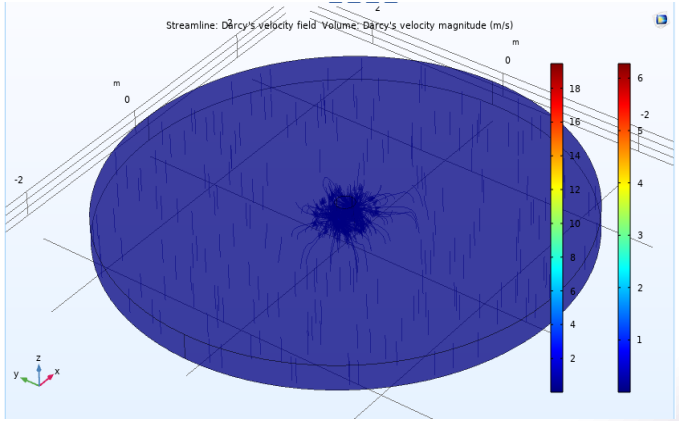
EOSS PARTNERS

SYNERGY ENGINEERING SOLUTIONS

TECHNOLOGY TO INCREASE HYDRAULIC CONNECTIVITY

WELL - RESERVOIR



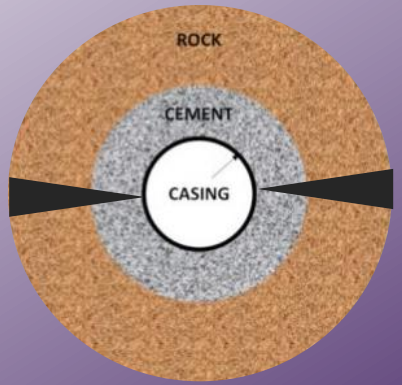
THE IMPORTANCE OF HYDRAULIC CONNECTIVITY

HYDRAULIC CONNECTIVITY BETWEEN WELL AND FORMATION IS ONE OF THE VARIABLES THAT CONTROL WELL PRODUCTIVITY.

THE DYNAMIC CONNECTIVITY OF THE RESERVOIR DESCRIBES THE MOVEMENT OF FLUIDS ONCE THE PRODUCTION STAGE BEGINS.

THIS CONNECTIVITY IS DEPENDENT/BASED ON HAVING A CLEAR OPENING IN:

WELLBORE - CEMENTED AREA - FORMATION



HYDRAULIC CONNECTIVITY

REQUIRED EQUIPMENT FOR THE OPERATION

RIG SERVICE – W-O PULLING UNIT

TUBING STRING FOR RIG SERVICE

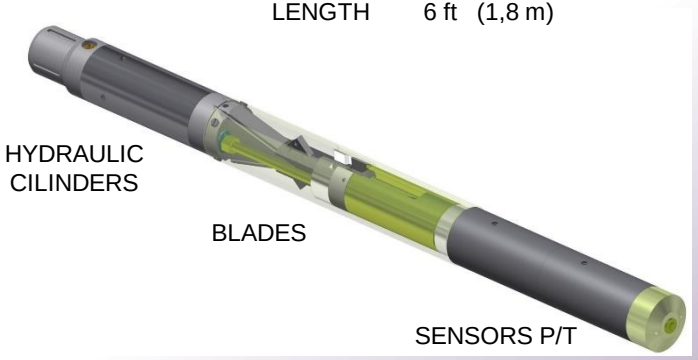
INJECTION PUMP - 3000 PSI & 3 BPM (126 GPM)

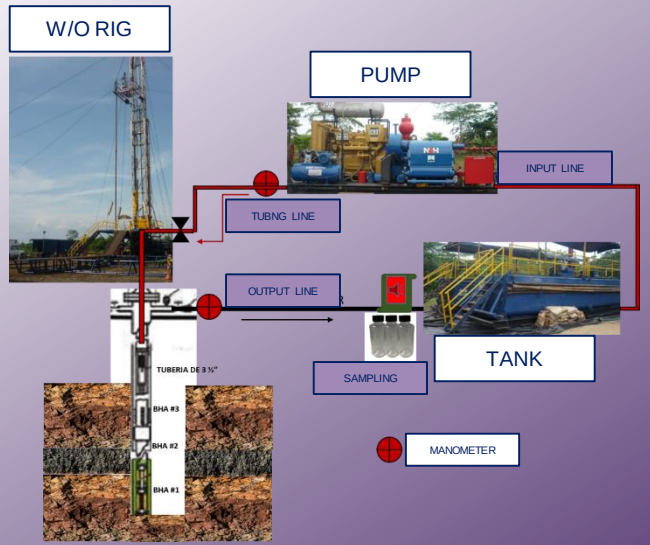
WORK FLUID - WATER, BRINE, OIL

HYDRO-MECHANICAL PERFORATOR

DOWNHOLE SENSORS – PRES / TEMP

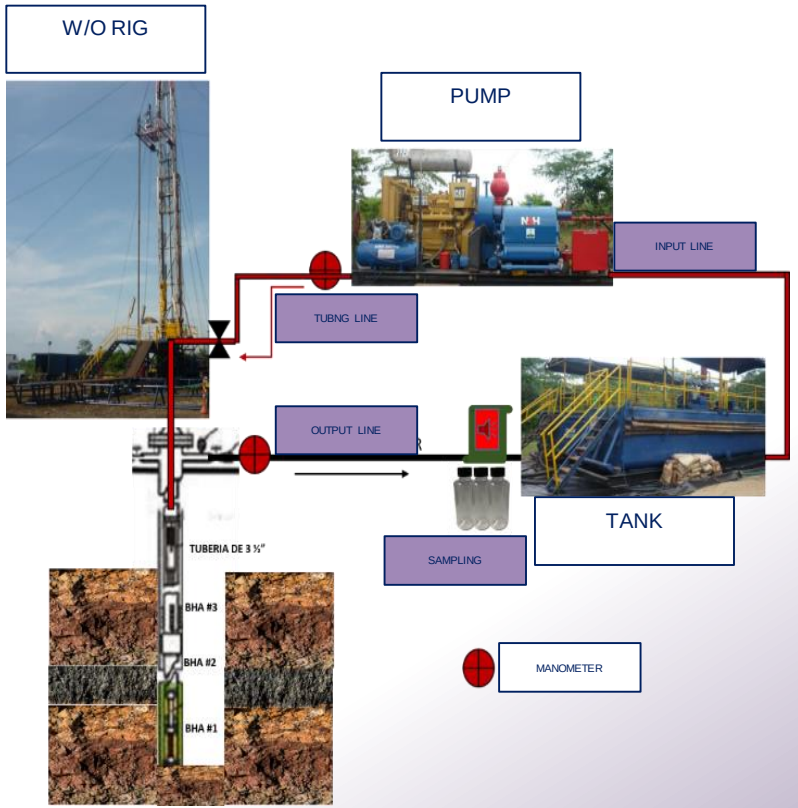
WEIGHT 220 Pounds (100 Kg)
LENGTH 6 ft (1,8 m)

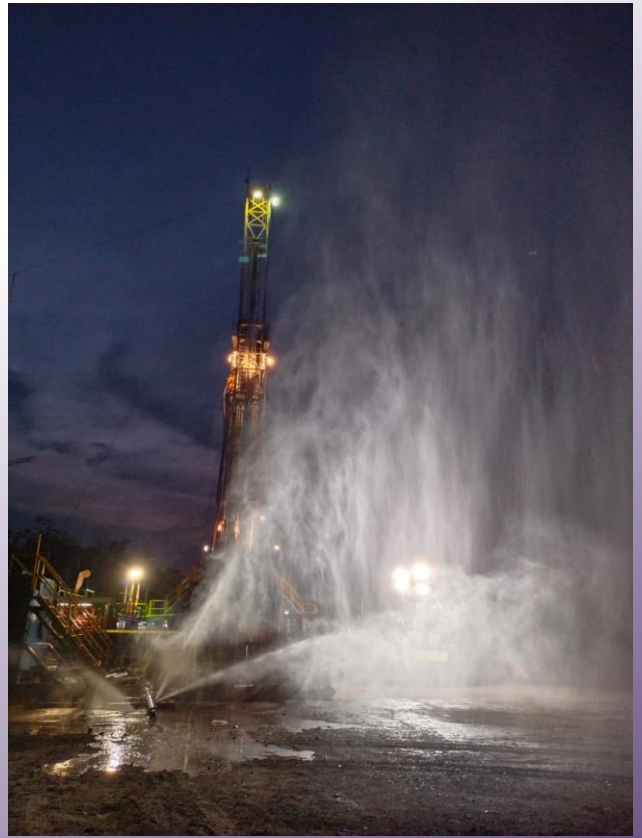




HYDRAULIC CONNECTIVITY

OPERATION LAYOUT





HYDRAULIC CONNECTIVITY

SURFACE EQUIPMENT

HOSES / TUBING HEAD CONNECTOR

TRIPLEX PUMP
3000 PSI 3BPM

WORKING FLUID TANKS

HYDRAULIC CONNECTIVITY

HYDRO-MECHANICAL PERFORATOR

TUBING

X-OVER

CIRCULATION PORTS

BLADES

HYDRO-MECHANICAL CYLINDERS & SPRINGS

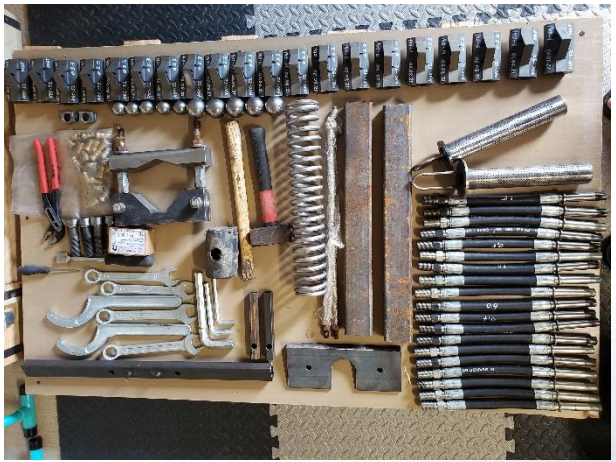
CARRIER SENSORS P/T

CUTTING & JETTING MECHANISM

HYDRAULIC CONNECTIVITY

ADDITIONAL RESOURCES

SENSORS
P/T



MAINTENANCE KIT

WORKING BENCH

ENGINEERING FIELD SUPPORT

HYDRAULIC CONNECTIVITY

TECHNICAL SPECIFICATIONS – PERFORATOR UNIT

The Perforator is operated by hydraulic pressure activating two blades positioned at 180 ° each with 2 nozzles of 0.125 ”diameter jets.

Hydraulic cylinders, circulation chambers, high tension spring and high pressure hoses, comprise the internal unit.

Housing Material	9840 Alloy Steel
Max. Operation Temperature	350 °F
Max. Operation Pressure	10,000 PSI
Max. Differential Pressure	2,755 PSI

Perforator #	102	114	127	140	146	168	178	219	245
Casing OD (in)	4.000	4.488	5.000	5.511	5.748	6.614	7.000	8.622	9.645
Perf. OD (in)	3.228	3.622	4.015	4.488	4.645	5.433	5.826	7.480	8.464
Length (ft)	8.25	8.25	8.25	6.00	5.33	5.41	5.41	5.41	5.41

HYDRAULIC CONNECTIVITY

OPERATION

INJECTION – OPENING – JETTING

1. CASING OPENING

The Hydro-Mechanical Device Activates the Blades that Mechanically Cut the Casing

Creating a Greater Flow Area – 2 Rectangular Holes of 0.7" x 1.6“ at 180°

Length of Affected Area up to 60" (1.5 mts) and 4" (0.10 mts) of Thickness

Applicable in any Casing Grades H – J – K – L – N – D P-110 Q-125 **7 ” 5 ½ ” 4 ½ ” 4 ”**

Blades of Perforator can be used up to 400 Intervals in a Single Operation

2. JETTING OPERATION ON THE CEMENTED AREA AND FORMATION

Holding the Injection Pressure for a Calculated Time, the Cemented Zone is Removed and

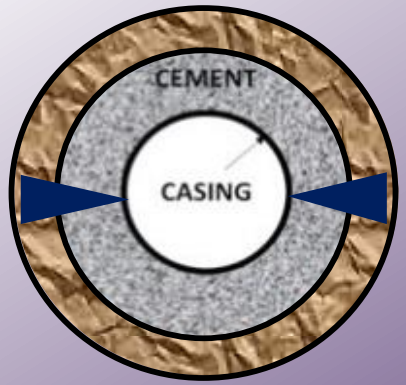
Penetrates the Formation at a Fluid Velocity of More than 600 ft/sec (200 mts/sec)

HYDRAULIC CONNECTIVITY

APPLICATION OF THE TECHNOLOGY FOR WELL INTEGRITY OPERATIONS
P&A – P&W

The Perforator is specifically designed to perform the Perforate & Wash Technology (P&WT) function, which involves connecting a targeted casing section with the annular space. It serves the purpose of washing and cleaning the perforated section before proceeding with the squeeze cement job.

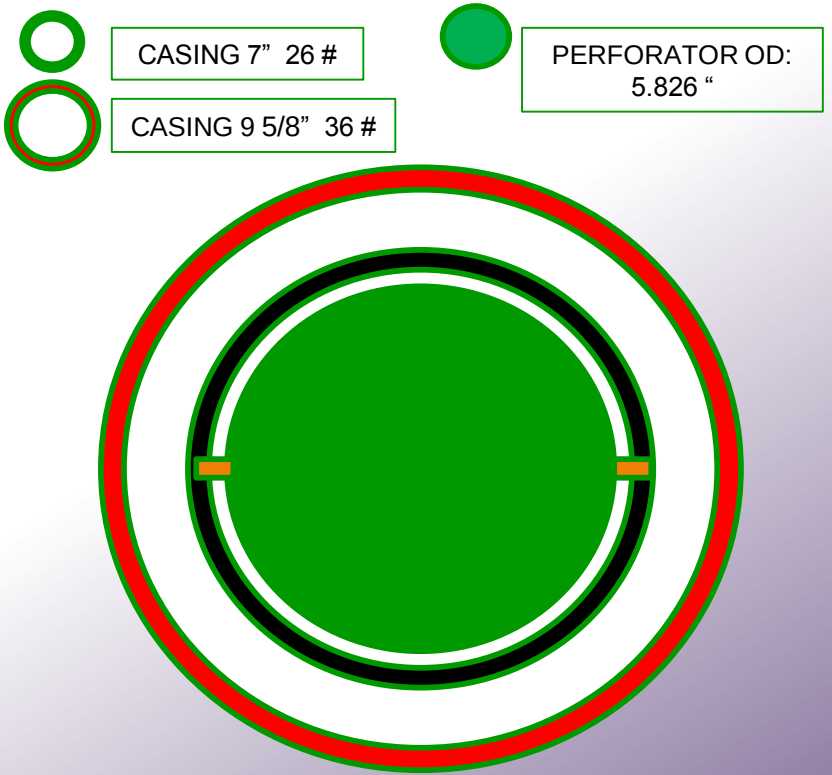
The initial operation is the two casing openings of an area of 2.24 in^2 per foot*, hydraulically connecting the annular.



Then the actions of the jettings (2-4 jets) are activated to remove cement or other material and clean the area for subsequent forced cementation operations.

HYDRAULIC CONNECTIVITY

APPLICATION OF THE TECHNOLOGY FOR WELL INTEGRITY OPERATIONS
P&A – P&W



HYDRAULIC CONNECTIVITY

APPLICATION OF THE TECHNOLOGY FOR WELL INTEGRITY OPERATIONS P&A – P&W

The diameter of the perforated section allows as much fluid as possible to be injected into the annular space, and the jetting creates a vortex phenomenon to wash through the annular space.

The vortex in the open section is in a turbulent flow regime that drags debris and dirt and transports them back to the well.

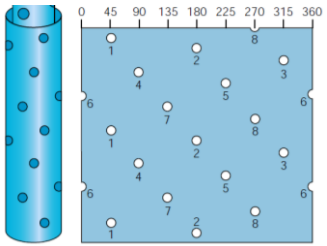
Removing all fluids and debris in the annular space prepares the area for good cement jobs to comply with P&A protocols.

HYDRAULIC CONNECTIVITY

OPERATIONAL RESULTS

TCP 12 TPP

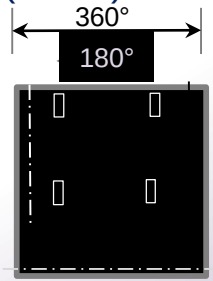
Total Opening Area = 1,33 in^2

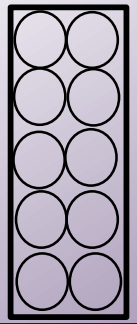


Ø 3/8” = 0,375”
(Área = 0.11 in^2)

HYDRAULIC CONNECTIVITY

Total Opening Area = 2,24 in^2
(+60%)

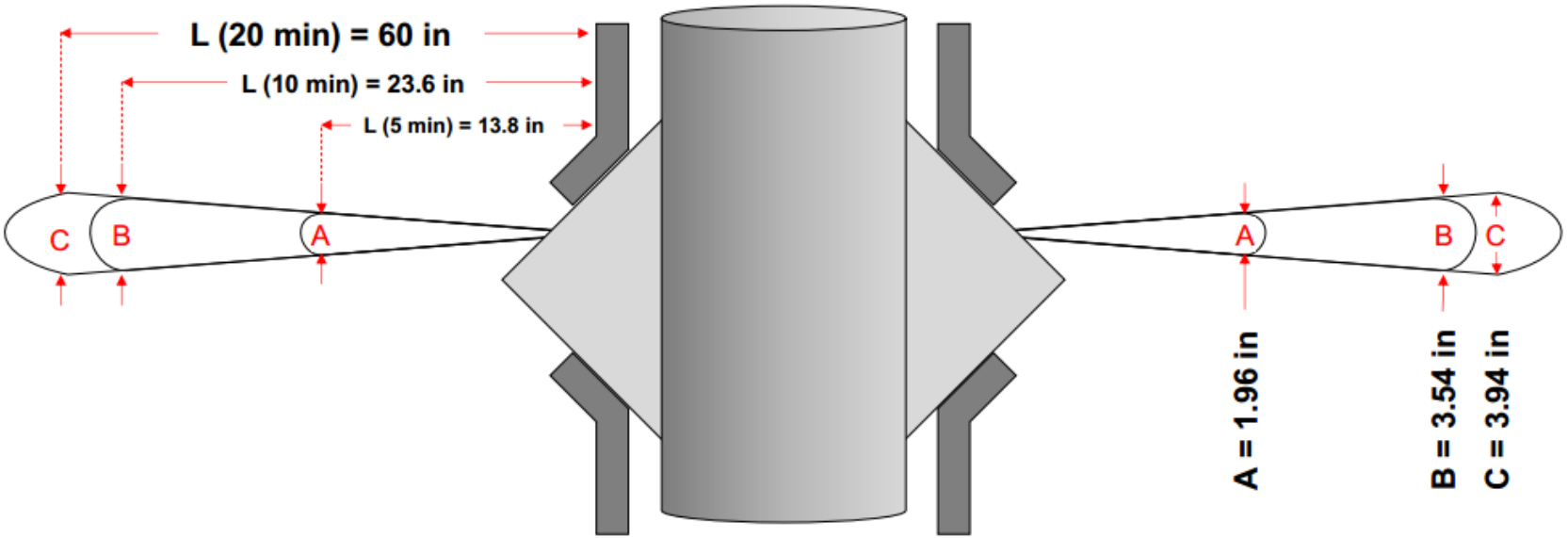




0,70” x 1,60”
Área = 1.12 in^2

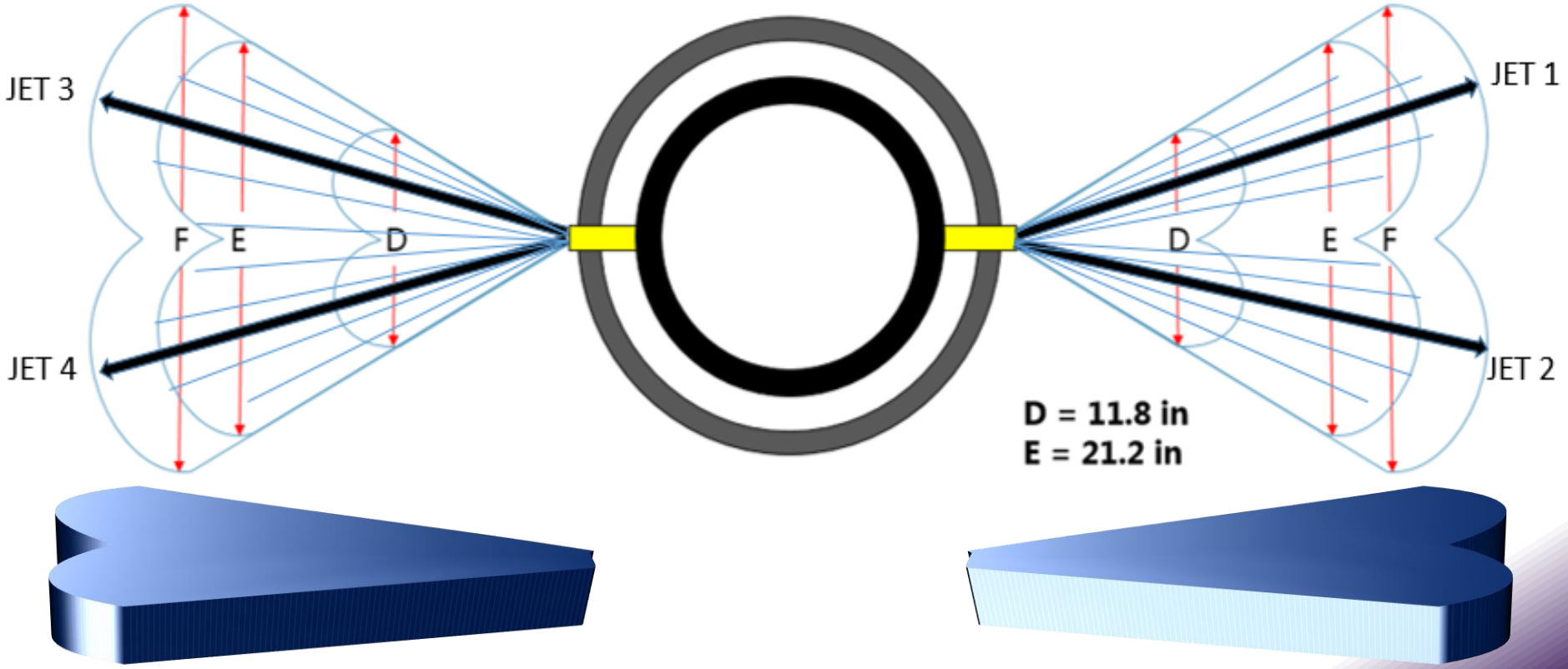
HYDRAULIC CONNECTIVITY

OPERATIONAL RESULTS
Section View



HYDRAULIC CONNECTIVITY

OPERATIONAL RESULTS
Areal or Top View



HYDRAULIC CONNECTIVITY

FIELD TEST

JETS TESTING

EXTERNAL HOLE

CASING OPENING WITH BLADES

HYDRAULIC CONNECTIVITY

ADVANTAGES OF THE OPERATION

1- INCREASES EFFICIENCY IN THE FLOW AREA

A Maximized Flow Area allows Increase of the Fluid Flow from the Formation

Minimized Formation Damage due to the Connectivity between the Wellbore and the Formation

2- CLEANING THE OPEN AREA- CLEAN-UP

Continuous Recirculation is Performed during Operation in the Affected Area

3- TREATMENT WITH SPECIAL FLUIDS

It is Possible to Simultaniously carry out Special Fluid Injection Treatment

4- SAFE OPERATION

Because it does not use Explosives it is a Safe Operation.It does not Require any Special Handling or Transportation

HYDRAULIC CONNECTIVITY

EXPERIENCE IN RUSSIA

ROSNEFT	LUKOIL	BASHNEFT	TATNEFT
150 WELLS 100 PRODUCERS 50 INJECTORS EFECTIVITY 100% REDUCE 40% OF CONECTIVITY COSTS	200 PRODUCERS WELLS INCREASE OF PRODUCTION MINIMIZE OPERATING COSTS	110 WELLS PRODUCERS CHEMICAL INJECTION REDUCTION OF OPERATING COST	80 WELLS 50 PRODUCERS 30 INJECTORS CHEMICAL TRACERS OPTIMIZATION ON WELLS OF 5 ½”

HYDRAULIC CONNECTIVITY

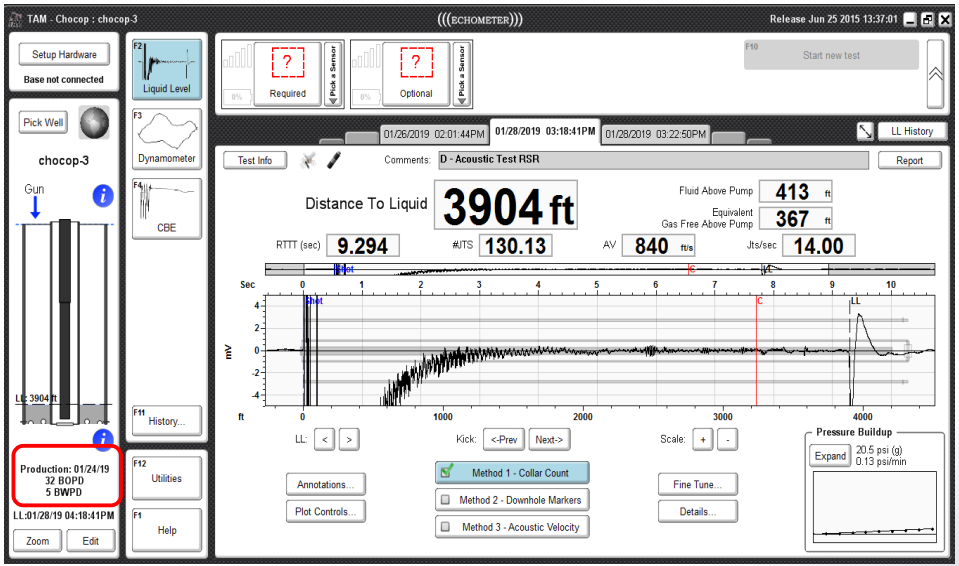
EXPERIENCE IN GUATEMALA

COMPANY:	PETRO ENERGY S.A.
FIELD:	CHOCOP
FORMATION:	COBAN (LIMESTONES)
DEPTH:	4,200 ft (1.280 m)
CASING:	7”
TYPE :	13 °API
LIFTING SYSTEM:	BEAM PUMPING
PERFORATIONS:	30 ft

	BOPD	FLUID LEVEL FROM SURFACE
BEFORE	**32**	3,904 ft
AFTER	**148**	339 ft

HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA

PRESSURE/TEMPERATURE DATA DURING THE OPERATION

Data | Program | Options

Connect New Tool | Help

Index	CalendarTime	ElapsedTime (hrs)	Press. (psia)	Temp. (degF)
34338	2019-03-04 07:06:30	17.52500	1831.398	106.053
34339	2019-03-04 07:06:31	17.52528	1831.387	106.054
34340	2019-03-04 07:06:32	17.52556	1831.360	106.054
34341	2019-03-04 07:06:33	17.52583	1831.347	106.055
34342	2019-03-04 07:06:34	17.52611	1831.326	106.057
34343	2019-03-04 07:06:35	17.52639	1831.299	106.058
34344	2019-03-04 07:06:36	17.52667	1831.270	106.057
34345	2019-03-04 07:06:37	17.52694	1831.242	106.058
34346	2019-03-04 07:06:38	17.52722	1831.209	106.057

Chart Info
Max P: 1955.217 psia
Max T: 118.440 degF

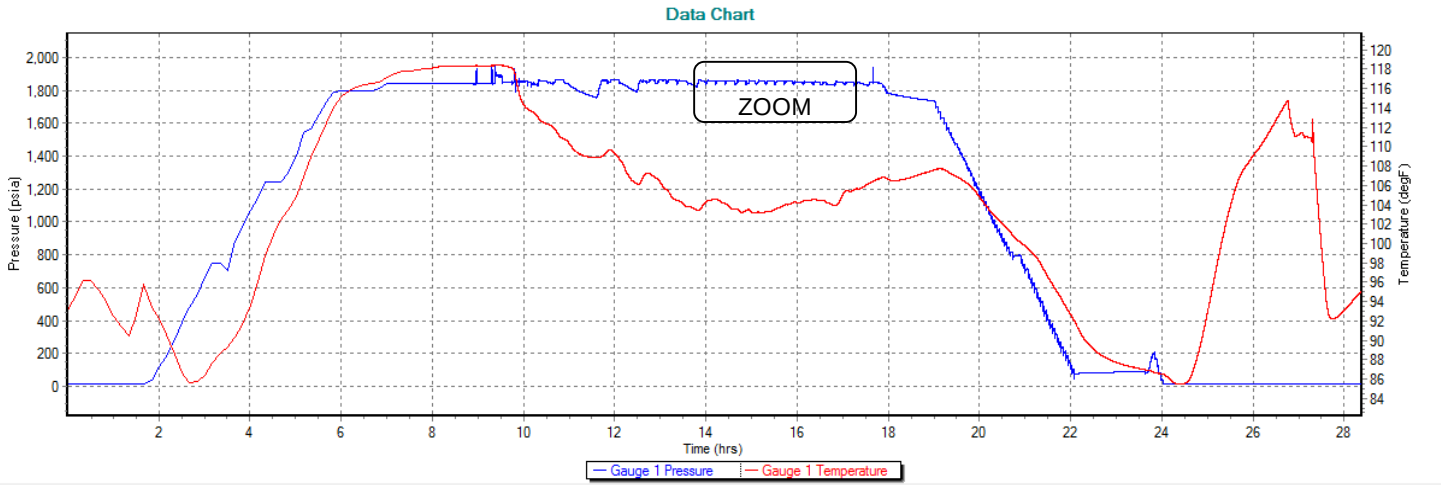
Gauge 1 Pressure and Gauge 1 Temperature
17.52611 hours
04-Mar-19 7:06:34 AM
1831.326 psia
106.057 degF

Download | Read File | Save as | Export | Compress | Uncompress | Print Report

Selection Start | Selection End | Filter | Undo Filter | View Pressure Diff. | Add File | Remove File | Add Gradient | View Gradient | Add Event | View Event

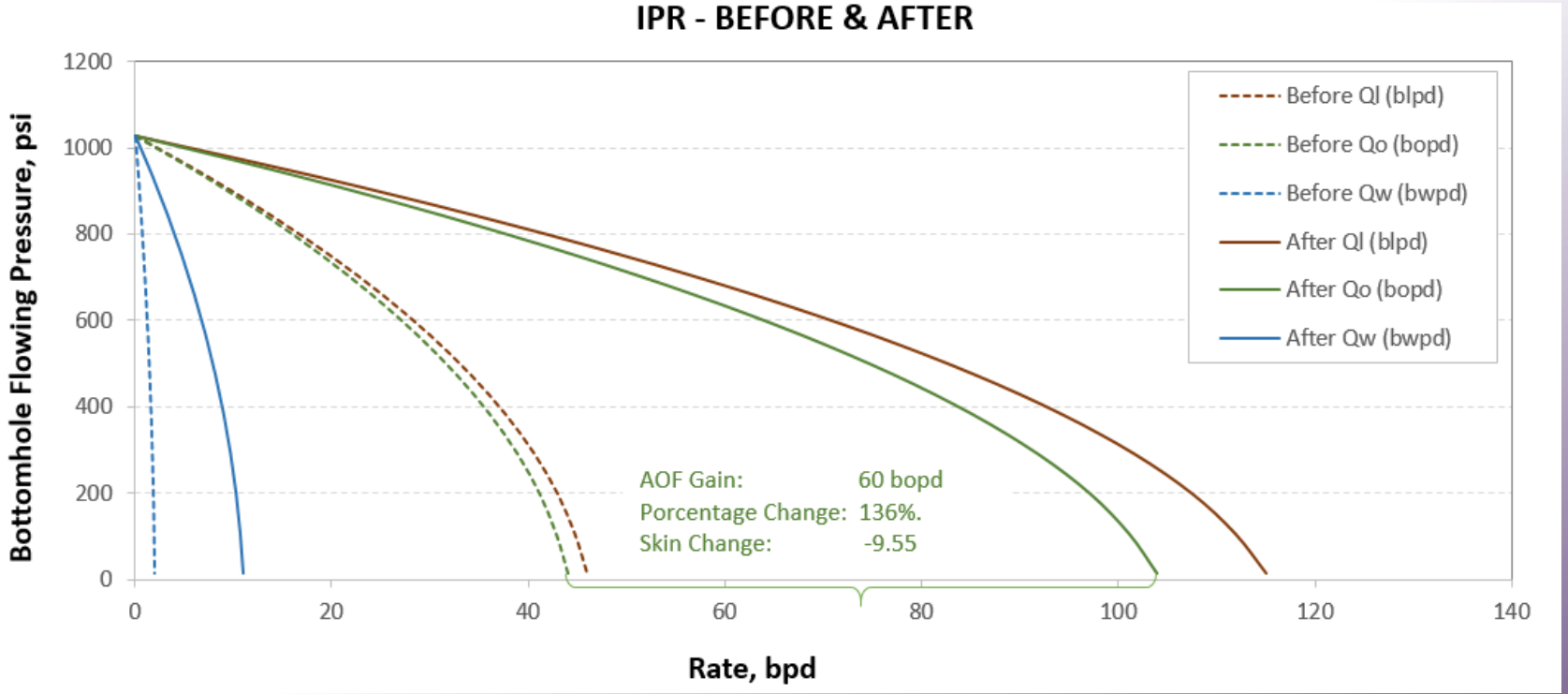
Show Annotations

Units convertor



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA

PRESSURE/TEMPERATURE DATA DURING THE OPERATION

Data | Program | Options

Connect New Tool | Help

Index	CalendarTime	ElapsedTime (hrs)	Press. (psia)	Temp. (degF)
28663	2019-03-04 05:31:55	15.94861	1853.446	104.273
28664	2019-03-04 05:31:56	15.94889	1853.243	104.278
28665	2019-03-04 05:31:57	15.94917	1853.467	104.273
28666	2019-03-04 05:31:58	15.94944	1854.244	104.276
28667	2019-03-04 05:31:59	15.94972	1853.548	104.273
28668	2019-03-04 05:32:00	15.95000	1852.908	104.270
28669	2019-03-04 05:32:01	15.95028	1853.865	104.278
28670	2019-03-04 05:32:02	15.95056	1853.304	104.274
28671	2019-03-04 05:32:03	15.95083	1852.106	104.277

Chart Info
Max P: 1955.217 psia
Max T: 118.440 degF
Gauge 1 Pressure and Gauge 1 Temperature
15.94972 hours
04-Mar-19 5:31:59 AM
1853.548 psia
104.273 degF

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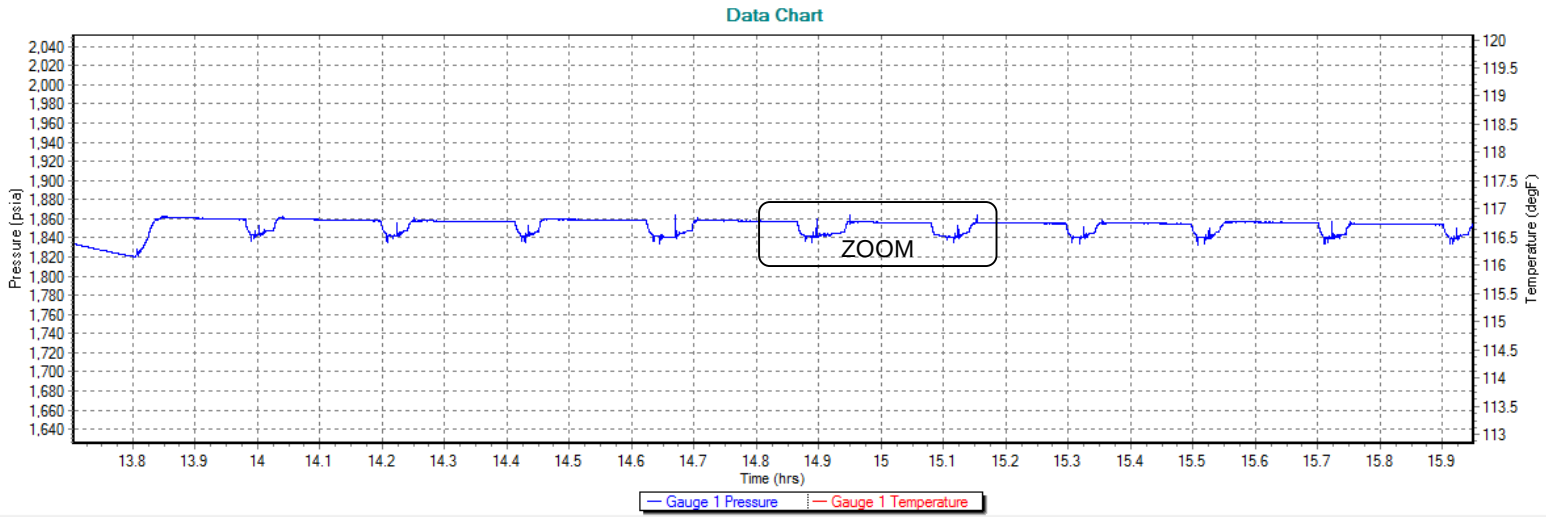
Show Annotations

Units convertor



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA

PRESSURE/TEMPERATURE DATA DURING THE OPERATION

Data | Program | Options

Connect New Tool | Help

Index	CalendarTime	ElapsedTime (hrs)	Press. (psia)	Temp. (degF)
25874	2019-03-04 04:45:26	15.17389	1856.162	103.230
25875	2019-03-04 04:45:27	15.17417	1856.006	103.232
25876	2019-03-04 04:45:28	15.17444	1855.987	103.229
25877	2019-03-04 04:45:29	15.17472	1856.103	103.227
25878	2019-03-04 04:45:30	15.17500	1856.052	103.229
25879	2019-03-04 04:45:31	15.17528	1856.041	103.228
25880	2019-03-04 04:45:32	15.17556	1856.143	103.227
25881	2019-03-04 04:45:33	15.17583	1855.990	103.228
25882	2019-03-04 04:45:34	15.17611	1856.180	103.230

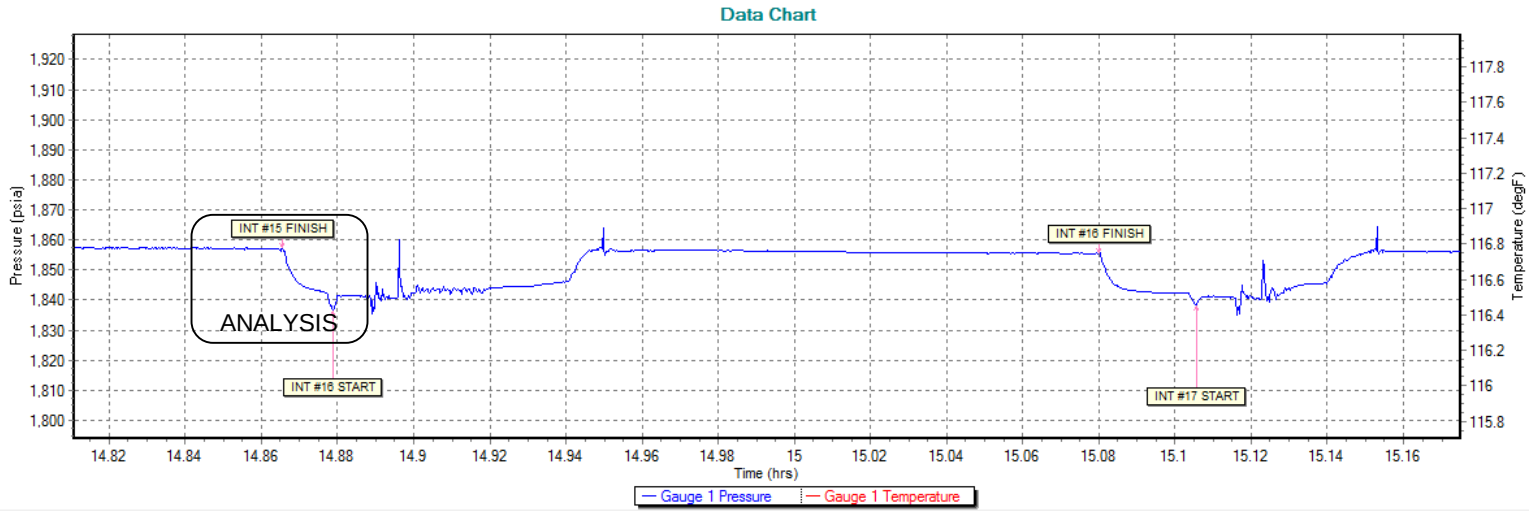
Chart Info
Max P: 1955.217 psia
Max T: 118.440 degF
Gauge 1 Pressure and Gauge 1 Temperature
15.17500 hours
04-Mar-19 4:45:30 AM
1856.052 psia
103.229 degF

Download | Read File | Save as | Export | Compress | Uncompress | Print Report

Selection Start | Selection End | Filter | Undo Filter | View Pressure Diff. | Add File | Remove File | Add Gradient | View Gradient | Add Event | View Event

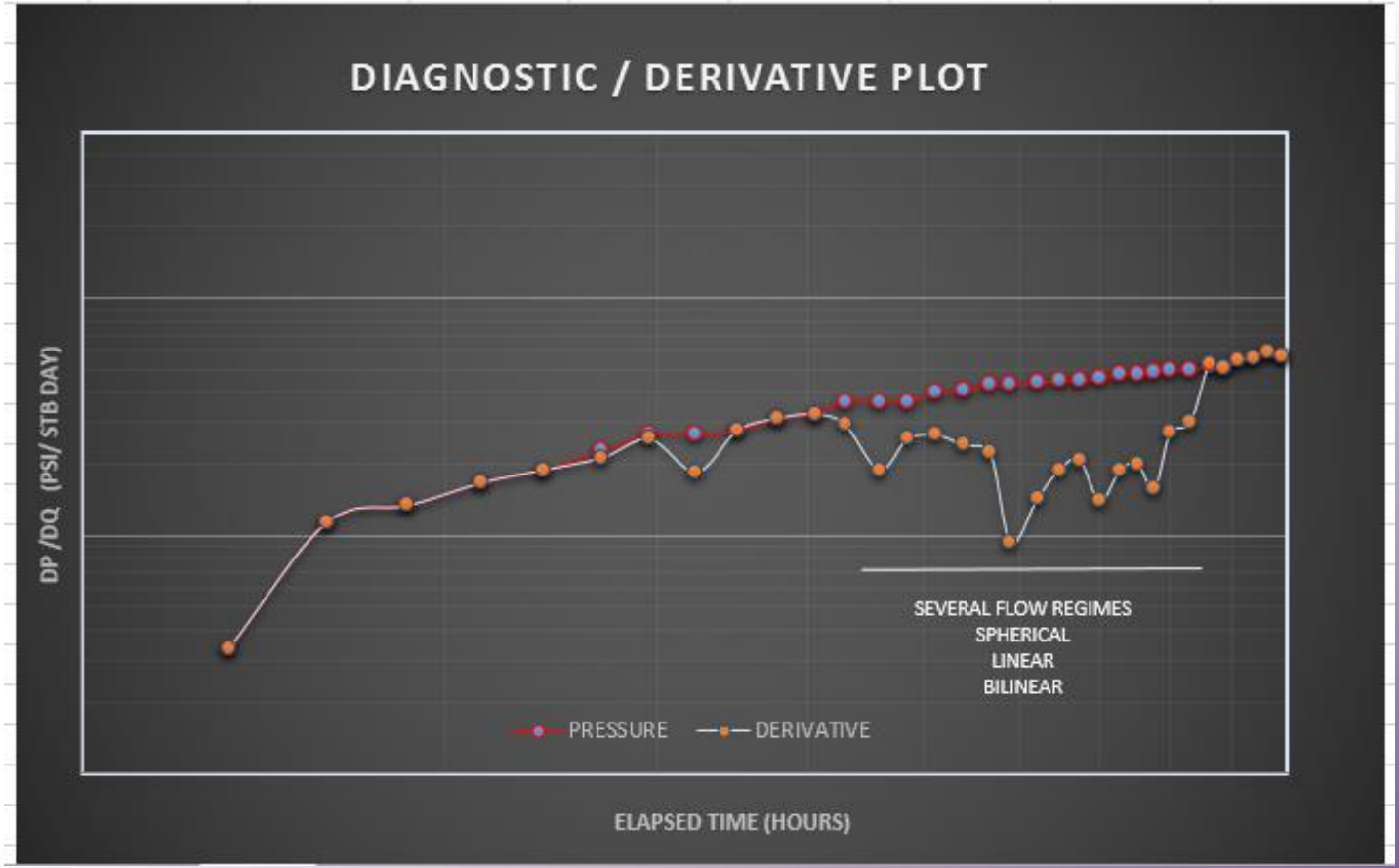
Show Annotations

Units convertor



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA



HYDRAULIC CONNECTIVITY

EXPERIENCE IN GUATEMALA

INJECTOR WELL

COMPANY:	PERENCO GUATEMALA
FIELD / WELL:	XAN / XAN-XX
FORMATION:	XX (DOLOMITE)
DEPTH:	+ 2500 ft
CASING:	7”
FLUID:	INJECTION WATER
PERFORATION:	- 20 ft

HYDRAULIC CONNECTIVITY

EXPERIENCE IN COLOMBIA

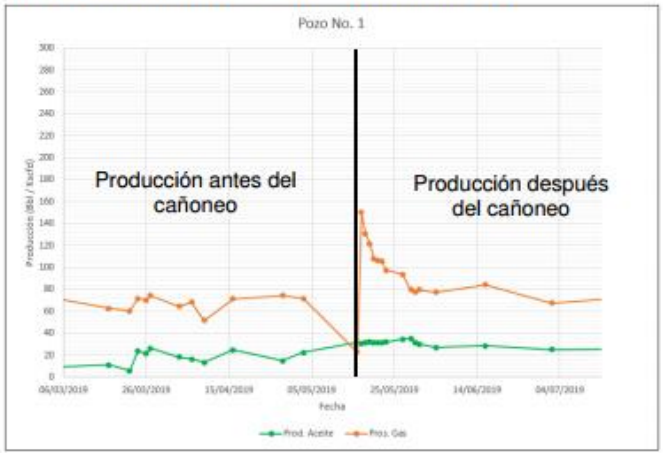
Cañoneo Hidromecánico

INTEROIL

RESULTADOS OPERACIONALES
Pozo No. 1

BOPD antes del cañoneo: 12,0
BOPD después del cañoneo: 26,0

Comportamiento de la producción de crudo y gas



Comportamiento de la curva de declinación

HYDRAULIC CONNECTIVITY

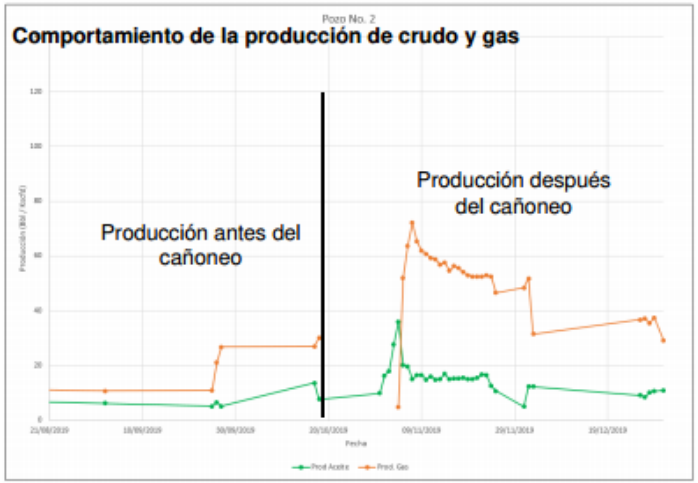
EXPERIENCE IN COLOMBIA

Cañoneo Hidromecánico

INTEROIL

RESULTADOS OPERACIONALES
Pozo No. 2

BOPD antes del cañoneo: 6,0
BOPD después del cañoneo: 16,0



HYDRAULIC CONNECTIVITY

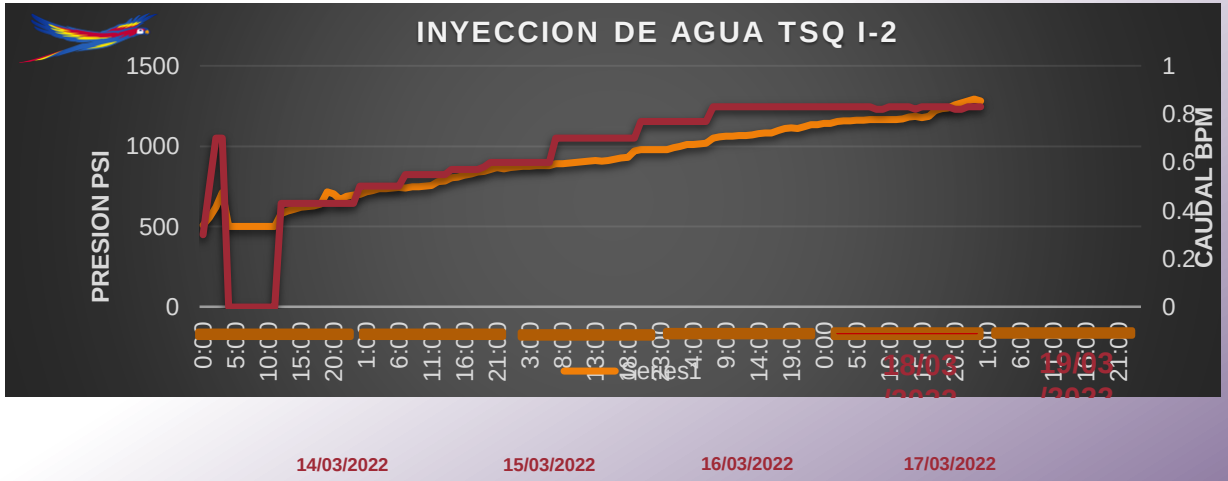
EXPERIENCE IN COLOMBIA

BACKGROUND

In the TIQ-2I injection well, a Hydro-mechanical Connectivity operation was carried out in February 2022, in the intervals 7865 – 7880 & 7880 – 7910 ft of the Lisama B formation.

Injection potential at the end of 2021 was 0.0 BWPD, with 3000 psi of WHP, due to formation damage.

With the use of this technology the injectivity is recovered, the injection potential is 1000 BWPD with 1000 psi of WHP.



HYDRAULIC CONNECTIVITY

EXPERIENCE IN USA
2022-2023

COMPANY	FIELD STATE	WELL NAME	WELL TYPE	INTERVAL DEPTHS	INITIAL STATUS	FINAL STATUS
DAF OPERATING LLC	HAROLD TEXAS	CLEMMER-2	INJECTOR/DISPOSAL	2410 - 2422	INJ PRESS: O PSI 0 BWPD	INJ PRESS: 100O PSI 700 BWPD
DAF OPERATING LLC	HAROLD TEXAS	CLEMMER-4	OIL PRODUCER	2604-2618 2635-2639	0 BOPD	10 BOPD
DAF OPERATING LLC	HAROLD TEXAS	CLEMMER-7	OIL PRODUCER	2632-2634 2384-2386	4 BOPD	15 BOPD
HYDROGEO ENERGY LLC	HILLTOP TEXAS	ELLISON-1	OIL PRODUCER	6772-6810 7181-7211 7333-7396	2 BOPD 2 BWPD	45 BOPD 5 BWPD
GEOMATRIX ENERGY	LONGWOOD LOUISIANA	MITCHELL-2	OIL PRODUCER	2408-2470	3 BOPD	15 BOPD