





## Dance on a volcano! Piller and the industrial furnace.

*If you didn't know it already, you wouldn't believe the extremely high temperatures necessary to produce "cool" materials like steel, aluminium, glass and ceramics.*

Piller's custom made hot-gas circulation fans are integrated in nearly every process in the production of these high-quality materials all over the world. The high reliability as well as the impressive capacity makes Piller fans important modules of modern high-tech processes.

With extreme process temperatures between 800 °C (1,470 °F) and 1,200 °C (2,190 °F)\*, Piller's hot-gas circulation fans are the industry's favorites because even under such extreme conditions, Piller fans operate reliably.

\* You can find such high temperatures at the edge of an active, lava-spitting volcano.





## Circulation fan

Hot-gas circulators are used in a variety of industrial heat treatment furnaces to improve convective heat transfer and for more even energy application.

### Application areas

Examples of furnace types equipped with Piller circulation fans include:

- continuous furnaces
- chamber furnaces
- strip suspension furnaces
- aging furnaces
- pit furnaces
- high-convection furnaces
- pusher furnaces
- roller hearth furnaces
- walking beam furnaces
- etc.

Hot-gas circulators are necessary in order to meet the various requirements of industrial furnaces and are an essential element of these systems. The components of the hot-gas circulators are specifically configured to achieve optimal results. Piller hot-gas circulation fans were developed with special emphasis on compact design and ease of installation.

The following components can be selected:

### Type of drives

Hot-gas circulators can be equipped with different types of drives. The R version allows a special speed adaption as the motor transfers the power via a belt to the impeller. With the M version, the motor and impeller are directly connected; consequently the power is directly transferred from the motor to the impeller. The selection of the drive depends on the requirements. Our sales team supports you to find the best solution for your requirements.

Intelligent solutions allow the safe use of standard IEC and NEMA motors with temperatures up to 900 °C meaning the customer no longer needs to stock expensive special replacement motors.

By using IEC or NEMA standard motors of any motor manufacturer can be employed.



Special solutions that guarantee reliable operation are available for extreme applications and temperatures up to 1,200 °C (2,190 °F).

These include:

water-cooled motors

water-cooled insulating boxes

emergency cooling in case of emergency switch-off at high temperatures

gas-tight models

motors with special shafts (e. g. Inconel 600)

dual-speed motors for lowering the speed at high temperatures

### **Bearings**

Thanks to the special shaft-hub design, original motor bearings can be used with the M version; for the R version rolling bearings with a grease lubrication are available. Additional bearing cooling is not needed, thanks to the sophisticated design and minimized heat transfer from the furnace to the mounting plate of the circulation fan. This reduces the fan cost, energy usage and increases reliability.

### **Impellers**

Unlike conventional impellers, high-temperature impellers require unique design provisions.

Hot gas impellers are a compromise between efficiency, material tensile strength at elevated temperatures and reasonable production costs. In order to achieve this goal special impellers are available for standard applications with a focus on economy and minimal capital costs.

For higher pressure ranges, Piller offers an impeller design that provides top notch performance at high temperatures. Through the use of FEA (Finite Element Analysis) Piller has developed impeller that operate at tip speeds of 170 m/s even at 600 °C (1,110 °F).



### Impeller materials

The selection of the impeller material, in addition to the mechanical design, is essential in determining the service life and performance of the impellers.

Typical materials:

up to 600 °C (1,110 °F)	1.4878 (AISI 248)
above 600 °C (1,110 °F)	1.4876 (Incoloy 800) AVESTA 253 Ma Inconel 617

Other special materials are available for other difficult furnace applications.

Naturally, even these materials reach their physical limits at extreme temperatures and high tip speeds. Standard design calculations using the material yield strength are no longer adequate and impellers must be designed using the endurance strength method. Piller's experience with design of hot-gas circulation fans has determined a minimum creep rupture strength of 10,000 hours at maximum temperature and maximum speed results in good life as the calculated durability depends entirely on the

maximum values of temperature and speeds which are not usually seen 100 percent of the time. A small reduction of these parameters achieves significantly increasing creep rupture strength. Impellers achieve in general a durability of more than ten years.

### Shaft seals

In addition to reasonably priced stuffing box seals for standard applications, carbon ring labyrinth seals can be used if necessary for gas-tight designs where complete separation of the furnace from the surrounding area is required. By using a buffer gas, the undesired flow of ambient air into the process through the shaft seal (in vacuum mode) or the emission of furnace gas (in pressure mode) are prevented. For special applications also sealed motors are used.



### **Insulation materials**

In order to reduce heat transfer to critical fan components, thereby minimizing heat loss and increasing reliability of the fans, it is essential to integrate an efficient insulation system into the fans. High-quality, environmentally friendly materials (chosen based on the area of application) are used in Piller circulation fans for this purpose.

### **Installation**

The connection to the furnace ceiling or the side walls is made via a flange (round or square). The hot-gas circulation fans special plug-in design enables the customer to easily install the fan in a minimum amount of time. An insulating box designed according to the furnace heat reduces the heat loss, protects the bearing and drive from these high temperatures and serves as a mount for the motor and bearings.

### **Easy service**

The plug-in design allows for the complete unit to be easily exchanged guaranteeing continuous and safe operation of the furnace providing high added value for our customers.

Should you have any further questions, please do not hesitate to contact our Service Department.



The Center of Motion.

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