

# ET 830

## Steam power plant, 1,5kW



### Description

- complete laboratory-sized steam power plant
- closed steam-water circuit
- plant monitored and controlled with PLC

In steam power plants, thermal energy is first converted into mechanical energy and then into electrical energy. A steam power plant essentially consists of a heat source for generating steam, a turbine with load, and a cooling mechanism for condensing the steam.

ET 830 has been designed specifically for engineering education in the field of power plant technology, and driving and driven machines. It offers a wide range of experiments to learn about the operational processes in a steam power plant.

An oil-fired once-through steam boiler produces wet steam that is turned into superheated steam by means of a superheater. The boiler's short heat-up time means rapid steam generation is possible. Load is applied to the turbine with a generator. The turbine output is determined by speed and torque.

Downstream of the turbine, the steam is condensed and returned to the boiler. The feedwater circuit is fitted with a complete water treatment system, which consists of a regenerable ion exchanger and chemical dosing. Sensors record the temperature, pressure, speed, 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 control panel includes a clear process schematic of the plant. The system is monitored and controlled by a programmable logic controller (PLC).

The experimental plant is built in accordance with statutory safety regulations and includes the mandatory safety facilities. The steam generator is type tested and does not require specific permissions.

The plant can optionally be operated with the cooling tower ET 830.01 or ET 830.02 to supply cooling water.

### Learning objectives/experiments

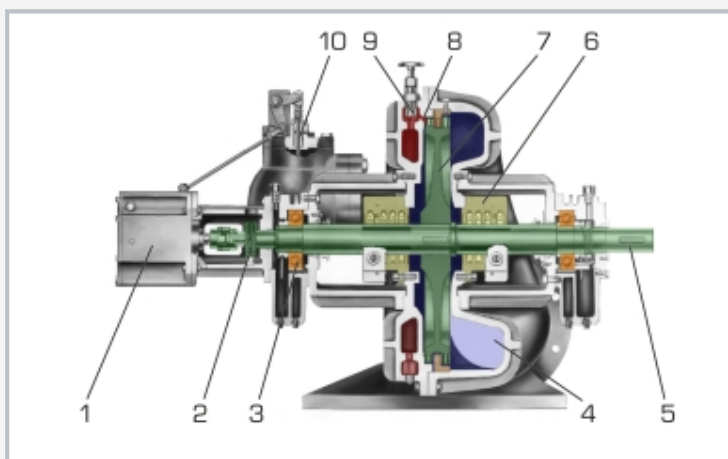
- steam power plant and its components
- start-up, operation and shut down of a steam power plant
- closed steam-water circuit with feed-water treatment
- among others, determining:
  - ▶ boiler efficiency
  - ▶ mechanical/thermal efficiency of the turbine
  - ▶ condenser efficiency
  - ▶ specific fuel consumption of the plant

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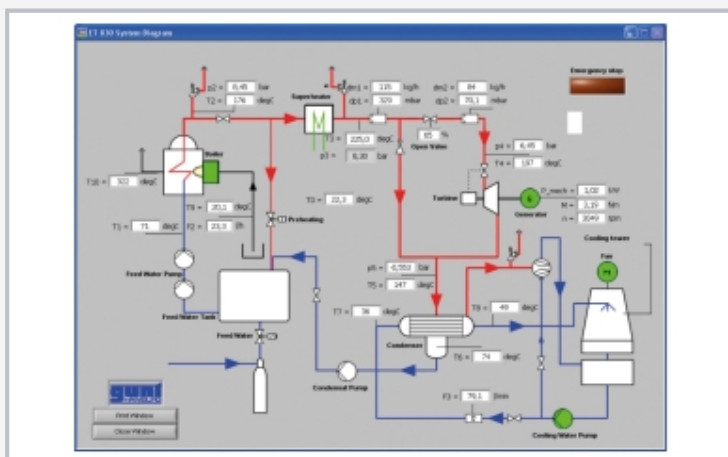
## Steam power plant, 1,5kW



1 superheater, 2 burner, 3 boiler, 4 condenser, 5 condensate pump, 6 turbine, 7 displays and controls, 8 feedwater tank with feedwater treatment



Sectional representation of the steam turbine used: 1 speed regulator, 2 tripping function, 3 bearing, 4 exhaust nozzle, 5 shaft, 6 shaft seal, 7 Curtis wheel, 8 nozzle, 9 nozzle valve, 10 control valve



Software screenshot: process schematic

### Specification

- [1] laboratory-sized steam power plant
- [2] oil-fired steam generator with electric superheater
- [3] single-stage axial turbine with Curtis wheel, vacuum or exhaust operation
- [4] DC generator as turbine load
- [5] water-cooled condenser
- [6] feedwater treatment
- [7] GUNT software for data acquisition via USB under Windows 10
- [8] plant monitored and controlled with integrated PLC
- [9] cooling water connection 10m<sup>3</sup>/h or cooling tower ET 830.01/ET 830.02 required

### Technical data

#### Steam generator

- steam output: 200kg/h at 11 bar
- max. fuel consumption: 12L/h
- heat-up time: 8min
- max. pressure: 13bar

#### Superheater

- power: 7kW

#### Single-stage axial turbine with Curtis wheel and hydraulic speed regulator

- power: max. 1,5kW at 3000min<sup>-1</sup>

#### Water-cooled condenser

- cooling capacity: 98kW
- transfer surface: 2,5m<sup>2</sup>

#### Measuring ranges

- temperature: 9x 0...400°C, 2x 0...100°C
- flow rate: 0...167L/min (cooling water)
- pressure: 3x 0...16bar, 1x ±1bar
- torque: 0...20Nm
- speed: 0...4000min<sup>-1</sup>

#### 400V, 50Hz, 3 phases

#### 400V, 60Hz, 3 phases, 230V, 60Hz, 3 phases

LxWxH: 3500x2000x2450mm

Weight: approx. 1950kg

### Required for operation

- cooling water 10m<sup>3</sup>/h, drain or ET 830.01/ET 830.02
- compressed air connection: 4,5bar, 150L/h
- ventilation, exhaust gas routing
- PC with Windows recommended

### Scope of delivery

- 1 experimental plant
- 1 GUNT software + USB cable
- 1 set of instructional material including detailed operating manual

## **ET 830**

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Optional accessories

ET 805.50            Determination of the vapour content

for the operation at ambient temperatures below 27°C

ET 830.01            Cooling tower 115kW

for the operation at ambient temperatures above 27°C

ET 830.02            Cooling tower 140kW

for Remote Learning

GU 100            Web Access Box

with

ET 830W            Web Access Software