

Evaporate Produced Water with Safe, Direct Heat

INTRODUCING THE

PYROS™

Powered by ShockWave Power™ Reactor Technology

EVAPORATION SYSTEM

The PYROS™ Series 4 is a versatile, self-contained, tank-to-tank, continuous evaporation system. Fluid is pumped into the PYROS Series 4, heated to evaporation temperatures, concentrated - based on sophisticated instrumentation, then is pumped out of the unit at safe, tank storage temperatures. The byproduct of the process is clean steam that is condensed into fresh water by heating the incoming fluid. Recycling the steam heat not only doubles the throughput, but it dramatically improves the economics of the process.

The PYROS Series 4 harnesses the power of controlled cavitation to heat most any fluid safely and effectively. The technology is built around the patented Shockwave Power™ Reactor (SPR)* that heats any fluid without a flame, and is by definition, non-scaling heat. Evaporation and concentration take place in a specially engineered flash tank in which fluid is continuously circulating. Cold fluid comes into the circulating loop where it is heated to boiling, and then continues to circulate until it is concentrated. The hot concentrated fluid is pumped out through a heat exchanger that cools it to less than 150°F for tank storage. Raw fluid is always being pumped into the system and concentrated fluid is continuously pumped out.

The PYROS Series 4 also synergistically takes advantage of engine exhaust heat to maximize produced heat. The SPR efficiently converts shaft horsepower from the diesel engine into heat, but a diesel engine, by definition, loses much of the heat in diesel fuel to exhaust gas. The PYROS 4 includes a heat exchanger to recover exhaust heat. That raises the efficiency of the unit to compare favorably with a steam boiler, but without the related safety issues.

The first Law of Thermodynamics is the conservation of energy and that means heat does not disappear, but it can be recycled. By definition you need



**TOTAL SEPARATION
SOLUTIONS, LLC**

*Innovative Technologies in Fluid Filtration,
Processing and Reclamation*

www.totalsep.com

1000 BTU of heat to evaporate one pound of water. If you heat water to its boiling point and add 2.5 million BTU per hour, then you make steam that is equal to 2.5 million BTU per hour or 2500 pounds of steam. The steam heat goes to the atmosphere. If you recycle the steam heat, that multiplies the heat from the SPR. The SPR and Exhaust add make-up heat that increases the throughput and makes evaporation an economical process.

The PYROS Series 4 is a modified version of the Series 14 unit. To recycle the steam heat and produce fresh water, either vacuum is used in the flash tank to increase the efficiency of the system, or steam is superheated to gain multiple-effect evaporation. In climates with low humidity, atmospheric evaporation enhances the process.

The PYROS Series 4 includes a cross-flow filtration module since produced water and frac flow back waters are often contaminated with solids. Cross-flow filtration using sintered metal tubes allows the continuous operation without replacing filters.

Designed for mobility, the PYROS 4 is part of a modular system. For example, a second 10-foot module is added to the system for vacuum condensation of the steam and cross-flow filtration. Everything is diesel driven with all the ancillary support systems. The complete PYROS Series 4 Evaporator does not require any additional services and it can be run anywhere as a stand alone unit. It is small enough to be installed at the point source of the produced water to eliminate excessive trucking costs.

* Total Separation Solutions is the exclusive licensee for SPR technology in the oil and gas industry.
License provided by Hydro Dynamics, Inc.



TOTAL SEPARATION SOLUTIONS, LLC

Innovative Technologies in Fluid Filtration, Processing and Reclamation

6650 W. Sam Houston Parkway N. • Suite 450 • Houston, TX 77041
Phone: 832-467-3400 • Fax: 832-467-4800 • www.totalsep.com

- **Controlled Cavitation plus Heat Recovery**
 - Converts shaft horsepower into heat
 - Exhaust heat is used to increase efficiency
 - Steam from evaporation is recycled in a vacuum condensation process.
- **Continuous evaporation**
 - Fluid is continuously heated and circulated through flash tank
 - Sophisticated Process Logic Control (PLC) with instrumentation automates process
 - Input fluid is efficiently evaporated and exits the PYROS as concentrate
 - Percent evaporation is determined based on properties of concentrate.
- **Shockwave Power™ Reactor**
 - Harness the power of controlled cavitation
 - Proven technology for heating fluids
 - Spinning disk with closed boreholes creates an area of low pressure
 - Tiny cavitation bubbles form and collapse
 - Restricting the cavitation inside the boreholes prevents damage
- **Specifications**
 - Cummins KTA-19
 - Hydro Dynamics 32-inch Shockwave Power Reactor
- **Performance Specifications**
 - 5,000,000 BTU/hour of safe heat
 - 5,000 pounds of steam/hour
 - Steam equivalent to a 150 HP boiler
 - 85,000 BTU per minute
 - Consumes 33 gallons of diesel per hour
 - Evaporate up to 5000 bbls of water per day.
- **Dimensions**
 - Modular Skids
 - PYROS SPR skid 8.5 x 14 feet