

## PDQ™ Environmental Fluid Management System EFMS™

The Environmental Fluid Management System (EFMS) is an integrated system of solids control, fluid recovery, and drilling waste management equipment masterfully packaged into a single mud tank configuration.

An ideal solution for operators drilling in zero-discharge environments, the EFMS eliminates the need for a reserve pit and drastically reduces site reclamation requirements. The system connects directly to the flow line, making integration into existing drilling rigs a simple exercise.

The EFMS maximizes separation of solids and liquids, while comprehensively managing both phases after separation. Discarded cuttings are prepared for off-site disposal through an automated system of screw conveyors; drilling fluids are recycled and liquid phases primed for re-use in the active mud system.



## EFMS™: Environmental Fluid Management System

### Features:

#### Flowline Annular Jet Pump

The Flowline Jet is installed in the flowline between the bell nipple and the shale shaker mud box. The EFMS piping system is designed to utilize clean drilling fluid to pressurize the flowline jet, generating a low pressure region upstream and a high velocity mud flow downstream. The higher return velocities facilitate rapid displacement of drill solids. By diluting the flowline returns, the elasticity and viscosity of the drilling fluid are reduced, thereby enhancing shaker screen and hydrocyclone separation of low gravity drilled solids.

#### Dual Motion Shale Shakers

The EFMS shakers combine linear and balanced elliptical motion technologies for superior performance.

The linear motion setting, capable of producing 6.9 G's, is ideal for processing large cuttings volumes associated with surface hole sections. With the flip of a switch, the shakers instantaneously shift to balanced elliptical mode.

In balanced elliptical mode, G-forces are reduced (5.7 G's) and cuttings spend more time in contact with screens, increasing fluid-recovery rates and reducing operating costs.

#### Hydrocyclones

Simple to operate and maintain, hydrocyclones are an integral component of the mud cleaning process, particularly in larger surface hole sections.

The EFMS utilizes a combination of 2", 4", and 6" hydrocyclones, enabling a finer, more consistent separation of solids when compared to traditional desander/desilter configurations.

With the introduction of twenty (20) 2" cones, the operator is able to remove solids as small and less than 5 microns.

#### Chaos Mixers

Separation efficiency of the 2", 4" and 6" hydrocyclones is enhanced by utilizing a chaos mixer upstream of each set of EFMS hydrocyclones.

The dynamic shearing stress imparted in the mixing chamber of the chaos mixer develops velocity forces at the solid / liquid interface, resulting in a reduction of surface tension and lower viscosity, which in turn improves flow rate, separation and filterability.

#### Vertical Cuttings Dryer

The EFMS cuttings dryer works to remove residual drilling fluids from well-bore cuttings previously discarded by the shakers and hydrocyclones.

By producing up to 400 G's of centrifugal force, the cuttings dryer can process solids with an oil-on-cuttings ratio as low as 1%, helping operators meet compliance regulations for waste disposal. The additional separation achieved by the cuttings dryer increases fluid recovery rates, resulting in lower costs for replacement fluid, further reducing operating costs.

To ensure optimum operation, a dedicated rotary lobe pump is used to circulate drilling fluid through the cuttings dryer assembly. This added feature prevents solids from settling out in the dryer during connections and tripping operations.

#### VFD Decanting Centrifuge

The high-volume decanting centrifuge is the final piece of separation equipment in the EFMS.

Using variable frequency drive, the EFMS centrifuge has speed capabilities ranging anywhere from 1,900 to 3,250 rpm and G-Forces from 500 to 2100 G's. This versatility allows the EFMS centrifuge to be used in two operational modes: 1) barite recovery or 2) fine-silts removal, with a cut point as low as 3 microns.

#### Screw Conveyor System

The screw conveyor is a simple, yet highly effective means of transporting drill cuttings.

Through the EFMS automated system of screw conveyors, all discarded well-bore cuttings are safely and efficiently transported and collected for off-site treatment or disposal.

### OPERATIONAL BENEFITS:

- 1) Eliminate the use of reserve pits
- 2) Limit hauling and disposal costs
- 3) Build smaller, more compact locations
- 4) Reduce site reclamation
- 5) Efficiently manage well-bore cuttings and disposal
- 6) Recycle oil with as low as 1% oil retention on cuttings by weight
- 7) Reduce water consumption per well
- 8) Reduce overall well costs

## Land Rig: EFMS™

### MUD PROCESSING TANK

Quantity:	One (1)
Footprint (L x W x H):	45' x 10' x 8.5'
Active Capacity:	345 bbl in five (5) compartments
Mud Mixing:	Bottom guns w/ Radial Eductors

### DUAL MOTION SHALE SHAKER

Quantity:	Two (2)
Footprint (L x W x H):	94" x 72" x 44"
Weight:	2,965 lbs (each)
Screen Area:	22 sq ft (ea.)
Vibrating Motors:	4.6 hp (ea.)

### HYDROCYCLONES

Configuration:	Four (4) x 6" cones
	Four (4) x 4" cones
	Twenty (20) x 2" cones

### CHAOS MIXER

Configuration:	One (1) Upstream of 6" cones
	One (1) Upstream of 4" cones
	One (1) Upstream of 2" cones

### MUD CIRCULATION PUMP

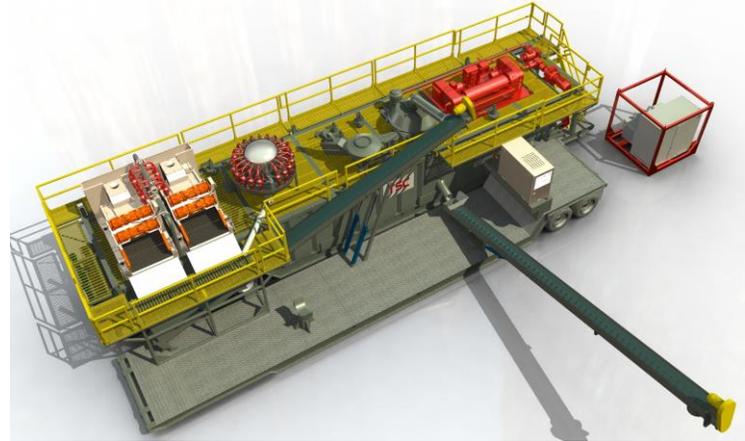
Quantity:	Three (3)
Configuration:	8 x 6 x 14
Drive Motors:	100 hp @ 1800 rpm
Volumetric Capacity:	2,600 gpm/pump; 7,800 gpm total

### ATMOSPHERIC DEGASSER

Quantity:	One (1)
Footprint (L x W x H):	67" x 40" x 95"
Weight:	1,000 lbs
Flow Rate:	600 gpm

### VERTICAL CUTTINGS DRYER

Quantity:	One (1)
Footprint (L x W x H):	89" x 64" x 48"
Weight:	4,200 lbs
Screen Area:	7.11 sq ft
Main Drive Motor:	30 hp
Max. Processing Capacity:	40 tons/hour
Dryer Circulation Pump:	10 hp Rotary Lobe Pump



### VFD CENTRIFUGE

Quantity:	One (1)
Footprint (L x W x H):	119" x 70" x 34"
Weight:	6,200 lbs
Bowl Diameter:	14"
Bowl Length:	56"
Main Drive Motor:	50 hp
Back Drive Motor:	15 hp
Centrifuge Feed Pump:	20 hp Rotary Lobe Pump

### SCREW CONVEYOR SYSTEM

Quantity:	Two (2)
Auger Size (O.D.):	14"
Auger Length:	36 ft (each)
Drive Motors:	15 hp

### TRANSPORTATION SYSTEM

Mud Processing Tank:	57 ft Quad-axle Rockover Trailer w/ hydraulic landing gear
Screw Conveyors:	55 ft Dual-axle Rockover Trailer w/ hydraulic landing gear

### ADDITIONAL EQUIPMENT

Lighting:	LED Lighting System
Miscellaneous:	32 HP Diesel HPU for hydraulically-actuated walkways, roof, landing gear & augers; 15 HP Compressed air system

