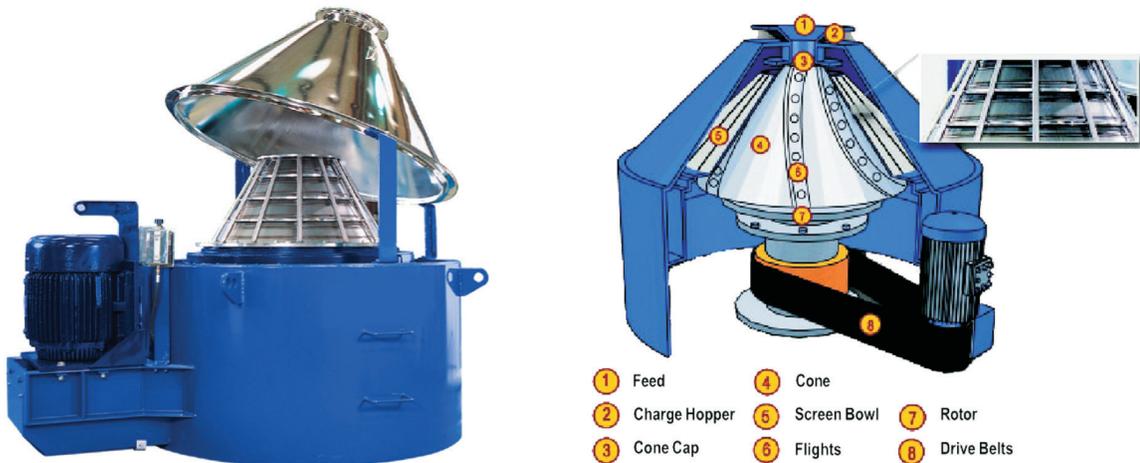


ENHANCING THE RECOVERY OF BASE FLUID FROM DRILL CUTTINGS



The VORTEX Dryer reduces and recovers base fluid from a variety of feed slurries. In drilling operations, shale shakers can discard drilled cuttings that are up to 20% oil by weight. Treatment with the VORTEX Dryer has proven to reduce this oil content dramatically, in some cases below 2%.

Additional Benefits:

- Recover valuable base fluid for reuse
- Reduce solid waste volumes to curb haulage cost
- Meet environmental objectives or guidelines
- Reduce fluid content on cuttings prior to other forms of treatment, thereby increasing waste treatment efficiency

Often, the VORTEX Dryer can meet more than one of these objectives simultaneously. In some applications, it offsets operational costs by saving time, reducing drilling fluid dilution needs, or increasing process treatment capacity.

The VORTEX Dryer uses centrifugal force to recover oil from drilled solids in oil or synthetic base fluids. A stainless steel screen bowl traps “wet” solids and accelerates them up to 540 G’s with centrifugal force. Liquid is forced through the screen bowl openings, while “dry” solids are extracted by the angled flights attached to the cone, which rotate slightly slower than the bowl. Tungsten carbide protects the flights from abrasive solids and ensures long operational life. This aids in maintaining a constant gap between the scroll and screen bowl, which is crucial for proper operation.

Extensive field use of the VORTEX Dryer and long-term monitoring has proven that it can meet strict environmental discharge criteria. The VORTEX Dryer system can help operators comply with effluent limitations as mandated by the US Environmental Protection Agency for offshore drilling operations.

The VORTEX Dryer has been used in various applications including thermal desorption pre-treatment and bioremediation pre-treatment. Numerous benefits are realized including energy conservation and increased process efficiency. The VORTEX Dryer is designed with particular care to assure vibration-free operation. Rotating components are individually balanced,

making parts interchangeable without disturbing the balance of the entire rotating assembly.

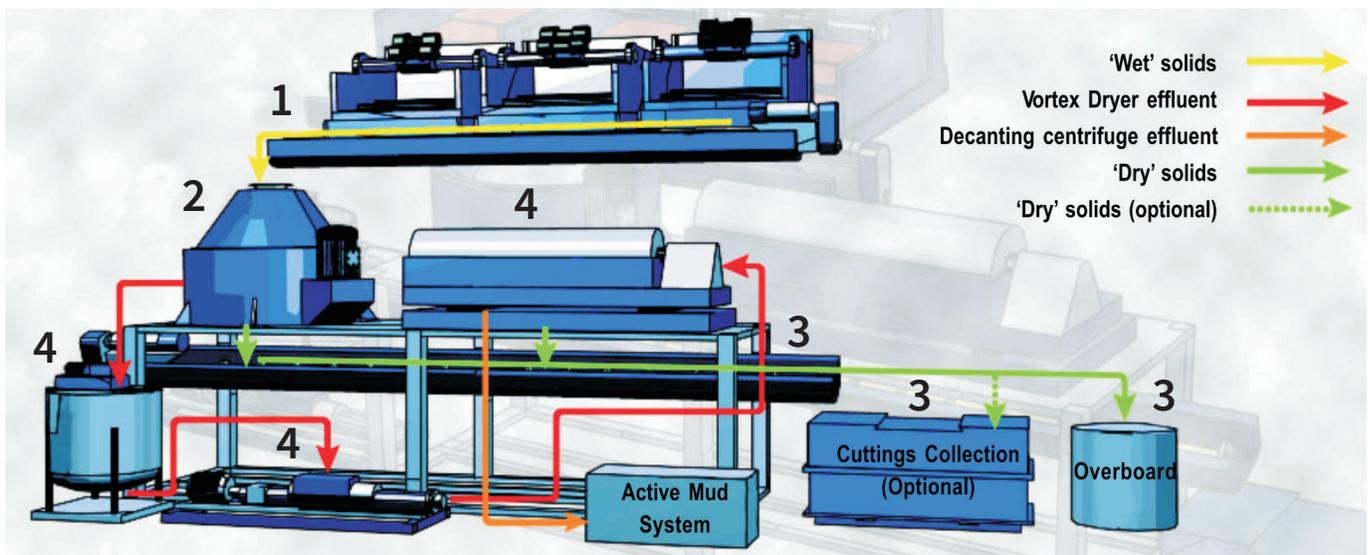
Every effort has been made to reduce maintenance requirements for the VORTEX Dryer. Normal wear parts are accessible from the top of the machine; belts can be changed without removing the gear assembly and the entire gear assembly can be removed with little effort. Special materials, like tungsten carbide and ceramic tiles, are applied to high wear areas.

The dryer comes with two flush lines that clean the screens in case they get filled and blinded with solids. An externally mounted oil lubrication system circulates clean lubricant to the differential gear assembly. The lubrication system is electrically interlocked with the main motor starter to prevent machine operation in the event of low or no oil pressure to the gearbox. Each VORTEX Dryer system is configured to specific site requirements. Low-profile versions integrate dual augers to remove solids and are ideal for height restrictive installations. Most units will come with an overhead crane to facilitate maintenance of the screen bowl and rotating components. VORTEX Dryer systems have set the standard for offshore operation.

VORTEX™ Dryer

Specifications and Dimensions

Separation	Screen produces up to 540 G's of separating force Screen openings: 0.008" to 0.020" (210 to 500 micron)
Power Requirements	75 hp, 230/460 VAC, 60 Hz EXP (other VAC and Hz are available) Ratings — UL, CSA, and CENELEC
Capacity	80 Metric Tons per Hour
PHYSICAL DATA	
Overall Dimensions (L x W x H)	71.25 in x 116 in x 71.375 in (nominal height) 1810 mm x 2946 mm x 1813 mm (nominal height)
Weight	12,000 lb (5443 kg)
*Specifications are subject to change based on configuration selected. Please contact your NOV Sales Representative for more information.	



BASIC COMPONENTS:

NOV supplies the VORTEX Dryer as part of a total system. A properly engineered and operated system consists of four main elements:

- 1) Delivery system to move cuttings to the VORTEX Dryer
- 2) VORTEX Dryer
- 3) "Dry" solids discharge / collection system
- 4) Centrifuge to polish the VORTEX Dryer effluent

Each piece is crucial to proper operation and must be engineered accordingly.

1) Feed System

Size, shape, volume and moisture content of drilled solids can vary greatly. Installing a proper delivery system to deal with the range and volume of material is critical. There are several types of delivery systems including:

- A variety of screw conveyors and chutes
- Vacuum transfer systems
- Positive pressure transfer systems
- Modular purpose-built systems that may use combinations of these technologies.

2) VORTEX Dryer

The VORTEX Dryer processes drilled cuttings to between 1% and 5% wet weight oil. The VORTEX Dryer has comfortably processed cuttings generated at 150 feet per hour in 20-inch hole (46 meters per hour in 508-mm hole).

3) "Dry" Solids Discharge or Collection

A screw conveyor is usually installed beneath the VORTEX Dryer and collects the "dry" solids, which are sent overboard if regulations allow, or are collected for final disposal off-site.

4) Effluent Polishing

The VORTEX Dryer effluent is typically collected and pumped to a high-volume decanting centrifuge for further cleaning. The decanting centrifuge separates the slurry into fine solids and "cleaned" fluid, which is often sent back to the active drilling fluid system. A portion may be used as dilution for the VORTEX Dryer. The solids from the centrifuge can be collected in the same vessel or conveyor as solids from the VORTEX Dryer.