

# ET 850

## Steam generator



### Learning objectives/experiments

- specific characteristic values of a steam boiler
- efficiency of a steam generator
- analysis of the exhaust gases
- influence of different burner settings
- saturation temperature and pressure of the steam
- steam enthalpy
- determination of the heat flux density and the overall heat transfer coefficient

### Description

- **laboratory-scale steam generator for wet or overheated steam**
- **characteristic values of a steam boiler**
- **various safety and monitoring devices**
- **setting up a complete steam power plant in conjunction with the ET 851 steam turbine**

A steam generator generates steam which will later be used in drives for steam turbines or for heating. Steam generators and steam consumers together form a steam power plant. Steam power plants work according to the Rankine cycle which is still one of the most important industrially used cyclic processes. Steam power plants are mainly used for electrical power generation.

The ET 850 steam generator and the ET 851 axial steam turbine together form a complete laboratory-scale steam power plant.

The ET 850 trainer serves to familiarise students with the components and principle of operation of a steam generator and enables them to examine the characteristic values of the system.

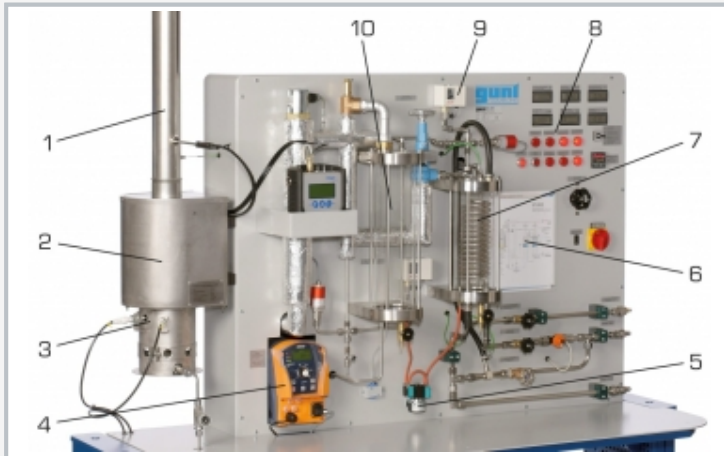
If the steam generator is operated without the steam turbine, the generated steam is directly liquefied in a condenser and fed back into the evaporation circuit via condensate and feed water pump. A water jet pump evacuates air from the condenser and generates negative pressure. The steam boiler is a once-through boiler with small water content and a short warm-up time.

As all components are clearly arranged on the front panel, the cyclic process can be easily monitored and understood. Sensors record the temperature, pressure and flow rate at all relevant points. The measured values can be read on digital displays. At the same time, the measured values can also be transmitted directly to a PC via USB. The data acquisition software is included.

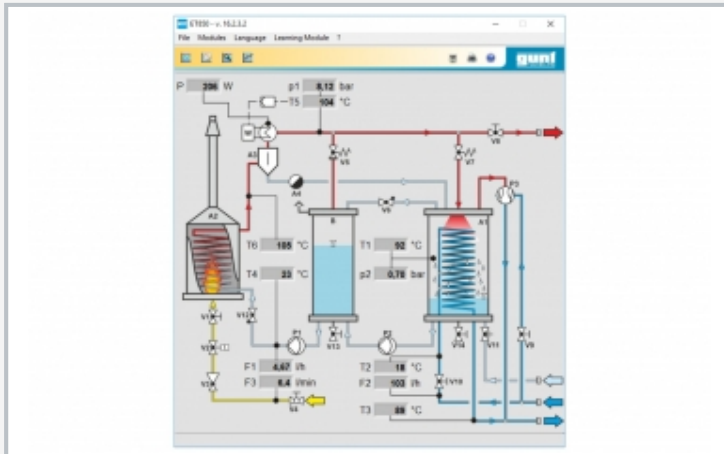
The steam generator has been constructed according to the Pressure Equipment Directive, it has been pressure-tested and is equipped with all legally required safety devices.

# ET 850

## Steam generator



1 chimney for exhaust gas, 2 steam boiler, 3 burner, 4 feed water pump, 5 condensate pump, 6 process schematic, 7 condenser, 8 displays and controls, 9 pressure switch, 10 feed water tank



Software screenshot: process schematic



Left: ET 850 steam generator; right: ET 851 axial steam turbine; set up ready for operation, together they form a steam power plant

### Specification

- [1] steam generator with gas-powered heater
- [2] ET 851 steam turbine can be connected to operate a steam power plant
- [3] condenser as a thick-walled glass cylinder with water-cooled tube coil and water jet pump for air extraction
- [4] closed-circuit feed water supply
- [5] sensor for temperature, pressure, flow rate
- [6] safety facilities in accordance with the Pressure Equipment Directive for safe operation
- [7] exhaust gas analysis with exhaust gas analyser
- [8] GUNT software for data acquisition via USB under Windows 7, 8.1, 10

### Technical data

#### Burner

- heating power: 6kW

#### Steam generator

- once-through boiler
- operating pressure: 8bar, max. pressure: 10bar
- max. steam temperature: 250°C
- max. steam output: 8kg/h
- power of superheater: 750W

#### Measuring ranges

- temperature: 0...400°C
- pressure:
  - ▶ 0...1,6bar abs. (condenser)
  - ▶ 0...16bar (live steam)
- flow rate:
  - ▶ 0...14L/min (propane gas)
  - ▶ 0...720L/h (cooling water)
  - ▶ 0...15L/h (feed water)

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase, 120V, 60Hz, 1 phase

LxWxH: 1830x790x1770mm (without chimney)

Weight: approx. 280kg

### Required for operation

gas supply (propane gas): 700g/h, 50mbar  
 water connection: 720L/h, 2bar, drain  
 ventilation, exhaust gas routing  
 PC with Windows recommended

### Scope of delivery

- 1 trainer
- 1 GUNT software CD + USB cable
- 1 exhaust gas analyser
- 1 packing unit of distilled water (20L)
- 1 set of tools
- 1 set of instructional material

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### Required accessories

061.85100	ET 851	Axial steam turbine
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### Optional accessories

061.80550	ET 805.50	Determination of the vapour content
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