Advanced Speed Control
for Pumps and Compressors.
Vorecon with Dual Torque Converter
Sir Isaac Newton (1643 – 1727)

It is one of the most famous anecdotes in the history of science. An apple drops from a tree and hits the mathematician, physicist and astronomer Sir Isaac Newton on the head. This event inspires the scientist to formulate the law of gravity. Newton's laws form the basis of classical mechanics, even today.

You benefit from the most efficient and most reliable way of controlling speeds: Mechanically.
The new Vorecon with Dual Torque Converter

And hydrodynamically.

Prof. Dr.-Ing. Hermann Föttinger (1877 – 1945)

Hermann Föttinger worked with hydrodynamics — wear-free power transmission using a circulating fluid. He developed the hydrodynamic torque converter. With this, he was able to very efficiently convert torque and speed between the driving machine and the driven machine.
The Vorecon with Dual Torque Converter is a hydrodynamic variable speed planetary gear with two matched torque converters. It delivers high efficiency, even into the lower speed range. This gives you a very efficient way to control the speed of large pumps and compressors.

Control speeds in the power range of 6 – 50 MW
Drive systems with the Vorecon RWC-M-D have a high overall efficiency, even down into the lower speed range. They’re up to 2% more efficient than drive systems with a VFD.
The Vorecon with Dual Torque Converter is the ideal solution for operating points that frequently fall within the speed range of 60 % to 90 % of maximum speed.

High overall efficiency covering the entire speed control range

Comparison of overall efficiency
The Vorecon with Dual Torque Converter saves you money –
up to 200,000 USD per year compared to drive systems with VFDs.

$ 200,000
annual energy costs saved
## Drive systems in a pipeline compressor station: Vorecon with Dual Torque Converter in comparison to a VFD

<table>
<thead>
<tr>
<th>Operating points</th>
<th>Partial load 54%</th>
<th>Design 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating time</td>
<td>4,350 hours/year</td>
<td>4,350 hours/year</td>
</tr>
<tr>
<td>Compressor power consumption</td>
<td>6,902 kW</td>
<td>12,870 kW</td>
</tr>
<tr>
<td>Compressor operating speed</td>
<td>9,344 rpm</td>
<td>11,500 rpm</td>
</tr>
<tr>
<td>Relative operating speed</td>
<td>81%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Drive with VFD
(values from the publications of several VFD manufacturers and customer information)

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Partial load 54%</th>
<th>Design 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor efficiency</td>
<td>96.1%</td>
<td>97.3%</td>
</tr>
<tr>
<td>VFD efficiency</td>
<td>96.7%</td>
<td>98.5%</td>
</tr>
<tr>
<td>Isolation transformer efficiency</td>
<td>98.9%</td>
<td>99.9%</td>
</tr>
<tr>
<td>Harmonic filter efficiency</td>
<td>98.2%</td>
<td>99.9%</td>
</tr>
<tr>
<td>Gearbox efficiency</td>
<td>97.2%</td>
<td>98.5%</td>
</tr>
<tr>
<td>Lubricating oil pump efficiency</td>
<td>99.4%</td>
<td>99.7%</td>
</tr>
<tr>
<td>Air-conditioning equipment efficiency</td>
<td>99.3%</td>
<td>99.6%</td>
</tr>
<tr>
<td>Overall efficiency</td>
<td>86.6%</td>
<td>91.4%</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>34,677,559 kWh/year</td>
<td>61,244,590 kWh/year</td>
</tr>
</tbody>
</table>

### Drive with Vorecon RWC-M-D
(values from internal calculations)

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Partial load 54%</th>
<th>Design 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor efficiency</td>
<td>96.2%</td>
<td>97.5%</td>
</tr>
<tr>
<td>Vorecon efficiency</td>
<td>93.9%</td>
<td>95.0%</td>
</tr>
<tr>
<td>Overall efficiency</td>
<td>90.3%</td>
<td>92.6%</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>33,237,132 kWh/year</td>
<td>60,442,155 kWh/year</td>
</tr>
</tbody>
</table>

### Comparison

<table>
<thead>
<tr>
<th>Energy costs</th>
<th>Partial load 54%</th>
<th>Design 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy savings with Vorecon RWC-M-D</td>
<td>1,440,427 kWh/year</td>
<td>802,485 kWh/year</td>
</tr>
<tr>
<td>Savings per operating point</td>
<td>126,638 USD/year</td>
<td>72,224 USD/year</td>
</tr>
</tbody>
</table>

**Total savings with the Vorecon RWC-M-D**: 201,862 USD/year
The Mean Time Between Failures (MTBF) of the Vorecon is 48 years. Your production will run for a very long time without unplanned shut-downs, boosting the productivity of your system.
### Reliability, MTBF

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machines considered</td>
<td>201</td>
</tr>
<tr>
<td>Operating hours</td>
<td>8,065,000 hours</td>
</tr>
<tr>
<td>Reliability</td>
<td>99.99%</td>
</tr>
<tr>
<td>MTBF</td>
<td>≈ 48 years</td>
</tr>
</tbody>
</table>
The Vorecon lasts more than three times longer than a VFD. This gives you reliability in your long-term planning – for decades.
Hydrodynamic power transmission is wear-free. The mechanical power transmitting components are robust and designed for a long lifetime.

**A product with a long lifetime**

**Comparison of lifetime**

Vorecon No. 1

VFD No. 1 No. 2 No. 3

Commissioning 12 years 24 years
Thanks to hydrodynamic power transmission, the Vorecon offers significant reserve torque capacity compared with variable frequency drives (VFD). An oversized drive is not necessary. This cuts your investment costs for the drive by 20% to 40%.
Efficient Drive Solution

The Vorecon offers virtually constant power transmission capability over the entire control range. This means that high torque is available in the lower speed control range at partial load operating points. This torque is up to 42% higher than that provided by drive systems with variable frequency drives (VFD). The installed power is correspondingly lower.

Maximum available torque
It requires up to 68% less installation space than comparable drive systems having a VFD. This saves you money and weight in your system design.
The Vorecon is a unit comprising a speed control system, gearbox and oil supply. This considerably improves the drive system.

Low infrastructure costs

The Vorecon is a unit comprising a speed control system, gearbox and oil supply. This considerably improves the drive system.

Comparison of required installation space

Drive system with Vorecon

Electronic variable speed drive system

Motor Vorecon Cooling system

Run down oil tank
Air conditioning system
Building
Cooling system
VFD
Cooling system
Transformer
Drive solutions for a variety of applications

We work with you to review the visible and the hidden costs for your drive system. Together, we find the solution that reduces your total cost of ownership (TCO).
Oil and gas production
- Gas lift compressors
- Depletion compressors
- Reinjection compressors
- Natural gas production compressors

Offshore platforms
- Gas lift compressors
- Export gas compressors

Gas treatment
- Wet gas compressors

Gas transport
- Pipeline compressors
- Gas storage compressors

FPSO
- Reinjection compressors
- Export gas compressors

Power plants
- Boiler feed pumps
The dual torque converter design expands the speed range with optimal efficiency. This provides additional flexibility for your system. Even if the operating points in your process change over time, there’s no need to change your drive system. You gain extra security for your planning.
The basic components of the Vorecon RWC-M-D are two torque converters coupled with a planetary gear. The planetary gear is designed as a super-imposing gear. Both torque converters are matched to each other and alternate as the control unit.

- The drive motor starts up under load-relieved conditions because the driven machine only takes up a small amount of power due to the regulated speed.
- After starting up the motor, one torque converter is filled. The driven machine is then gently accelerated to minimum operating speed, even with a large mass moment of inertia.
- The speed is further controlled, depending upon the operating range, by one of the two torque converters with its adjustable guide vanes.

- Each torque converter has the optimum efficiency for its range.
- All components of the Vorecon RWC-M-D have a proven history and are currently in use in a wide range of hydrodynamic units. More than 140 customers worldwide trust Vorecon technology.