HEAT RECOVERY
WITH AERZEN TURBOS, BLOWERS AND COMPRESSORS

Reduce costs for compressed air generation

AERZEN

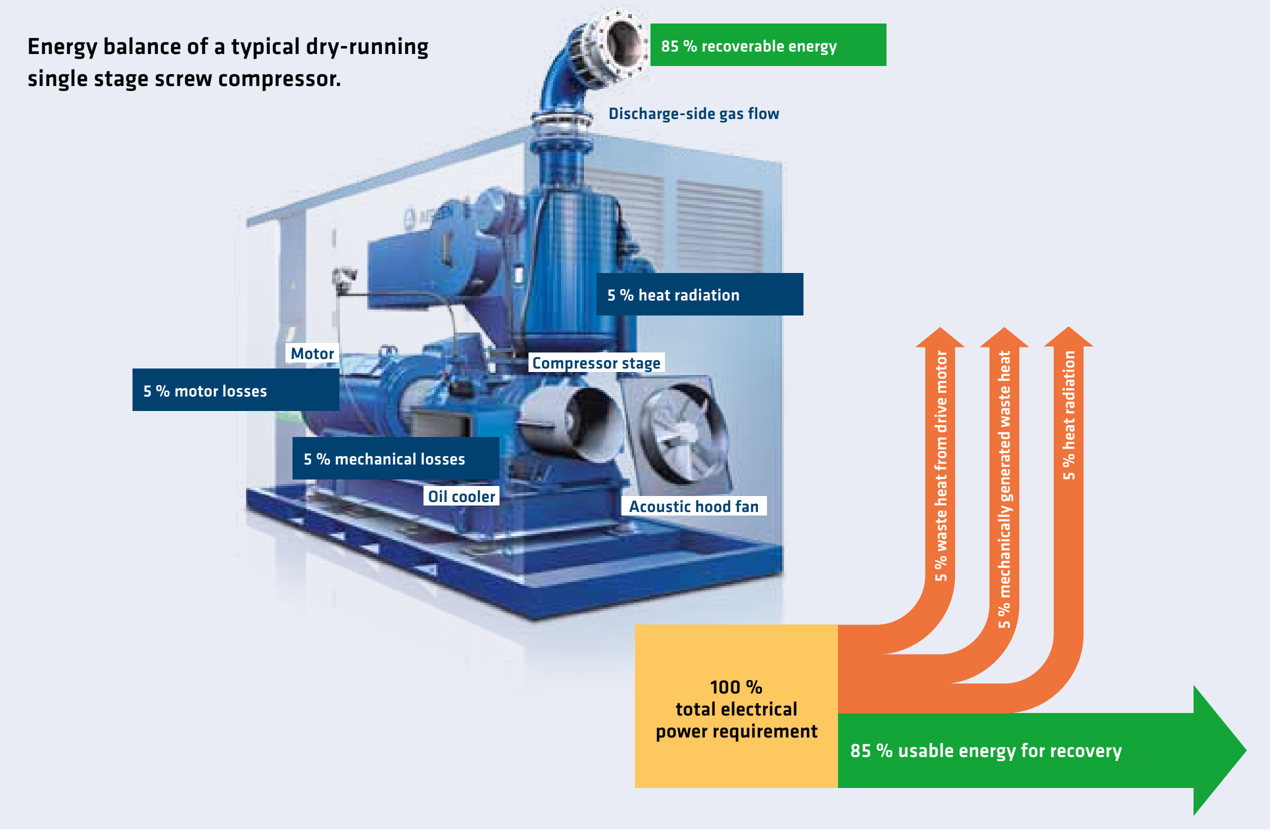
REDUCE COSTS FOR COMPRESSED AIR GENERATION – BENEFIT FROM SAVINGS POTENTIALS.

Dwindling resources, stringent environmental regulations, rising energy costs – there is a consensus across all sectors that more efficient energy utilisation is both sensible and necessary. Measures for saving energy are especially practical in the generation of compressed air, since expenses for energy are the biggest portion of the life cycle costs. With relatively simple and calculable measures you can recover a large part of the electrical energy used for the generation of compressed air while increasing the overall efficiency of your compressed air generation system.

Compressed air with reduced energy.
For thermodynamic reasons, compressed air generation always involves waste heat, since the electrical energy for the operating energy input is converted to heat. In many cases this heat is simply lost and not used. It is discharged by means of exhaust ducts or fans, or it dissipates through distribution of the compressed air, while the heating system next door is generating heat. That is incomprehensible in view of the issues of global warming and reduction of the CO_2 footprint.

An all-round perfect solution.
AERZEN offers intelligent heat recovery systems that will allow you to use this energy, for example in heat-led production processes, water heaters or heating systems. Compressed air systems with long life cycles are especially suitable for this purpose.
By recovering the heat generated in the compression process you can save energy and significantly boost the competitiveness of your plant. Only enterprises that manage all of their resources intelligently and ecologically can be assured of achieving long-term success and a competitive edge.

Energy balance of a typical dry-running single stage screw compressor.



Criteria for the use of energy from compressed air.

In order for heat recovery to be cost effective, the processes must be well coordinated and the cooling water discharge temperature needed for the process must be reached. Examples for use of cooling water from heat exchangers or waste heat: sludge drying 40 to 50 °C, pre-heating of hot water and supply air 30 to 50 °C, hot water forward flow 40 to 60 °C, building heat forward flow 60 to 85 °C.

Usable temperature level.

ΔT between waste heat source and heat sink (consumer) should be at least 5 to 10 K – the higher the better.

Heat quantity and heat output.

The recovered energy must be suitable for the process in use, to eliminate the need for additional heat generators during peak demand.

Continuity of use.

Heat recovery can also be worthwhile in systems with low waste heat if they achieve a high utilisation of capacities.

Physical proximity.

The waste heat source and heat sink should be as close to each other as possible, in order to minimise transport losses and costs.

Synchronisation of operating times.

Exact synchronisation of the operating times of the heat source and heat sink ensures more efficient use of the waste heat. If supply and demand are not completely synchronous, a heat accumulator could be a good solution.

Operating hours and service life.

Full system utilisation will achieve the maximum economic benefit.

Investment costs.

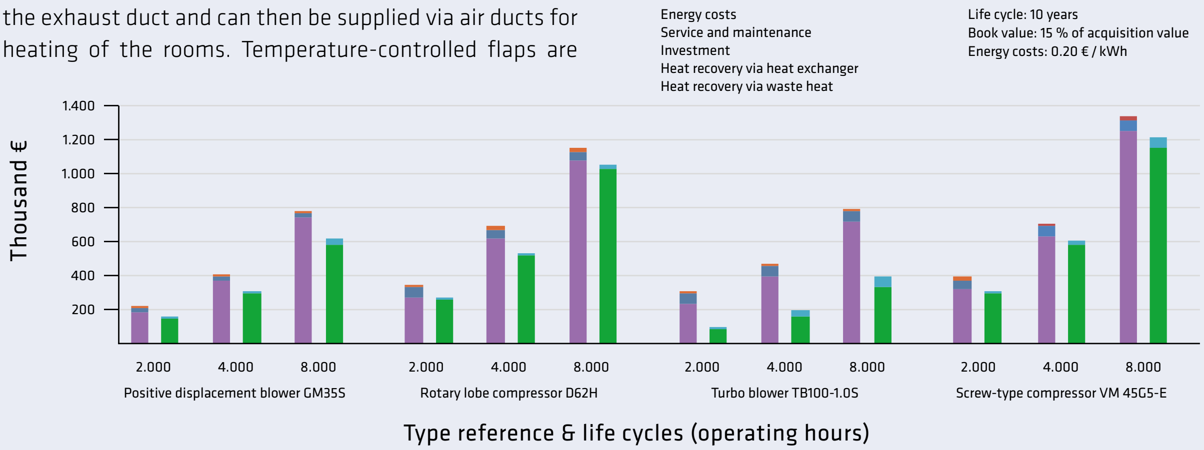
The investment costs are directly affected by factors such as transport and storage of the heat.

Reliability of supply.

If a sensitive process uses only waste heat, it may be necessary to provide a backup heat generation system in the event of a failure of the waste heat source.

Methods of heat recovery.

Air-cooled blowers, turbos or compressors with an acoustic hood are ideal for using exhaust air for room heating. For this purpose the exhaust air louvre of the AERZEN unit is equipped with an exhaust duct. This allows use of the cooling air for the compressor stage, the silencer and the pipe system under the acoustic hood, and the exhaust air from the oil cooler can be used for room heating. The waste heat, at a temperature of 30 to 60 °C, is bundled via the exhaust duct and can then be supplied via air ducts for heating of the rooms. Temperature-controlled flaps are used to regulate the room temperature. The waste heat from the discharge-side gas flow itself has even more potential for heat recovery. It contains up to the 85 % of the electrical energy in the form of heat. This energy can be recovered by means of a compact heat exchanger, which is installed in the piping downstream of the compressor (on the discharge side).



Examples for heat recovery

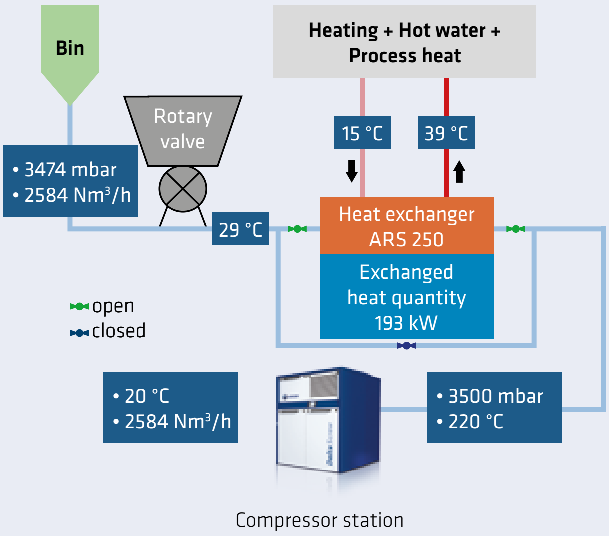
- Sludge drying
- Hot water for showers and lavatories
- Supplying central heating systems
- Warm-air heating of operational premises
- Warm air for drying processes
- Creating airlocks
- Pre-heating of burner air
- Room heating
- Paint shops
- Electroplating
- Drying of workpieces
- Heating of swimming pools
- Service water for restaurants and large kitchens
- Cleaning water for food processing

AREAS OF APPLICATION FOR AERZEN MACHINES.

Pneumatic conveying systems.
Pneumatic conveying applications generally use displacement machines such as blowers, rotary lobe compressors (Delta Hybrid) and screw-type compressors. The maximum air discharge temperature of a screw compressor can be as high as 280 °C. For use in the process, the air must often be cooled down to below 50 °C.

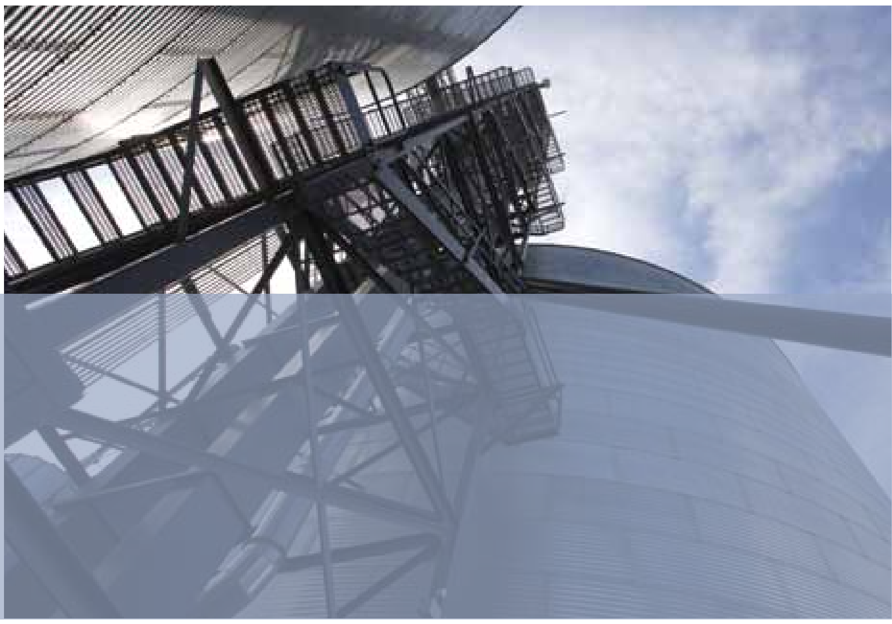
A heat exchanger and, if necessary, a condensate trap is installed downstream of the compressor, Delta Hybrid or blower. Although these components create additional pressure losses, this is negligible compared to the energy that can be recovered.

Heat recovery systems in pneumatic conveying applications are generally designed for a low gas discharge temperature with optimal heat transfer.



ARS 250	Case 1	Case 2	Case 3
Intake volume flow in Nm^3/h	2584	2584	2584
Cooler intake temperature in °C	220	220	220
Pressure loss in cooler in mbar	26	26	26
Energy required for compensation of pressure loss in cooler in kW	0.7	0.7	0.7
Cooling water flow in m^3/h	3	5	7
Cooling water intake temperature in °C	25	25	15
Gas discharge temperature in °C	44	55	39
Cooling water discharge temperature in °C	75	39	29
Exchanged heat quantity in kW	171	175	193
Total power required at the coupling in kW	198	198	198
Recovered energy in %	86	88	97

Case 1: hot water > 70 °C
Case 2: increased cooling water flow
Case 3: increased cooling water flow and transferred heat quantity optimised



Wastewater treatment.

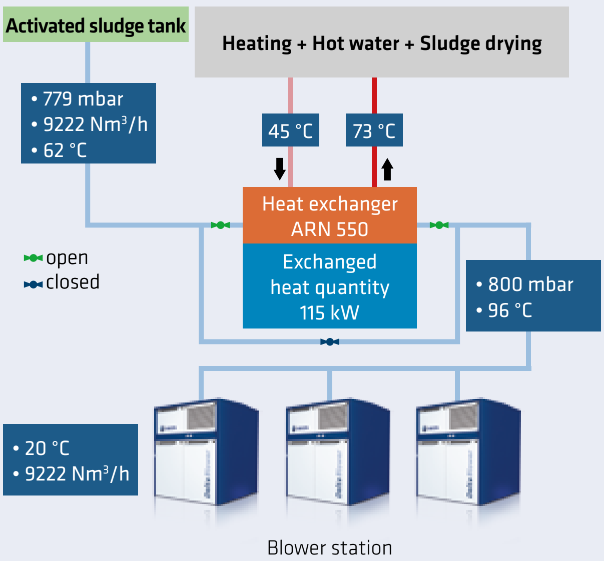
In wastewater treatment plants, blowers, Delta Hybrid compressors and turbos are used that reach maximum air discharge temperatures of 140 °C. A condensate trap is not necessary. Wastewater treatment plants are the facilities in cities and municipalities that use the most electricity. Therefore, due to widespread uncertainty concerning the future global energy matrix and the resulting energy market price, there is an urgent need to increase energy efficiency.

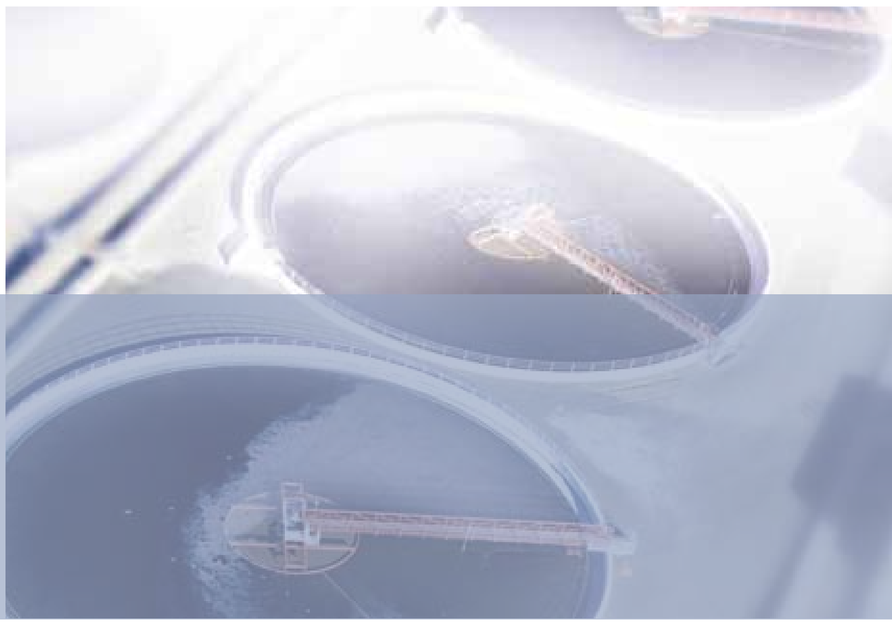
By using a heat exchanger with a low differential pressure (< 30 mbar) the blower station consumes only slightly more energy (< 2 % of the operating energy input). The energy saved, on the other hand, is many times higher than the additional input power required.

Heat recovery systems for wastewater treatment plants, e.g. for optimal support of sludge drying, are generally designed to generate the return flow of cooling water from the heat exchanger at > 70 °C and maximum heat transfer.

ARN 550	Case 1	Case 2	Case 3
Intake volume flow in Nm³/h	9222	9222	9222
Cooler intake temperature in °C	96	96	96
Pressure loss in cooler in mbar	21	21	20
Energy required for compensation of pressure loss in cooler in kW	6.6	6.6	6.6
Cooling water flow in m³/h	3.6	8	8
Cooling water intake temperature in °C	45	45	25
Cooling water discharge temperature in °C	73	59	48
Exchanged heat quantity in kW	115	132	183
Total power required at the coupling in kW	282	282	282
Recovered energy in %	41	47	64

Case 1: hot water > 70 °C
Case 2: increased cooling water flow
Case 3: increased cooling water flow and transferred heat quantity optimised





ADVANTAGES AND BENEFITS OF THE AERZEN AFTERCOOLER.

High energy savings

Inexpensive compressed air generation as a result of efficient heat recovery.

Point-to-point design

Design of the heat exchanger for maximum heat transfer and minimum pressure loss.

Large functional range

Water/air aftercoolers are also available for high intake temperatures up to 280 °C and in stainless steel.

Retrofitting is readily achievable

Older compressed air systems can also be optimised for energy recovery.

High flexibility

Due to the use of an external heat exchanger, a choice of different sizes is possible.

Broad scope of application

There are many possible applications for the use of recovered energy.

Low investment costs

The favourable ratio between the costs and the amount of recovered energy allows fast amortisation.

Everything from a single source

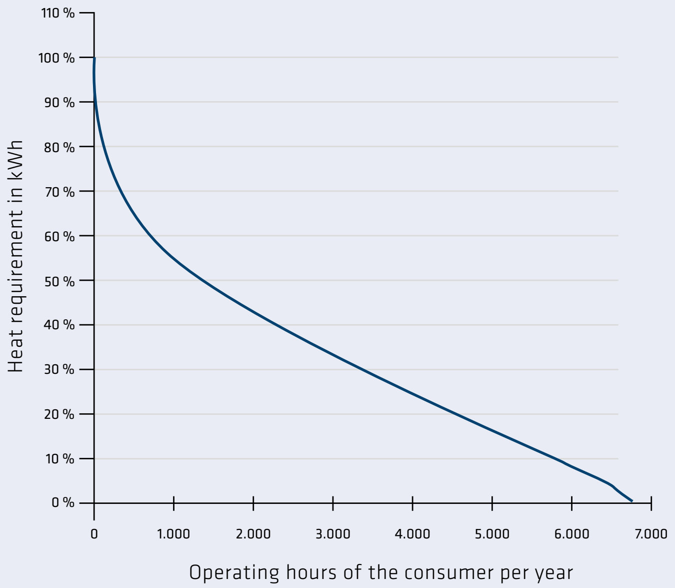
Service and maintenance are provided entirely by highly competent AERZEN personnel.

Add-ons and accessories

Stainless steel aftercoolers and compatible condensate traps.

Load duration curve and partial load.
A load duration curve can be used to estimate the percentage of required heat that can be achieved with a system designed for partial load operation. The example portrayed for a heating system shows that the peak capacity is needed only for a few hours during the year. In a system designed for 15 to 25 % of the power requirement, it is possible to cover 50 to 70 % of the heat requirement. Other applications must be analysed individually.

Available heat quantities.
Optimal waste heat recovery requires determination of the available heat quantity. This depends on the usable temperature difference, the mass flow / volume flow, the time of availability and the specific thermal capacity of the heat transfer medium.



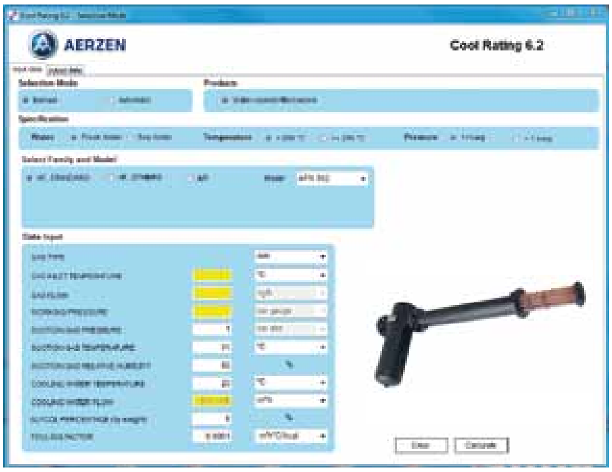
Properties of the aftercooler.

Function: Compressed medium flows through the cooler tubes and cooling water flows around the tubes in the counterflow. The louvre design of the tubes ensures effective thermal transfer and minimal pressure loss.

Variants: permanently installed or removable tube bundles, smooth or ribbed tubes, stainless steel for high gas temperatures, copper / nickel for seawater.

Accessories:

- Cyclone separator
- Automatic condensate drain
- Flange and counter flange kits



With our design tool we can immediately offer you the optimal heat exchanger for your system!

	Technical data					
	Cooler connections		Dimensions mm			Weight kg
Type Heat exchanger	Air	Water	A	B	C	
AFN027	DN100	1¼"	900	133	670	28
AFN036	DN100	1¼"	900	139.7	670	34
AFN050	DN125	1¼"	1300	168.3	1100	84
AFN060	DN150	1¼"	1300	193.7	1100	105
AFN/ARS090	DN200	1¼"	1300	244.5	1100	143
ARN/ARS130	DN250	1½"	1300	27	1050	224
ARN/ARS170	DN300	2"	1300	323.6	1050	280
ARN/ARS200	DN350	2"	1300	355.6	1050	370
ARN/ARS250	DN350	DN65	1500	375	1100	400
ARN/ARS350	DN450	DN80	1500	450	1200	585
ARN/ARS450	DN500	DN100	1500	519	1100	690
ARN/ARS550	DN600	DN100	1500	570	1100	1020

Explanations of the type designation.

A F N 550

Flow capacity in m³/min with intake air at 25 °C, 60 % residual moisture, 7 bar operating pressure and 120 °C cooler intake temperature

N = for standard conditions

Copper tubes, tube plates of normal steel, baffle plates for fixed tube bundles of aluminium and of brass for removable tube bundles, cooler sleeves of normal steel

S = for temperatures > 200 °C

Tubes, tube plates and baffles of stainless steel, cooler sleeves of normal steel

A = version entirely of stainless steel

C = for cooling with seawater

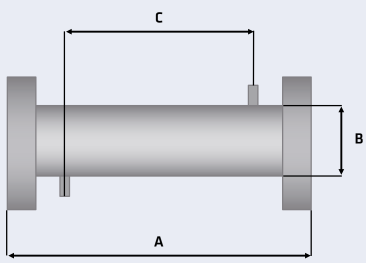
Tubes, tube plates, baffles and cooler sleeves of copper / nickel

F = fixed tube bundle, R = removable tube bundle

AERZEN water / air cooler

ARN removable tube bundle

AFN fixed tube bundle



A= cooler length (without flanges) in mm
B= flange width in mm
C= distance between the water connections in mm
The exact dimensions will be determined during the configuration phase.

AERZEN. Compressor technology as a principle for success.
Aerzener Maschinenfabrik was established in 1864. In 1868 we built Europe's first positive displacement blower. In 1911 we introduced the first turbo blowers, in 1943 the first screw-type compressors and in 2010 the first rotary lobe compressor units in the world. Innovations made by AERZEN continue to drive the development of compressor technology. Today AERZEN is one of the world's major long-established manufacturers of positive displacement blowers, rotary lobe compressors, rotary piston gas meters, screw compressors and turbo blowers. And in many areas of application an undisputed market leader.

In more than 45 subsidiaries around the world, more than 2,000 experienced employees are dedicated to progress in compressor technology. Their technical competence, our international network of experts and continuous feedback from our customers are the basis of our success. Products and services from AERZEN set standards. When it comes to reliability, long-term value and efficiency. Challenge us.

Aerzener Maschinenfabrik GmbH
Reherweg 28 – 31855 Aerzen / Germany
Phone: +49 5154 81-0 – Fax: +49 5154 81-9191
info@aerzener.de – www.aerzen.com

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