Technical Information

Applications of Direct Coolers

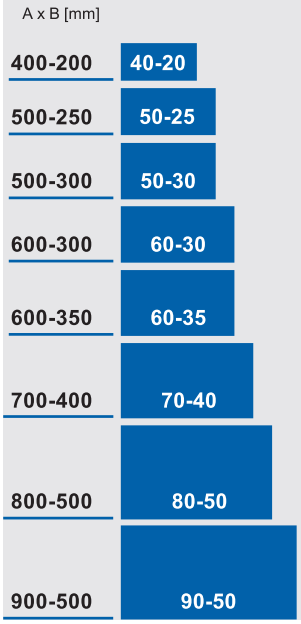
CHF direct coolers are intended for air cooling, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility and balanced parameters.

Operating conditions

The cooled air must be free of solid, fibrous, sticky and aggressive impurities. The air must also be free of corrosive chemicals or chemicals aggressive to aluminium, copper and/or zinc.
The cooler evaporator is filled with protective gas which is discharged after the evaporator is connected to the cooling circuit. The following operating coolants can be used: R123, R134a, R152a, R404a, R407c, R410a, R507, R12, and R22 (ASHRAE Number).

Dimensional Range

Figure 1 - Dimensions



CHF direct coolers are manufactured in a range of eight sizes according to the A x B dimensions of the connecting flange (see figure # 1). Three-row versions of coolers are available for all sizes. Non-standard versions of direct coolers can be delivered on the customer's request based on calculations performed using the AeroCAD design program. Direct coolers can be connected to air ducts in the same way as any other Vento duct system component. Direct coolers enable designers to cover the full air flow range of Vento fans.

Position and Location

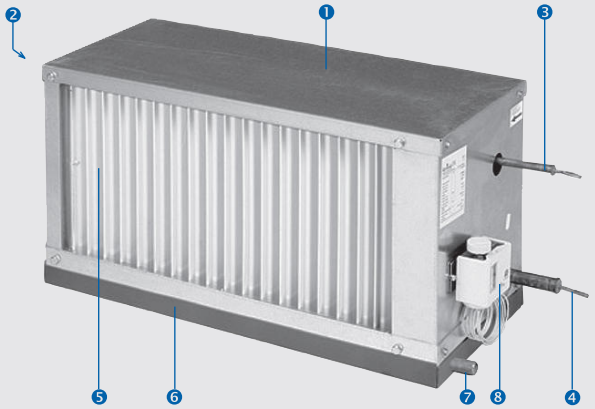
When projecting the layout of the direct cooler location in the air-handling system, we recommend observing the following principles:

- Direct coolers can work only in any position in which condensate draining is possible.
- Access to the cooler must always be ensured to enable checking and service.
- An air filter must be installed in front of the cooler to avoid its fouling (providing it has not already been installed, e.g. in front of the heater).
- The counter-current connection of the direct cooler is needed to achieve maximum output.
- The cooler can be situated either in front of or behind the fan.
- If the cooler is situated behind the fan, we recommend inserting between the fan and the evaporator a spacer (e.g. 1-1.5 m long straight duct) to steady the air flow.

Materials and Design

The external casing of the coolers is made of galvanized steel sheets insulated against moisture condensation. The heat exchange surface is created by 0.1 mm thick aluminium overlapping fins pulled on copper pipes of ø10 mm diameter. Standard CHF coolers are manufactured in two-row versions with shifted geometry (ST 25 x 22 mm). All used materials are carefully checked so they ensure long service life and reliability. Direct coolers are pre-filled with nitrogen in the production factory. As standard, direct coolers are delivered in a left-hand version, looking at the air flow direction, and are equipped with a drop eliminator, an insulated condensate drainage tray and an optional integrated anti-frost sensor. The cooler can also be ordered without the drop eliminator.

Figure 2 - Description of direct cooler parts

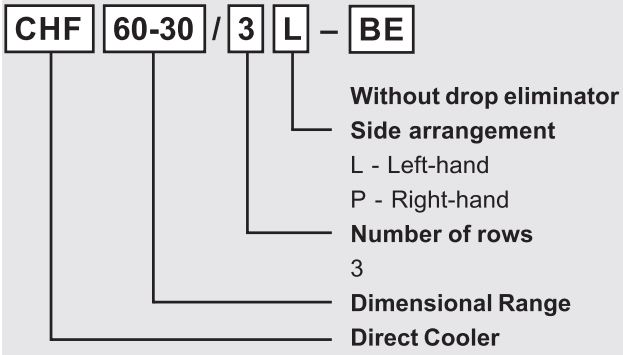


❶ External casing, ❷ Evaporator, ❸ Coolant inlet, ❹ Coolant outlet, ❺ Drop eliminator, ❻ Tray for condensate, ❼ Condensate drainage ❽ Capillary sensor (optional accessories, separate order necessary)

Designation of Direct Coolers

The type designation of coolers in projects and orders is defined by the key in figure # 3.

Figure 3 - Type designation



The above-mentioned specification without an ordering code corresponds to the stock configuration of the product, i.e. the three-row left-hand arrangement with a drop eliminator. Any other configuration (e.g. without a drop eliminator) must be specified by the ordering code. The cooler is a configured product which should be preferably ordered using AeroCAD software, which will generate its ordering code

Parameters

Dimensions and Weights

For important dimensions and weights (without water filling) of direct coolers, refer to figure # 4 and table # 1. The connection of the direct cooler depends on the selected dimensional range.

Direct Cooler Dimensioning

For nomograms showing the thermodynamic correlation for each direct cooler, refer to pages 202-209. All necessary final parameters of the direct cooler corresponding to the performance job can be obtained from the nomograms. The nomograms have been developed for direct coolers and most frequently used evaporating temperature: + 5 °C:

- **Required default parameters**
  - Selected cooler's size
  - Air flow rate (velocity in the cross-section)
  - Design inlet air temperature (+25 °C, +30 °C, +35 °C)
  - Relative air humidity (40 %, 50 %, or 60 %).
- **Determined final parameters**
  - Outlet air temperature
  - Output of the cooler
  - Air pressure loss

Direct Cooler Dimensioning Procedure

- Outlet air temperature behind the cooler ④ for required default parameters ①②③ can be determined from the nomograms.
- If the outlet air temperature ④ is the same or higher than the required temperature, the cooler complies with the performance job. (4
- Maximum output of the direct cooler at maximum required air flow for the required default parameters ①⑤⑥ can also be determined from the nomograms.
- The direct cooler's pressure loss at the given air flow rate for calculation of the assembly pressure loss balance needed for the fan selection can be obtained from the nomograms on pages 202-209.

The air pressure loss for all coolers can be determined from the nomogram on page 210. As the design of the direct coolers is standardized, the pressure loss only depends on the air flow velocity through the cooler. The nomogram also includes air flow rate - velocity conversion curves for all cooler sizes.

Figure 4 - Dimensions of CHF Direct Coolers

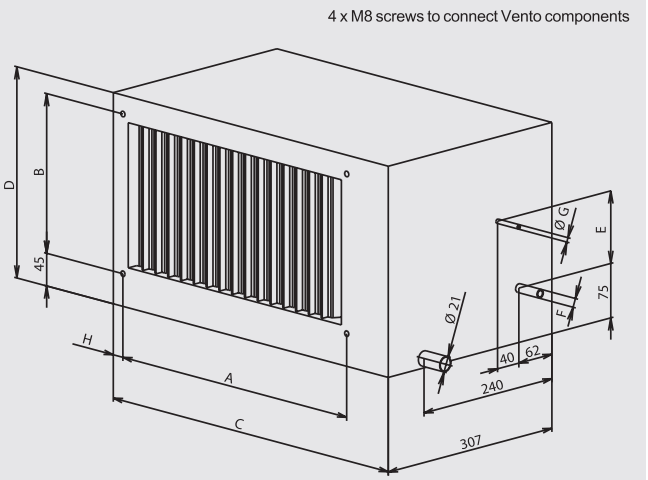


Table 1 - Dimensions of CHF Direct Coolers

Size	Dimensions in mm							
	A	B	C	D	E	F	G	H
CHV 40-20	420	220	506	280	100	16	12	23
CHV 50-25	520	270	606	330	150	16	12	23
CHV 50-30	520	320	606	380	150	16	12	23
CHV 60-30	620	320	706	380	200	22	12	23
CHV 60-35	620	370	706	430	200	22	12	23
CHV 70-40	720	420	806	480	200	28	12	23
CHV 80-50	820	520	906	580	250	28	16	23
CHV 90-50	930	530	1013	597	250	28	16	20

Installation, Service and Maintenance

Installation, servicing and maintenance can be performed only by a specialized company licensed in accordance with valid regulations and possessing the appropriate tools.

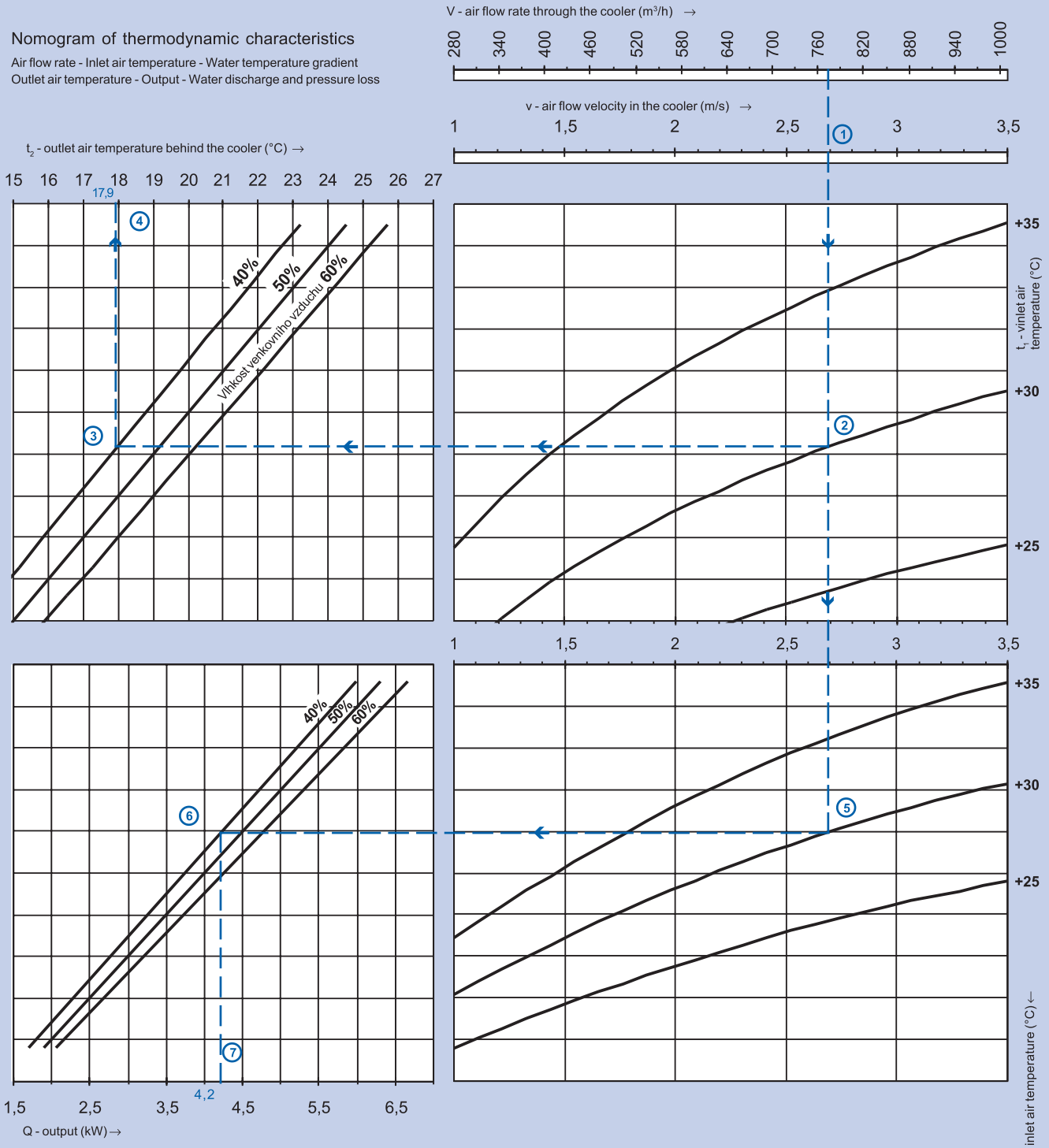
- There is no need for individual suspensions when installing the CHF direct coolers. The cooler can be inserted into the duct line, it must not be exposed to any strain or torsion caused by the connected duct line.
- Before installation, paste self-adhesive sealing onto the connecting flange face. To connect individual parts of the Vento system, use galvanized M8 screws and nuts. It is necessary to ensure conductive connection of the flange using fan-washers placed on both sides at least on one flange connection, or use Cu conductor wiring.

(4 It the outlet air temperature from the direct cooler in the given default conditions is higher than required, it is necessary to select a larger cooler, or ask REMAK or their distributor to calculate the CHF cooler's parameters for the required conditions.

CHF 40-20 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 775 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s.
For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.
Cooling output of the cooler of 4.2 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

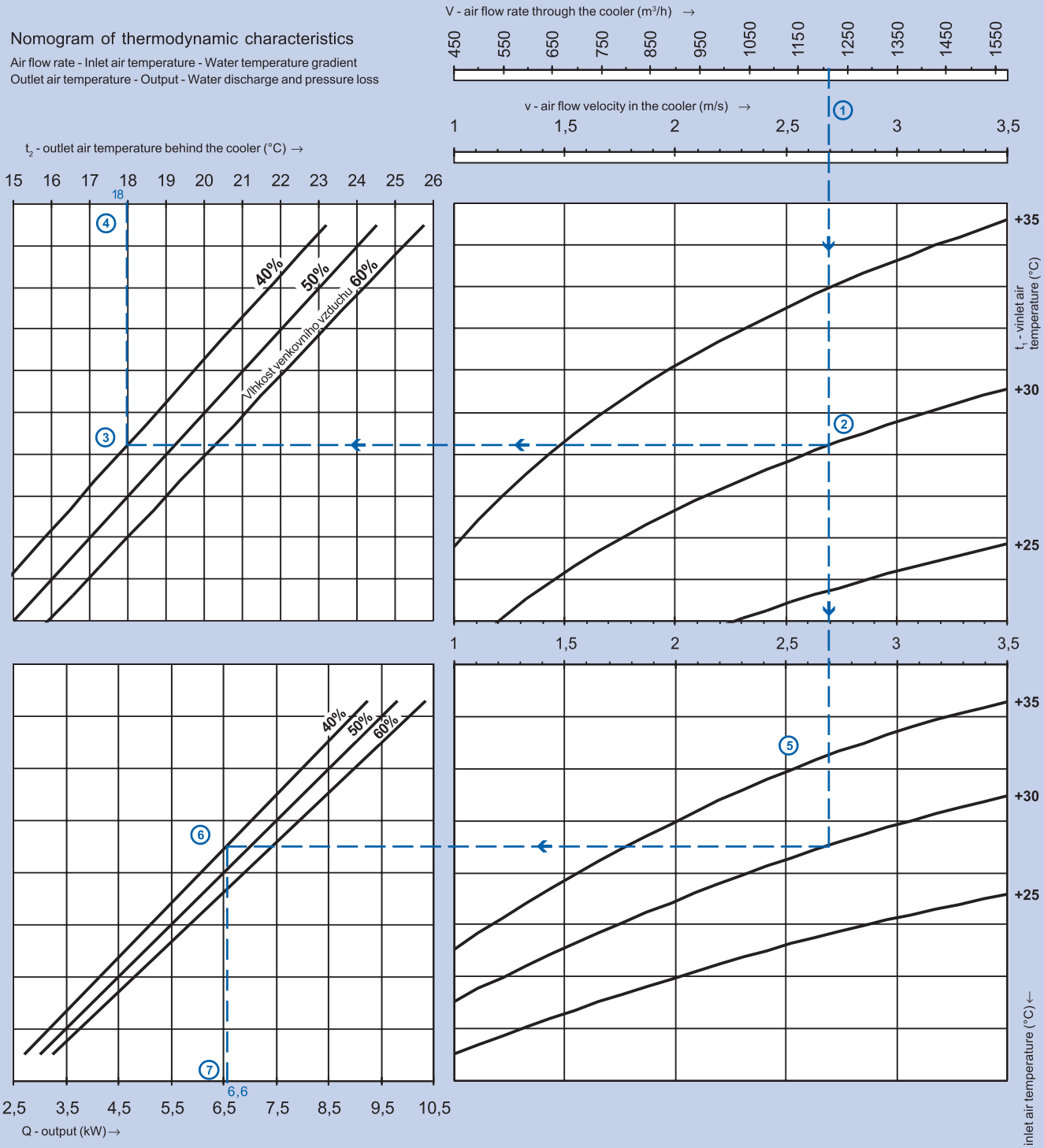
Values in the nomogram can be interpolated and extrapolated

Nomogram 1

CHF 50-25 / 3L

Nomogram of thermodynamic characteristics

Air flow rate - Inlet air temperature - Water temperature gradient
Outlet air temperature - Output - Water discharge and pressure loss



Example:

At the selected air flow rate of 1210 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18 °C ④.

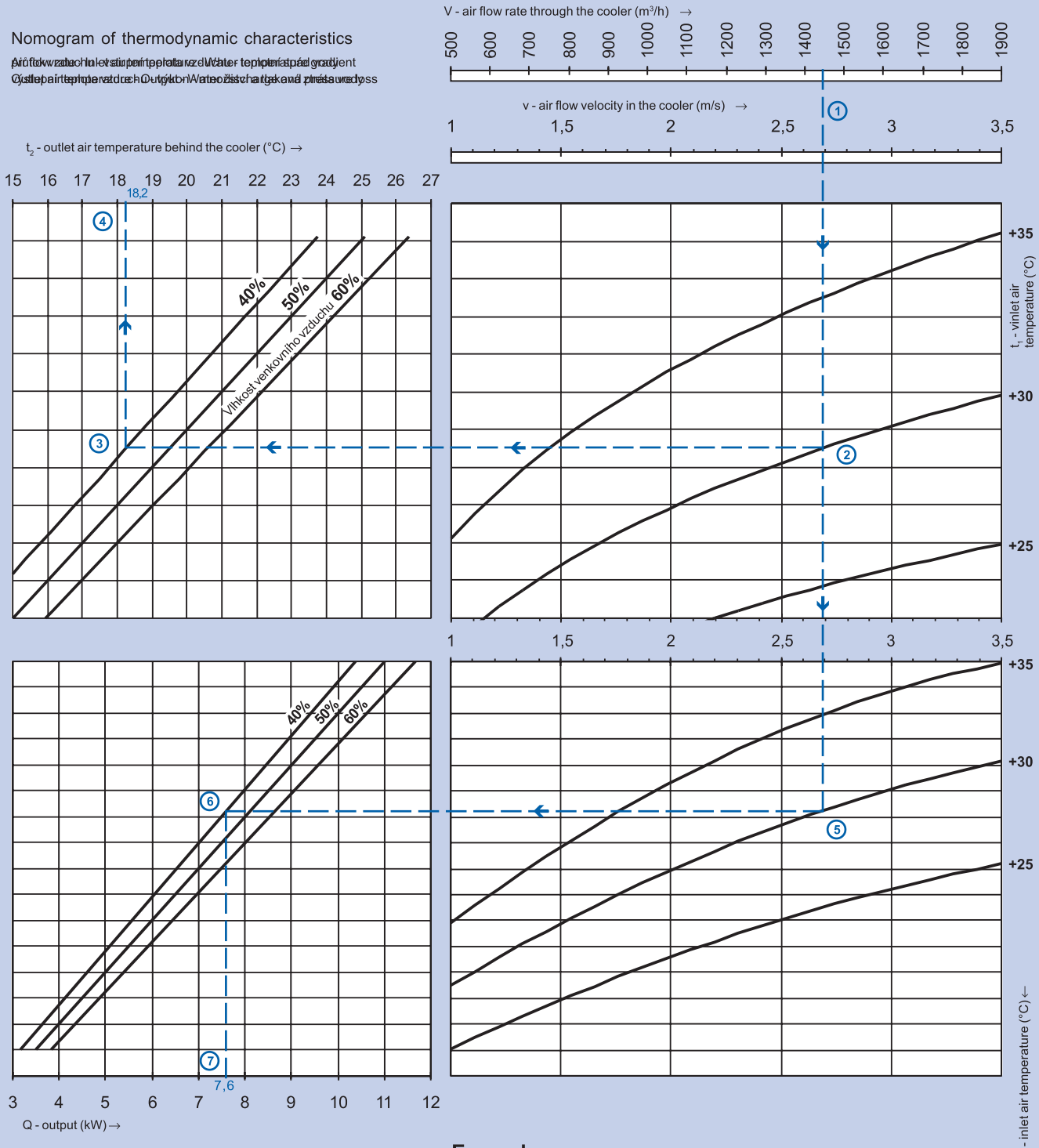
Cooling output of the cooler of 6,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 2

CHF 50-30 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +18,2 °C ④.

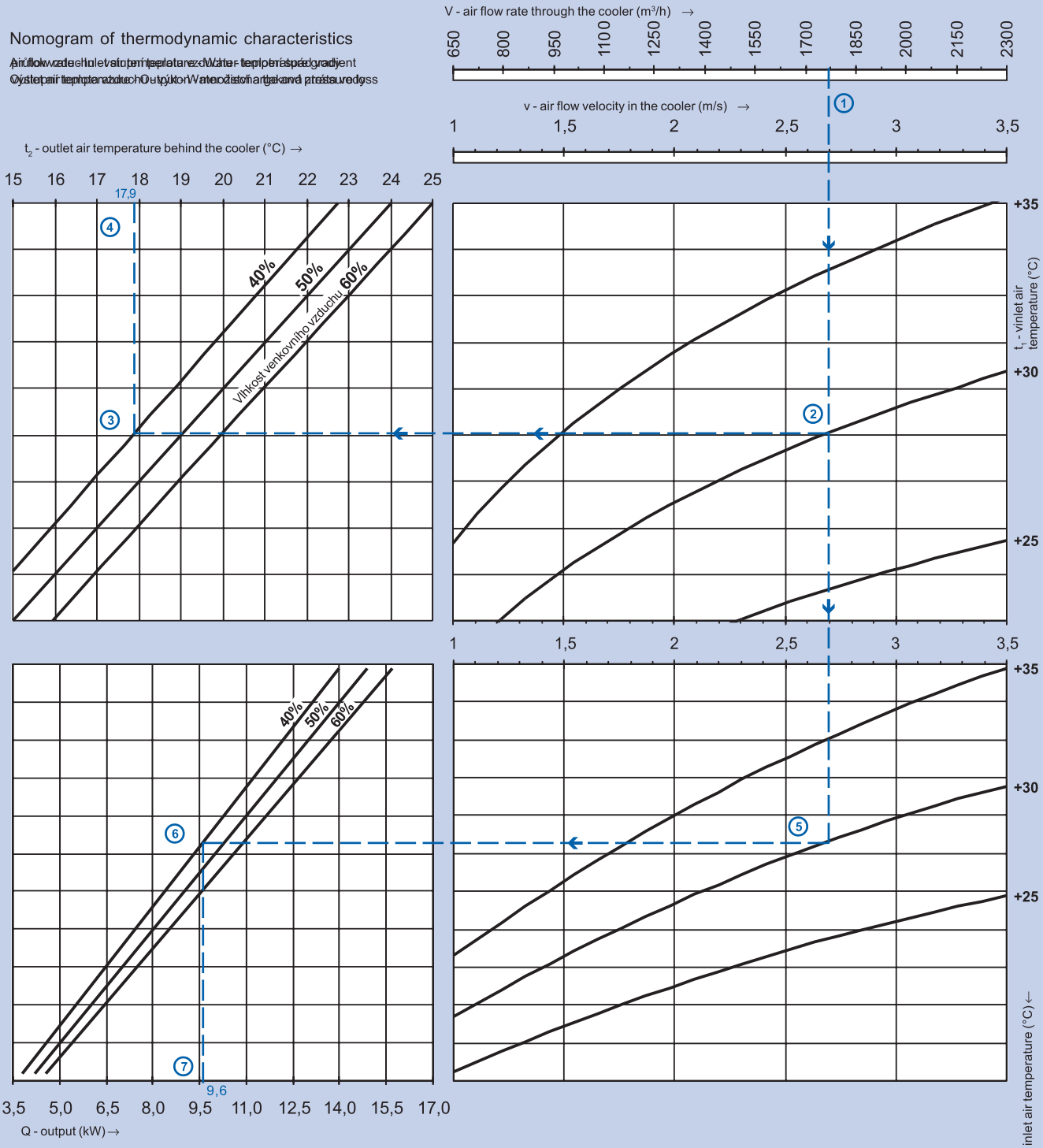
Cooling output of the cooler of 7,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 3

CHF 60-30 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

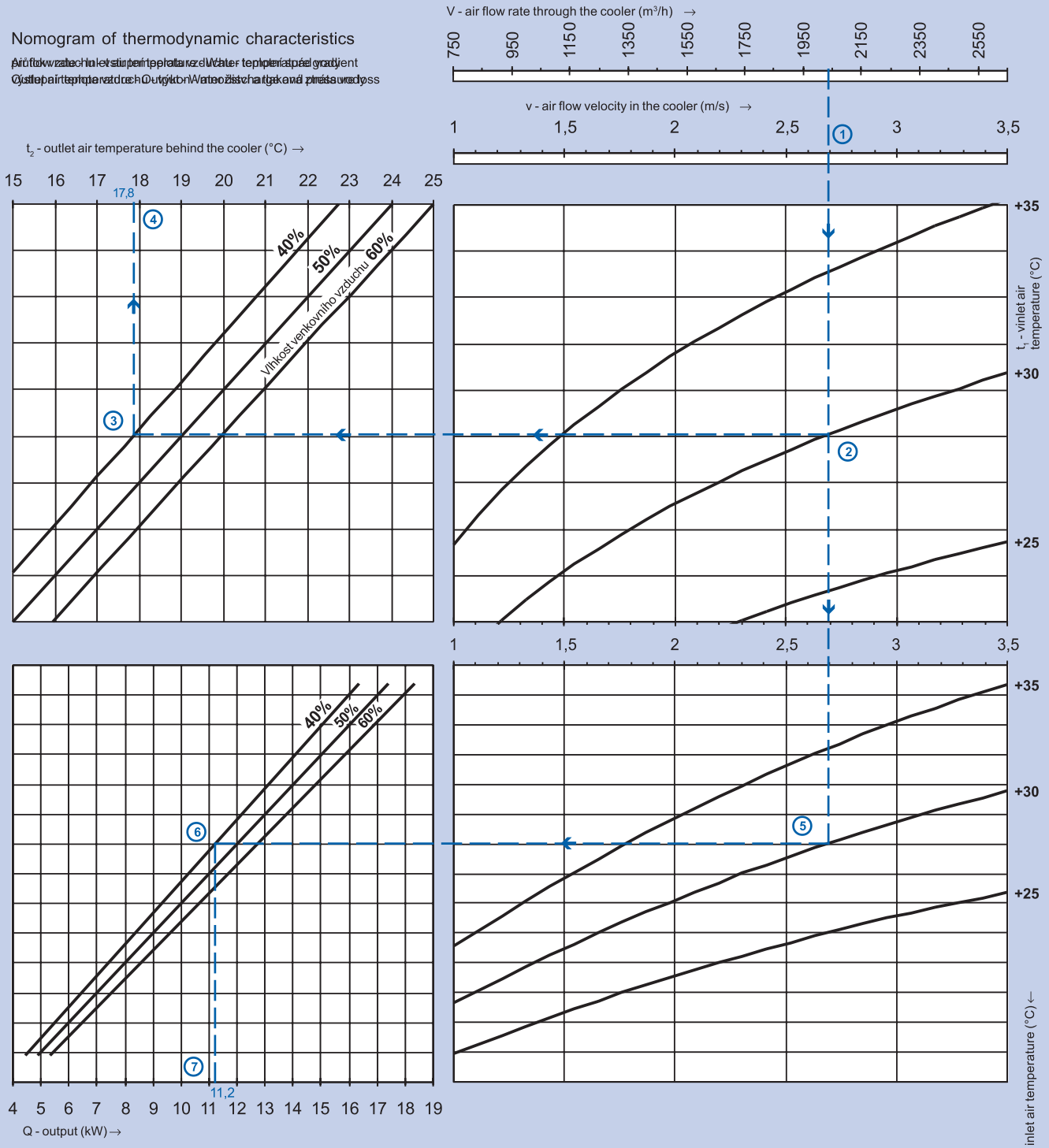
Cooling output of the cooler of 9,6 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 4

CHF 60-35 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 2040 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17,8 °C ④.

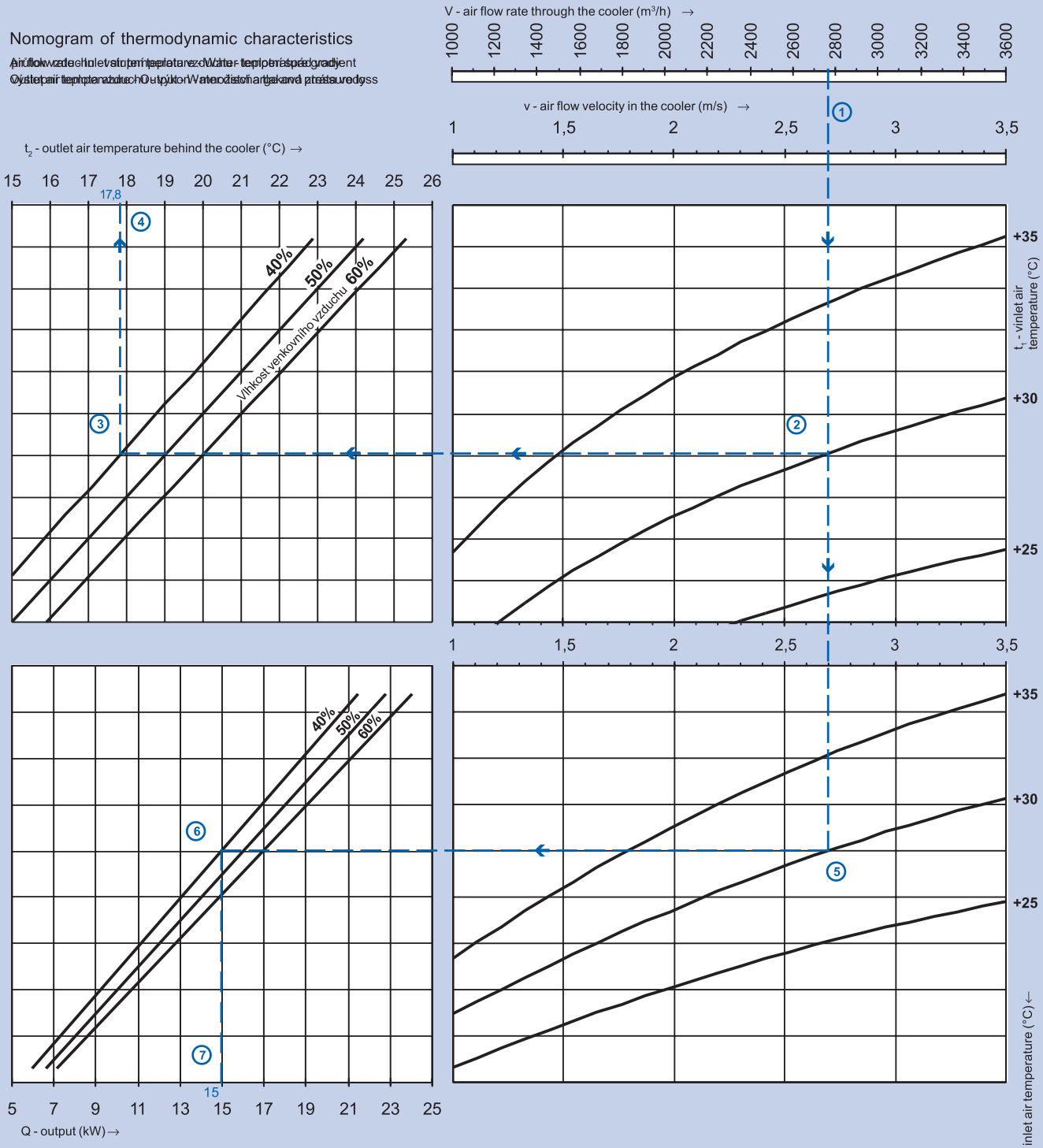
Cooling output of the cooler of 11,2 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 5

CHF 70-40 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 2760 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17,8 °C ④.

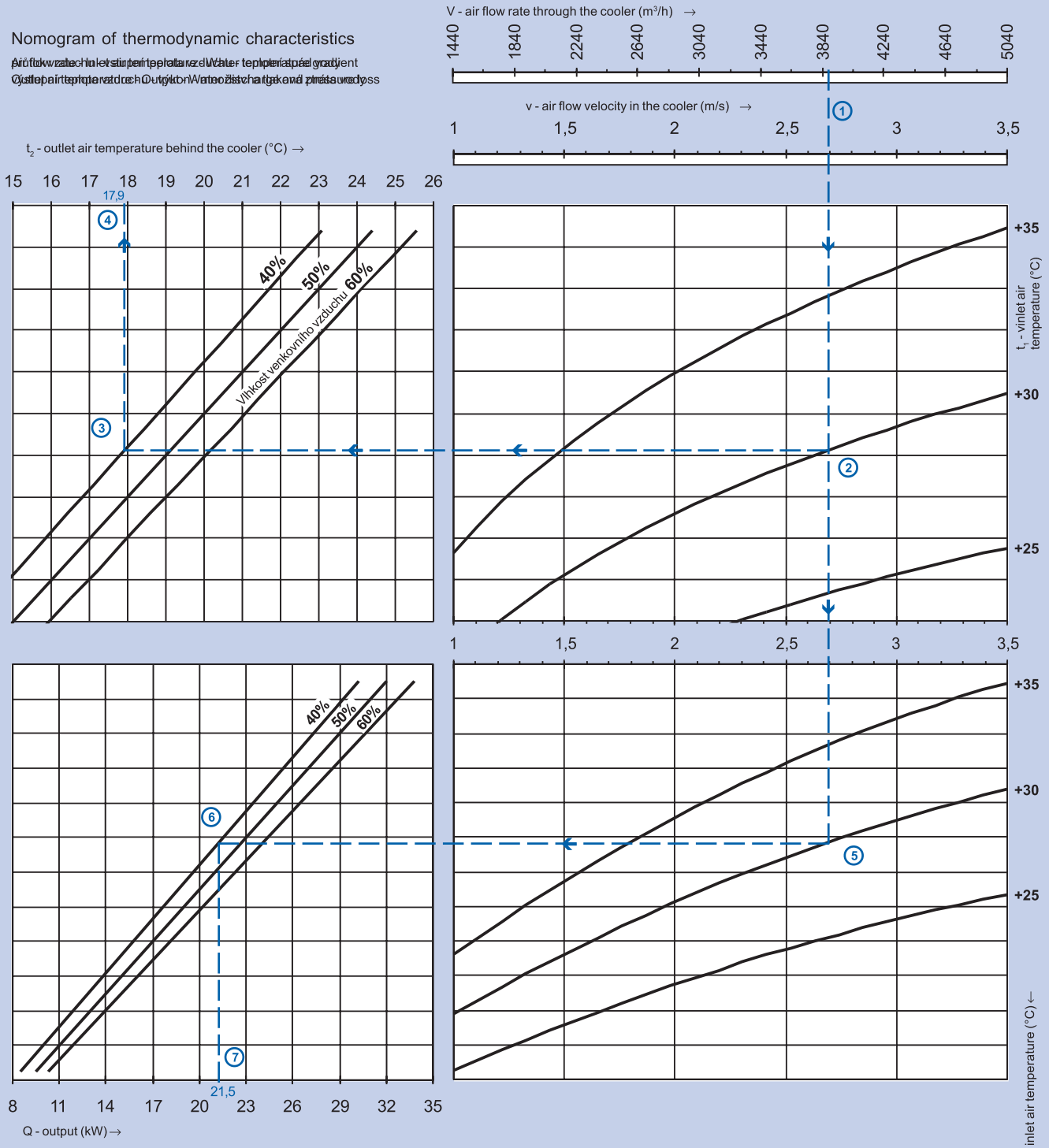
Cooling output of the cooler of 15 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 6

CHF 80-50 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 3880 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

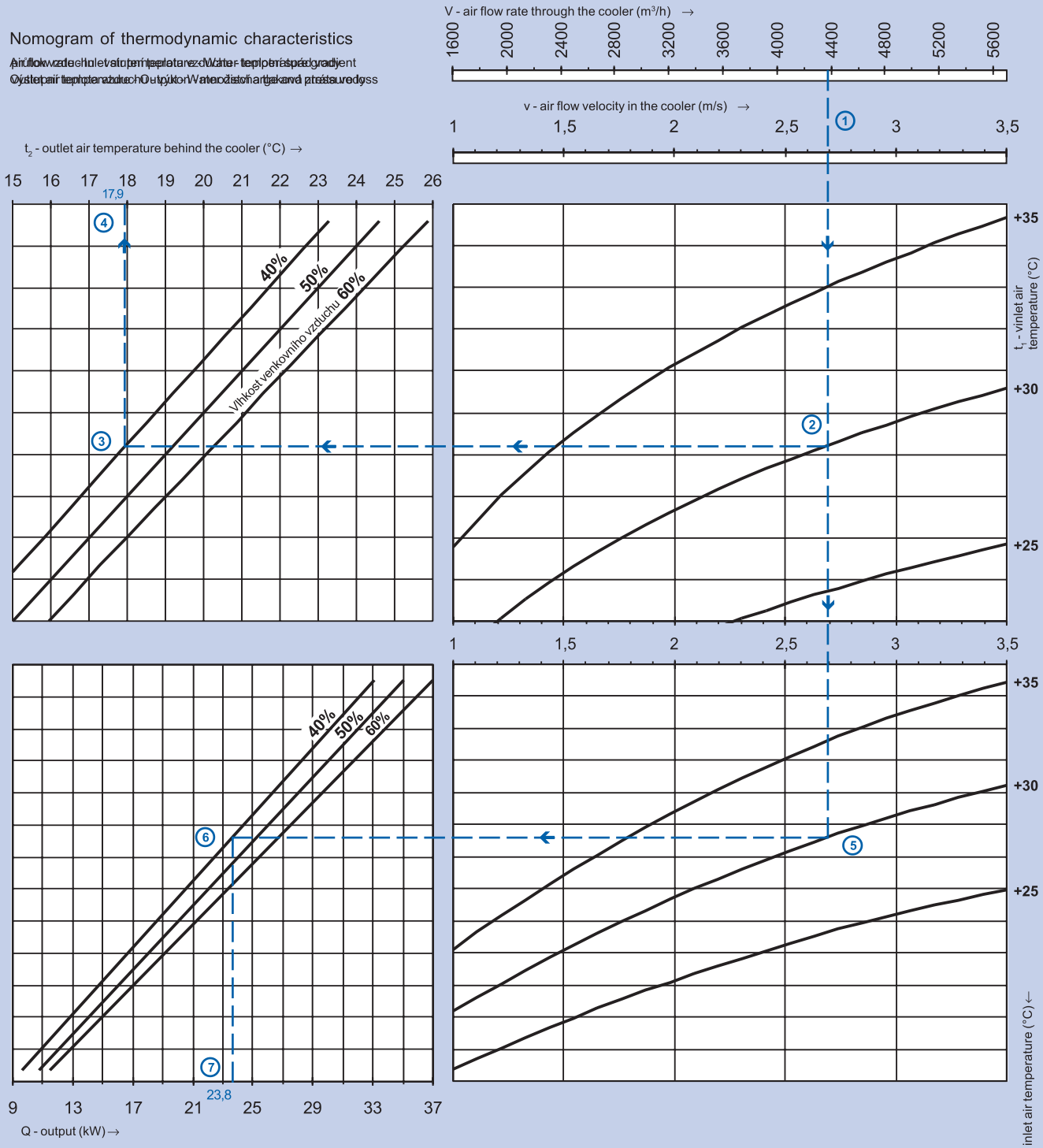
Cooling output of the cooler of 21,5 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

Values in the nomogram can be interpolated and extrapolated

Nomogram 7

CHF 90-50 / 3L

Nomogram of thermodynamic characteristics



Example:

At the selected air flow rate of 4380 m³/h ①, the velocity of the air flow through the CHF 40-20 / 3L cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40% ③, the outlet air temperature behind the cooler will be +17.9 °C ④.

Cooling output of the cooler of 23,8 kW ⑦ comports with the given air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥.

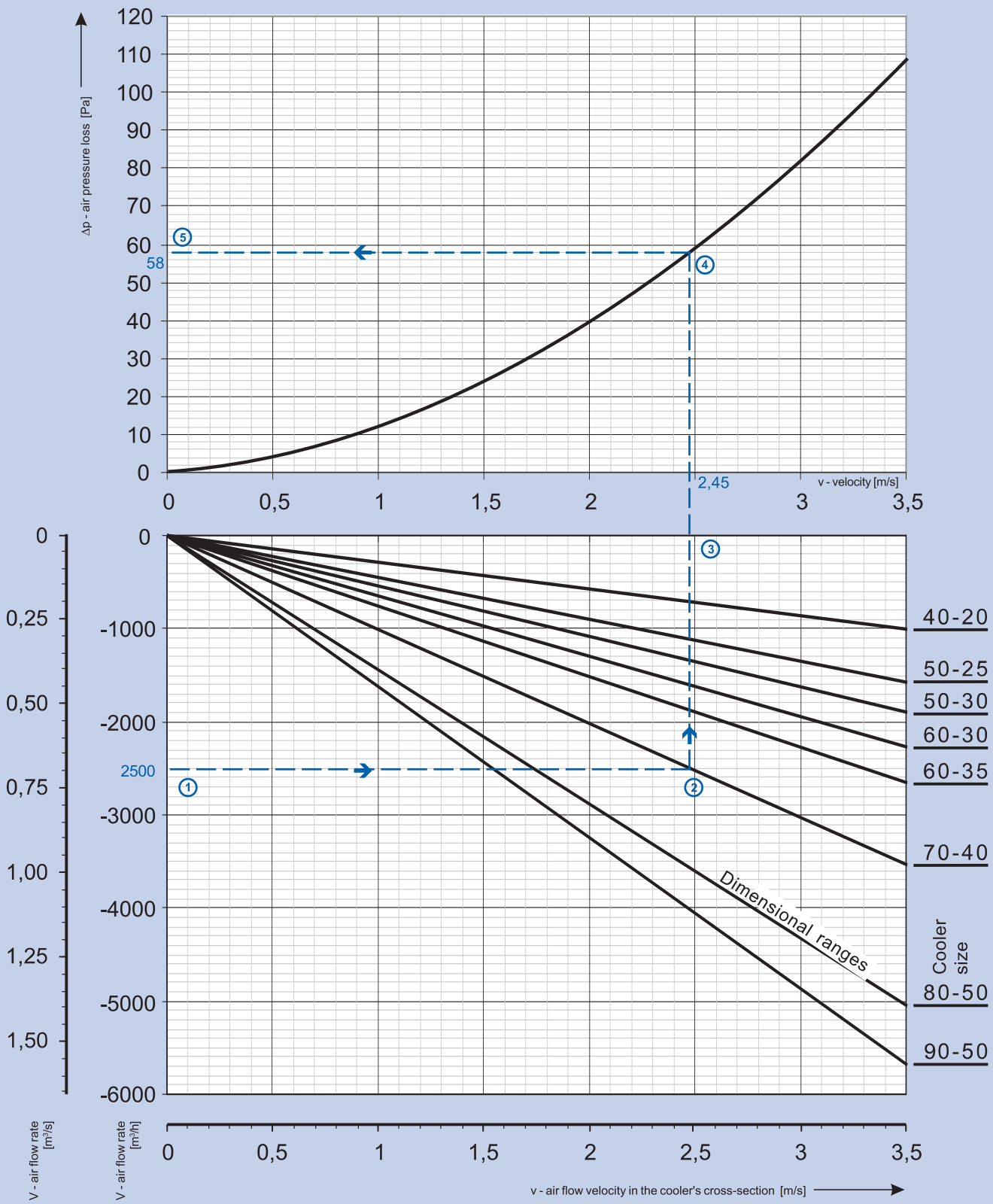
Values in the nomogram can be interpolated and extrapolated

Nomogram 8

Air Pressure Losses in CHF Direct Coolers

Nomogram of air pressure losses for all CHF direct coolers

The curve of pressure losses is valid for all CHF direct coolers. The air pressure loss depends on the air flow velocity, and it is calculated for the air velocity in a free cross section of all Vento system dimensional ranges.



The nomogram of pressure losses is valid for all CHF direct coolers. For the selected air flow rate ①, the air flow velocity ③ in the free cooler's cross-section ②, can be read in the lower graph, and then the corresponding cooler's air pressure loss ⑤ at the known velocity can be determined in the upper part ④.

Example:

At an air flow rate of 2,500 m3/h, the velocity of the air flow in the CHF 70-40 / 3L direct cooler will be 2.45 m/s. The direct cooler's air pressure loss for the above-mentioned air flow rate will be 58 Pa.