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Module 7

SAND CONTROL METHODS

CONTENT

- *Reservoirs with sanding problems*
- *Sand control methods*
- *The economics of sand control*

RESERVOIRS WITH SANDING PROBLEMS

Oil and gas reservoirs producing from sandstones will at some time in the field life produce sand. A number of conditions can cause these reservoirs to produce sand, the main ones are:

1. Reservoir is composed of weak or unconsolidated rocks leading to sand production from the early stages
2. Highly depleted reservoirs will tend to produce sand towards the late stages of field life
3. High near wellbore damage that will impose excessive drawdown pressures

Rock failure and mobilisation are required for sand to be produced, in oil bearing reservoirs the stresses generated by flow(Viscosity) induce mobilisation. In gas bearing reservoirs velocity plays the major role in mobilisation.

RESERVOIR WITH SANDING PROBLEMS (Continued)

There are two (2) basic options to deal with the issue of sand production:

1. *Active sand control* installed at the reservoir interval, 90% of the times this is the preferred solution as it ***"resolves"*** the problem at the source. Active sand control does indeed resolves the problem but it introduces other important issues such as production impairment
2. *Passive sand control* or sand management in which the sand is transported to surface to be separated/disposed. This option introduces higher risks but if properly designed and managed will result in higher productivity wells and reserves recovery

Each of these basic options include a number of different methods suitable for many of the conditions found in these type of reservoirs.

SAND CONTROL METHODS

Active and passive sand control methods and technologies vary significantly, there are over 12 different methods used in the industry such as

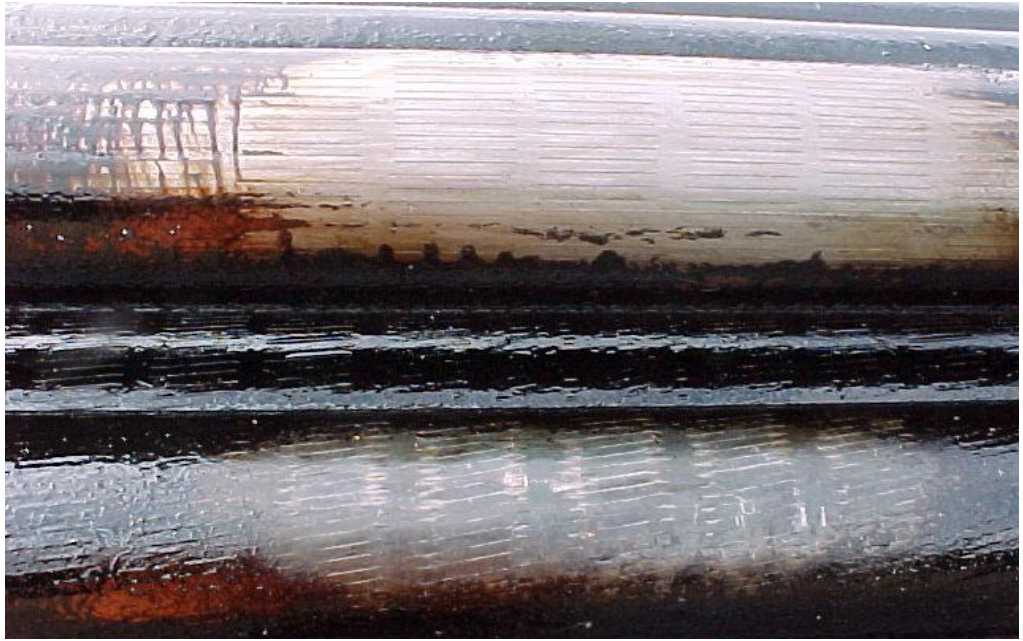
- Slotted liners
- Sand screens (4 types)
- Gravel packs (2 types)
- Sand consolidation
- Frack & Pack
- Swelling filters
- Oriented and selective perforating
- Sand management

COMPLETION OPTION	LIMITATIONS
Sand Management	• Requires high quality reservoir data • Strict monitoring of well & field performance • Facilities and surface equipment
Selective & Orientated perforation	• Requires good quality reservoir data • Difficult to implement in the field, due to depth and orientation problems.
Slotted liner & Screens	• Mechanical damage • Plugging and erosion • No flow conformance control
Gravel pack (Internal & External)	• PI reduction • Expensive • Operationally difficult, limited length in horizontal wells • Under-reaming might be required (EGP)
Hydraulic fracturing & Frac pack	• Impaired productivity of the propped fracture • Vertical containment of the fracture • Expensive • Operational risk • Proppant flow back
Expandable Screen Technology	• Reservoir compactation • Severe hole stability problems • Expensive

SAND CONTROL METHODS – Slotted liners

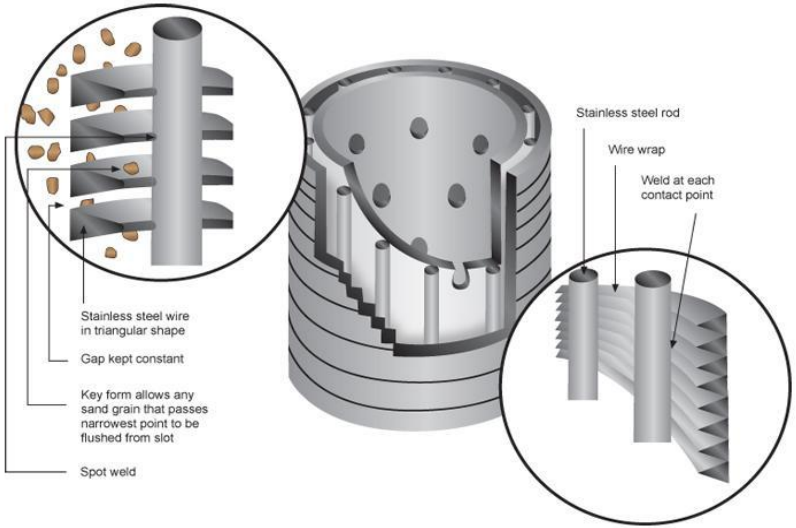
Slotted liners are an active sand control method, it is composed of:

- Base pipe and filter media
- Slots are the sand retention mechanism
- These slots are cut along the axis of the base pipe
- Utilised in reservoirs with very homogeneous sands
- Flow area does not exceeds 6%
- Mechanically very weak



SAND CONTROL METHODS - Screens

There are at least four (4) main types of sand screens:



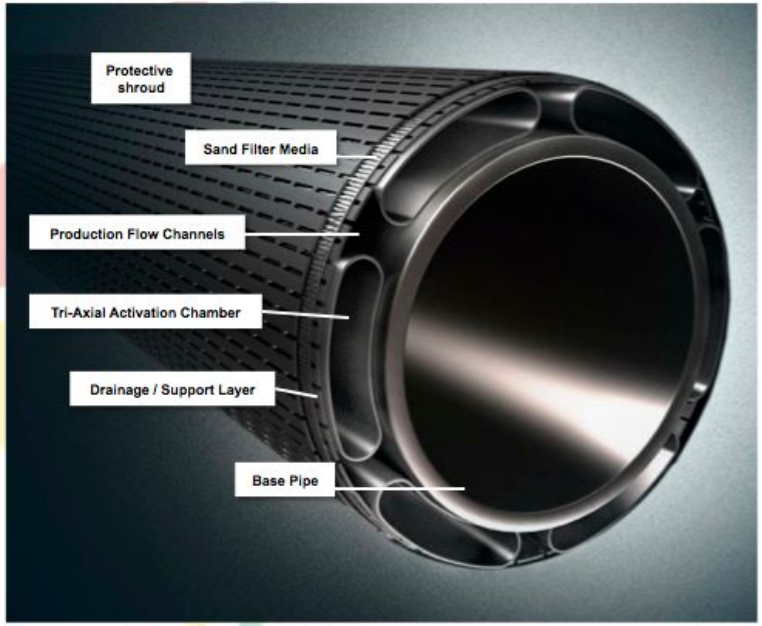
Wire-wrapped screens

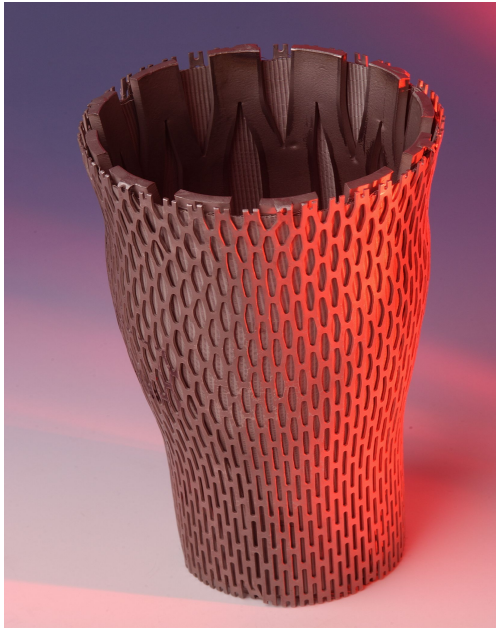
Pre-packed screens

Premium screens

SAND CONTROL METHODS – Screens (Continued)

Expandable type of screens are relative new technology, it involves the expansion of one or various of its components until it reaches the wellbore wall.

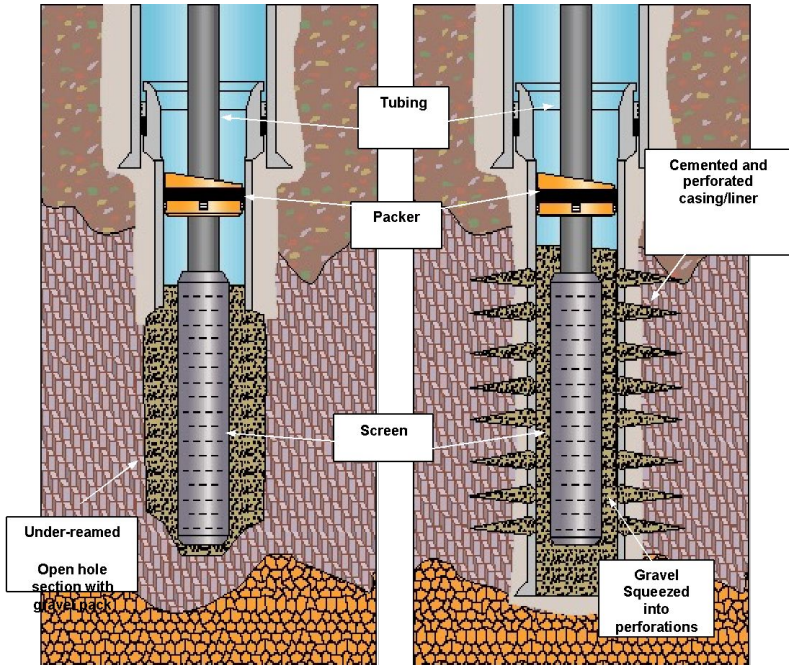




SAND CONTROL METHODS – Gravel packs

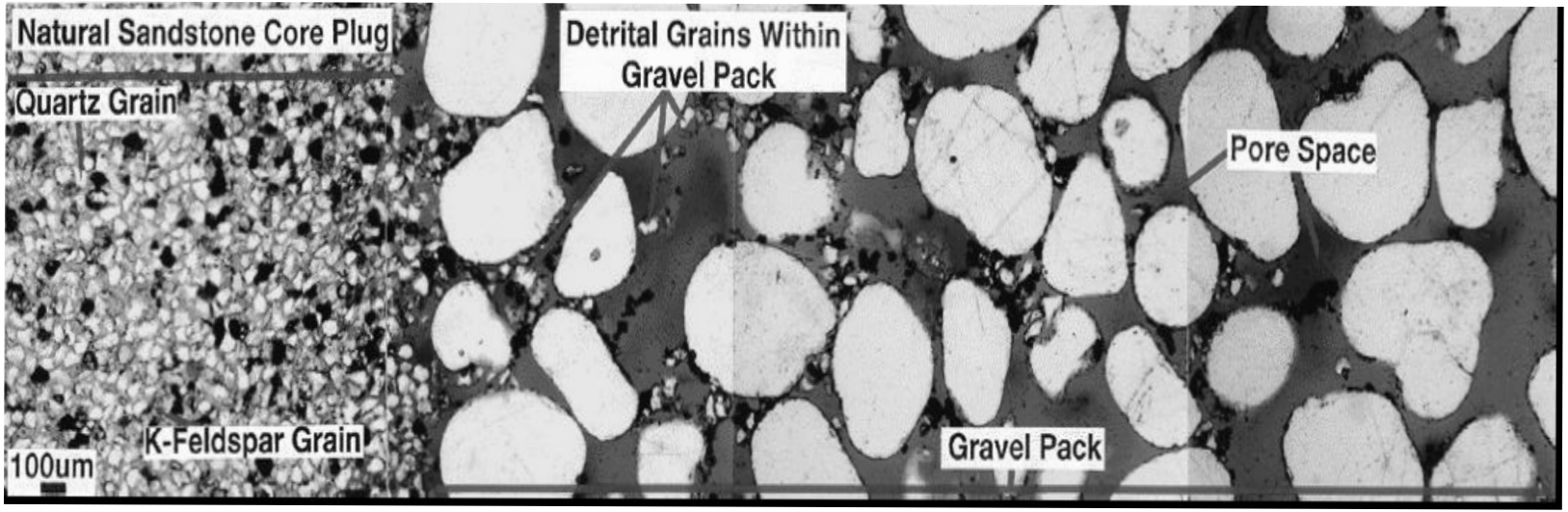
Gravel packs are common active methods of sand control, it involves the placement of gravel in between a screen and the wellbore wall, the gravel is the retention mechanism

- Offers larger flow area
- Gravel is the filter media
- Suitable for very heterogeneous formations
- Two (2) different types depending on well configuration (External & Internal)
- External GP for open hole and internal GP for cased/perforated completions
- Can have an impact on productivity, prone to plugging



SAND CONTROL METHODS – Gravel packs (Continued)

Internal and external gravel packs can be operationally complex particularly in long horizontal wells. Gravel placement is critical to maximum productivity

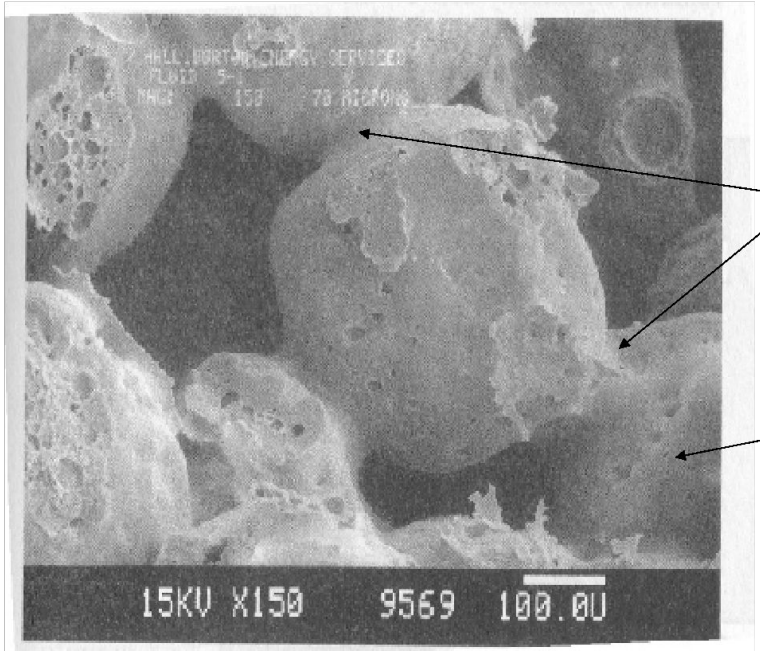


Courtesy of BP

SAND CONTROL METHODS – Sand consolidation

It is an active method of sand control that involves the strengthening of the near wellbore.

- The method is based on the injection of chemicals into the matrix that add strength to the formation
- It is sensitive to fluid contamination and temperature
- Used in very clean sands
- Designed for reservoirs with porosities higher than 30%
- Carried out in short intervals < 30 feet

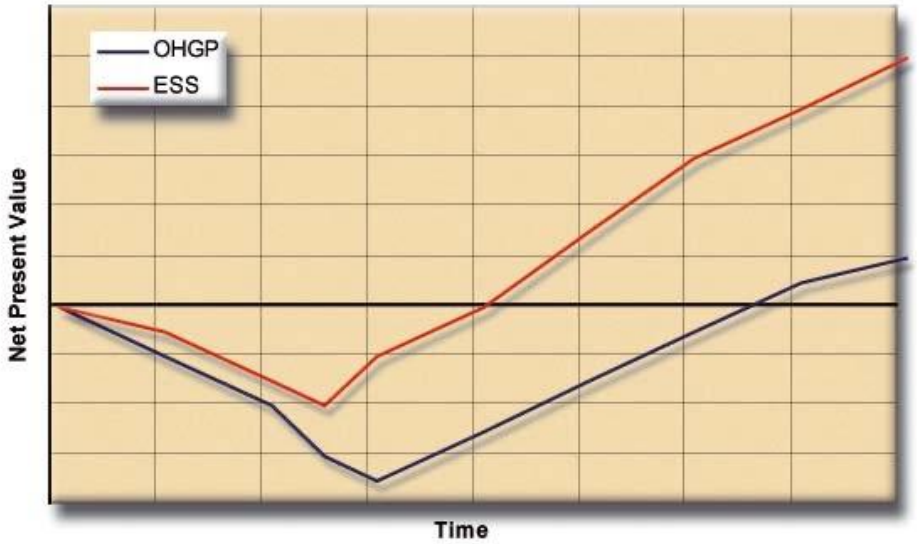


After Bertraux

THE ECONOMICS OF SAND CONTROL

Sand control completions require higher investment than sand management due to the cost of additional rig time and equipment. Two (2) cost factors impact the overall economics of a well

- Open hole sand control completions tend to deliver better productivity than cased/perforated
- This results in better ROI and NPV
- Rig time tend to be the higher cost for sand control completions
- Positive cashflow then results earlier



Courtesy of Weatherford

EFFECT OF NET PRESENT VALUE

MODULE 7 - SUMMARY

There are two (2) fundamental choices for completions in sandstone reservoirs, sand management and downhole sand control

- Sand management involves free production of acceptable levels of solids that can be cost effectively managed and disposed off at surface
- Downhole sand control involves placement of a filter at the sand face that will avoid sand being produced to surface.
- The main methods of downhole sand control include slotted liners, screens, gravel pack, sand consolidation, frac & pack and expandable screens
- Each sand control method requires detailed understanding of the rock properties and well operating philosophy.

MODULE 7 – SUMMARY (Continued)

- The choice between sand management and downhole sand control is a complex one that requires detailed assessment.

- Failure of the sand control method at some point in the life of a well leads to consideration for implementing a sand management program before a workover or recompletion is attempted.

- Sand control is CAPEX intensive and sand management is OPEX intensive.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