

The Oilfield Jumble



Volume 2 – Well Completion

In previous volume we discussed about the Exploration phase of an oilfield. In this volume we will discuss about the Development and Production phase.



Figure 1 A production platform complex from Vietsov Petro

At the start of the development phase, a drilling rig will position itself at the most optimum location in the oilfield, and drill many development wells. These development wells are usually drilled at high angle to increase the contact area with the reservoir.

All drilling, logging, casing and cementing processes etc... are done in a similar fashion with the (previous) exploration wells. The difference, is that operations in these wells are usually minimized to reduce cost.

When the final (total) depth is reached, the completion process starts, to ready the well(s) for production. Typically there are two types of completion: barefoot completion, and perforated casing/liner completion.

1. Barefoot completion: for well with very hard or consolidated formation. The hard formation help to maintain the borehole shape even when under production. Many wells offshore Vietnam are drilled into the basement of granite rock and as such have barefoot completion.
2. Perforated casing/liner completion: this is a more common method. The wellbore across the

oil and gas reservoir is cased by casing or liner, and then punched by perforation gun.

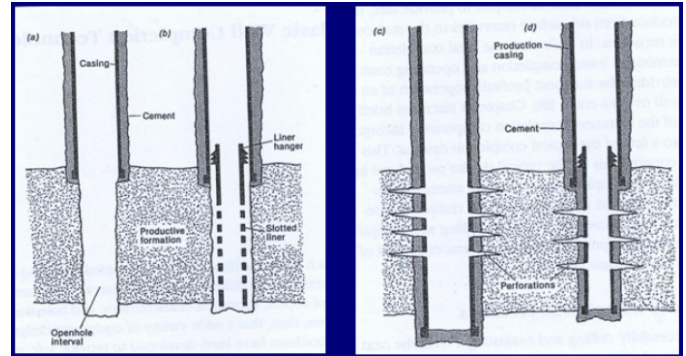


Figure 2 Different type of completion: (a) barefoot completion, (b) slotted liner, (c) perforated casing and (d) perforated liner

There are several ways to allow oil and gas to enter the wells:

- Barefoot completion.
- Slotted liner: liner was built with hole or slot from the factory, allowing fluid entry from the outside into the well.
- Screen: the casing is built like a mesh.
- Casing/Liner Perforation: using perforation gun to punch the casing/liner.

After the casing/liner is set in place (and/or perforated), it is time to run the completion string into the well.

Completion equipment includes surface and downhole equipment.

Surface equipment include well head equipment and Xmas tree.

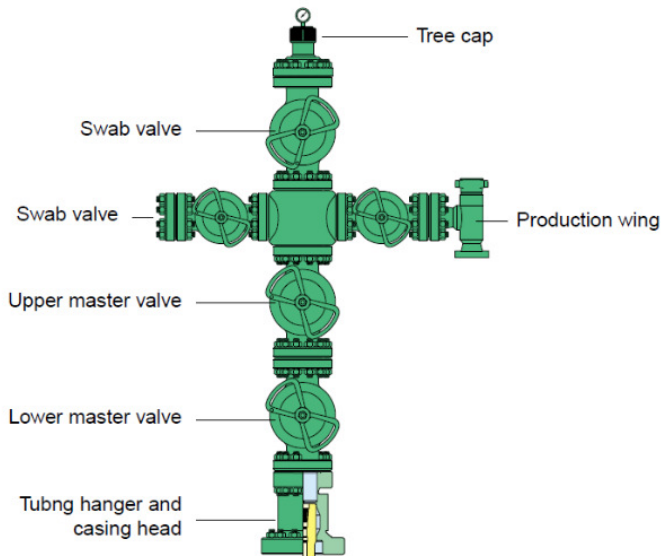


Figure 3 A typical well completion Xmas tree

Downhole completion equipment includes various type and functionality, some common equipment are listed below:

- Production tubing.
- Liner/tubing hanger.
- Perforating gun.
- Safety valve, downhole controllable valve.
- Plug and packer.
- Downhole pump.
- Downhole remote sensors.
- Gravel pack, screen...
- And many more

Well completion program and completion string must have been prepared well in advance before drilling. The completion string would be designed to maximize the oil and gas production, at the same time allow future work or intervention to be done easily.

Single or dual/triple completion

- **Single completion:** a single completion string is installed in the well.
- **Dual/triple completion:** two or three completion strings are installed in a single well, to allow for selective producing from different zone of the reservoir.

Single completion is simple, cheap and easy to install. However it would be impossible to control the inflow of reservoir fluid if there are more than one reservoir fluid entry into the well.

Dual or triple completion allows for selective producing. It would make it very easy to shut off the undesirable zone (for example, zone that is producing too much water). However it is more expensive, difficult to install and repair in the future.

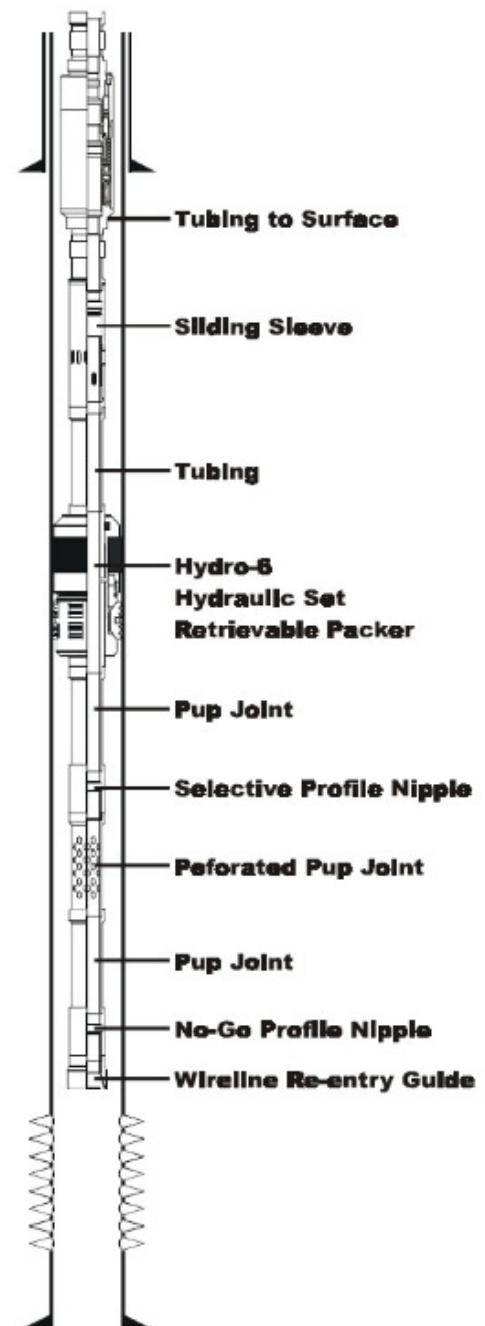


Figure 4 Typical equipment in a single completion string

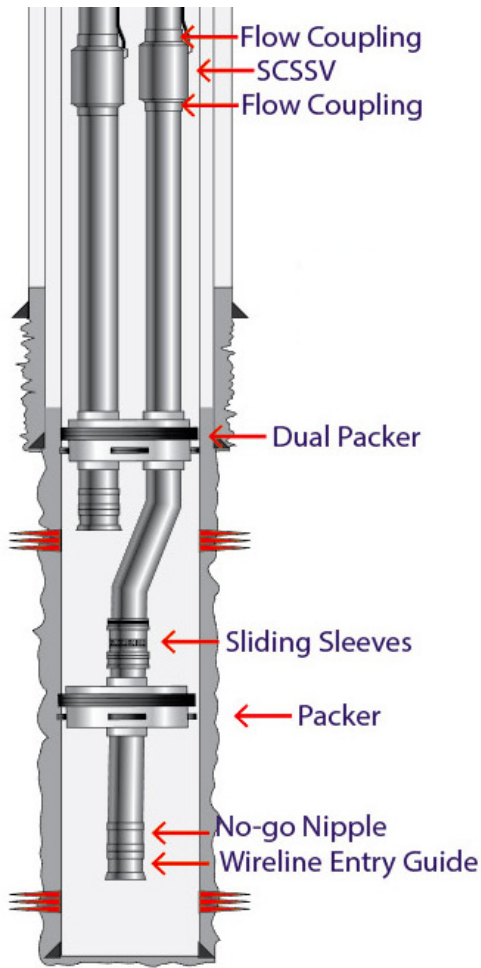


Figure 5 A well with dual completion string, allowing producing from two different reservoirs

Once all wells have been drilled and completed, the drilling rig will leave and production equipment are installed on the platform, getting ready for the production. All supporting equipment (pipe, flare, storage tank FPSO etc...) will also be setup nearby and connected to the platform.

Artificial Lift

Oil and gas from the reservoir usually don't come up the well naturally. It is normally necessary to perform "Artificial Lift", using various methods to bring the oil and gas from downhole up to the surface. Two of the common artificial lift methods:

- Gas lift: the inside of the production tubing is replaced with gas, usually CO₂. When the well is open, the low pressure at the well head let the gas inside the tubing to go up to surface, at the same time "lifts" the downhole oil and gas up.
- Using pump installed from downhole completion string.

Producer and Injector wells

Producer wells: oil and gas are produced from these wells.

Injector wells: not every wells on a production platform are producer wells. Often, one or more wells on a platform will be used as injector wells. Water or gas is pumped down these injector wells, and flows into the reservoir at the water aquifer, or the gas zone. This helps maintaining the pressure in the reservoir as the well produces, allowing more oil (or gas) entry into the producer wells.

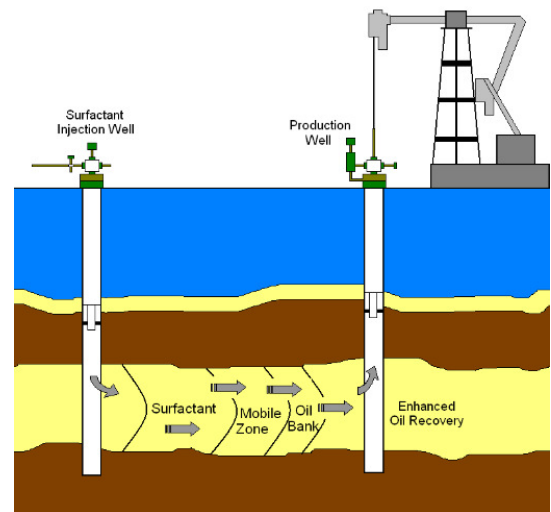


Figure 6 Injector (left) and Producer (right) well

During the lifetime of a production platform, producer and injector wells may swap, depending on the condition of each well and the overall condition of the oilfield.

Well Work Over and Well Intervention

When the production rate is not as expected, or when there is problem with the well(s), it will be necessary to re-enter the well and perform repairs, and to try and increase production level. These steps are called **Well Intervention** and **Work Over**.

Well Stimulations / Production Enhancement

These are part of the Well Intervention process, when additional work on the well is done to increase the production levels. Depending on the type and condition of the reservoir, and the type of the completion, there will be different method of well stimulation and production enhancement.