Vertical Cuttings Dryers Overview

2015 – Revision O

Maximizing WBM and OBM Drilling Fluid Recovery
Full-Service OEM
Engineering, Design, Manufacturing, Commissioning and Servicing.

Solids Control
Waste Management
System Integration and Modular Construction
Fluid Management and Conditioning

As a division of the Elgin Equipment Group, Elgin Separation Solutions is able to tackle both the small and the big projects, regardless of location or well complexity.
Organizational Footprint
And Key Customers.
VCD Application
VCD Application is Driven by Three Key Objectives:

Drilling Fluid Reclamation
VCD’s recover OBM and WBM from drill cuttings discharged from the flow line shakers. Shakers can discharge cuttings that are up to 25% by weight “wet”. When unrecovered, this lost fluid will cost the rig thousands per day.

Waste Solid Reduction
By reclaiming drilling fluid from the cuttings, the overall volume (or weight) of the cuttings is lowered, therefore lowering transport and disposal costs by the same percentage of fluid recovery, generating further savings.

Waste Solid Declassification
Depending on the rig site (offshore vs. onshore) or even on the region in which the drilling activity is occurring, the reduction of the fluid content can lower the hazard classification of the waste solids.

The application of a VCD is driven by return on investment generated from the above three goals.
VCD Application

VCD’s as a Waste Management Device.

VCD’s are not a solids control system, they are strictly designed for waste management and fluid recovery.
VCD Application
Representative vertical cuttings dryer performance capability.¹

A 2/3 reduction in drilling fluid loss can be achieved depending on the formation being drilled.

¹As referenced in EPA Compliance Cost Methodology for BAT/NSPS Cuttings Dryer Technology, performance data from 23 wells revealed that the Synthetic On Cuttings (SOC) was reduced from 11.7% to 4.15% by weight after being processed.
VCD Application
There are Several Considerations to Keep in Mind:

VCD operation requires qualified personnel. Elgin has a full team of specialists available for training and certification.

- **Consistent Feed Rate**: Consistent feed rates will optimize VCD performance and ensure that the system is not over-taxed. Screw conveyor feed is highly recommended in lieu of bucket loading.

- **Moisture Content**: Cuttings transport and the solids reduction efficiency can be hampered by cuttings that are too dry. Though counter-intuitive, sometimes it is best to reduce the cleaning capacity of the shakers.

- **Large Bore Limitation**: VCDs operate best when the particle size distribution of the cuttings is large. Fine cuttings and clays will impact will require additional oversight and maintenance.

- **Fluid Inhibition**: Though VCD’s can be used with both WBM and OBM, VCD’s work best when applied in drilling fluid applications that are highly inhibited.

- **VCD Post-Treatment**: Post-treatment, via centrifuge, is recommended to remove the fines from the centrate before being returned to the active mud system.
Intelligent Design
With Over 800 Worldwide Installations, No One Has More Expertise.

1. Engineered Flights
With various blade materials and coatings available, Elgin has developed the industry’s most durable and precise flights in the market. Single piece conical sections also available.

2. Screens
The heart of a VCD is the screen. By using a fully TIG welded, chromed screen, Elgin customers can experience screen life as long as a year. Screens with a slot size between 200 and 800 microns are available.

3. Spray Nozzles / Bar
By integrating the spray bar into the launder section, Elgin VCD’s can withstand the longest operating periods between service.

4. Tapered Launder
By tapering the launder section collected fluids flow more efficiently and significantly lower the risk of a back-up within the VCD.

Elgin’s Engineering Team continues to develop unique and proprietary improvements to maximize performance and durability.
Intelligent Design
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**Screen and Basket**
Fully welded basket secures the screen in place during operation.

**Maintenance / Inspection Hatch**
Three maintenance / inspection hatches are located around the body of the VCD.

**Water Shield Inspection**
Two inspection / clean out hatches are located on each side of the water shield.

**Lube Pump Filter**
Filter change is easy and efficient when operating the lube pump on the VCD.

**Lube Pump Configuration**
The VCD lube pump is conveniently located for easy maintenance with pressure gauge reading.
VCD Selection
Two Quality Field-Proven Products Available:

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<thead>
<tr>
<th></th>
<th>CSI-03</th>
<th>CSI-04</th>
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</thead>
<tbody>
<tr>
<td>Feed Capacity:</td>
<td>25 - 40 TPH (6.2 - 10 kg/s)</td>
<td>40 - 60 TPH (10 – 15 kg/s)</td>
</tr>
<tr>
<td>G Force:</td>
<td>518 G’s</td>
<td>403 G’s</td>
</tr>
<tr>
<td>Maximum Bowl Speed:</td>
<td>1,142 RPM</td>
<td>887.5 RPM</td>
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<tr>
<td>Gear Box Ratio:</td>
<td>74:1</td>
<td>71:1</td>
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<tr>
<td>Differential Speed:</td>
<td>15.4 RPM</td>
<td>12.5 RPM</td>
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<tr>
<td>Weight (Without Stand):</td>
<td>4,400 lbs (1,995 kgs)</td>
<td>7,700 lbs (3,492 kgs)</td>
</tr>
<tr>
<td>Screen Surface Area</td>
<td>7.11 sq. ft. (0.661 sq. m.)</td>
<td>13.1 sq. ft. (1.22 sq. m.)</td>
</tr>
<tr>
<td>Motor Horsepower:</td>
<td>30 HP (22.71 KW)</td>
<td>75 HP (60 KW)</td>
</tr>
<tr>
<td>Voltage (Dual-Rate Motors):</td>
<td>460v / 60Hz or 380V / 50Hz - 3 Phase</td>
<td>460v / 60Hz or 380V / 50Hz - 3 Phase</td>
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<tr>
<td>Dimensions (Without Stand):</td>
<td>7’ (2.1m) L x 6’ (1.8m) W x 5’ (1.5m) H</td>
<td>8.10 (2.5m) L x 7.3’ (2.2m) W x 5.9’ (1.8m) H</td>
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</table>
VCD Screen Selection Guides

Elgin Manufactures a Large Variety of Screens to Ensure Performance:

Be sure to talk with one of Elgin’s Applications Engineers to determine the best scraper and screen selection.
VCD Economic Evaluation Guides
Elgin Has Prepared a Series of ROI Calculators To Ensure Proper Decision Making

Be sure to talk with one of Elgin’s Applications Engineers to ensure the greatest return on your investment.

### Comparative Economic (Daily Rig Drilling Fluid and Waste Management Savings)

#### Evaluation of VCD’s With Traditional Drying Shakers

<table>
<thead>
<tr>
<th></th>
<th>No Waste Management</th>
<th>Drying Shaker System</th>
<th>Vertical Cutting Dryer System</th>
<th>Total Well Savings Generated With VCD</th>
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<tbody>
<tr>
<td>Wet Cuttings per Well in Tons</td>
<td>500</td>
<td>500</td>
<td>500</td>
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<tr>
<td>Wet Cuttings per Well in Pounds</td>
<td>1,000,000</td>
<td>1,000,000</td>
<td>1,000,000</td>
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<tr>
<td>Bulk Density of Inlet Cuttings (Pounds Per Gallon)</td>
<td>30</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Bulk Density of Drilling Fluid (Pounds Per Gallon)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
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<tr>
<td>Average Oil on Cuttings (“OOC”) Percentage</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
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<tr>
<td>Dry Cuttings per Well in Tons</td>
<td>820,000</td>
<td>820,000</td>
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<tr>
<td>Drilling Fluid Contained in Wet Cuttings per Well</td>
<td>180,000</td>
<td>180,000</td>
<td>180,000</td>
<td></td>
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<tr>
<td>Average Effluent OOC Percentage</td>
<td>18%</td>
<td>12%</td>
<td>4%</td>
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<tr>
<td>Weight of Recovered Drilling Fluid Unrecovered</td>
<td>180,000</td>
<td>120,000</td>
<td>40,000</td>
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<tr>
<td>Weight of Recovered Drilling Fluid Recovered</td>
<td>0</td>
<td>60,000</td>
<td>140,000</td>
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<tr>
<td>Gallons of Recovered Drilling Fluid Unrecovered</td>
<td>15,000</td>
<td>10,000</td>
<td>3,333</td>
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<tr>
<td>Gallons of Recovered Drilling Fluid Recovered</td>
<td>0</td>
<td>5,000</td>
<td>11,667</td>
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<tr>
<td>Total Number of Recovered Barrels</td>
<td>0</td>
<td>119</td>
<td>278</td>
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<tr>
<td>Value per Recovered Barrel</td>
<td>$110</td>
<td>$110</td>
<td>$110</td>
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<tr>
<td>Total Value of Recovered Drilling Fluid</td>
<td>$0</td>
<td>$13,095</td>
<td>$30,556</td>
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<tr>
<td>Equiv. Pounds per Well of Solids Discharge</td>
<td>1,000,000</td>
<td>940,000</td>
<td>860,000</td>
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<tr>
<td>Maximum Weight per Truck Load*</td>
<td>40,000</td>
<td>40,000</td>
<td>42,000</td>
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<tr>
<td>Number of Truck Loads</td>
<td>25</td>
<td>24</td>
<td>20</td>
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<tr>
<td>Average Cost per Truck Load for Disposal</td>
<td>$1,750</td>
<td>$1,750</td>
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<tr>
<td>Average Cost per Truck Load for Disposal</td>
<td>$43,750</td>
<td>$41,125</td>
<td>$35,833</td>
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</tbody>
</table>

*Maximum Weight Highly Influenced by Level of Liquid Thereof, Solids Solidification. The Drier the Solids, the More Solids That Can Be Disposed Per Truck Load.
VCD Options
Elgin can provide a host of VCD options.

Weather Proof Containerized
VCDs can be installed within fully enclosed, weather-proof structures for easy transport or operation in extreme weather conditions.

Telescoping Stands with Decks
Depending on the manner in which the VCD will be installed, telescoping stands, with or without walkways, can be provided. Cantilevered cover removal system included.

VFD Controls with HMI Interface
To control the imparted G-force, a VFD system can be added to the VCD. Explosion proof VFD Panel available.

There are a myriad of options available for each installation that should be considered before finalizing the system configuration.
Closing the OBM and WBM Loop
Integrated Solids Control and Waste Management Products.

Elgin’s product portfolio provides a “one-stop” shop for any solids control management or waste management challenge.
Elgin Value
Definitive Value Proposition in Utilizing Elgin VCD’s.

Elgin manufactures its own spare parts and consumables ensuring 100% integrated accountability for the entire VCD.

Unsurpassed Experience
Elgin has shipped more than 500 newly manufactured decanter centrifuges, 200 remanufactured centrifuges, 800 newly manufactured VCD’s and over 100 remanufactured VCDs’ to over 40 different countries.

Unsurpassed Durability
With more than 25 years of experience building centrifuges for the oil and gas industry, Elgin has developed a reputation for the most durable systems in the market. The average asset life exceeds 10 years with proper preventative maintenance.

Full-Scale Engineering Support
Elgin’s dedicated Engineering team evaluates system hydraulics, frictional losses, predictive reliability, and failure mode evaluation analysis (“FMEA”) for each VCD designed. Months of product validation testing is performed prior to the release of any Elgin VCD.

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