OIL AND GAS WELL RETRIEVAL TECHNOLOGY

MAXXWELL PRODUCTION ®

OIL WELL SLOTTING PROFESSIONAL SERVICE

MAXIMIZE WELL PRODUCTION

maxxwell production
well slotting service

CALCULATION OF TECHNOLOGICAL PARAMETERS FOR SLOTTING PERFORATION PROCESS

WELL INFORMATION

INPUT DATA

WELL PARAMETRS

	CASING (inches)	TUBING (inches)	CEMENT (inches)	TOTAL WELL (PACKER) DEPTH (feet)		
OD	5.50	2.38	7.87	TD	5225.00	
ID	4.95	1.70	(bbl)	Packer	0.00	(ft)
Drift	4.85	1.70	Water Vol	60.00	Level Water	0.00

RESERVOIR (WELL) TEMPERATURE 180.0 Fahrenheit (F°)

TOOL PARAMETRS

TOTAL TOOL LENGTH (FROM NOZZLES TO ADAPTER)	12.90	(feet)
NON-MAGNETIC MARKER LENGTH (UNTHREADED)	4.10	(feet)
ADDITIONAL PIPE JOINT LENGTH (UNTHREADED)	6.00	(feet)
AVERAGE LENGTH OF TUBING SECTION (UNTHREADED)	31.50	(feet)
WORKING FLUID TEMPERATURE (OUTSIDE)	95.0	(F°)

CUTTING (PUMP) PARAMETRS

CUTTING SPEED	0.20	(inches/min)	inches per minute
SLURRY RATE (PUMP)	5.45	(barrels/min)	barrels per minute
WORKING PRESSURE	5000.00	(PSI)	pound per square inch
SAND CONCENTRATION	4.50	(ounce/gal)	ounce per gallon
DENSITY (WORKING FLUID)	8.50	(ppg)	pound per gallon
FLUID TEMPERATURE	160.0	(F°)	Fahrenheit

CUTTING (TREATMENT) INTERVALS

	INTERVAL (#)	START (feet)	END (feet)	TIME (start)	TIME (finish)
Bottom	1	4914.83	4916.14	0:00	0:00
	2	4912.86	4914.17	0:00	0:00
	3	4910.89	4912.20	0:00	0:00
	4	4908.59	4910.23	0:00	0:00
	5	4906.30	4907.94	0:00	0:00
	6	4904.00	4905.64	0:00	0:00
	7	4886.48	4888.12	0:00	0:00
	8	4884.19	4885.83	0:00	0:00
	9	4881.89	4883.53	0:00	0:00
	10	4879.59	4881.23	0:00	0:00
	11	4877.30	4878.94	0:00	0:00
Topping	12	4875.00	4876.64	0:00	0:00

CONVERTER

	mm ► inches		inches ► mm	
L	0.00	0.00	0.00	0.00

	meters ► feet		feet ► meters	
L	0.00	0.00	0.00	0.00

	Celsius ► Fahrenheit		Fahrenheit ► Celsius	
T°	0.0	32.4	0.0	-17.8

RESULTS

A RIG (Required surface equipment and materials) :

1. rig with crew
2. wellhead and surface piping, (BOP equipment) frac valve + stripper ribbers for frac valve
3. tubing 156 sections
4. additional pipe joints 3 6.0 feet/each
5. non-magnetic marker 1 4.1 feet/each
6. screper 4.9 inches
7. caliber 4.9 inches

1 process
1 tool

PREPARATION

1. Preparing the site, wellhead installation, rig installation, surface (BOP) piping, tubing prepare.
2. Well preparation, pass with the screper, pass with the caliber.
3. Tool preparation, connect: tool + adapter + pipe joint + non-magnetic marker + tubing measure the length from the nozzle to the top and bottom of a non-magnetic marker.
4. Lower tubing with the tool into the well to the depth ~ 4915 feet
8. wireline service • (only for detection of the marker position)
5. Lowering the logging tool on the 4900 with log 4860 to 4900
6. According to the log results to make a correction of the tool (nozzles) position : 4914.4
   NOZZLES FIRST INITIAL POSITION : 4914.38 2 nozzles 4914.42 4 nozzles

B WATER & SAND (Required surface equipment and materials) :

9. water storage tank : lease water - non-soapy brine from nearby well 292 (bbl) 12275 (gal)
10. cutting tank : 168 (bbl) 7052 (gal)
11. shale shaker on top of cuttings tank
12. desired intermediate pump ~ 15-20 ft³/min or 120-150 gal (US) or 4-5 bbl (US)
13. water level: in the well should be 552 feet before surface or for prevent leakage of water on the surface when downhole tubing 111 (bbl) 4672 (gal)
    additional info: volume of water in the well (calculation of the level of water by volume in the well) 60 (bbl) 0 (gal) equal 2704 (feet)

• water volume without tubing:	124.37 (bbl)	5223 (gal)	5225 (ft)	
• water volume with tubing on the first cutting interval	111.12	4667	4915	(ft)
• water volume with tubing on the last cutting interval	111.23	4672	4875	(ft)

hydrostatic pressure 4914.83 ft equal 2201.51 psi • sand→nozzl 3.73 (min)

abrasive quartz sand	10/35	20/40	22.3 (tons)	2 nozzles	43.2 (tons)	4 nozzles

C PUMP (FRAC) (Required surface equipment and materials) :

14. high-pressure (triplex or more) frac-pump for operate in the following mode (max/min):

nozzles	Pressure	Rate	Slurry	Concentrat	Density	NET time	GROSS time
2	5500	6.0	252	2.67	8.42	8	12
4	6500	9.0	378	2.67	8.42	12	16
(pieces)	(psi)	(bbl/min)	(gal/min)	(ounces/gal)	(ppt)	(hours)	(hours)

15. sand hopper or dump truck compatible with blender concentration : 2.67 (ounces/gal)
16. high pressure iron tubing, including connections the length of ~ 100 (feet)
17. reverse flow manifold (opportunity to catch the valve ball on the surface at back flushing)
18. Frac Van (opportunity for monitoring working pressure, sand concentration, slurry rate)
7. prepare and connect high pressure line.
8. test the operation of pump aggregates and sand flow in the blender.
9. test the high pressure line before wellhead
10. disconnect high pressure line from wellhead, drop the testing ball (2"), connect again.
11. wait ~ 5 min (push the test ball with a little pressure) ~ 300 psi
12. test tubing connections with the pressure ~ 6779 during 1 min
13. switch manifold block, turn back flushing, catch the ball through the free pipe connection.
14. switch manifold block, disconnect high pressure line at wellhead, drop the metal valve ball (1").
15. wait ~ 5 min (push the test ball with a little pressure) ~ 300 psi

Avoid a sharp increase in pressure, avoid hydraulic impact the ball on tool and perforator. During the slotting perforation process avoid a sharp increase in pressure, pressure jumps when applying sand , the pressure must be constant. Avoid increasing the pressure above 5900 psi. When the shock pressure above this, tool stops working. With a decrease in pressure is less than 800 psi perforator returns to the starting position. Avoid of jumping the sand concentration, avoid supplying the sand by packs, this leads to clogging of the tool and hydraulic impact. Do not allow to stop the circulation of the working solution, in an emergency stop circuit immediately start back flushing to prevent sand filling tool.

V	mm/min ► inches/min	0.00	0.00
	inches/min ► mm/min	0.00	0.00
R	liters/min ► barrels/min	0.00	0.00
	barrels/min ► liters/min	0.00	0.00
R	liters/min ► gal/min	0.00	0.00
	gal/min ► liters/min	0.00	0.00
R	barrels/min ► gal/min	0.00	0.00
	gal/min ► barrels/min	0.00	0.00
R	liters/min ► m³/min	0.00	0.00
	m³/min ► liters/min	0.00	0.00
R	barrels/min ► m³/min	0.00	0.00
	m³/min ► barrels/min	0.00	0.00
R	gal/min ► m³/min	0.00	0.00
	m³/min ► gal/min	0.00	0.00
D/C	gram/liter ► ounces/gal	35.00	4.67
	ounces/gal ► gram/liter	0.00	0.00
D/C	gram/liter ► kg/m³	0.00	0.00
	kg/m³ ► gram/liter	0.00	0.00
D/C	gram/liter ► pound/gal	0.00	0.00
	pound/gal ► gram/liter	0.00	0.00
D/C	gram/liter ► ppg	0.00	#DIV/0!
	ppg ► gram/liter	0.00	#DIV/0!
P	psi ► Mpa	0.00	0.00
	MPa ► psi	0.00	0.00
P	psi ► atmospheres	0.00	0.00
	atmospheres ► psi	0.00	0.00
P	MPa ► atmospheres	0.00	0.00
	atmospheres ► Mpa	0.00	0.00

- The time to reach of waste rock the surface (min) 21

D HYDRO-SLOTTING PERFORATION PROCESS

	well	(in feet²)	2 noz (NET)	4 noz (NET)	2 noz (GRO)	4 noz (GRO)	weight	
• depth :	5225.0	open area :	334.2	651.7	417.6	814.3	0.7	ton
(in feet)		top	bottom	sum	NET	GROSS	sump	
• treatment intervals :		4875.0	4916.1	41.1	18.7	23.4	308.9	ft
	bottom	2 nozzles	4 nozzles	equal	elongation	2 nozzles	4 nozzles	
• initial nozzles position		4914.38	4914.42	4914.83	0.43	0.45	0.41	ft
	cement	casing	tubing ↑	tubing ↓	well	tubing ↑	tubing ↓	
• volume :	160.8	29.17	13.14	13.25	124.37	111.23	111.12	ft
	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	

16 slowly begin to increase the pressure to feel that the ball is in the saddle of perforator.

17 if the pressure normally rises, slowly raise the pressure to 4000 losses 566 psi

18 after ~ 5 minutes start the flow of sand with concentration 2.67 o/g

pressure	surface	tubing	perforator	shaker	sum	difference	nozzles	
• losses	147	42	294	220	704	pressure	4296	psi
• w/coeff	118	34	237	177	566	pressure	4434	psi

- time of reach the sand to the nozzles (min) ~ 3.73 time cutting casing 1.0 min

19 increase the pressure up to (psi) ~ 5000 increase sand concentration ~ 3.3 o/g

20 continue the process kiping of maintaining this mode, and according to the schedule below :

	INTERVAL (ft) start (ft)	finish (ft)	length (ft)	TIME (min) start sand after (min)	stop sand after (min)	flushing during (min)	stop pressure after (min)	LIFT UP tool on next level in (ft)
1	4914.83	4916.14	1.31	5	55	18	79	2
2	4912.86	4914.17	1.31	5	55	18	79	2
3	4910.89	4912.20	1.31	5	55	18	79	2
4	4908.59	4910.23	1.64	5	71	23	98	2
5	4906.30	4907.94	1.64	5	71	23	98	2
6	4904.00	4905.64	1.64	5	71	23	98	18
7	4886.48	4888.12	1.64	5	71	23	98	2
8	4884.19	4885.83	1.64	5	71	23	98	2
9	4881.89	4883.53	1.64	5	71	23	98	2
10	4879.59	4881.23	1.64	5	71	23	98	2
11	4877.30	4878.94	1.64	5	71	23	98	2
12	4875.00	4876.64	1.64	5	71	23	98	0

21 after finish interval 4875.00 make a complete flushing. For a complete flushing well need to switch back flushing, catch the ball on the surface (in open valve).

22 lower the tubing to a depth of 4916.14 feet, switch in direct flushing mode, and flushing the well 60 minutes "before clean water".

23 lift the tubing and the tool to the surface, disconnect the tool.

E FINISHING PROCEDURES

24 chemical treatment (acid bath) 20 % HCL during 24 hours at closed well. Volume of the well 124 bbl

25 wellhead dismantling, pump-jack installation.

F TIME

• Wireline service	2	hours	• Net time of slotting perforation 11 hours
• Chemical treatment service	1	days	• Time of slotting perforation with flushing 19 hours
• Frac (Pump) service	24	hours	• This slotting perforation process includes 1 replacement of perforator (nozzles)
• Water surface equipment (water tank, cutting tank, etc.)	4	days	• Lowering the lifting operation 6 hours
• Rig with crew	7	days	• Total time for slotting perforation operations 24 hours
• The time to reach of waste rock the surface	21	min	25 Stages