ET 292 Fuel Cell System

*** Water-cooled polymer-membrane fuel cell combined heat and power**

*** Integrated control and monitoring of all operating and safety parameters**

*** GUNT software for control and data acquisition**

Technical Description

Fuel cells are energy converters that, unlike heat engines, convert chemical energy directly into electrical energy. Heat is generated as a by-product during this process.

The main component of ET 292 is a polymer-membrane fuel cell which is operated in combined heat and power generation.

The system is supplied with high-purity hydrogen from a pressure vessel on the anode side and with oxygen from the ambient air on the cathode side. The fuel cell is operated either current-regulated, voltage-regulated or power-regulated via an integrated electronic load. The setpoint of the electronic load allows a precise adjustment of all operating points and a very accurate recording of characteristics. The technically usable thermal energy is dissipated to the environment via a cooling circuit and can be accounted for via the integrated instrumentation. The water accruing during operation is collected in a water separator. In the fuel cell's dead-end mode the accruing water is disposed of via a fully configurable purge valve for hydrogen. The system is operated via a PC.

Auxiliary energy for pump, fan and control required for operation is provided from the mains. The moisture in the stack can be regulated via the operating temperatures and the supplied air flow, so that no external humidification is required.

All relevant measuring values are recorded to work out the fuel cell's energy balance. The measured values are transmitted directly to a PC via USB. The GUNT data acquisition software is included.

The well-structured instructional material sets out the fundamentals and provides a step-by-step guide through the experiments.

Learning Objectives / Experiments

- conversion of chemical energy into electrical and thermal energy
- function and design of a fuel cell system
- relationships of fuel cell operating parameters
- effects on the electrical performance of fuel cells
- recording and visualisation of all relevant voltage/current characteristics
- calculation of relevant variables

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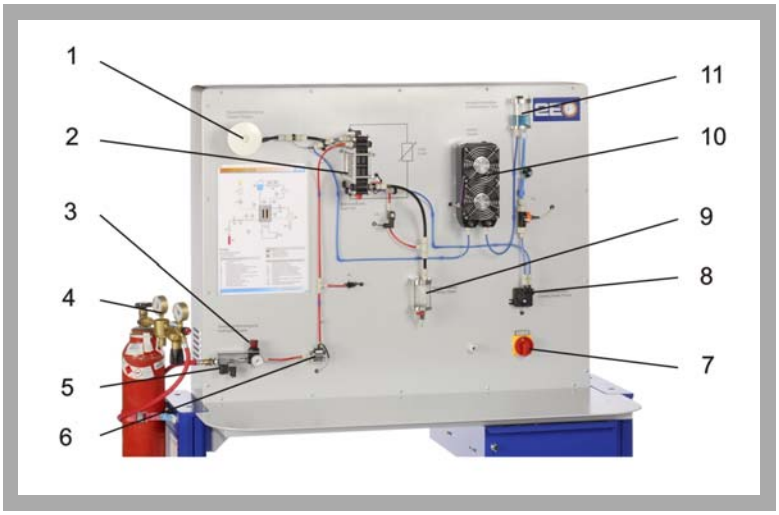
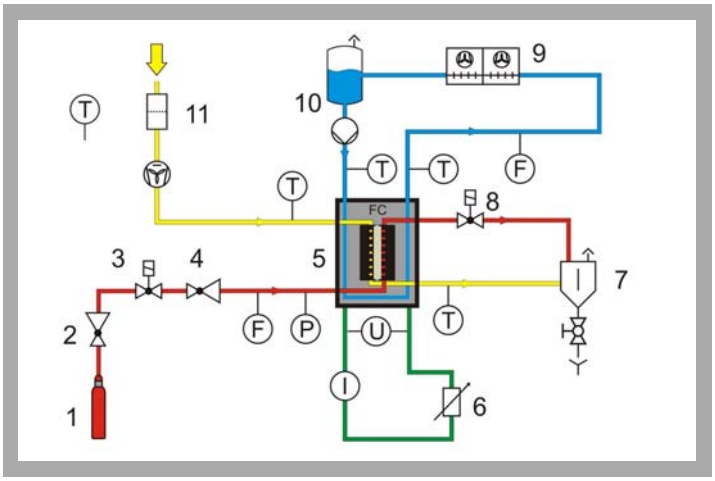
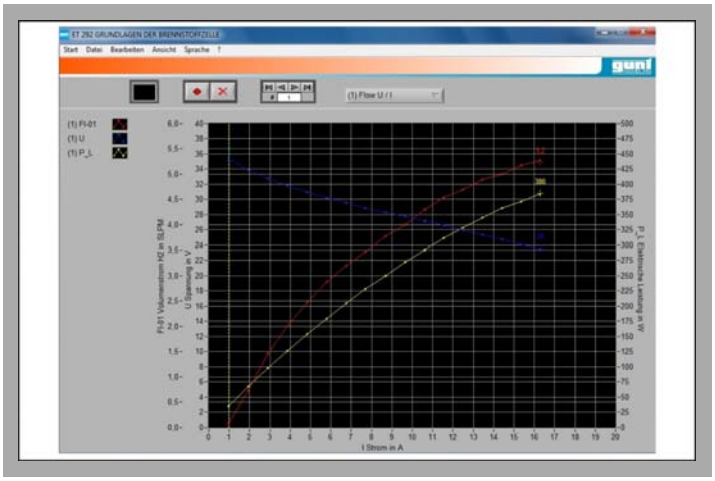


1 filter with cathode blower, 2 fuel cell, 3 low-pressure reducing valve, 4 high-pressure reducing valve with hydrogen pressure vessel, 5 inlet valve, 6 hydrogen flow rate sensor, 7 main switch, 8 cooling water pump, 9 water separator, 10 water cooler, 11 cooling water tank



1 hydrogen pressure vessel, 2 high-pressure reducing valve, 3 inlet valve, 4 low-pressure reducing valve, 5 fuel cell (FC), 6 electronic load, 7 water separator, 8 purge valve, 9 water cooler, 10 cooling water tank with cooling water pump, 11 filter with cathode blower; red: hydrogen, yellow: ambient air, blue: cooling water, green: load circuit; F flow rate, P pressure, T temperature, U voltage, I current



Software screenshot: Characteristic of the fuel cell

Specification

[1] investigation of a polymer-membrane fuel cell
[2] water cooled system in combined heat and power
[3] hydrogen supplied via standard pressure vessel
[4] high-pressure reducing valve for hydrogen pressure vessel supplied
[5] oxygen supplies directly from the ambient air
[6] precise adjustment of all operating points via electronic load
[7] regulation of moisture without external humidification
[8] sensors for flow rate, pressure, temperature, voltage and current strength
[9] complete operation and evaluation via a PC
[10] GUNT software for data acquisition via USB under Windows Vista or Windows 7

Technical Data

Nominal output: 360W
Nominal operating point: 15A / 24V
Thermal power: approx. 480W depending on ambient conditions
Required ambient temperature: 5...30°C
Required inlet pressure: 1...200bar

Measuring ranges
- flow rate (cooling water): 0,6...0,7L/min
- flow rate (hydrogen): 1...5L/min
- pressure in the system (hydrogen): 250...350mbar
- temperatures: 5...55°C
- voltage (stack): 20...40V
- current (stack): 0,1...20A

Dimensions and Weight

LxWxH: 1750x780x1770mm
Weight: approx. 180kg

Required for Operation

230V, 50/60Hz, 1 phase
Hydrogen of purity 3.0 in pressure vessel
Anti-freeze as anti-fouling additive
PC

Scope of Delivery

1 trainer
1 hydrogen hose
1 high-pressure reducing valve for hydrogen pressure vessel
1 CD with GUNT software + USB cable
1 set of instructional materials

Order Details

061.29200 ET 292 Fuel Cell System