Claims

1. A method for conditioning air in a test space of a test chamber which serves to receive test material and which can be sealed against an environment and is temperature-insulated, a temperature in a temperature range of −20 °C to +180 °C being established within the test space by a cooling device of a temperature control device of the test chamber, the cooling device comprising a cooling circuit with a refrigerant, a heat exchanger, a compressor, a condenser and an expansion element, an internal heat exchanger of the cooling circuit connected to a high-pressure side of the cooling circuit upstream of the expansion element and downstream of the condenser and to a low-pressure side of the cooling circuit upstream of the compressor and downstream of the heat exchanger being used to cool the refrigerant of the high-pressure side,
   wherein
   a zeotropic refrigerant is used as the refrigerant, cooling of the refrigerant of the high-pressure side by means of the internal heat exchanger being used to lower an evaporation temperature at the expansion element, and wherein a suction pressure of the refrigerant of the low-pressure side is kept constant while the evaporation temperature of the refrigerant of the high-pressure side is being lowered.

2. The method according to claim 1, wherein the refrigerant evaporates at constant suction pressure on an evaporation section of the cooling circuit from the expansion element up to and including the internal heat exchanger.

3. The method according to claim 1, wherein a first portion of the refrigerant routed via the expansion element is evaporated in the heat exchanger and a second portion of the refrigerant is evaporated in the internal heat exchanger.

4. The method according to claim 1, wherein the evaporation temperature of the refrigerant of the high-pressure side is lowered in a self-controlled manner.

5. The method according to claim 1, wherein the temperature control device is used to lower a temperature of > +60 °C to +180 °C to a temperature of ≤ −20 °C in the test space.

6. The method according to claim 1, wherein the temperature control device is used to establish a temperature in a temperature range of −57 °C to +180 °C in the test space.

7. The method according to claim 1, wherein a refrigerant having a temperature glide of ≥ 5 K is used.

8. The method according to claim 1, wherein the refrigerant is evaporated at a suction pressure in a pressure range of 0.3 to 5 bar absolute.

9. The method according to claim 1, wherein the refrigerant is condensed at a condensation pressure in a pressure range of 5 to 35 bar absolute.

10. The method according to claim 1, wherein a nonflammable refrigerant having a relative CO_2 equivalent of < 2500 over 20 years is used.

11. A method for conditioning air in a test space of a test chamber which serves to receive test material and which can be sealed against an environment and is temperature-insulated, a temperature in a temperature range of −20 °C to +180 °C being established within the test space by a cooling device of a temperature control device of the test chamber, the cooling device comprising a cooling circuit with a refrigerant, a heat exchanger, a compressor, a condenser and an expansion element, an internal heat exchanger of the cooling circuit connected to a high-pressure side of the cooling circuit upstream of the expansion element and downstream of the condenser and to a low-pressure side of the cooling circuit upstream of the compressor and downstream of the heat exchanger being used to cool the refrigerant of the high-pressure side,
wherein
a zeotropic refrigerant is used as the refrigerant, cooling of the refrigerant of the high-

pressure side by means of the internal heat exchanger being used to lower an evaporation temperature at the expansion element and wherein a refrigerant mixture composed of a mass fraction of carbon dioxide (CO_2) of 30 to 50 mass percent and a mass fraction of at least one other component is used as the refrigerant, the other component being pentafluoroethane (C_2HF_5) and/or difluoromethane (CH_2F_2).

12. A method for conditioning air in a test space of a test chamber which serves to receive test material and which can be sealed against an environment and is temperature-insulated, a temperature in a temperature range of −20 °C to +180 °C being established within the test space by a cooling device of a temperature control device of the test chamber, the cooling device comprising a cooling circuit with a refrigerant, a heat exchanger, a compressor, a condenser and an expansion element, an internal heat exchanger of the cooling circuit connected to a high-pressure side of the cooling circuit upstream of the expansion element and downstream of the condenser and to a low-pressure side of the cooling circuit upstream of the compressor and downstream of the heat exchanger being used to cool the refrigerant of the high-pressure side,
wherein
a zeotropic refrigerant is used as the refrigerant, cooling of the refrigerant of the high-pressure side by means of the internal heat exchanger being used to lower an evaporation temperature at the expansion element and wherein the cooling device is operated exclusively below the critical point of the refrigerant.

13. A test chamber for conditioning air, the test chamber comprising a test space which serves to receive test material and which can be sealed against an environment and is temperature-insulated, and a temperature control device for controlling the temperature of the test space, a temperature in a temperature range of −20 °C to +180 °C being establishable within the test space by the temperature control device, the temperature control device having a cooling device comprising a cooling circuit with a refrigerant, a heat exchanger, a compressor, a condenser and an expansion element, the cooling circuit having an internal heat exchanger, the internal heat exchanger being connected to a high-pressure side of the cooling circuit upstream of the expansion element and downstream of the condenser and to a low-pressure

side of the cooling circuit upstream of the compressor and downstream of the heat exchanger,

wherein

the refrigerant is a zeotropic refrigerant, the refrigerant of the high-pressure side being coolable by the refrigerant of the low-pressure side at constant suction pressure on the low-pressure side by means of the internal heat exchanger and wherein a dew point temperature of the refrigerant is greater than a minimum temperature of the temperature range.

14. The test chamber according to claim 13, wherein the heat exchanger is of such a size that the refrigerant can only partially evaporate in the heat exchanger.

15. The test chamber according to claim 13, wherein the condenser is realized as a cascade heat exchanger of another cooling circuit of the cooling device.

16. The test chamber according to claim 13, wherein the temperature control device has a heating device comprising a heater and a heating heat exchanger in the test space.

17. The test chamber according to claim 13, wherein a first bypass having at least one controllable second expansion element is realized in the cooling circuit, the first bypass being connected to the cooling circuit upstream of the internal heat exchanger and downstream of the condenser, the first bypass being realized as an additional controllable internal cooling.

18. The test chamber according to claim 13, wherein another bypass having at least one other expansion element is realized in the cooling circuit, the other bypass bypassing the compressor downstream of the compressor and upstream of the condenser in such a manner that a suction gas temperature and/or a suction gas pressure of the refrigerant on the low-pressure side of the cooling circuit can be controlled upstream of the compressor and/or that a pressure difference between the high-pressure side and the low-pressure side of the cooling circuit can be equalized.

19. A test chamber for conditioning air, the test chamber comprising a test space which serves to receive test material and which can be sealed against an environment and is temperature-insulated, and a temperature control device for controlling the temperature of the test space, a temperature in a temperature range of −20 °C to +180 °C being establishable within the test space by the temperature control device, the temperature control device having a cooling device comprising a cooling circuit with a refrigerant, a heat exchanger, a compressor, a condenser and an expansion element, the cooling circuit having an internal heat exchanger, the internal heat exchanger being connected to a high-pressure side of the cooling circuit upstream of the expansion element and downstream of the condenser and to a low-pressure side of the cooling circuit upstream of the compressor and downstream of the heat exchanger,
wherein
the refrigerant is a zeotropic refrigerant, the refrigerant of the high-pressure side being coolable by the refrigerant of the low-pressure side at constant suction pressure on the low-pressure side by means of the internal heat exchanger and wherein a second bypass having at least one third expansion element is realized in the cooling circuit, the second bypass bypassing the expansion element downstream of the condenser and upstream of the internal heat exchanger, refrigerant being meterable by means of the third expansion element in such a manner that a suction gas temperature and/or a suction gas pressure of the refrigerant is controllable on the low-pressure side of the cooling circuit upstream of the compressor.