ET 432

Behaviour of a piston compressor

Description

- **open two-cylinder piston compressor from refrigeration**
- **record of the pressure/volumetric flow rate characteristic**
- **measurement of intake volume and pressure ratio**
- **determination of volumetric and mechanical efficiency**
- **GUNT software for data acquisition**

Smaller refrigeration systems usually have a piston compressor. Piston compressors are positive displacement machines. These differ in their characteristics decisively from flow equipment which include the turbo compressors that are common in very large systems.

In piston compressors the flow rate is mainly dependent on the displaced volume and speed. Due to the unavoidable dead space the flow rate drops with increasing pressure ratio. Because the flow rate is a measure for the refrigeration capacity of the refrigeration system, the properties of the compressor are important for the capacity of the whole system.

In this trainer a commercial open refrigerant compressor is operated in an open process with air. The inlet and outlet pressures and thus the pressure ratio can be adjusted via valves in wide ranges. The drive via a frequency converter permits variable speeds. Pressures, temperatures, electric power consumption, speed and torque are recorded. The measured values are transmitted directly to a PC via USB. The data acquisition software is included.

Learning objectives/experiments

- determine characteristic variables of a piston compressor during experiments
- record of the pressure/volumetric flow rate characteristic
- determination of the volumetric efficiency at different intake pressures, pressure ratios and speeds
- determination of the isothermal compressor capacity
- measurement of the mechanical and electrical power consumption in dependence of the intake pressure and pressure ratio
- determination of the mechanical efficiency and the overall efficiency

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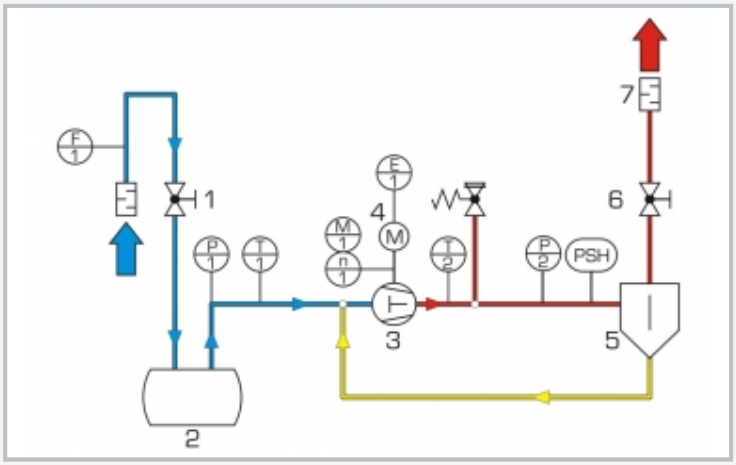
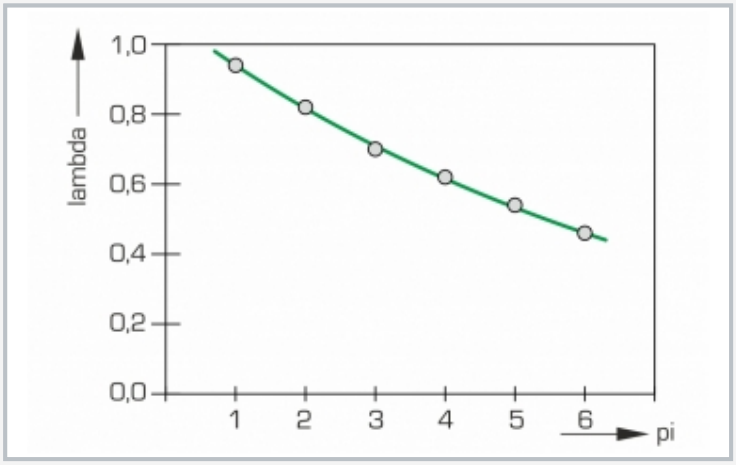
1 displays and controls, 2 flow meter, 3 refrigerant compressor, 4 stabilisation tank, 5 drive motor with torque measurement, 6 manometer, 7 oil separator, 8 pressure switch, 9 valve



1 intake side valve, 2 stabilisation tank, 3 compressor, 4 drive motor, 5 oil separator, 6 delivery side valve, 7 silencer; F flow rate, T temperature, P pressure, M torque, n speed, E electric power, PSH pressure switch; blue: low pressure, red: high pressure, yellow: oil return



Progression of the volumetric efficiency lambda in dependence on the pressure ratio pi

Specification

[1] experimental unit for piston compressor from refrigeration
[2] open process with air
[3] typical open two-cylinder compressor
[4] drive via asynchronous motor with frequency converter for speed adjustment
[5] inlet pressure and outlet pressure (pressure ratio) adjustable via valves
[6] instruments: 2 manometers, flow meter, sensors for pressure, temperature, speed, torque (via force), flow rate, digital power indication
[7] GUNT software for data acquisition via USB under Windows 7, 8.1, 10

Technical data

Compressor
- speed: 465...975min^{-1}
- number of cylinders: 2
- stroke: 26mm
- borehole: 35mm
- displaced volume: 50cm^3
- max. displacement: 2,92m^3/h (at 1450min^{-1} motor speed)

Drive motor
- power: 550W
- speed: 0...1400min^{-1}

Measuring ranges
- torque: 0...10Nm
- speed: 0...2500min^{-1}
- power: 0...600W
- temperature: 1x 0...100°C, 1x 0...200°C
- flow rate: 0,4...3,2Nm^3/h
- pressure:
  - pressure sensor: -1...1,5bar / -1...24bar
  - manometer: -1...9bar / -1...24bar

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase
120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 1510x790x1750mm
Weight: approx. 148kg

Required for operation

PC with Windows recommended

Scope of delivery

1 trainer
1 GUNT software CD + USB cable
1 set of instructional material