



XLC Split Bearing Design Delivers Dramatic Enhancements to a Large U.S. Refinery

A large independent refining and chemicals company in the United States sought a more reliable, safe, and efficient replacement for the traditional roller bearing in its ACHE (Air Cooled Heat Exchanger) fans. Working closely with Flowserve, a valued strategic partner, Greene Tweed engineers developed a composite non-contact bearing that dramatically extends the operational life of current bearing assembly designs. This innovative solution delivers longer, uninterrupted service life. With its unique split design, the XLC bearing can be installed, maintained, and replaced without disassembling the ACHE's fan unit. With the new split bearing design, a repair that once took two to three days per fan can now be completed in less than four hours. The new bearing design reduces the need for frequent maintenance, increases equipment uptime, and minimizes the number of replacement components. When adopted across all fans, the XLC split bearing design will save the refining company approximately \$1.5 million over five years* in associated maintenance costs. Life cycle cost calculations indicate that the company's capital expenditure will be recovered in less than 18 months, resulting in a substantial return on investment.

\$1.5 million in savings due to reduced downtime and maintenance cost over the next five years.

About the Customer

Our customer, a large independent U.S. refining company, produces fuels, petrochemicals, asphalts, and base oils. With six decades of refining experience, the company continues to expand its production capacity through acquisitions and capital projects to meet the needs of its customer base in Alaska, the Midwest, and Texas. Additional products supplied go to the global polymers, olefins, aromatics, and intermediate chemicals industries.

Recently our customer acquired a large manufacturing facility that is a leading U.S. producer of ethylene and propylene – the basic chemical building blocks used to manufacture products such as trash bags, automotive parts, and medical devices. With the capacity to produce nearly 1.4 billion pounds (635,029 mt) of ethylene and 700 million pounds (317,515 mt) of chemical grade propylene per year, this plant utilizes a complex system of heavy industrial equipment to maximize production.

Critical Production Requirements

In a facility this size, keeping the plant running at full capacity is critical to the bottom line. By regularly scheduling maintenance and repairs on each piece of equipment, the plant ensures that it meets annual production goals. Downtime is minimal because equipment runs efficiently throughout the year.

ACHEs arranged in multiple banks use large-diameter fans to move air over finned tubes. The fans remove heat from process fluids to ensure safe operating temperatures for processing and handling. The region's high seasonal temperatures – ranging from 50°F (10°C) in winter to 100°F (40°C) in summer – and the plant's coastal location, contribute to the reduced operating life of the existing roller bearings. Traditional roller bearings that operate constantly through the summer deliver a MTBF (mean time between failure) of 12 months (with some bearings failing in less than nine months). The XLC bearing solution extends MTBF to between two or three times that of the existing bearing solution.

**These savings will be realized when our customer replaces all of its ACHEs fan bearings with the XLC.*



This innovative design reduces replacement time from two to three days to less than 4 hours, dramatically lowering resource requirements and maintenance costs.

About the Customer

Detecting problems and performing maintenance on ACHE fans can be challenging, considering the equipment is installed 30 feet (9 meters) above ground level. The units are regularly inspected and lubricated from the ground, but they're only repaired after significant problems are reported. By the time a problem is discovered, the fan's cowling, shaft, and/or drive system has often been irreparably damaged.

Heavy Cost of Repair

To replace the existing roller bearing within an induced air fan assembly, the fan cowl and impeller must be removed to give access to the upper bearing assembly. To accomplish this, maintenance staff must use heavy lifting equipment (i.e., cranes) and scaffolding for safe access. They must also wear protective suits and breathing apparatus to combat high temperatures in the working environment because these repairs are carried out on a live system.

With an average repair taking two to three days to complete per fan, our customer found the resulting equipment downtime and maintenance resources had become an expensive endeavor. They needed a bearing assembly solution that would extend MTBF by two to three times. The company also wanted a solution that could be quickly and easily changed out. The XLC split bearing design, developed by Greene Tweed, resolved these issues, and will save the company approximately \$20,000 per ACHE failure moving forward.

Split Design Cuts the Cost of Repair

Greene Tweed worked with leading refiners to validate that ACHE fan failure was being experienced across a broad spectrum of companies within the refining and chemical processing industries. Our engineers identified the discreet modes of failure inherent in the current design and eliminated the faults with the new bearing design upgrade.

Highlights

CUSTOMER

- A large, independent refining and chemicals company in North America

CHALLENGE

- Our customer uses ACHEs (Air Cooled Heat Exchangers) that are difficult and costly to maintain and/or replace, due to location of installation
- The ACHE traditional roller bearing design delivered a MTBF (mean time between failures) of only 9 to 12 months
- Our customer needed a new bearing solution that would extend component life and reduce downtime

SOLUTION

- The innovative split-design XLC bearing assembly consists of a fiber-enforced composite (WR[®] 600) with internal energized seals housed in a universal stainless steel carrier
- Co-designed with global pump manufacturer Flowserve
- Innovative, turn-key solution that is safer and dramatically reduces maintenance requirements and replacement costs

RESULTS

- Longer uninterrupted service life. Replacement time was reduced from two to three days to less than four hours, drastically lowering resource requirements and maintenance costs
- Dramatically reduced downtime. The innovative split design of the XLC bearing eliminated the need to disassemble fan units and remove fan impellers during replacement
- \$1.5 million in savings due to reduced downtime and maintenance cost over the next five years



Repair costs alone can exceed \$20,000 per ACHE – not including the much higher cost of lost production throughout the facility.

Greene Tweed’s bearing assembly, developed with a patent-pending split design, consists of a carbon fiber reinforced composite (WR® 600) bearing sleeve and internal energized seals to prevent element ingress. These components are all housed in a universal stainless steel carrier. The assembly offers longer, uninterrupted service life. The unique split design eliminates the need to disassemble the fan unit and remove heavy fan impellers during replacements. The innovative design also reduces replacement time from two to three days per fan to less than four hours, dramatically lowering resource requirements and maintenance costs. The universal housing of the XLC split bearing solution fits many fan variants and bearing elements and can be custom sized to meet any application requirement. The ball and socket design of the metallic bearing carrier also provides for easier alignment between the shaft and housing during assembly. Energized seals keep foreign bodies from entering the bearing surface and help it to retain the lubricant applied during installation. The bearing material can also withstand operating temperatures up to 390°F (200°C).

Proving the Value of Engineered Design

The dramatically enhanced reliability of the XLC split bearing design, when compared to the legacy solution, delivers significant savings with less downtime, lower maintenance costs and fewer replacement parts. The design has been so successful that this large U.S. refining company is currently replacing all of its upper fan bearings with our innovative solution. When the installations are complete, the company will realize maintenance savings of approximately \$1.5 million over a 5-year operating period.

Strength in Partnership

Greene Tweed has worked closely with its strategic partner, Flowserve, throughout the design and development of the split bearing assembly. Flowserve has adopted Greene Tweed’s innovative technology into its product portfolio and will exclusively market the solution under the product name ‘XLC Bearing’ (Extended Life Composite). Flowserve is a leading manufacturer and aftermarket

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Innovative split-design XLC bearing assembly



Easy installation process



Attaching the carrier

service provider of flow control products and services for the world’s most critical applications. Operating in 56 countries, the company produces engineered and industrial pumps, seals, and valves, as well as a range of related flow management services.