

Hydraulic Fracturing & Hydraulic Fluids

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Abstract:

The purpose of this research paper is to give a detail idea about the hydraulic fracturing and the different type of fluids which are used in this job in the oil and gas wells, where there is a big formation but having less permeability. Fracturing technique were developed more or less since the 1948s and the first fracturing job in economical way was conducted in 1949, industry modernism has radically enhanced the process, unlocking beforehand unachievable supplies of natural gas throughout the world. This research paper also gives smallest amount of criteria for the management for the hydraulic fracturing treatments. We have also some types of formulas which are used in this paper for the required job of fracturing.

Key words: Hydraulic Fracturing, Hydraulic Fluids, Permeability, Fracture Containment & Fracture Conductivity.

Introduction:

The wells in low permeability to modest permeability zones can be treated to add to their performance and this is done by hydraulic fracturing. The Hydraulic fracturing job is very costly some time it may be equal to 100% of the cost of well but it will then be necessary to optimize a particular treatment. Even

though the fracturing is always designed to gain the maximum benefits from the well and there are some problems which are of operational types and they can cause the failure in the hydraulic fracture treatment. Major challenges which are faced in hydraulic fracturing treatments are Fracture Containment and fracture conductivity.

The significant element for hydraulic fracturing job is the fracturing fluids. Major purposes of fracturing fluids are to open the fractures in the formation and the transportation of propping agent along the distance end to end of the fracture. As a result, fluid viscous properties are often considered the most vital. Some other special properties of the fluid are required for the successful hydraulic fracturing job. To show the appropriate viscosity in the fracture they must show low friction pressure while pumping, to provide good fluid for loss control, cleanup and break quickly after treatment and should be as economical as practical. The conditions of all reservoirs are different from each other such as temperature, porosity, pressure rock composition permeability and due to this reason large number of different fluids are developed to make available the properties which are maintained above.

The uniqueness of this paper as compare to others is the practical work and also observation of the data which was gain from different companies and some was also estimated due to that observations and then that data was studied in the descriptive manner to get new point from that and then it was discussed with different peoples of the oil industry and they gave a lot of extra knowledge about that and also composition and the properties of the fluids.

Literature review:

There have been a lot of studies about the hydraulic fracturing and hydraulic fluids and this job is one of the most important activities in the oil and gas industry now a days. Hydraulic

fracturing job is very costly some time it may be equal to 100% of the cost of well.

Hydraulic Fracturing:

One of the main and significant well stimulation developments is hydraulic fracturing method. J.B Clark first introduced this method in 1949 to the industry and he was the worker of Stanolind Oil & Gas Company. By the termination of 1955 a large number of these jobs were performed and this job and method has been extensive. The fracturing is mechanical method and is related to some other phenomena in which the major three are

- In water injection wells the Pressure parting.
- During drilling the loss of fluids in the formation.
- During the operations of squeeze cementing the Breakdown of formation.

If we Preceding to 1948, in study of pressure parting Dickey and Andresen (1945) had already queried this common estimation and the Walker in (1946 and 1949) who was studying the squeeze cementing and given the point that the pressures needed were mainly not as much of those of the overburden and in directed that the fracture must be vertical (Walker, 1949). Afterward Fast and Howard in the period of (1950) and, Bearden Scott & Howard all the three in the year (1953) given the statement that the total heaviness of the overstrain is not required to be lifted to bring into being horizontal fractures, as an alternative it is merely essential to lift an effective overburden, relatively a slighter pressure. Hubert in the period (1953) pointed out that usual situation of stress subversive is one of imbalanced principle stresses and in tectonically relaxed areas the least stress should be horizontal. Consequently, in many of the cases and situations the fracturing job should be able with the pressure that is less then

the overburden and furthermore the fractures that are making should be in vertical shape.

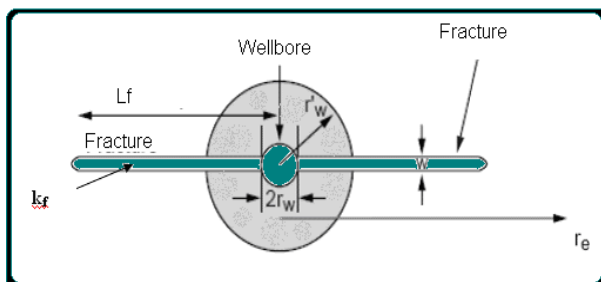


Figure: Propped hydraulic fracture geometry

The process of creating fractures in the formation rocks which are around the well bore those which have good prospective but not having good permeability. This fracturing technique is used to make a contact between the potential reservoirs to the surface. Normally in the pore spaces of subsurface rocks the oil and gas accretion occurs. In the oil bearing rocks when the well is drilled the fluids have to flow in the direction of the surrounding and to the well bore. Every formation rocks which having some potency are depending on its compaction, structures and its cementation.

The least requirement for the hydraulic fracturing treatment and it's summary is given in the underneath table:

Parameter	Oil Reservoir	Gas Reservoir
Reservoir Pressure	<70 % depleted	Two times abandonment pressure
Permeability (K)	1- 50mD	0.01- 10mD
Water Cut	<30%	<200bbls
HC Saturation	>40%	>50%
Unpleasant	>10m	>10m
Reservoir Height		
Production System	20% Extra ability	

Hydraulic Fluids:

Key purposes of fracturing fluids are to open the fractures in the formation and the carrying of propping agent along the total distance of the fracture. The worth mentioning element for hydraulic fracturing treatment is the fracturing fluids. Different types of the fluids are Water Base Fluids, Oil Base Fluids, Multiphase fluids and Additives. Each type having its own purpose and properties and are used according to their requirements. If we take the types of additives used in hydraulic fracturing processes their details are:

Types of Additives	Description of Points	Chemicals
Proppants	The purpose of props is to open fractures and gas/fluids are allowed to flow easily in well bore.	Zirconium Oxides ceramic bends, Sintered bauxite etc.
Surfactants	It is used to minimize the surface tension of the fracturing fluids thereby aiding fluids recovery.	Isopropanol, Methanol, Ethoxylated Alcohol etc.
Acids	Acids provides reachable path to formation, drilling mud previous to injection of fracturing fluids and cleanup perforation time of cement.	HCL (3%-29%) or Muriatic acid.
Corrosion inhibitors	It minimizes the formation of rust on steel tubing, tools used in well, well casings, etc.	Methanol ammonium Bisulfate for Oxygen scavengers and etc.
Iron controls	It is used to stop precipitation sulfate and carbonates that can plug off our formation.	Ethylene glycol, ammonium chloride etc.
Clay Stabilizers Control	To avoid swelling and the migration of formation clays that can block the pore space and due to that the permeability can be reduced.	Salts (KCL, Tetramethyl ammonium Chloride etc.)

Some other types of additives are Breakers, Bactericides or Biocides, Buffer, cross linkers, Gelling Agents and solvents. Each and every additive has its own purpose and importance.

Link of Hydraulic fracturing and Hydraulic Fluids:

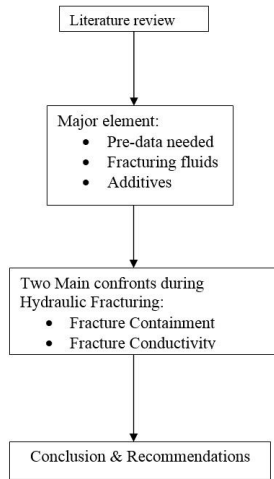
When the fracturing job is done by injection of Fracturing fluids and the flow is upturned to produce the well, then the pressure

will slowly return turn down to reservoir pressure. Normally the fracturing has proved very successful in limestone, dolomites and sands. The stretchy nature of soft shale and clays makes them complex to fracture.

Methodology:

The methodology of Paper is clear in figure which is given below. The study starts with introduction and then the literature review. Literature review helps to recognize key fundamentals of hydraulic fracture treatment or job. It gives us the complete information that is required for hydraulic fracturing, fracturing fluid, and types of additives. Like all treatments there are challenges linked with the hydraulic fracturing process. Target of the study is to recognize challenges, most often meet in fracturing. For appropriate recognition of the major challenges and sources responsible for that a sequential methodology used that are:

- In beginning of the research we identified the major problems in the hydraulic fracturing job through the literature review. The gives the brief study of the problems that are related to the failure of the job.
- In this step we taken the permeability ranges of 5md and 100md for the matrix acidizing decision table.
- In the final step result and the recommendations which were observed from our study.



Matrix Acidizing Decision table:

When Permeability range is 5md:

Preferred Penetration	Range of Permeability	Injection Pressure and rate
0.5 ft	0.56bbl/min/ft	26,799 psi
1.0 ft	1.7bbl/min/ft	117008 psi

When Permeability range is 100md:

Preferred Penetration	Range of Permeability	Injection Pressure and rate
0.5ft	0.25bbl/min/ft	625 psi
1.0 ft	0.76bbl/min/ft	2710 psi
5.0ft	14.2bbl/min/ft	94,000 psi

Results:

The research paper gives a techniques being used in industry to control the above and below fracture height growth and to keep hold of fracture conductivity. Has these are two main challenges that are faced by the oil industry to gain a successful hydraulic fracturing treatment. These both are operational troubles and being faced onsite.

Recommendations:

- Before the designing and implementation of the treatment the information of the stress and modulus difference that is so important must be known.
- The fluids that are used in the fracturing treatments must be intended to keep the density of the fluid lesser than the fracture gradient of the neighboring deposits.
- We must be aware about the fracture closure stress earlier than designing and performing the treatment.
- To avoid the use of breakers and polymers the newly made fracturing fluid Visco Elastic surfactant (VES) should be used.

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