



▲ Compressor with attached motor

ABOUT PANKL TURBOSYSTEMS

Pankl Turbosystems GmbH was founded in Mannheim in 2009 and is a subsidiary of Pankl Racing Systems AG. Pankl Turbosystems' system expertise lies in the development, testing and production of innovative turbocharging systems for a wide range of motorsport, high-performance, commercial vehicle, off-road, aviation and fuel cell applications. In addition to complete developments, the company also offers its customers engineering services in the areas of design and simulation as well as testing services for conventional and electrically assisted turbocharging systems.

MAXIMUM EFFICIENCY

thanks to optimized simulation and motor development

LCM develops powerful electric motors for fuel cell air supply systems (FCAS = Fuel Cell Air Supply) and electrically assisted turbochargers (EAT = Electrically Assisted Turbocharger) from Pankl Turbosystems.

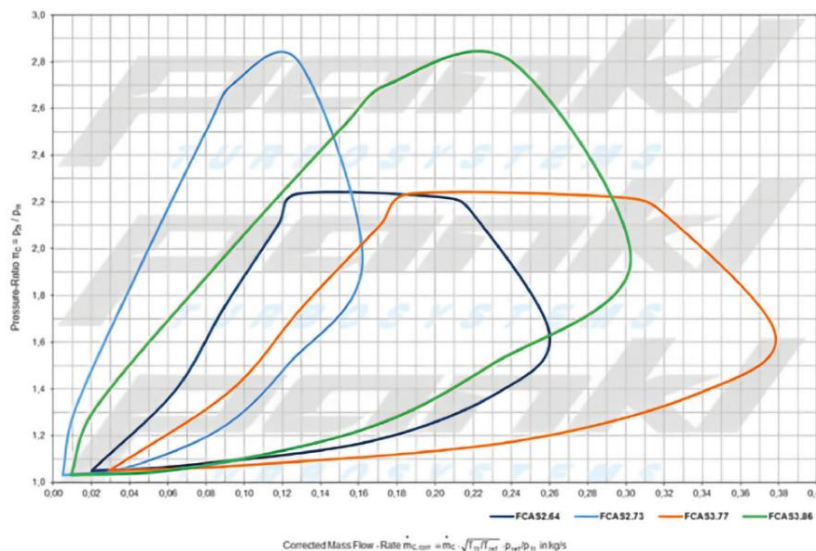
Pankl Turbosystems is successful worldwide with innovative turbocharger applications for aviation, commercial vehicles, trains, motor sports and defense applications. The growth potential is enormous, particularly for state-of-the-art electric fuel cell air compressors (FCAS) and

electrically assisted exhaust gas turbochargers (EAT). In order to extend its technological lead in this future market, Pankl Turbosystems awarded LCM a complex development contract. Its declared aim was to make electric motors for FCAS and EAT systems lighter, smaller and more powerful. The aim was to achieve an excellent ratio of weight, size and performance and to optimize the highly dynamic transient response and start-stop operation. In order to be able to respond quickly to specific customer inquiries with tailor-made solutions, it was

necessary to completely redesign the motors.

Multi-objective optimization with "SyMSpace"

In order to achieve the optimum drive, all parameters - from the size and choice of materials to the dimensioning of each component - had to be coordinated. The "SyMSpace" simulation software from LCM carried out the multi-objective optimization required for this. Target variables such as the length of the motor and the weight are minimized, while



stability, rotor integrity and efficiency are maximized. The result of this calculation with several thousand variants was an electric motor with the required size of around nine centimetres in length and a diameter of around ten centimetres. This achieves speeds of up to 140,000 rpm and a rated power of 22 kW. The system also has a compressor stage efficiency of 78%.

Independent development partner

The special topology of the high-speed motor could not be realized with standard components available on the market.

As a pure development company, LCM is not bound to any supplier and can concentrate fully on the best technical and economic solution for the customer. functional samples could be delivered after just nine months.

Thanks to the close cooperation with specialized production companies for small series, the first

Paving the way for the energy transition

An optimized compressor has even made it on board an unmanned zero-emission flying object from the British

Stratospheric Platforms Ltd. In future, this will ensure uninterrupted LTE/4G/5G data connections from the stratosphere. The multi-stage system required for this was developed by Pankl Turbosystems and ensures the optimum air supply for the fuel cell at any altitude. Successful validation was achieved by simulating stratospheric environmental conditions during flight tests. LCM was also an indispensable partner in this hydrogen technology project. As a pioneer of the energy transition, the Linz Motor Technology team once again made a decisive contribution to making future technologies practicable.

"LCM masters extremely demanding technical and time challenges. We are now able to deliver a prototype within six to nine months of a customer inquiry."

Gerhard Krachler,
Managing Director of
Pankl Turbosystems GmbH

FACTBOX ELECTRIC DRIVE TECHNOLOGY AND MOTOR DESIGN

LCM supports companies in the development of electric drives with customized know-how and comprehensive services for simulation and optimization.

- ◆ LCM provides support in concept development and in the redesign of existing systems through to the design of individual components or entire drive systems with support for series implementation or certification.
- ◆ We provide specialized simulation and optimization expertise, especially for special requirements in terms of power density, efficiency, costs, operating conditions or service life.
- ◆ We perfectly combine all relevant competencies such as modelling, simulation, optimization, electronics, control and data analysis.
- ◆ Optimization is carried out not only in separate subject areas, but across all areas (electromagnetics, rotor dynamics, thermal conditions, magnetic losses, PWM losses, NVH, etc.).
- ◆ Thanks to our in-house production, we are able to quickly and flexibly assemble and commission functional models for electric drives.