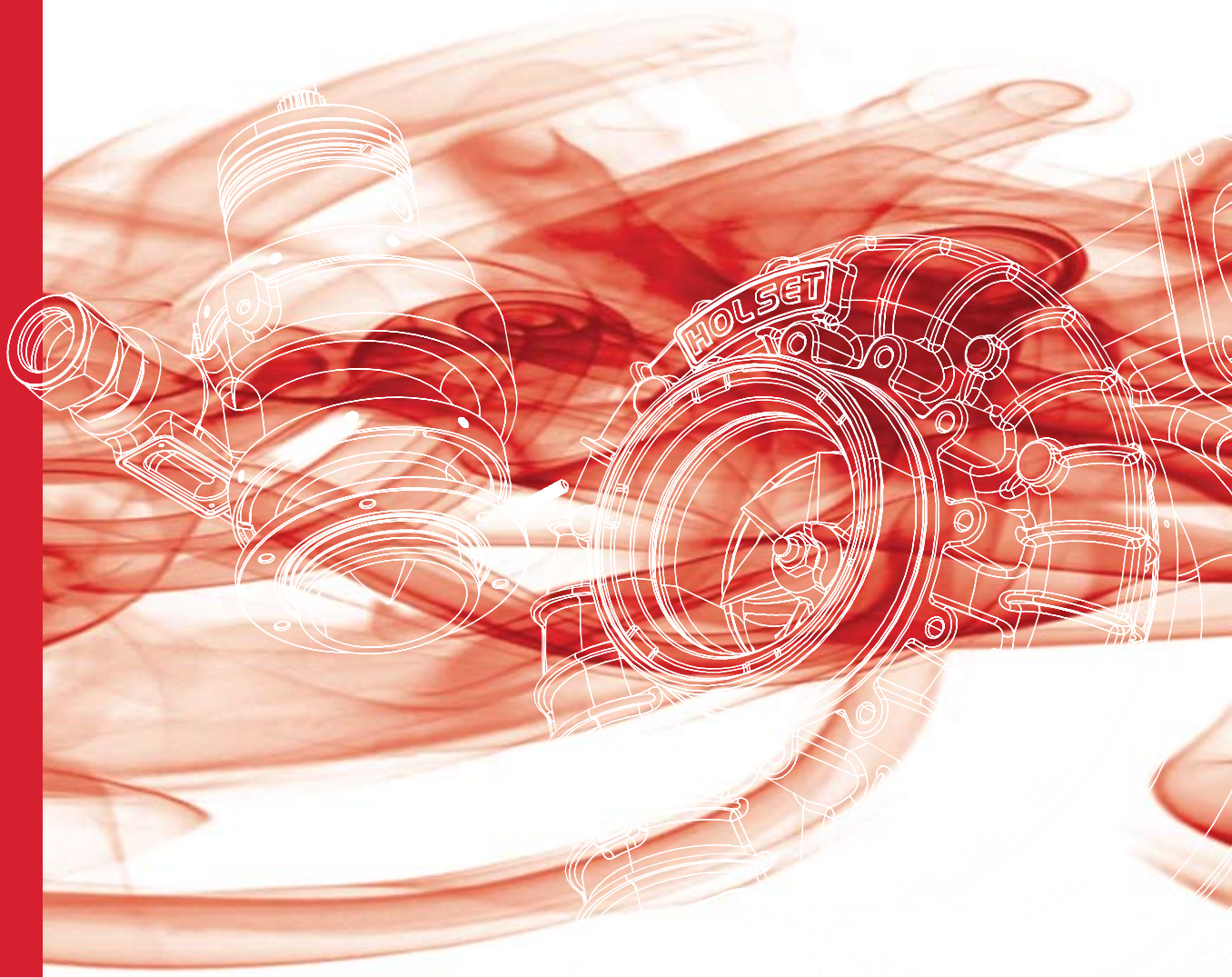
Turbo Technologies

The Right Technology



Who We Are

Vision

Making people's lives better by unleashing the power of Cummins

Mission

We unleash the power of Cummins by:

- Motivating people to act like owners working together
- Exceeding customer expectations by always being first to market with the best products
- Partnering with our customers to make sure that they succeed
- Demanding that everything we do leads to a cleaner, healthier, safer environment
- Creating wealth for all stakeholders

Values

Integrity – Strive to do what is right and do what we say we will do
Innovation – Apply the creative ingenuity necessary to make us better, faster, first
Delivery Superior Results – Exceed expectations, consistently
Corporate Responsibility – Serve and improve the communities in which we live
Diversity – Embrace the diverse perspectives of all people and honour both with dignity and respect
Global Involvement – Seek a world view and act without boundaries

I am Cummins. You can depend on me.

Global Technology Partner

The Holset turbocharger is synonymous with turbomachinery and airflow management excellence across the globe. Cummins Turbo Technologies' collaborative approach with key OEMs worldwide to develop optimum solutions for every vehicle, application and market requirement has led to unrivalled expertise in a wide variety of technical solutions including wastegated, variable geometry, power turbine and two-stage architectures.

Our experience in commercial engine turbomachinery and our ability to innovate has enabled us to tailor durable and high performance products for customers in the light, medium and heavy duty markets.

Our aim is to engineer turbomachinery as a critical component within our customers' engines for improved system integration across a wide variety of operating environments. Holset turbochargers are designed to reduce overall powertrain costs and cost of ownership. For example, the Holset VGT ™ delivers engine braking, thermal management of aftertreatment systems and other benefits. Our network of global technical centres is responsive to individual needs with specialist engineering teams leading a comprehensive design process incorporating engine system modelling, rigorous analysis and testing for right first time turbo selection and engine performance prediction.

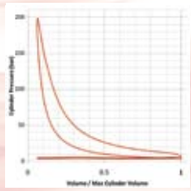
Expertise

Experience

Renowned as a great place to work, Cummins Turbo Technologies works hard to attract and retain the best talent. Specialists and experts across all the key fields of engineering contribute to our capacity and capability to optimise technologies with high investment in training and professional development in our worldwide technical centres. Fresh talent is combined with experience in diverse teams that work in partnership with customers to provide the expertise and innovation required to drive success.

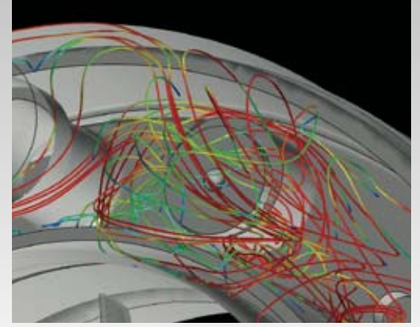
Understanding Engines

We have developed detailed knowledge of engines through longstanding OEM relationships spanning over 50 years and as an autonomous unit of the Cummins organisation. This enables us to develop new turbomachinery using engine performance simulation software and engine test cells to optimise the application of turbochargers for customers. Our understanding of engines is essential to ensure complex air handling solutions work, including turbocompounding, engine braking and aftertreatment thermal management.



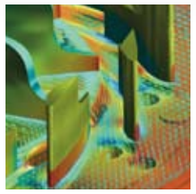
Understanding Applications

Many of our customers have applications with high power ratings with little margin for error. When engines and turbochargers are pushed this hard, it is important to know where boundaries and limits lie for each application. Cummins Turbo Technologies has decades of experience in specifying turbochargers for a wide range of arduous highly cyclic, high altitude and high temperature applications as well as more conventional on highway trucks and light duty applications.



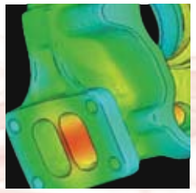
Aerodynamic Design

In house turbocharger and wheel geometry design capabilities using inverse design techniques optimise performance and position the maximum efficiency just where you need it. Our patented map width enhancement gives Holset turbochargers the widest compressor map width of any turbocharger available on the market and our patented variable geometry turbines are the most popular brand in heavy duty markets worldwide.



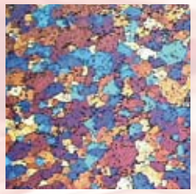
Mechanical Design

Our Applied Mechanics team ensure that the turbocharger designs are physically robust enough for their applications. Pressure, thermal and centrifugal loads combine with vibration and external loads to provide a complex stress situation that must be thoroughly understood to ensure turbocharger durability without adding excess weight or cost. The noise and vibration characteristics of the turbocharger are also engineered to meet customer requirements.



Materials

Holset turbochargers have had titanium compressor wheels as an option since 1999 and many aerospace materials and coatings have been used in our VGT turbochargers since their introduction in 1998. Research into new materials and coatings continues to reduce any wear, corrosion and fouling and our research into new technologies such as waste heat recovery systems has brought new materials into use.



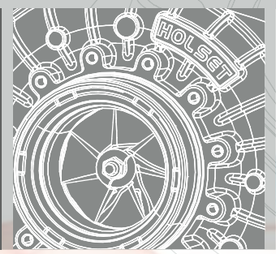
Electronics

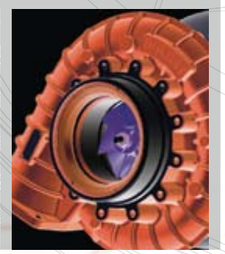
Our range of electric actuators has been developed in house by specialist mechatronics engineers with on-board electronics to communicate with the engine. Many functions relating to turbocharger operation are taken care of by the turbocharger itself, including speed and position sensing, feedback control and self diagnostics.

Technologies

Technologies
Fixed Geometry

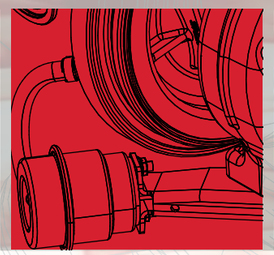
Established, robust and cost effective fixed geometry turbochargers are available in all our product ranges. They continue to be developed for higher efficiency and lower cost for applications where no turbine variability is required.

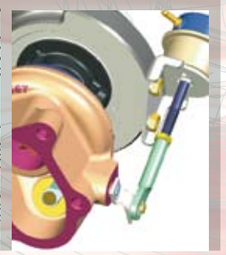




Technologies
Wastegate

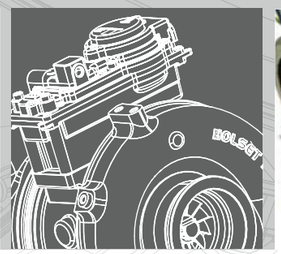
Cost effective, reliable and durable wastegate technologies for low to mid power densities. Pneumatic actuation of the valve by boost pressure or ECU controlled tank air is possible. For applications without tank air, our Command Valve technology allows further control of the wastegating. Specifications available include gas engines.

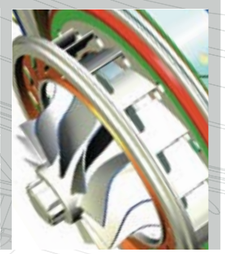




Technologies
Variable Geometry

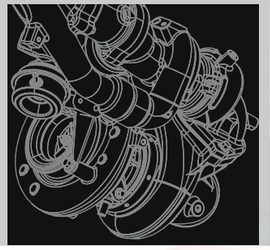
The Holset VGT ™ first launched in 1998 offers a wide flow range allowing higher boost pressures at low engine speeds, faster transient response times and characteristics ideally suited to EGR engines. Our patented sliding nozzle technology has fewer wear sites than any other variable turbine design, bringing unprecedented durability. Integral engine braking and aftertreatment thermal management capabilities reduce overall system cost whilst increasing reliability.





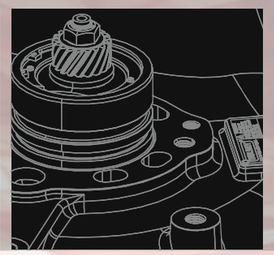
Technologies
Two-Stage

With over 25 years experience in two-stage turbocharging of large industrial engines, we offer a range of two-stage systems, with or without compressor bypass, for engine sizes from 3.8 litres to 78 litres. Individual turbocharger or complete system design expertise delivers pressure ratio, flow range, transient response and efficiency gains across a range of applications.



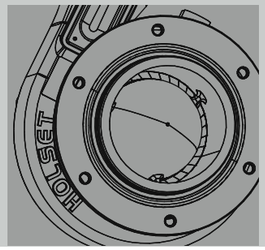
Technologies
Turbocompounding

First to market in 1991, this technology has been proven in the field to improve fuel efficiency on heavy duty engines. The additional downstream turbine extracts energy from the exhaust stream returning it to the crankshaft, improving fuel consumption (up to 5%), helping to drive EGR and recovering pumping losses. Both radial and axial power turbines are available.



Technologies
Waste Heat Expander

Waste heat recovery systems are designed to recover heat energy that would otherwise be lost to the atmosphere, improving fuel consumption by more than 5%. Heat can be recovered from EGR coolers, exhaust pipes and other heat sources using a Rankine Cycle system to extract the heat energy and convert it to mechanical or electrical energy using an efficient, compact turbine expander.



Product Overview

Series	Compressor Wheel Diameters (mm)	Fixed Geometry	Wastegate	Variable Geometry	Power Turbine (Axial and Radial)	Two-Stage	Waste Heat Expander
150	44 - 48	✓	✓	D			
200	54 - 58	✓	✓	✓		✓	
250	64 - 69	D	D	D			
300	68 - 85	✓	✓	✓		✓	
400	82 - 92	✓	✓	✓		✓	
500	98 - 108	✓	✓	✓		✓	✓
600	108 - 112	✓	✓			✓	
800	111 (turbine)				✓		
800	140 - 151	✓			✓	✓	
900	TBD	D				D	
1000	193	✓				✓	

D - In development

This overview illustrates products in production and in major development programmes with our customers. Cummins Turbo Technologies works as a technology partner and can apply technologies for these products across the range.

Features

Titanium Impellers for high boost temperatures and highly cyclic applications.

Cast iron compressor covers for high temperature applications.

Machined From Solid impellers for highly cyclic applications.

Inverse Design wheels for maximum efficiency, map width or pressure ratio.

Compressor map width enhancement – wider maps vs competition.

Command Valve wastegate allows wastegate operation at a wider range of engine speeds and loads.

Robust and high temperature wastegate for gas engines.

Rotary valve and integrated system for series-sequential two-stage systems.

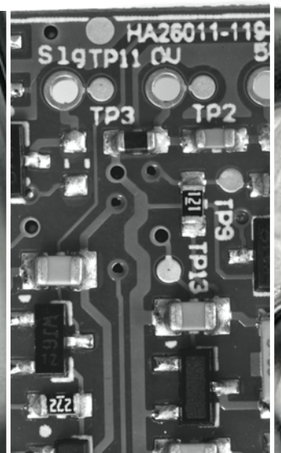
Water cooled bearing housing and turbine housings available for gas and marine applications.

Electric actuators with feedback for rapid response, accuracy and provision of self diagnostics.

Axial and radial turbines for power turbines to suit packaging requirements.

VGT nozzles for thermal management of exhaust aftertreatment systems.

Integrated, non-intrusive sensor systems to control speed, performance and wear even at low speeds.



Advanced Engineering

Noise Test Cell

Unique semi anechoic test cell facilities have been specifically designed and built by Cummins Turbo Technologies to measure the noise emitting from each part of a turbocharger. Induction, exhaust and ambient spaces are separated and measured individually so that the source of noise can be identified, analysis of improvements made and solutions developed.

Green Turbo Applications

Our innovative engineering capabilities and commitment to the environment is also applied to applications, some which do not involve an engine at all! One example is the Talbott's Biomass Generator where a Brayton cycle is used to extract heat energy from burning waste biomass and turn it in to electrical energy using a power turbine.

Guidelines and Training

All our customers benefit from a package of applications guidelines that detail the design considerations that we recommend for turbocharger installation in new applications. This tool is available online and is invaluable to those who need to know the more practical aspects of turbocharger application not covered in the theory books. We also offer training on turbocharging performance to our customers.

Turbine Dynamometer Test Cell

Cummins Turbo Technologies measures turbine performance on our own design of dedicated turbine dynamometers in order to obtain the maximum amount of test data for each turbine. This not only allows us to understand how turbines work with different compressors but to generate better map data for simulation programs.

Waste Heat Recovery Test Cell

Cummins Turbo Technologies is well placed to lead on new technologies required for emerging fuel economy and CO_2 legislation, with the development of a new test cell designed by our own engineers. This unique capability is already supporting current developments on our turbine expander for Rankine cycle waste heat recovery systems.

Extreme Applications

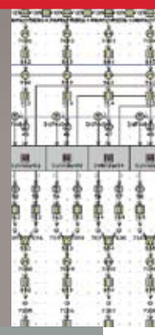
Holset turbochargers can be found in the most challenging of places. We have helped boost engines for Indycar, race trucks, high speed power boats, Paris Dakar trucks and even a Bio-diesel dragster! We are also the only turbo manufacturer to supply turbochargers to all the on-highway trucks sold at 700HP and above at Euro 5.

Inverse Design Wheels

Inverse design methodology is used to generate the wheel geometries required for our class leading performance. This approach involves defining what the performance map looks like and the computer code defines what the blade shape should be. Wheels and covers can be designed that now provide higher pressure ratio, higher efficiency and wider flow range than ever before.

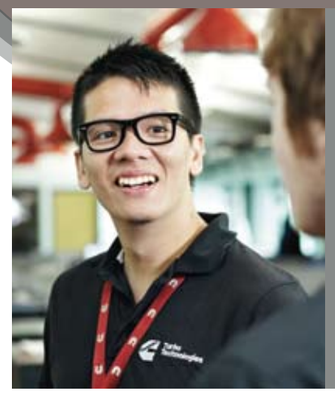
GT-Power Simulations

We now supply turbocharger maps directly in CMP and TRB format for GT-Power users and continue to develop and share our best practices for modelling turbocharger performance. We perform simulations in collaboration with our customers on many projects including transient response studies and efficiency improvements.



New Engine Test Cells

Cummins Turbo Technologies continues to invest in significant engine test cell facilities around the world to validate designs and ensure performance, durability and reliability targets are met. Facilities support a range of test engines from small light commercial vehicles up to industrial, marine and rail applications of 19 litres in size. The latest engine test cells are automated and can run transient cycles as well as steady state points.



Innovative Solutions

Cummins Turbo Technologies has generated many new concepts in its history and been first to market with many critical turbomachinery innovations. We are the leading supplier of turbocompound systems and have developed a robust variable geometry turbine. Our series sequential two-stage solution, uses a unique rotary valve that combines many functions in one. Electrically assisted turbochargers are being developed, as are new materials and coatings. Cummins Turbo Technologies is a technology partner, not just a turbo manufacturer. Come and consult our engineers to see how we can help.

www.cummins.com/turbos

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