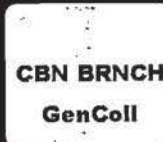


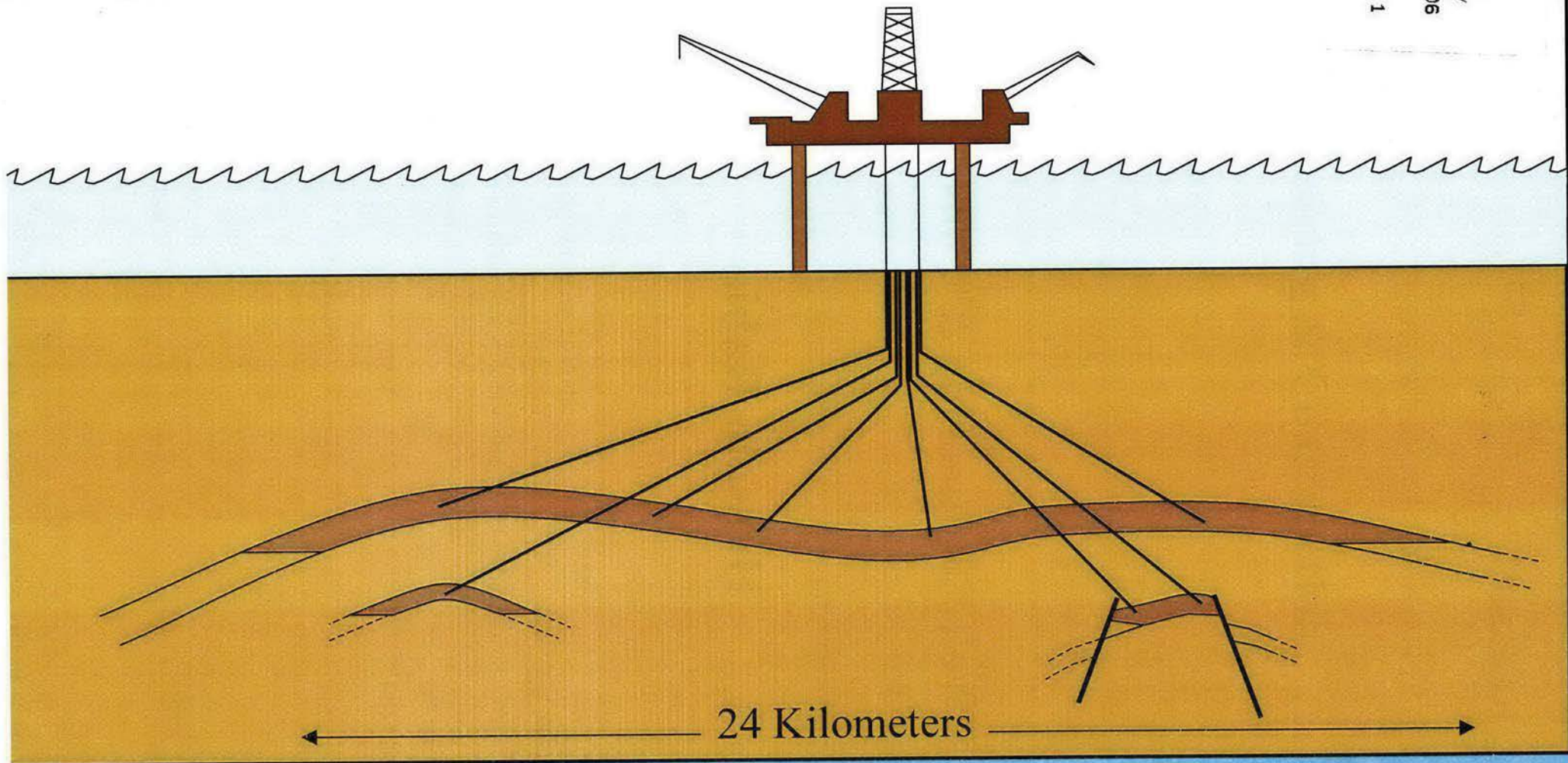
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- - Downward jarring is limited in highly deviated wells
- - Reliability is an issue (newer sealing materials may reduce problem)
- - Requires up to 1900 lbs to move sleeve
- - Seal failure due to sand

7.14.2 External Casing Packer

External casing packers (ECP's) (Figure 12.18) have long sealing elements (up to 40') and afford a seal in the open hole.

Inflatable external casing packers can be run on slotted pipe or wire-wrapped screen type liners. Once inside the hole, to inflate the ECP, a combination tool is located across the port, shearing the break off plug and fluid pressure is then applied. A typical inflation pressure is 1250 psi

Inflation fluids can be:

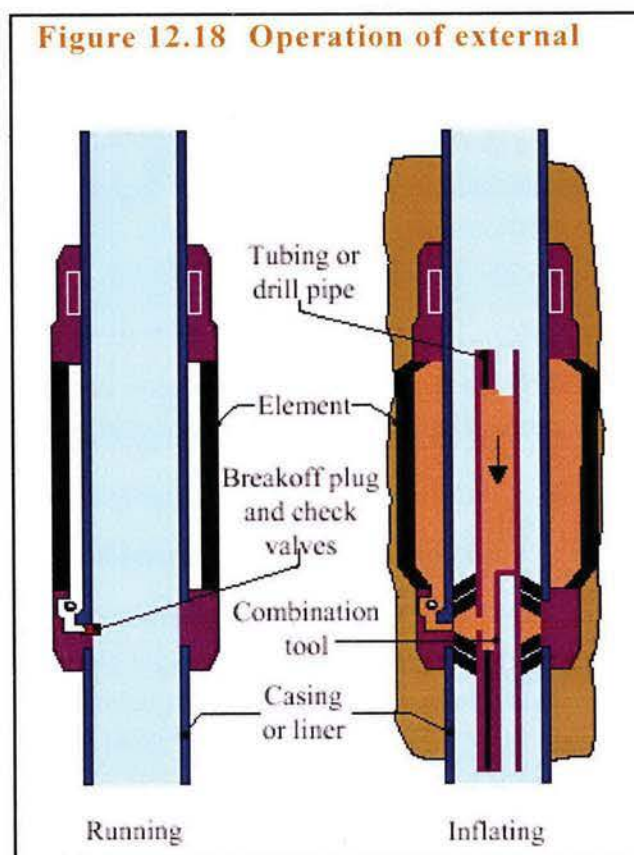
- Drilling fluids
- Completion fluid
- Cement
- Epoxy is proposed for future use

Advantages

Ability to seal and isolate in open hole

Disadvantages

The main disadvantage of an ECP is its reliability. Reliability depends on:



1. Unsealed roller bearing
2. Air bit
3. Sealed roller bearing
4. Sealed roller bearing with gauge protection
5. Sealed friction bearing
6. Sealed friction bearing with gauge protection
7. Special features - category now obsolete.

As an example a code of 1-2-1 indicates (**Figure 15.6**):

1. long, slim and widely spaced milled tooth bit
2. medium soft formations (if this number was 4, then it is hard soft formation)
3. non-sealed bearings

(see also **Figure 15.8**)

6.0 Polycrystalline Diamond Compact (PDC) Bits

6.1 Design Factors

A polycrystalline diamond compact (PDC) bit employs no moving parts (i.e. there are no bearings) and is designed to break the rock in shear and not in compression as is done with roller cone bits. Rock breakage by shear requires significantly less energy than in compression, hence less weight on bit can be used resulting in less tear and wear on the rig and drillstring.

A PDC bit employs a large number of cutting elements, each called a PDC cutter. The PDC cutter is made by bonding a layer of polycrystalline man-made diamond to a cemented tungsten carbide substrate in a high pressure, high temperature process. The diamond layer is

Cutter orientation is described by back rake and side rake angles. Back rake is the angle presented by the face of the cutter to the formation and is measured from the vertical, see [Figure 15.12](#).

The magnitude of rake angle affects penetration rate and cutter resistance to wear.

As the rake angle increase, ROP decreases but the resistance to wear increases as the applied load is now spread over a much larger area.

Small back rakes take large depths of cut, are therefore aggressive, generate high torque, and are subject to accelerated wear and greater risk of impact damage. High back rake is the reverse.

Back rake angles vary between, typically, 15° to 45° . They are not constant across the bit, nor from bit to bit.

4. Side Rake ¹

Side rake is an equivalent measure of the orientation of the cutter from left to right. Side rake angles are usually small. The side rake angle assists hole cleaning by mechanically directing cuttings toward the annulus.

5. Cutter Shape

The edge of the cutters may be bevelled or chamfered to reduce the damage caused by impacts.

6.2.3 Bit Geometry

The factors affecting bit geometry include:

1. Number of Blades

Using the same analogy for roller cone bits, a PDC bit designed for soft rocks has a fewer blades (and cutters) than one designed for hard rocks.