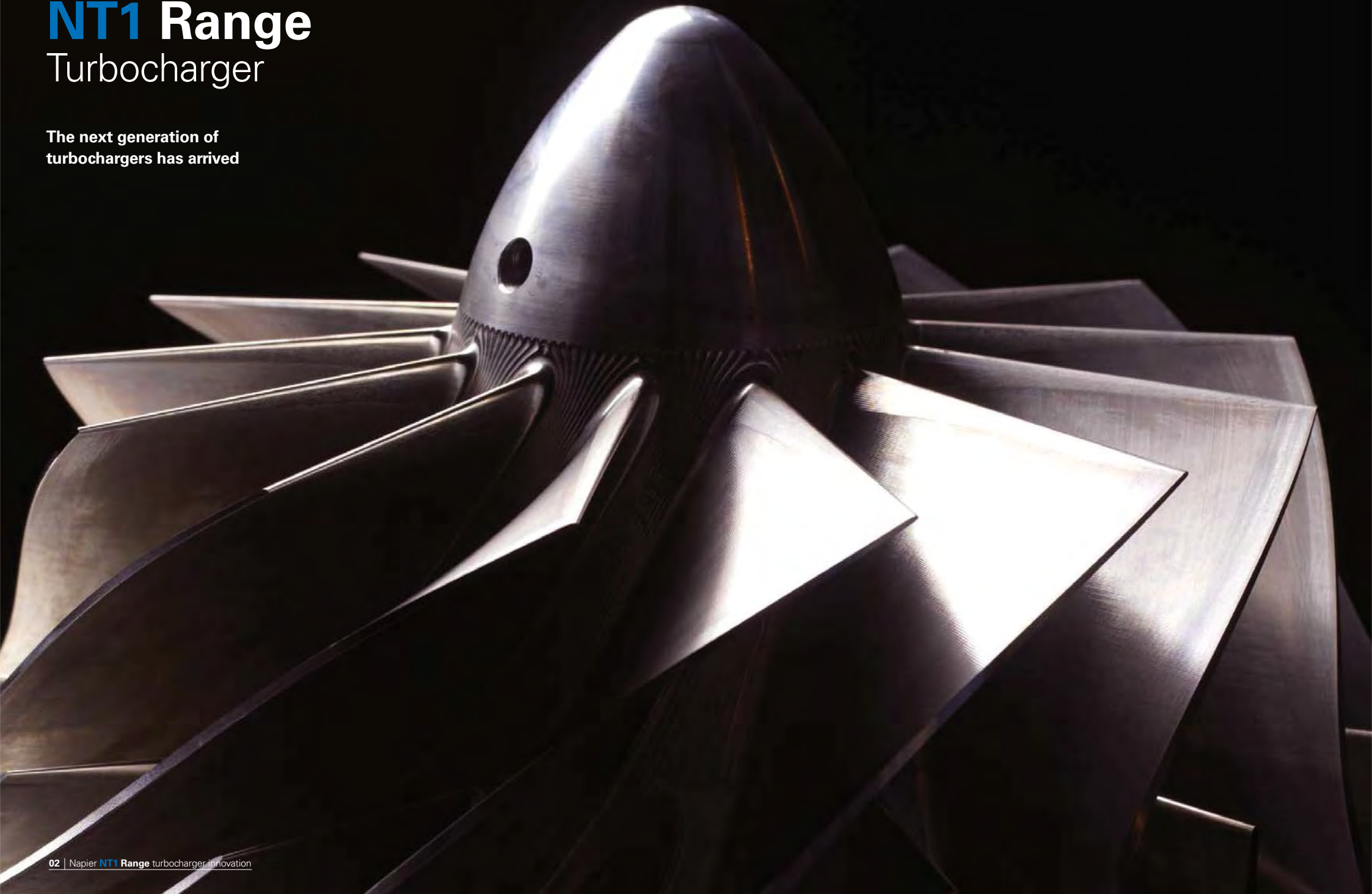




NT1 Range
State-of-the-art turbocharging

NT1 Range Turbocharger

The next generation of
turbochargers has arrived



Driving forward the development of turbochargers

Napier is a world leader in the design, manufacture and support of industrial turbochargers. With over 60 years of experience, our specialist engineers have produced more than 50,000 turbochargers for marine, power generation and rail applications. You will find our products across the globe, providing reliable performance in some of the most arduous environmental conditions, year after year.

In February 2013, Napier was bought by the Wabtec Corporation; a global provider of value-added, technology-based products and services primarily for the rail and transit industry. Wabtec is committed to investing further into the research and development that will allow Napier to continue innovating, leading the market in the development of cutting-edge technology and the search for ever-more efficient ways to help our customers to get more from their engines.

The **NT1 Range** is our very latest product range and has been designed to provide market-leading efficiencies and pressure ratios. It is your answer to achieving more power and efficiency, while lowering fuel consumption and emissions.



Global Operation

For over 60 years Napier Turbochargers have been successfully operating on engines in some of the world's harshest climates.



Proven Reliability

Napier Turbochargers are designed to operate with engines running on HFO, MDO, natural gas, landfill gas or a combination Dual Fuel engine.



Ease of Maintenance

Napier Turbochargers are designed to ensure ease of maintenance and service support.

NT1 Range innovation

- The market leader in pressure ratio and efficiency for a single-stage axial turbocharger
- Designed to meet current and future IMO11 diesel engine requirements
- Suitable for high altitude and high ambient installations
- Complies with all marine and land-based legislation
- Compatible with all fuel types, for ultimate flexibility
- Can be tailored for use in marine, power generation and rail applications
- Fully supported by our world-class global service network.

Napier

A story of progress

Since the company began, Napier has enjoyed a reputation for precision and invention unmatched in the history of British engineering.

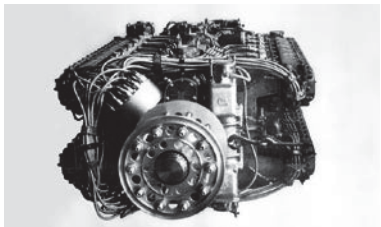


A rich history of precision and invention

Napier began in 1808, the brainchild of David Napier who learned his trade in the workshop of Henry Maudsley, inventor of the centre lathe which was the backbone machine of the industrial revolution. Mr Napier founded his own firm which soon built a reputation for quality and engineering excellence, developing everything from printing presses and franking machines, to cars and aero engines.

In the early 1900s, Napier began manufacturing cars and soon became Britain's leading car manufacturer. In 1918, Napier entered the aero-engine market and our engines powered the Typhoon and Tempest fighter bombers of the World War 2 D-Day offensive. After the war, the company took the lead in powering gas-

turbine helicopters, some of the learnings from which led, in 1947, to Napier beginning to design and manufacture turbochargers to support the next generation of engines. From 1969, we have solely specialised in turbochargers and, since February 2013, we have been part of the Wabtec Corporation.



Napier Dagger MkIII engine

24 Cylinder 'H' layout air-cooled, supercharged. Used in the Martin Baker MB2, Hawker Hector, Handley Page Hereford and Hawker Trainer.



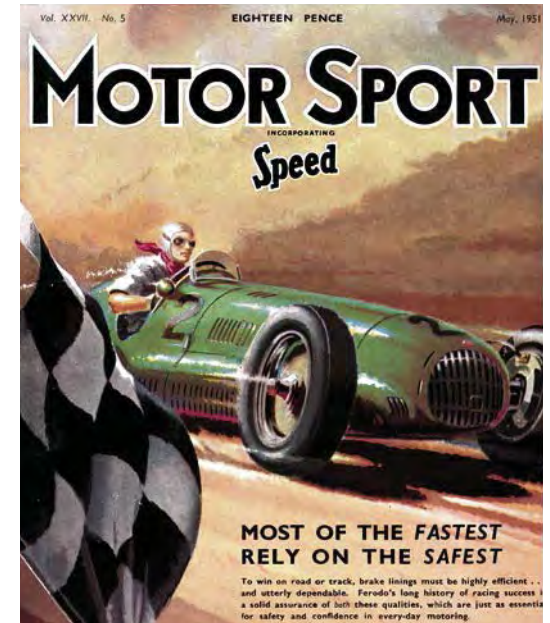
Napier Railton powered by the Lion engine

Napier held the Land Speed record with the Napier Lion engine over many years, finally achieving a speed of 400mph with the Napier-Railton LSR in 1947.



Typhoon 1B with Napier Sabre IIA engine

24 Cylinder 'H' layout Liquid-Cooled Sleeve Valve Twin Crankshaft with a 2-speed Supercharger. Used in the Hawker Typhoon, Hawker Tempest, Fairy Battle and Martin Baker MB3.



An unrivalled pedigree in the achievement of land, air and sea speed records

- 1919 Height Record: 30,500 feet
- 1929 Land Speed Record: 231.3 mph
- 1929 Air Speed Record: 336.3 mph
- 1930 Water Speed Record: 100.13 mph
- 1931 Land Speed Record: 246.1 mph
- 1932 Land Speed Record: 253.968 mph
- 1933 Air Long Distance Record: 5,309 miles
- 1939 Land Speed Record: 369.74 mph
- 1947 Land Speed Record: 394.196 mph

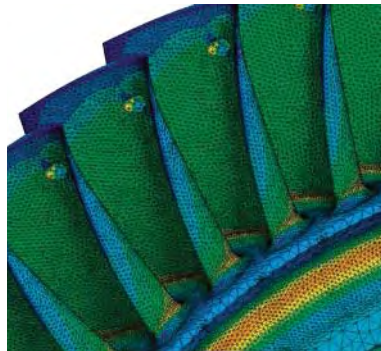
Specialist turbocharger engineering expertise

Since 1947, Napier has specialised in turbochargers; which allows us to focus all our thinking and efforts into leading the world in turbocharger design, development and manufacture.

We have a dedicated engineering team of global experts in advanced turbocharger technology with experience of developing new products from design concept to production readiness. These engineering experts utilise a suite of sophisticated tools and techniques to drive innovation and development.

Napier also supports multiple technology programs (including partnerships with industry and academia) in pursuit of future product development initiatives and market requirements.

We validate future engine and turbocharger concepts by creating engine simulation models in conjunction with OEM partners. All our design, development and manufacturing takes place at our own state-of-the-art plant using our own technology. This allows us complete control of every element of the process to ensure the quality, reliability and performance our turbochargers are renowned for around the world.



Test and Validation

We validate future engine and turbocharger concepts by creating engine simulation models.

Tools and Simulation

We utilise a suite of sophisticated tools and techniques to drive innovation and development.

In-house Engineering

We have a dedicated engineering team of global experts in advanced turbocharger technology.

Highly specialist, homegrown engineers, state-of-the-art facilities and in-depth research combine to create innovative solutions... like the **NT1 Range**

Advanced design techniques assist Napier Turbochargers to optimise engine operation

- Vibration analysis
- Engine performance modelling
- 3D CFD modelling
- FEA stress analysis
- Harmonic/resonance analysis
- Dedicated test facilities
- Technical engineering specialists.

First choice for the world's leading engine manufacturers

Napier **NT1 Range** turbochargers are designed and built to offer cutting-edge performance and reliability in marine, power generation and rail applications. Leading engine manufacturers around the world choose Napier Turbochargers for the following reasons:

Flexibility

We co-operate with engine manufacturers, tuning and adapting our product during the design stage to meet specific customer targets. This collaborative process has been invaluable in developing the **NT1 Range**. It has resulted in: market-leading pressure ratio and efficiency levels, enabling manufacturers to do more, for less, with their engines; and a simplified installation process. If the need arises we can also customise our turbochargers to meet specific engine installation or application requirements.

Cost effectiveness

Specific service solutions can be tailored to suit each customer. We optimise through-life costs by supplying a product that does exactly what you need it to, with additional tailoring to meet specific performance requirements. It's about best value and the best return on your investment.

Turbocharger performance

The **NT1 Range** represents a further shift in turbocharger performance, reinforcing Napier's leading position in the market. The **NT1 Range** has been developed to give engine manufacturers extra pressure ratio when required – at up to 6.0:1, the highest pressure ratio available for this type of turbocharger. Now, the **NT1 Range** combines this with market-leading efficiency levels.

Reduced emissions

The developments in the **NT1 Range** allow engine manufacturers to design and build engines that not only comply to the emissions legislation, but can also use more advanced miller timings to further reduce fuel consumption, while still being able to apply up-rates to increase power density.

Fuel flexibility

Napier Turbochargers can be fitted to engines running on all types of fuel: marine diesel, bio diesel, natural gas, LNG, LPG and heavy fuel oil (HFO). For HFO, we have developed state-of-the-art turbine water wash technology.

Global support

We offer a series of aftermarket support packages to suit your needs, and can provide servicing direct to end users. Our aim is to provide cost-effective solutions and to achieve minimum downtime which is crucial, particularly in marine and powerplant applications. For end users who wish to carry out their own servicing, genuine Napier parts are available direct from us and via the Napier service network. All of this gives engine end users more choice and competitive pricing.



Napier NT1 Range

More power, more efficiency,
less fuel, lower emissions



Aerodynamic components

Optimised for efficiency, pressure ratio and reliability.

Aluminium compressor wheel

Minimum cost with maximum performance.

Gas inlet options

Meet specific engine and engine room installation requirements.

Latest water-washing techniques

Efficient operation with minimum service downtime for HFO-powered engines.

Fabricated nozzle ring

High efficiency with excellent resilience to thermal transients.

Turbine

Stress optimised for durability and load optimised for low fuel consumption.

Hydrodynamic journal bearings

Feature a squeeze film damper for reduced wear.

Ergonomic bearing arrangement

Saves space.

Bearings

Designed for strength and durability.

Turbine seal innovation

Eliminates leaking at low speeds.

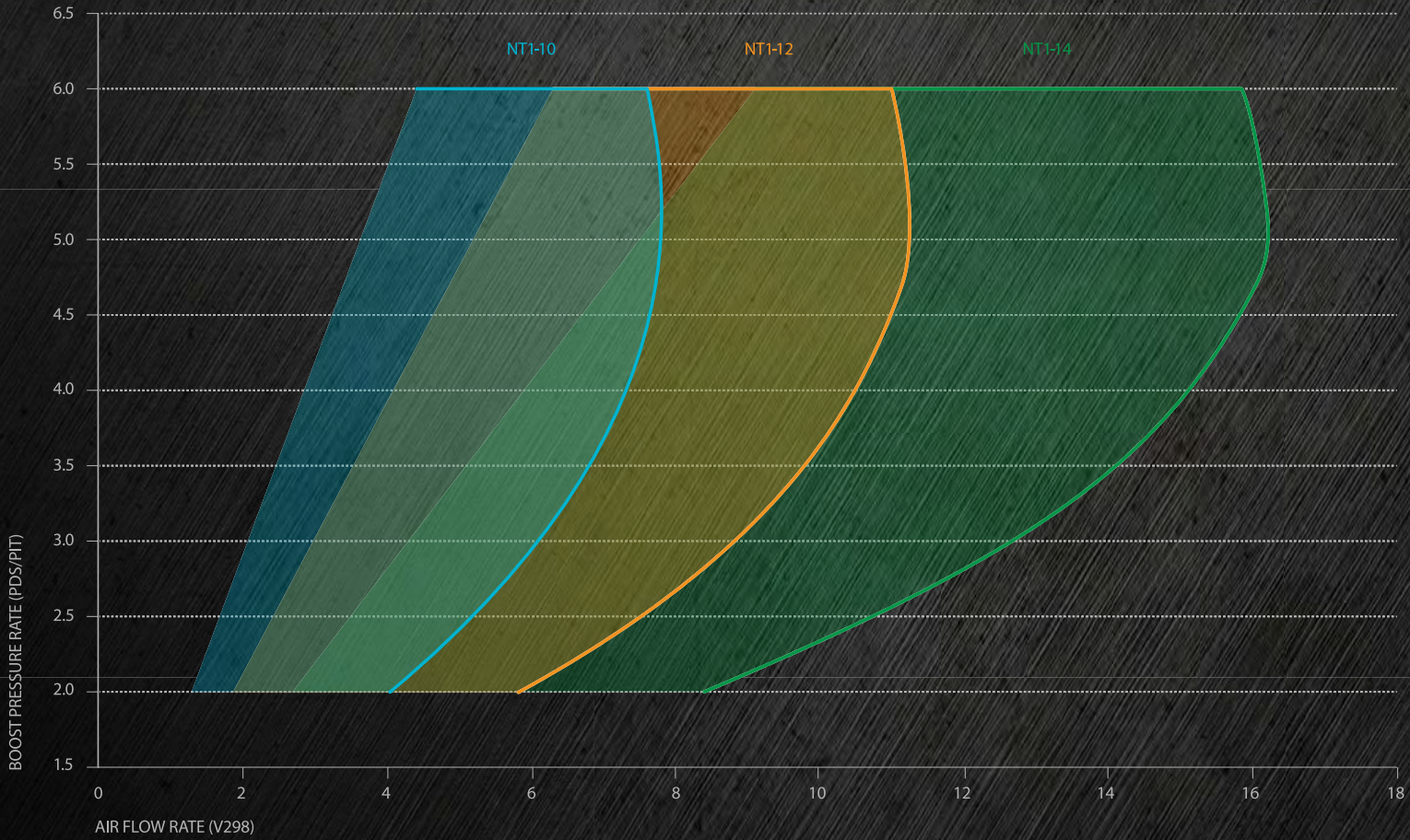
Anti-surge technology

Allows a wide compressor map giving optimal performance while eliminating surge risk.

Integrated oil inlet and oil drain

Pipeless engine principle, reducing cost and the potential for leakage.

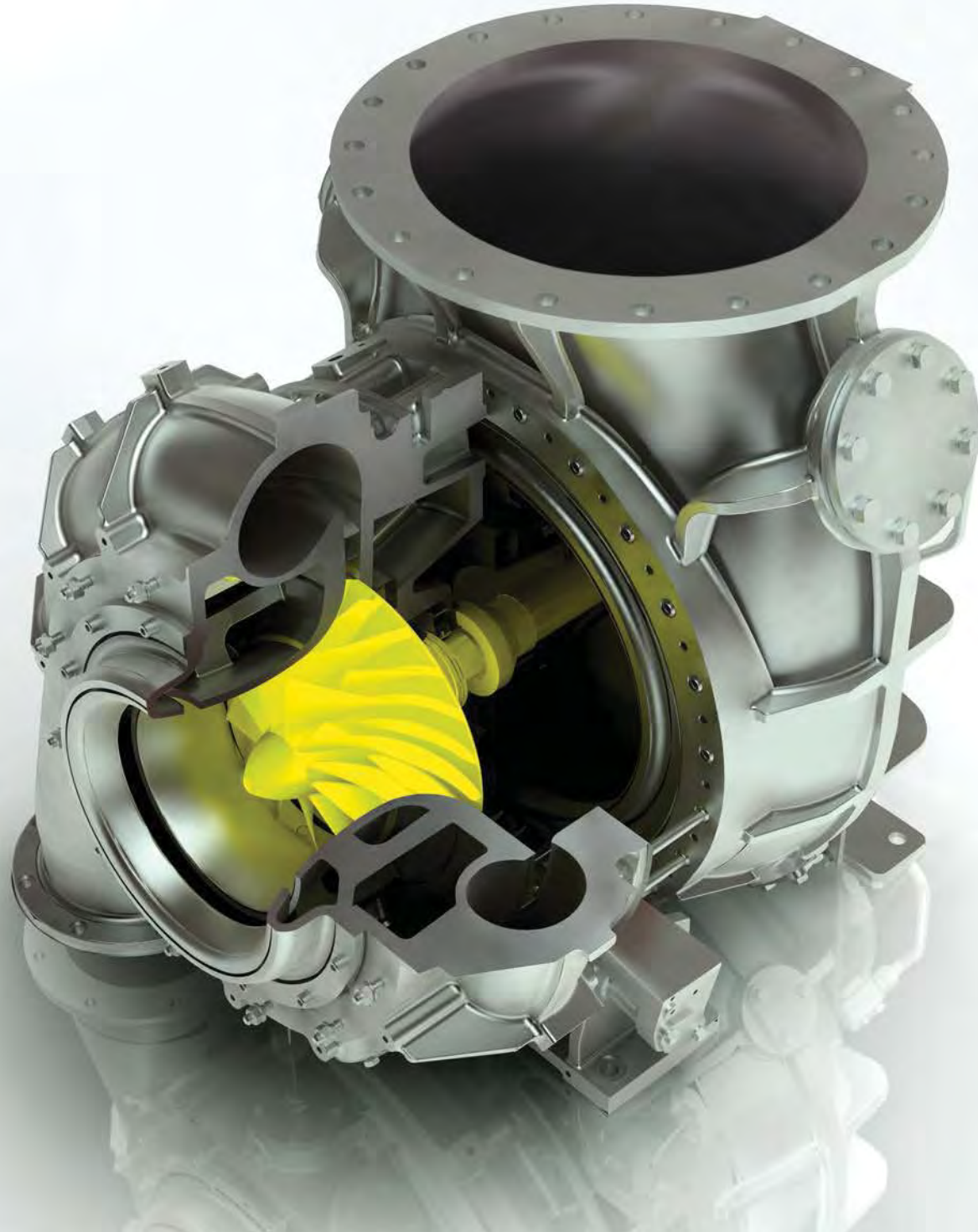
Napier Turbochargers Product Capacity Curves



Napier Turbochargers Product Capacity Curves

The latest generation Napier Turbocharger products utilise the latest technologies offering outstanding performance across the range. It is your answer to achieving more power and efficiency, whilst lowering fuel consumption and emissions.

NT1 Range Compressor



Technical Information

The **NT1** Range features the highest pressure ratio and efficiency available for this type of turbocharger in the market. This allows you to reduce emissions, achieve more power and reduce fuel consumption.

Aluminium compressor wheel is cost effective and stress resistant

The perception is that higher pressure ratio turbochargers require the use of more expensive materials, like titanium. Thanks to Napier technical expertise, we have been able to retain the use of an aluminium alloy, keeping costs down with no compromise on performance and durability.

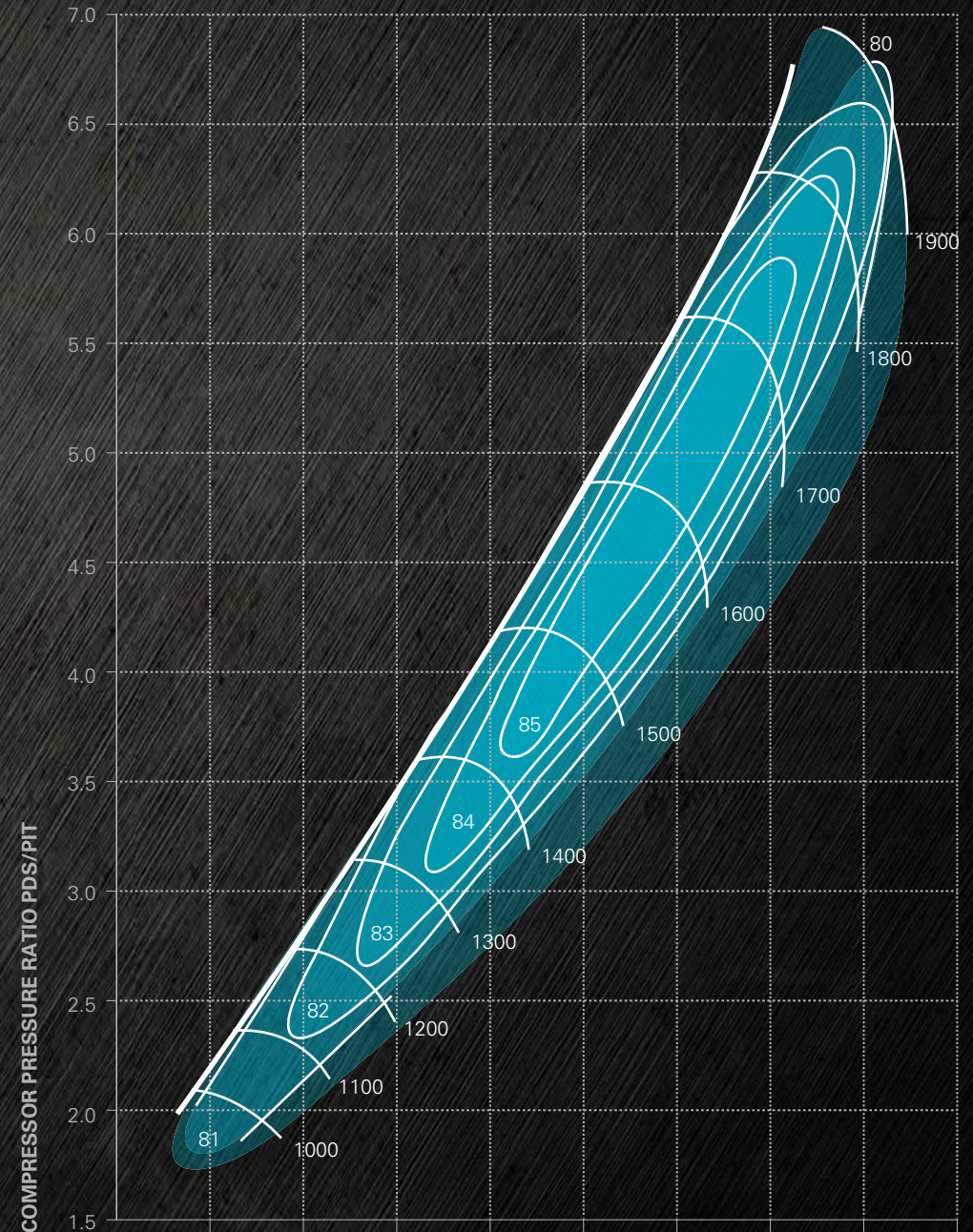
Anti-surge technology

This proven technology increases map width, allowing the compressor to operate at peak efficiency for different applications. It has increased the surge margin to a level which eliminates the risk of surge during operation.

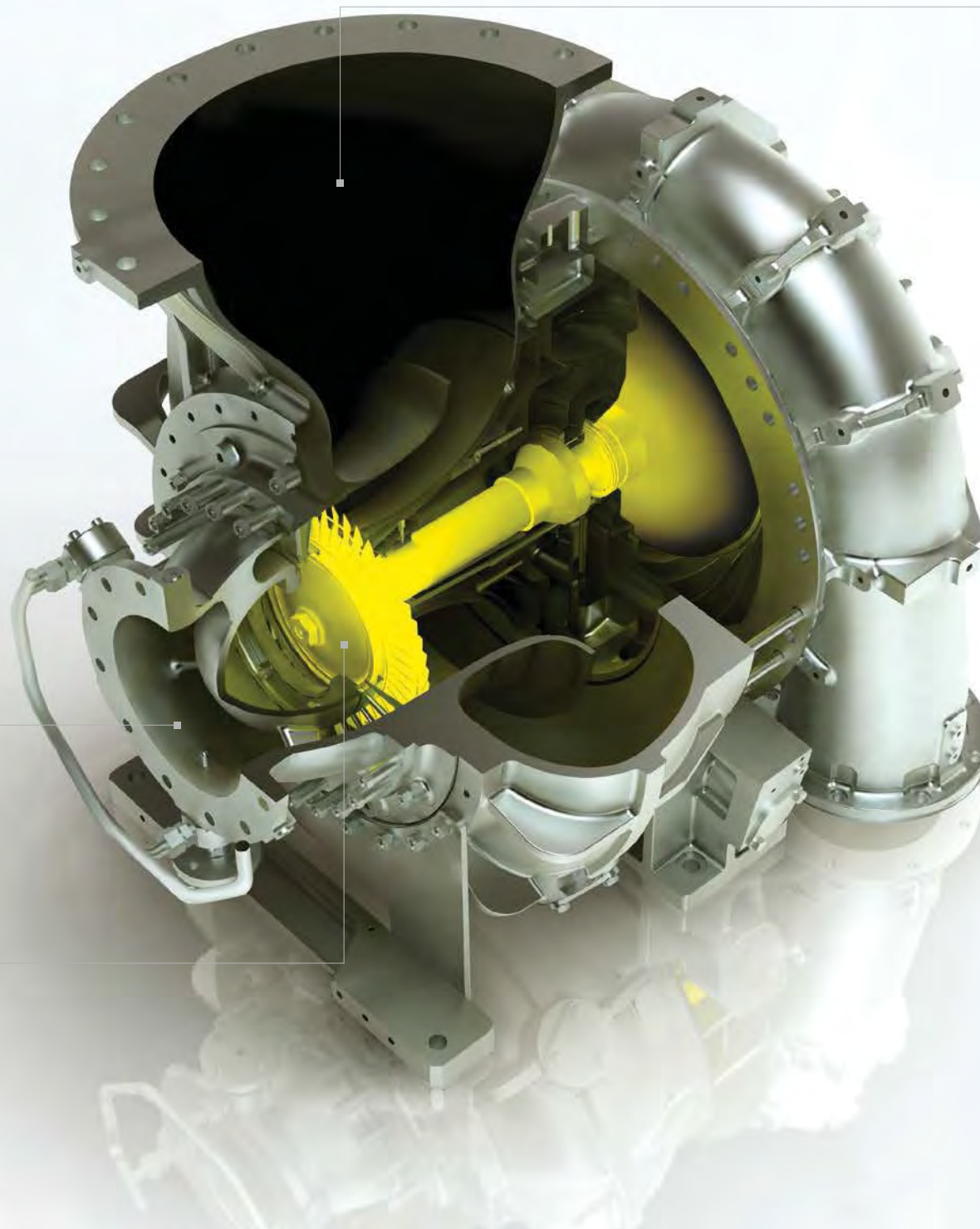
High efficiency compressor stage

All of the components that make up the aerodynamic elements of the compressor on the **NT1** Range are designed using 3D CFD calculations to ensure the highest possible levels of efficiency. Peak efficiency areas can be tailored to specific requirements and applications, such as part or full-load optimisation.

Typical NT1-10 Compressor Map



NT1 Range Turbine



Optimised airflow for better performance

Using the latest 3D CFD (Computational Fluid Dynamics) software, we have boosted the efficiency of the turbine stage for the **NT1 Range**, while retaining durability and life.

Fabricated nozzle ring for high efficiency

The nozzle design provides excellent resilience to thermal transients to ensure long service life under all conditions and duties.

Stress optimisation for greater durability

FEA (Finite Element Analysis) testing pinpoints high stress areas which, on the **NT1 Range** turbine, we have designed out for longer-lasting components. We test all components individually and as a system to ensure they work together seamlessly for greater efficiency and performance.

Heavy fuel oil optimisation

On the **NT1 Range**, we have carried out rigorous testing and analysis to optimise the turbocharger for operation with HFO. This has included extensive investigation into the latest water-washing techniques, specifically for the turbine.

Constant and pulse pressure compatibility

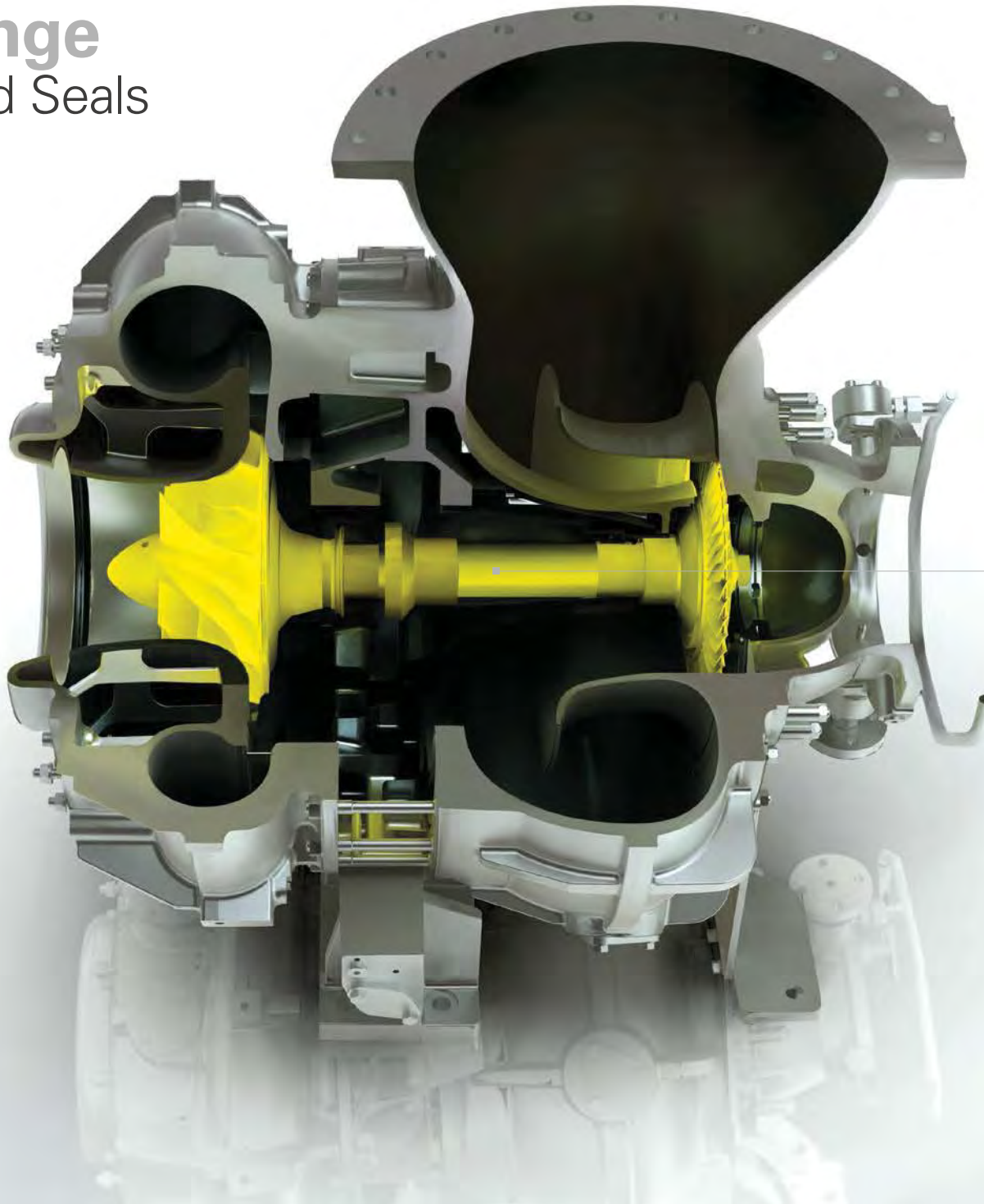
The **NT1 Range** is designed to operate with both constant and pulse pressure systems, giving you real flexibility and matching your engine set up.

Load optimisation for lowest fuel consumption

Whether you're a powerplant running at full load all the time, or a part load marine application, we tailor the **NT1 Range** turbine to your needs. The design allows us to move the peak efficiency point along the range to obtain the lowest possible fuel consumption, reducing cost for your operation.

NT1 Range

Bearing and Seals



Built for the higher demands of a higher pressure ratio turbocharger

The high pressure ratio on the **NT1** Range puts the bearings and seals under greater pressure, so we have designed them for strength and durable performance in these more arduous conditions where the machine is operating at higher speeds.

Semi-floating bearing design for reliability and reduced wear

Our hydrodynamic journal bearings feature a squeeze film damper for vibration resilience. The result is more reliable operation and extended service intervals.

Proven bearing arrangement saves space

The **NT1** Range uses our tried and tested bearing arrangement of mounting the thrust bearing between the journal bearings. It's the most ergonomic arrangement for a compact, space-saving design.

Compressor end sealing designed to meet the needs of high pressure ratio

We have developed our tried and trusted **7 Series** sealing arrangement to answer the more arduous demands of a high-pressure environment.

Innovative turbine seal eliminates leaking

Piston ring seals use air to help them seal, but at low speeds there isn't as much air and this can cause leaking. Developed by Napier engineers, our turbine seals don't rely on compressed air to work, so there is no leaking. We use turbine seal to improve turbine shaft sealing across the whole **NT1** Range range.

Examples of low-load applications which have benefitted from the innovative Napier design turbine seal include rig support vessels, tugs and standby generators.

NT1 Range Casing

Aircooled casing

A simple, efficient solution.

Lubrication is via the engine lube oil system

This is a cheaper, simpler solution as there is no need for a separate lube system.

Oil inlet and oil drain are integrated

This answers the needs of the pipeless engine principle, reducing cost and the potential for leakage.

Proven burst containment

NT1 Range turbochargers meet all classification society approvals as required, for complete safety.

Waste gate ports on gas inlet and outlets

Simplifies the engine package making it compact and cost effective.

Fully indexable with gas inlet options to meet specific engine installation requirements

Casings can be rotated and we offer a number of axial and radial gas inlet options, meeting a wide series of engine and engine room requirements.

Conforming with SOLAS (Safety Of Life At Sea)

The NT1 Range casing's insulation answers strict sound and temperature requirements for safety, liability and peace of mind.

Compressor inlet options

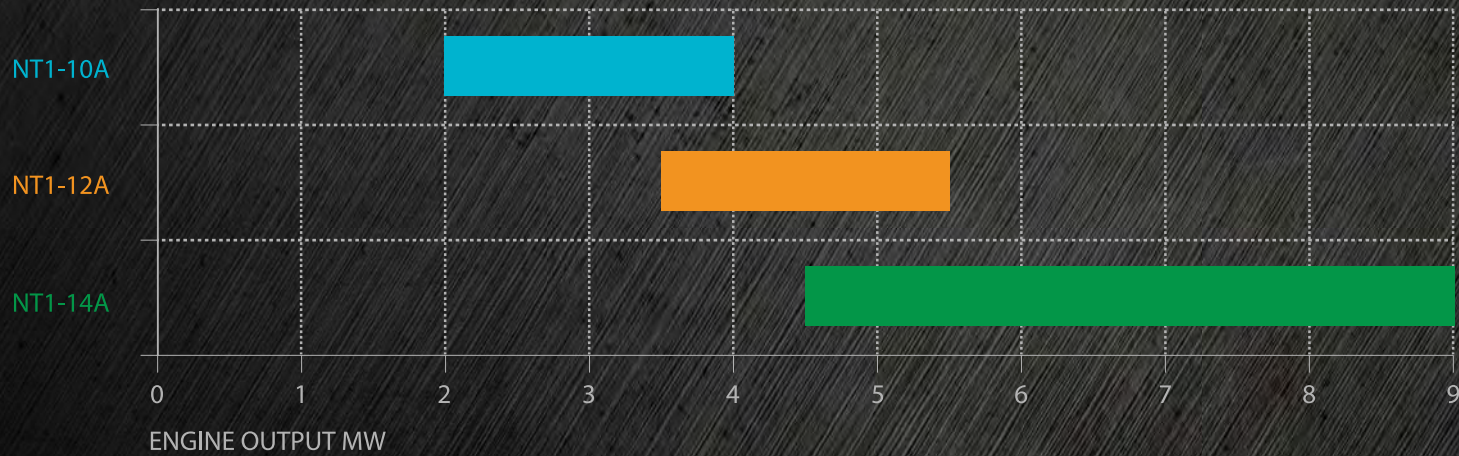
The NT1 Range is available with a number of compressor inlet options, including the NT1 Range air filter silencer, which meets all current legislation for noise emissions and side entry casings (also known as air inlet ducts), which are available in a variety of axial or radial options.



NT1 Range

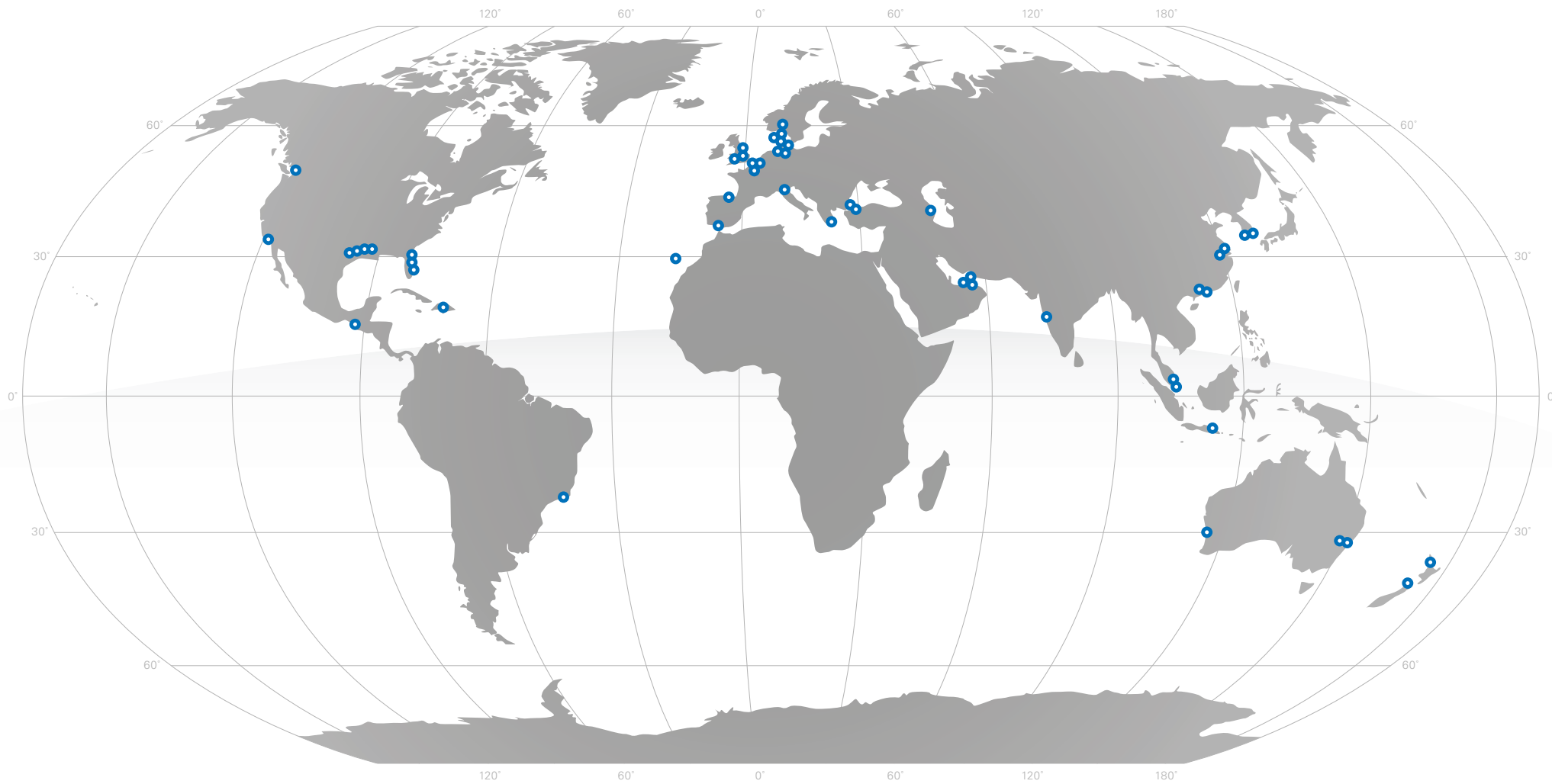
Specifications

Napier Turbochargers Engine Output (per single turbocharger)



Napier Turbochargers Specifications

Model	NT1-10A	NT1-12A	NT1-14A
Engine Power Output Max (MW)	4	5.5	9
Engine Power Output Min (MW)	2	3.5	4.5
Pressure Ratio	6.0:1	6.0:1	6.0:1
Weight (Kgs)	1220	2100	3600
Length (mm)	1500	1800	2170
Width (mm)	1000	1170	1400
Height (mm)	870	1050	1250



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