

ENGINEERED &
MANUFACTURED
IN THE UK



Howden
A Chart Industries Company

Peter Brotherhood Steam Turbines

Howden is one of the leading turbo machinery manufacturers supporting multiple sectors such as power generation, oil & gas, floating production and marine. With over 150 years of experience and continuous development, Howden Turbo UK are proud to offer the Peter Brotherhood product range of steam turbines.

- ✓ HIGH RELIABILITY
- ✓ LOW MAINTENANCE
- ✓ HIGH AVAILABILITY





Supplying customised steam solutions for 150 years.

Why choose a Peter Brotherhood steam turbine from Howden?

- Highly efficient, maximising power output and profitability
- High reliability, low maintenance, rapid return on capital investment
- World beating delivery times
- World-class project management
- Stringent compliance to customer specifications
 - meet international standards compliance
 - excellent after sales care
- Global reputation of delivering energy efficient solutions for land and marine based application
- Reliable, long service life (25+ years)
- Specialist application engineering capabilities

Powering customer profits in over 100 countries

40 MW

UK's only producer of steam turbines with outputs up to 40 MW



24/7

customer care and servicing globally

1,000+

steam turbines supplied for marine applications

33 MW

world leader in turbo generators for floating production vessels, including one of the world's largest of 33 MW

1,000 MW

installed power in Waste to Energy power plants



Howden Turbo UK are specialists in the design, manufacture, installation and servicing of steam turbine generators up to 40 MW.

We've delivered many world-firsts – including the first extraction-condensing Steam Turbine Generator (STG) on an FPSO and two of the largest STGs on an FLNG – that's why we have a global reputation as the first choice company for specialist steam turbine applications.

Our steam turbines cover a range of applications such as:

- Combined cycle and cogeneration
- District heating
- Industrial processes (Energy from Waste)
- Oil and gas production
- Refineries
- Petrochemical plants
- Floating Production Storage & Offloading (FPSO) vessels
- Floating Liquefied Natural Gas (FLNG)
- Floating Storage & Regasification Unit (FSRU)
- Waste heat recovery, industrial and marine applications

We don't just manufacture steam turbines. We provide the complete service – from initial concept development to installation and commissioning, as well as after sales support and on-site maintenance.

Throughout the whole product life cycle, we work to the highest quality assurance standards, including ISO 9001:2015, ISO 14001:2015 Environmental Management Standard and ISO 45001:2018 Health & Safety Management.

We combine traditional engineering skills with the latest techniques and equipment and have been providing engineered solutions to global customers since 1867.

Our Markets

- Marine
- Offshore production
- Petrochemical
- Waste to Energy power plants
- Combined Heat & Power (CHP)

Steam Turbine Types

- Condensing
- Extraction condensing
- Back pressure
- Extraction back pressure
- Induction (mixed pressure)

Standards

- API 611, 612, 613, 614
- NEMA SM23, SM24
- IEC 60045-1
- ATEX
- IEC 60034

Third Party Classifications

- Lloyds
- DNV
- ABS
- BV
- RINA

We have supplied steam solutions for a variety of applications not listed above. Please contact us with your individual application requirements.

WHAT SETS US APART IS OUR ABILITY TO DESIGN, MANUFACTURE AND INSTALL IN DIFFICULT LOCATIONS AND TO EXACTING CUSTOMER REQUIREMENTS.



Customised steam turbines to answer business and environmental challenges

Howden Turbo UK has a global reputation for delivering practical and economic engineering solutions. Our team of world-class engineers has experience in designing products and systems for many different industries.

Design Capabilities

We are not an 'off-the-shelf' supplier that engineers a solution to fit around our turbines, each turbine is individually designed to match the customer's specification.

Our design engineers are some of the finest in the world when designing for difficult applications such as remote locations or harsh marine environments.

Our mechanical and electromechanical skills are complemented by expertise in sophisticated control systems and software to ensure the optimum product performance.

We use a modular form of construction to enable standardisation of service-proven components. All our turbines and systems are customised to the client's exacting standards, international industry standards and regulations. We can help at every stage of development, from initial concept design through to production of detailed manufacturing drawings.

The service is totally flexible, enabling our skills to be utilised wherever appropriate. Designs can be produced to conform to any international, national or industry standard required.

ADVANTAGES OF CHOOSING A PETER BROTHERHOOD STEAM TURBINE

- Highly efficient, maximising power output and profitability
- Customised steam turbines answering customers individual requirements
- Best in class delivery times
- Design and manufacturer of steam turbines since 1907
- Global reputation of delivering energy efficient solutions for land and marine based applications
- Range from 1 MW to 40 MW
- Reliable, long service life (25+ years)
- Low maintenance (5+ years service intervals)

Reputation for Reliability

Howden Turbo UK has a "right first time" culture that has given us a global reputation for delivering practical and economic engineered solutions. Our world-class engineers are highly experienced in designing products and systems for many different industries, producing highly efficient machines for maximising power output and profitability, wherever they operate.

Committed to steam turbine efficiency and performance Howden Turbo UK minimise their impact on the environment through an environmental management system approved to ISO 14001.

We provide a complete service from initial concept development to installation and commissioning, as well as after sales support and on-site maintenance

Design

- Knowledge & expertise
- Technical experience
- Quality engineering
- Environmental focus

Manufacturing

- World-class skills
- Commitment to quality
- Right-first time, everytime

Installation & Commissioning

- High efficiency
- High quality
- High availability & reliability
- Short delivery time
- Full site support from:
 - site survey
 - customer handover

Service

- Maximising reliability & availability of equipment
- 24/7 global support
- 5D support model
- Customer Care Agreements (CCA)

Customised steam turbine generator sets

Solutions built to deliver a competitive advantage

For power generation applications Howden Turbo UK provide a complete package comprising the turbine, gearbox, generator, instrumentation, control and monitoring systems and associated auxiliary equipment. These units are normally mounted on a fabricated baseplate so that they can be transported to site in their assembled form, reducing site installation time.

1. Steam Turbine

Oil operated fail safe isolation valve with steam regulation through single or multi-valve control. The rotor and discs are manufactured from a single piece forging. Bearing pedestals are separate from the steam casings and exhaust orientation can be up, down or axial.

2. Condensers

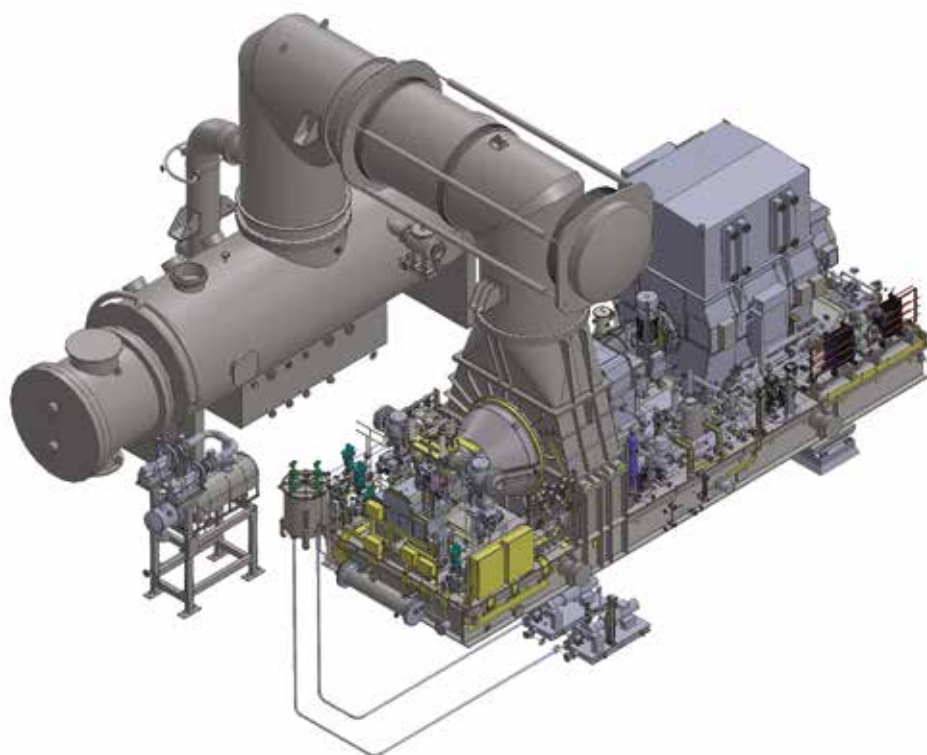
Water-cooled multi-pass shell and tube condensers can be provided together with vacuum-raising equipment and condensate extraction pumps.

3. Lubrication

Forced lubrication is normally provided by an oil pump driven from the gearbox. The oil is contained in the turbine base-plate and is passed through a heat exchanger and duplex cartridge type filters to the bearings and gearbox. A completely separate lubrication oil console can be supplied in accordance with the customer's specification and/or to API 614 standard.

4. Gearing

Peter Brotherhood turbine frames operate in the speed range 4,000 – 15,000 rpm. They are geared to the driven equipment's speed using a reduction gearbox.



5. Instrumentation

The level of instrumentation can be tailored to suit customers' needs and ranges from a simple local control panel to a sophisticated monitoring system remote from the turbine.

6. Control & Monitoring System

Electronic speed governing devices are fitted to provide either remote or local regulation of the turbine. Monitoring of vibration and the axial displacement of the rotor shaft can also be incorporated. Remote or local push-button starting using a PLC-based control system can be provided, as can systems to provide full remote control of the turbine.

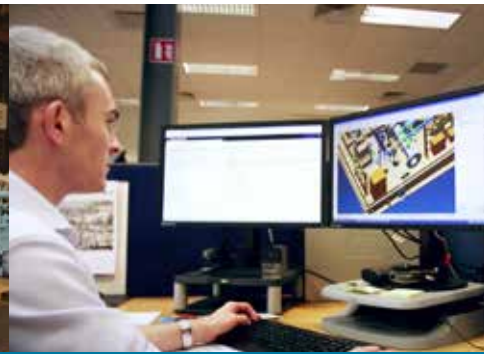
7. Security Trip Systems

An emergency trip is fitted on each turbine to trip it in the event of any fault condition arising. A SIL 3 electronic overspeed trip system is fitted as standard. Programmable control systems can be provided which initiate shutdown of the turbine in response to a variety of conditions, ranging from excessive vibration to low oil pressure.

8. Generators

Well-established relationships have been built with a number of leading generator suppliers to allow the company to supply the optimum unit for any application.

FROM COPING WITH A SHIP'S MOTION AND HARSH ENVIRONMENTS IN THE NORTH SEA TO THE EXTREME TEMPERATURES OF SUB-SAHARAN AFRICA, PETER BROTHERHOOD STEAM TURBINES ARE GENERATING PROFITS FOR OUR CUSTOMERS.



Specialist application design – powering business across a range of industries

Marine & Offshore Production

Howden Turbo UK has been supplying steam turbines to the marine industry for over 100 years.

Having considerable experience of marine standards, classification society requirements and petroleum industry standards, we have found ourselves in a unique position to provide steam turbines for FPSO (Floating Production Storage & Offloading) vessels, FLNG (Floating Liquefied Natural Gas), and FSRU's (Floating Storage Regasification Unit).

The use of such vessels for the recovery of offshore oil and gas is growing and Howden Turbo UK has supplied over 40 steam turbines that ensure reliable and efficient power supplies.

Our steam turbine packages are specifically designed to fully integrate within the confined spaces available on marine vessels and offshore platforms. We even help layout the turbine machine space and engine room to ensure that our turbine fits and that there is enough room for disassembly and laydown areas for equipment. We will work with you to fully understand your needs and to develop solutions to the problem.

Efficiently designing a turbine's footprint is not done at the compromise of maintenance – all equipment that requires planned maintenance such as oil filters are positioned so that ease of access is maximised.

OFFSHORE EXPERTISE

Our machines are designed to withstand the harshest environmental conditions the oceans can produce. We accommodate the pitch, roll yaw, sway, heave and surge of the vessels, along with the wave induced deflections.

If our turbines can run in these conditions, they can run anywhere.

We have developed many world-firsts for the marine industry:

- First Turbo Compound System (TCS) for container ships
- First steam turbine waste heat recovery on a vessel
- First controlled extraction condensing STG on an FPSO
- Largest deck mounted turbine generator sets on an FPSO

We have also been a trusted supplier to the Royal Navy for over 140 years, including supplying turbines for the Astute class of submarine.

Delivering power to recover “marginal oil”

Location: Offshore Brazil

Market: Marine

The FPSO required steam turbine generators to provide process power to the vessel which is capable of producing 100,000 barrels of oil per day. Howden Turbo UK supplied 3 x 24 MW steam turbine generators to fulfil the vessel's power consumption requirements.

Our reliable and robust design ensures that process power is constantly available to achieve this target. Due to vessel space constraints the steam turbine generators are located on the topside of the vessel exposed to the offshore environment – the harshest location for any equipment.

Topside, the forces, moment and accelerations transferred from the vessel motion to the steam turbine generator have to be considered during the design phase of the machine to ensure that tight clearance and alignments are not exceeded. Howden Turbo UK considerable experience in this industry means we know and understand the rigours of topside operation to ensure the reliability of this process critical application.



Howden Turbo UK has supplied equipment up to 33 MW to many of the world's leading FPSO operators including: Woodside, Single Buoy Moorings (SBM), BW Offshore, Bluewater, Saipem, Aker Floating Production, Fred Olsen Production and Maersk.



Oil & Gas Process Industries

The oil, gas and petrochemical industries are large users of steam turbines for driving pumps, compressors and generators. Howden Turbo UK has supplied many steam turbines for use in these industries both on land and offshore.

This industry has stringent specifications for both equipment safety and application. We have a highly experienced team who can work with customers to meet these exacting standards. Through this close relationship with our clients, Howden Turbo UK are able to deliver exactly what the client wants.

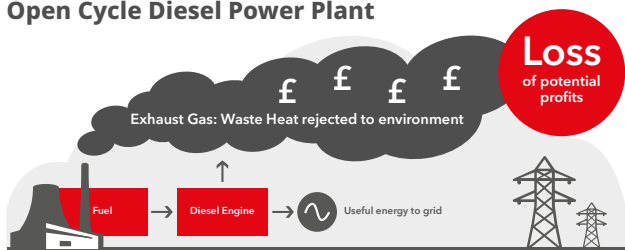
WE DO MORE

Our world-class engineering and project management teams frequently take on additional scope of supply for projects such as:

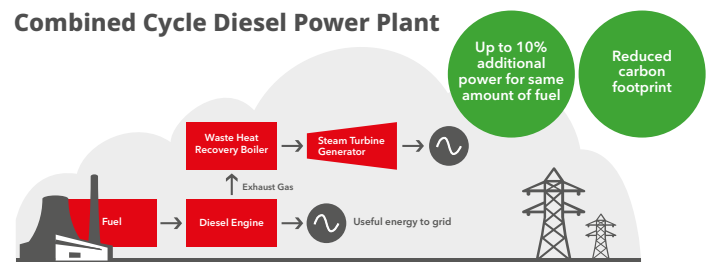
- Foundation design
- Steam inlet & exhaust piping design
- Safe area segregation enclosures
- Steam by-pass system & dump condensers
- Incoterm (Extended delivery)

The Howden Turbo UK advantage

Open Cycle Diesel Power Plant



Combined Cycle Diesel Power Plant



Reduction of energy costs and improved efficiency

Location: Europe

Market: Power Generation

Howden Turbo UK was approached by a newly constructed diesel engine power station in Malta to increase its overall efficiency. A steam turbine generator was required to convert the heat generated from the diesel engine exhaust gases into additional energy to the grid.

- Our steam turbine design proved invaluable as we had previously supplied the same customer with a similar solution for the same application in Kenya
- Diesel engine exhaust gas heat converted into free energy
- Power output of plant increased by 10%



We have in excess of one gigawatt of installed power in renewable and sustainable energy power plants. Our knowledge and expertise enables us to seamlessly integrate a steam turbine into customers processes.

DECADES OF ENGINEERING EXCELLENCE ENABLE US TO DESIGN AND MANUFACTURE STEAM TURBINES SPECIFIC TO YOUR UNIQUE APPLICATION AND PROJECT NEEDS.



Specialist application design – powering business across a range of industries

Energy from Waste

Howden Turbo UK has been engineering energy from waste systems globally since the 1950's. Our solutions are used across a vast spectrum of applications where waste can be used as a fuel to heat steam and drive a turbine generator set to produce power.

A Peter Brotherhood condensing steam turbine in a UK energy from waste plant generates power from steam raised by the incineration of meat and bone meal. In addition to the 9.1 MW turbine generator set and water-cooled condenser, the company was also responsible for the supply of a weatherproof acoustic enclosure over the complete unit.



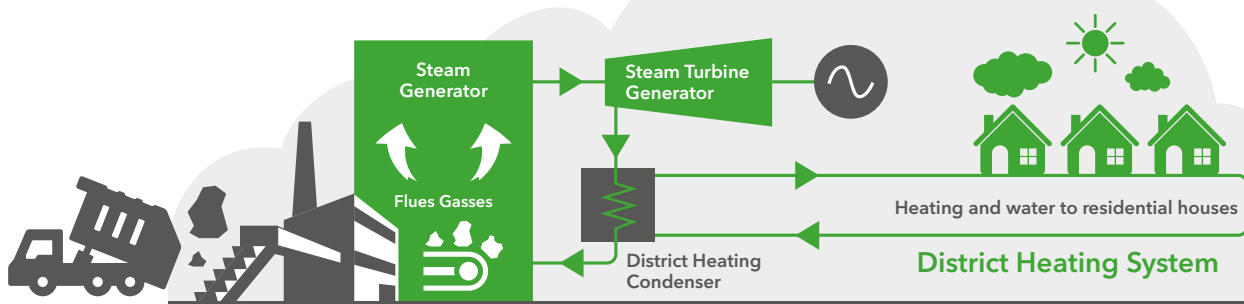
OPPORTUNITIES TO PRODUCE ENERGY

- Refuse-derived fuel (RDF)
- Municipal solid waste (MSW)
- Meat and bone meal (MBM)
- Clinical waste
- Used vehicle tyres
- Biomass
- Sawmill / wood processing waste
- Coppiced wood
- Forest residues
- Sewage sludge
- Landfill gas
- Sewage digester gas
- Refinery flare gas
- Mines gas
- Coke oven gas
- Bagasse & other agrifibres
- Olive-milling waste (OMW)

WASTE-TO-ENERGY

Steam turbines produce energy from a waste product providing a self-sufficient power supply to the plant:

- Helping to reduce running costs
- Making it self-sufficient
- Providing reliable power
- Surplus power can be used to power local villages and communities - benefiting the local community that otherwise would not have power or certainly an unreliable source of power due to the remote location





Our reputation for engineering is driven by our commitment to quality and client needs

Project Management

All customer projects are managed carefully through our manufacturing facilities by experienced teams of project managers, supported by production control and procurement staff.

Our purchasing teams include commercial specialists and engineers who source components from companies across the world.

We select suppliers carefully in order to maintain high quality product standards and reliable service in-line with project requirements. Our project managers are the focal point of customer orders during production. They use the latest software and systems to track every aspect of a customer order to ensure its smooth transition through our factory.

The project management team all possess extensive experience of working within a global market and cultures, and provide all of our clients continuous communication throughout the project lifecycle, from pre-award to handover.

Blades

The quality of our blading meets the highest standards. Where blading has been redesigned, improved efficiency has been proven when the turbines are returned to service.

The company's sophisticated machine tools enable us to manufacture straight or tapered and twisted blades, machined from solid metal billets to ensure the material integrity of the blade during operation.

Materials are carefully selected by the company's design engineers to meet the demands of the unique operating conditions of each machine. Blades can be manufactured and delivered to the customer within a very short timescale thus reducing machine downtime.

The quality of our blading meets the highest standards – we believe it is second to none. This is achieved by state of the art machining, measurement and quality control techniques.

Howden Turbo UK manufactures, supplies and fits rotor blades for many makes of turbine and can reproduce any blade profile and root section, making allowances for wear and damage. Component drawings can automatically be produced or the data transferred direct to the machine tools. This process reduces manufacturing lead times significantly.

A full fitting and balancing service providing certification to meet every safety and insurance requirement backs up the blading facility. The service engineers can provide onsite re-assembly and re-commissioning to ensure safe and efficient operation of the customer's turbine.

LIVE STEAM TESTING CAPABILITY

Howden Turbo UK test all of our products on live steam. We can produce 400°C 40 bar steam with a maximum flow rate of 12 tonnes per hour allowing us to test the whole range of products at full speed with no load.

This capability allows us to mechanically test the entire steam turbine package complete with contract control system, to rectify any issues within the factory environment with the right personnel, equipment and support to hand.





World-class manufacturing and customer support

Engineering Excellence

Howden Turbo UK's purpose-built world-class facility has first-class design and manufacturing facilities and a highly skilled workforce.

We offer a complete "one stop shop" from development of an initial concept through to site installation and commissioning, with a service tailored to meet client requirements.

Howden Turbo UK works to ISO 9001:2015 quality assurance standard, ISO 14001:2015 Environmental Management standard and ISO 45001:2018 Health & Safety Management.

Skilled Workforce

We are a highly skilled, multi-disciplinary team of professional engineers dedicated to fulfilling customer needs worldwide.

The company's analytical and design facilities include CAD/CAM, finite element analysis (linear, non-linear and multi-physics), computational fluid dynamics (CFD), and programs for rotor dynamics, heat transfer, control system design and materials science. These are complemented by advanced manufacturing, monitoring and test facilities.

Our steam turbines are the result of continuous, evolutionary development, to maximise efficiency for lower fuel consumption and carbon emissions.

The complete service - from initial concept development to installation and commissioning, as well as after sales support and on-site maintenance.

Installation & Commissioning

World-class project management ensures that globally sourced components arrive on-site, on-time to start a seamless installation and commissioning process.

Our team of experienced field service engineers are able to coordinate and conduct activities from the inspection of the turbine foundations to the commissioning and hand-over of the machine to the customer on land and marine based packages.

Servicing & Peace of mind

Howden Turbo UK offer repairs and re-rating to any make of reciprocating compressor or steam turbine.

A highly skilled team of engineers provide round the clock worldwide services. Often working under extreme conditions, the engineers are dedicated to solving customers' problems and reducing down time. The engineers are supported by design and technical staff based at our head office in the UK and if required, can be sent to the customers facility.

This, together with an international network of partner companies that offer local support and assistance, ensures we have the right personnel to provide solutions in the shortest time possible.

Continuous R&D

Our ongoing R&D, combined with the feedback from many hundreds of products in the field allows the company to continuously develop designs and manufacturing procedures, improving product capability, reliability and performance.

This minimises the time taken to implement new developments and maximises the company's responsiveness to customers' needs.

The 11,000m² manufacturing area includes:

- Assembly
- Machining
- Welding and fabrication
- Test bed with live steam
- Heat treatment
- Acid plant
- Pipe fabrication
- Warehouse and stores
- Radiography booth
- NDT – ultrasonic, dye penetrant, magnetic particle

In-house capabilities include:

- Assembly / testing of machines
- Gas, metal arc, MIG, and TIG welding
- Paint and blasting
- CNC and conventional machining
- Turbine blade manufacture
- Non-destructive testing
- Hydro testing
- Balancing

Manufacturing to quality standards including:

- NEMA SM24
- IEC 60045-1
- API 611, API 612
- API 613
- API 614
- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2018
- International Standards
- National Standards, CE Norms, European Directives
- Client and / or Industry Standards

Peter Brotherhood Steam Turbines

A proud history of innovation

- 1838 ○ Peter Brotherhood born (1838-1902)
- 1861 ○ Peter Brotherhood supervises installation of new rudder post and paddle wheels on Isambard Kingdom Brunel's vessel The Great Eastern – the largest ship in the world at the time
- 1867 ○ Peter Brotherhood company founded
- 1872 ○ Invented the three cylinder radial steam engine – the first steam engine to be coupled directly to a dynamo
- 1875 ○ Installed steam driven generator sets on the French warship Richelieu – the first major vessel in the world to have electricity
- 1876 ○ Installed steam driven generator sets on HMS Invincible – the Royal Navy's first vessel to have electricity
- 1924 ○ Supplied 7,500 kW condensing machines to coal fired power stations in the UK
- 1954 ○ Supplied the first Peter Brotherhood steam turbine to the cane sugar industry
- 1958 ○ Supplied the world's first marine waste heat recovery steam turbine
- 1976 ○ Supplied 10,000 kW back pressure turbine generator set to the Australian sugar industry
- 1994 ○ Moved to existing location in Peterborough
- 2001 ○ Supplied 20,000 kW back pressure turbine generator set to a sugar factory in Zimbabwe – the largest in Africa
- 2003 ○ Installed two 12,000 kW turbine generators, the largest in the world on an FPSO
- 2005 ○ Installed two 24,000 kW turbine generators, the largest in the world on an FPSO
- 2006 ○ Supplied 8,500 kW turbine generator set to Emma Maersk, the world's largest container ship
- 2007 ○ Installed two 27,000 kW turbine generators, the largest in the world on an FPSO
- 2008 ○ Installed 17,650 kW turbine generator in a diesel engine combined cycle – the largest in the world at this time
Installed three 24,000 kW turbine generators on an FPSO, the largest amount of steam produced electrical power output at sea
- 2012 ○ Supplied two 16,000 kW extraction turbine generator sets to FPSO for the North Sea, the world's first extraction condensing machines on an FPSO, and the largest in the North Sea
- 2013 ○ Supplied 38,000 kW back pressure turbine generator set - the largest in the world to the Mexican sugar industry
- 2015 ○ Supplied two 33,000 kW turbine generator sets to the world's first converted FLNG vessel
- 2016 ○ Supplied steam turbine generator sets to the Royal Navy – 140 years of continuous supply to the same customer
- 2020 ○ Supplied two 26,370 kW turbine generator sets to our second FLNG Project
- 2021 ○ Howden acquires Peter Brotherhood Ltd, offering the same steam turbine solutions under Howden Turbo UK company name
- 2023 ○ Chart Industries acquires Howden



Peter Brotherhood Steam Turbines. Proud to give you more.
More expertise. More support. More reliability. More value.

For your next steam turbine solution please
contact our sales team on: **+44 (0)1733 292200**
or **sales.HTO-UK@chartindustries.com**



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