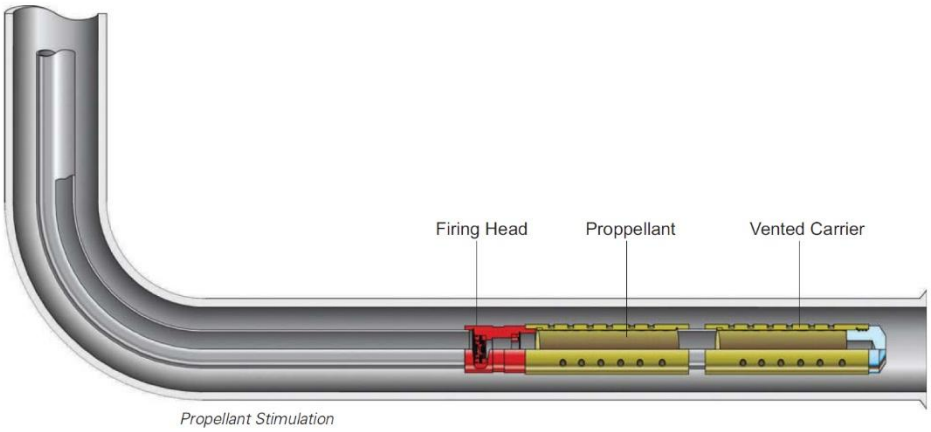
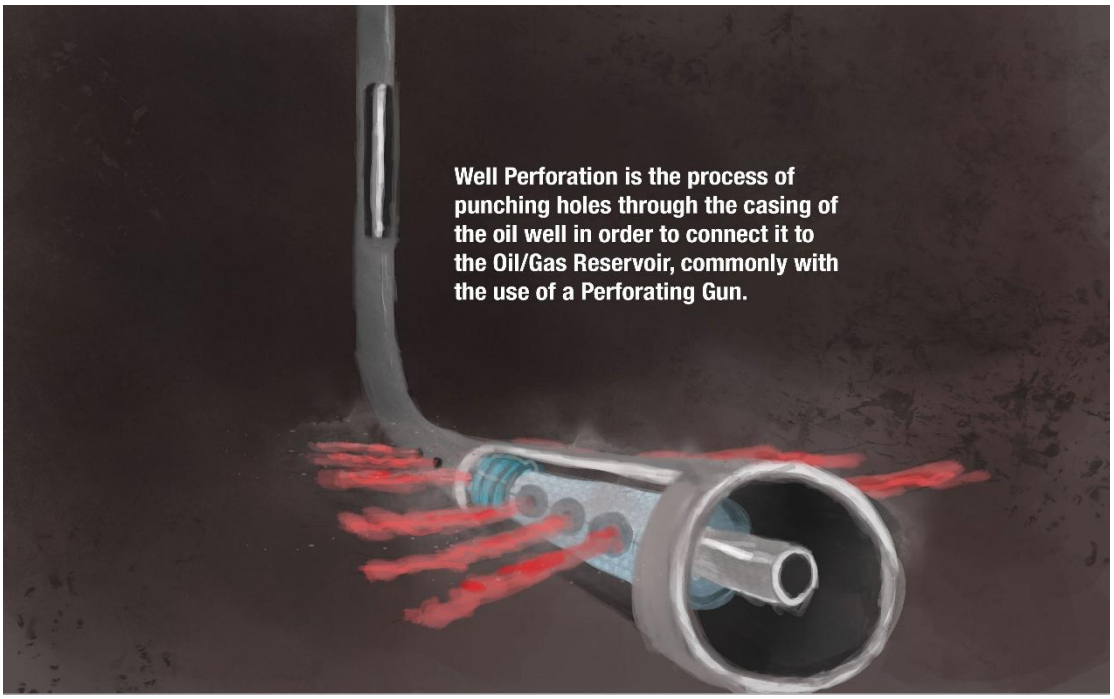
Firing Head Connector for Perforating Gun Equipment in Downhole & Offshore Application

Dual High Pressure 138Mpa (20,000PSI) benefit with Glass Sintered Sealing (The air leakage rate: 1x10-3 Pa.CM3 /s) technical, support environment temperature -60°C-200°C (harshness especial reach to 260°C max) against API-67 standard requested.



Propellant Stimulation

Perforation Gun, A device used to perforate oil and gas wells in preparation for production. Containing several shaped explosive charges, perforating guns are available in a range of sizes and configurations. The diameter of the gun used is typically determined by the presence of wellbore restrictions or limitations imposed by the surface equipment.



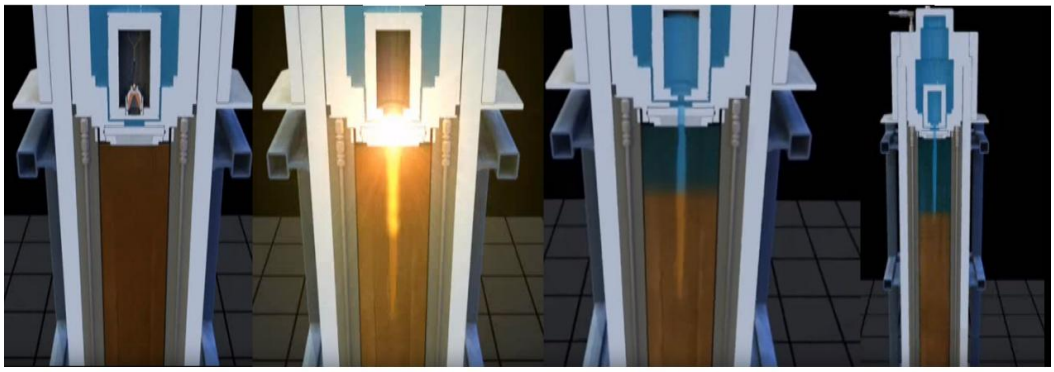
Perforation is an extremely important technique in petroleum exploration and recovery engineering, a major means of enhancing the recovery factor of gas and oil wells and also a typical method of tapping the potential of existing oil fields and increasing output.

Perforation completion is widely used worldwide and accounts for about over 90% of all well completions. Almost all reservoir beds can be opened by this method. In the method, in the course of gas and oil field exploitation the production casing is lowered and cemented and then special perforation instrument and devices are sent down to the predetermined depth and aimed at the target layer.

Through the key parts, the firing head connector

Animation Test Firing Head Connector

Perforating Gun in Lab



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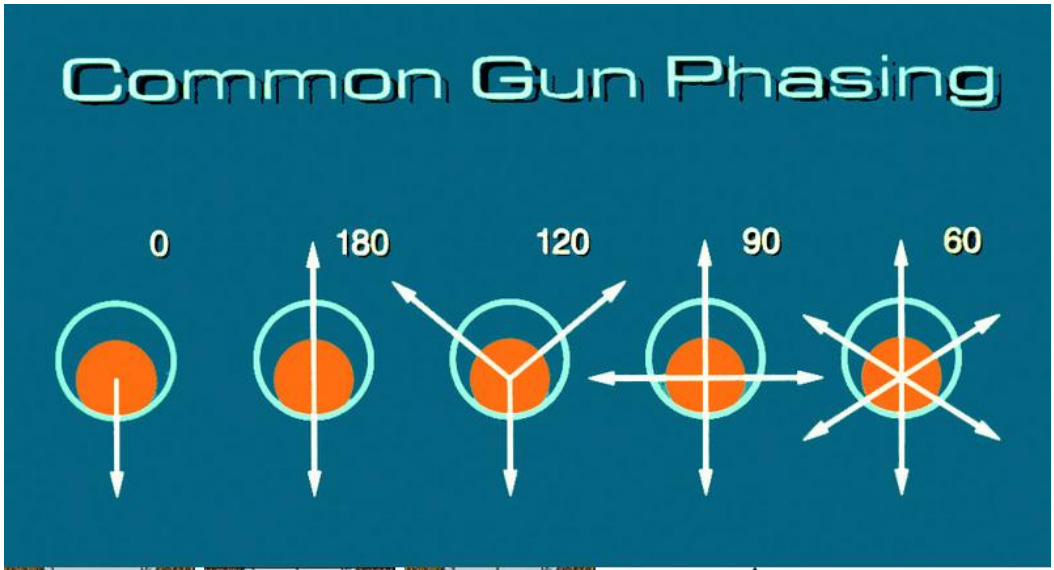
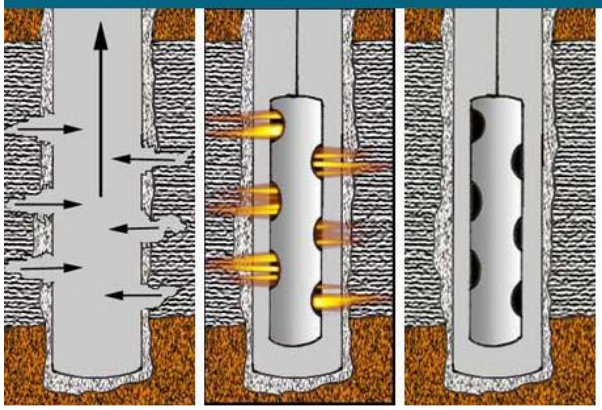
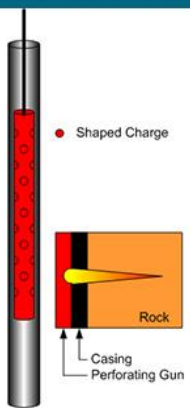
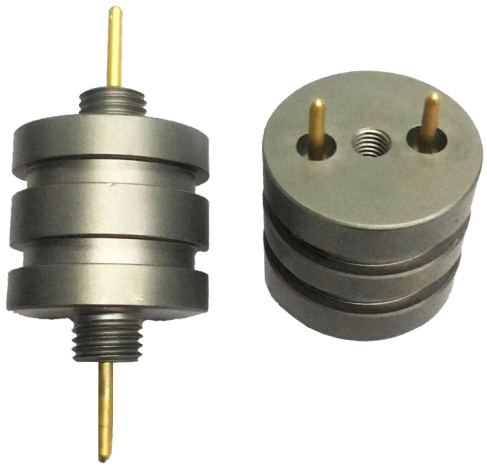






The perforator down in the well is ignited from the ground and the lined cavity charge (The propellant material is potassium perchlorate, an oxidizer that burns rapidly, creating CO2. As the shaped charges detonate, the propellant is ignited by extreme heat from the gun system. As it burns, the propellant generates CO2 at high peak pressures typically well above the formation fracture gradient.) is ignited which result in the detonation wave to transmit forward at a velocity of 7~8 km per second and high temperature and high-pressure shock waves are generated which penetrate through the casing, cement sheath and enter the stratum forming a hole canal, as illustrated by the diagram. Whichever perforation method you use, the performance and quality of the perforating gun (Including the perforating gun pipe) shall have a significant influence on the perforation quality of gas and oil wells.



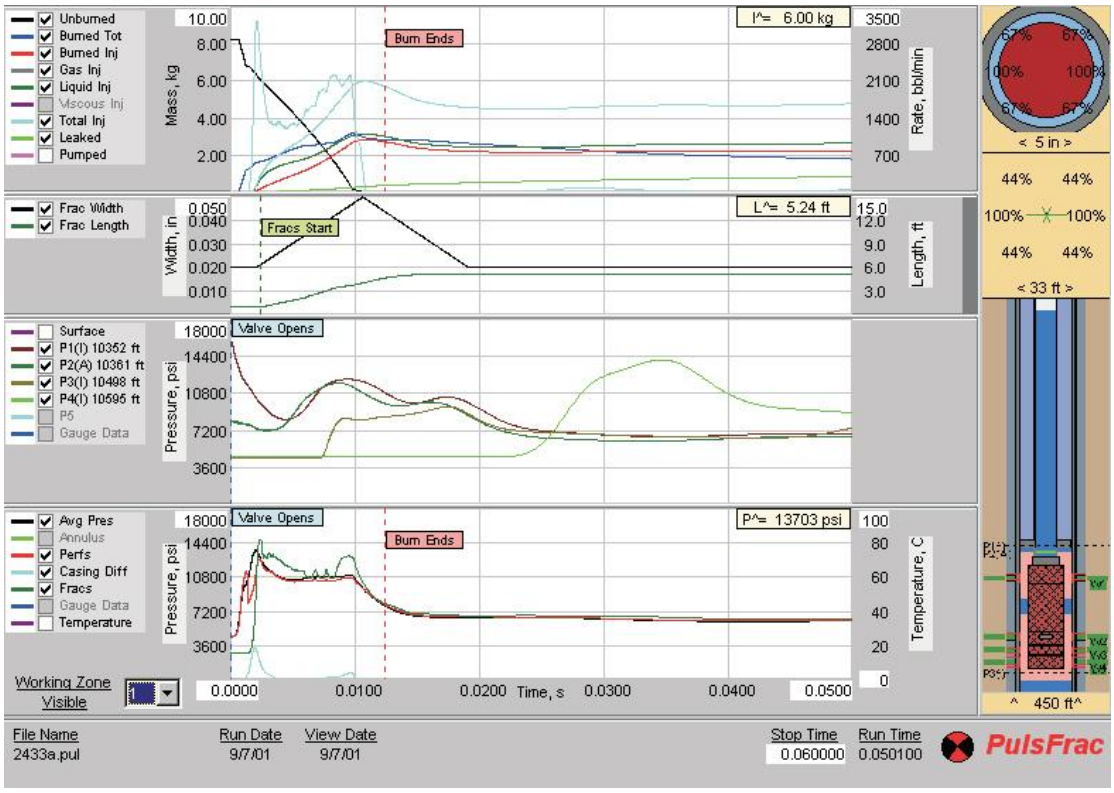
PRESSURE FIRING HEAD CONNECTOR SPECIFICATIONS

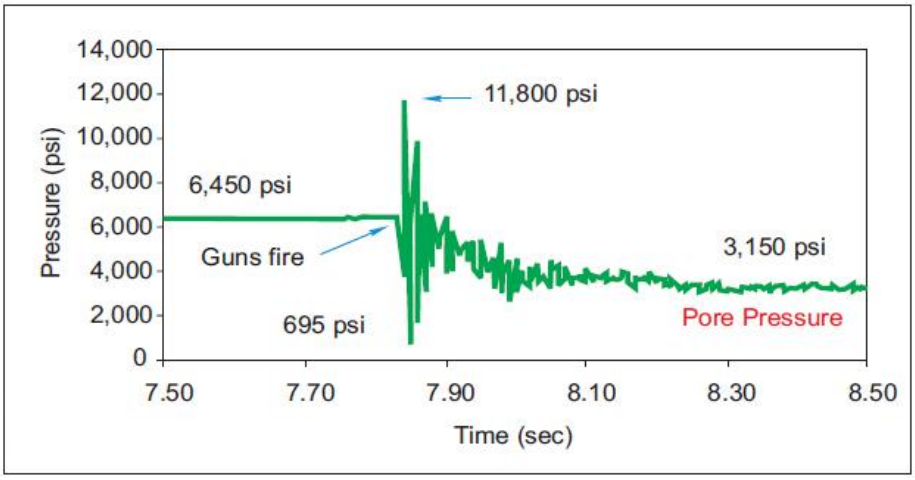
Firing Head Connector Part Number	SK19.SYD.001	SK19.SYD.002
O.D. [mm]	28±0.01	28±0.05
Pin connector Length mm	65+0.1	41±0.05
Max. 100 Hour Temperature Rating[oC]†	200	200
Min. Required Pinning Pressure (psi)[MPa]	1,800psi/12MPa	1,800psi/12MPa
Max. Operating Pressure (psi)[MPa]‡	20,000psi/138MPa	20,000psi/138MPa
Air Leakage Rate	$1x10^{-3}$ Pa.CM^3 /s	$1x10^{-3}$ Pa.CM^3 /s
Shell Material	X-750	X-750
Contact Material	Alloy 52 Gold Plating	Alloy 52 Gold Plating
Rated Current per Pin	5A	5A
Dielectric Strength	≥5000MΩ	≥5000MΩ
Contact Resistance	≤10mΩ	≤10mΩ
Life Time	1000times	1000times

Benefits / Capabilities

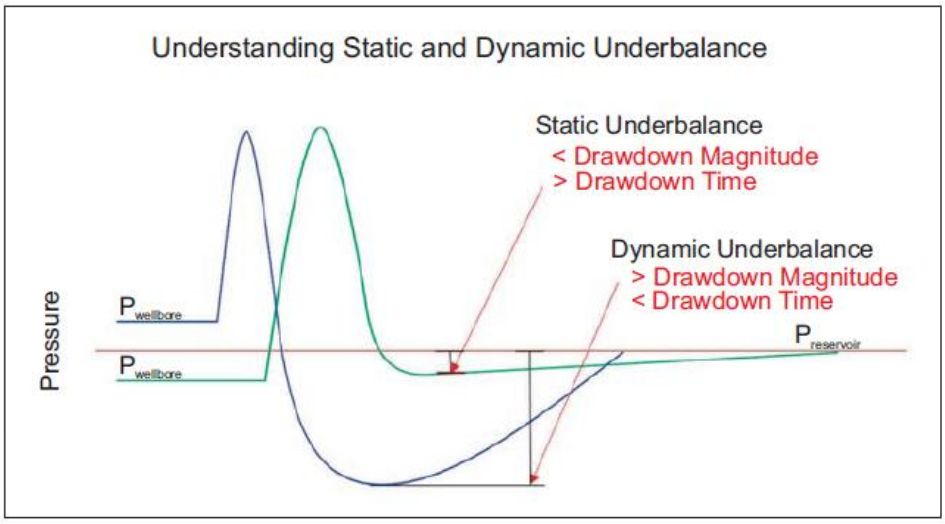
- Can re-perforate in old well without pulling the tubing out.
- Can be used with big charges to achieve deeper penetration.
- Firing circuitry is in short before the charges are released.
- Dual Pressure random mounting side
- Circulation flexibility—allowed in both directions before and after the guns are fired. Underbalanced perforating conditions are easily established.
- CT compatibility—the firing head can take a combination of shear pins and can be connected to any CT string by means of a crossover connector.
- Soldering mounting terminal Design efficient assembly to the equipment
- Ultra-tiny design fit for the drill head solution and equipment

LAB TEST DATA





High-Speed Pressure Recorder Data



Static vs. Dynamic Underbalance

Assembly & Mounting Steps

Step 1: Annulus pressure from above the packer enters the crossover tool and is applied to the first (bottom) time delay firing head. The first Sunkye firing sub prevents pressure from reaching the second firing head. The time delay provides time to bleed off pressure. When the guns detonate, the firing train continues to the firing sub. The sub fires, creating a path to the second firing head. The zone is tested.

Step 2: Annulus pressure is reapplied and travels to the second time-delay firing head. The first pressure isolation sub prevents pressure from venting through the first set of perforations. The pressure is released, the gun fires and the second Select Fire sub fires and opens a path to the third gun. Production from the second zone is commingled with pressure from the first zone for testing.

Step 3: Pressure applied to the annulus passes through the annulus pressure crossover and down the control line to the third time-delay firing head. The second pressure isolation sub prevents pressure from venting through perforations in the first and second zones. The pressure is released, the guns fired, and flow from all three are commingled for testing.