MOSUL UNIVERSITY
PETROLEUM & MINING ENGINEERING COLLEGE
3RD STAGE

OIL WELL CEMENTING - 2

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Primary Cementing Techniques

1. Single stage cementation
2. Multi stage cementation
3. Liner cementation

Single Stage Cementing

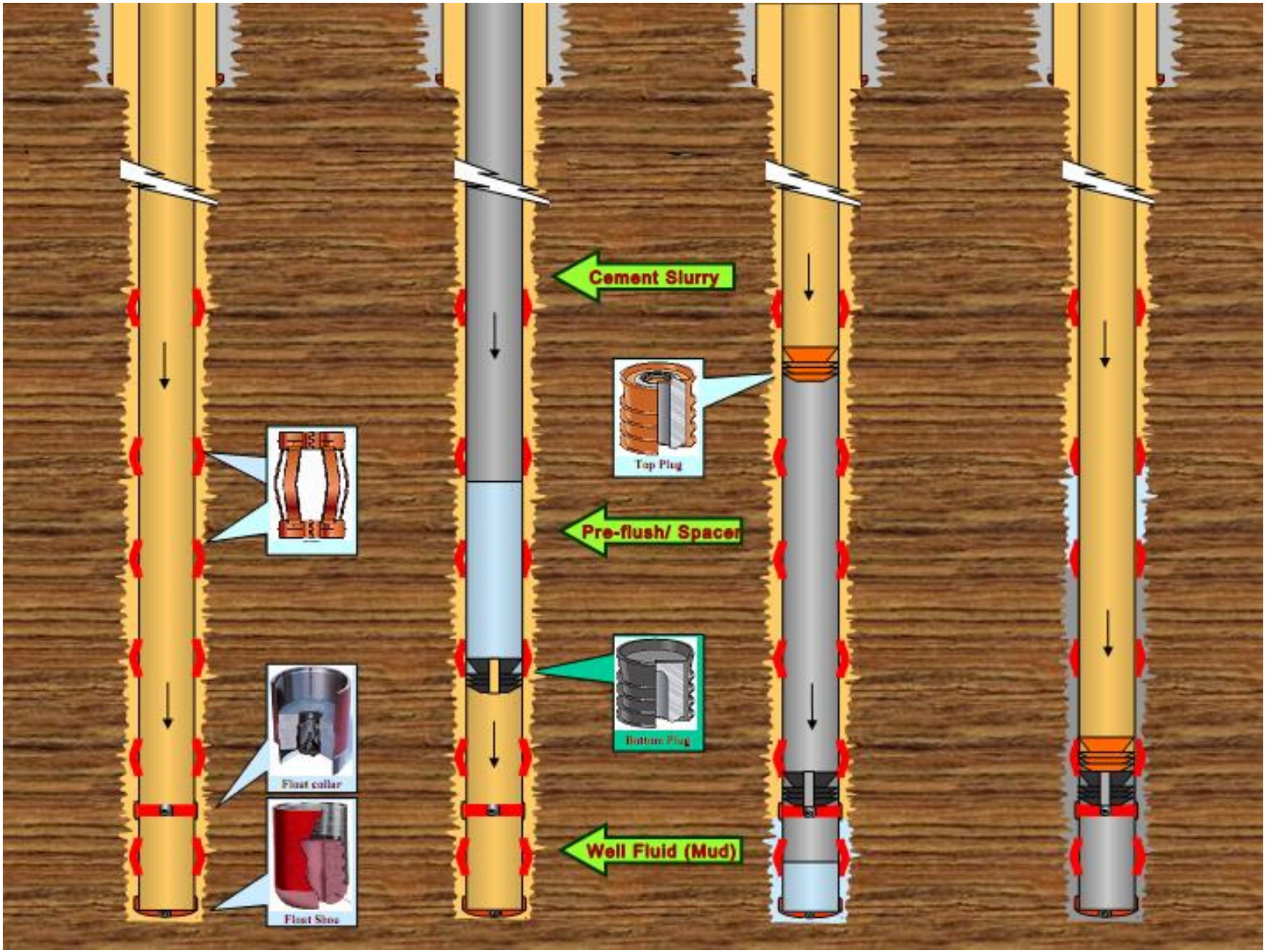
It is the Most common technique

Normally accomplished by pumping one batch of cement down the casing between two rubber plugs.

The bottom plug is placed in the casing, followed by cement slurry.

When the batch of cement has been pumped into the casing, a top plug is released.

The top plug is pumped down until it lands on the top of float collar, thus completing the cement job.

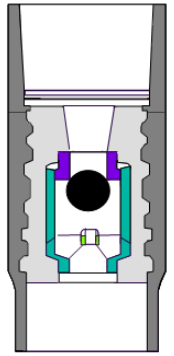

Cement Slurry
Top Plug
Pre-flush/ Spacer
Bottom Plug
Float collar
Float Shoe
Well Fluid (Mud)

Casing and Cementing Hardware:

1. **Guide shoes:** A guide shoe is used to guide the casing through the hole, avoiding jamming the casing in washed-out zones, or in deviated wells.

Float shoe: spring loaded (Halliburton)

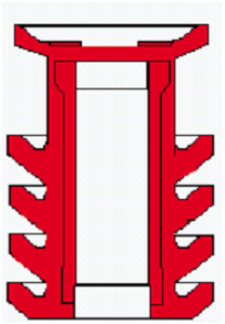
2. **Float Collars:** A float collar is a one way valve placed at one or two joints above the shoe.

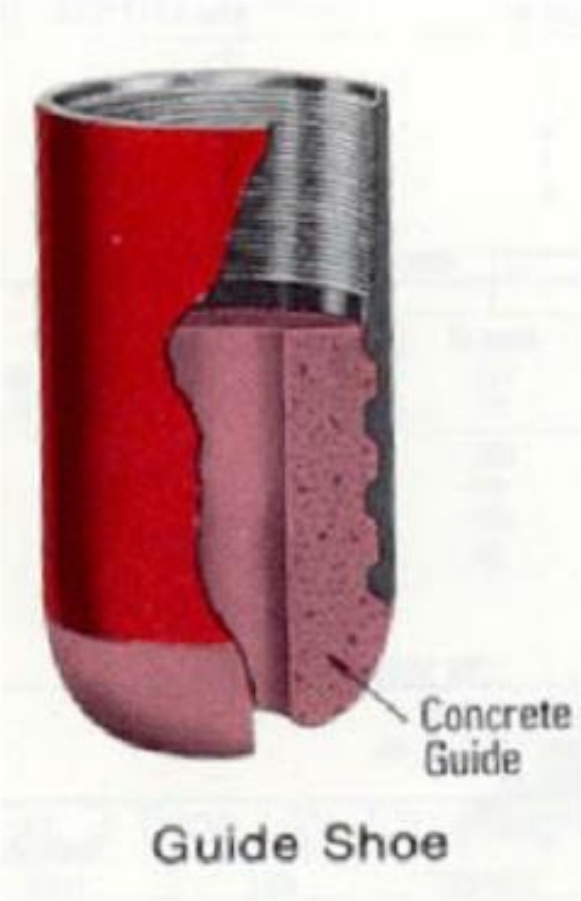


3. **Baskets and Centralisers:** These are used to centralise the casing within the hole to improve the cementing process.

4. **Cement Plugs:** The main functions of cement plugs are, Separate mud from cement

5. **Multi-Stage Collar:**





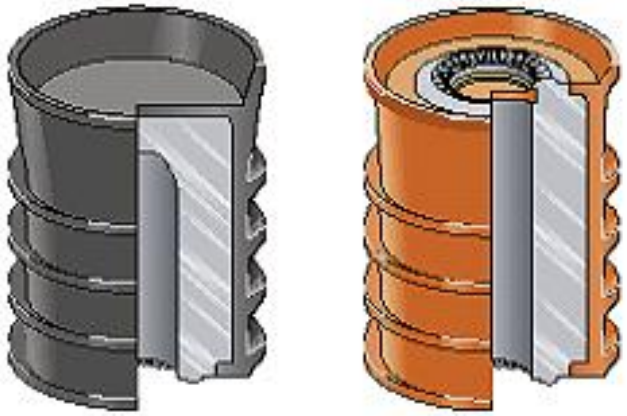
Guide Shoe

Guide Shoe

Float Collar

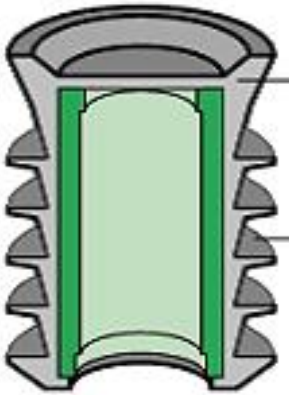
Rubber Plugs

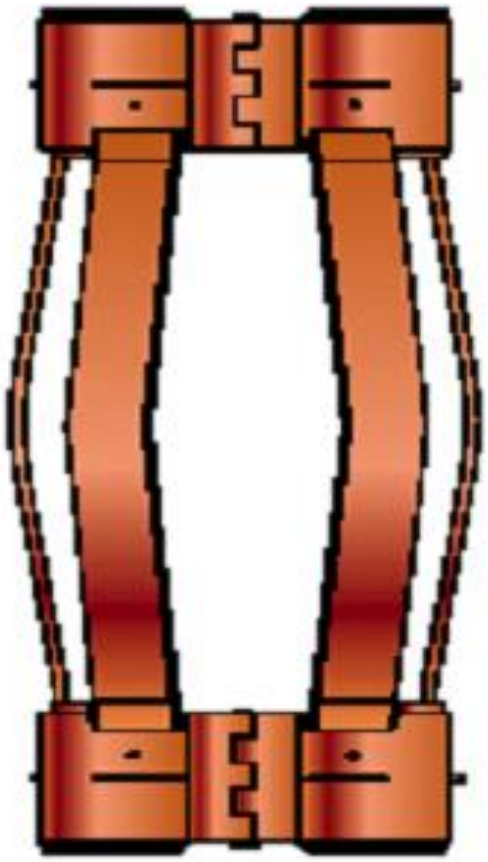
Top plug



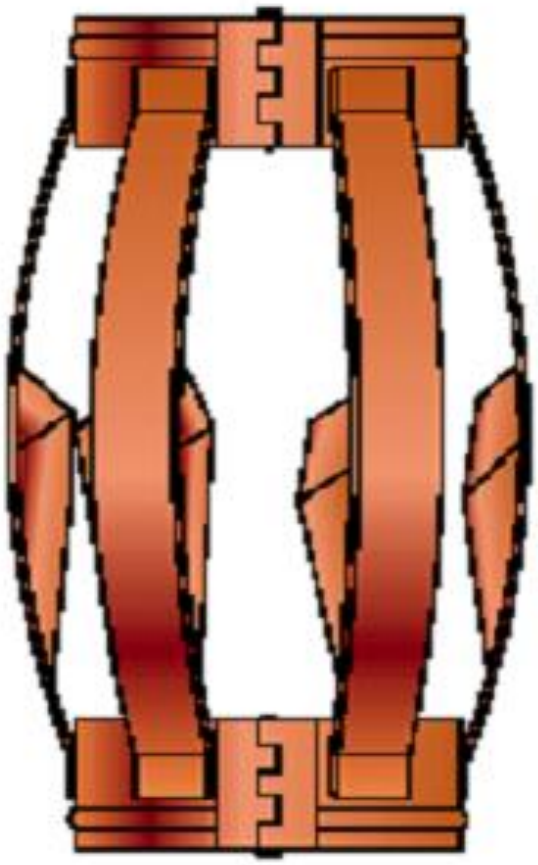
Halliburton Nonrotating (NR) Cementing Plugs

Bottom plug





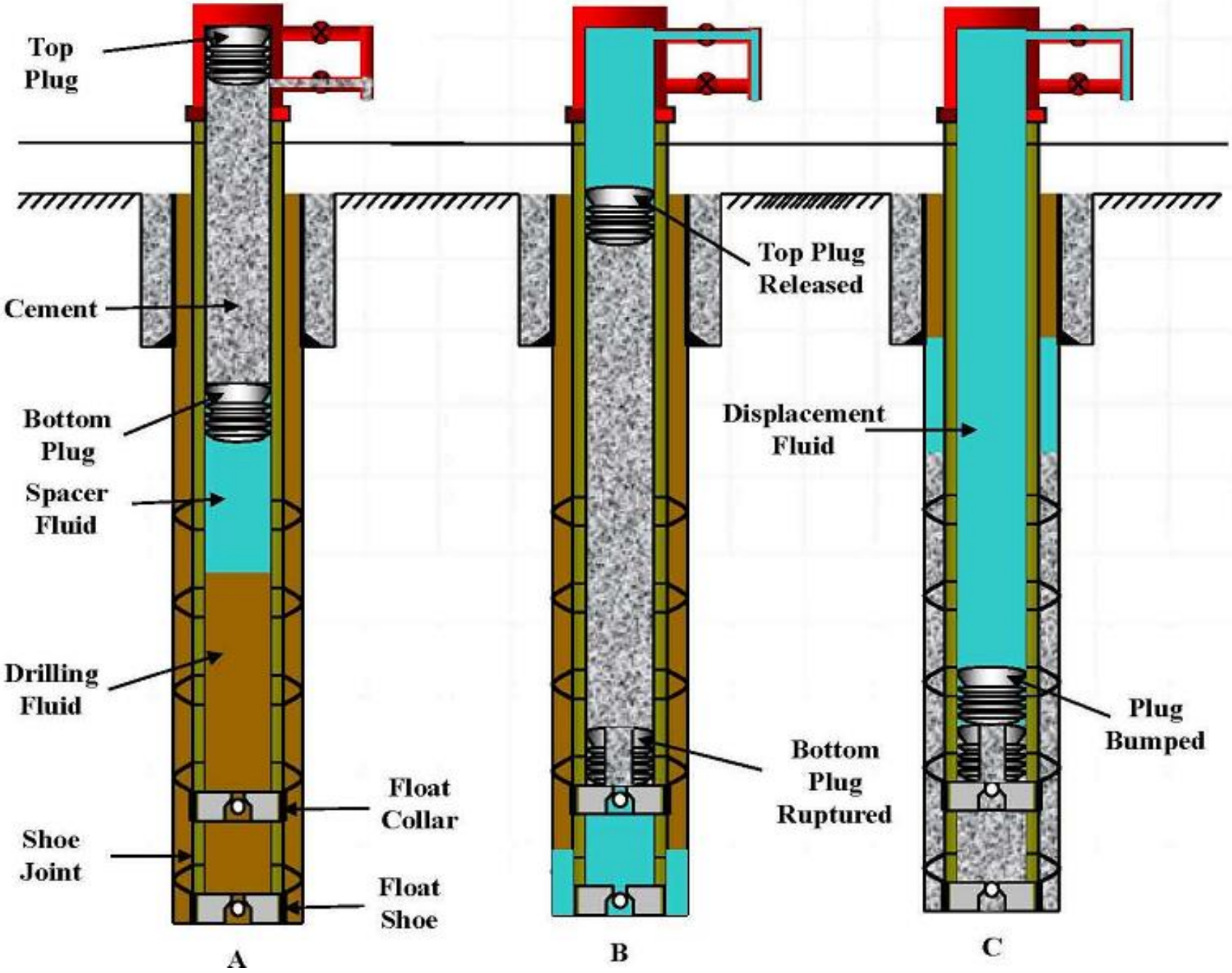
Halliburton
Nonwelded Bow-Spring
Centralizer



Halliburton
Welded Centralizer
with Turbofins

CEMENTING PROCESS

- Bottom rubber wiper plug is released to minimize cement contamination from drilling fluid.
- Spacer fluid (or mud pre flush) may be pumped also.
- Desired volume of slurry is pumped
- Top wiper plug is released
- Drilling fluid displaces the top plug down the casing
- When bottom plug reaches the float collar, its diaphragm ruptures.
- The whole cement slurry has been fully displaced when the top plug bumps the bottom plug.


Top Plug
Cement
Bottom Plug
Spacer Fluid
Drilling Fluid
Float Collar
Shoe Joint
Float Shoe
A
Top Plug Released
Bottom Plug Ruptured
B
Displacement Fluid
Plug Bumped
C

Stage Cementation: Reasons

a.Down hole formations unable to support hydrostatic pressure exerted by a long column of cement

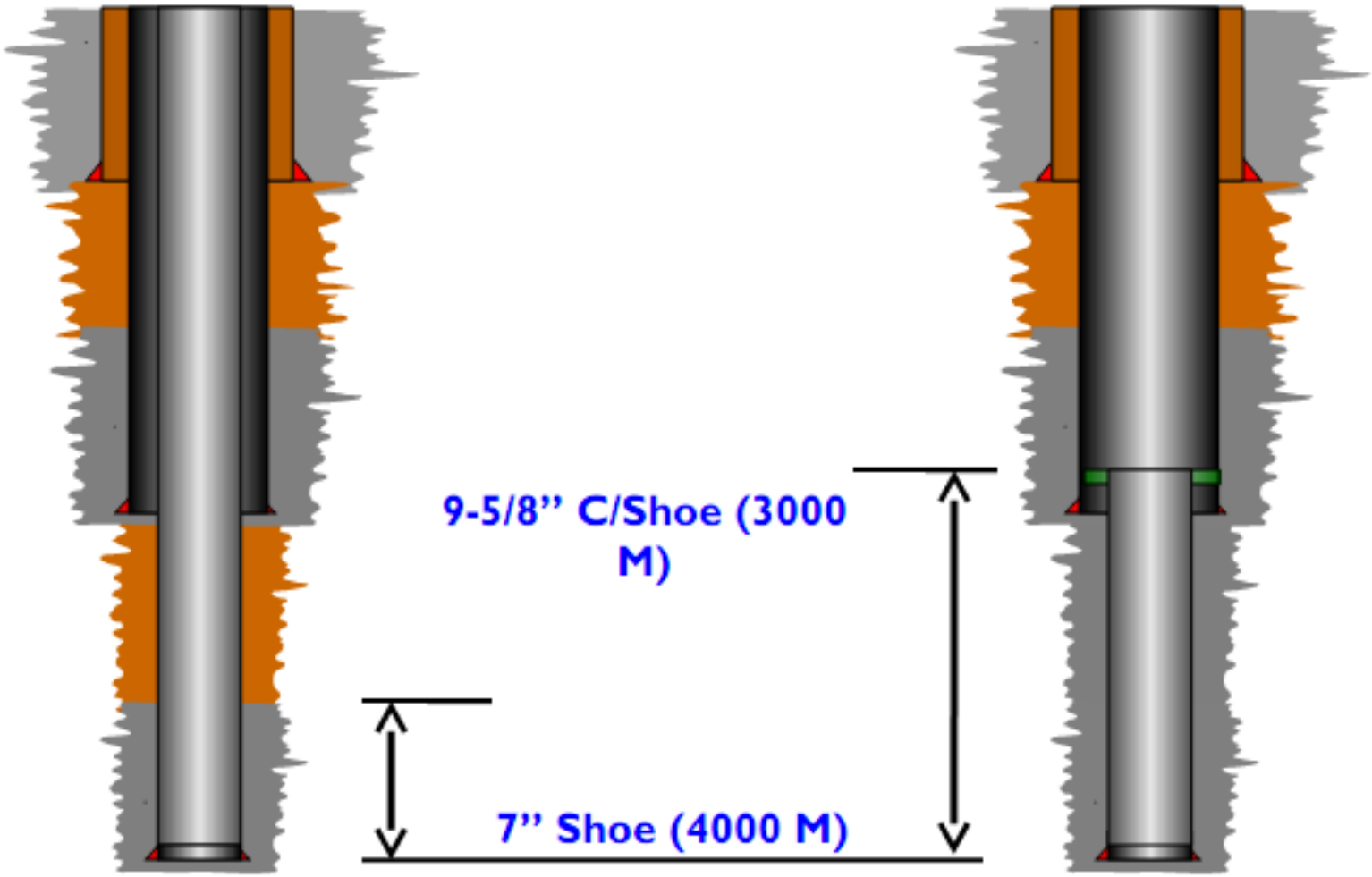
b.To cement wells having two or more zones of interest separated by long intervals

c.Limitations of cementing equipments

d.Cementing of high pressure gas zones & water producing horizons.

Liner Cementation

A liner is a standard string of casing, which does not extend all the way to surface, but is hung off inside the previous casing string.



Secondary Cementation

Any Cementing operation other than Primary Cementing Operation (Casing/ Liner Cementation) is referred to as **"Secondary Cementation"**

Types:

- → **Plug Cementing**
- → **Squeeze Cementing**

Plug Cementing

A cement plug of a specified length is placed across a selected interval in an open or a cased hole. The cement is normally pumped through open-ended drill pipe or tubing.

Reasons for setting a cement

1. To stop lost circulation during drilling.
2. Directional drilling and side tracking.
3. To plug back a depleted zone.
4. Abandonment.
5. To provide anchor for open hole test tool.

Plug Job Application

Directional Drilling & Side-tracking

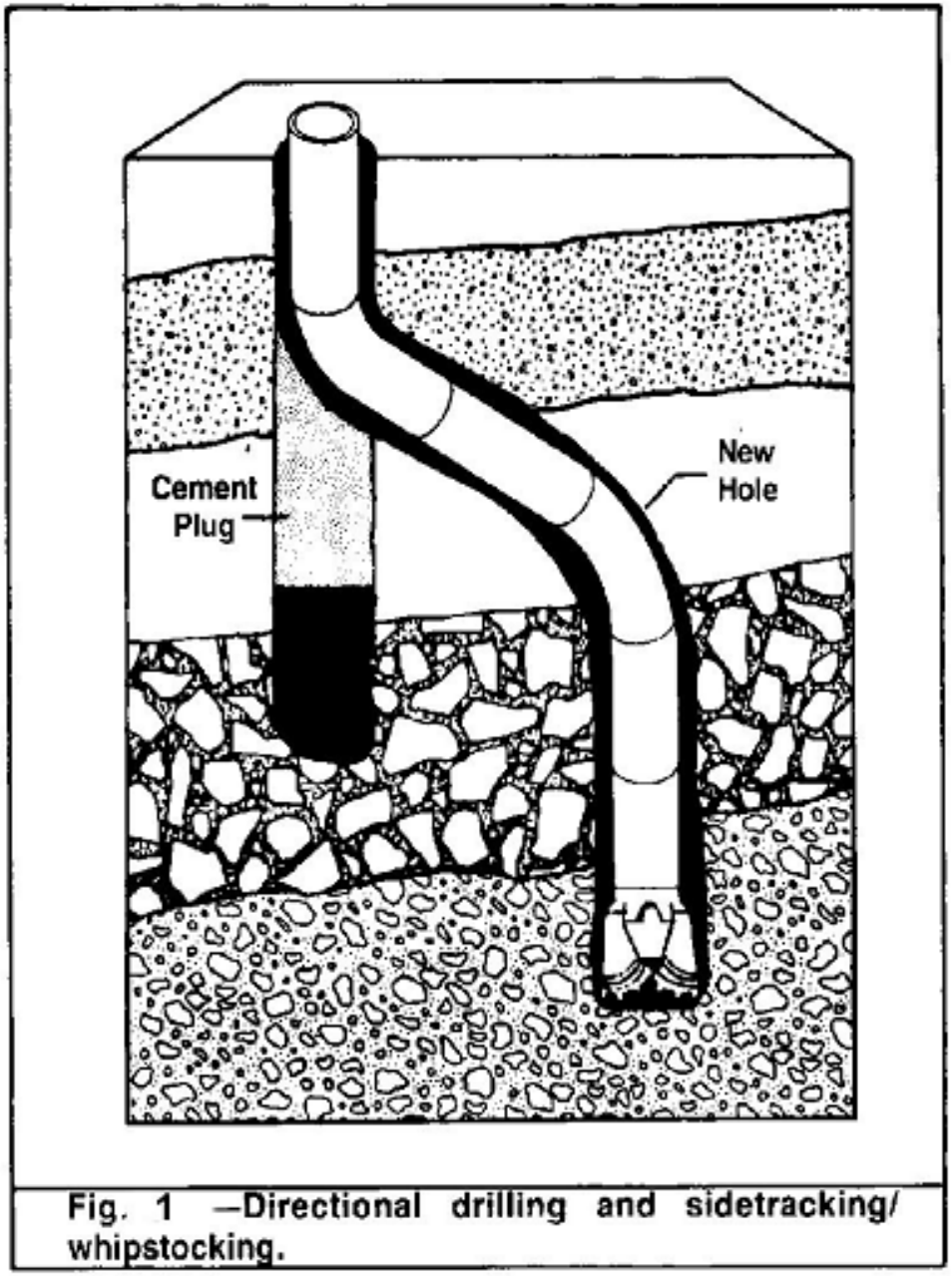


Fig. 1 —Directional drilling and sidetracking/ whipstocking.

Plug Job Application

Stopping Lost circulation

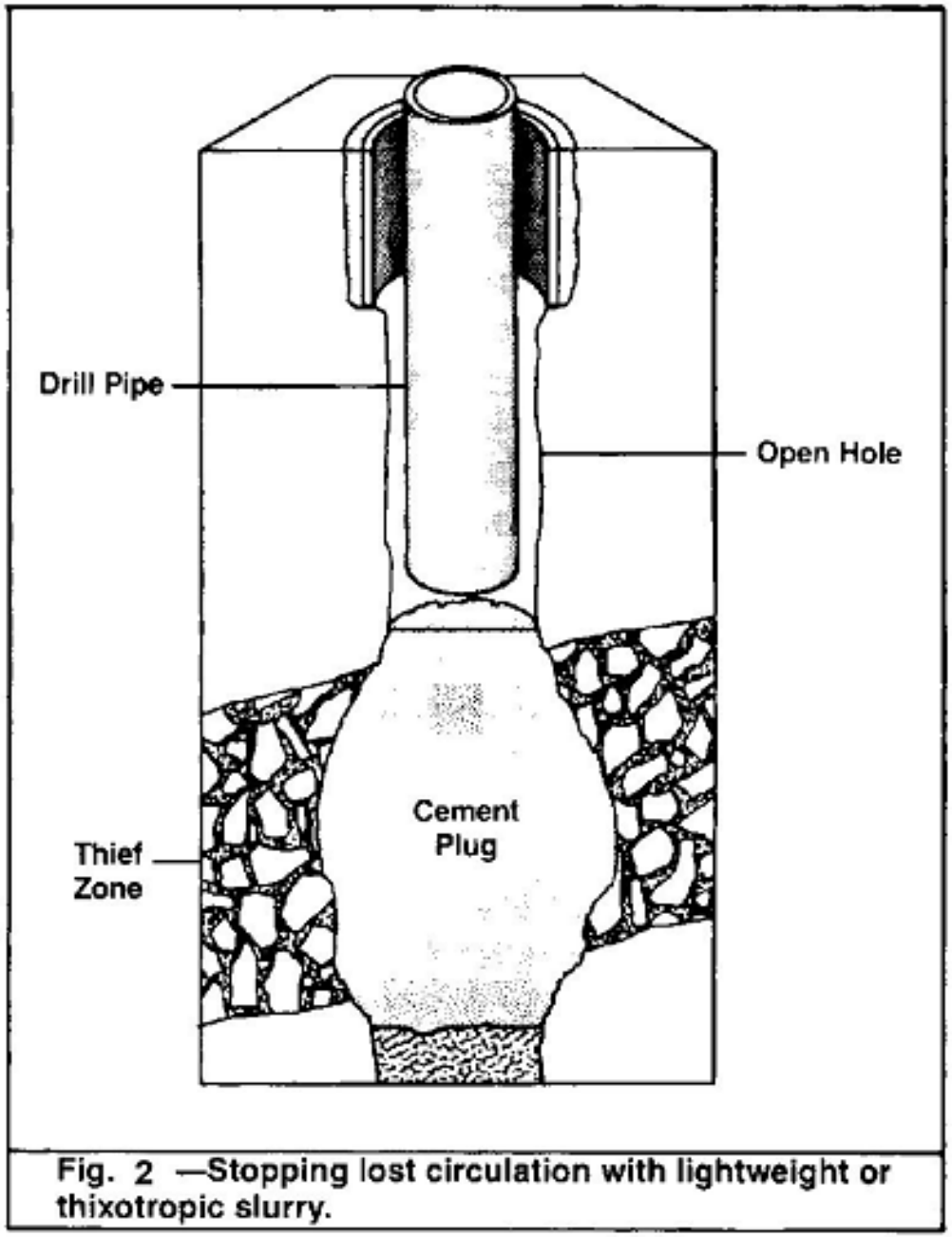


Fig. 2 —Stopping lost circulation with lightweight or thixotropic slurry.

Plug Job Application

Zonal Isolation

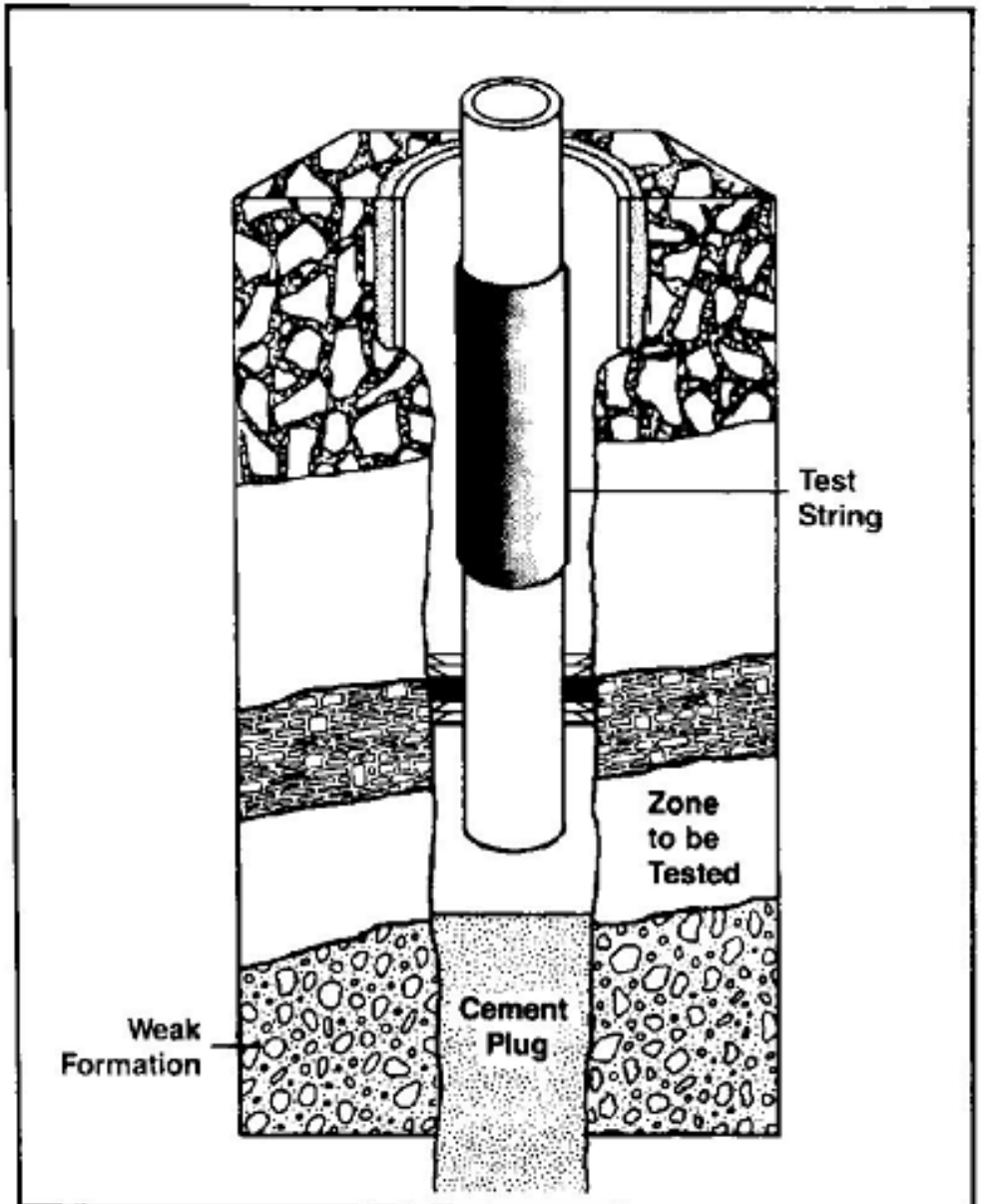


Fig. 3 —Zonal isolation.

Plug Job Application

Abandonment

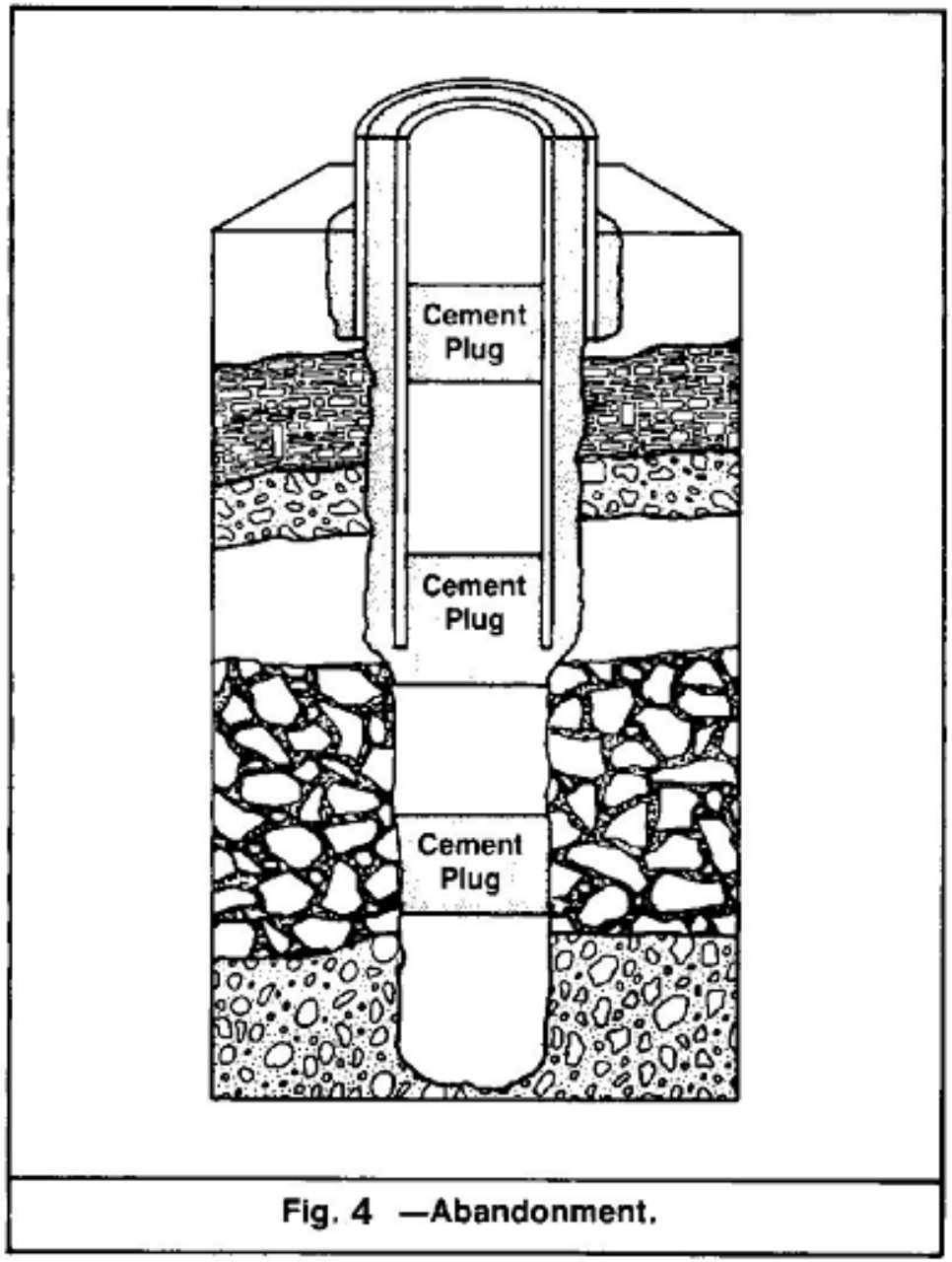


Fig. 4 —Abandonment.

Squeeze Cementing

The most common remedial method used

The slurry is forced by pressure to a specified point in the annulus to cause a seal at the point of squeeze.

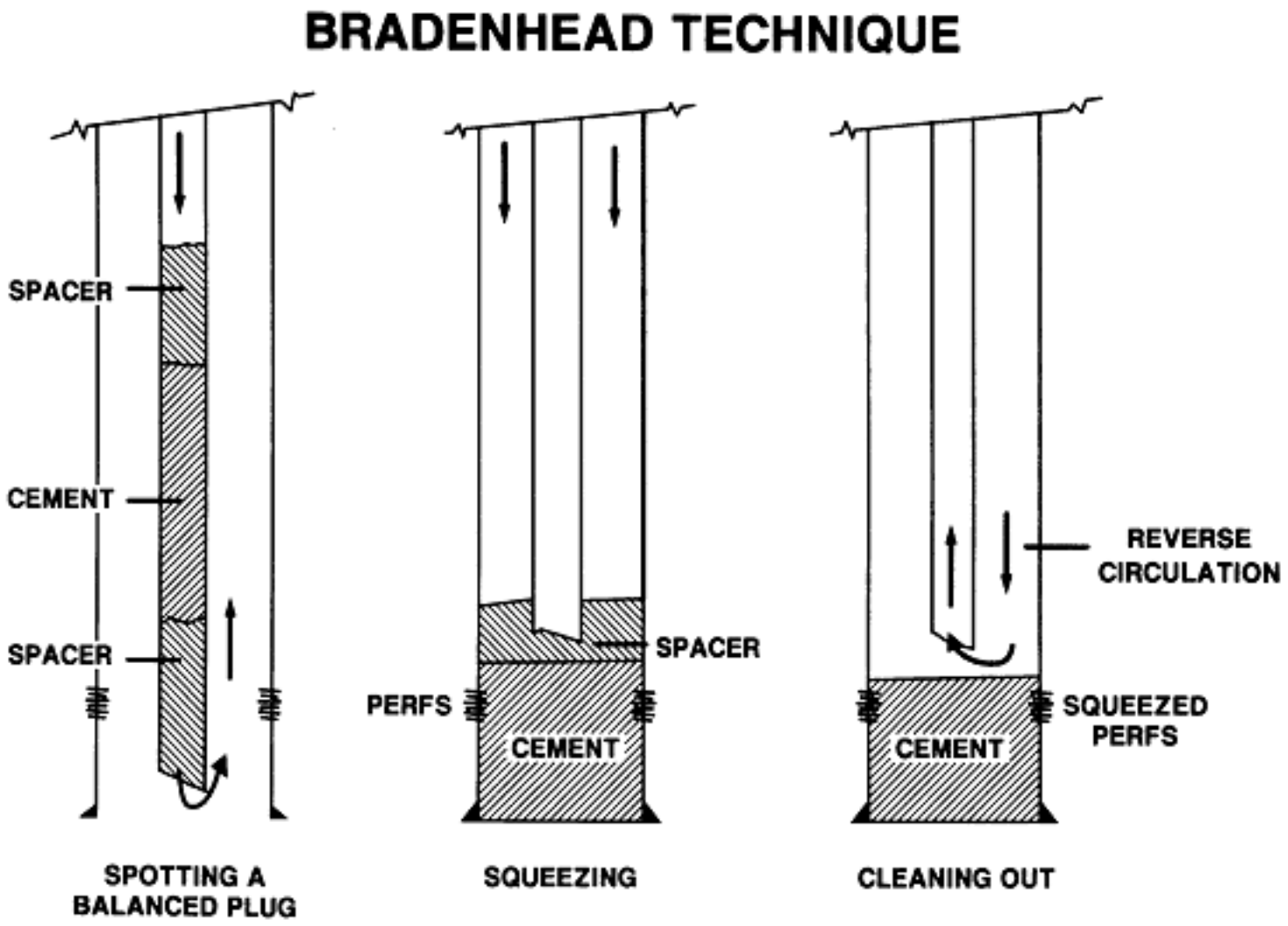
SQUEEZING TECHNIQUES

1. BRADENHEAD.
2. PACKER SQUEEZE.

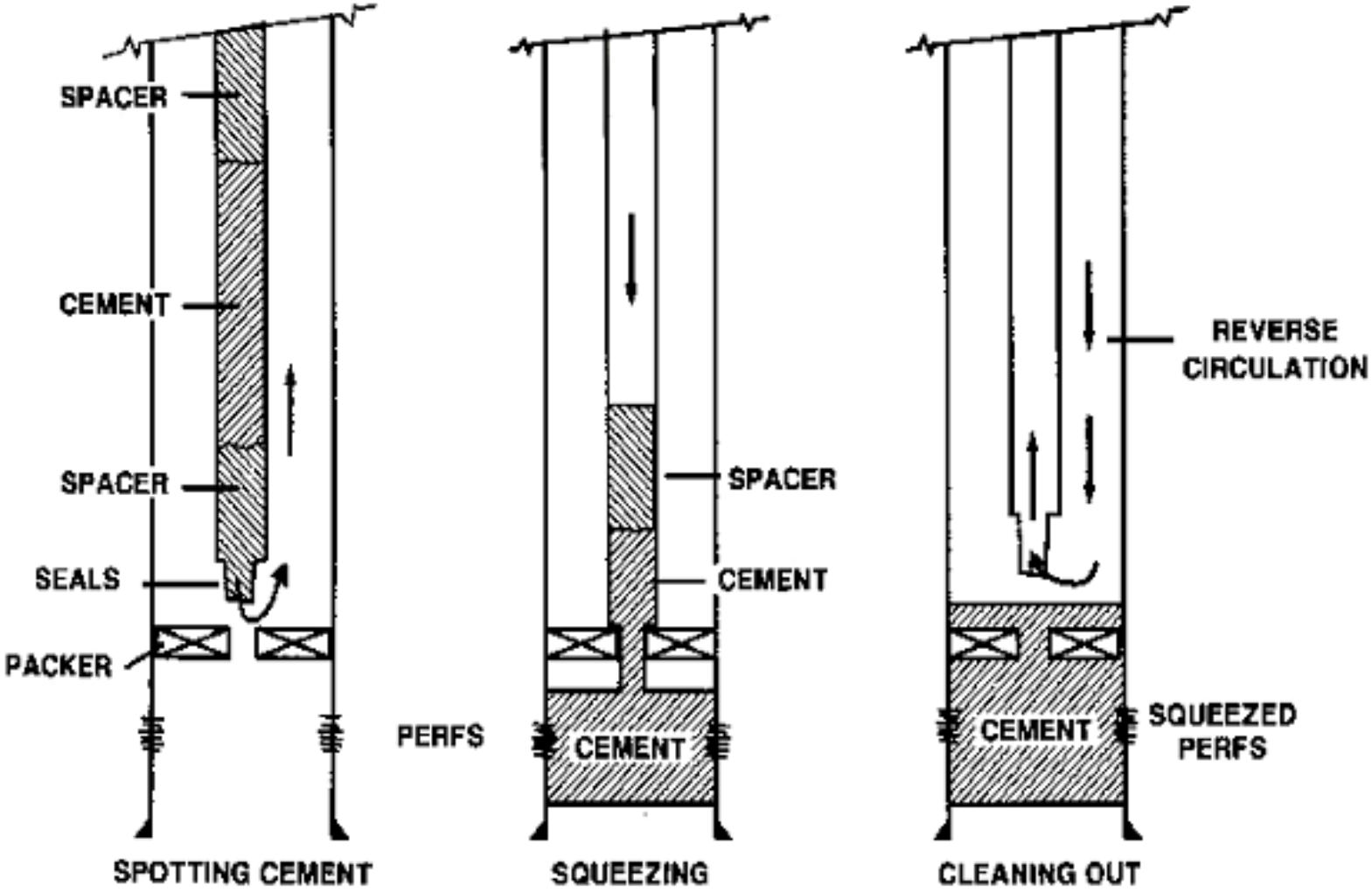
CLASSIFICATION BY PRESSURE

1. LOW PRESSURE SQUEEZING.
2. HIGH PRESSURE SQUEEZING.

Squeeze Techniques



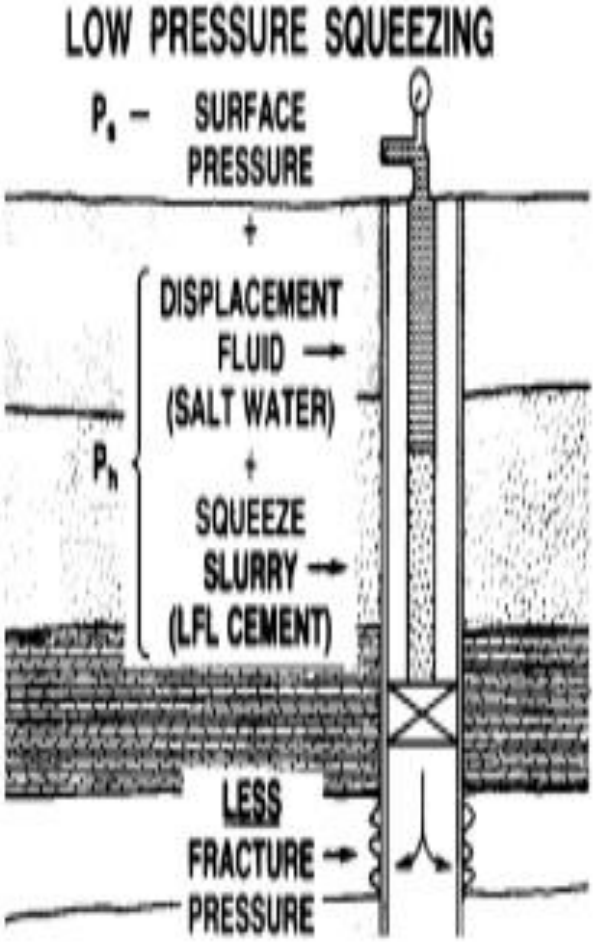
Squeeze with Packer (Cement Retainer)



CLASIFICATION BY PRESSURE

LOW PRESSURE SQUEEZING

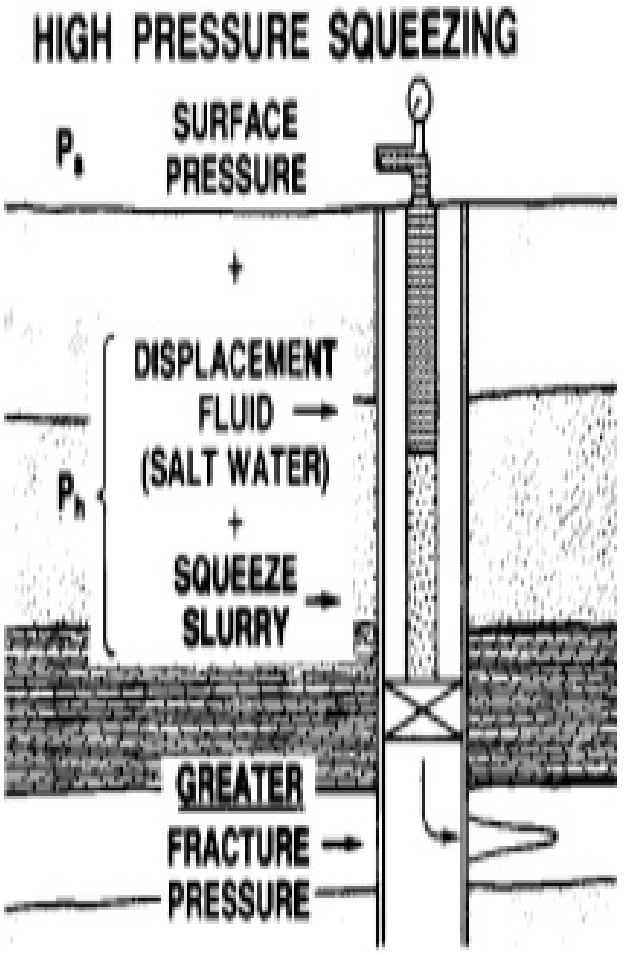
- → Injection pressure < formation fracture pressure
- → Cavities and interconnected voids filled with dehydrated cement
- → Volume of cement small
- → Perforation and channel clear of mud and other solids
- → Small node of cement filter cake with properly designed slurries
- → Highest success rate



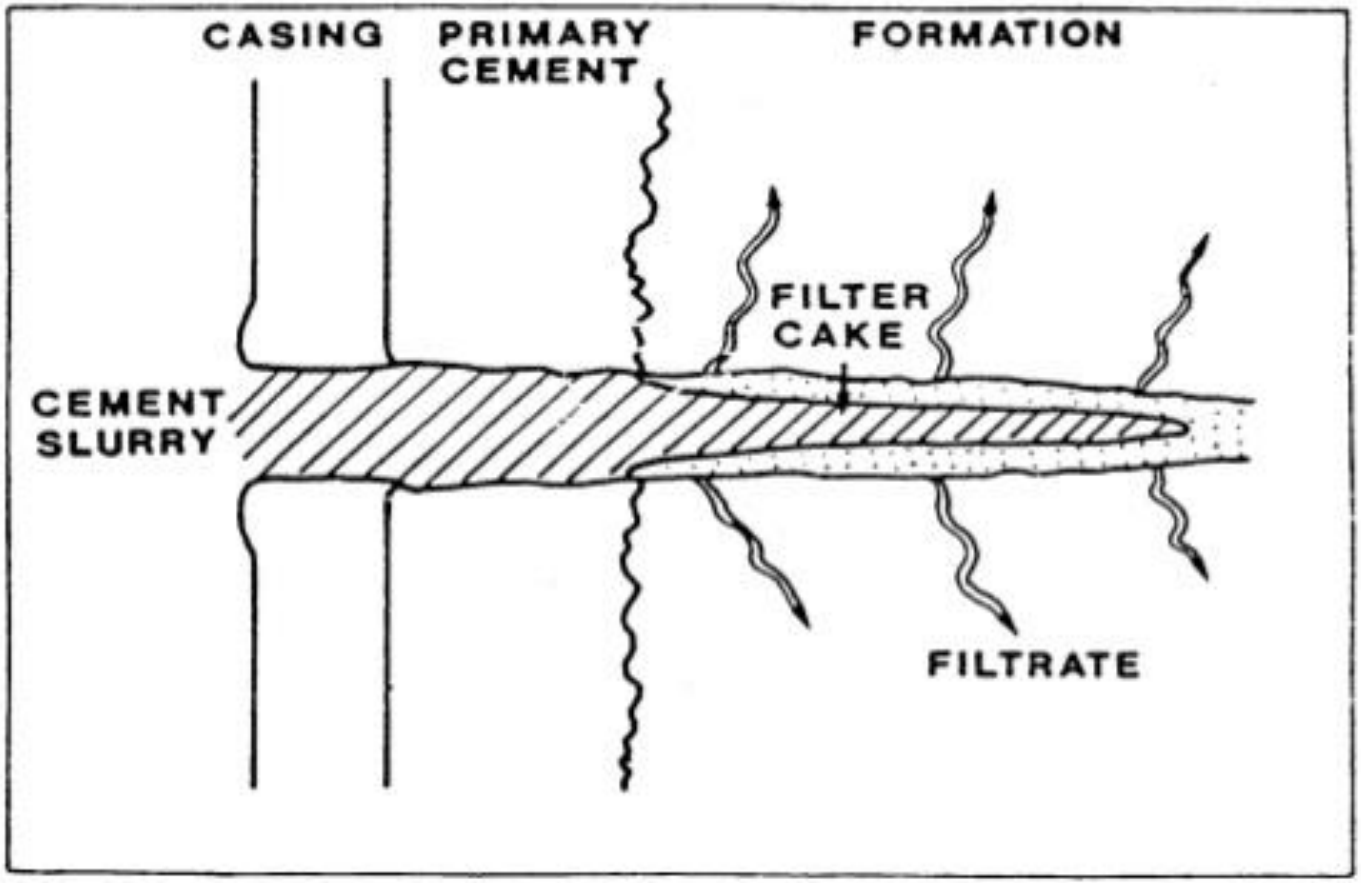
CLASIFICATION BY PRESSURE

HIGH PRESSURE SQUEEZE

- → Injection pressure > formation fracture pressure
- → Channels not directly connected to perforations
- → Impossible to remove plugging material inside perforations
- → Placement accomplished by breaking down formation
- → Location & orientation of fracture not controlled.



SQUEEZE DEFINITION



Applications :

1. Supplement a faulty primary cement job.
2. Reduce water/oil, water/gas, or gas/oil ratio.
3. Repair casing leaks.
4. Stop lost circulation in open hole while drilling.
5. Supplement primary cement around a liner by squeezing the top of the liner (during primary cementation)
6. Sealing leakage of the liner top (in case of failure after primary cementation).
7. Abandonment of single zones.

Summery

- Cementing is one of the most important operation in drilling & producing a well.
- Cement operation is a **"one shot"** process with no second chance, unlike mud is run as a dynamic, continuously changing process.
- The success of a cementing operation is affected by many factors.
- Everything, therefore, needs to be done to ensure that the first attempt is the very best possible job.