

Form 3160-5
(June 2019)UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENTFORM APPROVED
OMB No. 1004-0137
Expires: October 31, 2021**SUNDRY NOTICES AND REPORTS ON WELLS**
Do not use this form for proposals to drill or to re-enter an abandoned well. Use Form 3160-3 (APD) for such proposals.

5. Lease Serial No.

6. If Indian, Allottee or Tribe Name

SUBMIT IN TRIPLICATE - Other instructions on page 2

1. Type of Well

☐ Oil Well ☐ Gas Well ☐ Other

2. Name of Operator

3a. Address

3b. Phone No. (include area code)

4. Location of Well (Footage, Sec., T., R., M., or Survey Description)

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

8. Well Name and No.

9. API Well No.

10. Field and Pool or Exploratory Area

11. Country or Parish, State

12. CHECK THE APPROPRIATE BOX(ES) TO INDICATE NATURE OF NOTICE, REPORT OR OTHER DATA

TYPE OF SUBMISSION	TYPE OF ACTION				
<input type="checkbox"/> Notice of Intent	<input type="checkbox"/> Acidize	<input type="checkbox"/> Deepen	<input type="checkbox"/> Production (Start/Resume)	<input type="checkbox"/> Water Shut-Off	
<input type="checkbox"/> Subsequent Report	<input type="checkbox"/> Alter Casing	<input type="checkbox"/> Hydraulic Fracturing	<input type="checkbox"/> Reclamation	<input type="checkbox"/> Well Integrity	
<input type="checkbox"/> Final Abandonment Notice	<input type="checkbox"/> Casing Repair	<input type="checkbox"/> New Construction	<input type="checkbox"/> Recomplete	<input type="checkbox"/> Other	
	<input type="checkbox"/> Change Plans	<input type="checkbox"/> Plug and Abandon	<input type="checkbox"/> Temporarily Abandon		
	<input type="checkbox"/> Convert to Injection	<input type="checkbox"/> Plug Back	<input type="checkbox"/> Water Disposal		

13. Describe Proposed or Completed Operation: Clearly state all pertinent details, including estimated starting date of any proposed work and approximate duration thereof. If the proposal is to deepen directionally or recompleat horizontally, give subsurface locations and measured and true vertical depths of all pertinent markers and zones. Attach the Bond under which the work will be performed or provide the Bond No. on file with BLM/BIA. Required subsequent reports must be filed within 30 days following completion of the involved operations. If the operation results in a multiple completion or recompleat in a new interval, a Form 3160-4 must be filed once testing has been completed. Final Abandonment Notices must be filed only after all requirements, including reclamation, have been completed and the operator has detennined that the site is ready for final inspection.)

14. I hereby certify that the foregoing is true and correct. Name (Printed/Typed)

Title

Signature

Date

THE SPACE FOR FEDERAL OR STATE OFFICE USE

Approved by

Title

Date

Conditions of approval, if any, are attached. Approval of this notice 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.

Office

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.

(Instructions on page 2)

GENERAL INSTRUCTIONS

This form is designed for submitting proposals to perform certain well operations and reports of such operations when completed as indicated on Federal and Indian lands pursuant to applicable Federal law and regulations. Any necessary special instructions concerning the use of this form and the number of copies to be submitted, particularly with regard to local area or regional procedures and practices, are either shown below, will be issued by or may be obtained from the local Federal office.

SPECIFIC INSTRUCTIONS

Item 4 - Locations on Federal or Indian land should be described in accordance with Federal requirements. Consult the local Federal office for specific instructions.

Item 13: Proposals to abandon a well and subsequent reports of abandonment should include such special information as is required by the local Federal office. In addition, such proposals and reports should include reasons for the abandonment; data on any former or present productive zones or other zones with present significant fluid contents not sealed off by cement or otherwise; depths (top and bottom) and method of placement of cement plugs; mud or other material placed below, between and above plugs; amount, size, method of parting of any casing, liner or tubing pulled and the depth to the top of any tubing left in the hole; method of closing top of well and date well site conditioned for final inspection looking for approval of the abandonment. If the proposal will involve **hydraulic fracturing operations**, you must comply with 43 CFR 3162.3-3, including providing information about the protection of usable water. Operators should provide the best available information about all formations containing water and their depths. This information could include data and interpretation of resistivity logs run on nearby wells. Information may also be obtained from state or tribal regulatory agencies and from local BLM offices.

NOTICES

The privacy Act of 1974 and the regulation in 43 CFR 2.48(d) provide that you be furnished the following information in connection with information required by this application.

AUTHORITY: 30 U.S.C. 181 et seq., 351 et seq., 25 U.S.C. 396; 43 CFR 3160.

PRINCIPAL PURPOSE: The information is used to: (1) Evaluate, when appropriate, approve applications, and report completion of subsequent well operations, on a Federal or Indian lease; and (2) document for administrative use, information for the management, disposal and use of National Resource lands and resources, such as: (a) evaluating the equipment and procedures to be used during a proposed subsequent well operation and reviewing the completed well operations for compliance with the approved plan; (b) requesting and granting approval to perform those actions covered by 43 CFR 3162.3-2, 3162.3-3, and 3162.3-4; (c) reporting the beginning or resumption of production, as required by 43 CFR 3162.4-1(c) and (d) analyzing future applications to drill or modify operations in light of data obtained and methods used.

ROUTINE USES: Information from the record and/or the record will be transferred to appropriate Federal, State, local or foreign agencies, when relevant to civil, criminal or regulatory investigations or prosecutions in connection with congressional inquiries or to consumer reporting agencies to facilitate collection of debts owed the Government.

EFFECT OF NOT PROVIDING THE INFORMATION: Filing of this notice and report and disclosure of the information is mandatory for those subsequent well operations specified in 43 CFR 3162.3-2, 3162.3-3, 3162.3-4.

The Paperwork Reduction Act of 1995 requires us to inform you that:

The BLM collects this information to evaluate proposed and/or completed subsequent well operations on Federal or Indian oil and gas leases.

Response to this request is mandatory.

The BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN HOURS STATEMENT: Public reporting burden for this form is estimated to average 8 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to U.S. Department of the Interior, Bureau of Land Management (1004-0137), Bureau Information Collection Clearance Officer (WO-630), 1849 C St., N.W., Mail Stop 401 LS, Washington, D.C. 20240

Additional Information

Location of Well

0. SHL: NWNW / 280 FNL / 575 FWL / TWSP: 18S / RANGE: 27E / SECTION: 9 / LAT: 32.7687647 / LONG: -104.2901037 (TVD: 0 feet, MD: 0 feet)

PPP: NENE / 676 FNL / 135 FEL / TWSP: 18S / RANGE: 27E / SECTION: 8 / LAT: 32.7676804 / LONG: -104.2924119 (TVD: 3580 feet, MD: 4052 feet)

PPP: NWNW / 500 FNL / 1320 FWL / TWSP: 18S / RANGE: 27E / SECTION: 7 / LAT: 32.767317 / LONG: -104.304893 (TVD: 3580 feet, MD: 7908 feet)

BHL: NENE / 820 FNL / 1220 FEL / TWSP: 18S / RANGE: 27E / SECTION: 7 / LAT: 32.7673549 / LONG: -104.3131015 (TVD: 3580 feet, MD: 10432 feet)

District I

1625 N. French Dr., Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

District II

811 S. First St., Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

District III

1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

District IV

1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico

Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION

1220 South St. Francis Dr.

Santa Fe, NM 87505

Form C-102

Revised August 1, 2011

Submit one copy to appropriate

District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

¹ API Number 30-015-46816	² Pool Code 51120	³ Pool Name Red Lake; Glorieta-Yeso
⁴ Property Code 327298	⁵ Property Name CONDOR 8 FEDERAL COM	⁶ Well Number 4H
⁷ OGRID No. 330211	⁸ Operator Name REDWOOD OPERATING LLC	⁹ Elevation 3525.0

¹⁰ Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	9	18 S	27 E		280	NORTH	575	WEST	EDDY

¹¹ Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
A	7	18 S	27 E		500	NORTH	1319	EAST	EDDY

¹² Dedicated Acres 200	¹³ Joint or Infill	¹⁴ Consolidation Code	¹⁵ Order No.
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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.

<p>BOTTOM OF HOLE LAT. = 32.7682390°N LONG. = 104.3134220°W NMSP EAST (FT) N = 643217.95 E = 547457.76</p> <p>FIRST TAKE POINT 500' PNL, 100' FEL LAT. = 32.7681565°N LONG. = 104.2923030°W NMSP EAST (FT) N = 643189.80 E = 553949.23</p> <p>NW CORNER SEC. 7 LAT. = 32.7698077°N LONG. = 104.3264802°W NMSP EAST (FT) N = 643788.15 E = 543443.94</p> <p>NW CORNER SEC. 8 LAT. = 32.7695498°N LONG. = 104.3091295°W NMSP EAST (FT) N = 643695.09 E = 548777.05</p> <p>NW CORNER SEC. 9 LAT. = 32.7695301°N LONG. = 104.2919694°W NMSP EAST (FT) N = 643689.57 E = 554051.59</p> <p>NE CORNER SEC. 9 LAT. = 32.7695666°N LONG. = 104.2748572°W NMSP EAST (FT) N = 643705.32 E = 559311.36</p> <p>N/4 CORNER SEC. 7 LAT. = 32.7697774°N LONG. = 104.3177684°W NMSP EAST (FT) N = 643741.04 E = 546121.71</p> <p>N/4 CORNER SEC. 8 LAT. = 32.7695402°N LONG. = 104.3005448°W NMSP EAST (FT) N = 643692.32 E = 551415.74</p> <p>N/4 CORNER SEC. 9 LAT. = 32.7695488°N LONG. = 104.2834167°W NMSP EAST (FT) N = 643697.50 E = 556680.44</p> <p>W/4 CORNER SEC. 8 LAT. = 32.7622997°N LONG. = 104.3091424°W NMSP EAST (FT) N = 641057.42 E = 548773.70</p> <p>E/4 CORNER SEC. 8 LAT. = 32.7623157°N LONG. = 104.2920134°W NMSP EAST (FT) N = 641064.87 E = 554039.09</p> <p>E/4 CORNER SEC. 9 LAT. = 32.7623345°N LONG. = 104.2749216°W NMSP EAST (FT) N = 641074.18 E = 559293.01</p> <p>S/4 CORNER SEC. 7 LAT. = 32.7551705°N LONG. = 104.3177995°W NMSP EAST (FT) N = 638463.23 E = 546112.93</p> <p>S/4 CORNER SEC. 8 LAT. = 32.7550734°N LONG. = 104.3006071°W NMSP EAST (FT) N = 638428.13 E = 551398.24</p> <p>S/4 CORNER SEC. 9 LAT. = 32.7551020°N LONG. = 104.2835219°W NMSP EAST (FT) N = 638441.56 E = 556650.57</p> <p>SW CORNER SEC. 7 LAT. = 32.7552943°N LONG. = 104.3264680°W NMSP EAST (FT) N = 638508.01 E = 543448.03</p> <p>SW CORNER SEC. 8 LAT. = 32.7550456°N LONG. = 104.3091543°W NMSP EAST (FT) N = 638418.28 E = 548770.65</p> <p>SE CORNER SEC. 8 LAT. = 32.7551007°N LONG. = 104.2920617°W NMSP EAST (FT) N = 638439.96 E = 554025.27</p> <p>SE CORNER SEC. 9 LAT. = 32.7551009°N LONG. = 104.2749845°W NMSP EAST (FT) N = 638442.50 E = 559275.13</p> <p>LAST TAKE POINT 500' PNL, 1220' FEL LAT. = 32.7682343°N LONG. = 104.3131000°W NMSP EAST (FT) N = 643216.26 E = 547556.73</p> <p>CONDOR 8 FEDERAL COM 4H ELEV. = 3525.0' LAT. = 32.7687647°N (NAD83) LONG. = 104.2901037°W NMSP EAST (FT) N = 643411.35 E = 554625.16</p> <p>NOTE: LATITUDE AND LONGITUDE COORDINATES ARE SHOWN USING THE NORTH AMERICAN DATUM OF 1983 (NAD83) LISTED NEW MEXICO STATE PLANE EAST COORDINATES ARE GRID (NAD83). BASIS OF BEARING AND DISTANCES USED ARE NEW MEXICO STATE PLANE EAST COORDINATES MODIFIED TO THE SURFACE. VERTICAL DATUM NAVD83.</p>	<p>¹⁷ OPERATOR CERTIFICATION</p> <p>I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and 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 such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.</p> <p><i>Deana Weaver</i> 1/20/22 Signature Date</p> <p>Deana Weaver Printed Name</p> <p>dweaver@mec.com E-mail Address</p> <p>¹⁸ SURVEYOR CERTIFICATION</p> <p>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.</p> <p>JANUARY 17, 2022 Date of Survey</p> <p><i>William F. Jaramillo</i> Signature and Seal of Professional Surveyor</p> <p>Certificate Number: WILLIAM F. JARAMILLO, PLS 12797 NEW MEXICO PROFESSIONAL SURVEYOR NO. 7039D</p>
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Intent ☒ ☒ As Drilled ☐

API #		
Operator Name: REDWOOD OPERATING LLC	Property Name: CONDOR 8 FEDERAL COM	Well Number 4H

Kick Off Point (KOP)

UL D	Section 9	Township 18S	Range 27E	Lot	Feet 280	From N/S NORTH	Feet 575	From E/W WEST	County EDDY
Latitude 32.7687647					Longitude 104.2901037			NAD 83	

First Take Point (FTP)

UL A	Section 8	Township 18S	Range 27E	Lot	Feet 500	From N/S NORTH	Feet 100	From E/W EAST	County EDDY
Latitude 32.7681565					Longitude 104.2923030			NAD 83	

Last Take Point (LTP)

UL A	Section 7	Township 18S	Range 27E	Lot	Feet 500	From N/S NORTH	Feet 1220	From E/W EAST	County EDDY
Latitude 32.7682343					Longitude 104.3131000			NAD 83	

Is this well the defining well for the Horizontal Spacing Unit? ☐Is this well an infill well? ☐

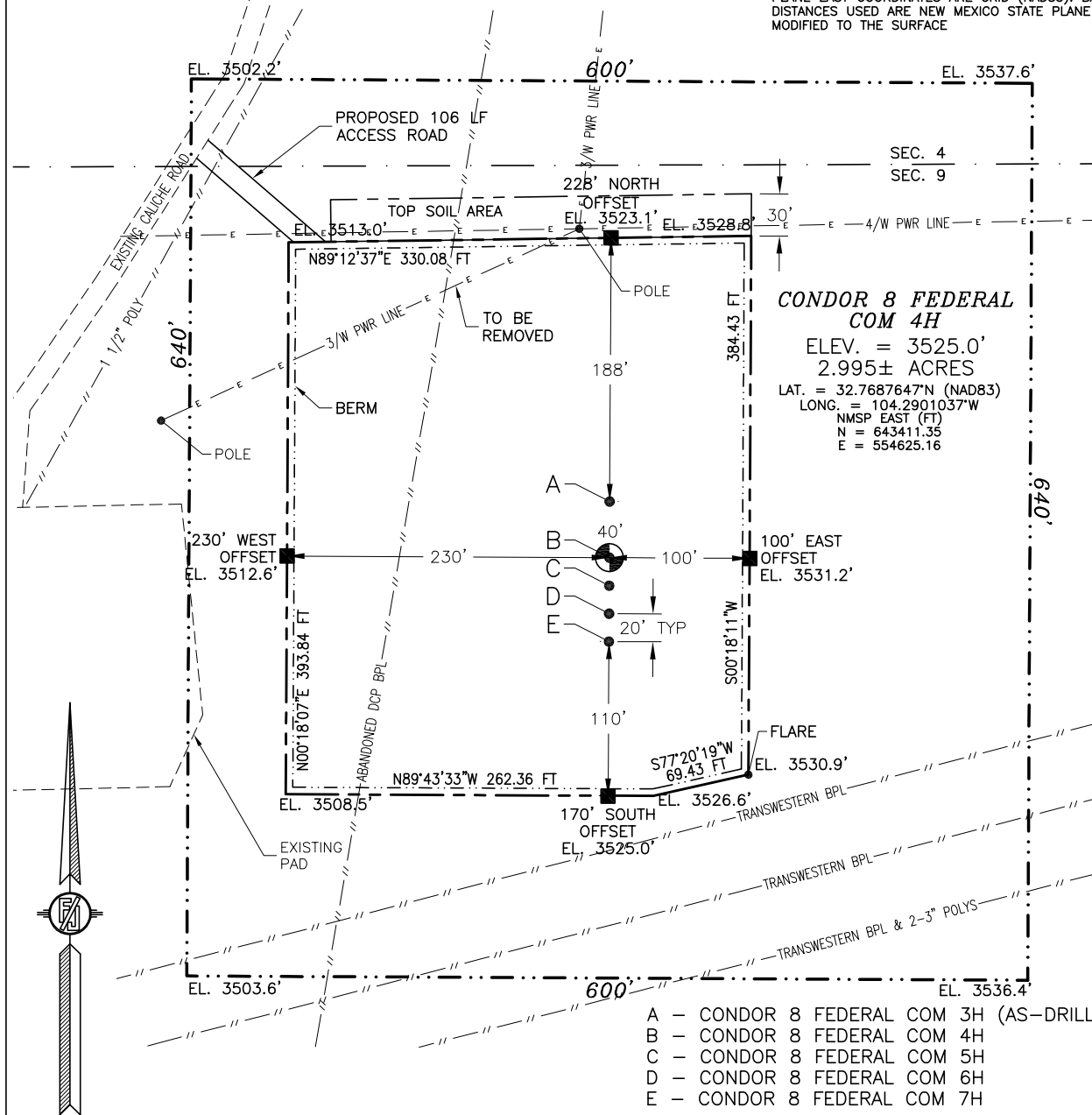
If infill is yes please provide API if available, Operator Name and well number for Defining well for Horizontal Spacing Unit.

API #		
Operator Name:	Property Name:	Well Number

KZ 06/29/2018

SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M. EDDY COUNTY, STATE OF NEW MEXICO SITE MAP

NOTE: LATITUDE AND LONGITUDE COORDINATES ARE SHOWN USING THE NORTH AMERICAN DATUM OF 1983 (NAD83). LISTED NEW MEXICO STATE PLANE EAST COORDINATES ARE GRID (NAD83). BASIS OF BEARING AND DISTANCES USED ARE NEW MEXICO STATE PLANE EAST COORDINATES MODIFIED TO THE SURFACE



- A - CONDOR 8 FEDERAL COM 3H (AS-DRILLED)
- B - CONDOR 8 FEDERAL COM 4H
- C - CONDOR 8 FEDERAL COM 5H
- D - CONDOR 8 FEDERAL COM 6H
- E - CONDOR 8 FEDERAL COM 7H

012 60 120 240
SCALE 1" = 120'

DIRECTIONS TO LOCATION

FROM CR 227 (LITTLE DIAMOND) AND CR 201 (CHALK BLUFF) GO SOUTHEAST ON CR 227 855', THEN EAST 340', TURN RIGHT ON CALICHE ROAD AND GO SOUTHEAST 0.1 OF A MILE, TURN RIGHT AND GO SOUTHWEST 0.1 OF A MILE TO ROAD SURVEY, FOLLOW FLAGS SOUTHEAST 106' TO THE NORTHWEST CORNER FOR THIS LOCATION.

I, FILMON F. JARAMILLO, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR, CERTIFY THAT I AM THE SURVEYOR RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY WAS CONDUCTED IN ACCORDANCE WITH THE BEST OF MY KNOWLEDGE AND BELIEF AND THAT I HAVE MET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

FILMON F. JARAMILLO, 12797

MADRON SURVEYING, INC.

301 SOUTH CANAL
(575) 234-3341

REDWOOD OPERATING LLC
CONDOR 8 FEDERAL COM 4H

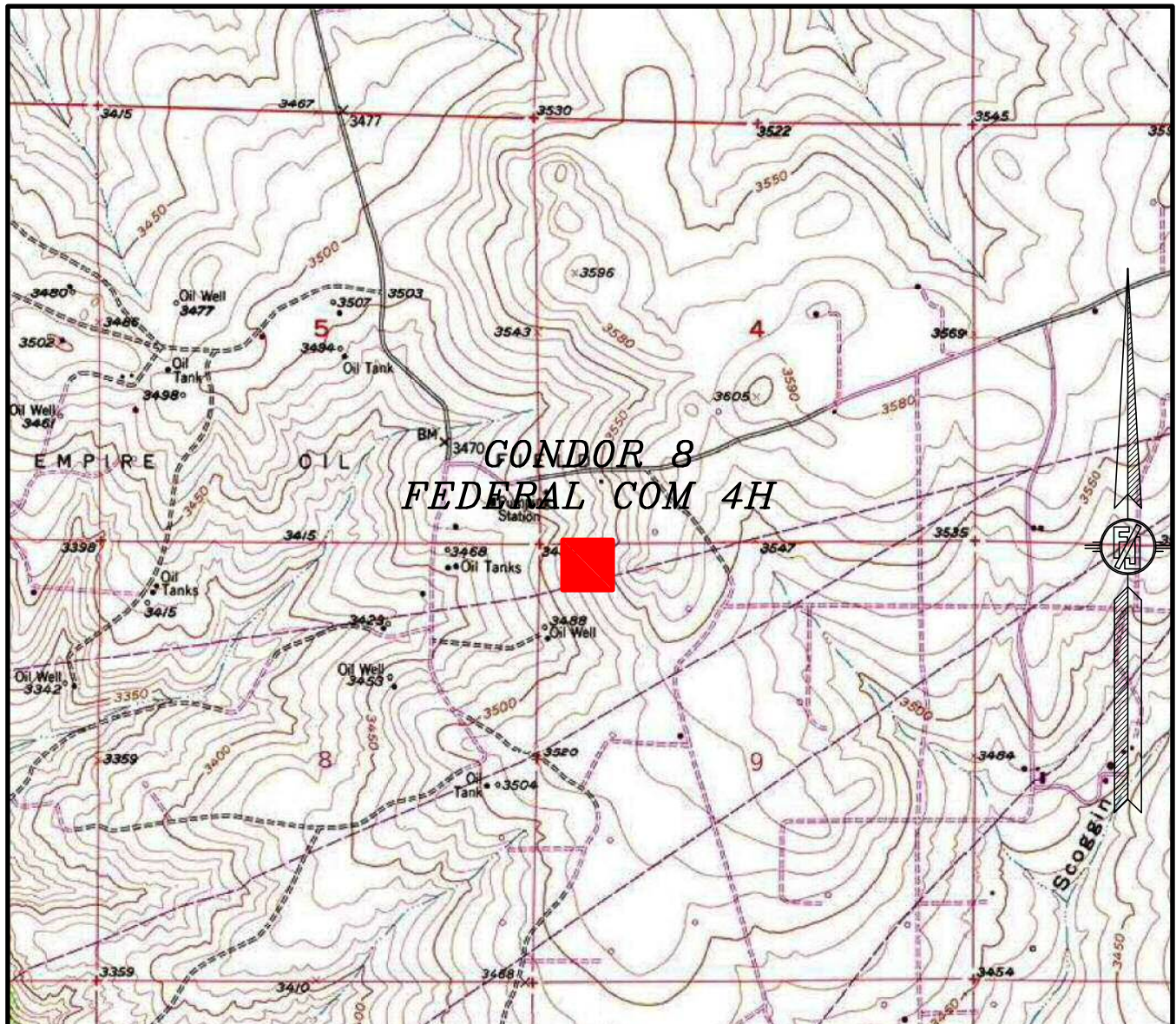
LOCATED 280 FT. FROM THE NORTH LINE
AND 575 FT. FROM THE WEST LINE OF
SECTION 9, TOWNSHIP 18 SOUTH,
RANGE 27 EAST, N.M.P.M.
EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

SURVEY NO. 7039D

CARLSBAD, NEW MEXICO

SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 LOCATION VERIFICATION MAP



USGS QUAD MAP:
 SPRING LAKE

NOT TO SCALE

REDWOOD OPERATING LLC
CONDOR 8 FEDERAL COM 4H
 LOCATED 280 FT. FROM THE NORTH LINE
 AND 575 FT. FROM THE WEST LINE OF
 SECTION 9, TOWNSHIP 18 SOUTH,
 RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO

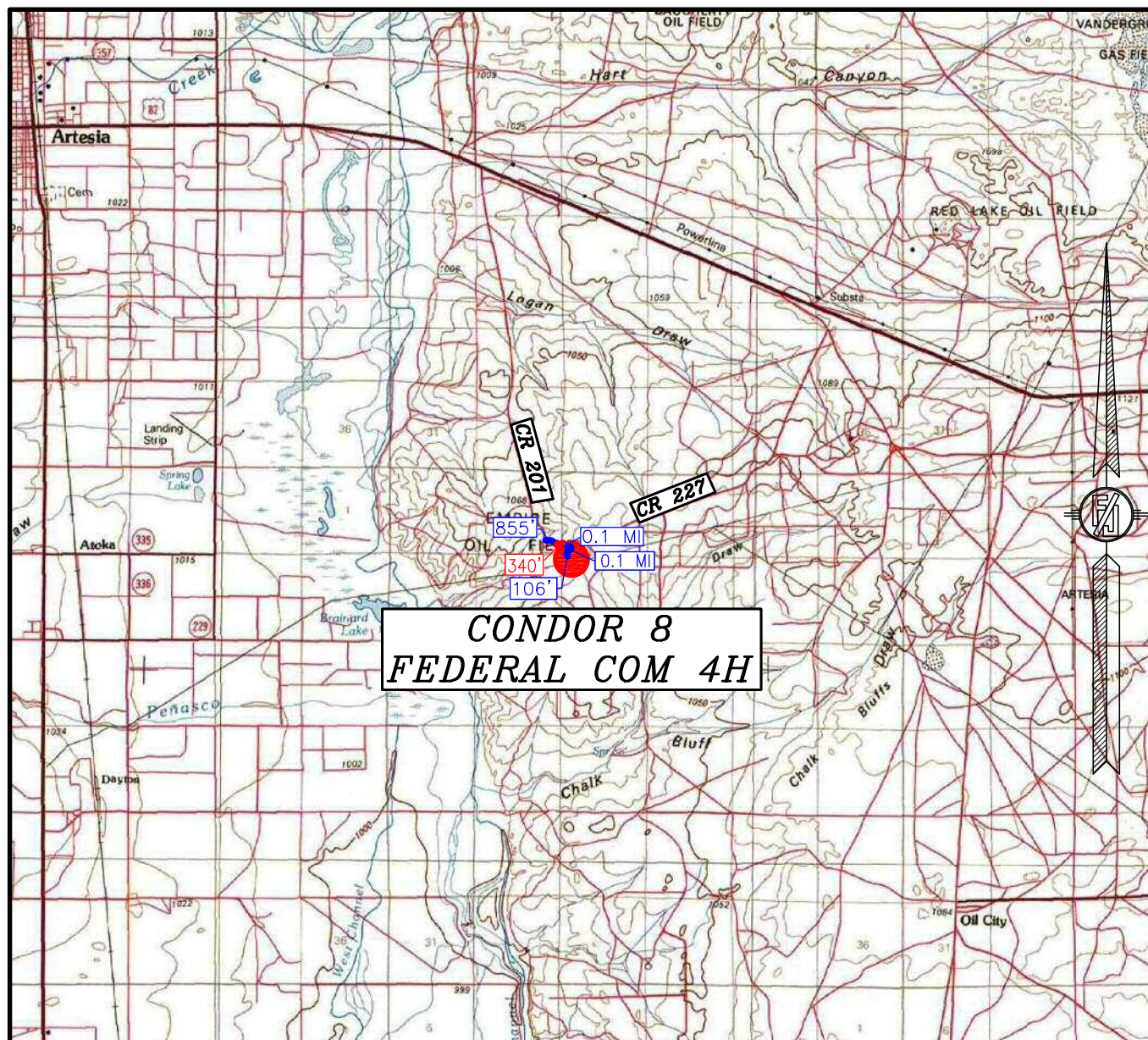
JANUARY 17, 2022

MADRON SURVEYING, INC.

301 SOUTH CANAL
 (575) 234-3341

SURVEY NO. 7039D
 CARLSBAD, NEW MEXICO

SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 VICINITY MAP



DISTANCES IN MILES

NOT TO SCALE

DIRECTIONS TO LOCATION

FROM CR 227 (LITTLE DIAMOND) AND CR 201 (CHALK BLUFF) GO SOUTHEAST ON CR 227 855', THEN EAST 340', TURN RIGHT ON CALICHE ROAD AND GO SOUTHEAST 0.1 OF A MILE, TURN RIGHT AND GO SOUTHWEST 0.1 OF A MILE TO ROAD SURVEY, FOLLOW FLAGS SOUTHEAST 106' TO THE NORTHWEST PAD CORNER FOR THIS LOCATION.

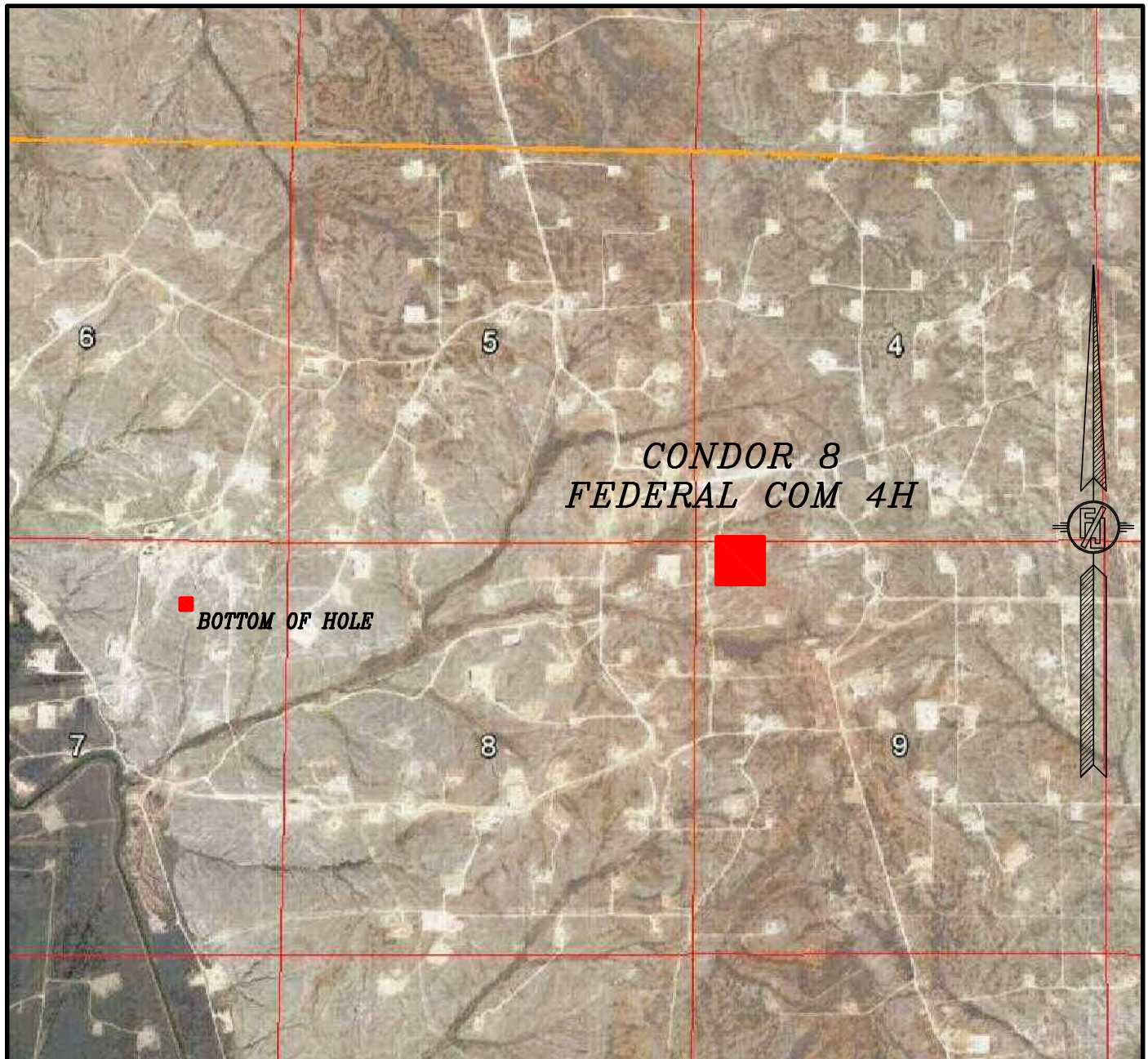
REDWOOD OPERATING LLC
CONDOR 8 FEDERAL COM 4H
 LOCATED 280 FT. FROM THE NORTH LINE OF
 AND 575 FT. FROM THE WEST LINE OF
 SECTION 9, TOWNSHIP 18 SOUTH,
 RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

MADRON SURVEYING, INC.

301 SOUTH CANAL
(575) 234-3341SURVEY NO. 7039D
CARLSBAD, NEW MEXICO

SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 AERIAL PHOTO



NOT TO SCALE
 AERIAL PHOTO:
 GOOGLE EARTH
 MARCH 2016

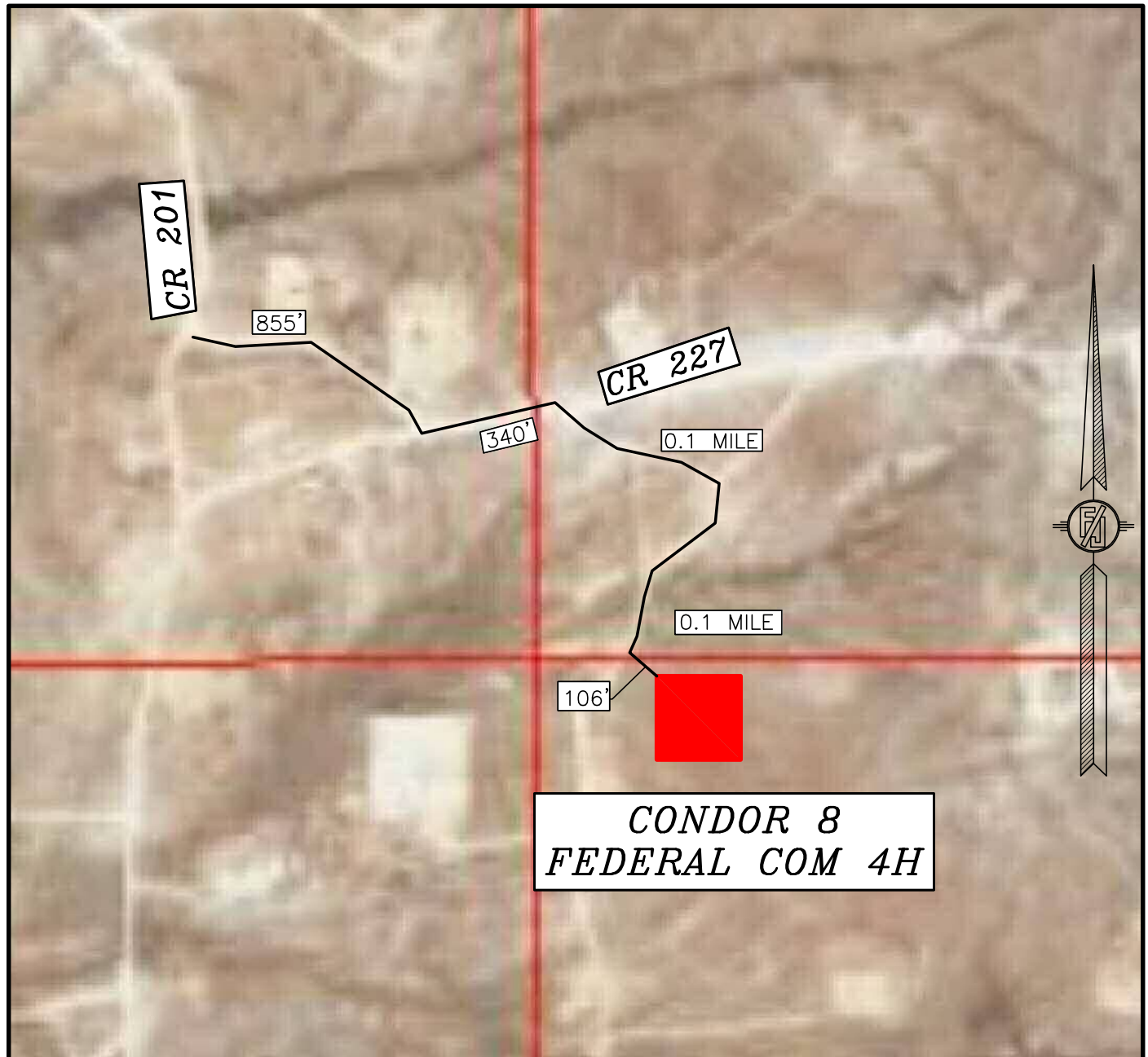
REDWOOD OPERATING LLC
CONDOR 8 FEDERAL COM 4H
 LOCATED 280 FT. FROM THE NORTH LINE
 AND 575 FT. FROM THE WEST LINE OF
 SECTION 9, TOWNSHIP 18 SOUTH,
 RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

MADRON SURVEYING, INC. 301 SOUTH CANAL
 (575) 234-3341

SURVEY NO. 7039D
 CARLSBAD, NEW MEXICO

SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 ACCESS AERIAL ROUTE MAP



NOT TO SCALE
 AERIAL PHOTO:
 GOOGLE EARTH
 MARCH 2016

REDWOOD OPERATING LLC
CONDOR 8 FEDERAL COM 4H
 LOCATED 280 FT. FROM THE NORTH LINE
 AND 575 FT. FROM THE WEST LINE OF
 SECTION 9, TOWNSHIP 18 SOUTH,
 RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

MADRON SURVEYING, INC.

301 SOUTH CANAL
 (575) 234-3341

SURVEY NO. 7039D
 CARLSBAD, NEW MEXICO

LIMITS OF
EARTHWORK
3:1 SLOPE (TYP.)

A	-	CONDOR	8	FEDERAL	COM	3H	(AS-DRILLED)
B	-	CONDOR	8	FEDERAL	COM	4H	
C	-	CONDOR	8	FEDERAL	COM	5H	
D	-	CONDOR	8	FEDERAL	COM	6H	
E	-	CONDOR	8	FEDERAL	COM	7H	

I, FILIMON F. JARAMILLO, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I DIRECTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

FILIMON F. JARAMILLO, PLS. 1279

REDWOOD OPERATING LLC
GRADING PLAN AND CROSS SECTIONS
FOR CONDOR 8 FEDERAL COM 4H
SECTION 9, TOWNSHIP 18 SOUTH,
RANGE 27 EAST, N.M.P.M.
EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

301 SOUTH CANAL
(575) 234-3341

CARLSBAD, NEW MEXICO

0 12 60 120 240

SCALE 1" = 120'

CUT	FILL	NET
17393 CU. YD	9885 CU. YD	7508 CU. YD (CUT)

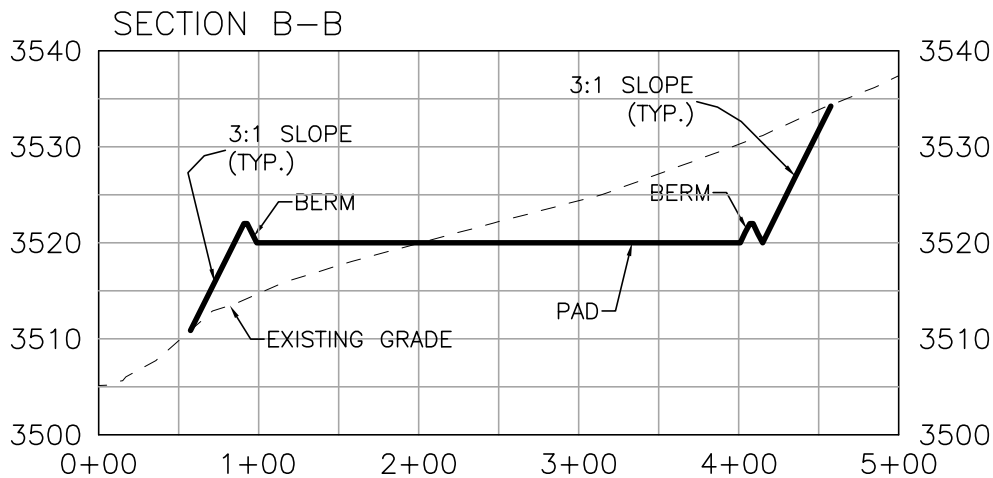
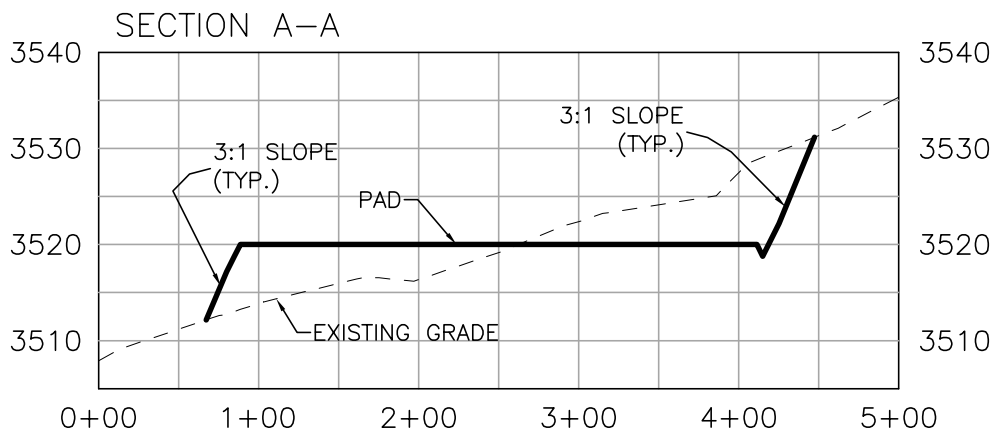
EARTHWORK QUANTITIES ARE ESTIMATED

SHEET 1-3
SURVEY NO. 7039D ☒

SHEET 1-3

SURVEY NO. 7039D

CROSS SECTIONS



I, FILIMON F. JARAMILLO, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I DIRECTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THE SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

FILIMON F. JARAMILLO 12797

REDWOOD OPERATING LLC
GRADING PLAN AND CROSS SECTIONS
FOR CONDOR 8 FEDERAL COM 4H
SECTION 9, TOWNSHIP 18 SOUTH,
RANGE 27 EAST, N.M.P.M.
EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

301 SOUTH CANAL
 (575) 234-3341

MADRON SURVEYING, INC. CARLSBAD, NEW MEXICO

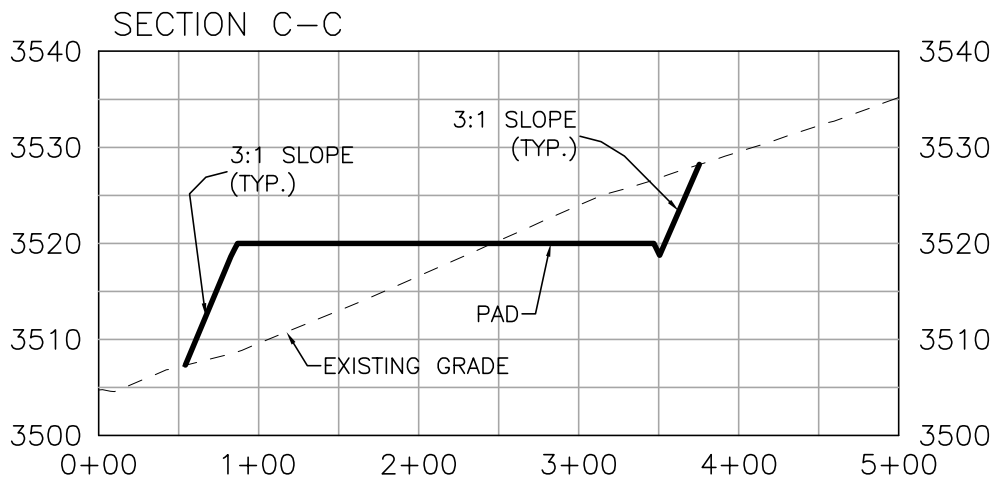
012 60 120 240
 SCALE 1" = 120' - 1" = 20' VER

CUT	FILL	NET
17393 CU. YD	9885 CU. YD	7508 CU. YD (CUT)

EARTHWORK QUANTITIES ARE ESTIMATED

SHEET 2-3
SURVEY NO. 7039D

CROSS SECTIONS



I, FILIMON F. JARAMILLO, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I DIRECTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.



REDWOOD OPERATING LLC
GRADING PLAN AND CROSS SECTIONS
FOR CONDOR 8 FEDERAL COM 4H
 SECTION 9, TOWNSHIP 18 SOUTH,
 RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO

JANUARY 17, 2022

301 SOUTH CANAL
 (575) 234-3341

MADRON SURVEYING, INC. CARLSBAD, NEW MEXICO

012 60 120 240
 SCALE 1" = 120' - 1" = 20' VER

CUT	FILL	NET
17393 CU. YD	9885 CU. YD	7508 CU. YD (CUT)

EARTHWORK QUANTITIES ARE ESTIMATED

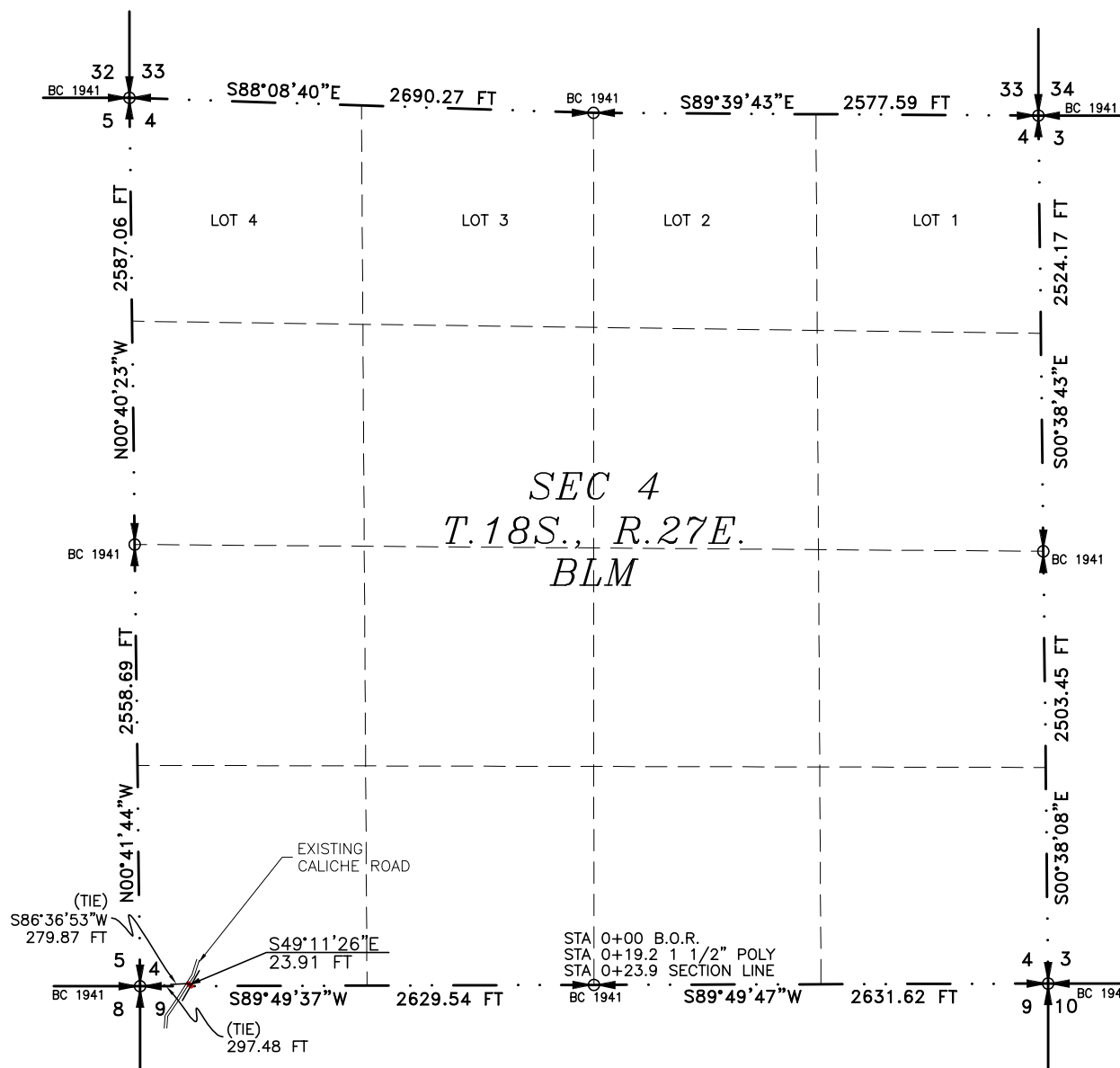
SHEET 3-3
 SURVEY NO. 7039D

ACCESS ROAD PLAT

ACCESS ROAD TO THE CONDOR 8 FEDERAL COM 3H, 4H, 5H, 6H, 7H

REDWOOD OPERATING LLC

CENTERLINE SURVEY OF AN ACCESS ROAD CROSSING
SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
EDDY COUNTY, STATE OF NEW MEXICO
JANUARY 17, 2022



SEE NEXT SHEET (2-4) FOR DESCRIPTION

GENERAL NOTES

- 1.) THE INTENT OF THIS ROUTE SURVEY IS TO ACQUIRE AN EASEMENT.
- 2.) BASIS OF BEARING AND DISTANCE IS NMSP EAST (NAD83) MODIFIED TO SURFACE COORDINATES. NAD 83 (FEET) AND NAVD 88 (FEET) COORDINATE SYSTEMS USED IN THE SURVEY.

SHEET: 1-4

MADRON SURVEYING, INC. CARLSBAD, NEW MEXICO

SURVEYOR CERTIFICATE

I, FILIMON F. JARAMILLO, A NEW MEXICO PROFESSIONAL SURVEYOR NO. 12797, HEREBY CERTIFY THAT I HAVE CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR LAND SURVEYING IN THE STATE OF NEW MEXICO.

IN WITNESS WHEREOF, THIS CERTIFICATE IS EXECUTED AT CARLSBAD, NEW MEXICO, THIS 18TH DAY OF JANUARY 2022

FILIMON F. JARAMILLO PLS 12797
NEW MEXICO PROFESSIONAL SURVEYOR

MADRON SURVEYING, INC.
301 SOUTH CANAL
CARLSBAD, NEW MEXICO 88220
Phone (575) 234-3341

SURVEY NO. 7039D

ACCESS ROAD PLAT
 ACCESS ROAD TO THE CONDOR 8 FEDERAL COM 3H, 4H, 5H, 6H, 7H
REDWOOD OPERATING LLC
 CENTERLINE SURVEY OF AN ACCESS ROAD CROSSING
 SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 JANUARY 17, 2022

DESCRIPTION

A STRIP OF LAND 30 FEET WIDE CROSSING BUREAU OF LAND MANAGEMENT LAND IN SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M., EDDY COUNTY, STATE OF NEW MEXICO AND BEING 15 FEET EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE SURVEY:

BEGINNING AT A POINT WITHIN THE SW/4 SW/4 OF SAID SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M., WHENCE THE SOUTHWEST CORNER OF SAID SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M. BEARS S86°36'53"W, A DISTANCE OF 279.87 FEET;

THENCE S49°11'26"E A DISTANCE OF 23.91 FEET THE TERMINUS OF THIS CENTERLINE SURVEY, WHENCE THE SOUTHWEST CORNER OF SAID SECTION 4, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M. BEARS S89°49'37"W, A DISTANCE OF 297.48 FEET;

SAID STRIP OF LAND BEING 23.91 FEET OR 1.45 RODS IN LENGTH, CONTAINING 0.016 ACRES MORE OR LESS AND BEING ALLOCATED BY FORTIES AS FOLLOWS:

SW/4 SW/4 23.91 L.F. 1.45 RODS 0.016 ACRES

GENERAL NOTES

1.) THE INTENT OF THIS ROUTE SURVEY IS TO ACQUIRE AN EASEMENT.

2.) BASIS OF BEARING AND DISTANCE IS NMSP EAST (NAD83) MODIFIED TO SURFACE COORDINATES. NAD 83 (FEET) AND NAVD 88 (FEET) COORDINATE SYSTEMS USED IN THE SURVEY.

SHEET: 2-4

MADRON SURVEYING, INC. 301 SOUTH CANAL CARLSBAD, NEW MEXICO (575) 234-3341

SURVEYOR CERTIFICATE

I, FILIMON F. JARAMILLO, A NEW MEXICO PROFESSIONAL SURVEYOR NO. 12797, HEREBY CERTIFY THAT I HAVE CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR LAND SURVEYING IN THE STATE OF NEW MEXICO.

IN WITNESS WHEREOF, THIS CERTIFICATE IS EXECUTED AT CARLSBAD, NEW MEXICO, THIS 18TH DAY OF JANUARY, 2022

[Signature]
 FILIMON F. JARAMILLO PLS 12797
 301 SOUTH CANAL CARLSBAD, NEW MEXICO (575) 234-3341

MADRON SURVEYING, INC.
 301 SOUTH CANAL
 CARLSBAD, NEW MEXICO 88220
 Phone (575) 234-3341

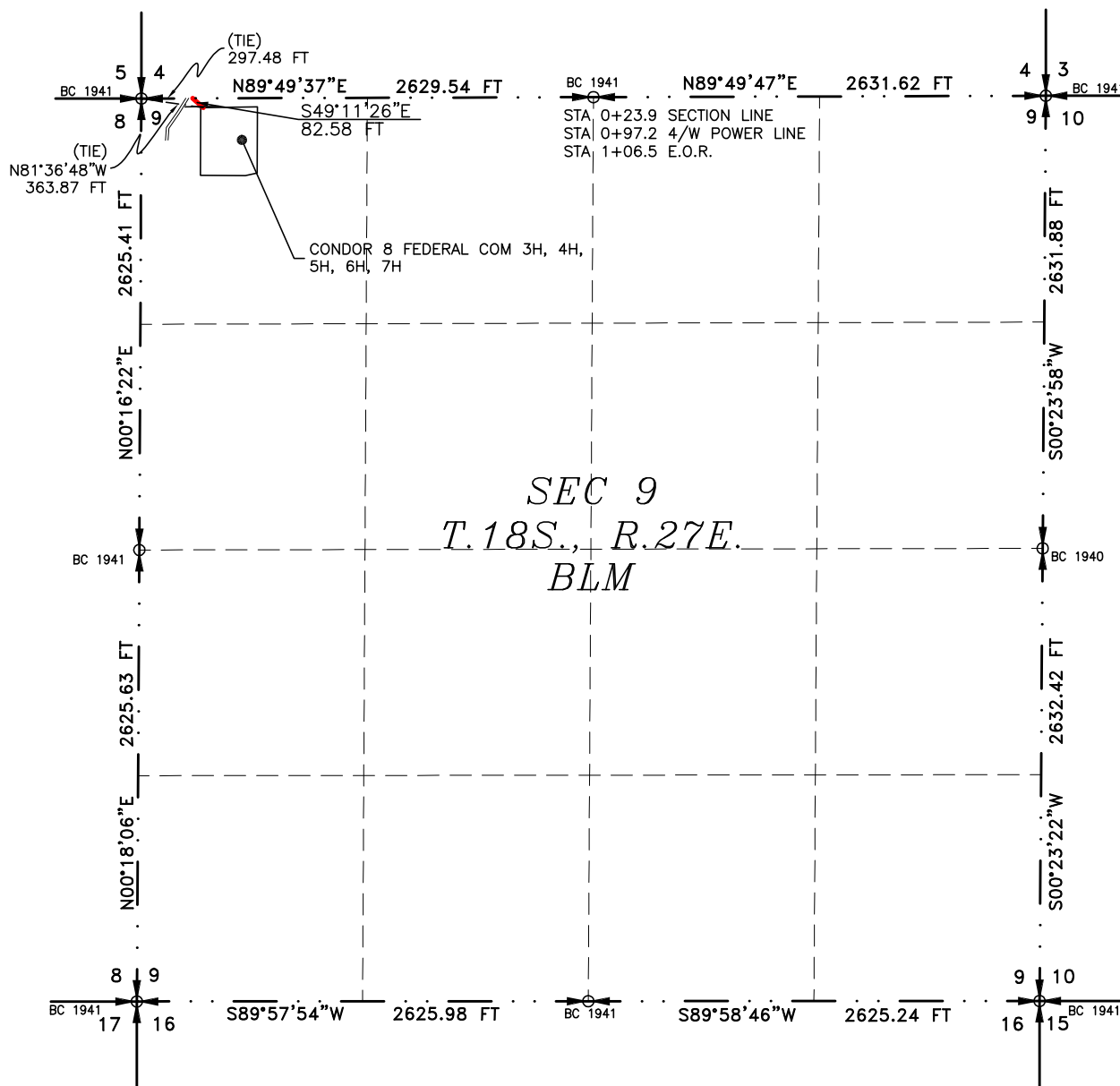
SURVEY NO. 7039D

ACCESS ROAD PLAT

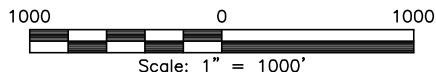
ACCESS ROAD TO THE CONDOR 8 FEDERAL COM 3H, 4H, 5H, 6H, 7H

REDWOOD OPERATING LLC

CENTERLINE SURVEY OF AN ACCESS ROAD CROSSING
SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
EDDY COUNTY, STATE OF NEW MEXICO
JANUARY 17, 2022



SEE NEXT SHEET (4-4) FOR DESCRIPTION

**GENERAL NOTES**

- 1.) THE INTENT OF THIS ROUTE SURVEY IS TO ACQUIRE AN EASEMENT.
- 2.) BASIS OF BEARING AND DISTANCE IS NMSP EAST (NAD83) MODIFIED TO SURFACE COORDINATES. NAD 83 (FEET) AND NAVD 88 (FEET) COORDINATE SYSTEMS USED IN THE SURVEY.

SHEET: 3-4

MADRON SURVEYING, INC.

SURVEYOR CERTIFICATE

I, FILIMON F. JARAMILLO, A NEW MEXICO PROFESSIONAL SURVEYOR NO. 12797, HEREBY CERTIFY THAT I HAVE CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR LAND SURVEYING IN THE STATE OF NEW MEXICO.

IN WITNESS WHEREOF, THIS CERTIFICATE IS EXECUTED AT CARLSBAD, NEW MEXICO, THIS 18TH DAY OF JANUARY 2022

FILIMON F. JARAMILLO, PLS 12797
 301 SOUTH CANAL
 CARLSBAD, NEW MEXICO 88220
 Phone (575) 234-3341

MADRON SURVEYING, INC.
 301 SOUTH CANAL
 CARLSBAD, NEW MEXICO 88220
 Phone (575) 234-3341

SURVEY NO. 7039D

CARLSBAD, NEW MEXICO

ACCESS ROAD PLAT
 ACCESS ROAD TO THE CONDOR 8 FEDERAL COM 3H, 4H, 5H, 6H, 7H
REDWOOD OPERATING LLC
 CENTERLINE SURVEY OF AN ACCESS ROAD CROSSING
 SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M.
 EDDY COUNTY, STATE OF NEW MEXICO
 JANUARY 17, 2022

DESCRIPTION

A STRIP OF LAND 30 FEET WIDE CROSSING BUREAU OF LAND MANAGEMENT LAND IN SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M., EDDY COUNTY, STATE OF NEW MEXICO AND BEING 15 FEET EACH SIDE OF THE FOLLOWING DESCRIBED CENTERLINE SURVEY:

BEGINNING AT A POINT WITHIN THE NW/4 NW/4 OF SAID SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M., WHENCE THE NORTHWEST CORNER OF SAID SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M. BEARS S89°49'37"W, A DISTANCE OF 297.48 FEET;
 THENCE S49°11'26"E A DISTANCE OF 82.58 FEET THE TERMINUS OF THIS CENTERLINE SURVEY, WHENCE THE NORTHWEST CORNER OF SAID SECTION 9, TOWNSHIP 18 SOUTH, RANGE 27 EAST, N.M.P.M. BEARS N81°36'48"W, A DISTANCE OF 363.87 FEET;

SAID STRIP OF LAND BEING 82.58 FEET OR 5.00 RODS IN LENGTH, CONTAINING 0.057 ACRES MORE OR LESS AND BEING ALLOCATED BY FORTIES AS FOLLOWS:

NW/4 NW/4 82.58 L.F. 5.00 RODS 0.057 ACRES

GENERAL NOTES

1.) THE INTENT OF THIS ROUTE SURVEY IS TO ACQUIRE AN EASEMENT.

2.) BASIS OF BEARING AND DISTANCE IS NMSP EAST (NAD83) MODIFIED TO SURFACE COORDINATES. NAD 83 (FEET) AND NAVD 88 (FEET) COORDINATE SYSTEMS USED IN THE SURVEY.

SHEET: 4-4

MADRON SURVEYING, INC. 301 SOUTH CANAL CARLSBAD, NEW MEXICO 88220
 (575) 234-3341

SURVEYOR CERTIFICATE

I, FILIMON F. JARAMILLO, A NEW MEXICO PROFESSIONAL SURVEYOR NO. 12797, HEREBY CERTIFY THAT I HAVE CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR LAND SURVEYING IN THE STATE OF NEW MEXICO.

IN WITNESS WHEREOF, THIS CERTIFICATE IS EXECUTED AT CARLSBAD, NEW MEXICO, THIS 18TH DAY OF JANUARY 2022

(Signature of Filimon F. Jaramillo)
 FILIMON F. JARAMILLO, PLS. 12797
 NEW MEXICO PROFESSIONAL SURVEYOR

MADRON SURVEYING, INC.
 301 SOUTH CANAL
 CARLSBAD, NEW MEXICO 88220
 Phone (575) 234-3341

SURVEY NO. 7039D

Condor 8 Federal Com #4H, Plan 1

Operator	Redwood Operating LLC			Units	feet, °/100ft		14:55 Wednesday, January 19, 2022 Page 1 of 5				
Field	Red Lake			County	Eddy		Vertical Section Azimuth	270.25			
Well Name	Condor 8 Federal Com #4H			State	New Mexico		Survey Calculation Method	Minimum Curvature			
Plan	1			Country	USA			Database	Access		
Location	SL: 280 FNL & 575 FWL Section 9-T18S-R27E BHL: 500 FNL & 1319 FEL Secition 7-T18S-27E					Map Zone	UTM		Lat Long Ref		
Site						Surface X	1858808.3		Surface Long		
Slot Name						Surface Y	11895185		Surface Lat		
Well Number	4H			API	3001546816		Surface Z	3542		Global Z Ref	KB
Project				MD/TVD Ref	KB		Ground Level	3525		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 = 2784.00)											
2784.00	0.00	0.0	2784.00	0.00	0.00		0.00	1858808.30	11895185.00	758.00	
2800.00	0.00	0.0	2800.00	0.00	0.00	0.00	0.00	1858808.30	11895185.00	742.00	
2850.00	0.00	0.0	2850.00	0.00	0.00	0.00	0.00	1858808.30	11895185.00	692.00	
*** KOP 8 DEGREES (at MD = 2884.00)											
2884.00	0.00	0.0	2884.00	0.00	0.00	0.00	0.00	1858808.30	11895185.00	658.00	
2900.00	1.28	251.0	2900.00	-0.06	-0.17	8.00	0.17	1858808.13	11895184.94	642.00	
2950.00	5.28	251.0	2949.91	-0.99	-2.87	8.00	2.87	1858805.43	11895184.01	592.09	
3000.00	9.28	251.0	2999.49	-3.05	-8.86	8.00	8.85	1858799.44	11895181.95	542.51	
3050.00	13.28	251.0	3048.52	-6.24	-18.11	8.00	18.08	1858790.19	11895178.76	493.48	
3100.00	17.28	251.0	3096.74	-10.52	-30.56	8.00	30.52	1858777.74	11895174.48	445.26	
3150.00	21.28	251.0	3143.93	-15.90	-46.17	8.00	46.10	1858762.13	11895169.10	398.07	
3200.00	25.28	251.0	3189.85	-22.33	-64.85	8.00	64.75	1858743.45	11895162.67	352.15	
3250.00	29.28	251.0	3234.28	-29.79	-86.52	8.00	86.39	1858721.78	11895155.21	307.72	
3300.00	33.28	251.0	3277.00	-38.24	-111.06	8.00	110.89	1858697.24	11895146.76	265.00	
3350.00	37.28	251.0	3317.81	-47.64	-138.36	8.00	138.15	1858669.94	11895137.36	224.19	
3400.00	41.28	251.0	3356.50	-57.94	-168.28	8.00	168.03	1858640.02	11895127.06	185.50	
3450.00	45.28	251.0	3392.90	-69.10	-200.69	8.00	200.38	1858607.61	11895115.90	149.10	
3500.00	49.28	251.0	3426.81	-81.06	-235.41	8.00	235.06	1858572.89	11895103.94	115.19	
3550.00	53.28	251.0	3458.08	-93.76	-272.29	8.00	271.88	1858536.01	11895091.24	83.92	
*** 55 DEGREE TANGENT (at MD = 3571.50)											
3571.50	55.00	251.0	3470.67	-99.43	-288.76	8.00	288.33	1858519.54	11895085.57	71.33	
3600.00	55.00	251.0	3487.02	-107.03	-310.84	0.00	310.37	1858497.46	11895077.97	54.98	
3650.00	55.00	251.0	3515.70	-120.36	-349.56	0.00	349.04	1858458.74	11895064.64	26.30	
3700.00	55.00	251.0	3544.38	-133.70	-388.29	0.00	387.70	1858420.01	11895051.30	-2.38	
3750.00	55.00	251.0	3573.06	-147.03	-427.02	0.00	426.37	1858381.28	11895037.97	-31.06	
3800.00	55.00	251.0	3601.74	-160.37	-465.74	0.00	465.04	1858342.56	11895024.63	-59.74	
*** 10 DEGREE BUILD (at MD = 3821.50)											
3821.50	55.00	251.0	3614.07	-166.10	-482.40	0.00	481.67	1858325.90	11895018.90	-72.07	
3850.00	57.46	252.7	3629.91	-173.47	-504.91	10.00	504.15	1858303.39	11895011.53	-87.91	
3900.00	61.83	255.6	3655.18	-185.23	-546.40	10.00	545.59	1858261.90	11894999.77	-113.18	
3950.00	66.25	258.2	3677.06	-195.43	-590.17	10.00	589.31	1858218.13	11894989.57	-135.06	
4000.00	70.71	260.6	3695.40	-204.00	-635.87	10.00	634.97	1858172.43	11894981.00	-153.40	
4050.00	75.20	262.9	3710.06	-210.86	-683.16	10.00	682.23	1858125.14	11894974.14	-168.06	
4100.00	79.71	265.1	3720.91	-215.97	-731.68	10.00	730.73	1858076.62	11894969.03	-178.91	
4150.00	84.24	267.2	3727.89	-219.28	-781.07	10.00	780.10	1858027.23	11894965.72	-185.89	
4200.00	88.78	269.3	3730.93	-220.78	-830.94	10.00	829.97	1857977.36	11894964.22	-188.93	
*** LANDING POINT (at MD = 4221.83)											
4221.83	90.76	270.3	3731.02	-220.86	-852.76	10.00	851.79	1857955.54	11894964.14	-189.02	

Condor 8 Federal Com #4H, Plan 1

Operator	Redwood Operating LLC	Units	feet, °/100ft	14:55 Wednesday, January 19, 2022	Page 2 of 5
Field	Red Lake	County	Eddy	Vertical Section Azimuth	270.25
Well Name	Condor 8 Federal Com #4H	State	New Mexico	Survey Calculation Method	Minimum Curvature
Plan	1	Country	USA	Database	Access
Location	SL: 280 FNL & 575 FWL Section 9-T18S-R27E BHL: 500 FNL & 1319 FEL Section 7-T18S-27E			Map Zone	UTM
Site				Surface X	1858808.3
Slot Name				Surface Y	11895185
Well Number	4H	API	3001546816	Surface Z	3542
Project		MD/TVD Ref	KB	Ground Level	3525
				Lat Long Ref	
				Surface Long	
				Surface Lat	
				Global Z Ref	KB
				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
4250.00	90.76	270.3	3730.65	-220.73	-880.93	0.00	879.96	1857927.37	11894964.27	-188.65
4300.00	90.76	270.3	3729.98	-220.52	-930.93	0.00	929.96	1857877.37	11894964.48	-187.98
4350.00	90.76	270.3	3729.32	-220.30	-980.92	0.00	979.95	1857827.38	11894964.70	-187.32
4400.00	90.76	270.3	3728.66	-220.08	-1030.92	0.00	1029.95	1857777.38	11894964.92	-186.66
4450.00	90.76	270.3	3727.99	-219.86	-1080.91	0.00	1079.94	1857727.39	11894965.14	-185.99
4500.00	90.76	270.3	3727.33	-219.64	-1130.91	0.00	1129.94	1857677.39	11894965.36	-185.33
4550.00	90.76	270.3	3726.67	-219.42	-1180.90	0.00	1179.93	1857627.40	11894965.58	-184.67
4600.00	90.76	270.3	3726.00	-219.21	-1230.90	0.00	1229.93	1857577.40	11894965.79	-184.00
4650.00	90.76	270.3	3725.34	-218.99	-1280.89	0.00	1279.93	1857527.41	11894966.01	-183.34
4700.00	90.76	270.3	3724.68	-218.77	-1330.89	0.00	1329.92	1857477.41	11894966.23	-182.68
4750.00	90.76	270.3	3724.01	-218.55	-1380.88	0.00	1379.92	1857427.42	11894966.45	-182.01
4800.00	90.76	270.3	3723.35	-218.33	-1430.88	0.00	1429.91	1857377.42	11894966.67	-181.35
4850.00	90.76	270.3	3722.69	-218.12	-1480.87	0.00	1479.91	1857327.43	11894966.88	-180.69
4900.00	90.76	270.3	3722.02	-217.90	-1530.87	0.00	1529.90	1857277.43	11894967.10	-180.02
4950.00	90.76	270.3	3721.36	-217.68	-1580.86	0.00	1579.90	1857227.44	11894967.32	-179.36
5000.00	90.76	270.3	3720.70	-217.46	-1630.86	0.00	1629.89	1857177.44	11894967.54	-178.70
5050.00	90.76	270.3	3720.03	-217.24	-1680.85	0.00	1679.89	1857127.45	11894967.76	-178.03
5100.00	90.76	270.3	3719.37	-217.02	-1730.85	0.00	1729.89	1857077.45	11894967.98	-177.37
5150.00	90.76	270.3	3718.71	-216.81	-1780.84	0.00	1779.88	1857027.46	11894968.19	-176.71
5200.00	90.76	270.3	3718.05	-216.59	-1830.84	0.00	1829.88	1856977.46	11894968.41	-176.05
5250.00	90.76	270.3	3717.38	-216.37	-1880.83	0.00	1879.87	1856927.47	11894968.63	-175.38
5300.00	90.76	270.3	3716.72	-216.15	-1930.83	0.00	1929.87	1856877.47	11894968.85	-174.72
5350.00	90.76	270.3	3716.06	-215.93	-1980.83	0.00	1979.86	1856827.47	11894969.07	-174.06
5400.00	90.76	270.3	3715.39	-215.72	-2030.82	0.00	2029.86	1856777.48	11894969.28	-173.39
5450.00	90.76	270.3	3714.73	-215.50	-2080.82	0.00	2079.86	1856727.48	11894969.50	-172.73
5500.00	90.76	270.3	3714.07	-215.28	-2130.81	0.00	2129.85	1856677.49	11894969.72	-172.07
5550.00	90.76	270.3	3713.40	-215.06	-2180.81	0.00	2179.85	1856627.49	11894969.94	-171.40
5600.00	90.76	270.3	3712.74	-214.84	-2230.80	0.00	2229.84	1856577.50	11894970.16	-170.74
5650.00	90.76	270.3	3712.08	-214.63	-2280.80	0.00	2279.84	1856527.50	11894970.37	-170.08
5700.00	90.76	270.3	3711.41	-214.41	-2330.79	0.00	2329.83	1856477.51	11894970.59	-169.41
5750.00	90.76	270.3	3710.75	-214.19	-2380.79	0.00	2379.83	1856427.51	11894970.81	-168.75
5800.00	90.76	270.3	3710.09	-213.97	-2430.78	0.00	2429.82	1856377.52	11894971.03	-168.09
5850.00	90.76	270.3	3709.42	-213.75	-2480.78	0.00	2479.82	1856327.52	11894971.25	-167.42
5900.00	90.76	270.3	3708.76	-213.53	-2530.77	0.00	2529.82	1856277.53	11894971.47	-166.76
5950.00	90.76	270.3	3708.10	-213.32	-2580.77	0.00	2579.81	1856227.53	11894971.68	-166.10
6000.00	90.76	270.3	3707.43	-213.10	-2630.76	0.00	2629.81	1856177.54	11894971.90	-165.43
6050.00	90.76	270.3	3706.77	-212.88	-2680.76	0.00	2679.80	1856127.54	11894972.12	-164.77

Condor 8 Federal Com #4H, Plan 1

Operator	Redwood Operating LLC			Units	feet, °/100ft		14:55 Wednesday, January 19, 2022 Page 3 of 5			
Field	Red Lake			County	Eddy		Vertical Section Azimuth		270.25	
Well Name	Condor 8 Federal Com #4H			State	New Mexico		Survey Calculation Method		Minimum Curvature	
Plan	1			Country	USA		Database		Access	
Location	SL: 280 FNL & 575 FWL Section 9-T18S-R27E BHL: 500 FNL & 1319 FEL Section 7-T18S-27E					Map Zone	UTM		Lat Long Ref	
Site						Surface X	1858808.3		Surface Long	
Slot Name						Surface Y	11895185		Surface Lat	
Well Number	4H					Surface Z	3542		Global Z Ref KB	
Project						MD/TVD Ref	KB		Ground Level 3525 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
6100.00	90.76	270.3	3706.11	-212.66	-2730.75	0.00	2729.80	1856077.55	11894972.34	-164.11
6150.00	90.76	270.3	3705.44	-212.44	-2780.75	0.00	2779.79	1856027.55	11894972.56	-163.44
6200.00	90.76	270.3	3704.78	-212.23	-2830.74	0.00	2829.79	1855977.56	11894972.77	-162.78
6250.00	90.76	270.3	3704.12	-212.01	-2880.74	0.00	2879.78	1855927.56	11894972.99	-162.12
6300.00	90.76	270.3	3703.45	-211.79	-2930.73	0.00	2929.78	1855877.57	11894973.21	-161.45
6350.00	90.76	270.3	3702.79	-211.57	-2980.73	0.00	2979.78	1855827.57	11894973.43	-160.79
6400.00	90.76	270.3	3702.13	-211.35	-3030.72	0.00	3029.77	1855777.58	11894973.65	-160.13
6450.00	90.76	270.3	3701.47	-211.14	-3080.72	0.00	3079.77	1855727.58	11894973.87	-159.47
6500.00	90.76	270.3	3700.80	-210.92	-3130.71	0.00	3129.76	1855677.59	11894974.08	-158.80
6550.00	90.76	270.3	3700.14	-210.70	-3180.71	0.00	3179.76	1855627.59	11894974.30	-158.14
6600.00	90.76	270.3	3699.48	-210.48	-3230.70	0.00	3229.75	1855577.60	11894974.52	-157.48
6650.00	90.76	270.3	3698.81	-210.26	-3280.70	0.00	3279.75	1855527.60	11894974.74	-156.81
6700.00	90.76	270.3	3698.15	-210.04	-3330.69	0.00	3329.75	1855477.61	11894974.96	-156.15
6750.00	90.76	270.3	3697.49	-209.83	-3380.69	0.00	3379.74	1855427.61	11894975.17	-155.49
6800.00	90.76	270.3	3696.82	-209.61	-3430.68	0.00	3429.74	1855377.62	11894975.39	-154.82
6850.00	90.76	270.3	3696.16	-209.39	-3480.68	0.00	3479.73	1855327.62	11894975.61	-154.16
6900.00	90.76	270.3	3695.50	-209.17	-3530.67	0.00	3529.73	1855277.63	11894975.83	-153.50
6950.00	90.76	270.3	3694.83	-208.95	-3580.67	0.00	3579.72	1855227.63	11894976.05	-152.83
7000.00	90.76	270.3	3694.17	-208.74	-3630.66	0.00	3629.72	1855177.64	11894976.26	-152.17
7050.00	90.76	270.3	3693.51	-208.52	-3680.66	0.00	3679.71	1855127.64	11894976.48	-151.51
7100.00	90.76	270.3	3692.84	-208.30	-3730.65	0.00	3729.71	1855077.65	11894976.70	-150.84
7150.00	90.76	270.3	3692.18	-208.08	-3780.65	0.00	3779.71	1855027.65	11894976.92	-150.18
7200.00	90.76	270.3	3691.52	-207.86	-3830.64	0.00	3829.70	1854977.66	11894977.14	-149.52
7250.00	90.76	270.3	3690.85	-207.64	-3880.64	0.00	3879.70	1854927.66	11894977.36	-148.85
7300.00	90.76	270.3	3690.19	-207.43	-3930.64	0.00	3929.69	1854877.67	11894977.57	-148.19
7350.00	90.76	270.3	3689.53	-207.21	-3980.63	0.00	3979.69	1854827.67	11894977.79	-147.53
7400.00	90.76	270.3	3688.86	-206.99	-4030.63	0.00	4029.68	1854777.67	11894978.01	-146.86
7450.00	90.76	270.3	3688.20	-206.77	-4080.62	0.00	4079.68	1854727.68	11894978.23	-146.20
7500.00	90.76	270.3	3687.54	-206.55	-4130.62	0.00	4129.67	1854677.68	11894978.45	-145.54
7550.00	90.76	270.3	3686.87	-206.34	-4180.61	0.00	4179.67	1854627.69	11894978.66	-144.87
7600.00	90.76	270.3	3686.21	-206.12	-4230.61	0.00	4229.67	1854577.69	11894978.88	-144.21
7650.00	90.76	270.3	3685.55	-205.90	-4280.60	0.00	4279.66	1854527.70	11894979.10	-143.55
7700.00	90.76	270.3	3684.89	-205.68	-4330.60	0.00	4329.66	1854477.70	11894979.32	-142.89
7750.00	90.76	270.3	3684.22	-205.46	-4380.59	0.00	4379.65	1854427.71	11894979.54	-142.22
7800.00	90.76	270.3	3683.56	-205.25	-4430.59	0.00	4429.65	1854377.71	11894979.76	-141.56
7850.00	90.76	270.3	3682.90	-205.03	-4480.58	0.00	4479.64	1854327.72	11894979.97	-140.90
7900.00	90.76	270.3	3682.23	-204.81	-4530.58	0.00	4529.64	1854277.72	11894980.19	-140.23

Condor 8 Federal Com #4H, Plan 1

Operator	Redwood Operating LLC			Units	feet, °/100ft		14:55 Wednesday, January 19, 2022 Page 4 of 5				
Field	Red Lake			County	Eddy		Vertical Section Azimuth		270.25		
Well Name	Condor 8 Federal Com #4H			State	New Mexico		Survey Calculation Method		Minimum Curvature		
Plan	1			Country	USA		Database		Access		
Location	SL: 280 FNL & 575 FWL Section 9-T18S-R27E BHL: 500 FNL & 1319 FEL Section 7-T18S-27E					Map Zone	UTM		Lat Long Ref		
Site						Surface X	1858808.3		Surface Long		
Slot Name						Surface Y	11895185		Surface Lat		
Well Number	4H			API	3001546816		Surface Z	3542		Global Z Ref	KB
Project				MD/TVD Ref	KB		Ground Level	3525		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	
7950.00	90.76	270.3	3681.57	-204.59	-4580.57	0.00	4579.64	1854227.73	11894980.41	-139.57	
8000.00	90.76	270.3	3680.91	-204.37	-4630.57	0.00	4629.63	1854177.73	11894980.63	-138.91	
8050.00	90.76	270.3	3680.24	-204.15	-4680.56	0.00	4679.63	1854127.74	11894980.85	-138.24	
8100.00	90.76	270.3	3679.58	-203.94	-4730.56	0.00	4729.62	1854077.74	11894981.06	-137.58	
8150.00	90.76	270.3	3678.92	-203.72	-4780.55	0.00	4779.62	1854027.75	11894981.28	-136.92	
8200.00	90.76	270.3	3678.25	-203.50	-4830.55	0.00	4829.61	1853977.75	11894981.50	-136.25	
8250.00	90.76	270.3	3677.59	-203.28	-4880.54	0.00	4879.61	1853927.76	11894981.72	-135.59	
8300.00	90.76	270.3	3676.93	-203.06	-4930.54	0.00	4929.60	1853877.76	11894981.94	-134.93	
8350.00	90.76	270.3	3676.26	-202.85	-4980.53	0.00	4979.60	1853827.77	11894982.15	-134.26	
8400.00	90.76	270.3	3675.60	-202.63	-5030.53	0.00	5029.60	1853777.77	11894982.37	-133.60	
8450.00	90.76	270.3	3674.94	-202.41	-5080.52	0.00	5079.59	1853727.78	11894982.59	-132.94	
8500.00	90.76	270.3	3674.27	-202.19	-5130.52	0.00	5129.59	1853677.78	11894982.81	-132.27	
8550.00	90.76	270.3	3673.61	-201.97	-5180.51	0.00	5179.58	1853627.79	11894983.03	-131.61	
8600.00	90.76	270.3	3672.95	-201.75	-5230.51	0.00	5229.58	1853577.79	11894983.25	-130.95	
8650.00	90.76	270.3	3672.28	-201.54	-5280.50	0.00	5279.57	1853527.80	11894983.46	-130.28	
8700.00	90.76	270.3	3671.62	-201.32	-5330.50	0.00	5329.57	1853477.80	11894983.68	-129.62	
8750.00	90.76	270.3	3670.96	-201.10	-5380.49	0.00	5379.56	1853427.81	11894983.90	-128.96	
8800.00	90.76	270.3	3670.29	-200.88	-5430.49	0.00	5429.56	1853377.81	11894984.12	-128.29	
8850.00	90.76	270.3	3669.63	-200.66	-5480.48	0.00	5479.56	1853327.82	11894984.34	-127.63	
8900.00	90.76	270.3	3668.97	-200.45	-5530.48	0.00	5529.55	1853277.82	11894984.55	-126.97	
8950.00	90.76	270.3	3668.30	-200.23	-5580.47	0.00	5579.55	1853227.83	11894984.77	-126.30	
9000.00	90.76	270.3	3667.64	-200.01	-5630.47	0.00	5629.54	1853177.83	11894984.99	-125.64	
9050.00	90.76	270.3	3666.98	-199.79	-5680.46	0.00	5679.54	1853127.84	11894985.21	-124.98	
9100.00	90.76	270.3	3666.32	-199.57	-5730.46	0.00	5729.53	1853077.84	11894985.43	-124.32	
9150.00	90.76	270.3	3665.65	-199.36	-5780.45	0.00	5779.53	1853027.85	11894985.64	-123.65	
9200.00	90.76	270.3	3664.99	-199.14	-5830.45	0.00	5829.53	1852977.85	11894985.86	-122.99	
9250.00	90.76	270.3	3664.33	-198.92	-5880.44	0.00	5879.52	1852927.86	11894986.08	-122.33	
9300.00	90.76	270.3	3663.66	-198.70	-5930.44	0.00	5929.52	1852877.86	11894986.30	-121.66	
9350.00	90.76	270.3	3663.00	-198.48	-5980.44	0.00	5979.51	1852827.86	11894986.52	-121.00	
9400.00	90.76	270.3	3662.34	-198.26	-6030.43	0.00	6029.51	1852777.87	11894986.74	-120.34	
9450.00	90.76	270.3	3661.67	-198.05	-6080.43	0.00	6079.50	1852727.87	11894986.95	-119.67	
9500.00	90.76	270.3	3661.01	-197.83	-6130.42	0.00	6129.50	1852677.88	11894987.17	-119.01	
9550.00	90.76	270.3	3660.35	-197.61	-6180.42	0.00	6179.49	1852627.88	11894987.39	-118.35	
9600.00	90.76	270.3	3659.68	-197.39	-6230.41	0.00	6229.49	1852577.89	11894987.61	-117.68	
9650.00	90.76	270.3	3659.02	-197.17	-6280.41	0.00	6279.49	1852527.89	11894987.83	-117.02	
9700.00	90.76	270.3	3658.36	-196.96	-6330.40	0.00	6329.48	1852477.90	11894988.04	-116.36	
9750.00	90.76	270.3	3657.69	-196.74	-6380.40	0.00	6379.48	1852427.90	11894988.26	-115.69	

Condor 8 Federal Com #4H, Plan 1

Operator	Redwood Operating LLC	Units	feet, °/100ft	14:55 Wednesday, January 19, 2022 Page 5 of 5	
Field	Red Lake	County	Eddy	Vertical Section Azimuth	270.25
Well Name	Condor 8 Federal Com #4H	State	New Mexico	Survey Calculation Method	Minimum Curvature
Plan	1	Country	USA	Database	Access
Location	SL: 280 FNL & 575 FWL Section 9-T18S-R27E BHL: 500 FNL & 1319 FEL Section 7-T18S-27E			Map Zone	UTM
Site				Surface X	1858808.3
Slot Name				Surface Y	11895185
Well Number	4H	API	3001546816	Surface Z	3542
Project		MD/TVD Ref	KB	Ground Level	3525
				Lat Long Ref	
				Surface Long	
				Surface Lat	
				Global Z Ref	KB
				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
9800.00	90.76	270.3	3657.03	-196.52	-6430.39	0.00	6429.47	1852377.91	11894988.48	-115.03
9850.00	90.76	270.3	3656.37	-196.30	-6480.39	0.00	6479.47	1852327.91	11894988.70	-114.37
9900.00	90.76	270.3	3655.70	-196.08	-6530.38	0.00	6529.46	1852277.92	11894988.92	-113.70
9950.00	90.76	270.3	3655.04	-195.86	-6580.38	0.00	6579.46	1852227.92	11894989.14	-113.04
10000.00	90.76	270.3	3654.38	-195.65	-6630.37	0.00	6629.46	1852177.93	11894989.35	-112.38
10050.00	90.76	270.3	3653.71	-195.43	-6680.37	0.00	6679.45	1852127.93	11894989.57	-111.71
10100.00	90.76	270.3	3653.05	-195.21	-6730.36	0.00	6729.45	1852077.94	11894989.79	-111.05
10150.00	90.76	270.3	3652.39	-194.99	-6780.36	0.00	6779.44	1852027.94	11894990.01	-110.39
10200.00	90.76	270.3	3651.72	-194.77	-6830.35	0.00	6829.44	1851977.95	11894990.23	-109.72
10250.00	90.76	270.3	3651.06	-194.56	-6880.35	0.00	6879.43	1851927.95	11894990.44	-109.06
10300.00	90.76	270.3	3650.40	-194.34	-6930.34	0.00	6929.43	1851877.96	11894990.66	-108.40
10350.00	90.76	270.3	3649.74	-194.12	-6980.34	0.00	6979.42	1851827.96	11894990.88	-107.74
10400.00	90.76	270.3	3649.07	-193.90	-7030.33	0.00	7029.42	1851777.97	11894991.10	-107.07
10450.00	90.76	270.3	3648.41	-193.68	-7080.33	0.00	7079.42	1851727.97	11894991.32	-106.41
10500.00	90.76	270.3	3647.75	-193.47	-7130.32	0.00	7129.41	1851677.98	11894991.53	-105.75
10550.00	90.76	270.3	3647.08	-193.25	-7180.32	0.00	7179.41	1851627.98	11894991.75	-105.08
*** TD (at MD = 10587.83)										
10587.83	90.76	270.3	3646.58	-193.08	-7218.14	0.00	7217.23	1851590.16	11894991.92	-104.58

Casing DesignWell:

Condor 8 Federal Com #4H

String Size & Function:

13 3/8"

in

surface

x

intermediate

Total Depth:

375

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:

187.2

psi

Burst:

187.2

psi

joint strength:

187.2

psi

Partially evacuated hole?Pressure gradient remaining:

10

#/gal

Max. Shut in surface pressure:

500

psi

1st segment	375 ft	to	0 ft	Make up Torque ft-lbs			Total ft =	375
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	375	S.F.	Actual	Desire
			collapse	3.952991	>= 1.125
	375 ft to 0 ft		burst-b	4.667192	>= 1.25
	13.375 36 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	28.19715	>= 1.8

Casing DesignWell: Condor 8 Federal Com #4H

String Size & Function:9 5/8 in surfaceintermediateX

Total Depth:1230 ftTVD:1230 ft

Pressure Gradient for Calculations(While drilling)

Mud weight, collapse:10 #/galSafety Factor Collapse:1.125

Mud weight, burst:10 #/galSafety Factor Burst:1.25

Mud weight for joint strength:10 #/galSafety Factor Joint Strength1.8

BHP @ TD for:collapse:639.6 psiBurst:639.6 psi, joint strength:639.6 psi

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

Max. Shut in surface pressure:500 psi

1st segment	1230 ft	to	0 ft	Make up Torque ft-lbs			Total ft =	1230
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	1230	S.F.	Actual	Desire
			collapse	3.158224	>= 1.125
	1230 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	10.50522	>= 1.8

Casing Design

Well: Condor 8 Federal Com #4H

String Size & Function:

5 1/2"x 7" in

Production

x

Total Depth:

10588 ft

TVD:

3647 ft

Pressure Gradient for Calculations

(While drilling)

Mud weight, collapse:

10.3 #/gal

Safety Factor Collapse:

1.125

Mud weight, burst:

10.3 #/gal

Safety Factor Burst:

1.25

Mud weight for joint strength:

10.3 #/gal

Safety Factor Joint Strength

1.8

BHP @ TD for:

collapse:

1953.333 psi

Burst:

1953.333 psi

joint strength:

1953.333 psi

Partially evacuated hole?

Pressure gradient remaining:

10 #/gal

Max. Shut in surface pressure:

3000 psi

1st segment	10588 ft	to	3875 ft	Make up Torque ft-lbs	Total ft =	6713
O.D.	Weight	Grade	Threads	opt.	min.	mx.
5.5 inches	17 #/ft	L-80	BTC	3410	2560	4260
Collapse Resistance	Internal Yield	Joint Strength	Body Yield	Drift		
6,290	7,740 psi	338 ,000 #	397 ,000 #	4.767		

2nd segment	2775 ft	to	3875 ft	Make up Torque ft-lbs	Total ft =	1100
O.D.	Weight	Grade	Threads	opt.	min.	mx.
7 inches	26 #/ft	L-80	BTC	5110	3830	6390
Collapse Resistance	Internal Yield	Joint Strength	Body Yield	Drift		
5,410 psi	7,240 psi	511 ,000 #	604 ,000 #	6.151		

3rd segment	2775 ft	to	0 ft	Make up Torque ft-lbs	Total ft =	2775
O.D.	Weight	Grade	Threads	opt.	min.	mx.
7 inches	26 #/ft	L-80	LT&C	5110	3830	6390
Collapse Resistance	Internal Yield	Joint Strength	Body Yield	Drift		
5,410 psi	7,240 psi	511 ,000 #	604 ,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	10588	S.F.	Actual	Desire
			collapse	3.220137	>= 1.125
	10588 ft to 3875 ft		burst-b	2.730325	>= 1.25
	5.5 26 L-80 BTC		burst-t	2.633056	
	Top of segment 1 (ft)	3875	S.F.	Actual	Desire
Select	2nd segment from bottom		collapse	2.467821	>= 1.125
			burst-b	2.462962	>= 1.25
	3875 ft to 2775 ft		burst-t	2.448668	
	7 26 L-80 BTC		jnt strngth	3.515828	>= 1.8

Top of segment 2 (ft)		2775	S.F.	Actual		Desire
Select	3rd segment from bottom		collapse	3.383682	>=	1.125
			burst-b	2.448668	>=	1.25
			burst-t	2.413333		
			jnt strngth	4.250201	>=	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
			burst-t	0		
			jnt strngth	4.2502	>=	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
			burst-t	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
			burst-t	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:		2.75584
S.F. Burst bottom of segment:		
S.F. Burst top of segment		
S.F. Joint strength bottom of segment:		473.389
S.F. Joint strength top of segment:		
S.F. Body yield strength bottom of segment:		556.022
S.F. Body yield strength top of segment:		4.12954

Collapse calculations for 1st segment - casing evacuated

Buoyancy factor collapse:	0.84241	
calculations for bottom of segment @	3647 ft	
hydrostatic pressure collapse - backside:	1953.33 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:	6290 psi	
Actual safety factor	3.22014	adjusted casing rating / actual pressure

Condor 8 Federal Com #4H

Surface- 17 ½" hole 375' 13 3/8" 48# J-55

nStage 1	Slurry	Density	Yield	Mix H2O Gals./sk	# of Sacks	% Excess	Slurry Top
Lead							
Tail	Class C+1%PF1	14.8	1.34	6.307	420	100	Surface

Comments	20bbls Gel Spacer. 50 sacks of 11# Scavenger cement.	Cu/Ft per Lin /Ft 261
----------	---	-----------------------------

Intermediate- 12 ¼" hole 1,230' 9 5/8"-36#-J-55

Stage 1	Slurry	Density	Yield	Mix H2O Gals./sk	# of Sacks	% Excess	Slurry Top
Lead	Class C +4%PF20+1% PF1+0.125#/skPF29+.4%PF 45	13.5	1.72	9.102	250	100	Surface
Tail	Class C+.1%PF1	14.8	1.34	6.307	200	100	1,800'

Comments	20bbls Gel Spacer. 50 sacks of 11# Scavenger cement.	Cu/Ft per lin/Ft 385.23
----------	---	----------------------------------

Production-10,588' 7"-26#-L-80 LT&C and BTC (3,875') XO 5 ½" 17# L-80 BTC (6,713')

Stage 1	Slurry	Density	Yield	Mix H2O Gals./sk	# of Sacks	% Excess	Slurry Top
Lead	35/65 Perlite/C 5% PF44+6%PF20+.2%PF13+3ppsPF 42+.4ppsPF45+.125ppsPF29	12.9	1.82	9.21	515	35	Surface
Tail	PVL+1.3%PF44(BWOW)+5%PF1 74+.5%PF506+0.1%PF153+.4#PF 45	13	1.48	7.57	1825	35	2,700'

Condor 8 Federal Com #4H

Comments		Cu/Ft per lin/Ft
	20bbls Gel Spacer. 50 sacks of 11# Scavenger cement.	2674.52

Prior to any cement job it is Mack Energy policy to circulate bottoms up 1 time before commencing with cement operations. On wells where hole conditions have been an issue during the drilling and reaming process the number of circulations needs to increase to a minimum of 2 times around.

All production cement figured with an additional 10% for washout unless otherwise noted. Flush is figured with a 40' shoe joint. Do not displace more than 2bbls over calculated flush without prior approval.

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.



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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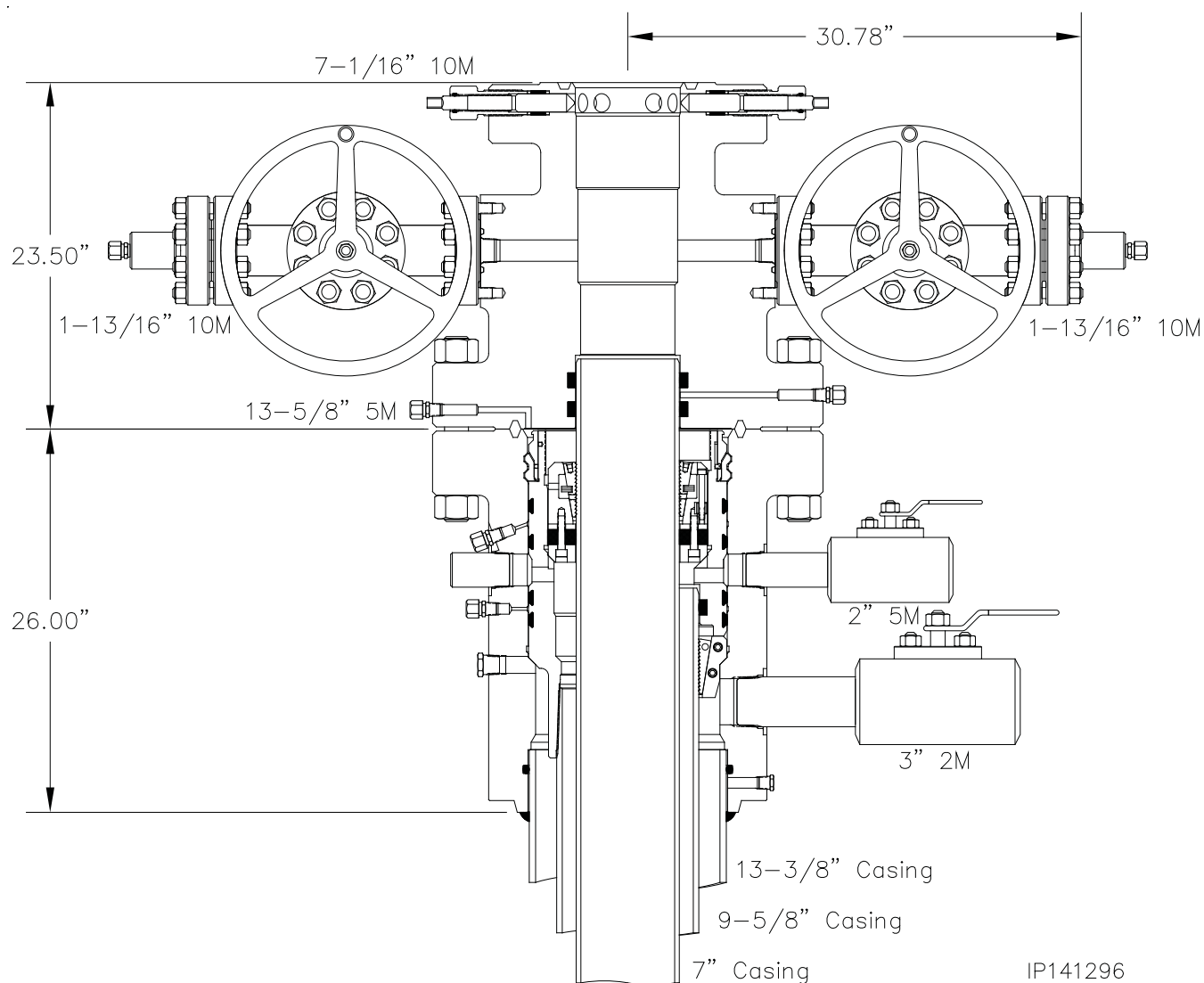
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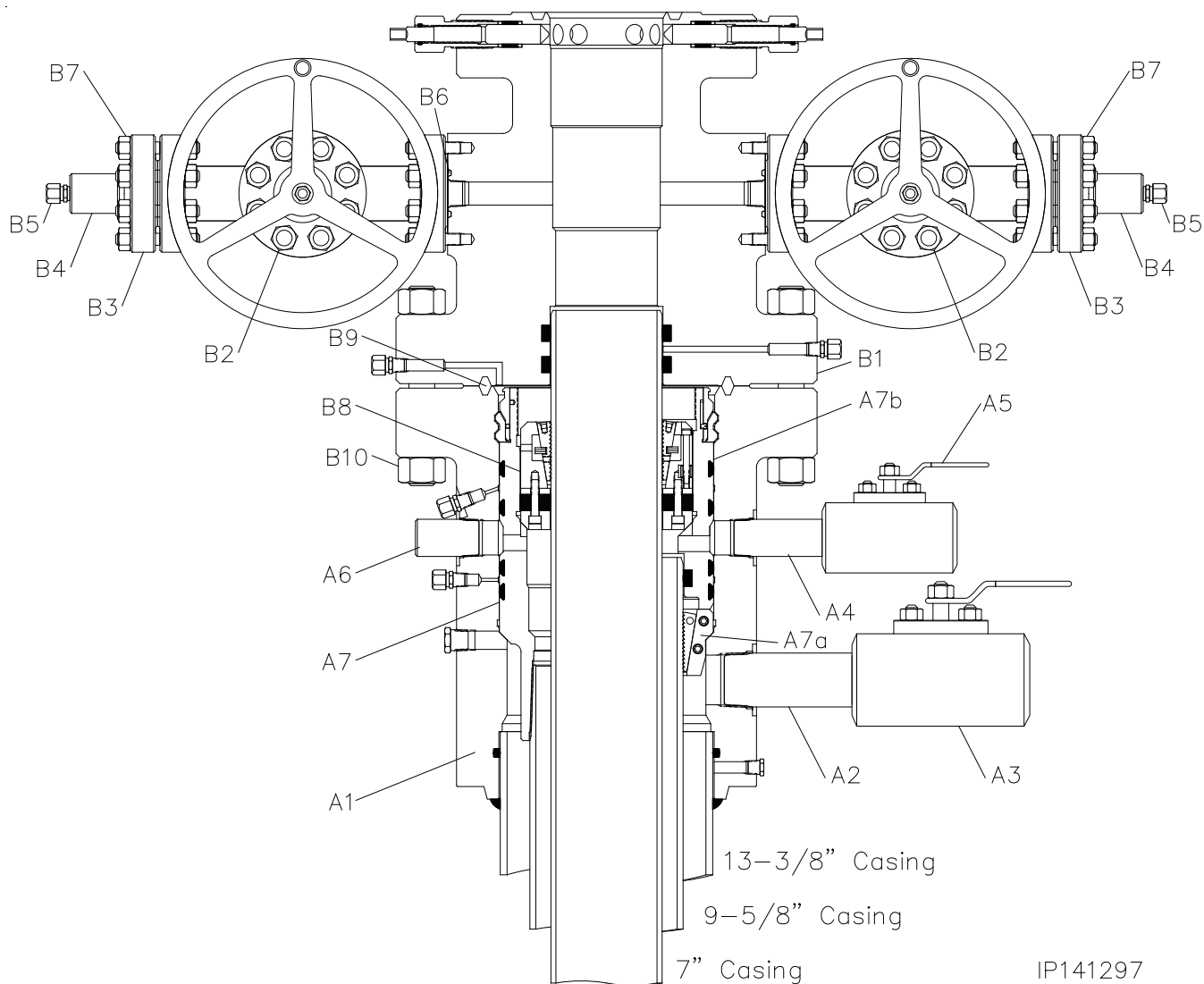
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System Drawing



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Bill of Materials



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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-LR, 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



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

IP 0228
Page 3

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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.

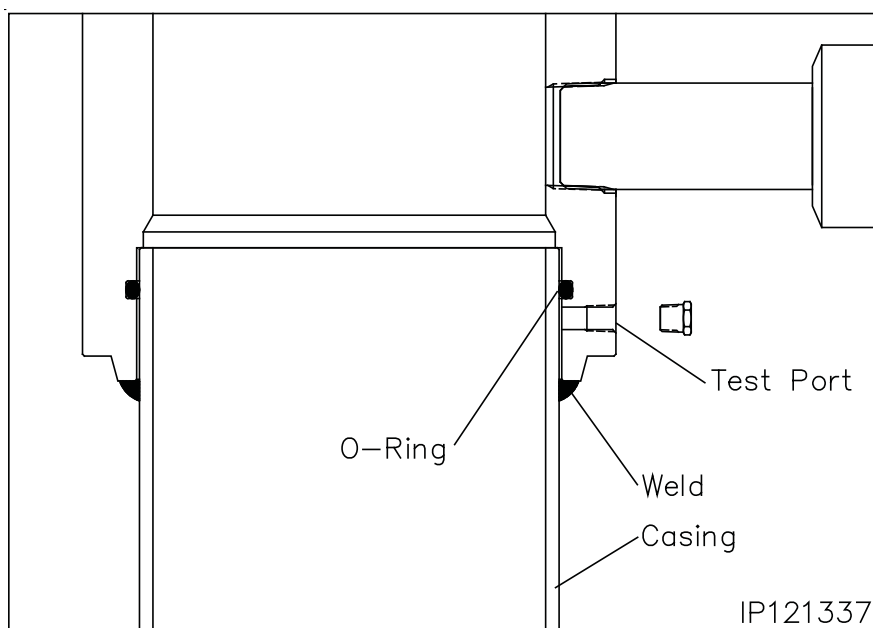
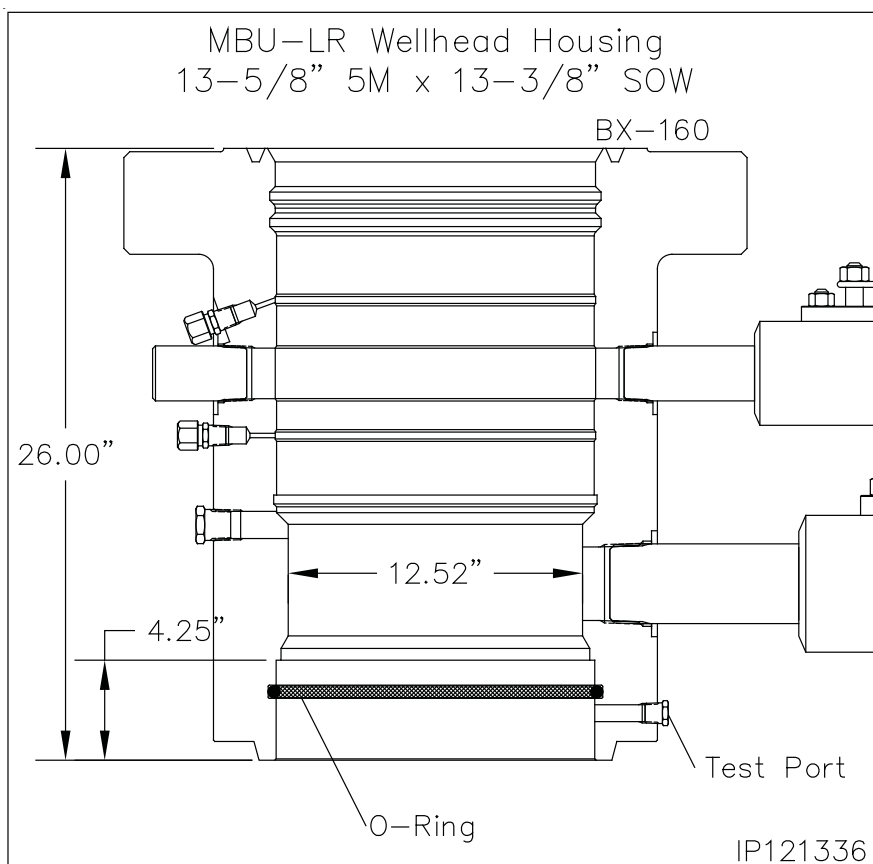
6. Remove the pipe plug from the port on the bottom of the Head.

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.



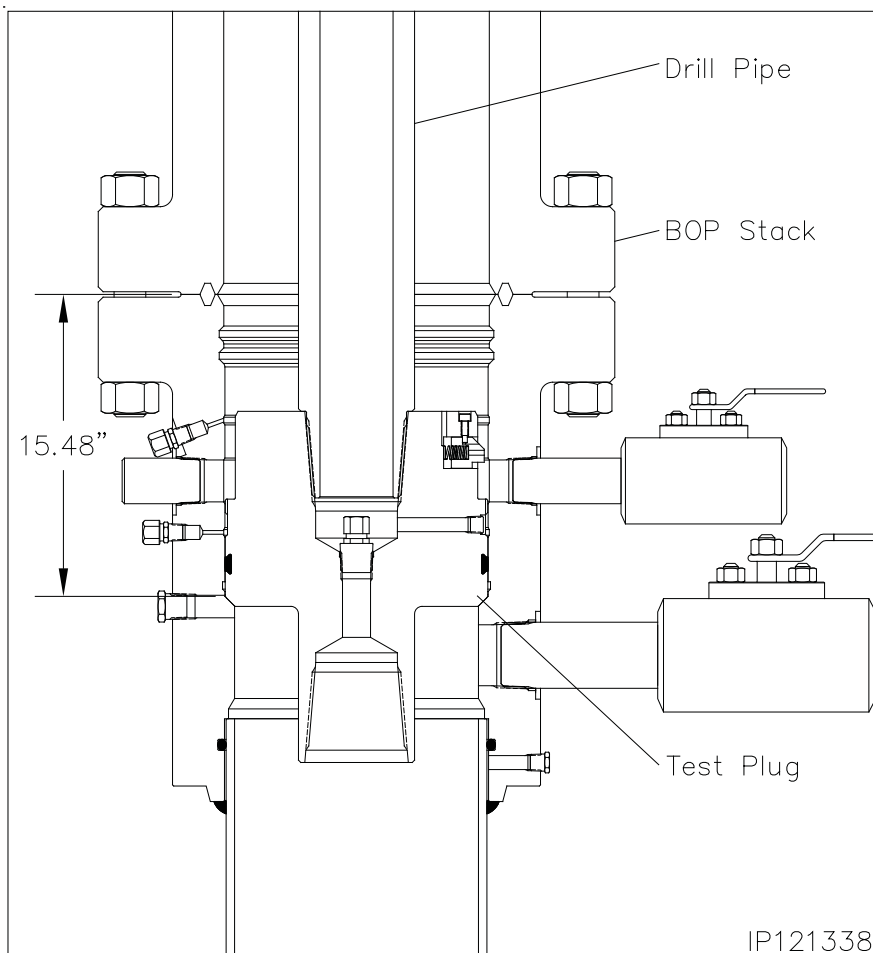
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Stage 2 — Test the BOP Stack

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.



IP121338

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

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.

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

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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

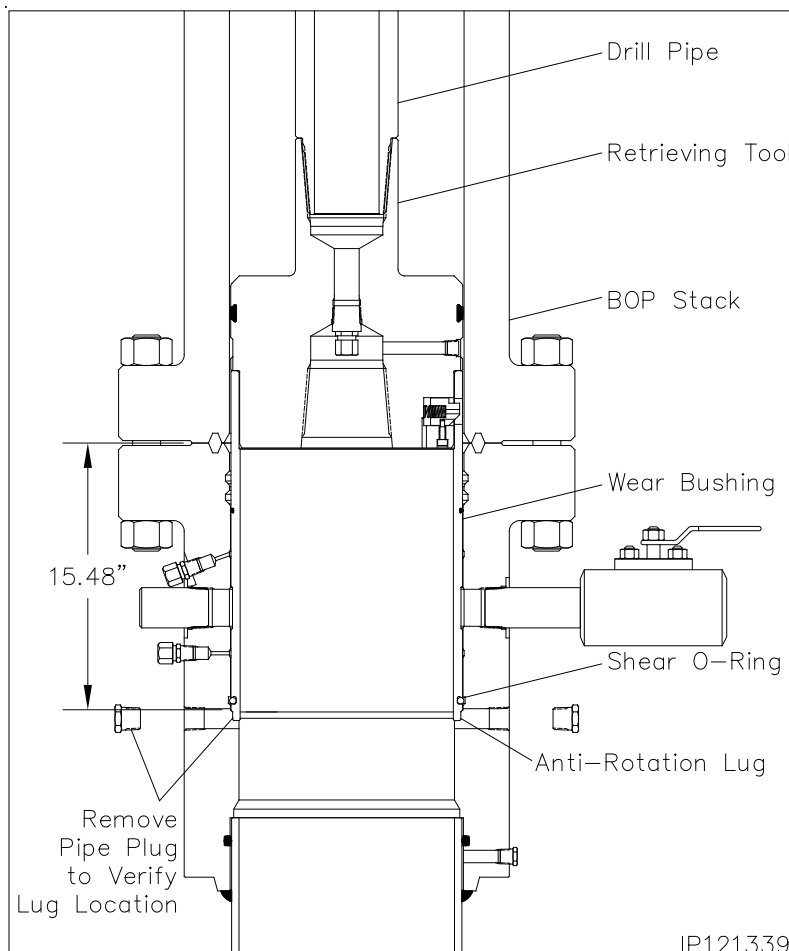
Run the Wear Bushing Before Drilling

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. Reinstall 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.

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Stage 4 — Hang Off the 9-5/8" Casing

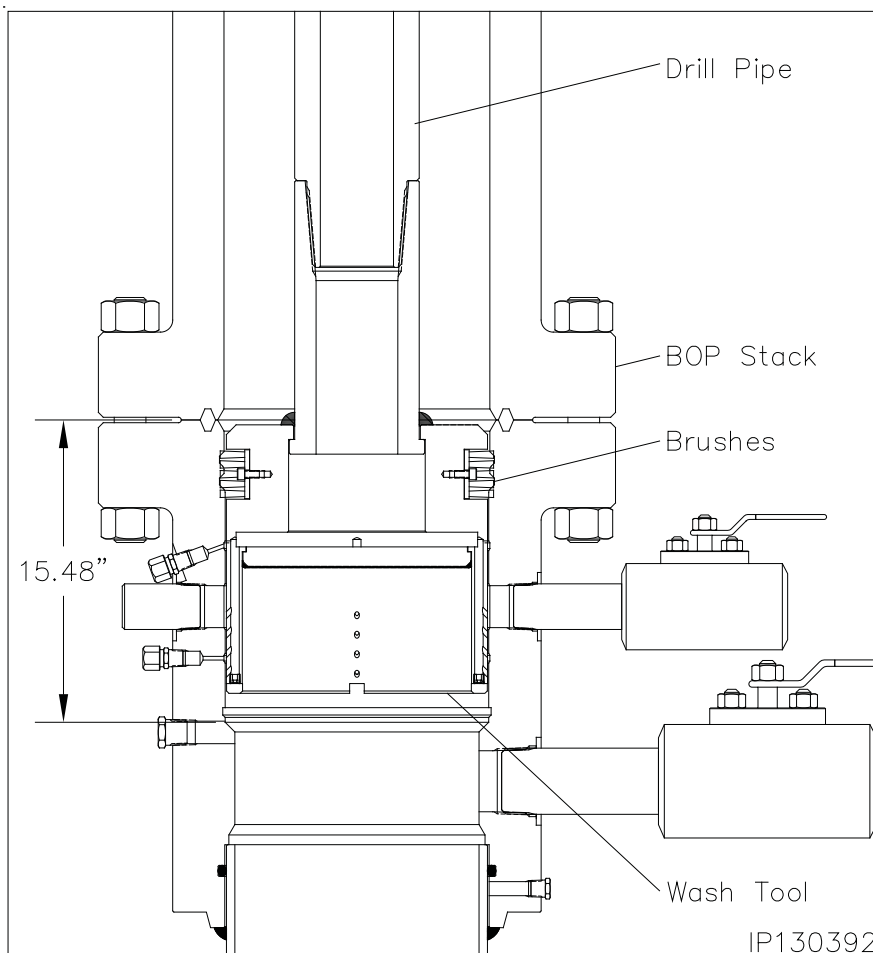
Due to the possible build up of debris in the bore and locking groove of the MBU-LR wellhead it is recommended to run the 13-5/8" Wash Tool prior to running the 9-5/8 casing.

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.



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Stage 4 — Hang Off the 9-5/8" Casing

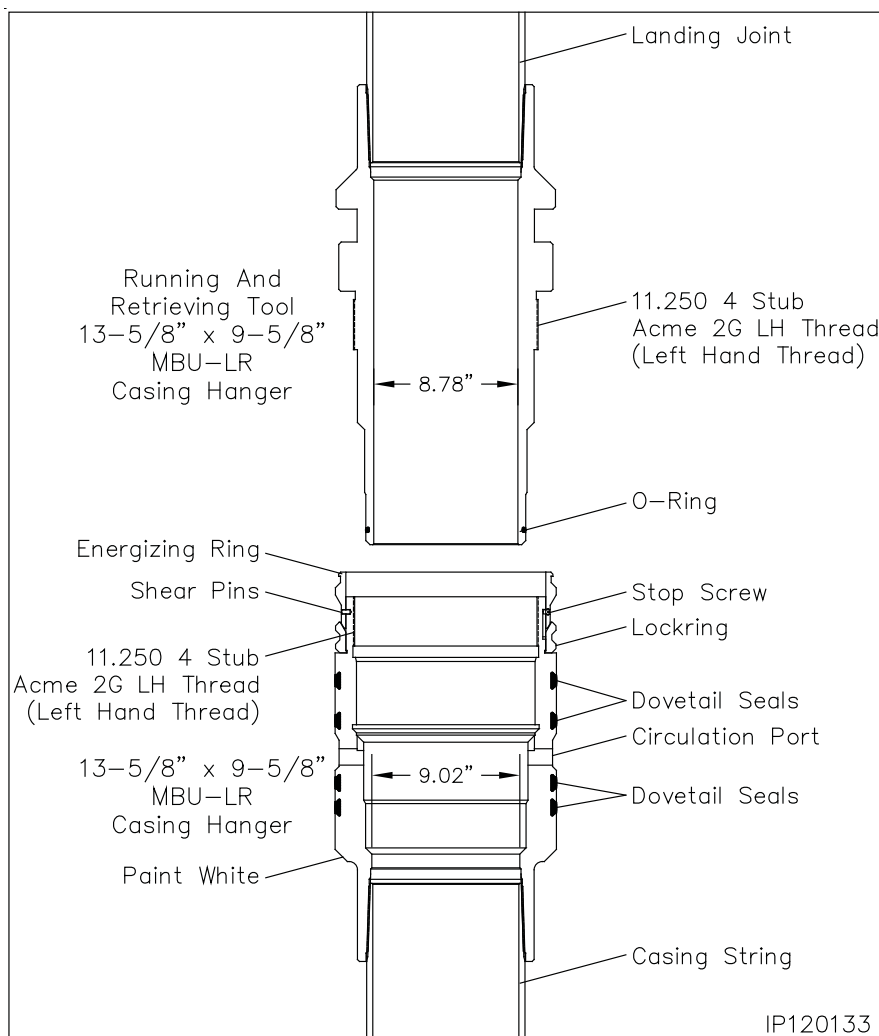
The 9-5/8" MBU-LR casing hanger and running and retrieving tool should be shipped to location pre assembled as a full joint. If not, follow steps 1 through for assembling on the pipe rack.

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
- locking 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



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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.

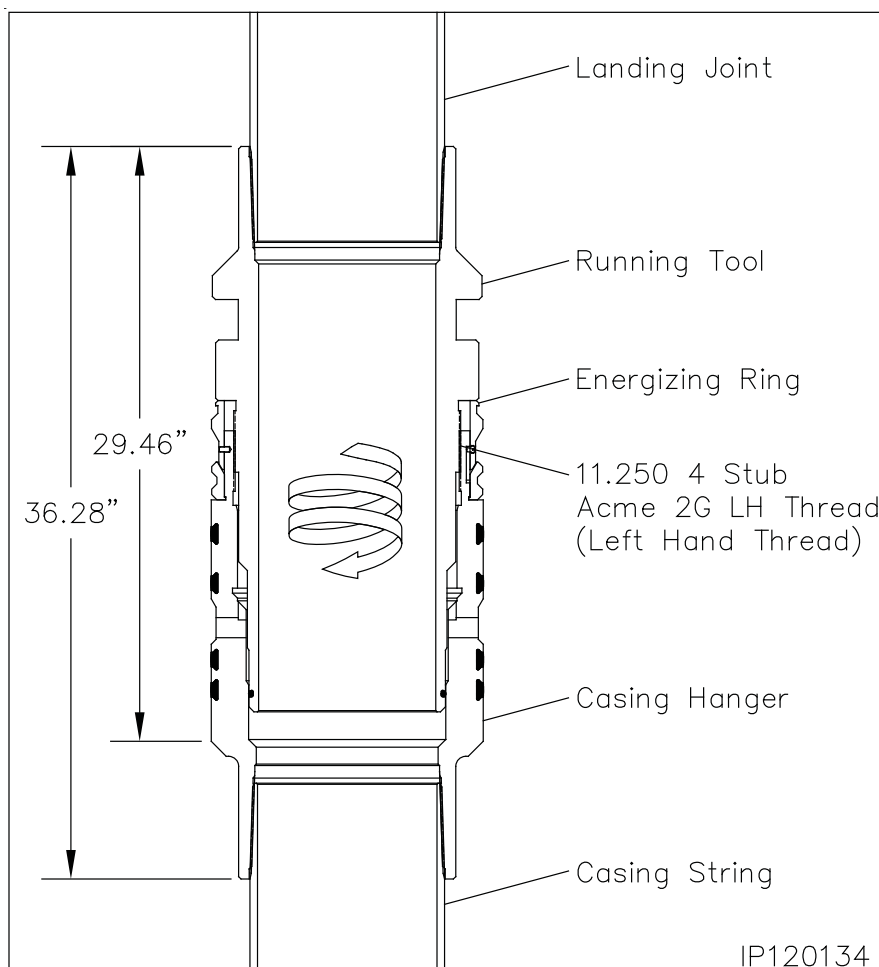
WARNING: Do Not apply torque to the Hanger/Tool connection.

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.

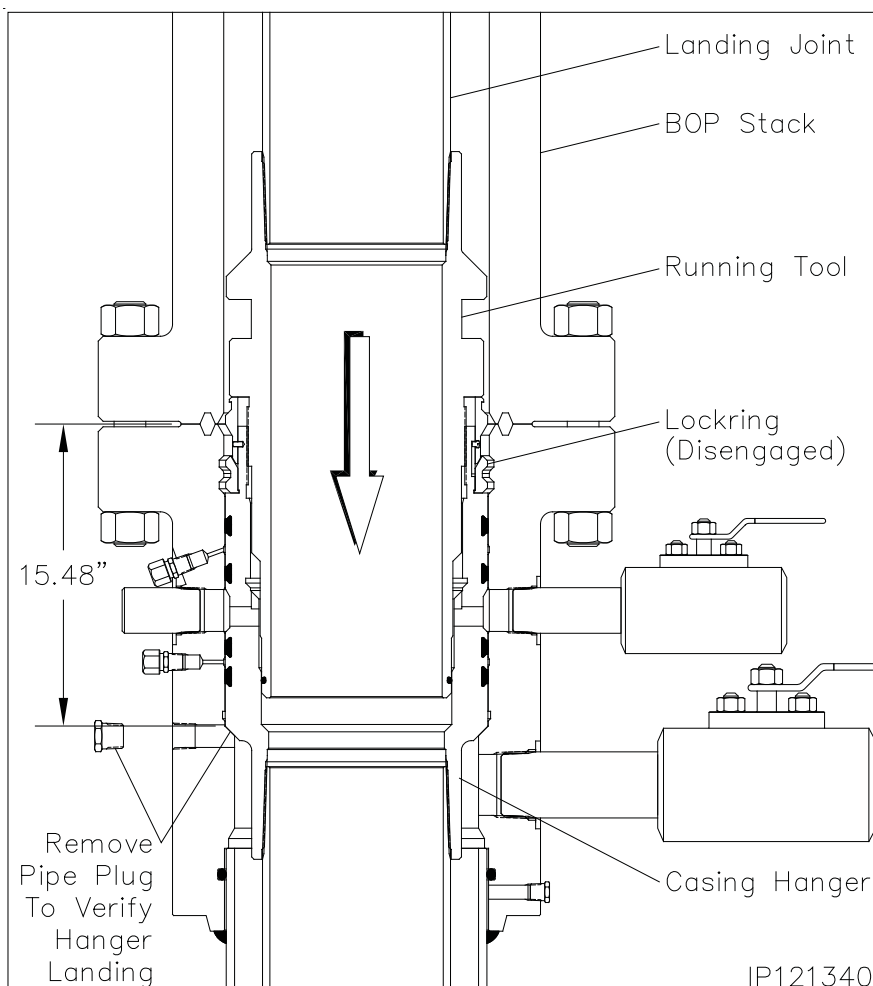
WARNING: Do Not apply torque to the Hanger/Tool connection.



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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 stack, 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.

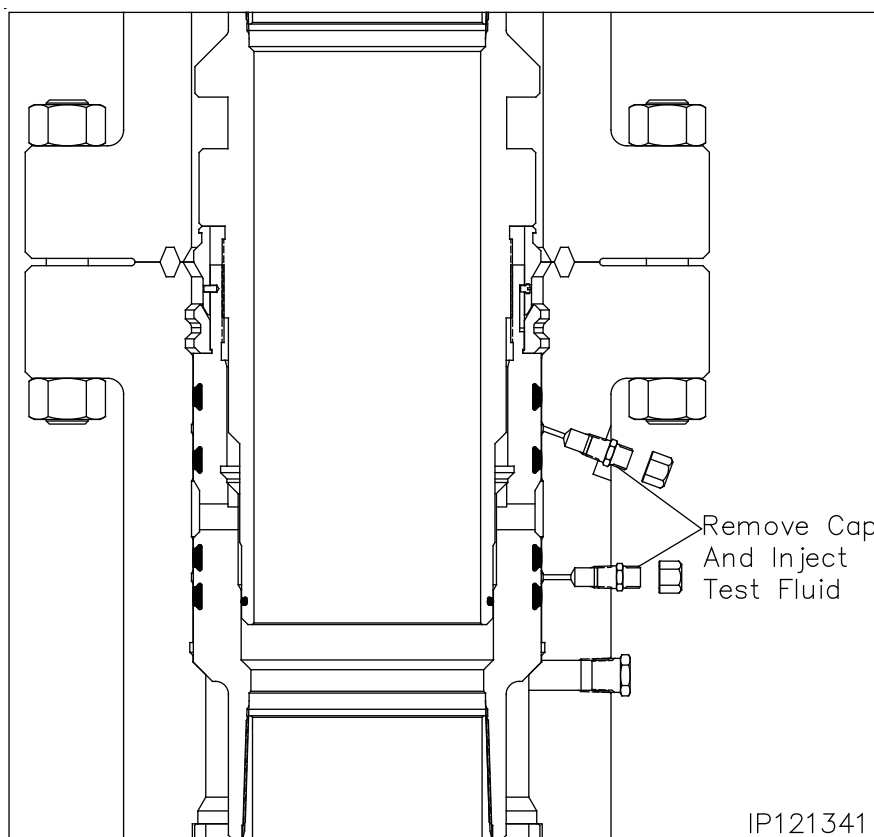


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Stage 4 — Hang Off the 9-5/8" Casing

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



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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 locking 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 locking out. A positive stop will be encountered when the locking 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 locking. This can be accomplished with the use of the air hoist.

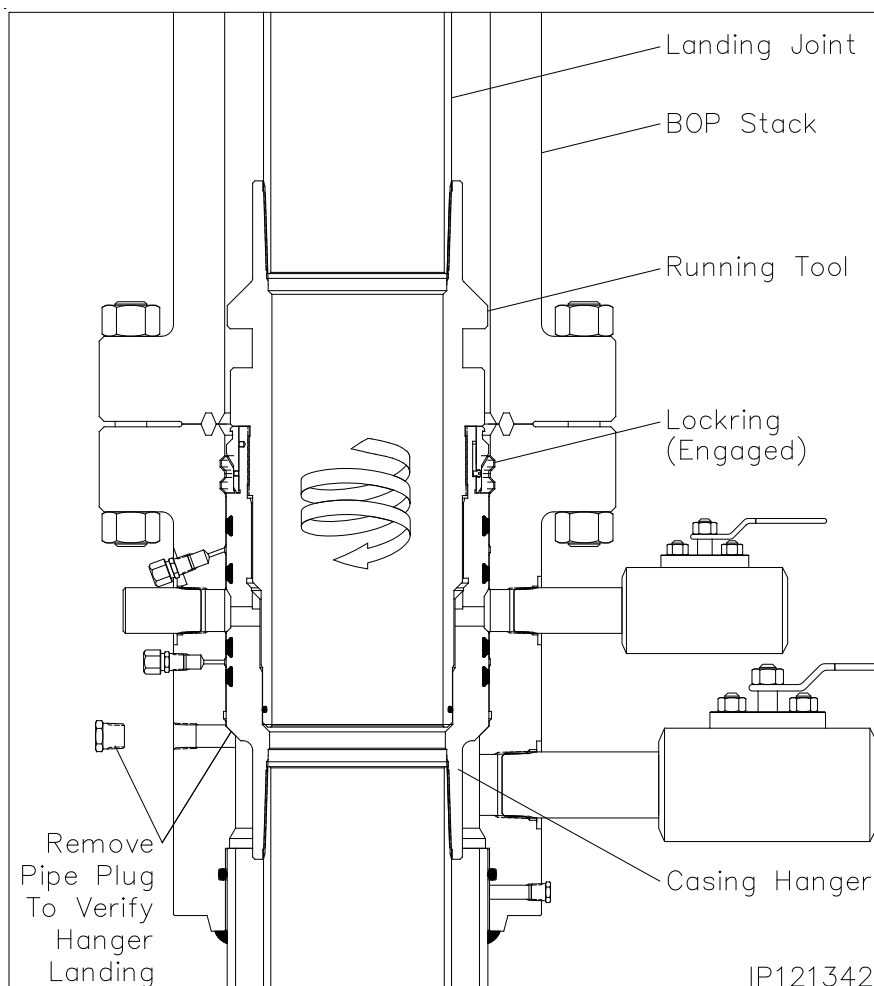
WARNING: If the required turns to engage the locking or not met or excessive torque is encountered, remove the casing hanger and call Houston Engineering.

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 locking 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.

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Stage 4 — Hang Off the 9-5/8" Casing

Retrieving The Casing Hanger

In the event that the casing hanger needs to be removed, 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 locking 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.

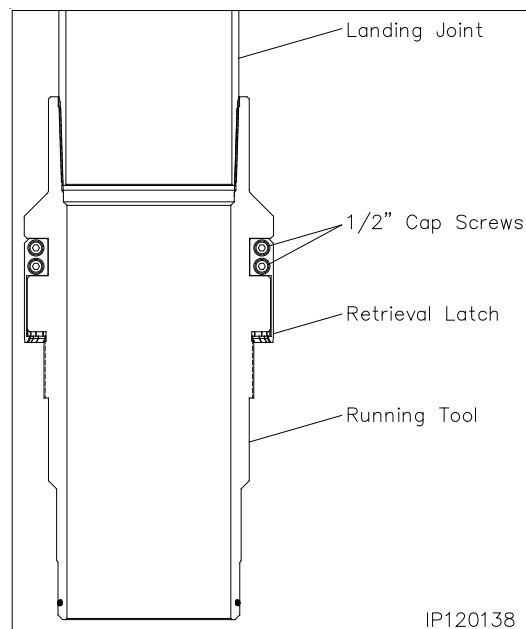
WARNING: Ensure the latch rotates freely on the tool. If not remove and check the latch and tool for burrs or imperfections in the groove.

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.

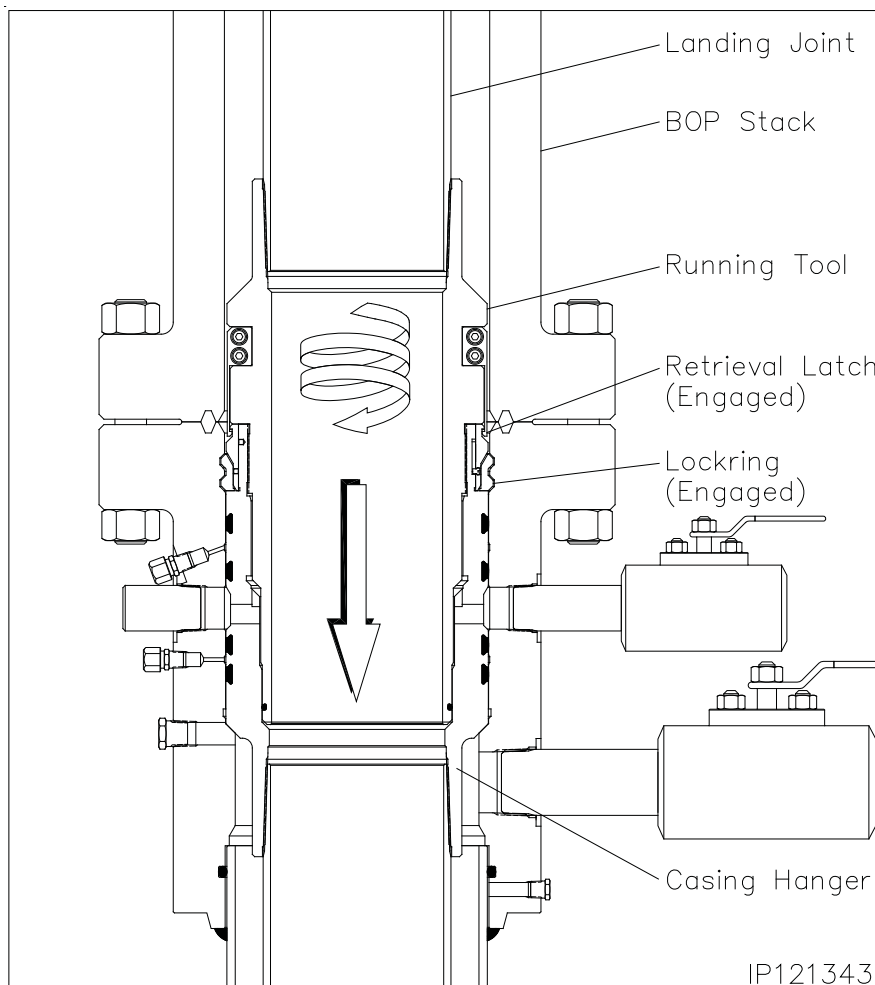
Note: Contact should be made at previously attained RKB dimension.

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.



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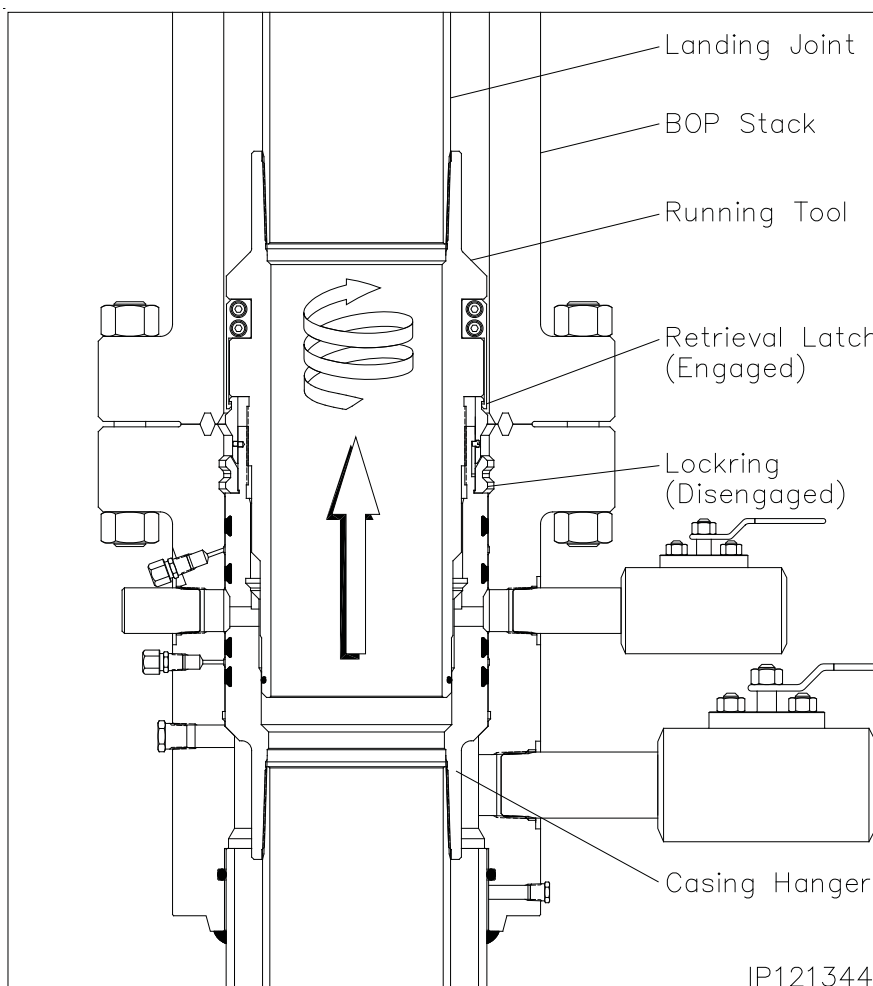
Stage 4 — Hang Off the 9-5/8" Casing

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 locking.

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.

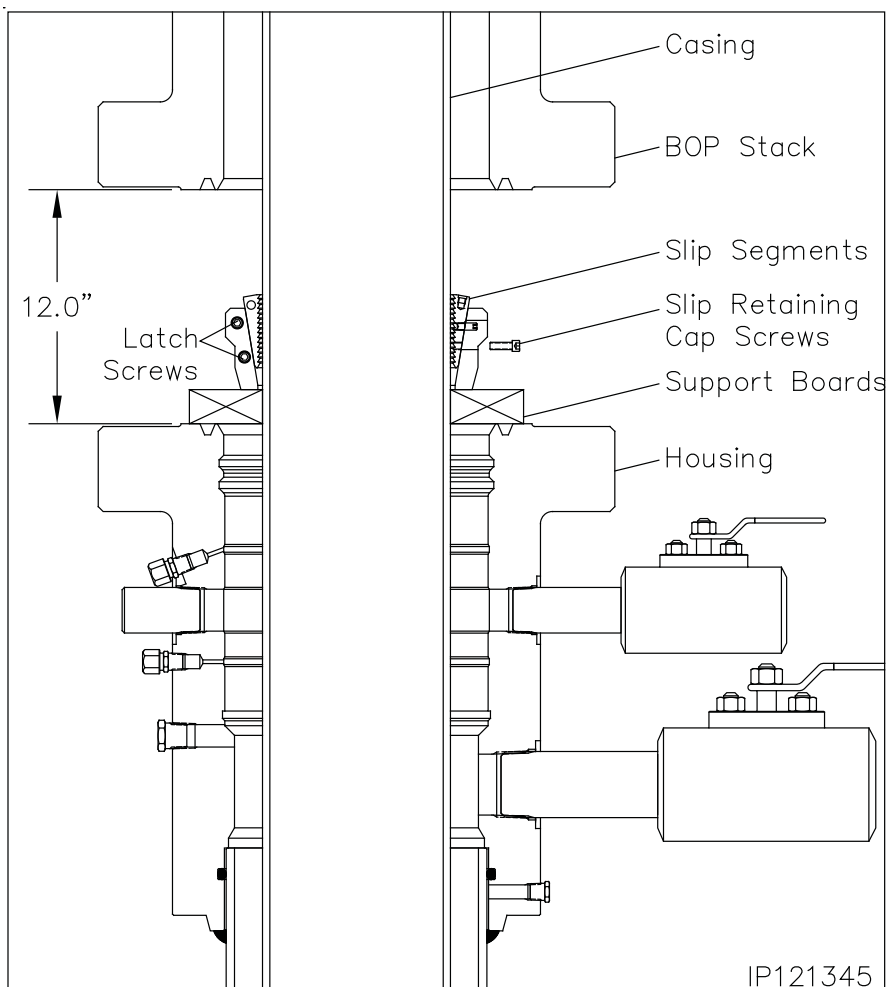
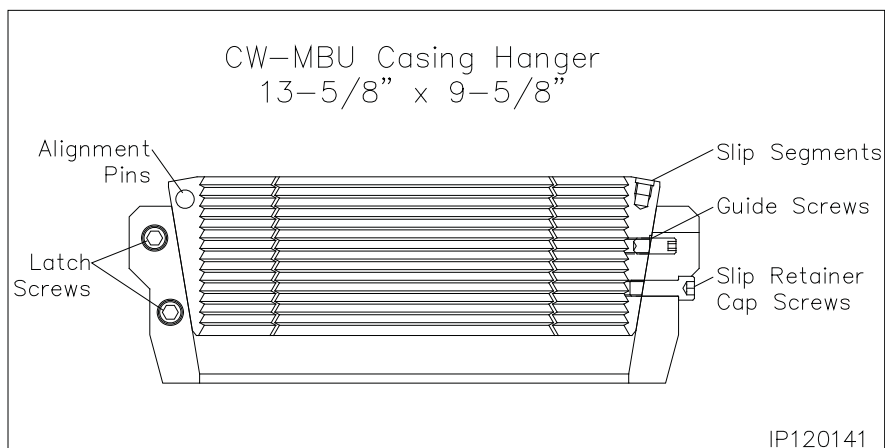


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Stage 4A — Hang Off the 9-5/8" Casing (Emergency)

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.



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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.

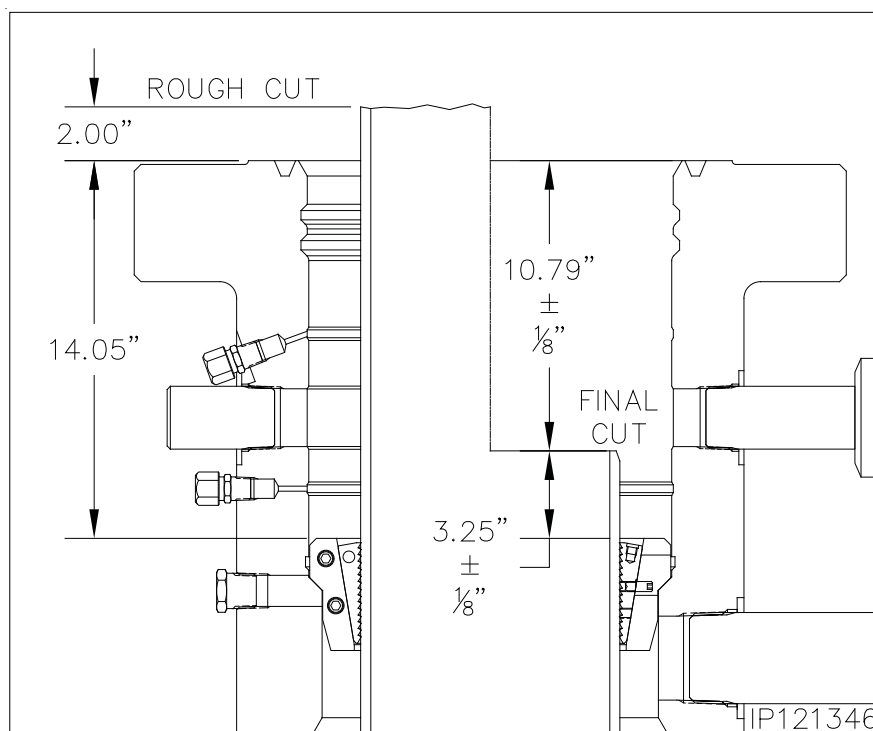
Note: A sharp decrease on the weight indicator will signify that the Hanger has taken weight and at what point, If this does not occur, pull tension again and slack off once more.

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" \pm 1/8" below the housing flange or 3.25" \pm 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.

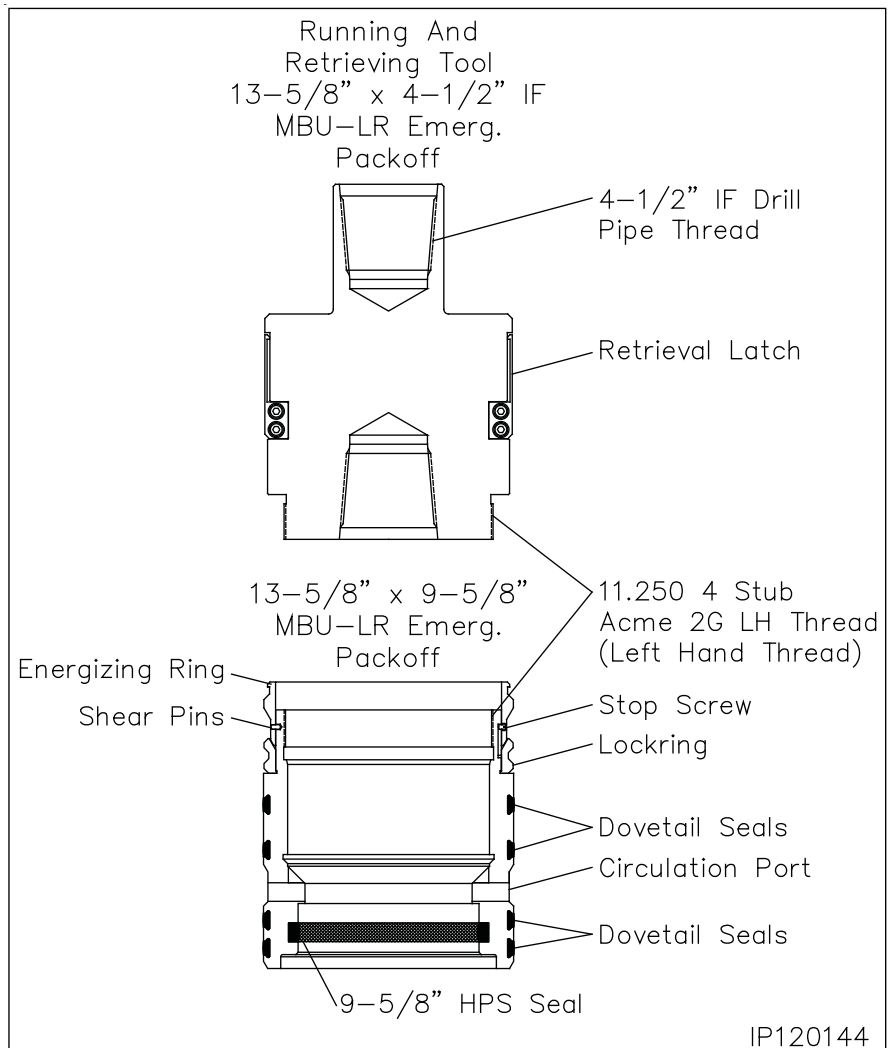
20. Remove the wear bushing and then thoroughly clean the housing bowl, removing all cement and cutting debris.

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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.

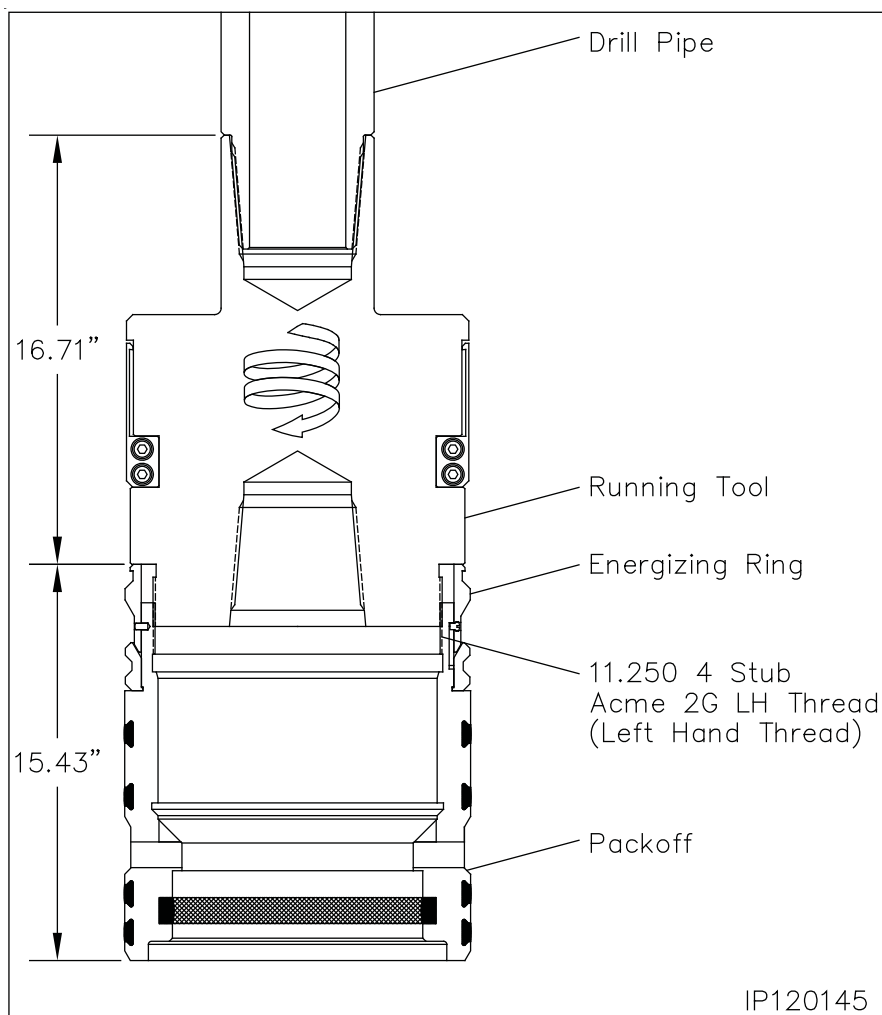
1. Examine the **13-5/8" Nominal x 9-5/8" x 11.250" 4 Stub Acme 2G LH box top MBU-LR Packoff Assembly (Item A7b)**. Verify the following:
 - all elastomer seals are in place and undamaged
 - internal bore, and ports, are clean and in good condition
 - lockring is fully retracted
 - energizer ring is 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 in safe place



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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.



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

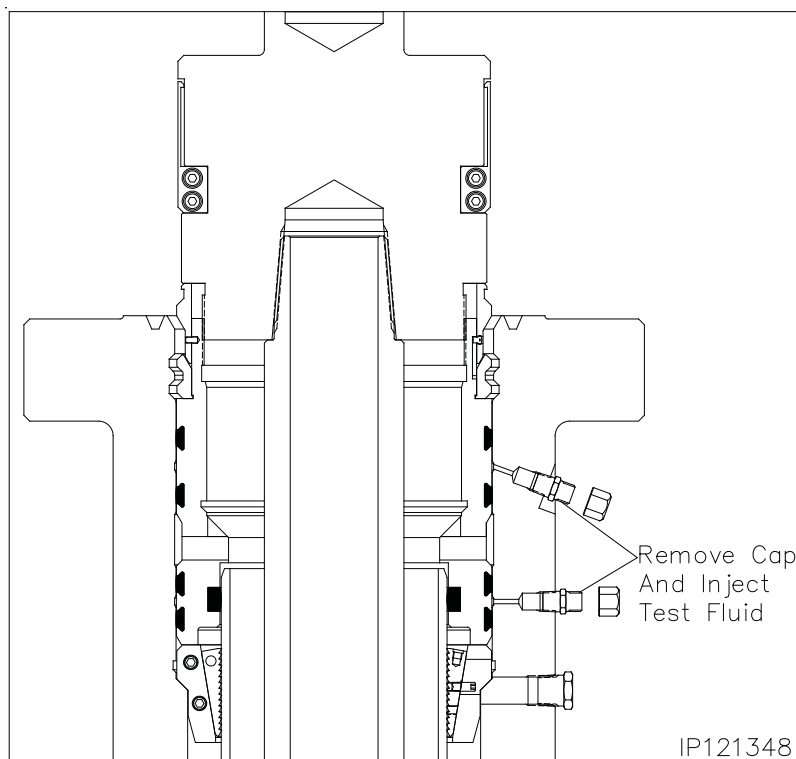
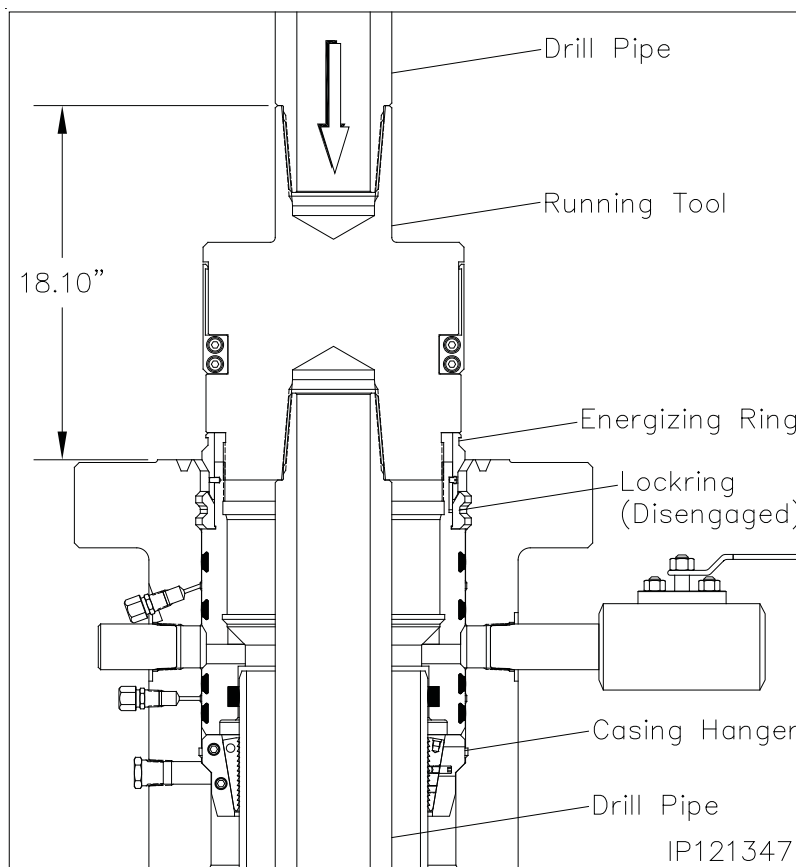
Landing the Packoff

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



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

Engaging the Lockring

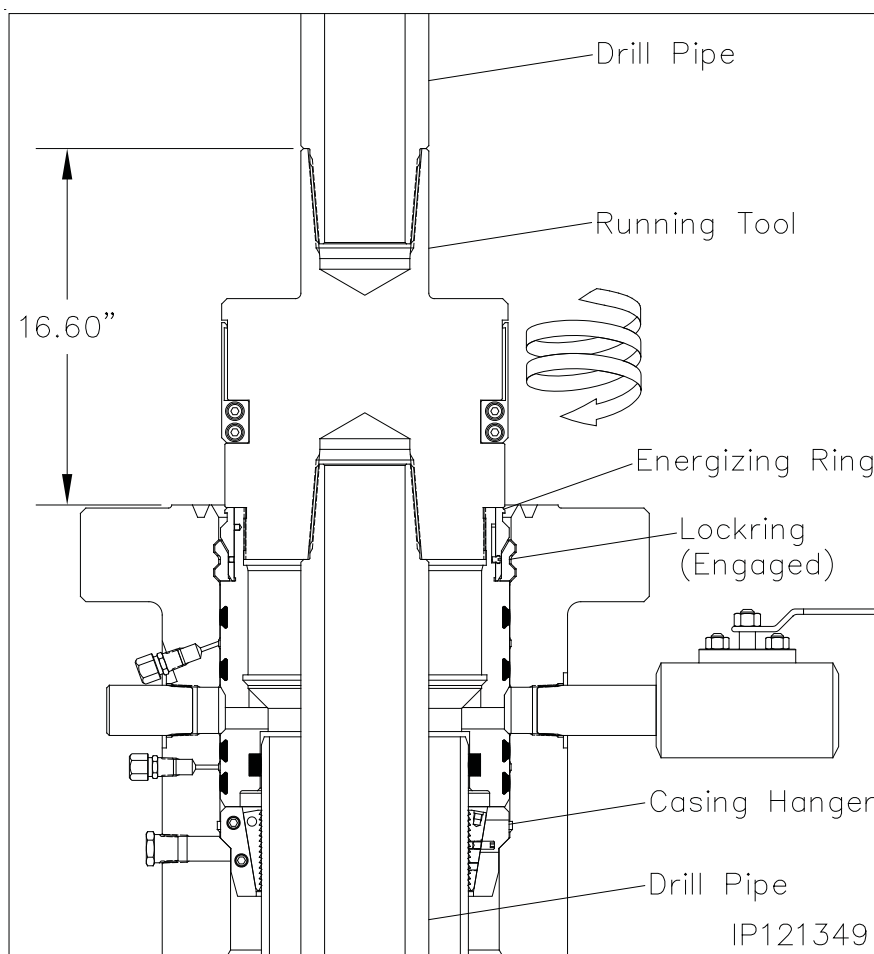
8. Using only chain tongs, rotate the landing joint approximately 6 turns counter clockwise (Left) to engage the packoff locking in its mating groove in the bore of the MBU-LR housing.

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 locking out. A positive stop will be encountered when the locking is fully engaged.

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

WARNING: If the required turns to engage the locking 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.



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

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

Retrieving the Packoff

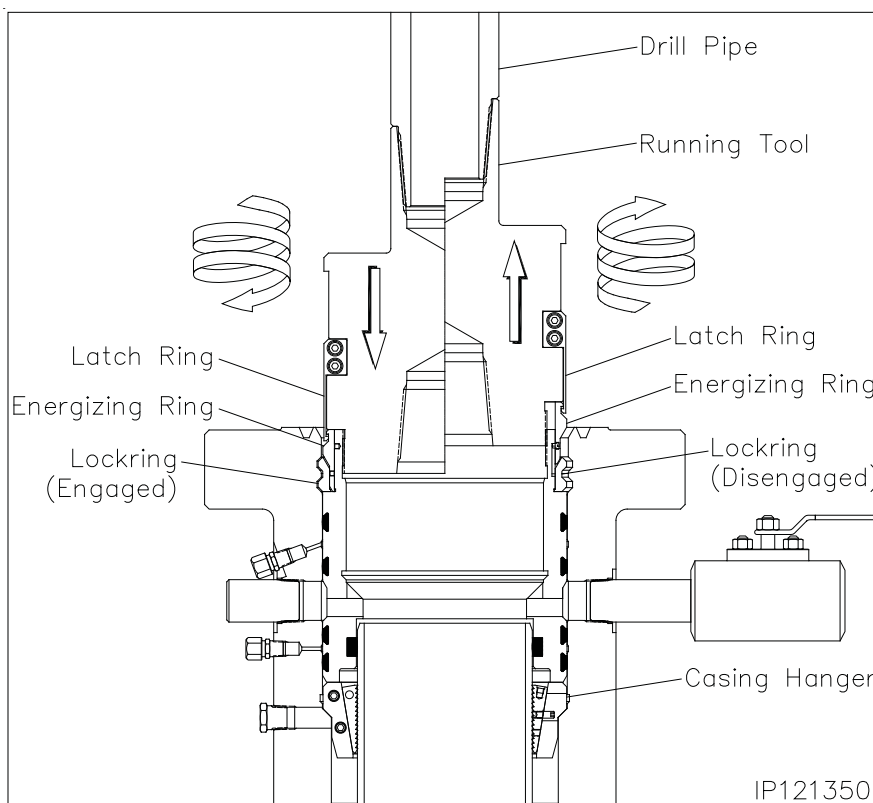
1. Locate the retrieval latch assembly with (4) 1/2" cap screws
2. Install the retrieval latch onto the running tool with the latch fingers facing down and install the cap screws and tighten them securely.
3. Ensure the retrieval latch freely rotates on the running tool actuation sleeve.
4. Carefully 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.

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.



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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.

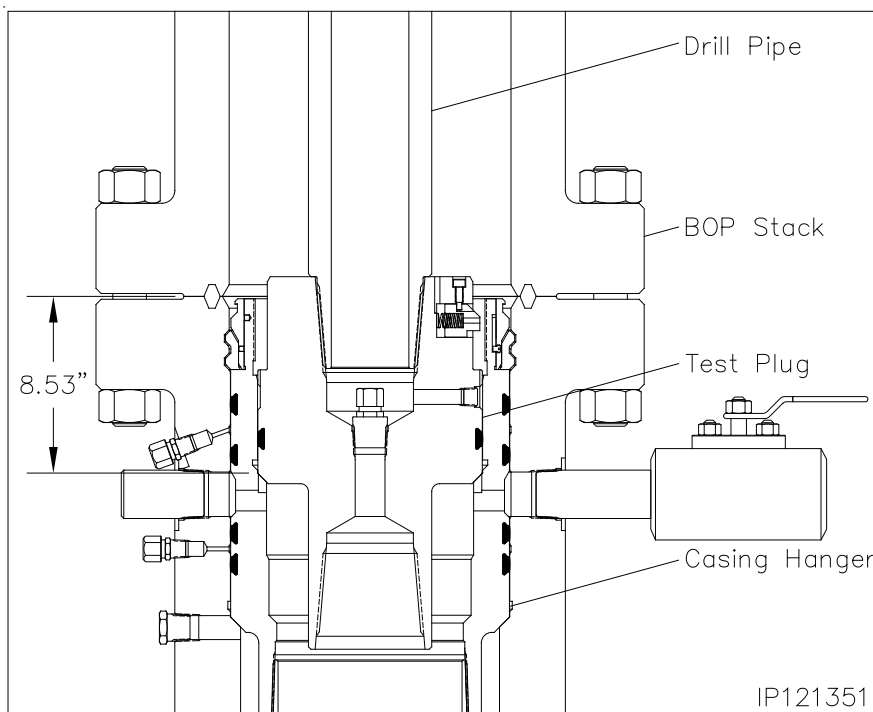
1. Examine the **11" Nominal x 4-1/2" IF CW Test Plug/Retrieving Tool (Item ST5)**. Verify the following:
 - 1-1/4" VR plug and weep hole plug are in place and tightened securely
 - elastomer seal is in place and in good condition
 - retractable lift lugs are in place, clean, and free to move
 - drill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

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.

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

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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.

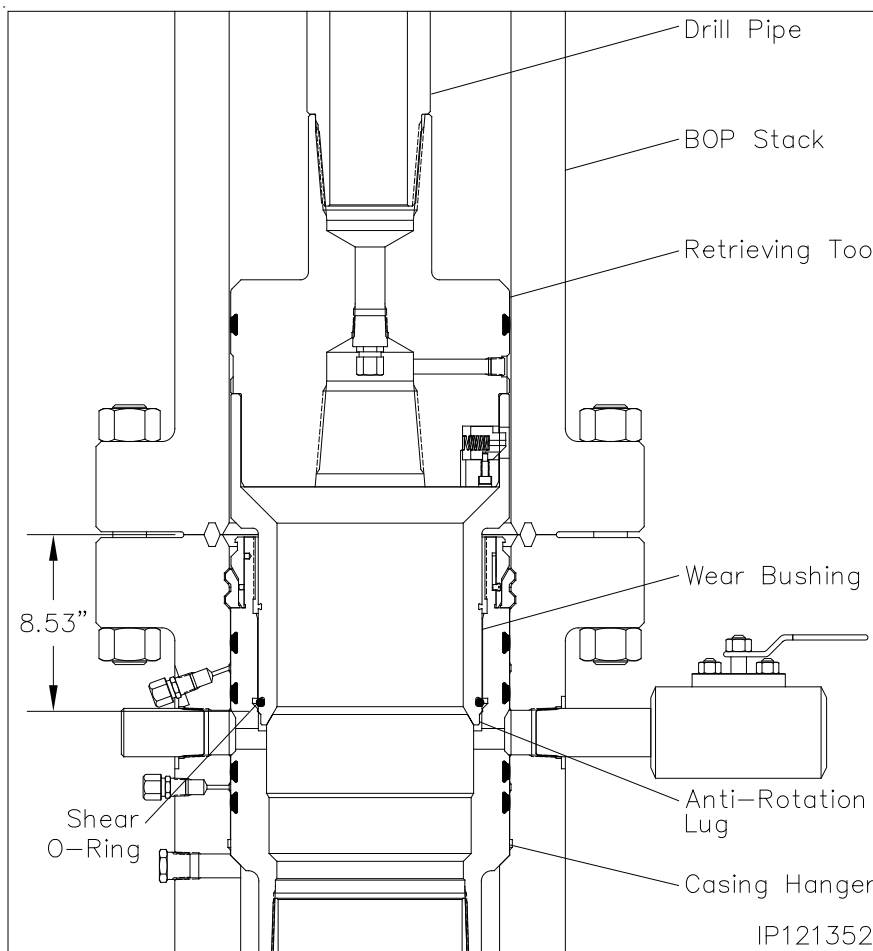
1. Examine the **13-5/8" x 11" x 9.00" ID MBU-LR-UPR Wear Bushing (Item ST6)**. Verify the following
 - internal bore is clean and in good condition
 - o-ring is in place and in good condition
 - shear o-ring cord is in place and in good condition
 - paint anti-rotation lugs white and allow paint to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

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Stage 7 — Hang Off the 7" Casing

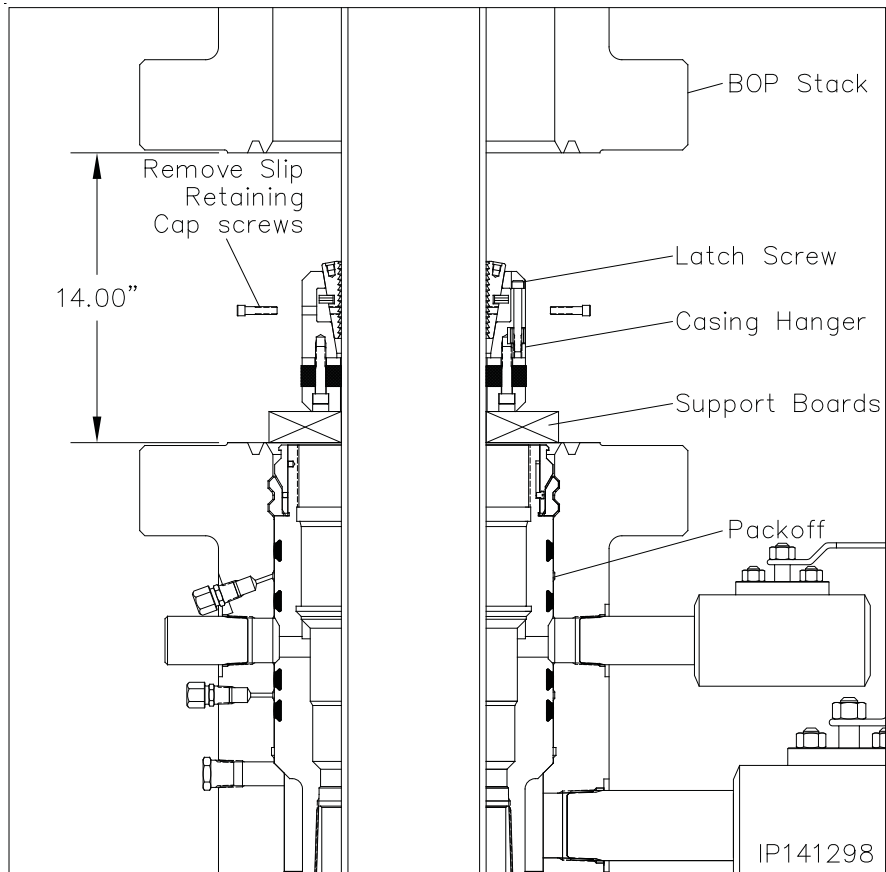
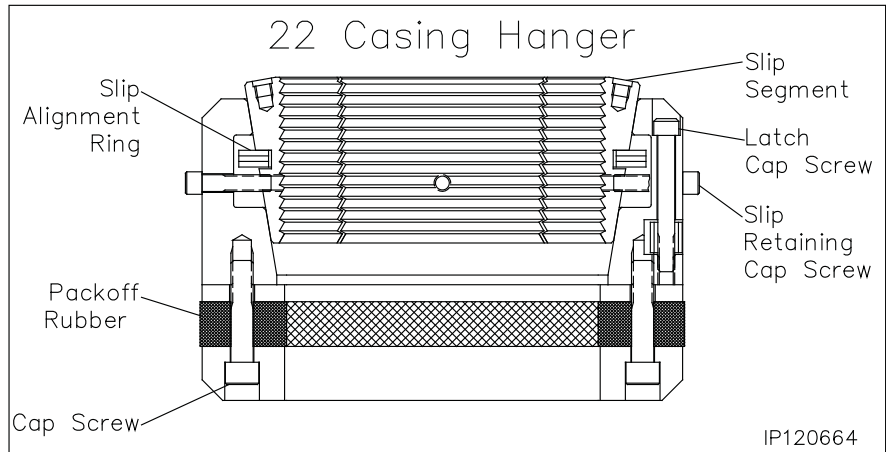
1. Run the 7" casing string as required and cement in place.
2. Drain the housing bowl through the upper side outlet.
3. Separate the BOP from the MBU-LR housing and lift the BOP approximately 14" above the housing and secure BOP with safety slings.
4. Using a fresh water hose, thoroughly wash out the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



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Stage 7 — Hang Off the 7" Casing

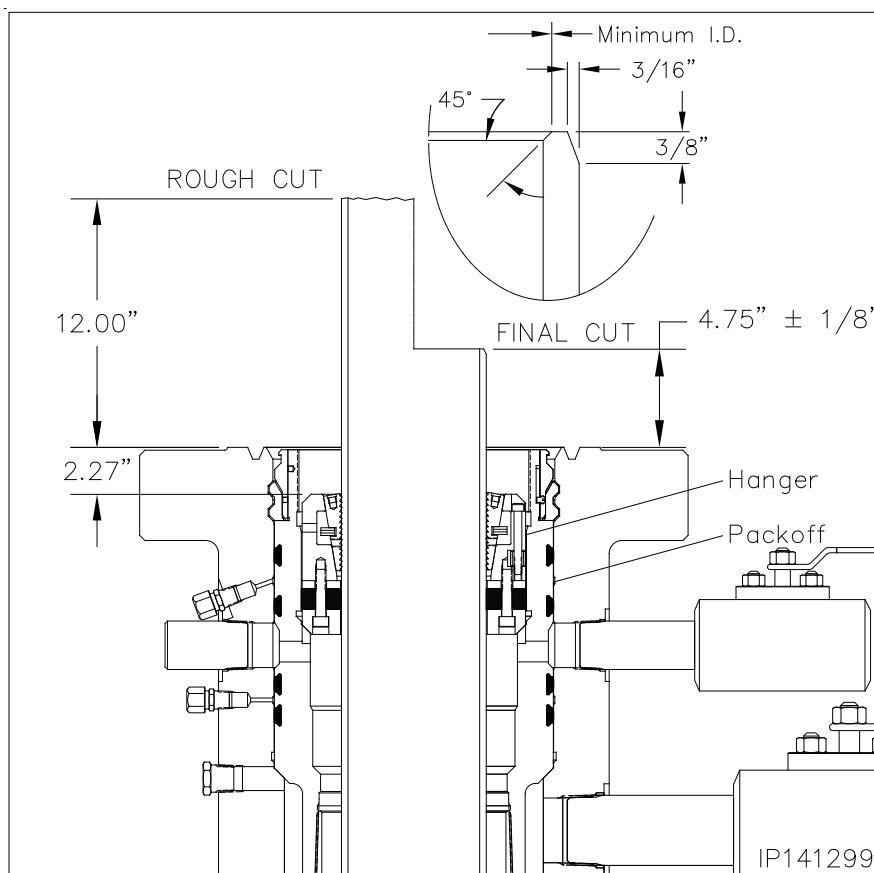
11. Remove the boards and allow the Hanger to slide into the packoff bowl. When the Hanger is down, the top of the hanger body will be approximately 2.27" below the top of the housing, pull tension on the casing to the desired hanging weight and then slack off..

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.

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" \pm 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

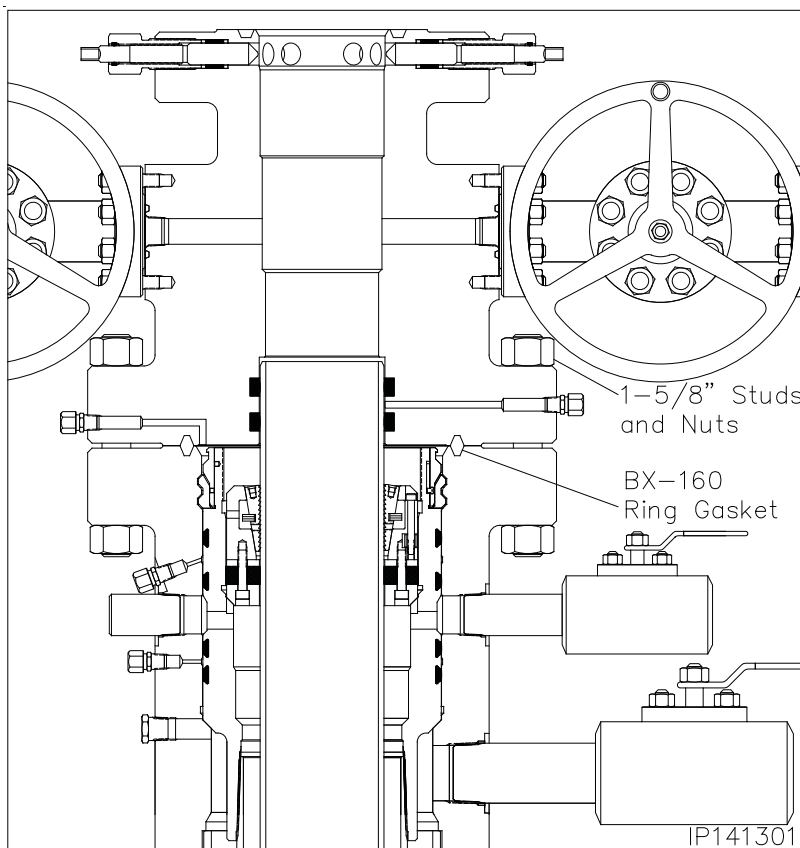
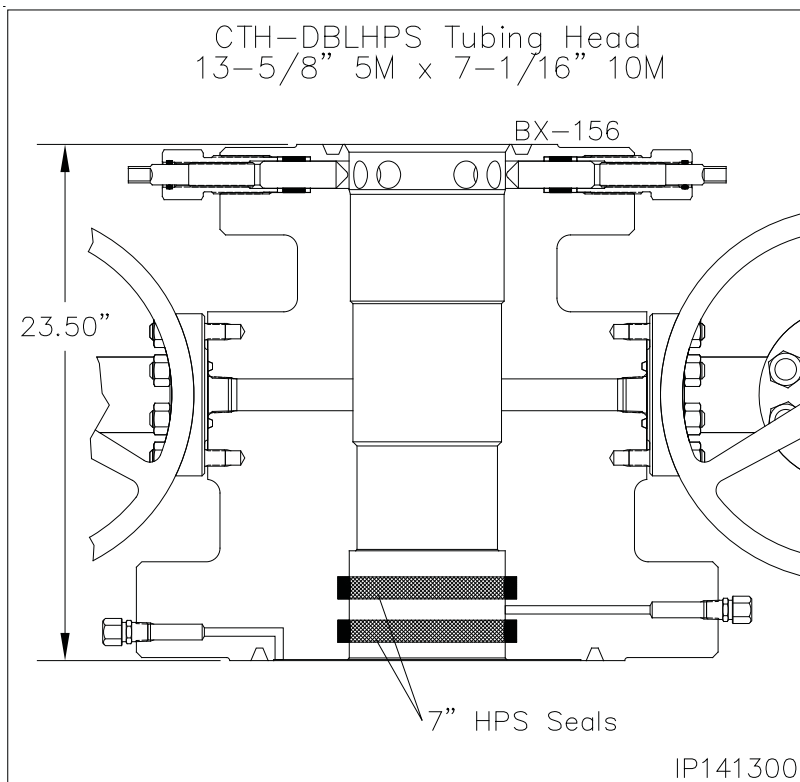
- Examine the **13-5/8" 5M x 7-1/16" 10M CW, CTH-DBLHPS Tubing Head (Item B1)**. Verify the following:
 - seal area and bore are clean and in good condition
 - HPS Secondary Seals** are in place and in good condition
 - all peripheral equipment is intact and undamaged
- Clean the mating ring grooves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

- Install a new **BX-160 Ring Gasket (Item B14)** in the ring groove of the MBU-LR Housing.
- Pick up the Tubing Head and suspend it above the MBU-LR Housing and casing stub.
- 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!

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

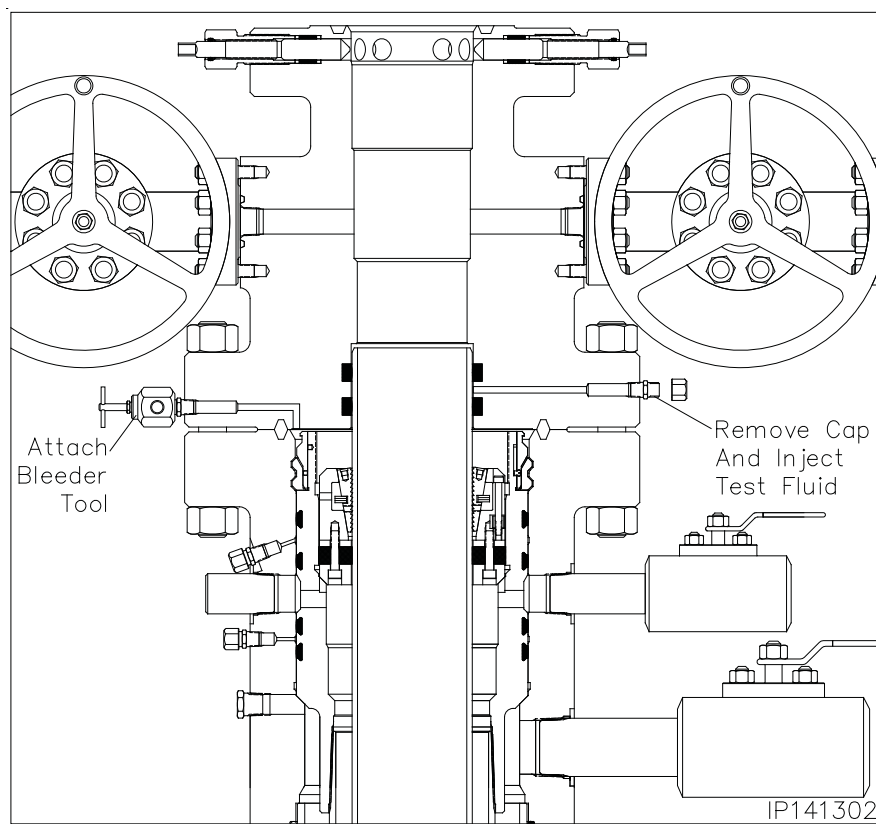


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Stage 8 — Install the Tubing Head

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.



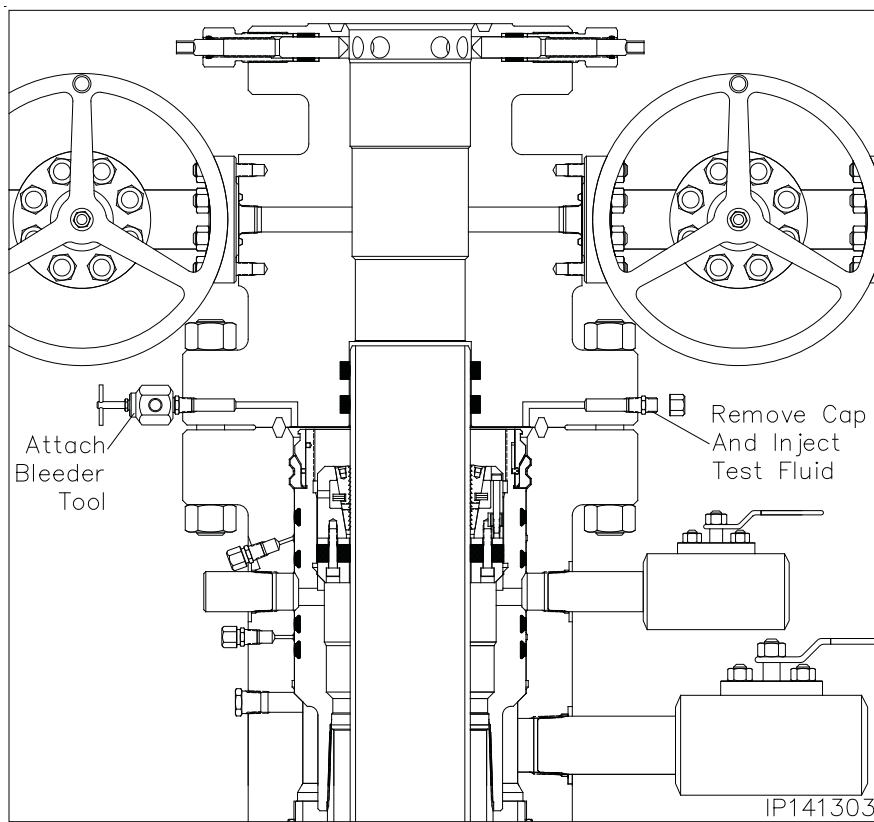
Seal Test	
Leak Location	Appropriate Action
Open bleeder tool - Lower HPS seal leaking	Remove Tubing Head and replace leaking seals. Reland and retest seals
Into the Tubing Head bore- Upper HPS Seal is Leaking	

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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

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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.

Caution: 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.

- 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 600°F to 700 °F (316°C to 371 °C) 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.



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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 200°F to 325°F or 93 °C to 160°C 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 400°F to 600°F or 200°C to 300°C.
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 250°F to 300°F or 120 °C to 150°C 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 400°F to 600°F or 200°C to 300°C.
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.

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State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 122115

CONDITIONS

Operator: Redwood Operating LLC PO Box 1370 Artesia, NM 88210	OGRID: 330211
	Action Number: 122115
	Action Type: [C-103] NOI Change of Plans (C-103A)

CONDITIONS

Created By	Condition	Condition Date
kpickford	Adhere to previous NMOCD Conditions of Approval	7/7/2022