

# ET 860

## Safety devices on steam boilers



### Description

- steam boiler simulation with pressure and water level regulation
- safety chain with commercially available components
- transparent boiler, clear view of the water level

The pressure and temperature in a steam boiler are increased by constantly supplying energy so that the liquid medium (in most cases water) becomes gaseous. Steam boilers are monitored by safety devices which are electrically connected in series, the so-called "safety chain". If one of the monitoring or control devices trips, an alarm is triggered and the entire system or the affected system component is switched off.

The ET 860 trainer enables a steam boiler simulation to demonstrate the operating principle and response behaviour of a safety chain according to legal regulations. The trainer has a closed water circuit which consists of a supply tank, a pump and a transparent steam boiler model with burner. The boiler is equipped with industrial components which monitor and/or regulate the water level and the pressure.

The components used have a high practical relevance. The safety chain for the burner is functional. Burner operation is simulated.

In addition to the safety devices, the system is equipped with 15 fault circuits. This enables the simulation of system component faults so that students can learn how to localise the faults.

Sensors measure the water level and the pressure. The measured values are transmitted directly to a PC via USB. The data acquisition software is included. The process schematic with the safety components, the pressure curves and a representation of the water level can be observed in the software.

### Learning objectives/experiments

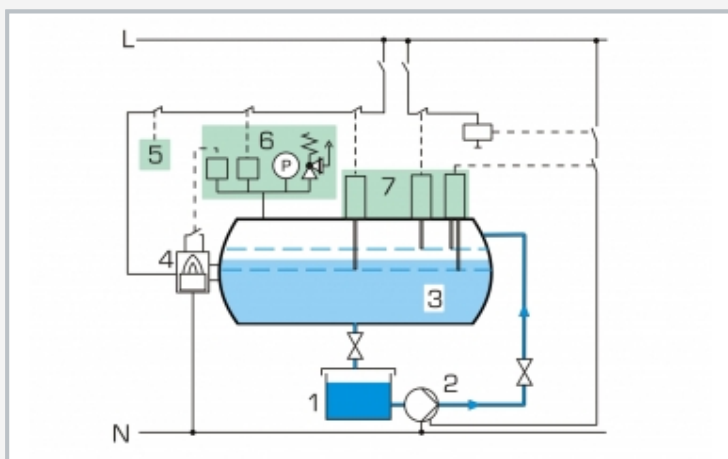
- model of an oil-fired steam boiler with operating and safety components
- characteristics of the monitoring elements
- fault circuits
  - ▶ burner with flame monitoring
  - ▶ pressure switch and limiter
  - ▶ feed water and level controller
  - ▶ high and low water limiter

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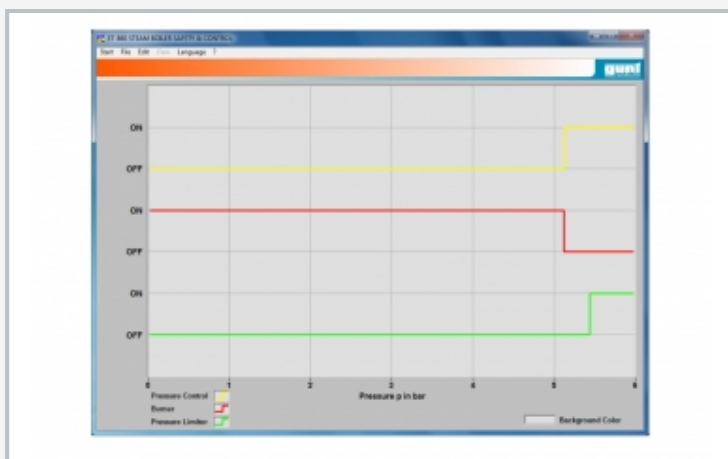
## Safety devices on steam boilers



1 water level monitoring, 2 burner, 3 steam boiler model, 4 supply tank, 5 switch cabinet, 6 switch box for fault circuit, 7 pressure measurement equipment



Safety chain of a steam boiler  
1 supply tank, 2 feed water pump, 3 boiler, 4 burner, 5 time control, 6 pressure monitoring, 7 water level monitoring;  
green: safety chain according to legal regulations, blue: water



Software screenshot: behaviour of burner, pressure limiter and pressure controller if the pressure in the boiler rises

### Specification

- [1] simulation of the operation of a steam boiler
- [2] control of water level and pressure of the boiler and fault circuit
- [3] 15 faults that trigger the safety chain
- [4] safety chain according to legal regulations containing: level switches, pressure switch and pressure controller
- [5] transparent boiler to observe the water level
- [6] steam pressure simulated using compressed air
- [7] operation of burner simulated
- [8] front panel with process schematic, indicator lamps and lab jacks
- [9] GUNT software for data acquisition via USB under Windows 8.1, 10

### Technical data

Boiler capacity: 110L  
Supply tank capacity: 150L

Pump  
 ■ power consumption: 40...70W  
 ■ max. flow rate: 66L/min  
 ■ max. head: 4m

Pressure switch: 0,5...6bar  
 Pressure limiter: 0,5...6bar  
 Safety valve: 6bar

Measuring ranges  
 ■ pressure: 0...6bar  
 ■ level: 0...100%

230V, 50Hz, 1 phase  
 230V, 60Hz, 1 phase  
 120V, 60Hz, 1 phase  
 UL/CSA optional  
 LxWxH: 1850x790x1800mm  
 Weight: approx. 220kg

### Required for operation

compressed air connection: 5bar  
 PC with Windows

### Scope of delivery

- 1 trainer
- 1 GUNT software + USB cable
- 1 multimeter
- 1 set of laboratory cables
- 1 set of instructional material