ACS5000 drives improve electrical fracturing in oil and gas industry

Honghua Group Ltd. provides fracturing systems for shale gas extraction. Its first electric-run 6000HP fracturing pump was introduced in 2019. Typically, each system includes 8 pumps driven by highly reliable and efficient ACS5000 drives from ABB. Compared to the traditional diesel-driven system, the new solution is more beneficial for both the customer and the end-users.

Honghua
Honghua Group Ltd. is one of the leading land drilling equipment manufacturers in the world and the largest land drilling rig exporter in PRC. The company is primarily engaged in manufacturing conventional land drilling rigs, digital drilling rigs, accessories for drilling rigs, as well as the parts and components for their machines. With an annual manufacturing capacity of 120 drilling rigs and 500 mud pumps, Honghua has the world’s largest rig assembly and test yard in China, where 24 rigs can be assembled/rigged up simultaneously.

Leveraging on the strong R&D strength, high-quality production facilities and mature international sales network, Honghua is delivering 80% of their products to the biggest oil and gas exploration companies all over the world, including the major oil-production regions such as North America, Middle East, and emerging markets including South America, India, Russia and Africa.

Electrical fracturing
Electrical fracturing is the latest technique to replace traditional diesel-driven systems with direct variable speed drives. In 2019, Honghua released their first 6000HP digitally controlled electric fracturing system with the world’s largest single-machine. The fracturing system adopts their patented motor construction and ABB MV drives, which realizes accurate flow and pressure control of the pump and effectively reduces energy consumption, maintenance, and labor costs required for pump operation.

Highlights
- Property investment saving of 30%
- Energy saving of 40%
- System installation area saving of 30%~50%
- ~50% labour cost reduction
- 100% reduction in CO2 emission
Challenge
Oil and gas fields are usually located in mountain areas, high above the sea level, making it difficult to transport large and heavy equipment. High installation altitude also means that the cooling of the electrical equipment is more challenging and needs to be very efficient and reliable. Additionally, the drive system has to be compact enough to fit two units into one container, but without compromising its strong mechanical construction and robustness which ensures safety of the equipment during transportation and operation. The process of oil and gas fracturing requires higher starting torque and operation with constant torque even when the driven equipment is a pump. The drive system has to be capable of constantly providing 100% rated motor torque.

Solution
To meet our customer’s requirements and challenges, ABB has provided customized ACS5000 medium voltage drive for this application. The most significant modification of the drive’s construction, including moving the cooling fans from the roof to the back of the drive led to the decrease in the drive’s height to fit it ideally into the container. To be able to fit two drives with two separated transformers into one container, the input and output cable connection busbars have been redesigned accordingly. The ACS5000 drive offers advanced motor control technology - Direct Torque Control (DTC), which is ideal for demanding constant torque applications, without the need for additional speed feedback sensors.

Benefits
- More precise variable speed control with a wider speed range compared to the traditional non-electrical solution.
- Fracturing efficiency has been improved from 20% to 60% and operating costs are much lower compared to the diesel-driven pumps.
- Outstanding reliability and availability of the drive system.
- The Ride Through function in ACS5000 helps to prevent the system from tripping caused by a weak grid and probable under-voltage situations.
- Electrical variable speed control of a pump resolved the problem of running at low speed which is very problematic for traditional fracturing systems and can damage the diesel engine as a result.

ACS5000 key data

<table>
<thead>
<tr>
<th>Inverter type</th>
<th>Nine-level Voltage Source Inverter (VSI)</th>
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<tbody>
<tr>
<td>Power range</td>
<td>Air cooling: 1500 kVA – 7000 kVA</td>
</tr>
<tr>
<td>Output voltage</td>
<td>6000V, 6600V, 6900V</td>
</tr>
<tr>
<td>Maximum output frequency</td>
<td>250 Hz</td>
</tr>
<tr>
<td>Converter efficiency</td>
<td>Typically, &gt; 98%</td>
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For more information please contact your local ABB representative or visit:
abb.com/drives
www.hh-gltd.com

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