

TCR Turbocharger

The cutting edge



Engineering the Future – since 1758.

MAN Diesel & Turbo





TCR

The cutting edge

MAN Diesel & Turbo is the world's leading designer and manufacturer of large exhaust gas turbochargers for low and medium speed diesel and gas engines.

As an integral part of a leading developer and builder of two- and four-stroke, low and medium speed engines, the MAN Diesel & Turbo Business Unit Turbocharger has a deep understanding of all the core technologies of large engines and their interaction with the turbocharger.

The result is world and market leading turbocharger technology.

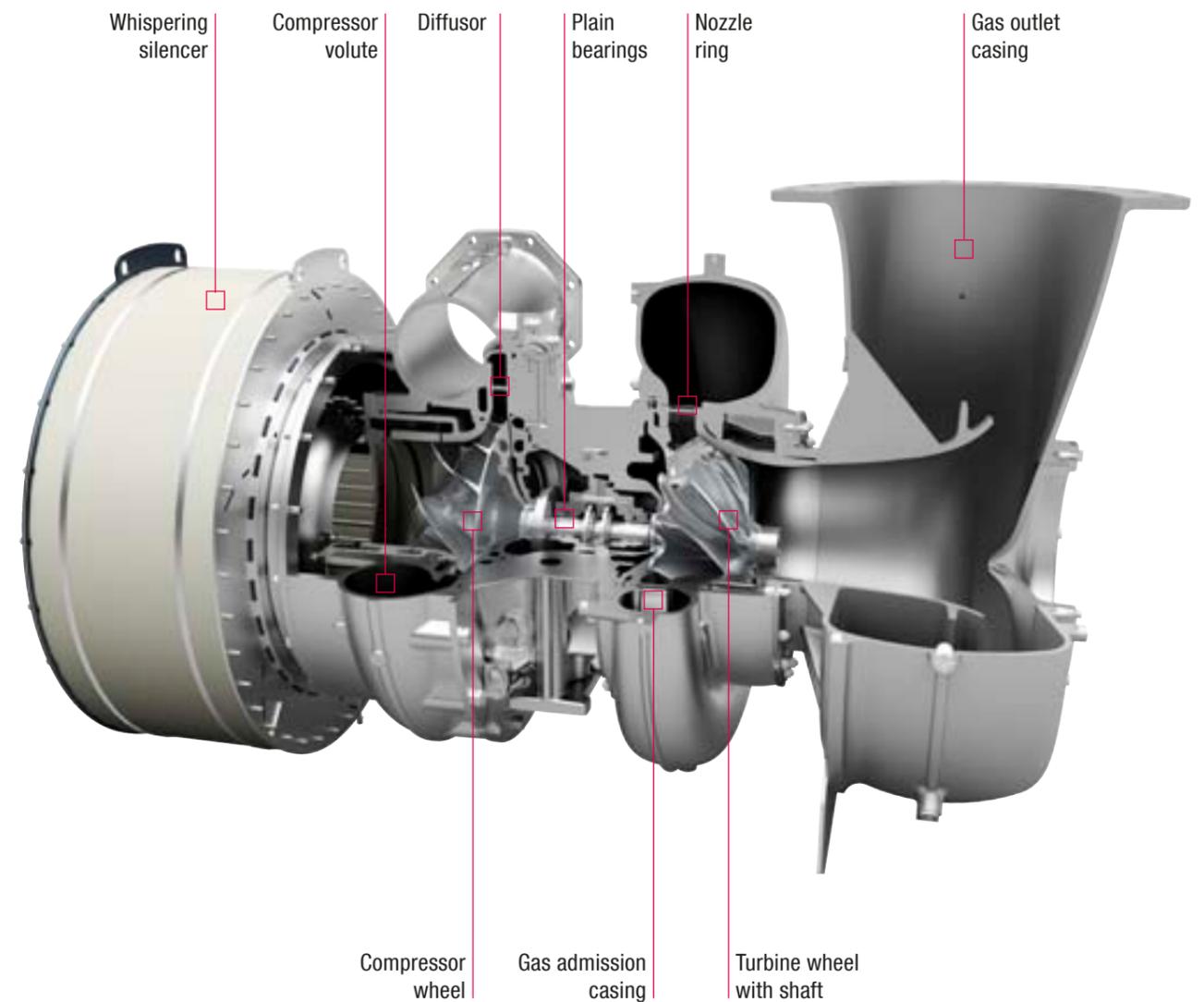
More than ever before, the development focus at the MAN Diesel & Turbo Business Unit Turbocharger is the environmental performance of low and medium speed diesel and gas engines. The contribution of high efficiency exhaust gas turbochargers to this goal has been – and will continue to be – considerable.

MAN Diesel and Turbo's absolute commitment to reducing emissions while increasing fuel efficiency and power density starts with our active partnership in the emissions law making process and ends with the delivery of turbochargers that achieve an ideal synthesis of product characteristics.

Enjoy the Benefits

Features	Benefits
Turbine	
New CFD-optimised profiled rotor blades, nozzle ring, inlet and outlet casing	Increased efficiency
Constant and pulse pressure turbocharging	
Optional variable turbine geometry	Excellent adaption to variable engine conditions
Optional turbine cooling	
Bearings	
High performance plain bearings	Minimised mechanical losses, extended service life
Optimised shaft diameter	Increased efficiency
Compact plain bearing concept	Ideal rotor dynamic behaviour
Compressor	
New CFD-optimised compressor wheel, diffuser ring and compressor volute	Increased efficiency
Extended pressure ratio and specific volume flow	Meeting future engine requirements and environmental regulations
Internal flow recirculation (IRC)	Extended surge margin
Optional jet assist	Excellent rotor acceleration
Optional water cooled compressor	High compressor pressure ratios
Easy Maintenance	
Extended inspection intervals	Less service stops required
Easy access to compressor wheel	Reduced service time
Reduced number of components	Low maintenance costs
New compressor wheel fixation	Reduced service time
Increased life time of parts	Low maintenance costs
Smart Design for Convenient Installation	
Uncooled casings	Less connections and no corrosion
Lubrication by the engine lube oil system	Simple installation, less sources of errors
Integrated oil inlet and oil drain	"Pipeless" design
Piston ring sealing	No sealing air required
Others	
Suitable for HFO, MDO, dual fuel and gas engines	
Compliance with present and future engine standards and environmental regulations	
Containment proven	Safe operation
Low moment of inertia	Excellent transient behaviour
New developed silencer	Low noise

Vital components that increase engine power by more than 300%



TCR

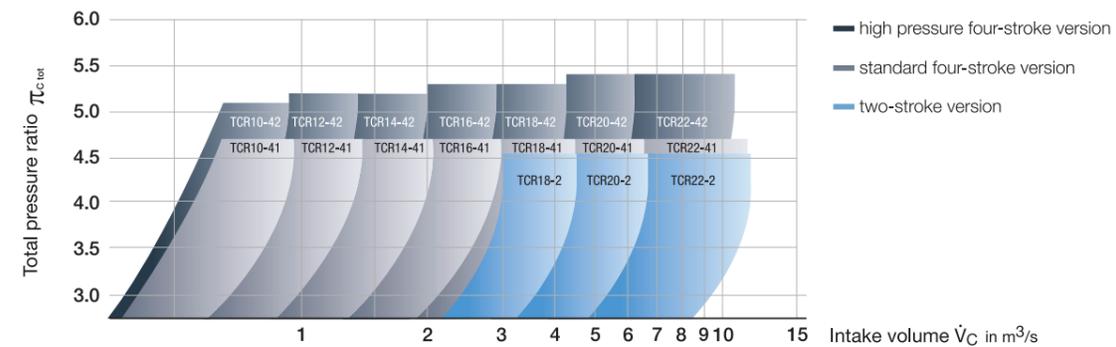
The cutting edge

The new TCR turbochargers were designed to comply with the special demands made on HFO, MDO, biofuel and gas engines. They cover the complete range of possible applications, like propulsion and stationary engines, GenSets as well as traction engines, which are subject to the strictest requirements with regard to size and weight. As compared to the previous generation, these new turbochargers offer the advantage of increased compactness and less weight without any concessions regarding efficiency and performance. Advanced materials ensure extended service lives and easier maintenance.

The TCR is a completely redesigned turbocharger with:

- Engine outputs from 390 to 6,700 kW
- Maximum pressure ratio of 5.2
- Optimised compressor and turbine wheel for increased efficiency
- Constant and pulse pressure turbocharging
- Low moment of inertia for best dynamic behaviour
- New compressor wheel fixation for easy servicing
- Uncooled casings
- Pipeless design with integrated oil inlet and oil drain
- No sealing air required

MAN Turbocharger application ranges TCR



Turbocharger programme

Type	Supercharged engine output [kW]		Max. permissible speed (rpm)	Mass (kg)
	2-stroke	4-stroke		
	$l_e^* = 7.0 \text{ kg/kWh}$	$l_e^* = 6.5 \text{ kg/kWh}$		
TCR10	-	600	85,000	50
TCR12	-	880	70,900	100
TCR14	-	1,300	58,700	110
TCR16	-	1,850	48,800	180
TCR18	2,700	2,750	40,300	300
TCR20	4,000	4,000	33,400	500
TCR22	7,000	6,850	25,600	1,050

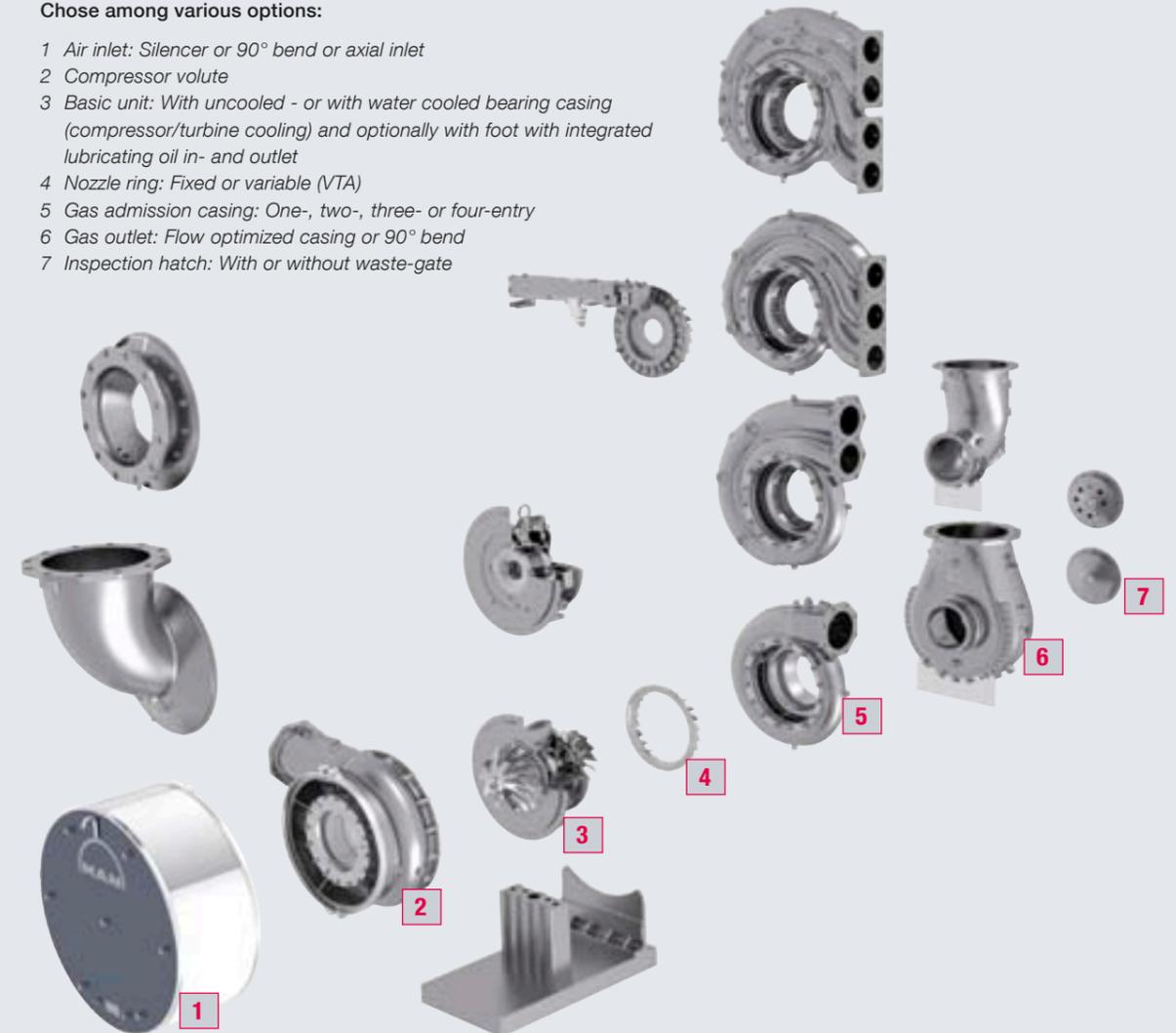
* Specific air consumption

Modular Design Concept

The modular design concept allows customizing the TCR turbocharger to different fields of applications such as low, medium and high-speed engines, locomotive applications, gas engines, 2-stage turbocharging or industrial applications thus meeting very individual requirements.

Chose among various options:

- 1 Air inlet: Silencer or 90° bend or axial inlet
- 2 Compressor volute
- 3 Basic unit: With uncooled - or with water cooled bearing casing (compressor/turbine cooling) and optionally with foot with integrated lubricating oil in- and outlet
- 4 Nozzle ring: Fixed or variable (VTA)
- 5 Gas admission casing: One-, two-, three- or four-entry
- 6 Gas outlet: Flow optimized casing or 90° bend
- 7 Inspection hatch: With or without waste-gate



Compressor



By applying up-to-date 3D CFD and FEA calculations, a new compressor wheel geometry has been created with further improved efficiencies. Depending on the application, part-load and full-load optimisation is possible by means of flow area combinations.

TCR turbochargers are equipped with the IRC system (internal recirculation) which is able to provide a larger compressor characteristic map with increased surge margin ability.

The compressor wheel is milled from a high resistant aluminium alloy that can withstand intake conditions within a wide temperature spectrum.

A new type of compressor wheel attachment, with a new designed retainer, simplifies maintenance and extends the service life of this component which is subject to great stresses.

- New CFD-optimised compressor wheel, diffuser ring and compressor volute for increased efficiency
- Extended pressure ratio and specific volume flow
- Internal flow recirculation (IRC) for extended surge margin
- New compressor wheel fixation for easy servicing
- Jet assist for quick rotor acceleration (optional)
- Optional compressor cooling

Bearing



The TCR bearing includes tried and tested aspects of the radial and axial bearing design of the NR series, such as the floating radial bearing bushes coupled with new detail solutions like the non-rotating radial bearings. The new “semi-floating” design permits most reliable operation and low wear.

The most evident modification is the axial bearing now being arranged between the radial bearings.

This arrangement enables an extremely space-saving bearing design. For easy servicing, all bearings are housed in a bearing body.

- Semi-floating bearings with squeeze oil damper
- Compact bearing concept with centre thrust bearing
- Oil pressure adjusted by the turbocharger manufacturer
- Piston ring sealing without sealing air

Turbine



All the flow-through components of the TCR turbocharger have been flow and stress optimised by means of modern 3D-CFD and FEA calculations. Part or full load optimisation is possible by means of a variety of different rotor/nozzle ring flow area combinations.

- New CFD-optimised profiled rotor blades, nozzle rings, inlet and outlet casing for increased efficiency
- Constant and pulse pressure turbocharging
- Variable nozzle ring (optional)
- Optional turbine cooling

Nozzle Ring



TCR nozzle rings are manufactured from an extremely resistant material which ensures a long service life. Optimum adaptation of the turbocharger to the respective engine is achieved by means of individually selected flow areas (matching).

A variable nozzle ring is optionally available. The variable nozzle ring permits optimum adaptation of the flow cross-section to the corresponding load conditions of the engine, thus reducing fuel consumption and pollutant emissions as well as improving dynamic load acceptance.

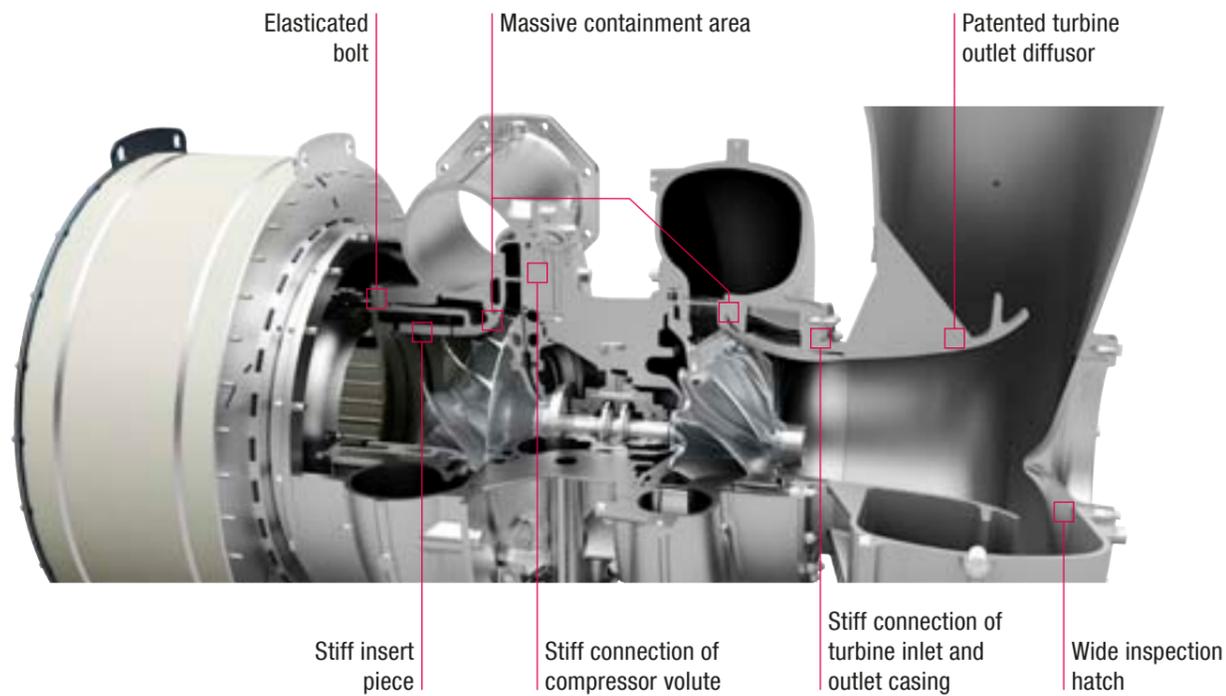
Casing

The uncooled casing of the TCR series has been designed in accordance with the 'pipeless engine' principle. All supply pipelines are integrated in the casing. The compressor and turbine casings have measuring connections for monitoring the pressure and temperature. A speed pick-up is also included in the scope of supply. The casings, which are manufactured from SiMo steel or ductile cast iron respectively are designed and have been tested to be containment proof.

Claw connections facilitate fast disassembly and allow the casing to be rotated into any required position. The casings are heat insulated and comply with the SOLAS requirements. The turbine outlet casing comes with a wide inspection hatch that provides good access to the turbine wheel for inspection and cleaning.

Integrated turbine and compressor washing devices are optionally available. The DIN flange of the flow-optimised turbine outlet casing allows it to be easily fitted to the exhaust gas pipe. Alternatively, a simple and spacesaving 90° elbow can be supplied.

- Uncooled casings (optional water cooled bearing casing)
- Lubrication by means of the engine lube oil system
- Integrated oil inlet and oil drain for pipeless engine
- Ports for pressure and temperature measurement on compressor and turbine side
- Containment proven
- Continuously rotatable
- Turbine outlet casing with DIN flange
- SOLAS conformity



Maintenance

The best maintenance would be if no maintenance were necessary at all. In this respect the new TCR series features extended maintenance intervals of up to 30,000 operating hours.

When designing the turbocharger, great care was taken to ensure that servicing – even though seldom – can be carried out as easily as possible. For example, the compressor wheel can be taken out without dismantling the compressor casing. On the turbine side, the outlet casing comes with a wide inspection hatch that provides good access to the turbine wheel for inspection and cleaning.

MAN Diesel & Turbo has also reduced the number of screws and components to a minimum, developed a complete set of special tools and included a large number of pull-off devices and other helpful features to assist the service engineer during assembly.

- Extended maintenance intervals
- Easy access to compressor and turbine wheel
- Reduced number of components



World-Class Service

Marine propulsion, gensets and stationary plants



The PrimeServ offering

The MAN Diesel & Turbo Group offers worldwide, round-the-clock service, 365 days a year. In addition to MAN Diesel & Turbo's service headquarters in Augsburg, Copenhagen, Frederikshavn, Saint-Nazaire, Hamburg and Stockport, service centers on all continents provide comprehensive and continuous support.

MAN Diesel & Turbo engines are renowned for their quality and durability. We are a global organization with a strong local presence, delivering exceptional field service management, tailor-made solutions, and first-class technical support.

PrimeServ provides advice and assistance to customers throughout the product lifecycle, from delivery to resale. With our far-reaching network of Service centers, we respond rapidly to customer needs. What's more, we offer outstanding service and unrivalled technical expertise. Plus, we only use genuine spare parts – safeguarding the longevity of your engine.

PrimeServ's aim is to provide:

- Prompt delivery of high demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintainers
- Global service, open 24 hours-a-day, 365 days-a-year
- Diagnosis and troubleshooting with our high performance Online Service



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MAN Diesel & Turbo

86224 Augsburg, Germany

Phone +49 821 322-0

Fax +49 821 322-3382

turbochargers@mandieselturbo.com

www.mandieselturbo.com