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CORRECTION TO "GEOLOGICAL PROGNOSIS & DRILLING PROGRAM WELL 34/10-3"

Please note that pages 34 - 44:"Casing cement data and calculations" are to be replaced by the following pages.

Also please note telephone number correction on page 7:

S. Nedland, Area Geologist mobile telephone: 64906

Sendes:

Oljedirektoratet (2)
Esso Exploration
Norsk Hydro
Saga Petroleum
Svein Nedland
Svein G. Larsen
Jakob Bleie
D.I. Milton
Tore Sund

10000-6-75 LITHOGRAFEN 6424

CASING CEMENT DATA AND CALCULATIONS, 30" CASING.

GENERAL: The cement volume is calculated on the basis of theoretical hole volume, and the casing to be cemented to the sea bed with 150% excess on oper hole volume.

WELL DATA:

Depth kb-sea bed	197	m
Depth kb-last shoe	-	m
Depth kb-casing set point	250	m
Open hole dia	36	"
Annulus capacity, cased hole	-	l/m
Annulus capacity, open hole	200	l/m
Internal capacity, " casing	397	l/m
Mud weight	1.1	g/cm^3
Bottom hole hydrostatic pres. (BHHP)		bar
Est. bottom hole static temp. (BHST)	27	^oC
Est. bottom hole circulating temp. (BHCT)	27	^oC
Est. formation integrity	-	bar/m

CEMENT SLURRY COMPOSITION		FILLER/LEAD SLURRY	TAIL IN SLURRY
		CLASS + 3.2 l/100 kg Econolite	CLASS + 1 kg/100 kg $CaCl_2$
Mix water	l/100 kg	93 sea	44 sea
Total liquid	l/100 kg	96.2	44.6
Slurry weight	g/cm^3	1.56	1.91
Slurry yield	l/100 kg	128	76
TEST DATA @ BHCT			
Thickening time @ BHHP, hr:min		5:00	4:00
Crit. Turb. Flow rate: m/s (l/min)			
Fluid loss, ml/30 min, 70 bar			
TEST DATA @ BHST, BHHP			
Compr. strength,	bar 12hr	-13.6	102.0
	bar 24hr	37.4	125.8
REMARKS:			

Volume calculations: (30" casing)

Annular volume:	0.200 $m^3/m \cdot 54$ m	= 10.6 m^3
3 m plug at shoe:	0.397 $m^3/m \cdot 3$ m	= 1.3 m^3
Total :		11.8 m^3
Volume + 150% excess in open hole:		27.7 m^3

USE:

Lead: Class G cement + 3.2 l/100 kg Econolite
14000 kg (328 sacks) cement
equal to 17.92 m^3 slurry.

Tail in: Class G cement + 1 kg/100 kg $CaCl_2$
12800 kg (300 sacks) cement
equal to 9.73 m^3 slurry

Job preparation:

Total liquid lead slurry: 14000 kg cmt (93+3.2)l/100 kg
= 13468 liter (= 13.47 m^3 or 85 bbls)

Volume of Econolite needed in each 10 bbls (1.59 m^3)

displacement tank: 1590 liter $\frac{3.2}{93 + 3.2}$ = 53 liter

Total volume Econolite: 53 liter $\cdot \frac{85}{10}$ = 450 liter

Total liquid tail in: 12800 kg cmt. $\cdot$ 44.6 l/100 kg = 5709 liter
(= 5.71 m^3 or 36 bbls)

Amount of $CaCl_2$ needed = 12800 kg $\cdot$ 1 kg/100 kg = 128 kg

CASING CEMENT DATA AND CALCULATIONS, 20 " CASING.

GENERAL: The cement volume is calculated on the basis of the theoretical annulus volume, and the casing to be cemented to the sea bed with 100% excess on the open hole volume.

WELL DATA:

Depth kb-sea bed	197	m
Depth kb-last shoe	250	m
Depth kb-casing set point	550	m
Open hole dia	26	"
Annulus capacity, cased hole	195	1/m
Annulus capacity, open hole	140	1/m
Internal capacity, 20 " casing	178	1/m
Mud weight	1.1	g/cm^3
Bottom hole hydrostatic pres. (BHHP)	59	bar
Est. bottom hole static temp. (BHST)	96	°C
Est. bottom hole circulating temp. (BHCT)	31	°C
Est. formation integrity	0.149	bar/m

		FILLER/LEAD SLURRY	TAIL IN SLURRY
CEMENT SLURRY COMPOSITION		CLASS G +3.2 1/100 kg Econolite	CLASS G neat
Mix water	1/100 kg	93 sea	44 sea
Total liquid	1/100 kg	96.2	44
Slurry weight	g/cm^3	1.56	1.92
Slurry yield	1/100 kg	128	76
TEST DATA @ BHCT			
Thickening time @ BHHP, hr:min		4:00	4:00
Crit. Turb. Flow rate: m/s (l/min)			
Fluid loss, ml/30 min, 70 bar			
TEST DATA @ BHST, BHHP			
Compr. strength,	bar 12 hr @ 27°C	-	
	bar 24 hr @ 27°C	37.4	163.3
	12 hr @ 36°C		146.3
REMARKS:	24 hr @ 36°C		243.2

Volume calculations: (20" casing)

Annular volume: 0.140 m^3/m • (550 - 250) m	=	42.00 m^3
Volume between the casings: 0.195 m^3/m • (250-197)m	=	10.34 m^3
10 m plug at shoe: 0.187 m^3/m • 10 m	=	1.78 m^3
Total theoretical volume:		54.12 m^3
100% excess in open hole:		42.00 m^3
Total cement slurry volume:		96.12 m^3

USE:

Lead slurry: Class G cement + 3.2 l/100 kg Econolite
67400 kg (1580 sacks) cement
equal to 86.27 m^3 slurry.

Tail in slurry: Class G cement neat with seawater
13000 kg (305 sacks) cement
equal to 9.88 m^3 slurry

Job preparation:

Total liquid lead slurry: 67400 kg • 96.2 l/100 kg =
64840 liter (= 64.84 m^3 or 408 bbls)

Volume of Econolite needed in each 10 bbls
displacement tank: 1590 liter $\frac{3.2}{96.2}$ = 53 liter

Total volume of Econolite needed: 53 liter $\frac{408}{10}$ = 2160 liter

Total liquid tail in slurry: 13000 kg • 44 l/100 kg =
5720 liter (= 5.72 m^3 or 36 bbls)

Time estimate for cement job:

Mix cement: 92.12 m^3/0.8 m^3/m	= 120 min
Displacement: 54 m^3/1.0 m^3/min	= 45 min
Total pumping time:	= 174 min

Hydrostatic pressure at the casing shoe (550 m):

Height of tail in slurry: (9.88 - 1.78)m^3/0.140 m^3/m = 58 m

Hydrostatic head lead slurry: 0.153 bar/m (550-197-58)m	= 45.1 bar
Hydrostatic head tail in slurry: 0.188 bar/m 58 m	= 10.9 bar
Hydrostatic head seawater: 0.100 bar/m (197-25)m	= 17.2 bar
Total hydrostatic pressure:	= 73.2 bar

Equivalent gradient: 73.2 bar/550 m = 0.133 bar/m

Estimated formation integrity: 0.149 bar/m

CASING CEMENT DATA AND CALCULATIONS, 13 3/8" CASING.

GENERAL: The cement volume is calculated on the basis of the theoretical annulus volume, and the casing to be cemented 100 m into the 20" casing with 25% excess on open hole volume.

WELL DATA:

Depth kb-sea bed	197	m
Depth kb-last shoe	550	m
Depth kb-casing set point	1470	m
Open hole dia	17½	"
Annulus capacity, cased hole	94.7	l/m
Annulus capacity, open hole	64.5	l/m
Internal capacity, 13 3/8" casing, 72 lb/ft	77.3	l/m
Mud weight	1.4	g/cm^3
Bottom hole hydrostatic pres. (BHHP)	202	bar
Est. bottom hole static temp. (BHST)	51	°C
Est. bottom hole circulating temp. (BHCT)	40	°C
Est. formation integrity	0.181	bar/m

		FILLER/LEAD SLURRY	TAIL IN SLURRY
CEMENT SLURRY COMPOSITION		CLASS G + 3.2 l/100 kg Econolite	CLASS G neat
Mix water	l/100 kg	89 fresh	44 fresh
Total liquid	l/100 kg	92.2	44
Slurry weight	g/cm^3	1.56	1.90
Slurry yield	l/100 kg	124	76
TEST DATA @ BHCT			
Thickening time @ BHHP, hr:min		5:00+	3:00
Crit. Turb. Flow rate: m/s (l/min)			
Fluid loss, ml/30 min, 70 bar			
TEST DATA @ BHST, BHHP			
Compr. strength,	bar 12 hr @ 27°C	-	
	bar 24 hr @ 27°C		
REMARKS:	bar 12 hr @ 51°C	not set	113.9
	bar 24 hr @ 51°C	28	170.1

Hydrostatic pressure at the casing shoe (1470 m):

Height of tail in slurry: (9.88 - 1.86)m^3/0.0645 m^3/m	=	124 m
Maximum height lead cement:		
Volume to 20" shoe: 0.0645 m^3/m • (1470-124-550) m	=	51.3 m^3
Volume above 20" shoe: 75.65 m^3 - 51.3 m^3	=	24.35 m^3
Height above 20" shoe: 24.35 m^3/0.0947 m^3/m	=	257 m
Maximum height lead cement: (1470-550-124+257)m	=	1053 m
Hydrostatic head lead slurry: 153 bar/m • 1053 m	=	161.1 bar
Hydrostatic head tail in slurry: 0.186 bar/m • 124 m	=	23.1 bar
Hydrostatic head mud: 0.137 bar/m • 293 m	=	40.1 bar
Total hydrostatic pressure	=	224.3 bar
Equivalent gradient: 224.3 bar/1470 m	=	0.153 bar/m
Estimated formation integrity:	=	0.181 bar/m

CASING CEMENT DATA AND CALCULATIONS, " CASING.

GENERAL: The cement volume is calculated on the basis of the theoretical annulus volume and the casing to be cemented 100 m into the 13 3/8" casing with 25% excess on open hole volume.

WELL DATA:

Depth kb-sea bed	197	m
Depth kb-last shoe	1470	m
Depth kb-casing set point	1805	m
Open hole dia	12 1/4	"
Annulus capacity, cased hole	30.3	l/m
Annulus capacity, open hole	29.1	l/m
Internal capacity, 9 5/8" casing 43.5 and 47 lb/ft	38.8/38.2	l/m
Mud weight	1.75	g/cm^3
Bottom hole hydrostatic pres. (BHHP)	310	bar
Est. bottom hole static temp. (BHST)	69	°C
Est. bottom hole circulating temp. (BHCT)	46	°C
Est. formation integrity	0.193	bar/m

CEMENT SLURRY COMPOSITION		FILLER/LEAD SLURRY	TAIL IN SLURRY
		CLASS	CLASS G + 3.54 l/100kg Fh-l +2.57 l/100kg CFR-2L +0.13 l/100kg HR-GL
Mix water	l/100 kg		38.7 fresh
Total liquid	l/100 kg		44.9
Slurry weight	g/cm^3		1.90
Slurry yield	l/100 kg		76
TEST DATA @ BHCT			
Thickening time @ BHHP, hr:min			4:29
Crit. Turb. Flow rate: m/s (l/min)			
Fluid loss, ml/30 min, 70 bar			175
TEST DATA @ BHST, BHHP			
Compr. strength,	bar 12 hr		161.6
	bar 24 hr		226.2
REMARKS:			

Volume calculations: (9 5/8" casing)

Annular volume (12 1/4-9 5/8")	: 0.0291 m^3/m • (1805-1470)m	=	9.75 m^3
Volume between casings	: 0.0303 m^3/m • 100 m	=	3.03 "
24 m plug at shoe	: 0.0388 m^3/m • 24 m	=	0.93 "
Total theoretical volume	:	=	13.71 m^3
25% excess in open hole	: 9.75 m^3 • 0.25	=	2.44 "
Total slurry volume	:	=	16.15 m^3

USE:

Class G cement +
21250 kg (500 sacks) cement
equal to 16.15 m^3 slurry

Job preparation:

Total liquid needed; 21250 kg • 44.9 l/100 kg = 9541 ltr.
(= 9.54 m^3 or 60 bbls)

Volume of FL-1 needed in each
10 bbls displacement tank 1590 ltr • $\frac{3.54}{44.9}$ = 125 ltr.

Volume of CFR-2L needed in each
10 bbls displacement tank: 1590 ltr • $\frac{2.57}{44.9}$ = 91 ltr.

Volume of HR-6L needed in each tank: 1590 ltr • $\frac{6.13}{44.9}$ = 4.6 ltr

Total volume of HR-6L: 4.6 liter • $\frac{60}{10}$ = 28 liter

Total volume of FL-1 needed: 125 liter • $\frac{60}{10}$ = 750 liter

Total volume of CFR-2L needed: 91 liter • $\frac{60}{10}$ = 546 liter

20 bbls spacer to used at 1.82 kg/liter.

Time estimate for the job:

Mixing cement: 16.15 m^3/0.8 m^3/min.	=	20 min
Displacement: 71 m^3/1.0 m^3/min	=	71 min
Total pumping time:	=	91 min
	or	1 hour 31 min

Volume calculations:

Annular volume (17½"-13 3/8"):0.0645 m^3/m (1470-550)m	=	53.34 m^3
Volume between the casings: 0.0947 m^3/m • 100 m	=	9.47 m^3
24 m plug at shoe: 0.0773 m^3/m • 24 m	=	1.86 m^3
Total theoretical volume:	=	70.67 m^3
25% excess in open hole: 59.34 m^3 • 0.25	=	14.84 "
Total slurry volume:	=	85.51 m^3

USE:

Lead slurry: Class G cement + 3.2 l/100 kg Econolite
61000 kg (1430 sacks) cement
equal to 75.64 m^3 slurry

Tail in slurry: Class G cement neat with fresh water
13000 kg (305 sacks) cement
equal to 9.88 m^3 slurry

Job preparation:

Total liquid lead slurry: 61000 kg • 92.2 l/100 kg = 56242 ltr.
(= 5.62 m^3 or 354 bbls)

Volume of Econolite needed in each 10 bbls displacement tanks: 1590 liter • $\frac{3.2}{92.2}$ = 55.2 liter

Total volume of Econolite needed: 55.2 liter • $\frac{354}{10}$ = 1954 liter

Total liquid tail in slurry: 13000 kg • 44 l/100 kg = 5720 liter
(= 5.72 m^3 or 36 bbls)

Time estimate for the job:

Mixing cement: 85.51 m^3/0.8 m^3/min	=	107 min
Displacement: 101 m^3/1.0 m^3/min	=	101 min
Total pumping time:	=	208 min

or 2 hours 28 min.

Hydrostatic pressure at the casing shoe (1805 m):

Cement volume in annulus 13 3/8" - 9 5/8"	:16.15m^3-10.68m^3	= 5.47m^3
Height of cement in annulus 13 3/8"-9 5/8"	:5.47 m^3/0.0303m^3m	= 181m
Hydrostatic head cement slurry	:0.186 bar/m • 516m	= 96.0 bar
Hydrostatic head mud	:0.172 bar/m•1289 m	= 221.7bar
Total hydrostatic pressure	:	= 317.7bar
Equivalent gradient	:318 bar/1805 m	= 0.176bar/m
Estimated formation integrity	:	= 0.193bar/m