PETROLEUM PRODUCTION ENGINEERING I

LECTURE 8

PERFORATION

Perforating:

Is probably the most important of all completion functions in cased holes. Adequate communication between the wellbore and all desired zones, as well as isolation between zones, is essential to evaluate and to optimize production and recovery from each zone. The objective of perforating a well is to establish communication between the wellbore and the formation by making holes through the casing, cement and into formation in such a manner so as not to inhibit the inflow capacity of the reservoir.

The selection of a perforating technique can be a critical factor in successful testing of a well. It is therefore important to plan early so that the most suitable equipment will be available when required. To optimize perforating efficiency, it is not solely down to the perforating technique but relies extensively on the planning and execution of the well completion which includes selection of the perforated interval, fluid selection, gun selection, applied pressure differential or underbalance, well clean-up, and perforating orientation.

Although technology is available to insure good perforating in most wells, unsatisfactory perforating tends to be the rule in many areas. The three most prevalent causes for poor perforating probably are:

1. A lack of understanding of the requirements for optimum perforating.

2. Inadequate control of gun clearance, particularly with through tubing guns.

3. The rather widespread practice of awarding perforating jobs on the basis of price, rather than job quality.

Types of Perforators

- Bullet Perforators.
- Jet Perforators.
- Hydraulic Perforators.
- Mechanical Cutters – Knives and Milling Tools

Bullet Perforators

The diameter of the bullet perforators carriage is 3 ¼ in. or more, it used to perforate the inner reproduction and the rocks that resist the pressure less than 6000 pound/square node, but this method cannot be used in perforate the Christmas tree or production pipe because the diameter of the bullet perforators carriage is large but it is used in perforate the wells under drilling fluid pressure or the present of blow out preventer, therefore it is best to use method in low pressure wells.

Bullet guns 3 ¼ in. OD or larger are applicable in formations with compressive strength less than about 6000 psi. It may provide deeper penetration than many jet guns in formations with less than about 2000 psi compressive strength.

Muzzle velocity of bullet guns is about 3300 ft/sec. The bullet losses velocity and energy when the gun clearance exceeds 0.5 in., the clearance at which most comparative tests have been made Deburring of bullet holes is not dependent on decentralization if the bullet carries a deburring device. This device is more effective in deburring than using zero either selectivity or simultaneously.

Jet Perforating

This method is unique in having small measurement jet perforators container which made the use of it in the perforate of production pipe and chrisms trees, there is two sizes of jet perforators 8/21 node and 11/16 node.

An electrically fired detonator starts a chain reaction which successively detonates the prim cord, the high velocity booster in the charge, and finally, the main explosive. High pressure generated by the explosive causes the metal in the charge liner to flow, separating the inner and outer layers of the liner. Continued pressure buildup on the liner causes a needle like high speed jet of fine particles to spew from the cone at speed of about 20000 ft/sec at its tip with a pressure at this point estimated to be 5 million psi. The material used in explosion called (saiclonaet) it like T.N.T.

Water or dampness in the gun, primacard or charge may cause malfunction or low order detonation. High temperature aging of explosive in primacord or charge may reduce charge effectiveness or cause low order detonation.

Hydraulic Perforators

This method is used to make a fractured in the casing reproduction and the reproduction formation behind it by using high pressure, high injection speed hydraulic flow. This method is practically used in perforating the wells used in water injection. Action is obtained by jetting sand laden fluid through an orifice against the casing. Penetration is greatly reduced as wellbore pressure is increased from zero to 300 psi. Penetration can be increased appreciably by the addition of nitrogen to fluid stream.

Perforating Fluid:

1. Salt water or oil.

2. Acetic acid.

3. Nitrogen gas.

Selection of Perforated Interval:

The perforated interval in the production formation is chosen according to the following factors:

• Electrical, sound, radiation tentacle where this tentacle shows the limits of the oil formation.

• The formation test results while well drilling.

• The core separated from the well.

• Geological information.

When choosing the formation interval must consider the following:

• The distance of the lower end of the perforated interval from water and oil tangency level to avoid the problem of product water with oil because of the water coning phenomenon.

• The distance of the upper end of the perforated interval from gas and oil tangency to avoid the problem of product gas with oil because of the gas coning phenomenon.

• Choosing formations with high permeability and porosity and avoiding perforating shale zone.

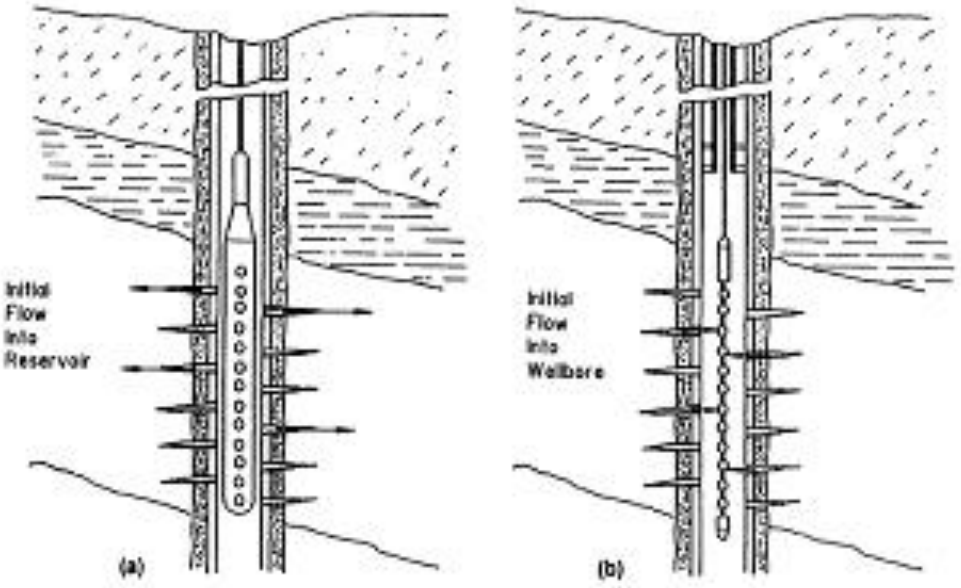
• Avoiding perforating casing connection.

• Choosing formations where it should be completed with less possible tries of setting down the bullet carriage.

• It is preferred to do the perforation process inside the well in the middle of a fluid that does not do any harm to the formation.

Factors Affecting Gun Perforating Results

1. Perforation Plugging.
2. Cleanout of Plugged Perforations.
3. Effect of Pressure Differential.
4. Effect of Clean Fluids.
5. Effect of Compressive Strength.
6. Perforation Density.
7. Cost-Perforating price.
8. Pressure and Temperature Limitations.
9. Well Control.
10. Casing and Cement Damage.
11. Need for Control of Gun Clearance.
12. Depth Measurements.
13. Oriented Perforating.
14. Penetration vs. Hole Size.


Initial
Flow
into
Reservoir
(a)
Initial
Flow
into
Wellbore
(b)