Filtrex

Conformable sand control system

TAQA

Introduction to Filtrex

Filtrex is an innovative, cost-effective, remedial sand control solution, designed to transit existing architectures to offer a compliant sand control system.

Filtrex can be utilised in multiple applications to restore sand control and improve well productivity. The use of Filtrex results in decreased intervention time and expensive associated run charges when compared to traditional thru-tubing methodologies.

The remediation system provides the flexibility to be installed thru-tubing, beyond tight restrictions, whilst offering compliance within the damaged section once set; resulting in effective sand control and unimpeded well performance.

The ability to perform sand clean out during the deployment when run on coil tubing/pipe reduces intervention trips. With the capability of self-centralising once expanded in any deviation, the tool is unique to the oil and gas industry.

The control mechanism employed by Filtrex is the exclusive award-winning porous multi-layer sand filter, which is comprised of an open cell matrix polymer (OCMP) of varying permeability, encasing a length of perforated tubing. This multi-layer porous conformable filter media ensures full expansion and compliance within the damaged screen or casing section regaining sand control in existing completions. The system design allows the combination of multiple distinct layers with a range of pore sizes resulting in a range of filter permeabilities that can be optimised for each application to ensure appropriate retention of sand in reservoirs up to 95°C/203°F*.

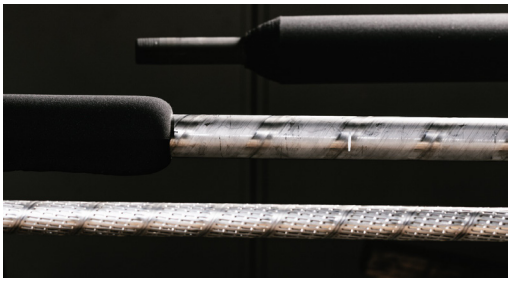
Filtrex is available in two generations, the original stackable version and newly released longer length system. Both systems utilise the same configuration of base pipe and OCMP, the only difference is the compression method impacting deployment.

CASING SETTING RANGE	2-7/8"	3-1/2"	4-1/2"	5-1/2"	7"	9-5/8"
MIN RESTRICTION ON TO PASS	2.350"	2.705"	3.810"	4.125"	5.750"	7.700"
MAX TOOL OD	2.250"	2.690"	3.625"	3.940"	4.400"	7.450"
MAX TEMP	95°C / 203°F					

Example Technical Specifications

Features

- Self-centralising once expanded in any deviation
- Open Cell Matrix Polymer - multi-layered conformable filter media
- Compatible in reservoirs up to 95°C/203°F
- Compatible with common wellbore fluids



Benefits

- Revives production
- Conforms to damaged section
- Thru-tubing design flexibility
- Retrievable
- OCMP sized appropriately to retain formation sands
- OCMP configuration bespoke to reservoir conditions and wellbore sand composition

Open Cell Matrix Polymer OCMP

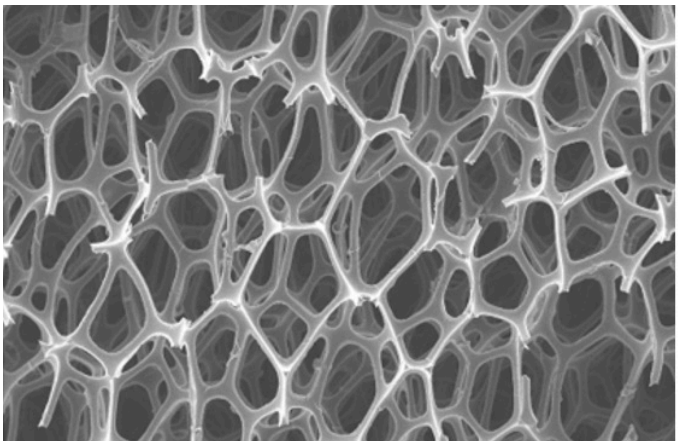
The key to the Filtrex system is the use of an Open Cell Matrix Polymer (OCMP) which consists of a primary retention layer with up to 85% porosity and 43D permeability. The system design allows the combination of distinct polymer layers with a range of pore sizes for bespoke engineered sand retention.

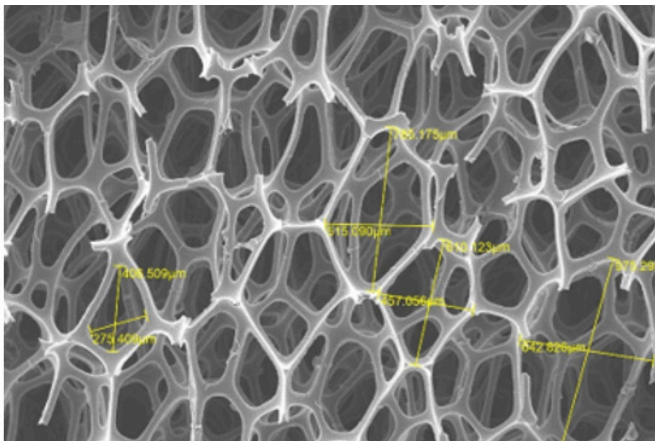
The OCMP has shown improved erosion and plugging resistance in comparison to standard metal screens.

The main benefit of the OCMP is the ability to compress and return to its previous shape without any further intervention. As there is no change to the OCMP once deployed, the pore size and shape is known prior to deployment enabling an accurate understanding of its performance in well environments.

This multilayer porous expandable filter media ensures full compliance within the damaged screen or casing section regaining sand control in existing completions. The OCMP is also set in compression aiding sand retention capability in challenging reservoirs.

Testing with the OCMP has shown a wide operating envelope with ability to hold back proppant and finer sands with the same OCMP configuration.





Sand Retention Testing

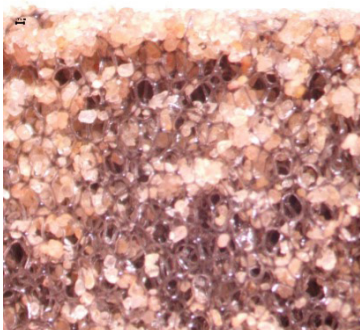
Retention testing can be performed in the laboratory to thoroughly assess the behaviour of the OCMP material under various levels of compression, simulating the tool set within a damaged screen or casing. The capability for sand retention, pressure responses, plugging, and material performance can all be meticulously evaluated to determine the optimal compression level that aligns with manufacturing specifications.

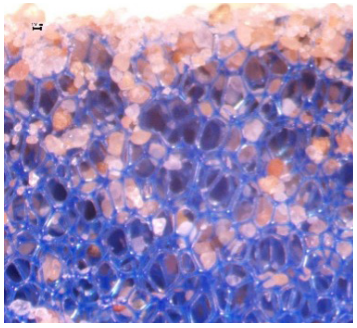
By utilising client reservoir data and/or conducting customised sand retention tests, TAQA can modify the OCMP filter layers to guarantee sufficient performance and retention for all applications.

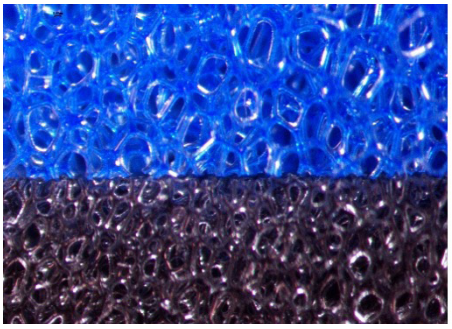
The OCMP has been evaluated with formation sand, outcrop sand and proppant. The polymer material will retain both natural gravel pack sand and ceramic proppant. Sand samples intended for retention testing will have their particle size assessed by industry standard sieve analysis. They will be devoid of hydrocarbon residue and completely disaggregated.

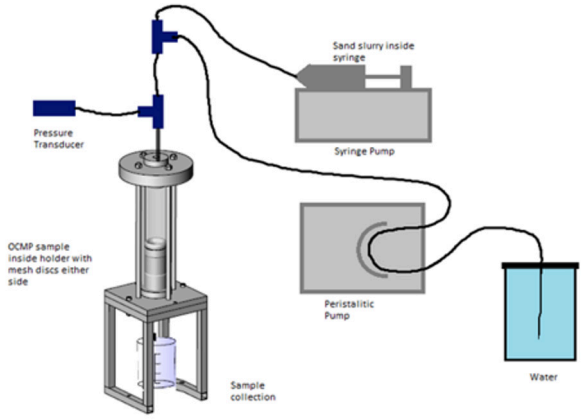
The prepared formation sand slurry is pumped and mixed with water before passing through the open cell matrix polymer filter. Pressures are recorded over time to observe the build-up during the test, which indicates whether the OCMP filter is providing sufficient retention and/or is prone to plugging. Effluent samples collected during the test are filtered using pre-weighed 1.2µm filter membranes, which are then dried and reweighed. The pressure data and sand through results are compiled and presented graphically for analysis.

The initial permeability of the OCMP is assessed prior to commencing the test, while the retained permeability is evaluated after the test concludes. This measurement is documented according to a constant flow rate before and after the addition of formation sand in the sand retention test and is calculated based on the rise in pressure using Darcy's equation.









Fluid Compatibility

Samples of the OCMP and bond are continually tested in numerous different fluids including crude oils, base oils, and brines at temperature over several months. Testing has shown the OCMP material to be compatible with many common fluids expected to be in contact with the filter.

Initial testing indicates that OCMP is compatible with short term exposure to Hydrochloric Acid (HCl) replicating exposure of a remedial acid treatment. Further testing with HF acid has also been conducted with no compatibility issues noted.

Commonly encountered oil field fluids continue to be tested at temperature to establish impact on the OCMP filter. For each new application, TAQA will perform testing when required to ensure compatibility for all exposed fluids within the reservoir.

Fluids Tested
Condensate
Crude Oil (20 API)
Light Crude Oil (29 API)
Crude Oil (34 APOI)
Claisol NS (40 API)
3.5% NaCl
Fresh Water
18% NaCl
17% NaCl
Acetic acid
Formic acid
Glycol
ScaleFix SSDX
15% HCl with 1% inhibitor
15% HCL
10% HCL
Organic Solvent
6% HCl / 1.5% HF
Xylene

Filtrex Gen[1] Stackable Design

The installation of Filtrex Gen[1] is performed over several stages and has the potential to significantly improve the financial feasibility of restoring production to failed wells without the requirement for an expensive or complicated workover.

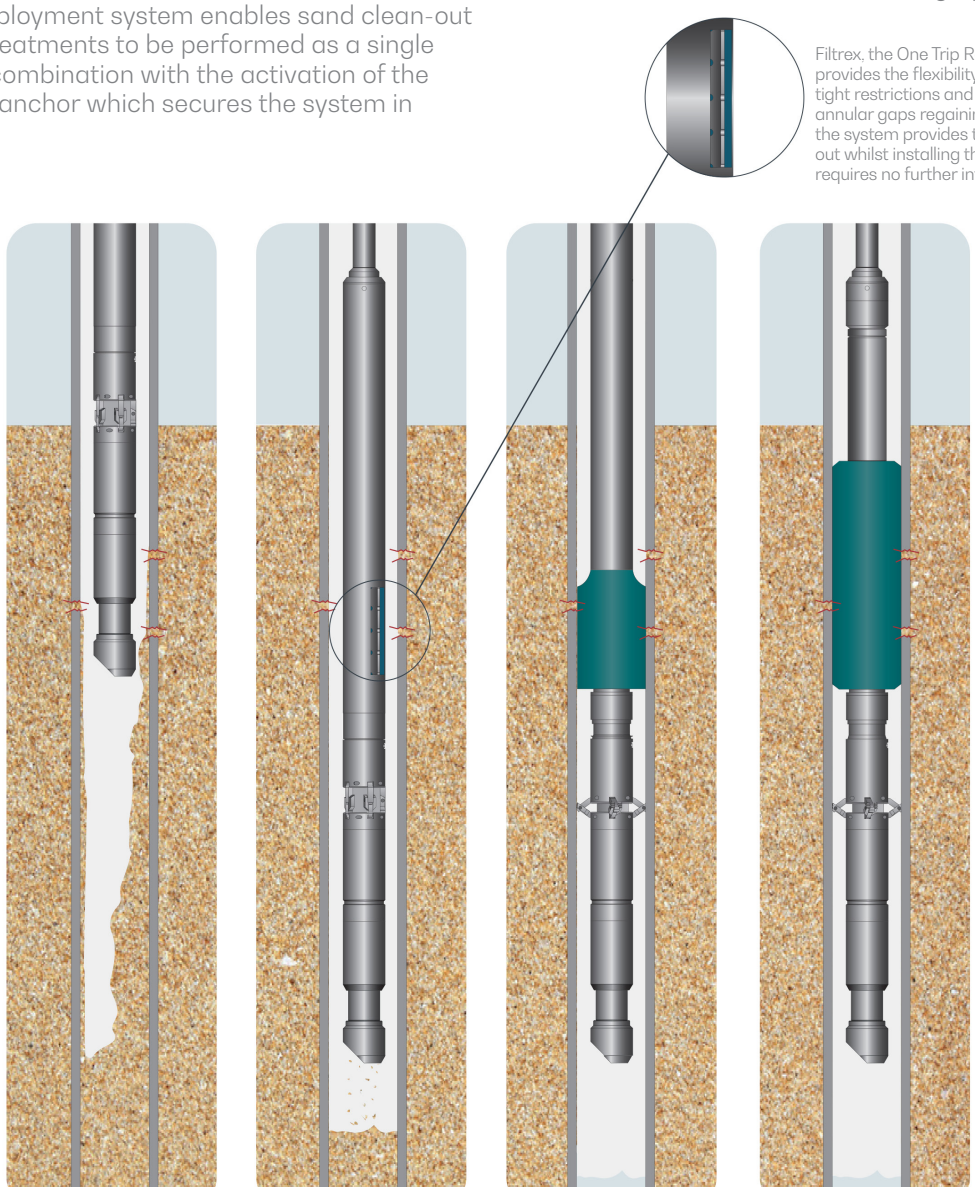
The conformable OCMP filter is deployed in hole compressed within the running tool and outer sleeve. Upon reaching the zone of interest, if required, integral jetting nozzles can be activated to begin sand clean out. The high compressibility of the OCMP filter allows the assembly to pass through tubing restrictions and expand into the larger casing/liner configurations providing a conforming sand control solution.

This live well deployment system enables sand clean-out and chemical treatments to be performed as a single trip process in combination with the activation of the high expansion anchor which secures the system in place.

Once set, the removal of the compression sleeve enables the OCMP to expand and conform to the ID of the casing or failed screen. The filling of the annular gap prevents further ingress of reservoir solids into the wellbore whilst still allowing passage of liquids or gases. The running tool is then pulled and retrieved from the hole.

The maximum length of any Filtrex Assembly conveyed on tubing is 5m and 2.5m if conveyed on slickline. Filtrex is available in numerous Filtrex Media lengths. In both deployment methods, a maximum of 5 Filtrex Assemblies can be stacked in sequence on a single Anchor or latched into a single packer.

Filtrex can be installed on coil tubing / pipe and wireline.



Filtrex, the One Trip Remedial Sand Control System, provides the flexibility to be installed thru tubing, through tight restrictions and expand into the casing ID filling all annular gaps regaining sand control. The first of its kind, the system provides the ability to perform sand clean out whilst installing the tool in one trip. Once set, the tool requires no further intervention.

Stage 1

An existing screen or perforations can become damaged, and provide a sand breakthrough point. Once damaged, there is no sand control and sand is free to fill the wellbore. This can lead to issues on surface and can result in well abandonment.

Stage 2

The Filtrex system is run in hole to depth using a running tool with compression outer sleeve.

Prior to expansion of the system, the jetting nozzles will activate and commence sand clean out.

Stage 3

Sand clean out is complete, the Filtrex system is ready to expanded. The anchor sub is activated and locked into the casing.

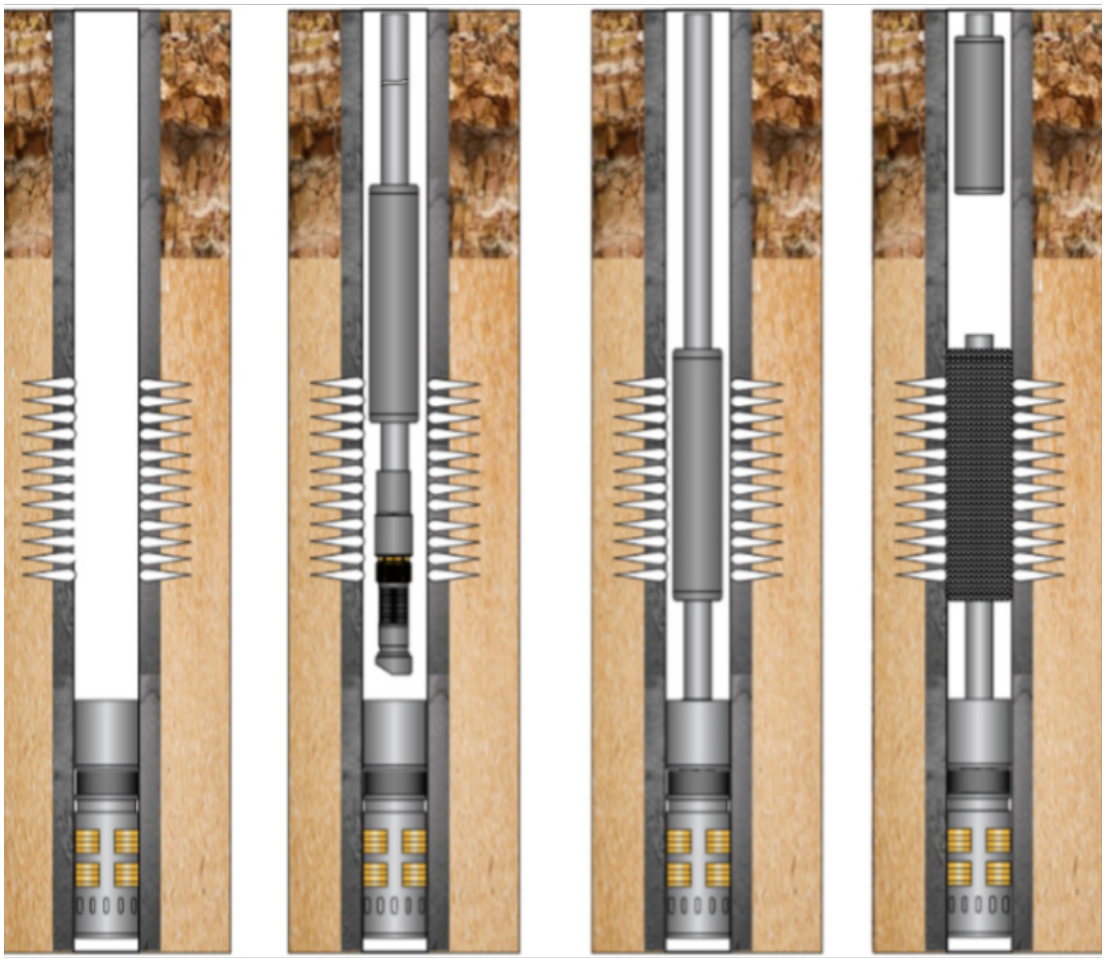
The running tool is pulled from the assembly removing the outer protecting sleeve, allowing the multi-layer OCMP to expand to confirm to the ID of the casing or liner.

Stage 4

The running tool is fully removed allowing the full filter section to expand to the damaged section. Anchors are locked in the casing and running tool is pulled out of hole.

Filtrex Deployment via Packer & Latch – Coil Tubing, Tubing, Drill Pipe or Slickline Pipe or Slickline

The installation of Filtrex using this system requires a packer to be installed at a specific depth after which the lower most Filtrex assembly complete with matched latch is deployed. It should be noted that although this system is primarily used in slickline applications, the same configuration can be utilised for Coiled Tubing, Tubing or Drill-pipe.



Stage 1

Set packer or anchoring device at correct depth so that the Filtrex will sit across the area to be covered.

Stage 2

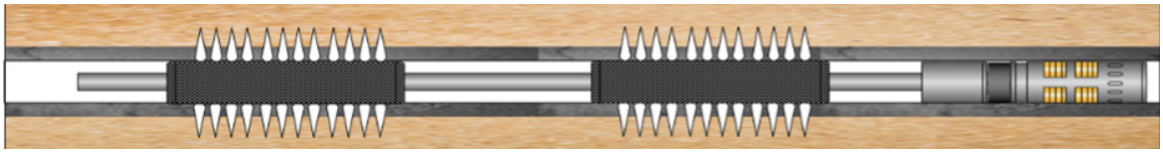
Run Filtrex on wireline/slickline with a spear or latching collet on the bottom to locate into the packer or anchoring device.

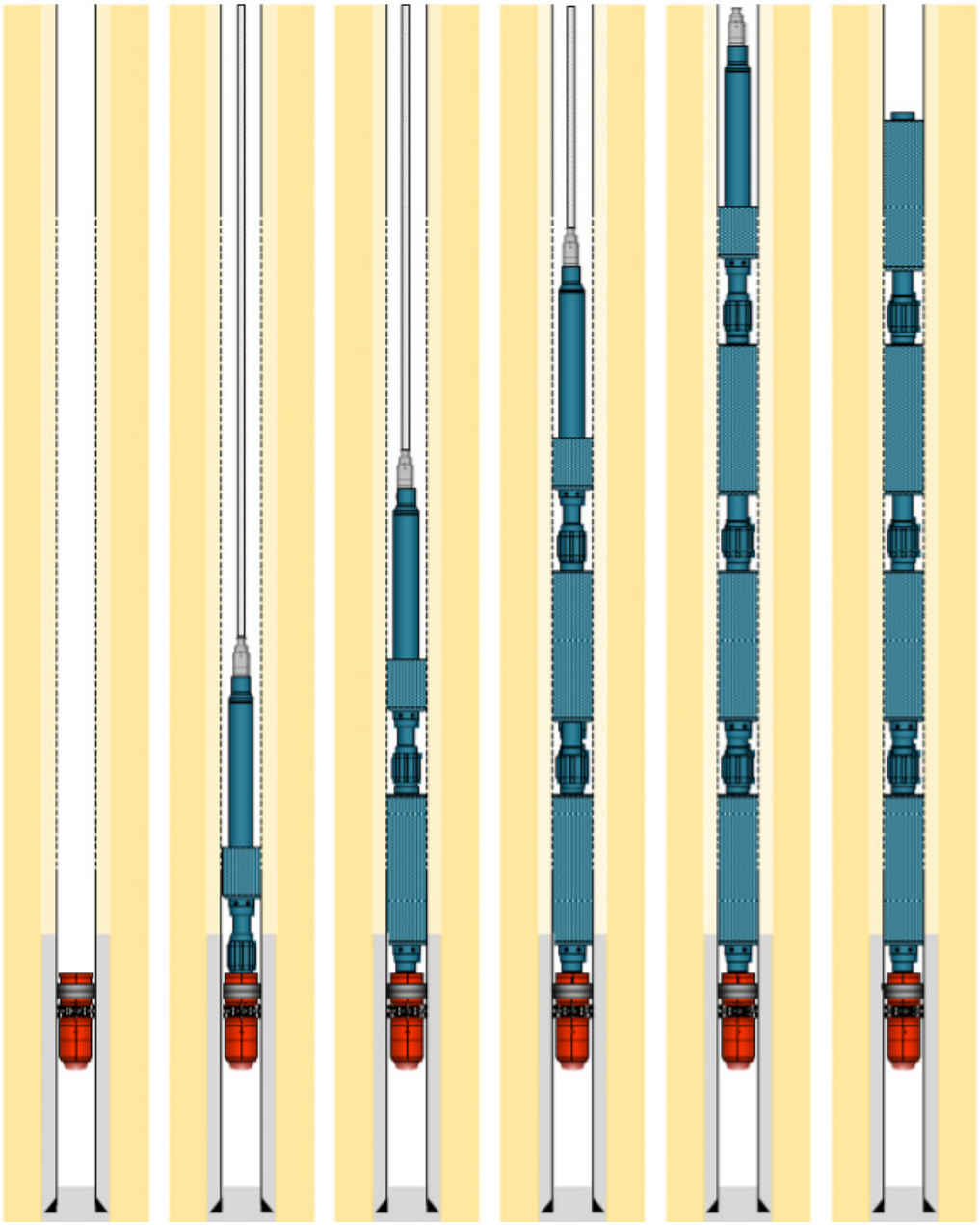
Stage 3

Once latched into the Anchor perform a pull test. Release of the running tool and removal of the compression sleeve is achieved by jarring or pulling upwards enabling the OCMP to expand and conform to the ID of the screen. The running tool and compression sleeve is then pulled to surface.

Stage 4

Each Filtrex joint has a fishing neck to enable a seal assembly to be latched in to deploy additional Filtrex joints above to cover larger perforation intervals.





Stage 1
Install Packer at Calculated Setting Depth for Filtrex Placement

Stage 2
Latch into Packer with 1st Filtrex Assy, Release Running Tool & Remove Shroud to Deploy Filtrex Media

Stage 3
Latch 2nd Filtrex Assy into 1st Filtrex Assy, Release Running Tool & Remove Shroud to Deploy Filtrex Media

Stage 4
Latch 3rd Filtrex Assy into 2nd Filtrex Assy, Release Running Tool & Remove Shroud to Deploy Filtrex Media

Stage 5
Latch 4th Filtrex Assy into 3rd Filtrex Assy, Release Running Tool & Remove Shroud to Deploy Filtrex Media

Stage 6
Lower Completion Filtrex Assemblies Deployed, Prepare Well for Upper Completion and Production

Features

- Stacking and Latching mechanism for slickline deployment
- One trip system - sand clean out and sand control restoration (Tubing deployment)
- High expansion anchor sub rated to 12T

Benefits

- Ability to cover larger perforation intervals and space out effectively using numerous deployments
- Proven track record

Filtrex Gen 2

Filtrex Gen2 is TAQA's next generation of the Filtrex design to enable longer lengths to be deployed in a single trip. This involves the use of a permeable degradable shroud, which compresses the filter to enable deployment and then dissolve in wellbore fluids to allow the OCMP to conform to casing or screen ID. This method involves a single trip deployment whereby the Filtrex Gen2 screens are run like standard screens which are hung from a packer or similar hanging device, rather than being latched into a packer and the shroud removed. The material used is a biodegradable, sustainable product which will completely dissolve in the running fluid with no additional intervention required.

The material compresses the OCMP to enable deployment and will dissolve in the temperature range provided.

The material is selected based on the temperature and fluid expected with dissolution timings of approx. 48 hours for full OCMP expansion, however, this is adjustable to suit operational demands. Fluid details would need to be assessed to confirm the appropriate fluid media for dissolution of the shroud.

Due to the joints being installed like conventional pipe, the number of runs will be significantly reduced compared to the current Filtrex Gen1 Stackable offering.

Note: A single trial run, in collaboration with a deployment provider, is essential to verify the feasibility of operating the Gen2 Filtrex system, focusing on torque/drag or Cerberus modeling.

Filtrex Gen 2 Deployment

Stage 1

• An initial run to confirm it is possible to RIH to depth and check / clear restrictions/ tight spots / sand infill.

• Perform a 'Dummy Run' using a BHA of similar OD & Length to ensure the Filtrex can get to depth

Stage 2

• Filtrex Gen2 is RIH on a packer via CT/Tubing/DP or Slickline c/w running tool

• The OCMP compressed by the biodegradable shroud

• RIH speed is limited by the Packer RIH Speed with a limit on drag

• The tool is run to the required setting depth

Stage 3

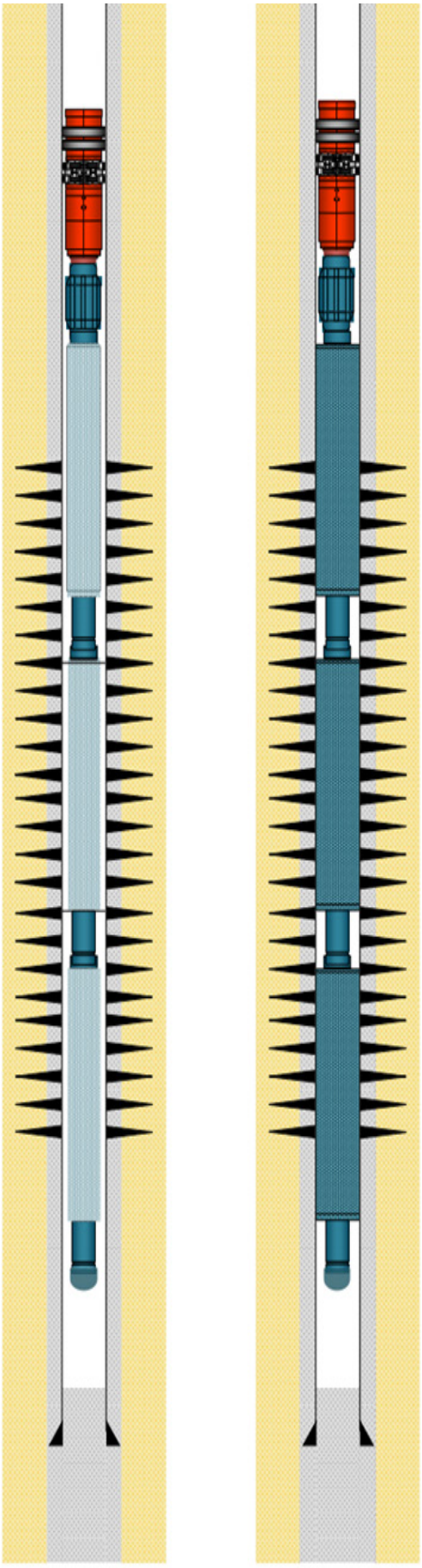
• Space out and Set Packer as per Packer Setting Procedure.

• Release Packer Running Tool from Packer leaving the Filtrex Assy's in place

Stage 4

• Filtrex Shroud Dissolves to allow Filtrex to conform to Casing ID and cover perforations

NOTE: Filtrex Gen2 provides sand control even without the shroud being dissolved or the OCMP not fully deployed due to the time it takes for the wrap to dissolve.



Features

- Ability to run longer screen lengths
- Biodegradable, permeable shroud enable to navigate tight architectures

Benefits

- Deployed as a conventional screen solution
- Sand control integrity throughout dissolution of shroud

Filtrex Success Story

ZERO
SAND PRODUCED AT SURFACE

4
MMscf/d OF GAS PRODUCED

$$$
COST SAVINGS COMPARED TO OTHER PRODUCTS

THE CHALLENGE

After being cased and perforated, a gas well began producing significant amounts of sand, necessitating effective sand control. Filtrex proved to be the ideal solution, as it was well-suited for the field's particle size distribution, with d50 ranging from 110-150 microns and up to 28% fine material. This made Filtrex the preferred choice over alternative sand control methods such as thru-tubing gravel packs and erosion resistant standalone screens.

THE SOLUTION

TAQA implemented a slickline-compatible Filtrex solution, using 9 stacks of 2.5m units to cover an 11m perforation length. This standardized product was thru-tubing compliant, even in tight restrictions. Once in place, it expanded and conformed to the tubing ID while ensuring reliable sand control. Filtrex features a multilayer sand filter around perforated tubing for optimal performance.

WELL DATA

- Location: Offshore Malaysia
- Well Type: Gas Producer
- Installation Date: Dec 2024
- Tubing Size: 3-1/2"
- Deviation: 38.81 degrees
- Deployment: Slickline

THE RESULT

Post installation, there were no signs of sand production at the surface. The well is currently producing 4MMscf/d of gas, validating the success of Filtrex in preventing sand production and enhancing well performance.