

ET 805

Steam power plant 20kW with process control system



Description

- complete steam power plant with process control system based on Ethernet and PLC
- plant monitored and controlled via touchscreen control station

Nowadays large process engineering systems, such as steam power plants, are managed with process control systems. The ET 805 Steam Power Plant is specifically designed for training purposes in the field of power plant engineering with process control systems. Due to the size and complexity of the system, in many aspects the operating behaviour corresponds to that of actual large-scale plants, thereby enabling training that is as close to the real thing as possible. The plant consists of four separate modules and can therefore be flexibly adapted to the space available in the laboratory:

Module A steam generator assembly: a gas/oil-fired once-through steam boiler and a downstream electric superheater generate superheated steam. The feedwater circuit is equipped with a water treatment system with ion exchangers and chemical dosing.

Module B steam turbine assembly: the superheated steam is fed to a single-stage industrial turbine with speed control. This drives a synchronous generator which can be operated in grid connected or stand-alone mode. The exhaust steam from the turbine is condensed and fed back to the feedwater circuit.

Module C wet cooling tower: with forced draught for operation outdoors.

Module D control station: sensors capture all relevant plant parameters. The measured values are both output to the process control system with programmable logic controller and sent to a PC for data acquisition, where they are presented and analysed with GUNT software.

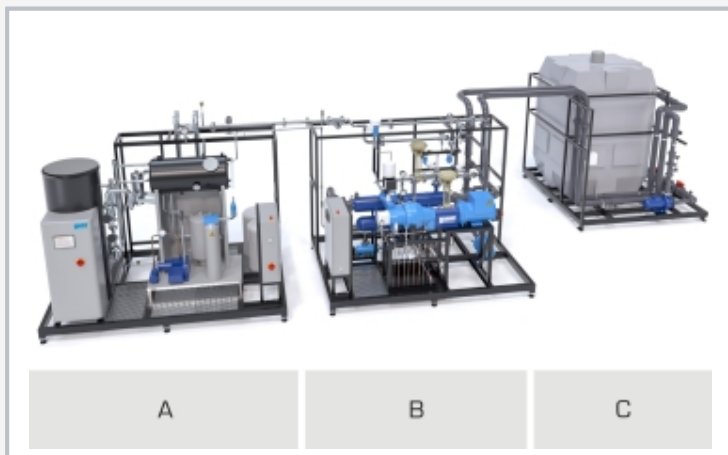
Operation of the plant is fully monitored and controlled by the process control system. It is operated via modern touchscreen technology on the control station. A safety system ensures the relevant components are shut-down and error conditions detected in critical operating states.

Learning objectives/experiments

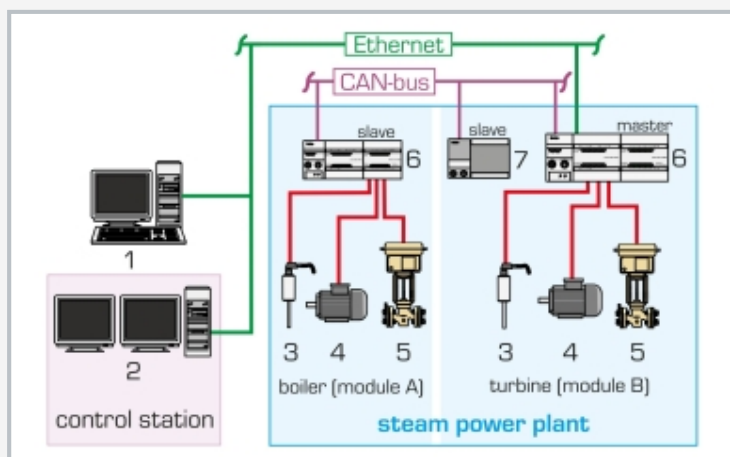
- design and function of a complete steam power plant with control and regulation system
- start-up, operation, shut down, servicing and maintenance of a steam power plant
- plant control and monitoring via a process control system
- recording and evaluation of the most important operating parameters
- determining: input and output power, component and system efficiency, specific fuel consumption

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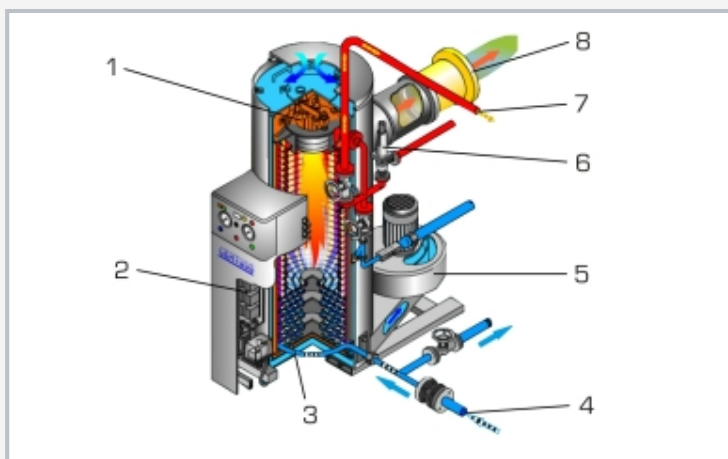
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Steam power plant modules without control station: module A steam generator with superheater and feedwater treatment, module B steam turbine with generator and condenser, module C wet cooling tower



Process control system and module D control station: 1 data acquisition PC, 2 control PC, 3 sensors, 4 pumps/motors, 5 valves, 6 PLC programmable logic controller, 7 PPU synchronous generator



Sectional representation of once-through steam boiler: 1 oil/gas burner, 2 electrical controller, 3 evaporating coil, 4 feedwater supply, 5 combustion air fan, 6 safety valve, 7 steam extraction, 8 exhaust gas nozzle

Specification

- [1] laboratory-sized steam power plant
- [2] gas/oil-fired once-through steam boiler with electrical superheater
- [3] single-stage industrial steam turbine with Curtis wheel
- [4] electronic speed control with electro-pneumatic control valve
- [5] synchronous generator with PPU synchronising device for grid connected or stand-alone operation
- [6] water-cooled condenser with cooling water circuit and wet cooling tower
- [7] feedwater treatment with ion exchanger and chemical dosing
- [8] modern digital plant control via a process control system
- [9] control station with complete instrumentation on modern LCD monitors, touchscreen operation

Technical data

Steam boiler

- max. steam output: 600kg/h at 13bar
- max. heat output: 393kW
- max. fuel consumption: 36,8kg/h

Superheater, capacity: 32kW, 250°C

Single-stage action turbine with Curtis wheel and electronic speed control

- max. power output: 20kW at 3600min⁻¹

Synchronous generator

- max. output: 17kVA with 400V, 60Hz

Water-cooled condenser

- cooling capacity: 389kW
- transfer surface: 5,5m²

Cooling tower, max. cooling capacity: 540kW

400V, 50Hz, 3 phases

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

LxWxH: 3100x2000x2500mm (steam generator)

LxWxH: 2400x2000x2500mm (steam turbine)

LxWxH: 2000x2000x2800mm (cooling tower)

Total weight: approx. 4500kg

Required for operation

water connection: 1,5m³/h, drain
compressed air: min. 8bar, 6000L/h
ventilation, exhaust gas routing

Scope of delivery

- 1 steam generator assembly
- 1 steam turbine assembly
- 1 cooling tower
- 1 control station including hardware and software
- 1 set of tools
- 1 set of instructional material

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Optional accessories

ET 805.50 Determination of the vapour content