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FireStorm® SAGD electric submersible pumping systems

Dependable technology for high-temperature applications

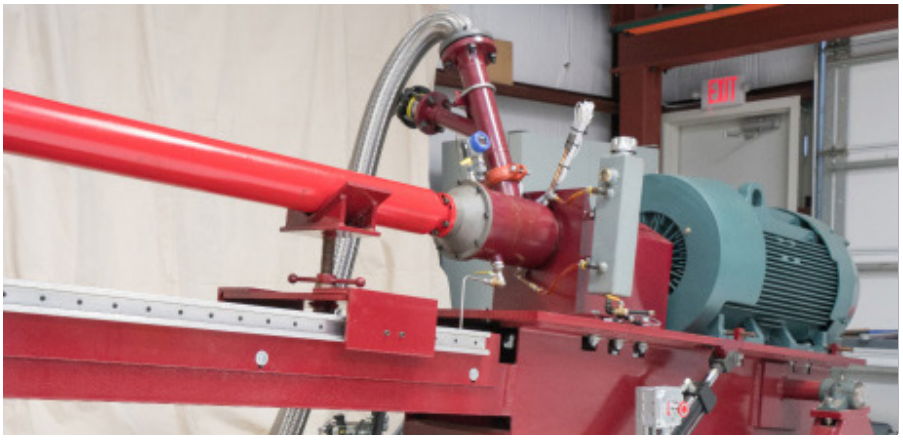
Introducing the FireStorm® extreme high-temperature SAGD pumping system

Maximize oil recovery in SAGD wells

Summit ESP® – A Halliburton Service delivers the latest electric submersible pump (ESP) technology for improved steam-to-oil ratio (SOR) and reliability in steam-assisted gravity drainage (SAGD) wells. Every component is designed and tested for conditions routinely encountered in SAGD applications – extreme operating temperatures, large temperature swings, wide production flow ranges, corrosion, abrasion, and dissolved free gas. The system is designed to tolerate bottomhole temperatures up to 250°C (482°F) and temperature cycles up to 140°C (284°F). The new generation of equipment provides additional tools for challenging SAGD reservoir production, allowing maximum contact between the steam and bitumen in the reservoir. Our gas avoidance technology helps increase production rates throughout all phases of SAGD well production.

Delivering results with velocity

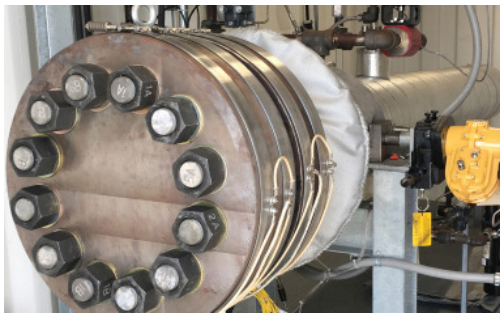
Our reputation for reliable, cost-effective solutions stems from our investment in research, development, and testing. We design and test our specially engineered SAGD systems for high performance under extreme thermal conditions. All SAGD components undergo extensive high-temperature horizontal well tests and two-phase gas loop tests at our Research and Technology Center and and have successfully passed rigorous third party testing conducted by C-FER Technologies. This rigorous process helps ensure our systems will perform as needed to maximize oil production in SAGD wells.



The high-pressure two-phase gas loop simulates and tests ESP components in liquid and gas flow conditions.

Our Research and Technology Center has the tools to validate theory, pushing the limits of understanding to drive ESP performance to the next level.

The 260°C (500°F) high-temperature flow loop system tests the ESP performance and reliability at high temperatures, simulating downhole conditions.



The MLE and cable test pressure vessel is rated for 207 bar (8000 psi) at 343°C (650°F) and is capable of simulating gas decompression events at live well operating temperature utilizing CO_2 and N_2

FEATURES	BENEFITS
MOTOR	
Rated up to 250°C (482°F) bottomhole temperature	Performs at high SAGD temperature
Polyimide and PEEK insulated magnet wire	Offers waterproof design that is reliable at high temperatures and resistant to damage in shipping
Encapsulant free slot design	Allows more efficient heat transfer to the wellbore
EQUALIZATION SYSTEM	
Corrosion-resistant metal bellow	Maximized expansion oil volumes allows for 140°C (284°F) temperature cycles
Filtration system	Protects the metal bellow from sand and particulates buildup
Single nested bellow, below the motor	Equalizes more volume per unit length and reduces risk associated with more complex design
Dual bellow system	Maximizes the expansion capacity below and above the motor
THRUST CHAMBER	
High-temperature impact resistance thrust bearings	Handles temperature up to 350°C (662°F) and resists shock loads due to gas pockets
Metal bellow mechanical seals	Expels oil with no ingress
Nickel alloy shaft	Protects from erosion and corrosion
Tungsten carbide runner	Shields against immediate erosion and degradation if contact between runner and bearings occurs
Optimized thrust chamber bearing placement	Enhances thrust bearing heat dissipation and reduces oil flashing
Easy fill metal bellow orientation	Eliminates need for vacuum filling, reducing service time
PUMP AND GAS-HANDLING STAGES	
Erosion Buster® diffuser erosion reduction technology	Improves wear resistance through redirecting sand particle flow to less-critical areas within pump stages
Extended range compression (XRC) pump configuration	Increases operating range (pressure and flow rate) by transferring downthrust to seal thrust chamber for pump and gas-handling stages
Mechanical thermal locking bearing system	Maintains proper bearing support at high temperature, providing torque resistance to keep bushing position static when press fit is insufficient
Proprietary-blend tungsten carbide bearings	Provides radial support with high resistance to abrasives (six times more resistant than industry-standard tungsten carbide)
Diffuser coupling mechanism	Eliminates diffuser stack spin as temperature fluctuates by coupling entire stack together
Gas-handling stage	Reduces two-phase solutions to one homogeneous solution, handling more than 60 percent free gas
Self-orienting intake	Reduces gas intake in first pump stage by orienting toward the naturally higher density of fluid at casing bottom
VARIABLE-SPEED DRIVE	
Varies speed to match set parameters and well conditions	Optimizes production and reduces downtime
Active front end	Cancels harmonics, making power more efficient
Unity power factor	Efficiently uses electricity from the grid and avoids penalties associated with lower power factor
Rugged outdoor-rated design	Provides assurance for harsh-environment operations in all climates

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.

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