CHEVRON USA

GOM DEEPWATER BUSINESS UNIT

MAXIMUM ANTICIPATED SURFACE PRESSURE

Well Name: **Sturgis North**

WD= 3,490
RKB-ML= 3,562

	void %	50%	50%	50%	50%	50%	50%	
	DESIGN CRITERIA (DRLG or PROD)	DRLG	DRLG	DRLG	DRLG	DRLG	HOLE	
A.	Casing (in.)	22	17 7/8	16	13 5/8	11 7/8	10 5/8	Assume 16" Hung off at 40' below HPWH
B.	Casing Setting Depth (TVD RKB ft.)	6,300	7,800	15,500	22,000	26,000	31,150	and isolates all but 2", X80- 23" from deeper loads
	MW at Casing Setting Depth	11.20	11.60	14.20	15.50	15.60	16.20	
	Drilling Liner Setting Depth (TVD RKB ft.)	7,800	7,800	26,000	26,000	26,000	26,000	Drlg liner setting depth is lowest exposed liner prior to being lapped, if lapped
C.	Max. Exposed Openhole Depth (TVD RKB ft.)	15500	15,500	31,150	31,150	31,150	31,150	
D.	Maximum M.W. @ Max OH Depth (ppg)	14.20	14.20	16.20	16.20	16.20	16.20	
E.	Maximum Formation Pressure @ Max OH (ppg)	14.00	14.00	16.00	16.00	16.00	16.00	
F.	Maximum Formation Pressure @ Max OH (psi)	11284	11284	25917	25917	25917	25917	
G.	Gas Gradient (psi/ft)	0.1327	0.1327	0.1475	0.1475	0.1475	0.1475	
H.	Surface Press. Neglecting Shoe(psi)	4533	4533	10499	10499	10499	10499	
	Gas or Oil/Mud Interface Depth (TVD RKB ft.)	7750	7750	15575	15575	15575	15575	
I.	Fracture Gradient at Lowest Shoe (ppg)	14.500	14.500	17.080	17.080	17.080	17.080	
J.	Fracture Pressure at Lowest Shoe (psi)	5881	5881	23092	23092	23092	23092	
K.	Surface Press. With Shoe Fracture Press. (psi)	4816	4816	12013	12013	12013	12013	Surface Press with Shoe Frac Press based on gas over mud
L.	**MASP**	**4533**	**4533**	**10499**	**10499**	**10499**	**10499**	MASP based on 50/50 calc to rig floor. Add 500 psi for BOP test pressure.
M.	**MAWP = Pi (internal wellhead)**	**5006**	**5006**	**11024**	**11024**	**11024**	**11024**	MAWP assumes gas gradient from rig floor to wellhead
N.	**Net Burst at subsea wellhead**	**3445**	**3445**	**9464**	**9464**	**9464**	**9464**	Net Burst at WH based on MAWP in line 26 reduced by SW backup

Verified by C.Beiriger 8/21/07

Note: Wellbore displaced to gas from Rig Floor to Section TD at a TVD 50% void ratio with gas considered on top of mud.

Formation pressures, fracture pressures, and mud weights are surface measured equivalents.

Example: TD at 31,150' TVD RKB', Rig floor at 0' TVD RKB. Distance = 31,150' TVD
1/2 of distance is mud on bottom = 15,575' and 1/2 gas on top = 15,575'
Interface depth between gas and mud is therefore 31,150' / 2 = 15,575' TVD from surface
MASP = 25,917 psi - (16.2 ppg mud * 0.052* 15,575 TVD) - (0.1475 psi/ft*15,575')
MASP = 10,499 psi

22" CASING TEST CALCULATIONS

Size	Wt/ft	Grade	Conn	Burst	Collapse
22	170.21	X-60	S-60MT	3325	1816

70% Internal Yield of Weakest Casing = 2493.75

Considering Internal Yield Test @ Mudline

Top of casing TVD=	3589
Test mud weight=	8.6
Pore pressure=	8.6
Differential pressure= (8.6 - 8.6) * 0.052 * 3589=	0
Test pressure top casing= 2493.75 - 0=	**2494**

Considering Internal Yield Test @ Shoe

Btm of casing TVD=	6,287
Test mud weight=	8.6
Pore pressure=	11.2
Differential pressure= (8.6 - 11.2) * 0.052 * 6287=	-850
Test pressure top casing= 2493.75 - -850=	**3344**

However, Considering the MAWP:

MAWP + 500 psi= 3445 + 500 psi=	**3945**
Shoe Test pressure=(11.9 - 8.6)*.052*6300+200 psi=	**1279**

Therefore:

Plan test pressure is lesser of the above, greater than shoe test	**2494**

Test casing to	**2500**	**psi for 30 min. with**	**8.60**	**ppg mud**

Notes: 1. Casing test pressures are based on the lower of MAWP + 500 psi (reduced by choke line hydrostatic) or 70% internal yield less differential of test mud weight and pore pressure behind casing.

2. Actual test pressure will be calculated based on actual mud weight

Test pressure will be greater than shoe test in all cases.

22" burst rating is based on 95% of 3500 psi burst disc rating

17-7/8" CASING TEST CALCULATIONS

Size	Wt/ft	Grade	Conn	Burst	
22	170.21	X-60	S-60MT	3325	Based on burst disc
17 7/8	93.50	P-110HC	Hydril 521	5380	

70% Internal Yield of 22'' Casing =	2494
70% Internal Yield of 17.875'' Casing =	3766

Considering Internal Yield Test @ Mudline

Top of casing TVD=	4430
Test mud weight=	11.3
Pore pressure=	8.90
Differential pressure= (11.3 - 8.9) * 0.052 * 4430=	552
Test pressure= 2493.75 - 552=	**1942**

Considering Internal Yield Test @ Shoe

Btm of casing TVD=	7800
Test mud weight=	11.3
Pore pressure =	11.3
Differential pressure= (11.3 - 11.3) * 0.052 * 7800=	0
Test pressure= 3766 - 0=	**3766**

However, Considering the MAWP:

MAWP + 500 psi=	3445 + 500 =	**3945**

Current Liner Top Test

17 7/8 Liner top test=(12 - 11.3)*.052*6300+500=	**729**

Current Shoe Test

Shoe Test pressure=(14.5 - 11.3)*.052*7800+200 psi =	**1498**

Therefore:

Test casing to be greater than shoe test or minimum of test pressure or liner top testing	**1942**

Test casing:	**2000**	**for 30 min. with**	**11.3**	**ppg mud**

16" CASING TEST CALCULATIONS

Size	Wt/ft	Grade	Conn	Burst
16.040	109.61	HCQ-125HP	SLSF	10385
16	97.00	HCQ-125	SLSF	8733

70% Internal Yield of 16.04" Casing =	7270
70% Internal Yield of 16" Casing =	6113
Considering Internal Yield Test @ Mudline	
Top of casing TVD=	3602
Test mud weight=	14.2
Pore pressure=	8.55
Differential pressure= (14.2 - 8.55) * 0.052 * 3602=	1056
Test pressure= 7269.5 - 1056=	**6214**
Considering Internal Yield Test @ Shoe	
Btm of casing TVD=	15500
Test mud weight=	14.2
Pore pressure =	14.0
Differential pressure= (14.2 - 14) * 0.052 * 15500=	161
Test pressure= 6113.1 - 161=	**5952**
However, Considering the MAWP:	
MAWP+ 500 psi= 9464 + 500 =	**9964**
Therefore:	
Plan test pressure is lesser of the above=	**5952**
Shoe Test pressure=(16.3 - 14.2)*.052*15500+200 psi =	**1893**

Future Liner pressure tests

However, for future liner testing:

Test 13.625 liner to	2300	psi for 30 min. with	15.5	ppg mud
Equates to casing test to	**3348**	psi for 30 min. with	14.2	**ppg mud**
Test 11.875 liner to	2100	psi for 30 min. with	15.60	ppg mud
Equates to casing test to	**3228**	psi for 30 min. with	14.2	**ppg mud**

Therefore:

Plan test pressure is maximum of the above = **5952**

Test casing:	6000	**for 30 min. with**	**14.2**	**ppg mud**

Note: Actual test pressure will be calculated based on actual mud weight

casing

13-5/8" LINER TEST CALCULATIONS

Size	Wt/ft	Grade	Conn	Burst
13.625	88.2	Q-125HC	SLSF	10030
16	97.0	Q-125	SLSF	8733

70% Internal Yield of 13.625" Casing =	7021	
70% Internal Yield of 16" Casing =	6113.1	
Considering Internal Yield Test @ Mudline		
Top of casing TVD=	3,602	**(TOP)**
Test mud weight=	15.5	
Pore pressure=	8.60	
Differential pressure= (15.5 - 8.6) * 0.052 * 3602=	1292	
Test pressure= 6113.1 - 1292=	**4821**	
Considering Internal Yield Test @ 13 5/8" Shoe		
Btm of casing TVD=	22,000	**(BOTTOM)**
Test mud weight=	15.5	
Pore pressure	15.40	
Differential pressure= (15.5 - 15.4) * 0.052 * 22000=	114	
Test pressure= 7021 - 114=	**6907**	
However, Considering the MAWP:		
MAWP + 500 psi= 9464 + 500 psi =	**9964**	
Current Liner Top Test		
13.625 Liner top test=(16.3 - 15.5)*.052*15200+500=	**1132**	
Therefore:		
Plan test pressure is lesser of the above=	**1132**	
Shoe Test		
Shoe Test pressure=(16.7 - 15.5)*.052*22000+200 psi =	**1573**	

Future Liner pressure tests

Test 11.875 liner to	2100	psi for 30 min. with	15.60	ppg mud
Equates to 13.625 liner test to	**2214**	psi for 30 min. with	15.5	**ppg mud**

Therefore:

Test casing to be greater than minimum test pressure or shoe or future liner top testing **2214**

Test casing to	**2300**	psi for 30 min. with	**15.5**	ppg mud

Notes: 1. Casing test pressures are based on the lower of MAWP + 500 psi, 70% internal casing yield less differential of test mud weight and pore pressure behind casing, or liner top plus 500 psi.
Test pressure will be **200 psi greater than shoe test**
2. Actual test pressure will be calculated based on actual mud weight

13-5/8" LINER

11.875" LINER TEST CALCULATIONS

Size	Wt/ft	Grade	Conn	Burst
11.875	71.8	HCQ-125	Hydril 513	10720
16	97.0	Q-125	SLSF	8733

70% Internal Yield of 11.875" Casing =	7504	
70% Internal Yield of 16" Casing =	6113.1	
Considering Internal Yield Test @ Mudline		
Top of casing TVD=	3,602	
Test mud weight=	15.60	
Pore pressure=	8.60	
Differential pressure= (15.6 - 8.6) * 0.052 * 3602=	1311	
Test pressure= 6113.1 - 1311=	**4802**	
Considering Internal Yield Test @ Shoe		
Btm of casing TVD=	26,000	
Test mud weight=	15.60	
Pore pressure=	15.50	
Differential pressure= (15.6 - 15.5) * 0.052 * 26000=	135	
Test pressure= 7504 - 135=	**7369**	
However, Considering the MAWP surface:		
MAWPsurf + 500 psi= 9464 + 500 =	**9964**	psi
11 7/8 Liner top test=(16.7 - 15.6)*.052*21700+500=	**1741**	psi
Therefore:		
Plan test pressure is lesser of the above=	**1741**	
11 7/8 Shoe Test pressure=(17 - 15.6)*.052*26000+200=	**2093**	

Future Liner pressure tests

Test 9.375 liner to	#REF!	psi for 30 min. with	16.2	ppg mud
Equates to 11.875 liner test to	**#REF!**	psi for 30 min. with	15.6	**ppg mud**

Therefore:

Test casing to be greater than minimum test pressure or shoe or future liner top testing

Plan test pressure =			**2093**	psi
Test casing to	2100	psi for 30 min. with	**15.6**	ppg mud

Notes: 1. Casing test pressures are based on the lower of MAWP + 500 psi, 70% internal casing yield less differential of test mud weight and pore pressure behind casing, or liner top plus 500 psi.
Test pressure will be **200 psi greater than shoe test**

2. Actual test pressure will be calculated based on actual mud weight

11.875" Liner