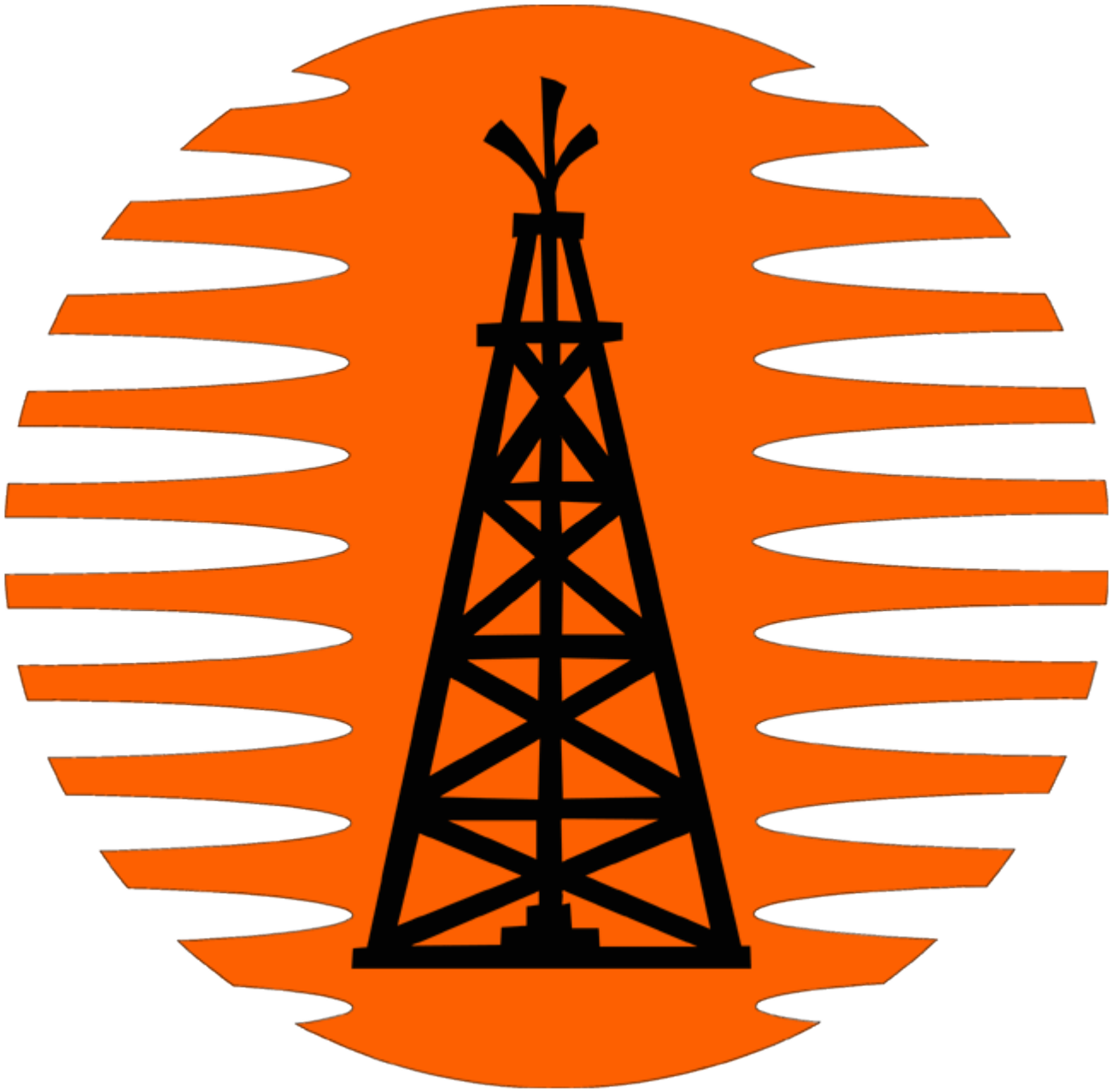
OIL AND GAS WELL SLOTTING PERFORATION PROFESSIONAL SERVICE COMPANY

# MAXXWELL PRODUCTION

ENHANCED OIL RECOVERY WITH SLOTTING PERFORATION TECHNOLOGY PROFESSIONAL SERVICE



## GEOPHYSICAL AND GEOLOGICAL ANALYSIS, WELL SELECTION, SLOTTING PERFORATION TECHNICAL PROJECT (“CUT PROGRAM”)

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

• ECOLOGICALLY SAFE • ENVIRONMENTALLY FRIENDLY • EFFECTIVE AFFORDABLE METHOD •

OIL AND GAS WELL HYDRO SLOTTING PERFORATION PROFESSIONAL SERVICE

Maximize well production

MAXXWELL PRODUCTION

CONTINUOUS MOVING JET SLOTTING PERFORATION TECHNOLOGY FOR VERTICAL AND HORIZONTAL WELLS

**Data**: February 10, 2019 # KA-**15-115-19225**

# Enhanced Oil Recovery (EOR) with Slotting Perforation Technology (SPT) Program

## Well CK Oil & Gas LLC # 3 Vogel (API # 15-115-19225, KID # 1043501323 Lost Springs deposit-field: Marion County, Kansas, USA

# Maxxwell Production® LLC[S]

Enhanced Oil/Gas Recovery (EOR) with Slotting Perforation Technology (SPT) professional service company


Business ID: NV20141386654
FEIN #: 35-2509442

Address: 848 N. Rainbow Blvd, 5353
Las Vegas, NV
United States
89107-1103

Toll free: 1.800.696.5721
Tel: 1.940.368.1192

Email: maxxwell@rogers.com
info@maxxwell.us

Internet: www.maxxwell.us
www.maxxwellproduction.com


Submitted by:

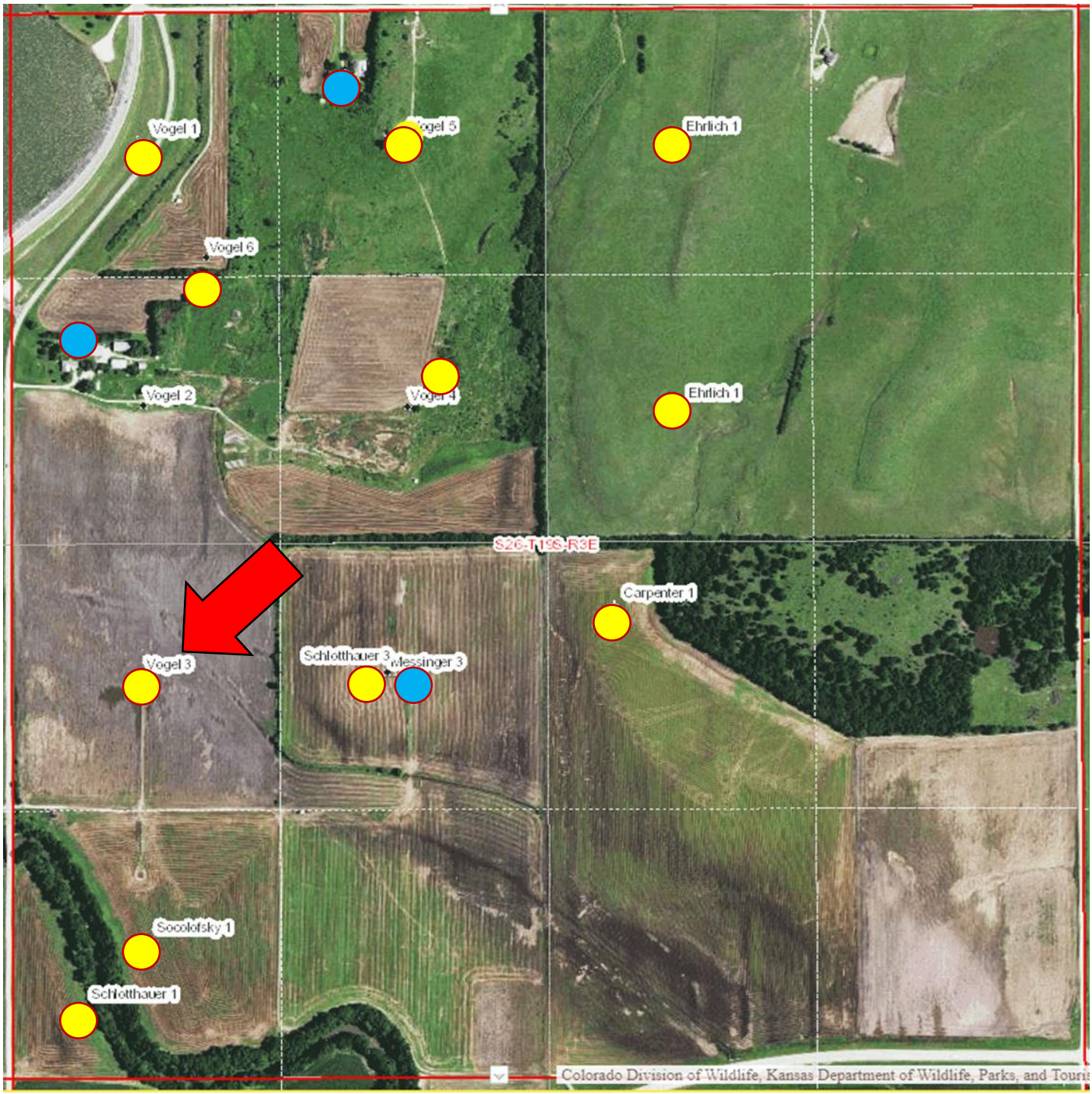
Anatoli Nikouline, CEO & EOR SPT Professional Service Engineer

Maxxwell Production appreciates the opportunity to present this proposal and looks forward to being of service to you

# Table of Contents

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# Well selection
## Lost Springs deposit-field




Well: Vertical oil well CK Oil & Gas LLC **Vogel # 3** (API # **15-115-19225**, KID # **1043501323** Lost Springs deposit-field: Marion County, Kansas, USA

Location: **38.3680947**, **-97.0744051**

# Vogel-3

OIL or GAS WELL

| | |
|---|---|
| API: | 15-115-19225 |
| Lease: | VOGEL |
| Well: | 3 |
| Original Operator: | Lario Oil and Gas Co. |
| Current Operator: | CK Oil & Gas LLC |
| Field: | |
| Location: | T19S R3E Sec. 26<br>SE NW NW SW<br>1996 North, 4596 West from SE corner |
| Longitude (NAD27): | -97.0744051 |
| Latitude (NAD27): | 38.3680947 |
| County: | Marion |
| Permit Date: | |
| Spud Date: | Dec-14-1961 |
| Completion Date: | Dec-22-1961 |
| Plugging Date: | |
| Well Type: | OIL |
| Status: | Producing |
| Total Depth: | 2418 |
| Elevation: | 1321.0000 KB |
| Producing Formation: | |
| IP Oil (bbl): | |
| IP Water (bbl): | |
| IP Gas (mcf): | |

**API:** 15-115-19225
**KID:** 1043501323
**Lease:** VOGEL
**Well:** 3
**Original operator:** Lario Oil and Gas Co.
**Current operator:** CK Oil & Gas LLC
**Field:**
**Location:** T19S R3E, Sec. 26
SE NW SW
1996 North, 4596 West, from SE corner
**Longitude:** -97.0744051
**Latitude:** 38.3680947
Lat-long from GPS
**County:** Marion

**Permit Date:**
**Spud Date:** Dec-14-1961
**Completion Date:** Dec-22-1961
**Plugging Date:**
**Well Type:** OIL
**Status:** Producing
**Total Depth:** 2418
**Elevation:** 1321 KB
**Producing Formation:**
**IP Oil (bbl.):**
**IP Water (bbl.):**
**IP GAS (MCF):**
**KDOR code for Oil:** 102655
**KDOR code for Gas:** 215773
**KCC Docket No.:**

View well on interactive map

**Well data**: https://chasm.kgs.ku.edu/ords/qualified.well_page.DisplayWell?f_kid=1043501323
**Oil production data**: https://chasm.kgs.ku.edu/ords/oil.ogl5.MainLease?f_lc=1001109585
**Gas production data**: https://chasm.kgs.ku.edu/ords/oil.ogl5.MainLease?f_lc=1001151194
**Log**: http://www.maxxwell.ca/wells/Vogel/Vogel-3.pdf
**Vogel # 3 Full Log**: http://www.maxxwell.ca/wells/Vogel/Vogel%20%23%203%20Full%20Log.pdf
**Vogel Lease Scout Cards**: http://www.maxxwell.ca/wells/Vogel/Vogel%20Lease%20Scout%20Cards.pdf

Extract from Marion Reservoir Project (Harold R. Trapp, Certified Petroleum Geologist (**316**) **262-7111**:

Lario Oil & Gas **Vogel # 3** (**NW SW** section **26-19S-3E**)

This well is also considered high priority and should be perforated immediately. There was 537 mcf rate of gas on a drill stem test that covered both the upper and lower zones. The well was perforated in the lower zone for an initial production rate of 70 BOPD after an acid and a frac job. I recommend perforating from 2331 to 2350 ft.

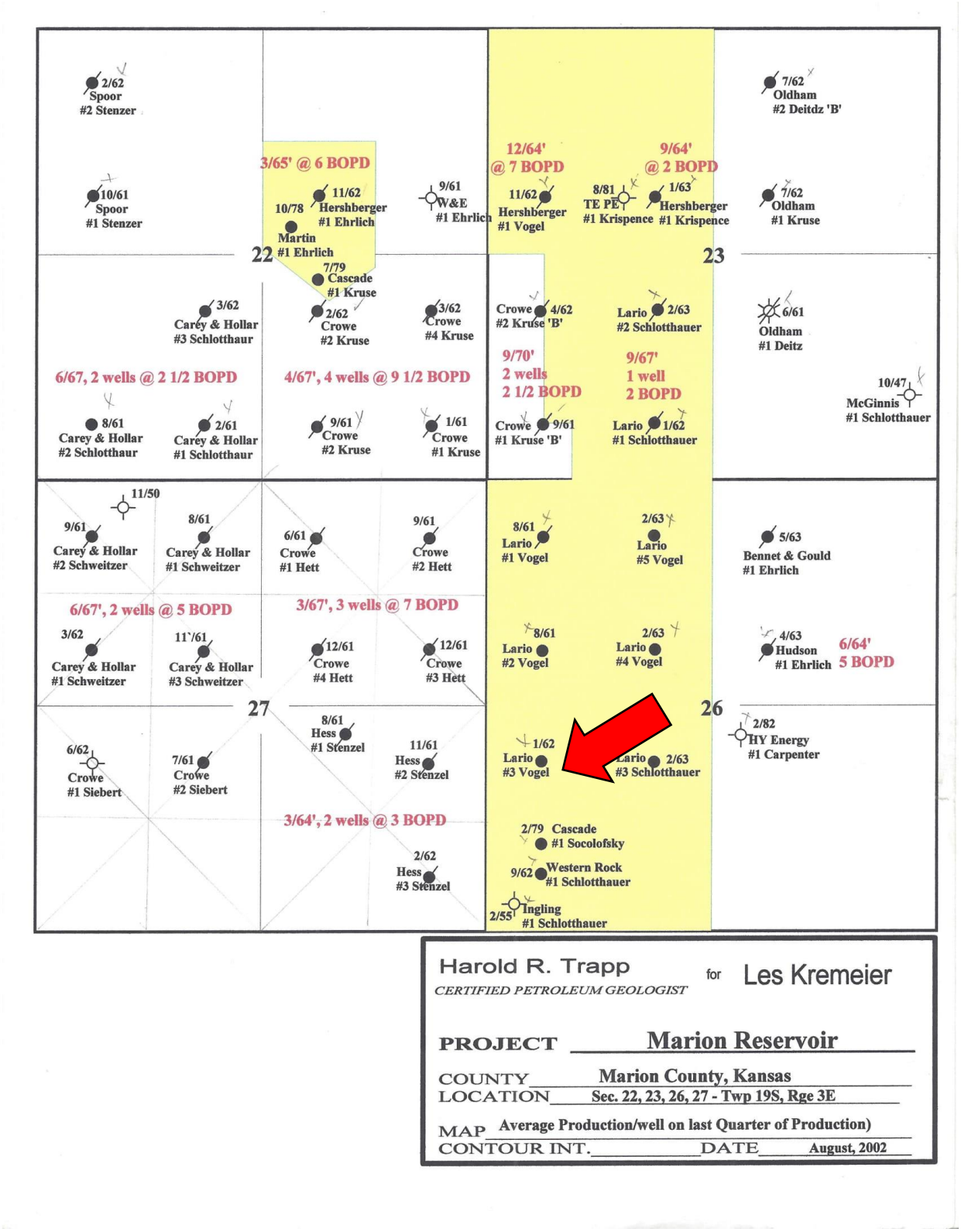
# Information

| | |
|---|---|
| **Well**: | Vertical oil well CK Oil & Gas LLC **Vogel # 3** |
| **API**: | 15-115-19225 |
| **KID**: | 1043501323 |
| **Field**: | Lost Springs deposit-field |
| **County**: | Marion County |
| **State**: | Kansas |

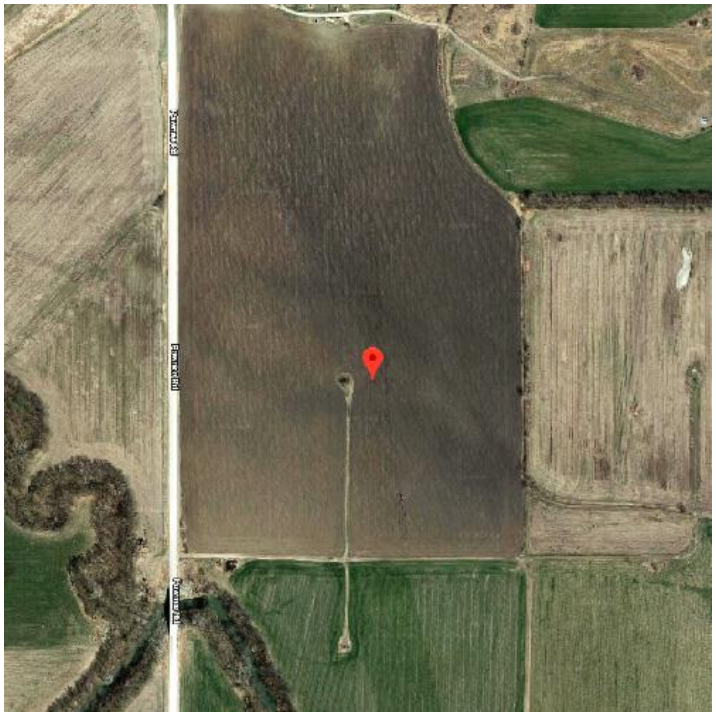
| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

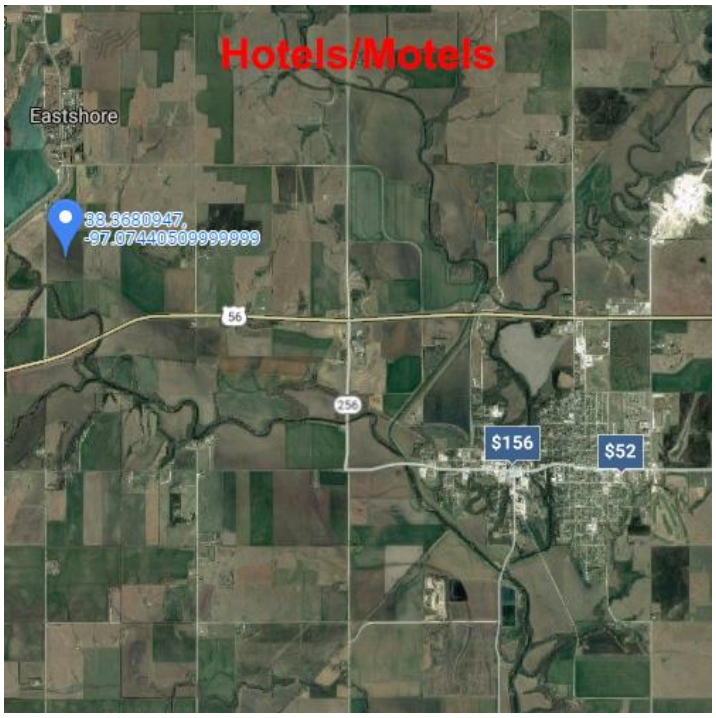
# Location

| | |
|---|---|
| Well: | Vertical oil well CK Oil & Gas LLC # 3 Vogel (API # 15-115-19225, KID # 1043501323 Lost Springs deposit-field: Marion County, Kansas, USA |
| Location: | Coordinates: 38.3680947, -97.0744051 |
| Internet: | 9W9G+66 Eastshore, Kansas, USA (Gale, KS, USA) |



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|




Nearest hotels:

Historic Elgin Hotel
115 Third, Marion, KS 66861, USA
8XXH+FV Marion, Centre, KS, USA
historicelginhotel.com
(620) 382-3200

Country Inn
1305 E Main St, Marion, KS 66861, USA
8XXV+54 Marion, Centre, KS, USA
booking.com
(620) 382-2147

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

35

LARIO OIL & GAS #3 VOGEL 35? 26-19-3E C NW SW

Contr. ELLIS DRLG. MARION County

E 1321 RB Comm. Comp. 1-12-62 IP 70 BOPD/MISS

| LOG Tops | Depth | Datum |
|---|---|---|
| | | |
| LANS | 1778 | -457 |
| | | |
| | | |
| MISS | 2330 | -1009 |
| | | |
| | | |
| MISS LM | 2405 | -1084 |
| | | |
| | | |
| | | |
| TD | 2418 | -1097 |

Casing
8" 201
5" 2439

DST 2332-90/45", G/3", 537 MCFG /5", SPRAY M/10", SPRAY O/20", 250' CL O, 18' MDY O, BHP 890#/ 30"

PERF 2380-90: ACID 250: FRAC

DOBBS POOL

INDEPENDENT OIL & GAS SERVICE
WICHITA, KANSAS

# WELEX

ORIGINATORS OF JET PERFORATING

## RADIOACTIVITY LOG

COMPANY LARIO OIL & GAS CO.
WELL VOGEL # 3
FIELD DOBBS
County MARION
State KANSAS
File

COMPANY LARIO OIL & GAS COMPANY
WELL VOGEL # 3
FIELD DOBBS
COUNTY MARION STATE KANSAS

Location
C-NW-SW
Sec. 26 Twp. 19S Rge. 3E

Other Logs

Elevation
KB. 1360'EST.
DF.
GL. 1355'EST.

Permanent Datum KELLY BUSHING Elev. 1360'EST.
Log Measured From 5'ABOVE GROUND LEVEL
Drilling Measured From KELLY BUSHING

| | | | | |
|---|---|---|---|---|
| Type Log | GAMMA | NEUTRON | SCATTERED GAMMA | |
| Run No. | ONE | ONE | ONE | |
| Date | 12-22-61 | 12-22-61 | 12-22-61 | |
| Total Depth Driller | 2440' | 2440' | 2440' | |
| Present Depth Driller | 2412' | 2412' | 2412' | |
| Total Depth Welex | 2418' | 2418' | 2418' | |
| Survey Begins | 2415' | 2418' | 2415' | |
| Survey Ends | 1550' | 1550' | 1550' | |
| Mud Data | | | | |
| Type Fluid in Hole | WATER | WATER | WATER | |
| Salinity PPM Cl | | | | |
| Weight lb./gal. | | | | |
| Fluid Level | FULL | FULL | FULL | |
| Max. Hole Temp. | | | | |
| Recorded By | H. STEITZ | | | |
| Witnessed By | MR. MILLS | | | |



| | BORE HOLE RECORD | | | CASING RECORD | | | |
|---|---|---|---|---|---|---|---|
| Run | Bit | From | To | Size | Wgt. | From | To |
| 1 | 12-1/4" | 202' | 0 | 8-5/8" | | 202' | 0 |
| | 7-7/8" | 2440' | 202' | 5-1/2" | 15.5 | 2439' | 0 |

SEC. 26-19S-3E

# Geological analysis

(Extracts from Geological analysis)

## Thickness of Chert Section

The chert section (containing hydrocarbon filled zones) is basically the section between the top of the Mississippian and the Mississippian Lime. Frequently, there is a shale between the chert and the limestone, which, of course is not reservoir material. In addition, not all the chert is porous and permeable. Non-the-less, it is this interval between the Mississippian Lime and the top of the Mississippian that contains any chert reservoir zones. It is a useful interval to map.
The penciled thickness map you gave me shows that the west half of the pool is relatively thin (40-50 feet), and the east half of the pool is much thicker (more like 50 to 70 feet).

## Multiple Zones

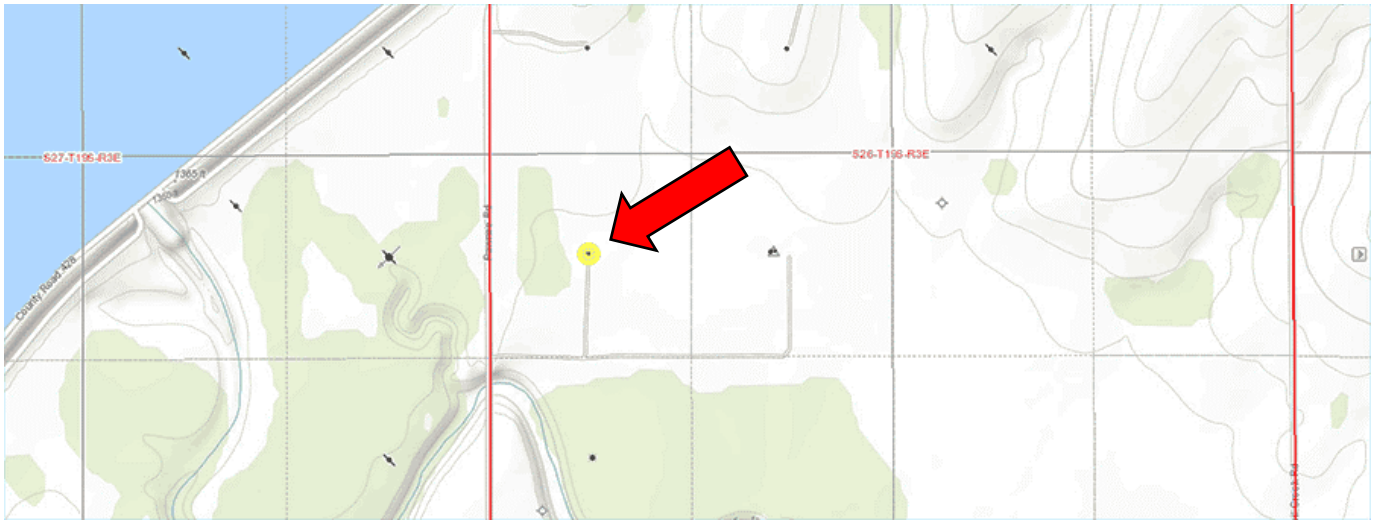
This thicker portion is very interesting as it has the same zone as the western portion of the pool (lower zone), as well as another, higher zone (upper zone). The discovery well (SE section 22) was drilled in an area where the Mississippian was only thick enough to have the lower zone. As drilling proceeded to the east, they chased and perforated and produced the lower zone. They did this even where there was added section and an upper zone present. Public records do not indicate that the upper zone was perforated and produced. It is this scenario that leads to the following recommendations.

## Perforation recommendations

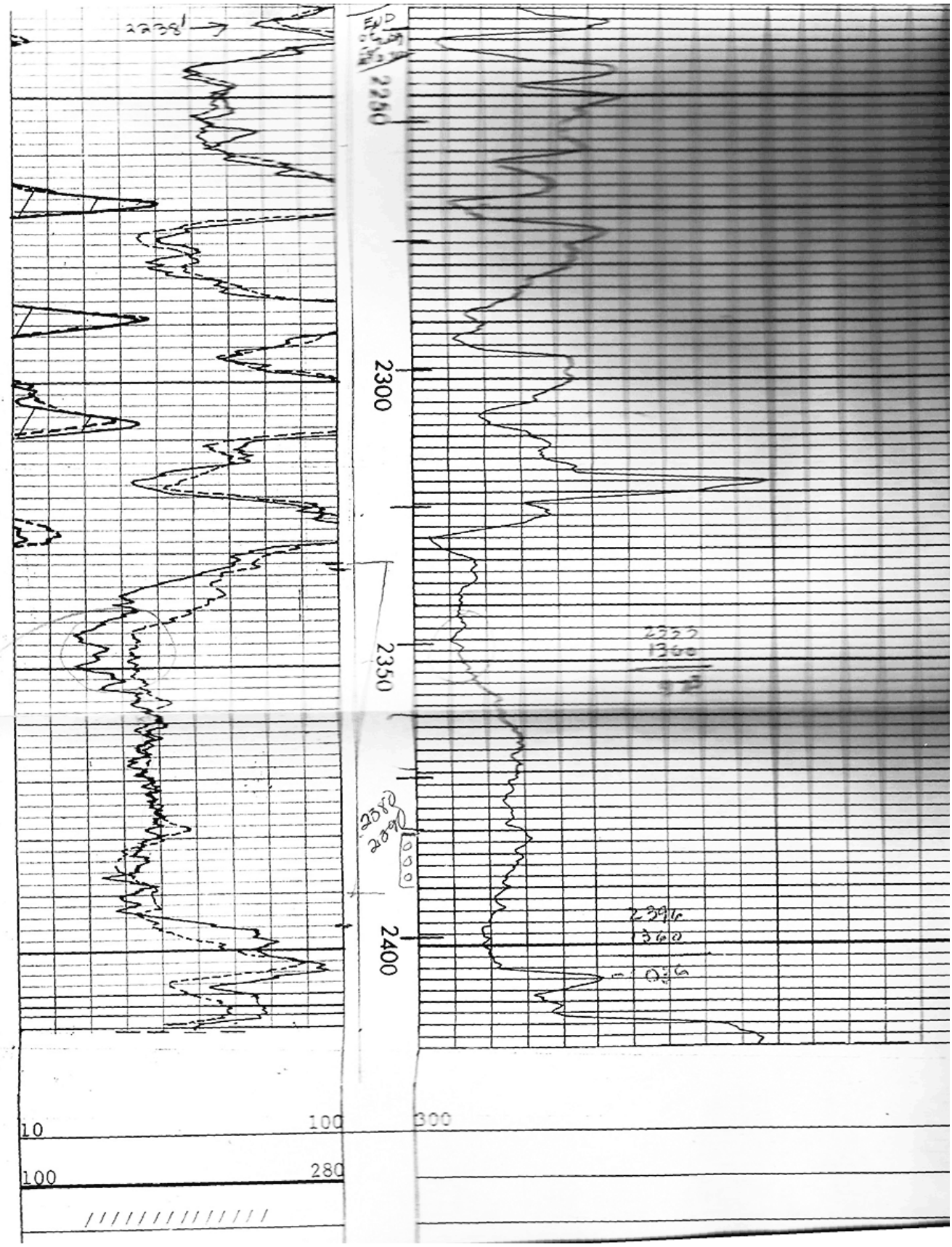
There are several wells in the W/2 of section 26 that are either producing or are otherwise not plugged. These wells each have an upper zone that appears not to have been perforated. The lower zones were perforated and produced. It is my guess that the upper zone was not perforated so as to preserve a pressure head on the oil, the preferred hydrocarbon.

The risk of the success of these perforations is whether, or not, the upper zone has been perforated and produced.

Public production records show three leases produced a minor amount of gas. The Bisbee Ehrlich lease in section 22 produced an average of 4 cfgpd in 2000 and 2 ½ cfgpd in 2001. This gas production could only be from the lower zone as the Mississippian chert section is too thin to have an upper zone in this well.



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# Conclusions from Geophysical/Geological analysis

Vertical oil well CK Oil & Gas LLC **Vogel # 3** (**API # 15-115-19225**, KID # **1043501323**)
Lost Springs deposit-field: Marion County, Kansas, USA

The following data was used for analysis:

- GIS curves
- Analysis of neighboring wells (Schlotthauer # 1, Vogel # 2, 4, 5) to determine the additional potential of gas or oil production
- Well design

| drilling end date | 01.12.1962 | | note |
|---|---|---|---|
| well design | OD (inches) | depth (ft.) | |
| casing 1 | 8 5/8 | 201′ | |
| casing 2 | 5 1/2 | 2439′ | |
| perforation intervals | 2380′-2390′ | | attached graphs |
| TD | 2440′ | | |

According to GIS data, the productive stratum lies in the range of 2330-2405 ft.

Within the productive layer has been determinate the next collector's intervals: 2336-2354 ft., 2380-2392 ft.

It is not possible to determine the porosity using well logging data due to the absence of a scale bar in the neutron and gamma diagram.

According to logging data, it can be concluded that the reservoir porosity in the 2336-2354 ft. interval is higher than in the 2380-2392 ft. interval.

According to the previously performed well's potential analysis, well Vogel-3 assumes the presence of hydrocarbon mixtures (gas, condensate, oil) above the perforation interval.

The available GIS curves (NK, GK) do not allow estimating the saturation of reservoirs.

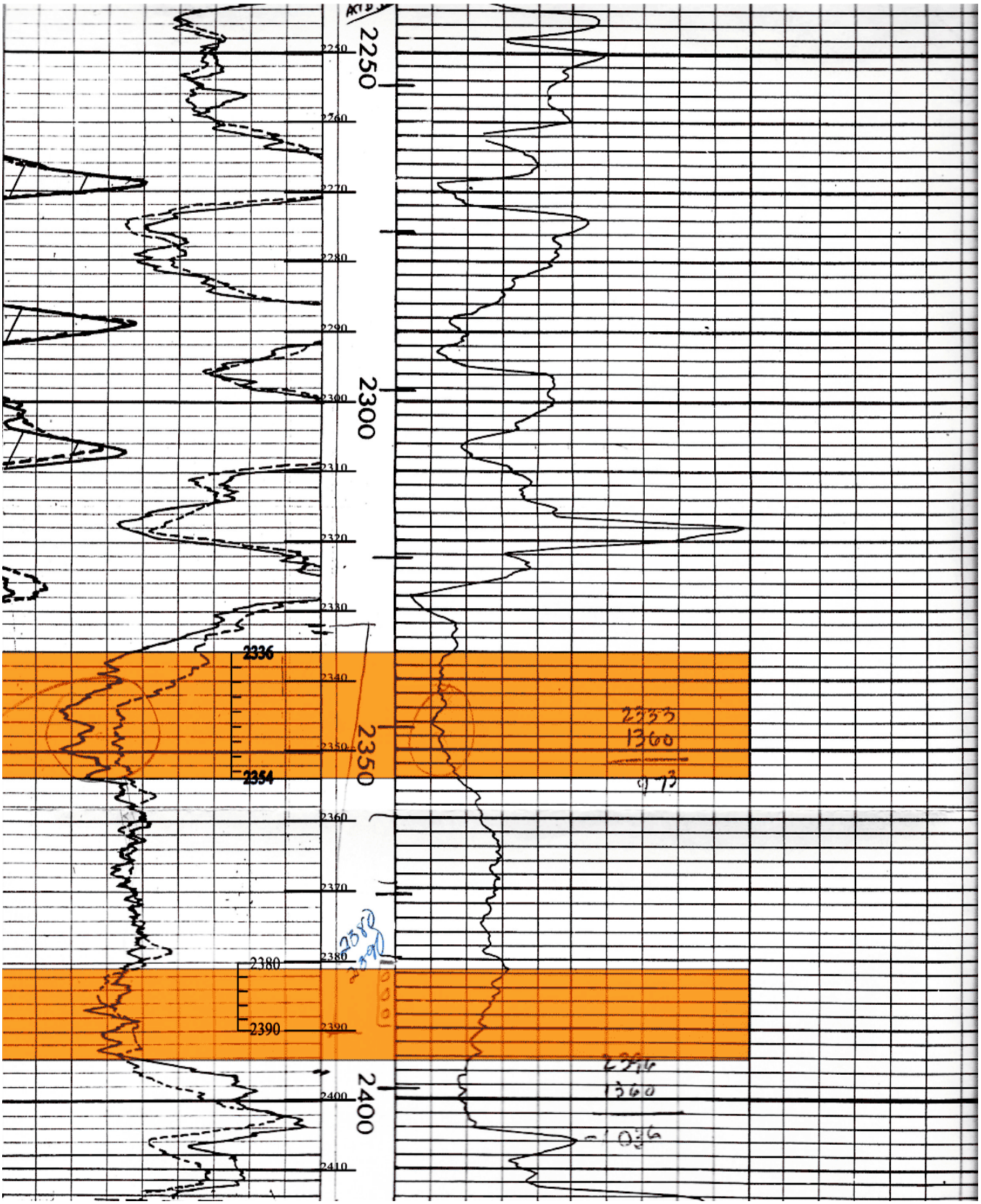
At the same time, it should be noted that gas was present in the wells during operation, and the productive formation was perforated only in the lower part, which means that the oil reservoir has a gas cap.

For restore the productivity of well Vogel # 3, a perforation of reservoirs is proposed in the interval 2336-2354 ft.

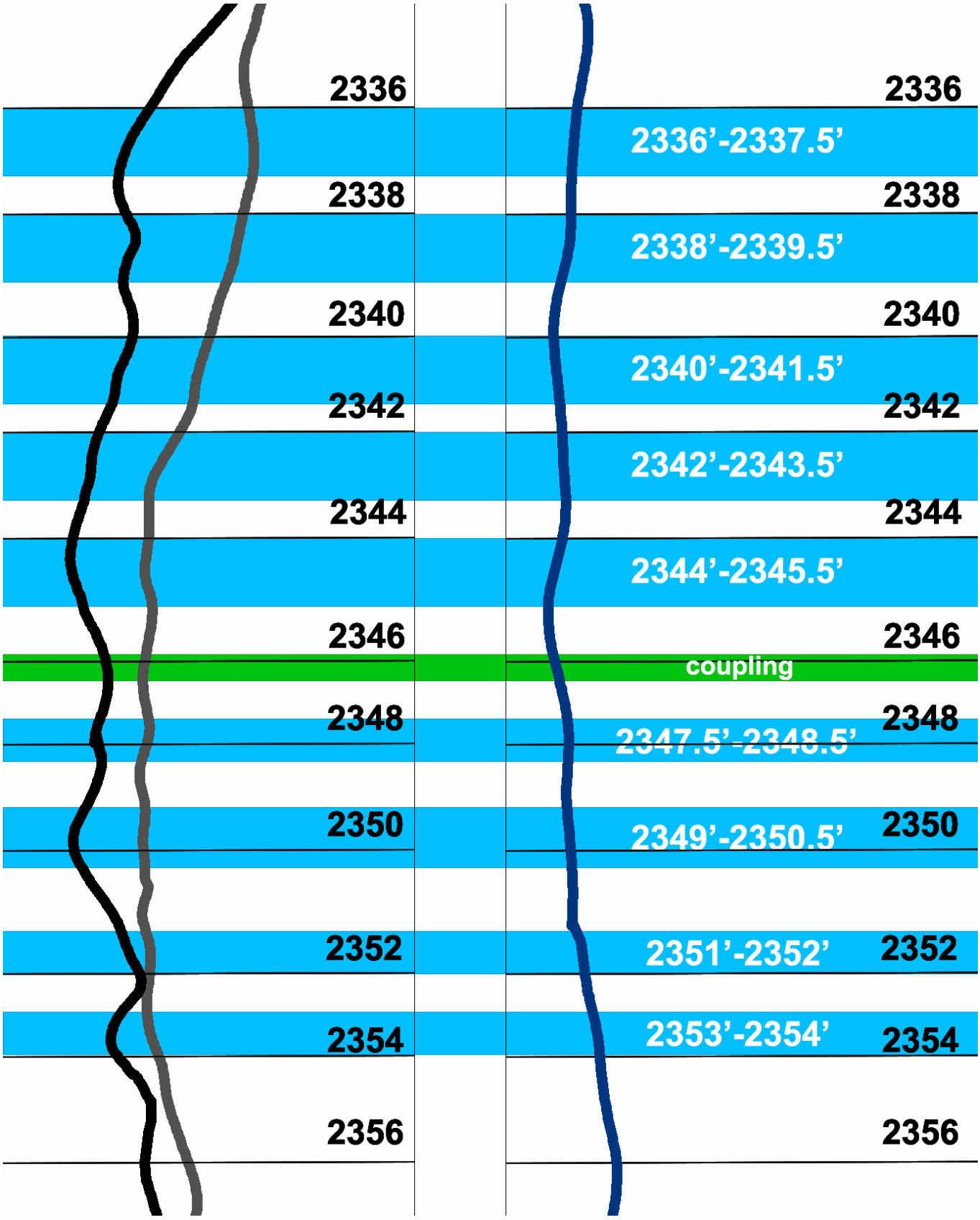
It is assumed to receive the flow of gas, oil and water from this interval.

The degree of watering of the reservoir is currently unknown, so the probability of water inflow is not excluded.

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# Initial parameters

| | |
|---|---|
| **Casing**: | **5 ½**“ (weight 15.5 according to radioactivity log “**WELEX**” from December **22**, **1962**) |

| | |
|---|---|
| **Tubing**: | **2 ⅞**” (may vary) |

| | |
|---|---|
| Well | CK Oil & Gas LLC, Vogel # **3** |
| **API** | 1**5-115-19225** |
| **KID** | **1043501323** |
| Deposit-field | Lost Springs Field |
| County | Marion |
| State | Kansas |
| Coordinates | **38.3680947**, **-97.0744051** |
| Internet | **9**W**9**G+**66** Eastshore, Kansas, (Gale) USA |
| **OD** casing | **5 ½**“ |
| Casing weight per linear foot | **15.5** |
| **ID** casing according to Hand Book | **4.95**” |
| **Drift ID** casing | **4.8**” |
| **Scraper size** for well **ID** check | **4.8**” |
| Perforator size according to **ID** | **4.5**” |
| **TD** (TDPB) | **2440**.0’ |
| Packer | x |
| Recommended **cut intervals** | **2336**.0’-**2354**.0’ |
| Initial (first) cut interval | **2353**.0’ |
| Total cut intervals | **11.5**’ |
| Surface Temp°(F) | **50**°(F) |
| Inside well (**2353**.0’) **Temp**°(F) | **90**°(F) |
| Required for cutting **Temp**°(F) | **105**°(F) |
| Heated water on the surface | **150**°(F) |
| Working pressure (surface) | **5500** psi |

# Recommended cut intervals

| # | cut interval | notes |
|---|---|---|
| 1 | 2353.0’-2354.0’ | |
| 2 | 2351.0’-2352.0’ | |
| 3 | 2349.0’-2350.5’ | |
| 4 | 2347.5’-2348.5’ | |
| | 2346.0’ | casing coupling |
| 5 | 2344.0’-2345.5’ | |
| 6 | 2342.0’-2343.5’ | |
| 7 | 2340.0’-2341.5’ | |
| 8 | 2338.0’-2339.5’ | |
| 9 | 2336.0’-2337.5’ | |
| Total cut intervals: **11.5**’ | | |

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|


# 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 | 2.88 | 7.87 | TD | 2440.00 | |
| ID | 4.95 | 2.00 | (bbl) | Packer | 0.00 | (ft) |
| Drift | 4.85 | 2.00 | Water Vol | 58.00 | Level Water | 0.00 |

RESERVOIR (WELL) TEMPERATURE: 105.0 Fahrenheit (F°)

### TOOL PARAMETRS

| | | |
|---|---|---|
| TOTAL TOOL LENGTH (FROM NOZZLES TO ADAPTER) | 11.20 | (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) | 105.0 | (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 | 5500.00 | (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 | 105.0 | (F°) | Fahrenheit |

### CUTTING (TREATMENT) INTERVALS

| | INTERVAL (#) | START (feet) | END (feet) | TIME (start) | TIME (finish) |
|---|---|---|---|---|---|
| Bottom | 1 | 2353.00 | 2354.00 | 0:00 | 0:00 |
| | 2 | 2351.00 | 2352.00 | 0:00 | 0:00 |
| | 3 | 2349.00 | 2350.50 | 0:00 | 0:00 |
| | 4 | 2347.50 | 2348.50 | 0:00 | 0:00 |
| | 5 | 2344.00 | 2345.50 | 0:00 | 0:00 |
| | 6 | 2342.00 | 2343.50 | 0:00 | 0:00 |
| | 7 | 2340.00 | 2341.50 | 0:00 | 0:00 |
| | 8 | 2338.00 | 2339.50 | 0:00 | 0:00 |
| | 9 | 2336.00 | 2337.50 | 0:00 | 0:00 |
| | 10 | 0.00 | 0.00 | 0:00 | 0:00 |
| | 11 | 0.00 | 0.00 | 0:00 | 0:00 |
| Topping | 12 | 0.00 | 0.00 | 0:00 | 0:00 |

### CONVERTER

## 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 75 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 ~ 2353 feet
8. wireline service * (only for detection of the marker position)
5. Lowering the logging tool on the 2340 with log 2321 to 2340
6. According to the log results to make a correction of the tool (nozzles) position : 2352.8
   NOZZLES FIRST INITIAL POSITION : 2352.78 2 nozzles 2352.80 4 nozzles

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

9. water storage tank : lease water - non-soapy brine from nearby well 136 (bbl) 5732 (gal)
10. cutting tank : 78 (bbl) 3293 (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 409 feet before surface or for prevent leakage of water on the surface when downhole tubing 48 (bbl) 2030 (gal)
    additional info: volume of water in the well (calculation of the level of water by volume in the well) 58 (bbl) 0 (gal) equal 3 (feet)

| | | | |
|---|---|---|---|
| • water volume without tubing: | 58.08 (bbl) | 2439 (gal) | 2440 (ft) |
| • water volume with tubing on the first cutting interval | 48.26 | 2027 | 2353 (ft) |
| • water volume with tubing on the last cutting interval | 48.33 | 2030 | 2336 (ft) |

hydrostatic pressure 2353.00 ft equal 1053.99 psi • sand→nozzl 1.62 (min)

abrasive quartz sand 10/35 20/40 14.3 (tons) 2 nozzles 27.8 (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 (pieces) | 6500 (psi) | 9.0 (bbl/min) | 378 (gal/min) | 2.67 (ounces/gal) | 8.42 (ppt) | 12 (hours) | 16 (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.

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

## CONVERTER

| | | | | |
|---|---|---|---|---|
| L | mm ▶ inches | 0.00 | 0.00 | |
| | inches ▶ mm | 0.00 | 0.00 | |
| L | meters ▶ feet | 0.00 | 0.00 | |
| | feet ▶ meters | 0.00 | 0.00 | |
| T° | Celsius ▶ Fahrenheit | 0.0 | 32.4 | |
| | Fahrenheit ▶ Celsius | 0.0 | -17.8 | |
| 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 | |

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.

D

## HYDRO-SLOTTING PERFORATION PROCESS

| | well | (in feet²) | 2 noz (NET) | 4 noz (NET) | 2 noz (GRO) | 4 noz (GRO) | weight | |
|---|---|---|---|---|---|---|---|---|
| depth : | 2440.0 | open area : | 214.6 | 418.4 | 268.1 | 522.7 | 0.4 | ton |
| (in feet) | | top | bottom | sum | NET | GROSS | sump | |
| treatment intervals : | | 2336.0 | 2354.0 | 18.0 | 12.0 | 15.0 | 86.0 | ft |
| | bottom | 2 nozzles | 4 nozzles | equal | elongation | 2 nozzles | 4 nozzles | |
| initial nozzles position | | 2352.78 | 2352.80 | 2353.00 | 0.21 | 0.22 | 0.20 | ft |
| | cement | casing | tubing ↑ | tubing ↓ | well | tubing ↑ | tubing ↓ | |
| volume : | 75.1 | 13.62 | 9.75 | 9.82 | 58.08 | 48.33 | 48.26 | 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 549 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 | 20 | 294 | 220 | 682 | pressure | 4818 | psi |
| w/coeff | | 118 | 16 | 237 | 177 | 549 | pressure | 4951 | psi |

time of reach the sand to the nozzles (min) ~ 1.62 time cutting casing 1.5 min

19 increase the pressure up to (psi) ~ 5500 increase sand concentration ~ 3.3 o/g

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

| | INTERVAL (ft) | | | TIME (min) | | | | LIFT UP tool |
|---|---|---|---|---|---|---|---|---|
| | start (ft) | finish (ft) | length (ft) | start sand | stop sand | flushing | stop pressure | on next level |
| 1 | 2353.00 | 2354.00 | 1.00 | 5 | 41 | 14 | 60 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 2 | 2351.00 | 2352.00 | 1.00 | 5 | 41 | 14 | 60 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 3 | 2349.00 | 2350.50 | 1.50 | 5 | 64 | 21 | 90 | 1 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 4 | 2347.50 | 2348.50 | 1.00 | 5 | 41 | 14 | 60 | 3 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 5 | 2344.00 | 2345.50 | 1.50 | 5 | 64 | 21 | 90 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 6 | 2342.00 | 2343.50 | 1.50 | 5 | 64 | 21 | 90 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 7 | 2340.00 | 2341.50 | 1.50 | 5 | 64 | 21 | 90 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 8 | 2338.00 | 2339.50 | 1.50 | 5 | 64 | 21 | 90 | 2 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 9 | 2336.00 | 2337.50 | 1.50 | 5 | 64 | 21 | 90 | 0 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 10 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |
| 11 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 |
| | | | | after (min) | after (min) | during (min) | after (min) | in (ft) |

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

| | MPa ▶ atmospheres | | atmospheres ▶ Mpa | |
|---|---|---|---|---|
| P | 0.00 | 0.00 | 0.00 | 0.00 |

- The time to reach of waste rock the surface (min) 9

| | INTERVAL (ft) | | | TIME (min) | | | | LIFT UP tool |
|---|---|---|---|---|---|---|---|---|
| | start (ft) | finish (ft) | length (ft) | start sand | stop sand | flushing | stop pressure | on next level |
| 11 | 0.00 | 0.00 | 0.00 | 0 after (min) | 0 after (min) | 0 during (min) | 0 after (min) | 0 in (ft) |
| 12 | 0.00 | 0.00 | 0.00 | 0 after (min) | 0 after (min) | 0 during (min) | 0 after (min) | 0 in (ft) |

21 after finish interval 2336.00 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 2354.00 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 58 bbl

25 wellhead dismantling, pump-jack installation.

F **TIME**

| | | | |
|---|---|---|---|
| • Wireline service | 2 hours | • Net time of slotting perforation | 7 hours |
| • Chemical treatment service | 1 days | • Time of slotting perforation with flushing | 12 hours |
| • Frac (Pump) service | 15 hours | • This slotting perforation process includes | 0 replacement of perforator (nozzles) |
| • Water surface equipment (water tank, cutting tank, etc.) | 3 days | • Lowering the lifting operation | 3 hours |
| • Rig with crew | 6 days | • Total time for slotting perforation operations | 15 hours |
| • The time to reach of waste rock the surface | 9 min | 25 Stages | |

• ECOLOGICALLY SAFE • ENVIRONMENTALLY FRIENDLY • EFFECTIVE AFFORDABLE METHOD •

OIL AND GAS WELL HYDRO SLOTTING PERFORATION PROFESSIONAL SERVICE

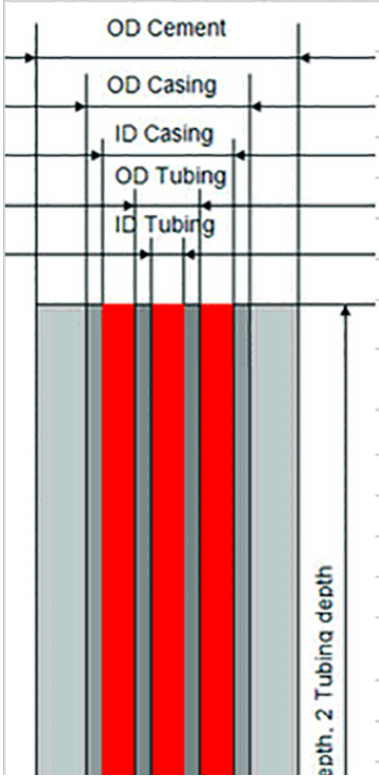
*Maximize well production*

# MAXXWELL PRODUCTION

CONTINUOUS MOVING JET SLOTTING PERFORATION TECHNOLOGY FOR VERTICAL AND HORIZONTAL WELLS

## PROGRAM FOR CALCULATION OF THE TECHNOLOGICAL PARAMETERS FOR HSP PROCESS

## INITIAL PARAMETERS




### WELL

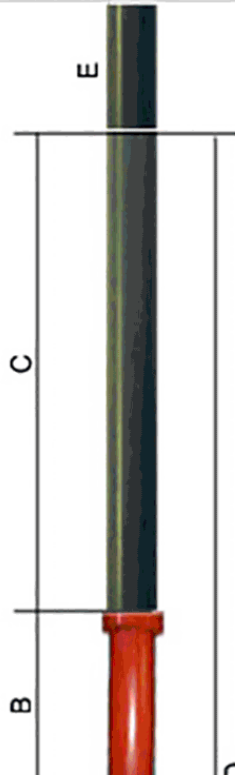
| | | | | | |
|---|---|---|---|---|---|
| BPTD | TOTAL | 2440.00 | feet | 0.00 | meters |
| | PACKER | 0.00 | feet | 0.00 | meters |
| CASING | OD | 5.50 | inches | 0 | mm |
| | ID | 4.95 | inches | 0 | mm |
| TUBING | OD | 2.88 | inches | 0 | mm |
| | ID | 2.00 | inches | 0 | mm |
| CEMENT | DRILL BIT | 7.87 | inches | 200 | mm |

### TOOL

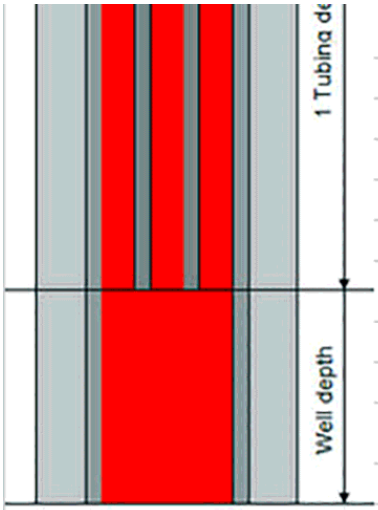
| | | | | | |
|---|---|---|---|---|---|
| LENGTH | TOTAL | 21.30 | feet | 0.00 | meters |
| | TOOL | 11.20 | feet | 3.41 | meters |
| | PIPE JOINT | 6.00 | feet | 1.83 | meters |
| | MARKER | 4.10 | feet | 1.25 | meters |
| | TUBING | 31.50 | feet | 9.60 | meters |

### NOZZLES

| | | | | |
|---|---|---|---|---|
| QUANTITY | 2 | 3 | 4 | 5 |
| | No | No | Yes | No |



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|




## SETTINGS

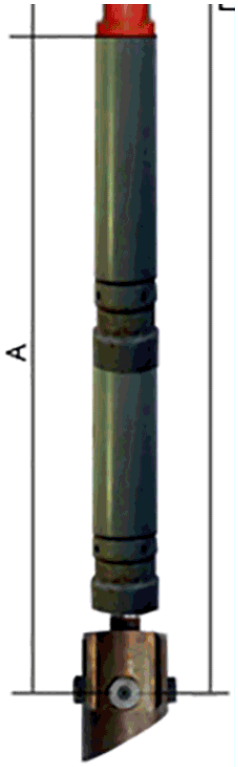
| | | | | |
|---|---|---|---|---|
| TEMPERATURE TD | 105 | F° | 40 | C° |
| PRESSURE | 5500 | psi | 37.9 | Mpa |
| SAND CONCENTRAT | 0.25 | ppg | 30 | kg/m³ |
| DENSITY | 8.48 | ppg | | |
| SLURRY RATE | 5.54 | bbl./min | 0.65 | m³/min |

## NITROGEN

| | | | | |
|---|---|---|---|---|
| PERCENTAGE | 5% | 10% | 15% | 20% |
| | No | No | No | No |

## SPEED

| | | | | |
|---|---|---|---|---|
| Conformity by graph | 40.0 | C° | 5.00 | mm/min |




## INTERVALS

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2353.00 | → | 2354.00 | feet | 0.00 | → | 0.00 | meters | | |
| 2 | 2351.00 | → | 2352.00 | feet | 0.00 | → | 0.00 | meters | | |
| 3 | 2349.00 | → | 2350.50 | feet | 0.00 | → | 0.00 | meters | | |
| 4 | 2347.50 | → | 2348.50 | feet | 0.00 | → | 0.00 | meters | | |
| 5 | 2344.00 | → | 2348.50 | feet | 0.00 | → | 0.00 | meters | | |
| 6 | 2344.00 | → | 2345.50 | feet | 0.00 | → | 0.00 | meters | | |
| 7 | 2342.50 | → | 2343.50 | feet | 0.00 | → | 0.00 | meters | | |
| 8 | 2338.00 | → | 2337.50 | feet | 0.00 | → | 0.00 | meters | | |
| 9 | 2336.00 | → | 2339.50 | feet | 0.00 | → | 0.00 | meters | | |
| 10 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 11 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 12 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 13 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 14 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 15 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 16 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 17 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 18 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 19 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |
| 20 | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters | | |

## OUTGOING RESULTS

## TOOLS

| | | | | |
|---|---|---|---|---|
| TUBING | 76 | sections | | |
| SCRAPER | 4.93 | inches | 0.00 | mm |
| CALIBER | 4.93 | inches | 0.00 | mm |

## VOLUMES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VOLUME | WELL (CASING) | 58.1 | Bbl. | 0.0 | m³ | | | | |
| | TUBING (UP/DOWN) | 9.7 | → | 9.8 | Bbl. | 0.0 | → | 0.0 | m³ |
| | WATER TANK | 82.1 | Bbl. | 0.0 | m³ | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CUTTING TANK | | 58.0 | Bbl. | 0.0 | $m^3$ | | | | |
| LEVEL | (MAX IN THE WELL) | | 409.8 | feet | #DIV/0! | meters | | | | |

## SAND

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAND | 47 | US tons | 0 | tons | | | | | | |

## TIME

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CUTTING | | #VALUE! | hours | #VALUE! | min | ROCK | | | | |
| FLUSHING | | 3.03 | hours | 1 | min | SAND → NOZZLES | | #VALUE! | min | |
| LIFTING ↕ | | 4.58 | hours | 3 | min | NOZZLES → SURFACE | | #VALUE! | min | |

## NOZZLES

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NOZZLES REPLACEMENT AFTER | | | | 6 | interval | 2344.00 | feet | 0.00 | meters | |

## INSTALLATION

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TUBING ELONGATION ↑ | | | 0.56 | feet | #DIV/0! | meters | | | | |
| TUBING ELONGATION ↓ | | | 0.62 | feet | #DIV/0! | meters | | | | |
| DEPTH | FOR LOGGING | | 0.00 | feet | 0.00 | meters | | | | |
| | FIRST INTERVAL | | 2353.00 | feet | 0.00 | meters | | | | |
| | INITIAL POSITION | | 2353.59 | feet | #DIV/0! | meters | | | | |

## PRESSURE

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| HYDROSTATIC PRESSURE | | | 1054 | psi | 0.0 | Mpa | | | | |
| LOSSES | SURFACE | | 147 | psi | 1.0 | Mpa | | | | |
| | TUBING | | 202 | psi | 0.0 | Mpa | | | | |
| | PERFORATOR | | 294 | psi | 2.0 | Mpa | | | | |
| | SHAKER | | 220 | psi | 1.5 | Mpa | | | | |
| | TOTAL | | 864 | psi | 4.6 | Mpa | | | | |
| NOZZLES DIFFERENCE | | | 4933 | psi | 34.5 | Mpa | | | | |

## TREATMENT

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SLOTS | GROSS | 18.00 | feet | 0.00 | meters | | ROCK | | | |
| | NET | 15.50 | feet | 0.00 | meters | VOLUME | 9.06 | $feet^2$ | 0.00 | $meters^2$ |
| DRAINAGE AREA | | 280 | $feet^2$ | 0 | $meters^2$ | WEIGHT | 0.72 | US tons | 0.00 | tons |

## SLOTTING

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FIRST INTERVAL INSTALLATION | | | | 0.00 | feet | 0.00 | meters | with elongation | | |
| CUTTING | 1 | interval | 2353.00 | → | 2354.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 2.00 | feet | 0.00 | meters | | | |
| CUTTING | 2 | interval | 2351.00 | → | 2352.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 2.00 | feet | 0.00 | meters | | | |
| CUTTING | 3 | interval | 2349.00 | → | 2350.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 1.50 | feet | 0.00 | meters | | | |
| CUTTING | 4 | interval | 2347.50 | → | 2348.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 3.50 | feet | 0.00 | meters | | | |
| CUTTING | 5 | interval | 2344.00 | → | 2348.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 6 | interval | 2344.00 | → | 2345.50 | feet | 0.00 | → | 0.00 | meters |

CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CUTTING | 5 | interval | 2344.00 | → | 2348.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 6 | interval | 2344.00 | → | 2345.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 1.50 | feet | 0.00 | meters | | | |
| CUTTING | 7 | interval | 2342.50 | → | 2343.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 5.00 | feet | 0.00 | meters | | | |
| CUTTING | 8 | interval | 2337.50 | → | 2338.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 1.50 | feet | 0.00 | meters | | | |
| CUTTING | 9 | interval | 2336.00 | → | 2339.50 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 10 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 11 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 12 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 13 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 14 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 15 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 16 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 17 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 18 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 19 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| CUTTING | 20 | interval | 0.00 | → | 0.00 | feet | 0.00 | → | 0.00 | meters |
| LIFTING TUBING TO THE NEXT INTERVAL | | | | 0.00 | feet | 0.00 | meters | | | |
| FLUSHING | | | | | | | | | | |
| LOWERING TUBING TO THE DEPTH | | | | 2353 | feet | 0 | meters | flushing | 0 | minutes |

# Calculation of cut's time by intervals

| cut intervals | | | cutting time | lifting | time | flushing time |
|---|---|---|---|---|---|---|
| initial position for the first cut interval 2352.5' with considering tubing stretching | | | | | | |
| 2353.0' | → | 2354.0' | 1 hour 00 min | 2' up | 5 min | 10 min |
| 2351.0' | → | 2352.0' | 1 hour 00 min | 2' up | 5 min | 10 min |
| 2349.0' | → | 2350.0' | 1 hour 00 min | 1.5' up | 5 min | 10 min |
| 2347.5' | → | 2348.5' | 1 hour 00 min | 3.5' up | 5 min | 10 min |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2344.0′ | → | 2345.5′ | 1 hour 30 min | 9.5′ down | 5 min | 10 min |
| 2353.5′ | flushing after cutting | | | x | x | 30 min |
| lifting tool to the surface | | | | 2353.5′ up | 1 hours 35 min | x |

| | |
|---|---|
| Total cut time: | 5 hours 30 min |
| Total flashing time: | 1 hour 55 min |
| Total pumping time: | 7 hours 25 min |
| Total lifting time: | 1 hours 35 min |
| Sum time: | 9 hours 00 min |

initial position for the first cut interval 2341.5′ with considering tubing stretching

| | | | | | | |
|---|---|---|---|---|---|---|
| lowering tool into the well | | | | 2341.5′ | 1 hours 35 min | x |
| 2342.0′ | → | 2343.5′ | 1 hour 30 min | 2′ up | 5 min | 15 min |
| 2340.0′ | → | 2341.5′ | 1 hour 30 min | 2′ up | 5 min | 15 min |
| 2338.0′ | → | 2339.5′ | 1 hour 30 min | 2′ up | 5 min | 15 min |
| 2336.0′ | → | 2337.5′ | 1 hour 30 min | 6.5′ down | 10 min | 15 min |
| 2342.5′ | flushing after cutting | | | x | x | 30 min |
| lifting tool to the surface | | | | 2342.5′ up | 1 hours 35 min | x |

| | |
|---|---|
| Total cut time: | 6 hours 00 min |
| Total flashing time: | 1 hour 30 min |
| Total pumping time: | 7 hours 30 min |
| Total lifting time: | 1 hours 35 min |
| Sum time: | 9 hours 05 min |

The actual practical time may differ slightly from the calculated one.

Total cut intervals: 11.5′

Bypass casing coupling: 2346.0′

Total tool lifting: 19.0′ Provide intermediate joint-pipes for lifting high pressure line to 19′ height

Initial nozzles position 1: 2352.5′ For the depth 2353.0′ with considering columns stretching 0.5′ at pressure 5500 psi

Wireline logging depth: 2340.0′ Maximum depth for lowering logging probe 2340.0′, this is one foot to the tool shank, but after non-magnetic marker visible due logging for snapping the depth.
note: non-magnetic marker 4.0-4.5′ is placed between tool and tubing (for visibility when logging).

Initial nozzles position 2: 2341.5′ For the depth 2342.0′ with considering columns stretching 0.5′ at pressure 5500 psi

Total cut+flushing time: 7 h 25 min For the first day

Total cut+flushing time: 7 h 30 min For the second day

Sum cut+flushing time: 15 h 00 min For two working days

# Tubing elongation

| | | |
|---|---|---|
| Tubing elongation ↑ | | 0.56′ |
| Tubing elongation ↓ | | 0.62′ |
| Depth | For logging | 2349.0′ |
| | First interval | 2352.5′ |
| | Initial position | 2352.0′ |

# SPT tool

| | | |
|---|---|---|
| Length | Total | 21.3′ |
| | Tool | 11.2′ |
| | Pipe Joint | 6.0′ |
| | Marker | 4.1′ |
| | Tubing | 31.5′ |

Tubing 76 sections (31.5′ each)
Perforator OD=4″ with 4 nozzles

# Volume

| | | |
|---|---|---|
| Volume | Well (casing) | 58.1 bbl. |
| | Tubing (up/down) | 9.7-9.8 bbl. |
| | Water tank | 82.1 bbl. |
| | Cutting tank | 58.0 bbl. |
| Level | (max in the well) | 409.8′ |

# Sand

| | |
|---|---|
| Sand | 30 (32) tons |

Abrasive quartz sand 20/40 mesh sand (optional 10/35 mesh sand) medium quality

# Temperature

| | |
|---|---|
| Temperature | 105° F |
| Pressure | 5500 psi |
| Sand concentrate | 0.25 ppg |
| Density | 8.48 ppg |
| Slurry rate | 5.54 bbl./min |

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# CUT PROGRAM

## Wellsite preparation

| | |
|---|---|
| 1-1 | Prepare wellsite. Inspection driveways, territory clean-up, coating gravel (if necessary) |
| 1-2 | Equip wellsite with safety requirements, electricity and lighting, toilet, sitting area |
| 1-3 | Organization wellsite, garbage collection and disposal, reservoir for rock, sludge and sand |

*Preparation & maintenance (cleaning, leveling, strengthening, access roads, driveways, digging trenches/reservoir, fencing: attention tapes and warning signs/posters, supervisor/command post with communication, CB-radio, safety equipment, first aid, PPE, $H_2S$ equipment, wind direction flag, arrange an immediate challenge (if necessary) of Police, Ambulance, Fire service, Environment service, etc.)*

## Equipment and supplies

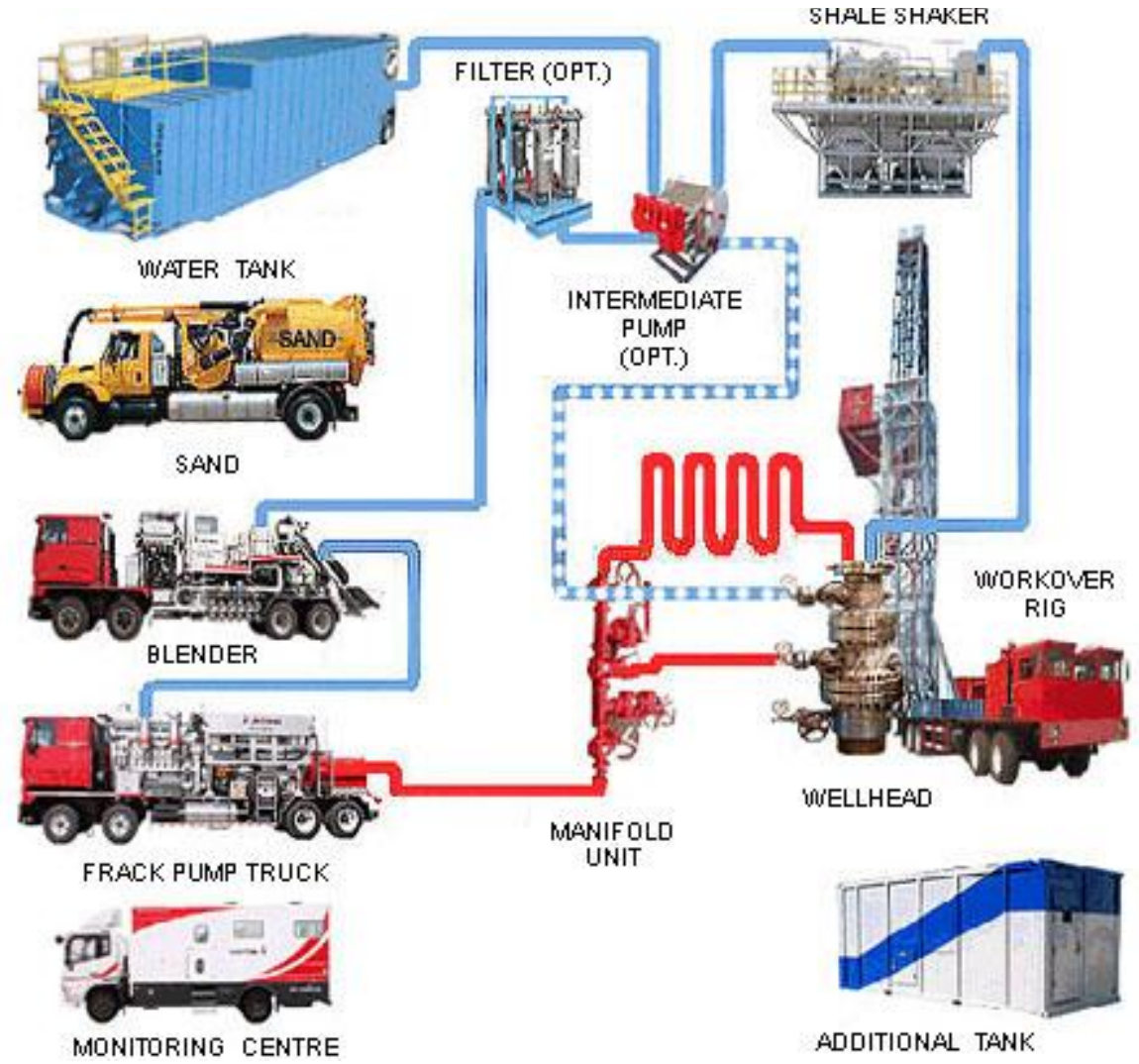
| | |
|---|---|
| 2-1 | Tractor/bulldozer/small excavator (if necessary) |
| 2-2 | **Wellhead** (wellhead top hole equipment with standard **BOP**/w preventer |
| 2-3 | Surface piping, connections, **low pressure line** |
| 2-4 | Misc., valves, fittings, **additional 3** (three) **joint-pipes 6'** for lifting high pressure line to sufficient height during cut procedure |
| 2-5 | Non-magnetic **1** (one) marker **4.0'-4.5'** for visibility during wireline logging correlation the initial depth nozzle's position for the first cut interval **2352.5'** with considering tubing stretching |
| 2-6 | Tubing: **2 ⅞"** (or **3 ½"**) (the calculation was made for tubing **2 ⅞"**) |
| 2-7 | Rods- (D grade) @ rental |
| 2-8 | **Scraper** or caliber **4.9"** (to determine the real **ID** (inner diameter) of the well at a depth **2336'** (must be **4.95"** for standard casing **OD=5 ½"** with weight 15 **½**). If the scraper fails, use scraper **4.0"** for approval of non-standard casing diameter **OD=5"**. |
| 2-9 | Intermediary **pumping unit** w/ **7.5** HP motor |
| 2-10 | **Water tank** (water hauling) **120** bbl./**5040** gal |
| 2-11 | **Empty tank** (empty hauling) **120** bbl./**5040** gal |
| 2-12 | **Cutting tank** (cut tank/shale shaker) with vibrator **80** bbl./**3360** gal |
| 2-13 | Brine (formation/layer) water w/delivery) **120** bbl./**5040** gal |
| 2-14 | **Abrasive quartz sand 20/40** mesh sand (optional **10/35** mesh sand) w/delivery **30-35** tons (sand consumption will depend on the concentration of the working fluid) |

## Wellsite organization

| | |
|---|---|
| 3-1 | Spot **RIG** and installation |
| 3-2 | **Pumpjack** disassembly |
| 3-3 | Lift service tubing and downhole equipment |
| 3-4 | Well should be filled with water |
| 3-5 | Wellhead with standard **BOP**/w preventer installation |
| 3-6 | Wellhead and surface piping, (**BOP** equipment) frac valve + stripper robbers for frac valve |
| 3-7 | Spot operation tubing **2 ⅞"** (or **3 ½"**) w/tubing trailer, **76 tubing sections** (**31.5'** each) |
| 3-8 | Spot **water storage tank** (water hauling) **120** bbl./**5040** gal |

| | |
|---|---|
| 3-9 | Fill water storage tank brine (layer) water |
| 3-10 | Spot **empty water tank** (empty hauling) **120** bbl./**5040** gal |
| 3-11 | Spot **cutting tank** (cut tank/shale shaker) **80** bbl./**3360** gal with vibrator (with shaker for reset the waste abrasive quartz sand) |
| 3-12 | **Surface piping**. Set up surface flow lines to be able to reverse flow **CSG/TBG** |
| 3-13 | Well inspection/preparation |
| 3-14 | Pass the well with **scraper** or caliber **4.9**" (to determine the real **ID** (inner diameter) of the well at a depth **2336**' (must be **4.95**" for standard casing **OD**=**5 ½**" with **weight** 15 **½**). If the scraper fails, use scraper **4.0**" for approval of non-standard casing diameter **OD**=**5**". Report in writing. |

# Surface equipment location scheme

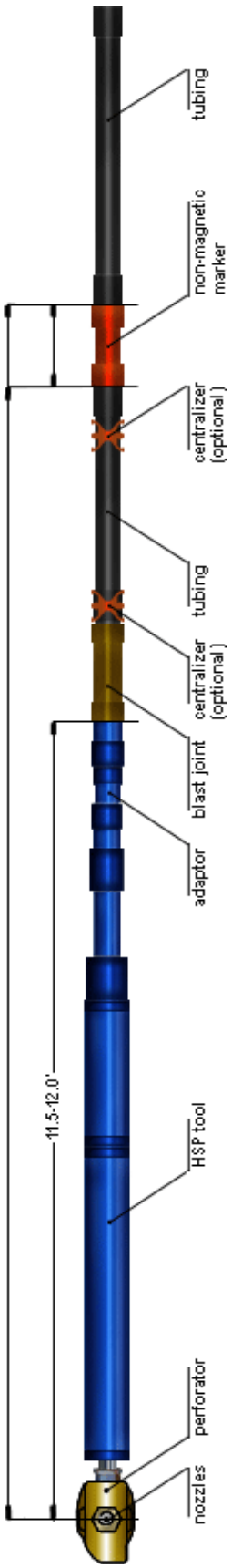



# Surface equipment and piping

For SPT it uses a closed circular scheme for water, and open scheme for abrasive filler (sand is separated in a special "cutting", "vibration" tank (look "surface equipment"). **Water tank** → **abrasive filler** → **pump** → **manifold block** → **high pressure line** → **wellhead** → **tubing** → **casing** → **wellhead with preventer** → **low pressure line** → **cutting tank**.

Length and diameter of low-pressure line should be sufficiently for not to create backpressure in the casing. Backpressure is worsening the cutting process, and maximum back pressure for old casing 500-700 psi. Should be provided for quick switching from direct to backwash in the case of accidently stop the pump (in some cases, using an intermediate pump).

# Slotting Perforation (SPT) tool




Underground hydro-slotting perforation tool for vertical wells (Patent **US 8863823**) is consists of perforator with jet's nozzles, return block, hydraulic block, shank, and adaptor (picture on the left).

## Operating principle

When pressure (working fluid: water with abrasive filler) is applied, perforator with jet's nozzles starts to perform a rectilinear movement with a constant velocity down, enough to cut of casing, cement, into the productive formation.

Usual operating pressure is **4500**-**5500** psi. When a pressure accidently jumps more **6500** psi tool stops (perforator with jet's nozzles no longer moves along the borehole) and cutting of slots no longer produced (it is possible only point perforation (abrasive jet perforation with a maximum depth of **1'**).

At reducing working pressure **800** psi (or cut the pressure) perforator with jet's nozzles automatically returns into the initial position. The depth of the cutting slots reaches **3-5'** (for unloading circular stress conditions in the near wellbore zone enough **3'**).

Number of simultaneously cutting slots depends on the number of jet's nozzles in the perforator (**2**, **3**, or **4**). The length of the cutting slots depends on the length of the working rod (in this particular model is **1.64'**).

In SPT tool is provides a number of safety protections for perforator (ergonomic form, does not jams and does not scratch the casing, ability to direct and backwash bypassing the nozzles, possibility of reverse circulation even when accidently landing on the ground), return block (ability to return the perforator into the initial position even in case of breakage of the return spring), hydraulic unit (ability for automatically change the internal volume depending on the external hydrostatic pressure, to prevent an explosion closed hermetic oil unit at a depth), etc.

## Connection SPT tool

**SPT tool** → **adapter** (for connection to a standard tubing **2 ⅜**, **2 ⅞**) → **blast joint** (or one tubing section) → **non-magnetic marker** (visible when logging) → **tubing** → **additional pipe joints** (for easy and quick change of sections when lifting the SPT tool to the next cutting interval, also it depends on the maximum lifting height of the high pressure line).

| | | |
|---|---|---|
| 1 | **SPT tool** | - |
| 2 | **Adapter** | for connection to a standard tubing **2 ⅜"**, **2 ⅞"** |
| 3 | **Blast joint** | or one tubing section |
| 4 | **Non-magnetic marker** | - |
| 5 | **Tubing** | - |
| 6 | **Additional pipe joints** | for easy and quick change of sections when lifting the SPT tool to the next cutting interval, also it depends on the maximum lifting height of the high-pressure line |

External diameter of SPT body tool is **3.5'**, inner diameter of the borehole (ID casing) is ~ **4.0"** (for casing **4.5"**) and ~ **4.8"** (for casing **5.5"**) (wall thickness depends on the weight of the linear ft.).

The distance between the SPT body tool and the borehole wall in the first case only **0.25"**, in the second case **0.65"**. Through this distance must pass the waste sand and rock with reverse fluid flow on the surface.

**Therefore, the use of any centralizers (especially in wells with a small casing's diameter (4.5') should to do very carefully, and perhaps even abandon this.**

# SPT tool assembly

| | |
|---|---|
| 4-1 | Slot perforation tool/equipment assembly |
| 4-2 | SPT tool/equipment + additional pipe joints + non-magnetic marker + tubing connection |
| 4-3 | * additional pipe joints (~ 3x6") are selected depending on the maximum allowable lift the high-pressure line when changing sections tubing during the cutting process |
| 4-4 | * non-magnetic marker (~ 4-5"') it must be visible during logging |
| 4-5 | Measure the length of the tool/equipment assembly to the nozzles |
| 4-6 | Lower SPT tool on the tubing into the well to the desired depth about 2352' |

# RIG

Surface equipment:

Rig, tubing (2 ⅞ or 2 ⅜), wellhead with BOP, scraper and caliber for the inner diameter of casing, well piping, low pressure line, intermediate rig's pump, additional intermediate's pipe joints, nonmagnetic marker or pipe joint (visible on logging), water tank(s), cutting tank (vibrating tank for the separation of waste sand and slag), in some cases it is required water heating. For work at night lighting is required.

Underground SPT tool is a high fairly accurate instrument, assembled and tested in special laboratories, under special conditions, temperatures and pressures. Some internal parts (hydraulic block, for example) have a size **0.03"**, and are sensitive to temperature, shock and vibration. Normal operation of the instrument depends on careful handling.

**Do not hit and do not throw on the ground SPT tool, it is not just a piece of pipe. Do not knock on the tool with a hammer.**

Reinforcement ribs of perforator are protecting the jet's nozzles from contact with the walls of the well (picture on the left). but if casing have any crumples, unevenness, protuberances (especially after repair of casing), when lowering the HSP tool in the well, violation (or even damage) of one of the nozzles may occur. Nozzles will run unevenly.

**Before lowering the SPT tool in the well must be sure to run scraper and calibration with the caliber for corresponding well's diameter.**

Before lowering the SPT tool into the well is necessary to measure and calculate the exact distance from the jet's nozzles to the top and bottom of non-magnetic marker.

If exist a map of most fractures' directions for deposit-field, is possible to use only two nozzles in the perforator (this will reduce the amount of abrasive quartz sand). Perforator oriented on the surface and further labels each tubing's section, lowered into the well.

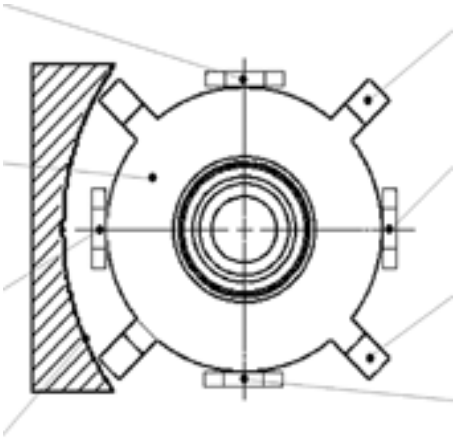
**Lowering the tool into the well must be carried out carefully and with a sufficiently low speed.**

Lower tool into the well at high speed can result in slip-off nozzles under the influence of rapidly increasing hydrostatic pressure (especially if the valve metal ball is already in the perforator).

Lower HSP tool into the well must be carried out under the constant supervision of the total weight of the column (tubing + SPT tool). At depths approaching to planned cutting intervals reduce speed of lowering and take extra care (possible sand). Unacceptable lowering of the SPT tool on the ground at high speed (at any stage of the process, including the final flushing).

When lowering the SPT tool on the ground (TD) at high speed (or any other obstacle, including unevenness of casing), under the multi-ton tubing's weight, perforator with the working rod are pressed into the tool (from the return block's side) (in normal condition the end of the working rod protrudes from the return unit on 7.68"), at the same time pressing in the main piston moves, occurs damage of main piston with control flow device, upper sealing cap of the hydraulic block is pressing in the shank, rods of the hydraulic and return blocks are bending, and a tool to be completely replaced (cannot be restored even in the factory).

SPT tool is lowered into the well to a depth of approximately selected first cutting interval.



# Wireline logging

| | |
|---|---|
| 5-1 | Wireline logging. Correlation log (backlights logging) |
| 5-2 | Correction SPT downhole tool based on the obtained log |
| 5-3 | Stop. Leave it in this position until the SPT process, do not move the tubing |

The inner diameter of the adapter smaller than the diameter of the log's probe.

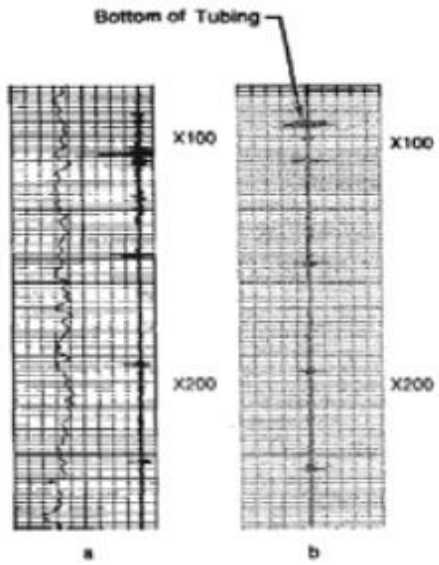
The log's probe must be lowered above the SPT tool (at least higher than nozzles level, and accordingly first cutting interval, for 12'.

Absolutely enough just to see on the log top and bottom of non-magnetic marker (because the distance from the nozzles to the marker is already known).

After logging is necessary to compare (correlate) two logs (an old original electric / induction and received new gamma-ray / neutron) by the most striking peak / points of chart.

If the peaks of the new logging below the original, necessary to subtract the difference. If the peaks of the new logging above the original, necessary to add the difference. Knowing the exact required distance from the jet's nozzles to the top and bottom of non-magnetic marker, and knowing the exact depth of the marker and cutting intervals, as well as knowing the exact difference between the first and second logging, is possible to calculate the exact distance for lifting or lowering the tubing, for jet's nozzles will stay exactly opposite the first cutting interval.

When the final installation should be considered the column's stretching under the work pressure at a given depth (take away from the value of the result).




# Frac (pump)

| | |
|---|---|
| 6-1 | Spot frac service (pump service) with frac-van (monitoring center) |
| 6-2 | Install high pressure line and Manifold block (to be able to reverse flow CSG/TBG) |
| 6-3 | * (optional) desired intermediate pump (to be able in emergency situation to reverse flow CSG/TBG |
| 6-4 | Abrasive quartz sand in the special track.<br>Abrasive quartz sand 20/40 mesh sand (optional 10/35 mesh sand) medium quality 30 (32) tons. |
| 6-5 | Blender/mixer for controlled and uniform supply of sand |
| 6-6 | Safety meeting |
| 6-7 | Pump pressure and high-pressure line test (before wellhead) |
| 6-8 | Optional: Tubing pressure test |
| 6-9 | Disconnect high pressure line from wellhead |
| 6-10 | Drop downhole cermet 1.5" ball |
| 6-11 | Connect high pressure line with wellhead |
| 6-12 | Supply pressure ~ 6500 psi for 1 min. If tubing keeps the pressure, cut the pressure |
| 6-13 | Switch Manifold block on the reverse flushing |
| 6-14 | By reverse flushing wash out the cermet 1.5" ball on the surface |

| | |
|---|---|
| 6-15 | Disconnect high pressure line from wellhead and drop downhole valve metal 1.0" ball |
| 6-16 | Optional: Procedures 27, 28 may skip if the tubing is new, all connections are good tight, and all pipes are clean. In this case the valve metal 1.0" ball can be put into the SPT tool before pull down into the well to the desired depth (paragraph 16) |

# Operating principle SPT for frac (pump)

Pump, frack-van (for monitoring SPT process) with the sensors for pressure and concentration, blender (mixer), manifold block for two lines: direct and reverse flushing, high pressure line.

As abrasive filler commonly used abrasive quartz sand 20/40, sometimes possible 10/20 (in truck).

If necessary, test the tubing (all connections at once) (unless of course the metal ball of the valve is not in the perforator, otherwise it is necessary to wash out on the surface with the reverse flushing, and catch the metal ball).

Should be provided for quick switching from direct to backwash in the case of accidently stop the pump (in some cases, using an intermediate pump).

It must be possible to switch the manifold unit on the backwash. It must be able to catch the balls on the surface.
The pump and pipes must be clean and not contain proppant (adhesive's sand) which is used at hydraulic fracturing. Leftovers of proppant (adhesive's sand) in the pump/pipes instantly clog HSP tool/equipment, which requires lifting the tool to the surface for full replacement.

Tubing's test (all connections at once): Drop the sintered metal ball 1.5" into the tubing, wait 10-15 min, possible carefully run the ball with supply low pressure up to 500 psi until the ball does not sit in a special ball's seat in the adapter (before HSP tool). Make sure that the ball is sitting in the saddle, increasing the pressure up to 2000-3000 psi. Give the pressure into the tubing 7000 psi for 1-2 min. If the pressure does not drop, it means all the connections of tubing OK. Wash out test ball on the surface by reverse circulation.

Poor connection can lead to leaks working fluid (water with abrasive quartz sand) anywhere in the well. The stream of the working fluid will cut a hole in the casing, cement and make a cavern in completely unexpected place (layer), possibly watered. This is especially dangerous for the oil and gas wells.

Drop the metal valve ball 1.0" into the tubing, wait 10-15 min, possible carefully run the ball with supply low pressure up to 500 psi until the ball does not sit in a special ball's seat in the perforator. Make sure that the ball is sitting in the perforator's saddle, increasing the pressure up to 1000-2000 psi.

Supply pressure should be smooth, without sharp jumps. Pressure jumps higher than 6500 psi are not permitted; this leads to stopping HSP tool (and respectively to the lifting HSP tool on the surface for replacement).

The cutting process starts with continuous pressure supply up to 4500-5000 psi. That is the working pressure during the whole HSP process.

As soon as the pressure becomes higher 1000-1500 psi perforator starts to perform a rectilinear movement with a constant velocity down. This is the start of readout time. Please note that in the present model total length of the working rod (and correspondingly maximum length of full perforator's movement and the cutting slots) equals 1.64'.

Even if the sand is not being supplied yet, at an operating pressure 4500-5000 psi it starts cutting the casing (with water only).

The pressure must not jump. The pressure should be kept at the same position. Jumping pressure accelerates erosion of the nozzles, nozzle-holders and perforator.

If pressure is normal, is possible to begin give the sand. Supply sand usually starts with a low concentration 0.2 pound/gal and subsequently can reach 0.35 pound/gal. That is the working concentration of abrasive during the whole SP process.

Sand's supply should be smooth, without jumps. The sand concentration must not jump and should be kept at the same position.

Jumping of sand supply accelerates erosion of the nozzles, nozzle-holders and perforator. Supply batches of sand or excess concentrations of sand above 0.5 pound per gallon leads to damage of perforator with jet's nozzles (and respectively to the lifting HSP tool on the surface for replacement).

In some cases, supply of sand in batches with the high jumping concentration can lead to tear off perforator from working rod. Consequences: jamming of perforator with nozzles in the borehole, where it is not possible to drill out with the standard methods (and without damage of casing).

If the pump's company fails to maintain a constant pressure or a constant concentration of sand, SPT process must be canceled.

Please keep in mind, that the time of reach the first batch of sand to the cutting nozzles is several minutes (calculated by a special program).

At reducing working pressure 800 psi (or cut the pressure) perforator with jet's nozzles automatically returns into the initial position.

Please keep in mind, that the time of reach the last batch of sand to the cutting nozzles and back to the surface is several tens of minutes (calculated by a special program).

Time of reach the last batch of sand to the surface is not equal the travel time of water in the amount volume of the well to the surface.

Cut the send does not stop cutting process immediately, keep in mind the time of reach the last batch of sand to the cutting nozzles.

At accidently stop pump during cutting process, a large amount of sand and slag located in the casing, starts to crumble down to the SPT tool.

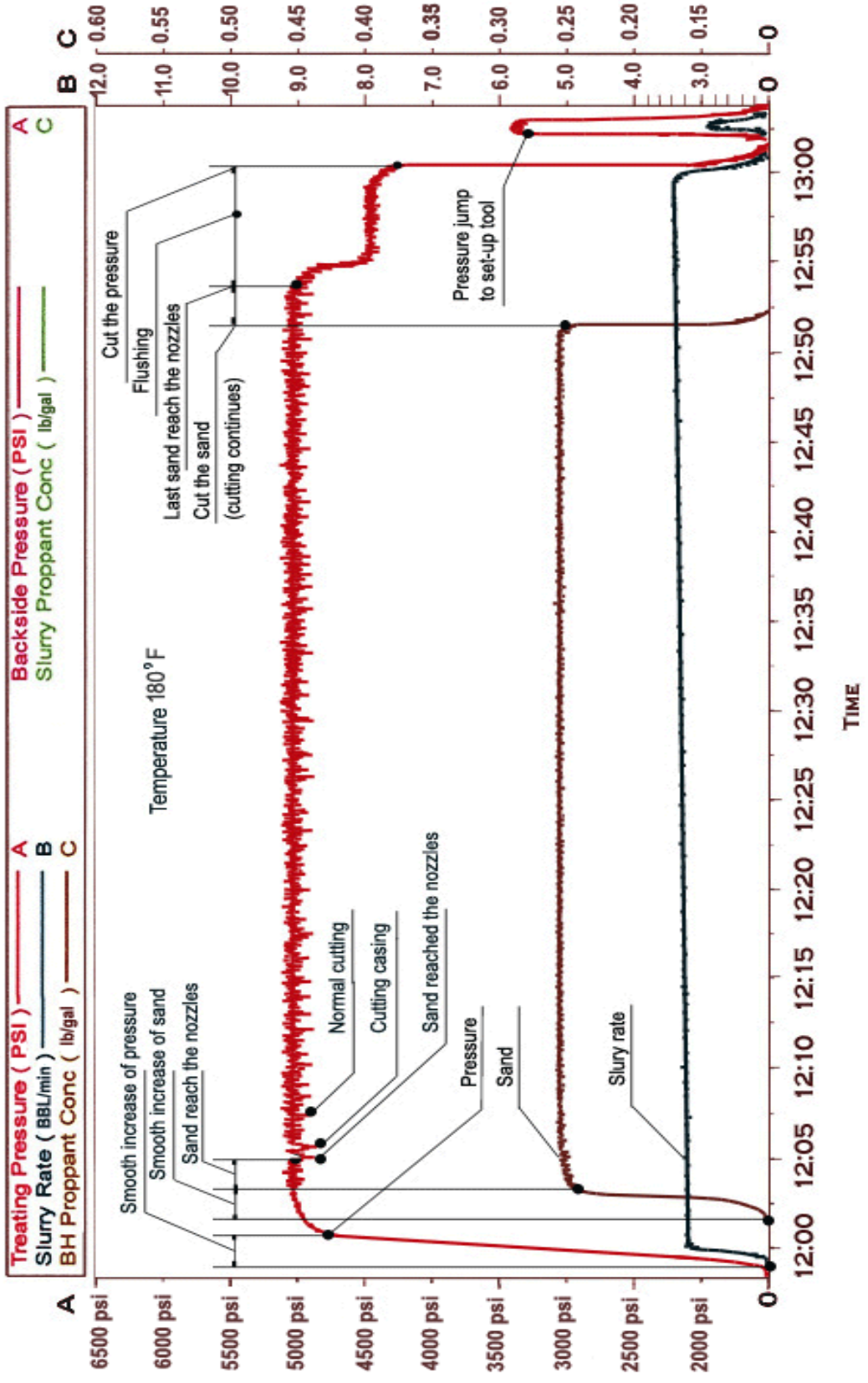
Only Immediate switching-on of additional pump for circulate the water can save the well from the loss.

After cut the sand and at the end of each cutting interval is recommended to make a "jump" with pressure from 4500-5000 psi to 500 psi for 2-4 sec (it is not necessary to wait for the command for increase the pressure, during this time the perforator will already back into initial position) and back to 4500-5000 psi for fit the perforator in the middle position in the slots.

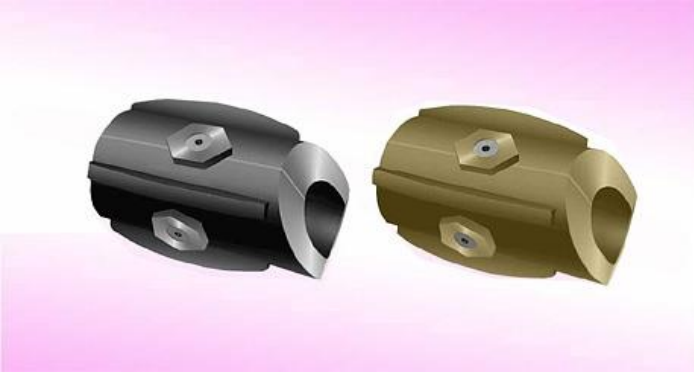
After this, the slots are flushing during 30 min. After that cut the pressure and lift the tubing to the next cutting interval.

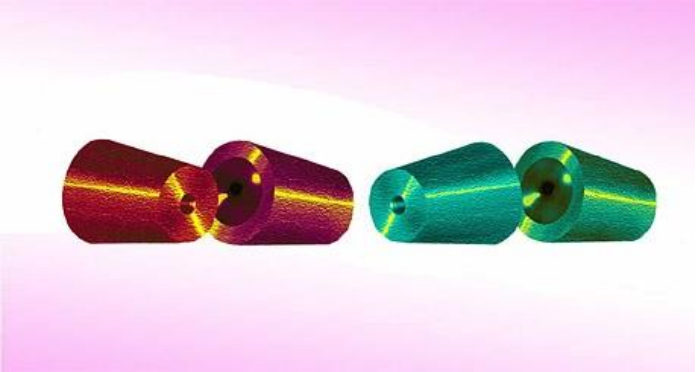
The operation is repeated.

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|



# Technical parameters





## Approximate nozzles (4) diameters (initial and final)

| | Initial diameter | | Final diameter | |
|---|---|---|---|---|
| Number of nozzles | 1 nozzle | all nozzles | 1 nozzle | all nozzles |
| 4 | 5.1 mm (0.2 inches) | 20.4 mm (0.8 inches) | 8.9 mm (0.35 inches) | 35.6 mm (1.4 inches) |

## Approximate erosion of nozzles (4) by cut intervals

| Start | End of 1 interval | End of 2 interval | End of 3 interval | End of 4 interval | End of 5 interval |
|---|---|---|---|---|---|
| 20.4 mm | 23.6 mm | 26.4 mm | 29.6 mm | 32.4 mm | 35.6 mm |
| 0.8 inches | 0.93 inches | 0.26 inches | 1.04 inches | 1.28 inches | 1.4 inches |

## Approximate pump rate by cut intervals (4 nozzles)

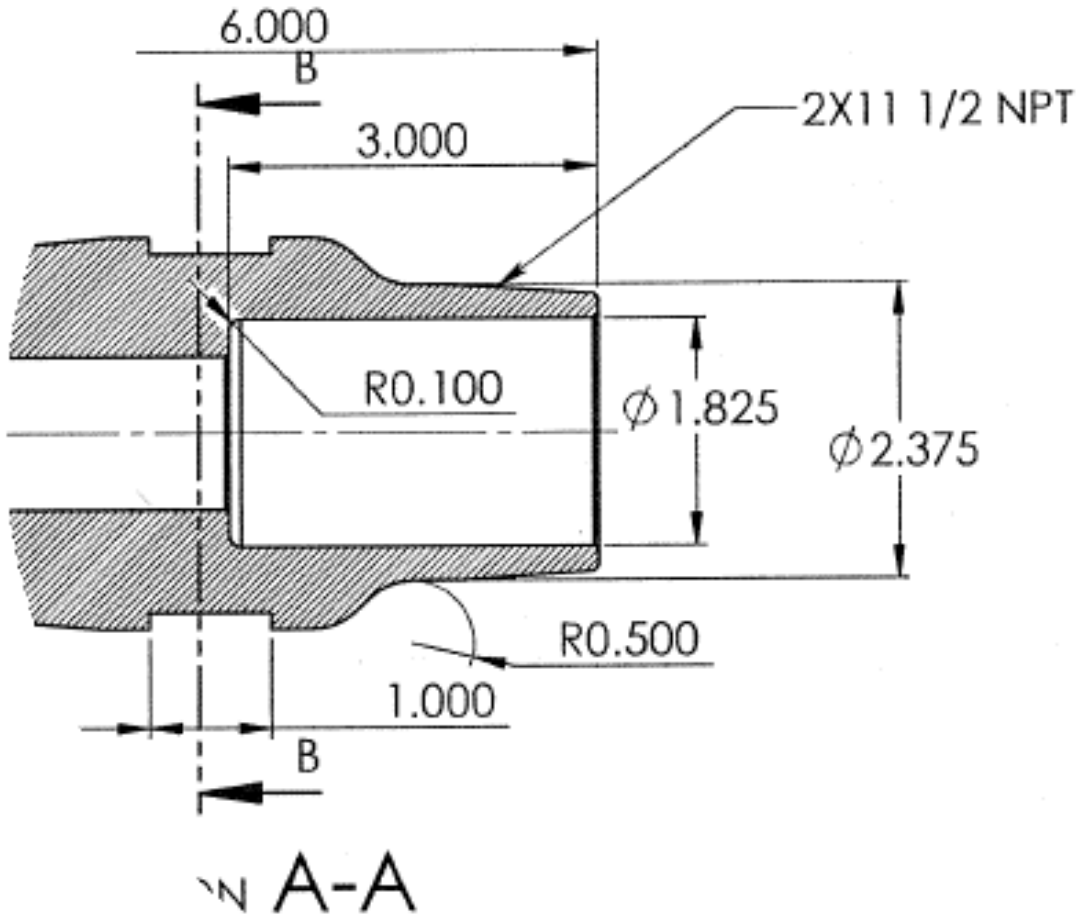
| Start | End of 1 interval | End of 2 interval | End of 3 interval | End of 4 interval | End of 5 interval |
|---|---|---|---|---|---|
| 0.65 $m^3$/min | 0.76 $m^3$/min | 0.87 $m^3$/min | 0.97 $m^3$/min | 1.08 $m^3$/min | 1.19 $m^3$/min |
| 5.45 bbl./min | 6.35 bbl./min | 7.33 bbl./min | 8.17 bbl./min | 9.09 bbl./min | 10.0 bbl./min |

## Working pressure & Sand concentration

| Working pressure | | Sand concentration | |
|---|---|---|---|
| min | max | min | max |
| 4000 psi | 5500 psi | 0.2 pound/gal | 0.35 pound/gal |

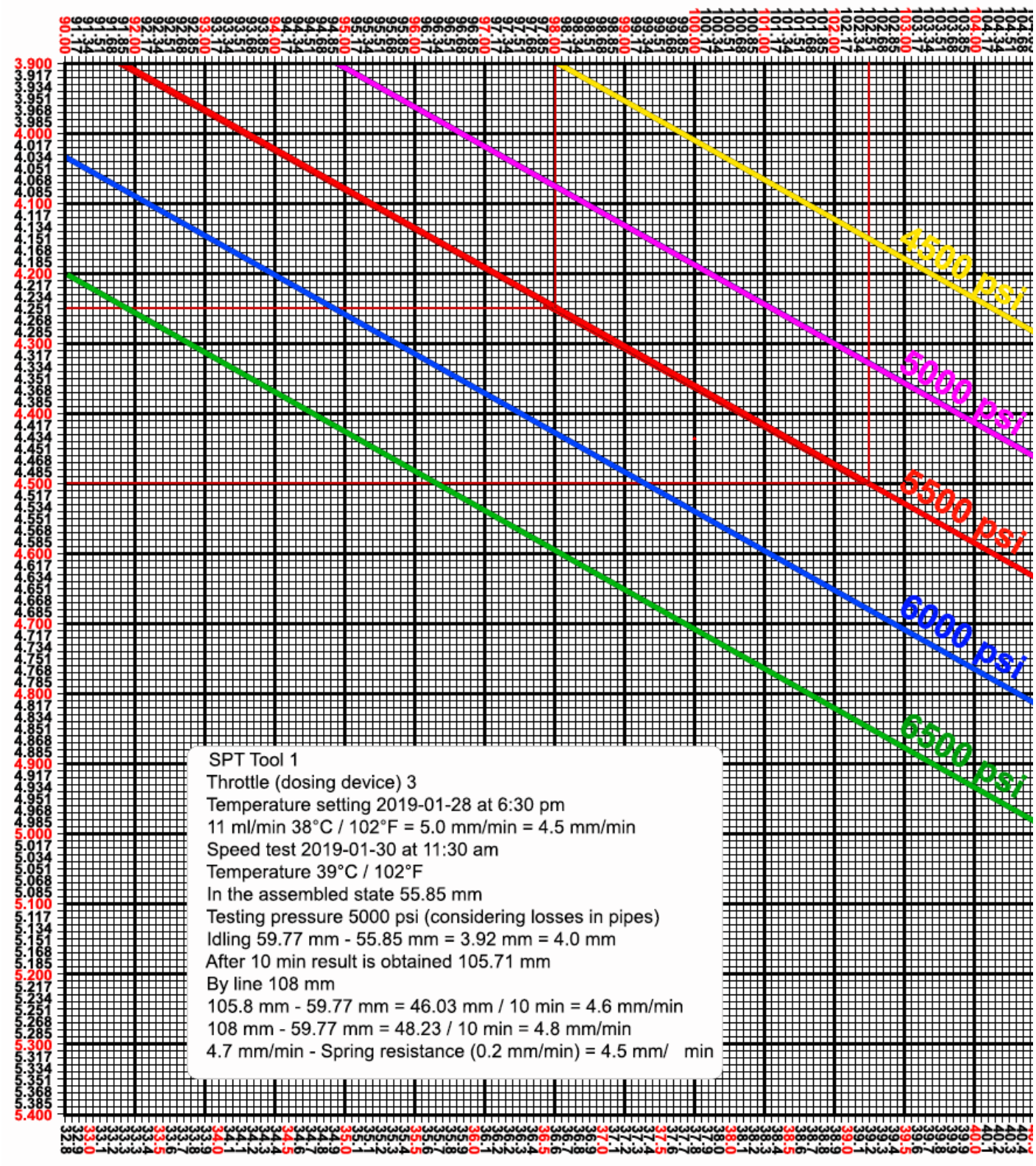

# SPT tool technical parameters

## Connection SPT tool's adapter with tubing



| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# Cut pressure → Temperature → Cut speed



# Flow control valve

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 |
| 1.0 | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 2.5 | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 3.5 | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| 4.5 | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| 5.5 | | | | | | | | | | | | | | | | | | | | | | |
| 6.0 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 6.5 | | | | | | | | | | | | | | | | | | | | | | |
| 7.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 7.5 | | | | | | | | | | | | | | | | | | | | | | |
| 8.0 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 |
| 8.5 | | | | | | | | | | | | | | | | | | | | | | |
| 9.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| 9.5 | | | | | | | | | | | | | | | | | | | | | | |
| 10.0 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| 10.5 | | | | | | | | | | | | | | | | | | | | | | |
| 11.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| 11.5 | | | | | | | | | | | | | | | | | | | | | | |
| 12.0 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 12.5 | | | | | | | | | | | | | | | | | | | | | | |
| 13.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| 13.5 | | | | | | | | | | | | | | | | | | | | | | |
| 14.0 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| 14.5 | | | | | | | | | | | | | | | | | | | | | | |
| 15.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| 15.5 | | | | | | | | | | | | | | | | | | | | | | |
| 16.0 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| 16.5 | | | | | | | | | | | | | | | | | | | | | | |
| 17.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| 17.5 | | | | | | | | | | | | | | | | | | | | | | |
| 18.0 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 | 8.5 |
| 18.5 | | | | | | | | | | | | | | | | | | | | | | |
| 19.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| 19.5 | | | | | | | | | | | | | | | | | | | | | | |
| 20.0 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 | 9.5 |

# Chemical additives

During slotting perforation process is possible to use any chemical additives to the working solution, favorably influencing present productive formation (HCL, nitrogen, for example).

Nitrogen, for example, also reduces the density of the solution, which increases the kinetic energy of the abrasive particles and contributes to greater cutting depth.

Absolutely unacceptable to use additives, that form foam (soap foam), this prevents the cutting process and kill it.

## Addition

Underground hydraulic slotting perforation tool/equipment, like any other hydraulic equipment, contains oil. Throughput capacity of oil and viscosity (and accordingly speed of rectilinear forward movement of the working rod with perforator and cutting nozzles, and accordingly cutting speed) is sensitive to changes in temperature.

Each SPT tool is installed and tested (under different pressures and at different temperatures) in a special laboratory. Each SPT tool is prepared for use in a next well with predetermined parameters of temperature. Sometimes the temperature data in the well does not correspond to reality, then the cutting speed is either too fast or too slow. In this case SPT specialists trying to adjust the optimum cutting speed by the change pressure, concentration or heat water. Also rating of cut determined by the emerging rock (sludge) and its size.

## Cutting at the same speed at different temperatures

| Temperature ($F^o$) | Pressure (psi) |
|---|---|
| 120°F | 4500 psi |
| 115°F | 4700 psi |
| 110°F | 5000 psi |
| 105°F | 5500 psi |
| 100°F | 6000 psi |
| 95°F | 6300 psi |
| 90°F | 6700 psi |
| 85°F | 7000 psi |

## SPT process preparation

1. Have site cleaned up and prepared for operations. Notify Operator at least 24 hours before starting operations.

2. Notify the SIR and the land owner at least 24 hours before commencing wellsite operations. When notifying these contacts, inform them of the intended operations, the start and the expected duration of time. Record the names and the times of the notifications on the first day's report. Ensure all residents within a 1-mile radius of the well receive the notification letter & note this on the first daily report. Spot water tank. Before moving be sure to open tank and take pictures of the amount of sand in the tank.

3. Move-in and rig-up mobile service rig, specifications complete with pump, clean rig tank, and BOP system. Conduct detailed CAODC Service Rig Inspection and report any equipment/safety deficiencies, inoperable service rig components or negative pressure test results before proceeding. Install and pull test rig anchors to service rig manufacturers specifications (if required). Perform a surface casing vent flow test and report the vent status.

4. Hold a safety and procedural meeting with all onsite personnel.

5. Remove the wellhead top section and install and pressure test the BOP to 200 psi and 2000 psi for 10 minutes each.

6. Set up surface flow lines to be able to reverse flow casing and tubing (manifold for casing/tubing reverse flow). Have tanker truck bring water into the storage tank. Record well pressure before taking off gauge. Bleed off any pressure (< 100 psi). ND tree & NU Frac Valve (if necessary). Pressure test Frac Valve. Kill well.

7. Pressure test tubing with pump in the hole. If tubing does not pressure test call monoscope to scan tubing.

8. If needed, pump hot formation water down backside of the tubing and establish circulation down the backside and up the tubing and up over the rods. Unseat the pump and pull pump and rods to surface. Inspect the rods on the site to see if any need replacing. If the pump needs to be replaced or refurbished, hot shot for service.

9. Confirm is an anchor downhole, if so, unseat anchor and pull tubing. Inspect tubing on lease to identify any pieces that need replacing.

10. Pressure test the blind rams, HCR and manifold to a low test and a high test for duration of 15 minutes and record in tour sheet.

11. Pressure test the pipe rams and annular preventer to a low test and a high test for a duration of 15 minutes each. Test Kelly cock, stabbing valve and motor kills. Ensure that all BOP control equipment tests positive prior to drill out and all motor kills are working properly.

12. Have rentals delivered: Pipe Elevator, Cross-over to tubing and tuning pieces, Centrifuge, Command Center, 3 x Light Plant, Reamer, 2x open tanks, Trash Pump, Genset and Shale Shaker.

13. Have Geological Services on-site to collect cuttings.

14. Run in hole with directional equipment.

15. Take and record a survey.

16. Pressure test SPT tool on surface so that it is ready to be installed. While is being tested, the mixing skid, twin pumper and nitrogen unit should arrive and be setting up high pressure iron and sand mixer with ~ 50 T of 20/40 abrasive quartz sand. Once the tool is positioned, hook-up all iron and pressure test. The slotting intervals and ideal cutting parameters can be seen below.

18. Run SPT tool down to the first (deepest, further away) slot (be sure to account for elongation).

19. Formation water on-site.

20. Filtration and settling area will be set-up on site so that all of the cuttings can be separated once each slot has been cut, the cuttings will be collected in a pail and the slot interval will be marked. Then the volume excavated from each slot can be calculated to determine the dimensions of each slot interval. While we are slotting the sand, cutting fluid, excavated reservoir pieces and nitrogen will be flowing up the back side of the tubing. The fluid will flow over the Shale Shaker first to remove the large pieces of material and then into a settling tank where the nitrogen bubbles can settle out and the larger pieces of material will settle out. Fluid will then be sucked out of the settling tank with a Trash Pump and into the Centrifuge to take out the smaller material from the slotting fluid. From there the fluid will go into the rig tank and water tank to be treated with KCl and Biotide (swelling clays and micro-organisms) before being pulled into the mixer and pushed back downhole with sand.

# Precautionary measures

| | |
|---|---|
| A | First (initial) cutting interval taking into account the elongation of tubing. |
| B | The system and tubing must be absolutely clean (without residual of proppant which is used in hydraulic fracturing), otherwise such foreign bodies will get stuck in the nozzles. |
| C | The speed of movement of the cutting nozzles along the wellbore depends on the temperature and pressure (graph is attached). The actual temperature is determined in the process of slotting perforation. Depending on the temperature optimal cutting modes are chosen (pressure and sand concentration). Initial pressure parameters - 4500 psi, sand concentration - 0.21 lb/gal. |
| D | The initial pressure supply should be smooth (approximately during a minute). Hydraulic impacts (caused by the rapid increase in pressure, initial overpressure, jumps pressure) on the tool not allowed. When the pressure is established, it is possible to supply the abrasive sand. |
| E | Pressure drop below 800 psi leads to set up the tool (perforator is set to the starting position). Set up time is 4 sec. The maximum pressure on the tool may not exceed 6500 psi. |
| F | The initial abrasive sand supply should be smooth (approximately during a minute). Feed sand with packs, irregular supply of abrasive sand, over sand, jumping concentration of abrasive sand unacceptable and leads to failure of the nozzles. |
| G | Incorrect supply of pressure and abrasive sand reduces working time of nozzles to one or two cutting intervals. |
| H | If it is impossible to establish normal operation (conditions) for slotting perforation process - stop the process. |
| I | (Graph of sample for slotting perforation process is attached). Immediately after the filling of abrasive sand the cutting does not occur. Time to reach the abrasive sand to nozzles is approximately 4-5 min (depending on slurry rate). During the slotting perforation process the pressure and concentration curves (on the monitor) must be sufficiently straight, without jumps. Pressure curve should be a “small teeth of saw”. The process should not be interrupted during cutting through the whole interval. |
| J | Emergency stop pressure must immediately provide additional circulation of the working fluid to prevent the filling tool with the sand and rock, because it could lead to the loss of the well. |
| K | Time of working process is determined according to the speed-temperature graph (temperature graph is attached). It is required take into account the time for flushing. |
| L | Full stroke of working stock in the tool is 1.64’ inches including the time to reach the sand to nozzles and flushing after slotting perforation process. |
| M | Under the normal operating conditions (supply the pressure and sand concentration) the slurry rate and erosion of nozzles (4 nozzles) should have approximately the aforecited parameters. |
| N | An excessively high or over limit slurry rate at high pressure should serve as grounds for lifting the tool on the surface for replace the nozzles. |
| O | At the termination supply of abrasive sand, the cutting process continues until the last batch of sand will reach the nozzles (approximately 4-5 min, depending on slurry rate). |
| P | At the end of the operation there needs to be done flushing during 10-15 min. Sand and rock reaches the surface during approximately 20-25 min. During flushing the pressure may be reduced up to 4000-4500 psi). |
| Q | (Optional) After cut the pressure it is recommended make the jump of pressure (as shown on the slotting graph) up to 3500 psi for greater certainty that perforator took the starting position and is ready for cutting of the next interval. |

CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas

# START

| | |
|---|---|
| **7-1** | Slowly raise the pressure up to **4500** psi (without hydraulic shocks). |
| **7-2** | After two or three minutes of normal operation (rate **5.45** bbl./min) begin to gradually apply the sand. The concentration not more than **0.21** lb/gal. |
| **7-3** | After **4** minutes, the sand reaches the nozzles. Follow the graph, the pressure and the concentration of sand. Working conditions: Pressure ~ **5000** psi, Concentration ~ **0.25-0.28** lb/gal. |
| **7-4** | Measure the temperature in the cutting tank. Compare with the speed graph. Specifies the time for cutting the interval. |
| **7-5** | After **20-25-30** minutes, in the cutting (shaker) tank should be a rock. |
| **7-6** | At the end of the cutting interval stop the flow of sand but cutting continues for **4** minutes more. |
| **7-7** | (**Optional**) After passing through the nozzles pure water waiting **5** minutes with the same pressure, then make the leap by the pressure **5000** psi→**900** psi→**5000** psi (to nozzle were in the middle of the interval) and flushing for **15** minutes. |
| **7-8** | (**Optional**) For ensure that the perforator with nozzles got to the starting position can again raise pressure up to **3000** psi and stop. |
| **7-9** | After cut pressure and pull the tool in the next interval. |

# Possible violations of SPT technological process

| | |
|---|---|
| **A** | The presence in the pumping system, manifold block or in the high-pressure line a residual of proppant (fracturing sand). |
| **B** | The presence in the tubing/pipe's residual of rock, mud, clay, foreign particles, etc. |
| **C** | Inability to gradually raise the pressure pump, inability of pump to keep the pressure on the same position, pressure jumps, stop the pump, the inability to create a back flushing. |
| **D** | Inability to continuously supply of abrasive quartz sand, sand feed by batches, inability to supply the sand concentration at the same position, excess concentrations of sand, concentration jumps. |

# Slotting Perforation (Day 1)

| | | |
|---|---|---|
| **8-1** | Initial position for **first** interval **2352.5**' with considering tubing stretching | - |
| **8-2** | Cut **first** interval **2353**.0'-**2354**.0' | **1** hour 00 min |
| **8-3** | Flushing **10** min | **10** min |
| **8-4** | SPT tool lifting up for **2**" to the next interval **2351**.0'-**2352**.0' | **5** min |
| **8-5** | Position for **2** interval **2351**.0' | - |
| **8-6** | Cut **2** interval **2351**.0'-**2352**.0' | **1** hour 00 min |
| **8-7** | Flushing **10** min | **10** min |
| **8-8** | SPT tool lifting up for **2**" to the next interval **2349**.0'-**2350**.0' | **5** min |
| **8-9** | Position for **3** interval **2349**.0' | - |
| **8-10** | Cut **3** interval **2349**.0'-**2350**.0' | **1** hour 00 min |
| **8-11** | Flushing **10** min | **10** min |
| **8-12** | SPT tool lifting up for **1.5**" to the next interval **2347**.5'-**2348**.5' | **5** min |
| **8-13** | Position for **4** interval **2347.5**' | - |
| **8-14** | Cut **4** interval **2347**.5'-**2348**.5' | **1** hour 00 min |
| **8-15** | Flushing **10** min | **10** min |
| **8-16** | SPT tool lifting up for **3.5**" to the next interval **2344**.0'-**2345**.5' | **5** min |

| | | |
|---|---|---|
| 8-17 | Position for 5 interval 2344.0’ | - |
| 8-18 | Cut 5 interval 2344.0’-2345.5’ | 1 hour 00 min |
| 8-19 | Flushing 10 min | 10 min |
| 8-20 | Lowering SPT tool down for 9.5” to the depth 2353.5’ | 5 min |
| 8-21 | Position 2353.5’ | - |
| 8-23 | Flushing the well after slot perforation 30 min | 30 min |
| 8-24 | Lifting SPT tool up to the surface | 1 hour 35 min |

| | |
|---|---|
| Total cut time: | 5 hours 30 min |
| Total flashing time: | 1 hour 55 min |
| Total pumping time: | 7 hours 25 min |
| Total lifting time: | 1 hours 35 min |
| Sum time: | 9 hours 00 min |

# Slotting Perforation (Day 2)

| | | |
|---|---|---|
| 8-1 | Initial position for 6 interval 2341.5’ with considering tubing stretching | - |
| 8-2 | Cut 6 interval 2342.0’-2343.5’ | 1 hour 30 min |
| 8-3 | Flushing 15 min | 15 min |
| 8-4 | SPT tool lifting up for 2” to the next interval 2340.0’-2341.5’ | 5 min |
| 8-5 | Position for 7 interval 2340.0’ | - |
| 8-6 | Cut 7 interval 2340.0’-2341.5’ | 1 hour 30 min |
| 8-7 | Flushing 15 min | 15 min |
| 8-8 | SPT tool lifting up for 2” to the next interval 2338.0’-2339.5’ | 5 min |
| 8-9 | Position for 8 interval 2338.0’ | - |
| 8-10 | Cut 8 interval 2338.0’-2339.5’ | 1 hour 30 min |
| 8-11 | Flushing 15 min | 15 min |
| 8-12 | SPT tool lifting up for 2” to the next interval 2336.0’-2337.5’ | 5 min |
| 8-13 | Position for 9 interval 2336.0’ | - |
| 8-14 | Cut 9 interval 2336.0’-2337.5’ | 1 hour 30 min |
| 8-15 | Flushing 15 min | 15 min |
| 8-16 | Lowering SPT tool down for 6.5” to the depth 2342.5’ | 5 min |
| 8-21 | Position 2342.5’ | - |
| 8-23 | Flushing the well after slot perforation 30 min | 30 min |
| 8-24 | Lifting SPT tool up to the surface | 1 hour 35 min |

| | |
|---|---|
| Total cut time: | 6 hours 00 min |
| Total flashing time: | 1 hour 30 min |
| Total pumping time: | 7 hours 30 min |
| Total lifting time: | 1 hours 35 min |
| Sum time: | 9 hours 05 min |

→ If time permits, it is possible to flush the well from the lower interval 2353.5’
→ After SPT procedure additional nitrogen/chemical treatment service with well closure on the day
→ The next day, open a well and swap water (making the pressure difference) until oil appears

# SAFETY FIRST

## Safety and operational requirements

1. It is expected the field operations representatives will use their judgment and knowledge in executing the program and supervising the operations to ensure that all work is conducted in a safe manner that results in the greatest degree of protection possible for the on-site personnel, the public and the environment. The program is a guide and cannot replace good judgment on the wellsite.

2. Safety and Operational requirements are encouraging and stresses the importance of safety in all aspects of its operations and therefore expects contractors and wellsite supervisors to adhere to recommended safe industry practices and Occupational Health and Safety regulations. All work must be conducted in compliance with the following:

- SIR Regulations
- Occupational Health and Safety Regulations
- Applicable ARP's
- Safety Specifications
- Safety Meetings

3. Regular safety meetings are to be held and documented by the wellsite supervisor responsible for coordinating the activities of contractors. These meetings are held at the beginning of each day, prior to each high-pressure operation or stimulation and more frequently as conditions warrant.

4. Meetings will be held with all involved personnel to ensure that each individual is familiar with the overall objectives, their specific duties, pressure limitations, and emergency and safety procedures.

5. These meetings are to be documented on the Daily Tour Sheets.

## Notifications

6. Provide 24-hour notification of flaring operations and any pending operations if applicable to the SER area office. Record SIR contact, dates, and times on the Daily Morning Report. When notifying via the Digital Data Submission system note the electronic confirmation number on the morning report.

7. Notify appropriate PFRA office in areas that fall under their direction.

8. Venting and flaring notifications must be done 24-hours prior to commencement of flaring. Residents within 1.5 km radius (sweet) or 3 km radius (sour) of the well must be notified if the flaring or cleanup operation is to exceed 4 hours duration and/or the 24-hour flare volume is to exceed 30E3$m^3$ (1 mile for H2S<1% & 2 miles for H2S>1%. Refer to SIR Guidelines, to ensure that all flaring notification requirements have been met.

9. The SIR has adopted a policy that places responsibilities of resident notification with the operating oil company (contract field supervisor) and failure to comply with this policy could result in a total shutdown of operations. It is therefore extremely important for the wellsite supervisor to establish communications with any residents in the vicinity of the well who may be affected by the following operations and keep them informed of any activity that is deemed to be disruptive to their daily routine - e.g. Acidizing, Fracturing, testing, perforating, etc.

10. Ensure the operators field superintendent is contacted prior to moving on equipment.

11. Rig Inspection and BOP

12. Rig inspections are to be done on the first well for a new contractor and every two weeks after. BOP drills are to be done on every well and at least once every seven calendar days and recorded in the Daily Tour Sheet.

13. BOP should be done more often to bring crew training up to an acceptable level if required.

14. The BOP form is to be filled out and noted on the Daily Tour Sheet.

15. A Walk around Rig Inspection is to be conducted at the beginning of each day and recorded in the Daily Tour Sheet.

## Emergency Response Plan - Schedule A

16. The supervisor and rig manager should be familiar with the Emergency Response Plan.

17. Ensure that on all wells with site specific Emergency Response Plans (ERP), crew members are briefed and trained about their respective duties when an ERP goes into effect.

18. Ensure that the Emergency Response Plan Contact list is filled out and posted.

## Ground Disturbance

19. All ground disturbance must follow all applicable regulations.

20. Rig anchors should never be installed without a line locate pull test to 20000 lbs.

21. All ground disturbance greater than 1 foot, within 16 feet of ANY underground facility, anode bed, pipeline/riser or electrical cable must be exposed via Hydrovac or Hand exposing. This is critical before cutting and capping well bores.

22. The use of mechanical equipment (backhoe) within 2 feet of exposed or buried pipelines or electrical cables is not allowed.

23. All operations are to remain on operators right of way (see survey plan). If in doubt check concerning re-staking the lease and road.

## Pressure Testing

24. Prior to the installation of BOP's, unless the well has not been completed, conduct a stump test of the BOP equipment, safety valve, pump manifold and lines to a low of 200 psi and a high of either; 2000 psi, the pressure rating of the production casing flange or the formation pressure, whichever is the greater.

25. Upon installation of the BOP's ensure that the ring groove connection is pressure tested as above and that all BOP components are function tested as per regulations. Prior to starting other operations, such as Fracture, acidizing, wireline operations, etc., ensure that all equipment that has potential to be exposed to well pressure or that is used to control well pressure is pressure tested as above and/or in accordance with the contractor's specifications.

26. All pressure tests are to be recorded in the **Daily Tour Sheet** as per regulations.

# Vent Flow Test

27. Conduct a bubble test on the surface casing vent to check for flow. Fill out a **Surface Casing Vent Flow / Gas Migration** sheet and e-mail with the first morning report.

# Emergency Response Plan

28. The **Emergency Response Plan** must contain telephone numbers of provincial regulatory agencies, emergency response agencies, company personnel, and on-site personnel who may need to be contacted in the event of an emergency. It also contains the legal site description and simple directions for the most efficient way.

29. Following are the procedures to be followed in the event of an emergency. It is the responsibility of every worker on site to familiarize themselves with these procedures and know their role within each one. It is the responsibility of the site consultant/operator to delegate these roles and ensure that workers have an opportunity to practice them.

30. The goal is a safe and healthy worksite from start to finish. Should an emergency arise, a quick, well prepared response will give us our best chance for a positive outcome. Emergencies that could arise at this site are:

- Incidents which result in or could result in serious injury or loss of life; (Medical Emergency)
- Well blow-out or other emergencies related to drilling & field operations;
- H2S release;
- Major fire;
- Spill of a product or chemical which may be hazardous to health and/or property/environment;
- Acts of God such as a blizzard; and
- Bomb Threat.

# Emergency Medical Response Procedure

| | |
|---|---|
| 1 | Assess the situation – is it safe to approach the victim? Note the time of incident. |
| 2 | First person on the scene contact or direct someone to contact site supervisor and emergency medical services. |
| | - Provide information about location of incident |
| | - Provide information on nature of injuries |
| | - Stay on the line with emergency services until they decide to end the call |
| 3 | Perform critical interventions (i.e. CPR/control massive hemorrhage) |
| 4 | Treat injuries to the best that training and available equipment allows |
| 5 | Do not leave the patient until another person with more advanced training arrives to take over. |
| 6 | Stand-by and be prepared to assist as necessary. |
| 7 | If patient can be moved (no suspected neck or spine injury) begin moving to more advanced medical aid only if necessary. Transport to hospital requires driver and attendant. Stay in contact with ambulance and transport patient until transfer can be made with ambulance. |
| 8 | If suspected neck or spine injury, move only if leaving patient would put them in greater danger (fire, chemical spill, etc.). Make every attempt to keep the head and neck as stable as possible. |
| 9 | If patient cannot be moved, wait for ambulance to arrive, keeping patient as comfortable as possible. |

| | |
|---|---|
| 10 | Monitor and record vital signs (including the time when the vital signs are taken) every five to ten minutes; |
| The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an injury or accident. | |

# Fire Emergency Procedure

| | |
|---|---|
| 1 | Immediately shut off power, engines, and any fuel sources if safe to do so. |
| 2 | Move fuel sources away from fire if safe to do so |
| 3 | Have all non-essential personnel evacuate to muster point and assign someone to do a head count. |
| 4 | If the fire is controllable, use extinguisher to fight fire - if not call fire department and clear the area. Ensure the proper extinguisher is used depending on the fire. |
| 5 | Make notifications as per notification flow chart. |
| The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an accident or injury. | |

# Spill or Release Procedure

| | |
|---|---|
| 1 | Identify product. |
| 2 | Clear area and make any local notifications if necessary, to protect public health. |
| 3 | Make sure to get proper **PPE**. Check **MSDS**. |
| 4 | Control product flow. |
| 5 | Attempt to contain product. Divert from water courses if possible. |
| 6 | Lay out absorbent material. |
| 7 | Make notifications according to flow chart. |
| The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an accident or injury. | |

# H2S Emergency Procedure

In the event of an **H2S** release, it is imperative that the following seven step response strategy is followed in order. Remember, **Hydrogen Sulphide** can render your unconscious with one breath. The first step is always to get yourself to safety.

## Seven Step Response Strategy:

| | |
|---|---|
| 1 | Evacuate - Immediately move upwind (check on-site wind sock) if release is downwind of you or move crosswind if release is upwind of you. If possible, move to higher ground as **H2S** is heavier than air. |
| 2 | Assess - Do a head count and look for other hazards. |
| 3 | Alarm - Call for help by whatever means available ex. horn, radio, whistle, etc. Call or have someone call fire dept. |
| 4 | Protect - Must use an **SCBA** if a rescue is to be attempted. If no **SCBA** is available, do not attempt rescue - wait for fire dept. |
| 5 | Rescue - If **SCBA** is available, put on and retrieve victim. Move to a safe area. |
| 6 | Revive - Apply **CPR** if necessary. |
| 7 | Medical Aid - Arrange for transport of victim to nearest medical facility. |
| The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media. | |

# Emergency Response for Storm

| | |
|---|---|
| 1 | During working hours, the site supervisor is to monitor weather both visually and by **radio** or **highway hotline**. |
| 2 | If a weather warning is issued, the site supervisor must determine if the threat is imminent and decide on a course of action which may include shutting down the site, securing equipment and structures that may be affected, or sending workers home in advance of storm if safe to do so. |
| 3 | If weather conditions do not permit travel, workers should go to wait out the storm. The site supervisor should gather any emergency equipment that may be needed. |
| 4 | **Site supervisor** or designate conduct a visual inspection of site to confirm all people have evacuated to safe area. Once all people are gathered, perform a head count and verify with signing sheet. |
| 5 | **Site supervisor** to advise **Management** of the situation, giving details of location, number of workers kept on site, and readiness for the storm. If possible, supervisor should periodically re-establish contact to keep management informed of conditions. |
| 6 | Once storm has passed, supervisor must assess site for any damage and determine the next course of action. |
| 7 | Workers are not to leave the site until the supervisor authorizes that it is safe to do so, based on most current weather broadcast. If possible, recommend that workers travel in groups of at least **2** vehicles. If their vehicles do not have survival gear, they should be supplied with whatever is available from the site (to be returned later). They should also have a cell phone with them. |
| 8 | If stranded in vehicle, **Do Not Leave the Vehicle**. Stay in vehicle and wait for someone to come to you. Conserve fuel by only starting vehicle periodically. |

# Response to a Bomb Threat

| | |
|---|---|
| 1 | **Threat received by telephone**: |
| | Respond as follows: |
| | A. Do not put caller on hold. Listen to them and do not interrupt. |
| | B. Remain as calm as you can. |
| | C. Note the time and write it down. |
| | D. Notify the supervisor/consultant if possible while you are on the phone. |
| | E. Stall any way you can. Ask questions such as: |
| | - Where is the bomb? |
| | - When will it go off? |
| | - What kind of bomb is it? |
| | - How do you know so much about the bomb? |
| | - Why are you doing this? |
| | - Did you put it there? |
| | - What is your name? |
| | F. As you are talking make written notes on such things as: |
| | - Male of female? |
| | - Accent? Mannerisms? |
| | - Approx. age? |
| | - Background noise, if any o Etc. |
| 2 | **When you hang up, if you haven't yet notified the supervisor/consultant do so now**. |
| 3 | **Supervisor/consultant is to call R.C.M.P. Person who took the call should remain close as R.C.M.P. may want to talk to them**. |
| 4 | **Supervisor/consultant to decide whether or not to evacuate the site**. |

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

# Medical Information Form

| | |
|---|---|
| Name: | Age: |
| Known Allergies: | |
| Known Medical Conditions: | |
| Relevant Medical History: | |
| Currently on the Following Medications: | |
| Emergency Contact: | |

# Emergency Drill Evaluation Form

| | |
|---|---|
| Date/Time of Drill: | Location |
| Drill Scenario Summary: | |

| | | | | |
|---|---|---|---|---|
| Was the drill treated as a real life incident | ☐ | Yes | ☐ | No |
| Were necessary notifications made? | ☐ | Yes | ☐ | No |
| **IF NOT—What happened?** | | | | |
| Problems observed during the drill: | | | | |
| Were the goals of the drill met? | ☐ | Yes | ☐ | No |
| **IF NOT—Why were goals not met?** | | | | |
| Is a re-drill necessary at this time? | ☐ | Yes | ☐ | No |

| CK Oil & Gas LLC, Vogel # 3 | API 15-115-19225 (KID 1043501323) | Lost Springs Field, Marion, Kansas |
|---|---|---|

| Corrective Actions and Recommendations | Assigned to: | Date Completed: |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

# Emergency Drill Planning Form

| | | | |
|---|---|---|---|
| Location of proposed practice drill: | | | |
| | | | |
| Type of drill (circle all that apply): | Medical | Site Evacuation | Fire |
| | Natural Disaster | Haz Mat | Confined Space |
| | Rescue | Blow-Out | Other (specify) |
| Details of drill scenario: | | | |
| | | | |
| Safety or Environmental Concerns about this scenario? | | | |
| | | | |
| How have concerns been addressed? | | | |
| | | | |
| Who are the intended victims of this drill (if any)? | | | |
| | | | |
| What equipment will be needed? | | | |
| | | | |
| What are the goals of the drill? | | | |
| | | | |
| What Emergency Response Agencies will be involved? | | | |
| | | | |
| Have Emergency Response Agencies, adjacent facilities and surrounding community been notified of drill in advance? | | | |
| | | | |
| Media involved/notified? | | | |
| | | | |
| Manager Comments: | | | |