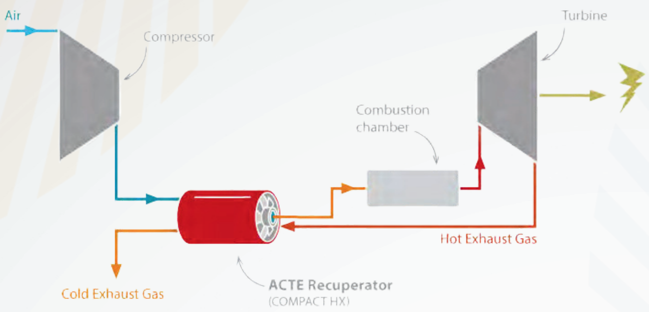
# COMPACT 95-9-0

## Technical Datasheet




**Gas-to-air** heat exchanger
Designed for **micro-gas turbines** within:
- Power range from **180 to 250 kWe**
- Exhaust gas from **200°C to 700°C**
- Flow range from **1.2 to 1.8 kg/s**

## WHY THE **COMPACT** HEAT RECUPERATORS

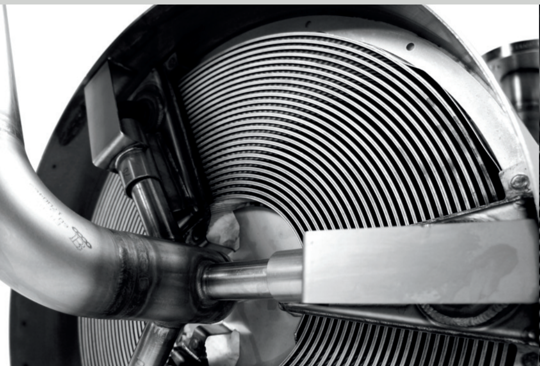
The ACTE COMPACT-type heat recuperator is at the cutting edge of micro gas turbine recovery technology. This dedicated heat exchanger combines increased performance with lifetime extension in a compact design. Our device makes optimizing micro gas turbine efficiency easy and sustainable.

### Thermal shocks and lifetime: the issue with flat plates

The main design challenge for small gas turbine heat recuperators is ensuring a good lifetime while preventing significant performance losses due to transient thermal shocks i.e. when the gas turbine is starting or stopping.
This issue can be attributed to the main component of every plate heat exchanger: the pressure retention system. In order to warrant the heat exchanger pressure resistance, heavy parts are frequently used to hold all the plates in contact. However, the heavy parts higher thermal inertia generates mechanical conflicts with the honeycomb primary surface structure.

### COMPACT heat recuperator: the benefits from the curvature

A flat plate's deformation direction cannot be determined in advance, whereas a curved plate's deformation is predictable and constant. That is the reason the COMPACT recuperator combines an annular shaped heat exchanger with radial collectors and a local pressure retention system. Thanks to its design, ACTE heat recuperators provide higher performances and extended lifetimes by reducing the thermal inertia difference in spare parts and managing thermal shock stress.



# Heat exchanger overview

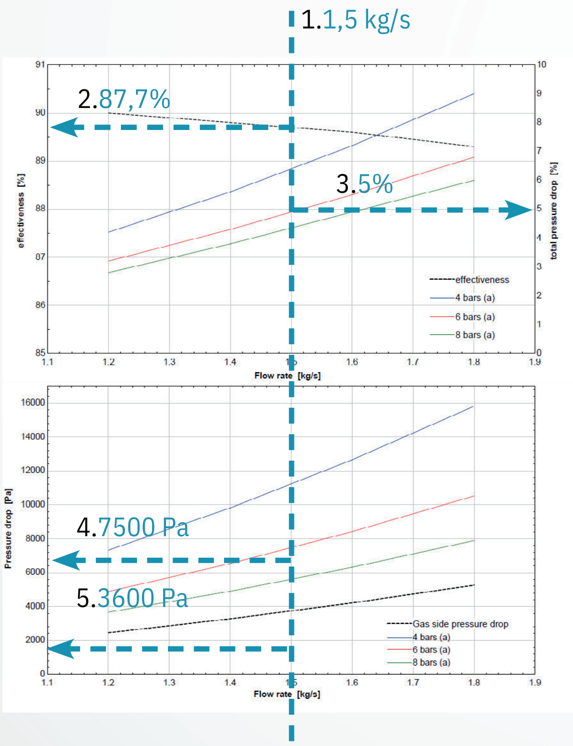
## Mechanical **features**:

**Size and weight:**
External diameter: 950 mm
Internal diameter: 325 mm
Connection pipes: DN50

**Primary exchange surface:**
Projected surface: 107 m²
Plates thickness: 3/10 mm
Weight: 320 kg

## Technical features:

To estimate your recuperator's performance, apply the 5-stage procedure below:

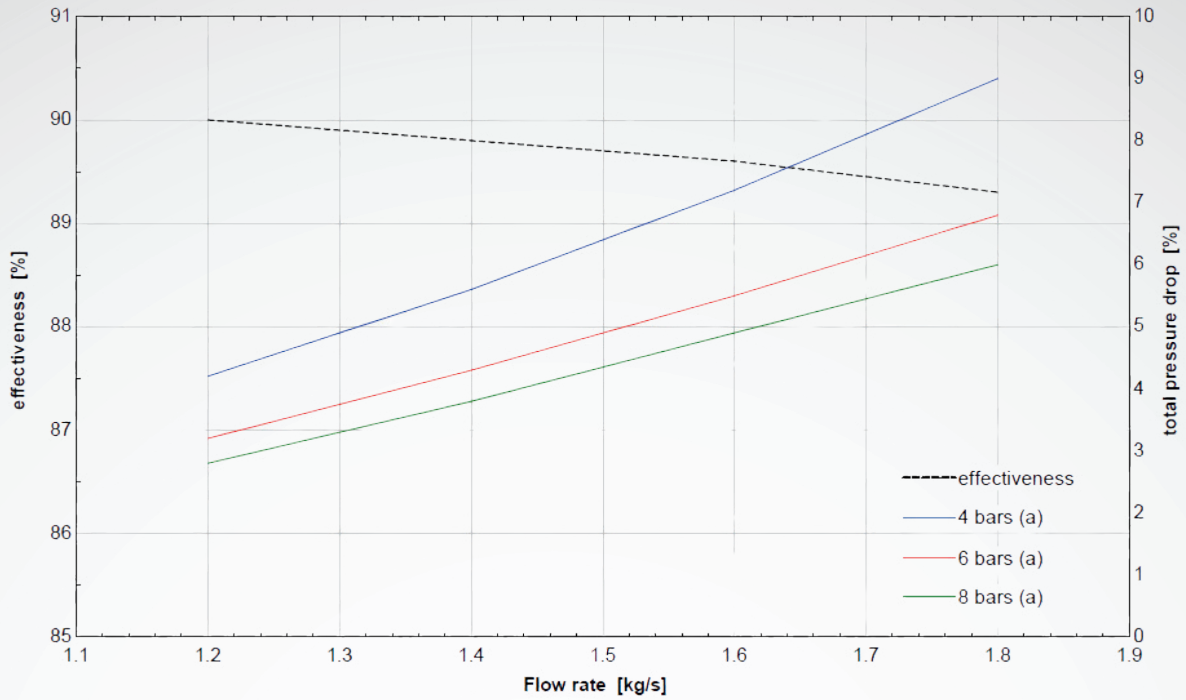


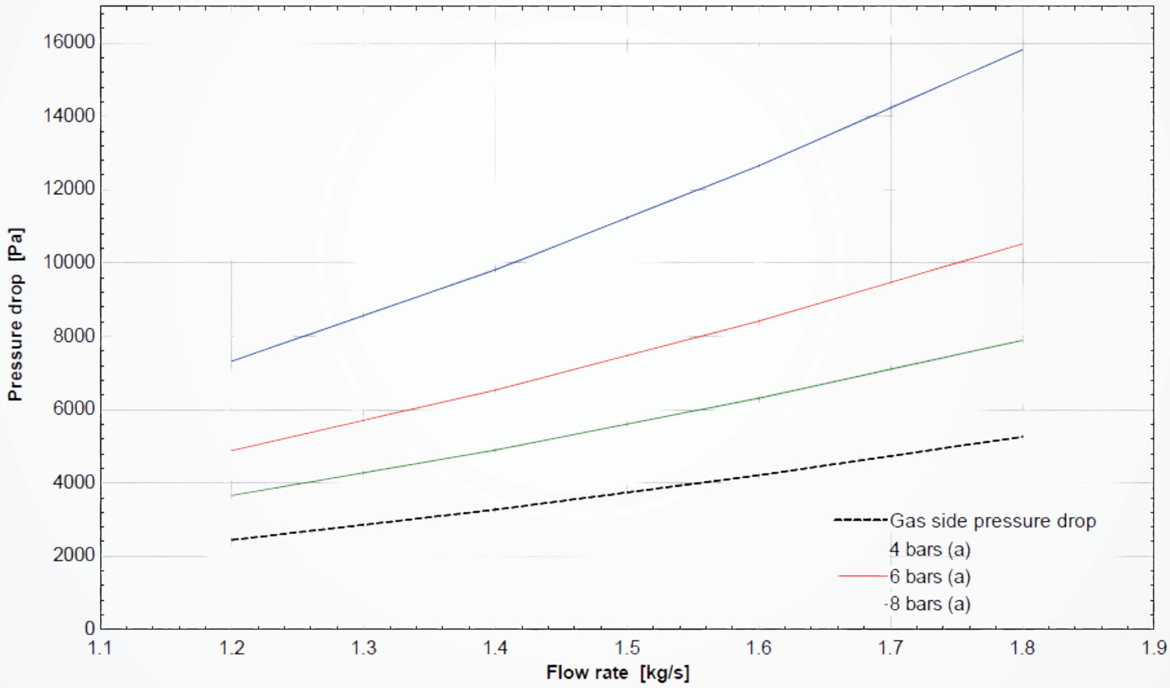

1. Trace a vertical straight line through the two graphs corresponding to the exhaust gas flow rate.
2. On the top graph, read the effectiveness from the black dashed curve and the left axis.
3. Depending on the pressure of the compressed air, read the total pressure drop on the right axis.
4. On the bottom graph, read the air pressure drop on the left axis from the curve corresponding to the pressure of the air.
5. Read the pressure drop on the exhaust gas on the left axis from the black dashed curve.

Example:
Let's consider an exhaust flow rate of 1.5 kg/s and an air pressure of 6 bars (a) :

» The effectiveness is 89,7%
» The total pressure drop is 5%
» The pressure drop on the air side is 7500 Pa
» The pressure drop on the gas side is 3600 Pa

# Performances




## Computation notes:

In the charts above, the curves are designed with an equivalent gas and air flow rate.

The total pressure drop is computed as follows:

$$\Delta p_{tot} = \left[ \frac{\Delta p_{air}}{P_{air}} + \frac{\Delta p_{gas}}{P_{gas}} \right] \cdot 100$$

The recuperator's thermal power and the outlet temperature can be computed from the charts by solving the following equations:

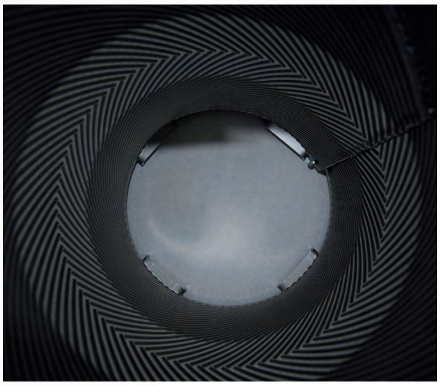
$$\dot{Q} = \varepsilon \cdot \dot{M}_{air} \cdot cp_{air} \cdot (T_{in,gas} - T_{in,air})$$

$$\dot{Q} = \dot{M}_{air} \cdot cp_{air} \cdot (T_{out,air} - T_{in,air})$$

$$\dot{Q} = \dot{M}_{gas} \cdot cp_{gas} \cdot (T_{in,gas} - T_{out,gas})$$

where: flow rate is in [kg/s], heat capacity in [J/(kg*K)], and the temperature in [C] or [K].

**Exchangers in parallel:**
If the drop in pressure on the fumes is too great, it is always possible to put two exchangers in parallel, which will have the effect of dividing the fume flow rate by two. The thermal power recovered then represents twice the power given by the graph. The liquid flow rate to be taken into account is also twice that given by the graph.
*For instance: for a flow rate of 6000 Nm3 per hour at 450°C, the graph indicates a pressure drop of 2840 Pa, which may be too high according to your specification. By putting two exchangers in parallel the fumes flow rate under consideration is then 3000 Nm3 per hour with the result that the pressure drop is 780 Pa.*



**Exchangers in line:**
If the drop in pressure on the fumes, calculated from the graph, is lower than the acceptable value for your system, it is then possible to recover more heat by using a second exchanger in line with the first one.
The pressure drop on the fumes is then double the initial value. In this case, please contact us for an estimate of other values.

**Notes:**

1. The graphs shown above give the possibility of drawing up an initial technical validation from the values of your thermal energy source. Please note that you are welcome to contact us for further technical details.
2. For any sizing where hot gas is used to reheat the air or for generating steam, please contact us directly.