



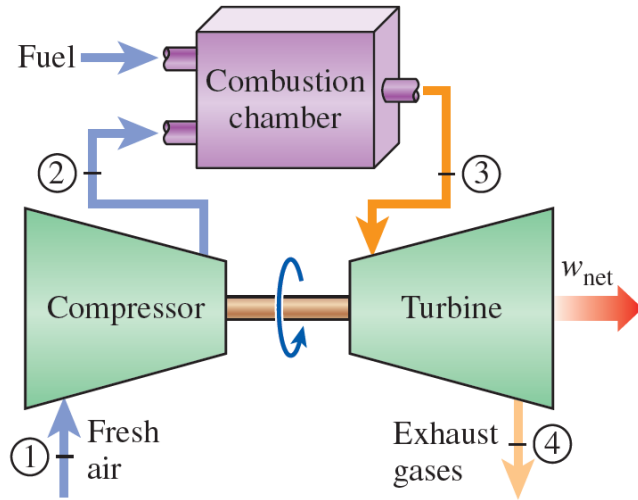
Gas turbine (Experimental device)

Agenda

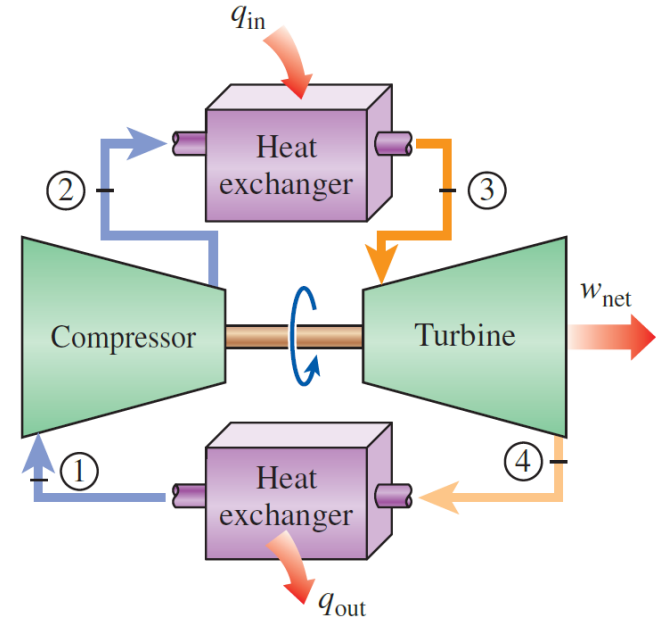
- **Introduction to gas turbines**
- **Basic schematic of the educational experimental device at TUL**
- **Diagram of individual loops (proces schematic)**

Introduction to gas turbines

Basic schematic of gas turbine



An open-cycle gas-turbine engine.

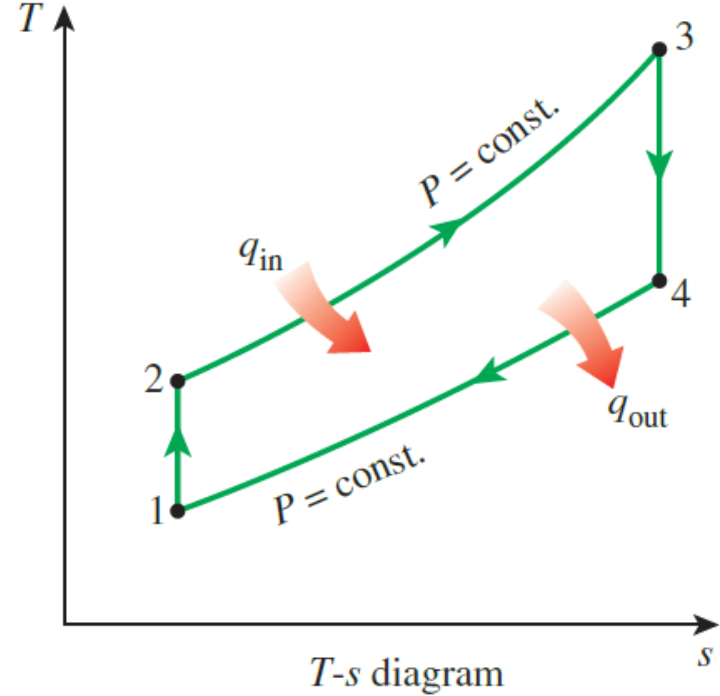
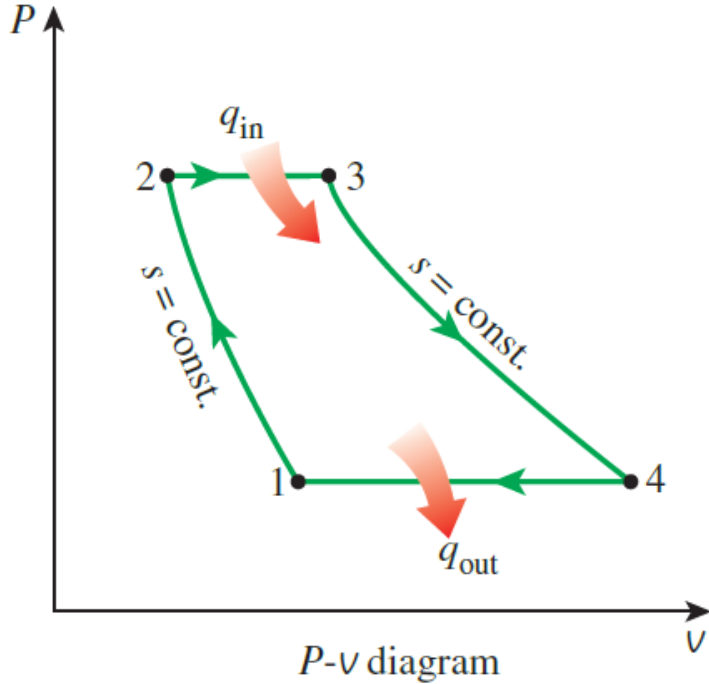


A closed-cycle gas-turbine engine.

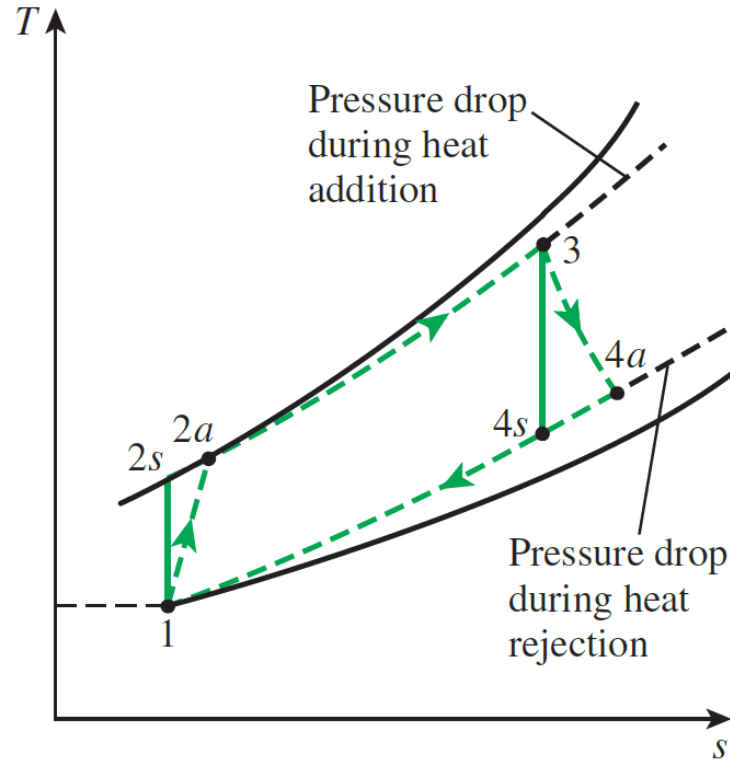
Thermodynamics of gas turbines

- Pracovní cyklus plynové turbíny lze zjednodušeně popsat tzv. **Braytonovým cyklem**
- Cyklus může být **ideální** nebo může zahrnovat např. vliv tlakových ztrát (**reálný**)

Diagrams of Brayton cycle (p-v, T-s)



Diagrams of Brayton cycle – real cycle

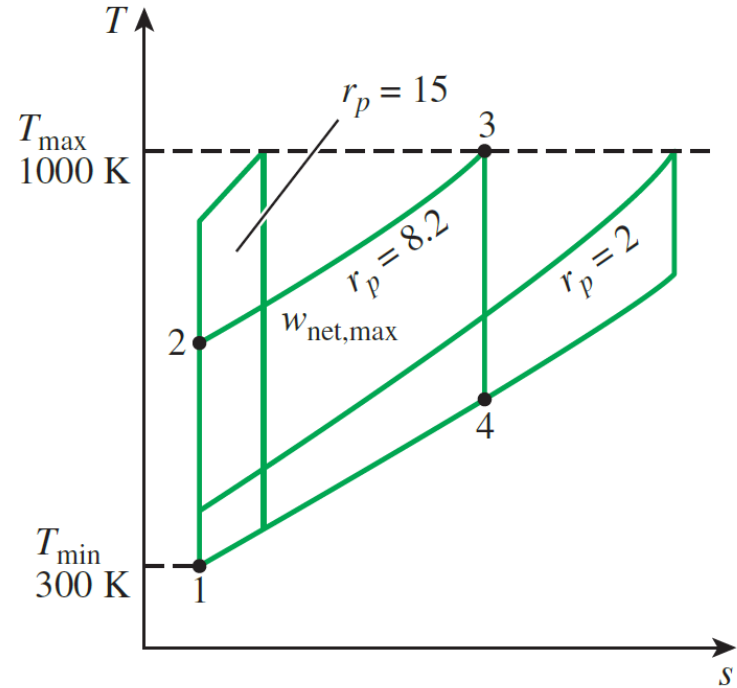
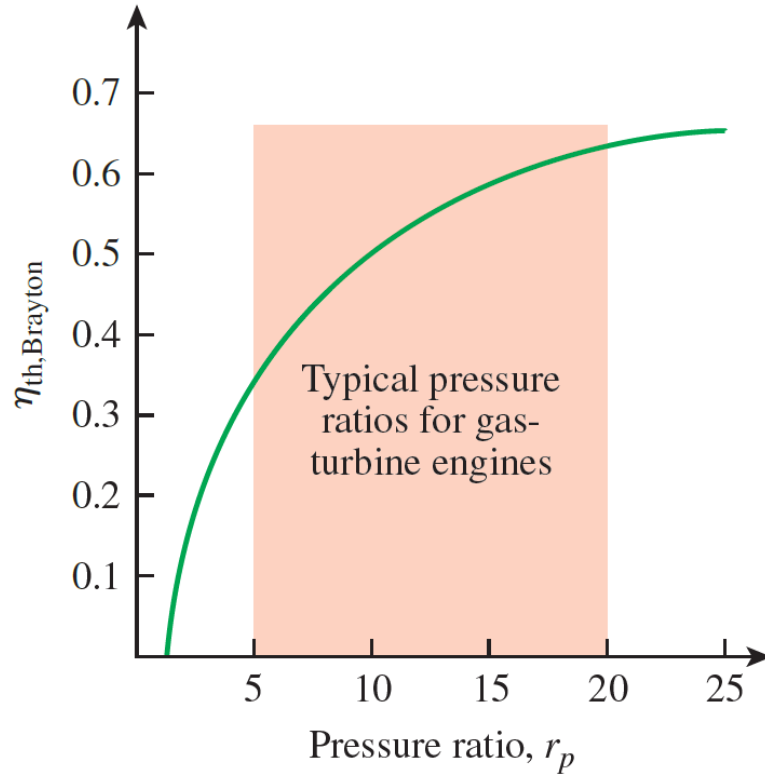


Brayton cycle efficiency

$$\eta_{\text{th,Brayton}} = 1 - \frac{1}{r_p^{(k-1)/k}}$$

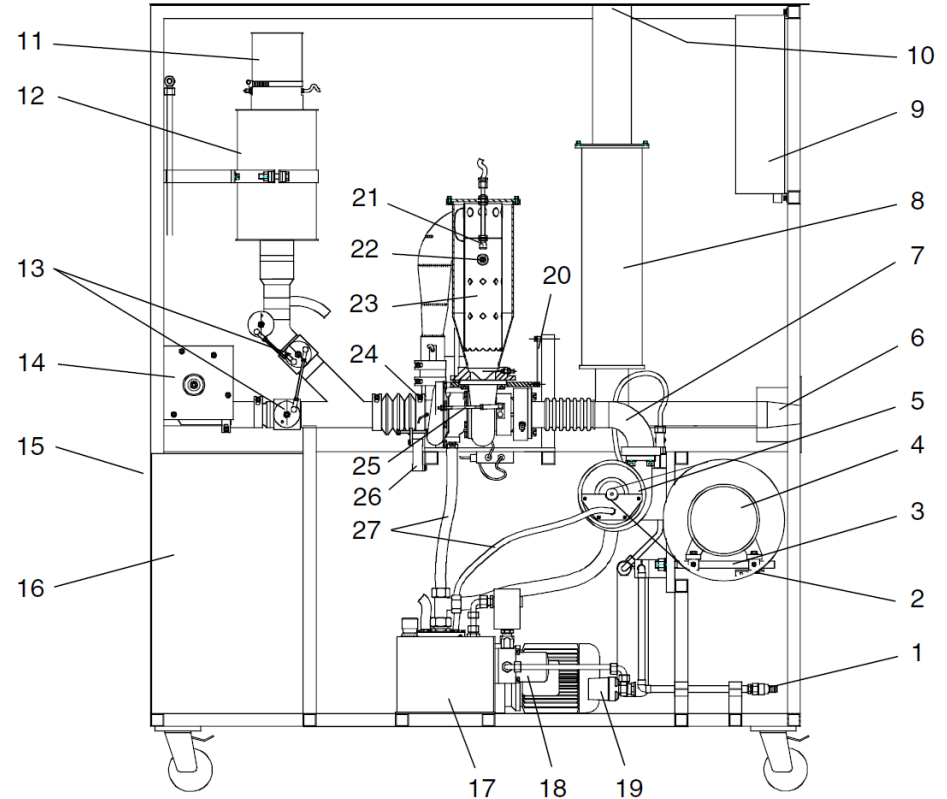
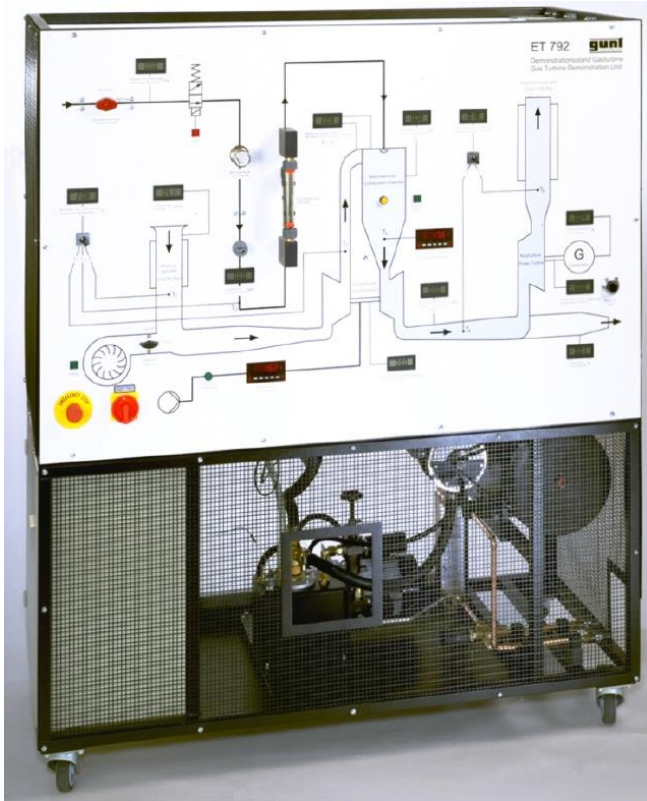
$$r_p = \frac{P_2}{P_1}$$

Brayton cycle efficiency (2)

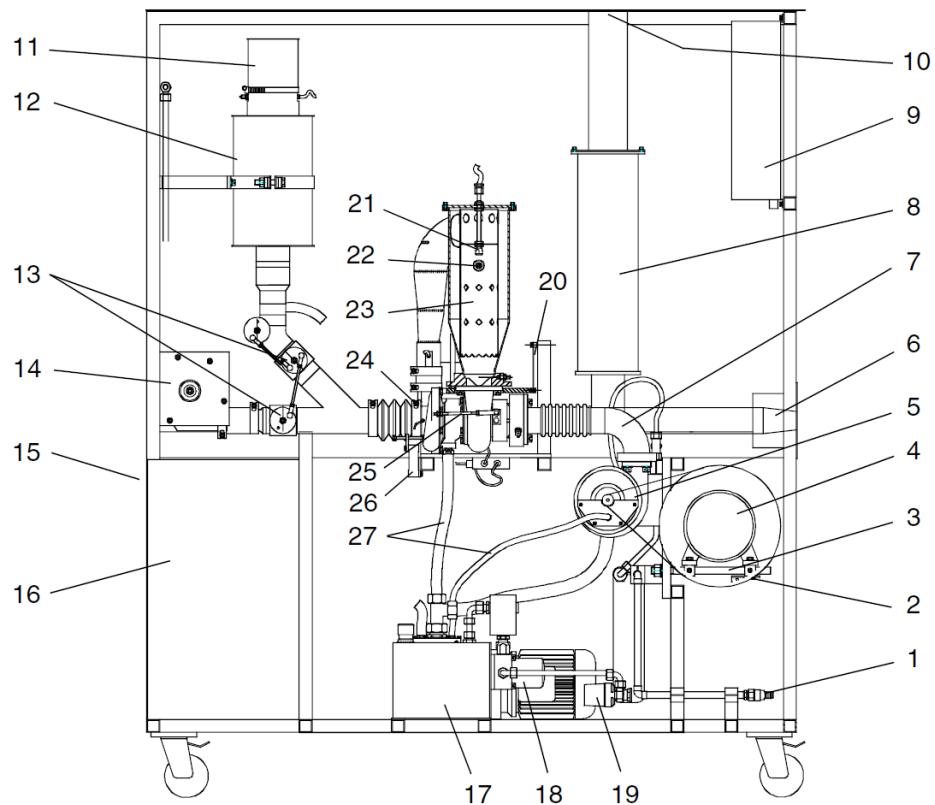


Basic schematic of the educational experimental device at TUL

Gas turbine unit schematic



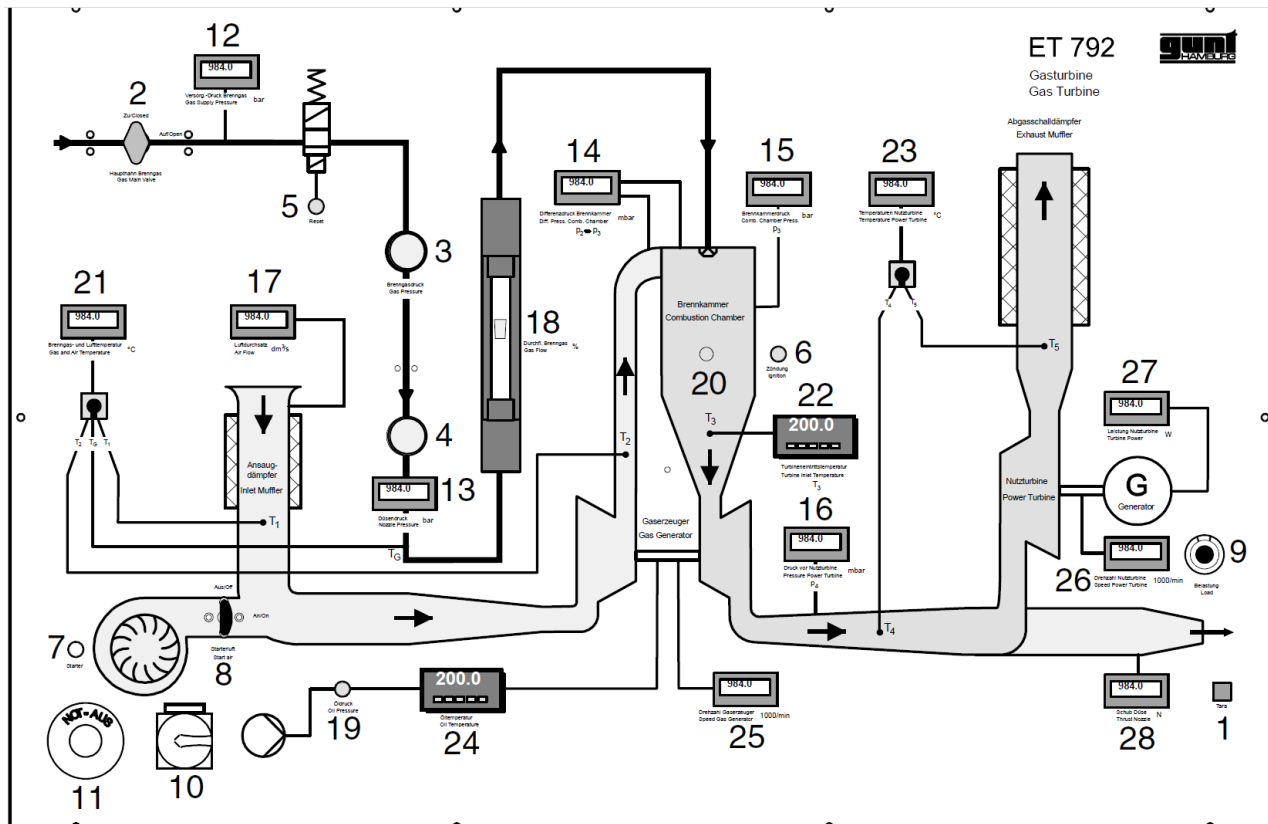
Gas turbine unit schematic (2)



Gas turbine unit schematic (3)

1	Cooling water inlet and outlet	15	USB port
2	Speed sensor power turbine	16	Switch box
3	Belt tensioner	17	Oil tank
4	Generator	18	Oil filter
5	Power turbine	19	Oil cooler thermostat
6	Jet pipe and nozzle	20	Leaf spring mounting
7	Connecting pipe to power turbine	21	Gas nozzle
8	Exhaust muffler	22	Ignition plug
9	Braking resistors	23	Combustion chamber
10	Exhaust outlet	24	Speed sensor gas generator
11	Intake funnel with measuring orifice	25	Gas generator
12	Intake muffler	26	Force transducer
13	Change-over damper	27	Oil return pipes
14	Starting fan		

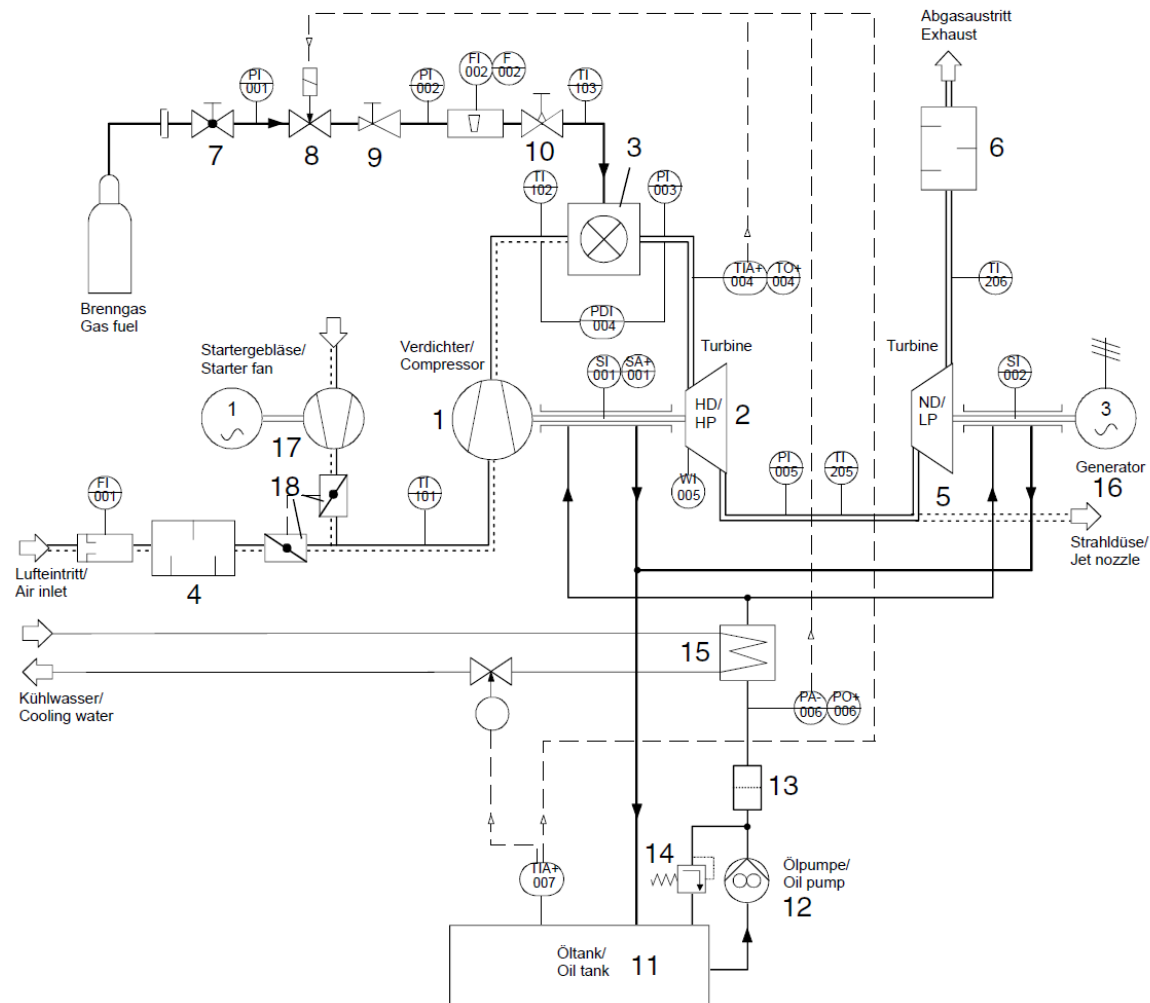
Gas turbine unit schematic (4)



Gas turbine unit schematic (5)

1	Tara thrust display	15	Pressure before the turbine (G)
2	Main gas valve	16	Pressure before the power turbine (G)
3	Gas pressure regulator	17	Air flow rate, speed at the inlet
4	Gas control valve	18	Gas flow rate
5	Rapid shut down button	19	Oil pressure indicator lamp
6	Ignition button	20	Ignition indicator lamp
7	Starting fan switch	21	Temperatures at air inlet, gas inlet and compressor
8	Change-over damper rotary knob for starting air	22	Temperature at turbine inlet
9	Potentiometer for generator load	23	Temperatures at power turbine inlet and power turbine outlet
10	Master switch	24	Oil temperature
11	Emergency stop switch	25	Speed at gas generator
12	Gas supply pressure (bottle pressure) (G)	26	Speed at power turbine
13	Gas nozzle pressure (G)	27	Power at generator
14	Differential pressure, combustion chamber (D)	28	Thrust

Diagram of individual loops (proces schematic)



Schematic of individual loops - legend

1	Compressor	10	Control valve
2	Turbine	11	Tank
3	Combustion chamber	12	Oil pump
4	Muffler	13	Oil filter
5	Power turbine	14	Pressure regulator
6	Exhaust muffler	15	Oil cooler
7	Main valve	16	Generator
8	Rapid action stop valve	17	Starting fan
9	Pressure regulator	18	Change-over damper

Lecture summary

- **Gas turbines theory**
- **Brayton cycle (open vs closed)**
- **Basic schematic of the experimental unit**



Thank You!