Rec'd 06/25/2020 - NMOCD

Form 3160-5
(June 2015)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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

## 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.***

***SUBMIT IN TRIPLICATE - Other instructions on page 2***

5. Lease Serial No.
NMNM138886

6. If Indian, Allottee or Tribe Name

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

1. Type of Well
☒ Oil Well ☐ Gas Well ☐ Other

8. Well Name and No.
BRECKENRIDGE FED COM 706H

2. Name of Operator
FRANKLIN MOUNTAIN ENERGY LLC
Contact: RACHAEL OVERBEY
E-Mail: roverbey@fmellc.com

9. API Well No.
30-025-47029

3a. Address
2401 E 2ND AVENUE SUITE 300
DENVER, CO 80206

3b. Phone No. (include area code)
Ph: 720-414-7868

10. Field and Pool or Exploratory Area
98098; WC-025G-09S243532M

4. Location of Well *(Footage, Sec., T., R., M., or Survey Description)*
Sec 9 T24S R35E Mer NMP SESE 325FSL 1268FEL
32.225682 N Lat, 103.368048 W Lon

11. County or Parish, State
LEA COUNTY, NM

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

| TYPE OF SUBMISSION | TYPE OF ACTION | | | |
|---|---|---|---|---|
| ☒ Notice of Intent | ☐ Acidize | ☐ Deepen | ☐ Production (Start/Resume) | ☐ Water Shut-Off |
| ☐ Subsequent Report | ☐ Alter Casing | ☐ Hydraulic Fracturing | ☐ Reclamation | ☐ Well Integrity |
| ☐ Final Abandonment Notice | ☐ Casing Repair | ☐ New Construction | ☐ Recomplete | ☒ Other Drilling Operations |
| | ☐ Change Plans | ☐ Plug and Abandon | ☐ Temporarily Abandon | |
| | ☐ Convert to Injection | ☐ Plug Back | ☐ 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 recomplete 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 recompletion 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 determined that the site is ready for final inspection.

Franklin Mountain Energy, LLC (FME), Operator, respectfully requests approval to make the following changes to the proposed drilling plan for the above referenced well:

All Previous COAs Still Apply.

SHL and BHL remain the same but FME would like to utilize the attached, revised, directional plan to back-build and capture as much resource as possible. Please see attached Plan #3 and revised 14-point plan.

Production Casing: FME would like approval to utilize 5.5 inch Anaconda 656 23lb. P-110 in the drilling of this bore. Please see attached data sheet and revised 14-point plan.

WH: A multi-bowl wellhead system will be utilized while drilling; FME would like approval to use the attached multi-bowl Cactus WH running procedure.

14. I hereby certify that the foregoing is true and correct.

**Electronic Submission #519849 verified by the BLM Well Information System**
**For FRANKLIN MOUNTAIN ENERGY LLC, sent to the Hobbs**
**Committed to AFMSS for processing by PRISCILLA PEREZ on 06/22/2020 ()**

Name *(Printed/Typed)* VLADIMIR ROUDAKOV — Title DIRECTOR DRILLING OPERATIONS

Signature (Electronic Submission) — Date 06/22/2020

## THIS SPACE FOR FEDERAL OR STATE OFFICE USE

Approved By Long Vo — Title Petroleum Engineer — Date 6/25/2020

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 CFO

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)

**** OPERATOR-SUBMITTED ** OPERATOR-SUBMITTED ** OPERATOR-SUBMITTED ****

Accepted - KMS NMOCD

## Additional data for EC transaction #519849 that would not fit on the form

**32. Additional remarks, continued**

BOP: FME requests approval to utilize the attached BOP/CM configuration while drilling this pad of wells; please see attached BOP diagram and well control procedure.
~~FME requests a variance to Break Test the BOP utilizing the attached procedure. Please see attached Break Test document.~~

Break testing not allow.

FRANKLIN MOUNTAIN ENERGY

# Breckenridge Fed Com 706H

1. **Geologic name of surface location:** Permian

2. **Estimated tops of important geological markers:**

| Formations | PROG SS | PROG TVD | Picked TVD | delta | Potential/Issues |
|---|---|---|---|---|---|
| Cenozoic Alluvium (surface) | 3,375' | 21' | 21' | 0 | Sand/Gravels/unconsolidated |
| Rustler | 2,434' | 962' | | | Carbonates |
| Salado | 2,337' | 1,059' | | | Salt, Carbonate & Clastics |
| Base Salt | 412' | 2,984' | | | Shaley Carbonate & Shale |
| Lamar | -1,884' | 5,280' | | | Carbonate & Clastics |
| Bell Canyon | -1,988' | 5,384' | | | Sandstone - oil/gas/water |
| Cherry Canyon | -2,894' | 6,290' | | | Sandstone - oil/gas/water |
| Brushy Canyon | -4,236' | 7,632' | | | Sand/carb/shales - oil/gas/water |
| Bone Spring Lime | -5,545' | 8,941' | | | Shale/Carbonates - oil/gas |
| Avalon | -5,571' | 8,967' | | | Shale/Carbonates - oil/gas |
| First Bone Spring Sand | -6,662' | 10,058' | | | Sandstone - oil/gas/water |
| Second Bone Spring Carbonates | -6,830' | 10,226' | | | Shale/Carbonates - oil/gas |
| Second Bone Spring Sand | -7,237' | 10,633' | | | Sandstone - oil/gas/water |
| Third Bone Spring Carbonates | -7,761' | 11,157' | | | Shale/Carbonates - oil/gas |
| Third Bone Spring Sand | -8,203' | 11,599' | | | Sandstone - oil/gas/water |
| Wolfcamp | -8,563' | 11,959' | | | Overpressure shale/sand- Oil/Gas |
| **HZ Target** | -8,577' | 11,973' | | | Overpressure Shale - Oil/Gas |
| Wolfcamp A | -8,591' | 11,987' | | | Overpressure Shale - Oil/Gas |
| Wolfcamp B | -8,790' | 12,186' | | | Overpressure Shale - Oil/Gas |

3. **Estimated depth of anticipated fresh water, oil or gas:**

| | | |
|---|---|---|
| Upper Permian Sands | 0- 400’ | Fresh Water |
| Delaware Sands | 5,384’ | Oil |
| Bone Spring | 10,058’ | Oil |
| Wolfcamp | 11,959’ | Oil |

No other formations are expected to give up oil, gas or fresh water in measurable quantities. Surface freshwater sands will be protected by setting 13 3/8” casing at 1,300’and circulating cement back to surface.

4. **Casing Program:**

All casings strings will be run new. Safety factors calculated assuming the well is vertical.

| Casing string | Weight | Grade | Burst | Collapse | Tension | Conn | Length | API design factor | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Burst | Collapse | Tension | Coupling |
| Surface 13 3/8" | 54.5 | J-55 | 2730 | 1130 | 853 | BTC 909 | 1300 | 1.18 | 1.67 | 4.99 | 5.32 |
| Intermediate 9 5/8" | 40 | HCL-80 | 7430 | 4230 | 916 | BTC 1042 | 5400 | 1.72 | 1.67 | 2.90 | 3.30 |
| Intermediate 7 5/8" | 29.7 | HCP-110 | 8280 | 7150 | 827 | Stinger 564 | 12100 | 1.1 | 1.26 | 1.8 | 1.23 |
| Long string 5 1/2" | 23 | P-110 | 14520 | 14520 | 729 | Anaconda 656 | 22151 | 1.32 | 1.4 | 1.2 | 1.08 |

Preliminary plan is to set 7 5/8” string before entering Wolfcamp formation at 11,907’TVD/12,100’MD at 64° Inc due too potential overpressure. Safety factors calculated assuming the well is vertical.

**Cementing Program:**

Cementing Stage tool can be placed in the 1st Intermediate string around 4,000' TVD as a contingency to ensure required TOC to surface.

| String Type | Hole Size | Casing Size | Setting Depth | Sacks | Lead Type of cmt | Lead Yield ft3/sk | Lead Water gal/sk | Lead TOC ft | Tail Sacks | Tail Type of cmt | Tail Yield ft3/sk | Tail Water gal/sk | Tail TOC | Excess |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surf | 17.5 | 13.375 | 1300 | 795 | Extenda Cem, 13.5 ppg Class C, 3lb/sk Kol-Seal 0.125pps Poly-E-Flake | 1.747 | 9.06 | 0 | 334 | HalCem TM, 14.8 ppg, Class C, 1% CaCl2, 0.125pps Celo-Flake | 1.349 | 6.51 | 1000 | 100% |
| Int1 | 12.25 | 9.625 | 5400 | 1167 | Neocem TM, 11.5 ppg, Class C 5% Salt, 0.125 pps Poly-E-Flake, 3lb/sk Kol-Seal | 2.444 | 14.32 | 0 | 153 | HalCem TM, 14.8 ppg, Class C, 0.1% HR 800 .125 pps Poly-E-Flake | 1.334 | 6.42 | 5100 | 100% |
| Int2 | 8.75 | 7.625 | 12100 | 345 | NeoCem, 11 ppg, Class C 3lb/sk Bridgemaker Gel, 5% Salt, 5pps LCM, 0.25pps Cello-Flake | 2.798 | 17.15 | 4400 | 112 | NeoCem 13.2 ppg, Class C 0.25 pps Cello-Flake, 2% CaICl2 | 1.44 | 7.29 | 11100 | 50% |
| Prod | 6.75 | 5.5 | 22151 | 814 | NeoCem, 13.5 ppg, Gas Migration Control | 1.357 | 6.65 | 11100 | | | | | | 20% |

## 5. Minimum Specifications for Pressure Control:

The minimum blowout preventer equipment (BOPE) shown in Exhibit #1 will consist of a single ram, mud cross and double ram-type (10,000 psi WP) preventer and an annular preventer (5,000-psi WP). Both units will be hydraulically operated, and the ram-type will
be equipped with blind rams on bottom and 4 ½" x 7" variable pipe rams on top. All BOPE will be tested in accordance with Onshore Oil & Gas order No. 2.
Before drilling out of the surface casing, the ram-type BOP and accessory equipment will be tested to 5,000/250 psig and the annular preventer to 5,000/250 psig. The surface casing will be tested to 1500 psi for 30 minutes.

Before drilling out of the second intermediate casing, the ram-type BOP and accessory equipment will be tested to 10,000/250 psig and the annular preventer to 5,000/250 psig. The second intermediate casing will be tested to 2000 psi for 30 minutes prior to drillout.
Pipe rams will be operationally checked each 24-hour period. Blind rams will be operationally checked on each trip out of the hole. These checks will be noted on the daily tour sheets.

A hydraulically operated choke will be installed prior to drilling out of the intermediate casing shoe.

FRANKLIN MOUNTAIN ENERGY

## 6. Types and characteristics of the proposed mud system:

During this procedure we plan to use a Closed-Loop System and haul contents to the required disposal. The applicable depths and properties of the drilling fluid systems are as follows.

| Depth | Type | Weight (ppg) | Viscosity | Water Loss |
|---|---|---|---|---|
| 0 – 1,300' | Fresh - Gel | 8.6-8.8 | 28-34 | N/c |
| 1,300' – 12,100' | Brine | 8.8-10.2 | 28-34 | N/c |
| 12,100' – 22,151' Lateral | Oil Base | 10.0-11.0 | 58-68 | 3 - 6 |

The highest mud weight needed to balance formation is expected to be 10-11 ppg. In order to maintain hole stability, mud weights up to 12.5 ppg may be utilized.
An electronic pit volume totalizer (PVT) will be utilized on the circulating system, to monitor pit volume, flow rate, pump pressure and stroke rate.
Sufficient mud materials to maintain mud properties and meet minimum lost circulation and weight increase requirements will be kept at the wellsite at all times.

## 7. Auxiliary well control and monitoring equipment:

(A) A kelly cock will be kept in the drill string at all times.
(B) A full opening drill pipe-stabbing valve (inside BOP) with proper drill pipe connections will be on the rig floor at all times.
(C) H2S monitoring and detection equipment will be utilized from surface casing point to TD.
(D) A wear bushing will be installed in the wellhead prior to drilling out of the surface casing.

## 8. Logging, testing and coring program:

GR–CCL-CNL Will be run in cased hole during completions phase of operations.
Open-hole logs are not planned for this well.

## 9. Abnormal conditions, pressures, temperatures and potential hazards:

The estimated bottom-hole temperature at 11,963' TVD (deepest point of the well) is 195F with an estimated maximum bottom-hole pressure (BHP) at the same point of 7,776 psig (based on 12.5 ppg MW). Hydrogen sulfate may be present in the area. All necessary precautions will be taken before drilling operations commence. See Hydrogen Sulfide Plan below:

## 10. Hydrogen Sulfide Plan:

A. All personnel shall receive proper awareness H2S training.
B. Briefing Area: two perpendicular areas will be designated by signs and readily accessible.
C. Required Emergency Equipment
    a. Well Control Equipment
        i. Flare line 150' from wellhead to be ignited by auto ignition sparking system.
        ii. Choke manifold with a remotely operated hydraulic choke.
        iii. Mud/gas separator
    b. Protective equipment for essential personnel
        i. Breathing Apparatus
            1. Rescue packs (SCBA) – 1 unit shall be placed at each briefing area, 2 shall be stored in a safety trailer on site.
            2. Work/Escape packs – 4 packs shall be stored on the rig floor with sufficient air hose not to restrict work activity

3. Emergency Escape Packs – 4 packs shall be stored in the doghouse for emergency evacuation

ii. Auxiliary Rescue Equipment
   1. Stretcher
   2. Two OSHA full body harnesses
   3. 100 feet of 5/8 inches OSHA approved rope
   4. 1-20# class ABC fire extinguisher

c. H2S Detection and Monitoring Equipment
   i. A stationary detector with three sensors will be placed in the doghouse if equipped, set to visually alarm at 10 ppm and audible at 14 ppm. The detector will be calibrated a minimum of every 30 days or as needed. The sensors will be placed in the following places:
      1. Rig Floor
      2. Below Rig Floor / Near BOPs
      3. End of flow line or where well bore fluid is being discharged (near shakers)
   ii. If H2S is encountered, measured values and formations will be provided to the BLM.

d. Visual Warning Systems
   i. One color code condition sign will be placed at the entrance to the site reflecting the possible conditions at the site.
   ii. A colored condition flag will be on display, reflecting the current condition at the site at the time.
   iii. Two windsocks will be placed in strategic locations, visible from all angles.

e. Mud Program
   i. The Mud program will be designed to minimize the volume of H2S circulated to surface. The operator will have the necessary mud products to minimize hazards while drilling in H2S bearing zones.

f. Metallurgy
   i. All drill strings, casings, tubing, wellhead, blowout preventer, drilling spool, kill lines, choke manifold and lines, and valves shall be suitable for H2S service at the anticipated operating pressures to prevent sour sulfide stress cracking.

g. Communication
   i. Communication will be via cell phones and walkie talkies on location.

Franklin Mountain Energy has conducted a review of offset operated wells to determine if an H2S contingency plan is required for the proposed well. Based on concentrations of offset wells, proximity to main roads, and distance to populated areas, the radius of exposure created by a potential release was determined to be minimal and low enough to not necessitate an H2S contingency plan. This will be reevaluated during wellbore construction if H2S is observed and after the well is on production.

**11. Anticipated starting date and duration of operations:**

The drilling operations on the well should be finished in approximately one month. However, in order to minimize disturbance in the area and to improve efficiency Franklin Mountain is planning to drill all the wells on the pad prior to commence completion operations. To even further reduce the time heavy machinery is used the “batch drilling” method may be used. The drilling rig with walking/skidding capabilities will be used.

## 12. Disposal/environmental concerns:

(A) Drilled cuttings will be hauled to and disposed of in a state-certified disposal site.
(B) Non-hazardous waste mud/cement from the drilling process will be also be hauled to and disposed of in a state-certified disposal site.
(C) Garbage will be hauled to the Pecos City Landfill.
(D) Sewage (grey water) will be hauled to the Carlsbad City Landfill

## 13. Wellhead:

A multi-bowl wellhead system will be utilized.
After running the 13 3/8" surface casing, a 13-5/8" BOP/BOPE system with a minimum working pressure of 10,000 psi will be installed on the wellhead system and will be pressure tested to 250 psi low followed by a 5,000 psi pressure test. This pressure test will be repeated at least every 21 days, as per Onshore Order No. 2

The minimum working pressure of the BOP and related BOPE required for drilling below the surface casing shoe shall be 5,000 psi.

After running the 2nd intermediate casing, and before drilling out, the wellhead, BOP, and related equipment will be tested to 10,000/250 psig.

The multi-bowl wellhead will be installed by vendor's representative(s). A copy of the installation instructions for the Cameron Multi-Bowl WH system has been sent to the BLM office in Carlsbad.

The wellhead will be installed by a third party welder while being monitored by WH vendor's representative.

All BOP equipment will be tested utilizing a conventional test plug. Not a cup or J-packer type.

A solid steel body pack-off will be utilized after running and cementing the intermediate casing strings. After installation of the first intermediate string the pack-off and lower flanges will be pressure tested to 5000 psi. After installation of the second intermediate string, the pack-off and upper flange will be pressure tested to 10,000 psi.

Both the surface and intermediate casing strings will be tested as per Onshore Order No. 2 to at least 0.22 psi/ft or 1500 psi, whichever is greater.

## 14. Additional variance requests

A. Casing.
In order to minimize potential environmental and technical hazards, this well is planned with two intermediate strings of casing.

1. Variance is requested to wave the centralizer requirements for the 7 5/8" casing due to the tight clearance with 9 5/8" string.
2. Variance is requested to wave/reduce the centralizer requirements for the 5 ½" casing due to the tight clearance with 6 3/4" hole and 5 ½" casing due to tight clearances.

# Franklin Mountain Energy

# DrilTech, LLC

**Golden - Breckenridge Site**
**Breckenridge Fed Com 706H**
**Wellbore #1**
**Plan #3**

FRANKLIN MOUNTAIN ENERGY

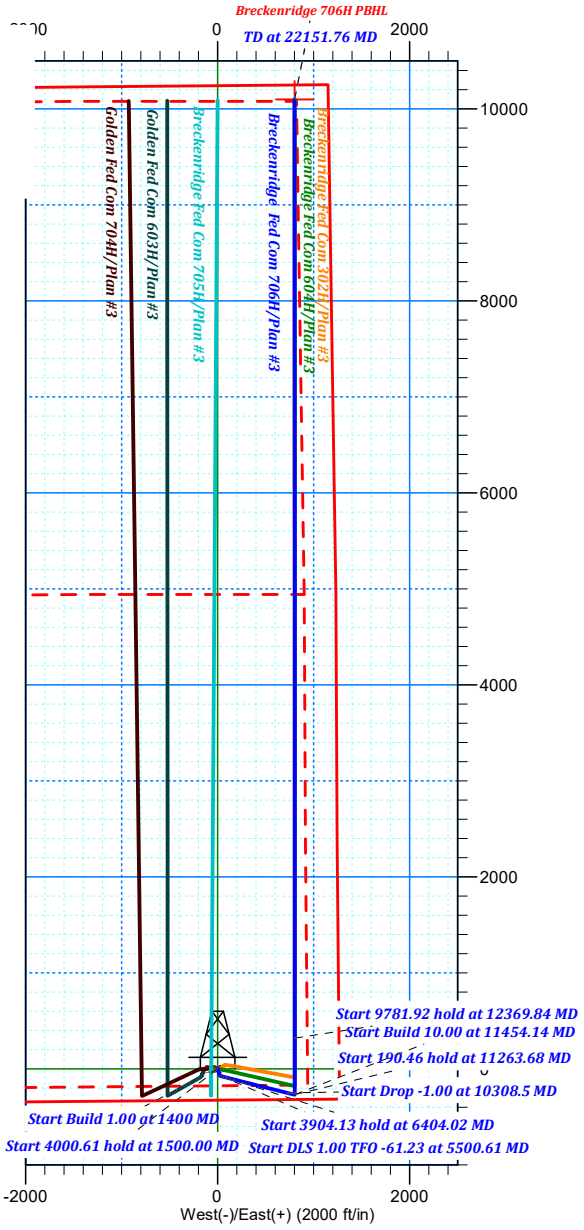
| SURFACE LOCATION | | | | |
|---|---|---|---|---|
| US State Plane 1983<br>New Mexico Eastern Zone<br>Elevation: GL 3375' + RBK 21' @ 3396.00ft | | | | |
| Northing | Easting | Latittude | Longitude | Slot |
| 447177.71 | 839835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W | |

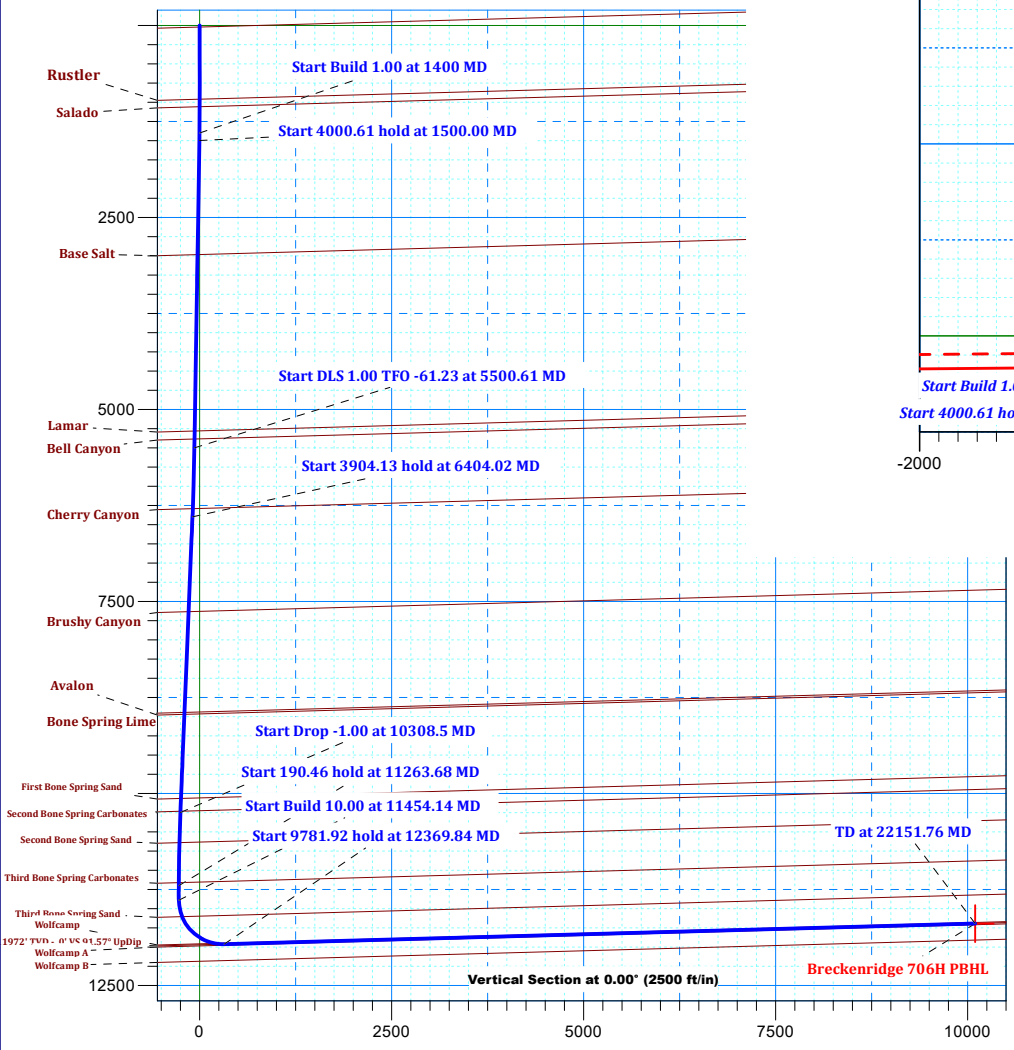
SECTION DETAILS

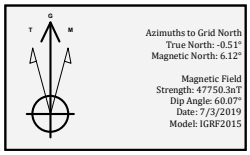
| MD | Inc | Azi | TVD | +N/-S | +E/-W | Dleg | TFace | VSect |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1400.00 | 0.00 | 0.00 | 1400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1500.00 | 1.00 | 160.00 | 1499.99 | -0.82 | 0.30 | 1.00 | 160.00 | -0.82 |
| 5500.61 | 1.00 | 160.00 | 5500.00 | -66.43 | 24.18 | 0.00 | 0.00 | -66.43 |
| 6404.02 | 9.56 | 103.99 | 6398.94 | -92.01 | 99.79 | 1.00 | -61.23 | -92.01 |
| 10308.15 | 9.56 | 103.99 | 10248.90 | -248.64 | 728.66 | 0.00 | 0.00 | -248.64 |
| 11263.68 | 0.00 | 0.00 | 11200.00 | -267.85 | 805.80 | 1.00 | 180.00 | -267.85 |
| 11454.14 | 0.00 | 0.00 | 11390.46 | -267.85 | 805.80 | 0.00 | 0.00 | -267.85 |
| 12369.84 | 91.57 | 359.99 | 11963.21 | 320.81 | 805.68 | 10.00 | 359.99 | 320.81 |
| 22151.76 | 91.57 | 359.99 | 11695.20 | 10099.06 | 803.71 | 0.00 | 0.00 | 10099.06 |

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

| Name | TVD | +N/-S | +E/-W | Northing | Easting |
|---|---|---|---|---|---|
| Breckenridge 706H PBHL | 11695.20 | 10099.06 | 803.71 | 457276.75 | 840639.00 |



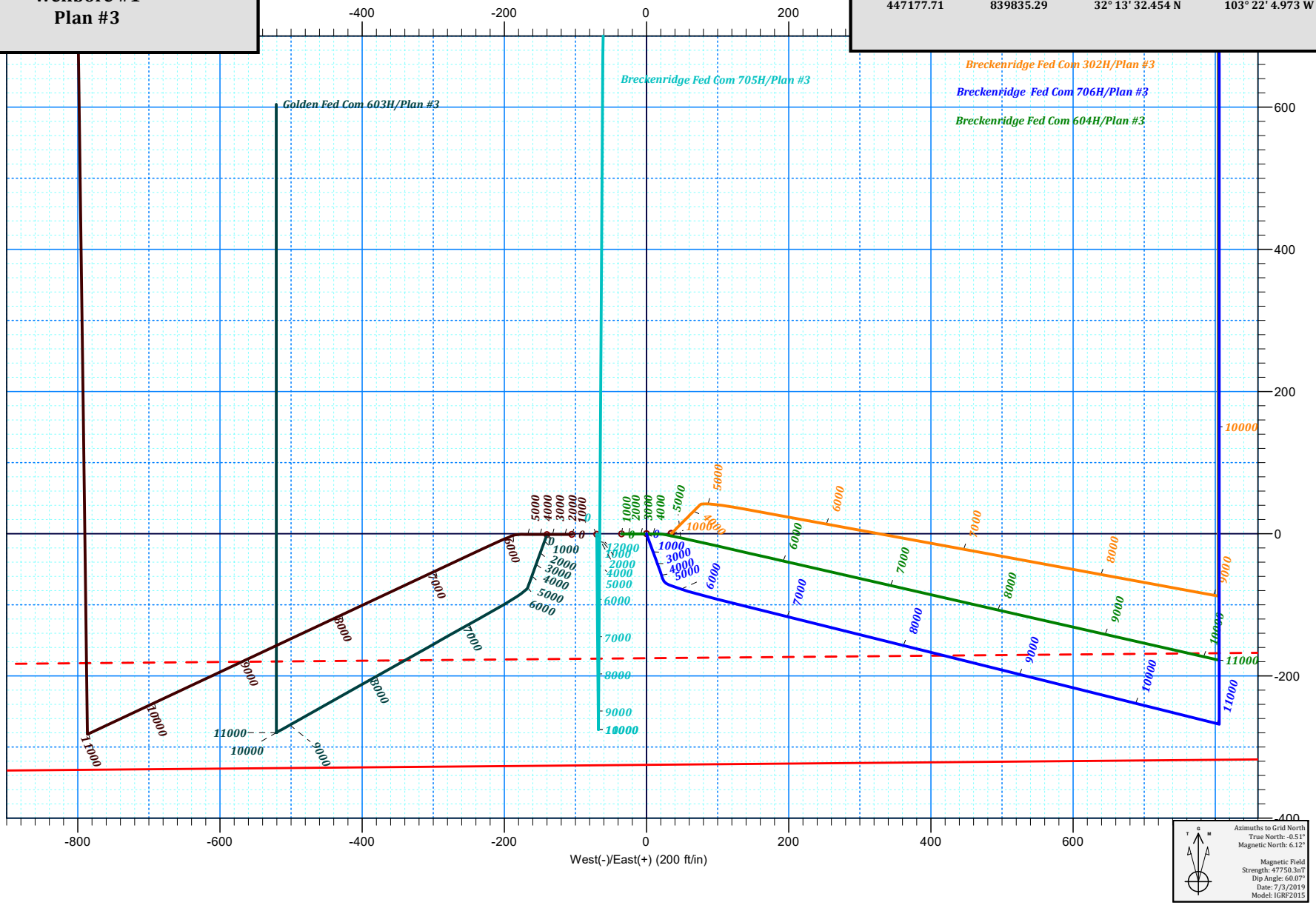



# Franklin Mountain Energy

## DrilTech, LLC

**Golden - Breckenridge Site**
**Breckenridge Fed Com 706H**
**Wellbore #1**
**Plan #3**

| SURFACE LOCATION | | | |
|---|---|---|---|
| US State Plane 1983<br>New Mexico Eastern Zone<br>Elevation: GL 3375' + RBK 21' @ 3396.00ft | | | |
| Northing | Easting | Latittude | Longitude |
| 447177.71 | 839835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |



# Franklin Mountain Energy

**Golden - Breckenridge Site**
**Lea County, NM (NAD 83)**
**Breckenridge  Fed Com 706H**

**Wellbore #1**

**Plan: Plan #3**

# Standard Planning Report

**20 March, 2020**

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Project** Golden - Breckenridge Site

| | | | |
|---|---|---|---|
| **Map System:** | US State Plane 1983 | **System Datum:** | Mean Sea Level |
| **Geo Datum:** | North American Datum 1983 | | |
| **Map Zone:** | New Mexico Eastern Zone | | |

**Site** Lea County, NM (NAD 83)

| | | | | | |
|---|---|---|---|---|---|
| **Site Position:** | | **Northing:** | 447,177.09 usft | **Latitude:** | 32° 13' 32.454 N |
| **From:** | Map | **Easting:** | 839,765.30 usft | **Longitude:** | 103° 22' 5.788 W |
| **Position Uncertainty:** | 0.00 ft | **Slot Radius:** | 13.200 in | **Grid Convergence:** | 0.51 ° |

**Well** Breckenridge Fed Com 706H

| | | | | | | |
|---|---|---|---|---|---|---|
| **Well Position** | **+N/-S** | 0.62 ft | **Northing:** | 447,177.71 usft | **Latitude:** | 32° 13' 32.454 N |
| | **+E/-W** | 69.99 ft | **Easting:** | 839,835.29 usft | **Longitude:** | 103° 22' 4.973 W |
| **Position Uncertainty** | | 0.00 ft | **Wellhead Elevation:** | | **Ground Level:** | 3,375.00 ft |

**Wellbore** Wellbore #1

| Magnetics | Model Name | Sample Date | Declination (°) | Dip Angle (°) | Field Strength (nT) |
|---|---|---|---|---|---|
| | IGRF2015 | 7/3/2019 | 6.64 | 60.07 | 47,750.29337949 |

**Design** Plan #3

**Audit Notes:**

| | | | | | |
|---|---|---|---|---|---|
| **Version:** | | **Phase:** | PROTOTYPE | **Tie On Depth:** | 0.00 |

| Vertical Section: | Depth From (TVD) (ft) | +N/-S (ft) | +E/-W (ft) | Direction (°) |
|---|---|---|---|---|
| | 0.00 | 0.00 | 0.00 | 0.00 |

**Plan Survey Tool Program** **Date** 3/20/2020

| | Depth From (ft) | Depth To (ft) | Survey (Wellbore) | Tool Name | Remarks |
|---|---|---|---|---|---|
| 1 | 0.00 | 22,151.76 | Plan #3 (Wellbore #1) | MWD | |
| | | | | MWD - Standard | |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Plan Sections**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) | TFO (°) | Target |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 1,400.00 | 0.00 | 0.00 | 1,400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 1,500.00 | 1.00 | 160.00 | 1,499.99 | -0.82 | 0.30 | 1.00 | 1.00 | 0.00 | 160.00 | |
| 5,500.61 | 1.00 | 160.00 | 5,500.00 | -66.43 | 24.18 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 6,404.02 | 9.56 | 103.99 | 6,398.94 | -92.01 | 99.79 | 1.00 | 0.95 | -6.20 | -61.23 | |
| 10,308.15 | 9.56 | 103.99 | 10,248.90 | -248.64 | 728.66 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 11,263.68 | 0.00 | 0.00 | 11,200.00 | -267.85 | 805.80 | 1.00 | -1.00 | 0.00 | 180.00 | |
| 11,454.14 | 0.00 | 0.00 | 11,390.46 | -267.85 | 805.80 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 12,369.84 | 91.57 | 359.99 | 11,963.21 | 320.81 | 805.68 | 10.00 | 10.00 | 0.00 | 359.99 | |
| 22,151.76 | 91.57 | 359.99 | 11,695.20 | 10,099.06 | 803.71 | 0.00 | 0.00 | 0.00 | 0.00 | Breckenridge 706H P |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21.00 | 0.00 | 0.00 | 21.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cenozoic Alluvium (surface)** | | | | | | | | | |
| 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 200.00 | 0.00 | 0.00 | 200.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 300.00 | 0.00 | 0.00 | 300.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 400.00 | 0.00 | 0.00 | 400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 500.00 | 0.00 | 0.00 | 500.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 600.00 | 0.00 | 0.00 | 600.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 700.00 | 0.00 | 0.00 | 700.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 800.00 | 0.00 | 0.00 | 800.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 900.00 | 0.00 | 0.00 | 900.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 962.00 | 0.00 | 0.00 | 962.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Rustler** | | | | | | | | | |
| 1,000.00 | 0.00 | 0.00 | 1,000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1,059.00 | 0.00 | 0.00 | 1,059.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Salado** | | | | | | | | | |
| 1,100.00 | 0.00 | 0.00 | 1,100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1,200.00 | 0.00 | 0.00 | 1,200.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1,300.00 | 0.00 | 0.00 | 1,300.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1,400.00 | 0.00 | 0.00 | 1,400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Start Build 1.00 at 1400 MD** | | | | | | | | | |
| 1,500.00 | 1.00 | 160.00 | 1,499.99 | -0.82 | 0.30 | -0.82 | 1.00 | 1.00 | 0.00 |
| **Start 4000.61 hold at 1500.00 MD** | | | | | | | | | |
| 1,600.00 | 1.00 | 160.00 | 1,599.98 | -2.46 | 0.90 | -2.46 | 0.00 | 0.00 | 0.00 |
| 1,700.00 | 1.00 | 160.00 | 1,699.96 | -4.10 | 1.49 | -4.10 | 0.00 | 0.00 | 0.00 |
| 1,800.00 | 1.00 | 160.00 | 1,799.95 | -5.74 | 2.09 | -5.74 | 0.00 | 0.00 | 0.00 |
| 1,900.00 | 1.00 | 160.00 | 1,899.93 | -7.38 | 2.69 | -7.38 | 0.00 | 0.00 | 0.00 |
| 2,000.00 | 1.00 | 160.00 | 1,999.92 | -9.02 | 3.28 | -9.02 | 0.00 | 0.00 | 0.00 |
| 2,100.00 | 1.00 | 160.00 | 2,099.90 | -10.66 | 3.88 | -10.66 | 0.00 | 0.00 | 0.00 |
| 2,200.00 | 1.00 | 160.00 | 2,199.89 | -12.30 | 4.48 | -12.30 | 0.00 | 0.00 | 0.00 |
| 2,300.00 | 1.00 | 160.00 | 2,299.87 | -13.94 | 5.07 | -13.94 | 0.00 | 0.00 | 0.00 |
| 2,400.00 | 1.00 | 160.00 | 2,399.86 | -15.58 | 5.67 | -15.58 | 0.00 | 0.00 | 0.00 |
| 2,500.00 | 1.00 | 160.00 | 2,499.84 | -17.22 | 6.27 | -17.22 | 0.00 | 0.00 | 0.00 |
| 2,600.00 | 1.00 | 160.00 | 2,599.83 | -18.86 | 6.86 | -18.86 | 0.00 | 0.00 | 0.00 |
| 2,700.00 | 1.00 | 160.00 | 2,699.81 | -20.50 | 7.46 | -20.50 | 0.00 | 0.00 | 0.00 |
| 2,800.00 | 1.00 | 160.00 | 2,799.80 | -22.14 | 8.06 | -22.14 | 0.00 | 0.00 | 0.00 |
| 2,900.00 | 1.00 | 160.00 | 2,899.78 | -23.78 | 8.66 | -23.78 | 0.00 | 0.00 | 0.00 |
| 2,984.92 | 1.00 | 160.00 | 2,984.69 | -25.17 | 9.16 | -25.17 | 0.00 | 0.00 | 0.00 |
| **Base Salt** | | | | | | | | | |
| 3,000.00 | 1.00 | 160.00 | 2,999.77 | -25.42 | 9.25 | -25.42 | 0.00 | 0.00 | 0.00 |
| 3,100.00 | 1.00 | 160.00 | 3,099.75 | -27.06 | 9.85 | -27.06 | 0.00 | 0.00 | 0.00 |
| 3,200.00 | 1.00 | 160.00 | 3,199.74 | -28.70 | 10.45 | -28.70 | 0.00 | 0.00 | 0.00 |
| 3,300.00 | 1.00 | 160.00 | 3,299.72 | -30.34 | 11.04 | -30.34 | 0.00 | 0.00 | 0.00 |
| 3,400.00 | 1.00 | 160.00 | 3,399.71 | -31.98 | 11.64 | -31.98 | 0.00 | 0.00 | 0.00 |
| 3,500.00 | 1.00 | 160.00 | 3,499.69 | -33.62 | 12.24 | -33.62 | 0.00 | 0.00 | 0.00 |
| 3,600.00 | 1.00 | 160.00 | 3,599.68 | -35.26 | 12.83 | -35.26 | 0.00 | 0.00 | 0.00 |
| 3,700.00 | 1.00 | 160.00 | 3,699.66 | -36.90 | 13.43 | -36.90 | 0.00 | 0.00 | 0.00 |
| 3,800.00 | 1.00 | 160.00 | 3,799.64 | -38.54 | 14.03 | -38.54 | 0.00 | 0.00 | 0.00 |
| 3,900.00 | 1.00 | 160.00 | 3,899.63 | -40.18 | 14.62 | -40.18 | 0.00 | 0.00 | 0.00 |
| 4,000.00 | 1.00 | 160.00 | 3,999.61 | -41.82 | 15.22 | -41.82 | 0.00 | 0.00 | 0.00 |
| 4,100.00 | 1.00 | 160.00 | 4,099.60 | -43.46 | 15.82 | -43.46 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 4,200.00 | 1.00 | 160.00 | 4,199.58 | -45.10 | 16.41 | -45.10 | 0.00 | 0.00 | 0.00 |
| 4,300.00 | 1.00 | 160.00 | 4,299.57 | -46.74 | 17.01 | -46.74 | 0.00 | 0.00 | 0.00 |
| 4,400.00 | 1.00 | 160.00 | 4,399.55 | -48.38 | 17.61 | -48.38 | 0.00 | 0.00 | 0.00 |
| 4,500.00 | 1.00 | 160.00 | 4,499.54 | -50.02 | 18.21 | -50.02 | 0.00 | 0.00 | 0.00 |
| 4,600.00 | 1.00 | 160.00 | 4,599.52 | -51.66 | 18.80 | -51.66 | 0.00 | 0.00 | 0.00 |
| 4,700.00 | 1.00 | 160.00 | 4,699.51 | -53.30 | 19.40 | -53.30 | 0.00 | 0.00 | 0.00 |
| 4,800.00 | 1.00 | 160.00 | 4,799.49 | -54.94 | 20.00 | -54.94 | 0.00 | 0.00 | 0.00 |
| 4,900.00 | 1.00 | 160.00 | 4,899.48 | -56.58 | 20.59 | -56.58 | 0.00 | 0.00 | 0.00 |
| 5,000.00 | 1.00 | 160.00 | 4,999.46 | -58.22 | 21.19 | -58.22 | 0.00 | 0.00 | 0.00 |
| 5,100.00 | 1.00 | 160.00 | 5,099.45 | -59.86 | 21.79 | -59.86 | 0.00 | 0.00 | 0.00 |
| 5,200.00 | 1.00 | 160.00 | 5,199.43 | -61.50 | 22.38 | -61.50 | 0.00 | 0.00 | 0.00 |
| 5,282.30 | 1.00 | 160.00 | 5,281.72 | -62.85 | 22.88 | -62.85 | 0.00 | 0.00 | 0.00 |
| **Lamar** | | | | | | | | | |
| 5,300.00 | 1.00 | 160.00 | 5,299.42 | -63.14 | 22.98 | -63.14 | 0.00 | 0.00 | 0.00 |
| 5,386.37 | 1.00 | 160.00 | 5,385.77 | -64.56 | 23.50 | -64.56 | 0.00 | 0.00 | 0.00 |
| **Bell Canyon** | | | | | | | | | |
| 5,400.00 | 1.00 | 160.00 | 5,399.40 | -64.78 | 23.58 | -64.78 | 0.00 | 0.00 | 0.00 |
| 5,500.00 | 1.00 | 160.00 | 5,499.39 | -66.42 | 24.17 | -66.42 | 0.00 | 0.00 | 0.00 |
| 5,500.61 | 1.00 | 160.00 | 5,500.00 | -66.43 | 24.18 | -66.43 | 0.00 | 0.00 | 0.00 |
| **Start DLS 1.00 TFO -61.23 at 5500.61 MD** | | | | | | | | | |
| 5,600.00 | 1.72 | 129.48 | 5,599.36 | -68.19 | 25.62 | -68.19 | 1.00 | 0.72 | -30.70 |
| 5,700.00 | 2.63 | 118.26 | 5,699.29 | -70.23 | 28.80 | -70.23 | 1.00 | 0.91 | -11.22 |
| 5,800.00 | 3.58 | 112.91 | 5,799.14 | -72.53 | 33.69 | -72.53 | 1.00 | 0.96 | -5.35 |
| 5,900.00 | 4.56 | 109.83 | 5,898.88 | -75.09 | 40.31 | -75.09 | 1.00 | 0.98 | -3.08 |
| 6,000.00 | 5.54 | 107.84 | 5,998.50 | -77.92 | 48.65 | -77.92 | 1.00 | 0.98 | -1.99 |
| 6,100.00 | 6.53 | 106.45 | 6,097.94 | -81.01 | 58.71 | -81.01 | 1.00 | 0.99 | -1.39 |
| 6,200.00 | 7.53 | 105.42 | 6,197.19 | -84.37 | 70.48 | -84.37 | 1.00 | 0.99 | -1.03 |
| 6,296.16 | 8.48 | 104.66 | 6,292.41 | -87.84 | 83.41 | -87.84 | 1.00 | 0.99 | -0.79 |
| **Cherry Canyon** | | | | | | | | | |
| 6,300.00 | 8.52 | 104.63 | 6,296.21 | -87.98 | 83.96 | -87.98 | 1.00 | 0.99 | -0.70 |
| 6,400.00 | 9.52 | 104.01 | 6,394.97 | -91.85 | 99.14 | -91.85 | 1.00 | 1.00 | -0.62 |
| 6,404.02 | 9.56 | 103.99 | 6,398.94 | -92.01 | 99.79 | -92.01 | 1.00 | 1.00 | -0.56 |
| **Start 3904.13 hold at 6404.02 MD** | | | | | | | | | |
| 6,500.00 | 9.56 | 103.99 | 6,493.58 | -95.86 | 115.25 | -95.86 | 0.00 | 0.00 | 0.00 |
| 6,600.00 | 9.56 | 103.99 | 6,592.19 | -99.87 | 131.36 | -99.87 | 0.00 | 0.00 | 0.00 |
| 6,700.00 | 9.56 | 103.99 | 6,690.81 | -103.89 | 147.47 | -103.89 | 0.00 | 0.00 | 0.00 |
| 6,800.00 | 9.56 | 103.99 | 6,789.42 | -107.90 | 163.57 | -107.90 | 0.00 | 0.00 | 0.00 |
| 6,900.00 | 9.56 | 103.99 | 6,888.03 | -111.91 | 179.68 | -111.91 | 0.00 | 0.00 | 0.00 |
| 7,000.00 | 9.56 | 103.99 | 6,986.64 | -115.92 | 195.79 | -115.92 | 0.00 | 0.00 | 0.00 |
| 7,100.00 | 9.56 | 103.99 | 7,085.26 | -119.93 | 211.90 | -119.93 | 0.00 | 0.00 | 0.00 |
| 7,200.00 | 9.56 | 103.99 | 7,183.87 | -123.94 | 228.01 | -123.94 | 0.00 | 0.00 | 0.00 |
| 7,300.00 | 9.56 | 103.99 | 7,282.48 | -127.96 | 244.11 | -127.96 | 0.00 | 0.00 | 0.00 |
| 7,400.00 | 9.56 | 103.99 | 7,381.09 | -131.97 | 260.22 | -131.97 | 0.00 | 0.00 | 0.00 |
| 7,500.00 | 9.56 | 103.99 | 7,479.71 | -135.98 | 276.33 | -135.98 | 0.00 | 0.00 | 0.00 |
| 7,600.00 | 9.56 | 103.99 | 7,578.32 | -139.99 | 292.44 | -139.99 | 0.00 | 0.00 | 0.00 |
| 7,658.39 | 9.56 | 103.99 | 7,635.90 | -142.33 | 301.84 | -142.33 | 0.00 | 0.00 | 0.00 |
| **Brushy Canyon** | | | | | | | | | |
| 7,700.00 | 9.56 | 103.99 | 7,676.93 | -144.00 | 308.55 | -144.00 | 0.00 | 0.00 | 0.00 |
| 7,800.00 | 9.56 | 103.99 | 7,775.55 | -148.02 | 324.65 | -148.02 | 0.00 | 0.00 | 0.00 |
| 7,900.00 | 9.56 | 103.99 | 7,874.16 | -152.03 | 340.76 | -152.03 | 0.00 | 0.00 | 0.00 |
| 8,000.00 | 9.56 | 103.99 | 7,972.77 | -156.04 | 356.87 | -156.04 | 0.00 | 0.00 | 0.00 |
| 8,100.00 | 9.56 | 103.99 | 8,071.38 | -160.05 | 372.98 | -160.05 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 8,200.00 | 9.56 | 103.99 | 8,170.00 | -164.06 | 389.08 | -164.06 | 0.00 | 0.00 | 0.00 |
| 8,300.00 | 9.56 | 103.99 | 8,268.61 | -168.07 | 405.19 | -168.07 | 0.00 | 0.00 | 0.00 |
| 8,400.00 | 9.56 | 103.99 | 8,367.22 | -172.09 | 421.30 | -172.09 | 0.00 | 0.00 | 0.00 |
| 8,500.00 | 9.56 | 103.99 | 8,465.83 | -176.10 | 437.41 | -176.10 | 0.00 | 0.00 | 0.00 |
| 8,600.00 | 9.56 | 103.99 | 8,564.45 | -180.11 | 453.52 | -180.11 | 0.00 | 0.00 | 0.00 |
| 8,700.00 | 9.56 | 103.99 | 8,663.06 | -184.12 | 469.62 | -184.12 | 0.00 | 0.00 | 0.00 |
| 8,800.00 | 9.56 | 103.99 | 8,761.67 | -188.13 | 485.73 | -188.13 | 0.00 | 0.00 | 0.00 |
| 8,900.00 | 9.56 | 103.99 | 8,860.28 | -192.14 | 501.84 | -192.14 | 0.00 | 0.00 | 0.00 |
| 8,987.29 | 9.56 | 103.99 | 8,946.36 | -195.65 | 515.90 | -195.65 | 0.00 | 0.00 | 0.00 |
| **Bone Spring Lime** | | | | | | | | | |
| 9,000.00 | 9.56 | 103.99 | 8,958.90 | -196.16 | 517.95 | -196.16 | 0.00 | 0.00 | 0.00 |
| 9,013.69 | 9.56 | 103.99 | 8,972.39 | -196.71 | 520.15 | -196.71 | 0.00 | 0.00 | 0.00 |
| **Avalon** | | | | | | | | | |
| 9,100.00 | 9.56 | 103.99 | 9,057.51 | -200.17 | 534.06 | -200.17 | 0.00 | 0.00 | 0.00 |
| 9,200.00 | 9.56 | 103.99 | 9,156.12 | -204.18 | 550.16 | -204.18 | 0.00 | 0.00 | 0.00 |
| 9,300.00 | 9.56 | 103.99 | 9,254.73 | -208.19 | 566.27 | -208.19 | 0.00 | 0.00 | 0.00 |
| 9,400.00 | 9.56 | 103.99 | 9,353.35 | -212.20 | 582.38 | -212.20 | 0.00 | 0.00 | 0.00 |
| 9,500.00 | 9.56 | 103.99 | 9,451.96 | -216.22 | 598.49 | -216.22 | 0.00 | 0.00 | 0.00 |
| 9,600.00 | 9.56 | 103.99 | 9,550.57 | -220.23 | 614.59 | -220.23 | 0.00 | 0.00 | 0.00 |
| 9,700.00 | 9.56 | 103.99 | 9,649.18 | -224.24 | 630.70 | -224.24 | 0.00 | 0.00 | 0.00 |
| 9,800.00 | 9.56 | 103.99 | 9,747.80 | -228.25 | 646.81 | -228.25 | 0.00 | 0.00 | 0.00 |
| 9,900.00 | 9.56 | 103.99 | 9,846.41 | -232.26 | 662.92 | -232.26 | 0.00 | 0.00 | 0.00 |
| 10,000.00 | 9.56 | 103.99 | 9,945.02 | -236.27 | 679.03 | -236.27 | 0.00 | 0.00 | 0.00 |
| 10,100.00 | 9.56 | 103.99 | 10,043.63 | -240.29 | 695.13 | -240.29 | 0.00 | 0.00 | 0.00 |
| 10,121.27 | 9.56 | 103.99 | 10,064.61 | -241.14 | 698.56 | -241.14 | 0.00 | 0.00 | 0.00 |
| **First Bone Spring Sand** | | | | | | | | | |
| 10,200.00 | 9.56 | 103.99 | 10,142.25 | -244.30 | 711.24 | -244.30 | 0.00 | 0.00 | 0.00 |
| 10,291.82 | 9.56 | 103.99 | 10,232.80 | -247.98 | 726.03 | -247.98 | 0.00 | 0.00 | 0.00 |
| **Second Bone Spring Carbonates** | | | | | | | | | |
| 10,300.00 | 9.56 | 103.99 | 10,240.86 | -248.31 | 727.35 | -248.31 | 0.00 | 0.00 | 0.00 |
| 10,308.15 | 9.56 | 103.99 | 10,248.90 | -248.64 | 728.66 | -248.64 | 0.00 | 0.00 | 0.00 |
| **Start Drop -1.00 at 10308.5 MD** | | | | | | | | | |
| 10,400.00 | 8.64 | 103.99 | 10,339.59 | -252.15 | 742.75 | -252.15 | 1.00 | -1.00 | 0.00 |
| 10,500.00 | 7.64 | 103.99 | 10,438.58 | -255.57 | 756.49 | -255.57 | 1.00 | -1.00 | 0.00 |
| 10,600.00 | 6.64 | 103.99 | 10,537.81 | -258.57 | 768.54 | -258.57 | 1.00 | -1.00 | 0.00 |
| 10,700.00 | 5.64 | 103.99 | 10,637.23 | -261.15 | 778.91 | -261.15 | 1.00 | -1.00 | 0.00 |
| 10,702.94 | 5.61 | 103.99 | 10,640.16 | -261.22 | 779.19 | -261.22 | 1.00 | -1.00 | 0.00 |
| **Second Bone Spring Sand** | | | | | | | | | |
| 10,800.00 | 4.64 | 103.99 | 10,736.83 | -263.32 | 787.60 | -263.32 | 1.00 | -1.00 | 0.00 |
| 10,900.00 | 3.64 | 103.99 | 10,836.57 | -265.06 | 794.60 | -265.06 | 1.00 | -1.00 | 0.00 |
| 11,000.00 | 2.64 | 103.99 | 10,936.42 | -266.38 | 799.91 | -266.38 | 1.00 | -1.00 | 0.00 |
| 11,100.00 | 1.64 | 103.99 | 11,036.35 | -267.28 | 803.53 | -267.28 | 1.00 | -1.00 | 0.00 |
| 11,200.00 | 0.64 | 103.99 | 11,136.33 | -267.76 | 805.46 | -267.76 | 1.00 | -1.00 | 0.00 |
| 11,228.02 | 0.36 | 103.99 | 11,164.34 | -267.82 | 805.69 | -267.82 | 1.00 | -1.00 | 0.00 |
| **Third Bone Spring Carbonates** | | | | | | | | | |
| 11,263.68 | 0.00 | 0.00 | 11,200.00 | -267.85 | 805.80 | -267.85 | 1.00 | -1.00 | 0.00 |
| **Start 190.46 hold at 11263.68 MD** | | | | | | | | | |
| 11,300.00 | 0.00 | 0.00 | 11,236.32 | -267.85 | 805.80 | -267.85 | 0.00 | 0.00 | 0.00 |
| 11,400.00 | 0.00 | 0.00 | 11,336.32 | -267.85 | 805.80 | -267.85 | 0.00 | 0.00 | 0.00 |
| 11,454.14 | 0.00 | 0.00 | 11,390.46 | -267.85 | 805.80 | -267.85 | 0.00 | 0.00 | 0.00 |
| **Start Build 10.00 at 11454.14 MD** | | | | | | | | | |
| 11,500.00 | 4.59 | 359.99 | 11,436.27 | -266.01 | 805.80 | -266.01 | 10.00 | 10.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 11,600.00 | 14.59 | 359.99 | 11,534.75 | -249.38 | 805.79 | -249.38 | 10.00 | 10.00 | 0.00 |
| 11,674.25 | 22.01 | 359.99 | 11,605.20 | -226.09 | 805.79 | -226.09 | 10.00 | 10.00 | 0.00 |
| **Third Bone Spring Sand** | | | | | | | | | |
| 11,700.00 | 24.59 | 359.99 | 11,628.85 | -215.90 | 805.79 | -215.90 | 10.00 | 10.00 | 0.00 |
| 11,800.00 | 34.59 | 359.99 | 11,715.70 | -166.59 | 805.78 | -166.59 | 10.00 | 10.00 | 0.00 |
| 11,900.00 | 44.59 | 359.99 | 11,792.67 | -102.95 | 805.77 | -102.95 | 10.00 | 10.00 | 0.00 |
| 12,000.00 | 54.59 | 359.99 | 11,857.42 | -26.91 | 805.75 | -26.91 | 10.00 | 10.00 | 0.00 |
| 12,100.00 | 64.59 | 359.99 | 11,907.98 | 59.22 | 805.73 | 59.22 | 10.00 | 10.00 | 0.00 |
| 12,200.00 | 74.59 | 359.99 | 11,942.81 | 152.82 | 805.71 | 152.82 | 10.00 | 10.00 | 0.00 |
| 12,247.58 | 79.34 | 359.99 | 11,953.54 | 199.16 | 805.70 | 199.16 | 10.00 | 10.00 | 0.00 |
| **Wolfcamp** | | | | | | | | | |
| 12,300.00 | 84.59 | 359.99 | 11,960.87 | 251.05 | 805.69 | 251.05 | 10.00 | 10.00 | 0.00 |
| 12,369.84 | 91.57 | 359.99 | 11,963.21 | 320.81 | 805.68 | 320.81 | 10.00 | 10.00 | 0.00 |
| **Start 9781.92 hold at 12369.84 MD** | | | | | | | | | |
| 12,400.00 | 91.57 | 359.99 | 11,962.38 | 350.96 | 805.67 | 350.96 | 0.00 | 0.00 | 0.00 |
| 12,500.00 | 91.57 | 359.99 | 11,959.64 | 450.92 | 805.65 | 450.92 | 0.00 | 0.00 | 0.00 |
| 12,600.00 | 91.57 | 359.99 | 11,956.90 | 550.88 | 805.63 | 550.88 | 0.00 | 0.00 | 0.00 |
| 12,700.00 | 91.57 | 359.99 | 11,954.16 | 650.84 | 805.61 | 650.84 | 0.00 | 0.00 | 0.00 |
| 12,800.00 | 91.57 | 359.99 | 11,951.42 | 750.81 | 805.59 | 750.81 | 0.00 | 0.00 | 0.00 |
| 12,900.00 | 91.57 | 359.99 | 11,948.68 | 850.77 | 805.57 | 850.77 | 0.00 | 0.00 | 0.00 |
| 13,000.00 | 91.57 | 359.99 | 11,945.94 | 950.73 | 805.55 | 950.73 | 0.00 | 0.00 | 0.00 |
| 13,100.00 | 91.57 | 359.99 | 11,943.20 | 1,050.69 | 805.53 | 1,050.69 | 0.00 | 0.00 | 0.00 |
| 13,200.00 | 91.57 | 359.99 | 11,940.46 | 1,150.66 | 805.51 | 1,150.66 | 0.00 | 0.00 | 0.00 |
| 13,300.00 | 91.57 | 359.99 | 11,937.72 | 1,250.62 | 805.49 | 1,250.62 | 0.00 | 0.00 | 0.00 |
| 13,400.00 | 91.57 | 359.99 | 11,934.98 | 1,350.58 | 805.47 | 1,350.58 | 0.00 | 0.00 | 0.00 |
| 13,500.00 | 91.57 | 359.99 | 11,932.24 | 1,450.54 | 805.45 | 1,450.54 | 0.00 | 0.00 | 0.00 |
| 13,600.00 | 91.57 | 359.99 | 11,929.50 | 1,550.51 | 805.43 | 1,550.51 | 0.00 | 0.00 | 0.00 |
| 13,700.00 | 91.57 | 359.99 | 11,926.76 | 1,650.47 | 805.41 | 1,650.47 | 0.00 | 0.00 | 0.00 |
| 13,800.00 | 91.57 | 359.99 | 11,924.02 | 1,750.43 | 805.39 | 1,750.43 | 0.00 | 0.00 | 0.00 |
| 13,900.00 | 91.57 | 359.99 | 11,921.28 | 1,850.39 | 805.37 | 1,850.39 | 0.00 | 0.00 | 0.00 |
| 14,000.00 | 91.57 | 359.99 | 11,918.54 | 1,950.36 | 805.35 | 1,950.36 | 0.00 | 0.00 | 0.00 |
| 14,100.00 | 91.57 | 359.99 | 11,915.80 | 2,050.32 | 805.33 | 2,050.32 | 0.00 | 0.00 | 0.00 |
| 14,200.00 | 91.57 | 359.99 | 11,913.06 | 2,150.28 | 805.31 | 2,150.28 | 0.00 | 0.00 | 0.00 |
| 14,300.00 | 91.57 | 359.99 | 11,910.32 | 2,250.24 | 805.29 | 2,250.24 | 0.00 | 0.00 | 0.00 |
| 14,400.00 | 91.57 | 359.99 | 11,907.58 | 2,350.21 | 805.27 | 2,350.21 | 0.00 | 0.00 | 0.00 |
| 14,500.00 | 91.57 | 359.99 | 11,904.84 | 2,450.17 | 805.25 | 2,450.17 | 0.00 | 0.00 | 0.00 |
| 14,600.00 | 91.57 | 359.99 | 11,902.10 | 2,550.13 | 805.23 | 2,550.13 | 0.00 | 0.00 | 0.00 |
| 14,700.00 | 91.57 | 359.99 | 11,899.36 | 2,650.09 | 805.21 | 2,650.09 | 0.00 | 0.00 | 0.00 |
| 14,800.00 | 91.57 | 359.99 | 11,896.62 | 2,750.06 | 805.19 | 2,750.06 | 0.00 | 0.00 | 0.00 |
| 14,900.00 | 91.57 | 359.99 | 11,893.88 | 2,850.02 | 805.17 | 2,850.02 | 0.00 | 0.00 | 0.00 |
| 15,000.00 | 91.57 | 359.99 | 11,891.15 | 2,949.98 | 805.15 | 2,949.98 | 0.00 | 0.00 | 0.00 |
| 15,100.00 | 91.57 | 359.99 | 11,888.41 | 3,049.94 | 805.13 | 3,049.94 | 0.00 | 0.00 | 0.00 |
| 15,200.00 | 91.57 | 359.99 | 11,885.67 | 3,149.91 | 805.11 | 3,149.91 | 0.00 | 0.00 | 0.00 |
| 15,300.00 | 91.57 | 359.99 | 11,882.93 | 3,249.87 | 805.09 | 3,249.87 | 0.00 | 0.00 | 0.00 |
| 15,400.00 | 91.57 | 359.99 | 11,880.19 | 3,349.83 | 805.07 | 3,349.83 | 0.00 | 0.00 | 0.00 |
| 15,500.00 | 91.57 | 359.99 | 11,877.45 | 3,449.79 | 805.05 | 3,449.79 | 0.00 | 0.00 | 0.00 |
| 15,600.00 | 91.57 | 359.99 | 11,874.71 | 3,549.76 | 805.03 | 3,549.76 | 0.00 | 0.00 | 0.00 |
| 15,700.00 | 91.57 | 359.99 | 11,871.97 | 3,649.72 | 805.01 | 3,649.72 | 0.00 | 0.00 | 0.00 |
| 15,800.00 | 91.57 | 359.99 | 11,869.23 | 3,749.68 | 804.99 | 3,749.68 | 0.00 | 0.00 | 0.00 |
| 15,900.00 | 91.57 | 359.99 | 11,866.49 | 3,849.64 | 804.97 | 3,849.64 | 0.00 | 0.00 | 0.00 |
| 16,000.00 | 91.57 | 359.99 | 11,863.75 | 3,949.61 | 804.95 | 3,949.61 | 0.00 | 0.00 | 0.00 |
| 16,100.00 | 91.57 | 359.99 | 11,861.01 | 4,049.57 | 804.93 | 4,049.57 | 0.00 | 0.00 | 0.00 |
| 16,200.00 | 91.57 | 359.99 | 11,858.27 | 4,149.53 | 804.91 | 4,149.53 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 16,300.00 | 91.57 | 359.99 | 11,855.53 | 4,249.49 | 804.89 | 4,249.49 | 0.00 | 0.00 | 0.00 |
| 16,400.00 | 91.57 | 359.99 | 11,852.79 | 4,349.46 | 804.87 | 4,349.46 | 0.00 | 0.00 | 0.00 |
| 16,500.00 | 91.57 | 359.99 | 11,850.05 | 4,449.42 | 804.85 | 4,449.42 | 0.00 | 0.00 | 0.00 |
| 16,600.00 | 91.57 | 359.99 | 11,847.31 | 4,549.38 | 804.83 | 4,549.38 | 0.00 | 0.00 | 0.00 |
| 16,700.00 | 91.57 | 359.99 | 11,844.57 | 4,649.34 | 804.81 | 4,649.34 | 0.00 | 0.00 | 0.00 |
| 16,800.00 | 91.57 | 359.99 | 11,841.83 | 4,749.31 | 804.79 | 4,749.31 | 0.00 | 0.00 | 0.00 |
| 16,900.00 | 91.57 | 359.99 | 11,839.09 | 4,849.27 | 804.77 | 4,849.27 | 0.00 | 0.00 | 0.00 |
| 17,000.00 | 91.57 | 359.99 | 11,836.35 | 4,949.23 | 804.75 | 4,949.23 | 0.00 | 0.00 | 0.00 |
| 17,100.00 | 91.57 | 359.99 | 11,833.61 | 5,049.19 | 804.73 | 5,049.19 | 0.00 | 0.00 | 0.00 |
| 17,200.00 | 91.57 | 359.99 | 11,830.87 | 5,149.15 | 804.71 | 5,149.15 | 0.00 | 0.00 | 0.00 |
| 17,300.00 | 91.57 | 359.99 | 11,828.13 | 5,249.12 | 804.69 | 5,249.12 | 0.00 | 0.00 | 0.00 |
| 17,400.00 | 91.57 | 359.99 | 11,825.39 | 5,349.08 | 804.67 | 5,349.08 | 0.00 | 0.00 | 0.00 |
| 17,500.00 | 91.57 | 359.99 | 11,822.65 | 5,449.04 | 804.65 | 5,449.04 | 0.00 | 0.00 | 0.00 |
| 17,600.00 | 91.57 | 359.99 | 11,819.91 | 5,549.00 | 804.63 | 5,549.00 | 0.00 | 0.00 | 0.00 |
| 17,700.00 | 91.57 | 359.99 | 11,817.17 | 5,648.97 | 804.61 | 5,648.97 | 0.00 | 0.00 | 0.00 |
| 17,800.00 | 91.57 | 359.99 | 11,814.43 | 5,748.93 | 804.59 | 5,748.93 | 0.00 | 0.00 | 0.00 |
| 17,900.00 | 91.57 | 359.99 | 11,811.69 | 5,848.89 | 804.57 | 5,848.89 | 0.00 | 0.00 | 0.00 |
| 18,000.00 | 91.57 | 359.99 | 11,808.95 | 5,948.85 | 804.55 | 5,948.85 | 0.00 | 0.00 | 0.00 |
| 18,100.00 | 91.57 | 359.99 | 11,806.21 | 6,048.82 | 804.53 | 6,048.82 | 0.00 | 0.00 | 0.00 |
| 18,200.00 | 91.57 | 359.99 | 11,803.47 | 6,148.78 | 804.51 | 6,148.78 | 0.00 | 0.00 | 0.00 |
| 18,300.00 | 91.57 | 359.99 | 11,800.73 | 6,248.74 | 804.49 | 6,248.74 | 0.00 | 0.00 | 0.00 |
| 18,400.00 | 91.57 | 359.99 | 11,797.99 | 6,348.70 | 804.47 | 6,348.70 | 0.00 | 0.00 | 0.00 |
| 18,500.00 | 91.57 | 359.99 | 11,795.25 | 6,448.67 | 804.45 | 6,448.67 | 0.00 | 0.00 | 0.00 |
| 18,600.00 | 91.57 | 359.99 | 11,792.51 | 6,548.63 | 804.43 | 6,548.63 | 0.00 | 0.00 | 0.00 |
| 18,700.00 | 91.57 | 359.99 | 11,789.77 | 6,648.59 | 804.41 | 6,648.59 | 0.00 | 0.00 | 0.00 |
| 18,800.00 | 91.57 | 359.99 | 11,787.03 | 6,748.55 | 804.39 | 6,748.55 | 0.00 | 0.00 | 0.00 |
| 18,900.00 | 91.57 | 359.99 | 11,784.29 | 6,848.52 | 804.37 | 6,848.52 | 0.00 | 0.00 | 0.00 |
| 19,000.00 | 91.57 | 359.99 | 11,781.55 | 6,948.48 | 804.35 | 6,948.48 | 0.00 | 0.00 | 0.00 |
| 19,100.00 | 91.57 | 359.99 | 11,778.81 | 7,048.44 | 804.33 | 7,048.44 | 0.00 | 0.00 | 0.00 |
| 19,200.00 | 91.57 | 359.99 | 11,776.07 | 7,148.40 | 804.31 | 7,148.40 | 0.00 | 0.00 | 0.00 |
| 19,300.00 | 91.57 | 359.99 | 11,773.33 | 7,248.37 | 804.29 | 7,248.37 | 0.00 | 0.00 | 0.00 |
| 19,400.00 | 91.57 | 359.99 | 11,770.59 | 7,348.33 | 804.27 | 7,348.33 | 0.00 | 0.00 | 0.00 |
| 19,500.00 | 91.57 | 359.99 | 11,767.85 | 7,448.29 | 804.25 | 7,448.29 | 0.00 | 0.00 | 0.00 |
| 19,600.00 | 91.57 | 359.99 | 11,765.11 | 7,548.25 | 804.23 | 7,548.25 | 0.00 | 0.00 | 0.00 |
| 19,700.00 | 91.57 | 359.99 | 11,762.37 | 7,648.22 | 804.20 | 7,648.22 | 0.00 | 0.00 | 0.00 |
| 19,800.00 | 91.57 | 359.99 | 11,759.63 | 7,748.18 | 804.18 | 7,748.18 | 0.00 | 0.00 | 0.00 |
| 19,900.00 | 91.57 | 359.99 | 11,756.89 | 7,848.14 | 804.16 | 7,848.14 | 0.00 | 0.00 | 0.00 |
| 20,000.00 | 91.57 | 359.99 | 11,754.15 | 7,948.10 | 804.14 | 7,948.10 | 0.00 | 0.00 | 0.00 |
| 20,100.00 | 91.57 | 359.99 | 11,751.41 | 8,048.07 | 804.12 | 8,048.07 | 0.00 | 0.00 | 0.00 |
| 20,200.00 | 91.57 | 359.99 | 11,748.67 | 8,148.03 | 804.10 | 8,148.03 | 0.00 | 0.00 | 0.00 |
| 20,300.00 | 91.57 | 359.99 | 11,745.93 | 8,247.99 | 804.08 | 8,247.99 | 0.00 | 0.00 | 0.00 |
| 20,400.00 | 91.57 | 359.99 | 11,743.19 | 8,347.95 | 804.06 | 8,347.95 | 0.00 | 0.00 | 0.00 |
| 20,500.00 | 91.57 | 359.99 | 11,740.45 | 8,447.92 | 804.04 | 8,447.92 | 0.00 | 0.00 | 0.00 |
| 20,600.00 | 91.57 | 359.99 | 11,737.71 | 8,547.88 | 804.02 | 8,547.88 | 0.00 | 0.00 | 0.00 |
| 20,700.00 | 91.57 | 359.99 | 11,734.98 | 8,647.84 | 804.00 | 8,647.84 | 0.00 | 0.00 | 0.00 |
| 20,800.00 | 91.57 | 359.99 | 11,732.24 | 8,747.80 | 803.98 | 8,747.80 | 0.00 | 0.00 | 0.00 |
| 20,900.00 | 91.57 | 359.99 | 11,729.50 | 8,847.77 | 803.96 | 8,847.77 | 0.00 | 0.00 | 0.00 |
| 21,000.00 | 91.57 | 359.99 | 11,726.76 | 8,947.73 | 803.94 | 8,947.73 | 0.00 | 0.00 | 0.00 |
| 21,100.00 | 91.57 | 359.99 | 11,724.02 | 9,047.69 | 803.92 | 9,047.69 | 0.00 | 0.00 | 0.00 |
| 21,200.00 | 91.57 | 359.99 | 11,721.28 | 9,147.65 | 803.90 | 9,147.65 | 0.00 | 0.00 | 0.00 |
| 21,300.00 | 91.57 | 359.99 | 11,718.54 | 9,247.62 | 803.88 | 9,247.62 | 0.00 | 0.00 | 0.00 |
| 21,400.00 | 91.57 | 359.99 | 11,715.80 | 9,347.58 | 803.86 | 9,347.58 | 0.00 | 0.00 | 0.00 |
| 21,500.00 | 91.57 | 359.99 | 11,713.06 | 9,447.54 | 803.84 | 9,447.54 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) |
|---|---|---|---|---|---|---|---|---|---|
| 21,600.00 | 91.57 | 359.99 | 11,710.32 | 9,547.50 | 803.82 | 9,547.50 | 0.00 | 0.00 | 0.00 |
| 21,700.00 | 91.57 | 359.99 | 11,707.58 | 9,647.47 | 803.80 | 9,647.47 | 0.00 | 0.00 | 0.00 |
| 21,800.00 | 91.57 | 359.99 | 11,704.84 | 9,747.43 | 803.78 | 9,747.43 | 0.00 | 0.00 | 0.00 |
| 21,900.00 | 91.57 | 359.99 | 11,702.10 | 9,847.39 | 803.76 | 9,847.39 | 0.00 | 0.00 | 0.00 |
| 22,000.00 | 91.57 | 359.99 | 11,699.36 | 9,947.35 | 803.74 | 9,947.35 | 0.00 | 0.00 | 0.00 |
| 22,100.00 | 91.57 | 359.99 | 11,696.62 | 10,047.32 | 803.72 | 10,047.32 | 0.00 | 0.00 | 0.00 |
| 22,151.76 | 91.57 | 359.99 | 11,695.20 | 10,099.06 | 803.71 | 10,099.06 | 0.00 | 0.00 | 0.00 |
| **TD at 22151.76 MD** | | | | | | | | | |

**Design Targets**

| Target Name - hit/miss target - Shape | Dip Angle (°) | Dip Dir. (°) | TVD (ft) | +N/-S (ft) | +E/-W (ft) | Northing (usft) | Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| Breckenridge 706H PBH<br>- plan hits target center<br>- Point | 0.00 | 0.01 | 11,695.20 | 10,099.06 | 803.71 | 457,276.75 | 840,639.00 | 32° 15' 12.309 N | 103° 21' 54.558 W |

**Formations**

| Measured Depth (ft) | Vertical Depth (ft) | Name | Lithology | Dip (°) | Dip Direction (°) |
|---|---|---|---|---|---|
| 21.00 | 21.00 | Cenozoic Alluvium (surface) | | -1.57 | 0.00 |
| 962.00 | 962.00 | Rustler | | -1.57 | 0.00 |
| 1,059.00 | 1,059.00 | Salado | | -1.57 | 0.00 |
| 2,984.92 | 2,984.69 | Base Salt | | -1.57 | 0.00 |
| 5,282.30 | 5,281.72 | Lamar | | -1.57 | 0.00 |
| 5,386.37 | 5,385.77 | Bell Canyon | | -1.57 | 0.00 |
| 6,296.16 | 6,292.41 | Cherry Canyon | | -1.57 | 0.00 |
| 7,658.39 | 7,635.90 | Brushy Canyon | | -1.57 | 0.00 |
| 8,987.29 | 8,946.36 | Bone Spring Lime | | -1.57 | 0.00 |
| 9,013.69 | 8,972.39 | Avalon | | -1.57 | 0.00 |
| 10,121.27 | 10,064.61 | First Bone Spring Sand | | -1.57 | 0.00 |
| 10,291.82 | 10,232.80 | Second Bone Spring Carbonates | | -1.57 | 0.00 |
| 10,702.94 | 10,640.16 | Second Bone Spring Sand | | -1.57 | 0.00 |
| 11,228.02 | 11,164.34 | Third Bone Spring Carbonates | | -1.57 | 0.00 |
| 11,674.25 | 11,605.20 | Third Bone Spring Sand | | -1.57 | 0.00 |
| 12,247.58 | 11,953.54 | Wolfcamp | | -1.57 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Plan Annotations**

| Measured Depth (ft) | Vertical Depth (ft) | Local Coordinates +N/-S (ft) | +E/-W (ft) | Comment |
|---|---|---|---|---|
| 1,400.00 | 1,400.00 | 0.00 | 0.00 | Start Build 1.00 at 1400 MD |
| 1,500.00 | 1,499.99 | -0.82 | 0.30 | Start 4000.61 hold at 1500.00 MD |
| 5,500.61 | 5,500.00 | -66.43 | 24.18 | Start DLS 1.00 TFO -61.23 at 5500.61 MD |
| 6,404.02 | 6,398.94 | -92.01 | 99.79 | Start 3904.13 hold at 6404.02 MD |
| 10,308.15 | 10,248.90 | -248.64 | 728.66 | Start Drop -1.00 at 10308.5 MD |
| 11,263.68 | 11,200.00 | -267.85 | 805.80 | Start 190.46 hold at 11263.68 MD |
| 11,454.14 | 11,390.46 | -267.85 | 805.80 | Start Build 10.00 at 11454.14 MD |
| 12,369.84 | 11,963.21 | 320.81 | 805.68 | Start 9781.92 hold at 12369.84 MD |
| 22,151.76 | 11,695.20 | 10,099.06 | 803.71 | TD at 22151.76 MD |

# Franklin Mountain Energy

**Golden - Breckenridge Site**
**Lea County, NM (NAD 83)**
**Breckenridge  Fed Com 706H**

**Wellbore #1**

**Plan: Plan #3**

# Standard Planning Report - Geographic

**20 March, 2020**

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Project** Golden - Breckenridge Site

| | | | |
|---|---|---|---|
| **Map System:** | US State Plane 1983 | **System Datum:** | Mean Sea Level |
| **Geo Datum:** | North American Datum 1983 | | |
| **Map Zone:** | New Mexico Eastern Zone | | |

**Site** Lea County, NM (NAD 83)

| | | | | | |
|---|---|---|---|---|---|
| **Site Position:** | | **Northing:** | 447,177.09 usft | **Latitude:** | 32° 13' 32.454 N |
| **From:** | Map | **Easting:** | 839,765.30 usft | **Longitude:** | 103° 22' 5.788 W |
| **Position Uncertainty:** | 0.00 ft | **Slot Radius:** | 13.200 in | **Grid Convergence:** | 0.51 ° |

**Well** Breckenridge Fed Com 706H

| | | | | | | |
|---|---|---|---|---|---|---|
| **Well Position** | **+N/-S** | 0.00 ft | **Northing:** | 447,177.71 usft | **Latitude:** | 32° 13' 32.454 N |
| | **+E/-W** | 0.00 ft | **Easting:** | 839,835.29 usft | **Longitude:** | 103° 22' 4.973 W |
| **Position Uncertainty** | | 0.00 ft | **Wellhead Elevation:** | | **Ground Level:** | 3,375.00 ft |

**Wellbore** Wellbore #1

| Magnetics | Model Name | Sample Date | Declination (°) | Dip Angle (°) | Field Strength (nT) |
|---|---|---|---|---|---|
| | IGRF2015 | 7/3/2019 | 6.64 | 60.07 | 47,750.29337949 |

**Design** Plan #3

**Audit Notes:**

| | | | | | |
|---|---|---|---|---|---|
| **Version:** | | **Phase:** | PROTOTYPE | **Tie On Depth:** | 0.00 |

| Vertical Section: | Depth From (TVD) (ft) | +N/-S (ft) | +E/-W (ft) | Direction (°) |
|---|---|---|---|---|
| | 0.00 | 0.00 | 0.00 | 0.00 |

**Plan Survey Tool Program** **Date** 3/20/2020

| | Depth From (ft) | Depth To (ft) | Survey (Wellbore) | Tool Name | Remarks |
|---|---|---|---|---|---|
| 1 | 0.00 | 22,151.76 | Plan #3 (Wellbore #1) | MWD<br>MWD - Standard | |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Plan Sections**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Dogleg Rate (°/100ft) | Build Rate (°/100ft) | Turn Rate (°/100ft) | TFO (°) | Target |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 1,400.00 | 0.00 | 0.00 | 1,400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 1,500.00 | 1.00 | 160.00 | 1,499.99 | -0.82 | 0.30 | 1.00 | 1.00 | 0.00 | 160.00 | |
| 5,500.61 | 1.00 | 160.00 | 5,500.00 | -66.43 | 24.18 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 6,404.02 | 9.56 | 103.99 | 6,398.94 | -92.01 | 99.79 | 1.00 | 0.95 | -6.20 | -61.23 | |
| 10,308.15 | 9.56 | 103.99 | 10,248.90 | -248.64 | 728.66 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 11,263.68 | 0.00 | 0.00 | 11,200.00 | -267.85 | 805.80 | 1.00 | -1.00 | 0.00 | 180.00 | |
| 11,454.14 | 0.00 | 0.00 | 11,390.46 | -267.85 | 805.80 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 12,369.84 | 91.57 | 359.99 | 11,963.21 | 320.81 | 805.68 | 10.00 | 10.00 | 0.00 | 359.99 | |
| 22,151.76 | 91.57 | 359.99 | 11,695.20 | 10,099.06 | 803.71 | 0.00 | 0.00 | 0.00 | 0.00 | Breckenridge 706H P |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 21.00 | 0.00 | 0.00 | 21.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| **Cenozoic Alluvium (surface)** | | | | | | | | | |
| 100.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 200.00 | 0.00 | 0.00 | 200.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 300.00 | 0.00 | 0.00 | 300.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 400.00 | 0.00 | 0.00 | 400.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 500.00 | 0.00 | 0.00 | 500.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 600.00 | 0.00 | 0.00 | 600.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 700.00 | 0.00 | 0.00 | 700.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 800.00 | 0.00 | 0.00 | 800.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 900.00 | 0.00 | 0.00 | 900.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 962.00 | 0.00 | 0.00 | 962.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| **Rustler** | | | | | | | | | |
| 1,000.00 | 0.00 | 0.00 | 1,000.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 1,059.00 | 0.00 | 0.00 | 1,059.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| **Salado** | | | | | | | | | |
| 1,100.00 | 0.00 | 0.00 | 1,100.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 1,200.00 | 0.00 | 0.00 | 1,200.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 1,300.00 | 0.00 | 0.00 | 1,300.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| 1,400.00 | 0.00 | 0.00 | 1,400.00 | 0.00 | 0.00 | 447,177.71 | 839,835.29 | 32° 13' 32.454 N | 103° 22' 4.973 W |
| **Start Build 1.00 at 1400 MD** | | | | | | | | | |
| 1,500.00 | 1.00 | 160.00 | 1,499.99 | -0.82 | 0.30 | 447,176.89 | 839,835.59 | 32° 13' 32.446 N | 103° 22' 4.970 W |
| **Start 4000.61 hold at 1500.00 MD** | | | | | | | | | |
| 1,600.00 | 1.00 | 160.00 | 1,599.98 | -2.46 | 0.90 | 447,175.25 | 839,836.18 | 32° 13' 32.430 N | 103° 22' 4.963 W |
| 1,700.00 | 1.00 | 160.00 | 1,699.96 | -4.10 | 1.49 | 447,173.61 | 839,836.78 | 32° 13' 32.413 N | 103° 22' 4.956 W |
| 1,800.00 | 1.00 | 160.00 | 1,799.95 | -5.74 | 2.09 | 447,171.97 | 839,837.38 | 32° 13' 32.397 N | 103° 22' 4.949 W |
| 1,900.00 | 1.00 | 160.00 | 1,899.93 | -7.38 | 2.69 | 447,170.33 | 839,837.97 | 32° 13' 32.381 N | 103° 22' 4.943 W |
| 2,000.00 | 1.00 | 160.00 | 1,999.92 | -9.02 | 3.28 | 447,168.69 | 839,838.57 | 32° 13' 32.365 N | 103° 22' 4.936 W |
| 2,100.00 | 1.00 | 160.00 | 2,099.90 | -10.66 | 3.88 | 447,167.05 | 839,839.17 | 32° 13' 32.348 N | 103° 22' 4.929 W |
| 2,200.00 | 1.00 | 160.00 | 2,199.89 | -12.30 | 4.48 | 447,165.41 | 839,839.77 | 32° 13' 32.332 N | 103° 22' 4.922 W |
| 2,300.00 | 1.00 | 160.00 | 2,299.87 | -13.94 | 5.07 | 447,163.77 | 839,840.36 | 32° 13' 32.316 N | 103° 22' 4.916 W |
| 2,400.00 | 1.00 | 160.00 | 2,399.86 | -15.58 | 5.67 | 447,162.13 | 839,840.96 | 32° 13' 32.299 N | 103° 22' 4.909 W |
| 2,500.00 | 1.00 | 160.00 | 2,499.84 | -17.22 | 6.27 | 447,160.49 | 839,841.56 | 32° 13' 32.283 N | 103° 22' 4.902 W |
| 2,600.00 | 1.00 | 160.00 | 2,599.83 | -18.86 | 6.86 | 447,158.85 | 839,842.15 | 32° 13' 32.267 N | 103° 22' 4.895 W |
| 2,700.00 | 1.00 | 160.00 | 2,699.81 | -20.50 | 7.46 | 447,157.21 | 839,842.75 | 32° 13' 32.251 N | 103° 22' 4.888 W |
| 2,800.00 | 1.00 | 160.00 | 2,799.80 | -22.14 | 8.06 | 447,155.57 | 839,843.35 | 32° 13' 32.234 N | 103° 22' 4.882 W |
| 2,900.00 | 1.00 | 160.00 | 2,899.78 | -23.78 | 8.66 | 447,153.93 | 839,843.94 | 32° 13' 32.218 N | 103° 22' 4.875 W |
| 2,984.92 | 1.00 | 160.00 | 2,984.69 | -25.17 | 9.16 | 447,152.54 | 839,844.45 | 32° 13' 32.204 N | 103° 22' 4.869 W |
| **Base Salt** | | | | | | | | | |
| 3,000.00 | 1.00 | 160.00 | 2,999.77 | -25.42 | 9.25 | 447,152.29 | 839,844.54 | 32° 13' 32.202 N | 103° 22' 4.868 W |
| 3,100.00 | 1.00 | 160.00 | 3,099.75 | -27.06 | 9.85 | 447,150.65 | 839,845.14 | 32° 13' 32.185 N | 103° 22' 4.861 W |
| 3,200.00 | 1.00 | 160.00 | 3,199.74 | -28.70 | 10.45 | 447,149.01 | 839,845.73 | 32° 13' 32.169 N | 103° 22' 4.855 W |
| 3,300.00 | 1.00 | 160.00 | 3,299.72 | -30.34 | 11.04 | 447,147.37 | 839,846.33 | 32° 13' 32.153 N | 103° 22' 4.848 W |
| 3,400.00 | 1.00 | 160.00 | 3,399.71 | -31.98 | 11.64 | 447,145.73 | 839,846.93 | 32° 13' 32.137 N | 103° 22' 4.841 W |
| 3,500.00 | 1.00 | 160.00 | 3,499.69 | -33.62 | 12.24 | 447,144.09 | 839,847.53 | 32° 13' 32.120 N | 103° 22' 4.834 W |
| 3,600.00 | 1.00 | 160.00 | 3,599.68 | -35.26 | 12.83 | 447,142.45 | 839,848.12 | 32° 13' 32.104 N | 103° 22' 4.827 W |
| 3,700.00 | 1.00 | 160.00 | 3,699.66 | -36.90 | 13.43 | 447,140.81 | 839,848.72 | 32° 13' 32.088 N | 103° 22' 4.821 W |
| 3,800.00 | 1.00 | 160.00 | 3,799.64 | -38.54 | 14.03 | 447,139.17 | 839,849.32 | 32° 13' 32.071 N | 103° 22' 4.814 W |
| 3,900.00 | 1.00 | 160.00 | 3,899.63 | -40.18 | 14.62 | 447,137.53 | 839,849.91 | 32° 13' 32.055 N | 103° 22' 4.807 W |
| 4,000.00 | 1.00 | 160.00 | 3,999.61 | -41.82 | 15.22 | 447,135.89 | 839,850.51 | 32° 13' 32.039 N | 103° 22' 4.800 W |
| 4,100.00 | 1.00 | 160.00 | 4,099.60 | -43.46 | 15.82 | 447,134.25 | 839,851.11 | 32° 13' 32.023 N | 103° 22' 4.794 W |
| 4,200.00 | 1.00 | 160.00 | 4,199.58 | -45.10 | 16.41 | 447,132.61 | 839,851.70 | 32° 13' 32.006 N | 103° 22' 4.787 W |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 4,300.00 | 1.00 | 160.00 | 4,299.57 | -46.74 | 17.01 | 447,130.97 | 839,852.30 | 32° 13' 31.990 N | 103° 22' 4.780 W |
| 4,400.00 | 1.00 | 160.00 | 4,399.55 | -48.38 | 17.61 | 447,129.33 | 839,852.90 | 32° 13' 31.974 N | 103° 22' 4.773 W |
| 4,500.00 | 1.00 | 160.00 | 4,499.54 | -50.02 | 18.21 | 447,127.69 | 839,853.49 | 32° 13' 31.958 N | 103° 22' 4.766 W |
| 4,600.00 | 1.00 | 160.00 | 4,599.52 | -51.66 | 18.80 | 447,126.05 | 839,854.09 | 32° 13' 31.941 N | 103° 22' 4.760 W |
| 4,700.00 | 1.00 | 160.00 | 4,699.51 | -53.30 | 19.40 | 447,124.41 | 839,854.69 | 32° 13' 31.925 N | 103° 22' 4.753 W |
| 4,800.00 | 1.00 | 160.00 | 4,799.49 | -54.94 | 20.00 | 447,122.77 | 839,855.29 | 32° 13' 31.909 N | 103° 22' 4.746 W |
| 4,900.00 | 1.00 | 160.00 | 4,899.48 | -56.58 | 20.59 | 447,121.13 | 839,855.88 | 32° 13' 31.892 N | 103° 22' 4.739 W |
| 5,000.00 | 1.00 | 160.00 | 4,999.46 | -58.22 | 21.19 | 447,119.49 | 839,856.48 | 32° 13' 31.876 N | 103° 22' 4.733 W |
| 5,100.00 | 1.00 | 160.00 | 5,099.45 | -59.86 | 21.79 | 447,117.85 | 839,857.08 | 32° 13' 31.860 N | 103° 22' 4.726 W |
| 5,200.00 | 1.00 | 160.00 | 5,199.43 | -61.50 | 22.38 | 447,116.21 | 839,857.67 | 32° 13' 31.844 N | 103° 22' 4.719 W |
| 5,282.30 | 1.00 | 160.00 | 5,281.72 | -62.85 | 22.88 | 447,114.86 | 839,858.16 | 32° 13' 31.830 N | 103° 22' 4.713 W |
| **Lamar** | | | | | | | | | |
| 5,300.00 | 1.00 | 160.00 | 5,299.42 | -63.14 | 22.98 | 447,114.57 | 839,858.27 | 32° 13' 31.827 N | 103° 22' 4.712 W |
| 5,386.37 | 1.00 | 160.00 | 5,385.77 | -64.56 | 23.50 | 447,113.15 | 839,858.79 | 32° 13' 31.813 N | 103° 22' 4.706 W |
| **Bell Canyon** | | | | | | | | | |
| 5,400.00 | 1.00 | 160.00 | 5,399.40 | -64.78 | 23.58 | 447,112.93 | 839,858.87 | 32° 13' 31.811 N | 103° 22' 4.705 W |
| 5,500.00 | 1.00 | 160.00 | 5,499.39 | -66.42 | 24.17 | 447,111.29 | 839,859.46 | 32° 13' 31.795 N | 103° 22' 4.699 W |
| 5,500.61 | 1.00 | 160.00 | 5,500.00 | -66.43 | 24.18 | 447,111.28 | 839,859.47 | 32° 13' 31.795 N | 103° 22' 4.699 W |
| **Start DLS 1.00 TFO -61.23 at 5500.61 MD** | | | | | | | | | |
| 5,600.00 | 1.72 | 129.48 | 5,599.36 | -68.19 | 25.62 | 447,109.52 | 839,860.91 | 32° 13' 31.777 N | 103° 22' 4.682 W |
| 5,700.00 | 2.63 | 118.26 | 5,699.29 | -70.23 | 28.80 | 447,107.48 | 839,864.09 | 32° 13' 31.757 N | 103° 22' 4.645 W |
| 5,800.00 | 3.58 | 112.91 | 5,799.14 | -72.53 | 33.69 | 447,105.18 | 839,868.98 | 32° 13' 31.733 N | 103° 22' 4.589 W |
| 5,900.00 | 4.56 | 109.83 | 5,898.88 | -75.09 | 40.31 | 447,102.62 | 839,875.60 | 32° 13' 31.707 N | 103° 22' 4.512 W |
| 6,000.00 | 5.54 | 107.84 | 5,998.50 | -77.92 | 48.65 | 447,099.79 | 839,883.94 | 32° 13' 31.679 N | 103° 22' 4.415 W |
| 6,100.00 | 6.53 | 106.45 | 6,097.94 | -81.01 | 58.71 | 447,096.70 | 839,893.99 | 32° 13' 31.647 N | 103° 22' 4.298 W |
| 6,200.00 | 7.53 | 105.42 | 6,197.19 | -84.37 | 70.48 | 447,093.34 | 839,905.76 | 32° 13' 31.613 N | 103° 22' 4.162 W |
| 6,296.16 | 8.48 | 104.66 | 6,292.41 | -87.84 | 83.41 | 447,089.88 | 839,918.70 | 32° 13' 31.578 N | 103° 22' 4.011 W |
| **Cherry Canyon** | | | | | | | | | |
| 6,300.00 | 8.52 | 104.63 | 6,296.21 | -87.98 | 83.96 | 447,089.73 | 839,919.25 | 32° 13' 31.576 N | 103° 22' 4.005 W |
| 6,400.00 | 9.52 | 104.01 | 6,394.97 | -91.85 | 99.14 | 447,085.86 | 839,934.43 | 32° 13' 31.536 N | 103° 22' 3.829 W |
| 6,404.02 | 9.56 | 103.99 | 6,398.94 | -92.01 | 99.79 | 447,085.70 | 839,935.08 | 32° 13' 31.535 N | 103° 22' 3.821 W |
| **Start 3904.13 hold at 6404.02 MD** | | | | | | | | | |
| 6,500.00 | 9.56 | 103.99 | 6,493.58 | -95.86 | 115.25 | 447,081.85 | 839,950.54 | 32° 13' 31.495 N | 103° 22' 3.642 W |
| 6,600.00 | 9.56 | 103.99 | 6,592.19 | -99.87 | 131.36 | 447,077.84 | 839,966.65 | 32° 13' 31.454 N | 103° 22' 3.455 W |
| 6,700.00 | 9.56 | 103.99 | 6,690.81 | -103.89 | 147.47 | 447,073.82 | 839,982.76 | 32° 13' 31.413 N | 103° 22' 3.267 W |
| 6,800.00 | 9.56 | 103.99 | 6,789.42 | -107.90 | 163.57 | 447,069.81 | 839,998.86 | 32° 13' 31.372 N | 103° 22' 3.080 W |
| 6,900.00 | 9.56 | 103.99 | 6,888.03 | -111.91 | 179.68 | 447,065.80 | 840,014.97 | 32° 13' 31.331 N | 103° 22' 2.893 W |
| 7,000.00 | 9.56 | 103.99 | 6,986.64 | -115.92 | 195.79 | 447,061.79 | 840,031.08 | 32° 13' 31.290 N | 103° 22' 2.706 W |
| 7,100.00 | 9.56 | 103.99 | 7,085.26 | -119.93 | 211.90 | 447,057.78 | 840,047.19 | 32° 13' 31.249 N | 103° 22' 2.519 W |
| 7,200.00 | 9.56 | 103.99 | 7,183.87 | -123.94 | 228.01 | 447,053.77 | 840,063.29 | 32° 13' 31.207 N | 103° 22' 2.332 W |
| 7,300.00 | 9.56 | 103.99 | 7,282.48 | -127.96 | 244.11 | 447,049.75 | 840,079.40 | 32° 13' 31.166 N | 103° 22' 2.145 W |
| 7,400.00 | 9.56 | 103.99 | 7,381.09 | -131.97 | 260.22 | 447,045.74 | 840,095.51 | 32° 13' 31.125 N | 103° 22' 1.958 W |
| 7,500.00 | 9.56 | 103.99 | 7,479.71 | -135.98 | 276.33 | 447,041.73 | 840,111.62 | 32° 13' 31.084 N | 103° 22' 1.771 W |
| 7,600.00 | 9.56 | 103.99 | 7,578.32 | -139.99 | 292.44 | 447,037.72 | 840,127.73 | 32° 13' 31.043 N | 103° 22' 1.584 W |
| 7,658.39 | 9.56 | 103.99 | 7,635.90 | -142.33 | 301.84 | 447,035.38 | 840,137.13 | 32° 13' 31.019 N | 103° 22' 1.475 W |
| **Brushy Canyon** | | | | | | | | | |
| 7,700.00 | 9.56 | 103.99 | 7,676.93 | -144.00 | 308.55 | 447,033.71 | 840,143.83 | 32° 13' 31.002 N | 103° 22' 1.397 W |
| 7,800.00 | 9.56 | 103.99 | 7,775.55 | -148.02 | 324.65 | 447,029.70 | 840,159.94 | 32° 13' 30.961 N | 103° 22' 1.210 W |
| 7,900.00 | 9.56 | 103.99 | 7,874.16 | -152.03 | 340.76 | 447,025.68 | 840,176.05 | 32° 13' 30.919 N | 103° 22' 1.023 W |
| 8,000.00 | 9.56 | 103.99 | 7,972.77 | -156.04 | 356.87 | 447,021.67 | 840,192.16 | 32° 13' 30.878 N | 103° 22' 0.835 W |
| 8,100.00 | 9.56 | 103.99 | 8,071.38 | -160.05 | 372.98 | 447,017.66 | 840,208.26 | 32° 13' 30.837 N | 103° 22' 0.648 W |
| 8,200.00 | 9.56 | 103.99 | 8,170.00 | -164.06 | 389.08 | 447,013.65 | 840,224.37 | 32° 13' 30.796 N | 103° 22' 0.461 W |
| 8,300.00 | 9.56 | 103.99 | 8,268.61 | -168.07 | 405.19 | 447,009.64 | 840,240.48 | 32° 13' 30.755 N | 103° 22' 0.274 W |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 8,400.00 | 9.56 | 103.99 | 8,367.22 | -172.09 | 421.30 | 447,005.62 | 840,256.59 | 32° 13' 30.714 N | 103° 22' 0.087 W |
| 8,500.00 | 9.56 | 103.99 | 8,465.83 | -176.10 | 437.41 | 447,001.61 | 840,272.70 | 32° 13' 30.673 N | 103° 21' 59.900 W |
| 8,600.00 | 9.56 | 103.99 | 8,564.45 | -180.11 | 453.52 | 446,997.60 | 840,288.80 | 32° 13' 30.632 N | 103° 21' 59.713 W |
| 8,700.00 | 9.56 | 103.99 | 8,663.06 | -184.12 | 469.62 | 446,993.59 | 840,304.91 | 32° 13' 30.590 N | 103° 21' 59.526 W |
| 8,800.00 | 9.56 | 103.99 | 8,761.67 | -188.13 | 485.73 | 446,989.58 | 840,321.02 | 32° 13' 30.549 N | 103° 21' 59.339 W |
| 8,900.00 | 9.56 | 103.99 | 8,860.28 | -192.14 | 501.84 | 446,985.57 | 840,337.13 | 32° 13' 30.508 N | 103° 21' 59.152 W |
| 8,987.29 | 9.56 | 103.99 | 8,946.36 | -195.65 | 515.90 | 446,982.06 | 840,351.19 | 32° 13' 30.472 N | 103° 21' 58.988 W |
| **Bone Spring Lime** | | | | | | | | | |
| 9,000.00 | 9.56 | 103.99 | 8,958.90 | -196.16 | 517.95 | 446,981.55 | 840,353.24 | 32° 13' 30.467 N | 103° 21' 58.965 W |
| 9,013.69 | 9.56 | 103.99 | 8,972.39 | -196.71 | 520.15 | 446,981.01 | 840,355.44 | 32° 13' 30.461 N | 103° 21' 58.939 W |
| **Avalon** | | | | | | | | | |
| 9,100.00 | 9.56 | 103.99 | 9,057.51 | -200.17 | 534.06 | 446,977.54 | 840,369.34 | 32° 13' 30.426 N | 103° 21' 58.778 W |
| 9,200.00 | 9.56 | 103.99 | 9,156.12 | -204.18 | 550.16 | 446,973.53 | 840,385.45 | 32° 13' 30.385 N | 103° 21' 58.590 W |
| 9,300.00 | 9.56 | 103.99 | 9,254.73 | -208.19 | 566.27 | 446,969.52 | 840,401.56 | 32° 13' 30.344 N | 103° 21' 58.403 W |
| 9,400.00 | 9.56 | 103.99 | 9,353.35 | -212.20 | 582.38 | 446,965.51 | 840,417.67 | 32° 13' 30.303 N | 103° 21' 58.216 W |
| 9,500.00 | 9.56 | 103.99 | 9,451.96 | -216.22 | 598.49 | 446,961.50 | 840,433.77 | 32° 13' 30.261 N | 103° 21' 58.029 W |
| 9,600.00 | 9.56 | 103.99 | 9,550.57 | -220.23 | 614.59 | 446,957.48 | 840,449.88 | 32° 13' 30.220 N | 103° 21' 57.842 W |
| 9,700.00 | 9.56 | 103.99 | 9,649.18 | -224.24 | 630.70 | 446,953.47 | 840,465.99 | 32° 13' 30.179 N | 103° 21' 57.655 W |
| 9,800.00 | 9.56 | 103.99 | 9,747.80 | -228.25 | 646.81 | 446,949.46 | 840,482.10 | 32° 13' 30.138 N | 103° 21' 57.468 W |
| 9,900.00 | 9.56 | 103.99 | 9,846.41 | -232.26 | 662.92 | 446,945.45 | 840,498.21 | 32° 13' 30.097 N | 103° 21' 57.281 W |
| 10,000.00 | 9.56 | 103.99 | 9,945.02 | -236.27 | 679.03 | 446,941.44 | 840,514.31 | 32° 13' 30.056 N | 103° 21' 57.094 W |
| 10,100.00 | 9.56 | 103.99 | 10,043.63 | -240.29 | 695.13 | 446,937.42 | 840,530.42 | 32° 13' 30.015 N | 103° 21' 56.907 W |
| 10,121.27 | 9.56 | 103.99 | 10,064.61 | -241.14 | 698.56 | 446,936.57 | 840,533.85 | 32° 13' 30.006 N | 103° 21' 56.867 W |
| **First Bone Spring Sand** | | | | | | | | | |
| 10,200.00 | 9.56 | 103.99 | 10,142.25 | -244.30 | 711.24 | 446,933.41 | 840,546.53 | 32° 13' 29.974 N | 103° 21' 56.720 W |
| 10,291.82 | 9.56 | 103.99 | 10,232.80 | -247.98 | 726.03 | 446,929.73 | 840,561.32 | 32° 13' 29.936 N | 103° 21' 56.548 W |
| **Second Bone Spring Carbonates** | | | | | | | | | |
| 10,300.00 | 9.56 | 103.99 | 10,240.86 | -248.31 | 727.35 | 446,929.40 | 840,562.64 | 32° 13' 29.932 N | 103° 21' 56.533 W |
| 10,308.15 | 9.56 | 103.99 | 10,248.90 | -248.64 | 728.66 | 446,929.07 | 840,563.95 | 32° 13' 29.929 N | 103° 21' 56.517 W |
| **Start Drop -1.00 at 10308.5 MD** | | | | | | | | | |
| 10,400.00 | 8.64 | 103.99 | 10,339.59 | -252.15 | 742.75 | 446,925.57 | 840,578.04 | 32° 13' 29.893 N | 103° 21' 56.354 W |
| 10,500.00 | 7.64 | 103.99 | 10,438.58 | -255.57 | 756.49 | 446,922.14 | 840,591.77 | 32° 13' 29.858 N | 103° 21' 56.194 W |
| 10,600.00 | 6.64 | 103.99 | 10,537.81 | -258.57 | 768.54 | 446,919.14 | 840,603.83 | 32° 13' 29.827 N | 103° 21' 56.054 W |
| 10,700.00 | 5.64 | 103.99 | 10,637.23 | -261.15 | 778.91 | 446,916.56 | 840,614.20 | 32° 13' 29.801 N | 103° 21' 55.934 W |
| 10,702.94 | 5.61 | 103.99 | 10,640.16 | -261.22 | 779.19 | 446,916.49 | 840,614.48 | 32° 13' 29.800 N | 103° 21' 55.930 W |
| **Second Bone Spring Sand** | | | | | | | | | |
| 10,800.00 | 4.64 | 103.99 | 10,736.83 | -263.32 | 787.60 | 446,914.39 | 840,622.89 | 32° 13' 29.779 N | 103° 21' 55.833 W |
| 10,900.00 | 3.64 | 103.99 | 10,836.57 | -265.06 | 794.60 | 446,912.65 | 840,629.89 | 32° 13' 29.761 N | 103° 21' 55.752 W |
| 11,000.00 | 2.64 | 103.99 | 10,936.42 | -266.38 | 799.91 | 446,911.33 | 840,635.20 | 32° 13' 29.747 N | 103° 21' 55.690 W |
| 11,100.00 | 1.64 | 103.99 | 11,036.35 | -267.28 | 803.53 | 446,910.43 | 840,638.82 | 32° 13' 29.738 N | 103° 21' 55.648 W |
| 11,200.00 | 0.64 | 103.99 | 11,136.33 | -267.76 | 805.46 | 446,909.95 | 840,640.74 | 32° 13' 29.733 N | 103° 21' 55.625 W |
| 11,228.02 | 0.36 | 103.99 | 11,164.34 | -267.82 | 805.69 | 446,909.89 | 840,640.98 | 32° 13' 29.732 N | 103° 21' 55.623 W |
| **Third Bone Spring Carbonates** | | | | | | | | | |
| 11,263.68 | 0.00 | 0.00 | 11,200.00 | -267.85 | 805.80 | 446,909.86 | 840,641.09 | 32° 13' 29.732 N | 103° 21' 55.622 W |
| **Start 190.46 hold at 11263.68 MD** | | | | | | | | | |
| 11,300.00 | 0.00 | 0.00 | 11,236.32 | -267.85 | 805.80 | 446,909.86 | 840,641.09 | 32° 13' 29.732 N | 103° 21' 55.622 W |
| 11,400.00 | 0.00 | 0.00 | 11,336.32 | -267.85 | 805.80 | 446,909.86 | 840,641.09 | 32° 13' 29.732 N | 103° 21' 55.622 W |
| 11,454.14 | 0.00 | 0.00 | 11,390.46 | -267.85 | 805.80 | 446,909.86 | 840,641.09 | 32° 13' 29.732 N | 103° 21' 55.622 W |
| **Start Build 10.00 at 11454.14 MD** | | | | | | | | | |
| 11,500.00 | 4.59 | 359.99 | 11,436.27 | -266.01 | 805.80 | 446,911.70 | 840,641.09 | 32° 13' 29.750 N | 103° 21' 55.621 W |
| 11,600.00 | 14.59 | 359.99 | 11,534.75 | -249.38 | 805.79 | 446,928.33 | 840,641.08 | 32° 13' 29.915 N | 103° 21' 55.620 W |
| 11,674.25 | 22.01 | 359.99 | 11,605.20 | -226.09 | 805.79 | 446,951.62 | 840,641.08 | 32° 13' 30.145 N | 103° 21' 55.617 W |
| **Third Bone Spring Sand** | | | | | | | | | |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 11,700.00 | 24.59 | 359.99 | 11,628.85 | -215.90 | 805.79 | 446,961.81 | 840,641.08 | 32° 13' 30.246 N | 103° 21' 55.616 W |
| 11,800.00 | 34.59 | 359.99 | 11,715.70 | -166.59 | 805.78 | 447,011.12 | 840,641.07 | 32° 13' 30.734 N | 103° 21' 55.611 W |
| 11,900.00 | 44.59 | 359.99 | 11,792.67 | -102.95 | 805.77 | 447,074.76 | 840,641.05 | 32° 13' 31.364 N | 103° 21' 55.605 W |
| 12,000.00 | 54.59 | 359.99 | 11,857.42 | -26.91 | 805.75 | 447,150.80 | 840,641.04 | 32° 13' 32.116 N | 103° 21' 55.597 W |
| 12,100.00 | 64.59 | 359.99 | 11,907.98 | 59.22 | 805.73 | 447,236.93 | 840,641.02 | 32° 13' 32.968 N | 103° 21' 55.588 W |
| 12,200.00 | 74.59 | 359.99 | 11,942.81 | 152.82 | 805.71 | 447,330.53 | 840,641.00 | 32° 13' 33.894 N | 103° 21' 55.578 W |
| 12,247.58 | 79.34 | 359.99 | 11,953.54 | 199.16 | 805.70 | 447,376.87 | 840,640.99 | 32° 13' 34.353 N | 103° 21' 55.574 W |
| **Wolfcamp** | | | | | | | | | |
| 12,300.00 | 84.59 | 359.99 | 11,960.87 | 251.05 | 805.69 | 447,428.76 | 840,640.98 | 32° 13' 34.866 N | 103° 21' 55.568 W |
| 12,369.84 | 91.57 | 359.99 | 11,963.21 | 320.81 | 805.68 | 447,498.52 | 840,640.97 | 32° 13' 35.557 N | 103° 21' 55.561 W |
| **Start 9781.92 hold at 12369.84 MD** | | | | | | | | | |
| 12,400.00 | 91.57 | 359.99 | 11,962.38 | 350.96 | 805.67 | 447,528.67 | 840,640.96 | 32° 13' 35.855 N | 103° 21' 55.558 W |
| 12,500.00 | 91.57 | 359.99 | 11,959.64 | 450.92 | 805.65 | 447,628.63 | 840,640.94 | 32° 13' 36.844 N | 103° 21' 55.548 W |
| 12,600.00 | 91.57 | 359.99 | 11,956.90 | 550.88 | 805.63 | 447,728.59 | 840,640.92 | 32° 13' 37.833 N | 103° 21' 55.538 W |
| 12,700.00 | 91.57 | 359.99 | 11,954.16 | 650.84 | 805.61 | 447,828.55 | 840,640.90 | 32° 13' 38.822 N | 103° 21' 55.527 W |
| 12,800.00 | 91.57 | 359.99 | 11,951.42 | 750.81 | 805.59 | 447,928.52 | 840,640.88 | 32° 13' 39.811 N | 103° 21' 55.517 W |
| 12,900.00 | 91.57 | 359.99 | 11,948.68 | 850.77 | 805.57 | 448,028.48 | 840,640.86 | 32° 13' 40.800 N | 103° 21' 55.507 W |
| 13,000.00 | 91.57 | 359.99 | 11,945.94 | 950.73 | 805.55 | 448,128.44 | 840,640.84 | 32° 13' 41.789 N | 103° 21' 55.497 W |
| 13,100.00 | 91.57 | 359.99 | 11,943.20 | 1,050.69 | 805.53 | 448,228.40 | 840,640.82 | 32° 13' 42.779 N | 103° 21' 55.486 W |
| 13,200.00 | 91.57 | 359.99 | 11,940.46 | 1,150.66 | 805.51 | 448,328.36 | 840,640.80 | 32° 13' 43.768 N | 103° 21' 55.476 W |
| 13,300.00 | 91.57 | 359.99 | 11,937.72 | 1,250.62 | 805.49 | 448,428.33 | 840,640.78 | 32° 13' 44.757 N | 103° 21' 55.466 W |
| 13,400.00 | 91.57 | 359.99 | 11,934.98 | 1,350.58 | 805.47 | 448,528.29 | 840,640.76 | 32° 13' 45.746 N | 103° 21' 55.456 W |
| 13,500.00 | 91.57 | 359.99 | 11,932.24 | 1,450.54 | 805.45 | 448,628.25 | 840,640.74 | 32° 13' 46.735 N | 103° 21' 55.445 W |
| 13,600.00 | 91.57 | 359.99 | 11,929.50 | 1,550.51 | 805.43 | 448,728.21 | 840,640.72 | 32° 13' 47.724 N | 103° 21' 55.435 W |
| 13,700.00 | 91.57 | 359.99 | 11,926.76 | 1,650.47 | 805.41 | 448,828.18 | 840,640.70 | 32° 13' 48.713 N | 103° 21' 55.425 W |
| 13,800.00 | 91.57 | 359.99 | 11,924.02 | 1,750.43 | 805.39 | 448,928.14 | 840,640.68 | 32° 13' 49.702 N | 103° 21' 55.415 W |
| 13,900.00 | 91.57 | 359.99 | 11,921.28 | 1,850.39 | 805.37 | 449,028.10 | 840,640.66 | 32° 13' 50.691 N | 103° 21' 55.404 W |
| 14,000.00 | 91.57 | 359.99 | 11,918.54 | 1,950.36 | 805.35 | 449,128.06 | 840,640.64 | 32° 13' 51.680 N | 103° 21' 55.394 W |
| 14,100.00 | 91.57 | 359.99 | 11,915.80 | 2,050.32 | 805.33 | 449,228.02 | 840,640.62 | 32° 13' 52.669 N | 103° 21' 55.384 W |
| 14,200.00 | 91.57 | 359.99 | 11,913.06 | 2,150.28 | 805.31 | 449,327.99 | 840,640.60 | 32° 13' 53.659 N | 103° 21' 55.374 W |
| 14,300.00 | 91.57 | 359.99 | 11,910.32 | 2,250.24 | 805.29 | 449,427.95 | 840,640.58 | 32° 13' 54.648 N | 103° 21' 55.363 W |
| 14,400.00 | 91.57 | 359.99 | 11,907.58 | 2,350.21 | 805.27 | 449,527.91 | 840,640.56 | 32° 13' 55.637 N | 103° 21' 55.353 W |
| 14,500.00 | 91.57 | 359.99 | 11,904.84 | 2,450.17 | 805.25 | 449,627.87 | 840,640.54 | 32° 13' 56.626 N | 103° 21' 55.343 W |
| 14,600.00 | 91.57 | 359.99 | 11,902.10 | 2,550.13 | 805.23 | 449,727.84 | 840,640.52 | 32° 13' 57.615 N | 103° 21' 55.333 W |
| 14,700.00 | 91.57 | 359.99 | 11,899.36 | 2,650.09 | 805.21 | 449,827.80 | 840,640.50 | 32° 13' 58.604 N | 103° 21' 55.322 W |
| 14,800.00 | 91.57 | 359.99 | 11,896.62 | 2,750.06 | 805.19 | 449,927.76 | 840,640.48 | 32° 13' 59.593 N | 103° 21' 55.312 W |
| 14,900.00 | 91.57 | 359.99 | 11,893.88 | 2,850.02 | 805.17 | 450,027.72 | 840,640.46 | 32° 14' 0.582 N | 103° 21' 55.302 W |
| 15,000.00 | 91.57 | 359.99 | 11,891.15 | 2,949.98 | 805.15 | 450,127.68 | 840,640.44 | 32° 14' 1.571 N | 103° 21' 55.292 W |
| 15,100.00 | 91.57 | 359.99 | 11,888.41 | 3,049.94 | 805.13 | 450,227.65 | 840,640.42 | 32° 14' 2.560 N | 103° 21' 55.281 W |
| 15,200.00 | 91.57 | 359.99 | 11,885.67 | 3,149.91 | 805.11 | 450,327.61 | 840,640.40 | 32° 14' 3.549 N | 103° 21' 55.271 W |
| 15,300.00 | 91.57 | 359.99 | 11,882.93 | 3,249.87 | 805.09 | 450,427.57 | 840,640.38 | 32° 14' 4.539 N | 103° 21' 55.261 W |
| 15,400.00 | 91.57 | 359.99 | 11,880.19 | 3,349.83 | 805.07 | 450,527.53 | 840,640.36 | 32° 14' 5.528 N | 103° 21' 55.251 W |
| 15,500.00 | 91.57 | 359.99 | 11,877.45 | 3,449.79 | 805.05 | 450,627.50 | 840,640.34 | 32° 14' 6.517 N | 103° 21' 55.240 W |
| 15,600.00 | 91.57 | 359.99 | 11,874.71 | 3,549.76 | 805.03 | 450,727.46 | 840,640.32 | 32° 14' 7.506 N | 103° 21' 55.230 W |
| 15,700.00 | 91.57 | 359.99 | 11,871.97 | 3,649.72 | 805.01 | 450,827.42 | 840,640.30 | 32° 14' 8.495 N | 103° 21' 55.220 W |
| 15,800.00 | 91.57 | 359.99 | 11,869.23 | 3,749.68 | 804.99 | 450,927.38 | 840,640.28 | 32° 14' 9.484 N | 103° 21' 55.210 W |
| 15,900.00 | 91.57 | 359.99 | 11,866.49 | 3,849.64 | 804.97 | 451,027.35 | 840,640.26 | 32° 14' 10.473 N | 103° 21' 55.199 W |
| 16,000.00 | 91.57 | 359.99 | 11,863.75 | 3,949.61 | 804.95 | 451,127.31 | 840,640.24 | 32° 14' 11.462 N | 103° 21' 55.189 W |
| 16,100.00 | 91.57 | 359.99 | 11,861.01 | 4,049.57 | 804.93 | 451,227.27 | 840,640.22 | 32° 14' 12.451 N | 103° 21' 55.179 W |
| 16,200.00 | 91.57 | 359.99 | 11,858.27 | 4,149.53 | 804.91 | 451,327.23 | 840,640.20 | 32° 14' 13.440 N | 103° 21' 55.168 W |
| 16,300.00 | 91.57 | 359.99 | 11,855.53 | 4,249.49 | 804.89 | 451,427.19 | 840,640.18 | 32° 14' 14.429 N | 103° 21' 55.158 W |
| 16,400.00 | 91.57 | 359.99 | 11,852.79 | 4,349.46 | 804.87 | 451,527.16 | 840,640.16 | 32° 14' 15.419 N | 103° 21' 55.148 W |
| 16,500.00 | 91.57 | 359.99 | 11,850.05 | 4,449.42 | 804.85 | 451,627.12 | 840,640.14 | 32° 14' 16.408 N | 103° 21' 55.138 W |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 16,600.00 | 91.57 | 359.99 | 11,847.31 | 4,549.38 | 804.83 | 451,727.08 | 840,640.12 | 32° 14' 17.397 N | 103° 21' 55.127 W |
| 16,700.00 | 91.57 | 359.99 | 11,844.57 | 4,649.34 | 804.81 | 451,827.04 | 840,640.10 | 32° 14' 18.386 N | 103° 21' 55.117 W |
| 16,800.00 | 91.57 | 359.99 | 11,841.83 | 4,749.31 | 804.79 | 451,927.01 | 840,640.08 | 32° 14' 19.375 N | 103° 21' 55.107 W |
| 16,900.00 | 91.57 | 359.99 | 11,839.09 | 4,849.27 | 804.77 | 452,026.97 | 840,640.06 | 32° 14' 20.364 N | 103° 21' 55.097 W |
| 17,000.00 | 91.57 | 359.99 | 11,836.35 | 4,949.23 | 804.75 | 452,126.93 | 840,640.04 | 32° 14' 21.353 N | 103° 21' 55.086 W |
| 17,100.00 | 91.57 | 359.99 | 11,833.61 | 5,049.19 | 804.73 | 452,226.89 | 840,640.02 | 32° 14' 22.342 N | 103° 21' 55.076 W |
| 17,200.00 | 91.57 | 359.99 | 11,830.87 | 5,149.15 | 804.71 | 452,326.85 | 840,640.00 | 32° 14' 23.331 N | 103° 21' 55.066 W |
| 17,300.00 | 91.57 | 359.99 | 11,828.13 | 5,249.12 | 804.69 | 452,426.82 | 840,639.98 | 32° 14' 24.320 N | 103° 21' 55.056 W |
| 17,400.00 | 91.57 | 359.99 | 11,825.39 | 5,349.08 | 804.67 | 452,526.78 | 840,639.95 | 32° 14' 25.309 N | 103° 21' 55.045 W |
| 17,500.00 | 91.57 | 359.99 | 11,822.65 | 5,449.04 | 804.65 | 452,626.74 | 840,639.93 | 32° 14' 26.299 N | 103° 21' 55.035 W |
| 17,600.00 | 91.57 | 359.99 | 11,819.91 | 5,549.00 | 804.63 | 452,726.70 | 840,639.91 | 32° 14' 27.288 N | 103° 21' 55.025 W |
| 17,700.00 | 91.57 | 359.99 | 11,817.17 | 5,648.97 | 804.61 | 452,826.67 | 840,639.89 | 32° 14' 28.277 N | 103° 21' 55.015 W |
| 17,800.00 | 91.57 | 359.99 | 11,814.43 | 5,748.93 | 804.59 | 452,926.63 | 840,639.87 | 32° 14' 29.266 N | 103° 21' 55.004 W |
| 17,900.00 | 91.57 | 359.99 | 11,811.69 | 5,848.89 | 804.57 | 453,026.59 | 840,639.85 | 32° 14' 30.255 N | 103° 21' 54.994 W |
| 18,000.00 | 91.57 | 359.99 | 11,808.95 | 5,948.85 | 804.55 | 453,126.55 | 840,639.83 | 32° 14' 31.244 N | 103° 21' 54.984 W |
| 18,100.00 | 91.57 | 359.99 | 11,806.21 | 6,048.82 | 804.53 | 453,226.51 | 840,639.81 | 32° 14' 32.233 N | 103° 21' 54.974 W |
| 18,200.00 | 91.57 | 359.99 | 11,803.47 | 6,148.78 | 804.51 | 453,326.48 | 840,639.79 | 32° 14' 33.222 N | 103° 21' 54.963 W |
| 18,300.00 | 91.57 | 359.99 | 11,800.73 | 6,248.74 | 804.49 | 453,426.44 | 840,639.77 | 32° 14' 34.211 N | 103° 21' 54.953 W |
| 18,400.00 | 91.57 | 359.99 | 11,797.99 | 6,348.70 | 804.47 | 453,526.40 | 840,639.75 | 32° 14' 35.200 N | 103° 21' 54.943 W |
| 18,500.00 | 91.57 | 359.99 | 11,795.25 | 6,448.67 | 804.45 | 453,626.36 | 840,639.73 | 32° 14' 36.189 N | 103° 21' 54.933 W |
| 18,600.00 | 91.57 | 359.99 | 11,792.51 | 6,548.63 | 804.43 | 453,726.33 | 840,639.71 | 32° 14' 37.179 N | 103° 21' 54.922 W |
| 18,700.00 | 91.57 | 359.99 | 11,789.77 | 6,648.59 | 804.41 | 453,826.29 | 840,639.69 | 32° 14' 38.168 N | 103° 21' 54.912 W |
| 18,800.00 | 91.57 | 359.99 | 11,787.03 | 6,748.55 | 804.39 | 453,926.25 | 840,639.67 | 32° 14' 39.157 N | 103° 21' 54.902 W |
| 18,900.00 | 91.57 | 359.99 | 11,784.29 | 6,848.52 | 804.37 | 454,026.21 | 840,639.65 | 32° 14' 40.146 N | 103° 21' 54.892 W |
| 19,000.00 | 91.57 | 359.99 | 11,781.55 | 6,948.48 | 804.35 | 454,126.18 | 840,639.63 | 32° 14' 41.135 N | 103° 21' 54.881 W |
| 19,100.00 | 91.57 | 359.99 | 11,778.81 | 7,048.44 | 804.33 | 454,226.14 | 840,639.61 | 32° 14' 42.124 N | 103° 21' 54.871 W |
| 19,200.00 | 91.57 | 359.99 | 11,776.07 | 7,148.40 | 804.31 | 454,326.10 | 840,639.59 | 32° 14' 43.113 N | 103° 21' 54.861 W |
| 19,300.00 | 91.57 | 359.99 | 11,773.33 | 7,248.37 | 804.29 | 454,426.06 | 840,639.57 | 32° 14' 44.102 N | 103° 21' 54.851 W |
| 19,400.00 | 91.57 | 359.99 | 11,770.59 | 7,348.33 | 804.27 | 454,526.02 | 840,639.55 | 32° 14' 45.091 N | 103° 21' 54.840 W |
| 19,500.00 | 91.57 | 359.99 | 11,767.85 | 7,448.29 | 804.25 | 454,625.99 | 840,639.53 | 32° 14' 46.080 N | 103° 21' 54.830 W |
| 19,600.00 | 91.57 | 359.99 | 11,765.11 | 7,548.25 | 804.23 | 454,725.95 | 840,639.51 | 32° 14' 47.069 N | 103° 21' 54.820 W |
| 19,700.00 | 91.57 | 359.99 | 11,762.37 | 7,648.22 | 804.20 | 454,825.91 | 840,639.49 | 32° 14' 48.059 N | 103° 21' 54.810 W |
| 19,800.00 | 91.57 | 359.99 | 11,759.63 | 7,748.18 | 804.18 | 454,925.87 | 840,639.47 | 32° 14' 49.048 N | 103° 21' 54.799 W |
| 19,900.00 | 91.57 | 359.99 | 11,756.89 | 7,848.14 | 804.16 | 455,025.84 | 840,639.45 | 32° 14' 50.037 N | 103° 21' 54.789 W |
| 20,000.00 | 91.57 | 359.99 | 11,754.15 | 7,948.10 | 804.14 | 455,125.80 | 840,639.43 | 32° 14' 51.026 N | 103° 21' 54.779 W |
| 20,100.00 | 91.57 | 359.99 | 11,751.41 | 8,048.07 | 804.12 | 455,225.76 | 840,639.41 | 32° 14' 52.015 N | 103° 21' 54.768 W |
| 20,200.00 | 91.57 | 359.99 | 11,748.67 | 8,148.03 | 804.10 | 455,325.72 | 840,639.39 | 32° 14' 53.004 N | 103° 21' 54.758 W |
| 20,300.00 | 91.57 | 359.99 | 11,745.93 | 8,247.99 | 804.08 | 455,425.68 | 840,639.37 | 32° 14' 53.993 N | 103° 21' 54.748 W |
| 20,400.00 | 91.57 | 359.99 | 11,743.19 | 8,347.95 | 804.06 | 455,525.65 | 840,639.35 | 32° 14' 54.982 N | 103° 21' 54.738 W |
| 20,500.00 | 91.57 | 359.99 | 11,740.45 | 8,447.92 | 804.04 | 455,625.61 | 840,639.33 | 32° 14' 55.971 N | 103° 21' 54.727 W |
| 20,600.00 | 91.57 | 359.99 | 11,737.71 | 8,547.88 | 804.02 | 455,725.57 | 840,639.31 | 32° 14' 56.960 N | 103° 21' 54.717 W |
| 20,700.00 | 91.57 | 359.99 | 11,734.98 | 8,647.84 | 804.00 | 455,825.53 | 840,639.29 | 32° 14' 57.949 N | 103° 21' 54.707 W |
| 20,800.00 | 91.57 | 359.99 | 11,732.24 | 8,747.80 | 803.98 | 455,925.50 | 840,639.27 | 32° 14' 58.939 N | 103° 21' 54.697 W |
| 20,900.00 | 91.57 | 359.99 | 11,729.50 | 8,847.77 | 803.96 | 456,025.46 | 840,639.25 | 32° 14' 59.928 N | 103° 21' 54.686 W |
| 21,000.00 | 91.57 | 359.99 | 11,726.76 | 8,947.73 | 803.94 | 456,125.42 | 840,639.23 | 32° 15' 0.917 N | 103° 21' 54.676 W |
| 21,100.00 | 91.57 | 359.99 | 11,724.02 | 9,047.69 | 803.92 | 456,225.38 | 840,639.21 | 32° 15' 1.906 N | 103° 21' 54.666 W |
| 21,200.00 | 91.57 | 359.99 | 11,721.28 | 9,147.65 | 803.90 | 456,325.35 | 840,639.19 | 32° 15' 2.895 N | 103° 21' 54.656 W |
| 21,300.00 | 91.57 | 359.99 | 11,718.54 | 9,247.62 | 803.88 | 456,425.31 | 840,639.17 | 32° 15' 3.884 N | 103° 21' 54.645 W |
| 21,400.00 | 91.57 | 359.99 | 11,715.80 | 9,347.58 | 803.86 | 456,525.27 | 840,639.15 | 32° 15' 4.873 N | 103° 21' 54.635 W |
| 21,500.00 | 91.57 | 359.99 | 11,713.06 | 9,447.54 | 803.84 | 456,625.23 | 840,639.13 | 32° 15' 5.862 N | 103° 21' 54.625 W |
| 21,600.00 | 91.57 | 359.99 | 11,710.32 | 9,547.50 | 803.82 | 456,725.19 | 840,639.11 | 32° 15' 6.851 N | 103° 21' 54.615 W |
| 21,700.00 | 91.57 | 359.99 | 11,707.58 | 9,647.47 | 803.80 | 456,825.16 | 840,639.09 | 32° 15' 7.840 N | 103° 21' 54.604 W |
| 21,800.00 | 91.57 | 359.99 | 11,704.84 | 9,747.43 | 803.78 | 456,925.12 | 840,639.07 | 32° 15' 8.829 N | 103° 21' 54.594 W |
| 21,900.00 | 91.57 | 359.99 | 11,702.10 | 9,847.39 | 803.76 | 457,025.08 | 840,639.05 | 32° 15' 9.819 N | 103° 21' 54.584 W |

| | | | |
|---|---|---|---|
| **Database:** | EDM | **Local Co-ordinate Reference** | Well Breckenridge Fed Com 706H |
| **Company:** | Franklin Mountain Energy | **TVD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Project:** | Golden - Breckenridge Site | **MD Reference:** | GL 3375' + RBK 21' @ 3396.00ft |
| **Site:** | Lea County, NM (NAD 83) | **North Reference:** | Grid |
| **Well:** | Breckenridge Fed Com 706H | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #3 | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Map Northing (usft) | Map Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| 22,000.00 | 91.57 | 359.99 | 11,699.36 | 9,947.35 | 803.74 | 457,125.04 | 840,639.03 | 32° 15' 10.808 N | 103° 21' 54.573 W |
| 22,100.00 | 91.57 | 359.99 | 11,696.62 | 10,047.32 | 803.72 | 457,225.01 | 840,639.01 | 32° 15' 11.797 N | 103° 21' 54.563 W |
| 22,151.76 | 91.57 | 359.99 | 11,695.20 | 10,099.06 | 803.71 | 457,276.75 | 840,639.00 | 32° 15' 12.309 N | 103° 21' 54.558 W |
| **TD at 22151.76 MD** | | | | | | | | | |

**Design Targets**

| Target Name - hit/miss target - Shape | Dip Angle (°) | Dip Dir. (°) | TVD (ft) | +N/-S (ft) | +E/-W (ft) | Northing (usft) | Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| Breckenridge 706H PBH<br>- plan hits target center<br>- Point | 0.00 | 0.01 | 11,695.20 | 10,099.06 | 803.71 | 457,276.75 | 840,639.00 | 32° 15' 12.309 N | 103° 21' 54.558 W |

**Formations**

| Measured Depth (ft) | Vertical Depth (ft) | Name | Lithology | Dip (°) | Dip Direction (°) |
|---|---|---|---|---|---|
| 21.00 | 21.00 | Cenozoic Alluvium (surface) | | -1.57 | 0.00 |
| 962.00 | 962.00 | Rustler | | -1.57 | 0.00 |
| 1,059.00 | 1,059.00 | Salado | | -1.57 | 0.00 |
| 2,984.92 | 2,984.69 | Base Salt | | -1.57 | 0.00 |
| 5,282.30 | 5,281.72 | Lamar | | -1.57 | 0.00 |
| 5,386.37 | 5,385.77 | Bell Canyon | | -1.57 | 0.00 |
| 6,296.16 | 6,292.41 | Cherry Canyon | | -1.57 | 0.00 |
| 7,658.39 | 7,635.90 | Brushy Canyon | | -1.57 | 0.00 |
| 8,987.29 | 8,946.36 | Bone Spring Lime | | -1.57 | 0.00 |
| 9,013.69 | 8,972.39 | Avalon | | -1.57 | 0.00 |
| 10,121.27 | 10,064.61 | First Bone Spring Sand | | -1.57 | 0.00 |
| 10,291.82 | 10,232.80 | Second Bone Spring Carbonates | | -1.57 | 0.00 |
| 10,702.94 | 10,640.16 | Second Bone Spring Sand | | -1.57 | 0.00 |
| 11,228.02 | 11,164.34 | Third Bone Spring Carbonates | | -1.57 | 0.00 |
| 11,674.25 | 11,605.20 | Third Bone Spring Sand | | -1.57 | 0.00 |
| 12,247.58 | 11,953.54 | Wolfcamp | | -1.57 | 0.00 |

**Plan Annotations**

| Measured Depth (ft) | Vertical Depth (ft) | Local Coordinates +N/-S (ft) | Local Coordinates +E/-W (ft) | Comment |
|---|---|---|---|---|
| 1,400.00 | 1,400.00 | 0.00 | 0.00 | Start Build 1.00 at 1400 MD |
| 1,500.00 | 1,499.99 | -0.82 | 0.30 | Start 4000.61 hold at 1500.00 MD |
| 5,500.61 | 5,500.00 | -66.43 | 24.18 | Start DLS 1.00 TFO -61.23 at 5500.61 MD |
| 6,404.02 | 6,398.94 | -92.01 | 99.79 | Start 3904.13 hold at 6404.02 MD |
| 10,308.15 | 10,248.90 | -248.64 | 728.66 | Start Drop -1.00 at 10308.5 MD |
| 11,263.68 | 11,200.00 | -267.85 | 805.80 | Start 190.46 hold at 11263.68 MD |
| 11,454.14 | 11,390.46 | -267.85 | 805.80 | Start Build 10.00 at 11454.14 MD |
| 12,369.84 | 11,963.21 | 320.81 | 805.68 | Start 9781.92 hold at 12369.84 MD |
| 22,151.76 | 11,695.20 | 10,099.06 | 803.71 | TD at 22151.76 MD |

# 5.5 23# P-110 MS2 Anaconda-SP SF

| Pipe Body Data | | |
|---|---|---|
| Nominal OD | 5.500 | Inches |
| Wall Thickness | 0.415 | Inches |
| Weight | 23.00 | lb/ft |
| PE Weight | 22.56 | lb/ft |
| Nominal ID | 4.670 | Inches |
| Drift | 4.545 | Inches |
| Minimum Yield Strength | 110,000 | PSI |
| Minimum Tensile Strength | 120,000 | PSI |
| RBW | 87.5% | Rating |

| Connection Data | | |
|---|---|---|
| Connection OD | 5.753 | Inches |
| Connection ID | 4.670 | Inches |
| Make-Up loss | 4.774 | Inches |
| Tension Efficiency | 90% | Rating |
| Compression Efficiency | 90% | Rating |
| Yield Strength in Tension | 656,000 | LBS. |
| Yield Strength in Compression | 656,000 | LBS. |
| MIYP (Burst) | 14,530 | PSI |
| Collapse Pressure | 14,540 | PSI |
| Uniaxial Bending | 83 | degrees |

| Make-Up torques | | |
|---|---|---|
| Yield torque | 42,000 | FT-LBS. |
| Max Operating Torque | 33,600 | FT-LBS. |
| Max Make-Up | 20,000 | FT-LBS. |
| Optimum Make-Up | 16,500 | FT-LBS. |
| Minimum Make-Up | 13,000 | FT-LBS. |

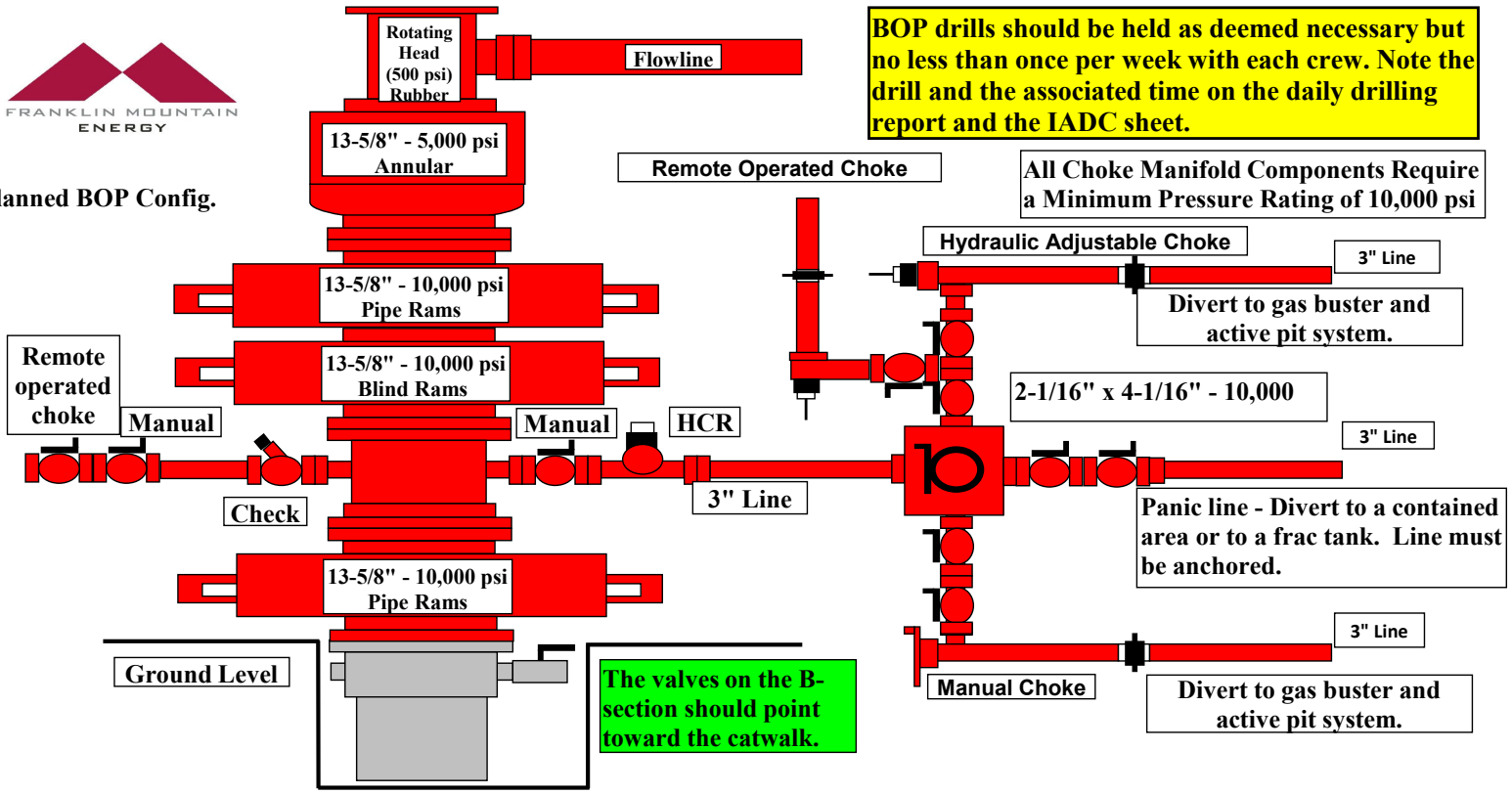

**Technical Sales Support: Rafael Escamilla Jr., Cell: 281-961-7704, jescamilla@ofsint.com**



Product is sold by OFSI under a license from Fermata Technologies, LLC

FRANKLIN MOUNTAIN ENERGY

**Planned BOP Config.**




**Note - Actual BOP configuration subject to change given wellsite requirements.**
**Lower BOP outlet can be used in place of mud cross if necessary.**
**Choke manifold configuration may vary but must have 1 manual and 1 adjustable choke with at least a 10,000 psi rating.**

## BOP Description:

Use contractor's 13-5/8", 10K double BOP (drill pipe rams on top and blind rams on bottom), single 13-5/8", 10K pipe rams beneath the double and 13-5/8", 5K annular. RU 10K psi choke manifold equipped with one manual adjustable choke and one hydraulically adjustable choke. Kill line and choke line should be located below blind ram chamber. Install two (2) full opening gate valves and a check valve on the kill line with the gate valve nearest to the wellhead. The choke line shall be equipped with a manual full opening gate valve and an HCR valve. The manual valve should be open and the HCR valve should be closed during drilling operations. Chokes should be closed at all times as well. All lines should be flushed on a regular basis to avoid blockage (barite plugging). The pressure rating of the choke and kill lines and all valves should be equal to or greater than the BOP rams. RU contractor's accumulator system.

Test the accumulator system noting the initial pressure, final pressure and the amount of time required to close the various BOP components. Prior to drilling out, pressure test the casing and BOP equipment, using test plug, as follows and record test information on the daily report. Ensure casing head valves are open while testing BOPs. Test BOPs, choke manifold and lines, HCR, standpipe, mud line and all safety valves to 5,000 psig (high) and 250 psig (low) for 5 min. Test the annular to 5,000 psig (high) and 250 (low) for 5 minutes.

Drillpipe safety valves (TIW) should be full opening and have a rated working pressure of at least 5,000 psi. Safety valves for each size of drillpipe in use with the proper connection should be available on the rig floor in front of the drawworks at all times in the open position. Safety valves with the proper crossover should also be available if drill collars have a different connection than the drillpipe. IThe appropriate wrench for all manually operated valves should be marked and readily available on the rig floor at all times.

Ensurepressure guage on choke manifold is operational. All BOP connections subjected to well pressurewill be flanged, welded or clamped. All choke lines will be straight, turns will have tee blocks or targeted and shall be anchored.

# Well Control Procedure

BOP & related components will be tested to required BLM specifications. Should a well-control situation arise, a contingency plan will be implemented. The plan is as follows.

Preparation:

- Sufficient kill mud volume will be prepared in the pre-mix tank prior to testing BOP components.
- Kill mud weight will be adequate to combat Maximum Anticipated Surface Pressure
- Choke manifold system is operable set up according to the BLM requirements and connected to the kill mud storage

Execution:

During any well control issues if the annular preventer should become inoperable or a wash out occurs

- well control will continue using the upper pipe rams in place of the annular preventer.
    - Close pipe rams
    - Pump kill mud to neutralize the well control situation
- Constantly monitor situation using choke manifold
- Use Kill lines of manifold if necessary

This additional well control procedure, as required by the BLM, is applicable to testing Annular Preventor to 100% of the rating.

**Installation Procedure Prepared For:**

# Franklin Mountain Operating LLC.

## (20”) x 13-3/8” x 9-5/8” x 7-5/8” x 5-1/2”
## MBU-4T-CFL-R-DBLO Wellhead System
## With CTH-DBLHPS Tubing Head

**Publication # IP1104 Rev. 0**

**February, 2020**

# Table of Contents

# Warning, Caution & Note Defined

**WARNING:**

**Definition:**

An operating or servicing procedure, practice, condition or statement, which if not strictly observed could result in environmental harm, serious injury or death to personnel or long term health hazards.

**CAUTION:**

**Definition:**

An operating or service procedure, practice, condition or statement, which if not strictly observed could result in damage to or destruction of equipment or rig down time.

**NOTE:**

**Definition:**

An operating procedure, condition or statement which is essential to highlight.

# Reference Documents

**Health, Safety and Environmental Handbook**

**CAS-003 Rev. B**
Assembly of Threaded Connections to Valves and Wellhead Equipment

**Field Service Manual Sections 3 Page 3-4 - Lockscrews**

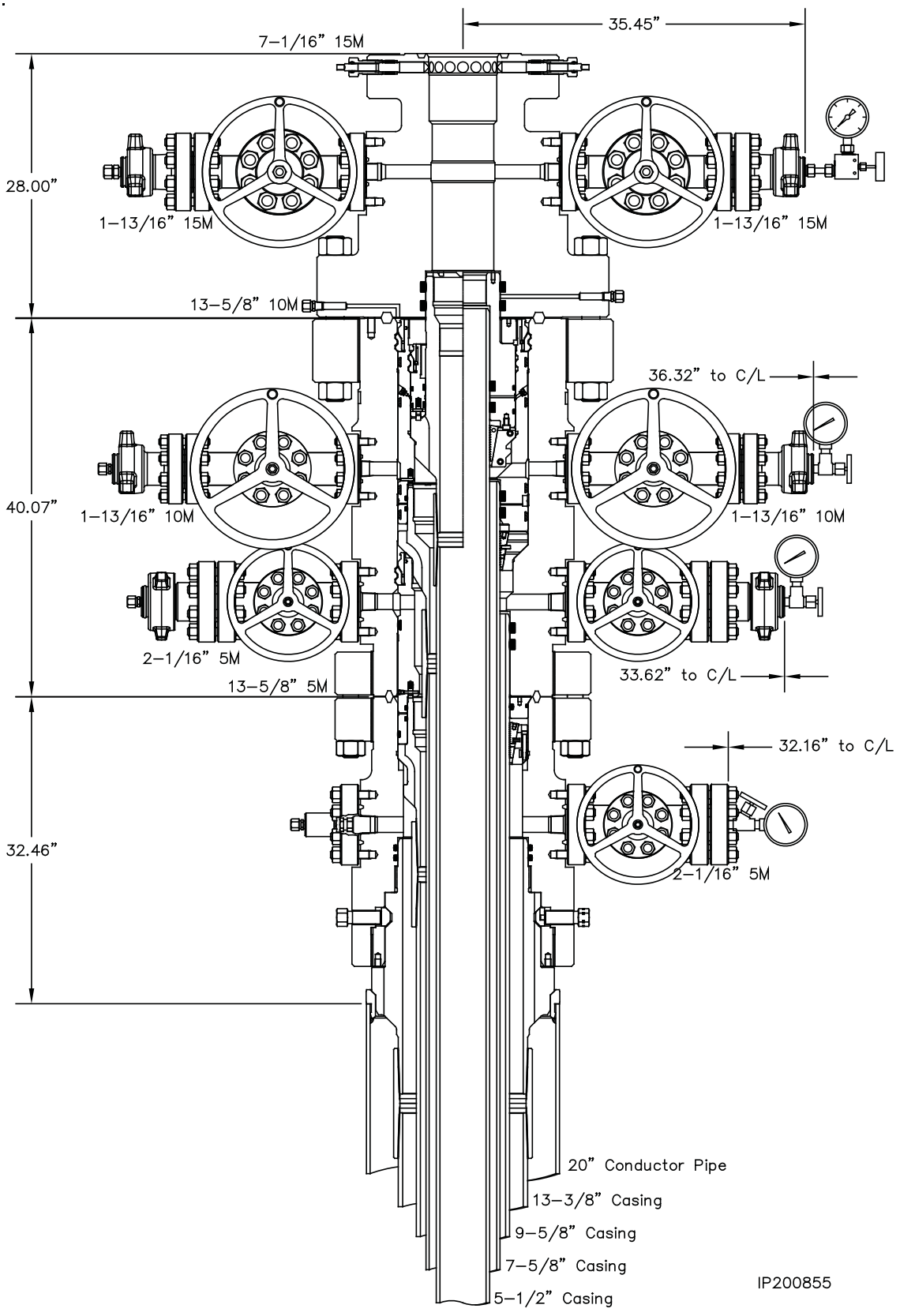
**Field Service Manual Sections 7 - Service Tools**

**Field Service Manual Sections 9 - Quick Connects**

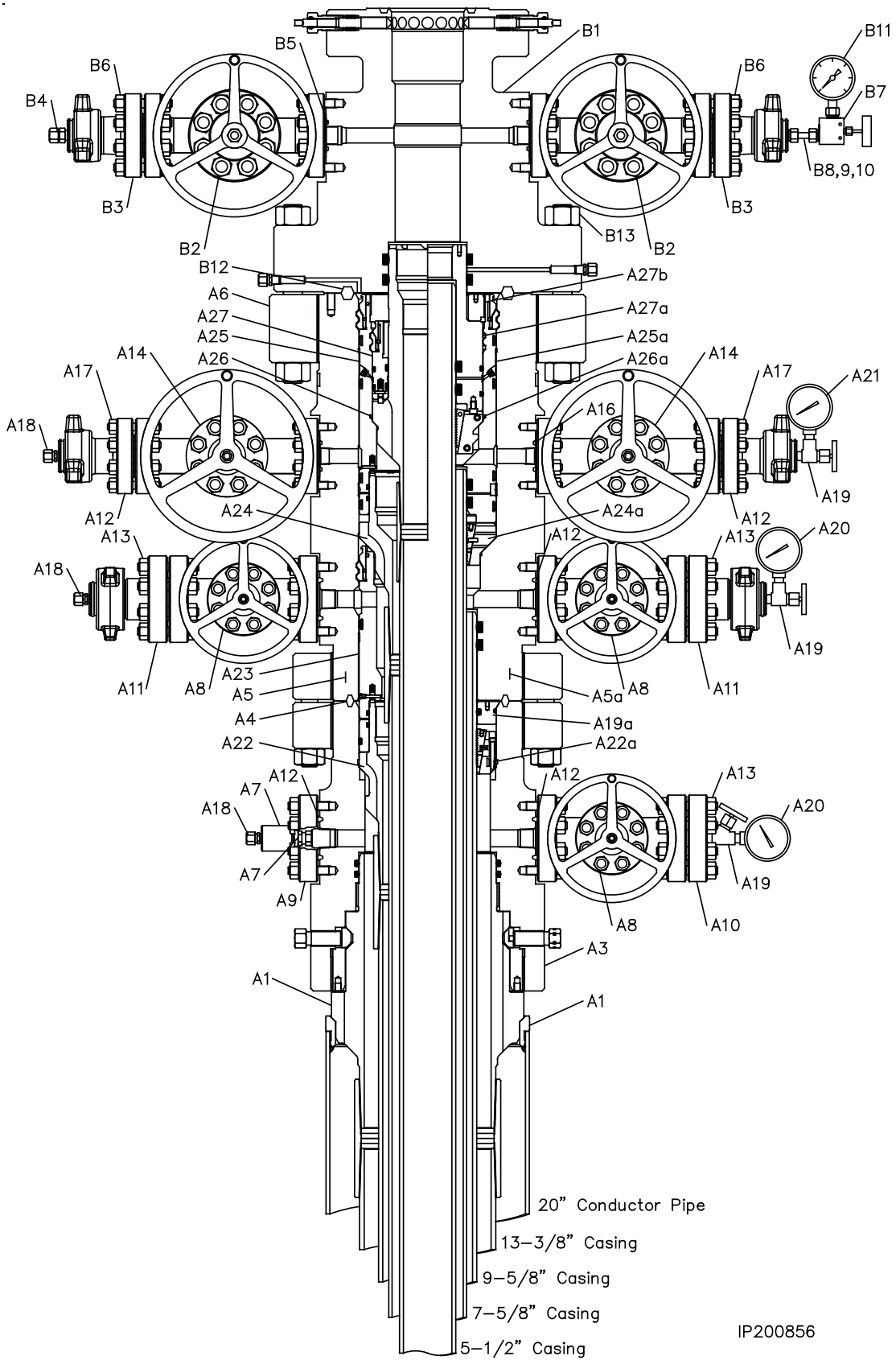
**Field Service Manual Sections 10 - Specifications**
Flange Bolting/Torque Requirements, Tubing Specifications, and Casing Specifications

**OM-016**
Installation, Operation and Maintenance Manual for 6-3/4” Type LR Back Pressure Valve

# System Drawing



# Bill of Materials



## MBU-4T HOUSING ASSEMBLY

| Item | Qty | Description |
|---|---|---|
| A1 | 1 | Landing Ring, CW, 20" SOW x 3/8" Casing Weight x 20.06" O.D. x 18.13" I.D., 4140 110K<br>Part # 116444 |
| A2 | 1 | Casing Hanger, CW, MBU-3T-CFL-R, 13-3/8", 13-3/8" (54.5-61#) Buttress Pin Bottom x 14.000" 2 Stub Acme 2G LH Pin Top, 12.489" Min. Bore, 6A-U-AA-1-2<br>Part # 118174 |
| A3 | 1 | Housing, CW, MBU-4T-LWR-CFL-R-DBLO, 13-3/8", 13-5/8" 5M Threaded Flange, With Two 2-1/16" 5M Studded Outlets, 6A-PU-EE-NL-1-2<br>Part # 122608 |
| A4 | 1 | Ring Gasket, BX-160, 13-5/8" 5M<br>Part # BX160 |
| A5 | 1 | Housing, CW, MBU-4T-UPR-SF, 13-5/8" 5M Threaded Flange Studded Bottom x 13-5/8" 10M Threaded Flange Top, With Two 1-13/16" 10M Studded Upper Outlets & Two 2-1/16" 5M Studded Lower Outlets, Without 13-5/8" 10M Threaded Flange, 6A-PU-EE-2-2<br>Part # 122622P2 |
| A6 | 1 | Flange, Threaded, 13-5/8" 10M With 21.750" 2 Stub Acme 2G Left Hand Box Thread. 31.00" O.D., 4130 75K<br>Part # 110578 |
| A7 | 1 | Valve Removal Plug, CW, 1-1/2" (1.900") Sharp Vee x 1-1/4" Hex, 6A-DD-NL<br>Part # VR2 |
| A8 | 3 | Valve, Hand Wheel Operated, CEPAI, M-EXP, 2-1/16" 3/5M Flanged End 6A LU AA/DD-NL PSL2 PR1 Hand Wheel Operated, 4130 QPQ Seat/Gate, 4140 QPQ Stem<br>Part # 125097 |
| A9 | 1 | Companion Flange, CW, 2-1/16" 5M x 2" Line Pipe, 6A-KU-EE-NL-1<br>Part # 200002 |

## MBU-4T HOUSING ASSEMBLY

| Item | Qty | Description |
|---|---|---|
| A10 | 1 | Blind Flange, CW, 2-1/16" 5M x 1/2" NPT, 6A-LU-E-1<br>Part # 191005 |
| A11 | 2 | Adapter, CFH, 2-1/16" 5M x 2" figure 1502 x 1/2" NPT<br>Part # 117656 |
| A12 | 7 | Ring Gasket, R-24, 2-1/16" 3/5M<br>Part # R24 |
| A13 | 24 | Stud, All-Thread With Two Nuts, Black, 7/8" x 6-1/2" Long, B7/2H<br>Part # 780067 |
| A14 | 2 | Gate Valve, AOZE, FC, 1-13/16" 10M, Flanged End, Handwheel Operated, 6A-LU-EE-0,5-3-1<br>Part # 103188 |
| A15 | 2 | Adapter, FH, 1-13/16" 10M x 2" figure 1502 x 1/2" NPT, nace service<br>Part # 100981 |
| A16 | 4 | Ring Gasket, BX-151, 1-13/16" 10M<br>Part # BX151 |
| A17 | 16 | Stud, All-Thread With Two Nuts, Black, 3/4" x 5-1/2" Long, B7/2H<br>Part # 780080 |
| A18 | 3 | Fitting, Grease, Vented Cap, 1/2" NPT, 4140 -50F, With Electroless Nickel Coating Nace, K-Monel Ball, Inconel X-750 Spring<br>Part # 100048 |
| A19 | 3 | Needle Valve, MFA, 1/2" NPT, 10M Service<br>Part # NVA |
| A20 | 2 | Pressure Gauge, 5M, 4-1/2" Face, Liquid Filled, 1/2" NPT<br>Part # PG5M |
| A21 | 1 | Pressure Gauge, 10M, 4-1/2" Face, Liquid Filled, 1/2" NPT<br>Part # PG10M |
| A22 | 1 | Casing Hanger, CW, MBU-3T LWR-TP4, Fluted, 13-5/8" x 9-5/8" (40#) Buttress Pin Bottom x 10.250" 4 Stub Acme 2G RH Box Top, With 11-1/2" OD Neck, 6A-U-AA-1-2<br>Part # 117760 |

## MBU-4T HOUSING ASSEMBLY

| Item | Qty | Description |
|---|---|---|
| A23 | 1 | Packoff, CW, MBU-4T-LWR, Mandrel, 13-5/8" Stack, With 10.500" 4 Stub Acme 2G Left Hand Box Top, 6A-U-AA-1-2<br>Part # 124176 |
| A24 | 1 | Casing Hanger, CW, MBU-4T-MID-TP8, Fluted, 13-5/8" x 7-5/8" (29.7#) STINGER FLUSH Pin Bottom x 10.250" 4 Stub Acme 2G Right Hand Box Top, With 11-1/2" O.D. Neck, 4140 110K, temp U, material AA, PSL2, PR2<br>Part # NPN |
| A25 | 1 | Packoff, CW, MBU-3T, Mandrel, 13-5/8" Nested x 11", With 11.250" 4 Stub Acme 2G Left Hand Box Top, With Rupture Disk, 6A-PU-AA-1-2<br>Part # 120158 |
| A26 | 1 | Casing Hanger, CW, MBU-3T-TP8-UPR, SN, 7-5/8" fluted, 11" nested x 5-1/2" (20#) ANACONDA FLUSH pin bottom x 6.125" 4 Stub Acme 2G RH box top & 4-13/16" BPV thread, special for rotating casing string, 4130 85K, temp U, material DD, PSL3, PR2<br>Part # NPN<br>ALTERNATE HANGER IF 7-5/8" EMERGENCY HANGER IS USED:<br>Casing Hanger, CW, MBU-4T-TP8-UPR, SN, 7-5/8" fluted, 11" nested x 5-1/2" (20#) ANACONDA FLUSH pin bottom x 6.125" 4 Stub Acme 2G RH box top & 4-13/16" BPV thread, special for rotating casing string, 4130 85K, temp U, material DD, PSL3, PR2<br>Part # NPN |
| A27 | 1 | Packoff, CW, CTF-SN, arranged for 7.75" seal prep with 8.750" 4 Stub Acme 2G LH box top, to land on 45°, 10,000 psi max WP, 6A-PU-DD-NL-2-2<br>Part # 115867 |

## TUBING HEAD ASSEMBLY

| Item | Qty | Description |
|---|---|---|
| B1 | 1 | Tubing Head, CW, CTH-DBLHPS, 7-5/8", 13-5/8" 10M x 7-1/16" 15M, With Two 1-13/16" 15M Studded Outlets, With 6.375" Minimum Bore, 17-4PH Lock Down Screws, 6A-PU-EE-0,5-3-2<br>Part # 115302 |
| B2 | 2 | Gate Valve, CW, SB100, 1-13/16" 15M, Flanged End, Handwheel Operated, BB/EE-0,5, (6A-LU-BB/EE-0,5-3-1)<br>Part # 113880 |
| B3 | 2 | Flange Adapter, CFH, 1-13/16" 15M x 2" figure 1502, 9/16 Autoclave, STD SRV, Non-Nace<br>Part # 112316 |
| B4 | 1 | Fitting, grease, vented cap, 9/16 Autoclave or equivalent, 316SS<br>Part #100326 |
| B5 | 4 | Ring Gasket, BX151, 1-13/16" 15M<br>Part # BX-151 |
| B6 | 16 | Studs, all thread with two nuts, black, 7/8" x 6-1/2" long, B7/2H, no plating<br>Part # 105477 |
| B7 | 1 | Needle Valve, Autoclave, 2 Way angle, 9/16 SOG, without collar and gland<br>Part # 810023 |
| B8 | 2 | Fitting, collar, 9/16 Autoclave<br>Part # 810021 |
| B9 | 2 | Fitting, Gland, 9/16 Autoclave<br>Part # 810020 |
| B10 | 1 | Nipple, 9/16 Autoclave x 4" long threaded and cone both ends, 316 SS<br>Part # 810026 |
| B11 | 1 | Pressure Gauge, 15M, 5-1/2" face, liquid filled, 9/16 Autoclave<br>Part # PG15M |
| B12 | 1 | Ring Gasket, BX-159, 13-5/8" 10M<br>Part # BX159 |
| B13 | 20 | Stud All-Thread, With Two Nuts, Black, 1-7/8" x 17-3/4" B7/2H, No Plating<br>Part # 102825 |

## EMERGENCY EQUIPMENT

| Item | Qty | Description |
|---|---|---|
| A5a | 1 | Housing, CW, MBU-4T-DBLHPS-UPR-SF, 9-5/8", 13-5/8" 5M Threaded Flange Studded Bottom x 13-5/8" 10M Threaded Flange Top, With Two 1-13/16" 10M Studded Upper Outlets & Two 2-1/16" 5M Studded Lower Outlets, 6A-PU-EE-NL-2-2<br>Part # NPN |
| A22a | 1 | Casing Hanger, CW, C21, 13-5/8" x 9-5/8"<br>Part # 100586 |
| A23a | 1 | Primary Seal, CW, H, 13-5/8" x 9-5/8", 6A-PU-AA-1-1<br>Part # 123962 |
| A24a | 1 | Casing Hanger, CW, MBU-4T-MID, Emergency, 13-5/8" x 7-5/8", 6A-PU-DD-NL-3-1<br>Part # 122659 |
| A25a | 1 | Packoff, CW, MBU-3T, Emergency, 13-5/8" Nested x 11" x 7-5/8" With 11.250" 4 Stub Acme 2G Left Hand Box Top, With Rupture Disk, 6A-U-AA-1-1<br>Part # 120920 |
| A2a | 1 | Casing Hanger, CW, MBU-3T/2LR, Upper, 11" x 5-1/2", 6A-PU-DD-3-2<br>Part # 108211 |
| A27a | 1 | Packoff, CW, MBU-3T, Inner, Emergency, Nested, 11" x 5-1/2" With 7-5/8" Seal Neck, 4-13/16" HBPV Threads & 4.74" Min. Bore, Arranged For Hold Down Ring, 6A-PU-EE-NL-1-2<br>Part # 119402 |
| A27b | 1 | Hold Down Ring, For 22 Slip Casing Hanger, With 11.250" 4 Stub Acme 2G Left Hand Thread Pin x 8.00" I.D. x 2.62" Long, 4140 110K<br>Part # 116161 |

## RENTAL EQUIPMENT

| Item | Qty | Description |
|---|---|---|
| R1 | 1 | Riser Adapter, CW, SRA, 20" x 20" SOW top x 19.5" ID, 8.5" Long With (8) 1" 8UNC-2B Taped Holes<br>Part # 100549 |
| R2 | 1 | Hub, CW, Threaded, MBU-3T, 13-5/8" 10M With 21.750" 2 Stub Acme 2G Left Hand Box Thread<br>Part # 116992 |
| R3 | 1 | Drilling Adapter, CW, MBU-3T, 13-5/8" 10M Quick Connect Bottom x 13-5/8" 10M Studded Top x 15.0" Long, Temp. Rating PU<br>Part # 116966 |
| R4 | 1 | TA Cap, CW, MBU-3T-HPS, 9", 13-5/8" 10M Quick Connect, With One 1-13/16" 10M Studded Outlet, VR Thread & 1/2" NPT Port, 6A-U-AA-1-1<br>Part # 117347 |
| R5 | 1 | Secondary Seal Bushing, CW, TA-HPS, 9" x 7-5/8" x 4.31" Long, With 7.731 Min. Bore, 6A-U-AA-1-1<br>Part # 108466 |
| R6 | 1 | Packoff Running/Cementing Tool, CW, MBU-3T-UPR, 13-5/8" with 11.250" 4 Stub Acme-2G LH pin bottom x 7-5/8" Buttress box top, with ball bearings<br>Part # 125221 |

## RECOMMENDED SERVICE TOOLS

| Item | Qty | Description |
|---|---|---|
| ST1 | 1 | Casing Hanger Lift Ring, CFL-R, With 14.000" 2 Stub Acme 2G Left Hand Threads, 4140 110K<br>Part # 119126 |
| ST2 | 1 | Casing Hanger Running Tool, CW, MBU-3T-CFL-R, 13-3/8" Buttress Box Top x 14.000" 2 Stub Acme 2G Left Hand Box Bottom Landing Thread, 12.60" Min. Bore<br>Part # 118176 |
| ST3 | 1 | Casing Hanger Torque Collar, CW, MBU-3T-CFL-R, For 16" Neck, 4140 110K<br>Part # 118178 |
| ST4 | 1 | Test Plug/Retrieving Tool, CW, MBU-3T, 13-5/8" x 4-1/2" IF (NC50) Box Bottom & Top, With 1-1/4" Line Pipe Bypass & Spring Loaded Dogs<br>Part # 116972 |
| ST5 | 1 | Test Plug Assembly With Spacer Subs, 13-5/8" 4-1/2" IF (NC50) Consisting Of: |
| | 2 | Test Plug/Retrieving Tool, CW, 13-5/8" x 4-1/2" IF (NC50) Box Bottom & Top, With 1-1/4" Line Pipe Bypass & Spring Loaded Dogs<br>Part # 104467 |
| | 2 | Sub, DARCO, 4-1/2" IF (NC50) Pin x 4-1/2" IF (NC50) Pin, 18" Long, (Threads On), 4140 110K<br>Part # 123926 |
| ST6 | 1 | Wear Bushing, CW, MBU-4T-LWR, 13-5/8" x 12.31" Min. Bore x 50.0" Long, With 12.489" I.D. From Top To 3.0" From Bottom, With 3/8" Upper O-Ring<br>Part # 126048 |
| ST7 | 1 | Casing Hanger Running Tool, CW, TP4, 13-5/8" x 9-5/8" Buttress Box Top x 10.250" 4 Stub Acme 2G Right Hand Pin Bottom, 1000K Max. Load Capacity, 18,000 Ft-Lbs Max. Torque, Spec. For Rotating Casing String<br>Part # 117769 |

## RECOMMENDED SERVICE TOOLS

| Item | Qty | Description |
|---|---|---|
| ST8 | 1 | Torque Collar, CW, For Use With Running Tool, TP, 10.250" 4 Stub Acme 2G Right Hand Pin Bottom, Arranged For 11.50" O.D. x 5.00" Long Box Hanger Neck, 36,000 Ft-Lbs Max. Torque<br>Part # 118906 |
| ST9 | 1 | Wash Tool, CW, MBU-3T-LR, MBS2 & Fluted, 13-5/8" x 4-1/2" IF (NC50) Box Top Thread, With Brushes<br>Part # 106277 |
| ST10 | 1 | Packoff Running Tool, CW, MBU-4T-LWR, 13-5/8" Stack With 10.500" 4 Stub Acme 2G Left Hand Pin Bottom x 4-1/2" IF (NC50) Box Top, With Ball Bearings<br>Part # 122647 |
| ST11 | 1 | Wear Bushing, CW, MBU-4T-MID, Stack, 13-5/8" x 9.00" I.D. x 28.0" Long<br>Part # 123523 |
| ST12 | 1 | Casing Hanger Running Tool, CW, TP8, 13-5/8" x 7-5/8" (29.7#) STINGER FLUSH Box Top x 10.250" 4 Stub Acme 2G Right Hand Pin Bottom, max load capacity 1000K, Max. Torque 18,000 Ft-Lbs, Spec. For Rotating Casing String<br>Part # NPN |
| ST13 | 1 | Packoff Running Tool, CW, MBU-3T-UPR, 13-5/8" Nested, With 11.250" 4 Stub Acme 2G Left Hand Pin Bottom x 4-1/2" IF NC50 Box Top, With Seal Sleeve & Ball Bearings (Seal Sleeve Removed)<br>Part # 117310<br>OR<br>Packoff Running Tool, CW, MBU-3T-UPR, 13-5/8" Stack With 11.250" 4 Stub Acme-2G LH Pin Bottom x 4-1/2" IF (NC50) Box Bottom And Top, With Ball Bearings<br>Part # 116996 |
| ST14 | 1 | Test Plug, CW, MBU-3T Inner, 11" x 4-1/2" IF (NC50) Box Bottom & Top, 1-1/4" Line Pipe bypass<br>Part # 125190 |

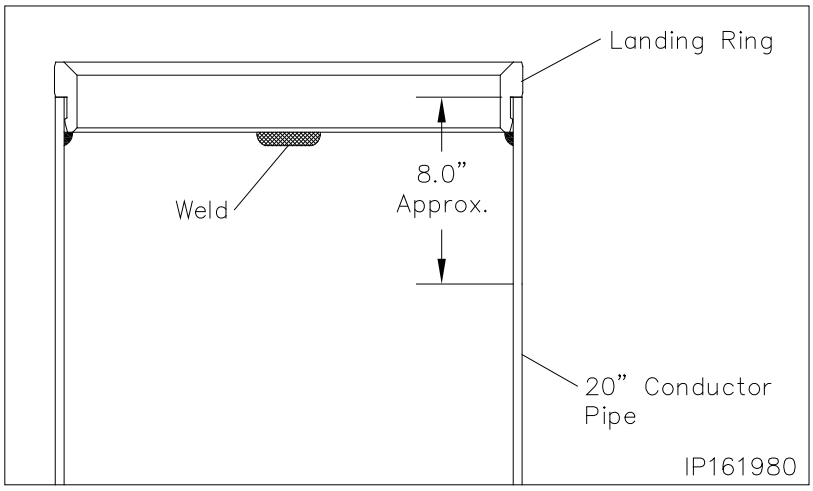
## RECOMMENDED SERVICE TOOLS

| Item | Qty | Description |
|---|---|---|
| ST15 | 1 | Wear Bushing, CW, MBU-3T (-ONE), Upper, Nested, 13-5/8" x 11" x 7.00" I.D. x 20.0" Long, Arranged For 13-5/8" Retrieving Tool<br>Part # 123959 |
| ST16 | 1 | Casing Hanger Running Tool, CW, TP8, 6.125" 4 Stub Acme RH pin bottom x 5-1/2" (20#) ANACONDA FLUSH box top, with 4.762" minimum bore & load capacity TBD, max torque TBD, special for rotating casing string, 4140 125K<br>Part # NPN |
| ST17 | 1 | Torque Collar, CW, casing hanger, for use with 7.62" OD x 15.44" long hanger neck and 10.83" OD running tool, maximum torque 35000 ft lbs.<br>Part # 117319 |
| ST18 | 1 | Wash Tool, CW, casing hanger, MBU-2LR/MBS2-R fluted, 11" x 4-1/2" IF (NC-50) box top threads, fabricated<br>Part # 103164 |
| ST19 | 1 | Packoff Running Tool, CW, MBU-3T-SN, 7-5/8", 8.750" 4 Stub Acme 2G LH pin bottom x 4-1/2" IF (NC-50) box top, with ball bearings<br>Part # 117306 |
| ST20 | 1 | Emergency Packoff Running Tool, Crossover Sub, CW, 4-13/16" HBPV Pin Thread Bottom x 4-1/2" IF (NC50) Box Top, 18.0" Long, 4140 110K<br>Part # 118942 |
| ST21 | 1 | Back Pressure Valve, CW, H-CW, 4-13/16" One Way 6A-DD<br>Part # 114980 |

# Stage 1 — Install the Landing Ring

1. Run the 20” conductor pipe to the required depth and cement.
2. Cut the 20” conductor pipe at predetermined elevation below grade to facilitate the installation of the balance of the wellhead equipment.
3. Grind stub level with the horizon and place an 1/8” x 1/8” bevel on the I.D. and O.D. of the stub.
4. Examine the ***20” Nominal x 20” x 3/8” WT, Landing Ring (Item A1)***. Verify the following:
   - grinding nib is free of excessive scratches or gouges
   - entire ring is clean and free of debris
5. Using a wire brush, thoroughly clean the top 6” of the conductor pipe stub, inside and outside, removing all loose rust and scale.
6. Using a pair of I.D. callipers, measure the I.D. of the 20” pipe stub in two opposing positions.
7. Using the O.D. caliper, measure the O.D. of the landing ring grind nib.
8. Using a disc grinder, grind the O.D. of the nib until its dimension is slightly smaller then the I.D. of the pipe.
9. Pick up the landing ring and carefully push it into the pipe stub until the stub contacts the stop shoulder on the O.D. of the ring as shown.

**NOTE:** Tack weld the bottom of the ring to the I.D. of the pipe in four equally spaced places. Tacks should be approximately 2” long.



# Stage 2 — Install the Diverter

The diverter riser is designed to carry the drilling fluids to the reserve pit during the drilling of the surface casing hole section. Due to the fact that the surface casing will be run and landed through the riser, it will be necessary to lift the riser a minimum of 21.0” in order to clear the surface casing hanger. Ensure that the riser is fabricated to consider these lift and height requirements.

1. Examine the ***20” Nominal x 20” Riser Connector (Item R1).*** Verify the following:
   - bore is clean and free of debris
   - hex head set screws are in place and fully retracted from the bore
   - o-ring is properly installed and undamaged
   - connector is properly welded to 20” fabricated riser

2. Lightly lubricate the I.D. of the riser connector and O.D. of the landing ring with light grease.

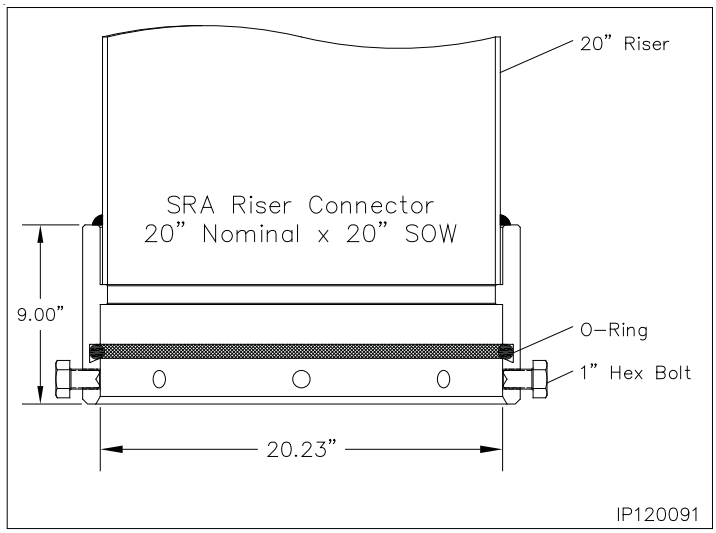
3. Slide the connector over the landing ring until the connector bottoms out on the landing ring.

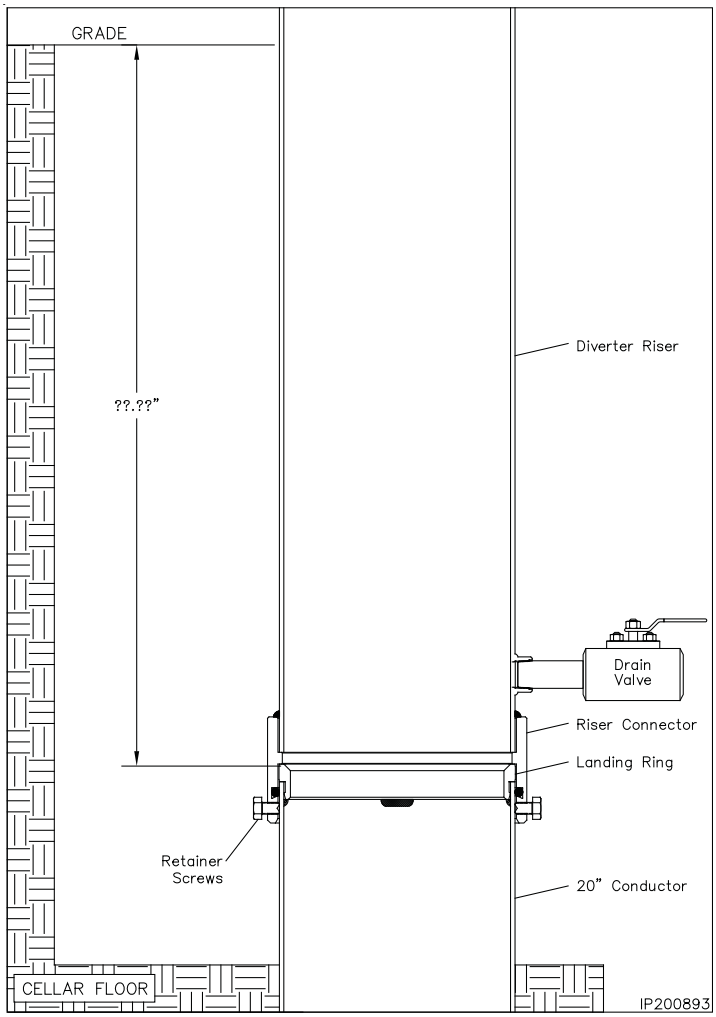
**NOTE:** In cold weather environments it is recommended to remove the o-ring from the connector and heat it on the floor board of the service vehicle or heat the O.D. of the connector with a rose bud to soften o-ring for easier installation.

4. Using a 1-5/8” socket, run in all 8 of the connector hex head set screws in an alternating cross fashion and torque to 100 ft-lbs.

5. Attach flow line and guide wires as required.

6. Drill out and condition the hole for the 13-3/8” surface casing.



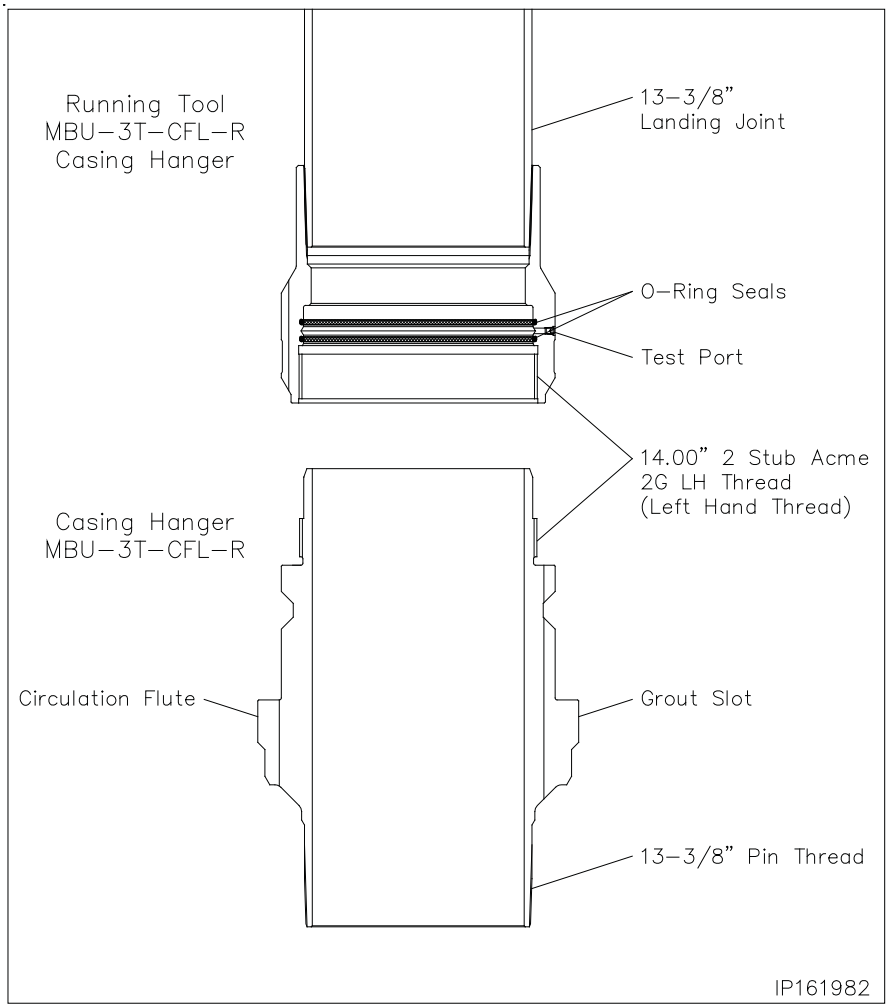



# Stage 3 — Hang Off the 13-3/8” Casing

1. Examine the ***13-3/8” (68#) Buttress Pin Bottom x 14.000” 2 Stub Acme 2G LH Pin Top MBU-3T-CFL-R Casing Hanger (Item A2).*** Verify the following:
   - external threads are clean and in good condition
   - bore is free of debris
   - seal area is clean and undamaged
   - casing thread protector is in place

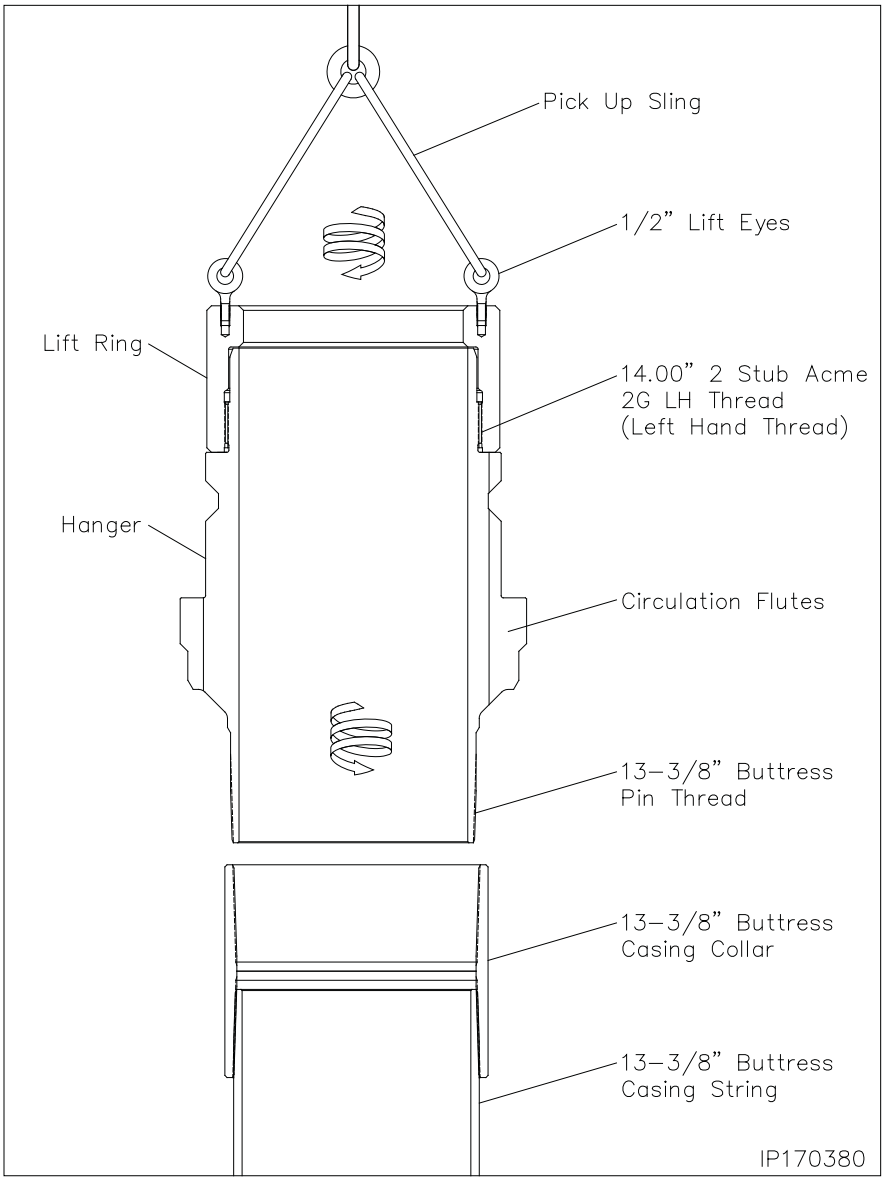
2. Examine the ***13-3/8” Box MBU-3T-CFL-R Casing Hanger Running Tool (Item ST2).*** Verify the following:
   - internal threads are clean and in good condition
   - bore is free of debris
   - o-rings are in place and undamaged

3. Make up a 13-3/8” landing joint in the top of the running tool and torque connection to thread manufacturer’s maximum make up torque.



# Stage 3 — Hang Off the 13-3/8” Casing

4. Examine the ***14.000” 2 Stub Acme LH Box Casing Hanger Lift Ring Assembly (Item ST1).*** Verify the following:
   - threads are clean and in good condition
   - 1/2” lifting eyes are in place and tightened securely
5. Liberally lubricate the mating threads of the lift ring and casing hanger.
6. Thread the lift ring onto the top of the casing hanger with counter clockwise rotation to a positive stop. Move the hanger to the rig floor.
7. Drill and condition the hole for the 13-3/8” casing.
8. Run the 13-3/8” casing as required and space out appropriately for the mandrel casing hanger.
9. Set the last joint of casing run in the floor slips.
10. Thoroughly clean and inspect the casing collar threads for and damage and repair or replace collar if necessary.
11. Remove the casing hanger pin thread protector.
12. Apply the appropriate thread lubricant the pin and box connection.
13. Attach a suitable lifting device to the hanger lift ring using the 3/4” lifting eyes and carefully lower the hanger into the casing collar.
14. Rotate the hanger by hand counter-clockwise to locate the thread start and then clockwise to a positive stop. Tighten securely with strap wrench.



# Stage 3 — Hang Off the 13-3/8” Casing

15. Remove the lift ring with clockwise rotation and set aside.

16. Pick up the running tool/landing joint.

17. Thoroughly clean and lightly lubricate mating threads, seal areas and o-rings of the casing hanger and running tool with oil or a light grease.

18. Carefully lower the running tool over the hanger neck until the acme threads make contact.

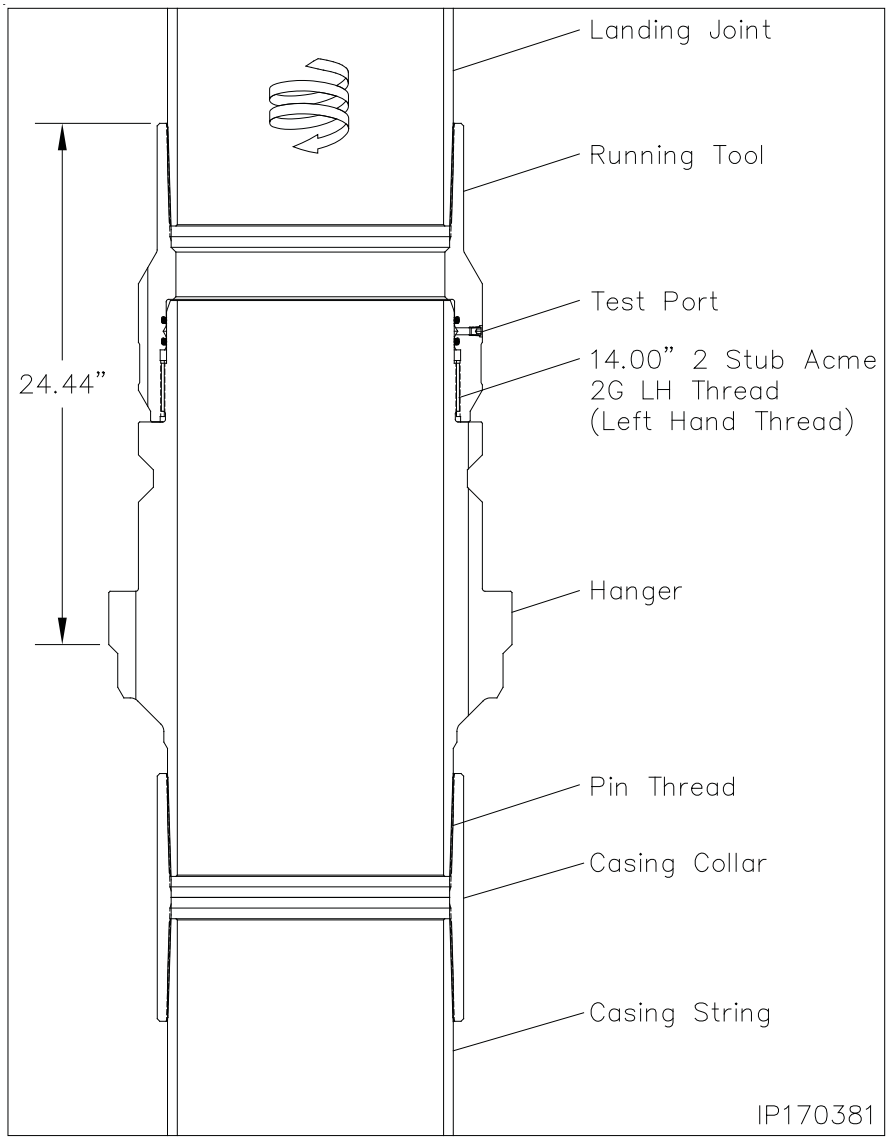
19. ***Using chain tongs only,*** rotate the running tool to the right to locate the tread start and then to the left to a positive stop. Approximately 4-1/2 turns.

**CAUTION: Do Not** apply torque to the hanger/tool connection.

20. Remove the 1/8” LP flush fitting Allen head pipe plug from the O.D. of the running tool and attach a test pump.

21. Apply hydraulic test pressure to ***5,000 psi*** and hold for 15 minutes or as required by drilling supervisor.

22. Upon completion of a successful test, bleed off pressure through the test pump and remove the pump. Reinstall the pipe plug in the open port and tighten securely.



# Stage 3 — Hang Off the 13-3/8” Casing

23. Rotate the running tool by hand counter clockwise to align the circulation flutes of the tool with the drilled holes in the body of the casing hanger.

24. Install the split assembly ring on the casing hanger as indicated and secure with assembly bolts.

25. Examine the ***16” Nominal Torque Collar (Item ST3).*** Verify the following:
    - cap screws are in place and in good condition
    - upper and lower torque pins are in place and fully retracted

26. Install the 1” lifting eyes in two upper 1” tapped holes located 180° apart and 90° from the split in the collar.

27. Remove the 3/4” assembly cap screws and separate the tool in half.

28. Remove the low set of torque pins.

29. Using a suitable lifting device with weight rated slings, assemble the two halves of the torque collar around the casing hanger/running tool assembly and secure the collar halves with the 3/4” cap screws. Torque screws to approximately 100 ft-lbs.

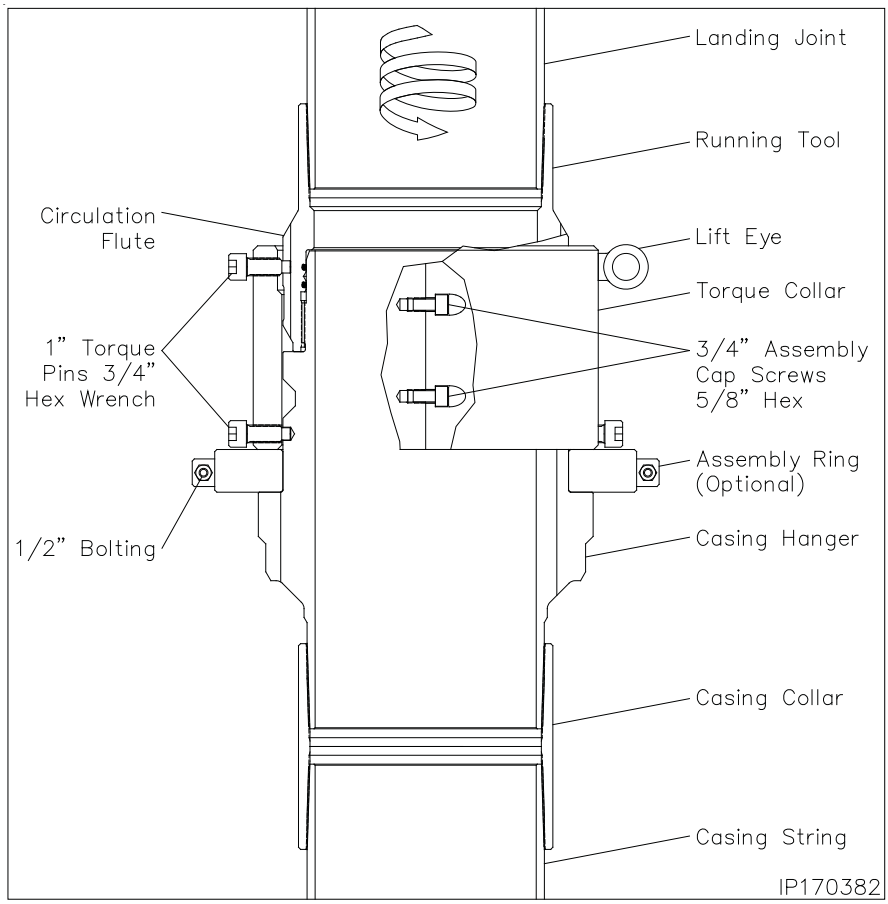
30. Remove the lifting eyes.

31. Align the lower tapped holes in the collar with the drilled holes in the hanger body.

32. Install the (4) lower torque pins and tighten securely.

33. Run in the (4) upper torque pins and tighten securely.

34. Engage the CRT tool to the landing joint and rotate the landing joint with casing hanger and running tool clockwise (right) until the optimum make up torque is achieved and the torque diamond is properly positioned.




35. Back off all (8) torque screws.

36. Remove two upper torque pins and install the lifting eyes.

37. Attach a suitable lifting device with weight rated slings to the torque collar halves and remove the 3/4” cap screws and separate the torque collar.

38. Set the assembly aside and remove the split assembly ring.

# Stage 3 — Hang Off the 13-3/8” Casing

39. Calculate the total landing dimension by adding the RKB dimension and predetermined dimension, the location of the landing ring below grade.

40. Starting at the top of the 45° angle load shoulder of the casing hanger measure up the landing joint the calculated distance and place a paint mark on the joint. Mark **HANGER LANDED**.

41. Pick up the casing string and remove the floor slips and rotary bushings.

42. Carefully lower the hanger through the diverter and land it on the landing ring.

43. Slack off all weight and verify that the paint mark on the landing joint has aligned with the rig floor.

44. Place a vertical paint mark on the landing joint to verify if the casing string rotates during the cementing process.

45. Cement the casing as required.

**NOTE:** Returns may be taken through the circulation slots and out the diverter or out the top out nipple below the diverter.

46. With cement in place, bleed off all pressure and remove the cementing head.

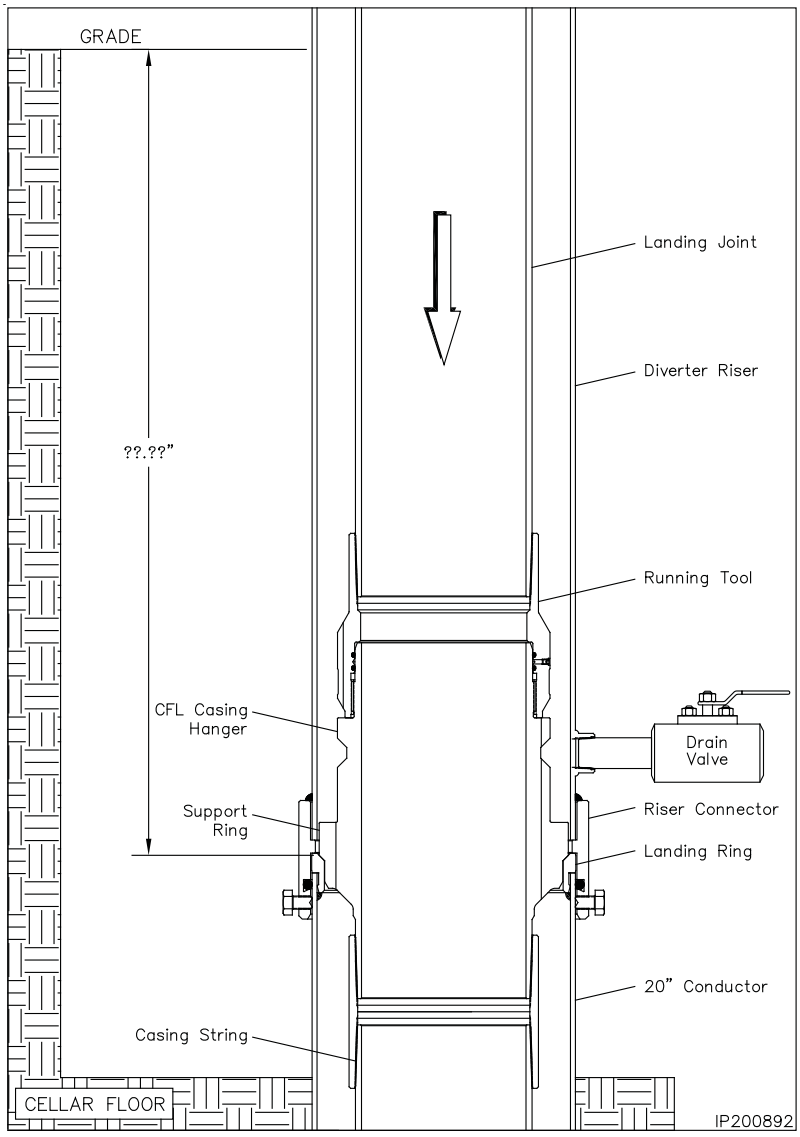
47. ***Using chain tongs only, located 180° apart,*** retrieve the running tool and landing joint by rotating the landing joint clockwise (right) approximately 4-1/2 turns or until the tool comes free of the hanger.

**CAUTION:** The rig floor tong may be used to break the connection but under no circumstances is the top drive to be used to rotate or remove the casing hanger running tool.

48. Attach a suitable lifting device to the diverter and remove the flow line and guide lines.

49. Using a 1-5/8” socket, fully retract the riser connector hex head set screws with left hand rotation.

50. Lift the riser a minimum of 21.0” to clear the casing hanger and then remove the riser from under the rig.




**NOTE:** If the running tool can not easily be removed, complete steps 48 through 50 with the exception of lifting the riser high enough to expose the running tool and landing joint.

51. Attach a back up tong to the casing hanger to resist right hand rotation.

52. Attach another tong to the running tool and apply right hand torque to the connection while rapping on the running tool with a sledge hammer to jar the connection.

53. Once friction bind is released, further rotate the landing joint 4-1/2 turns to remove the tool from the casing hanger.

54. Remove the diverter riser as previously outlined.

# Stage 3 — Hang Off the 13-3/8” Casing

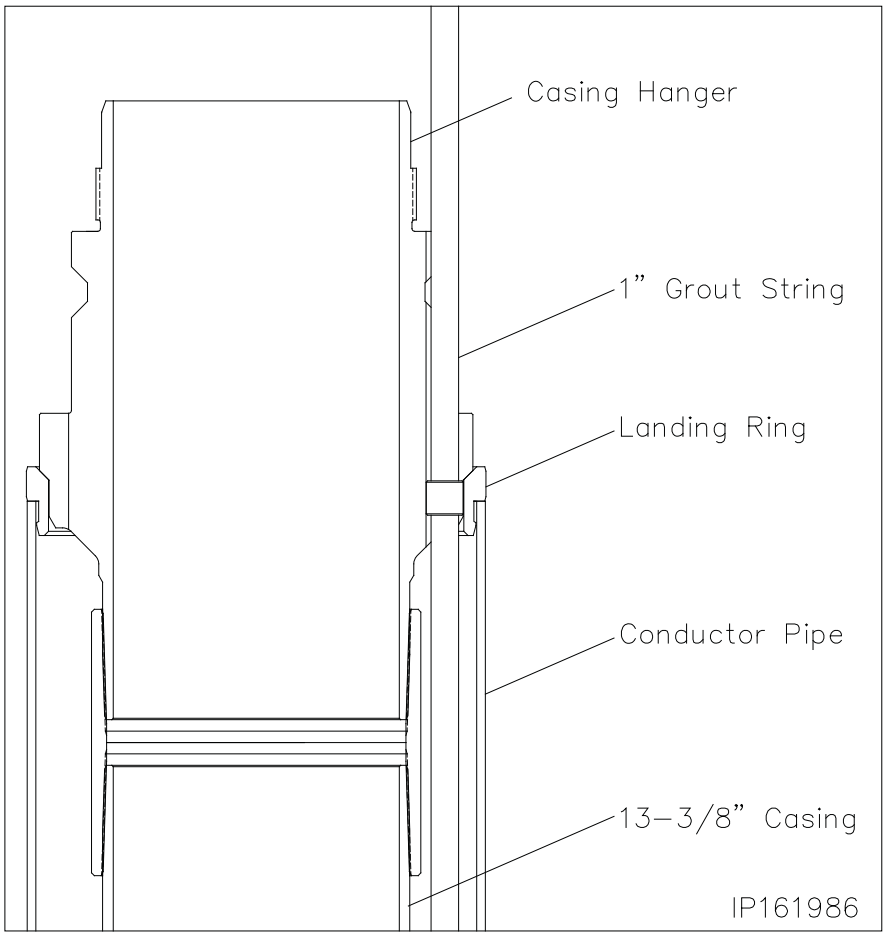
1. Using a 1-5/8” socket, fully retract the (8) riser connector hex head set screws with left hand rotation.

2. Lift the riser a minimum of 20.0” to clear the casing hanger and then remove the riser from under the rig.

In the event that the 13-3/8” surface casing cement requires topping off this can be accomplished through the 1-5/8” wide grout slots in the side of the casing hanger.

3. Carefully run the grout string through the grout slot and along side the 13-3/8” casing and top off the cement as required.

4. With top off complete remove the grout string.



# Stage 4 — Install the MBU-4T-CFL-R-DBLO Housings

1. Using a high pressure water hose, thoroughly clean the top and neck of the CFL hanger, removing all old grease and debris.

2. Examine the ***13-5/8" 10M x 13-3/8 Double 'O' Bottom MBU-4T-CFL-R-DBLO Wellhead Assembly (Item A3 & A5)***. Verify the following:
   - Acme thread are clean and in good condition
   - bore and all internal seal areas are clean and undamaged
   - CFL lockring is in place and fully retracted
   - valves are intact and in good condition
   - o-ring seals are in place and in good condition

**NOTE:** If the threaded hub has been pre-installed in the shop, skip steps 3 through 10.

3. Examine the ***13-5/8" 10M x 21.750" 2 Stub Acme Threaded Hub (Item R2)***. Verify the following:
   - Acme thread are clean and in good condition
   - remove the (4) retainer set screws an place them in a safe place

4. Thoroughly clean and lightly lubricate the mating threads of the housing and the threaded hub with copper coat or never seize.

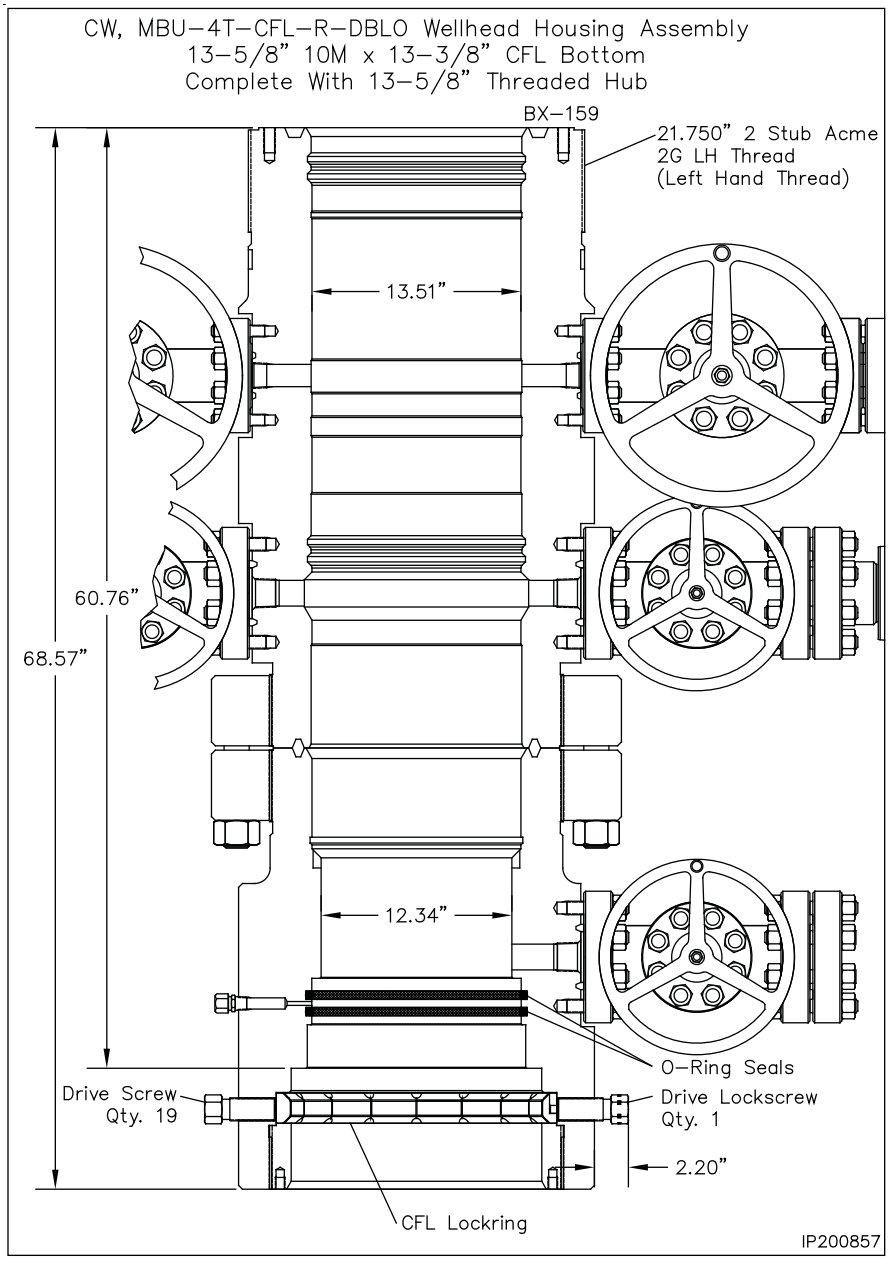
5. Pick up the hub and carefully thread it onto the top of the housing with counter clockwise rotation, until the top of the ring is approximately a 1/4" below the top of the housing.

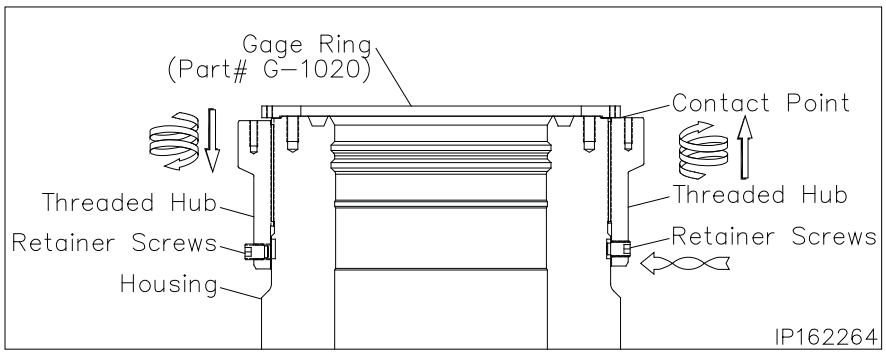
6. Position the hub gage ring on top of the housing with the counter bore down as indicated. Ensure the gage ring is level and straight.

7. Rotate the hub clockwise (UP) until it contacts the gage ring.

**CAUTION:** Do not off seat the gage ring.

8. Locate the retainer screw holes in the threaded hub.



# Stage 4 — Install the MBU-4T-CFL-R-DBLO Housings

9. Rotate the hub up or down to align the holes in the hub with the notches in the housing.

10. Install the set screws and tighten securely. Remove gage ring.

11. Thoroughly clean and lightly lubricate the mating seal surfaces of the hanger neck and the wellhead housing with oil or light grease.

12. Ensure the lockring is heavily coated with grease or copper coat and fully retracted from the bore.

13. Verify that the drive lockscrew is engaged in the retainer groove of the lockring and that the lockring does not rotate.

14. Verify drive screws extend out 2.20" as indicated.

**WARNING:** Keep body clear of all pinch points and suspended loads.

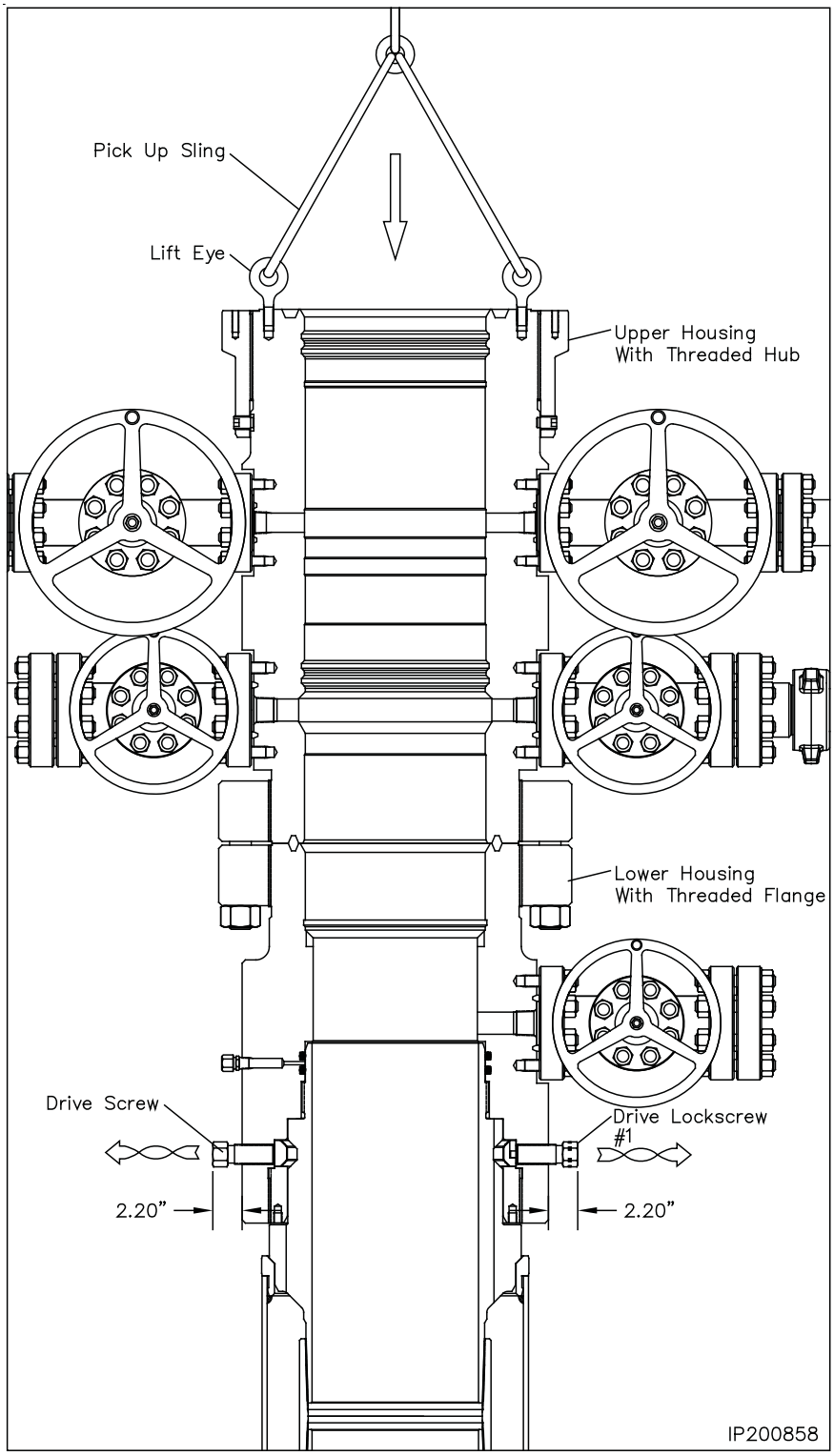
15. Attach a four point lifting sling to the lifting eyes of the housing and suspend the wellhead assembly over the well bore.

**CAUTION:** Ensure all of the lockring drive screws extend out approximately 2.20" (Approximately 5 threads showing). Also ensure drive screw #1 does not extend more then 2.38".

16. Align and level the wellhead assembly over the hanger neck, orienting the outlets so they will be compatible with the production equipment.

17. Carefully lower the assembly over the hanger and land it on the hanger neck.

18. Ensure the wellhead is correctly positioned. It can be rotated at this time to the right or left to attain proper alignment.



# Stage 4 — Install the MBU-4T-CFL-R-DBLO Housings

## Test Between the 'O-ring' Seals

1. Locate the "SEAL TEST" fitting on the lower O.D. of the housing and remove the fitting dust cap.

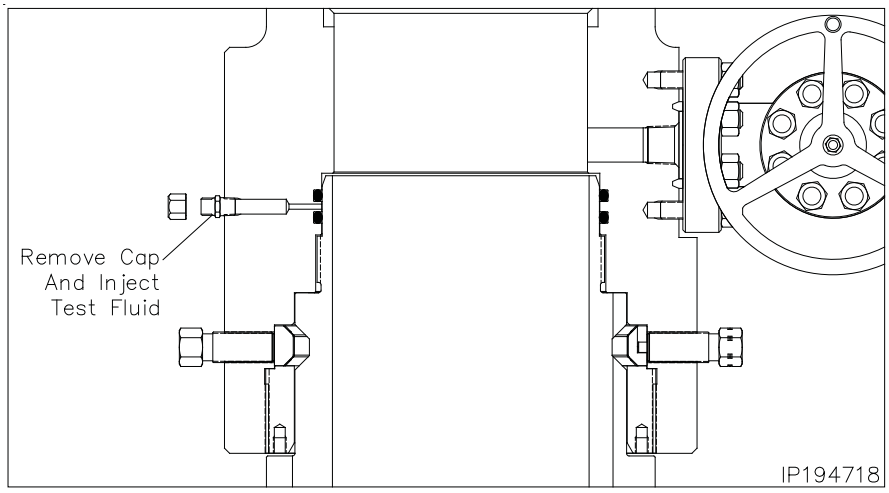
2. Attach a hydraulic test pump to the open fitting and inject test fluid between the 'o-ring' seals until a stable test pressure of ***5,000 psi*** is achieved**.** Hold the test pressure for 15 minutes or as required by drilling supervisor.

**CAUTION:** Do Not over pressurize!

3. If pressure drops one or both of the 'o-ring' seals may be leaking. Pick up the housing and replace the leaking o-ring seals.

4. Repeat steps 2 and 3 until a satisfactory test is achieved.

5. Bleed off test pressure, leaving the test manifold in place.



# Stage 4 — Install the MBU-4T-CFL-R-DBLO Housings

## Engaging the Lockring

1. Locate the drive lockscrew as indicated in IP Dwg, IP160164 with the scribe marks on the hex and number 1 stamped on the body above the screw.

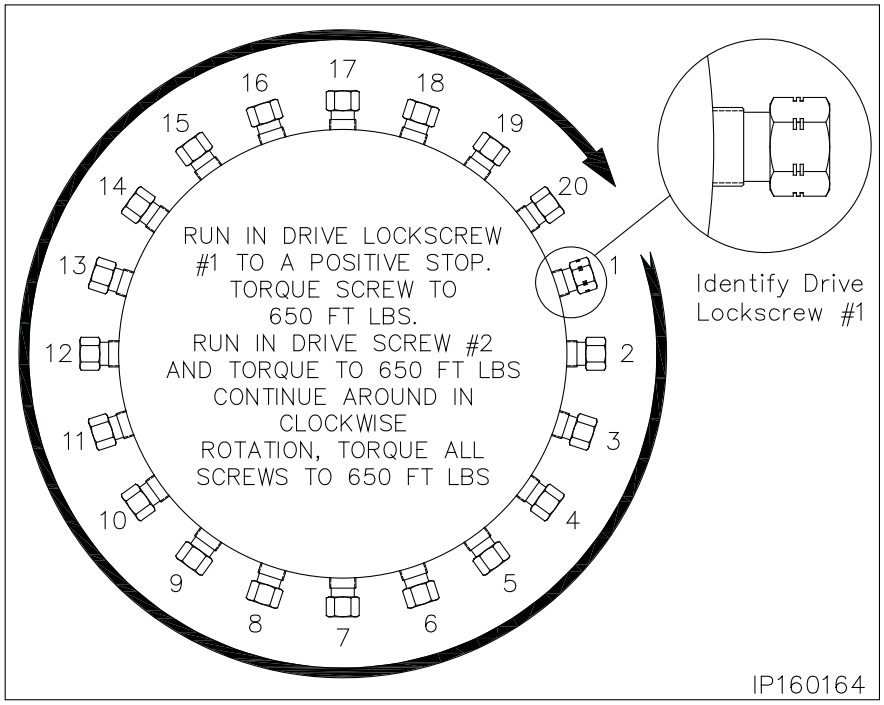
2. Using an 1-5/8" socket, run in the drive lockscrew to a positive stop and torque to 650 ft-lbs.

3. Locate the drive screw to the left marked 2 and fully run in that screw to a positive stop and torque to 650 ft-lbs.

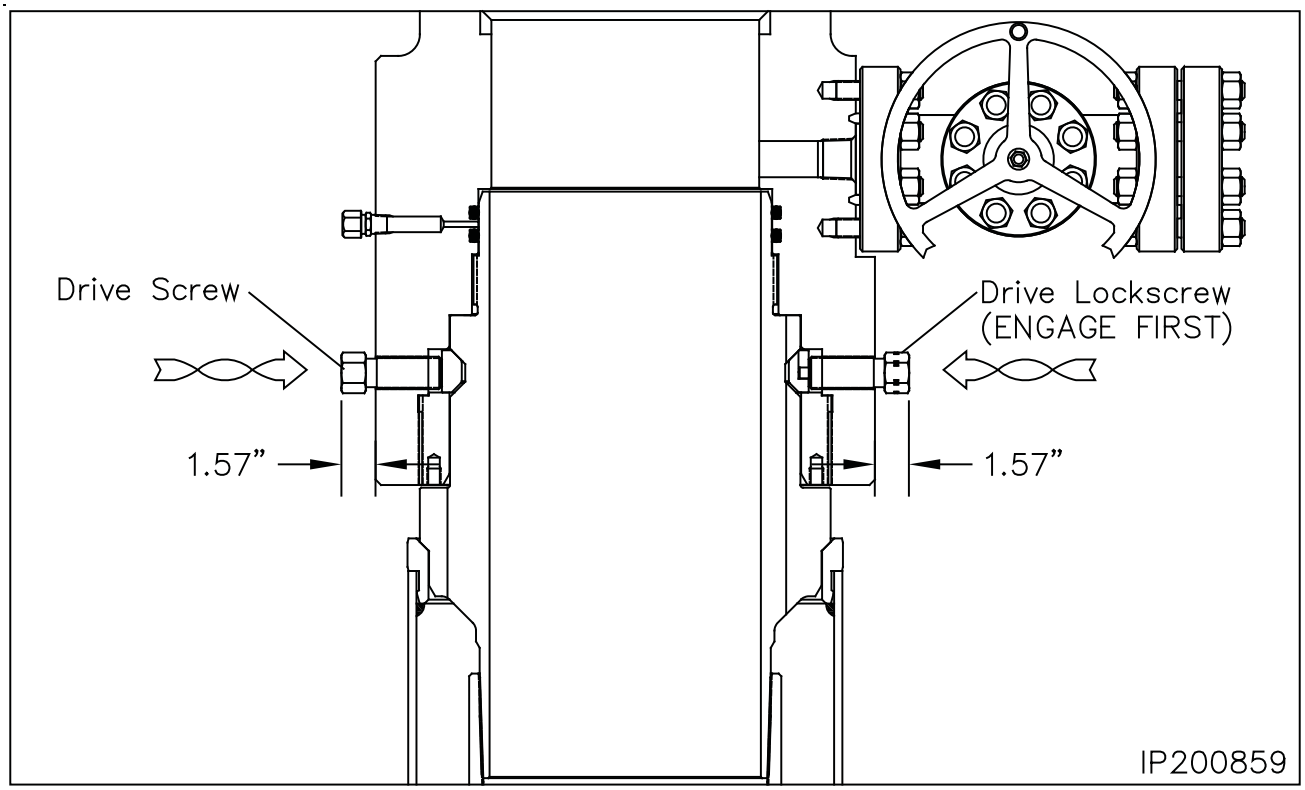
4. Continue around the housing in a clockwise direction, running in and torquing each screw to 650 ft-lbs.

**NOTE:** When properly engaged the drive screws will protrude approximately 1.57" from the O.D. of the housing.

5. With lockring engagement confirmed, reattach the test pump and retest the housing seals as previously outline to confirm seal integrity.




6. Bleed off test pressure and remove the test pump and manifold. Install the dust cap on the open fitting.



# Stage 5 — Install the 13-5/8” 10M Drilling Adapter

1. Examine the ***13-5/8” 10M Studded x 13-5/8” 10M Quick Connect Drilling Adapter (Item R3).*** Verify the following:
   - bores are clean and free of debris
   - ring grooves are clean and undamaged
   - (20) drive screws and clamp segments are properly installed and fully retracted
   - lifting eyes are installed and tightened securely

**NOTE:** Prior to installing the BOP/drilling adapter it is recommended to attain an accurate RKB dimension for future use to accurately land 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. Subtract 6” from this dimension (thickness of drilling adapter above the MBU-4T housing) and ensure this dimension is placed on the BOP board in the dog house and on the drillers daily report sheet.

2. Make up the drilling adapter to the bottom of the BOP stack using a new ***BX-159 Ring Gasket.***

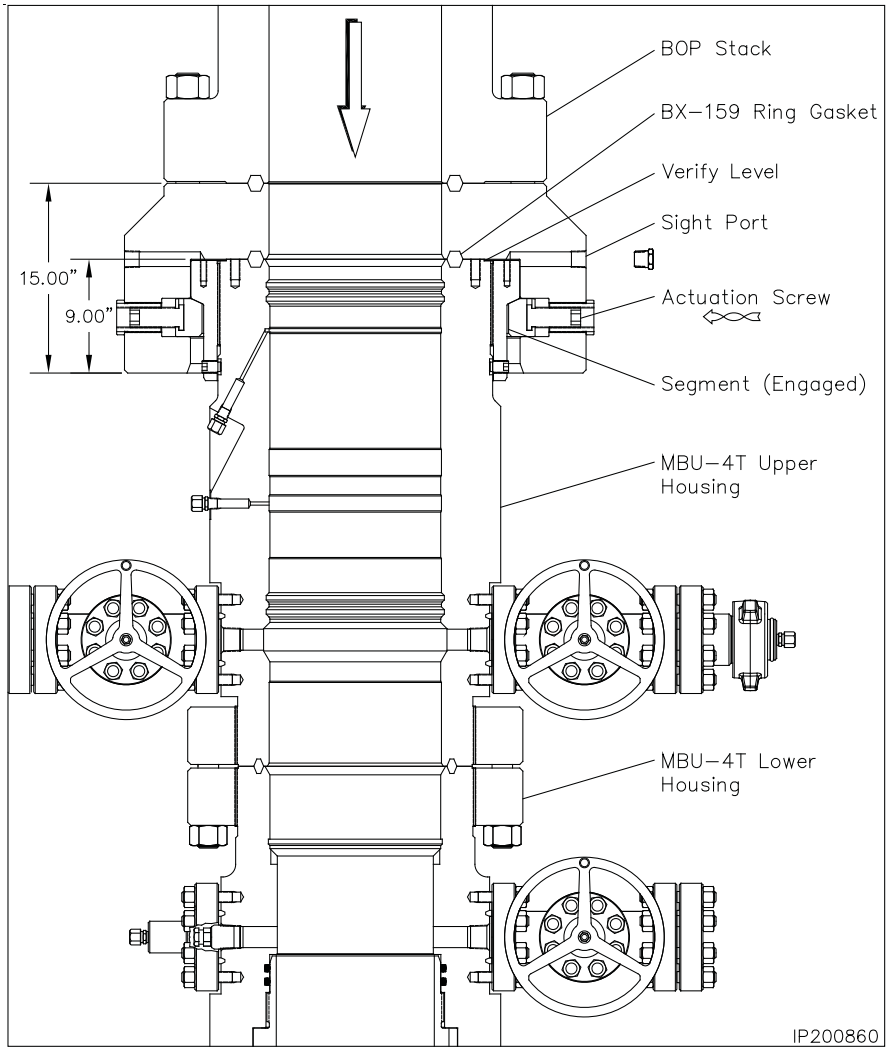
3. Thoroughly clean the threaded hub and ring groove of the MBU-4T housing and the mating clamp segments and ring groove of the drilling adapter.

4. Install a new ***BX-159 Ring Gasket*** into the ring groove of the MBU-4T housing.

**WARNING:** Keep body clear of all pinch points and suspended loads.

5. Pick up the BOP stack and carefully lower it over the top of the wellhead housing and land it on the ring gasket.

6. Remove the (4) 1” sight port pipe plugs and sight through each port to verify the drilling adapter and BOP is level and hub stand off is consistent.




7. Carefully run in all of the drive screws of the drilling adapter to contact point.

8. Ensure the assembly remains level, run in one actuation screw and torque to 100 ft-lbs.

9. Locate the screw 180° from the first and torque it to 100 ft-lbs.

10. Locate the screws 90° to the right and left and torque them to 100 ft-lbs.

11. Position the second 4 point sequence 90° from the first and torque each screw to 200 ft-lbs.

12. Run in all remaining screws to contact. Torque each screw to 400 ft-lbs.

13. Make one additional round until a stable torque of 650 ft-lbs on all (20) screws is achieved.

14. Sight through the 4 sight ports to confirm that the adapter and head are face to face on all sides and the BOP is level.

15. Reinstall the sight port plugs and tighten securely.

# Stage 6 — 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.

## 5,000 PSI Test

1. Examine the ***13-5/8" Nominal x 4-1/2" IF CW MBU-3T Test Plug/ Retrieving Tool (Item ST4)***. 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

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.

**CAUTION:** Ensure 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.

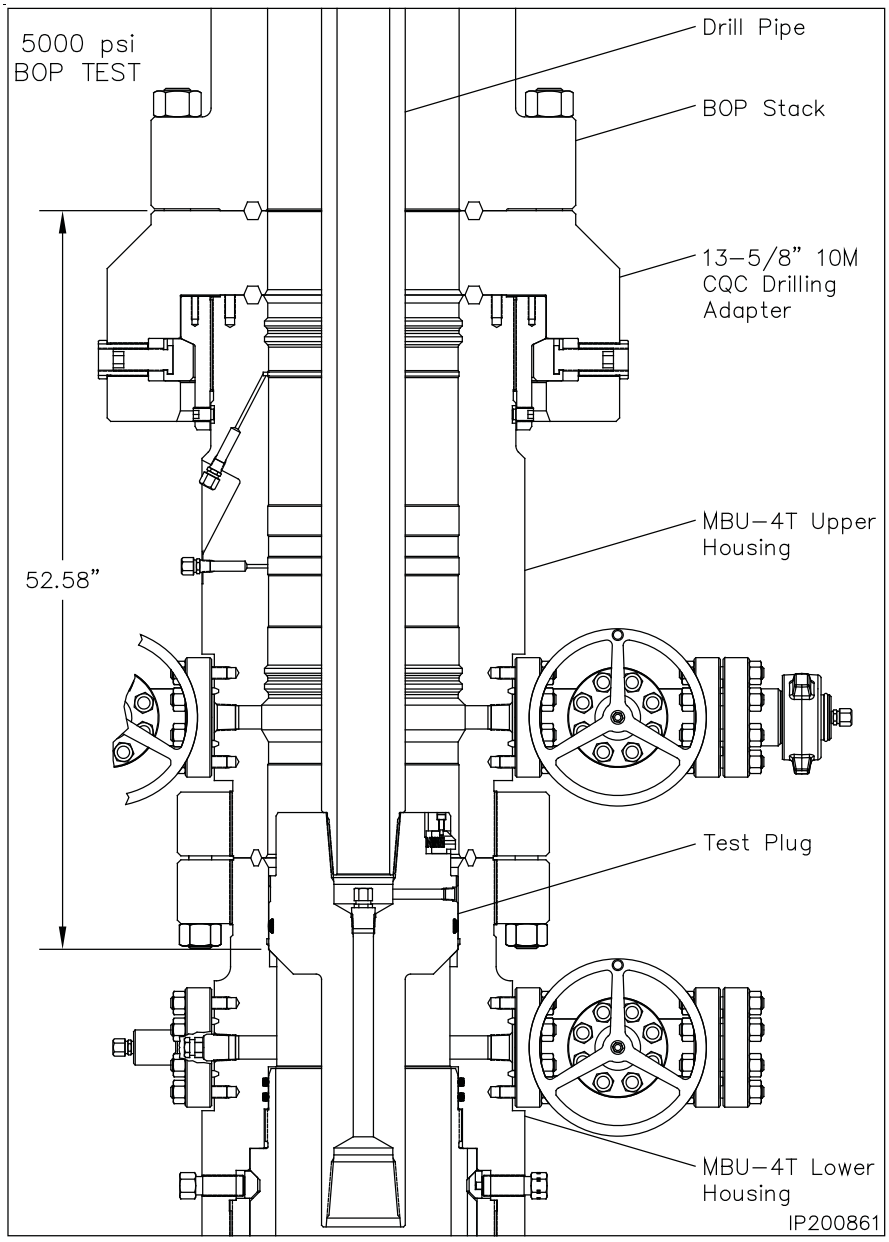
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

4. Open the lower housing lower 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 lower housing, 52.58" below the top of the drilling adapter.

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. Retrieve the test plug with a straight vertical lift.

# Stage 6 — Test the BOP Stack

## 10,000 PSI Test

**NOTE:** The BOP dual test plug assembly will be shipped to location pre-assembled to ensure proper orientation.

1. Examine the ***13-5/8" Nominal x 4-1/2" IF Dual Test Plug Assembly Consisting Of Two 13-5/8" x 4-1/2" IF Combination Tools And Two 4-1/2" IF x 18" Long Pin x Pin Drill Pipe Subs. (Item ST5)***. Verify the following:
   - 1-1/4" VR plug and weep hole plug are in place in upper tool body only and tightened securely
   - elastomer seal is in place on upper tool body only and in good condition
   - drill pipe threads are clean and in good condition

2. Position the assembly in the floor bushing with the pin end down.

**CAUTION:** Ensure the lift lugs are facing up.

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

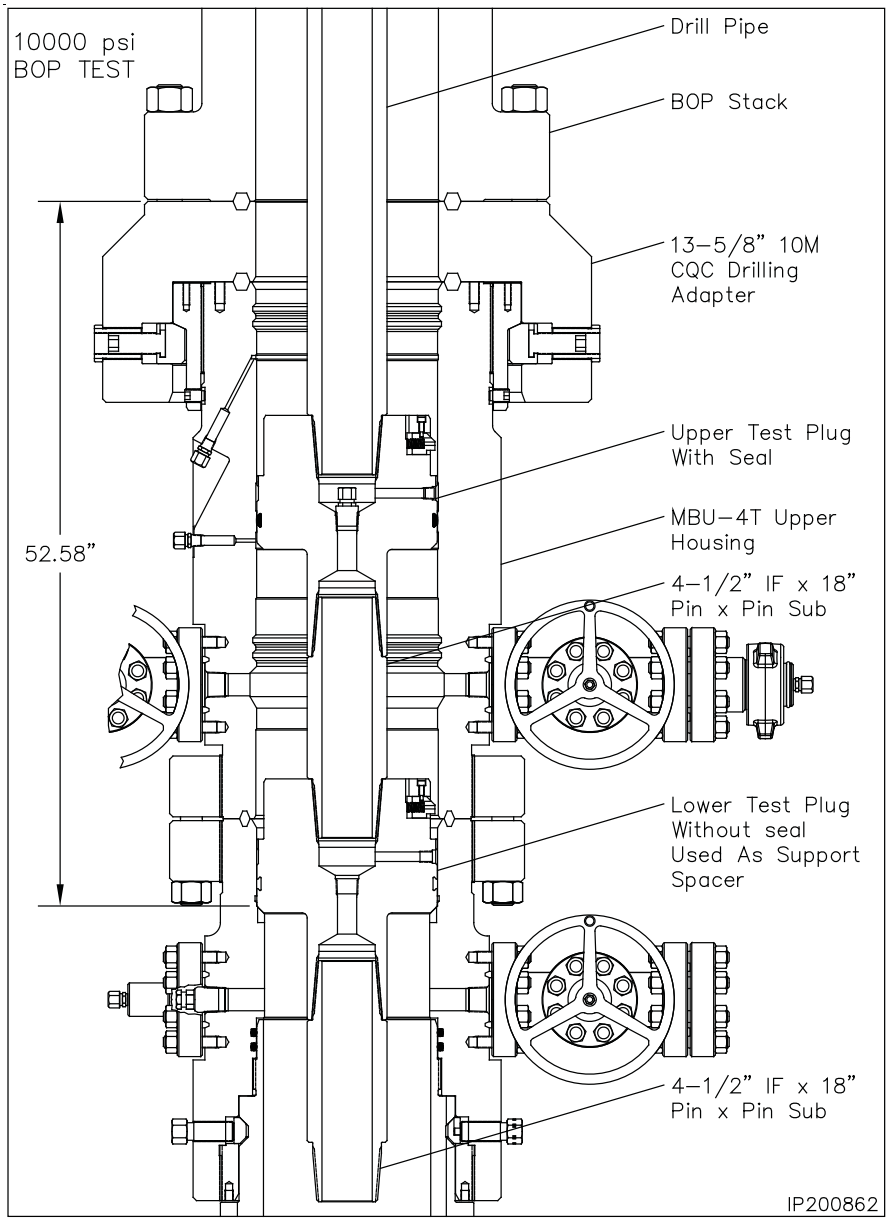
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

4. Open the upper housing lower 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 lower plug on the load shoulder in the lower housing, 52.58" below the top of the drilling adapter.

7. Close the BOP rams on the pipe and test the BOP to 10,000 psi.




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

**CAUTION:** 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 it from the drill pipe.

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. Retrieve the test plug assembly with a straight vertical lift.

10. Close all open valves.

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

# Stage 7 — Run the Lower Wear Bushing

**CAUTION: 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-4T-LWR Wear Bushing (Item ST6).*** Verify the following:
   - internal bore is clean and in good condition
   - trash and shear o-ring 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 (NC-50) CW Retrieving Tool (Item ST4)***. with lift lugs down.

3. Make up the retrieving tool to a joint of drill pipe.

4. Align the retractable lift lugs with the retrieval holes of the bushing and 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 O.D. of the bushing.

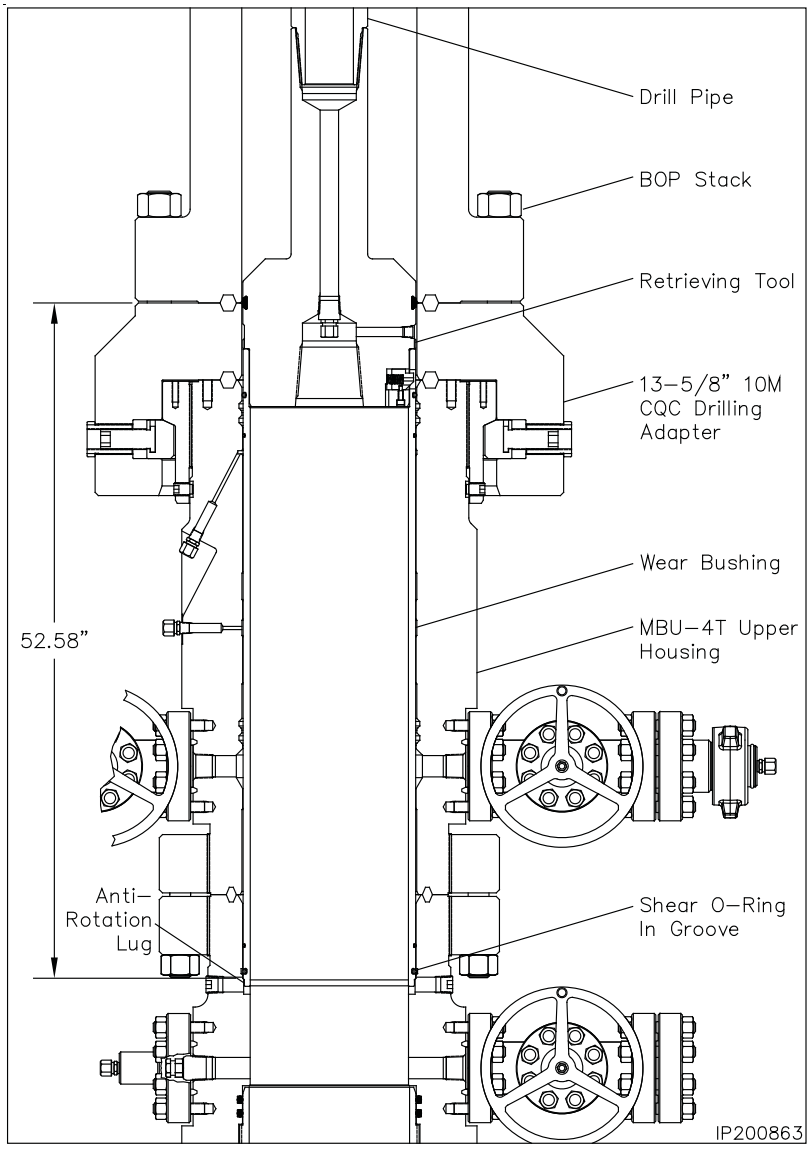
6. Slowly lower the tool/bushing assembly through the BOP stack and land it on the load shoulder in the housing, 52.58" below the top of the drilling adapter.

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".

**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.




**CAUTION:** 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 and rotate the retrieving tool clockwise until a positive stop is felt. This indicates the lugs have snapped into the holes in the bushing.

13. Retrieve the wear bushing. Remove it and the retrieving tool from the drill string.

# Stage 8 — Hang Off the 9-5/8" Casing

1. Examine the ***13-5/8" x 9-5/8" CW, TP4 Casing Hanger Running Tool (Item ST7).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - o-ring seal is clean and in good condition
   - torque dogs are in place, in upper most position and retainer set screws are tightened securely

2. Make up a landing joint to the top of the running tool and torque connection to thread manufacturer's maximum make up torque.

3. Lay down the landing joint on the pipe rack.

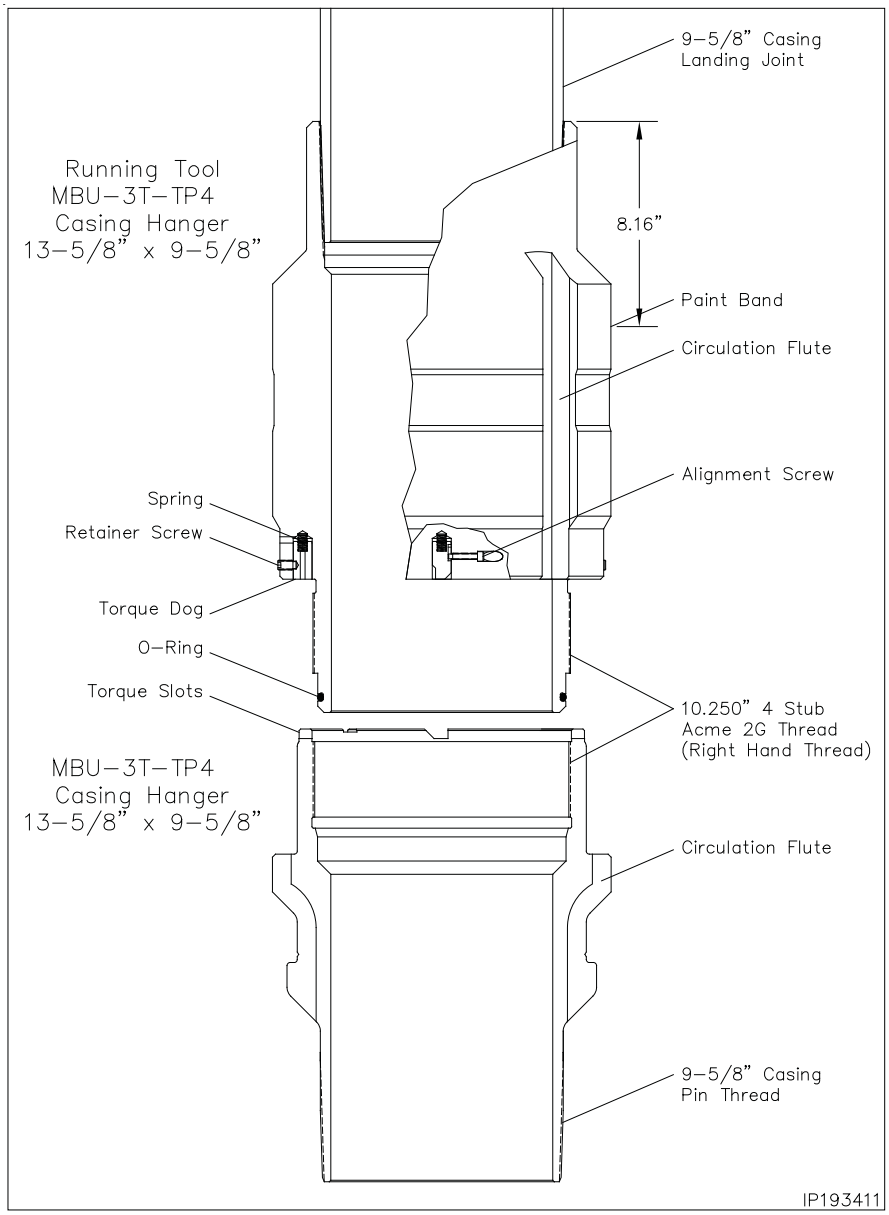
4. On the pipe rack, examine the ***13-5/8" x 9-5/8" CW, MBU-3T-LWR-TP4 Mandrel Casing Hanger (Item A22).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - neck seal area is clean and undamaged
   - torque slots are clean and in good condition
   - pin threads are clean and in good condition. **Install thread protector**
   - place a white paint band around the running tool, 8.16" below the top of the running tool, as indicated and allow paint to dry

5. Liberally lubricate the mating threads, seal areas and o-ring of the hanger and running tool with oil or light grease.

6. ***<u>Using chain tongs only</u>,*** thread the running tool into the hanger, with right hand rotation, until it shoulders out on the hanger body.

**CAUTION: Do Not** apply torque to the hanger/tool connection.

**CAUTION:** If steps 1 through 6 were done prior to being shipped to location, the running tool should be backed off 1 turn and made back up to ensure it will back off freely.



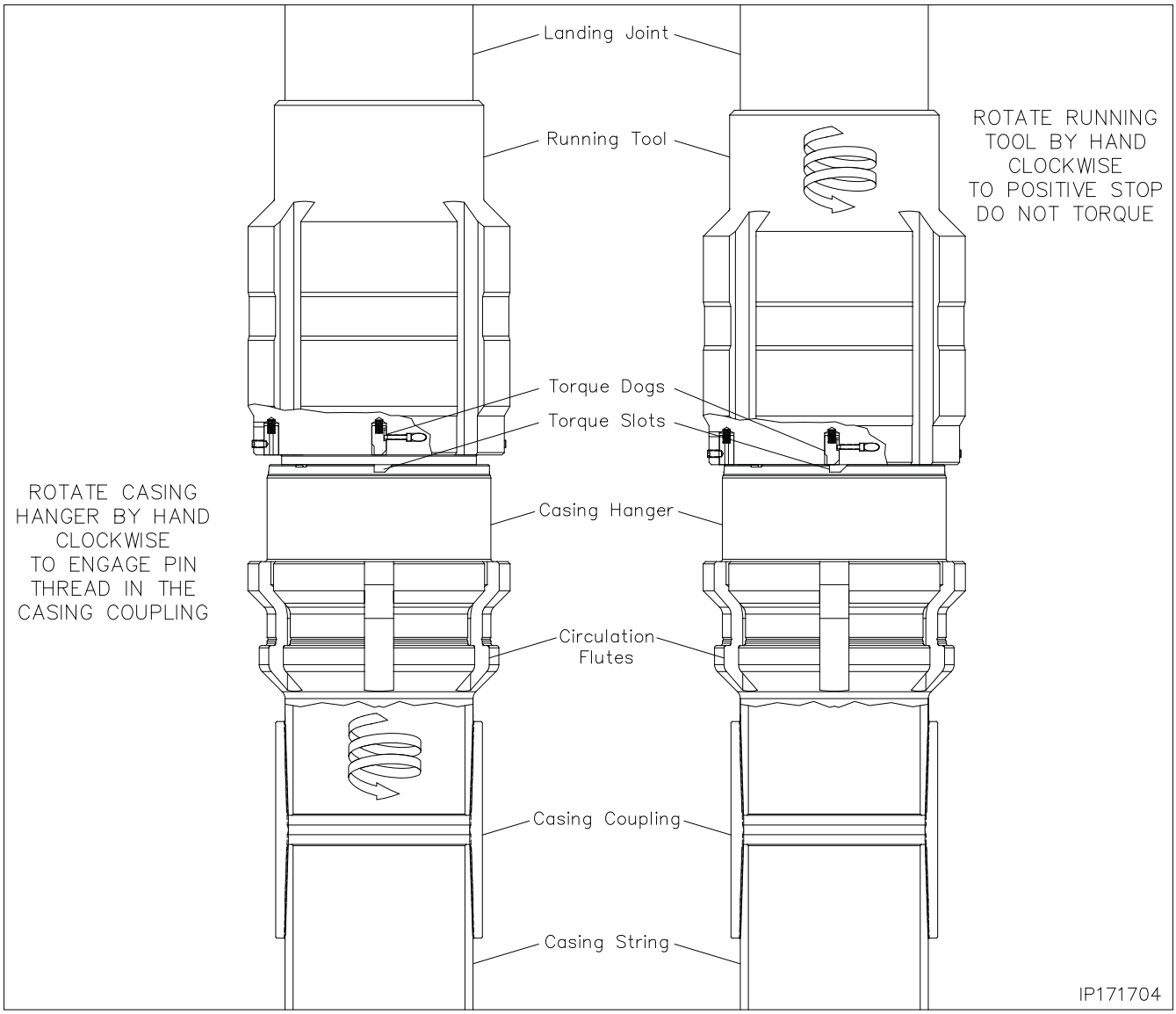

7. Calculate the total landing dimension by adding the previously determined RKB dimension and 52.58", the depth of the wellhead.

8. Starting at the top of the 45° angle load shoulder of the casing hanger, measure up the landing joint and place a paint mark on the joint. Mark **HANGER LANDED**.

9. Place a second mark 52" below the first and mark **STOP ROTATING**.

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

# Stage 8 — Hang Off the 9-5/8” Casing




**NOTE:** If the 9-5/8” casing becomes stuck and the mandrel casing hanger cannot be landed, refer to **Stage 8A** for the emergency procedure.

11. Pick up the casing hanger/running tool joint assembly.

12. Remove the casing hanger thread protector and carefully thread the hanger into the last joint of casing ran. Rotate the hanger clockwise, by hand, to a positive stop.

13. Rotate the running tool clockwise by hand to a positive stop.

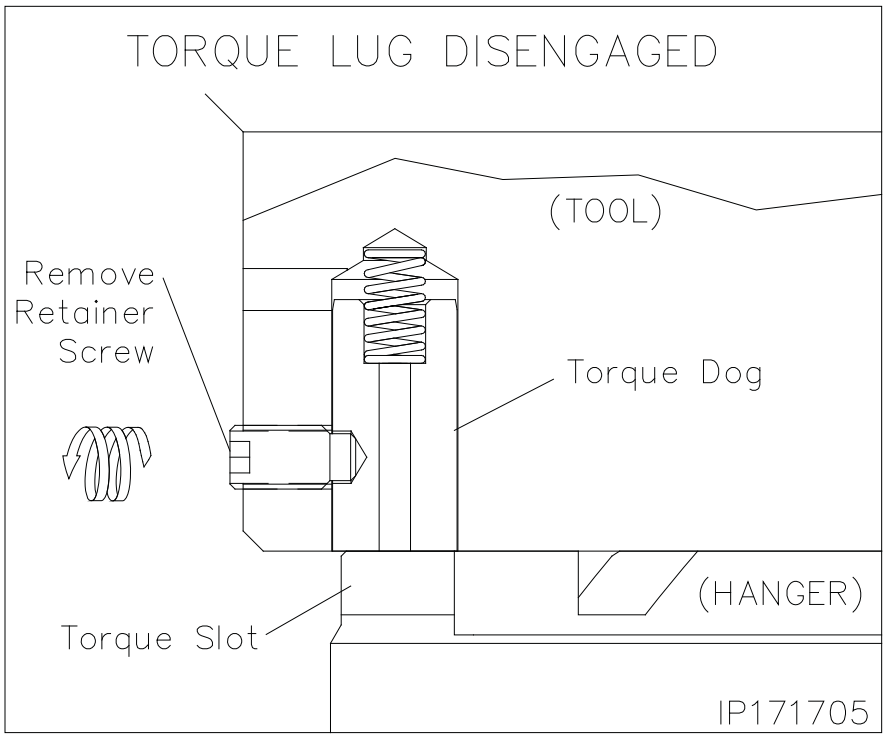
# Stage 8 — Hang Off the 9-5/8” Casing

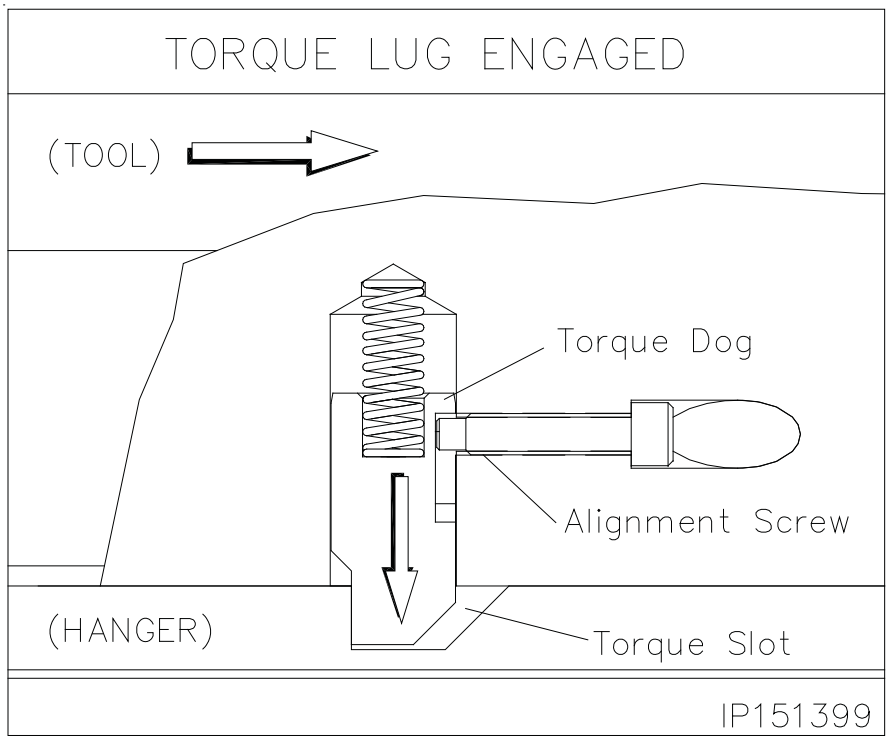
14. Locate the (4) 3/8” socket head set screws in the side of the hanger running tool and remove the screws. This will release the running tool torque dogs allowing them to move downward.

**NOTE:** Place the screws in a safe place to reinstall in the tool when the job is completed.

***15. Using chain tongs only,*** rotate the running tool to the left to allow the torque dogs to engage the torque slots in the top of the hanger.

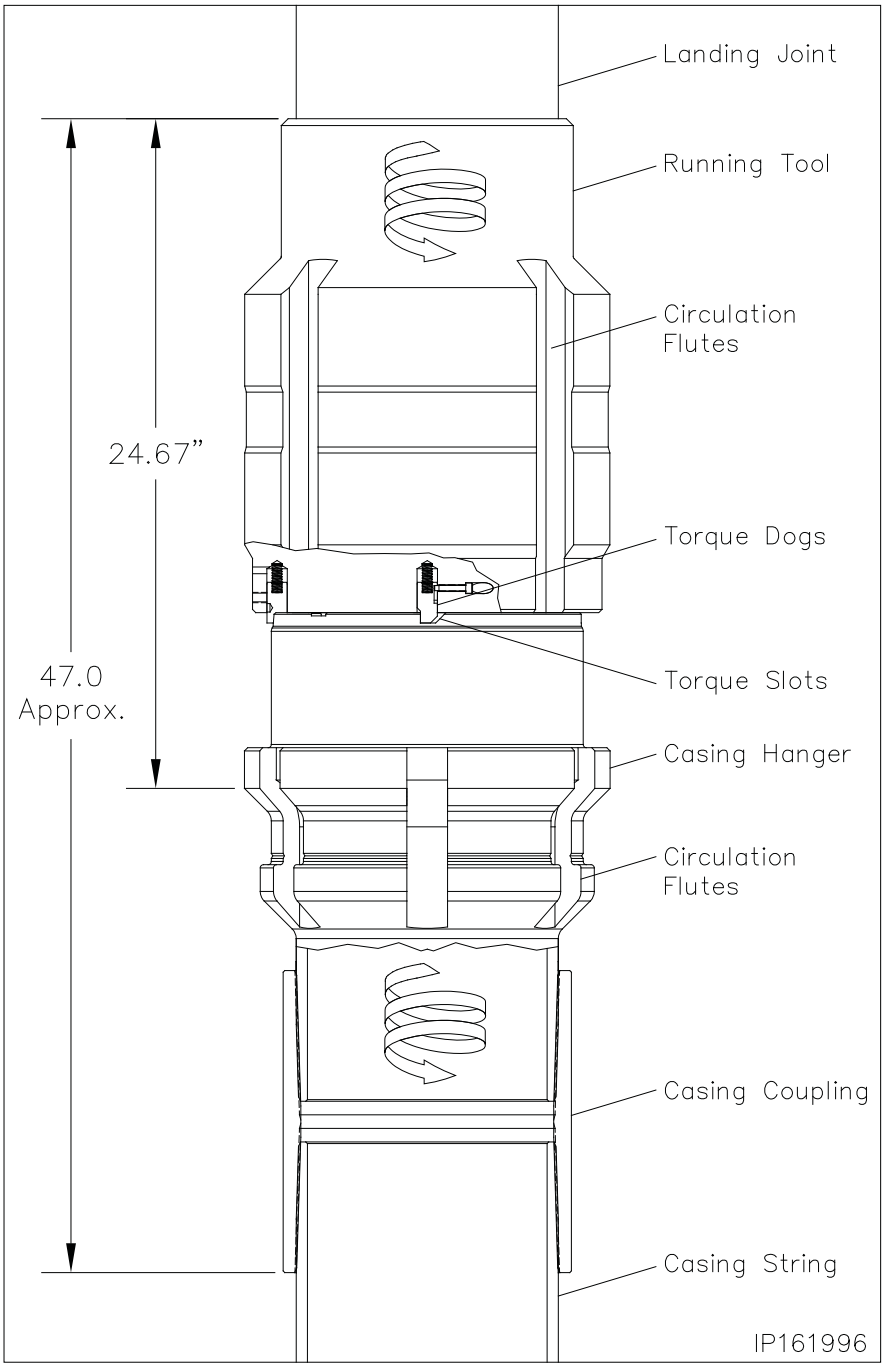
**CAUTION:** Do not rotate the running tool more than 1/4 turn to the left. Doing so will decrease the torque dog engagement.



# Stage 8 — Hang Off the 9-5/8” Casing

16. Engage the CRT tool in the landing joint and torque the casing hanger in the casing string to thread manufacturer’s maximum make up torque.



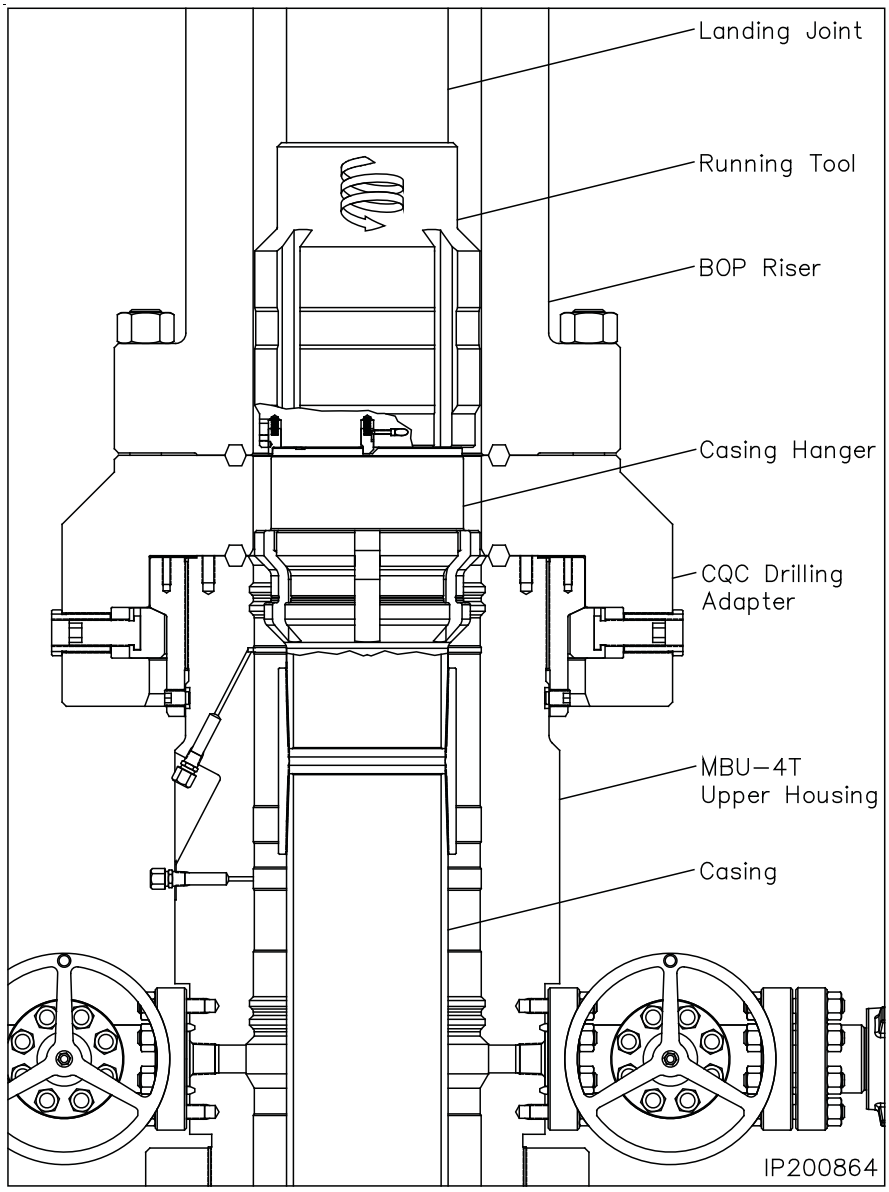
# Stage 8 — Hang Off the 9-5/8” Casing

17. Pick up the casing string and remove the floor slips and rotary bushings.

18. Carefully lower the hanger completely through the BOP annular and then engage the top drive to allow the casing to be rotated clockwise.

19. While rotating the casing clockwise, carefully lower the casing string until the **STOP ROTATING** mark on the landing joint is level with the rig floor.

**NOTE:** The torque dogs have a maximum rated capacity. Please reference the **Recommended Service Tools** section in the BOM for maximum torque allowed.



# Stage 8 — Hang Off the 9-5/8" Casing

**CAUTION:** Torque wrap can build in the casing string as it is rotated. Ensure the string comes to a neutral position, by allowing it to back off slowly counter clockwise, before the casing hanger is fully landed.

20. Cease rotation and continue carefully lowering the hanger through the wellhead and land it on the load shoulder in the lower MBU-4T housing, 52.58" below the top of the drilling adapter.

21. Slack off all weight on the casing and verify that the **HANGER LANDED** paint mark has aligned with the rig floor.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

22. Open the lower housing outlet valve and drain the BOP stack.

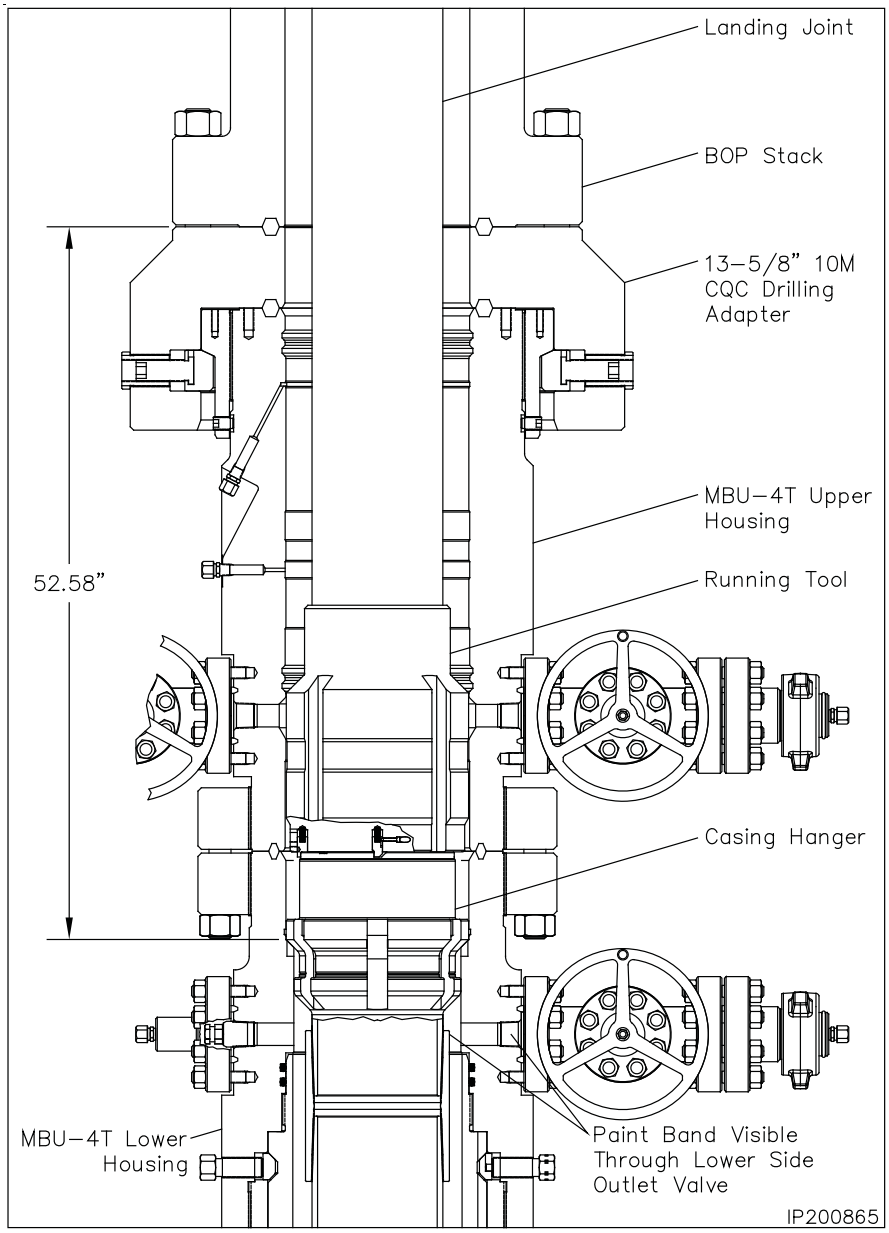
23. Open the upper housing lower outlet valve and sight through the valve bore to confirm the hanger is properly landed. The white paint band on the running tool will be clearly visible in the center of the open outlet valve.

24. Close the open valves and place a vertical paint mark on the landing joint to verify if the casing string rotates during the cementing process.

25. Cement the casing as required.

**NOTE:** Returns may be taken through the circulation slots and out the BOP or out the side outlets on the housing.

26. With cement in place, bleed off all pressure and remove the cementing head.




27. ***Using chain tongs only, located 180° apart,*** retrieve the running tool and landing joint by rotating the landing joint counter clockwise (left) approximately 13 turns or until the tool comes free of the hanger.

**CAUTION:** The rig floor tong may be used to break the connection but under no circumstances is the top drive to be used to rotate or remove the casing hanger running tool.

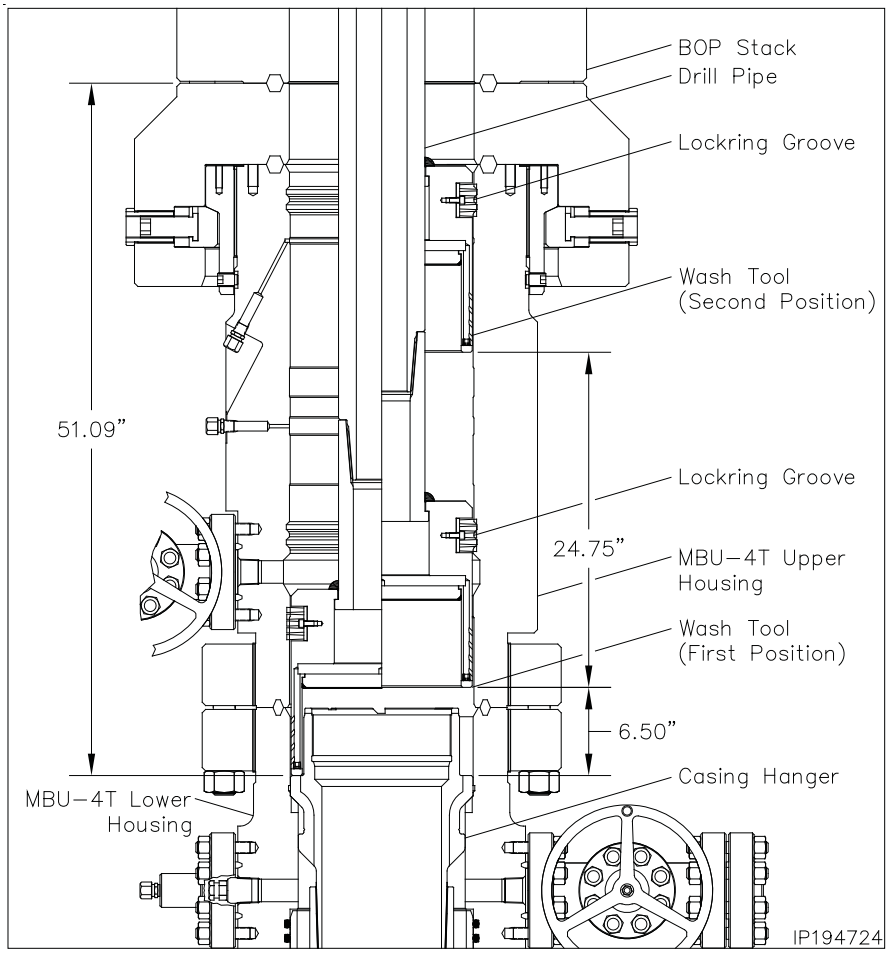
# Stage 8 — Hang Off the 9-5/8” Casing

## Running the 13-5/8” Wash Tool

1. Examine the ***13-5/8" x 4-1/2" IF Wash Tool (Item ST9).*** 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, 51.09” below the top of the drilling adapter.
4. Place a paint mark on the drill pipe level with the rig floor.
5. Using chain tongs, rotate the tool clockwise (right) approximately 6 turns to loosen any debris that may be on top of the hanger flutes.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

6. Open the lower side outlet valve and drain the BOP stack.
7. Pick up on the tool approximately 1" and attach a high pressure water line or the top drive to the end of the drill pipe and pump water at approximately 25 SPM through the tool and up the BOP stack.
8. Pick up the tool 6.50” above its landing position and rotate the tool to brush the lower lockring groove free of debris.
9. Pick up the tool an additional 24.75” and rotate the tool to brush the upper lockring groove free of debris.




10. While flushing, raise and lower the tool the full length of the wellhead and BOP stack. The drill pipe should be slowly rotated (approximately 20 RPM) while raising and lowering to wash the inside of the housing and BOP stack to remove all caked on debris.
11. Once washing is complete, land the wash tool on the hanger flutes.
12. Shut down pumps and observe the returns at the open lower outlet for debris.
13. Reengage the pump and fully wash the inside of the wellhead and the entire BOP one additional cycle ensuring the stopping point is with the wash tool resting on top of the hanger flutes.

**CAUTION:** Observe the returns at the open outlet valve. If returns are not clean, continue flushing until they are.

14. Once the returns are clean and free of debris, retrieve the tool to the rig floor.
15. Using a bright light, sight through the bore of the BOP stack and observe the top of the hanger neck and flutes. Ensure there are no dark areas on top of the hanger flutes.

**CAUTION:** Continue washing until all debris is removed.

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

**CAUTION:** 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.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

2. Drain the BOP stack through the lower MBU-4T housing side outlet valve.

3. Separate the connection between the upper and lower MBU-4T housings.

**WARNING:** Keep body clear of all pinch points and suspended loads.

4. Pick up on the BOP and upper housing a minimum of 14" and secure with safety sling.

5. Washout bowl as required.

6. Examine the ***13-5/8" x 9-5/8" C21 Slip Casing Hanger (Item A22a).*** Verify the following:
   - slips and internal bore are clean and in good condition
   - all screws are in place

7. Remove the latch cap screw and open the hanger.

8. Place two boards on the MBU-4T lower housing flange against the casing to support the hanger.

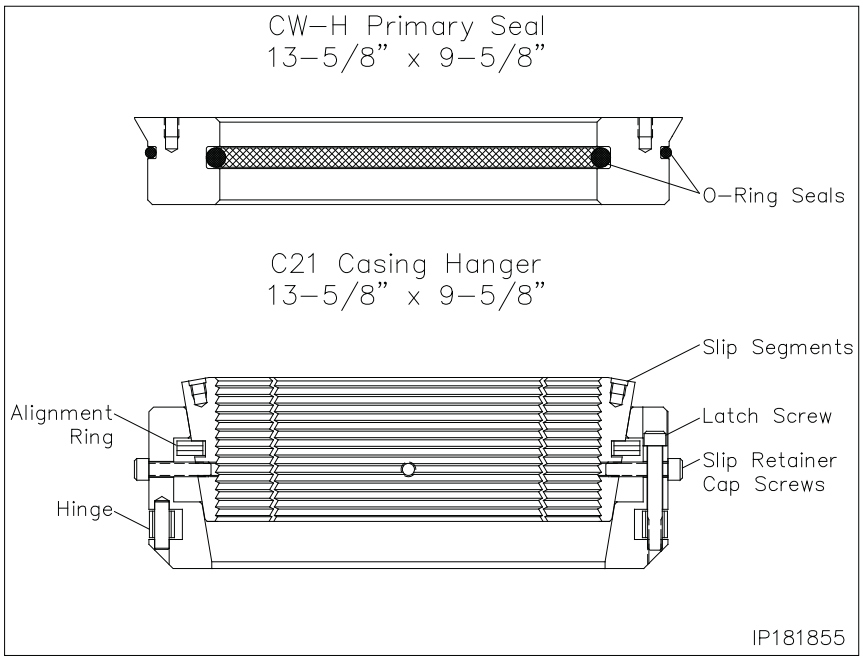
9. Pick up the hanger and place it around the casing and on top of the support boards and replace the latch screw.

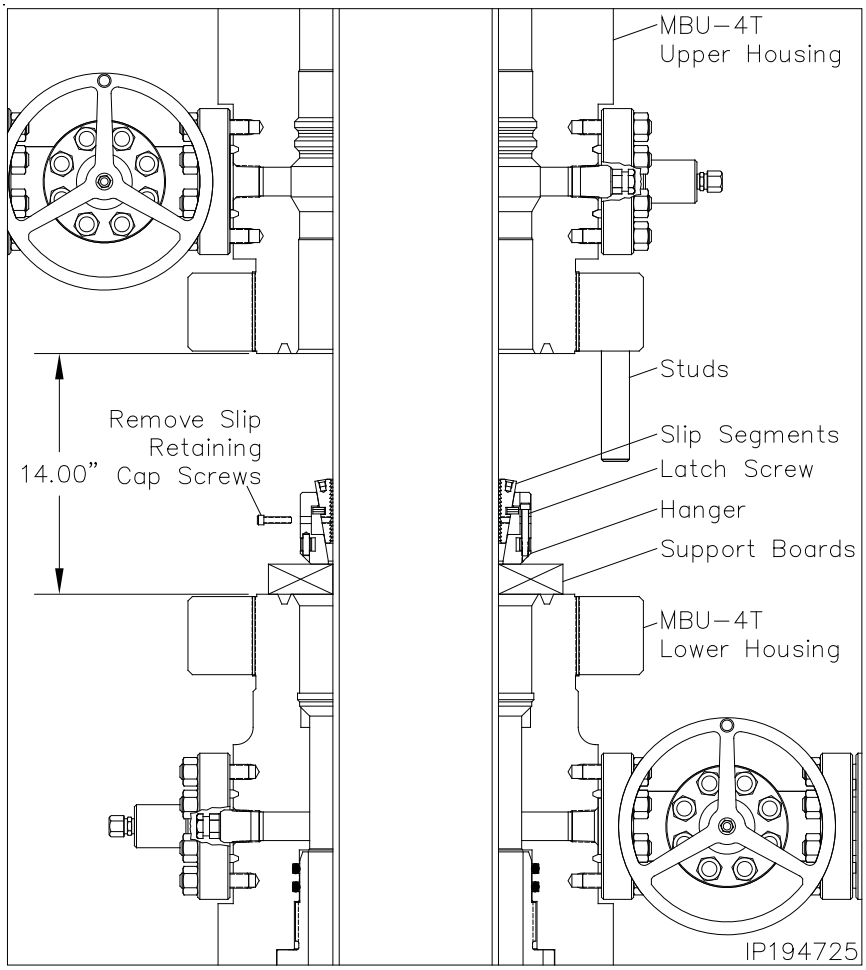
10. Prepare to lower the hanger into the housing bowl.

**CAUTION: Do Not** drop the casing hanger!

11. Grease the casing hanger body and remove the slip retaining screws.

12. Pull tension on the casing to the desired hanging weight.



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

13. Remove the boards and allow the hanger to slide into the bowl. When properly positioned the top of the hanger will be approximately 3.00” below the top of the flange.

14. Slack off the desired hanging weight.

**NOTE:** A sharp decrease on the weight indicator will signify that the hanger has taken weight. If this does not occur, pull tension again and slack off once more.

**WARNING:** Due to 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 gases, with an approved sensing device, prior to cutting the casing. If gas is present, do not use an open flame torch to cut the casing. It will be necessary to use an air driven mechanical cutter which is spark free.

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

16. Set the upper housing back down and break the connection between the upper housing and the quick connect adapter.

17. Lift the BOP stack and remove the upper housing from the well bore.

18. Final cut the casing at 8.75” ± 1/8” above the top of the lower housing.

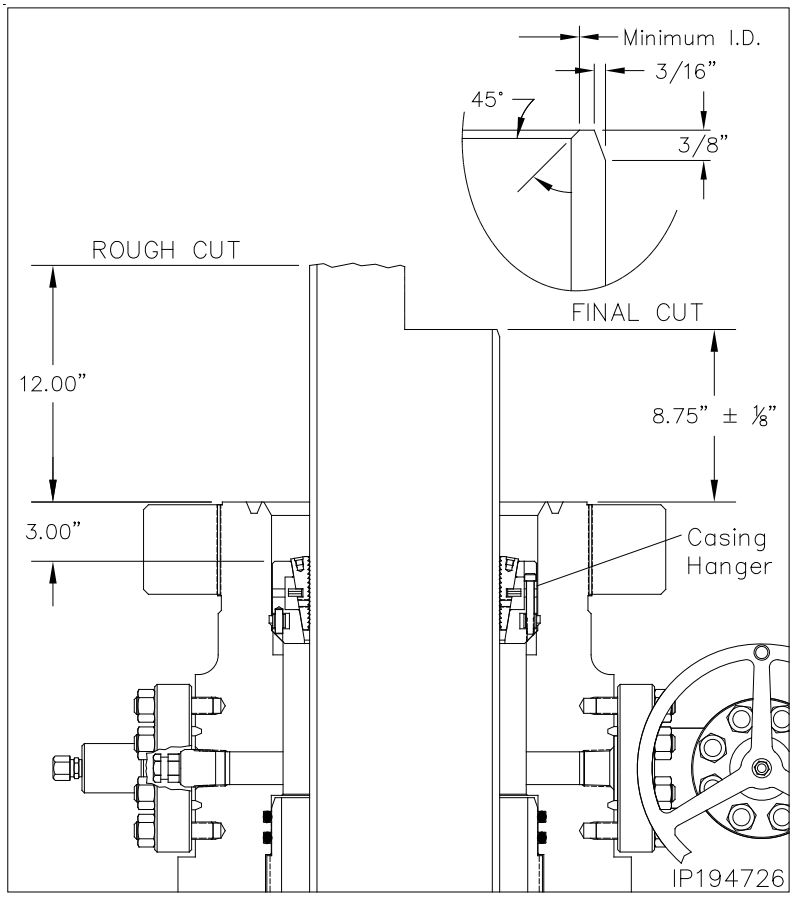
19. Grind the casing stub level, then place a 3/16” x 3/8” bevel on the O.D. and an I.D. chamfer to match the minimum bore of the housing to be installed.

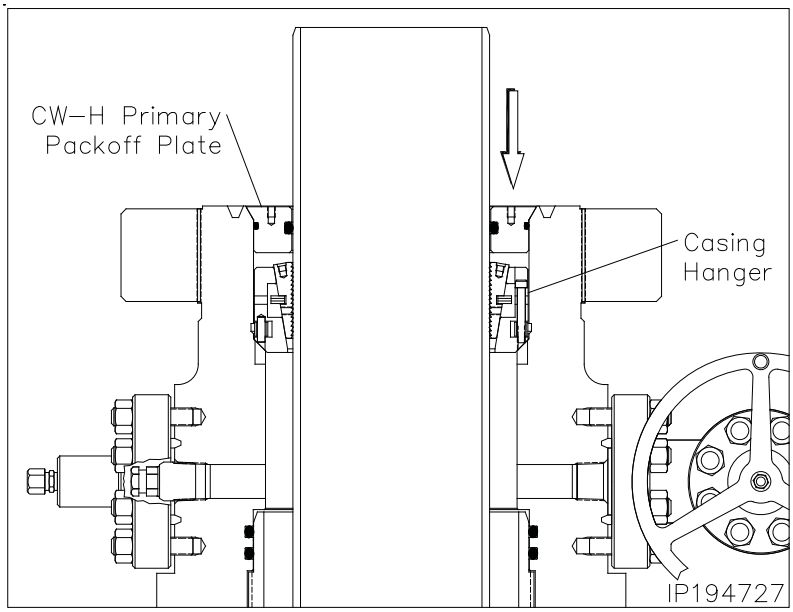
**CAUTION:** There must not be any rough edges on the casing or the seals of the packoff will be damaged.

20. Thoroughly clean the MBU-4T housing bowl, removing all cement and cutting debris.

21. Examine the ***13-5/8” x 9-5/8” CW-H Primary Packoff Plate (Item A23a)***. Verify the following:
    - o-ring seals are in place and in good condition

22. Lightly lubricate the primary seal plate o-ring seals with oil or a light grease.




23. Carefully slide the packoff plate over the casing stub and push it into the MBU-4T housing until the 30° tappers of the plate and housing come face to face.

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

1. Examine the ***13-5/8" 5M x 13-5/8" 10M MBU-4T-UPR Emergency Housing (Item A5a).*** Verify the following:
   - Acme threads are clean and in good condition
   - bore and all internal seal areas are clean and undamaged
   - 'HPS' seals are in place and in good condition
   - valves are intact and in good condition
   - studded threaded flange is installed on the bottom of the housing and is free to rotate
   - top threaded hub is installed and positioned with the I.D. threads level with the housing O.D. threads

**NOTE:** If the threaded hub has been pre-installed in the shop, skip steps 2 through 9.

2. Examine the ***13-5/8" 10M x 21.750" 4 Stub Acme Threaded Hub (Item R2)***. Verify the following:
   - Acme thread are clean and in good condition
   - remove the (4) retainer set screws an place them in a safe place

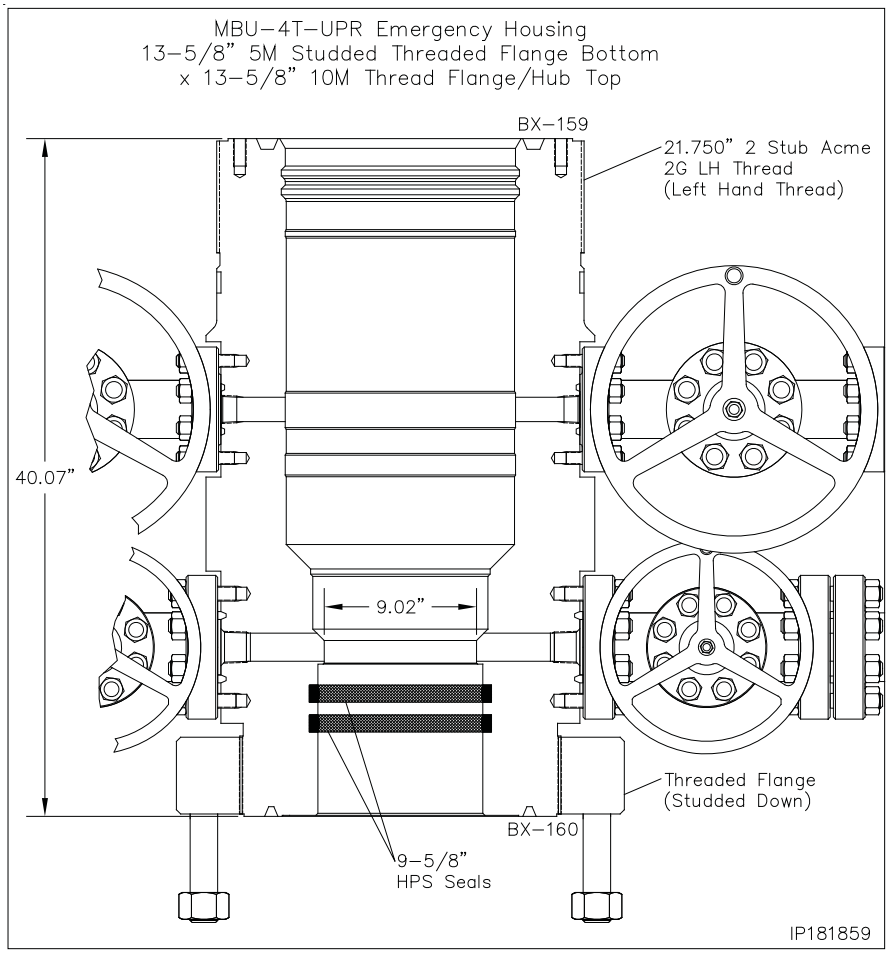
3. Thoroughly clean and lightly lubricate the mating threads of the housing and the threaded hub with copper coat or never seize.

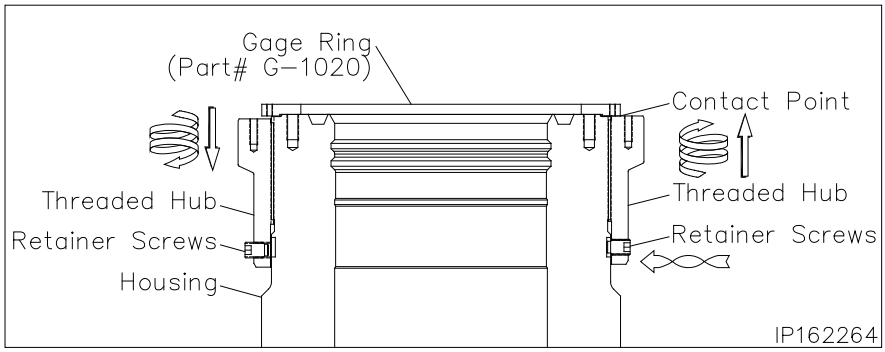
4. Pick up the hub and carefully thread it onto the top of the housing with counter clockwise rotation until the top of the ring is approximately a 1/4" below the top of the housing.

5. Position the hub gage ring on top of the housing with the counter bore down as indicated. Ensure the gage ring is level and straight.

6. Rotate the hub clockwise (UP) until it contacts the gage ring.

**CAUTION:** Do not off seat the gage ring.




7. Locate the retainer screw holes in the threaded hub.

8. Rotate the hub up or down to align the holes in the hub with the notches in the housing.

9. Install the set screws and tighten securely. (Do not Over Tighten)Remove gage ring.

**NOTE:** Using a yellow paint stick, paint the top of the housing where indicated for verifying level and adapter make up.

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

10. Attach a four point, properly rated, lifting sling to the lifting eyes of the housing and suspend the wellhead assembly over the well bore.

11. Thoroughly clean and lightly lubricate the ‘HPS’ seals of the upper housing with oil or light grease.

12. Thoroughly clean the mating ring grooves of the upper and lower housing removing all old grease and debris.

13. Install a new ***BX-160 Ring Gasket (Item A4)*** in the ring groove of the lower housing.

14. Position the threaded bottom flange with the I.D. thread of the flange level with the Acme thread of the upper housing.

**WARNING:** Keep body clear of all pinch points and suspended loads.

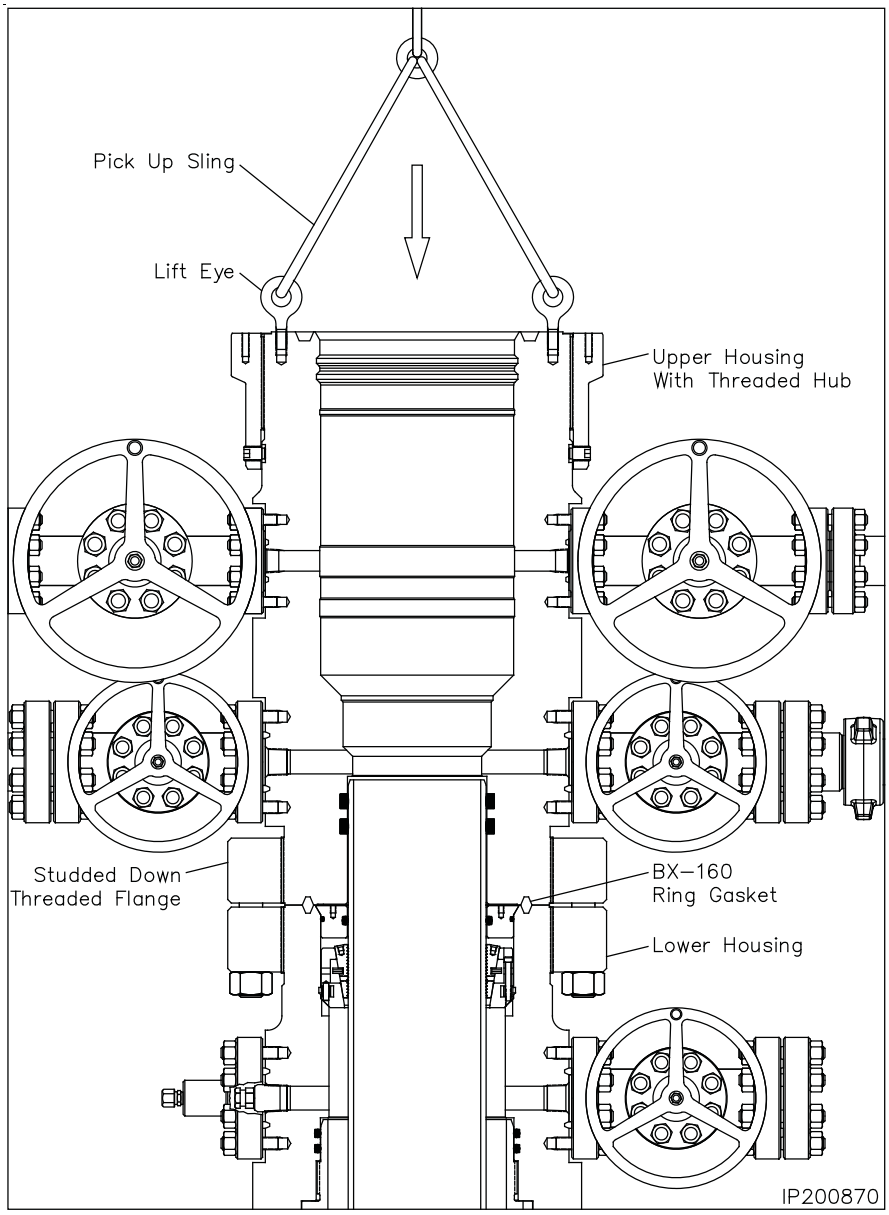
15. Orient the upper housing so the outlets are in the proper position, then two hole flange and remove all 1-5/8” nuts.

16. Carefully lower the assembly over the casing stub.

17. Align the studs with the bolt holes in the lower housing, then land the upper housing on the ring gasket.

18. Make up the flange connection with the threaded flange studs and nuts, tightening them in an alternating cross pattern until the housing connections come face to face and are level.

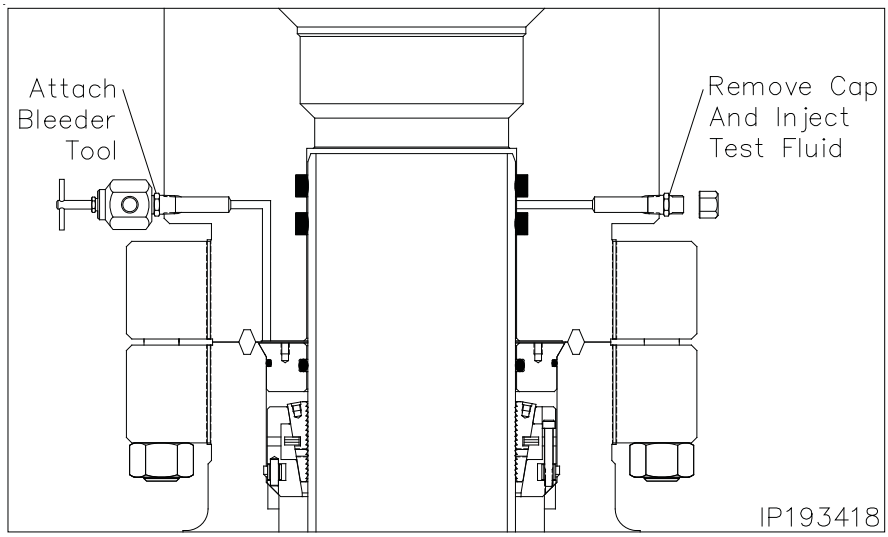
19. Remove the lifting eyes.



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

## Seal Test

1. Locate the “SEAL TEST” fitting and one “FLANGE TEST” fitting on the upper housing lower body and remove the dust cap from both fittings.
2. Attach a bleeder tool to the open “FLANGE TEST” fitting and open the tool.
3. Attach a test pump to the “SEAL TEST” fitting and pump clean test fluid between the ‘HPS’ seals until a test pressure of ***5,000 psi or 80% of casing collapse — whichever is less.***
4. Hold the test pressure for 15 minutes or as required by drilling supervisor.
5. If pressure drops, a leak has developed. Bleed off test pressure and take the appropriate action in the adjacent table.
6. After a satisfactory test is achieved, bleed off pressure. Remove the test pump, drain test fluid and reinstall the dust cap on the open “SEAL TEST” fitting.

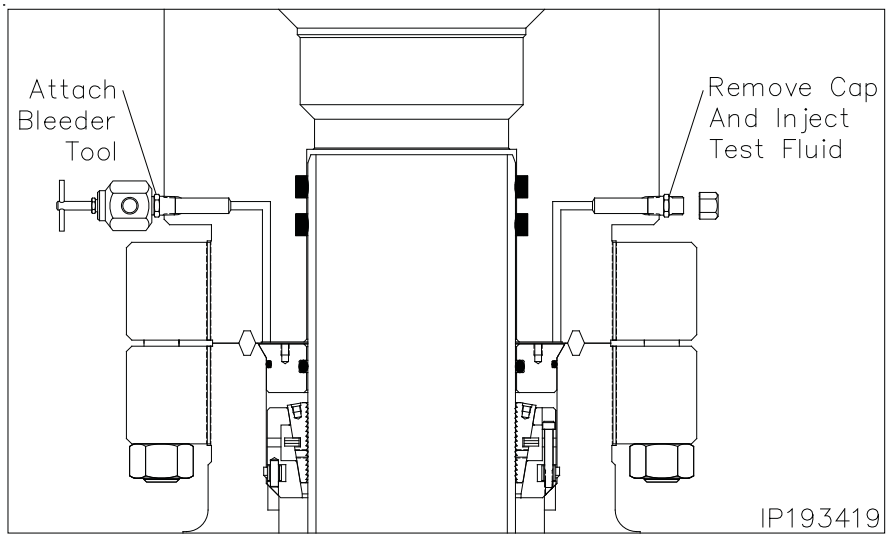



| Seal Test | |
|---|---|
| **Leak Location** | **Appropriate Action** |
| Open bleeder tool - Lower ‘HPS’ seal is leaking | Remove upper housing and replace leaking seals. Re-land and retest seals |
| Into housing bore - Upper ‘HPS’ seal is leaking | |

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

## Flange Test

1. Locate the remaining “FLANGE TEST” fitting on the upper housing lower body and remove the dust cap from the fitting.
2. Attach a test pump to the open “FLANGE TEST” fitting and inject test fluid into the flange connection until a stable test pressure of ***5,000 psi or 80% of casing collapse - Whichever is less.***
3. Hold the test pressure for 15 minutes or as required by drilling supervisor.
4. If pressure drops a leak has developed. Take the appropriate action from the adjacent chart.
5. Repeat this procedure until a satisfactory test is achieved.
6. Once a satisfactory test is achieved, bleed off pressure. Remove the test pump and bleeder tool, drain all test fluid, and reinstall the dust caps.
7. Reinstall the BOP with the 13-5/8” 10M QCQ adapter.




| Flange Test | |
|---|---|
| **Leak Location** | **Appropriate Action** |
| Between flanges - Ring gasket is leaking | Further tighten the flange connection |
| Into casing annulus - Primary seal o-rings are leaking | Remove upper housing and primary seal. Replace leaking seals. Reinstall the primary seal and upper housing and retest |

# Stage 9 — Install the MBU-4T Lower Mandrel Hanger Packoff

The following steps detail the installation of the MBU-4T lower packoff assembly for the mandrel hanger.

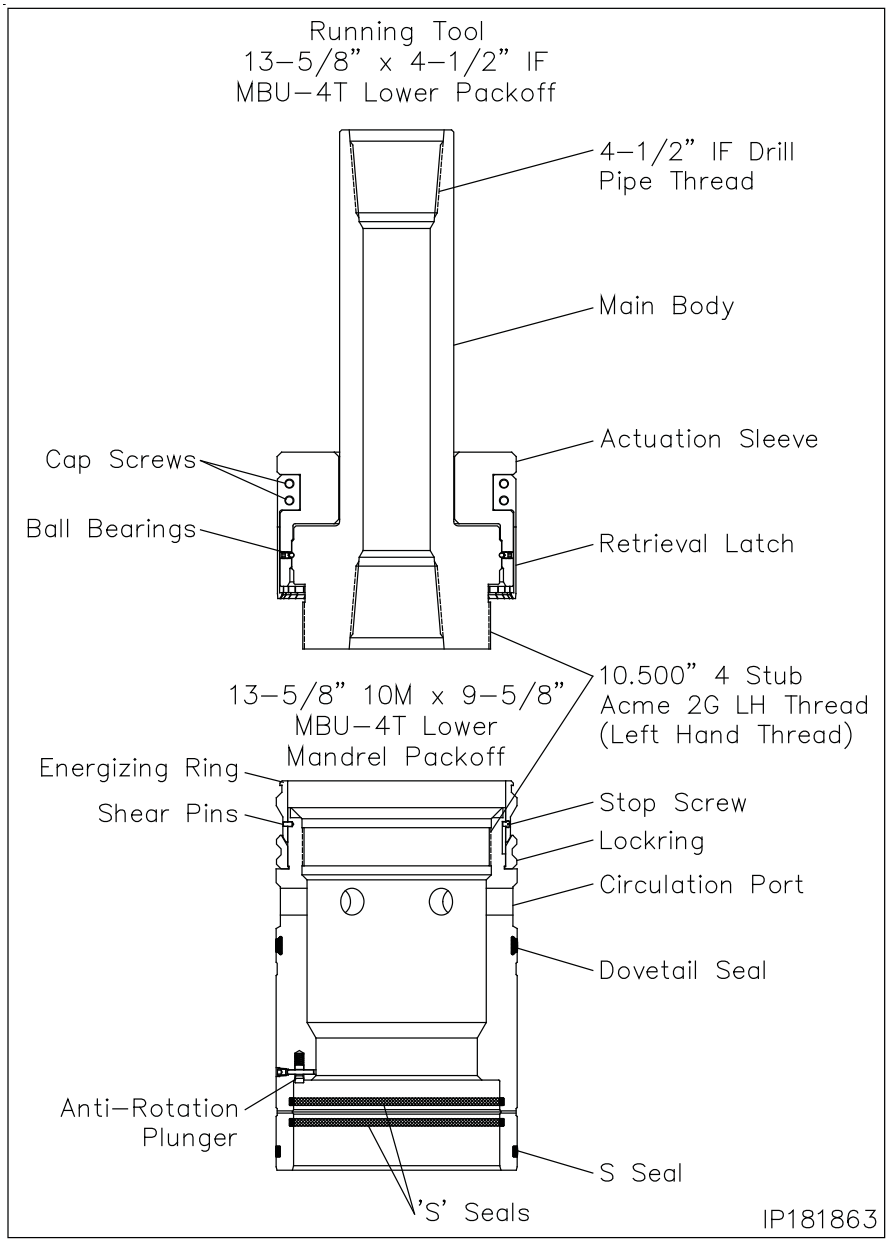
1. Examine the ***13-5/8" x 10.500" 4 Stub Acme 2G LH Box Top MBU-4T-LWR Mandrel Hanger Packoff Assembly (Item A23).*** Verify the following:
   - all elastomer seals are in place and undamaged
   - internal bore, and ports, are clean and in good condition
   - lockring is fully retracted
   - energizer ring is in its upper most position and retained with shear pins
   - guide screws are in place and back off 1/4 turn
   - anti-rotation plungers are in place, free to move

2. Inspect the I.D. and O.D. seals for any damage and replace as necessary.

3. Examine the ***13-5/8" Nominal x 10.500" 4 Stub Acme 2G LH, MBU-4T-LWR Packoff Running Tool (Item ST10).*** Verify the following:
   - Acme threads are clean and in good condition
   - retrieval latch is in position and retained with cap screws
   - actuation sleeve rotates freely

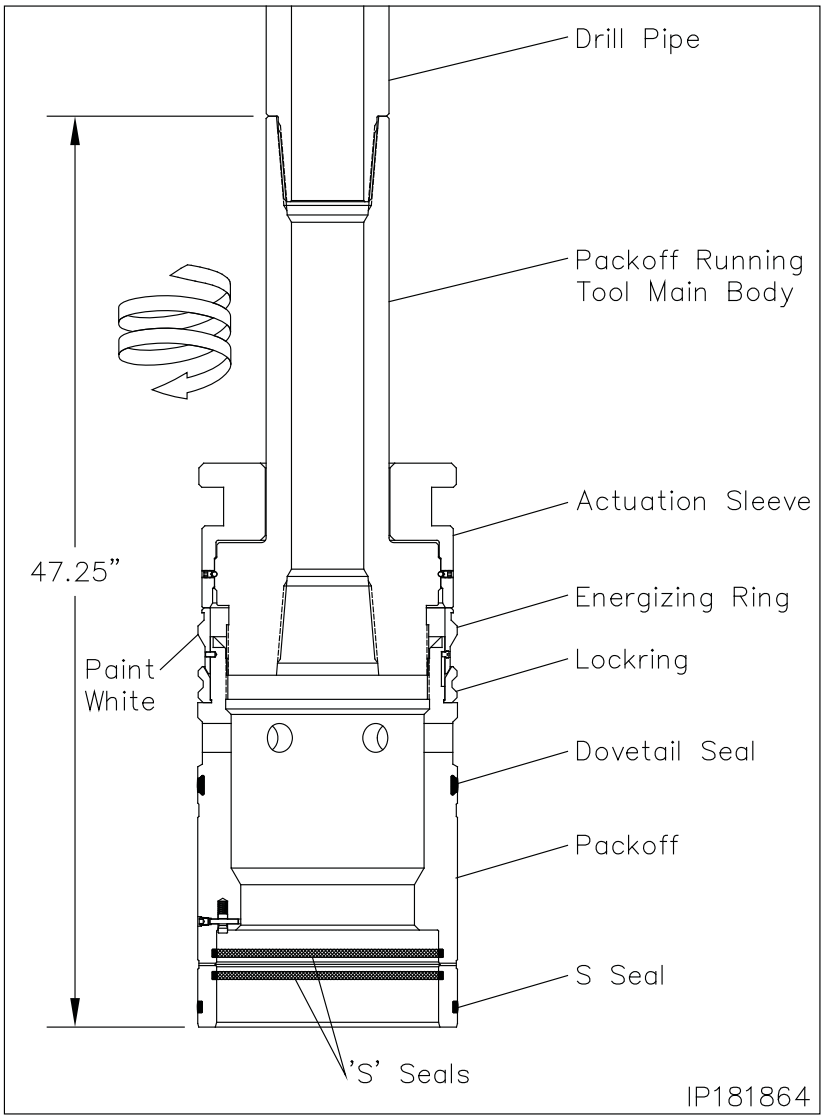
4. Remove the retrieval latch and set aside.

5. Make up the running tool to a 4-1/2" IF drill collar and tighten connection to thread manufacturer's optimum make up torque.



# Stage 9 — Install the MBU-4T Lower Mandrel Hanger Packoff

6. Pick up the running tool with drill pipe landing joint and suspend it above the packoff.
7. Thoroughly clean and lightly lubricate the mating Acme threads of the running tool and packoff with oil or light grease.
8. Carefully lower the tool into the packoff and thread them together by first rotating the tool clockwise (RIGHT) to locate the thread start and then counter clockwise (LEFT) until the tool actuation sleeve makes contact with the packoff energizing ring. Approximately 4 turns.
9. Place a white paint band around the packoff energizing ring as indicated and allow paint to dry.
10. Pick up the assembly and thoroughly clean and lightly lubricate the packoff I.D. 'S' seals and the O.D. dovetail and 'S' seal with oil or light grease.



# Stage 9 — Install the MBU-4T Lower Mandrel Hanger Packoff

11. Calculate the landing dimension by taking the previously taken RKB dimension and adding 51.09” the depth of the wellhead.

## Landing the Packoff

12. Remove the hole cover.

13. Measure up 5 foot from the bottom of the packoff and place a paint mark on the drill collar.

14. Pick up the packoff/running tool assembly and carefully lower the assembly through the BOP, marking the landing joint every five feet until the calculated dimension is reached.

15. Place a paint mark on the landing joint at that dimension and mark **LANDED**. Place an additional mark 1-1/2” above the first one and mark **ENGAGED**.

16. Continue lowering the packoff until it passes over the neck of the hanger and lands on the casing hanger flutes, 51.09” below the top of the drilling adapter.

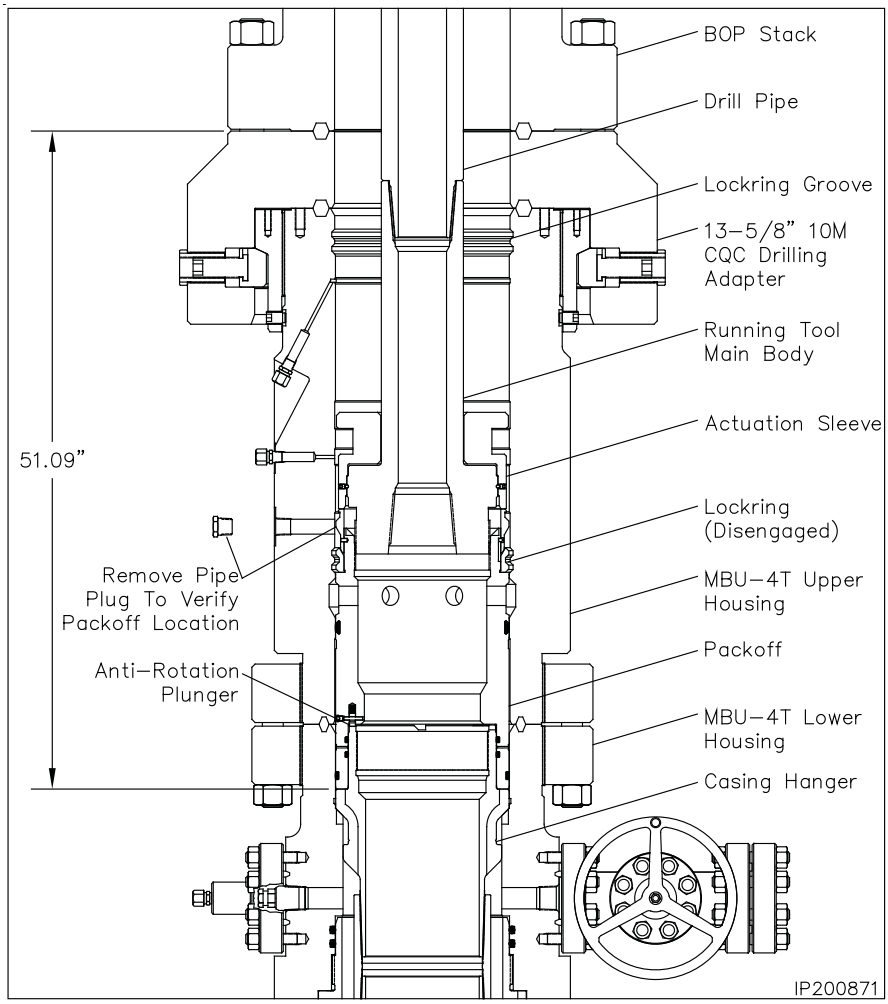
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

17. Open the upper housing lower side outlet valve.

18. Locate the lower 1” sight port pipe plug in the upper housing and remove the plug.

19. Look through the port to verify that the packoff is properly landed. The white painted energizing ring will be clearly visible in the center of the open port.

20. Reinstall the pipe plug and tighten securely.



# Stage 9 — Install the MBU-4T Lower Mandrel Hanger Packoff

## Seal Test

21. Locate the lower "SEAL TEST" fitting on the O.D. of the upper housing and remove the dust cap from the fitting.

22. Attach a test pump to the open fitting and pump clean test fluid between the seals until a stable test pressure of ***5,000 psi*** is achieved.

23. Hold the test pressure for 15 minutes or as required by drilling supervisor.

24. If a leak develops, bleed off test pressure. Remove the packoff from the wellhead and replace the leaking seals.

25. After a satisfactory test is achieved, bleed off the test pressure but leave the test manifold in place.

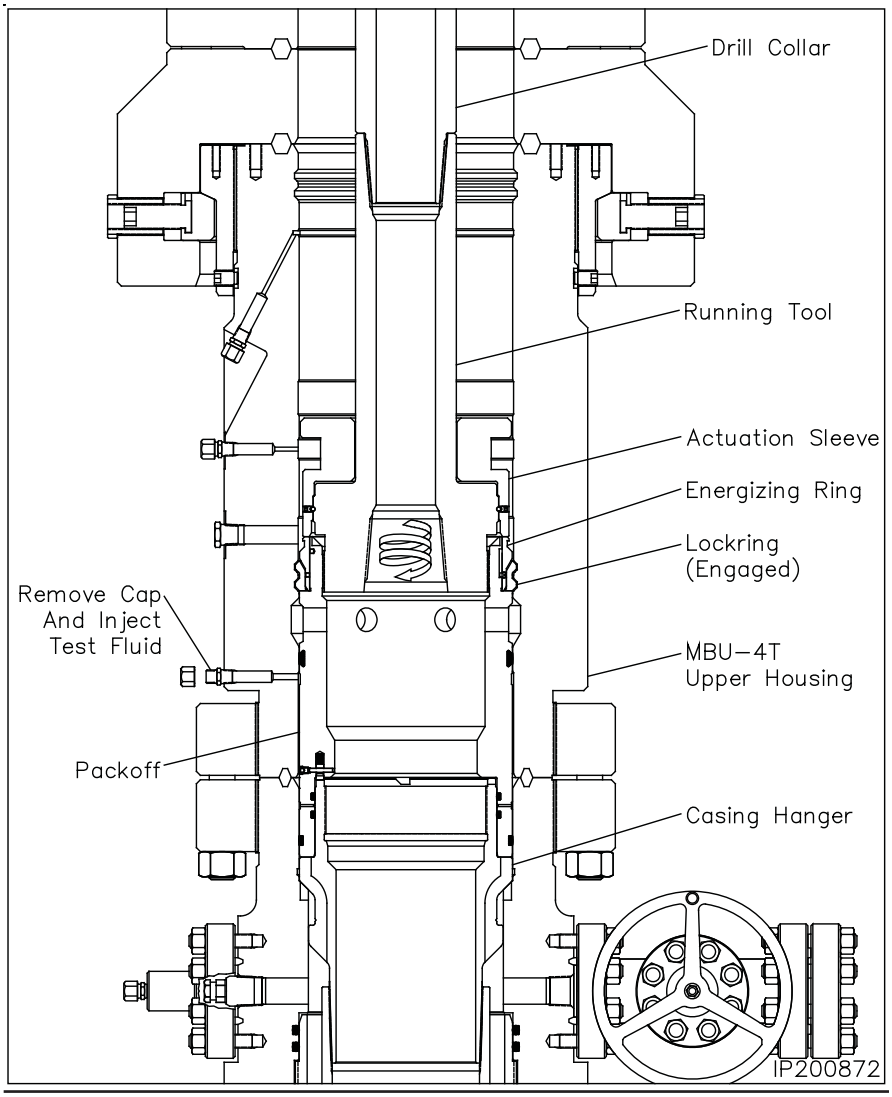
## Engaging the Lockring

***26.*** ***Using chain tongs only, located 180° apart***, slowly rotate the drill pipe counter clockwise until the anti-rotation plungers align with the slots in the top of the hanger. Expect torque of approximately 400 ft-lbs to rotate the packoff.

***27.*** ***Using chain tongs only,*** rotate the landing joint approximately 6 to 6-1/2 turns counter clockwise to engage the packoff lockring in its mating groove in the bore of the MBU-4T upper housing.

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

**NOTE:** When properly engaged the second paint mark on the landing joint will align with the rig floor. VERIFY PAINT MARKS.




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

**CAUTION:** If the required turns to engage the lockring are not met or excessive torque is encountered, remove the packoff. First call local branch. If further assistance is required then call Houston Engineering.

28. Back off the landing joint/running tool approximately three turns. Using the top drive, exert a 40,000 lbs. pull on the landing joint. After satisfactory test, slack off all weight.

29. Reattach the test pump to the open test manifold and retest the packoff seals to ***5,000 psi***. This will also verify that the packoff is in place.

30. After satisfactory test is achieved, bleed off all test pressure. Remove test pump and reinstall the dust cap on the open fitting.

***31.*** ***Using chain tongs only,*** rotate the landing joint clockwise until the tool comes free of the packoff (approximately 6 to 6-1/2 total turns) and then retrieve the tool with a straight vertical lift.

# Stage 9 — Install the MBU-4T Lower Mandrel Hanger Packoff

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

## Retrieving the Packoff

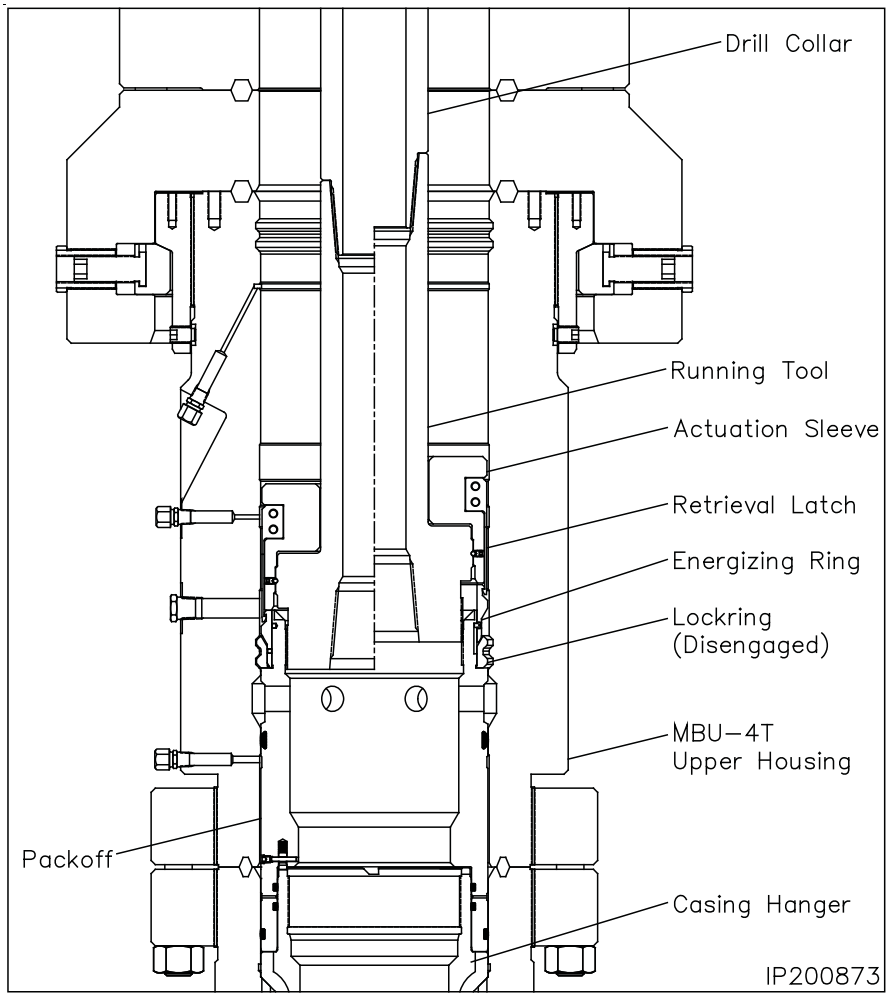
1. Position the retrieval latch so the latch finger extend from the bottom of the running tool body.
2. Reinstall the cap screws and tighten them securely.
3. Ensure the retrieval latch freely rotates on the running tool body.
4. Carefully lower the running tool through the BOP stack and into the packoff.
5. Rotate the drill pipe clockwise (Right) to locate the thread start and then counter clockwise (Left) (approximately 9 to 9-1/2 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 (right) approximately 6 turns to a positive stop. The drill pipe should rise approximately 1-1/2".

**CAUTION:** Do not exceed the 6 turns or the packoff may be seriously damaged.

7. Carefully pick up on the drill pipe and remove the packoff from the MBU-4T wellhead with a straight vertical lift.
8. Rotate the packoff 1 turn clockwise to relax the retrieval latch.
9. Remove the (4) 1/2" cap screws and remove the latch assembly.
10. Redress the packoff and reset as previously outlined.
11. Once the packoff is properly set, reinstall the retrieval latch on the tool.



# Stage 10 — 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 MBU-3T Test Plug/ Retrieving Tool (Item ST4)***. 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

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.

**CAUTION:** Ensure 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.

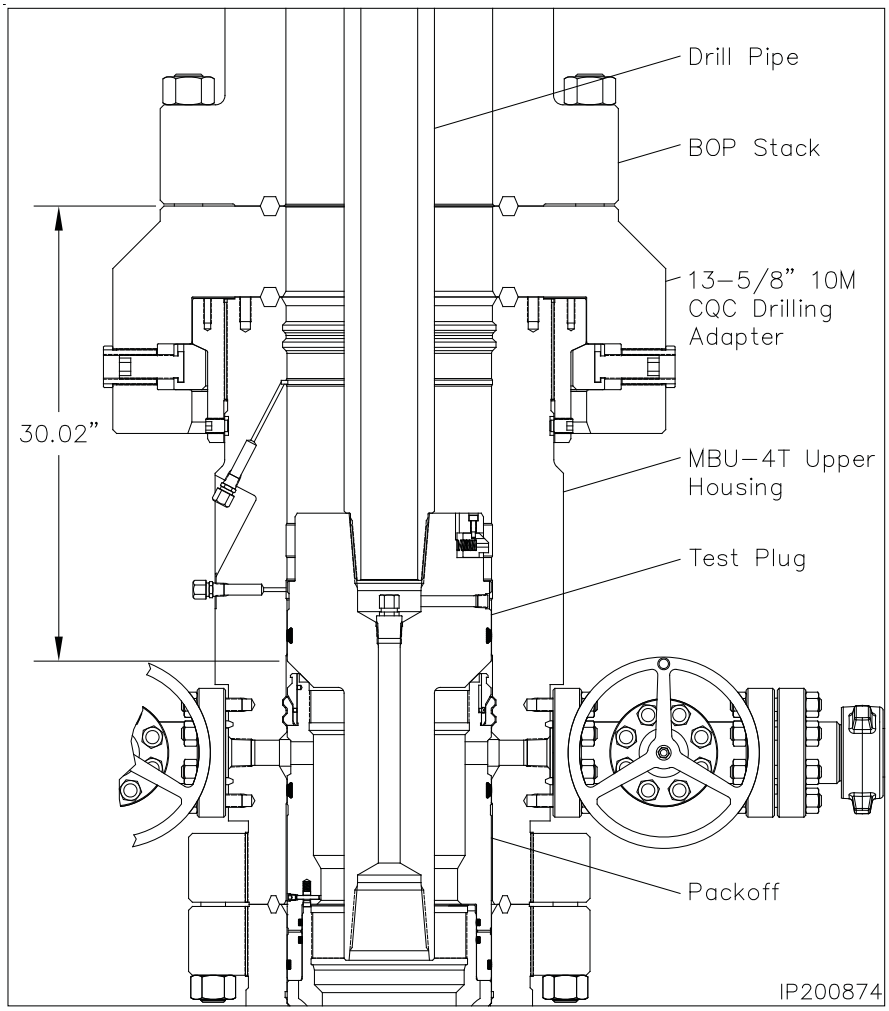
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

4. Open the upper housing lower 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 top of the 9-5/8" packoff or load shoulder in the emergency upper housing, 30.02" below the top of the drilling adapter.

7. Close the BOP rams on the pipe and test the BOP to 10,000 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. Retrieve the test plug with a straight vertical lift.

**CAUTION:** 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 it from the drill pipe.

10. Close all open valves.

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

# Stage 11 — Run the Intermediate Wear Bushing

**CAUTION: 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-4T-MID Wear Bushing (Item ST11).*** Verify the following:
   - internal bore is clean and in good condition
   - trash and shear o-ring cord are in place and in good condition
   - anti-rotation plungers are in place, free to move

## Run the Wear Bushing Before Drilling

2. Orient the ***13-5/8" Nominal x 4-1/2" IF CW Test Plug/Retrieving Tool (Item ST4)*** with drill pipe connection neck up.

3. Attach the retrieving tool to a joint of drill pipe.

4. Align the retractable lift lugs with the retrieval holes of the bushing and then 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 O.D. of the bushing.

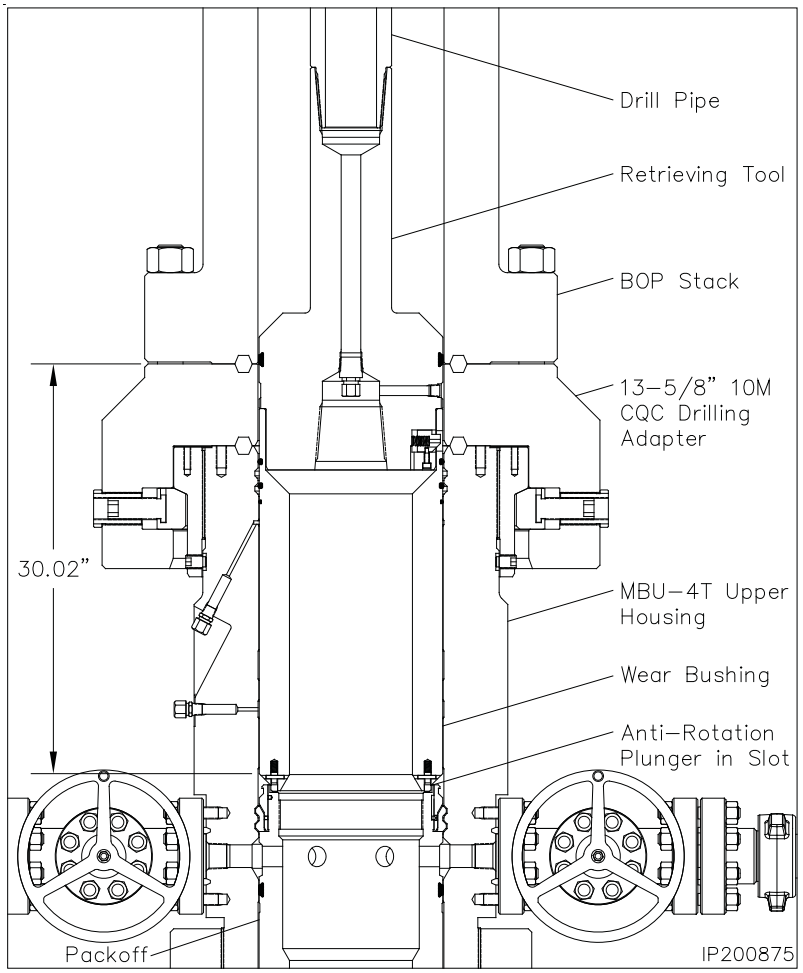
6. Slowly lower the tool/bushing assembly through the BOP stack and land it on top of the 9-5/8" packoff or emergency upper housing load shoulder, 30.02" below the top of the upper housing.

7. Rotate the drill pipe clockwise (right) to locate the anti-rotation plungers in their mating slots in the packoff or housing. When properly aligned the bushing will come to a positive stop.

**NOTE:** The shear o-ring on top of the bushing will locate in the upper lockring groove in the housing 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.




**CAUTION:** 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

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 counter clockwise two full turns to help clear the debris in the wear bushing windows. Then rotate clockwise until a positive stop is felt. This indicates the lugs have snapped into the holes in the bushing.

14. Retrieve the wear bushing. Remove it and the retrieving tool from the drill string.

# Stage 12 — Hang Off the 7-5/8" Casing

1. Examine the ***13-5/8" x 7-5/8" CW, TP8 Casing Hanger Running Tool (Item ST12).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - o-ring seal is clean and in good condition
   - torque dogs are in place, in upper most position and retainer hex head screws are tightened securely

2. Make up a landing joint to the top of the running tool and torque connection to thread manufacturer's maximum make up torque.

3. Lay down the landing joint on the pipe rack.

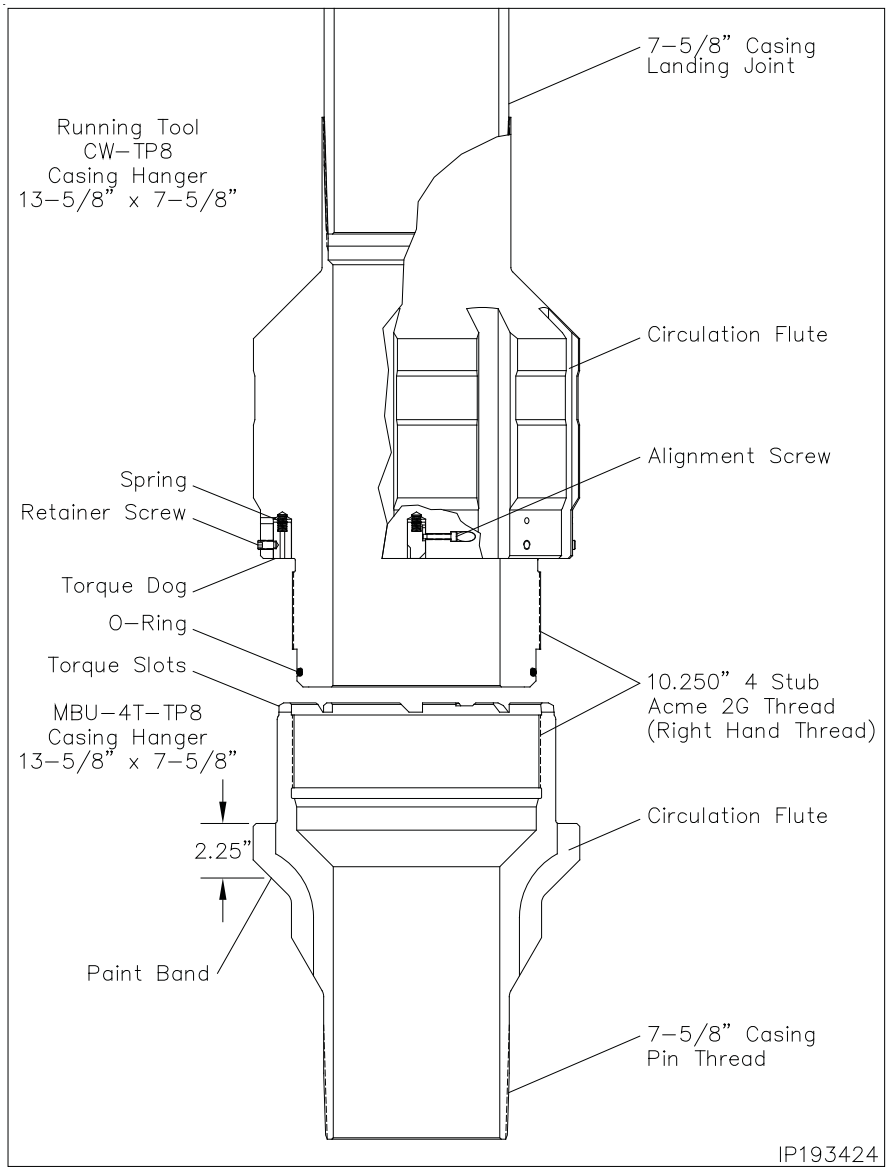
4. On the pipe rack, examine the ***13-5/8" x 7-5/8" CW, MBU-4T-MID-TP8 Mandrel Casing Hanger (Item A24).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - neck seal area is clean and undamaged
   - torque slots are clean and in good condition
   - pin threads are clean and in good condition. **Install thread protector**
   - place a white band around the hanger as indicated and allow paint to dry

5. Liberally lubricate the mating threads, seal areas and o-ring of the hanger and running tool with an oil or light grease.

6. ***<u>Using chain tongs only</u>,*** thread the running tool into the hanger, with right hand rotation, until it shoulders out on the hanger body.

**CAUTION: Do Not** apply torque to the hanger/tool connection.

**NOTE:** If steps 1 through 6 were done prior to being shipped to location, the running tool should be backed off 1 turn and made back up to ensure it will back off freely.



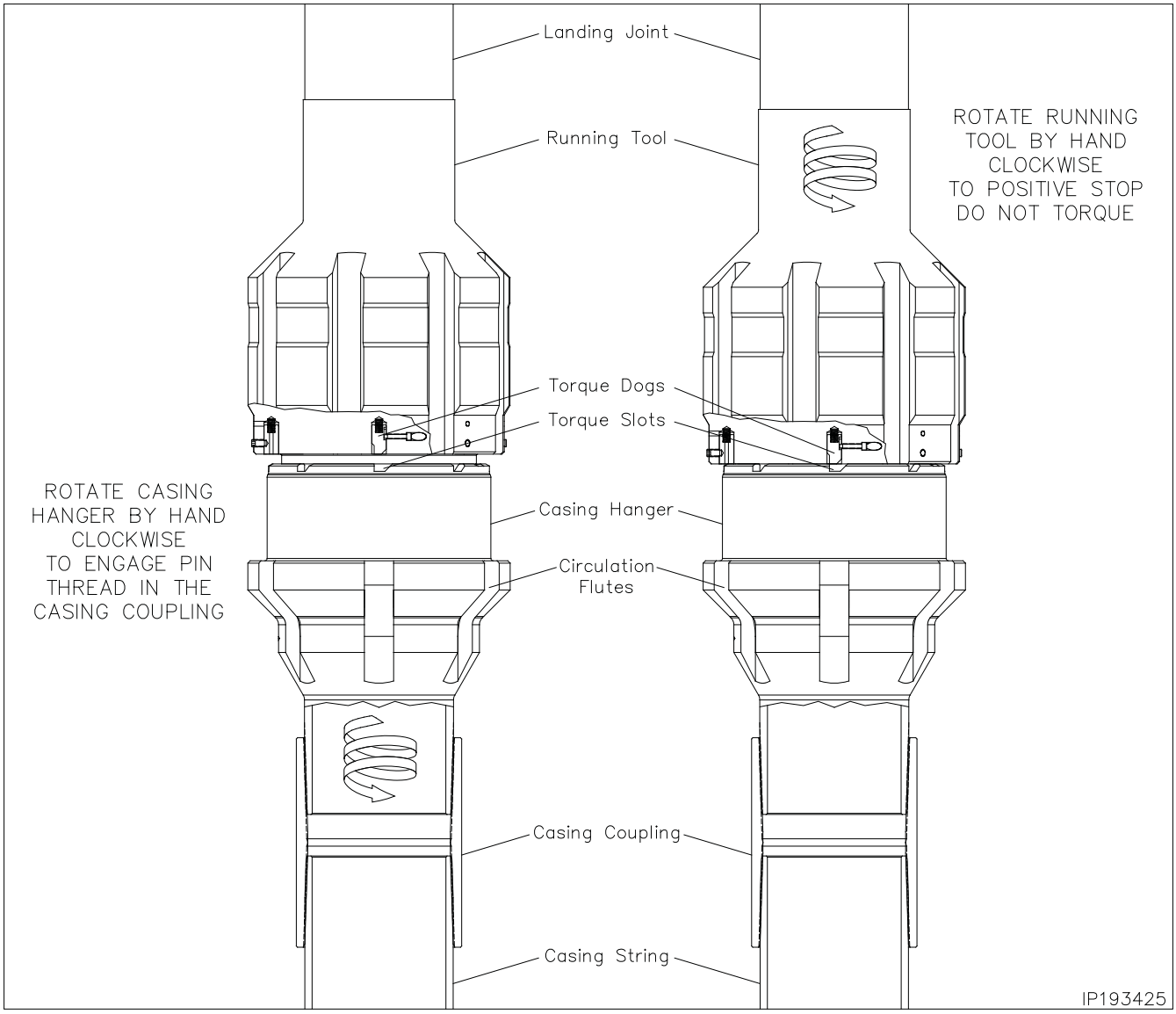

7. Calculate the total landing dimension by adding the previously determined RKB dimension and 30.00", the depth of the wellhead.

8. Starting at the top of the 45° angle load shoulder of the casing hanger measure up the landing joint and place a paint mark on the joint. Mark **HANGER LANDED**.

9. Place a second mark 30.00" below the first and mark **STOP ROTATING**.

10. Run the 7-5/8" casing as required and space out appropriately for the mandrel casing hanger.

# Stage 12 — Hang Off the 7-5/8” Casing




**NOTE:** If the 7-5/8” casing becomes stuck and the mandrel casing hanger cannot be landed, refer to **Stage 12A** for the emergency slip casing hanger procedure.

11. Pick up the casing hanger/running tool joint assembly.

12. Remove the casing hanger thread protector and carefully thread the hanger into the last joint of casing. Rotate the hanger clockwise, by hand, to a positive stop.

13. Rotate the running tool clockwise by hand to a positive stop.

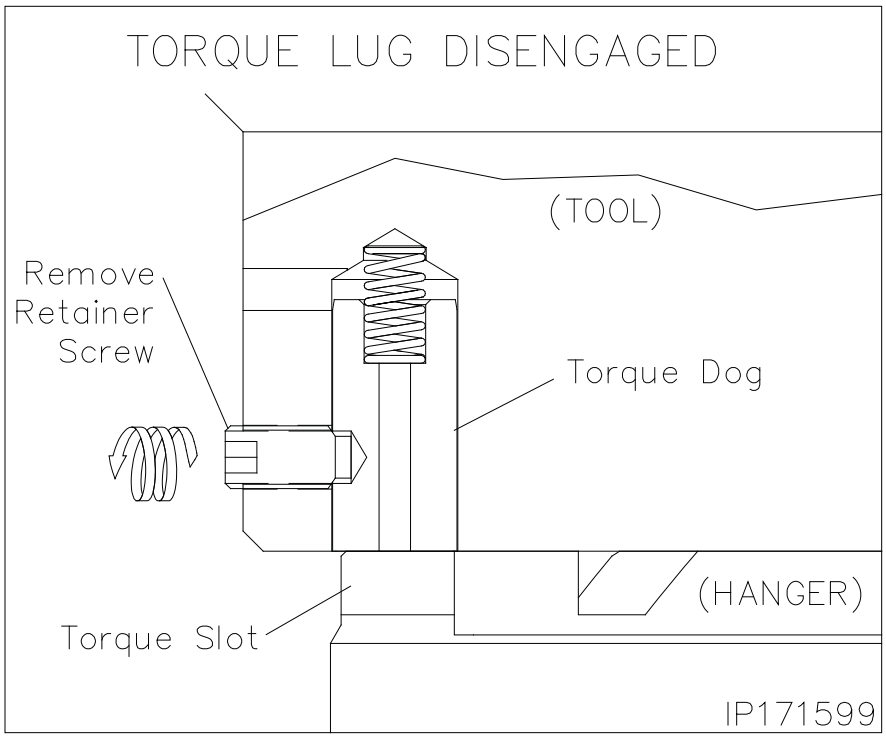
# Stage 12 — Hang Off the 7-5/8” Casing

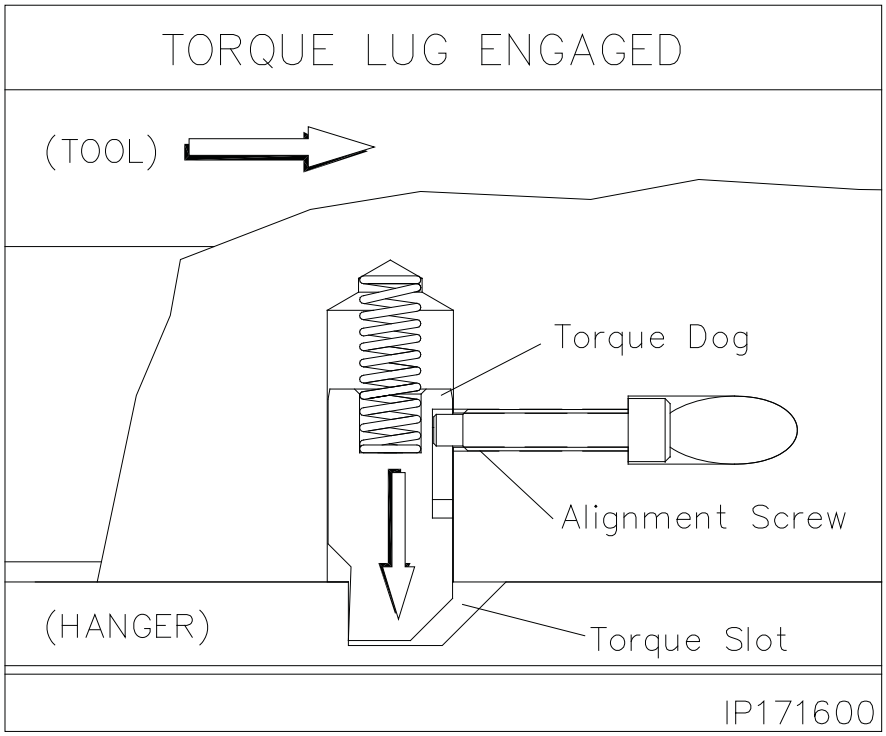
14. Locate the (8) socket head set screws in the side of the hanger running tool and completely remove the screws from the running tool. This will release the running tool torque dogs allowing them to move downward.

**NOTE:** Place the screws in a safe place to reinstall in the tool when the job is completed.

***15.*** ***Using chain tongs only,*** rotate the running tool to the left to allow the torque dogs to engage the torque slots in the top of the hanger.

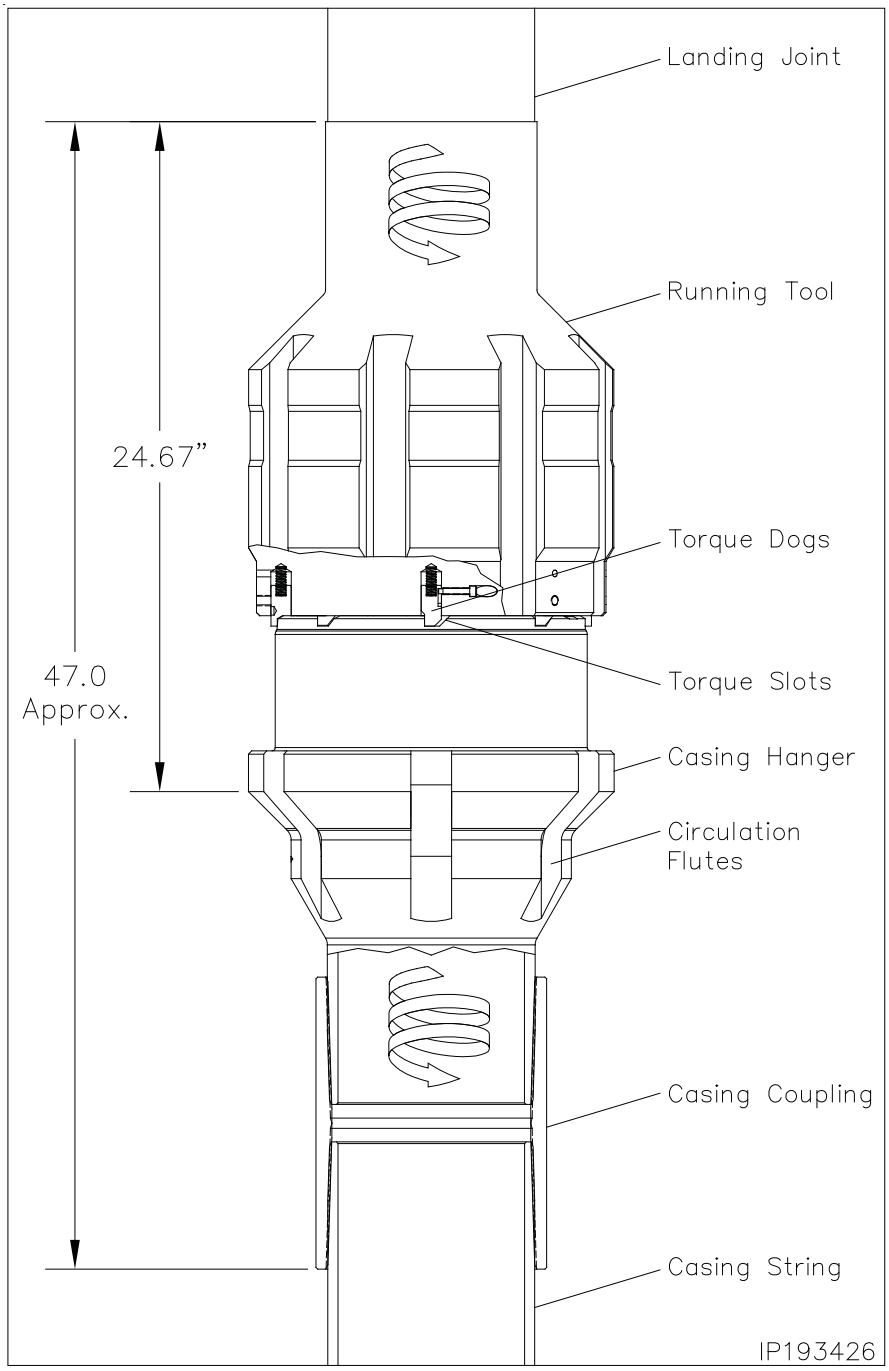
**CAUTION:** Do not rotate the running tool more than 1/4 turn to the left. Doing so will decrease the torque dog engagement.



# Stage 12 — Hang Off the 7-5/8” Casing

16. Engage the CRT tool in the landing joint and torque the casing hanger in the casing string to thread manufacturer’s maximum make up torque.



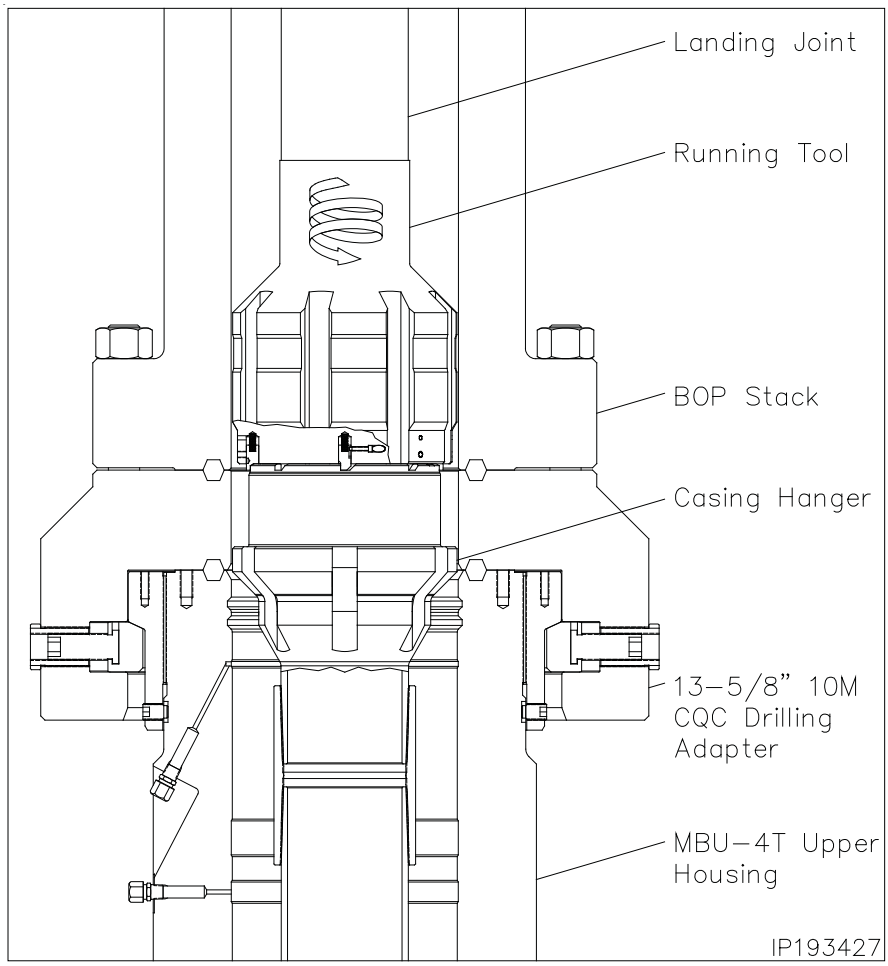
# Stage 12 — Hang Off the 7-5/8” Casing

17. Pick up the casing string and remove the floor slips and rotary bushings.

18. Carefully lower the hanger completely through the BOP annular and then engage the top drive to allow the casing to be rotated clockwise.

19. While rotating the casing clockwise, carefully lower the casing string until the **STOP ROTATING** mark on the landing joint is level with the rig floor.

**NOTE:** The torque dogs have a maximum rated capacity. Please reference the **Recommended Service Tools** section in the BOM for maximum torque allowed.



# Stage 12 — Hang Off the 7-5/8” Casing

**CAUTION:** Torque wrap can build in the casing string as it is rotated. Ensure the string comes to a neutral position, by allowing it to back off slowly counter clockwise, before the casing hanger is fully landed.

20. Cease rotation and continue carefully lowering the hanger through the wellhead and land it on top of the 9-5/8” MBU-4T packoff, 30.00” below the top of the drilling adapter.

21. Slack off all weight on the casing and verify that the **HANGER LANDED** paint mark has aligned with the rig floor.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

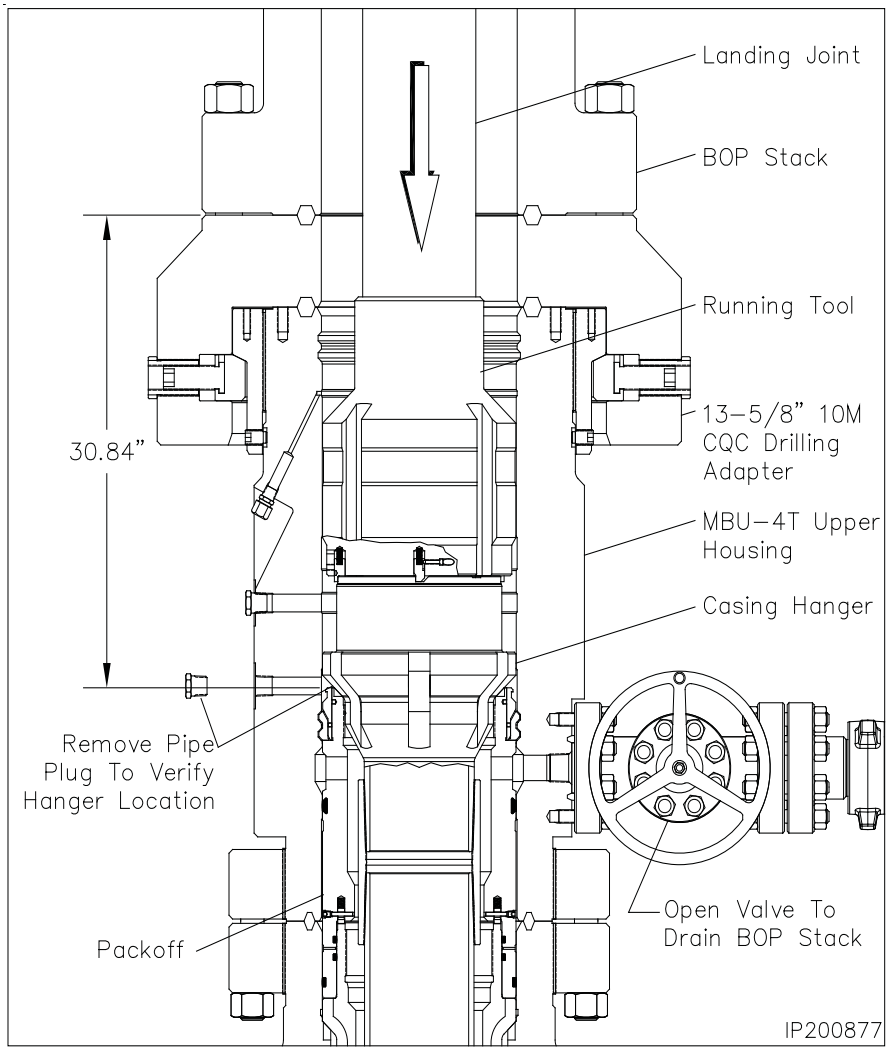
22. Open the lower outlet valve on the upper housing to drain the BOP stack.

23. Remove the lower 1” NPT sight port in the housing and look through the open port. The white paint mark on the casing hanger will be clearly visible.

24. Reinstall the pipe plug and tighten securely.

25. Close the open valve and place a vertical paint mark on the landing joint to verify if the casing string rotates during the cementing process.

26. Cement the casing as required.




**NOTE:** Returns may be taken through the circulation slots and out the BOP or out the side outlets on the housing.

27. With cement in place, bleed off all pressure and remove the cementing head.

***28. <u>Using chain tongs only, located 180° apart</u>,*** retrieve the running tool and landing joint by rotating the landing joint counter clockwise (left) approximately 15 turns or until the tool comes free of the hanger.

**CAUTION:** The rig floor tong may be used to break the connection but under no circumstances is the top drive to be used to rotate or remove the casing hanger running tool.

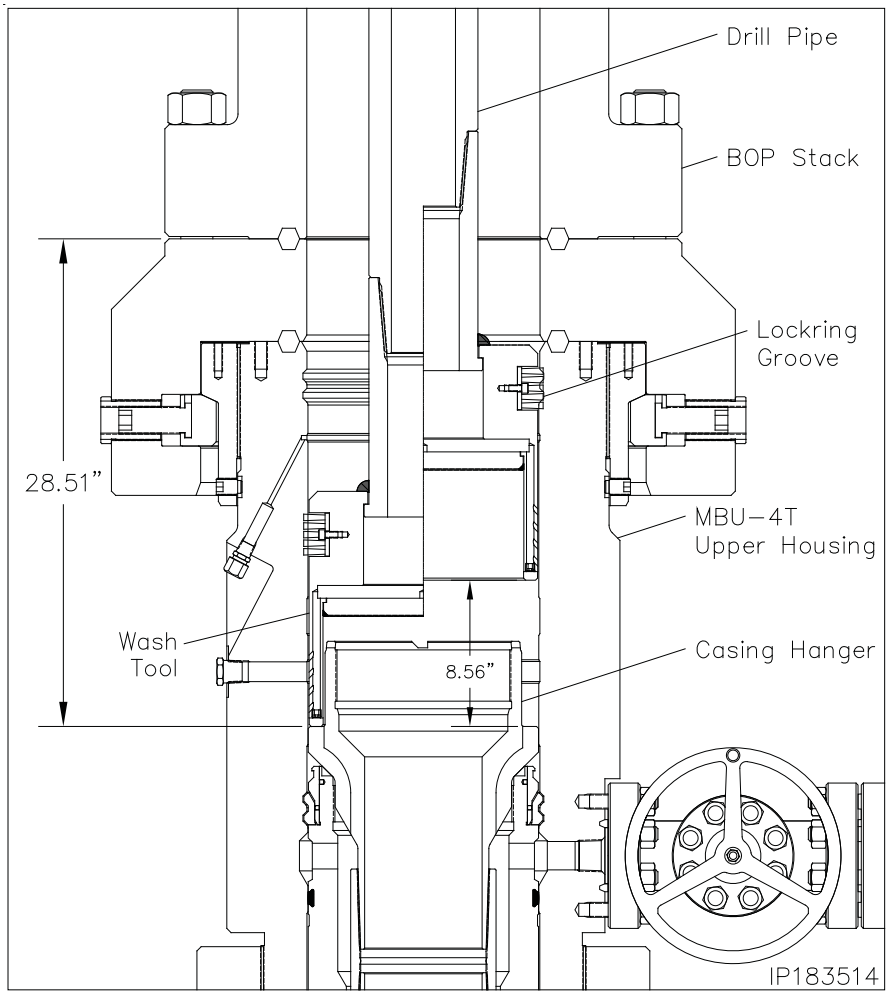
# Stage 12 — Hang Off the 7-5/8” Casing

## Running the 13-5/8” Wash Tool

1. Examine the ***13-5/8" x 4-1/2" IF Wash Tool (Item ST9).*** 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 7-5/8" casing hanger, 28.51” below the top of the drilling adapter.
4. Place a paint mark on the drill pipe level with the rig floor.
5. Using chain tongs, rotate the tool clockwise (right) approximately 6 turns to loosen any debris that may be on top of the hanger flutes.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

6. Open the lower side outlet valve and drain the BOP stack.
7. Pick up on the tool approximately 1" and attach a high pressure water line or the top drive to the end of the drill pipe and pump water at approximately 25 SPM through the tool and up the BOP stack.
8. Pick up the tool 8.56” total, above its landing position and rotate the tool to brush the lockring groove free of debris.
9. While flushing, raise and lower the tool the full length of the wellhead and BOP stack. The drill pipe should be slowly rotated (approximately 20 RPM) while raising and lowering to wash the inside of the housing and BOP stack to remove all caked on debris.
10. Once washing is complete, land the wash tool on the hanger flutes.




11. Shut down pumps and observe the returns at the open lower outlet for debris.
12. Reengage the pump and fully wash the inside of the wellhead and the entire BOP one additional cycle ensuring the stopping point is with the wash tool resting on top of the hanger flutes.

**CAUTION:** Observe the returns at the open outlet valve. If returns are not clean, continue flushing until they are.

13. Once the returns are clean and free of debris, retrieve the tool to the rig floor.
14. Using a bright light, sight through the bore of the BOP stack and observe the top of the hanger neck and flutes. Ensure that there are no dark areas on top of the hanger flutes.

**CAUTION:** Continue washing until all debris is removed.

# Stage 12A — Hang Off the 7-5/8" Casing (Emergency)

1. Cement the hole as required.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

2. Drain the BOP stack through the housing lower side outlet valve.

3. Locate the actuation screws on the O.D. of the drilling adapter.

4. Using a hex drive, fully retract the actuation screws until they are slightly over flush with the gland nuts.

**WARNING:** Keep body clear of all pinch points and suspended loads.

5. Pick up on the BOP stack a minimum of 12" above the housing and secure with safety slings.

6. Washout bowl as required.

7. Examine the ***13-5/8" x 7-5/8" MBU-4T-MID Slip Casing Hanger (Item A24a).*** Verify the following:
   - slips and internal bore are clean and in good condition
   - all screws are in place

8. There are four latch screws located in the side of the casing hanger body. Using a 5/16" Allen wrench, remove the four latch screws located 180° apart and separate the hanger into two halves.

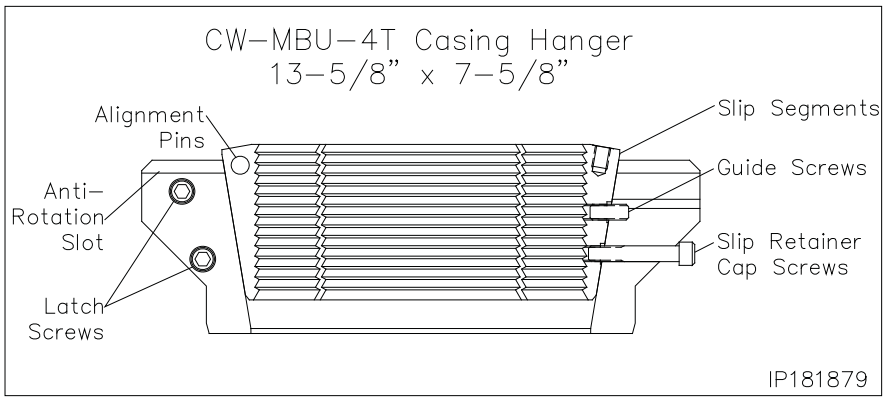
9. Place two boards on the lower adapter against the casing to support the hanger.

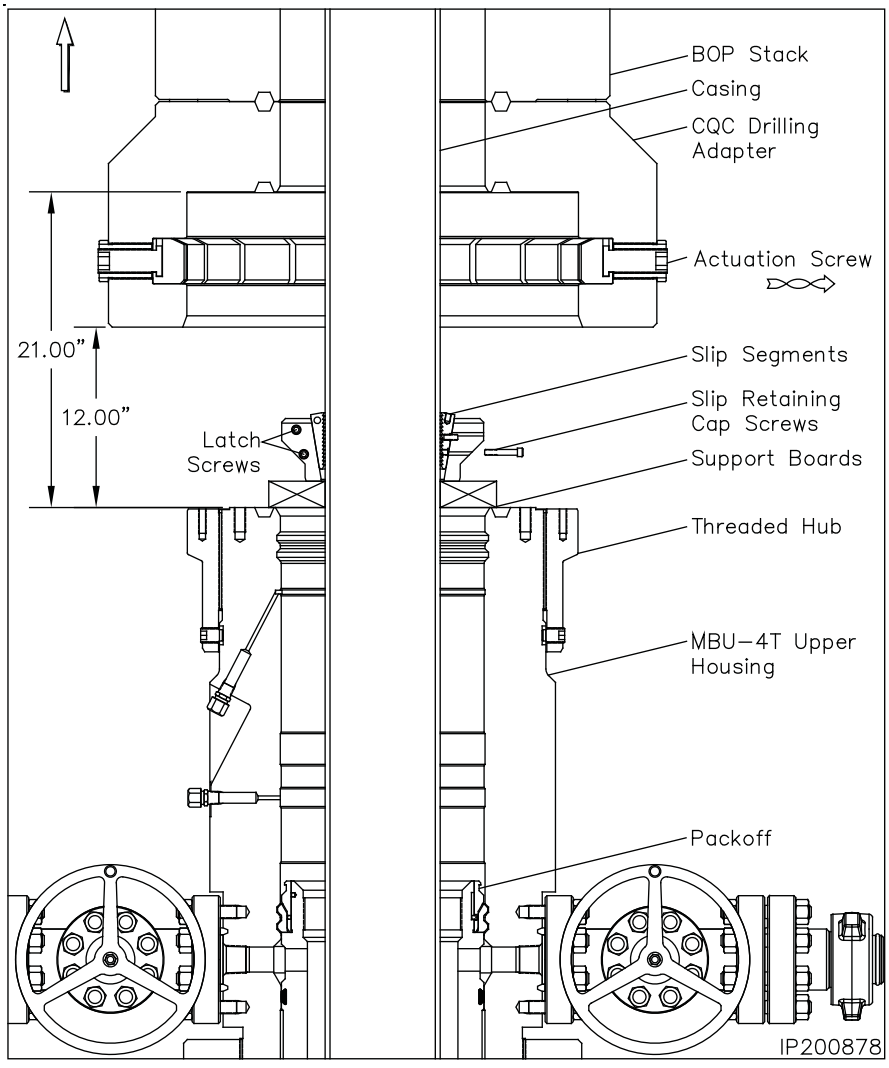
10. Pick up one half of the hanger and place it around the casing and on top of the boards.

11. Pick up the second hanger half and place it around the casing adjacent the first half.

12. Slide the two hanger halves together ensuring the slip alignment pins properly engage the opposing hanger half.

13. Reinstall the latch screws and tighten securely.




14. Prepare to lower the hanger into the housing bowl.

**CAUTION: Do Not** drop the casing hanger!

# Stage 12A — Hang Off the 7-5/8” Casing (Emergency)

15. Grease the casing hanger body and remove the slip retaining screws.

16. Pull tension on the casing to the desired hanging weight

17. Remove the boards and allow the hanger to slide into the housing bowl. When properly positioned the top of the hanger will be approximately 22.56” below the top of the housing.

18. Slack off the desired hanging weight.

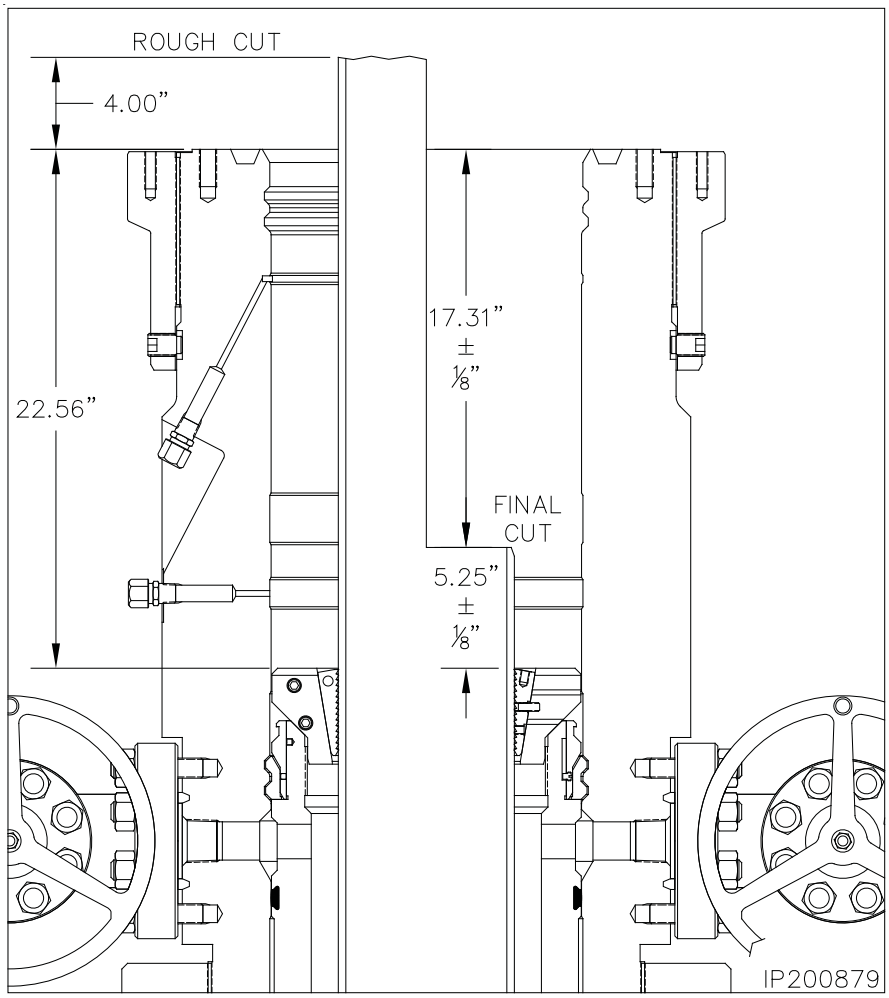
**NOTE:** A sharp decrease on the weight indicator will signify that the hanger has taken weight. If this does not occur, pull tension again and slack off once more.

**WARNING:** Due to 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 gases, with an approved sensing device, prior to cutting the casing. If gas is present, do not use an open flame torch to cut the casing. It will be necessary to use an air driven mechanical cutter which is spark free.

19. Rough cut the casing approximately 4” above the top of the housing and move the excess casing out of the way.

20. Using the internal casing cutter, final cut the casing at 17.31” ± 1/8” below the top of the lower adapter or 5.25” ± 1/8” above the hanger body.

21. Remove the internal casing cutter assembly and reconfigure the assembly to bevel the casing. Reinstall the cutter assembly and then place a 3/16” x 3/8” bevel on the O.D. and an I.D. chamfer to match the minimum bore of the packoff to be installed.




**CAUTION:** There must not be any rough edges on the casing or the seals of the packoff will be damaged.

22. Thoroughly clean the housing bowl, removing all cement and cutting debris.

# Stage 13 — Install the MBU-3T Mandrel Hanger Packoff

The following steps detail the installation of the MBU-3T nested packoff assembly for the mandrel hanger. If the casing was landed using the emergency slip hanger, skip this stage and proceed with **Stage 13A** for installing the emergency MBU-3T nested packoff.

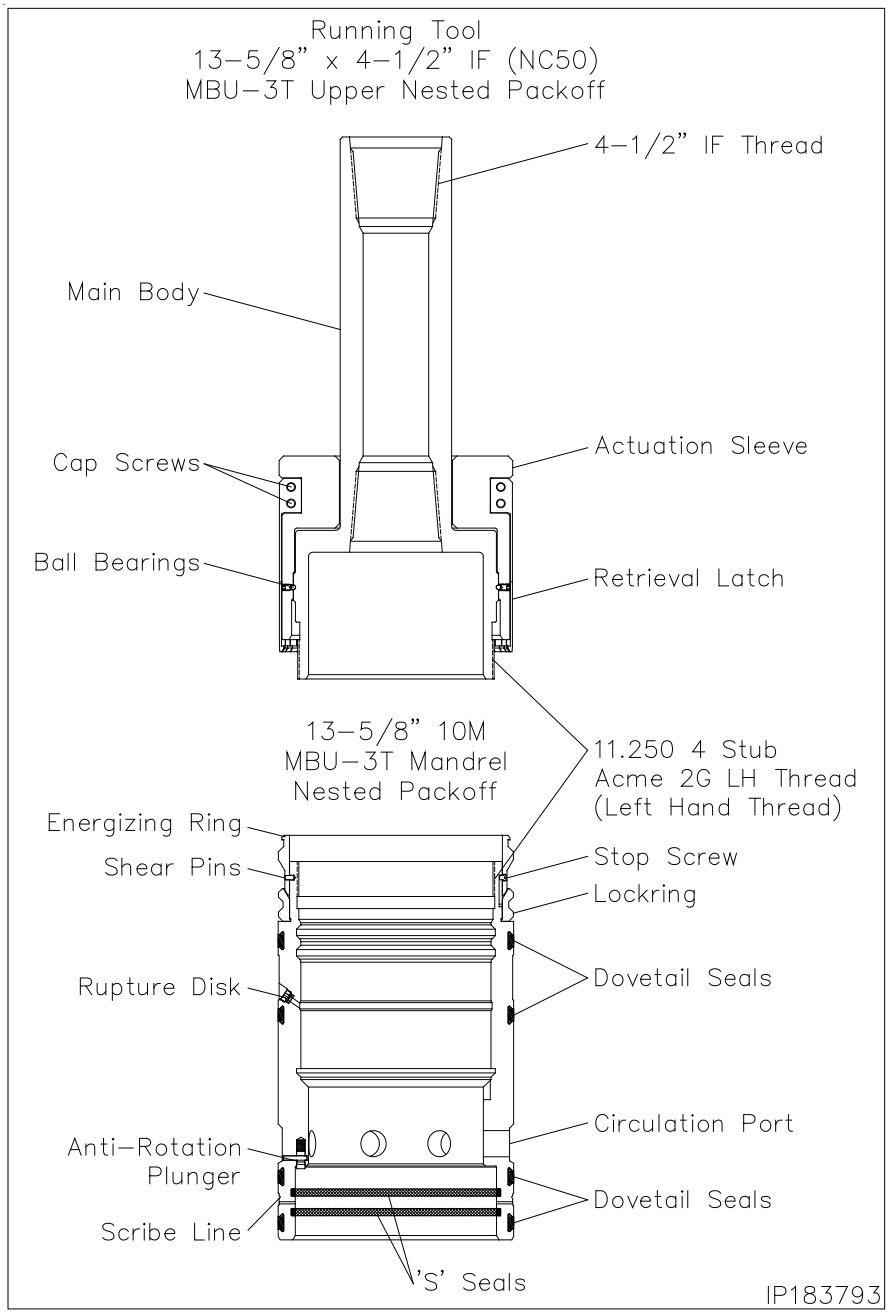
1. Examine the ***13-5/8" x 11.250" 4 Stub Acme 2G LH Box Top MBU-3T Mandrel Hanger Nested Packoff Assembly (Item A25).*** Verify the following:
   - all elastomer seals are in place and undamaged
   - internal bore, and ports, are clean and in good condition
   - lockring is fully retracted
   - rupture disk is in place and tightened securely
   - energizer ring is in its upper most position and retained with shear pins
   - guide screws are in place and back off 1/4 turn
   - anti-rotation plungers are in place, free to move

2. Locate the 5/16" scribe mark between the lower dovetail seals of the packoff and paint only the scribe mark white. Allow the paint to dry.

3. Inspect the I.D. and O.D. seals for any damage and replace as necessary.

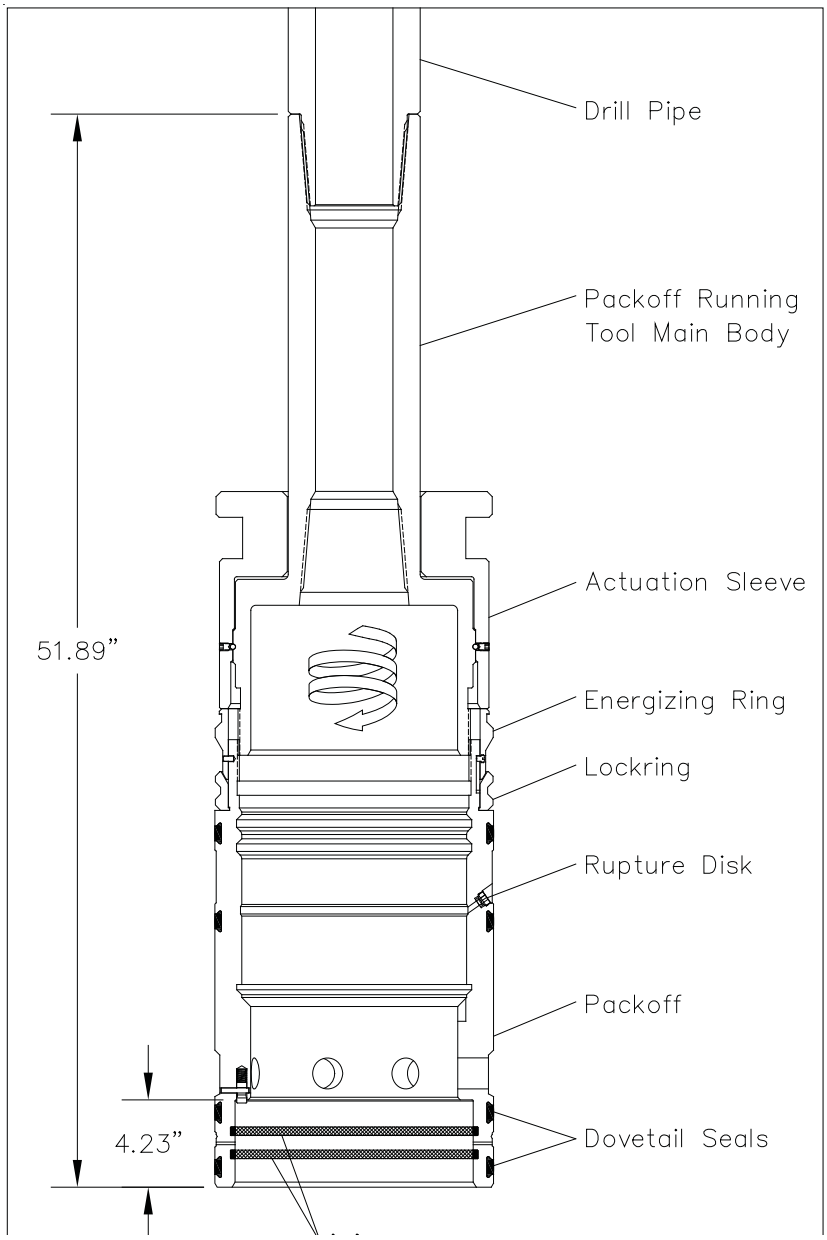
4. Examine the ***13-5/8" Nominal x 11.250" 4 Stub Acme 2G LH, MBU-3T-UPR Nested Packoff Running Tool (Item ST13).*** Verify the following:
   - Acme threads are clean and in good condition
   - retrieval latch is in position and retained with cap screws
   - actuation sleeve rotates freely
   - seal sleeve is removed

**NOTE:** Alternate tool may also be used.



# Stage 13 — Install the MBU-3T Mandrel Hanger Packoff

5. Remove the retrieval latch and set aside.
6. Make up the running tool to 4-1/2" IF (NC-50) drill collar and torque the connection to optimum make up torque.
7. Pick up the running tool assembly with drill pipe landing joint and suspend it above the packoff.
8. Carefully lower the tool into the packoff and thread them together by first rotating the tool clockwise (RIGHT) to locate the thread start and then counter clockwise (LEFT) approximately 3 turns until the tool actuation sleeve makes contact with the packoff energizing ring.
9. Pick up the assembly and thoroughly clean and lightly lubricate the packoff I.D. 'S' seals and the O.D. dovetail seals with oil or light grease.
10. Locate the upper and lower "SEAL TEST" fittings on the O.D. of the housing and remove the dust cap from the fittings.
11. Attach a test pump to both fittings and pump clean test fluid thru the fittings and ports to dislodge any old grease and trapped debris.
12. Remove the test pumps and reinstall the fitting dust caps.



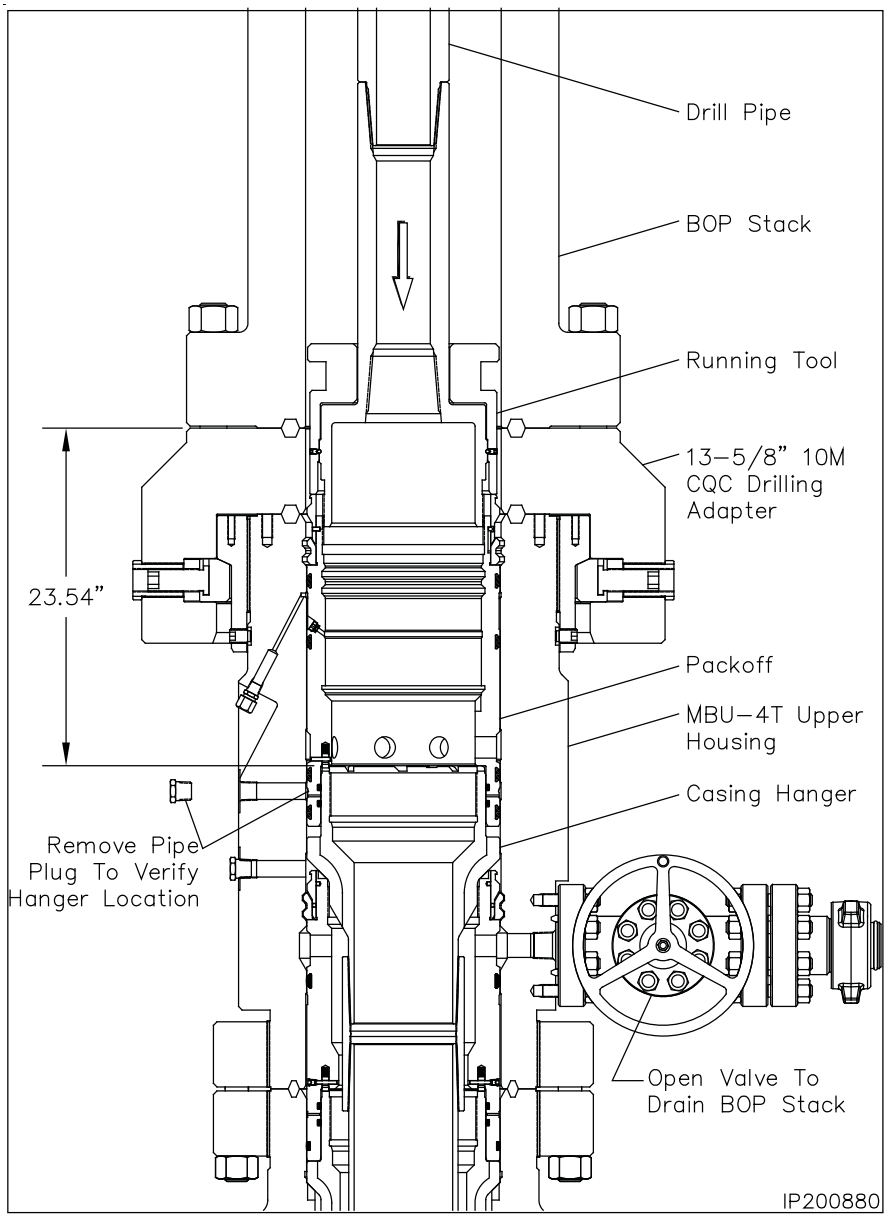
# Stage 13 — Install the MBU-3T Mandrel Hanger Packoff

## Landing the Packoff

13. Remove the hole cover.
14. Place a paint mark on the packoff 4.23” from the bottom.
15. Measure up 5 foot from that mark and place a paint mark on the drill pipe.
16. Pick up the packoff/running tool assembly and carefully lower the assembly through the BOP, marking the landing joint every five feet, until the calculated dimension is reached.
17. Place a paint mark on the landing joint at the dimension and mark **LANDED**. Place an additional mark 1-1/2” above the first one and mark **ENGAGED**.
18. Continue lowering the packoff until it passes over the neck of the hanger and lands on the casing hanger neck, 23.54” below the top of the drilling adapter.

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

19. Open the lower outlet valve on the upper housing to drain the BOP stack.
20. Locate the upper 1” sight port pipe plug and remove the plug.
21. Look through the port to verify that the packoff is properly landed. The white painted scribe mark on the packoff will be clearly visible in the center of the open port.
22. Reinstall the pipe plug and tighten securely.



# Stage 13 — Install the MBU-3T Mandrel Hanger Packoff

## Seal Tests

23. Locate the upper and lower “SEAL TEST” fittings on the O.D. of the upper housing and remove the dust caps from the fittings.

24. Attach a test pump to the open lower fitting and pump clean test fluid between the seals until a stable test pressure of ***5,000 psi*** is achieved.

25. Hold the test pressure for 15 minutes or as required by drilling supervisor.

26. If a leak develops, bleed off test pressure. Remove the packoff from the wellhead and replace the leaking seals.

27. Repeat steps 20 through 22 for the remaining upper fitting and test the upper seals to ***10,000 psi***.

28. After satisfactory tests are achieved, bleed off the test pressure but leave the test manifolds in place.

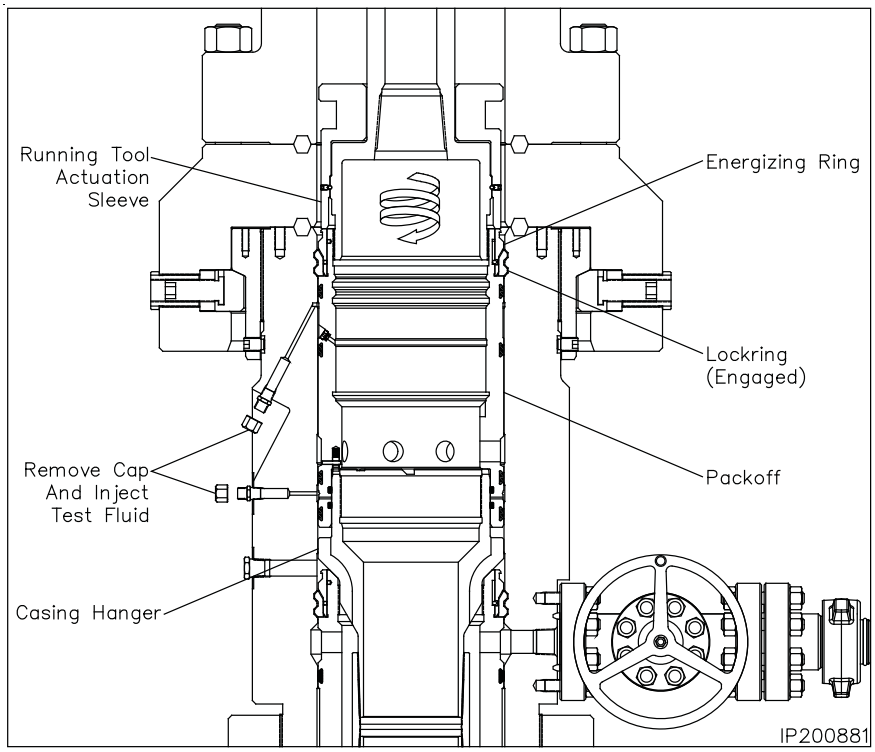
## Engaging the Lockring

***29.*** ***Using chain tongs only, located 180° apart***, slowly rotate the drill pipe counter clockwise until the anti-rotation plungers align with the slots in the top of the hanger. Expect torque of approximately 400 ft-lbs to rotate the packoff.

***30.*** ***Using chain tongs only,*** rotate the landing joint approximately 6 to 6-1/2 turns counter clockwise to engage the packoff lockring in its mating groove in the bore of the MBU-4T upper housing.

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

**NOTE:** When properly engaged the second paint mark on the landing joint will align with the rig floor. VERIFY PAINT MARKS.




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

**CAUTION:** If the required turns to engage the lockring are not met or excessive torque is encountered, remove the packoff. First call local branch. If further assistance is required then call Houston Engineering.

31. Back off the landing joint/running tool approximately three turns. Using the top drive, exert a 40,000 lbs. pull on the landing joint. After satisfactory test, slack off all weight.

32. Reattach the test pump to the open test manifolds and retest the packoff seals as previously outlined. This will also verify that the packoff is in place.

33. After satisfactory tests are achieved, remove test pump and manifold from the lower fitting and reinstall the dust cap on the lower fitting.

34. Using the test pump, increase the injection pressure on the upper test fitting to ***11,500 psi*** to burst the rupture disk in the packoff. This will open the test port passage for the upper packoff.

35. Remove test pump and attach a grease gun to the open upper fitting.

36. Pump grease thru the fitting and port until it flows into the ID of the packoff.

37. Remove the grease gun and reinstall the dust cap on the open fittings.

***38.*** ***Using chain tongs only,*** rotate the landing joint clockwise until the tool comes free of the packoff (approximately 9 to 9-1/2 total turns) and then retrieve the tool with a straight vertical lift.

# Stage 13 — Install the MBU-3T Mandrel Hanger Packoff

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

## Retrieving the Packoff

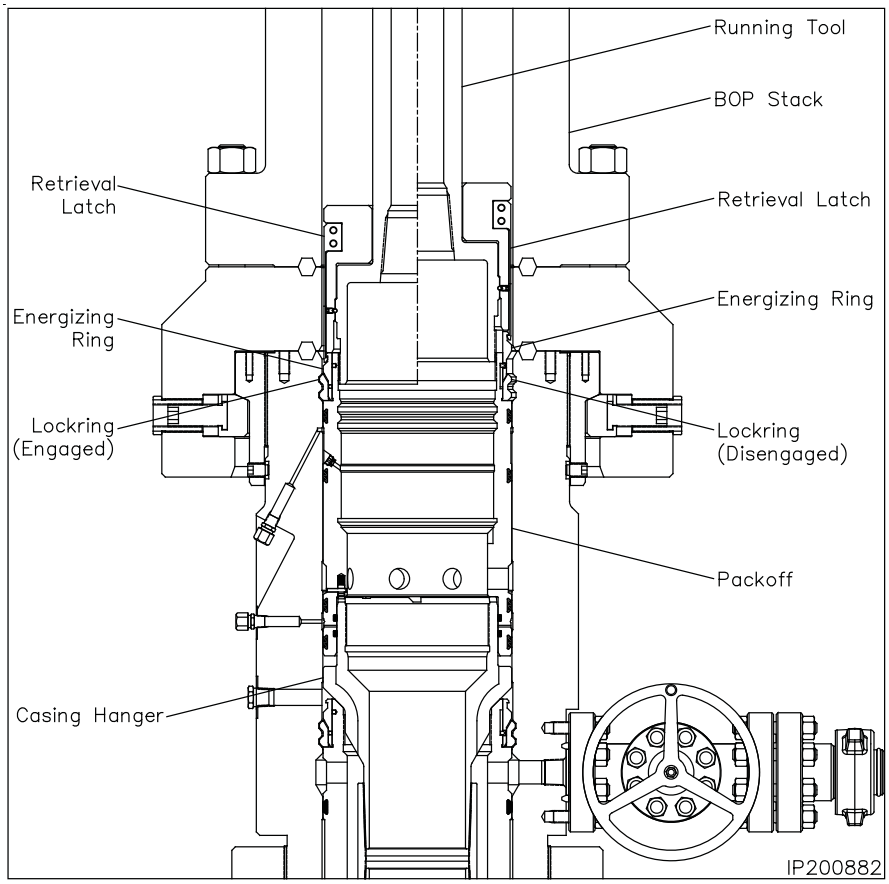
1. Position the retrieval latch so the latch fingers extend from the bottom of the running tool body.
2. Reinstall the cap screws and tighten them securely.
3. Ensure the retrieval latch freely rotates on the running tool body.
4. Carefully lower the running tool through the BOP stack and into the packoff.
5. Rotate the drill pipe clockwise (Right) to locate the thread start and then counter clockwise (Left) (approximately 9 to 9-1/2 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 (right) approximately 6 turns to a positive stop. The drill pipe should rise approximately 1-1/2”.

**CAUTION:** Do not exceed the 6 turns or the packoff may be seriously damaged.

7. Carefully pick up on the drill pipe and remove the packoff from the MBU-4T wellhead with a straight vertical lift.
8. Rotate the packoff 1 turn clockwise to relax the retrieval latch.
9. Remove the (4) 1/2” cap screws and remove the latch assembly.
10. Redress the packoff and reset as previously outlined.
11. Once the packoff is properly set, reinstall the retrieval latch on the tool.



# Stage 13A — Install the 7-5/8” Emergency Packoff

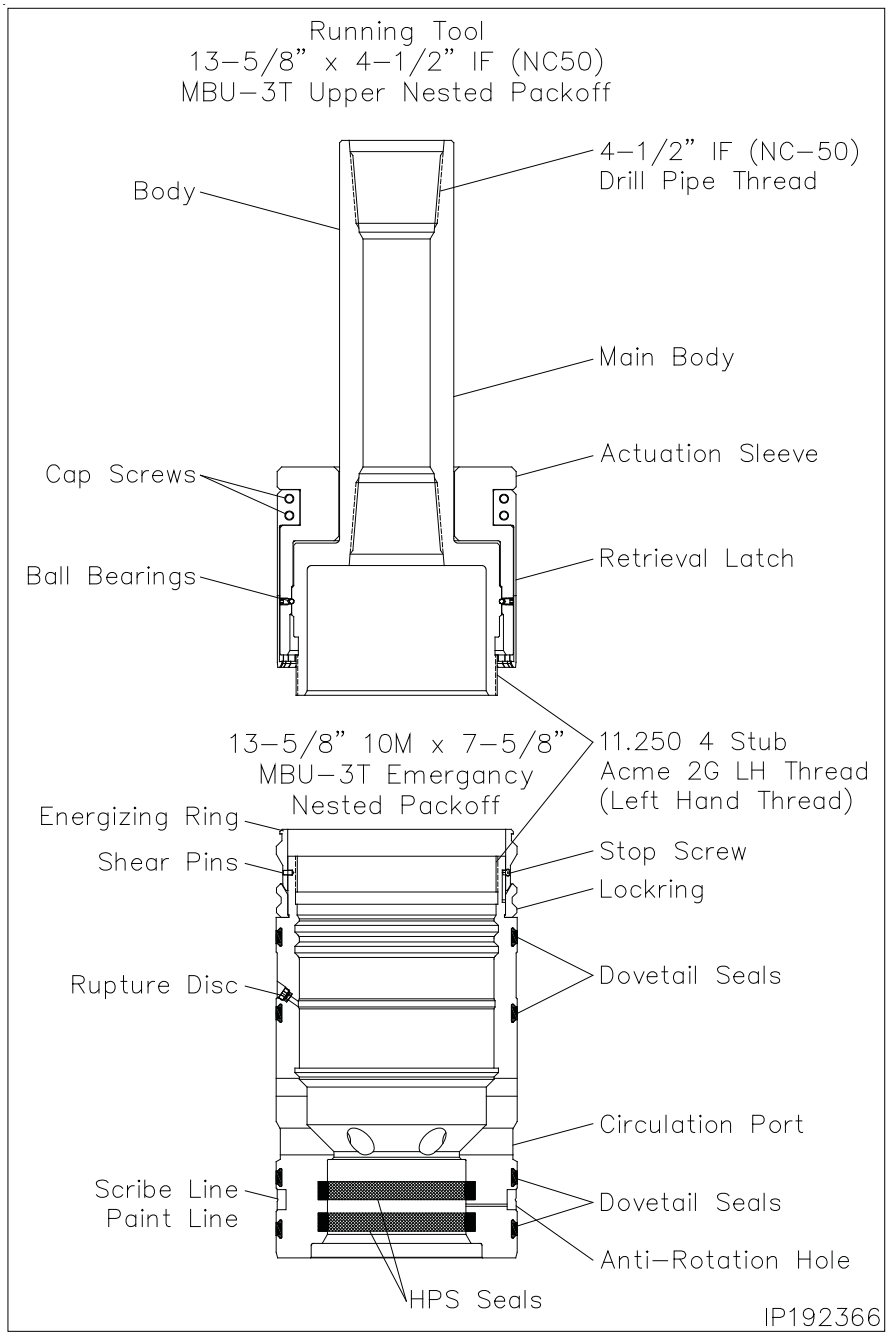
**NOTE:** Only use this stage if the 7-5/8” casing becomes stuck and the mandrel casing hanger cannot be landed. If the mandrel hanger has been set then skip this stage.

1. Examine the ***13-5/8” 10M x 7-5/8” x 11.250” 4 Stub Acme 2G LH Box Top MBU-3T Emergency Nested Packoff Assembly (Item A25a).*** 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
   - rupture disc is in place and tightened securely
   - energizer ring is in its upper most position and retained with shear pins
   - guide screws are in place and back off 1/4 turn
   - paint scribe line white and allow paint to dry

2. Inspect the I.D. and O.D. seals for any damage and replace as necessary.

3. Examine the ***13-5/8” Nominal x 11.250” 4 Stub Acme 2G LH, MBU-3T Nested Packoff Running Tool (Item ST13).*** Verify the following:
   - Acme threads are clean and in good condition
   - retrieval latch is in position and retained with cap screws
   - actuation sleeve rotates freely
   - seal sleeve is removed

**NOTE:** Alternate tool may also be used.



# Stage 13A — Install the 7-5/8” Emergency Packoff

4. Remove the retrieval latch and set aside.

5. Make up a joint 4-1/2” IF (NC-50) drill pipe to the top of the running tool and tighten connection to thread manufacturer’s maximum make up torque.

6. Run in the hole with two stands of drill pipe and set in floor slips.

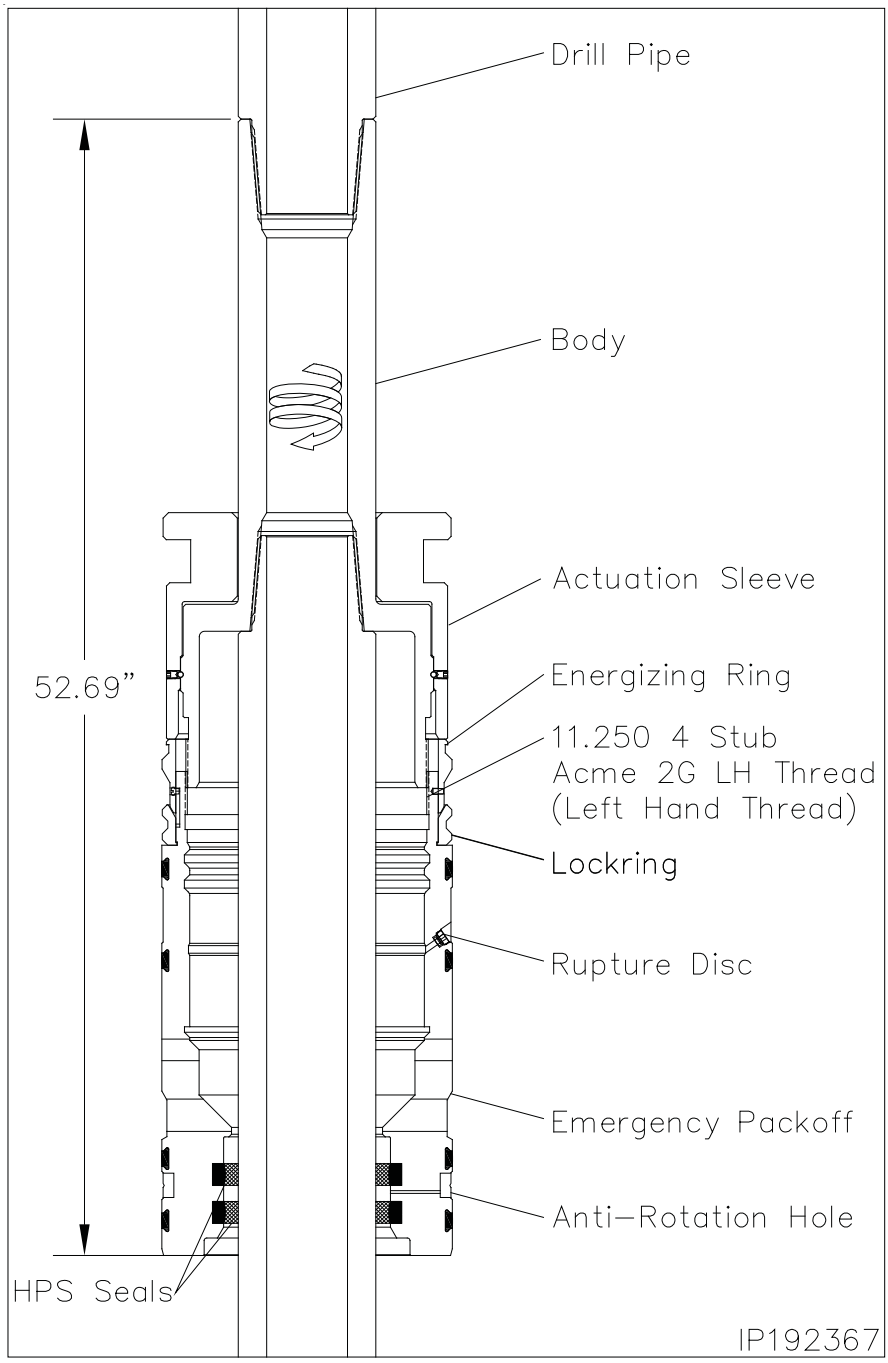
7. Pick up the packoff and carefully pass it over the drill pipe and set it on top of the floor slips.

8. Pick up the running tool with landing joint and make up the running tool to the drill pipe in the floor slips using the appropriate length pin x pin sub.

9. Pick up the packoff and thread it onto the running tool with clockwise (Right) rotation until the energizing ring makes contact with the actuation sleeve of the tool. (Approximately 4 turns).

**CAUTION:** Ensure the rupture disc is in place and tightened securely.

10. Thoroughly clean and lightly lubricate the packoff I.D. ‘HPS’ seals and the O.D. dovetail seals with oil or light grease.



# Stage 13A — Install the 7-5/8” Emergency Packoff

11. Locate the upper and lower “SEAL TEST” fittings on the O.D. of the housing and remove the dust cap from the fittings.

12. Attach a test pump to both fittings and pump clean test fluid thru the fittings and ports to dislodge any old grease and trapped debris.

13. Remove the test pumps and reinstall the fitting dust caps.

## Landing the Packoff

14. Pick up the drill string and remove the floor slips.

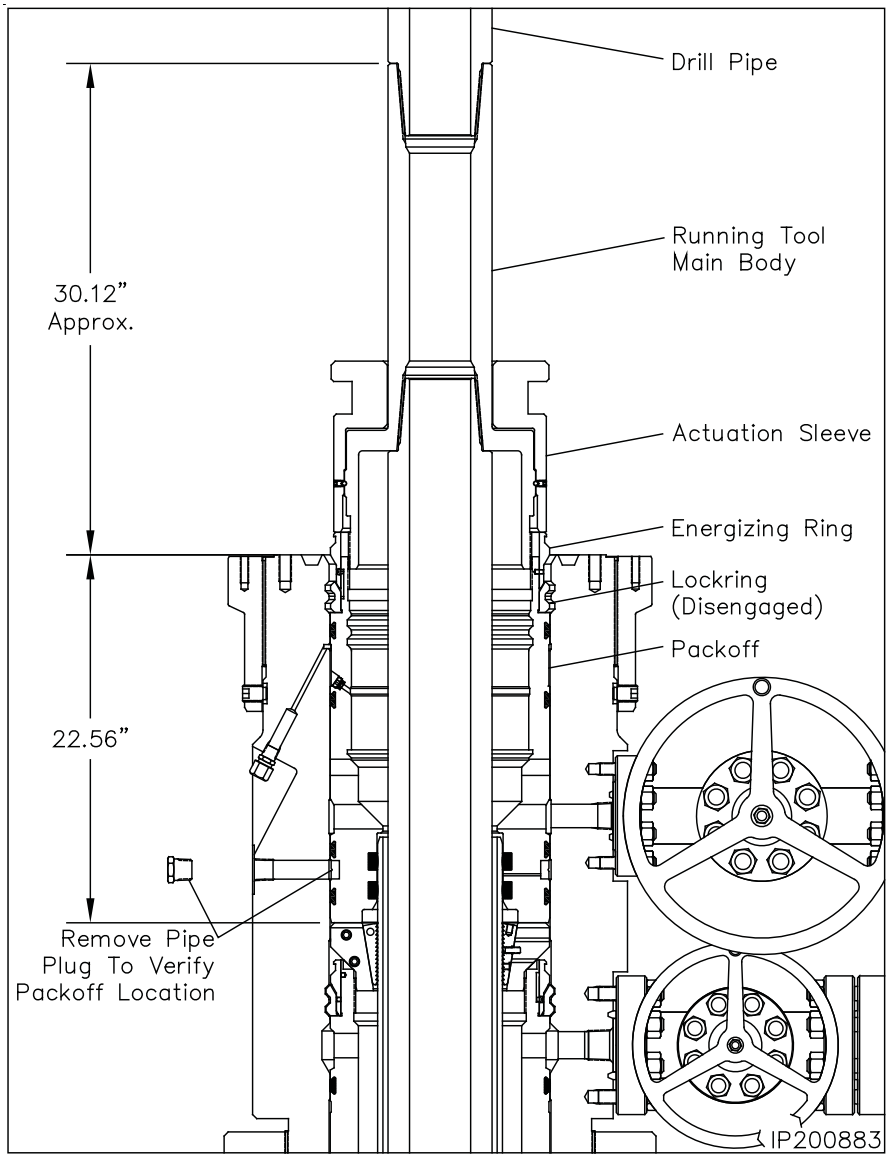
15. Carefully lower the packoff through the rig floor and position it just above the housing.

16. Carefully lower the packoff 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 30.12” above the top of the MBU-4T housing.

17. Remove the upper 1” LP pipe plug from the sight port to verify the packoff is properly landed. The 5/16” scribe line should be clearly visible in the center of the port.

18. With landing verified, reinstall the pipe plug and tighten securely.



# Stage 13A — Install the 7-5/8” Emergency Packoff

## Seal Test

19. Locate the upper and lower “SEAL TEST” fittings on the O.D. of the housing and remove the dust caps from the fittings.

20. Attach a test pump to the open lower fitting and pump clean test fluid between the seals until a stable test pressure of ***5,000 psi or 80% of casing collapse — whichever is less*** is achieved.

21. Hold the test pressure for 15 minutes or as required by drilling supervisor.

22. If a leak develops, bleed off test pressure, remove the packoff from the wellhead and replace the leaking seals.

23. After satisfactory test is achieved, bleed off the test pressure but leave the test manifold in place.

24. Repeat steps 17 through 20 for the remaining upper fitting and test upper seals to ***10,000 psi***.

## Engaging the Lockring

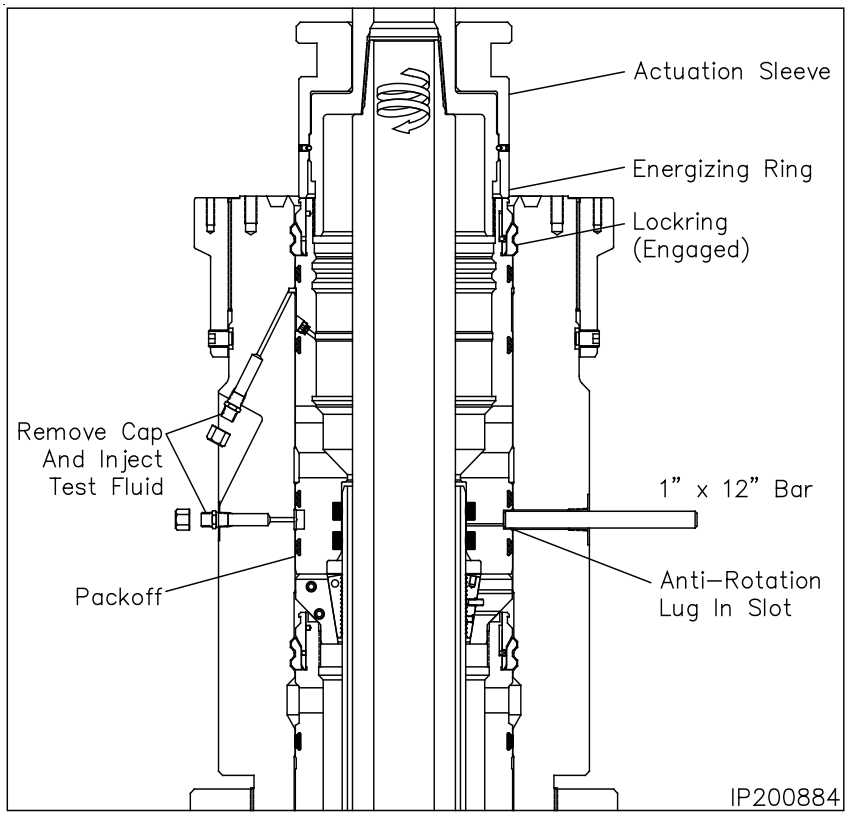
25. Remove the 1” sight port pipe plug and set aside.

26. Pass a 1” O.D. bar through the open port and hold inward pressure on the bar.

27. ***Using chain tongs only***, rotate the landing joint approximately 6 to 6-1/2 turns counter clockwise (Left) to engage the packoff lockring in its mating groove in the bore of the MBU-4T housing.

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

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




**CAUTION:** If the required turns to engage the lockring are not met or excessive torque is encountered, remove the packoff. First call local branch. If further assistance is required then call Houston Engineering.

28. Remove the 1” bar from the sight port and reinstall the pipe plug in the port.

29. Back off the landing joint/running tool approximately three turns. Using the top drive, exert a 40,000 lbs. pull on the landing joint. After satisfactory test, slack off all weight.

30. Reattach the test pump to the upper and lower test fittings and retest seals as previously outlined.

31. After a satisfactory test is achieved, increase the injection pressure in the upper test port to ***11,500 psi*** to burst the rupture disc in the packoff. This will open the test port passage for the upper packoff.

32. Remove test pump and attach a grease gun to the open upper fitting.

33. Pump grease thru the fitting and port until it flows into the ID of the packoff.

34. Remove the grease gun and reinstall the dust cap on the open fittings.

35. ***Using chain tongs only***, rotate the landing joint clockwise until the tool comes free of the packoff (approximately 6 to 6-1/2 total turns) and then retrieve the tool with a straight vertical lift.

36. Reinstall and nipple up the BOP stack.

# Stage 14 — 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, MBU-3T Inner Test Plug (Item ST14)***. Verify the following:
   - 1-1/4" VR plug and weep hole plug are in place and tightened securely
   - elastomer seals are in place and in good condition
   - drill pipe threads are clean and in good condition

2. Position the test plug with the long tong neck down 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.

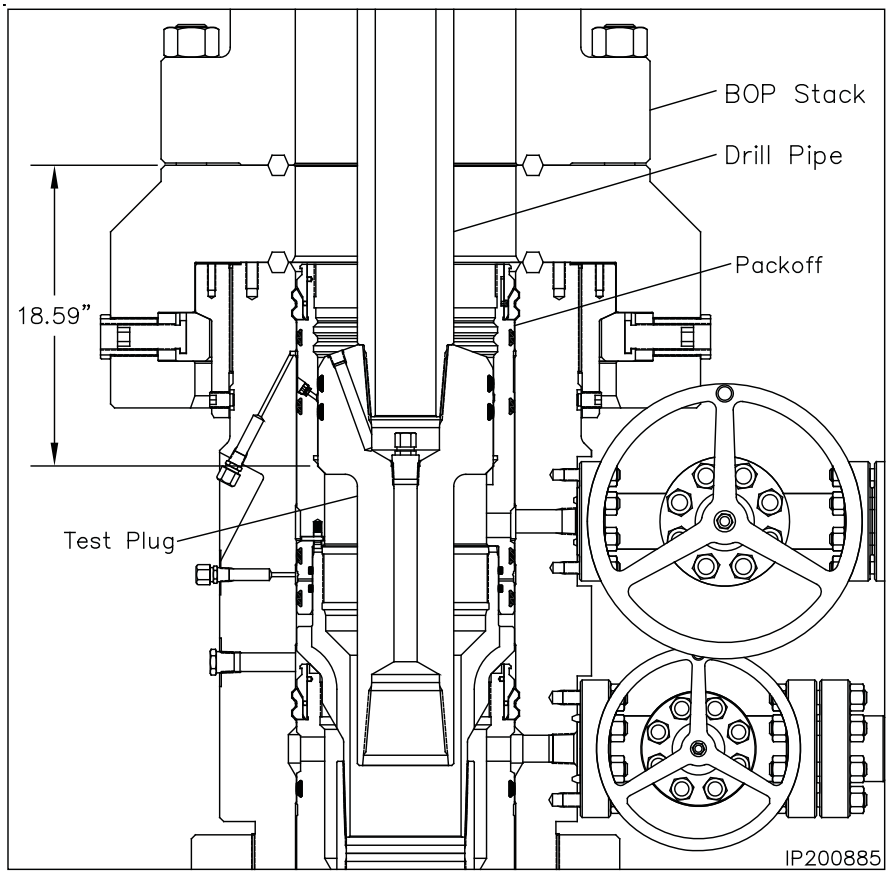
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

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, 18.59" below the top of the drilling adapter.

7. Close the BOP rams on the pipe and test the BOP to ***10,000 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. Retrieve the test plug with a straight vertical lift.

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

10. Close all open valves.

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

# Stage 15 — Run the Upper Wear Bushing

**CAUTION: 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 7.00" I.D. MBU-3T-UPR Wear Bushing (Item ST15).*** 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

## Run the Wear Bushing Before Drilling

2. Orient the ***13-5/8" Nominal x 4-1/2" IF (NC-50) CW Retrieving Tool (Item ST4)*** with drill pipe connection neck up.

3. Attach the retrieving tool to a joint of drill pipe.

**CAUTION:** Ensure the lift lugs are facing down.

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

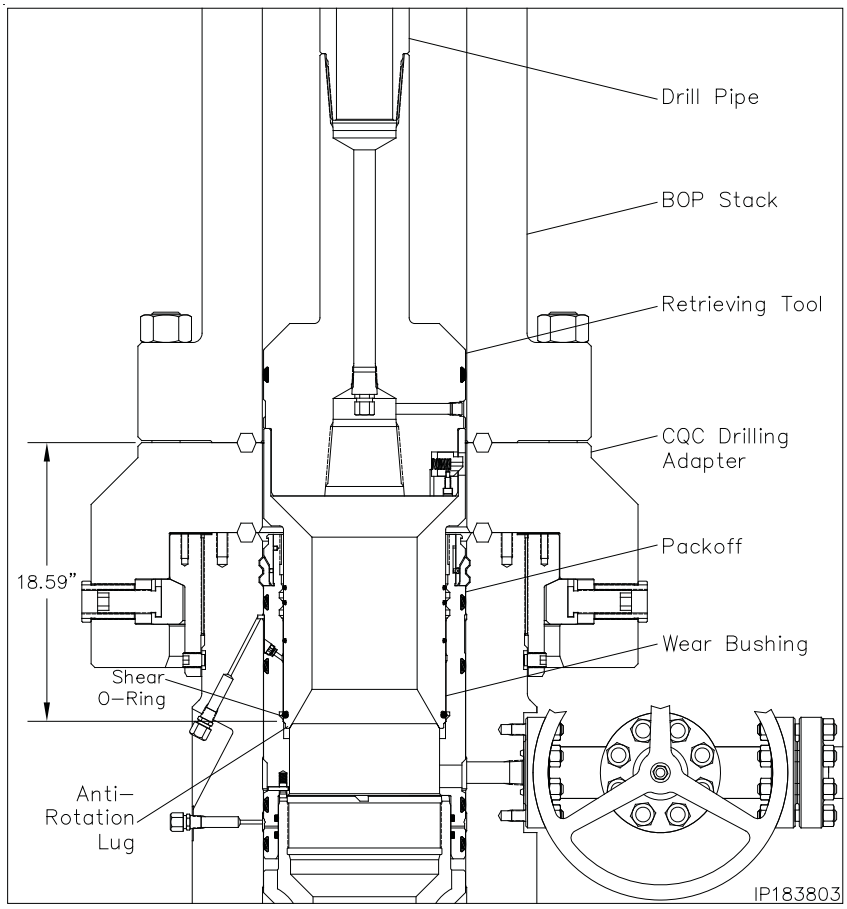
**NOTE:** If the lugs did not align with the holes, rotate the tool in either direction until they snap into place.

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

6. Ensure the BOP stack is drained and free of any debris from previous test.

7. Slowly lower the tool/bushing assembly through the BOP stack and land it on the load shoulder in the packoff, 18.59" below the top of the drilling adapter.

8. 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".




**NOTE:** The shear o-ring on bottom of the bushing will locate in a groove above the load shoulder in the packoff 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. Drill as required.

**CAUTION:** 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

11. Make up the retrieving tool to the drill pipe.

12. Slowly lower the tool into the wear bushing.

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. Remove it and the retrieving tool from the drill string.

# Stage 16 — Hang Off the 5-1/2" Casing

1. Examine the ***11" x 5-1/2" CW-CTH-TP8 Casing Hanger Running Tool (Item ST16).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - o-ring seal is clean and in good condition
   - torque dogs are in place, in upper most position and retainer set head screws are tightened securely

2. Make up a landing joint to the top of the Running Tool and torque connection to thread manufacturer's maximum make up torque.

3. Lay down the landing joint on the pipe rack.

4. On the pipe rack, examine the ***11" x 5-1/2" CW-MBU-3T-TP8 Mandrel Casing Hanger (Item A26).*** Verify the following:
   - internal bore and threads are clean and in good condition
   - neck seal area is clean and undamaged
   - torque slots are clean and in good condition
   - pin threads are clean and in good condition. **Install thread protector**

   .

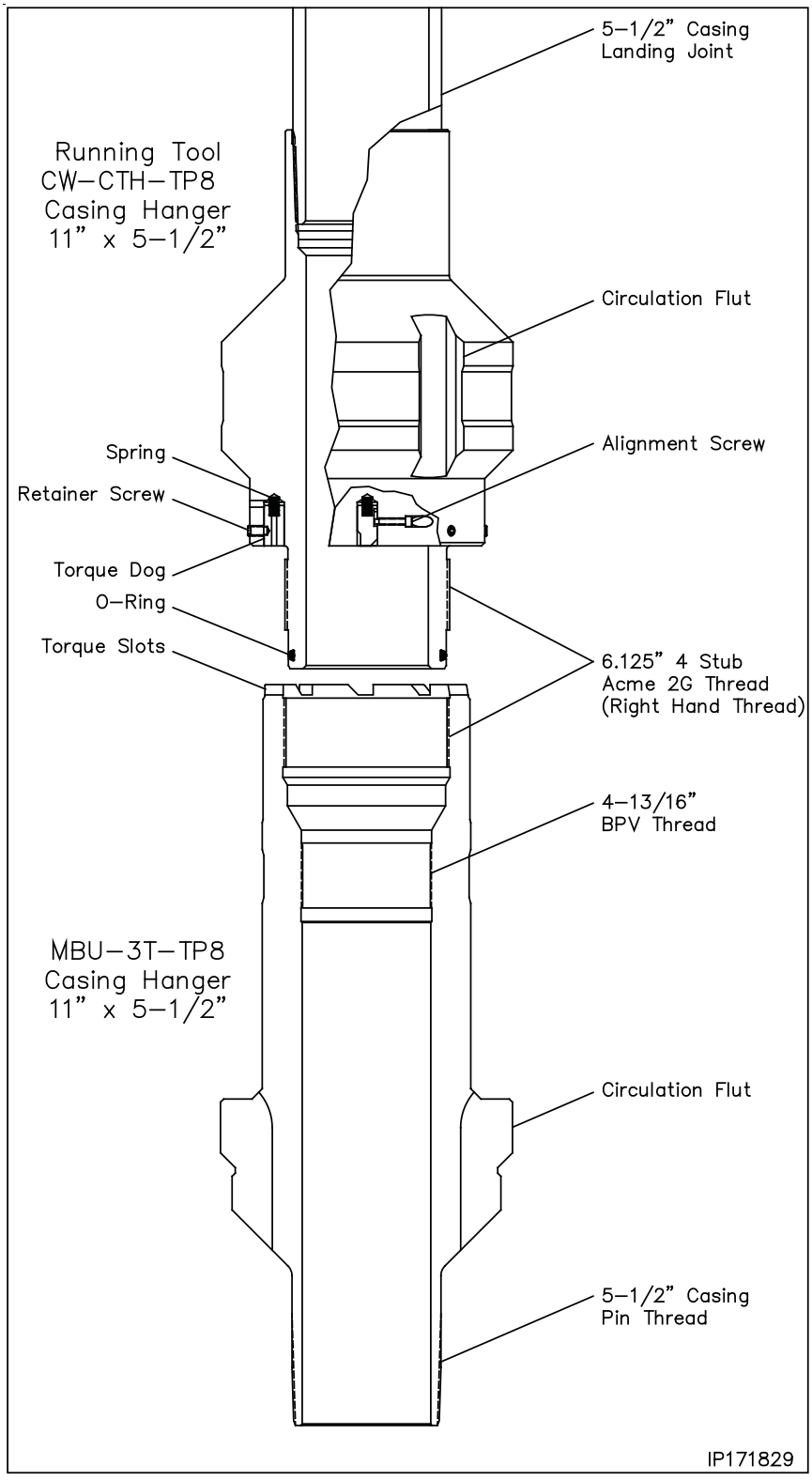
5. Liberally lubricate the mating threads, seal areas and o-ring of the hanger and running tool with a oil or light grease.

6. ***Using chain tongs only,*** thread the Running Tool into the hanger, with right hand rotation, until it shoulders out on the Hanger body.

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

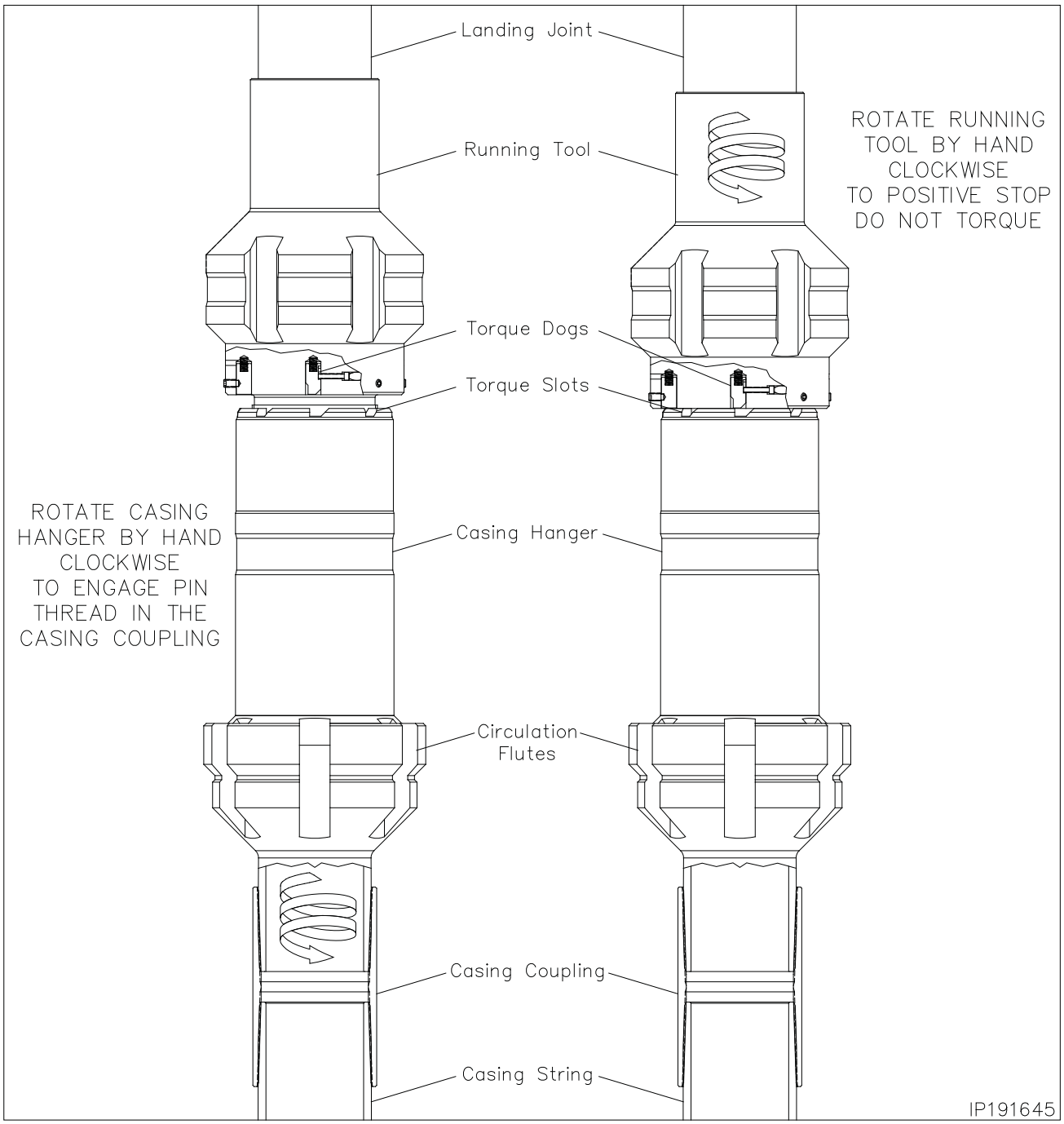
**NOTE:** If steps 1 through 6 were done prior to being shipped to location, the running tool should be backed off 1 turn and made back up to ensure it will back off freely.

7. Calculate the total landing dimension by adding the previously determined RKB dimension and 18.59", the depth of the wellhead.




8. Starting at the top of the 45° angle load shoulder of the casing hanger measure up the landing joint and place a paint mark on the joint. Mark **HANGER LANDED**.

# Stage 16 — Hang Off the 5-1/2” Casing




9. Place a second mark 18.00” below the first and mark **STOP ROTATING**.

10. Run the 5-1/2” casing as required and space out appropriately for the mandrel casing hanger.

**NOTE:** If the 5-1/2” casing becomes stuck and the mandrel casing hanger cannot be landed, Refer to **Stage 16B** for the emergency slip casing hanger procedure.

11. Pick up the casing hanger/running tool joint assembly.

12. Remove the casing hanger thread protector and carefully thread the hanger into the last joint of casing ran. Rotate the hanger clockwise, by hand, to a positive stop.

13. Rotate the running tool clockwise by hand to a positive stop.

# Stage 16 — Hang Off the 5-1/2” Casing

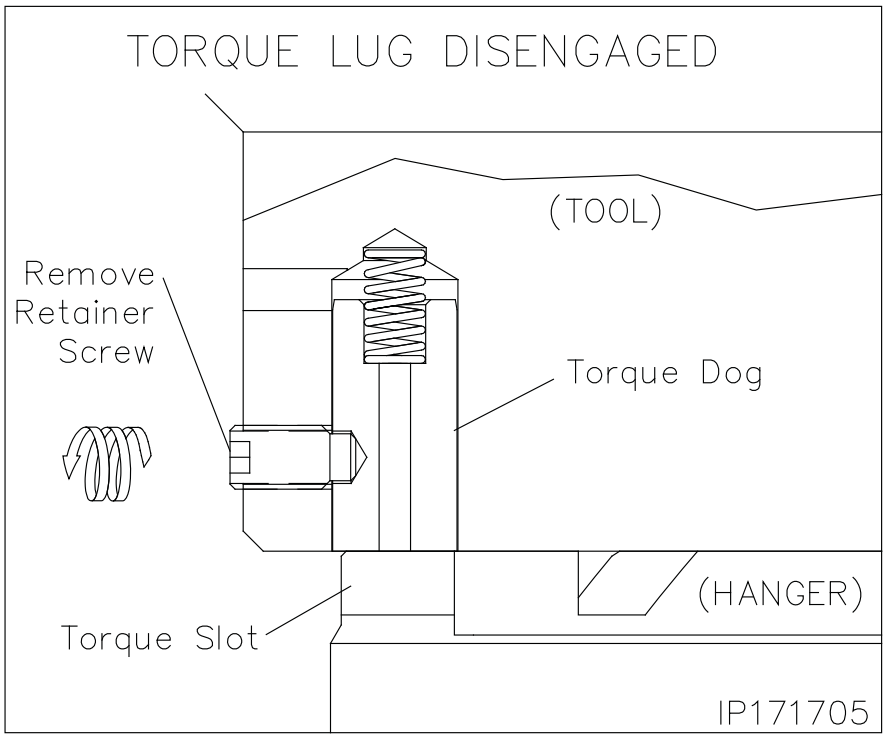
14. Locate the (8) 3/8” socket head set screws in the side of the hanger running tool and remove the screws.

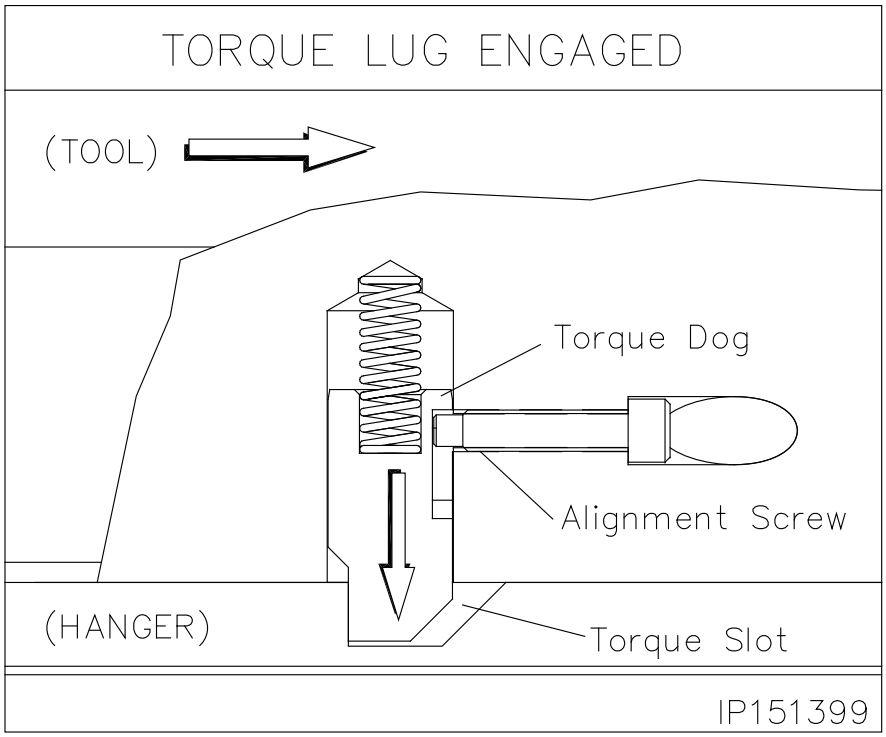
**CAUTION:** Place the screws in a safe place to reinstall in the tool when the job is completed.

**NOTE:** This will release the running tool torque dogs allowing them to move downward.

15. Using only chain tongs, rotate the running tool to the left to allow the torque dogs to engage the torque slots in the top of the hanger.

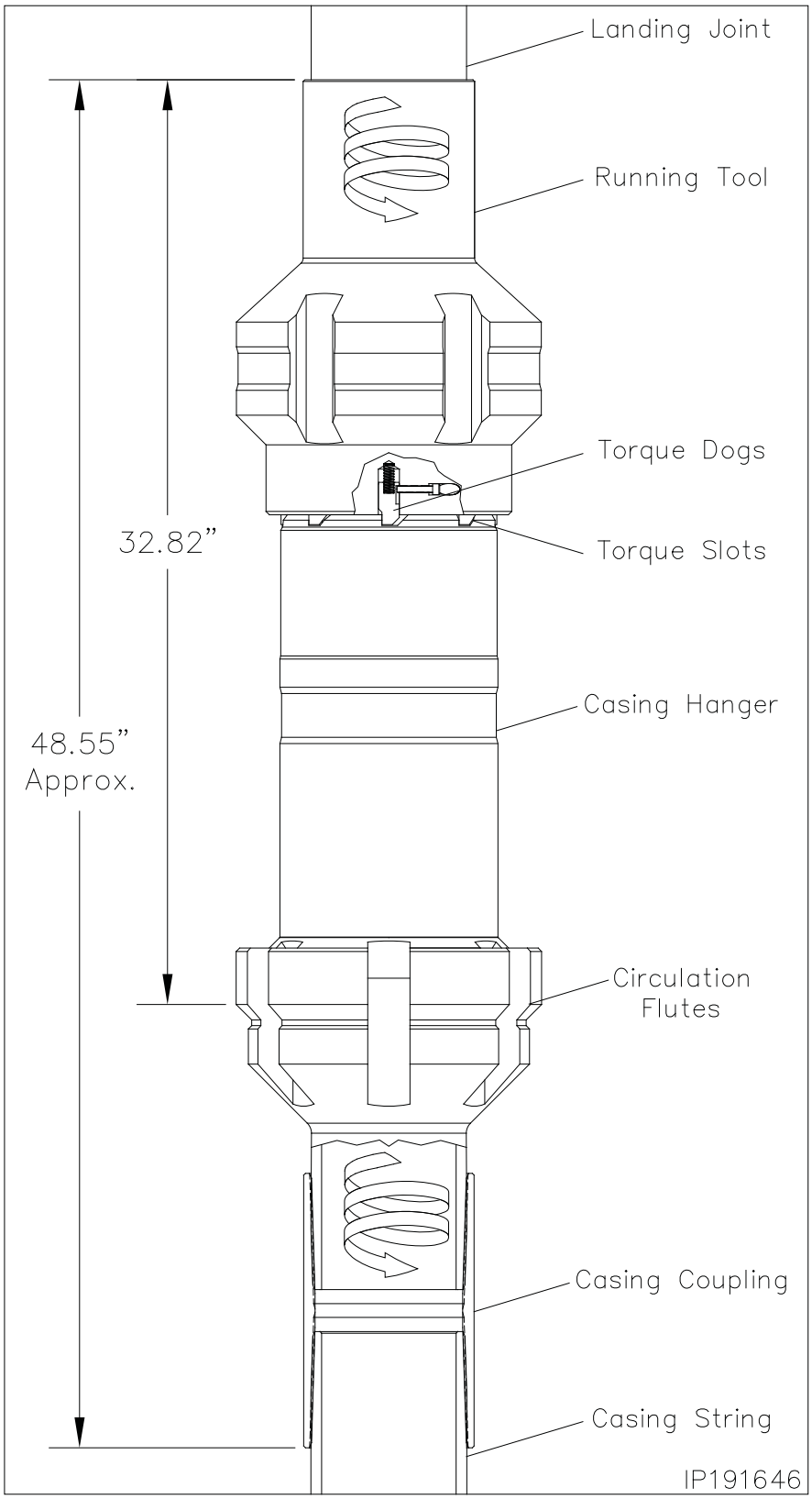
**CAUTION:** Do not rotate the running tool more than 1/4 turn to the left. Doing so will decrease the torque dog engagement



# Stage 16 — Hang Off the 5-1/2” Casing

16. Engage the CRT tool on the landing joint and torque the casing hanger in the casing string to thread manufacturer’s maximum make up torque.



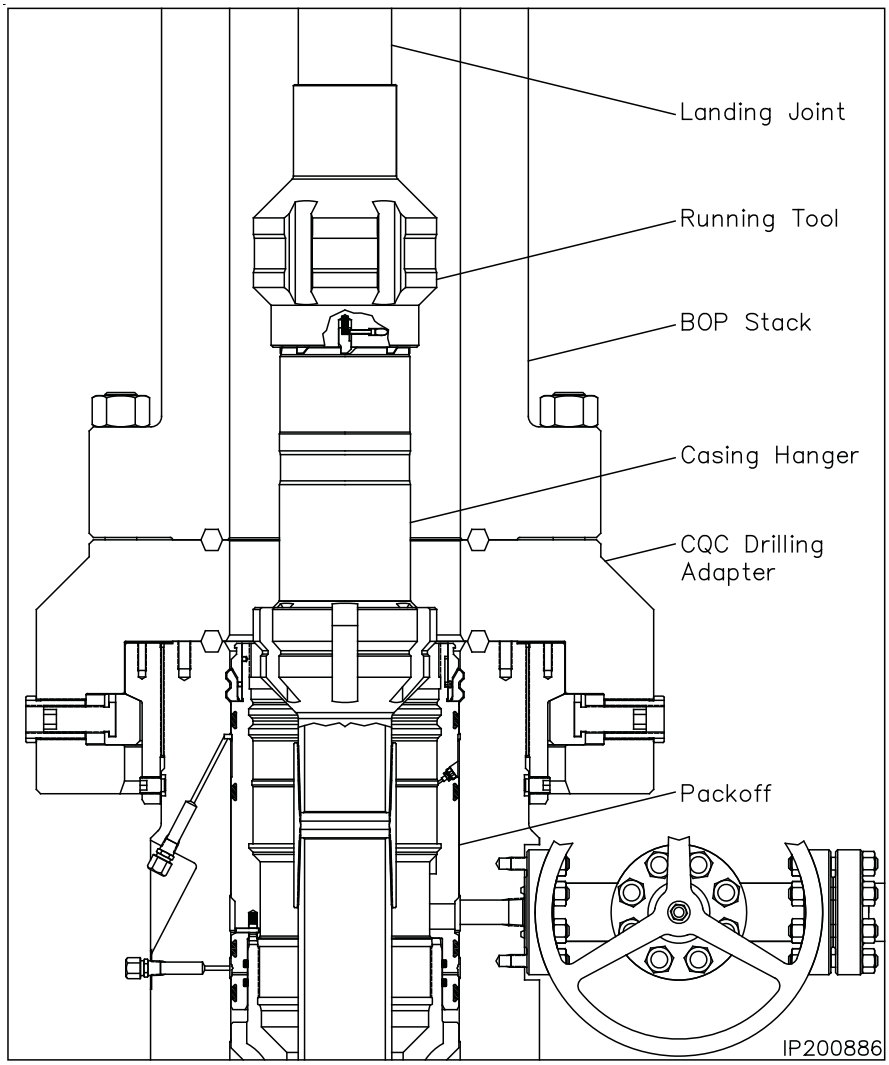
# Stage 16 — Hang Off the 5-1/2” Casing

17. Pick up the casing string and remove the floor slips and rotary bushings.

18. Carefully lower the hanger completely through the BOP annular and then engage the top drive to allow the casing to be rotated clockwise.

19. While rotating the casing clockwise, carefully lower the casing string until the **STOP ROTATING** mark on the landing joint is level with the rig floor.

**NOTE:** The torque dogs have a maximum rated capacity. Please reference the **Recommended Service Tools** section in the BOM for maximum torque allowed.



# Stage 16 — Hang Off the 5-1/2” Casing

**CAUTION:** Torque wrap can build in the casing string as it is rotated. Ensure the string comes to a neutral position, by allowing it to back off slowly counter clockwise, before the casing hanger is fully landed.

20. Cease rotation and continue carefully lowering the hanger through the wellhead and land it on the load shoulder in the MBU-3T nested packoff, 18.59” below the top of the drilling adapter.

21. Slack off all weight on the casing and verify that the **HANGER LANDED** paint mark has aligned with the rig floor.

22. Place a vertical paint mark on the landing joint to verify if the casing string rotates during the cementing process.

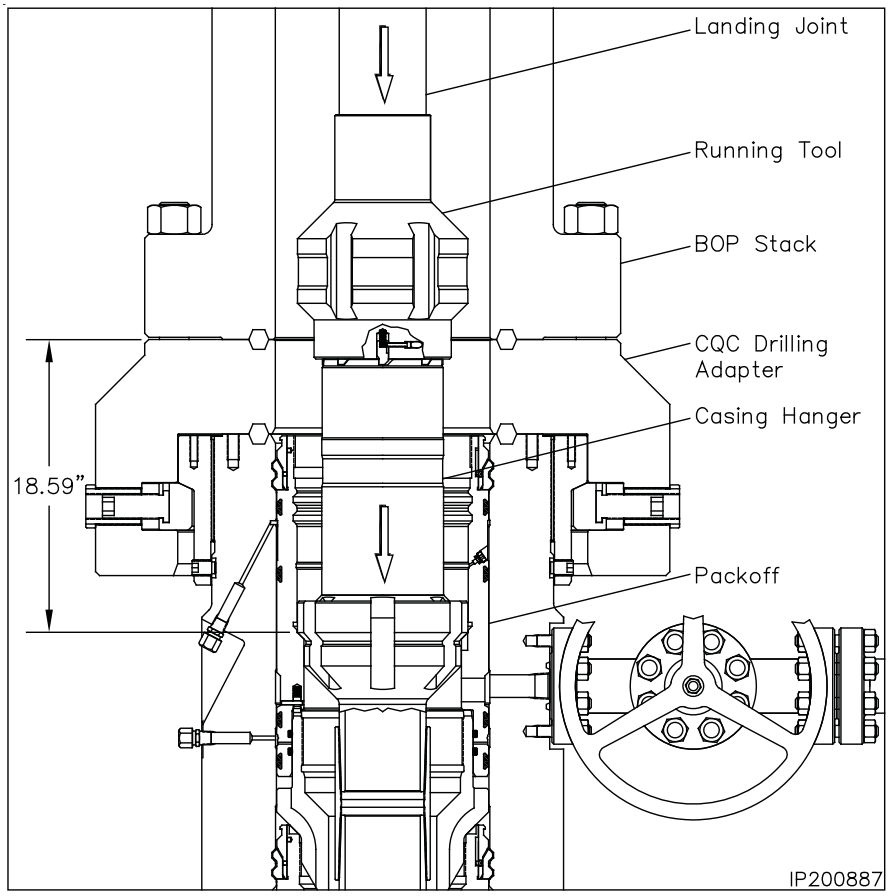
23. Cement the casing as required.

**NOTE:** Returns may be taken through the circulation slots and out the BOP or out the side outlets on the housing.

24. With cement in place, bleed off all pressure and remove the cementing head.

25. ***Using Chain Tongs Only located 180° apart,*** retrieve the Running Tool and landing joint by rotating the landing joint counter clockwise (left) approximately 13 turns or until the tool comes free of the hanger.

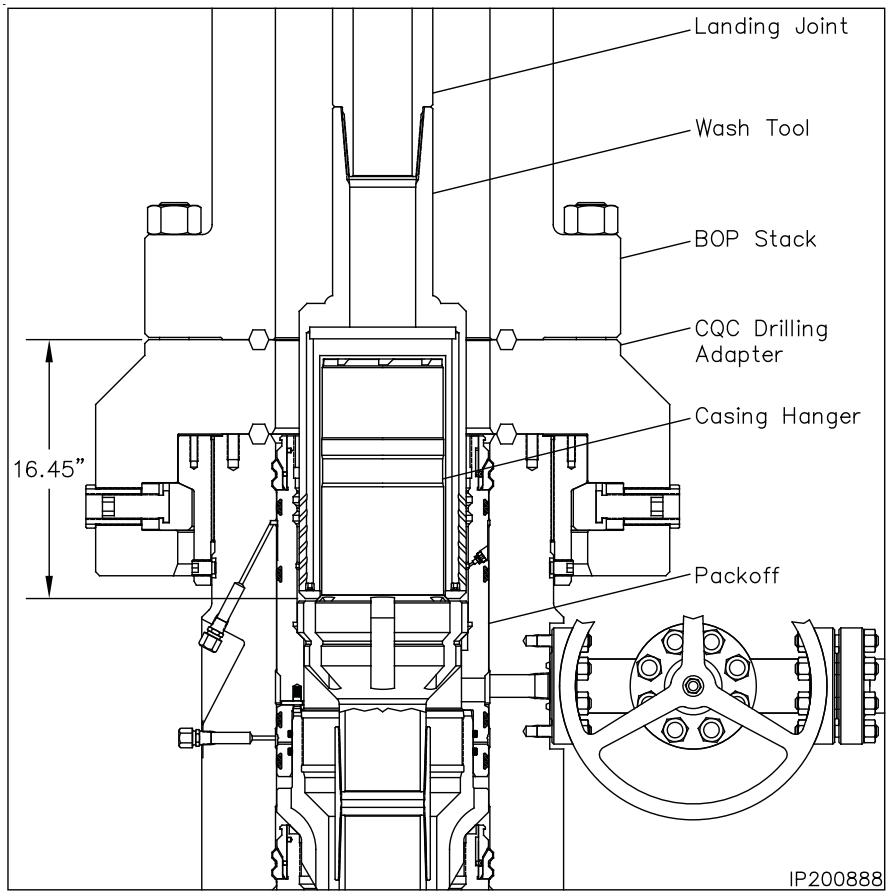
**CAUTION:** The rig floor tong may be used to break the connection but **under no circumstances is the top drive to be used to rotate or remove the casing hanger running tool.**



# Stage 16 — Hang Off the 5-1/2” Casing

## Running the 11” Wash Tool

1. Examine the ***11” x 4-1/2” IF (NC-50) Wash Tool (Item ST18).*** Verify the following:
   - drill pipe threads and bore are clean and in good condition
   - all ports are open and free of debris
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 5-1/2” casing hanger, 16.45” below the top of the drilling adapter.
4. Place a paint mark on the drill pipe level with the rig floor.
5. Using chain tongs, rotate the tool clockwise (right) approximately 6 turns to loosen any debris that may be on top of the hanger flutes.
6. Open the upper side outlet valve and drain the BOP stack.
7. Pick up on the tool approximately 1” and attach a high pressure water line or the top drive to the end of the drill pipe and pump water at approximately 25 SPM through the tool and up the BOP stack.
8. While flushing, raise and lower the tool the full length of the wellhead and BOP stack. The drill pipe should be slowly rotated (approximately 20 RPM) while raising and lowering to wash the inside of the housing and BOP stack to remove all caked on debris.
9. Once washing is complete, land the wash tool on the hanger flutes.
10. Shut down pumps and observe the returns at the open lower outlet for debris.




11. Reengage the pump and fully wash the inside of the wellhead and the entire BOP one additional cycle ensuring the stopping point is with the wash tool resting on top of the hanger flutes.

**NOTE:** Observe the returns at the open outlet valve. If returns are not clean, continue flushing until they are.

12. Once the returns are clean and free of debris, retrieve the tool to the rig floor.
13. Using a bright light, sight through the bore of the BOP stack and observe the top of the hanger neck and flutes. Ensure that there are no dark areas on top of the painted flutes of the hanger.

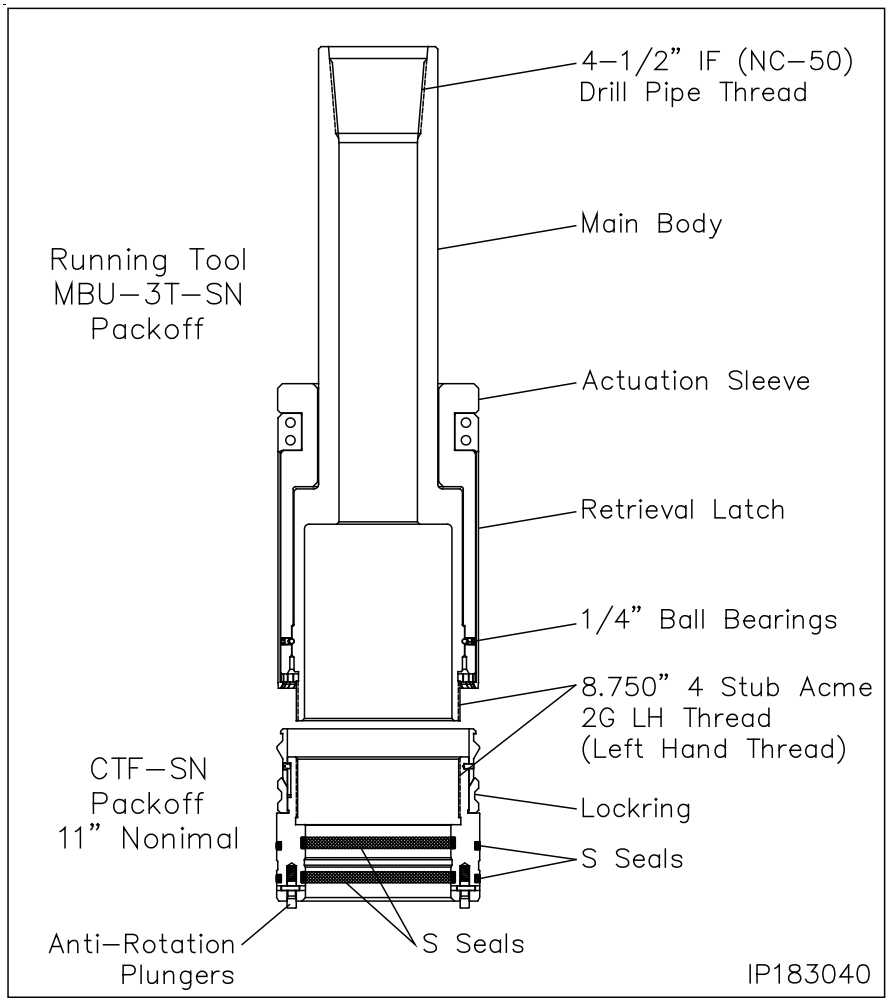
**CAUTION:** Continue washing until all debris is removed.

# Stage 16A — Install the MBU-3T Packoff

1. Examine the ***11" Nominal x 4-1/2" IF (NC-50) x 8.750" 4 Stub Acme 2G LH Pin Bottom MBU-3T-SN Mandrel Packoff Running Tool (Item ST19).*** Verify the following:
   - Acme threads are clean and in good condition
   - actuation sleeve is in place and rotates freely
   - retrieval latch is removed and stored is safe place

2. Make up the running tool to 4-1/2" drill pipe and torque the connection to optimum make up torque.

3. Examine the ***11" Nominal x 7-5/8" x 8.750" 4 Stub Acme 2G LH box top CTF/MBU-3T Packoff Assembly (Item A27).*** 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 plungers are in place, free to move



# Stage 16A — Install the MBU-3T Packoff

4. Thoroughly clean and lightly lubricate the mating acme threads of the running tool and packoff with oil or light grease.

5. Pick up the Running Tool Assembly with landing joint and suspend it above the packoff.

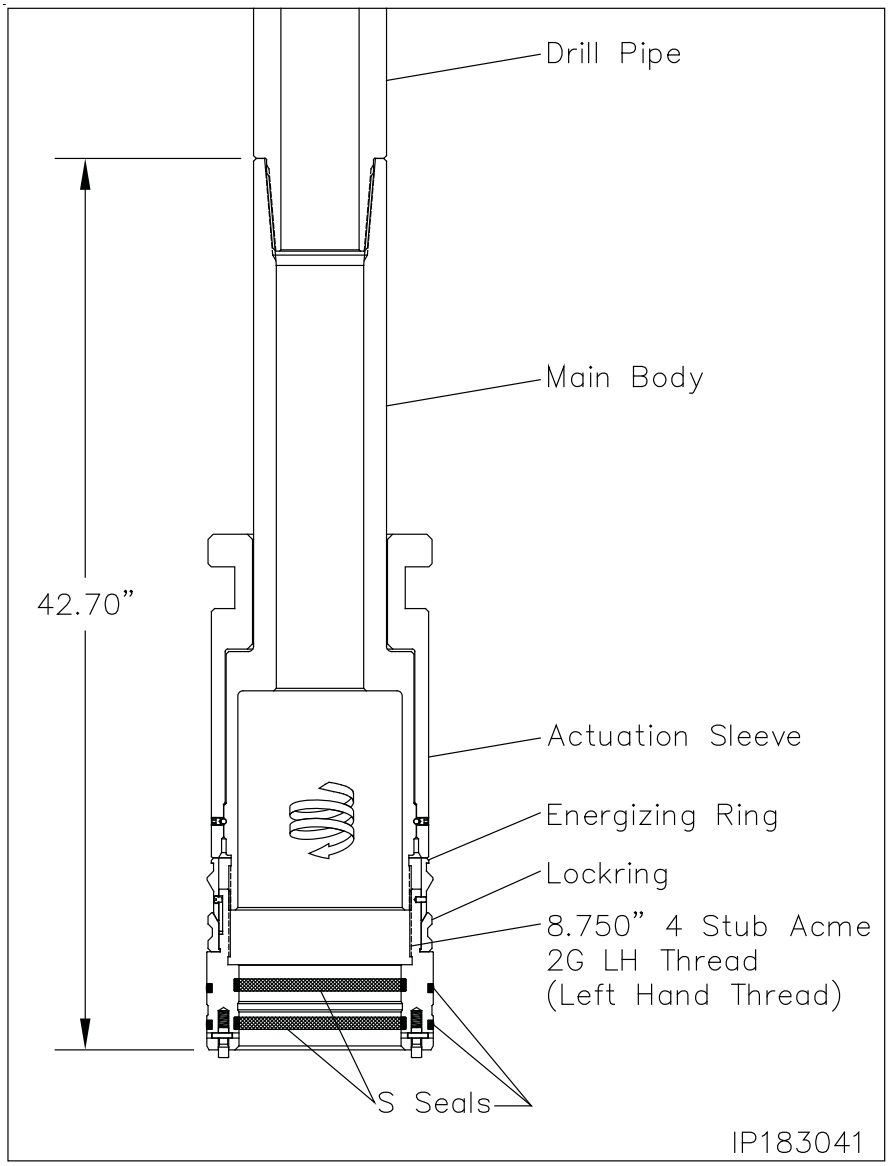
6. Carefully lower the tool into the packoff and thread them together by first rotating the tool clockwise (RIGHT) to locate the thread start and then counter clockwise (LEFT) approximately 3 turns until the tool actuation sleeve makes contact with the packoff Energizing Ring.

7. Pick up the assembly and thoroughly clean and lightly lubricate the packoff ID and OD S seals with oil or light grease.

8. Locate the upper and lower “SEAL TEST” fittings on the O.D. of the housing and remove the dust cap from the fittings.

9. Attach a test pump to both fittings and pump clean test fluid thru the fittings and ports to dislodge any old grease and trapped debris.

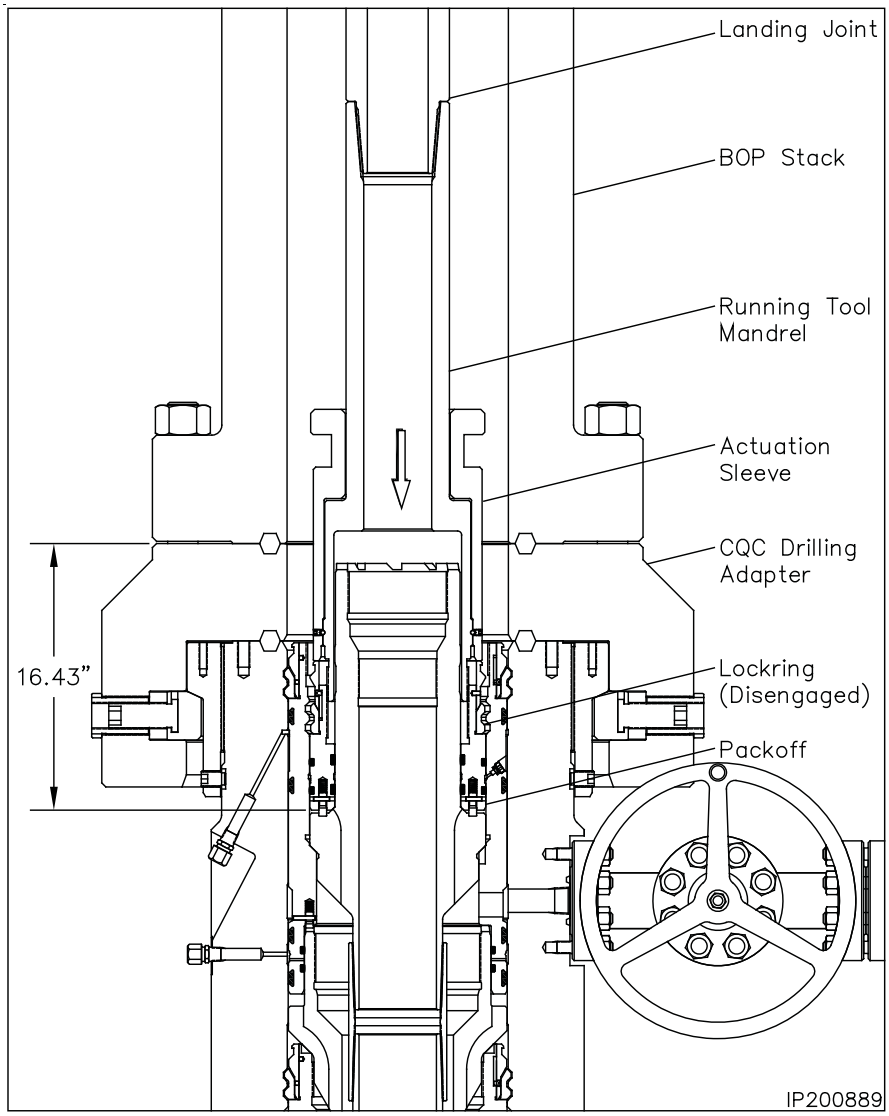
10. Remove the test pumps and reinstall the fitting dust caps.



# Stage 16A — Install the MBU-3T Packoff

## Landing the Packoff

11. Calculate the total landing dimension by taking the determined landing dimension of the 5-1/2" mandrel casing hanger and subtracting 2-1/8"
12. Remove the hole cover.
13. Measure up 5 feet from the bottom of the packoff and place a paint mark on the drill pipe landing joint.
14. Pick up the packoff/running tool assembly and carefully lower the assembly through the BOP marking the landing joint every five feet until you reach the calculated dimension.
15. Place a paint mark on the drill pipe at that dimension and mark land off. Place an additional mark 1-1/2" above the first one and mark engaged.
16. Continue lowering the packoff until it passes over the neck of the hanger and lands on top of the casing hanger load shoulder, 16.43" below the top of the drilling adapter.



# Stage 16A — Install the MBU-3T Packoff

## Seal Test

17. Locate the upper "SEAL TEST" fitting on the upper OD of the housing and remove the dust cap from the fitting.

18. Attach a test pump with manifold to the open fitting and pump clean test fluid between the packoff seals until a stable test pressure of 10,000 psi is achieved.

**NOTE:** It may be required to pressure up and bleed off test pressure several times to evacuate all air from the test area in order to attain a stable test pressure.

19. Hold test pressure for 15 minutes.

20. If pressure drops a leak has developed, remove the packoff and replace leaking seals.

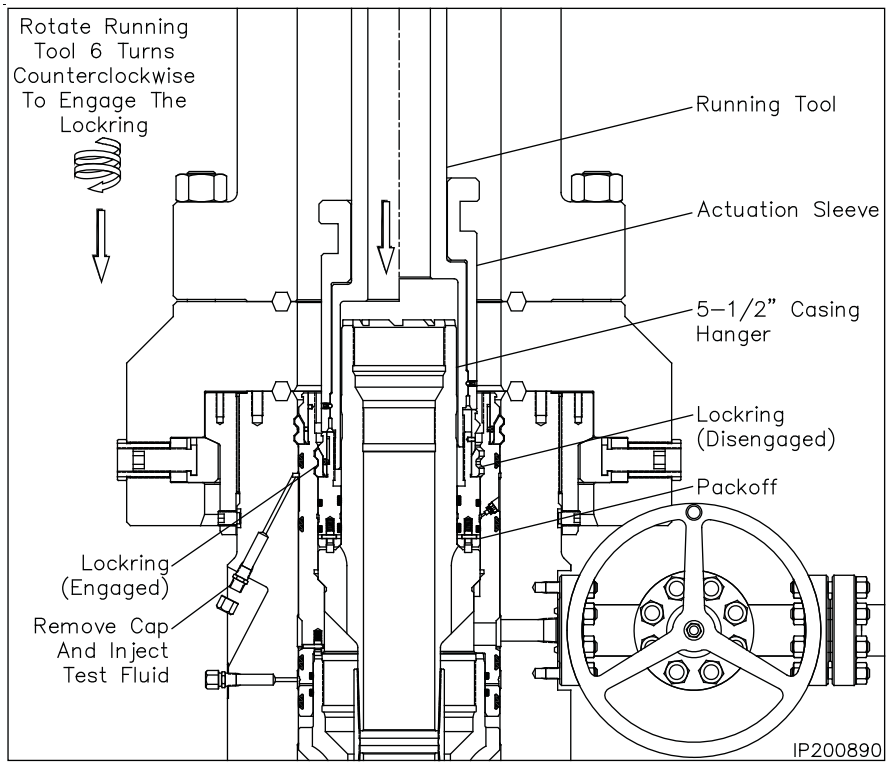
21. After a satisfactory test is achieved, bleed off test pressure, remove test pump and manifold and reinstall the dust cap on the open fitting.

## Engaging the Lockring

22. Using chain tongs only located 180° apart, slowly rotate the packoff assembly counter clockwise (left) until the anti-rotation plunger aligns with one of the circulation flutes of the hanger. Expect torque of approximately 400 ft lbs. to rotate the packoff.

23. Using only chain tongs, rotate the landing joint approximately 6 turns counter clockwise to engage the packoff lockring in its mating groove in the bore of the MBU-3T nested packoff.

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




**NOTE:** When properly engaged the second paint mark on the drill pipe will align with the rig floor.

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

**CAUTION:** If the required turns to engage the lockring are not achieved or excessive torque is encountered, remove the packoff and first call the local branch and then Houston Engineering.

24. Back off the landing joint/running tool approximately 3 turns. Using the drill pipe elevators, exert a 40,000 lbs. pull on the landing joint.

25. Reattach the test pump to the open test manifold and retest the packoff seals to 10,000 psi for 15 minutes. This will also verify that the packoff is in place.

26. After satisfactory test is achieved, bleed off all test pressure, remove test pump and reinstall the dust cap on the open fitting.

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

28. Using a dry rod with sliding sleeve tool, set the ***4-13/16" BPV (Item ST21)*** in the bore of the hanger. Ensure that the BPV makes a minimum of 6 turns before final make up and break out. Nipple down and remove the BOP stack.

# Stage 16A — Install the MBU-3T Packoff

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

## Retrieving the Packoff

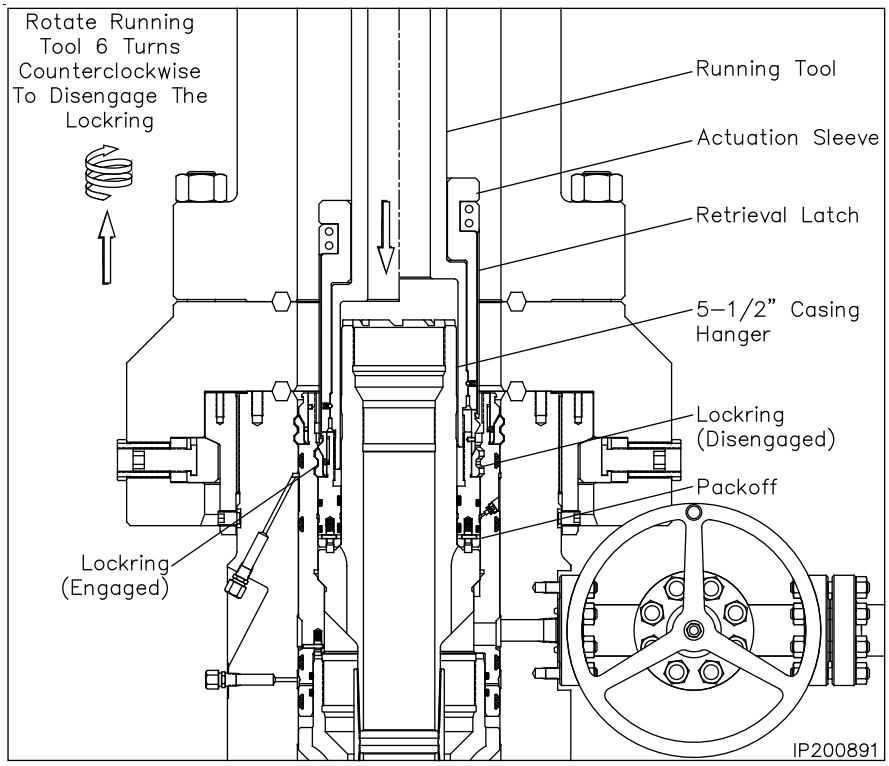
1. Locate the retrieval latch assembly with (4) 3/8" cap screws
2. Install the retrieval latch onto the running tool with the latch fingers facing down and install the cap screws and tighten them securely.
3. Ensure the retrieval latch freely rotates on the running tool actuation sleeve.
4. Carefully lower the running tool through the BOP stack and tag the top of the top of the packoff assembly.
5. Carefully rotate the drill pipe clockwise to locate the thread start and then counter clockwise (left) approximately 12 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 (right) approximately 6-1/2 turns to a positive stop. The drill pipe should rise approximately 1-1/2".

**CAUTION:** 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 wellhead with a straight vertical lift.
8. Redress the packoff and reset as previously outlined.



# Stage 16B — Hang Off the 5-1/2" Casing (Emergency)

**NOTE:** The following procedure should be followed **ONLY** if the 5-1/2" 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.

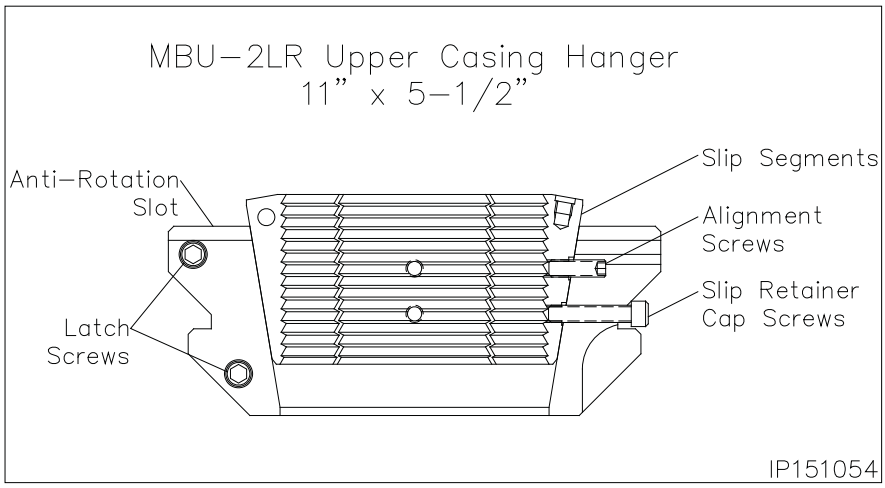
1. Cement the hole as required.

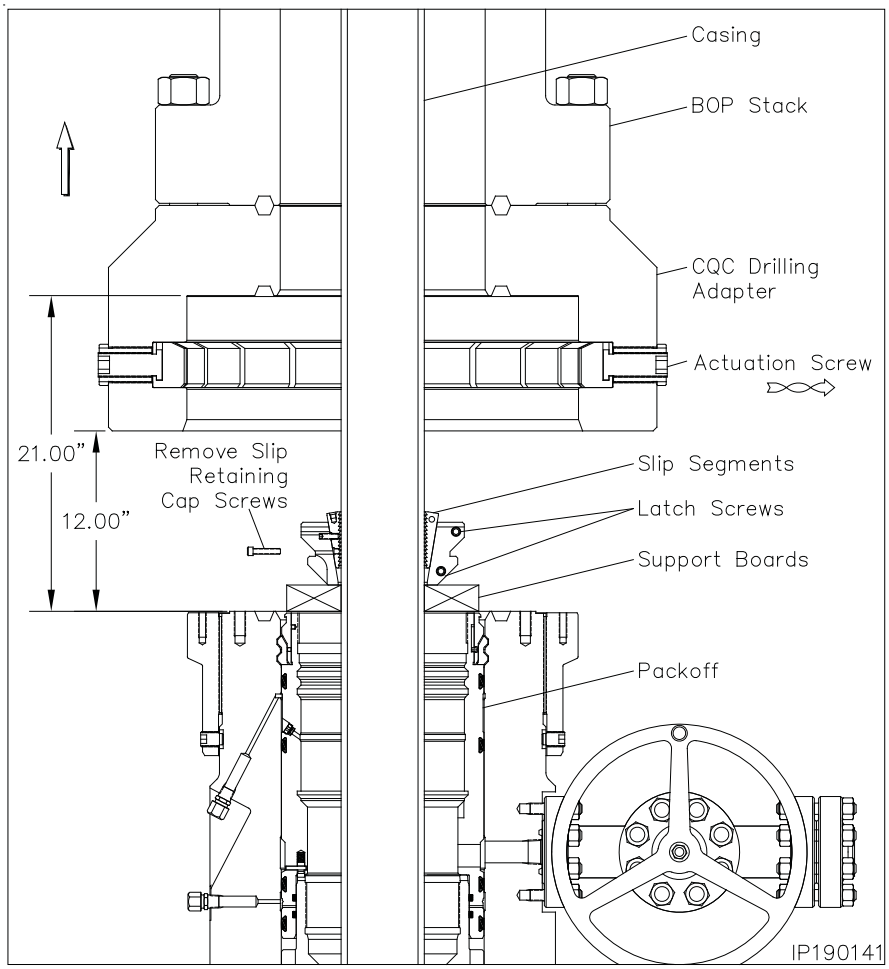
**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

2. Drain the BOP stack through the housing upper side outlet valve.
3. Locate the actuation screws on the O.D. of the drilling adapter.
4. Using a hex drive, fully retract the actuation screws until they are slightly over flush with the gland nuts.

**WARNING:** Keep body clear of all pinch points and suspended loads.

5. Pick up on the BOP stack a minimum of 12" above the housing and secure with safety slings.
6. Washout bowl as required.
7. Examine the ***11" x 5-1/2" MBU-2LR/3T Upper Slip Casing Hanger (Item A26).*** Verify the following:
   - slips and internal bore are clean and in good condition
   - all screws are in place
8. Remove the latch cap screws and separate the hanger into two halves.
9. Place two boards on the housing flange against the casing to support the hanger.
10. Pick up one half of the hanger and place it around the casing, on top of the support boards.
11. Place the second half adjacent the first and install the latch screws and tighten securely.
12. Prepare to lower the hanger into the housing bowl.



# Stage 16B — Hang Off the 5-1/2” Casing (Emergency)

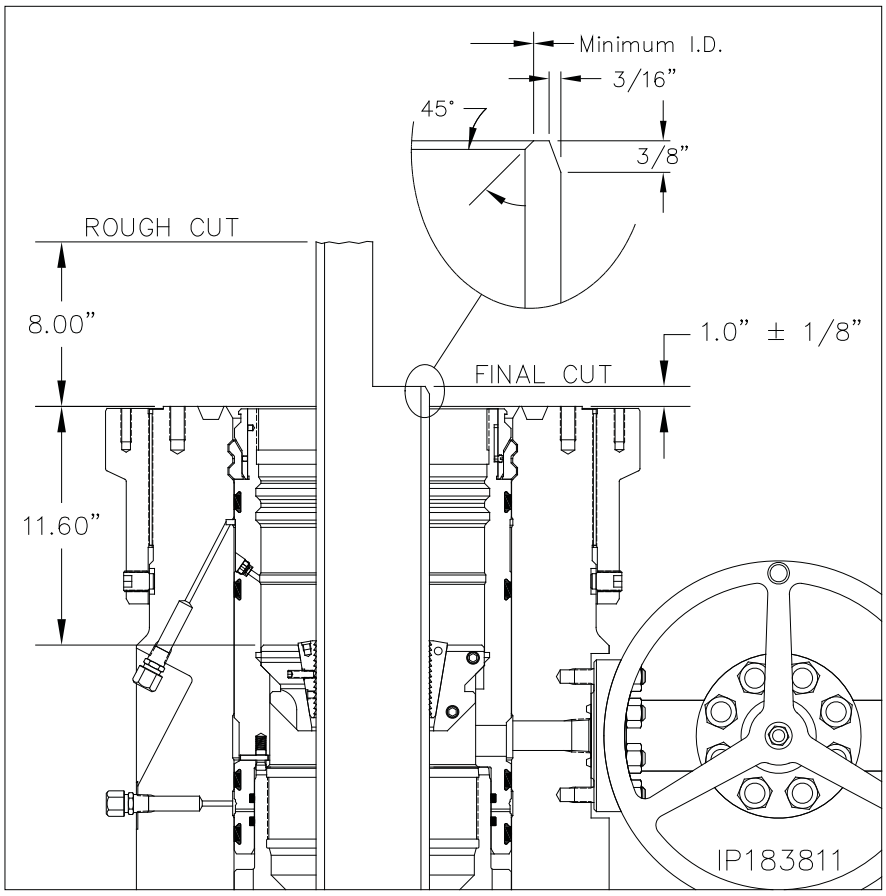
**CAUTION: Do Not** drop the casing hanger!

13. Grease the casing hanger body and remove the slip retaining screws.
14. Pull tension on the casing to the desired hanging weight.
15. Remove the boards and allow the hanger to slide into the packoff bowl. When properly positioned the top of the hanger will be approximately 11.60” below the top of the housing.
16. Slack off the desired hanging weight.

**NOTE:** A sharp decrease on the weight indicator will signify that the hanger has taken weight. If this does not occur, pull tension again and slack off once more.

**WARNING:** Due to 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 gases, with an approved sensing device, prior to cutting the casing. If gas is present, do not use an open flame torch to cut the casing. It will be necessary to use an air driven mechanical cutter which is spark free.

17. Rough cut the casing approximately 8” above the top flange and move the excess casing out of the way.
18. Final cut the casing at 1” ± 1/8” above the top of the housing.




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

**CAUTION:** There must not be any rough edges on the casing or the seals of the packoff will be damaged.

20. Thoroughly clean the housing bowl, removing all cement and cutting debris.
21. Place a straight edge on top of the slip bowl and in line with the center of one of the anti-rotation notches.
22. Ensure the straight edge is vertical and then place a paint mark on top of the housing in line with the notch in the slip bowl.

# Stage 16B — Hang Off the 5-1/2" Casing (Emergency)

## Install the Emergency Packoff

1. Examine the ***11" x 5-1/2" x 4-13/16" H BPV Thread MBU-3T Nested Emergency Packoff (Item A27)***. Verify the following:
   - bore and internal seal area are clean and in good condition
   - I.D. and O.D. seals are in place and in good condition
   - I.D. BPV threads are clean and in good condition

2. Thoroughly clean the I.D. and O.D. of the packoff removing all old grease and debris.

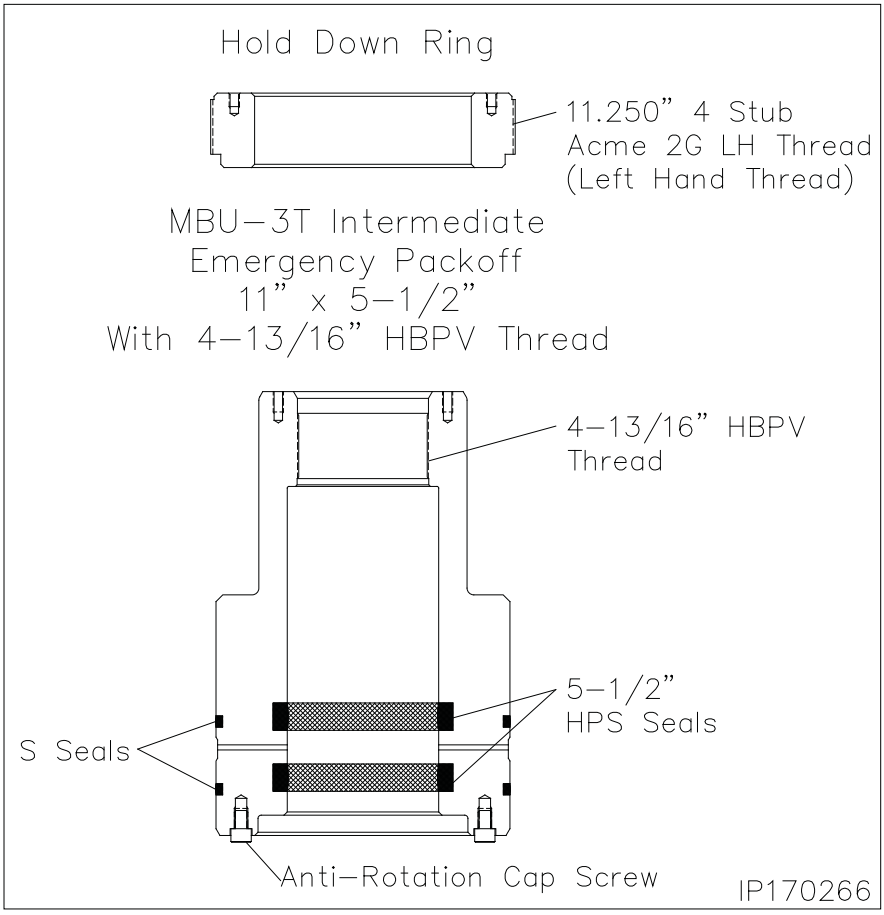
3. Carefully inspect the seals for any damage and replace if necessary.

4. Using a straight edge positioned vertically and centered on the anti-rotation cap screw on the bottom of the packoff, place a white paint mark up the side of the packoff in line with the cap screw.

**NOTE:** The line will be used to guide the packoff anti-rotation lug into its mating notch in the slip bowl.

5. Thoroughly clean and lightly lubricate the I.D. and O.D. seals of the packoff with oil or light grease.

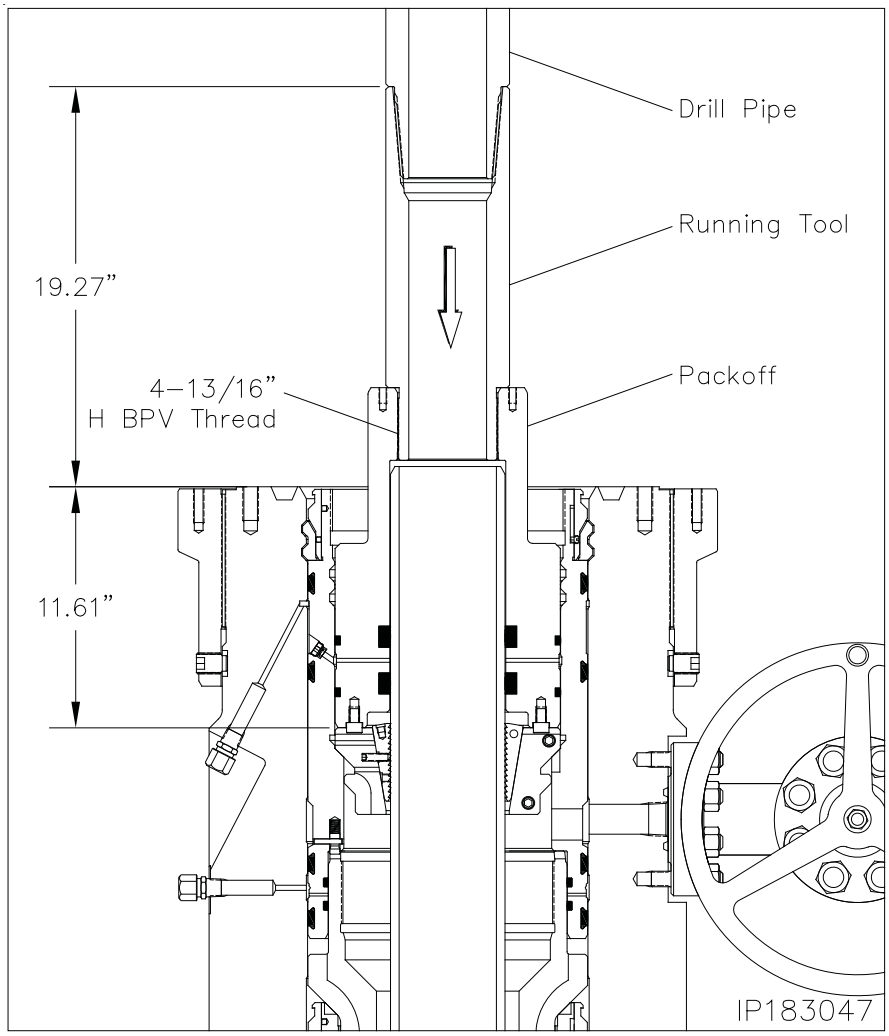
**CAUTION:** Before running packoff, locate the upper "SEAL TEST" fitting on the O.D. of the housing and remove the dust cap from the fitting. Attach a test pump to the open fitting and pump clean test fluid between the seals to insure the rupture disc has been ruptured, and the port is open.



# Stage 16B — Hang Off the 5-1/2” Casing (Emergency)

6. Examine the ***4-1/2” IF (NC-50) x 4-13/16” H BPV Thread Emergency Packoff Running Tool (Item ST20)***. Verify the following:
   - bore and threads are clean and in good condition
7. Make up the running tool to a joint of drill pipe.
8. Lightly lubricate the mating threads of the tool and the packoff with oil or a light grease.
9. Thread the running tool into the top of the packoff with left hand rotation to a positive stop.
10. Pick up the packoff with running tool and position it over the casing stub.
11. Align the anti-rotation cap screws with the mating slots in the top of the slip bowl. Use the marks on the housing and packoff body to keep the packoff properly aligned.
12. Carefully lower the packoff over the casing stub and push it into the packoff bowl until it bottoms out on the slip hanger body.

**CAUTION:** When properly positioned, the main body of the packoff will be 2.72” below the top of the housing flange as indicated.



# Stage 16B — Hang Off the 5-1/2” Casing (Emergency)

## Seal Test

13. Locate the upper “SEAL TEST” fitting on the O.D. of the housing and remove the dust cap from the fitting.

14. Attach a test pump to the open fitting and pump clean test fluid between the seals until a stable test pressure of ***10,000 psi or 80% of casing collapse — whichever is less*** is attained.

15. Hold the test pressure for 15 minutes or as required by drilling supervisor.

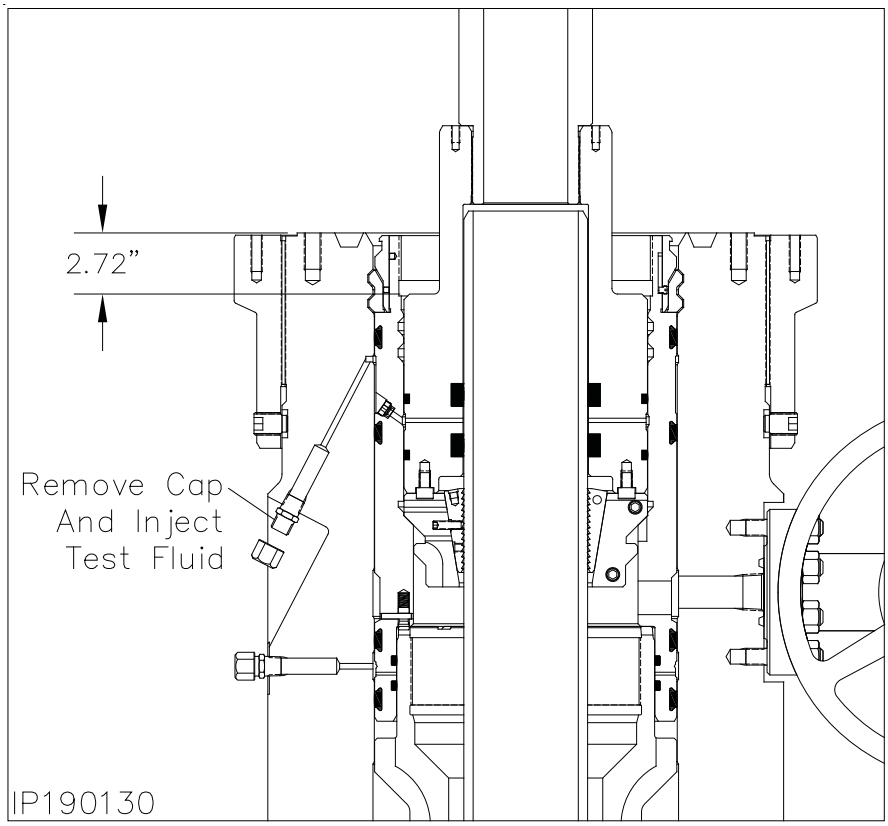
16. If a leak develops, bleed off test pressure, remove the packoff from the wellhead and replace the leaking seals.

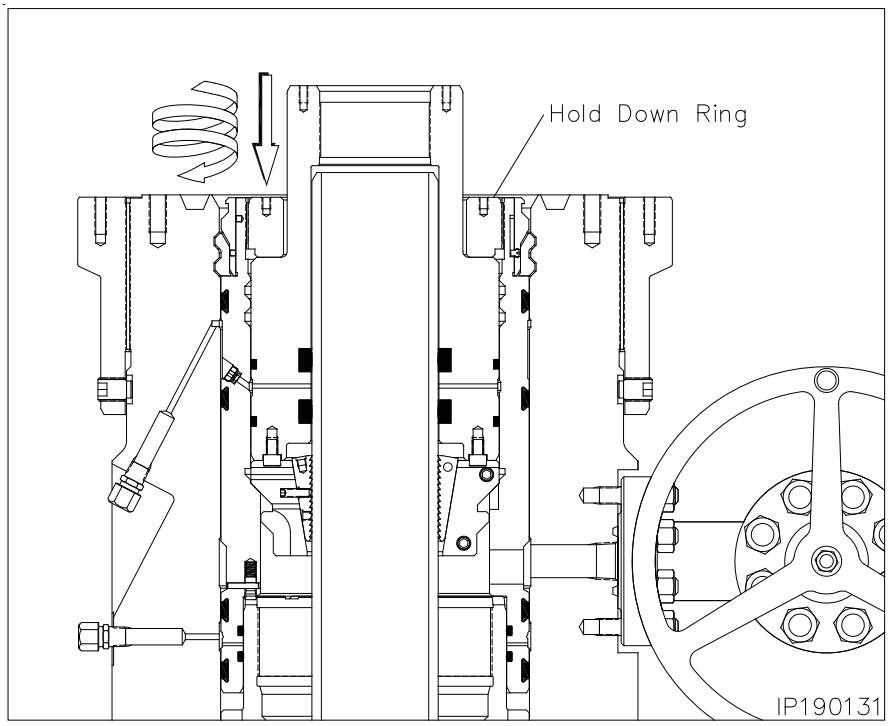
17. After satisfactory test is achieved, bleed off test pressure, remove test pump and reinstall the dust cap on the open fitting.

18. Thoroughly clean and lightly lubricate the mating Acme threads of the MBU-3T 7-5/8” packoff and the packoff ***Hold Down Ring (Item A27b)***.

19. Thread the ring into the 7-5/8” packoff with counter clockwise rotation to a positive stop on top of the 5-1/2” nested packoff body.

20. Using a dry rod with sliding sleeve tool, set the ***4-13/16” One Way H BPV (Item ST21)*** in the bore of the packoff. Ensure the BPV makes a minimum of 6 turns before final make up and break out.



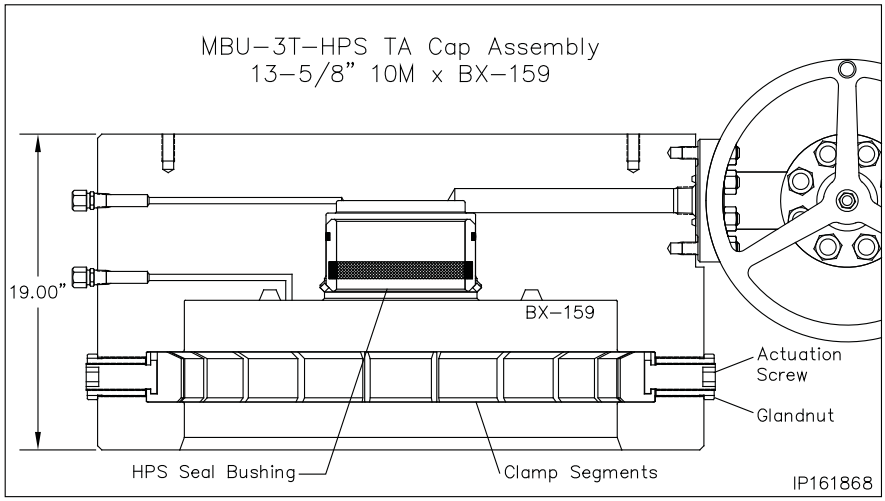



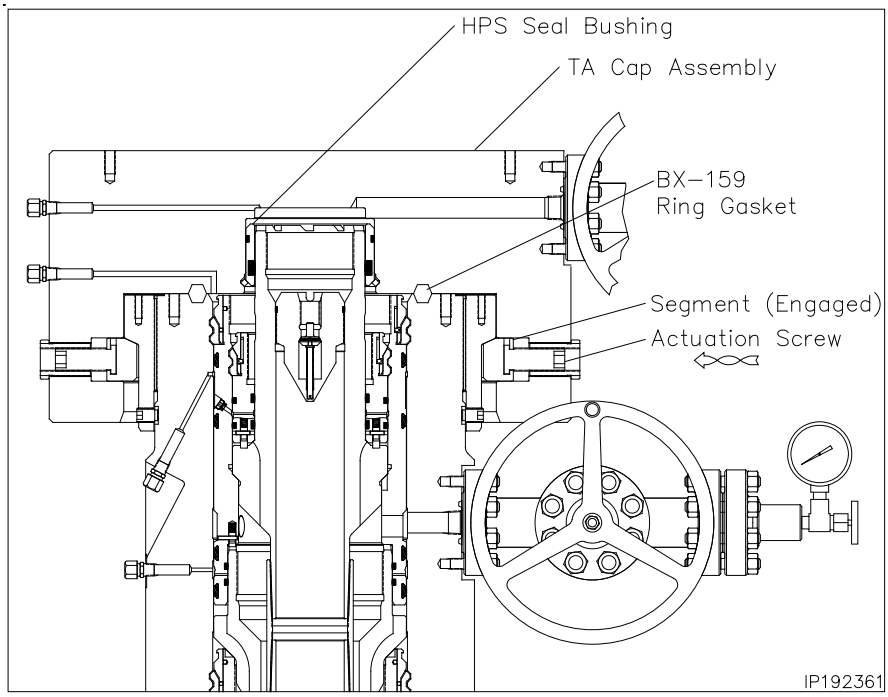
# Stage 17 — Install the Quick Connect TA Cap Assembly

1. Examine the ***13-5/8" 10M Quick Connect TA Cap Assembly (Item R4).*** Verify the following:
   - bore is clean and free of debris
   - ring groove is clean and undamaged
   - (20) drive screws and clamp segments are properly installed and fully retracted
   - ***7-5/8" HPS seal bushing (Item R5)*** is in place and properly retained with the square snap wire
2. Thoroughly clean the top of the MBU-4T housing, threaded hub, and the mating seal surfaces of the TA cap.
3. Install a new ***BX-159 Ring Gasket*** into the ring groove of the housing.
4. Install the lifting eyes in the top of the TA cap.

**WARNING:** Keep body clear of all pinch points and suspended loads.

5. Using a suitable lifting device with weight rated slings, pick up the TA cap assembly and carefully lower it over the packoff neck and land it on the ring gasket.
6. Ensure the TA cap is level and then carefully run in all of the drive screws of the TA cap to contact point.
7. Ensure the assembly remains level, run in one actuation screw and torque to 100 ft-lbs.
8. Locate the screw 180° from the first and torque to 100 ft-lbs.
9. Locate the screws 90° to the right and left and torque to 100 ft-lbs.
10. Position the second 4 point sequence 90° from the first and torque each screw to 200 ft-lbs.



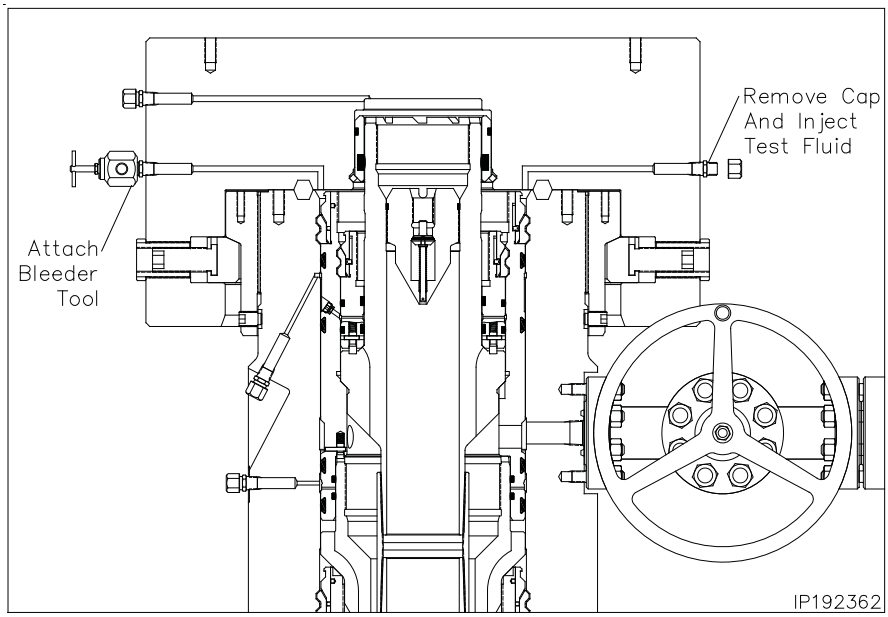




11. Run in all remaining screws to contact. Torque each screw to 400 ft-lbs.
12. Make one additional round until a stable torque of 650 ft-lbs on all (20) screws is achieved.

# Stage 17 — Install the Quick Connect TA Cap Assembly

## Connection Test

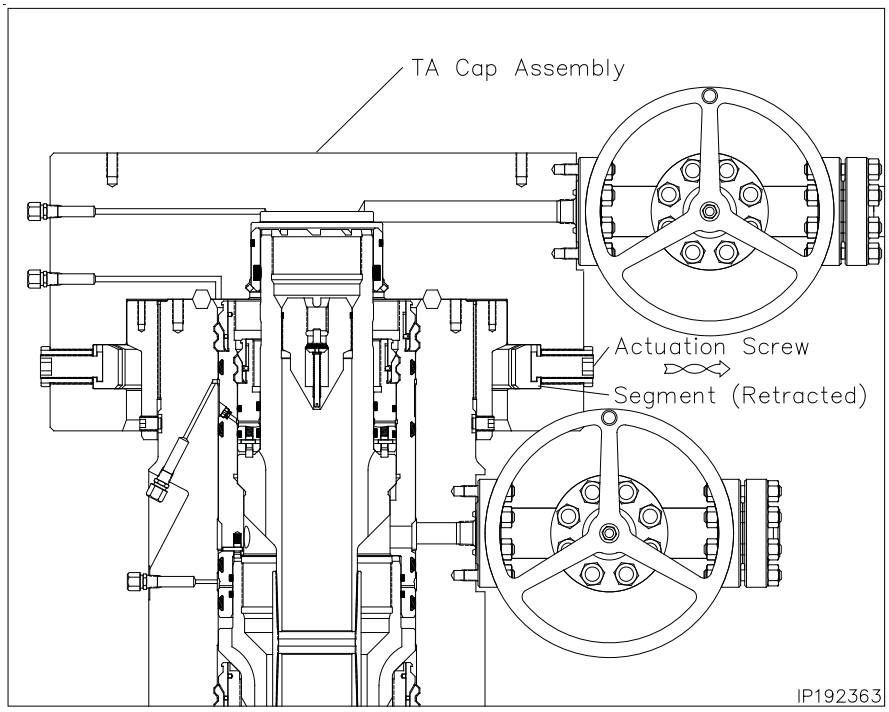
1. Open the TA cap ball valve and the housing upper side outlet valve to monitor leakage.
2. Locate the two test fittings marked “FLG TEST” and remove the dust caps from the fittings.
3. Attach a bleeder tool to one of the open fitting and open the tool.
4. Attach a test pump to the remaining open fitting and pump clean test fluid into the void area until a continuous stream flows from the open bleeder tool.
5. Close the tool and continue pumping fluid until a stable test pressure of ***10,000 psi***.
6. Hold the test pressure for 15 minutes or as required by drilling supervisor.
7. After a satisfactory test is achieved, bleed off the test pressure, drain the fluid, remove the bleeder tool and re-install the dust cap on the open fittings.
8. Close all open valves.

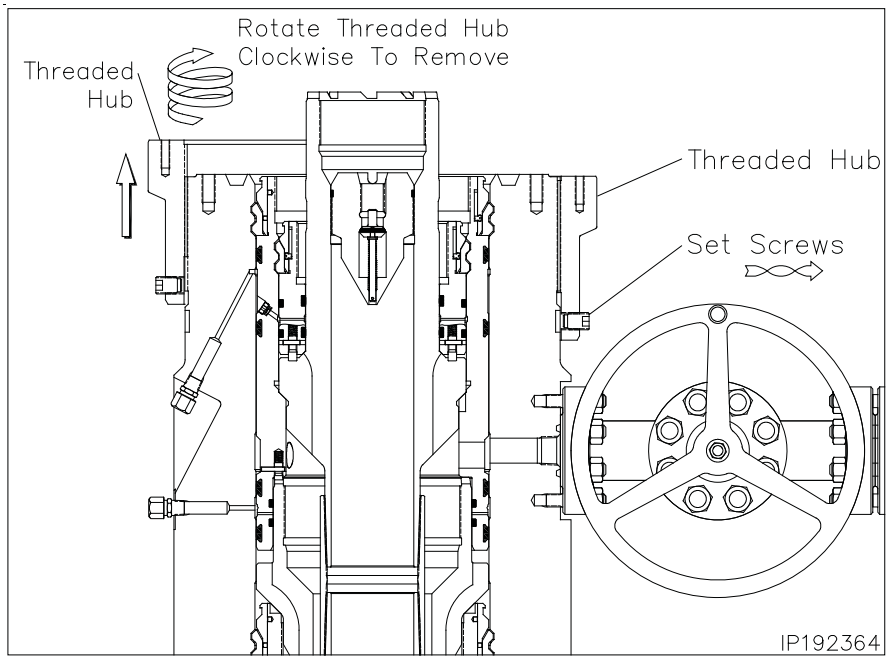


# Stage 18 — Remove the TA Cap Assembly

**WARNING:** Confirm with Drilling Supervisor that well bore conditions are safe.

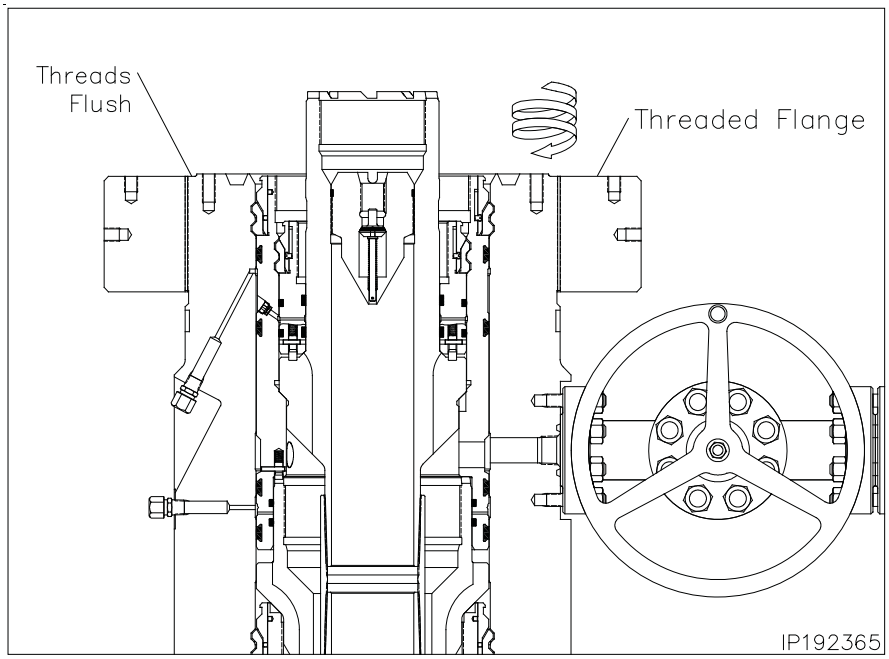
1. Open the ball valve on the TA cap to check for trapped pressure.
2. Locate the actuation screws on the O.D. of the TA cap assembly.
3. Using a hex drive, fully retract the actuation screws until they are slightly over flush with the gland nuts.
4. Install lifting eyes with pick up sling to the top of the TA cap and lift the cap free of the wellhead.
5. Remove the threaded hub set screws.
6. Remove the threaded hub from the top of the housing with clockwise rotation.



# Stage 18 — Remove the TA Cap Assembly

1. Examine the ***13-5/8" 10M Threaded Flange (Item A6)***. Verify the following:
   - Acme thread are clean and in good condition
2. Thoroughly clean and lightly lubricate the mating threads of the housing and the threaded flange with copper coat or never seize.
3. Pick up the flange and carefully thread it onto the top of the housing with counter clockwise rotation until the top of the flange is level with the top of the Acme thread of the housing.
4. Rotate the flange in either direction to two hole.
5. Prepare to install the tubing head.



# Stage 19 — Installing the Tubing Head

1. Examine the ***13-5/8" 10M x 7-1/16" 15M CTH-DBLHPS Tubing Head (Item B1).*** Verify the following:
   - seal area and bore are clean and in good condition
   - *'HPS' seals* are in place and in good condition
   - all peripheral equipment is intact and undamaged
   - all lockscrews are in place and fully retracted

2. Clean the mating ring grooves of the housing and tubing head assembly.

3. Lightly lubricate the I.D. 'HPS' seals and the packoff neck with a light grease.

**CAUTION:** Excessive grease may prevent a good seal from forming!

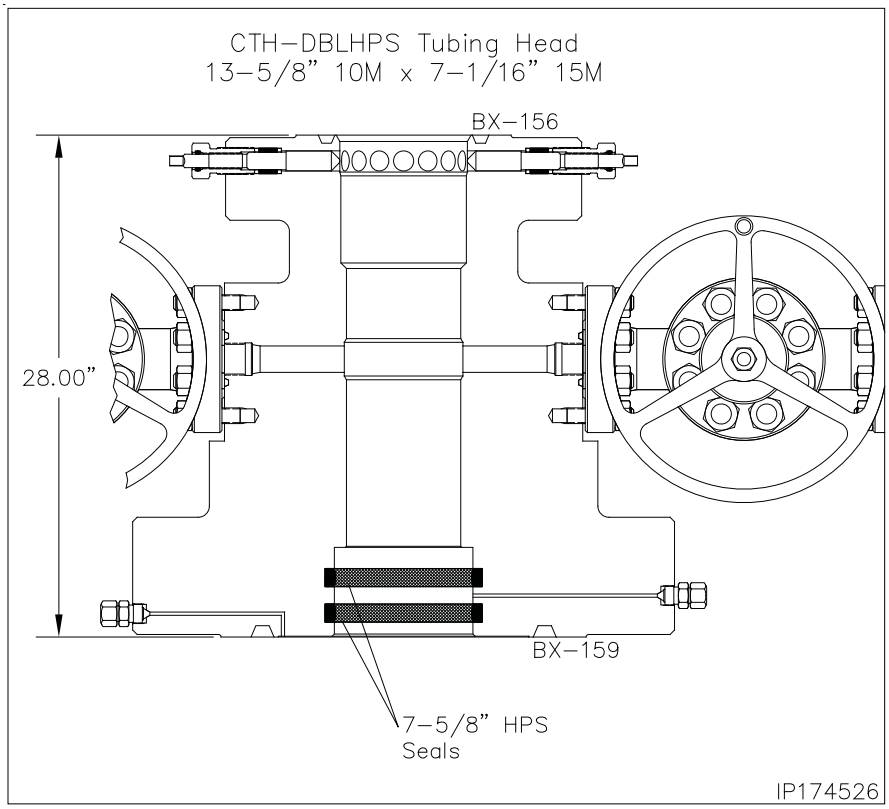
4. Install a new ***BX-159 Ring Gasket (Item B12)*** in the ring groove of the MBU-4T housing.

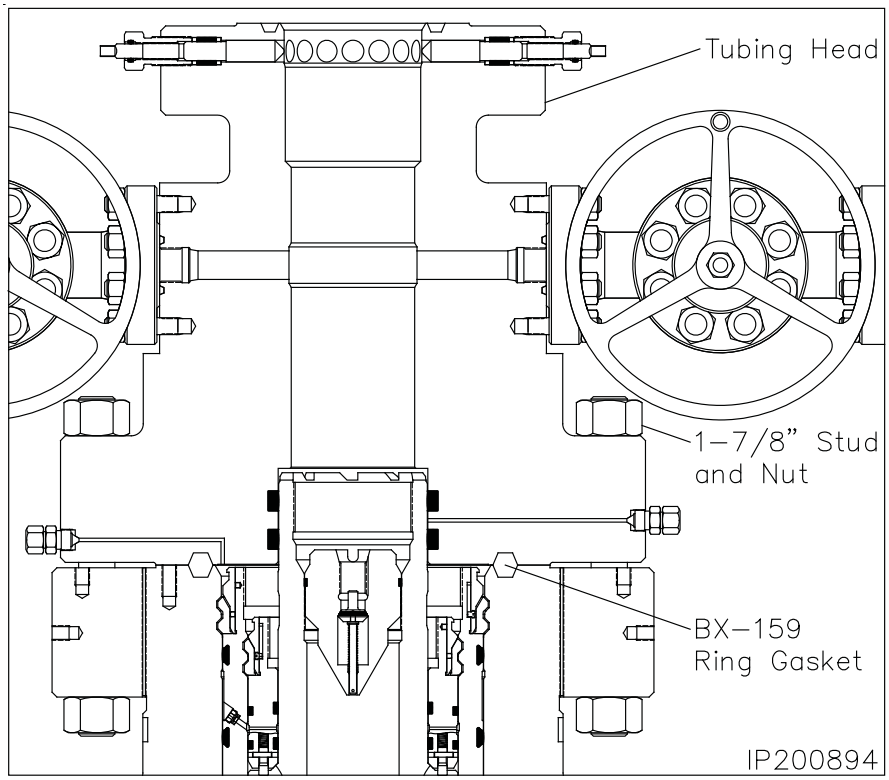
**WARNING:** Keep body clear of all pinch points and suspended loads.

5. Orient the tubing head so the outlets are in the proper position and then carefully lower the tubing head over the packoff neck and land it on the ring gasket.

**CAUTION:** Do Not damage the 'HPS' seal elements or their sealing ability will be impaired!

6. Make up the flange connection using the appropriate size ***Studs and Nuts (Item B13)***, tightening them in an alternating cross pattern.

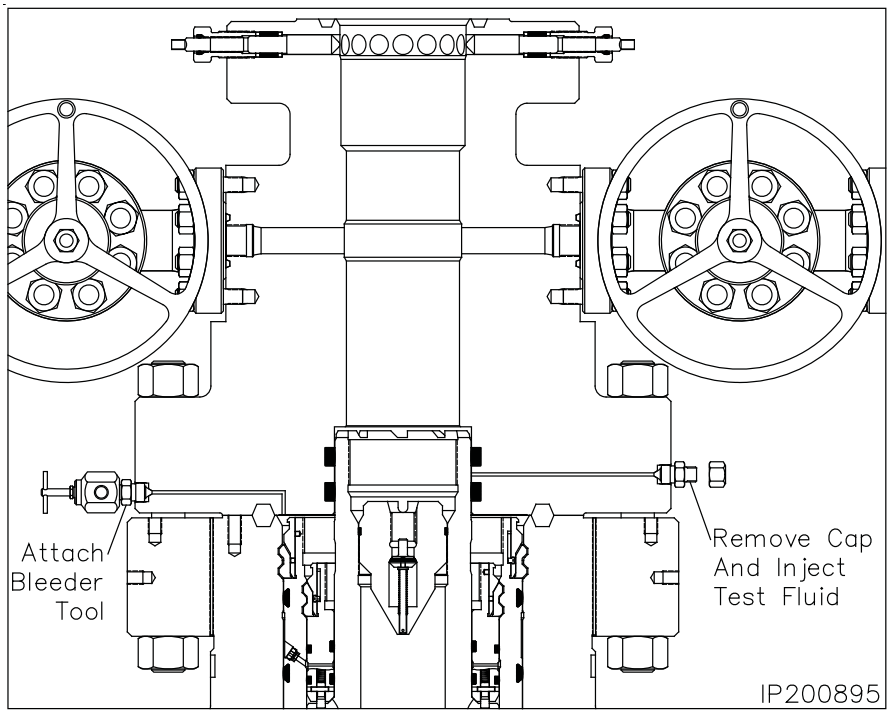


# Stage 19 — Installing the Tubing Head

## Seal Test

1. Locate the “SEAL TEST” fitting and one “FLG TEST” fitting on the tubing head lower flange 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 test pump to the “SEAL TEST” fitting and pump clean test fluid between the ‘HPS’ seals until a test pressure of ***15,000 psi.***
4. Hold the test pressure for 15 minutes or as required by drilling supervisor.
5. If pressure drops, a leak has developed. Bleed off test pressure and take the appropriate action in the adjacent table.
6. After a satisfactory test is achieved, carefully bleed off all test pressure and remove the test pump and bleeder tool.
7. Reinstall the dust cap on the open “SEAL TEST” fitting.

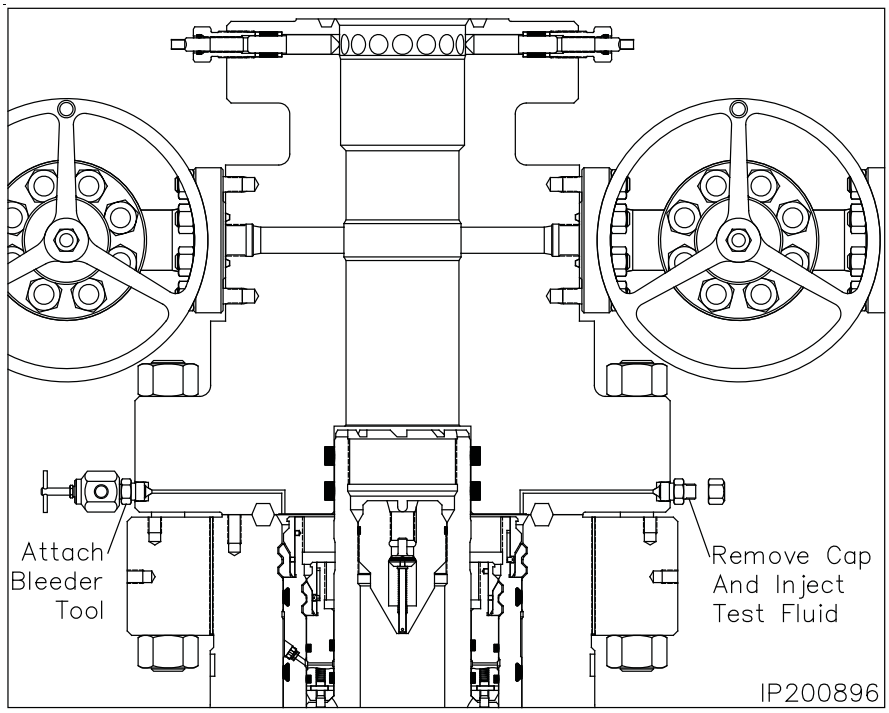



| Seal Test | |
|---|---|
| **Leak Location** | **Appropriate Action** |
| Open bleeder tool - Lower ‘HPS’ seal is leaking | Remove tubing head and replace leaking seals. Re-land and retest seals |
| From open tubing head outlet valve - Upper ‘HPS’ seal is leaking | |

# Stage 19 — Installing the Tubing Head

## Flange Test

1. Locate the remaining “FLG TEST” fitting on the tubing head lower flange and remove the dust cap from the fitting.
2. Attach a test pump to the open “FLG TEST” fitting and inject test fluid into the flange connection until a continuous stream flows from the opposite “FLG TEST” bleeder tool.
3. Close the bleeder tool and continue pumping test fluid to ***10,000 psi.***
4. Hold the test pressure for 15 minutes or as required by drilling supervisor.
5. If pressure drops a leak has developed. Take the appropriate action from the adjacent chart.
6. Repeat this procedure until a satisfactory test is achieved.
7. Once a satisfactory test is achieved, carefully bleed off all test pressure and remove the test pump and bleeder tool.
8. Reinstall the dust caps on the open fittings.




| Flange Test | |
|---|---|
| **Leak Location** | **Appropriate Action** |
| Between flanges - Ring gasket is leaking | Further tighten the flange connection |

# Section 2 — Offline Cementing the 7-5/8” Casing String

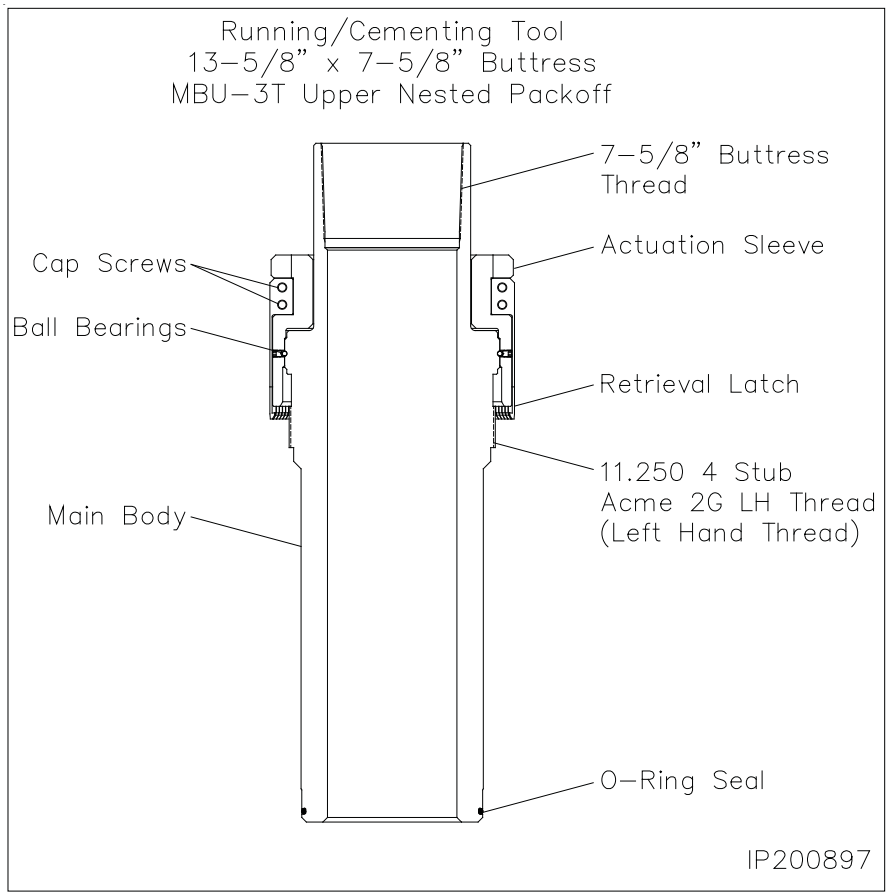
# Stage 1 — Cement 7-5/8” Casing String

1. Examine the ***13-5/8” x 7-5/8” Buttress x 11.250” 4 Stub Acme 2G LH, MBU-3T Nested Packoff Running/Cementing Tool (Item R6).*** Verify the following:
   - Acme threads are clean and in good condition
   - retrieval latch is in position and retained with cap screws
   - O-ring seal is in place and in good condition

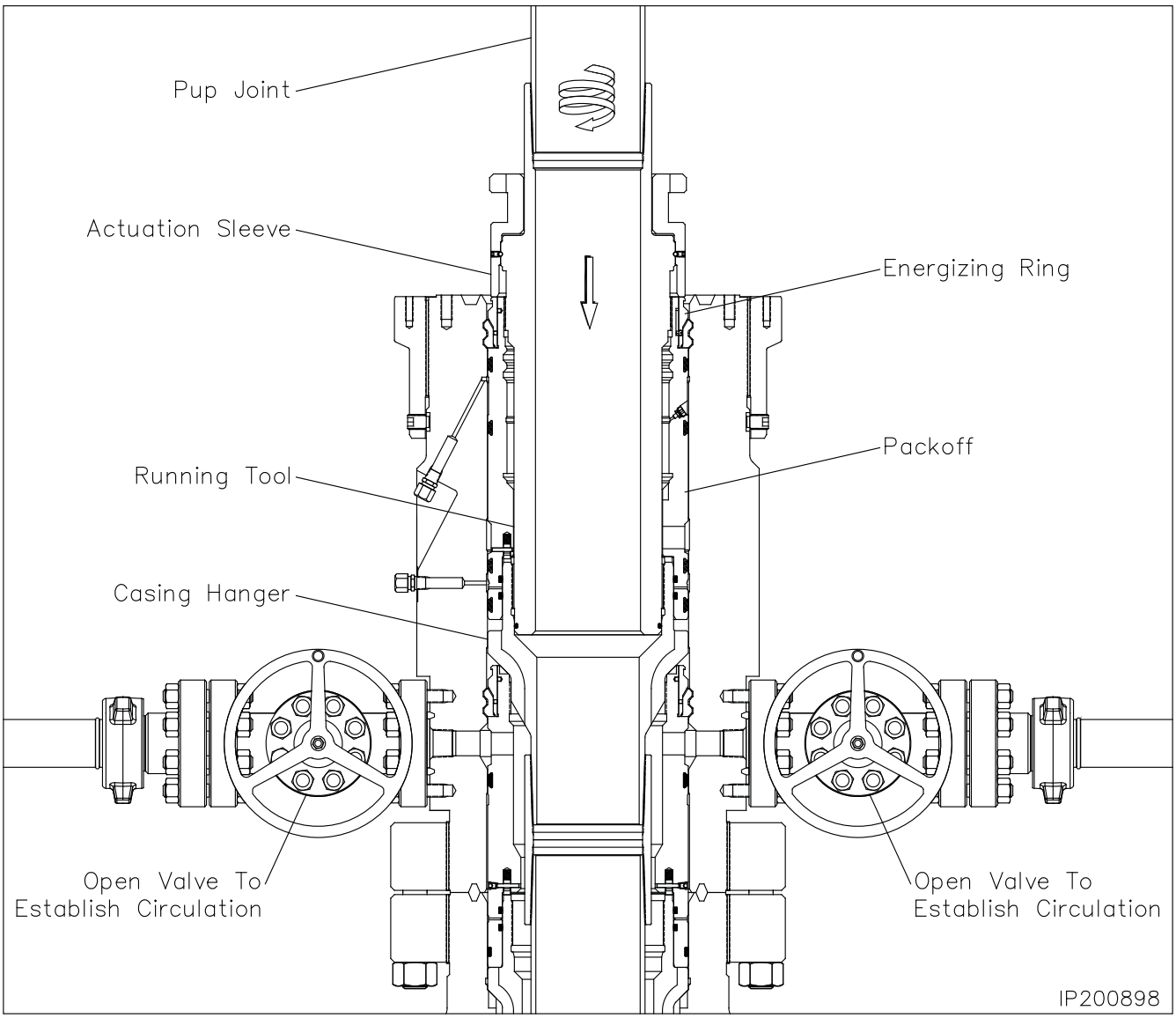
2. Remove the retrieval latch and set aside.

3. Make up the running tool to a 7-5/8” Buttress pup joint and torque connection to thread manufacturer’s optimum make up torque.

4. Pick up the Running Tool with pup joint and suspend it above the packoff.



# Stage 1 — Cement 7-5/8” Casing String




5. Carefully lower the tool into the packoff and thread them together by first rotating the tool clockwise (RIGHT) to locate the thread start and then counter clockwise (LEFT) until the tool actuation sleeve makes contact with the packoff Energizing Ring. Approximately 8 to 9 turns.
6. Install cement head adapter and cement head.
7. Rig up return lines to the lower outlets of the MBU-4T upper housing.
8. Establish circulation and cement casing as required.
9. With cement in place bleed off cementing pressure and close the side outlet valves.
10. Remove the cement head and adapter from the 7-5/8” pup joint.
11. Using only chain tongs, remove the running/cementing tool with clockwise rotation. Approximately 8 to 9 turns and retrieve the tool with a straight vertical lift.
12. Install TA cap as required