# PCM Vulcain™

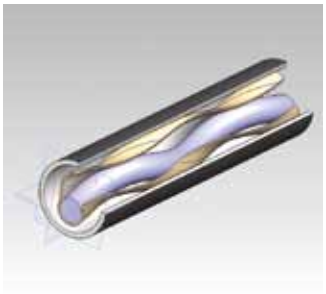
## High Temperature Package

Artificial lift for enhanced oil recovery


PCM | keep it moving

# UNLOCKING UNCONVENTIONAL RESERVES

It is estimated that half of the world's known oil reserves are difficult-to-extract unconventional reserves, such as heavy oil, extra heavy oil and bitumen.

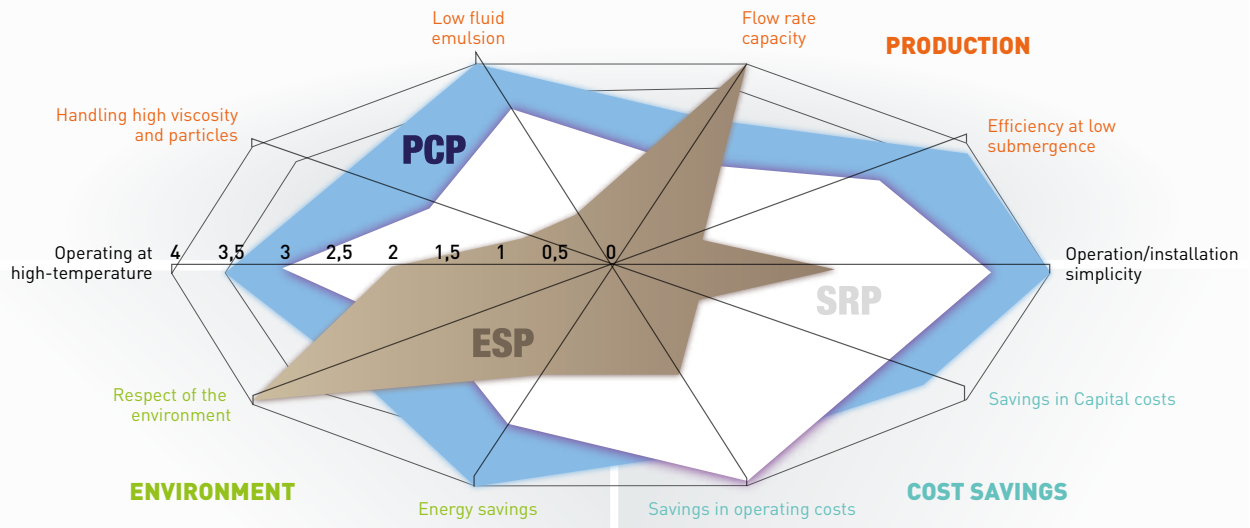


All metal progressing cavity pump

## MEETING THE CHALLENGES OF THERMAL RECOVERY

PCM Vulcain™ is an exclusive patented all-metal progressing cavity pump capable of pumping extremely hot (350°C/660°F), highly viscous unconventional hydrocarbons and high temperature water.
PCM Vulcain™ artificial lift package is ideally suited for SAGD*, Steam Flood and CSS** thermal recovery.
With a wealth of manufacturing experience behind it, PCM has the mature industrial capacity to satisfy the fast rising demand for unconventional oil production.
PCM Vulcain™ systems deliver as much as 5'000bpd, to satisfy most customers' requirements for field development.

*Steam-Assisted Gravity Drainage
**Cyclic Steam Stimulation




PCM Vulcain™ in comparison

## PCP ADVANTAGES AVAILABLE AT HIGH-TEMPERATURE


PCM Vulcain™ pump

### Steady and efficient production

PCM Vulcain™ is the ideal artificial lift system for thermal recovery. The PCM Vulcain™ outperforms sucker rod pumps (SRP) in overall system efficiency and is more robust than electric submersible pumps (ESP). It runs at low intake pressure, it keeps a good volumetric efficiency even when pumping 100% water and steam, and it handles very viscous fluid without experiencing rod fall issues in cold production phases.

PCM Vulcain™ rotor lifting

### Lower lifecycle costs

Capital cost for PCM Vulcain™ is lower than comparable submersible and rod pumps. PCM Vulcain™ uses the well known, reliable design of PCM progressing cavity pumps. Workover costs are lower than alternative technologies. It also offers reduced installation and operating complexity, making it ideal for remote, isolated areas.

PCM Vulcain™ surface equipment

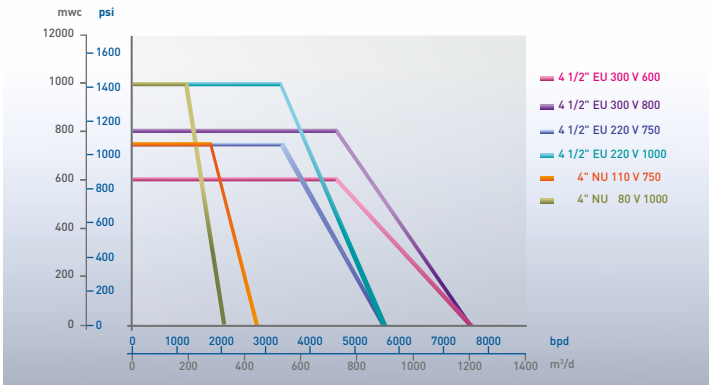
### Reduced environmental impact

A PCP system is more energy efficient than any other pump technology. It operates with low downhole pressure and ultra low viscosity in SAGD and handles higher viscosities in CSS, reducing your steam generation requirements. PCM Vulcain™ rotating seal packing is zero-leakage. Finally, the reduced footprint of PCM Vulcain™ preserves the landscape.

# FIELD PROVEN FOR THERMAL RECOVERY

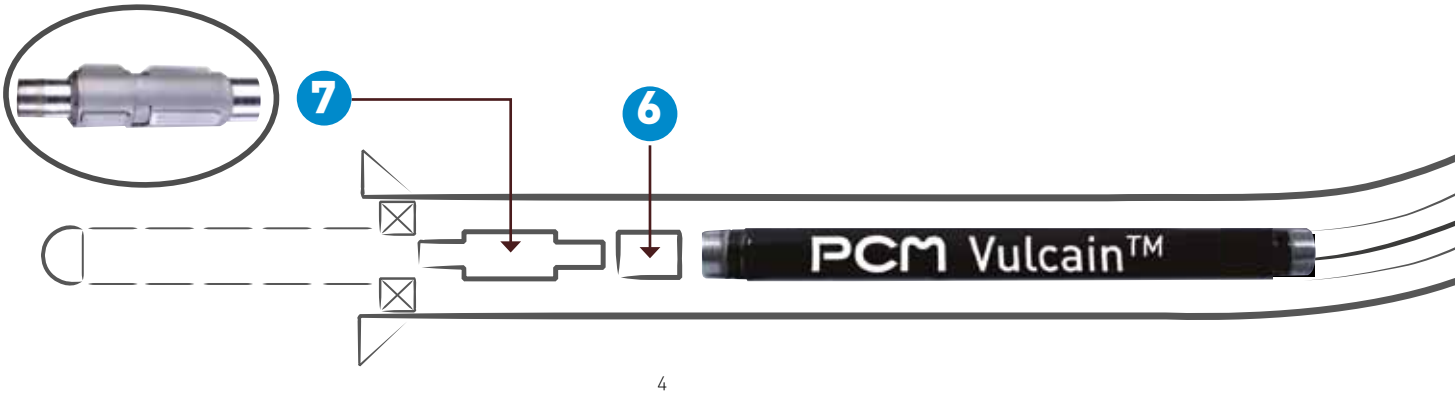
Thermal recovery includes different processes. PCM Vulcain™ high-temperature package has the suitable technology to meet the different requirements of all thermal recovery methods.

## PCM VULCAIN™ RANGE OF PUMPS




**Example:**
300 V 800 can produce:
- 300 m³/d at 0 bar and 100 rpm.
- Rated for a differential pressure of 800 mWC.

**Achievements :**
- Up to 2 years run life (continuous running)
- 330°C / 650°F Steam through pump stator
- High efficiency on extremely hot water
- High ability to run during steam flashing



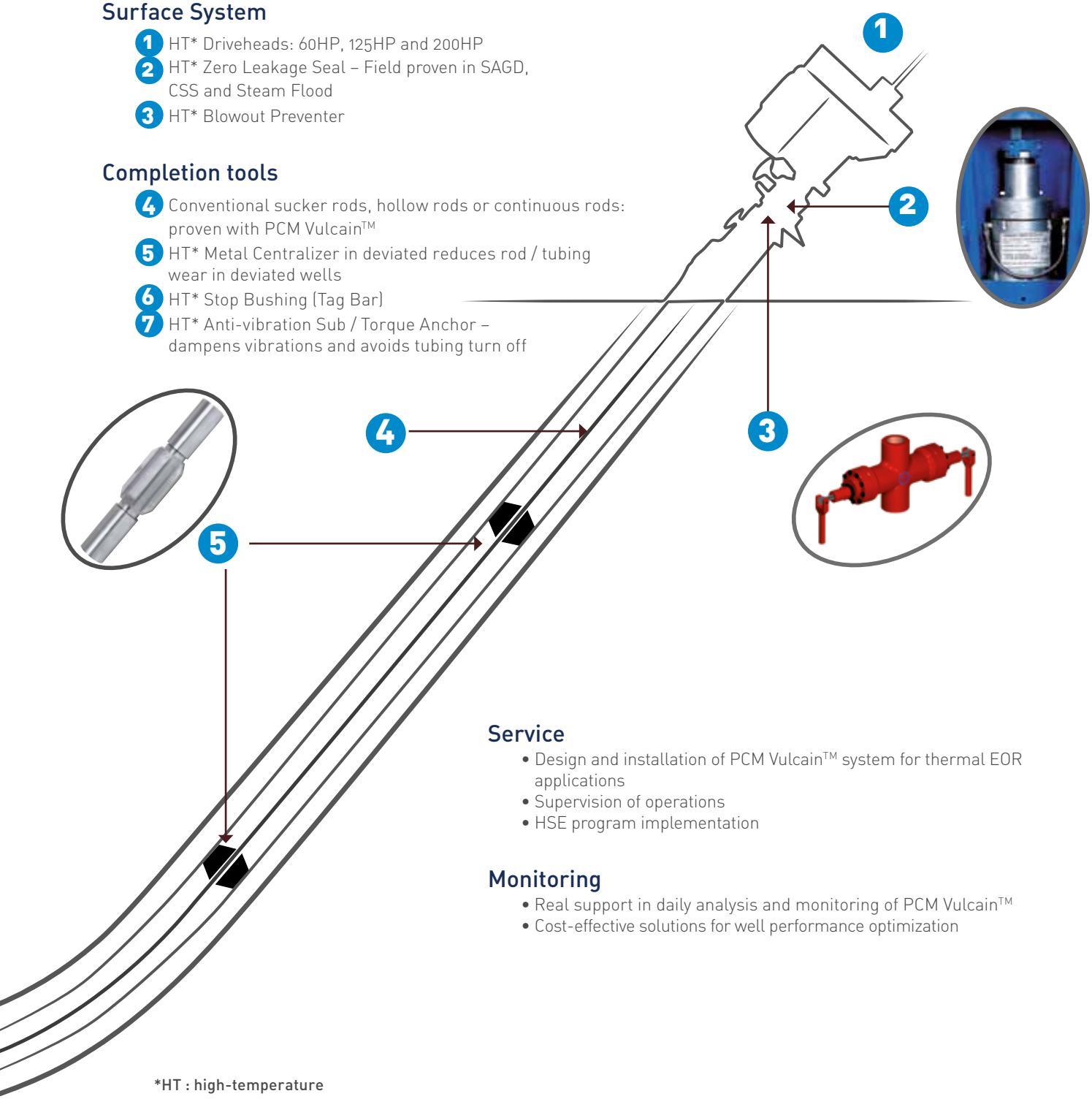

## HIGH-TEMPERATURE PACKAGE

### Surface System

1. HT* Driveheads: 60HP, 125HP and 200HP
2. HT* Zero Leakage Seal – Field proven in SAGD, CSS and Steam Flood
3. HT* Blowout Preventer

### Completion tools

4. Conventional sucker rods, hollow rods or continuous rods: proven with PCM Vulcain™
5. HT* Metal Centralizer in deviated reduces rod / tubing wear in deviated wells
6. HT* Stop Bushing (Tag Bar)
7. HT* Anti-vibration Sub / Torque Anchor – dampens vibrations and avoids tubing turn off




### Service

- Design and installation of PCM Vulcain™ system for thermal EOR applications
- Supervision of operations
- HSE program implementation

### Monitoring

- Real support in daily analysis and monitoring of PCM Vulcain™
- Cost-effective solutions for well performance optimization

*HT : high-temperature


# FOR ALL YOUR HIGH-TEMPERATURE DOWNHOLE APPLICATIONS

PCM Vulcain™ high-temperature package encompasses production requirements at all stages of your field life. This makes it "The unique life cycle pump".

SAGD field - Canada

## INCREASING RELIABILITY IN SAGD

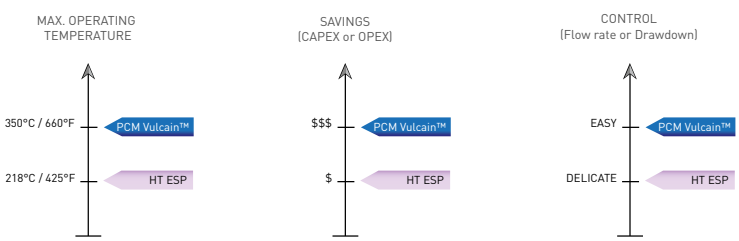
Finding a reliable artificial lift pumping system for SAGD is a challenge due to the high operating temperatures (up to 260°C / 500°F). Progressing cavity pumps with elastomer stators have proven unsuitable because the elastomers are limited to temperatures below 150°C/300°F.

While rod pumps offer high-temperature service, they are limited in the flowrate they can deliver. Electric submersible pump can handle high volumes of low viscosity fluids, but are limited in terms of maximum operating temperature, which causes extended downtime due to motor shutdowns.

PCM Vulcain™ is used for SAGD in Canada in shallow, very low pressure oil sands fields in the Athabasca area. Operators prefer the PCM Vulcain™ for SAGD and install PCM Vulcain™ pumps in new wells and use them to replace ESPs when they fail.

## Performance Comparison (PCM Vulcain™ vs. electric submersible pump)

SAGD /PCM **Vulcain**™ vs HT ESPs

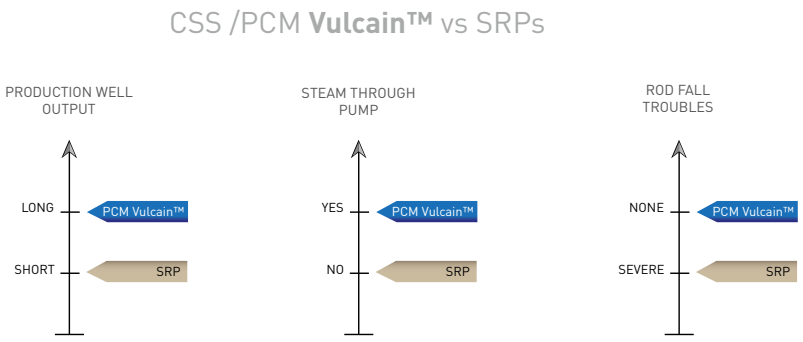



CSS field - Canada

## ACHIEVING LONGER PRODUCTION CYCLES IN CSS

CSS is a very common thermal EOR used to recover extra heavy oils from oil sands or to increase heavy oil recovery. PCM Vulcain™ is the right technology as it meets all the criteria. It can be kept in the wellbore during steaming and easily operates over a wide range of temperatures, pressures and flow-rates. In addition, PCM Vulcain™ offers lower capital costs than rod pumps for even higher production.

### Performance Comparison (PCM Vulcain™ vs. sucker rod pump)




Steam flood field - Oman

## LOWERING OPEX IN STEAM FLOOD

PCM Vulcain™ is uniquely adapted to handling the variation of inflow from cold to hot downhole conditions, as rotor/stator fit remains constant and flowrate is simply adjustable with speed.

PCM Vulcain™ delivers outstanding OPEX savings. It eliminates the costs of switching from one artificial lift technology to another (elastomer PCP, SRP or ESP) depending on the well productivity index. The resulting wellhead standardization and fewer switchover periods generate substantial cost savings. For these reasons, PCM Vulcain™ systems are used on a large scale in the Middle East to produce mature fields. PCM Vulcain™ increases production, with less downtime and smoother operation.

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