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RENEWABLES AND ESG DRIVE EXPANSION AT SSS CLUTCH

A 30,000 hp (22,380 kW) At 3000 rpm SSS Encased Clutch For A Dual-Driven FCC Refinery Compressor

BY DREW ROBB

The rise of renewable energy has eaten into the business of many companies along the oil and gas supply chain, but not SSS Clutch. The company is in a period of expansion, fueled largely by pipeline operators seeking to electrify their networks.

"We have been supplying clutches for dual-drive units for more than 20 years," said James Neeves, managing director of SSS Gears Ltd., the manufacturing center for SSS Clutch. "Now with the environmental, social, and governance [ESG] push giving more impetus to electrification and the use of renewable energy, pipeline operators are switching to electric drive."

However, utilities demand reliability. They may be willing to change to electric drive, but some are realizing the wisdom of retaining the existing gas engine or gas turbine for redundancy.

Neeves noted that dual-driven gas pipeline compressors installed by Energy Transfer and its subsidiary Dual Drive Technologies have been paramount in keeping pipelines in the southern United States operational during extreme events such as the February 2021 ice storm in Texas. The flexibility in the two prime movers is a must in the power industry and the increasing renewable power base. In addition to Energy Transfer gas plants, SSS Clutches will now be used on compressor sets owned by Howard Energy, TC Energy, Enbridge, and others who want to implement dual drives.

The growing popularity of dual drive is showing up in the horsepower involved. Where units used to always be below 5000 hp (3730 kW) for gas gathering and interconnecting pipelines, Neeves noted that some projects now are for dual-drive units on main pipelines of up to 20,000 hp (14,920 kW). As utilities gain confidence with dual drive on smaller gas engines, they are adding them to larger gas turbine-driven pipeline compressors that require larger clutches.

Recently Renovated Test Area At SSS factory In Middlesex, England

Original equipment manufacturers (OEMs) like Baker Hughes, Solar Turbines, and Siemens Energy, have also designed dual-drive packages for large pipelines. Here are a few examples:

- The planned Enbridge Ridgeline pipeline in Tennessee will use two dual-driven compressors. One end is driven by a motor, step up gear, and clutch, and the other end is driven by a Siemens Energy SGT-100 gas turbine and clutch. Both dual-driven compressor sets will be installed in one compressor station to serve the 117-mile (188-km), 30-in. (762-mm) pipeline looping. Electricity will be provided by Tennessee Valley Authority using renewable energy. This is an expansion of Enbridge's existing East Tennessee Natural Gas (ETNG) system and will provide natural gas to serve a power station that will replace the Kingston Coal Plant. The natural gas line should be in service by fall 2026.
- A G Equipment in Tulsa, Oklahoma, has converted 28 compressor packages to dual drive for USA Compression. These 2000-hp (1492-kW) Waukesha engine-driven compressors were reconfigured with new bases and had a clutch and an electric motor added between the engine and compressor. These reconfigured dual-driven compressor packages function as mobile units on skids that can be moved from one wellhead to another as part of the company's rental fleet.
- Howard Energy Partners (HEP) has been working on new pipeline construction projects to supply natural gas to Mexico from the Eagle Ford region. The natural gas will be used in several combined cycle plants. About 10 dual-drive compressor packages are included in the deal and have been delivered to HEP. These 5000-hp gas engine, clutch, electric motor, and compressor units are part of HEP's Dos Caminos joint venture aimed at doubling its natural gas gathering, treatment, and transport services in Texas to more than 2 Bscf/d (56.6 × 10^6 m^3/d) as it eyes opportunities for Mexican exports and liquefied natural gas (LNG).

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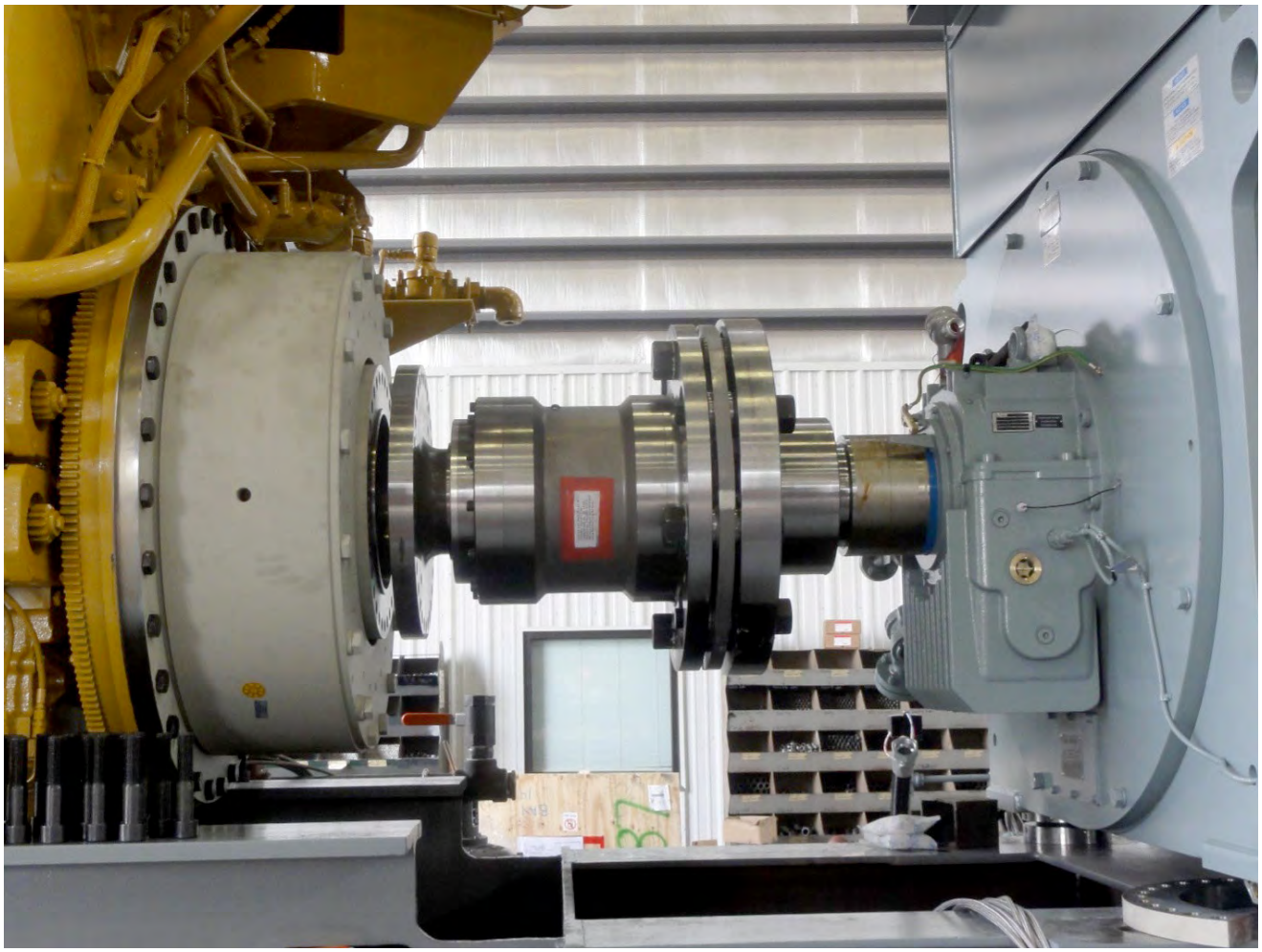

A 5000 hp (3730 kW) At 1000 rpm SSS Clutch, Flexible Disc Coupling, And Torsional Coupling For Dual-Driven Pipeline Compressor

- After TC Energy acquired the Columbia Gas Transmission system, it realized it needed to engage in significant upgrades. The pipeline extends from New York state and serves as a link between major natural gas basins and major markets. The Columbia Gas and Columbia Gulf pipelines span more than 15,000 miles (24,140 km) across North America. These assets deliver 20% of US LNG export supply. High on the TC Energy priority list is the replacement of aging compressor stations in the area around Richmond, Virginia. Some of the compressor stations still use Saturn gas turbines that are half a century old. The new stations will be equipped with a reciprocating engine, an SSS Clutch, and an electric motor, all driving a reciprocating compressor. "These units have been supplied by SSS Clutch and are now being commissioned," said Neeves.

FACILITY EXPANSION

SSS Gears Ltd. has its headquarters in Sunbury-on-Thames in the United Kingdom and its US headquarters (SSS Clutch Co.) in New Castle, Delaware. The UK facility has recently completed a major renovation and expansion, doubling its workshop space to 55,000 sq.ft. (5110 m^2). Larger and higher-powered testing beds, more craning capacity, and expanded clutch assembly shops are now available, enabling production to more than double.

Neeves reports that the company recently produced 100 small starting clutches for Mars and Titan Solar Turbines in one month. The average is about 50 per month. The plant can now build clutches that serve machines up to 400 MW. The new production line churns out 50 large clutches per year in the size range of 200 MW or more. For more than 60 years, thousands of SSS Clutches have been supplied for all sorts of unique dual-driven fans, pumps, and compressors. All facilities are devoted to the production of SSS Clutches.

SSS denotes Synchro-Self-Shifting. Conceived 70 years ago for use in automotive transmissions, the design has been used in gas turbines for more than 60 years for power generation, oil and gas, and marine propulsion.

"Since its inception, we have concentrated on the development and production of SSS Clutches," said Neeves. "We haven't tried to expand into other fields, preferring to perfect the SSS Clutch and to increase its use in more and more applications."

The SSS Clutch is a sophisticated freewheel that provides long life and reliability. The highest power SSS Clutch transmits 400 MW at 3000 rpm. The highest torque SSS Clutch transmits 4 MNm at 600 rpm, and the highest speed unit rotates at 16,000 rpm.

The company claims its units are "fit and forget." Two recent inspections validated this assertion. The first compressed air energy storage (CAES) plant in the United States was a 110-MW facility in McIntosh, Alabama, that began operation in 1991. The clutch from that unit was recently sent in for inspection and repair. It was found to be in good working order. Neeves noted another unit at the Huntorf, Germany, CAES plant is more than 50 years old. All major components of the clutch were in perfect working order. Minor upgrades were made to enable the clutch to take advantage of improvements in the technology.

HOW THE CLUTCH WORKS

The operation of an SSS Clutch is relatively simple. When the input shaft and sliding component reach the same speed as the output, they rotate until a ratchet tooth contacts the tip of a pawl on the output clutch ring. This prevents further rotation of the sliding component relative to the output clutch ring.

As the input shaft continues to rotate, the sliding component will move axially along the helical splines of the input shaft. When a ratchet tooth is in contact with a pawl tip, the clutch engaging teeth are perfectly aligned for engagement and thus will pass smoothly into mesh in a straight-line path.

As the sliding component moves along the input shaft, the pawl passes out of contact with the ratchet tooth, allowing the clutch teeth to come into flank contact and continue the engaging travel. Note that the only load on the pawl is that which is required to shift the lightweight sliding component along the helical spline.

Driving torque from the input shaft will only be transmitted when the sliding component completes its travel by contacting an end stop on the input shaft, with the clutch teeth fully engaged and pawls unloaded. When a nut is screwed against the head of a bolt, no external thrust is produced. Similarly, when the sliding component of an SSS Clutch reaches its end stop and the clutch is transmitting driving torque, no external thrust loads are produced by the helical splines.

If the speed of the input shaft is reduced relative to the output shaft, the torque on the helical splines will reverse. This causes the sliding component to return to the disengaged position and the clutch will overrun.

"The SSS Clutch can continuously operate engaged or overrunning at maximum speed without wear occurring," said Neeves.

At high overrunning speeds, pawl ratcheting is prevented by a combination of centrifugal and hydrodynamic effects acting on the pawls. Where necessary, an oil dashpot is incorporated in the end stop to cushion the clutch engagement. GCM