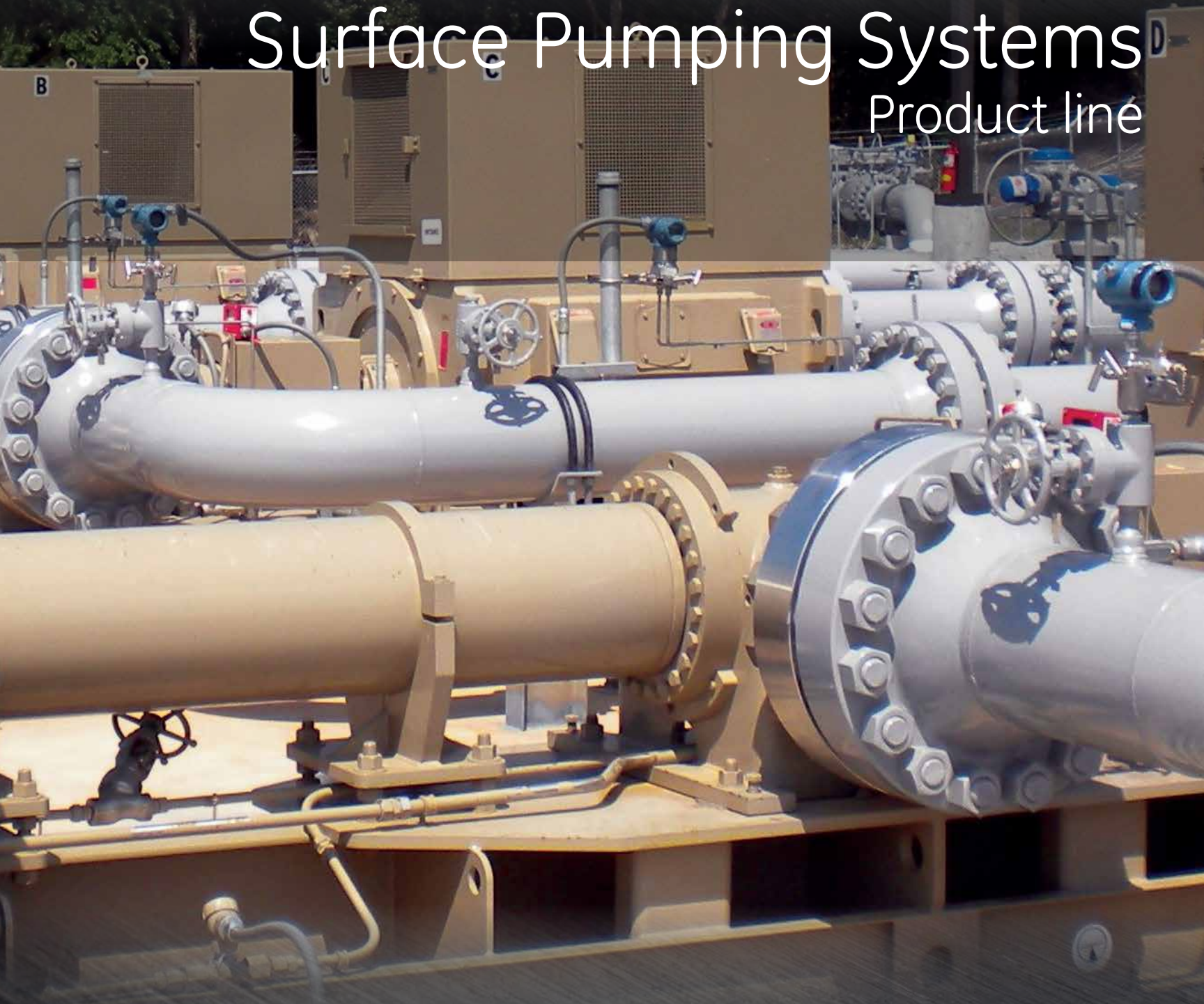


GE Oil & Gas

Surface Pumping Systems

Product line



GE imagination at work

We know that the life cycle of industrial pumps are often at the center of your decision making process. That is why GE is your partner for the long run. We carefully consider the life-cycle operating efficiencies, power consumption, environmental impact and reliability of our pumps to ensure they will meet your needs now and in the future.



Improved surface pumping solutions

The drive for long-lasting, highly-reliable, environmentally-friendly pumping solutions has led many customers to appreciate our SPST[™] Surface Pumping Systems. GE's SPS pumping systems provide versatile, low-maintenance alternatives to many high-speed integral gear-driven centrifugal (OH6), positive displacement (PD) and vertical-turbine pump (VTP) models.

Pre-packaged units

Our SPS pumps are available in gas, electric or diesel-powered models and can handle up to 2,500 gpm (85,000 BFPD) and discharge pressures up to 6000 psi.

SPS systems are delivered to the job site pre-assembled—only requiring suction flange, discharge flange and power hookups. The Easily Modified SPS Frame (EMF[™]) is pre-wired with instrumentation and cabling terminated in a central junction box. This proprietary frame, paired with the versatile design of our pumps, allows for easy on-site installation and maintenance with minimal site preparation.

Trouble-free service

The SPS pump is designed for years of trouble-free operation. There are no V-belts or packing to service. Routine maintenance consists of a quarterly lubricant change and component check. SPS units generate little to no vibration-related wear or stress on piping components and they are available with a variety of mechanical seal options (including API 682 seals).

The modular design makes SPS units suitable for a wide variety of applications, from routine water injection to mine dewatering and leaching operations. The GE SPS pump is very reliable, highly-efficient and easily modified in the field, saving you maintenance time.



GE's Surface Pumping Systems (SPS)

Pump

Multi-stage centrifugal pump with industry-leading, high-efficiency designs. The pump is supplied as an easily replaceable module. Additional pump elements can be added or "re-staged," if required for changing duty conditions. Most pumps are "mixed flow" design for enhanced abrasion resistance, improved gas handling and higher efficiency.

Mechanical Seal

All units feature an optimized mechanical seal and stub shaft with silicon carbide faces that operates at suction pressure. Seals are available up to 3000 PSI. Options include API-682 cartridge type, as well as API flush and quench plans. The patented Front Pull-Out™ design allows for rapid change-out of the seal and/or stub shaft without disturbing the bearing frame and flexible motor coupling, thus avoiding realignment or the spacer coupling requirement.

Thrust Chamber

The bearing-frame thrust chamber is an easily-interchangeable module that is compatible with other SPS units regardless of the pump size. It features a low number of rotating parts for long, trouble-free life, requires minimal maintenance, optimizes oil dispersion and reduces operating temperatures using an oil-ring lubrication system, and includes a thermocouple to provide temperature monitoring and shut-down protection. Labyrinth shaft seals protect the internals from the environment without wearing the shaft surface.

Pipe-work Height

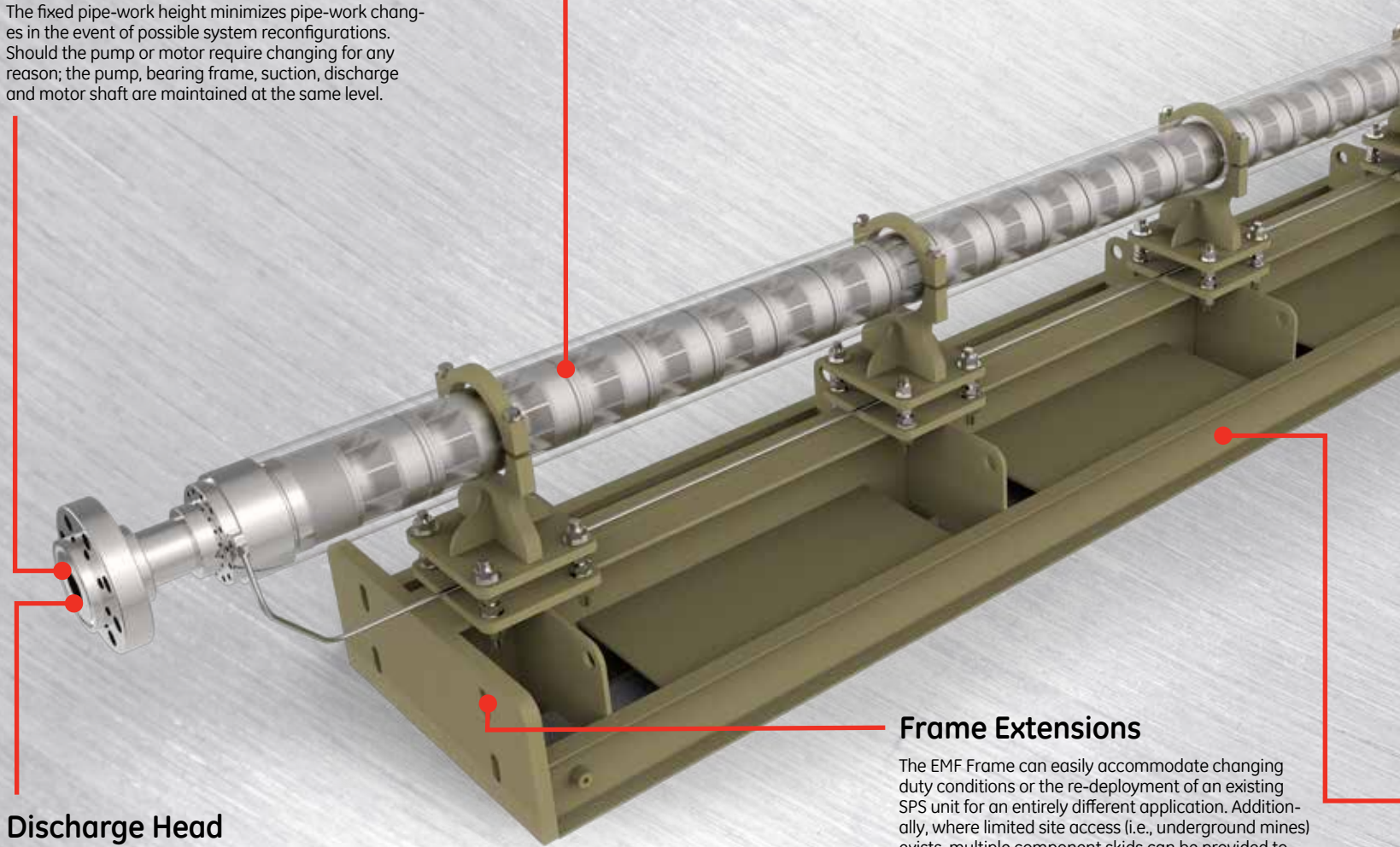
The fixed pipe-work height minimizes pipe-work changes in the event of possible system reconfigurations. Should the pump or motor require changing for any reason; the pump, bearing frame, suction, discharge and motor shaft are maintained at the same level.

Discharge Head

Standard flanges are ANSI-B16.5 class 300 through 2,500, lap joint type to allow for alignment with pipe work. Other connections/ flange standards are available.

Frame Extensions

The EMF Frame can easily accommodate changing duty conditions or the re-deployment of an existing SPS unit for an entirely different application. Additionally, where limited site access (i.e., underground mines) exists, multiple component skids can be provided to facilitate portability and assembly.



Motor/Prime Mover

An industry standard 2-pole NEMA and IEC foot-mounted electric motor is used in configurations to suit local requirements for enclosure type, voltage, frequency, insulation class, hazardous area, etc. Other drive options include gas or diesel engine via a speed increaser.

Flexible Coupling

A standard grid-style coupling provides for long life and minimizes maintenance requirements. Other coupling types are available on request.

Benefits

- Lower initial and whole-life cost
- Short construction lead-times
- Increased reliability and runtime
- Low noise and vibration levels
- Easy installation
- Remote monitoring and diagnostic capability
- Worldwide support

Applications

- Borehole mining
- CO₂ injection/booster
- CO₂ sequestration
- Condensate transfer
- Crude oil boosting/transfer
- Dust suppression
- Geothermal
- Hydraulic power fluid boosting
- Jet pumping
- Lean amine circulation
- Mine dewatering
- NGL boosting/transfer
- Offshore facilities fluid handling
- Pipeline boosting
- Process fluids transfer
- Produced water disposal/injection
- Salt dome leaching
- Seawater disposal/waterflooding
- Wash water circulation
- Water transfer

Instrumentation/Control Package

The standard SPS instrumentation package includes suction and discharge pressure gauges and control switches, a vibration switch and bearing frame thermocouple. Other instrumentation and control options are available.

Suction Chamber

This chamber can be rotated in 45° increments. Standard flanges are ANSI-B16.5 class 150 through 2500. Other connections/flange standards are available.

EMF™ Frame*

The patented Easily Modified Frame™ features a rigid base frame for low vibration and ease of installation. It incorporates integral lifting lugs throughout and/or machined motor adapter plate (shown in green), which together with the frame motor plate are predrilled for virtually all available motor options.

*A model FM1000 EMF frame is shown. Other models include FM75, FM150, FM1500 and FM3000.

Pump Comparison

Issue	Pump Type		
	SPS	PD	OH6
Capital cost	Low	Low	Moderate
Whole-life cost	Low	High	High
Up time	High %	Low %	Moderate %
Down time	Low %	High %	High %
Daily/weekly maintenance	No	Yes	No
Downtime per repair	Low	Moderate	Moderate
Cost of repair	Low	Moderate	High
Noise level	Low	High	High
Vibration	Low	High	Low
Pulsation	Nil	High	Nil
Seal (qty)	Mechanical (1)	Packing (3 or 5)	Mechanical (1)
Environmental leakage	Virtually Nil	High	Virtually Nil
Flow/pressure flexibility	High	Moderate	Low

PD = positive displacement reciprocating pump

OH6 = API 610 type OH6 High-speed integral gear-driven vertical single-stage overhung pump



Crude Oil Transfer (North America)



CO₂ injection (North America)



Waterflood (North America)



Water injection

Onshore Production

As your partner, we understand the specific pump requirements for onshore production and provide global pumping solutions to maximize project investments. Our SPS pumps are employed in a multitude of onshore production applications including:

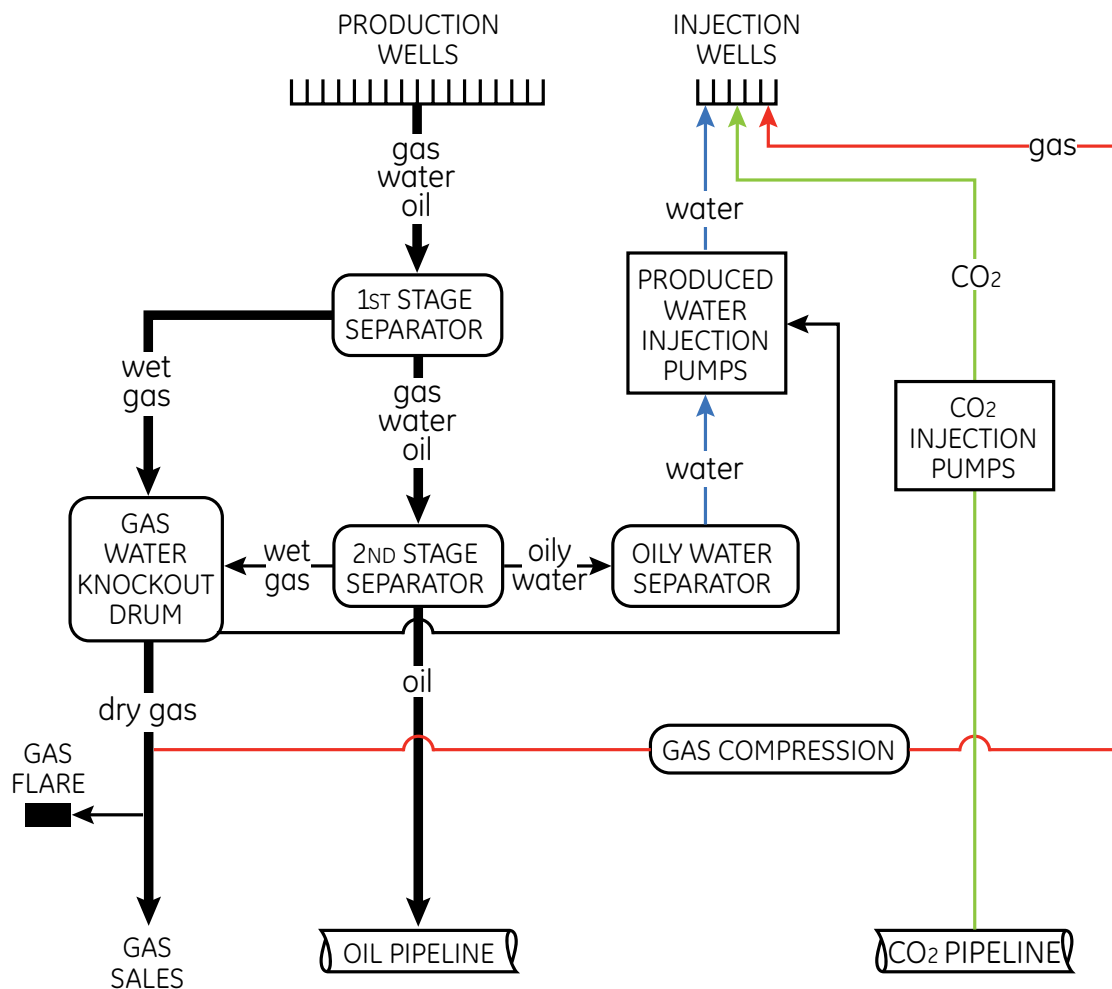
- Enhanced oil recovery systems (ex. CO₂ handling and injection)
- Gathering systems
- Production systems for conventional fluids (oil and petroleum products)
- Separations Systems
- Produced water handling and treating
- Steam-generating plants/distribution systems for thermal recovery projects
- Storage systems
- Water Injection & disposal systems



Water injection (Middle East)



Produced water disposal (North America)



Typical onshore production flow diagram



Offshore Production

Offshore fields account for approximately 35% of global oil and gas production. This is expected to increase as we continue to see growth in deepwater, remote and marginal fields. In these offshore applications, where pumps are used to inject, transfer and boost produced fluids, equipment reliability is critical to avoid downtime, increase run-life and improve operating efficiency.

Due to the requirements of deeper and further offshore applications, we developed a process to customize highly-reliable long service life pumping systems to meet your ship-and platform mounted pumping needs. These SPS systems maintain your reliability expectations of GE, while providing flexibility and responsiveness to application changes.

Offshore applications of GE's SPS pumps include:

- Crude Oil Transfers (platform to FPSO)
- Off-loading booster
- Seawater Injection
- Water Injection



FPSO treated sea water injection (Africa)



FPU crude oil transfer (Gulf of Mexico)



FPU water injection (South America)



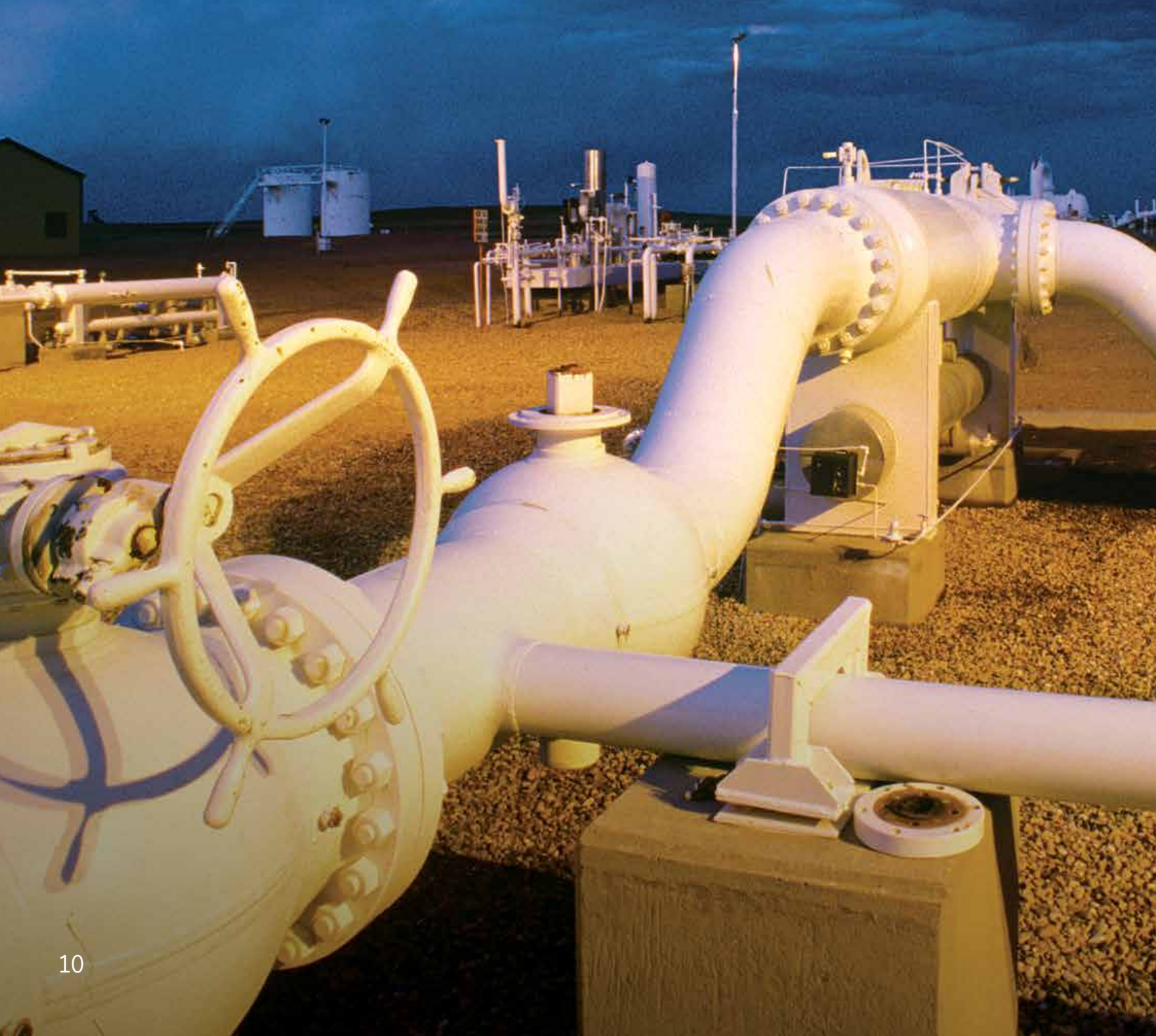
FPU crude oil transfer (South America)



Crude oil and Produced Water Injection (South America)



Ethane pipeline booster (North America)



Pipeline

Pipeline networks require high pressure pumps to move fluids over long distances. In certain instances, booster stations are needed to keep the pressure high enough so the fluid can reach its final destination.

Pipeline operators around the world have discovered that our SPS pumps provide versatile and low maintenance alternatives to split-case centrifugal and positive-displacement pump applications. GE's SPS pumps can boost, re-circulate and transfer a wide range of liquids through pipelines in oilfield and industrial applications including:

- Crude oil
- Light hydrocarbons (ethane, methane, butane, propane)
- CO₂
- Refined petroleum products (motor gasoline, aviation fuels, kerosene, diesel fuel, heating oil and fuel oils)
- Petrochemical feed stocks and products
- NGL (natural gas liquids)



CO₂ pipeline booster (North America)



Crude oil and Produced Water Injection (South America)



CO₂ pipeline booster (North America)



Hydrocarbon Processing

The process industries are among the world's largest users of industrial pumps. Refining, petrochemical and chemical process operations employ a multitude of methods that convert raw materials into finished products of value. Managing fluid flow (liquids and gases in motion) throughout a given operation is critical. To maximize your operating efficiencies, improve flexibility and create the potential to decrease environmental impact, we assess each of your applications in order to deliver the best possible pumping system.

GE's SPS pumps are extremely reliable, high performance units and are well-suited to a wide range of high pressure, heavy duty applications including:

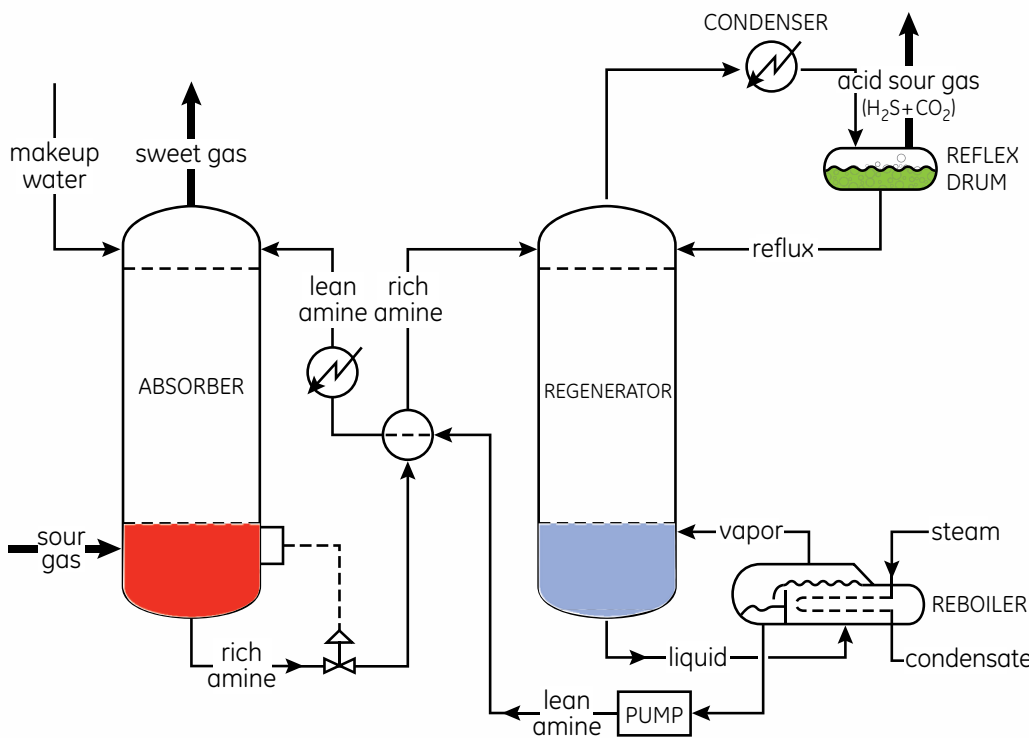
- CO₂ sequestration
- Condensate transfer
- Crude oil boosting and transfer
- Hydraulic power fluid boosting
- Lean amine circulation
- Liquefied/natural gas (NGL) boosting
- Liquefied/natural gas (NGL) transfer
- Process fluids transfer
- Wash water circulation



Mixed light hydrocarbons (North America)



Amine gas treating (North America)



Gas sweetening process flow diagram



Ethane Booster (North America)



Mining, Municipal, Industrial and Geothermal

Effective water management is critical in mining and salt dome leaching operations. GE's SPS pumps are available to the MMIG industry as **portable skid-mounted units**, **trailer-mounted units** and as multiple pumps in **fixed installations at main pump stations** and can be used in the following applications:

- Seawater transfer (to mines for processing)
- Mine de-watering
- Cavern (salt-dome) leaching
- Open pit and shaft mining
- Borehole mining

Mine Water Management

Mine operators must be able to manage water throughout the operation and quickly alleviate problems as they occur. Mine dewatering is usually undertaken to ensure the stability of mine walls during and after excavation, or to optimize mine production and increase operational efficiencies.

In many mines, the amount of water that must be pumped exceeds the mines' water consumption requirements. In this case, a majority of the excess water is discharged to our surface SPS water pumping systems, re-injected into aquifers, applied to crop land, or piped to power plants.

Cavern Leaching

There are numerous cavern leaching and/or formation jetting (borehole mining) applications. For example, a salt dome is a type of structural dome formed when a thick bed of water-soluble mineral sediments (mainly salt or halite) intrude vertically into surrounding rock strata, forming a diapir.

In salt dome leaching processes, our SPS pumps are frequently used to circulate water, absorbing the salt. A large underground cavern is formed after the salt has been leached and the water is removed. GE's SPS pumps are also used to re-inject materials such as oil, natural gas, hydrogen gas or even hazardous waste into the empty caverns for storage.



Salt dome leaching/brine water (North America)



Mining operations (North America)



Water transfer installation (North America)

Design, Engineering, Manufacturing & Custom Fabrication

Achieving the highest standards of performance with any pumping system requires attention to detail in every phase of design, engineering, manufacturing and service. Some companies call this quality assurance. **We call it commitment.**

With an emphasis on quality, cost and delivery, all our processes (engineering, quotation, manufacturing, fabrication, testing and tracking systems) are designed to reduce lead times and increase efficiency. Rigorous product testing ensures that our equipment meets design specifications and is highly-reliable.

GE maintains state-of-the-art facilities and a highly skilled workforce on a global scale. We are heavily invested in modern manufacturing systems geared to producing the best surface pumps, controls and communication products available. Our core business is providing engineered, application-specific, high-pressure pumping solutions.

From order to field installation, all of our systems are designed to produce pumping solutions with trouble-free performance in any environment.



Manufacturing



Assembly



One-half of a custom fabricated skid-mounted enclosure delivered to installation site



Two of three FM1000s inside custom fabricated enclosure



Vector VII VSD assembly



Vector VII VSD "plug and play," custom-fabricated control skid



Vector VII 561 KVA VSD

Surface Controls, Integration, Monitoring & Diagnostics

GE offers a wide variety of automation and surface control equipment to help you increase reliability and effectiveness and reduce operating costs of your Surface Pumping Systems.

Vector® VII Variable Speed Drives

Vector™ VII Variable Speed Drives (VSD) are compatible with surface pumping systems (SPS) and include an intuitive operator interface, application specific software and expanded communications capability. Available in ratings from 104-1515KVA, these drives include a full-color graphical interface to provide:

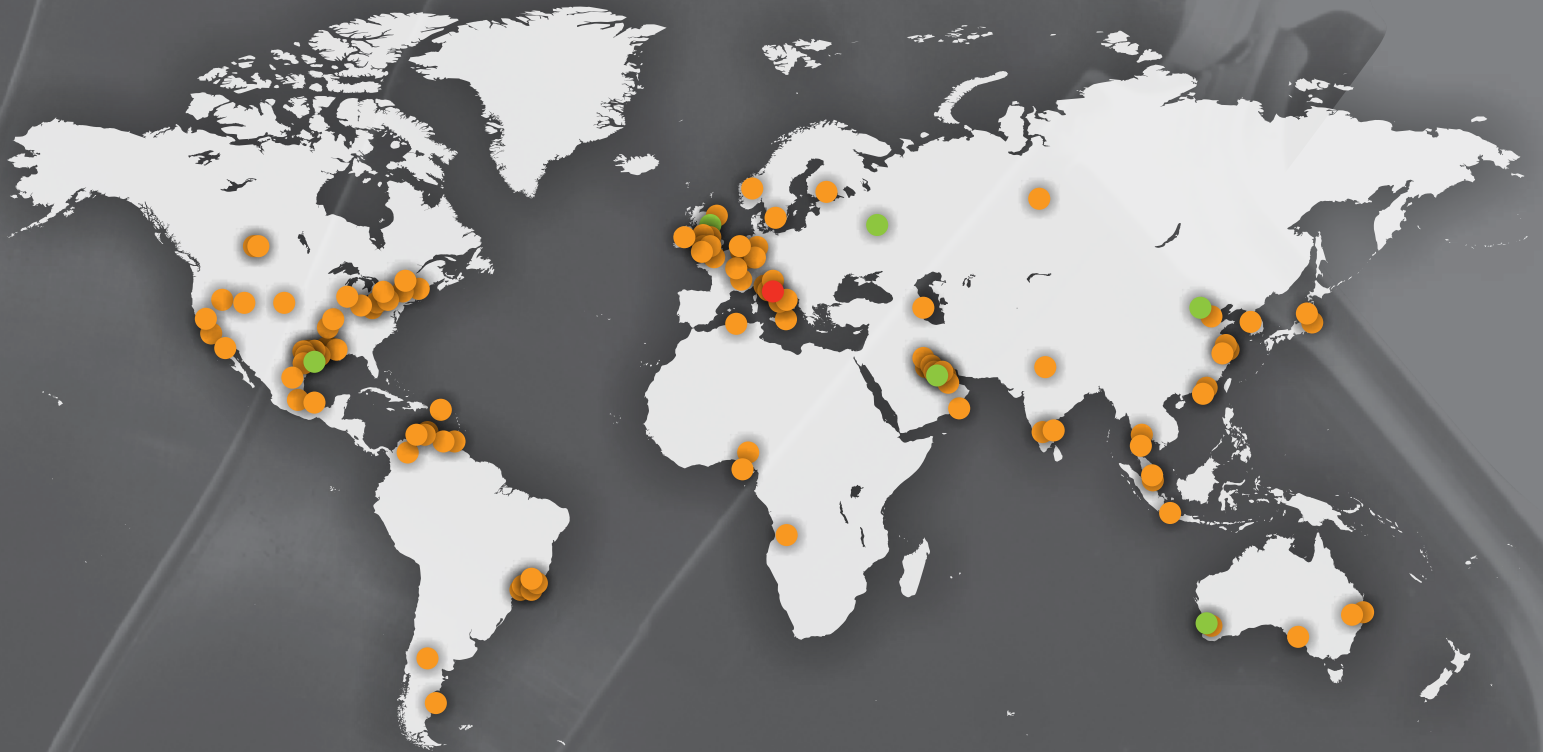
- Motor speed
- Motor current
- Motor overload and underload settings
- Controlled starts
- Auto restarts
- Restart delays
- Restart retries

Monitoring and Control Systems

Our monitoring systems can improve the effectiveness of your reliability/maintenance program by continually monitoring your pump system's health and automatically notifying you of changes or conditions that require intervention. We provide two intelligent motor control systems: an SPS Pump Controller for variable speed drive applications and the iMonitor™ motor controller for fixed speed use.

Using the latest advances in hardware, software and telecommunication technology, these units offer motor protection, data acquisition and event logging with the capability for real-time data analysis. Modular construction and add-on options allow these controllers to be configured for standalone operation or for use in coordinated pumping systems. Remote monitoring and control of pump operation is possible for sites located anywhere in the world using SCADA systems connected via Ethernet, wireless phone, or satellite communication systems.

Worldwide Industry wide






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GE imagination at work