

Research and Development

POLLRICH DLK[®]
FAN FACTORIES



Heavy-duty industrial centrifugal fans

Compact industrial centrifugal fans

Axial fans

Plug fans

Smoke extraction fans

For the innovative/efficient product development: The **CFD-Simulation.**

An important development tool at Pollrich DLK is available with Computational Fluid Dynamics. With this method the basic equations of fluid dynamics, the so-called **Navier-Stokes-Equations** are calculated numerically. The visualisation of the results supplies detailed information about the **flow pattern** of the fluid.

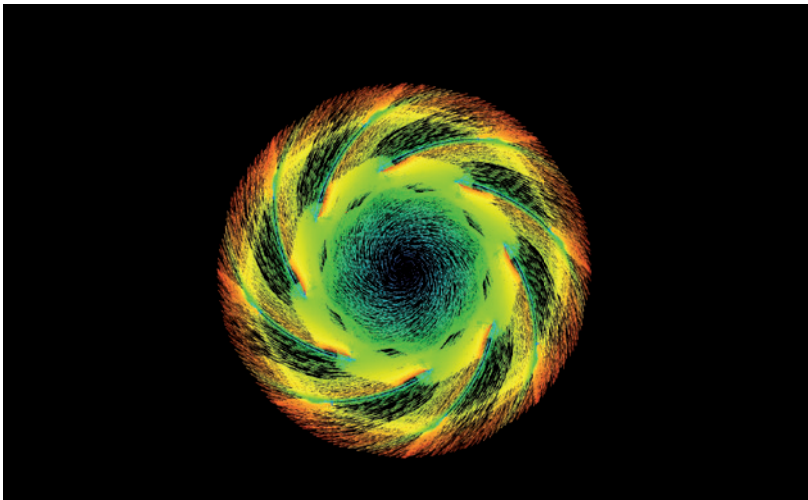
CFD simulation is used at Pollrich DLK for various applications, beginning with

aero-dynamical optimisation of single fan parts (blade geometry, guide vanes, casing shape, etc.) and **pre-calculation of aero-dynamic curves** up to the **analysis of complete car park ventilation systems.**

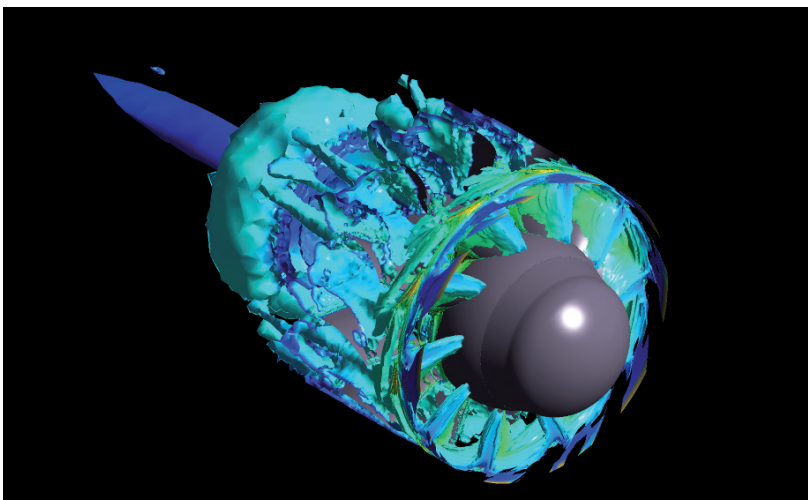
Furthermore, the use of CFD enormously increases the flexibility of the solution concepts for non-standardised projects.

Components can be optimally adapted to the aerodynamic characteristic in the development stage and therefore the degree of **efficiency can be optimised** with the aid of the simulation results.

For new products, the simulation of aero dynamical curves allows statements about the performance data of the fan already in early stages of the development and therewith ensuring an efficient development.



CFD calculation of a centrifugal impeller visualising the flow patterns as velocity vectors.



CFD calculation of an axial fan visualising the flow patterns as vortex structures.

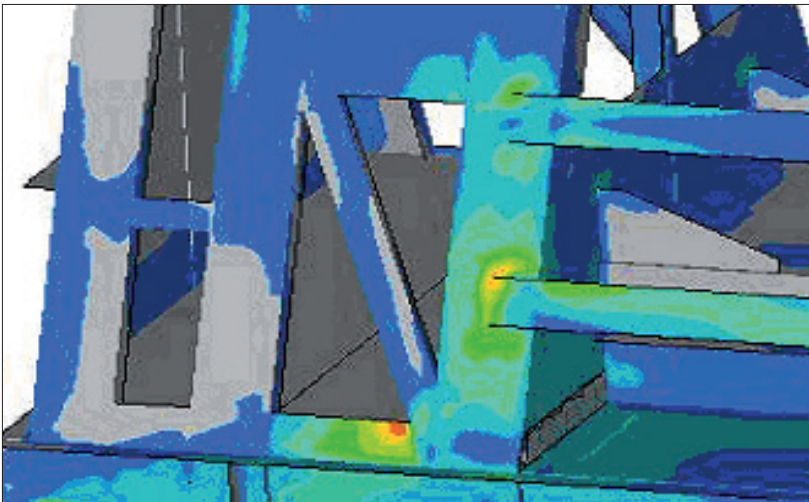
For the optimal operational reliability: The **FEM-Analysis**.

Pollrich DLK is using conventional strength calculation methods as well as **numerical structural analysis by FEM** (Finite-Elements-Method) for the verification of the material strength of the fan.

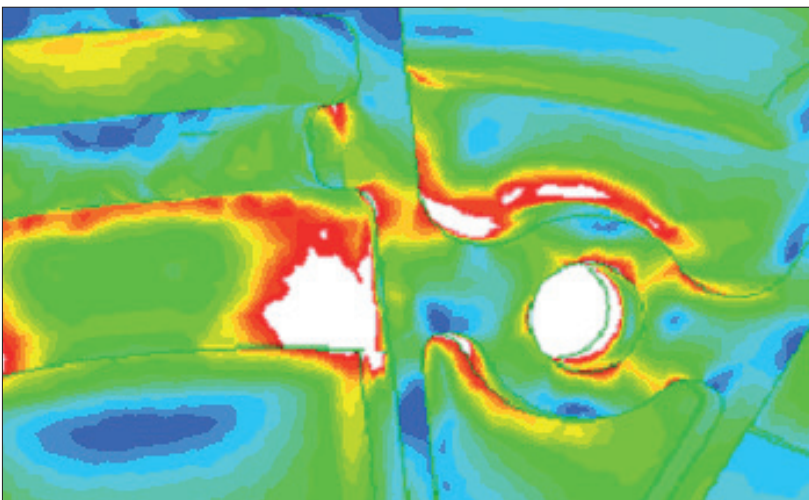
Besides the strength analysis of single components there are also complete systems being examined, which means that the interaction of different sub-assemblies will be evaluated. Within the scope of the structural analyses, joints

between components, e.g. welding seams, bolted or rivetted connections, are being designed depending on their strength resistance. In this regard, the determination of strengths and stresses in the component due to thermal and mechanical loads are particular essential.

The parameters strength and efficiency are optimised with the help of the structural analysis during the development of new products as well as for the further development of the existing portfolio. Also the use of new materials is evaluated.



Thermo mechanical strength analysis of a centrifugal fan bearing pedestal by FEM simulation



FEM simulation for the evaluation of critical areas of blade-hub-connections.

For the reliable determination of the fan curve: The **standard-conforming laboratory and measuring technology.**

Experimental research is essential in the context of product development. Pollrich DLK possesses all **necessary measuring and test equipment.**

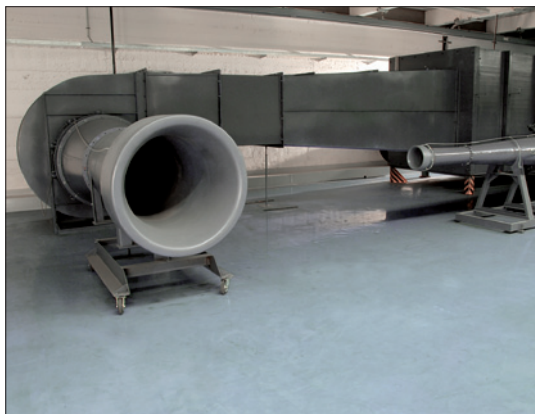
The aerodynamic fan curves of the most diverse fans are determined by using chamber- and duct test rigs according to F50 5801. Sound level measurements acc. to standardised procedures in the laboratory permit the **acoustic**

optimisation in the context of product development as well as flexible product adaptations according to individual customer request, e.g. silencer systems or sound hoods.

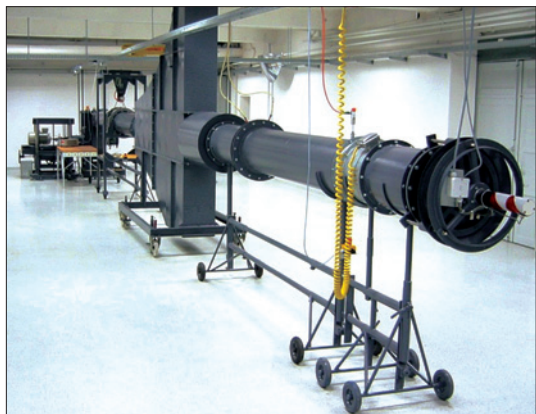
The experimental **stress analysis** of the fan is made by performing centrifuging tests. By doing so, maximum rotating speed can be determined. Also the **vibration level** and **resonance analysis** are being carried out.

Factory acceptance tests at Pollrich DLK are of course gladly carried out in the presence of customer representatives.

Renowned institutes support Pollrich DLK with fan acceptance tests regarding function and safety for **high temperature applications.**



Suction side chamber test rig to determine the aerodynamic fan performance curve acc. ISO 5801 for axial- and centrifugal fans



Pressure side duct test rig to determine the aerodynamic fan performance curve and sound data acc. ISO 5801



Suction side duct test rigs to determine the aerodynamic fan performance curve acc. ISO 5801 for axial fans of different diameters

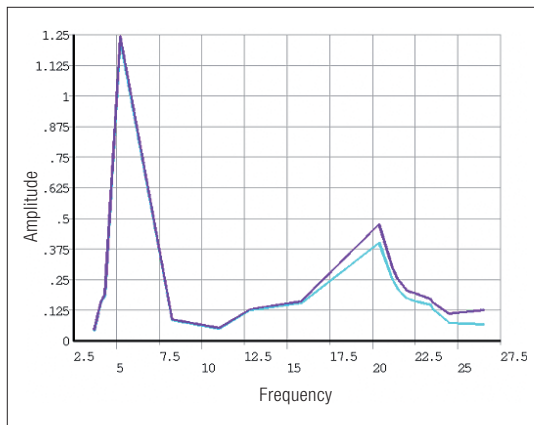
For vibration prevention: **The Vibration Analysis.**

Strength analysis and measuring techniques are completed by vibration analyses.

Vibration analyses are the pre condition to ensure a **low vibration level** and safe operation of the fans.

The **natural frequencies** of the fan are determined by **FEM** calculation already in the early development stage. This is ensuring the avoidance of vibration susceptible design in the further stages of the development process.

Each **prototype** is being measured in terms of its vibration characteristics. These tests enable us to identify critical rotating speeds immediately.



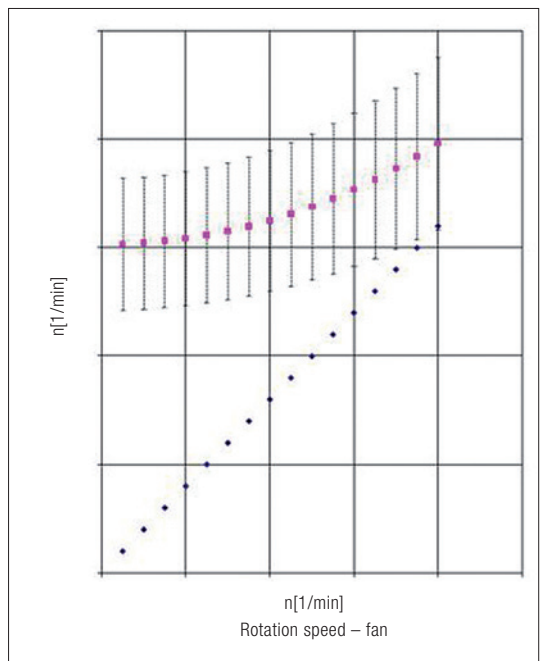
Natural frequencies of a fan calculated by FEM.

The fan must not be operated within a tolerance band around the thereby determined **rotating speeds**. This information is provided to the customer as **torsional vibration calculation chart**.

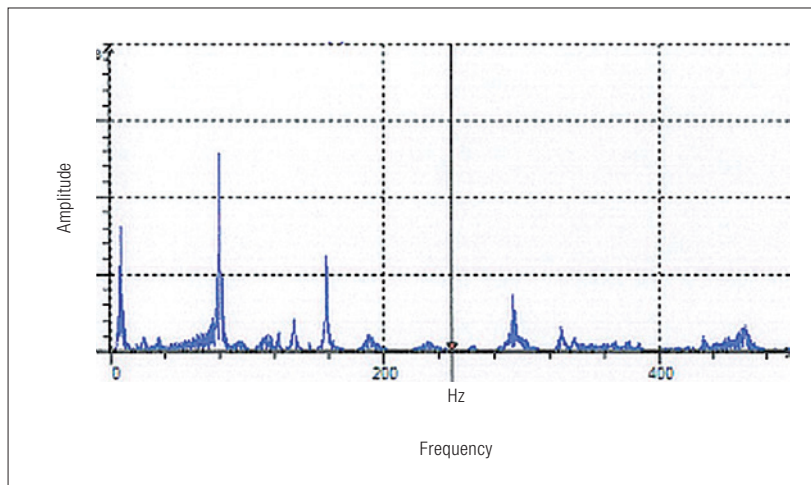
Especially important are these charts for operation on a frequency converter. A **backlash analyses** is carried out besides the analyses of the natural frequencies. This measurement

ensures a permissible vibration level during the **start up** and **shutting down** of the fan.

Ultimately, we are using the vibration analyses in combination with the respective standards to specify to the production the maximum permissible unbalances in order for the fan to operate with the **lowest possible vibration level** at any time.



The chart of torsional vibration calculation visualises the rotation speeds where the fan must not be operated in



Natural frequencies of a fan identified by measurement.

For the best possible acoustic quality: **Optimisation of sound.**

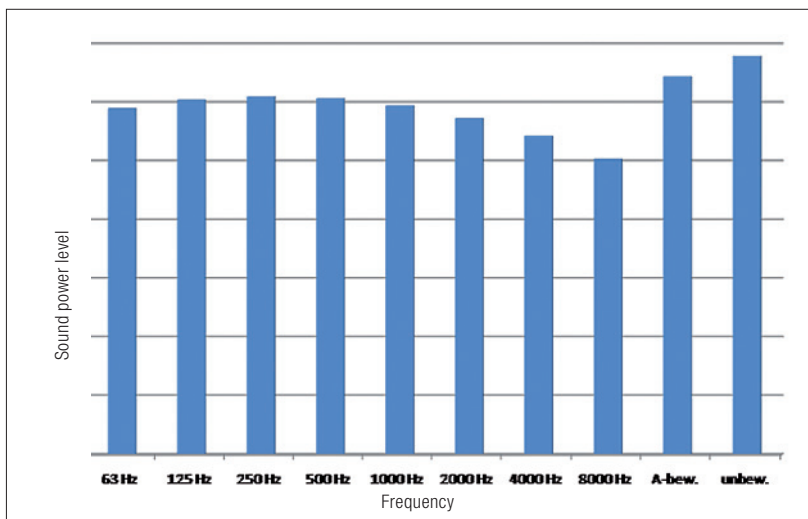
The **low operation sound level** is of increasing importance besides the aero dynamical characteristics of the fans.

Two different procedures are used to **determine the acoustic characteristics** at Pollrich DLK. The fans are also measured in terms of sound according to **DIN 45635** during the performance measurement. These measured data are complemented by acoustic calculations according to **VDI 3731**. Both procedures supply - depending on one another - the value for reliable upper limits.

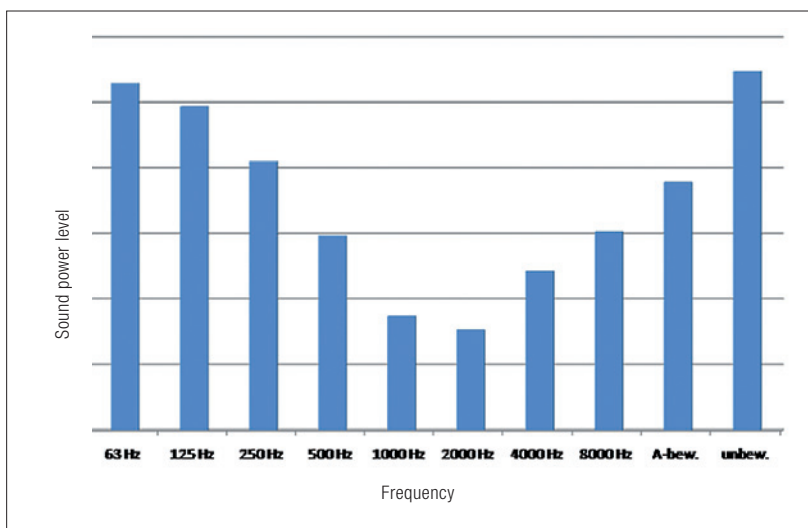
Various strategies are pursued in order to **reduce the sound emission**:

- Usually, poor aero dynamical characteristics are the reason for high sound levels. Therefore, the provision of a preferably **turbulence free** air flow is a first step towards sound optimisation.
- It is attempted to eliminate sound generating interactions between different components to a great extent by considering **design** measures.
- A further reduction of the sound level is ultimately achieved by the use of **silencers**. The R&D of Pollrich DLK is closely cooperating with its

suppliers in this field, in order to **define** the conditions for the application of the individual products and product lines.



Octave band of sound power level of a fan without silencer



Octave band of sound power level of a fan with silencer

The own Research & Development as basis for the **product development** and as sustained **success factor** of the company.

The R&D department of Pollrich DLK appeals by the combination of precise, well-engineered **measurement technology**, an immense **experience** and the knowledge in any area of fan technology, as well as by the use of **most recent development tools**.

The responsibilities of the R&D department are – among others – the **continuous development** of our **existing** products, the expansion of our product portfolio by introducing **new developments** and the technical/ scientific support for any **special designed unit** deviating from the standard ranges.

Within the scheme of a product development process the following stages have to be accomplished usually:

- After the agreement about the development objective, an aerodynamically optimised geometry will be defined by using CFD simulation analysing different concepts.

- The **FEM-Analysis** is another step in the field of computer aided development. Herewith, the optimal combination of various materials, designs (e.g. light weight) is tested and the necessary evidence regarding the material strengths is produced.

- Each **measuring examination** for all standard fans as well as for the prototypes is performed in our companies own to international standards conforming **test stands**. There, all products are being analysed for **aero dynamical, sound level** and **vibration characteristics** including the recording of the results.

The R&D is ensuring that a majority of the products offered by Pollrich DLK are not only designed for standard conditions, but are also suitable for **special applications**.

We supply smoke extraction fans up to **temperature class F600** as well as **explosion proof** versions. **Certificates** are available for both fan types issued by an authorized test institute.

By maintaining **research and development cooperation** with universities and consulting engineers, we are continuously improving our know how and are monitoring the current scientific and engineering state of the art.

Our scientific activities are increased by the **membership** in FLT e.V. (Forschungsgemeinschaft für Luft- und Trocknungs-technik = Community for research in aerodynamics and drying technology). By this membership, we are on the one hand always up-to-date and on the other hand we are able to incorporate our expert knowledge in the drafting of new technical guide lines.



The own R&D as an external **service provider** – for project management also on behalf of our customers.

Pollrich DLK is offering – beyond the standardised product range – customised project related solutions, by which a flexible reaction to the most diverse customer requirements of any industrial branch can be accomplished:

- largest impeller diameter
- extreme implementing situations
- special requirements to the aero-dynamical profile
- design of complete ventilation concepts (car park ventilation, tunnel ventilation, etc.)
- adapted materials (V2A, V4A, Al-alloys, ...)

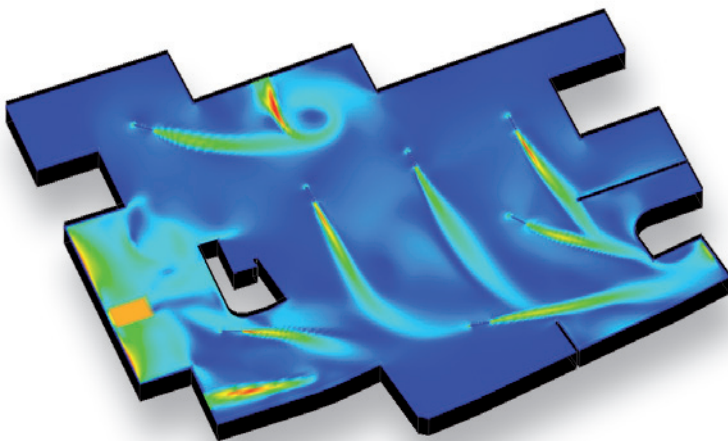
The R&D of Pollrich DLK develops these individual solutions in cooperation with the sales engineers and our customers. The experiences with these diverse project related solutions and the manufacturing knowledge derived from the

five product segments have resulted in development of such extensive know how that Pollrich DLK and its own R&D can assist customers any time with competent advice.

Of course we support you for any occurring aero dynamical issue besides the CFD simulation on customer request for **car park projects**.

We conceive for instance **air flow optimised solutions** for the assembly of blowers for car tests or the even air flow onto the cross section of a silencer or the loss minimizing design of transmission pieces of any kind.

We optimise **single components** of a system, for example by the use of guide plates, as well as for the complete ventilation concept or plant design.

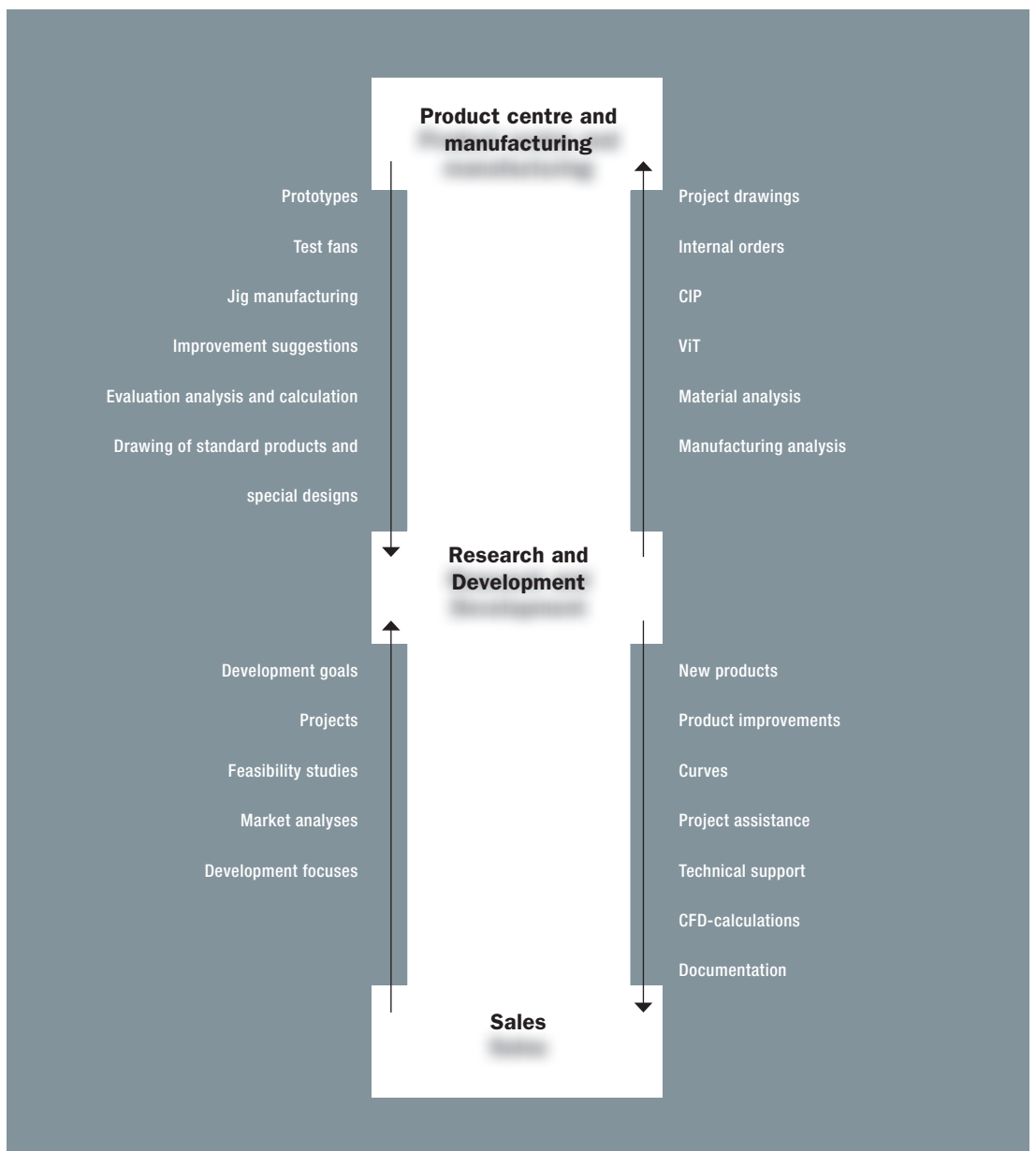


The own R&D as internal planning institution and **integral process optimiser.**

A leading role in the company is inherited by the R&D due to its primary knowledge based orientation.

The R&D is considered as interface between production and sales besides the methods applying to the complete company as **C**ontinuous **I**mprovement **P**rocess or “**V**erbesserung **i**m **T**eam” (improvement within the team). Here the basic suggestions for improvements are evaluated and verified, from here processes are structured and controlled.

The R&D is the central hub for innovation and therefore a significant key factor for the future of customer and company.



Service days last 24 hours

The modern quality management methods of our after sales and customer support centre ensure you quality standard, reliability and efficiency. Since fans belong to a great extend to the process determining factors of your business, we offer our service and assistance to you regardless of your fan supplier anywhere in the world within the shortest possible time if assistance is requested.

24h SERVICE for fan units – worldwide.

Service-hotline:

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service@pollrich.com

Our service-team is available for you around-the-clock

- Technical advice
- Assembly
- Commissioning
- Performance tests

- Noise and vibration measurements
- Inspection
- Preventative maintenance
- Maintenance and repair
- Electronic balancing
- System optimisation

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