

**BAKER
HUGHES**
a GE company



Power Transmission

**Global capabilities
and competitiveness**

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Manufacturing

Our 12,500 m² facility in Fougerolles, France, provides regional manufacturing and global design support. This site has a proven record of high quality and delivery performance for customers around the world since 1998.

Baker Hughes, a GE company (BHGE), recently expanded its capabilities, including more engineering expertise and support, as well as an additional \$10 million (USD) test stand with a 2.5 MW driving motor.

We are committed to providing high-quality equipment with competitive costs and delivery times no matter where our customers are located. Teams at Fougerolles can take advantage of related resources at other BHGE industry-leading facilities in the area, which helps further increase our efficiency and responsiveness to demand in all regions.

End-to-end solutions

- Customer collaboration from design to manufacturing
- High-speed and low-speed gearboxes
- Multistage epicyclic units for up to 32 MW
- Parallel shaft units for 100+ MW
- Combination parallel shaft and epicyclic units
- Couplings
- High-performance bearings
- Cradle gearboxes for test stands
- Multiple inputs or outputs
- Clutch integration
- Tilting pad journal bearings
- Sleeve and thrust bearings

Quality standards

- ISO 9001:2008
- ISO 14001:2004

High-speed design

- API 613 and 677
- AGMA 421/6011/6013
- ISO 6336
- DIN 3990

Country specifications

- ATEX/IECEx
- KOSHA
- PESO
- INMETROC
- CU-TR010/TR012



Service

We've centralized our five separate US operations into one recently updated facility in Lufkin, Texas, where our flagship technologies were developed nearly a century ago. This location, with a roofed area of ~37,000 m², is our Center of Excellence for repair, remanufacturing, and services.

The resources and expertise headquartered at this COE will ensure that we continue providing the high level of responsiveness and quality that our customers have relied on for 90 years. We are also bringing our services into the digital age by offering upgrades to connect customer equipment to GE's powerful Predix™ platform to enable advanced performance monitoring and optimization.

Full-service capabilities

- Engineering
- Full testing
- Diagnostics and analytics
- Maintenance
- Parts
- Machining
- Repairs
- Field services
- Technical assistance
- On-site inspections
- Start-up assistance
- Training

In addition to servicing our own Lufkin, Allen Gears, and legacy BHGE industrial gear products, we will continue providing the same high service level we always have for other OEM units, including:

- Amarillo
- BHS
- Brad Foote
- Chicago Gear
- D.O. James
- David Brown
- Delaval
- Falk
- Farrel
- Flender/
Graffestaden
- General Electric
- Hansen
- Hitach
- John Brown
- Link Belt
- Maag
- Marley
- Philadelphia
- Renk
- Santasalo
- SEW Eurodrive
- Sumitomo
- Terry
- Turbodyne
- Voith
- WECO
- Westec
- Western
- Westinghouse
- Worthington

Contents



Industries served

Power Transmission products are used in virtually every heavy industrial sector, including:

- Power generation
- Oil and gas, refining, and petrochemical
- Wind
- Paper mills
- Steel and metal mills
- Rubber and plastics
- Cement
- Sugar
- Marine propulsion



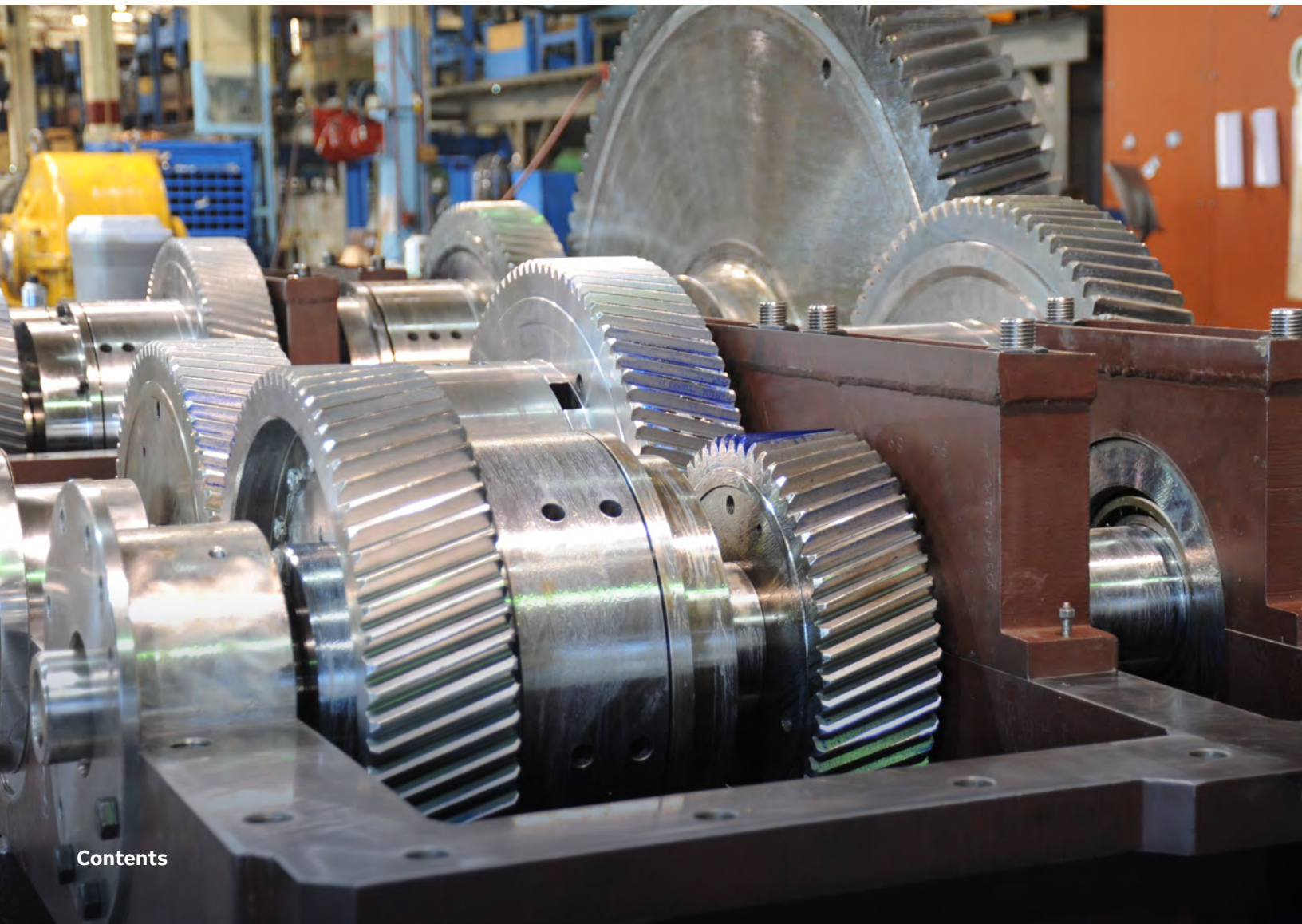
Applications

Industry	Gearbox applications	Types of gearboxes	Power	Ratio	Input speed	Output speed	Torque, SI	Torque, US	Weight
Cement	Pulverizers, grinding—ball mills, high pressure grinder, and kiln drives	Single, double, triple stage parallel shaft, epicyclic gears, and split torque gears	300 kW to 3000 kW	3:1 to 100:1	750 to 1,800 rpm	20 to 100 rpm	40 kN-m to 600 kN-M	30,000 to 450,000 ft-lb	5 to 40 ton
Mining	Crushing-pulverizers, grinding—ball mills, Sag mills, and kiln drives	Single, double, triple stage parallel shaft, and epicyclic gears	300 kW to 3000 kW	3:1 to 100:1	750 to 1,800 rpm	20 to 100 rpm	40 kN-m to 600 kN-M	30,000 to 450,000 ft-lb	5 to 40 ton
Rubber/tire	Calendars, mills, mixers, pin barrel, and extruders	Single, double, triple stage parallel shaft, and multiple output shafts	300 kW to 3000 kW	3:1 to 100:1	750 to 1,800 rpm	20 to 100 rpm	40 kN-m to 600 kN-M	30,000 to 450,000 ft-lb	5 to 40 ton
Plastics	Mixers, melt pumps, and extruders/pelletizers	Single, double, triple stage parallel shaft, and multiple output shafts	300 kW to 3000 kW	3:1 to 100:1	750 to 1,800 rpm	20 to 100 rpm	40 kN-m to 600 kN-M	30,000 to 450,000 ft-lb	5 to 40 ton
Metals (aluminum, steel)	Rolling mills, winders/rewinders, and z mills	Single, double, triple stage parallel shaft, multiple output shafts, and epicyclic gears	300 kW to 5000 kW	1:1 to 100:1	750 to 1,800 rpm	20 to 700 rpm	10 kN-m to 1000 kN-M	7,000 to 750,000 ft-lb	3 to 60 ton
Sugar	Cane knife, crushers, mills, and diffusers	Single, double, triple, and quad stage parallel shaft, epicyclic gears, and split torque gears	500 kW to 2000 kW	3:1 to 250:1	750 to 1,800 rpm	20 to 1,800 rpm	500 kN-m to 3600 kN-M	350,000 to 2,700,000 ft-lb	3 to 60 ton
Marine—blue water Medium- and high-speed diesels, steam and gas turbines, and electric-motor drives	Large yachts, high-speed ferries, offshore supply vessels, military marine, offshore patrol craft, articulating tug barges (ATB), and ship assist tugs	Single, two-stage, and compound gears for fixed pitch and controllable pitch wheels, parallel-shaft, and epicyclic gears	1,000 kW to 30 MW	2:1 to 15:1	500 to 3,600 rpm	100 to 500 rpm	40 kN-m to 1300 kN-M	30,000 to 1,000,000 ft-lb	3 to 50 ton
Marine—brown water Low- and medium-speed diesels, and electric-motor drives	Workboats/pushboats, tugs, ferries, and military marine	Single, two-stage, and compound gears for fixed pitch and controllable pitch wheels, parallel-shaft, and epicyclic gears	1,000 kW to 15 MW	2:1 to 12:1	500 to 800 rpm	100 to 300 rpm	40 kN-m to 1300 kN-M	30,000 to 1,000,000 ft-lb	3 to 40 ton
LNG, Refining, Chemical, Petrochemical	Compressors, pumps, fans, blowers, and expanders	Single, double-stage, parallel shaft gears, and epicyclic gears	500 kW to 60 MW	1.2:1 to 20.0:1	900 to 3,500 rpm	1,000 to 25,000 rpm	5 kN-m to 200 kN-M	3,500 to 150,000 ft-lb	2 to 30 ton
Air separation	Compressors and expanders	Single, double-stage, parallel shaft gears, and epicyclic gears	500 kW to 60 MW	1.2:1 to 20.0:1	900 to 3,500 rpm	1,000 to 3,600 rpm	5 kN-m to 200 kN-M	3,500 to 150,000 ft-lb	2 to 30 ton
Power generation	Steam/gas turbine generators, diesel generators, expanders pumps, and FD/ID fans	Single, double-stage, parallel shaft gears, and epicyclic gears	500 kW to 100 MW	1.2:1 to 10.0:1	900 to 3,500 rpm	1,000 to 3,600 rpm	5 kN-m to 350 kN-M	3,500 to 260,000 ft-lb	2 to 30 ton
Hydro power	Hydroturbine generators	Single, double-stage, parallel shaft gears, and epicyclic gears	300 kW to 20 MW	3:1 to 10:1	100 to 300 rpm	900 to 1,800 rpm	10 kN-m to 1,000 kN-M	7,000 to 750,000 ft-lb	2 to 40 ton

Examples from the GE Store

Our Power Transmission experts draw from and contribute to the unique range of solutions and knowledge available in the GE Store. That's what we call our global exchange that allows engineers and scientists across many industries to collaborate, share best practices, and develop synergies among different technology areas. This meeting of minds overcomes hurdles and drives innovation, performance, and outcomes—bringing speed-to-market and propelling growth in the most demanding industry landscapes.

The following pages show just two examples of pioneering projects made possible by innovations and collaborations within the GE Store—including solutions from BHGE Power Transmission.



Laggan-Tormore

The UK's biggest and most complex offshore gas project

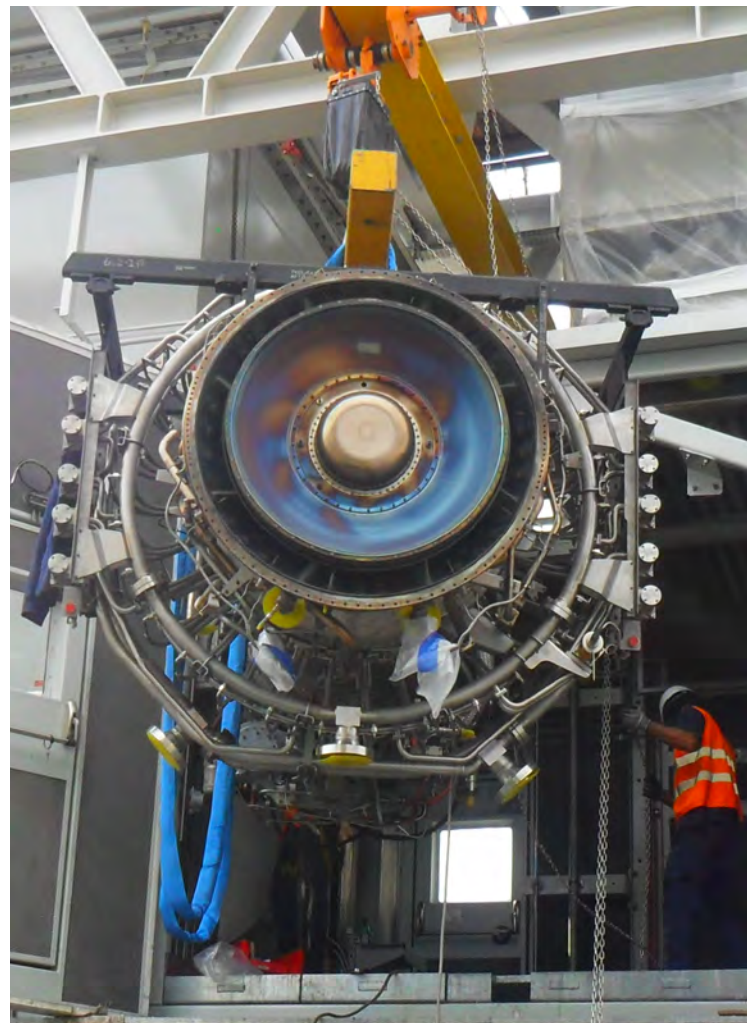
3 complete compression modules each including:

- 1 PGT25+ gas turbine driver
- 2 BCL centrifugal compressors
- Lufkin NF1619D parallel-shaft load gears

At depths of about 600 m in the North Sea, the Laggan and Tormore fields are the UK's deepest offshore production wells. They were developed using a 140 km subsea tie-back and control umbilical that connects to a new gas processing plant on the Shetland Islands. An estimated 500 million standard cubic feet per day (MMscfd) of gas is separated at the plant and compressed for export to the UK National Grid.

Plant design and construction were undertaken with high degrees of care and efficiency, since the Shetlands are home to protected species. Equipment was also designed for resilience to extreme conditions at the site, which is unprotected from high winds and harsh, salty Atlantic waves that average 18 m in height.

Benefits of our module designs include long-term reliability and availability to best manage the lifecycle maintenance challenges common with such remote sites. The high pressure (165 barg) export pipeline required careful core equipment selection and configuration. Each module is a complete compression train with a compact and powerful PGT25+ gas turbine driving two BCL centrifugal compressors through NF1619D high-energy gearboxes (>175m/s). We also provided external auxiliaries and waste heat recovery systems.



NovaLT16

Setting new standards for turbine design and performance

The dedicated test facility for the innovative NovaLT™16 development program included an electric generator from GE Energy Connections, and a Lufkin parallel-shaft gearbox from BHGE Power Transmission, which is recommended for all customer applications.

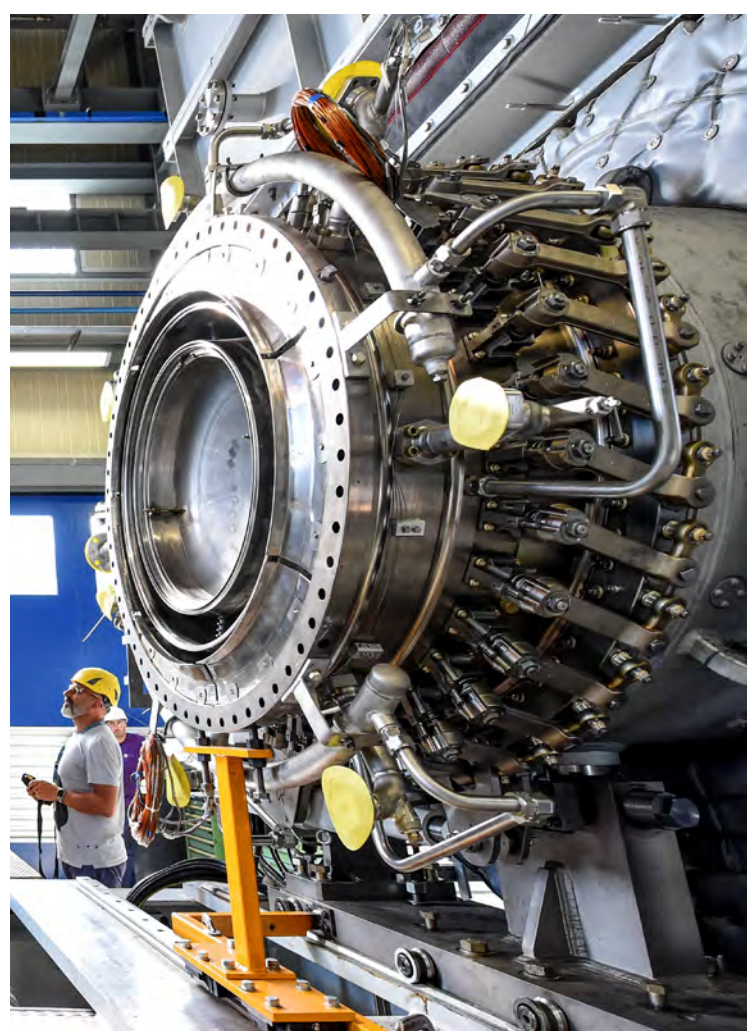
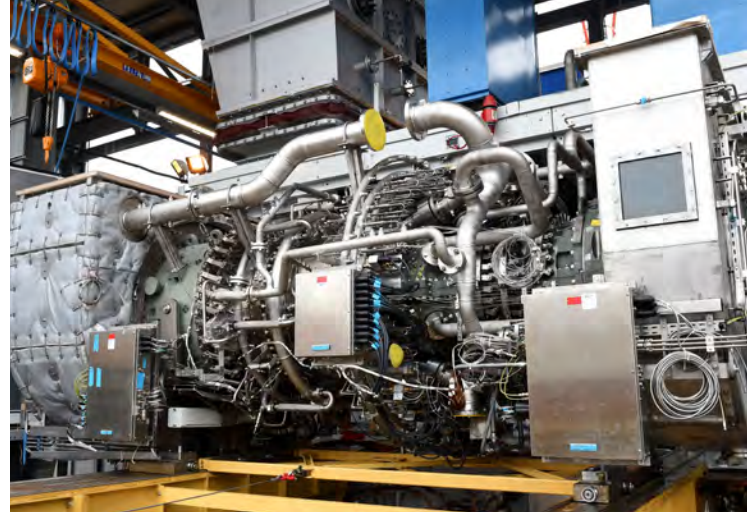
In 2011, BHGE teamed up with TransCanada for an innovative co-creation project using our FastWorks methodology. The result was NovaLT16, a new gas turbine package that launched just 30 months later—an incredibly fast and efficient achievement, considering that the average industrial turbine requires five to six years from concept to commercialization, while a new aeroderivative turbine can take almost 10 years.

The 16.5 MW unit sets a new standard for its turbine class in mechanical drive and power generation applications. The two-shaft gas turbine has a rated shaft speed of 7,800 rpm and is designed to deliver up to 99% availability and a 35,000-hour mean time between maintenance. That translates into four years of non-stop running—providing a significant competitive edge versus other options available in the market.

Not only does NovaLT16 run longer without maintenance, its modular design philosophy ensures that all maintenance activities take less time to perform. In fact, the package is so fully optimized that a cold-condition engine can be swapped in just 24 hours. On top of all these benefits, every NovaLT16 package is fully equipped with integrated monitoring and diagnostics sensors and remote tuning capability as standard.

Originally designed for pipeline compression stations, NovaLT16 has since been welcomed in various other power generation and mechanical drive applications. We used learnings from its co-creation project to add a 5 MW unit to the NovaLT family in 2015, and we have a wide range of package sizes planned for the future.

The NovaLT16 and NovaLT5 will meet a wide range of unique customer needs in mechanical drive and power generation applications by incorporating Lufkin parallel-shaft and Allen epicyclic gear technologies from BHGE Power Transmission.



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