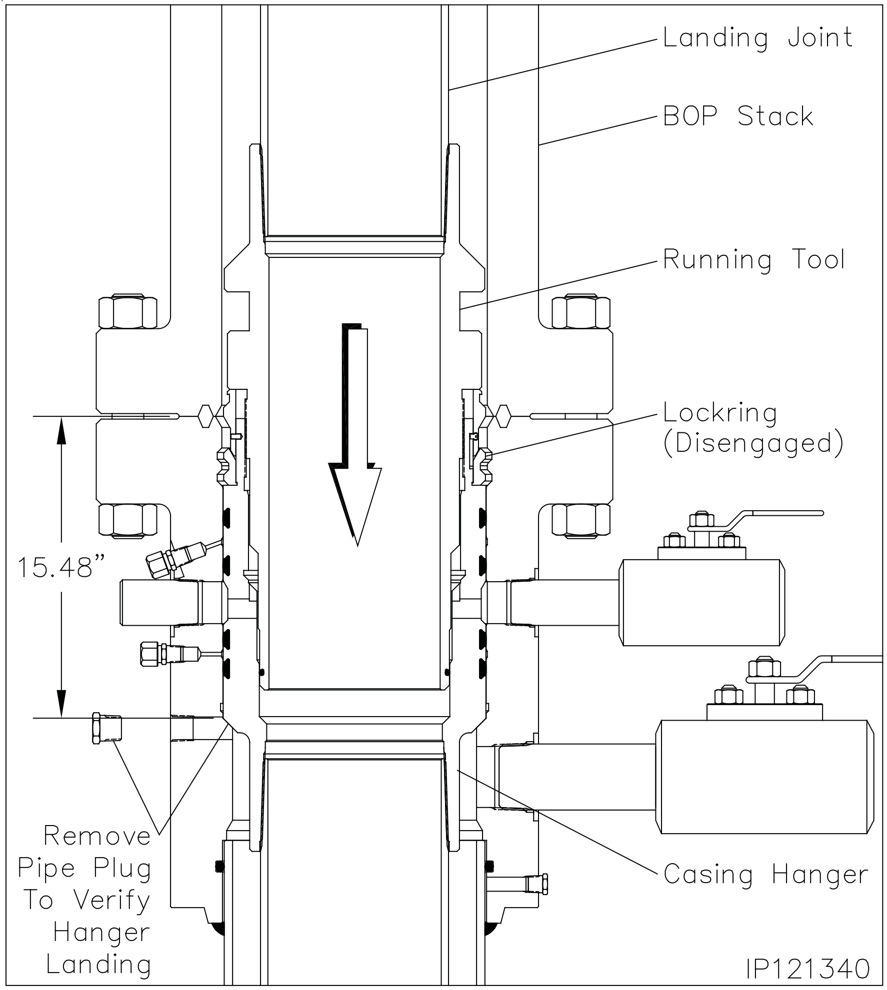
12. Using the 5 foot stick, slowly and carefully lower the Hanger through the BOP, marking the landing joint at five foot increments until you come to the calculated total landing dimension. Place a paint mark on the landing joint at that dimension and write the landing dimension next to the mark. Place an additional mark on the landing joint 1-1/2" above the first mark and write engaged.

13. Continue carefully lowering the hanger through the BOP stack and land it on the load shoulder in the housing, 15.48" below the top of the MBU-LR housing and slack off all weight and verify that the landing dimension paint mark has aligned with the rig floor.

14. Locate the 1" LP sight port on the lower O.D. of the housing and remove the pipe plug.

15. Look through the port to verify the hanger is properly landed. The white painted load shoulder will be clearly visible in the open port.

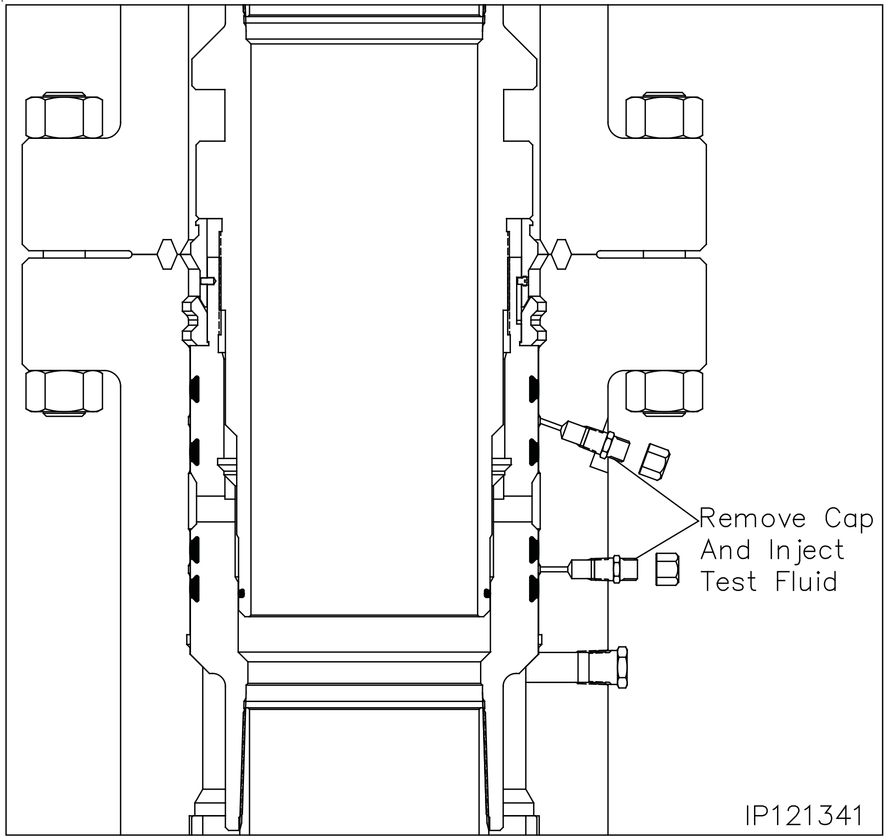
16. Reinstall the 1" pipe plug and tighten securely.



Stage 4 — Hang Off the 9-5/8" Casing

Seal Test

17. Locate the upper and lower seal test fittings on the O.D. of the housing and remove the dust caps from both fittings.
18. Attach a test pump to one of the open fittings and pump clean test fluid between the seals until a stable test pressure of 5,000 psi is attained.
19. If a leak develops, bleed off test pressure, remove the hanger from the wellhead and replace the leaking seals.
20. Repeat steps 17 through 19 for the remaining seal test.
21. After satisfactory test are achieved, bleed off all test pressure, remove test pump and reinstall the dust caps on the open fittings



Stage 4 — Hang Off the 9-5/8” Casing

Engaging the Lockring

22. Using Chain Tongs Only located 180° apart, , rotate the landing joint approximately 6 turns counter clockwise (Left) to engage the casing hanger lockring in its mating groove in the bore of the MBU-LR housing.

Note: Approximately 800 to 900 ft. lbs. of torque will be required to break over the shear pins in the hanger. The torque will drop off and then increase slightly when the energizing ring pushes the lockring out. A positive stop will be encountered when the lockring is fully engaged.

Note: When properly engaged the second paint mark on the landing joint will align with the rig floor.

WARNING: It is imperative that the landing joint remain concentric with the well bore when rotating to engage the lockring. This can be accomplished with the use of the air hoist.

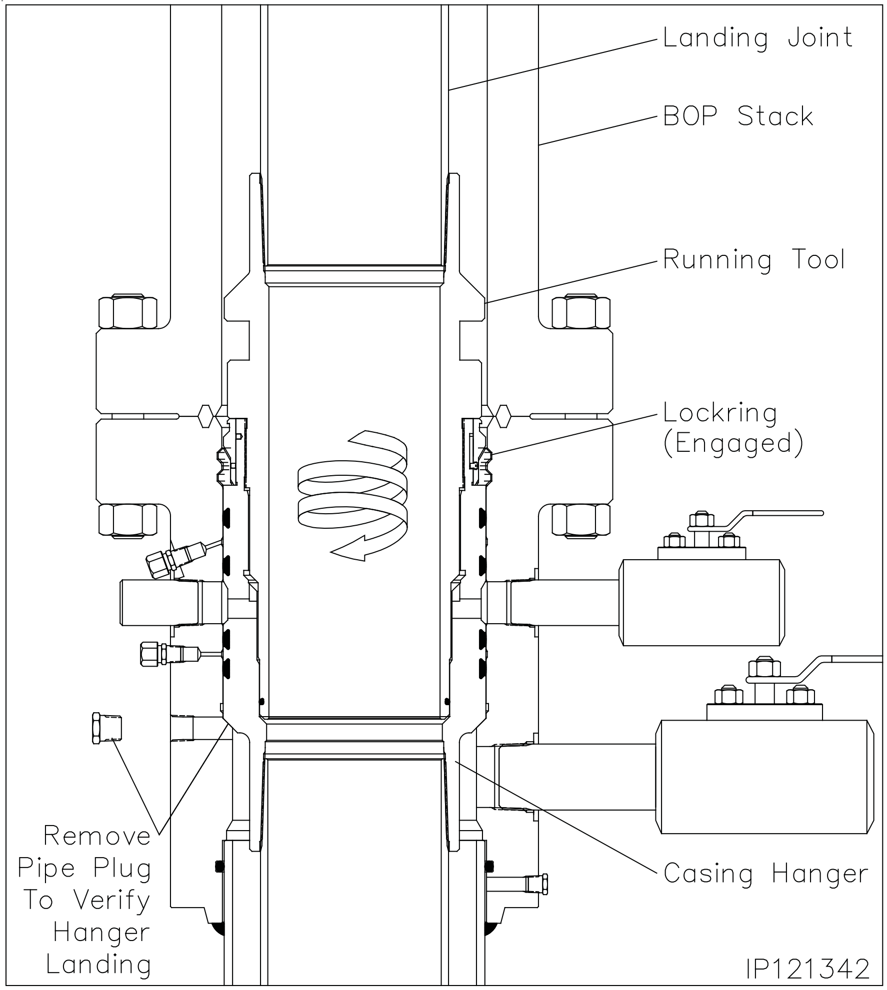
WARNING: If the required turns to engage the lockring or not met or excessive torque is encountered, remove the casing hanger and call Houston Engineering.

23. Back off the landing joint/running tool approximately three turns clockwise (Right). Using the elevators, exert a 30,000 lbs. over string weight pull on the landing joint to confirm positive lockring engagement.

24. Slack off all weight and place a vertical paint mark on the landing joint to verify if the casing string rotates during the cementing process.

Note: It is not necessary to remake the casing hanger running tool connection after the over pull. If desired two counter clockwise rotations may be made but full make up is not required.

25. Cement the casing as required, taking returns through the lower 3” outlet.



26. With cement in place, bleed off cement pressure and remove cementing equipment.

27. If well condition permit, remove the 1” sight port pipe plug to observe if the hanger rotates during the removal of the running tool.

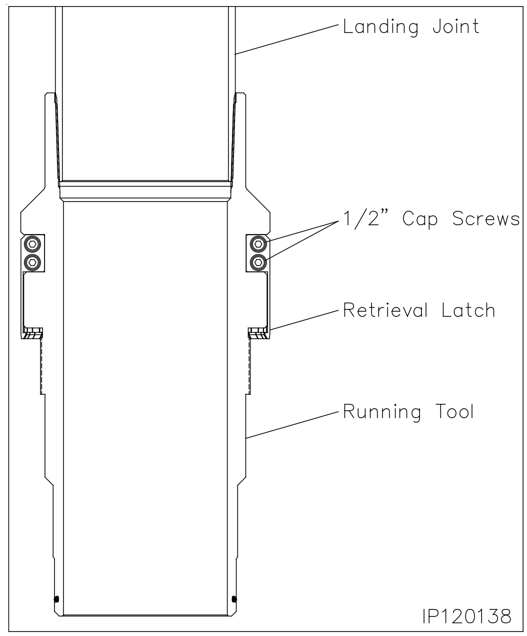
28. Using Chain Tongs Only located 180° apart, retrieve the Running Tool and landing joint by rotating the landing joint clockwise (Right) an additional 11 turns or until the tool comes free of the hanger. Retrieve the tool with a straight vertical lift.

29. Reinstall the 1” pipe plug and tighten securely.

Stage 4 — Hang Off the 9-5/8” Casing

Retrieving The Casing Hanger

In the event that the casing hanger needs to be remove the 13-5/8” x 9-5/8” MBU-LR Casing Hanger Running and retrieving tool can be fitted with a retrieval latch that will lift the casing hanger energizing ring and allow the lockring to disengage.



1. Examine the ***13-5/8” x 9-5/8” LC MBU-LR Casing Hanger Running and Retrieving Tool (Item ST3)***. Verify the following:
   - bore is clean and free of debris
   - O.D. Acme threads are clean and in good condition
   - o-ring is in place and in good condition
   - proper length landing joint is made up in top of the tool with thread lock compound
   - retrieval latch is available and in good condition

2. Thoroughly clean and lightly the latch groove of the tool with oil or light grease.

3. Remove the (4) 1/2” cap screws retaining the two halves of the retrieval latch.

4. Install the retrieval latch around the Retrieving Tool body as indicated and reinstall the 1/2” cap screws. Tighten screws securely.

WARNING: Ensure the latch rotates freely on the tool. If not remove and check the latch and tool for burrs or imperfections in the groove.

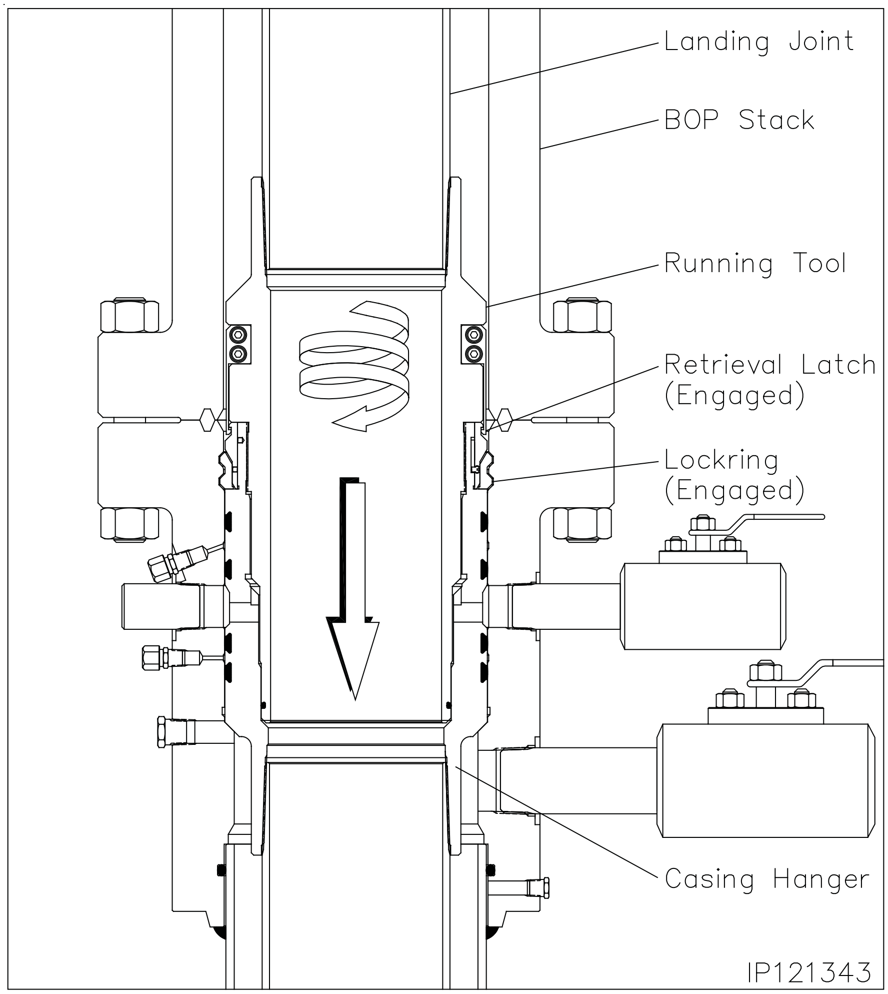
5. Thoroughly clean and lightly lubricate the seal surfaces and Acme threads of the tool with oil or a light grease.

6. Using the casing elevators, carefully lower the tool through the BOP stack and into the casing hanger bore until the tool contacts the top of the hanger Acme threads

Note: Contact should be made at previously attained RKB dimension.

7. **Using chain tongs only located 180° apart**, rotate the landing joint clockwise (Right) to locate the thread start then counter clockwise (Left) approximately 13 turns.

WARNING: Slowly make the last two revolutions. The torque will increase slightly as the latch passes over the top of the energizing ring and snaps into position under the lip of the ring.



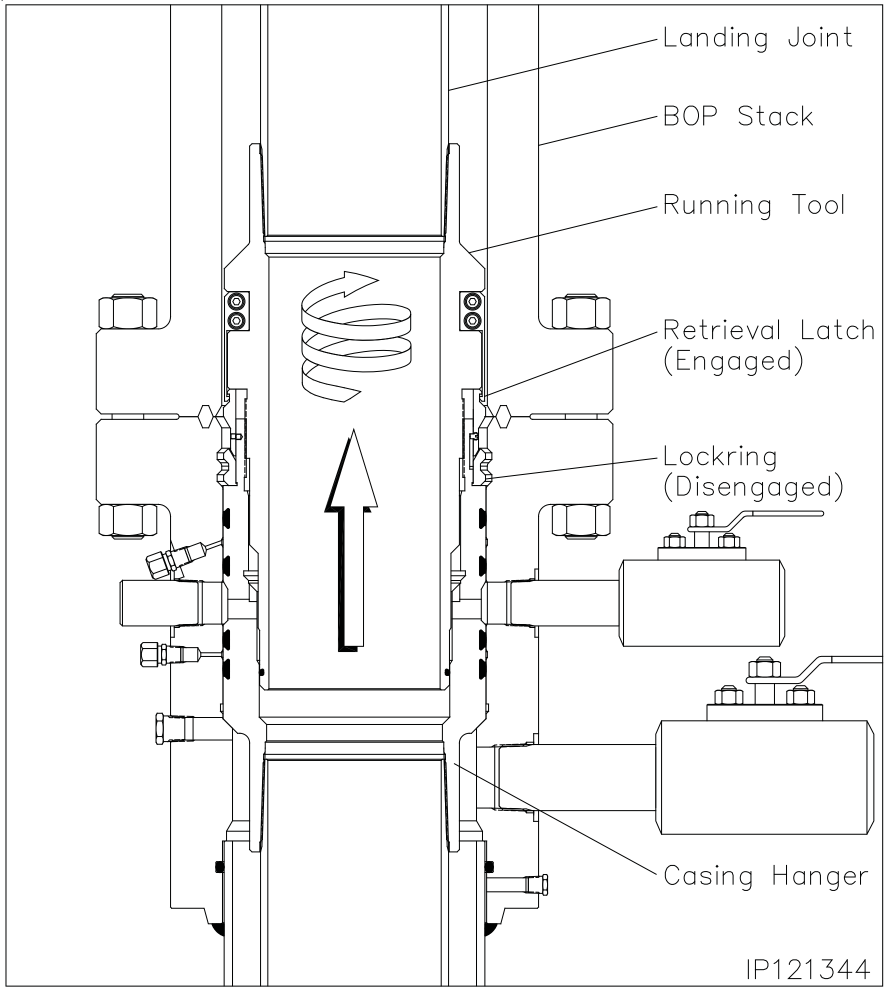
Stage 4 — Hang Off the 9-5/8” Casing

WARNING: The landing joint must remain concentric with the well bore when screwing into the hanger.

8. With positive engagement attained, reposition the tongs for clockwise (Right) rotation and then rotate the landing joint approximately 6 turns to lift the energizing ring and release the lockring.

Note: The landing joint should rise approximately 1-1/2” and come to a positive stop against the stop screws.

9. Halt rotation and remove the chain tongs.
10. Using the drill pipe elevators, slowly pick up on the casing hanger and retrieve it from the wellhead.
11. With the tool and hanger at the rig floor, set the casing in the floor slips and slack off.
12. Rotate the landing joint counter clockwise (Left) one turn.
13. Remove the (4) 1/2” cap screws from the retrieval latch and remove the latch assembly from the tool.
14. Remove the casing hanger and running tool from the casing string.



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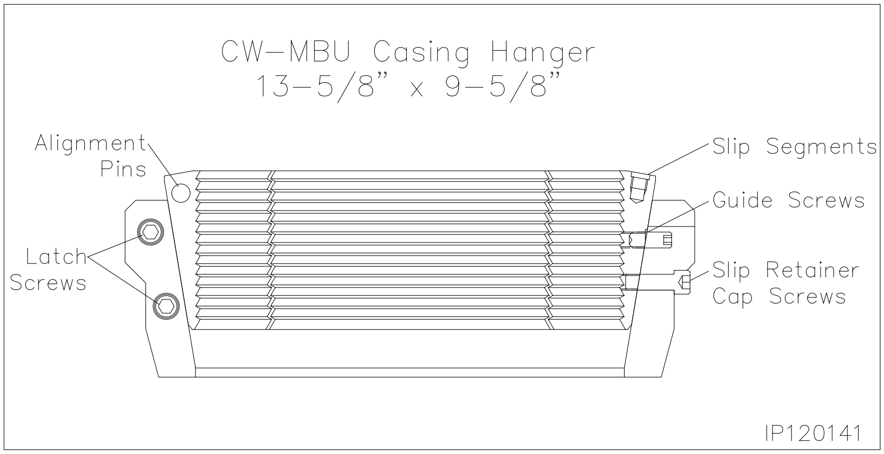
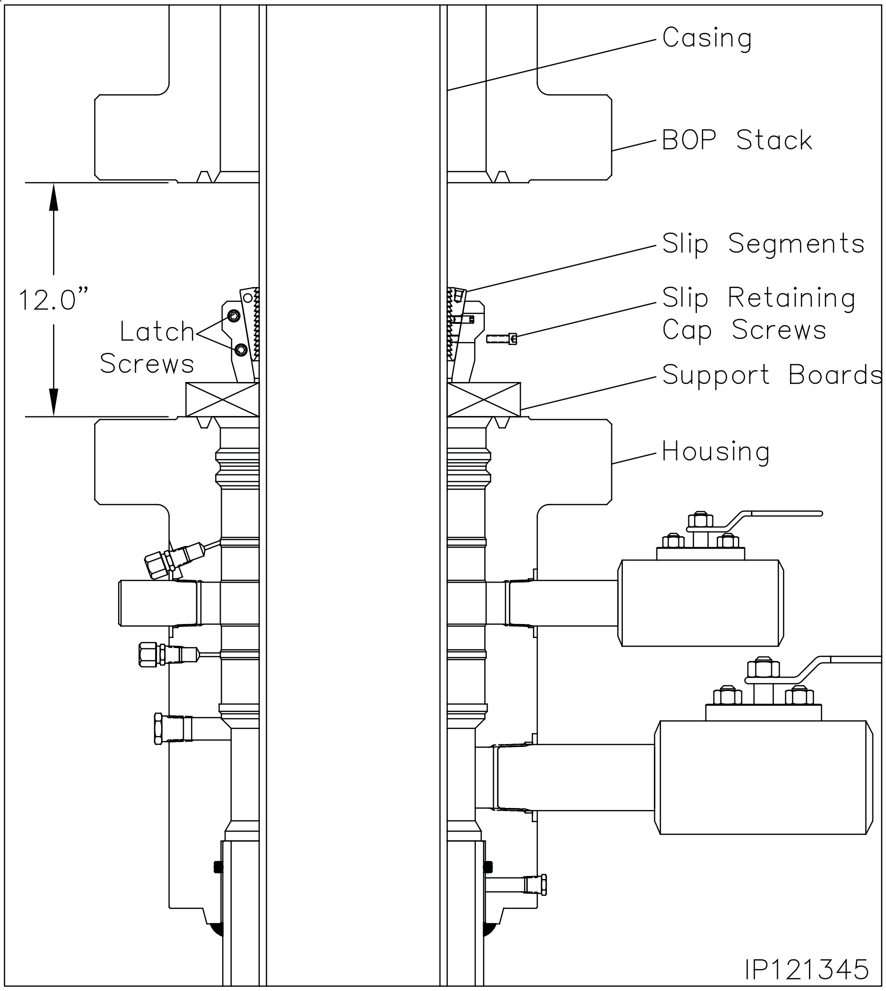
Stage 4A — Hang Off the 9-5/8” Casing (Emergency)

Note: The following procedure should be followed **ONLY** if the 9-5/8” casing should become stuck in the hole. If the casing did not get stuck and is hung off with the Mandrel Casing Hanger, skip this stage.

1. Cement the hole as required.
2. Drain the BOP stack through the housing side outlet valve.
3. Separate the connection between the BOP and the MBU-LR housing.
4. Pick up on the BOP stack a minimum of 12” and secure with safety slings.
5. Washout as required.
6. Examine the ***13-5/8” x 9-5/8” MBU Slip Casing Hanger (Item A7a).*** Verify the following:
    - slips and internal bore are clean and in good condition
    - all screws are in place
7. There are two latch screws located in the top of the casing hanger. Using a 5/16” Allen wrench, remove the two latch screws located 180° apart and separate the hanger into two halves.
8. Place two boards on the housing flange against the casing to support the Hanger.
9. Pick up one half of the hanger and place it around the casing and on top of the boards.
10. Pick up the second hanger half and place it around the casing adjacent the first half.
11. Slide the two hanger halves together ensuring the slip alignment pins properly engage the opposing hanger half.
12. Reinstall the latch screws and tighten securely.





Stage 4A — Hang Off the 9-5/8" Casing (Emergency)

13. Prepare to lower the Hanger into the housing bowl.

WARNING: Do Not Drop the Casing Hanger!

14. Grease the Casing Hanger's body and remove the slip retaining screws.

15. Remove the boards and allow the Hanger to slide into the housing bowl. When properly positioned the top of the hanger will be approximately 14.05" below the top of the housing.

16. Pull tension on the casing to the desired hanging weight and then slack off.

Note: A sharp decrease on the weight indicator will signify that the Hanger has taken weight and at what point, If this does not occur, pull tension again and slack off once more.

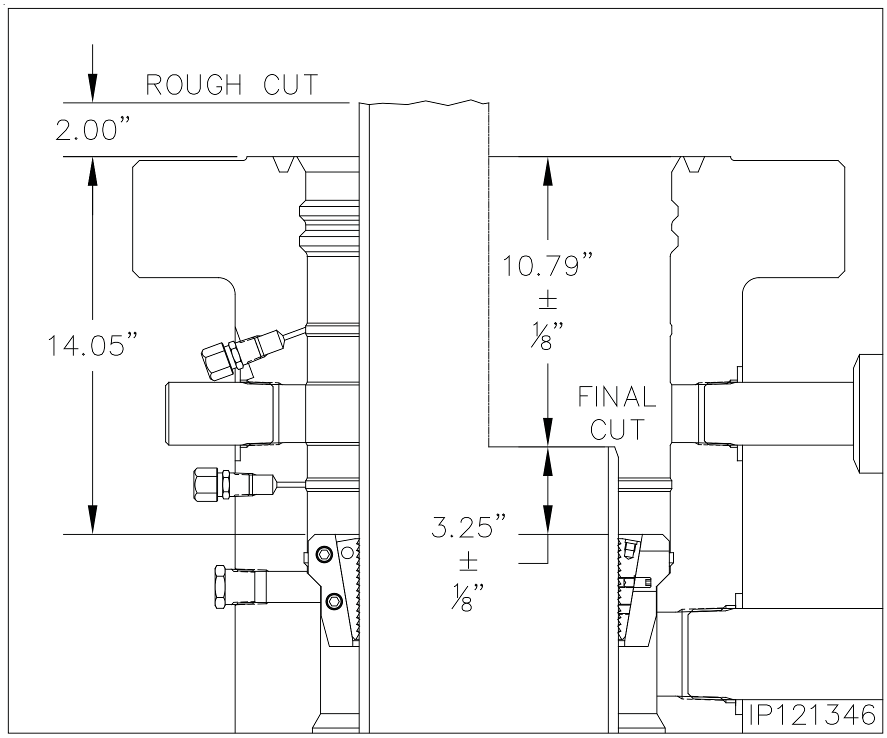
WARNING: Because of the potential fire hazard and the risk of loss of life and property, It is highly recommended to check the casing annulus and pipe bore for gas with an approved sensing device prior to cutting off the casing. If gas is present, do not use an open flame torch to cut the casing. It will be necessary to use a air driven mechanical cutter which is spark free.

17. Rough cut the casing approximately 2" above the top flange and move the excess casing out of the way.

WARNING: Install the long wear bushing in the housing to ensure the housing bore is not damaged with the torch or cutting debris.

18. Final cut the casing at 10.79" ± 1/8" below the housing flange or 3.25" ± 1/8" above the hanger body.

19. Grind the casing stub level and then place a 3/16" x 3/8" bevel on the O.D. and a I.D. chamfer to match the minimum bore of the packoff to be installed.



Note: There must not be any rough edges on the casing or the seals of the Packoff will be damaged.

20. Remove the wear bushing and then thoroughly clean the housing bowl, removing all cement and cutting debris.

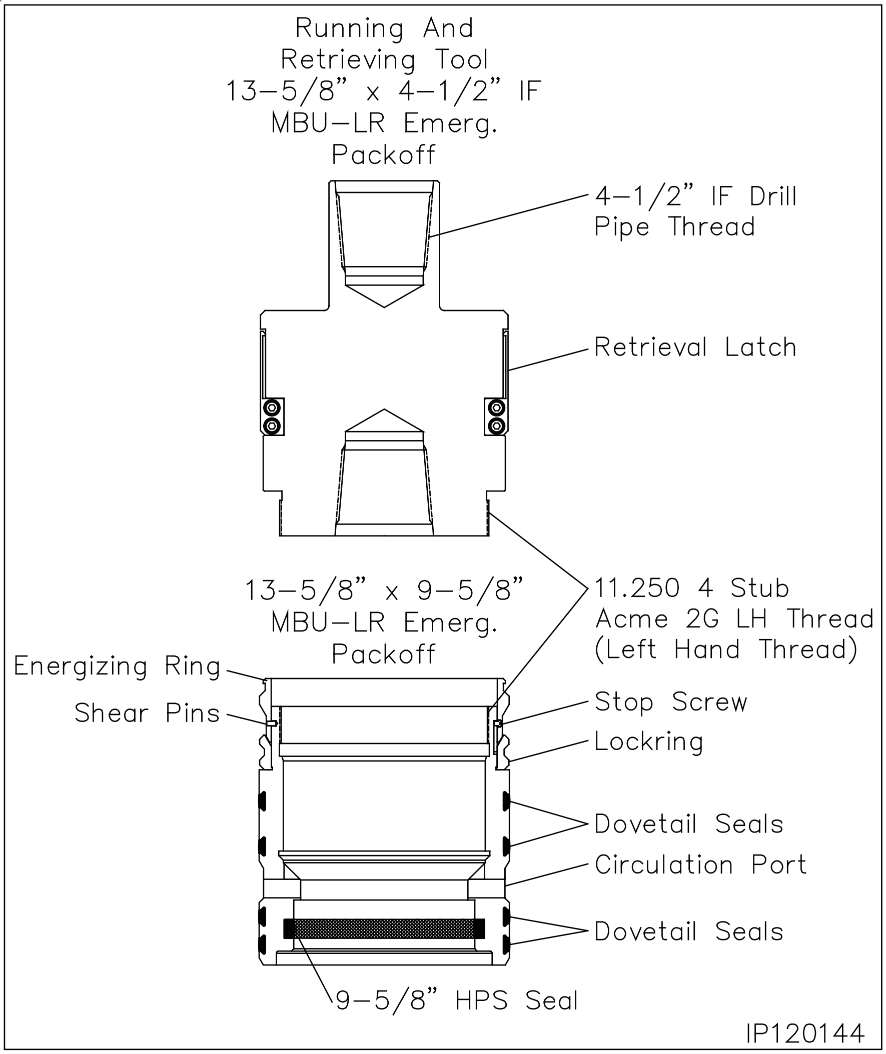
Stage 4B — Install the 9-5/8" MBU-LR Emergency Packoff

The following steps detail the installation of the CW MBU-LR Packoff Assembly for the emergency casing hanger.

1. Examine the ***13-5/8" Nominal x 9-5/8" x 11.250" 4 Stub Acme 2G LH box top MBU-LR Packoff Assembly (Item A7b).*** Verify the following:
   - all elastomer seals are in place and undamaged
   - internal bore, and ports, are clean and in good condition
   - lockring is fully retracted
   - energizer ring is in its upper most position and retained with shear pins
   - anti-rotation plunger is in place, free to move

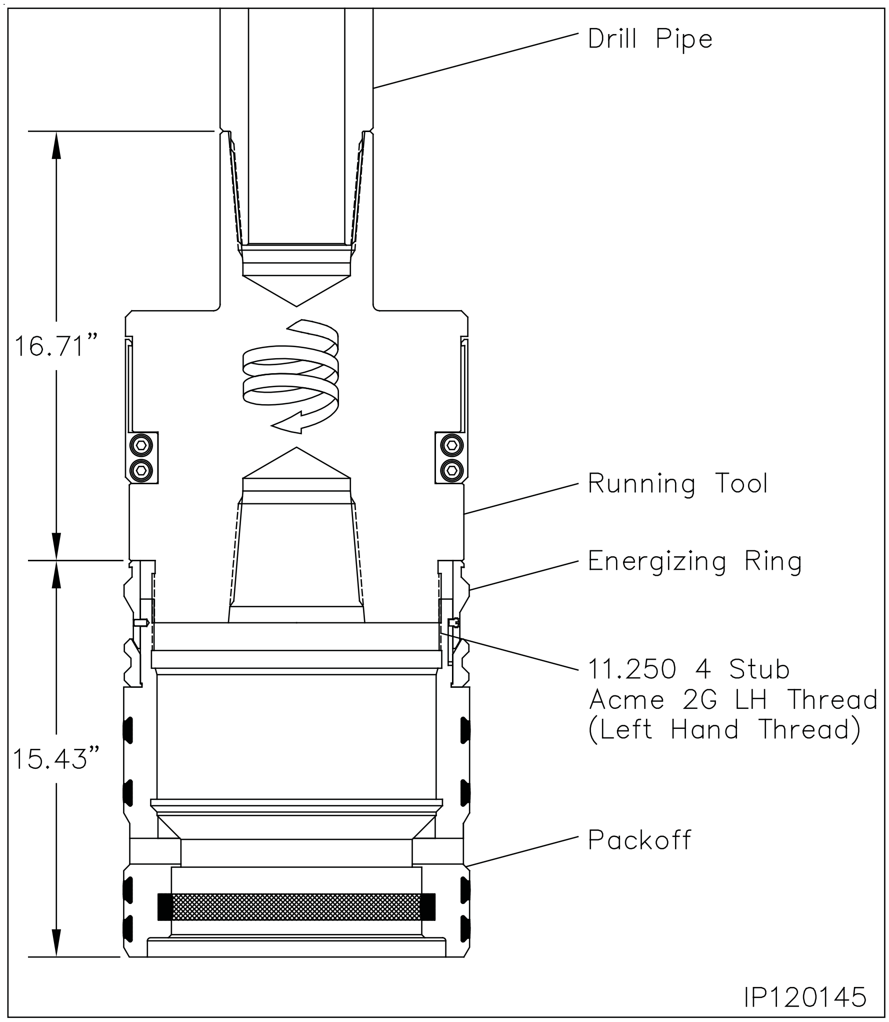
2. Lubricate the ID of the 'HPS' seal and the OD of the dovetail seals liberally with a light oil or grease.

3. Examine the ***13-5/8" Nominal x 4-1/2" IF x 11.250" 4 Stub Acme 2G LH box top MBU-LR Packoff Running Tool (Item ST4).*** Verify the following:
   - Acme threads are clean and in good condition
   - actuation sleeve is clean, in good condition and rotates freely
   - retrieval latch is removed and stored is safe place



Stage 4B — Install the 9-5/8” MBU-LR Emergency Packoff

4. Make up a 4-1/2” IF drill collar to the top of the Running Tool and tighten connection to thread manufacturer’s maximum make up torque.
5. Run in the hole with two stands of drill pipe and set in floor slips.
6. Thoroughly clean and lightly lubricate the mating Acme threads of the running tool and packoff with oil or light grease.
7. Pick up the packoff and carefully pass it over the drill pipe and set it on top of the floor slips.
8. Pick up the Running Tool with landing joint and make it up to the drill pipe in the floor slips.
9. Pick up the packoff and thread it onto the running tool with clockwise (Right) rotation until the Energizing Ring makes contact with the bottom shoulder of the tool. Approximately 4 turns.
10. Thoroughly clean and lightly lubricate the packoff ID ‘HPS’ seal and the OD dovetail seals with oil or light grease.



Stage 4B — Install the 9-5/8” MBU-LR Emergency Packoff

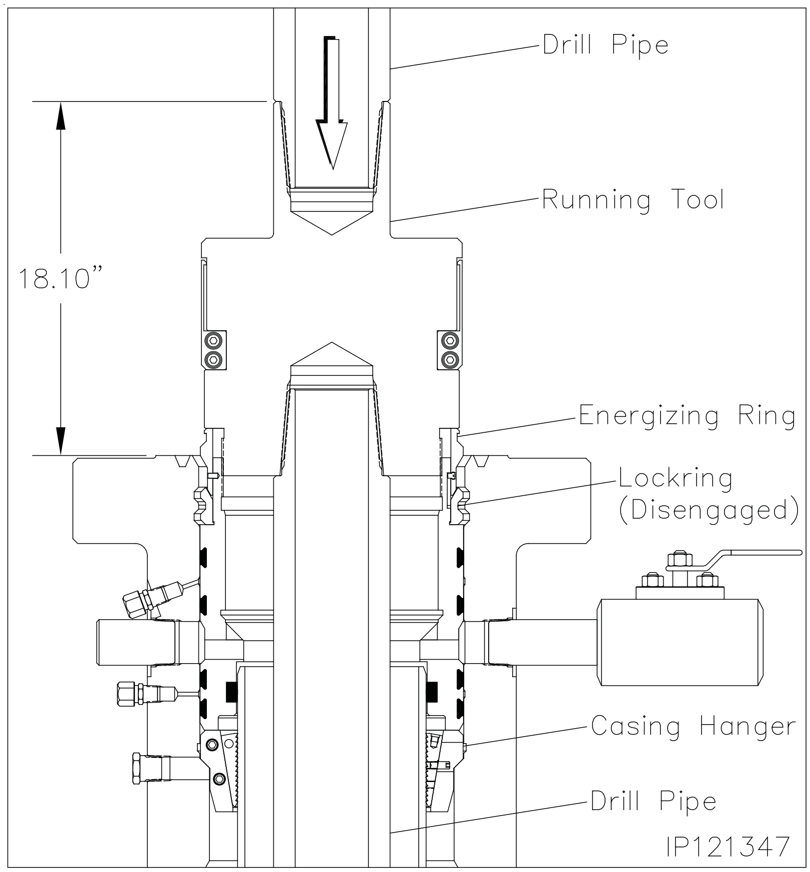
Landing the Packoff

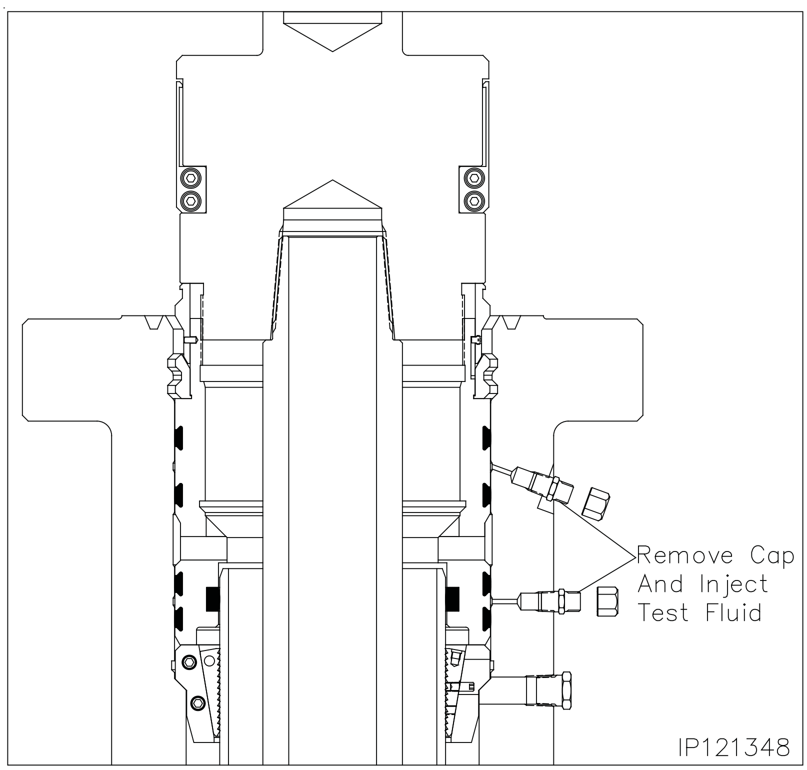
1. Pick up the drill string and remove the floor slips.
2. Carefully lower the packoff through the rig floor and into the housing until it lands on top of the slip hanger.

Note: When properly positioned the top of the running tool will be approximately 18.10” above the top of the MBU-LR Housing

Seal Test

3. Locate the upper and lower seal test fittings on the O.D. of the housing and remove the dust caps from both fittings.
4. Attach a test pump to one of the open fittings and pump clean test fluid between the seals until a stable test pressure of 5,000 psi is attained.
5. If a leak develops, bleed off test pressure, remove the hanger from the wellhead and replace the leaking seals.
6. Repeat steps 3 through 5 for the remaining seal test.
7. After satisfactory test are achieved, bleed off all test pressure, remove test pump and reinstall the dust caps on the open fittings





Stage 4B — Install the 9-5/8” MBU-LR Emergency Packoff

Engaging the Lockring

8. Using only chain tongs, rotate the landing joint approximately 6 turns counter clockwise (Left) to engage the packoff lockring in its mating groove in the bore of the MBU-LR housing.

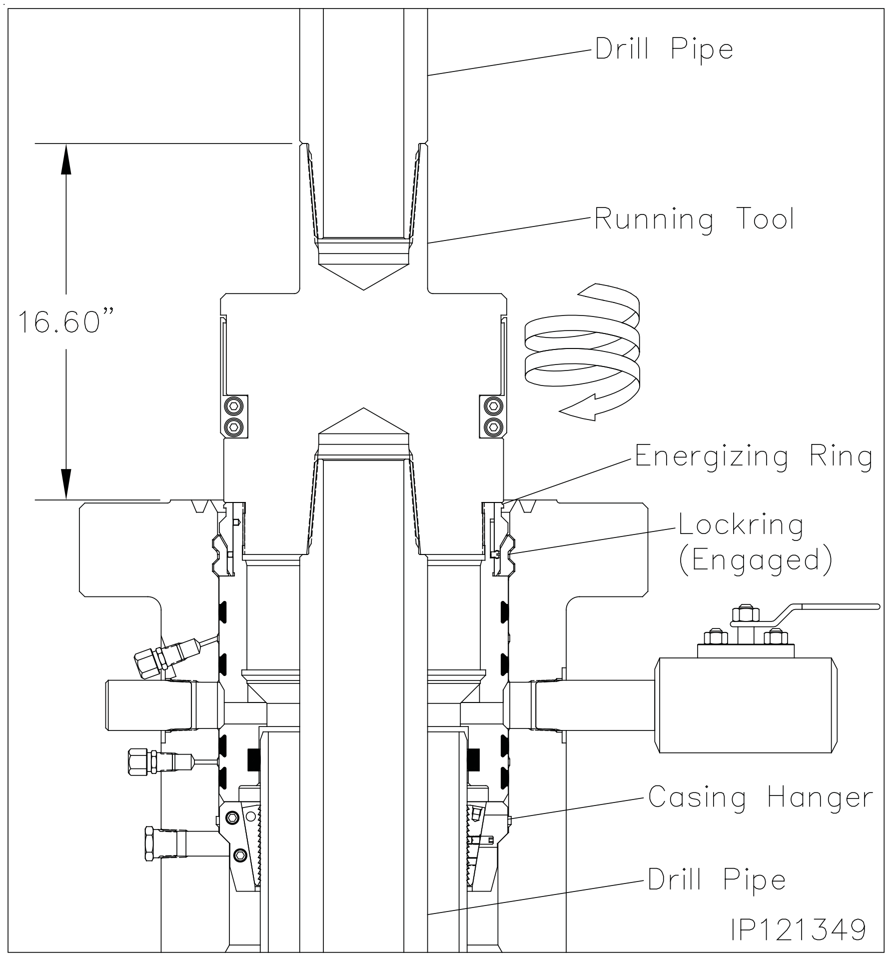
Note: Approximately 800 to 900 ft. lbs. of torque will be required to break over the shear pins in the packoff. The torque will drop off and then increase slightly when the energizing ring pushes the lockring out. A positive stop will be encountered when the lockring is fully engaged.

WARNING: It is imperative that the drill pipe landing joint remain concentric with the well bore when rotating to engage the lockring. This can be accomplished with the use of the air hoist.

WARNING: If the required turns to engage the lockring or not met or excessive torque is encountered, remove the packoff and call Houston Engineering.

9. Back off the landing joint/running tool approximately three turns. Using the drill pipe elevators, exert a 20,000 lbs. pull on the landing joint.

10. Using only chain tongs, rotate the landing joint clockwise until the tool comes free of the packoff (approximately 9 turns) and then retrieve the tool with a straight vertical lift.



Stage 4B — Install the 9-5/8" MBU-LR Emergency Packoff

In the event the packoff is required to be removed after the lockring is engaged the following procedure is to be followed.

Retrieving the Packoff

1. Locate the retrieval latch assembly with (4) 1/2" cap screws
2. Install the retrieval latch onto the running tool with the latch fingers facing down and install the cap screws and tighten them securely.
3. Ensure the retrieval latch freely rotates on the running tool actuation sleeve.
4. Carefully lower the running tool into the packoff.
5. Rotate the drill pipe clockwise (Right)to locate the thread start and then counter clockwise (Left) (approximately 10 turns) to a positive stop.

Note: At this point the retrieval latches will have passed over the energizing ring and snapped into place.

6. Rotate the drill pipe clockwise (approximately 6-1/2 turns) to a positive stop. The drill pipe should rise approximately 1-1/2".

Warning: Do not exceed the 6-1/2 turns or the packoff may be seriously damaged.

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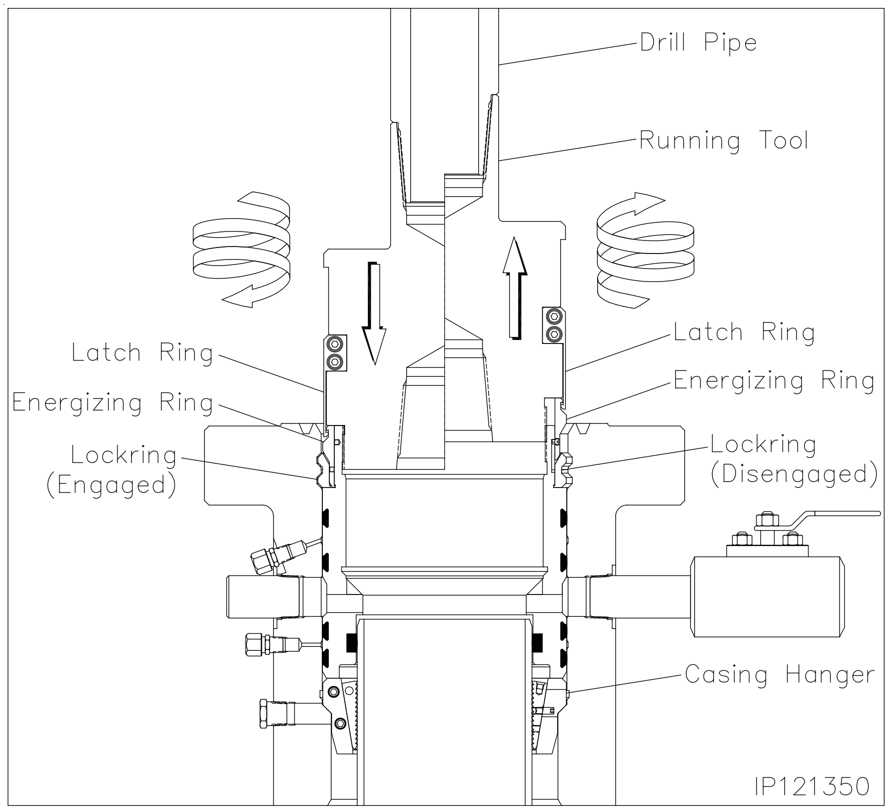
7. Carefully pick up on the drill pipe and remove the packoff from the MBU-LR wellhead with a straight vertical lift.
8. Redress the Packoff and reset as previously outlined.



Stage 5 — Test the BOP Stack

Immediately after making up the BOP stack and periodically during the drilling of the well for the next casing string the BOP stack (connections and rams) must be tested.

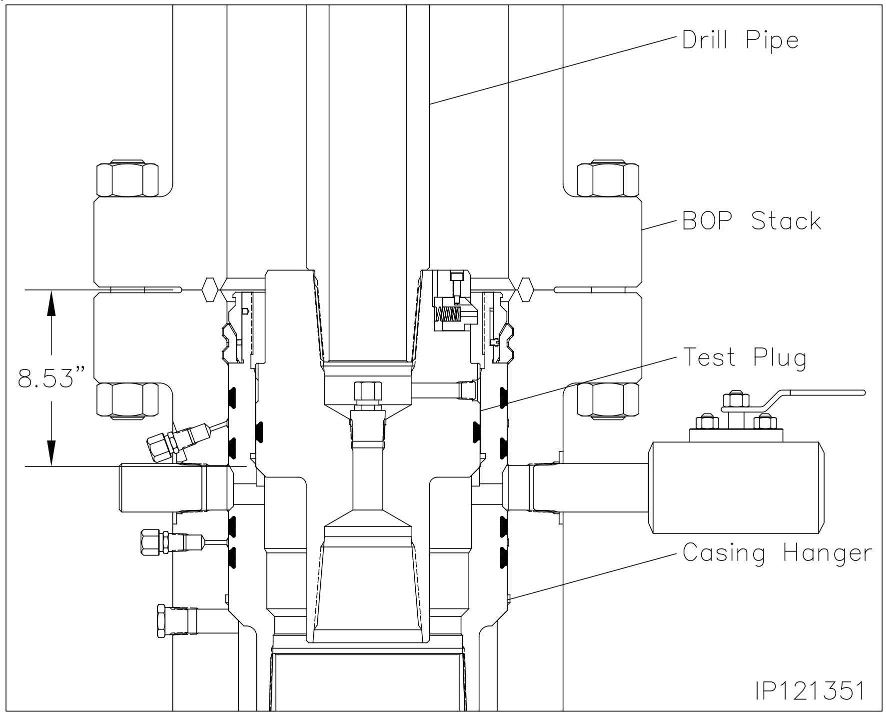
1. Examine the ***11" Nominal x 4-1/2" IF CW Test Plug/Retrieving Tool (Item ST5)***. Verify the following:
   - 1-1/4" VR plug and weep hole plug are in place and tightened securely
   - elastomer seal is in place and in good condition
   - retractable lift lugs are in place, clean, and free to move
   - drill pipe threads are clean and in good condition

Note: Prior to installing the BOP it is recommended to attain an accurate RKB dimension for future use for accurately landing test plugs and casing hangers. This dimension is attained by dropping a tape measure from the rig floor to the top of the wellhead flange. Pull tape taut and record the dimension from the wellhead to the top of the rig floor or kelly bushings. Ensure this dimension is placed on the BOP board in the dog house and on the drillers daily report sheet.

2. Position the test plug with the elastomer seal down and the lift lugs up and make up the tool to a joint of drill pipe.

WARNING: Ensure that the lift lugs are up and the elastomer seal is down

3. Remove the 1/2" NPT pipe plug from the weep hole if pressure is to be supplied through the drill pipe.



4. Open the housing upper side outlet valve.

5. Lightly lubricate the test plug seal with oil or light grease.

6. Carefully lower the test plug through the BOP and land it on the load shoulder in the packoff, 8.53" below the top of the housing.

7. Close the BOP rams on the pipe and test the BOP to 5,000 psi.

Note: Any leakage past the test plug will be clearly visible at the open side outlet valve.

8. After a satisfactory test is achieved, release the pressure and open the rams.

9. Remove as much fluid as possible from the BOP stack and the retrieve the test plug with a straight vertical lift.

Note: When performing the BOP blind ram test it is highly recommended to suspend a stand of drill pipe below the test plug to ensure the plug stays in place while disconnecting from it with the drill pipe.

10. Repeat this procedure as required during the drilling of the hole section.

Stage 6 — Run the Upper Wear Bushing

Note: Always use a Wear Bushing while drilling to protect the load shoulders from damage by the drill bit or rotating drill pipe. The Wear Bushing **must be retrieved** prior to running the casing.

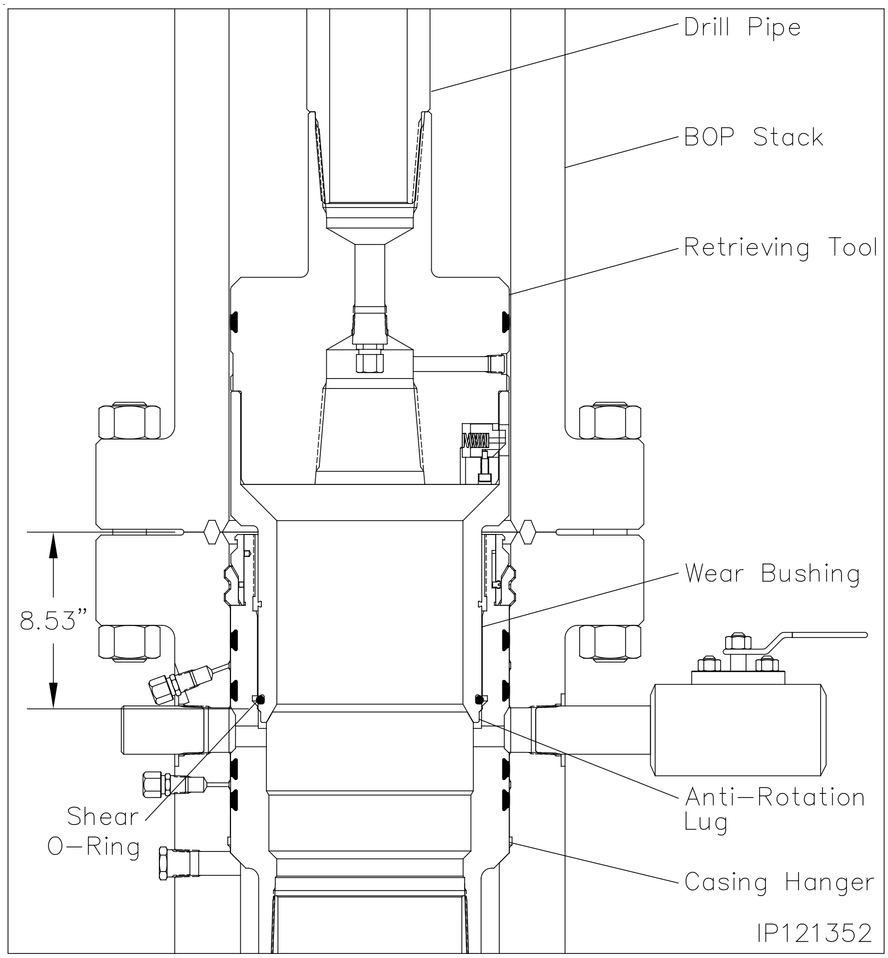
1. Examine the ***13-5/8" x 11" x 9.00" ID MBU-LR-UPR Wear Bushing(Item ST6).*** Verify the following
   - internal bore is clean and in good condition
   - o-ring is in place and in good condition
   - shear o-ring cord is in place and in good condition
   - paint anti-rotation lugs white and allow paint to dry

Run the Wear Bushing Before Drilling

2. Orient the ***13-5/8" Nominal x 4-1/2" IF CW Test Plug/Retrieving Tool (Item ST1)*** with drill pipe connection up.
3. Attach the Retrieving Tool to a joint of drill pipe.
4. Align the retractable lift lugs of the tool with the retrieval holes of the bushing and the carefully lower the tool into the Wear Bushing until the lugs snap into place.

Note: If the lugs did not align with the holes, rotate the tool in either direction until they snap into place.

5. Apply a heavy coat of grease, not dope, to the OD of the bushing.
6. Slowly lower the Tool/Bushing Assembly through the BOP stack and land it on the load shoulder in the packoff, 8.53" below the top of the housing.
7. Rotate the drill pipe clockwise (right) to locate the stop lugs in their mating notches in the packoff. When properly aligned the bushing will drop an additional 1/2".



Note: The Shear O-Ring on bottom of the bushing will locate in a groove above the load shoulder in the head to act as a retaining device for the bushing.

8. Remove the Tool from the Wear Bushing by rotating the drill pipe counter clockwise (left) 1/4 turn and lifting straight up
9. Drill as required.

Note: It is highly recommended to retrieve, clean, inspect, grease, and reset the wear bushing each time the hole is tripped during the drilling of the hole section.

Retrieve the Wear Bushing After Drilling

10. Make up the Retrieving Tool to the drill pipe .
11. Slowly lower the Tool into the Wear Bushing.
12. Pick up and balance the riser weight.
13. Rotate the Retrieving Tool clockwise until a positive stop is felt. This indicates the lugs have snapped into the holes in the bushing.
14. Retrieve the Wear Bushing, and remove it and the Retrieving Tool from the drill string.

Stage 7 — Hang Off the 7” Casing

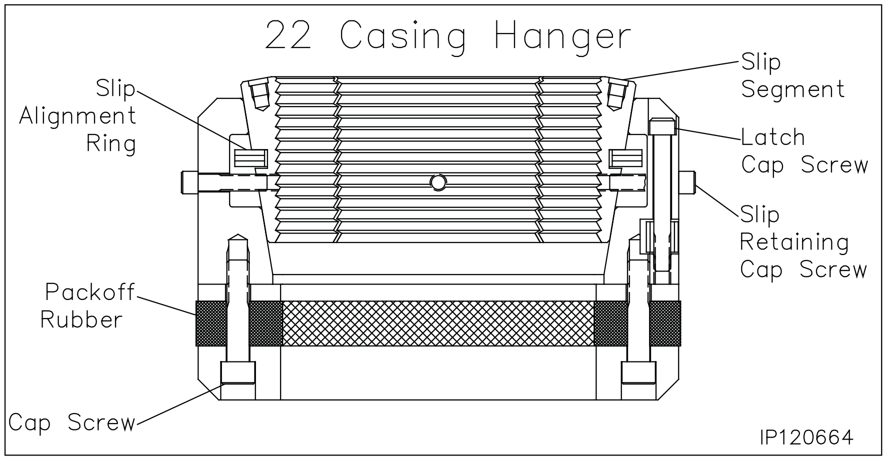
1. Run the 7” casing string as required and cement in place.
2. Drain the housing bowl through the upper side outlet.
3. Separate the BOP from the MBU-LR housing and lift the BOP approximately 14” above the housing and secure BOP with safety slings.
4. Using a fresh water hose, thoroughly wash out the packoff bowl.

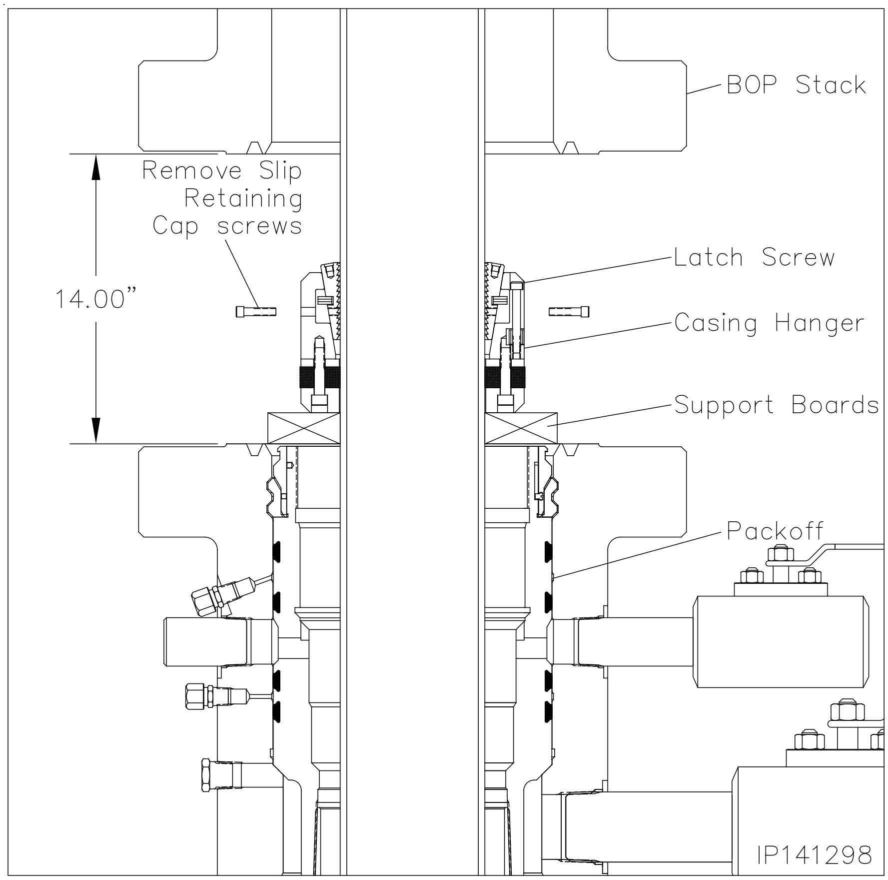
Note: Casing Head side outlet valve to remain open while setting the casing hanger.

5. Examine the ***11” X 7” C22 Casing Hanger (Item B9).*** Verify the following:
   - slips and internal bore are clean and in good condition
   - all screws are in place
   - seal element is in good condition

Note: Ensure that the packoff rubber does not protrude beyond the O.D. of the casing hanger body. If it is, loosen the compression cap screws in the top of the hanger.

6. Remove the latch screw to open the Hanger.
7. Place two boards on the Casing Head flange against the casing to support the Hanger.
8. Wrap the Hanger around the casing and replace the latch screw.
9. Prepare to lower the Hanger into the Casing Head bowl.
10. Grease the Casing Hanger’s body and remove the slip retaining cap screws.





Cactus Wellhead

Stage 7 — Hang Off the 7” Casing

11. Remove the boards and allow the Hanger to slide into the packoff bowl. When the Hanger is down, the top of the hanger body will be approximately 2.27” below the top of the housing, pull tension on the casing to the desired hanging weight and then slack off..

Note: A sharp decrease on the weight indicator will signify that the Hanger has taken weight and at what point, If this does not occur, pull tension again and slack off once more.

WARNING: Because of the potential fire hazard and the risk of loss of life and property, It is highly recommended to check the casing annulus and pipe bore for gas with an approved sensing device prior to cutting off the casing. If gas is present, do not use an open flame torch to cut the casing. It will be necessary to use a air driven mechanical cutter which is spark free.

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12. Rough cut the casing approximately 12” above the top flange and move the excess casing and BOP out of the way.

13. Final cut the casing at 4.75” ± 1/8” above the top flange of the housing.

14. Grind the casing stub level and then place a 3/16” x 3/8” bevel on the O.D. and a I.D. chamfer to match the minimum bore of the tubing head to be installed.

15. Using a high pressure water hose thoroughly clean the top of the casing hanger and void area above the hanger. Ensure all cutting debris are removed .

16. Fill the void above the hanger with clean test fluid to the top of the flange.

WARNING: Do Not over fill the void with test fluid - trapped fluid under the ring gasket may prevent a good seal from forming

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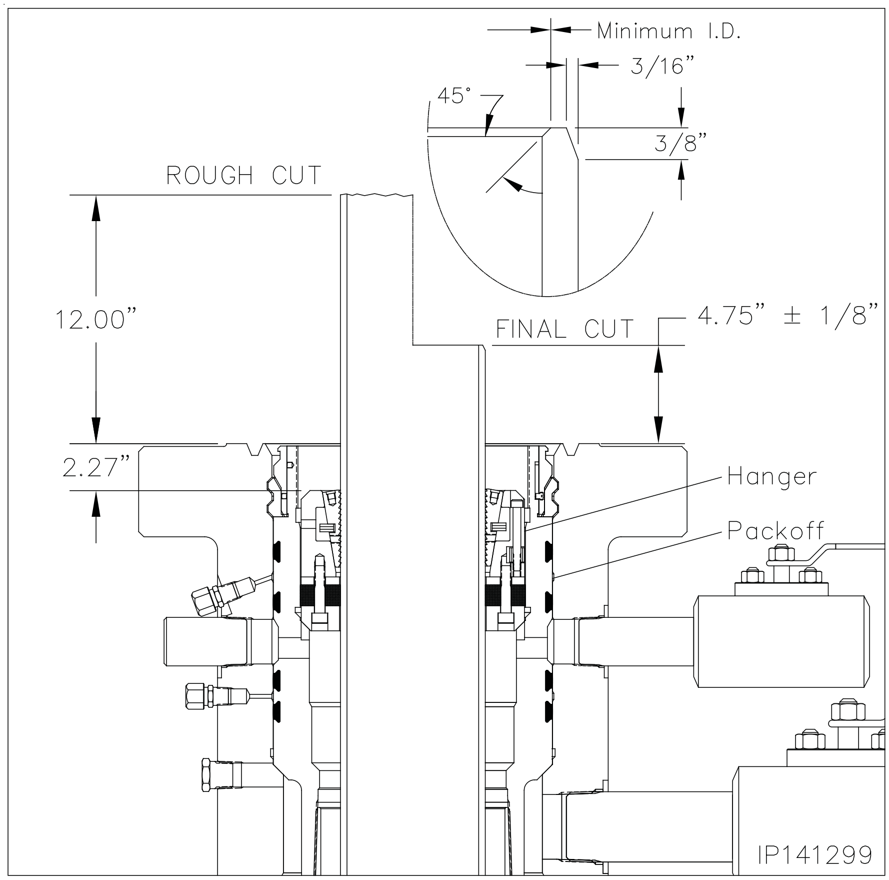


Stage 8 — Install the Tubing Head

1. Examine the ***13-5/8" 5M x 7-1/16" 10M CW, CTH-DBLHPS Tubing Head (Item B1).*** Verify the following:
   - seal area and bore are clean and in good condition
   - ***HPS Secondary Seals*** are in place and in good condition
   - all peripheral equipment is intact and undamaged

2. Clean the mating ring grooves of the MBU-LR and Tubing Head.

3. Lightly lubricate the ID of the Tubing Head HPS Seals, and the casing stub with a light grease.

Note: Excessive grease may prevent a good seal from forming!

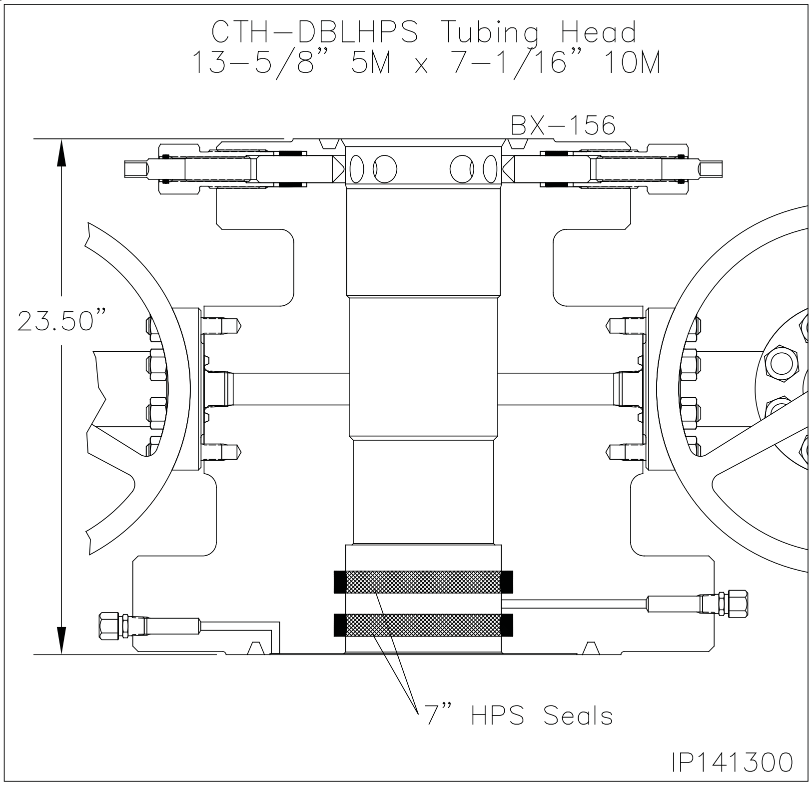
4. Install a new ***BX-160 Ring Gasket (Item B14)*** in the ring groove of the MBU-LR Housing.

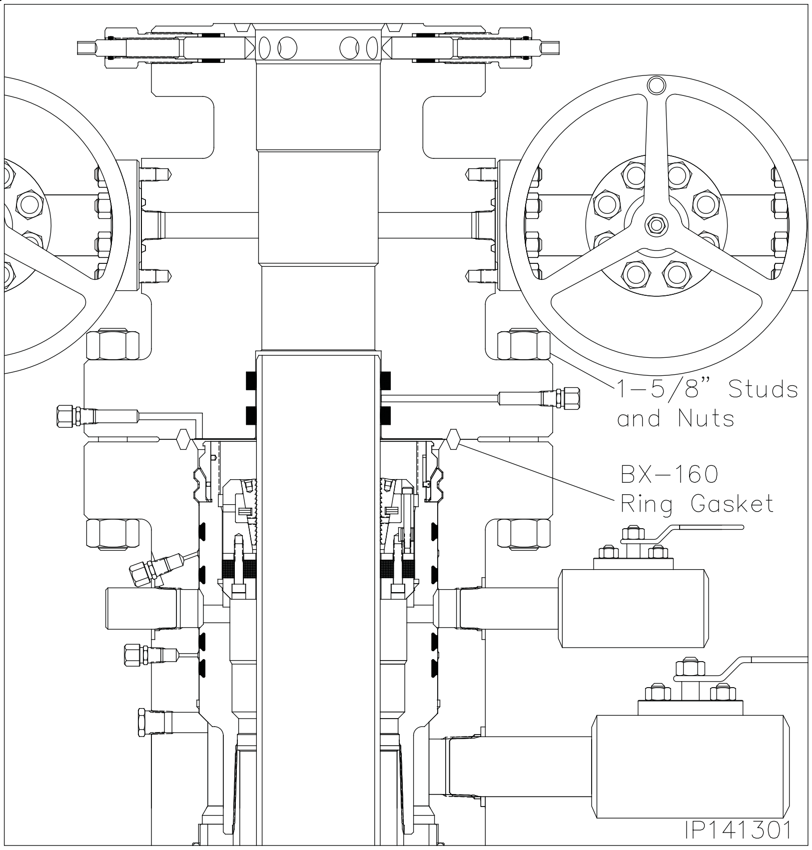
5. Pick up the Tubing Head and suspend it above the MBU-LR Housing and casing stub.

6. Orient the Tubing Head so the outlets are in the proper position and then carefully lower the head and DSPA over the casing stub and land it on the ring gasket.

Warning: Do Not damage the HPS Seal or their sealing ability will be impaired!

7. Make up the flange connection using the DSPA studs and nuts, tightening them in an alternating cross pattern.





Stage 8 — Install the Tubing Head

Seal Test

1. Locate the “SEAL TEST” fitting and one of the “FLG TEST” fittings on the Tubing Head and remove the dust cap from both fittings.

2. Attach a Bleeder Tool to the open “FLG TEST” fitting and open the Tool.

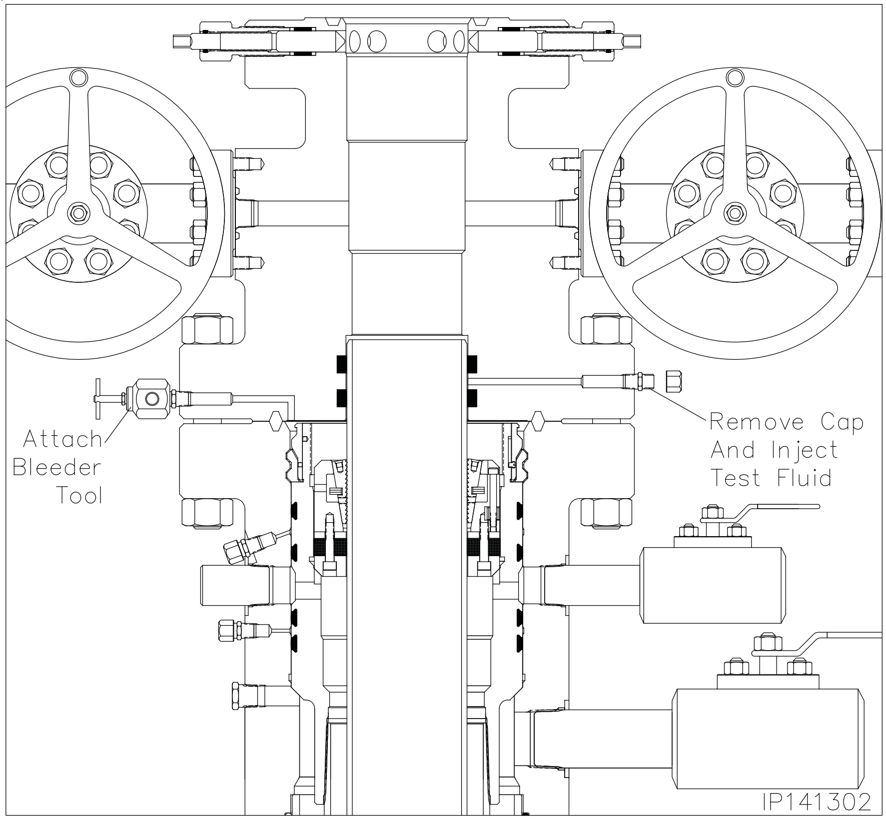
3. Attach a Hydraulic Test Pump to the “SEAL TEST” fitting and pump clean test fluid between the HPS Seals until a test pressure of ***10,000 psi. or 80% of casing collapse — whichever is less***

4. Hold the test pressure for fifteen (15) minutes or as desired by the drilling supervisor.

5. If pressure drops a leak has developed. Take the appropriate action in the table below.

6. Repeat steps 1 - 5 until a satisfactory test is achieved.

7. When a satisfactory test is achieved, remove Test Pump, drain test fluid, and reinstall the dust cap on the open “SEAL TEST” fitting.



Seal Test	
Leak Location	**Appropriate Action**
Open bleeder tool - Lower HPS seal leaking	Remove Tubing Head and replace leaking seals. Re land and retest seals
Into the Tubing Head bore- Upper HPS Seal is Leaking	

Stage 8 — Install the Tubing Head

Flange Test

1. Locate the remaining “FLG TEST” fitting on the Tubing Head and remove the dust cap from the fitting.

2. Attach a test pump to the open “FLG TEST” fitting and pump clean test fluid into the flange connection until a continuous stream flows from the open “FLG TEST” bleeder tool.

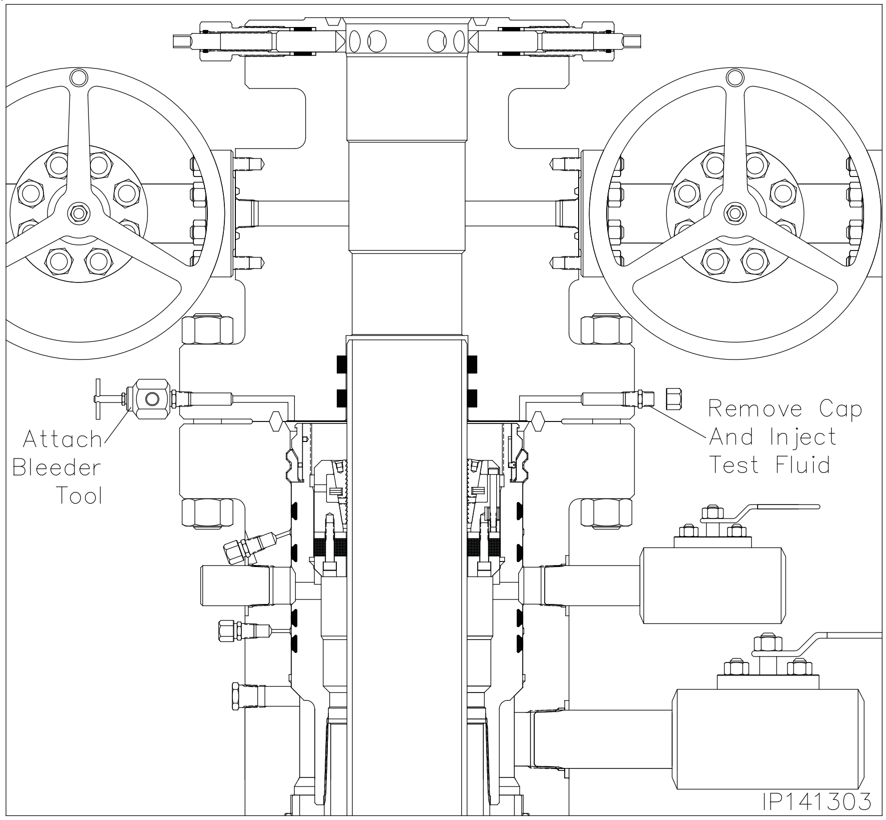
3. Close the bleeder tool and continue pumping test fluid to ***5,000 psi. or 80% of casing collapse — whichever is less.***

4. Hold the test pressure for fifteen (15) minutes or as desired by the drilling supervisor.

5. If pressure drops a leak has developed. Take the appropriate action from the adjacent chart.

6. Repeat steps 1 through 6 until a satisfactory test is achieved.

7. Once a satisfactory test is achieved, remove the test pump and “FLG TEST” bleeder tool, drain test fluid, and reinstall the dust caps on the open fittings.



Flange Test	
Leak Location	**Appropriate Action**
Into casing annulus - casing hanger seal element is leaking	Remove tubing head, spear casing and reset the casing hanger. Redress the casing, reinstall the Tubing Head and retest
Flange connection - Ring gasket is leaking	Further tighten the flange connection

Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal

1. **Introduction and Scope.** The following recommended procedure has been prepared with particular regard to attaining pressure-tight weld when attaching casing heads, flanges, etc., to casing. Although most of the high strength casing used (such as N-80) is not normally considered field weldable, some success may be obtained by using the following or similar procedures.

<u>Caution:</u> In some wellheads, the seal weld is also a structural weld and can be subjected to high tensile stresses. Consideration must therefore be given by competent authority to the mechanical properties of the weld and its heat affected zone.

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   a. The steels used in wellhead parts and in casing are high strength steels that are susceptible to cracking when welded. It is imperative that the finished weld and adjacent metal be free from cracks. The heat from welding also affects the mechanical properties. This is especially serious if the weld is subjected to service tension stresses.

   b. This procedure is offered only as a recommendation. The responsibility for welding lies with the user and results are largely governed by the welder's skill. Weldability of the several makes and grades of casing varies widely, thus placing added responsibility on the welder. Transporting a qualified welder to the job, rather than using a less-skilled man who may be at hand, will, in most cases, prove economical. The responsible operating representative should ascertain the welder's qualifications and, if necessary, assure himself by instruction or demonstration, that the welder is able to perform the work satisfactorily.

2. **Welding Conditions.** Unfavorable welding conditions must be avoided or minimized in every way possible, as even the most skilled welder cannot successfully weld steels that are susceptible to cracking under adverse working conditions, or when the work is rushed. Work above the welder on the drilling floor should be avoided. The weld should be protected from dripping mud, water, and oil and from wind, rain, or other adverse weather conditions. The drilling mud, water, or other fluids must be lowered in the casing and kept at a low level until the weld has properly cooled. It is the responsibility of the user to provide supervision that will assure favorable working conditions, adequate time, and the necessary cooperation of the rig personnel.

3. **Welding.** The welding should be done by the shielded metal-arc or other approved process.

4. **Filler Metal.** Filler Metals. For root pass, it's recommended to use E6010, E6011 (AC), E6019 or equivalent electrodes. The E7018 or E7018-A1 electrodes may also be used for root pass operations but has the tendency to trap slag in tight grooves. The E6010, E6011 and E6019 offer good penetration and weld deposit ductility with relatively high intrinsic hydrogen content. Since the E7018 and E7018-A1 are less susceptible to hydrogen induced cracking, it is recommended for use as the filler metal for completion of the weld groove after the root pass is completed. The E6010, E6011 (AC), E6019, E7018 and E7018-A1 are classified under one of the following codes AWS A5.1 (latest edition): Mild Steel covered electrodes or the AWS A5.5 (latest edition): Low Alloy Steel Covered Arc-Welding Electrodes. The low hydrogen electrodes, E7018 and E7018-A1, should not be exposed to the atmosphere until ready for use. It's recommended that hydrogen electrodes remain in their sealed containers. When a job arises, the container shall be opened and all unused remaining electrodes to be stored in heat electrode storage ovens. Low hydrogen electrodes exposed to the atmosphere, except water, for more than two hours should be dried 1 to 2 hours at 600ºF to 700 ºF (316ºC to 371 ºC) just before use. It's recommended for any low hydrogen electrode containing water on the surface should be scrapped.

5. **Preparation of Base Metal.** The area to be welded should be dry and free of any paint, grease/oil and dirt. All rust and heat-treat surface scale shall be ground to bright metal before welding.

Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal

6. **Preheating.** Prior to any heating, the wellhead member shall be inspected for the presence of any o-rings or other polymeric seals. If any o-rings or seals are identified then preheating requires close monitoring as noted in paragraph 6a. Before applying preheat, the fluid should be bailed out of the casing to a point several inches (>6" or 150 mm) below the weld joint/location. Preheat both the casing and wellhead member for a minimum distance of three (3) inches on each side of the weld joint using a suitable preheating torch in accordance with the temperatures shown below in a and b. The preheat temperature should be checked by the use of heat sensitive crayons. Special attention must be given to preheating the thick sections of wellhead parts to be welded, to insure uniform heating and expansion with respect to the relatively thin casing.

   a. Wellhead members containing o-rings and other polymeric seals have tight limits on the preheat and interpass temperatures. Those temperatures must be controlled at 200ºF to 325ºF or 93 ºC to 160ºC and closely monitored to prevent damage to the o-ring or seals.
   b. Wellhead members not containing o-rings and other polymeric seals should be maintained at a preheat and interpass temperature of 400ºF to 600ºF or 200ºC to 300ºC.

7. **Welding Technique.** Use a 1/8 or 5/32-inch (3.2 or 4.0 mm) E6010 or E7018 electrode and step weld the first bead (root pass); that, weld approximately 2 to 4 inches (50 to 100 mm) and then move diametrically opposite this point and weld 2 to 4 inches (50 to 100 mm) halfway between the first two welds, move diametrically opposite this weld, and so on until the first pass is completed. This second pass should be made with a 5/32-inch (4.0 mm) low hydrogen electrode of the proper strength and may be continuous. The balance of the welding groove may then be filled with continuous passes without back stepping or lacing, using a 3/16-inch (4.8 mm) low hydrogen electrode. All beads should be stringer beads with good penetration. There should be no undercutting and weld shall be workmanlike in appearance.

   a. Test ports should be open when welding is performed to prevent pressure buildup within the test cavity.
   b. During welding the temperature of the base metal on either side of the weld should be maintained at 200 to 300°F (93 to 149°C).
   c. Care should be taken to insure that the welding cable is properly grounded to the casing, but ground wire should not be welded to the casing or the wellhead. Ground wire should be firmly clamped to the casing, the wellhead, or fixed in position between pipe slips. Bad contact may cause sparking, with resultant hard spots beneath which incipient cracks may develop. The welding cable should not be grounded to the steel derrick, nor to the rotary-table base.

8. **Cleaning.** All slag or flux remaining on any welding bead should be removed before laying the next bead. This also applies to the completed weld.

9. **Defects.** Any cracks or blow holes that appear on any bead should be removed to sound metal by chipping or grinding before depositing the next bead.

10. **Postheating.** Post-heating should be performed at the temperatures shown below and held at that temperature for no less than one hour followed by a slow cooling. The post-heating temperature should be in accordance with the following paragraphs.

    a. Wellhead members containing o-rings and other polymeric seals have tight limits on the post-heating temperatures. Those temperatures must be controlled at 250ºF to 300ºF or 120 ºC to 150ºC and closely monitored to prevent damage to the o-ring or seals.
    b. Wellhead members not containing o-rings and other polymeric seals should be post-heated at a temperature of 400ºF to 600ºF or 200ºC to 300ºC.

11. **Cooling. *Rapid cooling must be avoided.*** To assure slow cooling, welds should be protected from extreme weather conditions (cold, rain, high winds, etc.) by the use of suitable insulating material. (Specially designed insulating blankets are available at many welding supply stores.) Particular attention should be given to maintaining uniform cooling of the thick sections of the wellhead parts and the relatively thin casing, as the relatively thin casing will pull away from the head or hanger if allowed to cool more rapidly. The welds should cool in air to less than 200°F (93°C) (measured with a heat sensitive crayon) prior to permitting the mud to rise in the casing.

12. **Test the Weld.** After cooling, test the weld. The weld must be cool otherwise the test media will crack the weld. The test pressure should be no more than 80% of the casing collapse pressure.

RELIANCE Industrial Products Ltd.

110, 7660 - 76 ST CLOSE
RED DEER , AB
T4P 4G6
(403) 309-6729

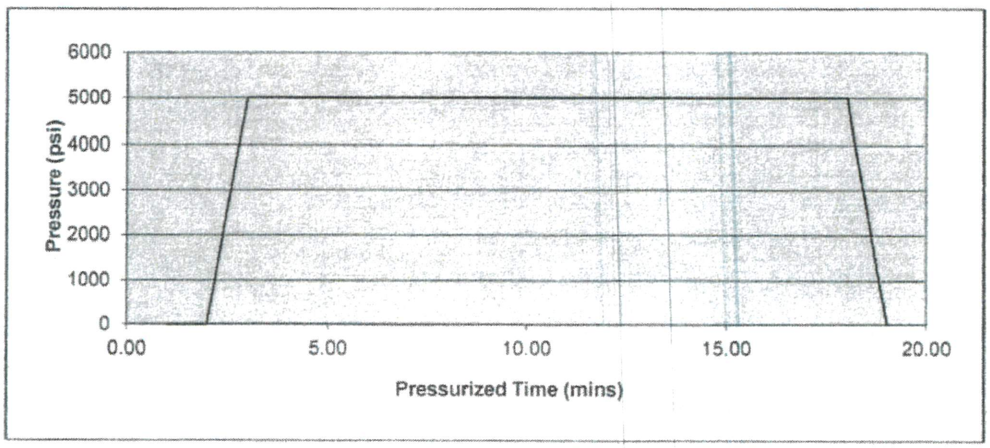
TEST CERTIFICATE

Customer:	HORIZON DRILLING
P.O. #:	103877
Invoice #:	002-103877
Material:	RFG5000-56
Description:	3 1/2" X 25 FT CHOKE HO
Coupling 1:	4"GRAYLOK
" Serial:	
" Quality:	USED
Coupling 2:	4"GRAYLOK
" Serial:	
" Quality:	USED
Working Pressure :	5000
Test Pressure:	5000
Duration (mins):	15

Cert. No. 525342-T01
Date: 1/30/2018

RIG 47
Bop To CATWALK
#170380

Date Calibrated: 1/30/2018



Conducted By: BRENT LOCKHART

☑ Acceptable

☐ Not Acceptable

RELIANCE Industrial Products Ltd.

110, 7660 - 76 ST CLOSE
RED DEER , AB
T4P 4G6
(403) 309-6729

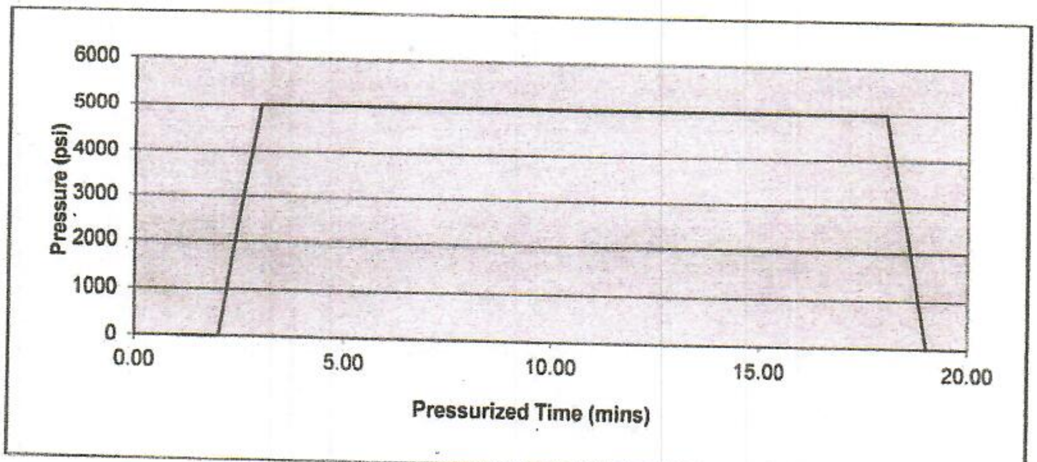
TEST CERTIFICATE

Customer:	HORIZON DRILLING
P.O. #:	103877
Invoice #:	002-103877
Material:	RFG5000-48
Description:	3 " X 13 FT KILL LINE
Coupling 1:	3" FIG 1502 H/U MALE
" Serial:	
" Quality:	USED
Coupling 2:	3" FIG 1502 H/U FEMALE
" Serial:	
" Quality:	USED
Working Pressure :	5000
Test Pressure:	5000
Duration (mins):	15

Cert. No. 524816-T03
Date: 1/30/2018

RIG 47
Kill Line Hose
#170375

Date Calibrated: 1/30/2018



Conducted By: BRENT LOCKHART

☑ Acceptable

☐ Not Acceptable

RELIANCE Industrial Products Ltd.

110, 7660 - 76 ST CLOSE
RED DEER , AB
T4P 4G6
(403) 309-6729

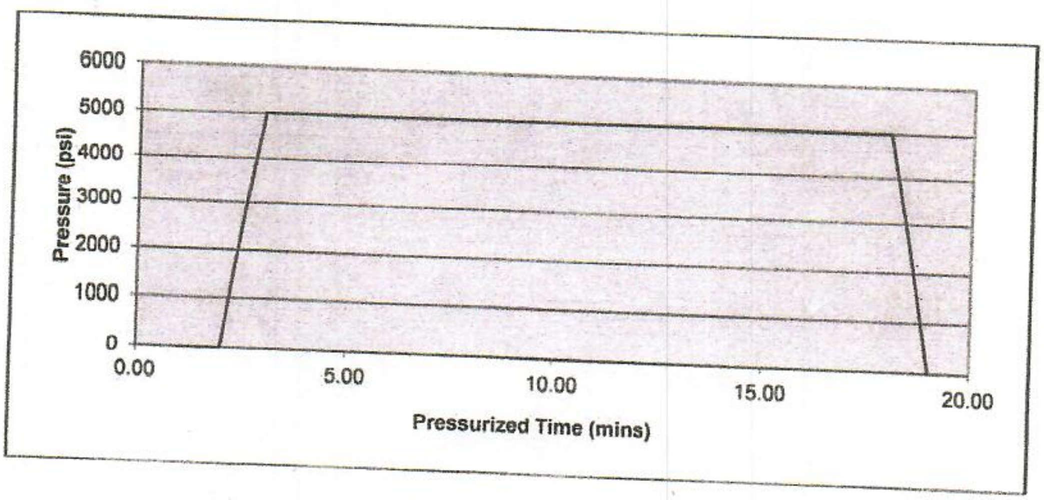
TEST CERTIFICATE

Customer:	HORIZON DRILLING
P.O. #:	103877
Invoice #:	002-103877
Material:	RFG5000-56
Description:	3 1/2" X 25 FT CHOKE HO
Coupling 1:	4"GRAYLOK
" Serial:	
" Quality:	USED
Coupling 2:	4"GRAYLOK
" Serial:	
" Quality:	USED
Working Pressure :	5000
Test Pressure:	5000
Duration (mins):	15

Cert. No. 524816-T13
Date: 1/30/2018

RIG 47
Spare # 170376

Date Calibrated: 1/30/2018



Conducted By: BRENT LOCKHART

☑ Acceptable

☐ Not Acceptable

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft	09:53 Friday, December 15, 2023	Page 1 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location	SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E			**Map Zone**	UTM	**Lat Long Ref**	
Site				**Surface X**	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
*** TIE (at MD = 2050.00)										
2050.00	0.00	0.0	2050.00	0.00	0.00		0.00	1930558.50	11989075.00	1748.80
2100.00	0.00	0.0	2100.00	0.00	0.00	0.00	0.00	1930558.50	11989075.00	1698.80
*** KOP 8 DEGREE (at MD = 2150.00)										
2150.00	0.00	0.0	2150.00	0.00	0.00	0.00	0.00	1930558.50	11989075.00	1648.80
2200.00	4.00	180.0	2199.96	-1.74	0.00	8.00	1.74	1930558.50	11989073.26	1598.84
2250.00	8.00	180.0	2249.68	-6.97	0.00	8.00	6.97	1930558.50	11989068.03	1549.12
2300.00	12.00	180.0	2298.91	-15.65	-0.01	8.00	15.65	1930558.49	11989059.35	1499.89
2350.00	16.00	180.0	2347.41	-27.74	-0.02	8.00	27.74	1930558.48	11989047.26	1451.39
2400.00	20.00	180.0	2394.95	-43.19	-0.03	8.00	43.19	1930558.47	11989031.81	1403.85
2450.00	24.00	180.0	2441.30	-61.92	-0.04	8.00	61.92	1930558.46	11989013.08	1357.50
2500.00	28.00	180.0	2486.23	-83.83	-0.06	8.00	83.83	1930558.44	11988991.17	1312.57
2550.00	32.00	180.0	2529.53	-108.83	-0.08	8.00	108.83	1930558.42	11988966.17	1269.27
2600.00	36.00	180.0	2570.97	-136.78	-0.10	8.00	136.78	1930558.40	11988938.22	1227.83
2650.00	40.00	180.0	2610.36	-167.56	-0.12	8.00	167.56	1930558.38	11988907.44	1188.44
2700.00	44.00	180.0	2647.51	-201.01	-0.14	8.00	201.01	1930558.36	11988873.99	1151.29
2750.00	48.00	180.0	2682.24	-236.97	-0.17	8.00	236.97	1930558.33	11988838.03	1116.56
2800.00	52.00	180.0	2714.37	-275.26	-0.19	8.00	275.26	1930558.31	11988799.74	1084.43
*** 55 DEGREE TANGENT (at MD = 2837.50)										
2837.50	55.00	180.0	2736.67	-305.40	-0.21	8.00	305.40	1930558.29	11988769.60	1062.13
2850.00	55.00	180.0	2743.84	-315.64	-0.22	0.00	315.64	1930558.28	11988759.36	1054.96
2900.00	55.00	180.0	2772.52	-356.60	-0.25	0.00	356.60	1930558.25	11988718.40	1026.28
2950.00	55.00	180.0	2801.20	-397.56	-0.28	0.00	397.56	1930558.22	11988677.44	997.60
3000.00	55.00	180.0	2829.88	-438.52	-0.31	0.00	438.52	1930558.19	11988636.48	968.92
*** 10 DEGREE BUILD (at MD = 3037.50)										
3037.50	55.00	180.0	2851.39	-469.23	-0.33	0.00	469.23	1930558.17	11988605.77	947.41
3050.00	56.25	180.0	2858.45	-479.55	-0.33	10.00	479.55	1930558.17	11988595.45	940.35
3100.00	61.25	180.0	2884.38	-522.28	-0.36	10.00	522.28	1930558.14	11988552.72	914.42
3150.00	66.25	180.0	2906.49	-567.11	-0.40	10.00	567.11	1930558.10	11988507.89	892.32
3200.00	71.25	180.0	2924.60	-613.70	-0.43	10.00	613.70	1930558.07	11988461.30	874.20
3250.00	76.25	180.0	2938.59	-661.68	-0.46	10.00	661.68	1930558.04	11988413.32	860.21
3300.00	81.25	180.0	2948.34	-710.71	-0.50	10.00	710.71	1930558.00	11988364.29	850.46
3350.00	86.25	180.0	2953.78	-760.40	-0.53	10.00	760.40	1930557.97	11988314.60	845.02
*** LANDING POINT (at MD = 3387.50)										
3387.50	90.00	180.0	2955.01	-797.87	-0.56	10.00	797.87	1930557.94	11988277.13	843.79
3400.00	90.00	180.0	2955.01	-810.37	-0.57	0.00	810.37	1930557.93	11988264.63	843.79
3450.00	90.00	180.0	2955.01	-860.37	-0.60	0.00	860.37	1930557.90	11988214.63	843.79
3500.00	90.00	180.0	2955.01	-910.37	-0.64	0.00	910.37	1930557.86	11988164.63	843.79
3550.00	90.00	180.0	2955.01	-960.37	-0.67	0.00	960.37	1930557.83	11988114.63	843.79

Hi Bob Federal #5H, Plan 1

Operator Mack Energy Corp **Units** feet, °/100ft 09:53 Friday, December 15, 2023 Page 2 of 4
Field Round Tank **County** Chaves **Vertical Section Azimuth** 180.04
Well Name Hi Bob Federal #5H **State** New Mexico **Survey Calculation Method** Minimum Curvature
Plan 1 **Country** USA **Database** Access

Location SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E **Map Zone** UTM **Lat Long Ref**
Site **Surface X** 1930558.5 **Surface Long**
Slot Name **UWI** **Surface Y** 11989075 **Surface Lat**
Well Number 5H **API** **Surface Z** 3798.8 **Global Z Ref** KB
Project **MD/TVD Ref** KB **Ground Level** 3781.3 **Local North Ref** Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
3600.00	90.00	180.0	2955.01	-1010.37	-0.71	0.00	1010.37	1930557.79	11988064.63	843.79
3650.00	90.00	180.0	2955.01	-1060.37	-0.74	0.00	1060.37	1930557.76	11988014.63	843.79
3700.00	90.00	180.0	2955.01	-1110.37	-0.78	0.00	1110.37	1930557.72	11987964.63	843.79
3750.00	90.00	180.0	2955.01	-1160.37	-0.81	0.00	1160.37	1930557.69	11987914.63	843.79
3800.00	90.00	180.0	2955.01	-1210.37	-0.85	0.00	1210.37	1930557.66	11987864.63	843.79
3850.00	90.00	180.0	2955.01	-1260.37	-0.88	0.00	1260.37	1930557.62	11987814.63	843.79
3900.00	90.00	180.0	2955.01	-1310.37	-0.91	0.00	1310.37	1930557.59	11987764.63	843.79
3950.00	90.00	180.0	2955.01	-1360.37	-0.95	0.00	1360.37	1930557.55	11987714.63	843.79
4000.00	90.00	180.0	2955.01	-1410.37	-0.98	0.00	1410.37	1930557.52	11987664.63	843.79
4050.00	90.00	180.0	2955.01	-1460.37	-1.02	0.00	1460.37	1930557.48	11987614.63	843.79
4100.00	90.00	180.0	2955.01	-1510.37	-1.05	0.00	1510.37	1930557.45	11987564.63	843.79
4150.00	90.00	180.0	2955.01	-1560.37	-1.09	0.00	1560.37	1930557.41	11987514.63	843.79
4200.00	90.00	180.0	2955.01	-1610.37	-1.12	0.00	1610.37	1930557.38	11987464.63	843.79
4250.00	90.00	180.0	2955.01	-1660.37	-1.16	0.00	1660.37	1930557.34	11987414.63	843.79
4300.00	90.00	180.0	2955.01	-1710.37	-1.19	0.00	1710.37	1930557.31	11987364.63	843.79
4350.00	90.00	180.0	2955.01	-1760.37	-1.23	0.00	1760.37	1930557.27	11987314.63	843.79
4400.00	90.00	180.0	2955.01	-1810.37	-1.26	0.00	1810.37	1930557.24	11987264.63	843.79
4450.00	90.00	180.0	2955.01	-1860.37	-1.30	0.00	1860.37	1930557.20	11987214.63	843.79
4500.00	90.00	180.0	2955.01	-1910.37	-1.33	0.00	1910.37	1930557.17	11987164.63	843.79
4550.00	90.00	180.0	2955.01	-1960.37	-1.37	0.00	1960.37	1930557.13	11987114.63	843.79
4600.00	90.00	180.0	2955.01	-2010.37	-1.40	0.00	2010.37	1930557.10	11987064.63	843.79
4650.00	90.00	180.0	2955.01	-2060.37	-1.44	0.00	2060.37	1930557.06	11987014.63	843.79
4700.00	90.00	180.0	2955.01	-2110.37	-1.47	0.00	2110.37	1930557.03	11986964.63	843.79
4750.00	90.00	180.0	2955.01	-2160.37	-1.51	0.00	2160.37	1930556.99	11986914.63	843.79
4800.00	90.00	180.0	2955.01	-2210.37	-1.54	0.00	2210.37	1930556.96	11986864.63	843.79
4850.00	90.00	180.0	2955.01	-2260.37	-1.58	0.00	2260.37	1930556.92	11986814.63	843.79
4900.00	90.00	180.0	2955.01	-2310.37	-1.61	0.00	2310.37	1930556.89	11986764.63	843.79
4950.00	90.00	180.0	2955.01	-2360.37	-1.65	0.00	2360.37	1930556.85	11986714.63	843.79
5000.00	90.00	180.0	2955.01	-2410.37	-1.68	0.00	2410.37	1930556.82	11986664.63	843.79
5050.00	90.00	180.0	2955.01	-2460.37	-1.72	0.00	2460.37	1930556.78	11986614.63	843.79
5100.00	90.00	180.0	2955.01	-2510.37	-1.75	0.00	2510.37	1930556.75	11986564.63	843.79
5150.00	90.00	180.0	2955.01	-2560.37	-1.79	0.00	2560.37	1930556.71	11986514.63	843.79
5200.00	90.00	180.0	2955.01	-2610.37	-1.82	0.00	2610.37	1930556.68	11986464.63	843.79
5250.00	90.00	180.0	2955.01	-2660.37	-1.86	0.00	2660.37	1930556.64	11986414.63	843.79
5300.00	90.00	180.0	2955.01	-2710.37	-1.89	0.00	2710.37	1930556.61	11986364.63	843.79
5350.00	90.00	180.0	2955.01	-2760.37	-1.93	0.00	2760.37	1930556.57	11986314.63	843.79
5400.00	90.00	180.0	2955.01	-2810.37	-1.96	0.00	2810.37	1930556.54	11986264.63	843.79

Hi Bob Federal #5H, Plan 1

Operator Mack Energy Corp **Units** feet, °/100ft 09:53 Friday, December 15, 2023 Page 3 of 4
Field Round Tank **County** Chaves **Vertical Section Azimuth** 180.04
Well Name Hi Bob Federal #5H **State** New Mexico **Survey Calculation Method** Minimum Curvature
Plan 1 **Country** USA **Database** Access

Location SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E **Map Zone** UTM **Lat Long Ref**
Site **Surface X** 1930558.5 **Surface Long**
Slot Name **UWI** **Surface Y** 11989075 **Surface Lat**
Well Number 5H **API** **Surface Z** 3798.8 **Global Z Ref** KB
Project **MD/TVD Ref** KB **Ground Level** 3781.3 **Local North Ref** Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
5450.00	90.00	180.0	2955.01	-2860.37	-2.00	0.00	2860.37	1930556.50	11986214.63	843.79
5500.00	90.00	180.0	2955.01	-2910.37	-2.03	0.00	2910.37	1930556.47	11986164.63	843.79
5550.00	90.00	180.0	2955.01	-2960.37	-2.07	0.00	2960.37	1930556.43	11986114.63	843.79
5600.00	90.00	180.0	2955.01	-3010.37	-2.10	0.00	3010.37	1930556.40	11986064.63	843.79
5650.00	90.00	180.0	2955.01	-3060.37	-2.14	0.00	3060.37	1930556.36	11986014.63	843.79
5700.00	90.00	180.0	2955.01	-3110.37	-2.17	0.00	3110.37	1930556.33	11985964.63	843.79
5750.00	90.00	180.0	2955.01	-3160.37	-2.21	0.00	3160.37	1930556.29	11985914.63	843.79
5800.00	90.00	180.0	2955.01	-3210.37	-2.24	0.00	3210.37	1930556.26	11985864.63	843.79
5850.00	90.00	180.0	2955.01	-3260.37	-2.28	0.00	3260.37	1930556.22	11985814.63	843.79
5900.00	90.00	180.0	2955.01	-3310.37	-2.31	0.00	3310.37	1930556.19	11985764.63	843.79
5950.00	90.00	180.0	2955.01	-3360.37	-2.35	0.00	3360.37	1930556.15	11985714.63	843.79
6000.00	90.00	180.0	2955.01	-3410.37	-2.38	0.00	3410.37	1930556.12	11985664.63	843.79
6050.00	90.00	180.0	2955.01	-3460.37	-2.42	0.00	3460.37	1930556.08	11985614.63	843.79
6100.00	90.00	180.0	2955.01	-3510.37	-2.45	0.00	3510.37	1930556.05	11985564.63	843.79
6150.00	90.00	180.0	2955.01	-3560.37	-2.49	0.00	3560.37	1930556.01	11985514.63	843.79
6200.00	90.00	180.0	2955.01	-3610.37	-2.52	0.00	3610.37	1930555.98	11985464.63	843.79
6250.00	90.00	180.0	2955.01	-3660.37	-2.56	0.00	3660.37	1930555.94	11985414.63	843.79
6300.00	90.00	180.0	2955.01	-3710.37	-2.59	0.00	3710.37	1930555.91	11985364.63	843.79
6350.00	90.00	180.0	2955.01	-3760.37	-2.63	0.00	3760.37	1930555.87	11985314.63	843.79
6400.00	90.00	180.0	2955.01	-3810.37	-2.66	0.00	3810.37	1930555.84	11985264.63	843.79
6450.00	90.00	180.0	2955.01	-3860.37	-2.70	0.00	3860.37	1930555.81	11985214.63	843.79
6500.00	90.00	180.0	2955.01	-3910.37	-2.73	0.00	3910.37	1930555.77	11985164.63	843.79
6550.00	90.00	180.0	2955.01	-3960.37	-2.76	0.00	3960.37	1930555.74	11985114.63	843.79
6600.00	90.00	180.0	2955.01	-4010.37	-2.80	0.00	4010.37	1930555.70	11985064.63	843.79
6650.00	90.00	180.0	2955.01	-4060.37	-2.83	0.00	4060.37	1930555.67	11985014.63	843.79
6700.00	90.00	180.0	2955.01	-4110.37	-2.87	0.00	4110.37	1930555.63	11984964.63	843.79
6750.00	90.00	180.0	2955.01	-4160.37	-2.90	0.00	4160.37	1930555.60	11984914.63	843.79
6800.00	90.00	180.0	2955.01	-4210.37	-2.94	0.00	4210.37	1930555.56	11984864.63	843.79
6850.00	90.00	180.0	2955.01	-4260.37	-2.97	0.00	4260.37	1930555.53	11984814.63	843.79
6900.00	90.00	180.0	2955.01	-4310.37	-3.01	0.00	4310.37	1930555.49	11984764.63	843.79
6950.00	90.00	180.0	2955.01	-4360.37	-3.04	0.00	4360.37	1930555.46	11984714.63	843.79
7000.00	90.00	180.0	2955.01	-4410.37	-3.08	0.00	4410.37	1930555.42	11984664.63	843.79
7050.00	90.00	180.0	2955.01	-4460.37	-3.11	0.00	4460.37	1930555.39	11984614.63	843.79
7100.00	90.00	180.0	2955.01	-4510.37	-3.15	0.00	4510.37	1930555.35	11984564.63	843.79
7150.00	90.00	180.0	2955.01	-4560.37	-3.18	0.00	4560.37	1930555.32	11984514.63	843.79
7200.00	90.00	180.0	2955.01	-4610.37	-3.22	0.00	4610.37	1930555.28	11984464.63	843.79
7250.00	90.00	180.0	2955.01	-4660.37	-3.25	0.00	4660.37	1930555.25	11984414.63	843.79

Hi Bob Federal #5H, Plan 1

Operator	Mack Energy Corp	**Units**	feet, °/100ft		09:53 Friday, December 15, 2023 Page 4 of 4
Field	Round Tank	**County**	Chaves	**Vertical Section Azimuth**	180.04
Well Name	Hi Bob Federal #5H	**State**	New Mexico	**Survey Calculation Method**	Minimum Curvature
Plan	1	**Country**	USA	**Database**	Access

Location	SL: 707 FSL & 1650 FWL Section 8-T15S-R29E BHL: 1 FSL & 1650 FWL Section 17-T15S-R29E			**Map Zone**	UTM	**Lat Long Ref**	
Site				**Surface X**	1930558.5	**Surface Long**	
Slot Name		**UWI**		**Surface Y**	11989075	**Surface Lat**	
Well Number	5H	**API**		**Surface Z**	3798.8	**Global Z Ref**	KB
Project		**MD/TVD Ref**	KB	**Ground Level**	3781.3	**Local North Ref**	Grid

DIRECTIONAL WELL PLAN

MD* ft	INC* deg	AZI* deg	TVD* ft	N* ft	E* ft	DLS* °/100ft	V. S.* ft	MapE* ft	MapN* ft	SysTVD* ft
7300.00	90.00	180.0	2955.01	-4710.37	-3.29	0.00	4710.37	1930555.21	11984364.63	843.79
7350.00	90.00	180.0	2955.01	-4760.37	-3.32	0.00	4760.37	1930555.18	11984314.63	843.79
7400.00	90.00	180.0	2955.01	-4810.37	-3.36	0.00	4810.37	1930555.14	11984264.63	843.79
7450.00	90.00	180.0	2955.01	-4860.37	-3.39	0.00	4860.37	1930555.11	11984214.63	843.79
7500.00	90.00	180.0	2955.01	-4910.37	-3.43	0.00	4910.37	1930555.07	11984164.63	843.79
7550.00	90.00	180.0	2955.01	-4960.37	-3.46	0.00	4960.37	1930555.04	11984114.63	843.79
7600.00	90.00	180.0	2955.01	-5010.37	-3.50	0.00	5010.37	1930555.00	11984064.63	843.79
7650.00	90.00	180.0	2955.01	-5060.37	-3.53	0.00	5060.37	1930554.97	11984014.63	843.79
7700.00	90.00	180.0	2955.01	-5110.37	-3.57	0.00	5110.37	1930554.93	11983964.63	843.79
7750.00	90.00	180.0	2955.01	-5160.37	-3.60	0.00	5160.37	1930554.90	11983914.63	843.79
7800.00	90.00	180.0	2955.01	-5210.37	-3.64	0.00	5210.37	1930554.86	11983864.63	843.79
7850.00	90.00	180.0	2955.01	-5260.37	-3.67	0.00	5260.37	1930554.83	11983814.63	843.79
7900.00	90.00	180.0	2955.01	-5310.37	-3.71	0.00	5310.37	1930554.79	11983764.63	843.79
7950.00	90.00	180.0	2955.01	-5360.37	-3.74	0.00	5360.37	1930554.76	11983714.63	843.79
8000.00	90.00	180.0	2955.01	-5410.37	-3.78	0.00	5410.37	1930554.72	11983664.63	843.79
8050.00	90.00	180.0	2955.01	-5460.37	-3.81	0.00	5460.37	1930554.69	11983614.63	843.79
8100.00	90.00	180.0	2955.01	-5510.37	-3.85	0.00	5510.37	1930554.65	11983564.63	843.79
8150.00	90.00	180.0	2955.01	-5560.37	-3.88	0.00	5560.37	1930554.62	11983514.63	843.79
8200.00	90.00	180.0	2955.01	-5610.37	-3.92	0.00	5610.37	1930554.58	11983464.63	843.79
8250.00	90.00	180.0	2955.01	-5660.37	-3.95	0.00	5660.37	1930554.55	11983414.63	843.79
8300.00	90.00	180.0	2955.01	-5710.37	-3.99	0.00	5710.37	1930554.51	11983364.63	843.79
8350.00	90.00	180.0	2955.01	-5760.37	-4.02	0.00	5760.37	1930554.48	11983314.63	843.79
8400.00	90.00	180.0	2955.01	-5810.37	-4.06	0.00	5810.37	1930554.44	11983264.63	843.79
8450.00	90.00	180.0	2955.01	-5860.37	-4.09	0.00	5860.37	1930554.41	11983214.63	843.79
8500.00	90.00	180.0	2955.01	-5910.37	-4.13	0.00	5910.37	1930554.37	11983164.63	843.79
8550.00	90.00	180.0	2955.01	-5960.37	-4.16	0.00	5960.37	1930554.34	11983114.63	843.79
8600.00	90.00	180.0	2955.01	-6010.37	-4.20	0.00	6010.37	1930554.30	11983064.63	843.79
*** TD (at MD = 8611.50)										
8611.50	90.00	180.0	2955.01	-6021.87	-4.20	0.00	6021.87	1930554.30	11983053.13	843.79

PECOS DISTRICT
DRILLING OPERATIONS
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Mack Energy Corporation**
LEASE NO.:	**NMNM-121949**
WELL NAME & NO.:	**Hi Bob Federal 5H**
SURFACE HOLE FOOTAGE:	**0707' FSL & 1650' FWL**
BOTTOM HOLE FOOTAGE	**0001' FSL & 1650' FWL Sec. 17, T. 15 S., R 29 E.**
LOCATION:	**Section 08, T. 15 S., R 29 E., NMPM**
COUNTY:	**Chaves County, New Mexico**

The Gamma Ray and Neutron well logs must be run from total depth to surface and e-mailed to McKitric Wier at mwier@blm.gov or hard copy mailed to 2909 West Second Street Roswell, NM 88201 to his attention.

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Chaves and Roosevelt Counties**
Call the Roswell Field Office, 2909 West Second St., Roswell NM 88201.
During office hours call (575) 627-0272.
After hours cll (575) 627-0205.

A. Hydrogen Sulfide

1. **Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

Approval Date: 03/26/2025

4. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.
Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well specific cement details onsite prior to pumping the cement for each casing string.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

Medium Cave/Karst
Possibility of water flows in the Rustler, Queen, Salado, and Artesia Group.
Possibility of lost circulation in the Rustler, Artesia Group, and San Andres.

1. The **13-3/8** inch surface casing shall be set at approximately **595** feet (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

b. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.**

c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

d. If cement falls back, remedial cementing will be done prior to drilling out that string.

2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing is:

   ☒ Cement to surface. If cement does not circulate see B.1.a, c-d above.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **7 X 5-1/2** inch production casing is:

   ☒ Cement to surface. If cement does not circulate, contact the appropriate BLM office.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. Variance approved to use flex line from BOP to choke manifold. Check condition of flexible line from BOP to choke manifold, replace if exterior is damaged or if line fails test. Line to be as straight as possible with no hard bends and is to be anchored according to Manufacturer's requirements. The flexible hose can be exchanged with a hose of equal size and equal or greater pressure rating. **Anchor requirements, specification sheet and hydrostatic pressure test certification matching the hose in service, to be onsite for review. These documents shall be posted in the company man's trailer and on the rig floor.** If the BLM inspector questions the straightness of the hose, a BLM engineer will be contacted and will review in the field or via picture supplied by inspector to determine if changes are required (operator shall expect delays if this occurs).

2. **Operator has proposed a multi-bowl wellhead assembly. This assembly will only be tested when installed on the surface casing. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be 3000 (3M) psi (testing to 2,000 psi).**
    a. **Wellhead shall be installed by manufacturer's representatives, submit documentation with subsequent sundry.**
    b. **If the welding is performed by a third party, the manufacturer's representative shall monitor the temperature to verify that it does not exceed the maximum temperature of the seal.**
    c. **Manufacturer representative shall install the test plug for the initial BOP test.**
    d. **Operator shall perform the intermediate casing integrity test to 70% of the casing burst. This will test the multi-bowl seals.**
    e. **If the cement does not circulate and one inch operations would have been possible with a standard wellhead, the well head shall be cut off, cementing operations performed and another wellhead installed.**

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

    b. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.

    c. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

    d. The results of the test shall be reported to the appropriate BLM office.

    e. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

f. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

D. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

E. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

JAM 05152024

Attached to Form 3160-3
Mack Energy Corporation
High Bob Federal #5H , NMNM-121949
SHL : 707 FSL & 1650 FWL, SESW, Sec. 8 T15S R29E
BHL : 1 FSL & 1650 FWL, SESW, Sec. 17 T15S R29E
Chaves County, NM

Mack Energy Corporation
Onshore Order #6
Hydrogen Sulfide Drilling Operation Plan

I. HYDROGEN SULFIDE TRAINING

All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, will receive training from a qualified instructor in the following areas prior to commencing drilling operations on this well:

1. The hazards an characteristics of hydrogen sulfide (H2S)
2. The proper use and maintenance of personal protective equipment and life support systems.
3. The proper use of H2S detectors alarms warning systems, briefing areas, evacuation procedures, and prevailing winds.
4. The proper techniques for first aid and rescue procedures.

In addition, supervisory personnel will be trained in the following areas:

1. The effects of H2S on metal components. If high tensile tubular are to be used, personnel well be trained in their special maintenance requirements.
2. Corrective action and shut-in procedures when drilling or reworking a well and blowout prevention and well control procedures.
3. The contents and requirements of the H2S Drilling Operations Plan and Public Protection Plan.

There will be an initial training session just prior to encountering a known or probable H2S zone (within 3 days or 500 feet) and weekly H2S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H2S Drilling Operations Plan and the Public Protection Plan. **The concentrations of H2S of wells in this area from surface to TD are low enough that a contingency plan is not required.**

II. H2S SAFETY EQUIPMENT AND SYSTEMS

Note: All H2S safety equipment and systems will be installed, tested, and operational when drilling reaches a depth of 500 feet above, or three days prior to penetrating the first zone containing or reasonable expected to contain H2S.

1. Well Control Equipment:

A. Flare line.
B. Choke manifold.
C. Blind rams and pipe rams to accommodate all pipe sizes with properly sized closing unit.
D. Auxiliary equipment may include if applicable: annular preventer & rotating head.

2. **Protective equipment for essential personnel:**

   A. Mark II Survive air 30-minute units located in the doghouse and at briefing areas, as indicated on well site diagram.

3. **H2S detection and monitoring equipment:**

   A. 1 portable H2S monitors positioned on location for best coverage and response. These units have warning lights and audible sirens when H2S levels of 20 PPM are reached.

4. **Visual warning systems:**

   A. Wind direction indicators as shown on well site diagram (Exhibit #8).
   B. Caution/Danger signs (Exhibit #7) shall be posted on roads providing direct access to location. Signs will be painted a high visibility yellow with black lettering of sufficient size to be readable at a reasonable distance from the immediate location. Bilingual signs will be used, when appropriate. See example attached.

5. **Mud program:**

   A. The mud program has been designed to minimize the volume of H2S circulated to surface. Proper mud weight, safe drilling practices and the use of H2S scavengers will minimize hazards when penetrating H2S bearing zones.

6. **Metallurgy:**

   A. All drill strings, casings, tubing, wellhead, blowout preventer, drilling spool, kill lines, choke manifold and lines, and valves shall be suitable for H2S service.
   B. All elastomers used for packing and seals shall be H2S trim.

7. **Communication:**

   A. Radio communications in company vehicles including cellular telephone and 2-way radio.
   B. Land line (telephone) communication at Office.

8. **Well testing:**

   A. Drill stem testing will be performed with a minimum number of personnel in the immediate vicinity, which are necessary to safely and adequately conduct the test. The drill stem testing will be conducted during daylight hours and formation fluids will not be flowed to the surface. All drill-stem-testing operations conducted in an H2S environment will use the closed chamber method of testing.

Attached to Form 3160-3
Mack Energy Corporation
High Bob Federal #5H , NMNM-121949
SHL : 707 FSL & 1650 FWL, SESW, Sec. 8 T15S R29E
BHL : 1 FSL & 1650 FWL, SESW, Sec. 17 T15S R29E
Chaves County, NM

B. There will be no drill stem testing.

EXHIBIT #7

WARNING

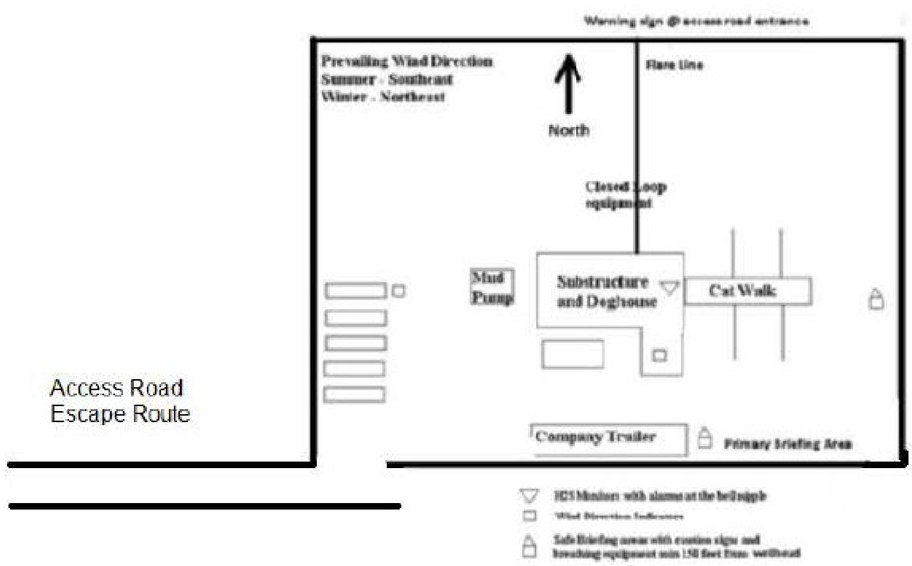
YOU ARE ENTERING AN H2S

AUTHORIZED PERSONNEL ONLY

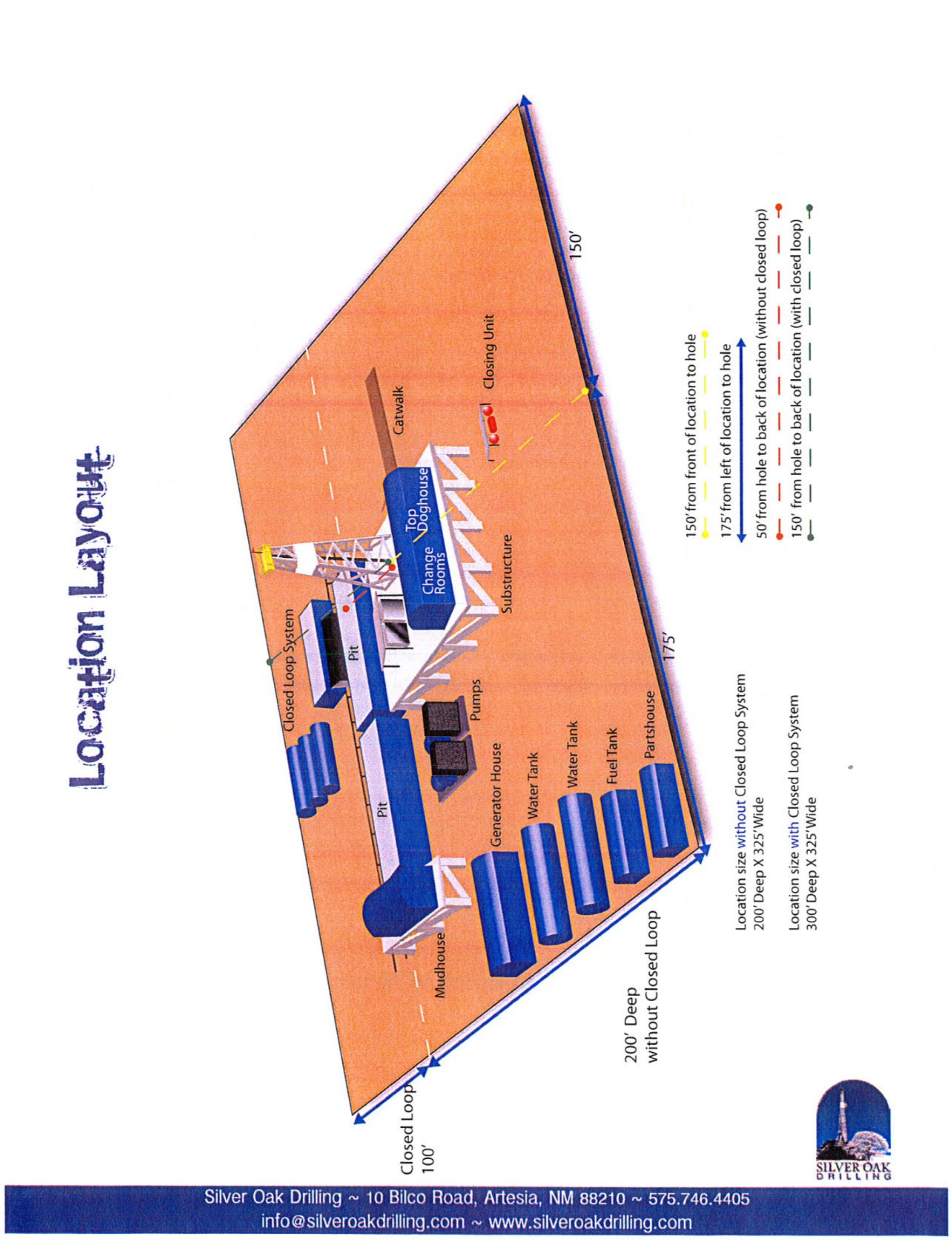
1. **BEARDS OR CONTACT LENSES NOT ALLOWED**
2. **HARD HATS REQUIRED**
3. **SMOKING IN DESIGNATED AREAS ONLY**
4. **BE WIND CONSCIOUS AT ALL TIMES**
5. **CHECK WITH MACK ENERGY FOREMAN AT OFFICE**

MACK ENERGY CORPORATION

1-575-748-1288



DRILLING LOCATION H2S SAFTY EQUIPMENT
Exhibit # 8



Mack Energy Corporation Call List, Chaves County

Artesia (575)	Cellular	Office
Jim Krogman	432-934-1596	748-1288
Emilio Martinez	432-934-7586	748-1288

Agency Call List (575)

Roswell

State Police……………………………………………..622-7200
City Police……………………………………………...624-6770
Sheriff's Office…………………………………………624-7590
Ambulance……………………………………………...624-7590
Fire Department……………………………………...624-7590
LEPC (Local Emergency Planning Committee………...624-6770
NMOCD………………………………………………...748-1283
Bureau of Land Management…………………………...627-0272

Emergency Services

Boots & Coots IWC……………..…1-800-256-9688 or (281)931-8884
Cudd pressure Control……………….(915)699-0139 or (915)563-3356
Halliburton……………………………………………..746-2757
Par Five………………………………………………..748-9539

Flight For Life-Lubbock, TX…….……………………(806)743-9911
Aerocare-Lubbock, TX………………………………...(806)747-8923
Med Flight Air Amb-Albuquerque, NM……………….(505)842-4433
Lifeguard Air Med Svc. Albuquerque, NM……………(505)272-3115

AFMSS

U.S. Department of the Interior
BUREAU OF LAND MANAGEMENT

Drilling Plan Data Report

03/26/2025

APD ID: 10400096387

Submission Date: 02/16/2024

Highlighted data reflects the most recent changes

Show Final Text

Operator Name: MACK ENERGY CORPORATION

Well Name: HIGH BOB FEDERAL

Well Number: 5H

Well Type: OIL WELL

Well Work Type: Drill

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical Depth	Measured Depth	Lithologies	Mineral Resources	Producing Formatio
15284236	RUSTLER	3781	240	240	ALLUVIUM	NONE	N
15284235	TOP OF SALT	3171	610	610	SALT	NONE	N
15284233	BASE OF SALT	3041	740	740	SALT	NONE	N
15284232	YATES	2884	897	897	ANHYDRITE, SILTSTONE	NATURAL GAS, OIL	N
15284234	SEVEN RIVERS	2621	1160	1160	ANHYDRITE, SILTSTONE	NATURAL GAS, OIL	N
15284237	QUEEN	2114	1667	1667	ANHYDRITE	NATURAL GAS, OIL	N
15284238	GRAYBURG	1716	2065	2065	ANHYDRITE, DOLOMITE, SILTSTONE	NATURAL GAS, OIL	N
15284239	SAN ANDRES	1434	2347	2386	ANHYDRITE, DOLOMITE	NATURAL GAS, OIL	Y

Section 2 - Blowout Prevention

Pressure Rating (PSI): 3M

Rating Depth: 8612

Equipment: Rotating Head, Mud Gas Separator

Requesting Variance? NO

Variance request:

Testing Procedure: The BOP/BOPE test shall include a low pressure test for 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30mins without a test plug. The estimated bottom hole at TD is 120 degrees and estimated maximum bottom hole pressure is 1414 psig (0.052*2955' TVD*9.2) less than 2900 bottom hole pressure. Well test to 2000 psi for 30 mins.

Choke Diagram Attachment:

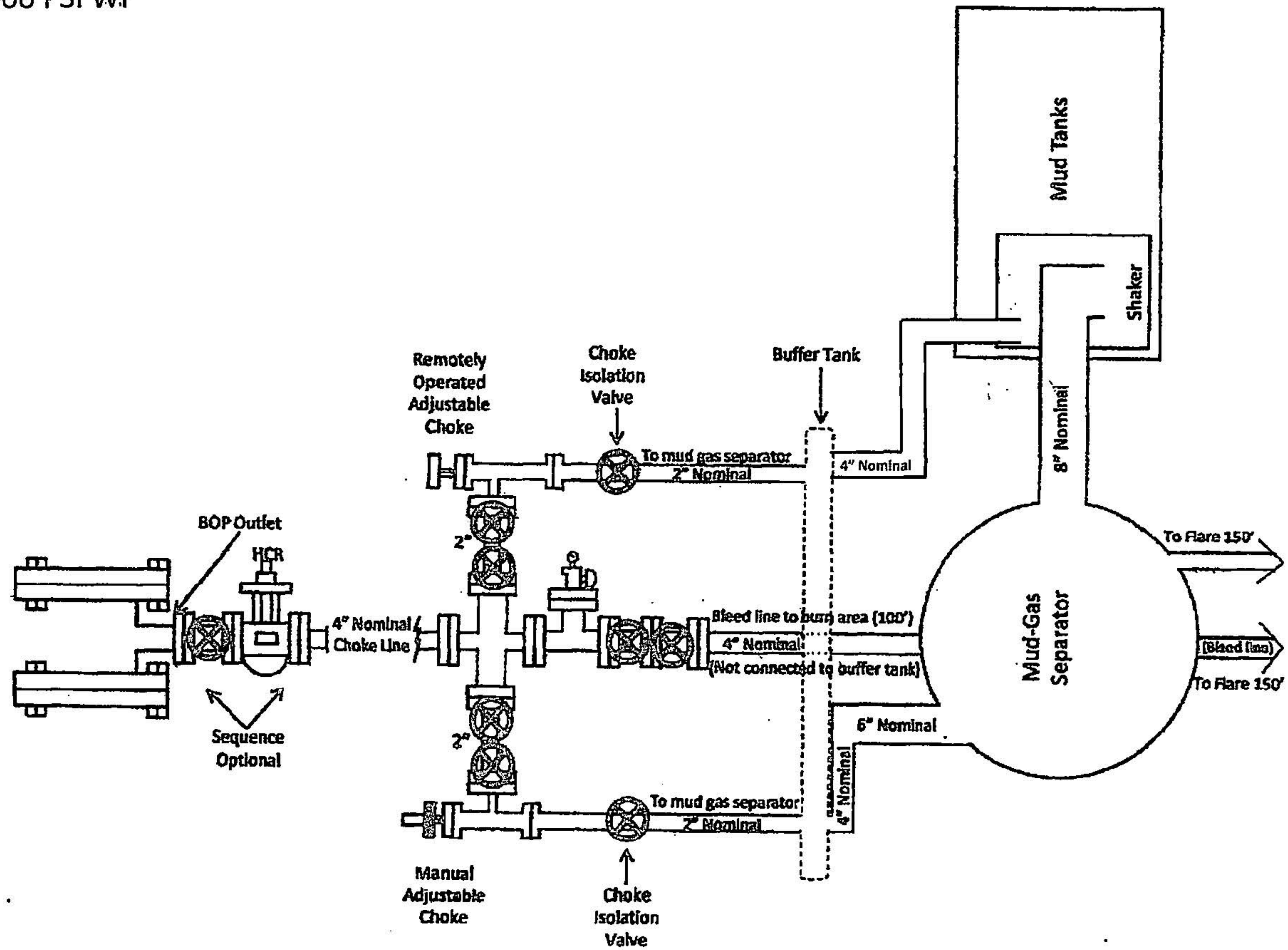
NEW_Choke_Manifold_3M_20231218150622.pdf

BOP Diagram Attachment:

NEW_BOP_3M_20231218150632.pdf

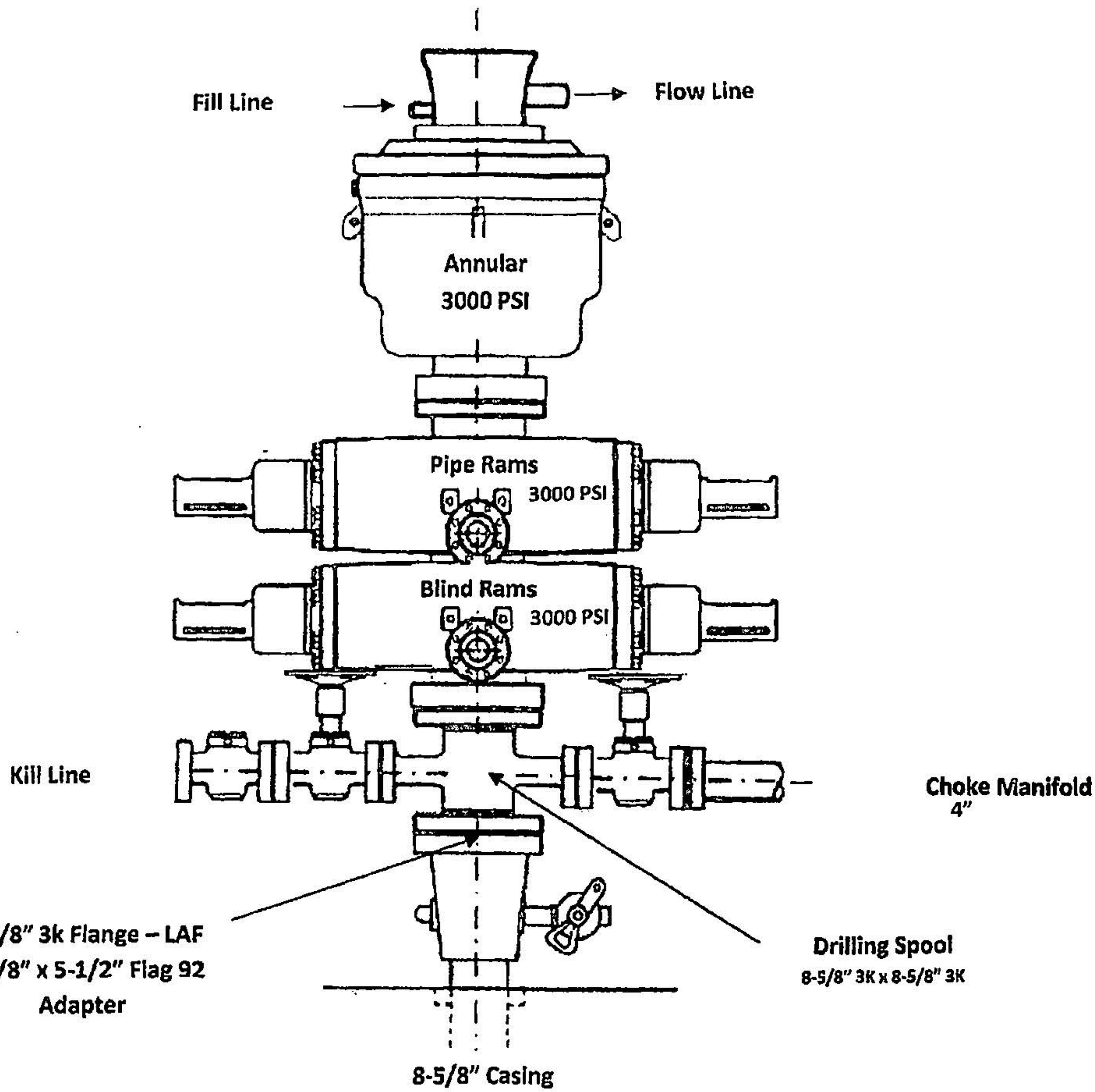
Choke Manifold

3000 PSI WP



BOP Diagram

Dual Ram BOP
3000 PSI WP



Sante Fe Main Office
Phone: (505) 476-3441

General Information
Phone: (505) 629-6116

Online Phone Directory
https://www.emnrd.nm.gov/ocd/contact-us

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 445984

CONDITIONS

Operator:	
MACK ENERGY CORP P.O. Box 960 Artesia, NM 882110960	OGRID: 13837
	Action Number: 445984
	Action Type: [C-101] BLM - Federal/Indian Land Lease (Form 3160-3)

CONDITIONS

Created By	Condition	Condition Date
dweaver	Cement is required to circulate on both surface and intermediate1 strings of casing.	3/26/2025
dweaver	If cement does not circulate on any string, a Cement Bond Log (CBL) is required for that string of casing.	3/26/2025
ward.rikala	Notify the OCD 24 hours prior to casing & cement.	4/15/2025
ward.rikala	File As Drilled C-102 and a directional Survey with C-104 completion packet.	4/15/2025
ward.rikala	Once the well is spud, to prevent ground water contamination through whole or partial conduits from the surface, the operator shall drill without interruption through the fresh water zone or zones and shall immediately set in cement the water protection string.	4/15/2025
ward.rikala	Oil base muds are not to be used until fresh water zones are cased and cemented providing isolation from the oil or diesel. This includes synthetic oils. Oil based mud, drilling fluids and solids must be contained in a steel closed loop system.	4/15/2025