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ResFlood

Multizonal selective injection system

Rated to 10,000 psi [68.9 MPa]

Rated to 285 degF [141 degC]

APPLICATIONS

- Water injection wells in heterogeneous reservoirs
- Horizontal injection wells with significant heel-to-toe effect
- Strategic contingency for production wells in heterogeneous reservoirs that will require future conversion to injection wells

BENEFITS

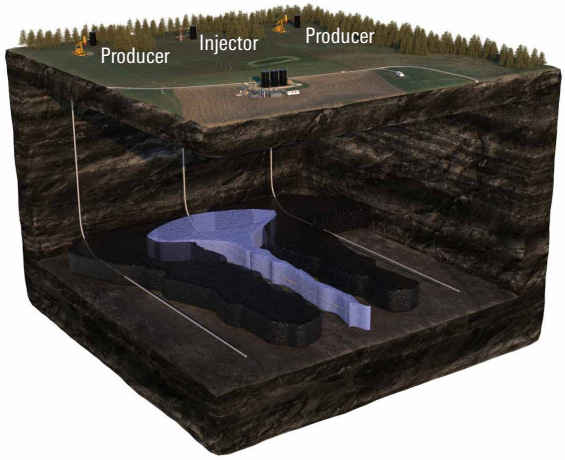
- Optimizes sweep efficiency by equalizing injection across permeability variations, fracture zones, and long laterals
- Improves recovery factor by enabling selective injection shutoff to prevent watering out producing wells
- Increases completion flexibility with unlimited opening and closing of injection ICDs in any order and multiple open and close operations in a single intervention

FEATURES

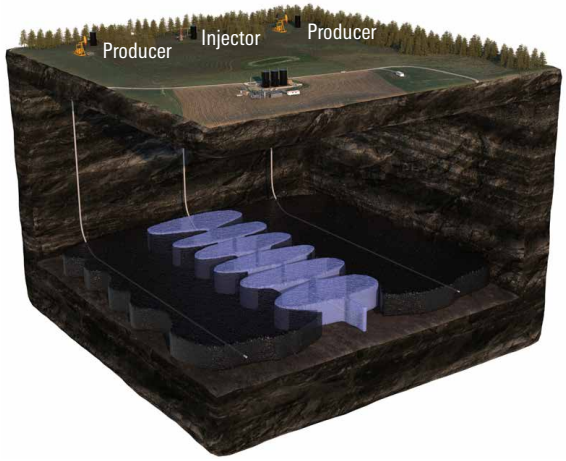
- Wellsite optimization of injection ICD nozzles
- Tungsten carbide nozzles for erosion resistance
- Injection zones as short as 4 ft [1.2 m] enabled by short tool length
- Ultraslim running profile suitable for 4½-in casing
- Fully retrievable system with rotate-to-release or pull-to-release configurations
- Self-centralizing, robust shifting tool with slim OD

ResFlood* multizonal selective injection system enhances waterflood sweep efficiency, and hence oil recovery, by compensating for reservoir injectivity variations along the wellbore. These fluctuations are caused by heterogeneous permeability, fracture networks, and frictional pressure losses along horizontal wells—the heel-to-toe effect.

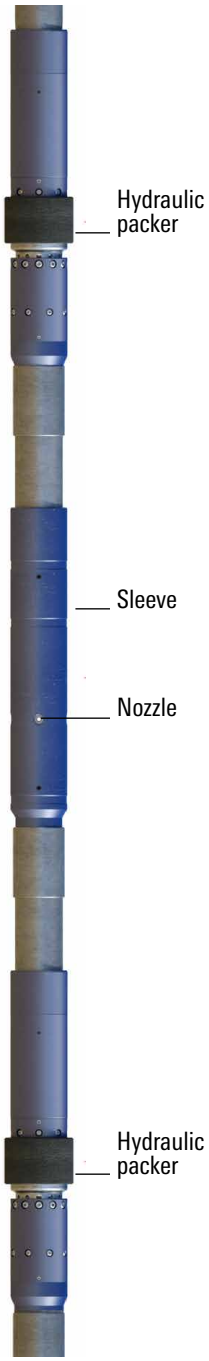
Installed as part of the tubing string in an open or cased hole, the engineered ResFlood system comprises an injection ICD fitted with a sleeve and up to four nozzles to regulate flow. ResFlood systems are used together with isolation packers to compartmentalize the wellbore (based on its natural injectivity profile) and a circulation valve at the toe of the string for fluid circulation during system installation.



Heterogeneous permeability and frictional pressure losses can lead to variable injectivity along long laterals.



The ResFlood system helps equalize the injection profile by restricting flow into high-permeability zones and encouraging injection into less permeable zones, improving sweep efficiency and recovery factor.



Each ResFlood system consists of an injection ICD fitted with a sleeve and up to four nozzles.

ResFlood

Injection profile control

Injection ICDs enable using the optimal number of injection points to help equalize the injection profile across the length of the wellbore and maximize sweep efficiency. In high-permeability zones they restrict flow, encouraging injection into less permeable zones. Injection ICD nozzles can be sized to suit specific well and reservoir characteristics.

Actuated by a hydraulic shifting tool run on CT or jointed pipe, the ResFlood system's sleeve allows or shuts off flow through the injection ICD nozzles, enabling selective injection into a given zone for greater control of the injection profile. For example, a zone can be shut off, if required, to prevent early watering out of the producing well. Any number of sleeve assemblies can be run in the well and each sleeve is opened and closed independently—as often as required over the life of the well.

ResFlood System Specifications	
Casing size	4.5 in [114.3 mm]
Casing weight	11.6–15.1 lbm/ft [17.3–22.5 kg/m]
Injection ICD	
Maximum OD	3.13 in [79.5 mm]
Pressure rating	10,000 psi [68.9 MPa]
Temperature rating	285 degF [141 degC]

Streamlined operation

The sleeves are run in the closed position to provide the completion string with the hydraulic integrity required for various operations, including circulation to the toe of the well and setting of the hydraulic packers. A dropped ball seats on the circulation valve to close it and enable pressurization of the workstring to set the packers. Subsequently, the sleeves are opened with one intervention run to commence injection.

Advanced design software

Each ResFlood system is optimally configured for the specific well using ICD Advisor* inflow control device planning software. This proprietary plug-in for the Petrel* E&P software platform takes all relevant reservoir, production, and completion information into account. For wells without existing injection profile data, ACTive Profiling* CT real-time production logging and distributed temperature sensing services can acquire data to enhance system design.

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