

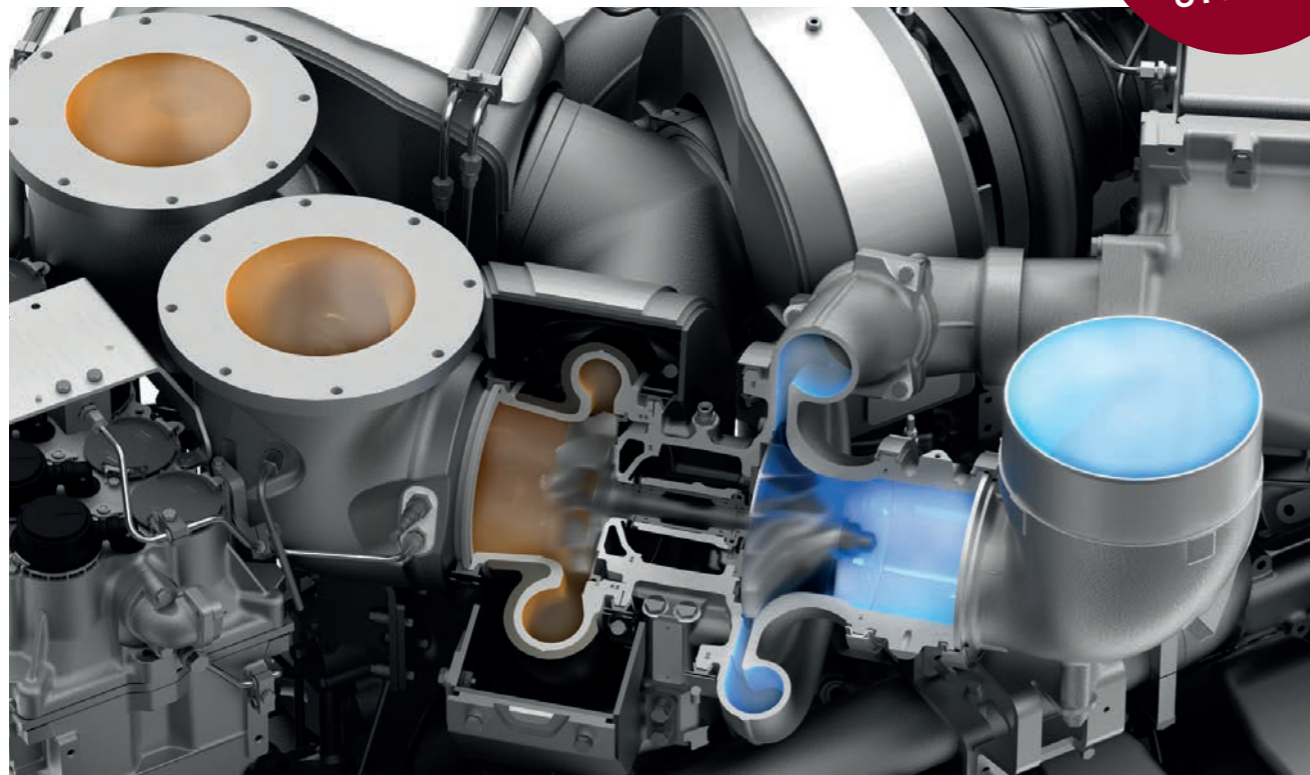
ENHANCING ENGINE PERFORMANCE
WITH OUR TURBOCHARGER SOLUTIONS

MORE POWER, LESS FUEL, LESS EMISSIONS: THE CUTTING-EDGE TURBOCHARGER SOLUTION

Woodward L'Orange, as a pioneer in state-of-the-art injection technology, stands for innovative strength, knowledge and experience. We realise, however, that we will only achieve technological leadership if we remain proactive – in terms of both our business operations and our technology. This is why we place a very strong focus on research and development. One outstanding example of this is our turbocharger solution.

The power and character of an internal combustion engine is essentially determined by adding turbocharging. A turbocharger compresses the air so that more air flows into the combustion chamber. This way, more fuel is burned and the engine's power output increases accordingly. The turbocharger is driven by exhaust gas, which makes turbocharged engines very efficient.

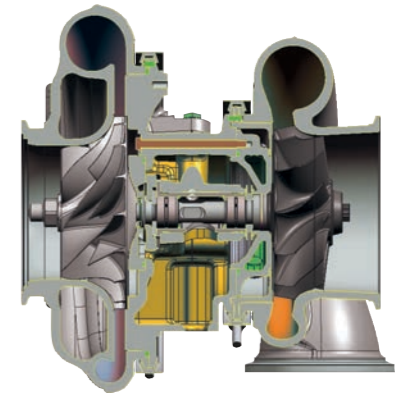
FLOW
RATES
UP TO
3.5 M³/S



THE TURBOCHARGER SOLUTION IN BRIEF – CUSTOMER BENEFITS AND KEY FEATURES

CUSTOMER BENEFITS

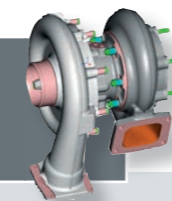
- Reduced consumption due to cutting-edge compressor and turbine designs
- High pressure ratios ensure maximum power density
- Wide compressor operating maps enable wide engine operating maps
- The rotor group is designed to facilitate high numbers of dynamic load cycles
- Centrifugal compressors with vaneless diffuser and nozzle-less radial or mixed-flow turbines lead to a robust design and excellent performance in a wide operation range
- Optional speed detection allows regulation of the engine's operating conditions
- Containment protection guarantees the highest possible operational safety
- Maintenance-free plain bearings reduce the LCC
- Reman concept gives the charger a second life



KEY FEATURES

- Turbocharger for genset, marine and industrial applications
- Flow rates up to 3.5 m³/s
- Milled compressors of forged aluminum or titanium

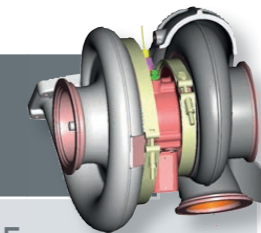
SMALL SERIES



ZR1.115,
ZR1.125

- compressor wheel:
Ø 115 to 135 mm
- turbine wheel:
Ø 103 to 123 mm
- p_{2t}/p_{1t} to 5.2
- $V_{red.}$ from 0.2 to 0.9 m³/s

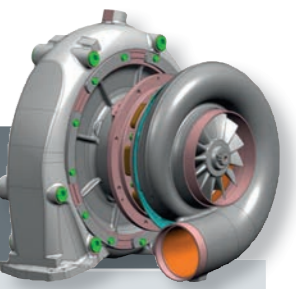
MEDIUM SERIES



ZR3.175,
ZR3.195, ZR3.205

- compressor wheel:
Ø 179 to 210 mm
- turbine wheel:
Ø 158 to 185 mm
- p_{2t}/p_{1t} to 5.5
- $V_{red.}$ from 0.8 to 2.0 m³/s

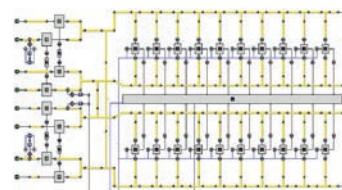
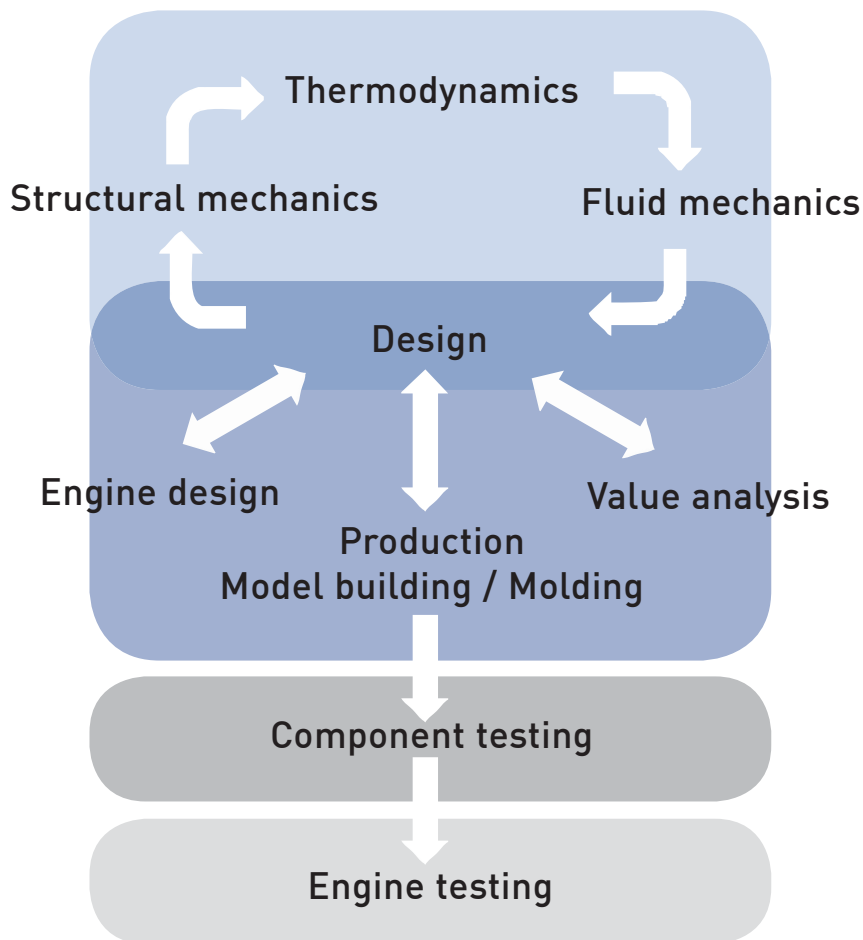
LARGE SERIES



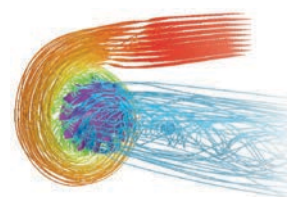
ZR5.265

- compressor wheel:
Ø 265 to 270 mm
- turbine wheel:
Ø 245 mm
- p_{2t}/p_{1t} to 5.5
- $V_{red.}$ from 1.8 to 3.5 m³/s

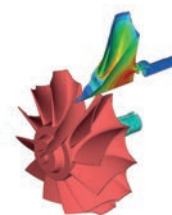
THE TURBOCHARGING DEVELOPMENT PROCESS



Thermodynamics



Fluid mechanics



Structural mechanics



Design

WOODWARD INC.

LINCOLN CAMPUS CORPORATE HEADQUARTERS
1081 WOODWARD WAY, FORT COLLINS, COLORADO 80524, USA
WWW.WOODWARD.COM

WOODWARD L'ORANGE GMBH

PORSCHESTRASSE 8, 70435 STUTTGART, GERMANY
WWW.LORANGE.COM