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PumpGuard intake sand control screen and valve assembly

Protect your ESPs, rod lift pumps, and gas lift completions from solids during production by cleaning fluid flow

Applications

- Wells fitted with ESPs, rod lift pumps, or gas lift
- Reservoirs with poorly defined particle-size distribution
- Reservoirs with widely varying particle sizes
- Recompletions where screens have failed
- Thermal and steam-assisted gravity drainage (SAGD) wells
- Vertical, deviated, and horizontal wells

What it replaces

PumpGuard* intake sand control screen and valve assembly is a more effective alternative to downhole desanders, which are sometimes called vortex desanders or swirl tubes. These conventional devices inefficiently separate† solids and collect them in bull-plugged pipe (commonly referred to as a mud anchor) or bull-plugged 2D sand control screens; the pipe or screens become plugged, requiring retrieval to surface and replacement.

How it improves wells

PumpGuard assembly integrates MeshRite* stainless steel wool screens with a pressure-activated cone valve that is set to open at a specific differential pressure. The assembly removes solids in production and cleans fluid flows in artificially lifted oil wells. As a result, it extends pump run life—more than downhole vortex desanders—and reduces workovers. It also extends the life of gas lift completions. By keeping the sand downhole, it significantly shortens or even eliminates the frac flowback period. The valve enables production to continue even after the sand control screens bridge.

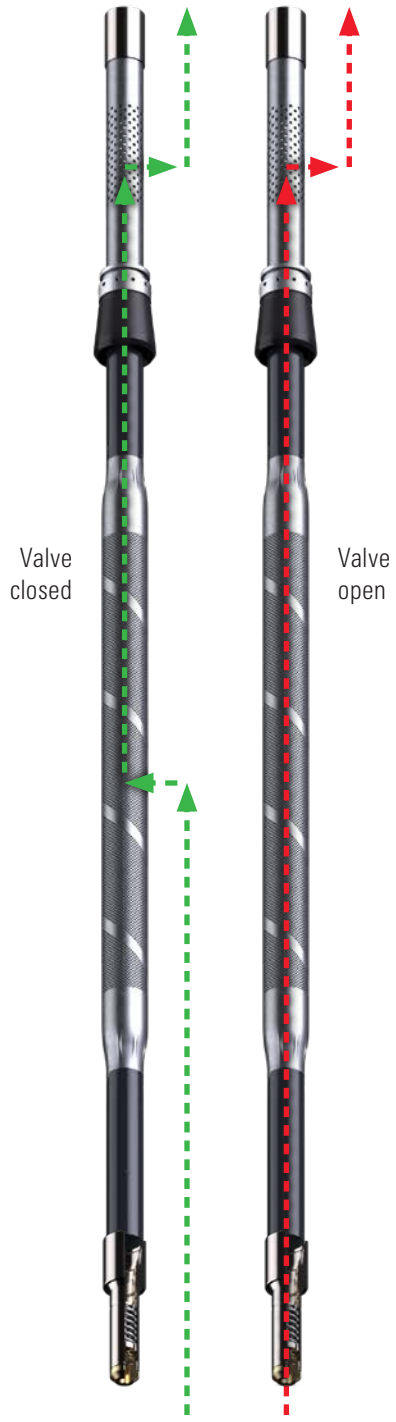
MeshRite screens incorporate a patented 3D pore structure, with angular pores ranging in size from 15 to 600 um. They have an initial open flow area of 40%—versus a maximum of 30% for other screens—and greater than 3,000-D air permeability. The unique pore structure is highly resistant to plugging, retains harmful solids, and minimizes risk of erosion. Unlike 2D sand control screens, the pores are difficult to plug because they retain harmful sand while allowing fines to pass through, ensuring higher retained permeability.

Downhole desanders use cyclonic separation, which depends on fluid velocity and viscosity. All wells, especially horizontal unconventional wells, have intermittent flow with slugs of oil, water, and gas, which degrades desander performance. Moreover, desanders are run with tailpipe below that retains the separated sand. The larger the quantity of sand, the longer the pipe. As a result, the pump is set higher up in the well, reducing the drawdown it can establish. The heavy sand-filled tailpipe can also increase the risk of parting the bottom of the assembly during pullout. The shorter, lighter PumpGuard assembly eliminates these issues and has the added benefit of single-trip installation.

How it works

The PumpGuard assembly is usually suspended from the pump or from a packer below. During initial production, the intake valve connected to the bottom of the screen is closed. Fluid flows (green arrows) radially into the MeshRite screen, which filters out sand and solids before the fluid flow enters the ESP or other downhole pump. Over time, the produced solids fill the annular space between the screen and the production casing, gradually restricting flow. As the particles consolidate, sand bridges can form and halt flow.

Pressure builds up below the restriction. When the differential pressure across the PumpGuard assembly valve reaches the field-set value, the valve opens and enables unfiltered flow (red arrows) up the screen ID and directly through the pump intake. As the pressure profile across the sand bridge reverses, unconsolidated sand settles gravitationally, causing the sand bridge to collapse. The differential pressure across the valve dissipates and it closes again. Production is once more filtered through the screen.



This configuration is used when the PumpGuard assembly is suspended with a cup packer below an ESP or rod lift pump. Green and red arrows indicate fluid flow paths when the pressure-activated valve is closed and open, respectively.

† Read SPE-94673-MS for more.

PumpGuard

Pairing ESP pumps with a downhole ESP gauge and remote surveillance service enables monitoring intake pressure changes to identify when the valve opens.

Pump life

The life of the downhole pump is extended by the total operating time during which the intake valve remains closed. This depends on the

- solids production rate
- screen and production casing annulus
- size of the sump below the perforation zone
- fluid velocity
- amount of fines and particle-size distribution of sand reaching the screen.

The adjustable intake valve is installed at the end of the screen, or operators may choose to extend the pump life further by installing more than one section of screen, with valve assemblies between sections, and an inner liner. Sand bridging between one screen and the casing causes the valve in that section to open, diverting flow through the cone valve and into the inner liner. The fluid passes out through a port between the screen joints to another screen section with its valve closed.

Sand Fallback Shield

During planned and unplanned ESP shutdowns, sand and solids (e.g., scale) suspended in the tubing column fall and settle into the fluid stage of the pump and can lead to multiple failed restart attempts. Excessive torque during these restarts risks large motor current, a consequent increase in motor winding temperature, reduced ESP run life, and shaft breakage. A proprietary Sand Fallback Shield above the ESP guards against these eventualities.

Under normal operation, the ESP lifts oil to surface unrestricted through the Sand Fallback Shield. During a shutdown, the shield restricts access, preventing sand and solids from falling into the pump. When the ESP restarts, the Sand Fallback Shield's vertically and radially distributed flow area enables jetting and agitation of the solids settled on the exterior of the shield. Unrestricted production resumes up the cylindrical shield and out through it, along the tubing. The shield also permits injection from above at rates up to 4 bbl/min for well stimulation or cleanup.

PumpGuard Assembly Specifications

	NU or EU Standard Connection				Standard 8 Round LTC Connection				
Nominal pipe OD, in [mm]	2.375 [60.325]	2.875 [73.025]	3.500 [88.900]	4.000 [10.160]	4.500 [114.300]	5.000 [127.000]	5.500 [139.700]	6.625 [168.275]	7.000 [177.800]
MeshRite screen OD, in [mm]	3.000 [76.200]	3.500 [88.900]	4.050 [102.870]	4.550 [115.57]	5.050 [128.27]	5.550 [140.97]	6.050 [153.67]	7.130 [181.102]	7.650 [194.31]
Valve section intake OD, in [mm]	3.000 [76.200]	3.500 [88.900]	4.050 [102.870]	4.550 [115.57]	5.050 [128.27]	5.550 [140.97]	6.050 [153.67]	7.130 [181.102]	7.650 [194.31]
Valve section length, in [mm]	6.000 [152.400]	6.500 [165.100]	7.000 [177.800]	7.500 [190.50]	8.000 [203.20]	8.500 [215.90]	9.000 [228.600]	9.500 [241.300]	10.000 [254.000]
Valve opening pressure, psi [KPa]†	20–50 [137.9–344.7]								
Overall length, ft [m]‡	60–105 [18.29–32.00] based on 30–35 [9.14–10.67] per joint of MeshRite screen, typically configured using 2–3 joints								
Sand Fallback Shield specifications									
Max. OD, in [mm]	4 [101.6]								
ID, in [mm]	3.45 [87.6]								
Overall length (OAL), ft [m]	20 [6.1]								

All specifications are subject to change without notice.

†Opening pressure can be set to lower than 20 psi [137.9 kPa] for special requests.

‡3.5-in [88.9-mm] OD MeshRite screen weighs 10–11 lbm/ft [16.32–19.59 kg/m].

The Sand Fallback Shield allows the ESP below to lift fluids to surface but prevents sand and solids from falling into the pump during a shutdown. The green arrows show the fluid flow path when the ESP is operating.

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