



# MICRO STEAM TURBINES

**POWER GENERATION UP TO 600 kW  
FROM STEAM**



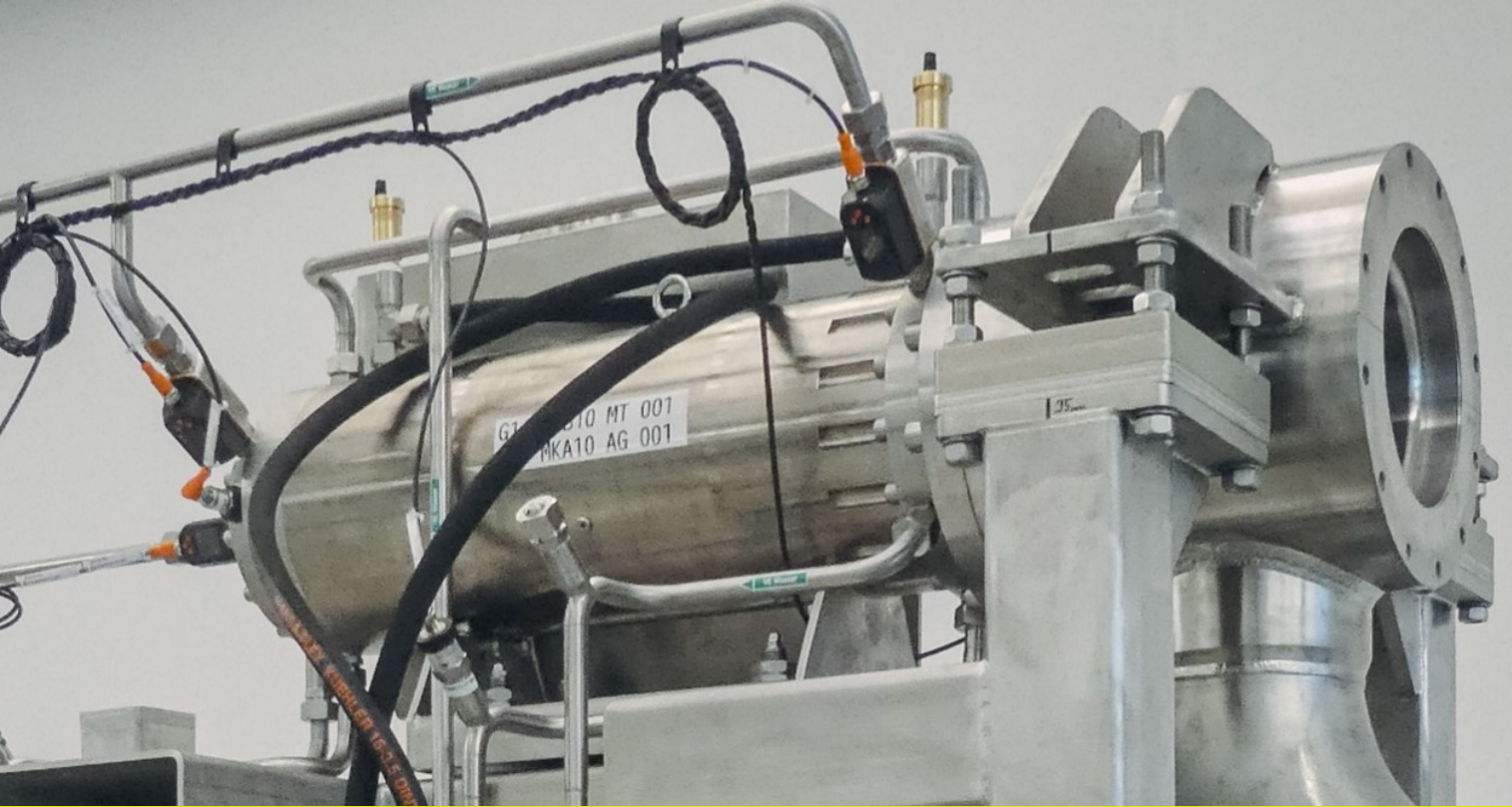
**HIGHEST EFFICIENCY IN  
THE POWER RANGE**

**SUITABLE FOR  
SATURATED STEAM**

**UP TO 50.000 RPM**

**WATER-LUBRICATED**

**FOR STEAM QUANTITIES  
FROM 1 t/h**



## TECHNOLOGY

The micro steam turbines are used to generate up to 600 kW of electricity per turbine. They are used where steam quantities are too low for the use of conventional turbines, e.g. in industrial processes and for pressure regulation instead of control valves.

The Turbonik-turbines are designed with the impeller and generator directly coupled, removing the need for a gear-box. This allows them to reach up to 50,000 revolutions per minute, currently the highest rotational speed for steam turbines worldwide. The generated electricity is converted to the grid frequency (50 Hertz, 400 Volts) via a frequency converter.

The single-stage micro steam turbines achieve an isentropic turbine efficiency that is 40% higher than comparable conventional steam turbines in their power range. This means that the fuel used to generate steam is utilized with maximum energy efficiency.

Under full load and continuous operation at 600 kW, a Turbonik turbine can generate around 5 GWh of electricity per year, which corresponds to the annual consumption of around 1,000 four-person households. Previous knowledge of steam turbine operation is not required for the use of an MDT due to the fully automatic mode of operation.

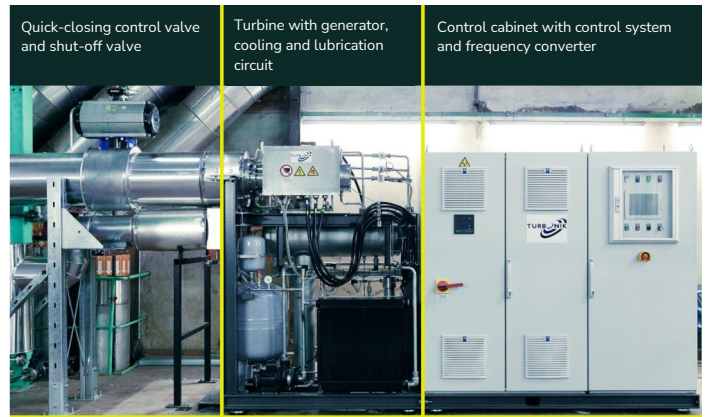
### Special features

- Highest efficiency in the power range thanks to speeds of up to 50,000 rpm and optimized blade geometry
- Water-lubricated
- Fully automatic operation
- Very small floor space (approximately the size of a Euro pallet)
- Also suitable for saturated steam

- **High cost-effectiveness and rapid amortization even with small steam quantities**
- **Effective use of steam, fuels and the existing technical infrastructure**
- **Up to 2,000 tons of CO<sub>2</sub> savings per year are possible**

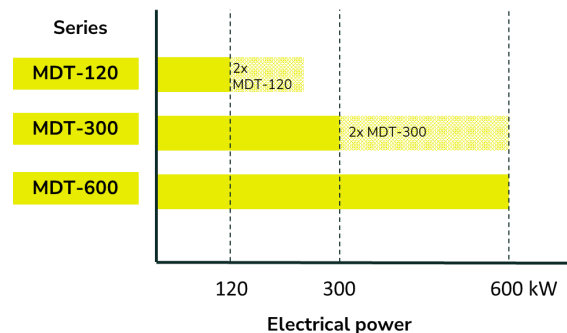
# TECHNICAL DATA

| Performance features    |  |
|-------------------------|--|
| Operating medium        | Steam, saturated steam or superheated steam              |
| Power range per turbine | 40 - 600 kW el. (Modulary expandable up to 1.200 kW el.) |
| Max. inlet pressure     | 40 bar g   |
| Outlet pressure         | -0,8 bar g bis 16 bar g                                  |
| Max. Inlet temperature  | 450 °C   |
| Max. Steam quantity     | 20 t/h   |
| Min. Steam quantity     | 1,0 t/h  |
| Part-load operation     | Up to approx. 35% of the max. design volume              |
| Number of stages        | Single stage   |
| Speed range             | Up to 50.000 rpm   |
| Isentropic efficiency   | Up to 75%  |
| Lubricant               | Water  |
| Grid feed-in            | 400 V, 50 Hz (frequency converter)                       |
| Control system          | SIEMENS S7 or comparable                                 |



## Power generation up to 600 kW in 3 series

The optimum size is selected according to the steam load curve. A parallel operation of several turbines is applicable.

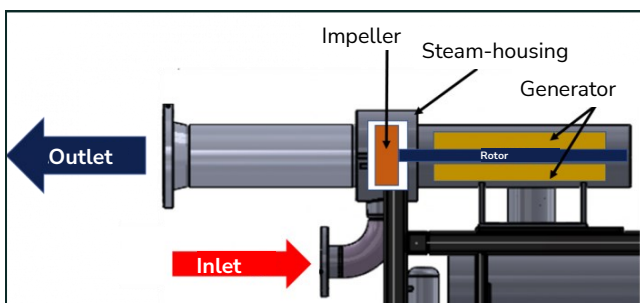


## Water-lubricated

The micro steam turbines are completely oil-free. **For the first time, water is being used as a lubricant instead of oil.** The bearing system was developed by Turbonik and optimized for customer use. Part of the expanded steam (a few liters per hour) condenses during turbine operation and constantly refills the water circuit. An automatic fill level control prevents overflows. The water circuit can be cooled via a recoler (air) or by directly connecting a heat exchanger to a cooling water network.

## Control system and automatic operation

- Visualization and provision of operating data
- Automatic start and stop possible
- Remote access enables online monitoring, support and operational optimization



## Technological principle

The impeller and generator are installed on a single shaft without a gearbox. **This enables high speeds and therefore optimum efficiency** and a very small design. The complete turboset is hermetically encapsulated.

# INTEGRATION



## Transport and installation

The space requirement is similar to a Euro pallet. It can therefore also be integrated into small spaces. Transport within factories is typically carried out using forklifts or pallet trucks.

## Scope of delivery

The Turbonik scope of delivery comprises essentially:

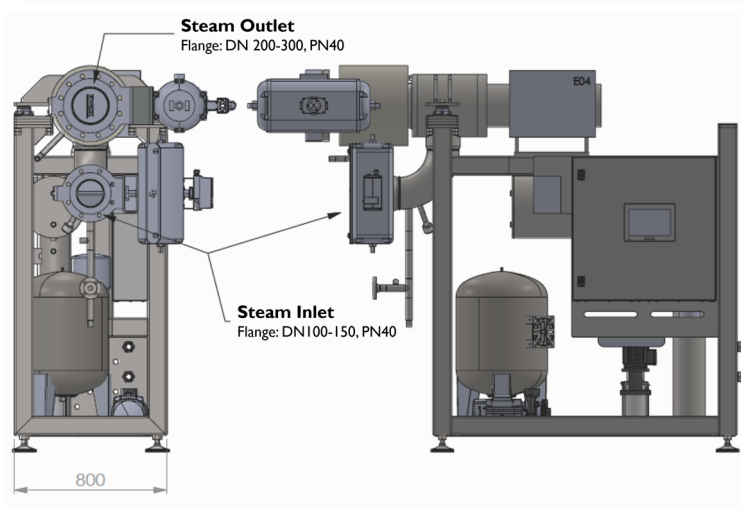
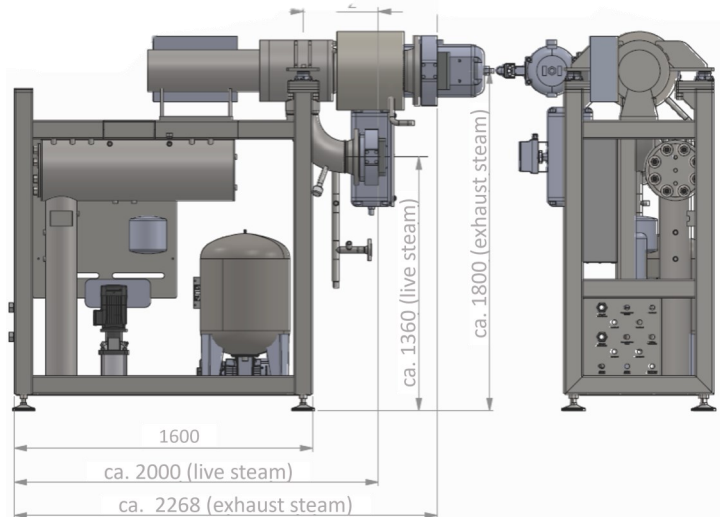
- Turboset, steam housing and generator
- Frame incl. lubricant and cooling circuit and control cabinet
- Power control cabinet with frequency converter
- Quick-closing control valve
- Exhaust steam flap
- Steam dryer
- Commissioning
- On-site training of operating personnel
- Setting up an interface for online monitoring
- EC Declaration of Conformity in accordance with the Machinery Directive 2006/42/EG

Changes may apply; please refer to the specific quote for details.

## Sound

The sound pressure level is  $\leq 85$  dB(A)

| On-site connections            |   |
|--------------------------------|---|
| Connection Live steam          | Flange, DN100 to DN 150, PN40 acc. to DIN EN 1092-1     |
| Connection Exhaust steam       | Flange, DN200 to DN300, PN40 acc. to DIN EN 1092-1      |
| Compressed air                 | 5-7 bar for control valves                              |
| Condensate lines               | 3 lines (live steam, exhaust steam, steam dryer)        |
| Weight turbine incl. generator | approx. 1.600 kg  |
| Weight power control cabinet   | approx. 1.000 kg (Spatially separable from the turbine) |
| Signal output                  | PN/PN coupler, Siemens PLC                              |
| Grid feed-in                   | 400V, 50Hz, 3 Ph., cosPhi=1, TNC                        |





## APPLICATION AREAS

### Combined heat and power generation in steam boiler systems

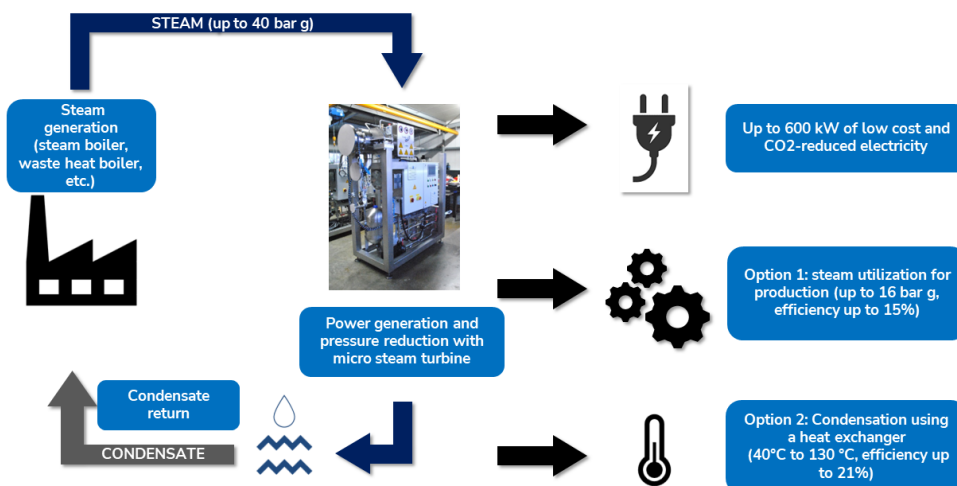
The micro steam turbines use pressure differences in the steam system to generate electricity (e.g. instead of control valves). The steam exiting the turbine can still be utilized for processes or heating at pressures up to 16 bar gauge.

Electricity is generated exactly when steam is needed for production. The fuel used (e.g., biomass, natural gas) is optimally utilized in the process.

### High-temperature waste heat utilization

For generating electricity from waste heat above 250°C, steam is the ideal medium. With the micro steam turbines, waste heat can be used economically and safely from a heat quantity of just 1.000 kW.

Steam is a safe working medium and enables the energetically optimal use of high temperatures without an intermediate thermal oil circuit.



A turbine can be designed as a backpressure or condensing turbine.

Steam availability in CHP operation is ensured at all times by a turbine bypass valve.



The micro steam turbine can be integrated and pre-installed in a container on request.

# MICRO STEAM TURBINES IN CUSTOMER USE



**thyssenkrupp steel europe AG**  
Power generation from waste heat



**GMVA Niederrhein**  
Pressure reduction instead of a control valve



**Schwarzwaldmilch Offenburg**  
Pressure reduction instead of a control valve.



**OIE AG**  
Power generation from biomass in the local heating supply

Power generation with micro steam turbines is possible in the following industries:

- Waste treatment
- Biomass plants
- Chemical industry
- Animal feed
- District and local heating supply
- Glass
- Foundries
- Wood processing
- Power stations
- Food processing
- Pulp and paper
- Pharmaceutical industry
- Shipbuilding
- Public utilities
- Steel and metal processing
- Cement and other building materi-

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