

Training Course “**Basics of Refrigeration Technology**”

The training course does not only cover the detailed function of the four main components evaporator, compressor, throttling devices and condenser, but also their cooperation in the cycle of a refrigeration system.

Objectives

Introduction of the (theoretical and practical) basics of refrigeration technology

Becoming acquainted with the structure and the function of the main components of a refrigerant cycle in refrigeration and air conditioning systems as well as heat pumps

Understanding the function and the operating behaviour of the refrigeration machine at different operating conditions

Determination and interpretation of overheating and subcooling with regard to operational reliability and the filling level

Target group

Prospective practically working personnel of the refrigeration, air conditioning and heat pump technology as well as prospective technicians and specialized staff in craftsman's establishments, in trade and industry as well as in public authorities and offices who will be responsible for the operation of compression refrigeration systems for the cooling and for the use in heat pumps (in particular with small and medium performance). Basic knowledge of physics and mathematics (rearranging simple equations) is required.

Subject matter: **Structure and operational principles of refrigeration circuits**

- Explanations of the state variables pressure, temperature, heat content (enthalpy), specific heat capacity, density and specific volume of a substance
- States of aggregation: solid / liquid / gaseous
- Wet vapour / saturated vapour / overheated vapour; evaporation and condensation of a substance (vapour pressure curve / vapour table)
- The procedures in a single-stage compression refrigeration system with the processes evaporation / compression / condensation and expansion
- Illustration of these procedures in the temperature-enthalpy diagram (t, h diagram)
- Explanations of the terms work and power
- Introduction of the most important standardized formula and graphic symbols
- Measuring points of the refrigerant cycle

Theory: 200 min

Subject matter: **Superheat / subcooling**

Both system-characteristics are discussed as important assessment criteria with regard to the operating conditions of the refrigeration system:

- Advantages, disadvantages
- Possibilities of setting and modification
- Effects on the performance of the system
- Influencing variables
- Examples

Theory: 130 min

Subject matter: **Condenser**

- Task, function and mode of operation of the condenser
- Temperature profile – refrigerant or air and waterside
- Influencing variables with regard to subcooling
- Types of condensers
- Effects on the operating behaviour of the refrigeration system by:
 - Contamination of the condenser surface
 - Problems concerning the air supply
 - Overfilling or lack of refrigerant
 - Increased air inlet temperature at the condenser
 - Modification of the heat transfer surface

Theory: 90 min praxis: 190 min

Subject matter: **Compressor**

- Function of compressors
- Important technical terms like dead clearance, volumetric efficiency λ , efficiency ratio e
- Performance and energy requirement at different operating conditions on the suction
- and pressure sides
- Range of application of a refrigerant compressor
- Different types of compressors, advantages and disadvantages

Theory: 95 min praxis: 190 min

Subject matter: **Evaporator**

- Function of the evaporator
- Course of temperature over the evaporation path on the refrigerant, air, water and coolants side
- Types of evaporators
- Influence of the acting temperature difference on the performance and as criterion for the performance data
- Influences on the performance of the evaporator, like overheating, contamination, icing, air quantity, evaporator surface
- direct / indirect evaporation
- flooded evaporation / dry expansion

Theory: 90 min

Subject matter: **Throttling devices**

- various types, like capillary, automatic, thermostatic and electronic expansion valves; function and design of these expansion devices
- Special properties, like external and internal pressure equalization
- Characteristics like static overheating, inlet overheating and operation overheating
- Behaviour of the control path expansion device / evaporator at different operating conditions

Theory: 85 min praxis: 190 min

Subject matter: **Components of the refrigeration system**

Besides the four main components, the following components are required for the trouble-free, reliable operation of the refrigeration system, in particular taking into consideration the prevention of accidents:

- Filter drier
- Sight glasses
- Oil separators
- Safety components
- High-pressure receiver
- Liquid separators

Theory: 90 min

Subject matter: **Refrigerants**

- Types of currently used refrigerants
- Properties of refrigerants
- Ozone depletion
- Greenhouse effect
- Legal regulations
- Technical terms like retrofit, drop-in, refrigerant mixtures, temperature glide

Theory: 95 min