

TCA

The Benchmark

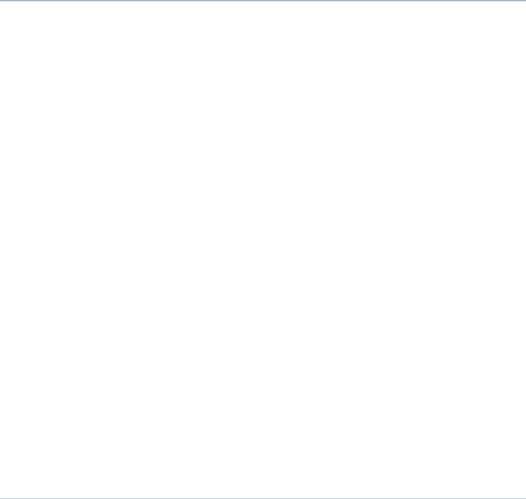


MAN Diesel





TCA – The New Turbocharger Generation



TCA – The Benchmark

MAN Diesel has more than 60 years unprecedented experience of producing turbochargers with plain bearings and uncooled hot gas casings.

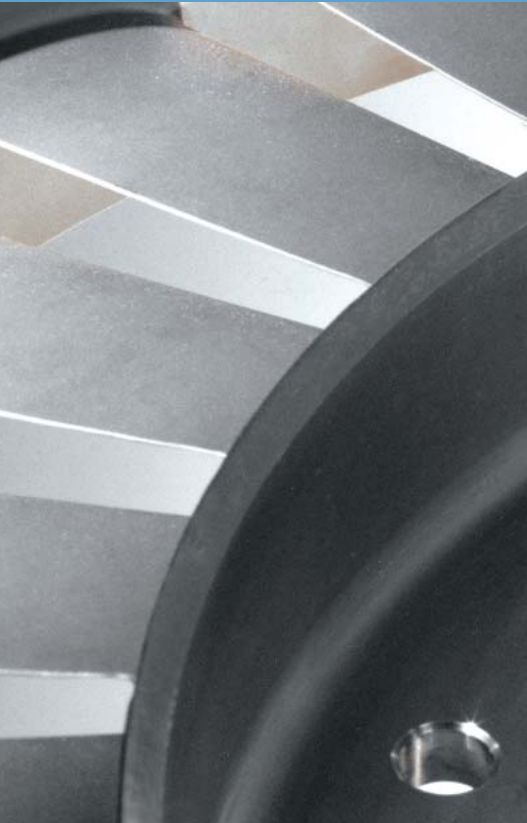
Modern turbochargers are crucial to generate high power and increased fuel efficiency for a wide range of engines, including ship propulsion systems, Diesel power plants and rail traction applications.

The new series of TCA turbochargers is available in 2-stroke and 4-stroke versions for Diesel, dual fuel and gas engines. They have been developed to provide a robust and reliable platform for engine applications ranging from approx. 3MW up to 30MW output per turbocharger.

Integral design combined with advanced materials has improved turbocharger efficiency, simplified installation on the engine, and has extended times between overhauls. Using fewer parts than any other generation has reduced maintenance and service times, which ensures lower life cycle costs.

The TCA range contributes to fuel oil savings and meets all environmental emission standards.

Enjoy the Benefits



Features

Benefits

Turbine

Newly developed wide-chord turbine blades without damping wire	Increases efficiency
New turbine nozzle ring	Extended life-time
Optional variable turbine area (VTA)	Reduces SFOC at part load
New optimised turbine outlet diffuser	Increases efficiency
New optimised turbine inlet casing	Increases efficiency

Bearings

Reduced shaft diameter	Minimises mechanical losses
High performance thrust bearings	Minimises mechanical losses
Floating journal bearing bushes	Optimises damping behaviour

Compressor

Newly developed compressor wheel	Reduces noise emission. Increased efficiency and optimisation of the engines operating line (in the map)
Optional internal re-circulation	Increases surge margin
Newly developed compressor volute	Increases efficiency
New compressor diffuser vanes	Increases efficiency
Optional Jet Assist	Fast rotor acceleration

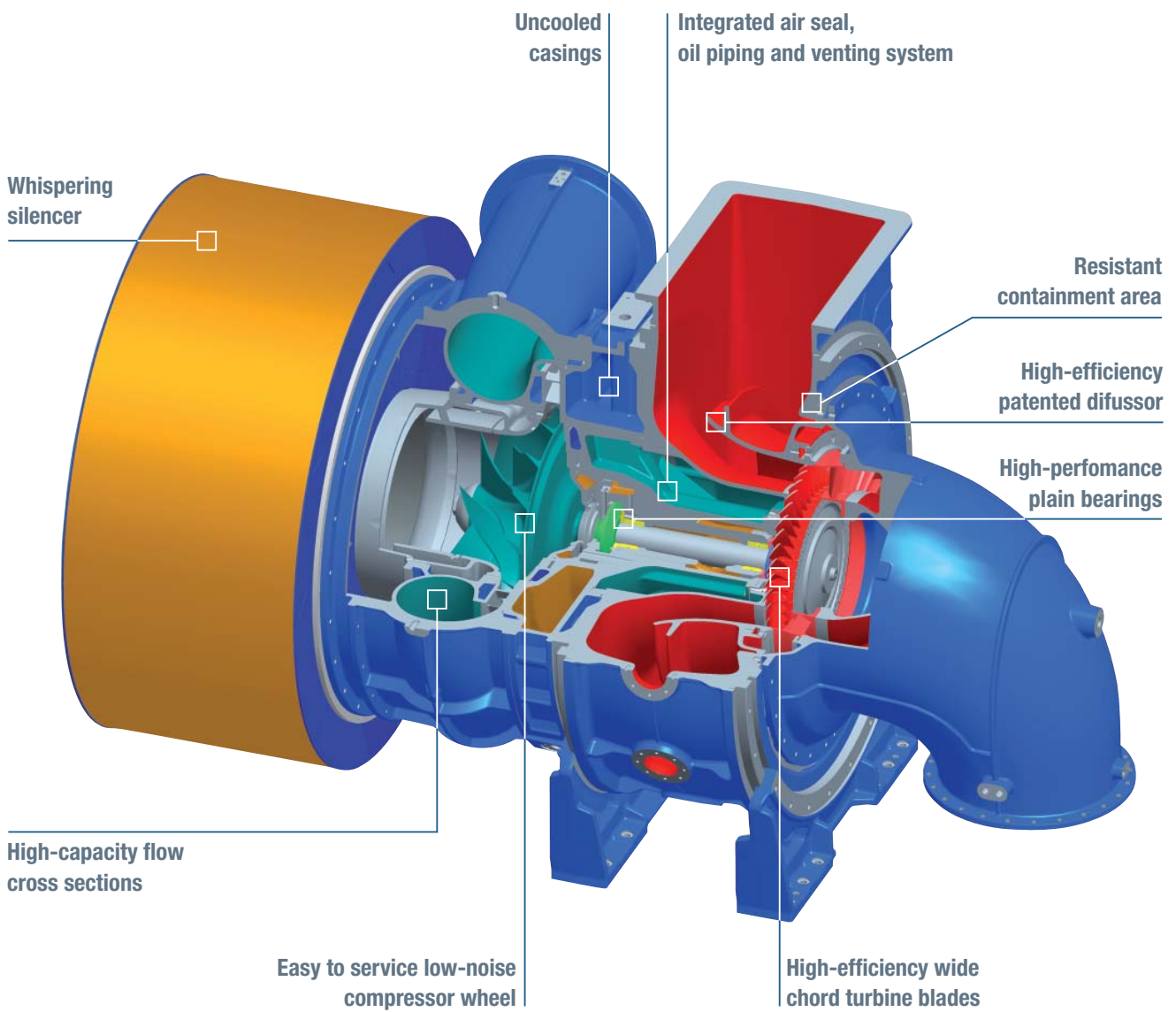
Easy Maintenance

Thrust bearing inspection without shaft removal	Reduces service time
Compressor wheel change	Basic tooling without dismantling compressor casing
Easy replacement of turbine blades	Reduces service time
Extended Parts Life-Time	Low maintenance costs

Design Features

Air cooled casings	No corrosion
Emergency and post lubrication tank	Safe operation
Lubrication by engine lube oil system	Simple and reliable
Integrated oil piping and oil venting system	Compact design
Integrated sealing air supply	Compact design
Reduced number of parts	Low maintenance costs
Integrated burst protection	Safe operation

Vital components that increase engine power by more than 300%.



Turbine



New turbine blade wide-chord design without damping wire

All components of the TCA turbocharger have been optimised with regard to flow control and stress reduction by means of modern 3D CFD and FEM calculations.

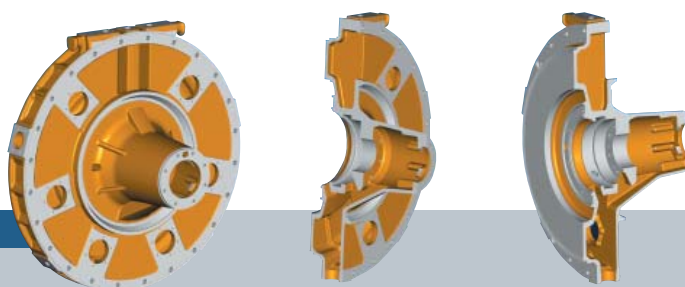
The result is a turbine with very stiff and high-wear resistant wide-chord blades, which are supported in the turbine disc by means of a 'fir tree foot'.

A damping wire is therefore no longer necessary, which makes maintenance work easier and improves efficiency.



Bearings

Integrated bearing casing design



The rotor is running on two internal radial bearings with floating bushes and a separate thrust bearing. The advanced design provides higher safety margins.

Bearing points with small diameters could be realised by optimising both the rotor dynamics and the shaft/hub connection of the compressor wheel and turbine shaft.

The result is low circumferential speeds of the bearing bushes and minimisation of the friction losses which contributes to a higher total efficiency.

Special features of the floating bearing bushes are very quiet running and minimal bearing wear. The expected service life of the bearing body is up to 50,000 hours.

Easy handling and short maintenance times were essential requirements for the support design. For example neither the compressor casing nor the turbine rotor has to be disassembled for removal of the thrust bearing.



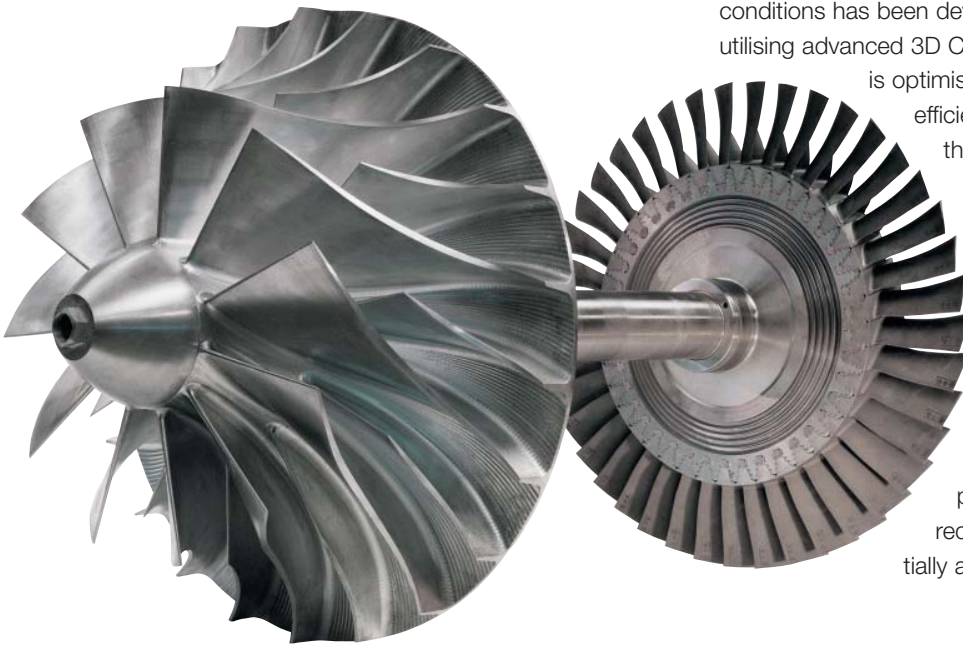
Compressor

The compressor wheel operates at a circumferential speed well over 500 m/s which results in very high centrifugal forces. The standard design of resistant aluminium alloy

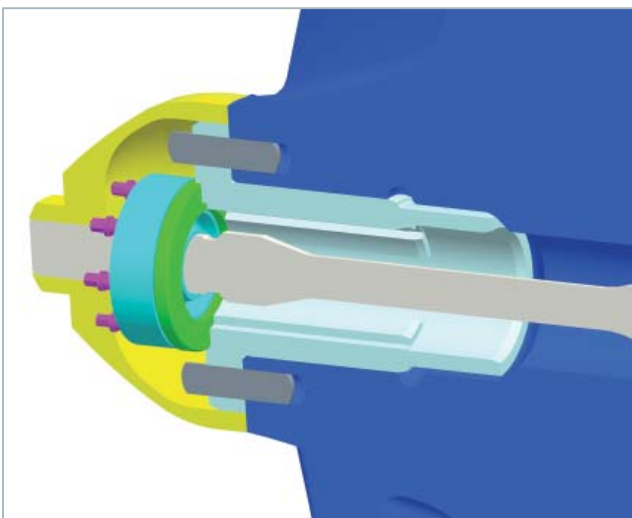
in combination with a specially adapted machining process ensures a long service life for this stressed component.

A compressor wheel suitable for use in very high pressure conditions has been developed specifically for the TCA series, utilising advanced 3D CFD and FEM calculations. The benefit is optimised geometry, which ensures a high efficiency at a safe surge margin within the whole operating range. In addition, noise is considerably reduced.

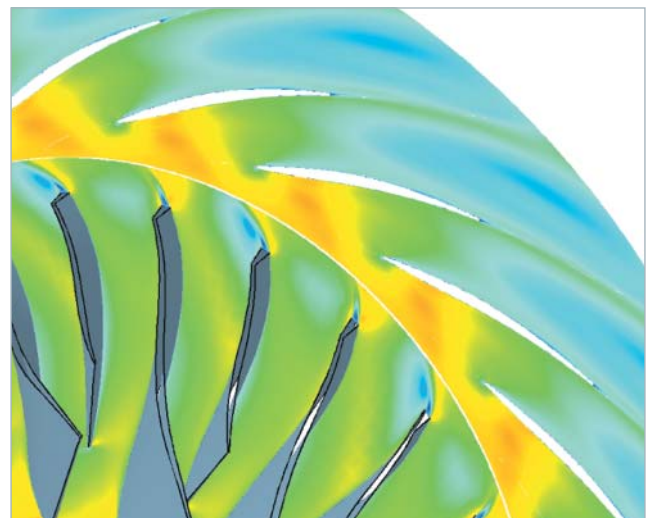
A new type of force and form locking compressor wheel attachment on the turbine shaft permits assembly and disassembly of the compressor wheel, without having to use an unwieldy hydraulic tool. This new shaft/hub connection protected by a MAN Diesel patent reduces replacement time substantially and makes maintenance easy.



Compressor and rotor assembly

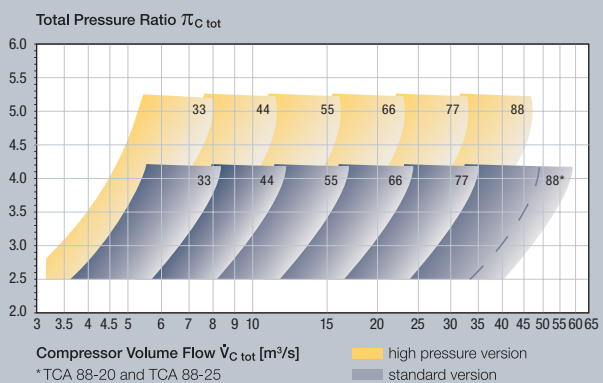


Patented shaft/hub connection

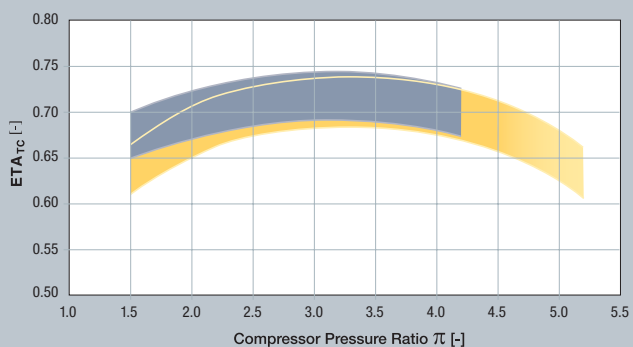


Pressure and mach number distribution

Turbocharger application range



Range of turbocharger efficiency



Technical data

Turbocharger programme			
Type	Max. Supercharged engine output [kW]		Max. permissible Speed [rpm]
	2-Stroke le* = 9 kg/kWh	4-Stroke le* = 7 kg/kWh	
TCA33	–	5,100	28,300
TCA44	5,600	7,200	23,880
TCA55	8,000	10,200	19,400
TCA66	11,400	14,700	16,900
TCA77	16,400	21,000	14,200
TCA88	27,300	30,000	12,000

*Specific air consumption



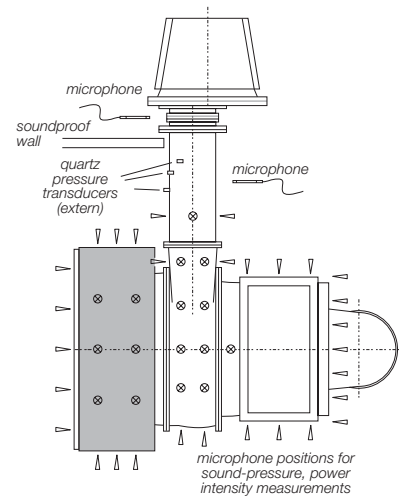
Nozzle Ring



TCA nozzle rings are manufactured from highly resistant materials which ensures a long service life. Optimum matching of the turbocharger to the corresponding engine is obtained by individually adapting nozzle rings.

As an option a variable turbine area (VTA) permits optimum adaptation of the 'flow cross section' to the corresponding load condition of the engine and therefore reduces both fuel consumption and pollutant emissions, especially at part load operation.

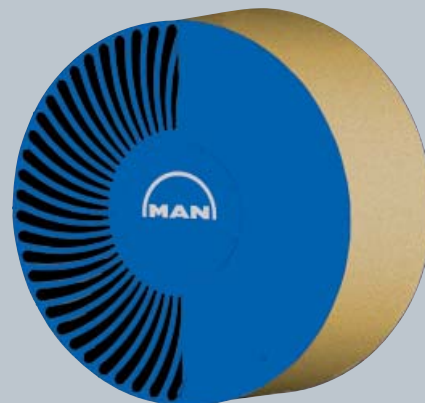
Whispering Silencer



Measurement of sound intensity

The newly developed radial silencer is able to reduce sound imissions down to a value of well under 105 db (A). The shape of the radially arranged damping segments provides optimum flow conditions and contributes to total turbocharger efficiency. The filter mat over the circumference of the silencer can easily be removed and cleaned when required.

Whispering silencer with patented axially inserted damping plates



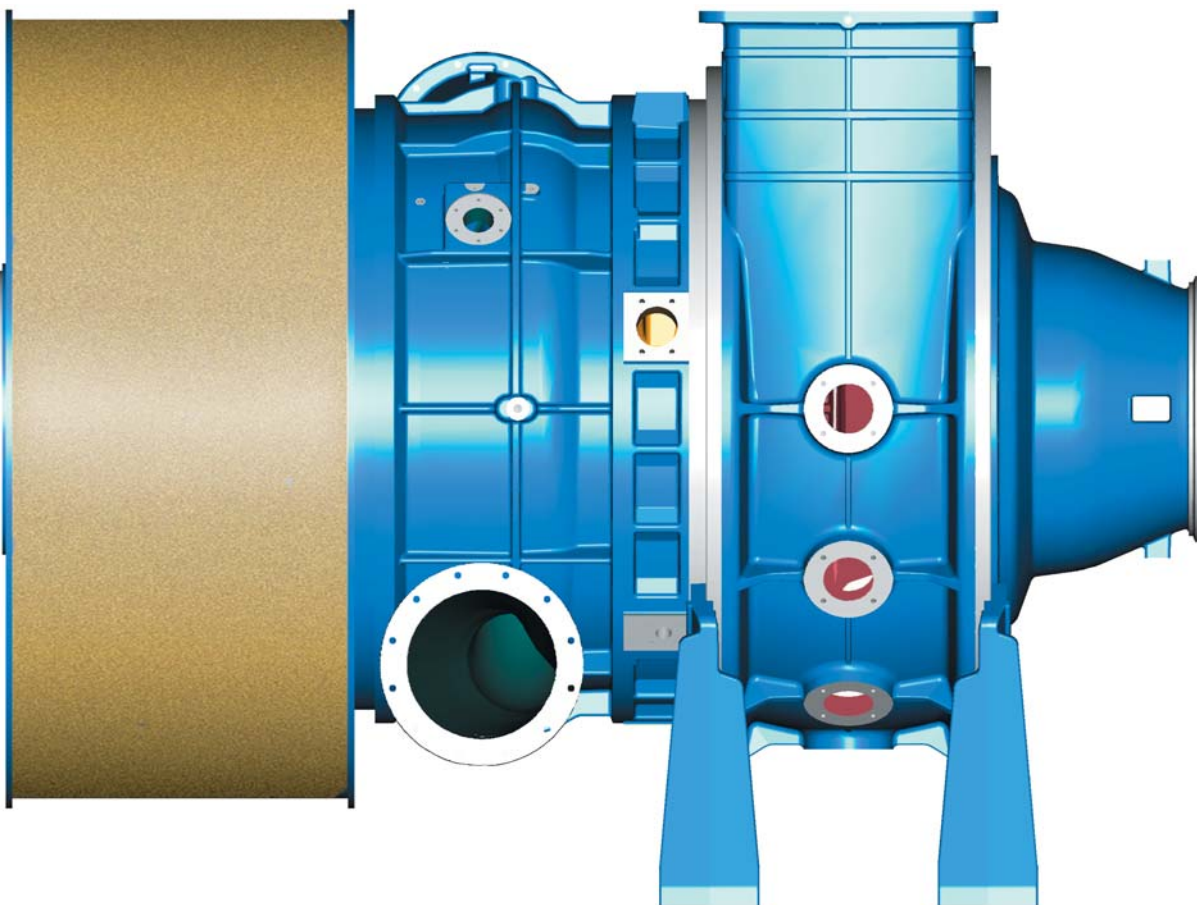
Casings

The uncooled casings of the TCA series are designed in accordance with the 'pipeless engine' principle. All supply pipes are fully integrated within the casing. Only one oil supply and discharge pipe and a venting pipe have to be connected externally.

Due to a robust structure and the material thickness of the casing walls, the TCA turbocharger will not require any additional burst protection; and the rigid connection of the turbine outlet, bearing and compressor casing by means of tie rods offers additional safety.

Newly developed one and two socket compressor spirals and diffusers permit optimum matching of the turbocharger to the engine. The stiff insert piece is part of the patented burst protection in the compressor.

An essential item of the development work was the design of the (patented) turbine outlet diffuser, which effectively converts kinetic energy remaining downstream of the turbine wheel into pressure. Simultaneously the outlet diffuser acts as an integrated burst protection within the turbine.



A further vital point is the reduction of noise emission. This is due to the compact design (the noise emitting surface area is greatly minimised), combined with newly developed insulation of the turbine outlet and compressor casing.

In order to permit optimum mounting to the engine all casings can be installed and turned in steps of 15°.

1 Stiff insert piece

2 Massive containment area

3 Compressor diffuser

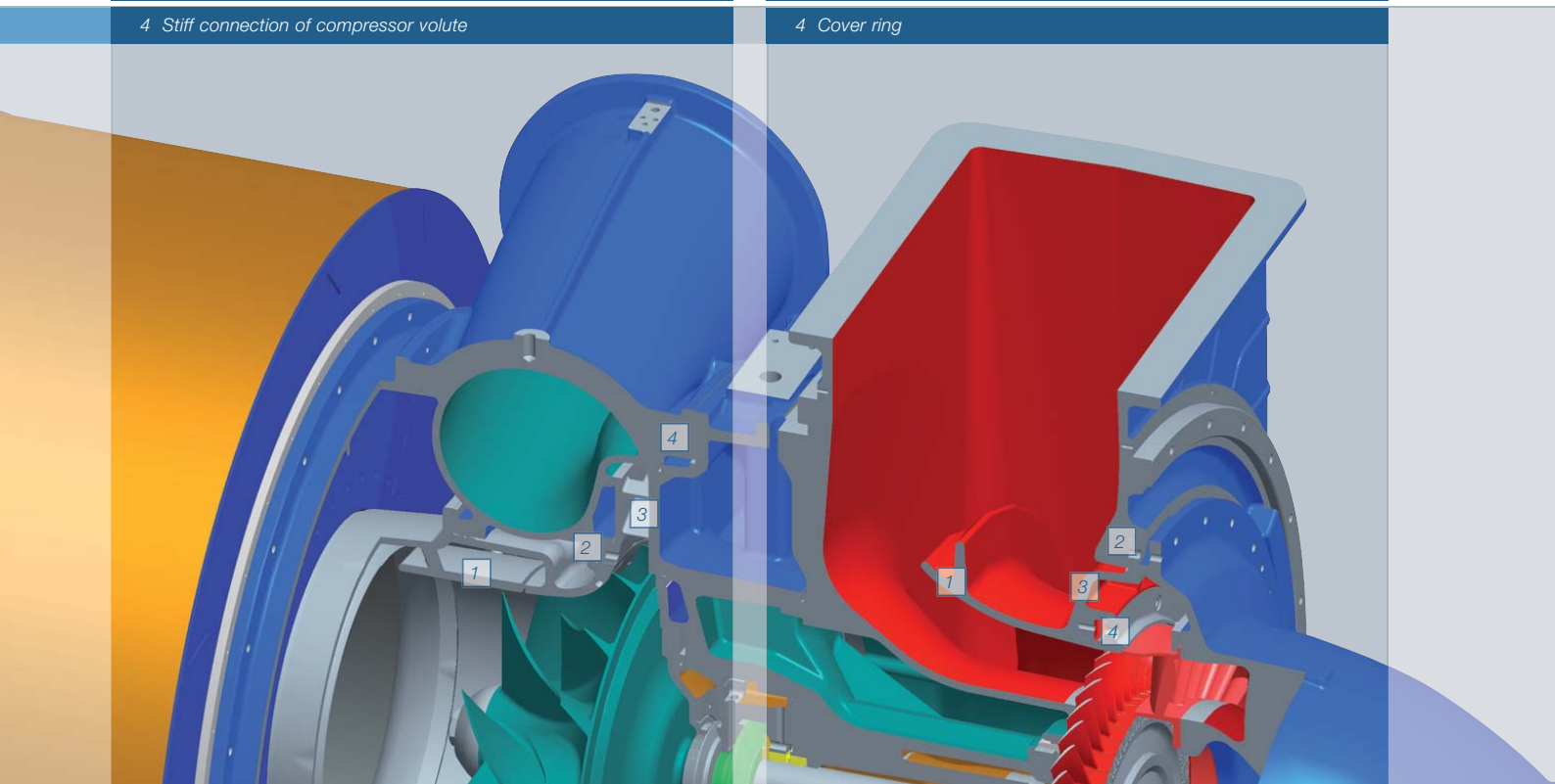
4 Stiff connection of compressor volute

1 Patented turbine outlet diffusor

2 Stiff connection of turbine inlet and outlet casing

3 Massive containment area

4 Cover ring



Customer Support



Around the Clock

Customer support for turbochargers is vital – MAN Diesel provides a worldwide service network for repairs and maintenance.

A fast delivery of spare parts is of utmost importance to avoid down times. MAN Diesel has an efficient processing and stock despatch system allowing most parts to be delivered within 24/48 hours.

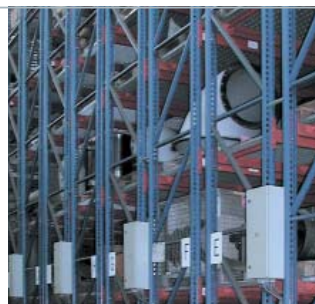
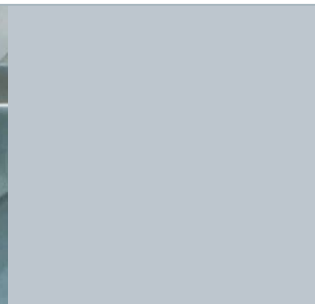
Continuous training of engineers, combined with regular service bulletins and video clips ensures the worldwide service network is always up to date.

A customer feedback programme also contributes to maintaining a high standard of service.

Close co-ordination with all licensees ensures that ‘products built under licence’ are fully covered by our global network.

Enjoy the Benefits

- >> Knowledgeable partners in more than 150 service stations worldwide.
- >> A one stop service for turbochargers, diesel and gas engines.
- >> Around the clock after sales service.
- >> Largest turbocharger ‘license net’ with full exchangeability of spare parts.
- >> A high availability of spare parts through an intelligent central stocking system.
- >> Attractive price/performance ratio.



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