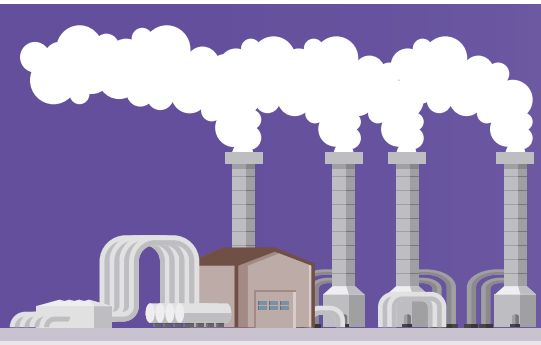
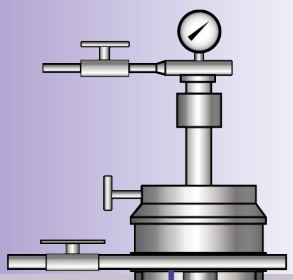
# ThermaGenix* Geothermal ESP System

High efficiency ESPs for reliable production of hot thermal water





The cost-efficient, reliable production of hot thermal water is an essential requirement for the economic development of a geothermal energy project.

Electric submersible pump (ESP) systems are among the best methods for providing the lift required to produce a large volume of hot fluid from deep geothermal wells. Although the produced geothermal water is warm, the downhole motor still provides effective motor cooling which is vital to ensuring long system run life.

Having supplied ESPs to the oil industry, the expertise built over decades of experience goes into Levare's vast portfolio of ESP systems designed for the most challenging down-hole conditions.

With all critical ESP components engineered to operate at bottom-hole temperatures up to 250°C (482°F). Levare's specially engineered Geothermal ESP systems are serving the growing clean energy market with fluid flow rates up to 60,000 bpd (9,540 $m^3$/day).

Further supporting clean energy initiatives, the Levare Geothermal ESP system incorporates a permanent magnet motor (PMM) in replacement of the traditional induction motor. Levare's PMMs are extraordinarily energy efficient, having shown to reduce electrical power consumption by as much as 20%. A Geothermal ESP system using a single section 980 hp PMM delivers an estimated annual savings of $50,000 in electrical cost when compared to an equivalent size induction motor (considering 0.07 $/kWh energy cost for a 1,000 hp application).

The ThermaGenix* MLE is engineered to withstand harsh environments at temperatures of 250°C (482°F). Its design incorporates PEEK insulation providing excellent resistance properties that are retained at high temperature cables, an upgraded pothead sealing design, and different material armor options for corrosive environments.

* mark of Levare International

### Electric Submersible Pump

Stainless steel housing or MONEL coating for protection against corrosion

Compression pump

Abrasion-resistant bearings

### Power Cable

Rated at 232°C (449°F)

Stainless steel or MONEL armor for protection against corrosion

### Metal Bellows Motor Seal

Rated at 250°C (482°F)

Improved reliability in harsh environments

### Motor Pothead Connection

Rated at 250°C (482°F)

MLE PEEK insulation option rated up to 500°F is available

### Permanent Magnet Motor

Up to 980HP in one section

Up to 20% energy savings compare to Induction analogues (Up to 93% efficiency)

Rated at 250°C (482°F)

**Successful runs over 500 days**

## 250°C Metal Bellows Motor Seal

The challenges of operating in high temperatures require engineering innovations and exacting manufacturing standards. To meet these challenges, Levare developed a motor seal using metal bellows that replace the more temperature susceptible elastomer bag design.

The advanced motor seal design features metal bellows set inside of two chambers with a five bellows array.

The combination of metal bellows connected in parallel and in series, provide a positive seal or barrier between the well fluids and the motor oil.

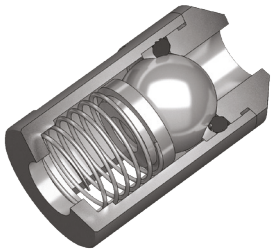
The thrust chamber includes a split sleeve instead of split ring and a Castle pump to force oil flow through the bearings for better lubrication and cooling. The thrust bearing is high temperature polymer coated and has a high load capacity of 14,000 lb with a maximum operating temperature of 250°C (482°F).

A series of three mechanical shaft seals provide triple re-dundancy. The mechanical seals have a proprietary diamond face and no dynamic elastomer for improved reliability in harsh downhole conditions.

The design also uses higher-pressure carbide ball check valves for increased reliability in high temperature and sandy wells. Additionally, the integration of zero-leak valves and plugs further enhances system reliability in severe environments, particularly those with $H_2S$ exposure.

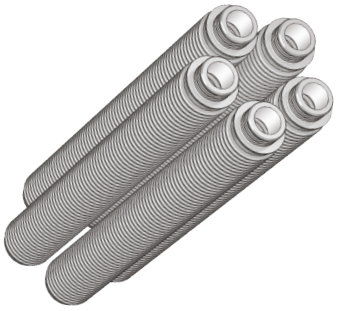
A fit-for-purpose solution, the Levare metal bellows motor seal delivers better protection against temperature cycling and chemical attack.

1 Ball-style Check Valve



2 Diamond Face Shaft Seals

3 Metal Bellows

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