

Turbo Tour: SSS Gears in London

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The advantage of SSS Gears is that it specializes in one product—the SSS Clutch—and benefits from the knowledge it has built up over so many years.



SSS Gears newly opened facilities near London.

Turbomachinery International recently visited the international headquarters of the SSS Clutch in London. SSS Gears Ltd. has been at Sunbury-on-Thames since the early 1970s, providing sales and application engineering, design, assembly, testing of each clutch, and repairs when needed. Component manufacturing takes place at other sites in England.

To increase capacity, the factory next door was acquired. Demolition and rebuilding the previous site—a five-year process—created a modern customized workshop, a high-power test facility, and offices. This facility doubles the manufacturing area to more than 60,000 square feet. Full operation commenced in 2023.

“We needed to greatly increase our production output in response to increasing demand for clutches of all sizes and applications, including marine, power generation, synchronous condensing, just to name a few dual-drive applications,” said SSS Gears’ CEO James Neeves.

TURBINES, LARGE AND SMALL

During the tour, Neeves showed an area of the floor space devoted to testing small starting and turning gear clutches used, for example, in applications such as Solar Turbines’ Mars and Titan turbine-driven compressors and generators. Facility expansion has doubled the production rate of these small clutches with the current average quantity of 50 per month, although Neeves reported 100 were made in October 2023. A test rig validates the assembly, function, and quality of each unit at a rate of several clutches per day.

A separate space is devoted to assembling and testing large turbine clutches for combined-cycle and peak-load gas turbine power plants. So far, the highest power SSS Clutch supplied is rated at 400 MW.

During the tour, a 300 MW unit was on the test stand. It takes several days to set up and test a machine of this size. During the facility upgrade, additional power was added to the workshop to test even bigger clutches, engaging and disengaging them, and rotating them at the speeds at which they would operate when installed. Crane capacity was boosted to handle these larger, heavier assemblies and the increased assembly area provides more working area for these large parts as well as short-term storage until they are inspected and approved for assembly.



SSS Gears now has a test rig capable of testing clutches as large as 400 MW.

“We now produce one clutch a week sized 200 MW or more and many other smaller clutches, but we’re still a bespoke engineering company,” said Neeves.

SSS Gears emphasizes the precision of its application engineering and design. In assembly, technicians use coordinate measuring machines (CMM) in temperature-controlled environments that measure parts and clutch assemblies by sensing discrete points on the object's surface with a probe. These CMM machines run in-house programs to verify whether components meet proprietary specifications for their specialized geometry.

"We haven't tried to expand into other fields, preferring to perfect the SSS Clutch and to increase its use in more applications beyond the fields in which they have previously been used," said Neeves.

Over the years, various companies have tried to make a competitive product to the SSS Clutch. Neeves said that the advantage of SSS is that it specializes in one product, a niche business, and benefits from the knowledge of all these applications built up over so many years. Potential competitors have struggled to master this. They are either too large to make this business profitable or too small to be able to invest in all the equipment and expertise required.

There have been several attempts to acquire the company; however, SSS Clutch is owned by a trust, for the benefit of the employees. As well as the obvious attraction for employees, it gives customers the confidence of long-term support from an organization that is not going to change hands.

"Too many times, a big firm will swoop in to acquire a smaller one, take the intellectual property, and lose the real knowledge of the experienced personnel," said Neeves. "That isn't going to happen here."

EXPANSION DRIVERS

As well as the need for more work areas to meet the increased production requirements, Neeves cited several other factors that drove facility expansion.

The global emphasis on switching to renewables has led to a greater demand for synchronous condensing, for which the SSS Clutch is used to enable any generator system to function as a synchronous condenser 24/7, even when not producing active power. This is a proven application that has returned to popularity in recent years in applications such as gas and hydrogen peakers, combined-cycle energy security systems, and physical energy storage sets.

Synchronous condensers provide system strength and inertia and are increasingly needed due to the large-scale adoption of inverter-based renewable generation. Electrical solutions are on the market, but they can be costly and at times unproven. An economical approach is to add the function to a new generator. Alternatively, to repurpose an aging turbine generator, some turn the generator into a synchronous condenser. This is done by installing a clutch between the turbine and the generator, enabling it to disengage when there isn't a need to produce electricity. The generator connected to the grid can provide stabilizing voltage, grid inertia, and voltage control.

Neeves noted that SSS Clutch has been receiving more orders for clutches to be used in this way. The largest order in 2023 was for three 360 MW units and the smallest was for a 120 kW diesel emergency power system. Inquiries are rolling in, too, particularly from Australia and across the United States, as grid issues rise due to the higher percentage of renewables.

“Synchronous condenser applications often require large units and some, for example in turbine-generator installations, need a casing to support the clutch. We can now design, supply, and test products even for the biggest models,” said Neeves.

DUAL-DRIVE BONANZA

In addition, the company is benefiting from a surge of interest in dual-driven compression, which provides the ability to switch from driving with either a gas turbine or reciprocating engine to driving with an electric motor.

“We have been supplying clutches for dual-drive units for more than 20 years,” said Neeves. “Environmental, social and governance (ESG) has given more impetus to electrification and the use of renewable energy, which encourages pipeline operators and others to switch to electric drive but maintain redundancy for reliable compression.”

In many cases, owners implement an electric drive to improve their ESG scores, while retaining the existing gas engine or turbine for redundancy. In some markets, it makes sense to change back and forth between gas and electric based on energy costs and emissions targets. Energy Transfer and its subsidiary Dual Drive Technologies, for example, sometimes provide a dual-drive package to a site for free in exchange for the right to trade excess energy.

Neeves noted that the success of dual-driven pipelines has made owners more comfortable with the technology and more willing to implement it in larger compressors. Whereas before most units were sized below 5,000 hp for gas gathering and interconnecting pipelines, orders are now coming in for major pipeline compressors up to 20,000 hp. Larger compressors mean larger clutches.

Meanwhile, AG Equipment in Tulsa, OK, converted 28 Waukesha engine-driven compressor packages to dual drive by adding a clutch and an electric motor. They are used as part of a rental fleet serving wellheads.



SSS technicians setting up large clutch test.

CLUTCH DESIGN

The original clutch design was conceived 90 years ago for automotive transmissions. The synchro-self-shifting (SSS) design was soon adapted for use in gas turbines for power generation and marine propulsion systems.

The SSS Clutch is a robust freewheel with models ranging from as low as 100 kW to 400 MW. As much as 4 MNm of torque can be transmitted at 600 rpm and rotational speeds can go as high as 16,000 rpm with smaller clutches. As well as power generation and oil and gas, these clutches are used in marine applications.

For example, the company supplies the main propulsion clutches used by more than 50 navies worldwide. The company's largest naval customer is the U.S. Navy, and the company received an order for two ship sets a year (expected to go on for at least five years) for the U.S. Navy FFG-62 Constellation-Class Frigates. These new multi-mission surface combatants can conduct air, anti-submarine, and surface warfare, as well as electronic warfare/information operations and intelligence, surveillance, and reconnaissance missions.

The ships are powered by a combined diesel-electric and gas system, which employs two electric propulsion motors and a single gas turbine. The single gas turbine drives through a high-speed SSS Clutch to a reduction gear from Philadelphia Gear to two propeller shaft mounted SSS Clutches and two electric motors from L3 Harris.

"This hybrid electric propulsion system uses electric motors as the main drivers with a large GE LM2500+ G4 turbine available when an extra boost of speed is required," said Neeves. "The clutches are self-lubricating and bi-directional."

The company has already delivered two ship sets of two propeller shaft clutches, as well as the gas turbine clutches to Philadelphia Gear, which will incorporate them into the reduction gear to be installed in the ships being constructed by Fincantieri Marinette Marine Shipyard in Marinette, WI.