Product information

A100-M/H radial
Currently the last word in single stage turbocharging
ABB Turbocharging’s A100 turbocharger series

High pressure ratios at high efficiencies, A100 turbochargers are a key factor in the success of modern diesel and gas engines, enabling both fuel savings and reduced emissions.

The A100-M and A100-H series of turbochargers for medium- and high-speed engines are designed specifically to meet market demand for highest compressor pressure ratios with single stage turbocharging.

Growing demand for energy, rising fuel costs and stricter emissions legislation are a significant influence on engine development in the marine and power generation segments. It goes without saying that these same factors, plus the on-going trend towards higher engine power densities, are also impacting turbocharger technology. Higher engine mean effective pressures require higher turbocharger pressure ratios, while optimization of combustion technology, new engine-internal measures and the focus on exhaust gas after treatment systems all influence the development of modern turbocharging systems. In short, highly efficient turbocharging systems are vital for energy efficient engines.

High compressor pressure ratios are required today, not only to increase power output, the key aim in the past, but also to achieve significant reductions in emissions levels. They are needed, for example, to enable the Miller/Atkinson process, which is used in some form on almost all modern diesel and gas engines. In diesel engines this process helps to reduce NOx emissions, while in gas engines it is used to shift the point at which knocking begins. Extra reserves of pressure ratio are also required for engines operating at high altitudes.

Turbocharger performance – a crucial factor

During the past decade engine builders have achieved a significant increase in mean engine power output in the medium-speed segment, while at the same time cutting specific fuel consumption and lowering engine emissions. This same period has also seen a substantial increase in the demands made on the turbocharger’s thermodynamic and mechanical performance.

The next generation of diesel and gas engines will fully utilize the considerable potential of the A100 generation turbocharger. Full load pressure ratios of up to 5.8 in continuous operation, at high efficiencies from compressors using aluminum compressor wheels are setting new benchmarks for power density in turbocharger design and take the known limits of single stage turbocharging a significant step further.

![Fig. 1: Increasing demands made on turbocharger performance.](image-url)
From TPS to A100-M/H turbochargers

Ten years after their introduction, more than 55,000 TPS series turbochargers are successfully operating on medium-speed diesel and high-speed diesel and gas engines rated from 500 kW to 3300 kW per turbocharger. While these turbochargers continue to be the preferred choice for engine series rated at current power levels, market demand for ever-higher engine power densities and higher efficiencies, as well as the need to curb engine emissions, call for new engine concepts and a new generation of turbochargers. It is for these advanced engines that ABB has developed the high-pressure A100-M/H series – the A100-H series for high-speed engines and the A100-M series for medium-speed engines.

The small and medium frame sizes of A100 radial turbochargers have the same external dimensions as the field-proven TPS turbochargers and, also like the TPS, have their oil inlet and outlet ducts integrated into the foot. This ensures that, in the case of further development of current TPS-turbocharged engine platforms, these engines can be fitted with A100 radial turbochargers without having to make any major changes to the turbocharger mounting.

The two latest family members of the A100-M series, the A150-M and A155-M, represent the largest radial type turbochargers from ABB and are key enablers of engine power outputs currently higher than 5000 kW per turbocharger, while at the same time meeting the highest levels of efficiency.

Design concept

A100 radial turbochargers are of modular construction with a minimized number of components and designed to allow matching to the special requirements of a maximum range of diesel and gas engine applications.

A range of specific design and configuration features, such as coatings and sophisticated, highly effective cleaning systems, enable A100-M radial turbochargers for medium-speed engines to be used with heavy fuel oils (HFO). The availability of multiple gas inlet casings facilitates operation in pulse turbocharging systems.
Aluminum compressor wheels as standard
For the A100 radial turbocharger series, ABB Turbocharging has developed a cooling technology that allows the continuing use of aluminum for the compressor wheels, even at such very high pressure ratios. And without compromising the high operational reliability and long component exchange intervals users have come to expect with this material.

In an extensive test program cooling using compressor air was shown to be the most efficient solution as well as the easiest and least costly for the engine builder to implement. The concept is widely proven in the field on A100 applications, having also been offered as an optional feature on ABB TPL-C turbochargers for several years now.

Containment concept successfully tested
The A100 casings take full account of the much higher mechanical demands made on them. During their design, ABB worked closely with engine builders to ensure a tight dimensional envelope as well as optimum mounting on the turbocharger bracket. The safety of the containment concept – a vital consideration in view of the significantly increased power density – has been confirmed both numerically and experimentally in turbocharger containment tests involving bursting components.

The high power delivered by the newly developed turbine was also a factor in the design of the A100. The overall centering concept of rotating components and casings which proved successful on the TPS-F turbocharger has been retained and further developed to ensure excellent, efficient turbocharger operation.
**Thermodynamic performance**

Three entirely new compressor stages, each with different compressor wheel vane designs, allow a wide compressor volume flow range, covering the full spectrum of TPS-F turbochargers but at significantly higher pressure ratios.

The A100 turbocharger features a single-piece aluminum compressor wheel. New high pressure diffusers and compressor vane geometry were developed in addition to adding compressor wheel cooling to ensure full load pressure ratios of up to 5.8 using aluminum wheels. The wide and modular range of compressor stages is available for every turbocharger frame size, allowing optimal matching to every application. The compressor map of the A145 turbocharger frame size demonstrates excellent map width, large overspeed margins and an optimal area placement of constant efficiencies along the whole operating range.

![Fig. 2: Pressure ratio versus volume flow for A100 radial turbochargers at full load (for certain specifications even higher values can be achieved).](image)

![Fig. 3: Compressor map (A145).](image)
New turbine stages
A new generation of mixed-flow turbines has been developed for use with the A100. Powering the new compressor stages, a characteristic of this new turbine family is their extensive operating range, allowing the high pressure ratio potential of the new compressor stage to be utilized over an even wider range of applications. The turbine’s design has been optimized in each specific volume flow range, so that the individual stages exhibit outstandingly high turbine efficiencies. Further development of sealing technologies has reduced blow-by, so that flow losses are also lower. In particular, this has allowed a substantial improvement in turbocharging performance at higher boost pressures.

A milestone in turbocharger development
A wide range of available compressor and turbine specifications makes the A100 ideally suited for applications on engines in the marine, industrial and power generation fields as well as for rail traction and mobile equipment drives. The outstanding thermo-dynamic potential of the A100 becomes clear in the case of a full load-optimized turbocharger specification. A comparison with TPS turbocharger efficiency levels clearly illustrates the performance gain, precisely in those engine applications which make very high demands on the achievable compressor pressure ratio. This underlines the quantum leap represented by the A100 in terms of turbocharger development for single stage turbocharging on modern medium- and high-speed engines.

Qualification program
Like all newly developed ABB turbochargers, the A100 was subject to a mandatory qualification program on ABB Turbocharging’s own test rigs to ensure safe and reliable operation. The comprehensive series of tests ranged from thermo-dynamic verification of the new compressor and turbine stages to full mechanical qualification of all newly designed components and assemblies.

Service and total cost of ownership
The A100 turbocharger represents a striking example of overall low TCO. The long maintenance intervals of TPS turbochargers have been matched by the A100, even though the demands made on its thermodynamic and mechanical performance are higher. The turbochargers of the new A100 generation will satisfy all demands in respect of high reliability and low maintenance operation. As well as long maintenance intervals and overhauls intervals of up to 24,000 hours, A100 turbochargers are specifically designed for ease of maintenance, repair and overhaul.

Qualified products with qualified service
Turbine, compressor and service efficiency mean long-term customer benefits.
Global service
The necessary service know-how and logistics support for the new turbochargers is ensured by a network of more than 100 ABB Turbocharging Service Stations in over 50 countries around the world.

Users of advanced diesel and gas engines employing ABB Turbocharging’s A100 turbochargers can thus rely on ABB Turbocharging Original Service using ABB Turbocharging Original Parts wherever their assets are located around the globe.

Past – present – future
During the introduction phase of the A100, engine test rig trials were carried out to verify thermodynamic performance. The high achievable pressure ratios and efficiencies of the A100 were clearly demonstrated on the engine side. In the meantime, hundreds of turbochargers operating in the field have confirmed the high performance level of the A100 in continuous operation. The latest family members, the A150-M and A155-M with pressure ratios of up to 5.8 at full load, have been successfully introduced to the market. The combination of range extensions via new frame sizes and continuous improvements, to components and performance give customers a constantly growing range of A100 product benefits.