



Cairo, Egypt. November 7-8, 2022

# MENAPS 2022

MIDDLE EAST AND NORTH AFRICA PERFORATING SYMPOSIUM

## Innovative TCP-ESP Underbalanced Perforation

- Objective of perforation is to establish effective flow communication between the wellbore and the formation.
- Achieving good well productivity (or injectivity) involves:
  - Selecting appropriate perforating equipment and techniques
  - Establishing conditions in the well at the time of perforating conducive to good perforation clean up or flow response (e.g. fluid type and differential pressure)

- Objective Flowing the Well
  - Fluid drag forces act on the compacted zone and debris
  - Usually inadequate
- Injecting Fluid (Perforation Breakdown)
  - Brine, KCl Water, Acetic Acid, HCl acid, and HF acid
  - Compatibility with formation is important
- Perforating Underbalanced
  - Reverse differential pressure perforating

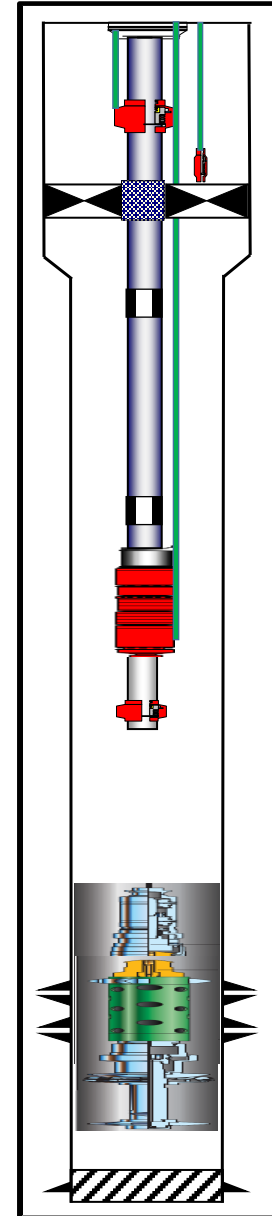
## Casing Guns

- One or more runs on E-line
- Over balanced perforation
- May cause damage around the well bore resulting in skin and thus lower productivity index

## TCP (Tubing Conveyed Perforation)

- Includes two runs:
  1. TCP to perforate the interested zone under balance
  2. ESP Completion string
- Risk of formation damage during well killing to proceed with 2<sup>nd</sup> run.

- Save the rig time and cost
- Bypass the tunnel damage (skin) resulting from over balanced perforation or killing the well.
- Increase the productivity index (Pi) and thus the production.




## The types of the system:

- 1- Gun hanger with electronic firing head.
- 2- Gun hanger with special time delaying hydraulic firing head.
- 3- Conventional PKR (permanent or hydraulic) equipped with on-off tool with the special time delaying hydraulic firing head.

# 1- Gun Hanger With Electronic Firing Head.

- The system components.
  - ✓ Hanging system (Gun Hanger)
  - ✓ Delaying system (electronic Firing Head)
- The system procedures.
- The advantages.
  - ✓ The possibility of restart
  - ✓ The back up firing head
  - ✓ The possibility of going with 2 runs (skirt and stinger)
- The disadvantages.
  - ✓ The high cost

TOOL STRING	DESCRIPTION
	DPU-GR Sensor Adapter Kit
	Stinger Assy W/ 2.313 IN. O.D. FISHNECK
	BI DI'S. SHOOTING SWIVEL,3.375"
	3 3/8" Shroud With Electronic firing head inside
	Dual Thread X-OVER,DUAL P,3 3/8 GUN B X P,2 1/2 TDF
	Detonation Interruption Safety Device
	GUN SPACER,
	TOP SHOT
	4 1/2" Extra DP LAODED GUNS 5 SPF, (22 FT Loaded)
	BOTTOM SHOT
	Blank Gun
	X-Over 3 3/8" B x 4 1/2" P
	EMERGENCY RELEASE, 3.375"
	7 " AUTOMATIC RELEASE GUN HANGER
Extended Delay Assembly (4 ea) Time Delay Firer Ported Nose plug	

# 1- Gun Hanger With Electronic Firing Head.

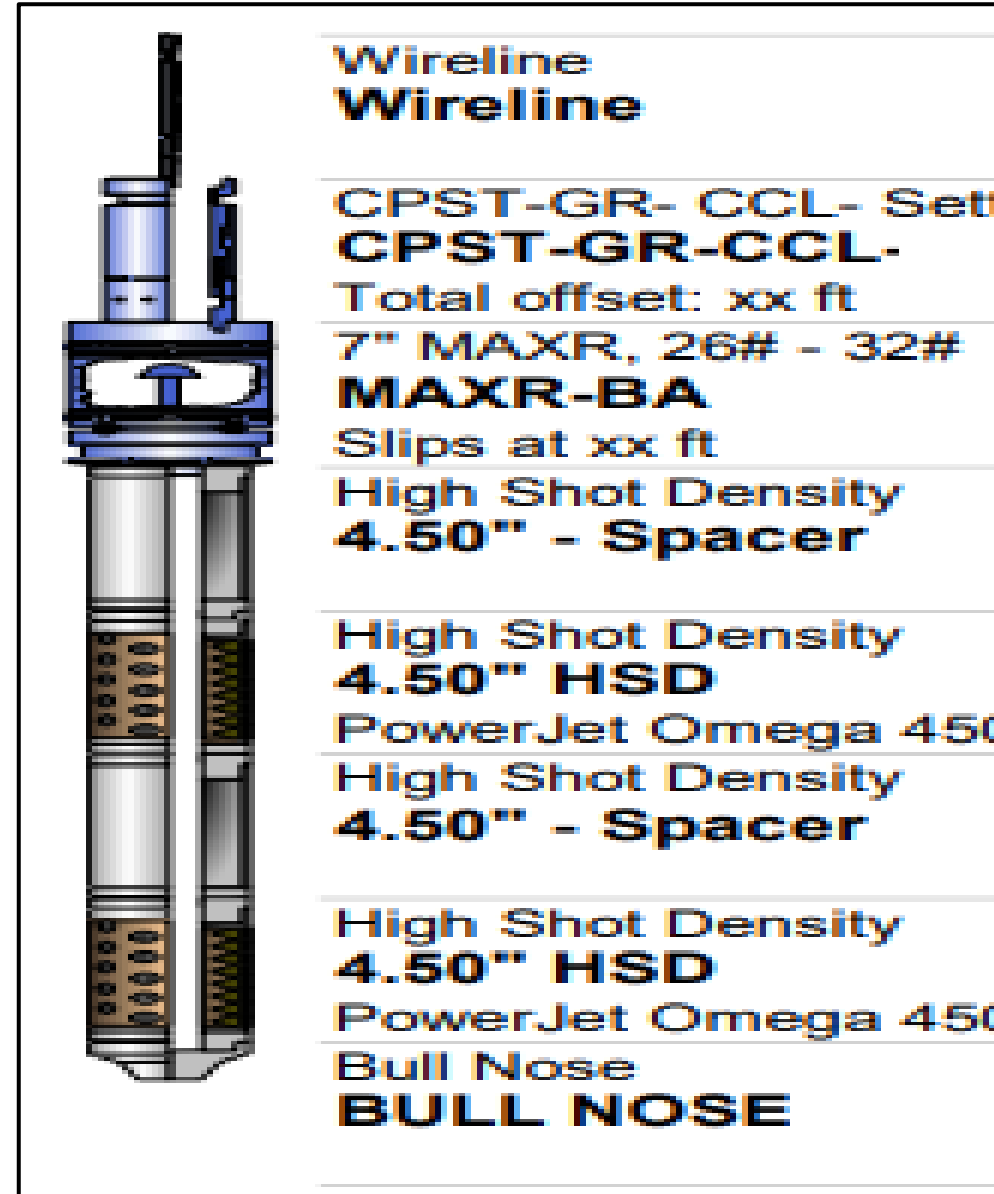


## The procedures:

- 1- M/U and P/U the guns stack and RIH.
- 2- Set the gun hanger.
- 3- RIH W/ the ESP string.
- 4- Activate the firing head with time delaying by pressure plus as shown in the figure.
- 5- Make the under balance using the ESP.
- 6- Fire and drop the gun hanger

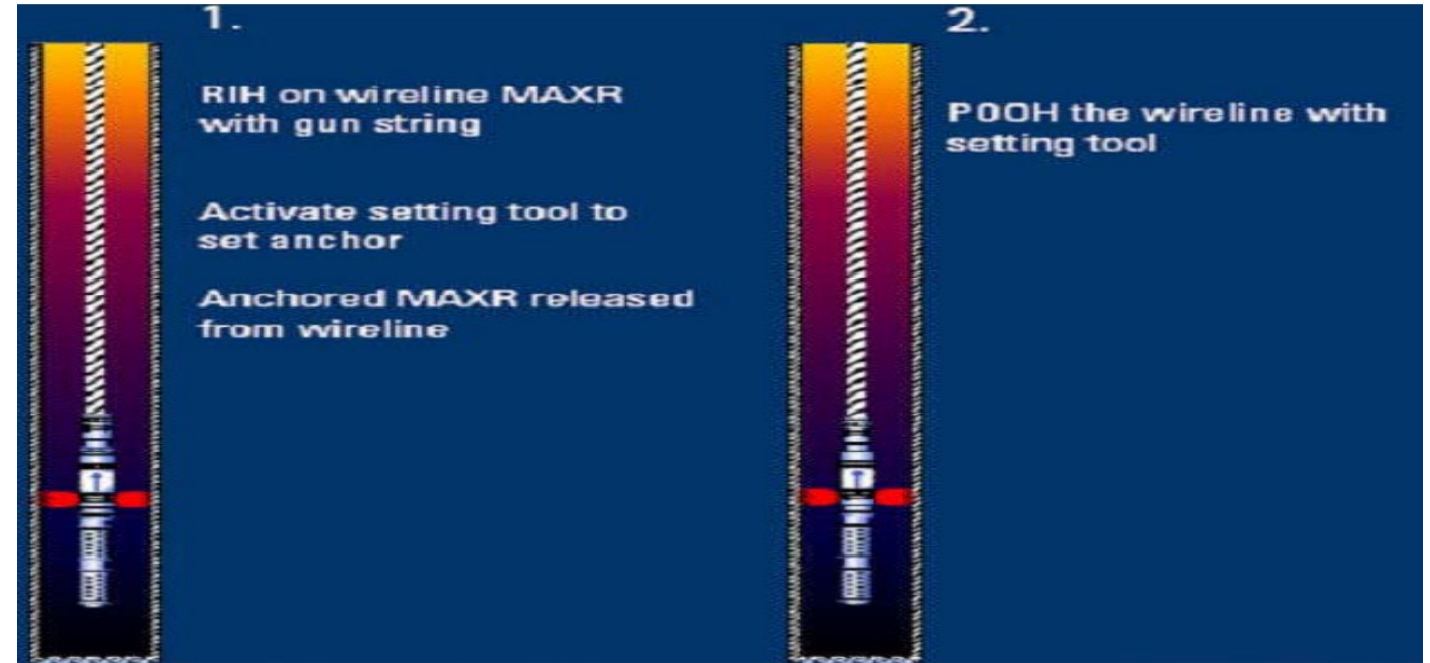


- The system components.
  - ✓ Hanging system (MAXR)
  - ✓ Delaying system (Special Time Delaying hydraulic Firing Head)
- The system procedures.
- The advantages.
  - ✓ The simplicity
  - ✓ Low cost
- The disadvantages.
  - ✓ No restart option
  - ✓ No back up firing head

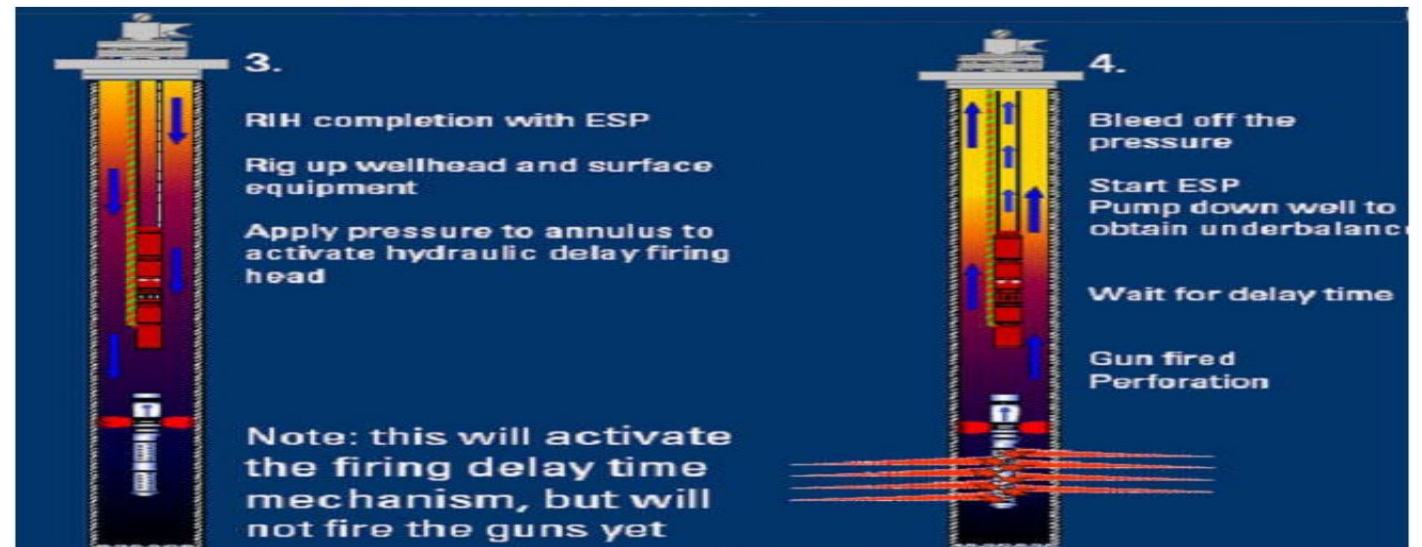


### The procedures:

- 1- M/U and P/U the guns stack and RIH.
- 2- Set the gun hanger and POOH.

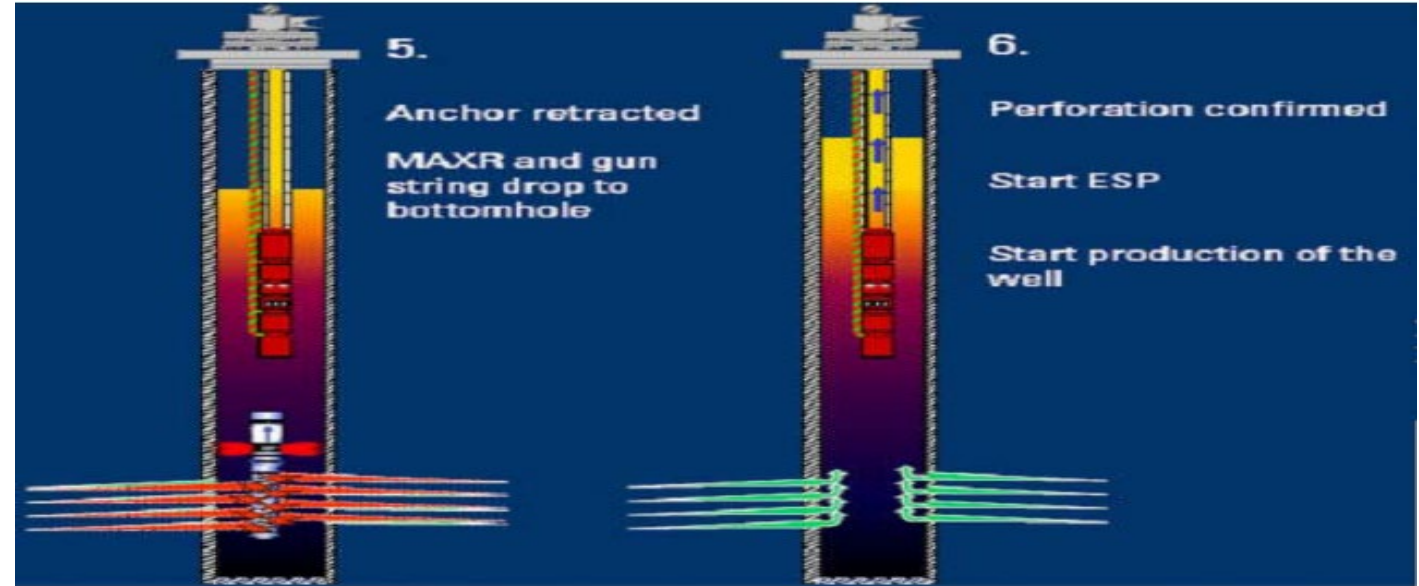


- 3- RIH W/ the ESP string.
- 4- Activate the firing head, make the under balance using the ESP

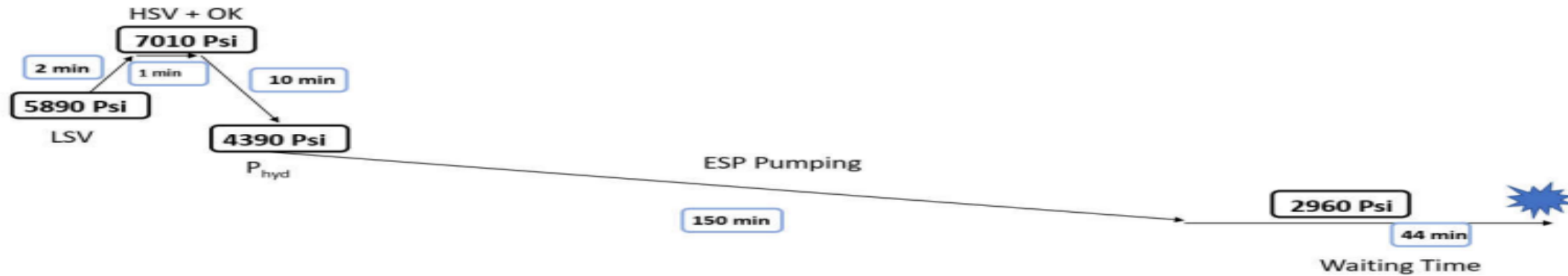


## The procedures:

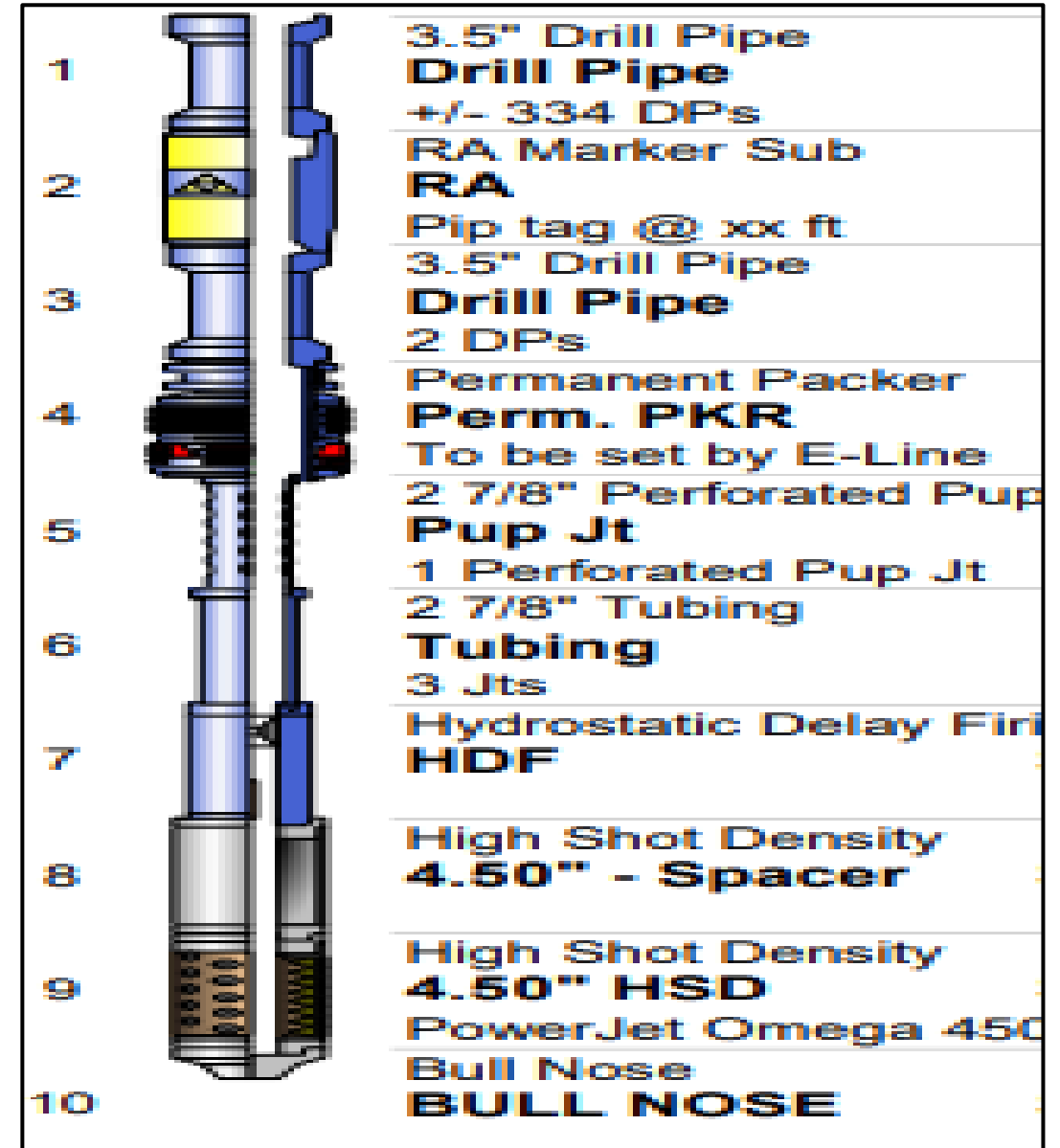
- 5- Fire and drop the gun hanger
- 6- Wait till debris settlement, start the ESP.



### ➤ Delay Time Chart



- The system components.
  - ✓ Hanging system (Conventional PKR )
  - ✓ Delaying system (Special Time Delaying hydraulic Firing Head)
- The system procedures.
- The advantages.
  - ✓ The simplicity
  - ✓ Lower cost
- The disadvantages.
  - ✓ No restart option
  - ✓ No back up firing head
  - ✓ No drop of the hanging system

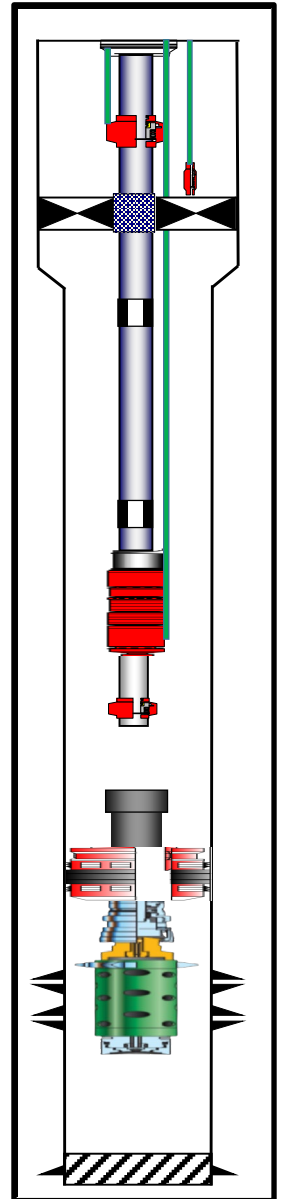


#### ➤ Delay Time Chart



#### The procedures:

- 1- M/U and P/U the guns stack and RIH.
- 2- Set the gun hanger.
- 3- RIH W/ the ESP string.
- 4- Activate the firing head with time delaying by exerting a certain pressure value at the surface.
- 5- Make the under balance using the ESP.
- 6- Fire and produce through the perforated pup joint.



1. Pre-job planning helped determine downhole configurations and helped create safe operating conditions during the perforating and production processes.
2. The perforating guns system was activated on the first attempt as designed.
3. The combination of technologies used in the well perforation helped demonstrate that formation damage can be minimized in production wells that use ESP completions.
4. The technologies used in this ESP completion helped reduce rig time and costs and helped enable well production earlier than expected at a **25%** higher rate.



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# Q&A