SAS INDUSTRIES, INC.

B&C CT UNIT 11457228 WELL CONTROL ACCUMULATOR SYSTEM EVALUATION

4-1/16" ES46 15M Dual-Combi Ram Stack + 4-1/16" ES46 15M Dual-Combi Ram Stack

Prepared by:	ALEXANDER SAS-JAWORSKY II	INPUT		
Manufacturer:	Texas Oil Tools ES46	Stack Size:	4-1/16	Inches
Closing Volume - Standard Rams (Quad Blind, Slip, Pipe)		0.41126	Gallon	(Hydraulic oil)
Closing Volume - Shear Rams (Quad)		1.29870	Gallon	(Hydraulic oil)
Closing Volume - Pipe-Slip Rams (Single)		0.41126	Gallon	(Hydraulic oil)
Closing Volume - Shear-Blind Rams (ES46 SBR)		1.29870	Gallon	(Hydraulic oil)
Opening Volume - Standard Rams (Quad Blind, Slip, Pipe)		0.41126	Gallon	(Hydraulic oil)
Opening Volume - Shear Rams (Quad)		1.29870	Gallon	(Hydraulic oil)
Opening Volume - Pipe-Slip Rams (Single)		0.41126	Gallon	(Hydraulic oil)
Opening Volume - Shear-Blind Rams (ES46 SBR)		1.29870	Gallon	(Hydraulic oil)
Accumulator Nitrogen Precharge Pressure :		1,150	Psig	(P p)
Accumulator Nitrogen Precharge Temperature :		74	Deg. F	(T @p)
Volume of Nitrogen at Precharge Pressure (per bottle) :		14.80	Gallons	(V @p)
Number of Accumulator Bottles in Circuit :		4	Bottles	(N a)
Maximum Accumulator System Hydraulic Pressure :		2,925	Psig	(P max)
30-Minute Stabilized Accumulator System Hydraulic Pressure :		2,900	Psig	(P stabilized)
30-Minute Stabilized Accumulator System Fluid Temperature :		110	Deg. F	(T @max)
Maximum Anticipated Wellhead Pressure :		9,500	Psig	(P wh)
Specified Grade and OD Size of Coiled Tube :	CT-110	1.750	Inches	
Specified Wall Thickness of Coiled Tube :		0.203	Inch	
Shear Blade SN :	Upper: 8801-0844	1.750	Lower: 8801-0744	
Shear-Blind Ram 1 Test Pressure Needed to Cut CT @ Pwh=0 :		1,962	Psig	(P shear)
Shear-Blind Ram Blade SN :	Upper: 8801-0844	1.750	Lower: 8801-0744	
Shear-Blind Ram 2 Test Pressure Needed to Cut CT @ Pwh=0 :		1,945	Psig	(P shear)
Standard Ram Set Closing Ratio (?/1) :		12.22	: 1	(Closing Ratio)
Shear-Blind Ram 1 Set Closing Ratio (?/1) :		19.69	: 1	(Closing Ratio)
Shear-Blind Ram 2 Set Closing Ratio (?/1) :		19.69	: 1	(Closing Ratio)

Minimum system pressure must be **2509** psig for precharge of **1150** psig to shear CT.

If the stabilized system pressure is **2,900** psig, Pp must exceed **460** psig to shear the CT.

If the accumulator circuit decreases below a N2 precharge pressure of **460** psig, then the number of bottles, N2 precharge pressure and/or system pressure must be increased.

Minimum accumulator volume must be **22.2528** gallons to complete the Close-Open-Close functions with 200 psi above precharge pressure remaining in the accumulator system

Calculated Excess Usable Oil is **13.298** Gallons

	OUTPUT		
Usable Hydraulic Fluid Per Accumulator Bottle :	6.003	Gallons	(V use)
Total Usable Hydraulic Fluid in Accumulator Circuit :	24.012	Gallons	(V totuse)
Minimum Pressure Needed to Shear CT at Pwh :	2,445	Psig	(P crit) for Shear
Minimum Pressure Needed to Shear CT and Seal at Pwh :	2,427	Psig	(P crit) for SBR

Hydraulic System Design

Hose ID :	0.375	Inches
Length :	250	Feet
Viscosity :	120.00	cP
Density :	7.19	PPG

ACCUMULATOR CIRCUIT PERFORMANCE - Predicted versus Actual / **ANALYSIS OF HYDRAULIC FLUID FLOW WITHIN SYSTEM**

C-O-C CYCLE Ram Functions		Accumulator Pressure Calculated (psig)	Accumulator Pressure Observed (psig)	Usable Volume (gallons)	Closing Time (sec.)	Fluid Flow Rate (gal. / min.)	Fluid Velocity (Ft. / Sec.)	Pressure / Rate Ratio (gpm/psig)	Predicted Flow Losses Fluid Flow (Psig)	Predicted Flow Losses @ Gauge (Psig)
Initial Status	0	2,900	2,900	24.012						
Close PS 1 Ram	1	2,840	2,800	23.601	4	6.169	17.92	0.00220	1,843	
Close SB 1 Ram	2	2,663	2,575	22.302	16	4.870	14.14	0.00189	1,474	
Close PS 2 Ram	3	2,608	2,500	21.891	5	4.935	14.33	0.00197	1,492	
Close SB 2 Ram	4	2,454	2,350	20.592	16	4.870	14.14	0.00207	1,474	
Open SB 2 Ram	5	2,314	2,200	19.294	15	5.195	15.09	0.00236	1,566	
Open PS 2 Ram	6	2,271	2,175	18.882	5	4.935	14.33	0.00227	1,492	
Open SB 1 Ram	7	2,149	2,075	17.584	17	4.584	13.31	0.00221	1,392	
Open PS 1 Ram	8	2,111	2,050	17.172	6	4.113	11.94	0.00201	1,258	
Close PS 1 Ram	9	2,076	2,000	16.761	6	4.113	11.94	0.00206	1,258	
Close SB 1 Ram	10	1,971	1,950	15.462	18	4.329	12.57	0.00222	1,320	
Close PS 2 Ram	11	1,939	1,900	15.051	6	4.113	11.94	0.00216	1,258	
Close SB 2 Ram	12	1,845	1,825	13.752	19	4.101	11.91	0.00225	1,255	
Open SB 2 Ram	13	1,759	1,750	12.454	18	4.329	12.57	0.00247	1,320	
Open PS 2 Ram	14	1,733	1,725	12.042	6	4.113	11.94	0.00238	1,258	
Open SB 1 Ram	15	1,656	1,650	10.744	19	4.101	11.91	0.00249	1,255	
Open PS 1 Ram	16	1,632	1,625	10.333	7	3.525	10.24	0.00217	1,091	

Total Hydraulic Volume Needed For COC Cycle : 9.0260 **Gallons (V coc)**
Minimum Accumulator N2 Volume Needed For COC Cycle : 22.2528 **Gallons (V acc)**

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WORKSHEET 1

DATE : May 22, 2012