Technical Information

Applications of Coolers

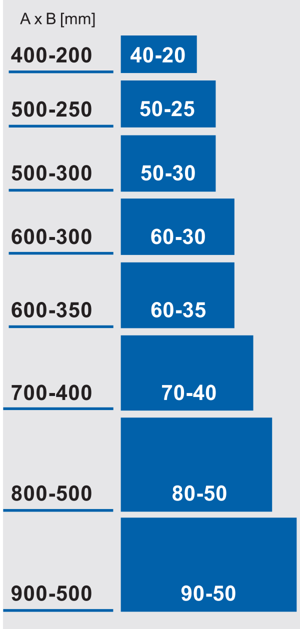
CHV water coolers are intended for air cooling, from simple venting installations to sophisticated air-handling systems. They are designed to be installed directly in square air ducts. Ideally, they can be used along with other components of the Vento modular system, which ensure inter-compatibility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

Operating conditions

The cooled air must be free of solid, fibrous, sticky and aggressive impurities. The heated air must also be free of corrosive chemicals or chemicals aggressive to aluminium, copper and zinc.Maximum allowed operating parameters of cooling water:
Maximum water operating pressure: 1,5 MPa

Performance properties of water coolers for common values of water temperature gradients, various air flow rates and inlet air temperatures for water as a heat-transfer agent are included in nomograms in the data section of this catalogue.

Figure 1 - Dimensions



Dimensional Range

VCHV water coolers are manufactured in a range of eight sizes according to the A x B dimensions of the connecting flange (see figure # 1). Two and three-row versions of coolers are available for all sizes. As standard, CHV water coolers are manufactured in three-row versions with shifted geometry (ST 25 x 22 mm). Water coolers can be connected to air ducts in the same way as any other Vento duct system component. Connections of all water coolers to the cooling water supply are maximally standardized. These coolers enable designers to cover the full air flow range of Vento fans.

Position and Location

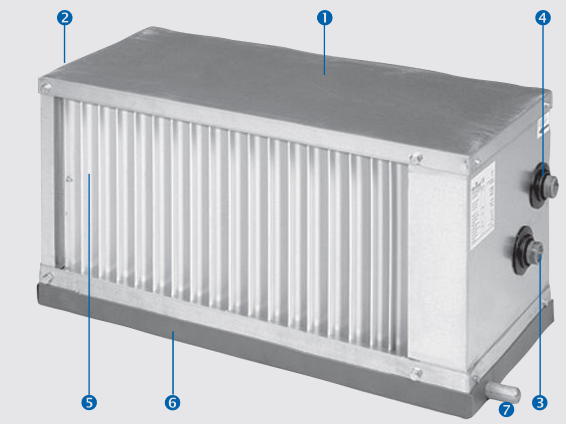
When projecting the layout of the cooler location in the air-handling system, we recommend observing the following principles:

- If water is used as the cooling medium, the cooler can then be situated only in an indoor environment where the temperature is maintained above freezing point (the main condition is to maintain the temperature of the transported air).
- Outdoor installation is allowed only if antifreeze solution is used as the cooling medium (mostly ethylene-glycol solution). However, the temperature limit of the used actuating mechanism of the mixing set must be taken into account; and in this case, the below-mentioned nomograms cannot be used when determining the cooler's parameters. The calculation must be performed using AeroCAD software.
- Water coolers can work only in the horizontal position, in which condensate draining and air venting of the cooler is possible.
- Access to the cooler must 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 cooler is essential 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 cooler 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. The headers are made of welded steel pipes and finished with a synthetic coating. The heat exchange surface is created by 0.1 mm thick aluminium overlapping fins pulled on copper pipes of ϕ10 mm.

Figure 2 - Standard design of the cooler



❶ External casing, ❷ Cooler, ❸ Coolant inlet, ❹ Coolant outlet, ❺ Drop eliminator, ❻ Tray for condensate, ❼ Condensate drainage (G $^{1}/_{2}$")

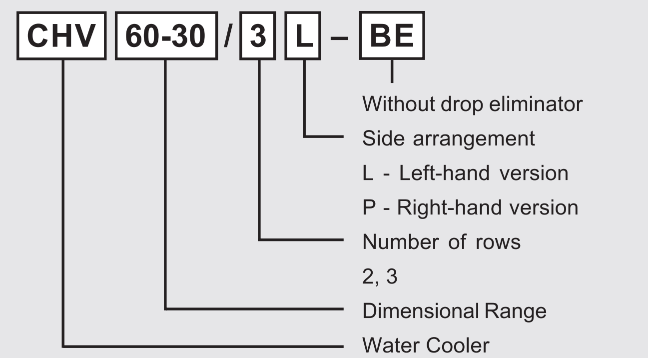
All used materials are carefully checked so they ensure long service life and reliability. All coolers are tested under water for leakage using pressurised air at 2 MPa for five minutes.
As standard, the water coolers are delivered in a left-hand version, looking at the air flow direction, and are equipped with a drop eliminator and an insulated condensate drainage tray.
In case of two-stage cooling, it is advisable to exclude the drop eliminator (order the water cooler without a drop eliminator).
The water cooler is equipped with a TACO automatic air-venting valve situated at the top of the headers, which ensures progressive air-venting of the cooler.

Parameters

Designation of 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.

Dimensions and Weights

For important dimensions and weights (without water filling) of coolers, refer to figure # 4 and table # 1.
The connection for the heating water is provided with a G1" outer thread.

Figure 4 - Dimensions of CHV Water Coolers

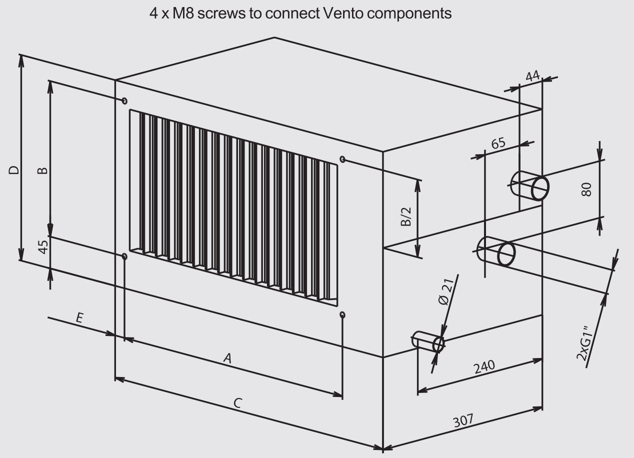


Table 1 - Dimensions of water coolers

Size	Dimensions in mm				
	A	B	C	D	E
CHV 40-20	420	220	516	280	18
CHV 50-25	520	270	616	330	18
CHV 50-30	520	320	616	380	18
CHV 60-30	620	320	716	380	18
CHV 60-35	620	370	716	430	18
CHV 70-40	720	420	816	480	18
CHV 80-50	820	520	916	580	18
CHV 90-50	930	530	1036	597	22

Cooler Accessories

Accessories like the TACO automatic air-venting valve and SUMX mixing set can be delivered as an internal part of the cooler. Accessories are not included in the cooler delivery so must be specified and ordered separately. Water coolers can be completed with accessories which ensure the following essential functions:

- **Output control**

CHV water coolers can be controlled using mixing sets, refer to the section "Mixing Sets".

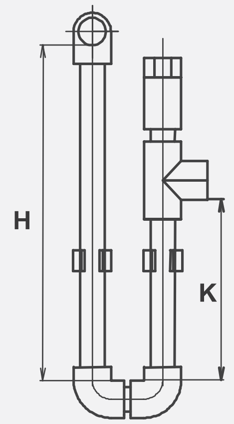
- **Condensate drainage (siphon)**

The cooler must always be equipped with a siphon to drain the condensate. Without the siphon, condensate drainage from the collecting tray is not ensured. The siphon can be replaced by a pump intended for condensate drainage.

Condensate Drainage

The cooler is equipped with a tray to collect condensate; the tray is terminated with an outlet to connect the condensate draining kit. The condensate draining kits are available as optional accessories. The siphon height depends on the total pressure of the fan, and ensures its proper functioning. The siphon must be designed depending on the fan pressure (see fig # 5).

Figure 5 - Example of condensate drainage siphon



H (mm)	K (mm)	P (Pa)
100	55	600
200	105	1100
260	140	1400

H... Siphon height
K... Siphon drain height
P... Total pressure of the fan

Cooler Dimensioning

Cooler Dimensioning

For nomograms showing the thermodynamic correlation for each cooler, refer to pages 189-196. All necessary final parameters of the cooler corresponding to the performance job can be obtained from the nomograms. The nomograms have been developed for three-row coolers and the most common water temperature gradient: +6 °C/+12 °C:

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

Warning: If other coolant is used, the calculation of the cooler's parameters must be performed using AeroCAD software.

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.
- Maximum output of the cooler ⑦, maximum water discharge ⑨ and water pressure loss ⑩ at maximum discharge for the required default parameters ①⑤⑥ can also be determined from the nomograms.[1]
- A suitable mixing set for water discharge ⑨ and pressure loss ⑩ at the given discharge can be determined following the procedure and characteristics of SUMX mixing sets included in the section "SUMX Mixing Sets", refer to pages 181-182.

Nominal operating conditions are included in the nomograms; i.e. the air flow rate at air flow velocity of 2.7 m/s, inlet air temperature of +30 °C, inlet relative air humidity of 40 %, water temperature gradient of +6 °C/+12 °C (i.e. water cooling by 6 K) and maximum output at these conditions at corresponding water discharge and water pressure loss. A mixing set can be connected to the water cooler in these conditions.

The air pressure loss for all coolers can be determined from the nomogram on page 197.

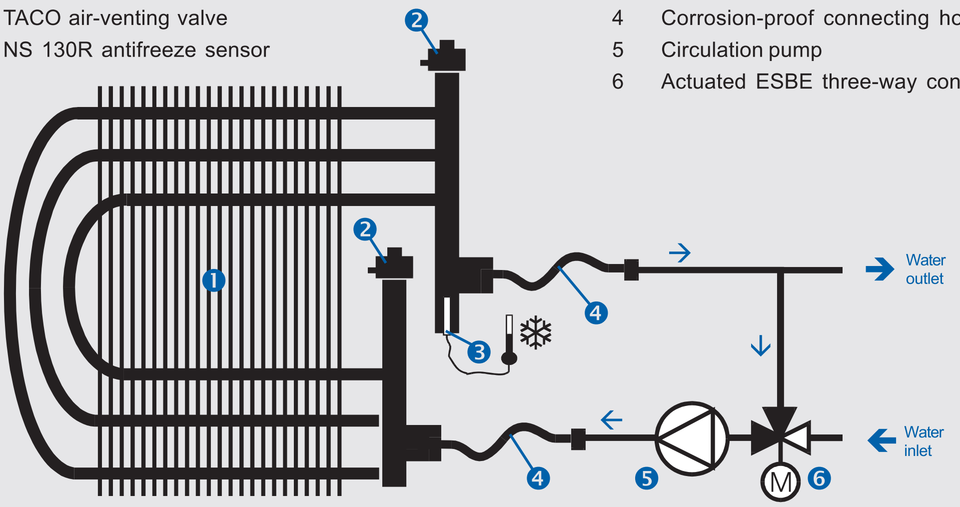
Cooler Control

SUMX mixing sets are designed as compact fixtures. They are dimensioned using the same principles applied when used with VO water heaters. For allocation of mixing sets to the corresponding water coolers, refer to table 5 in the section "Mixing Sets".

Figure 6 - Cooler equipped with a mixing set

1 CHV water cooler
2 TACO air-venting valve
3 NS 130R antifreeze sensor

SUMX Mixing Set Components:
4 Corrosion-proof connecting hoses
5 Circulation pump
6 Actuated ESBE three-way control valve

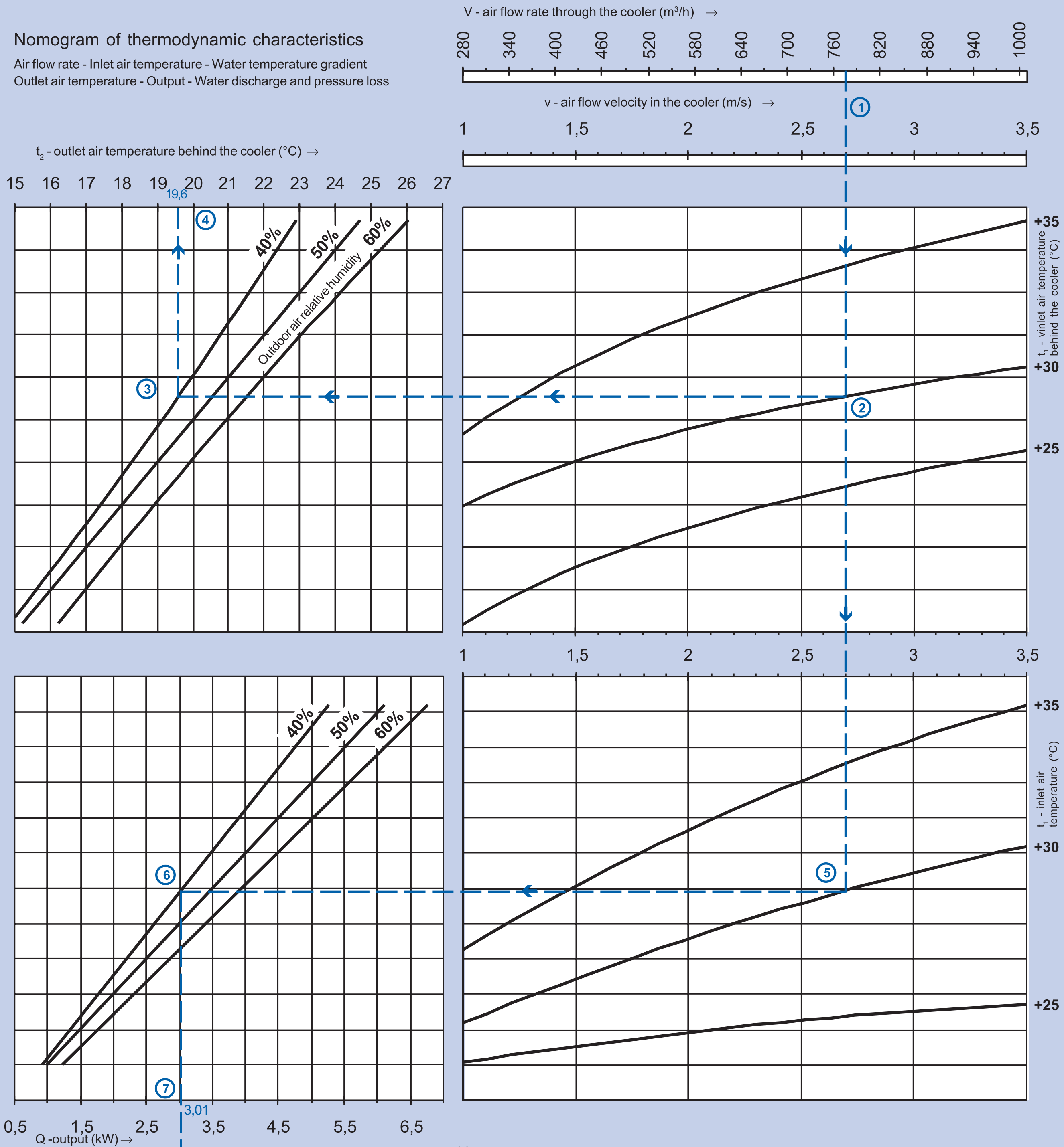


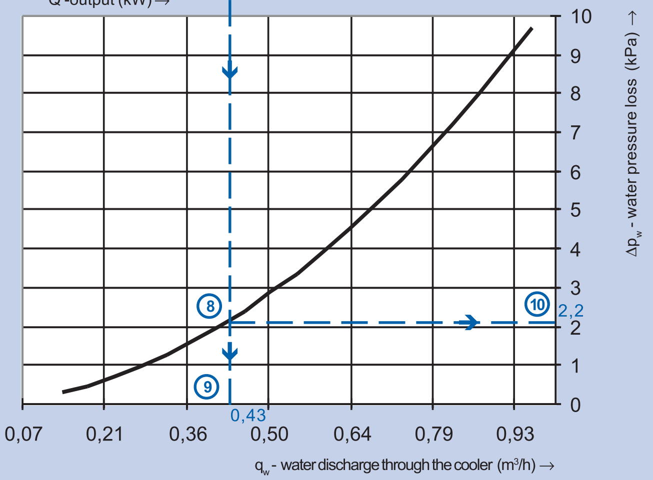
[1] The nomograms on pages 190 to 196 can be used to determine the maximum calculated output and water discharge because they are given for the fixed water temperature gradient $\Delta t_W = 6$ K.

CHV 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 CHV 40-20/3L water 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 +19.6 °C ④.
Cooling output of the cooler of 3.01 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 0.43 m3/h at water pressure loss ⑩ in a heater of 2.2 kPa.

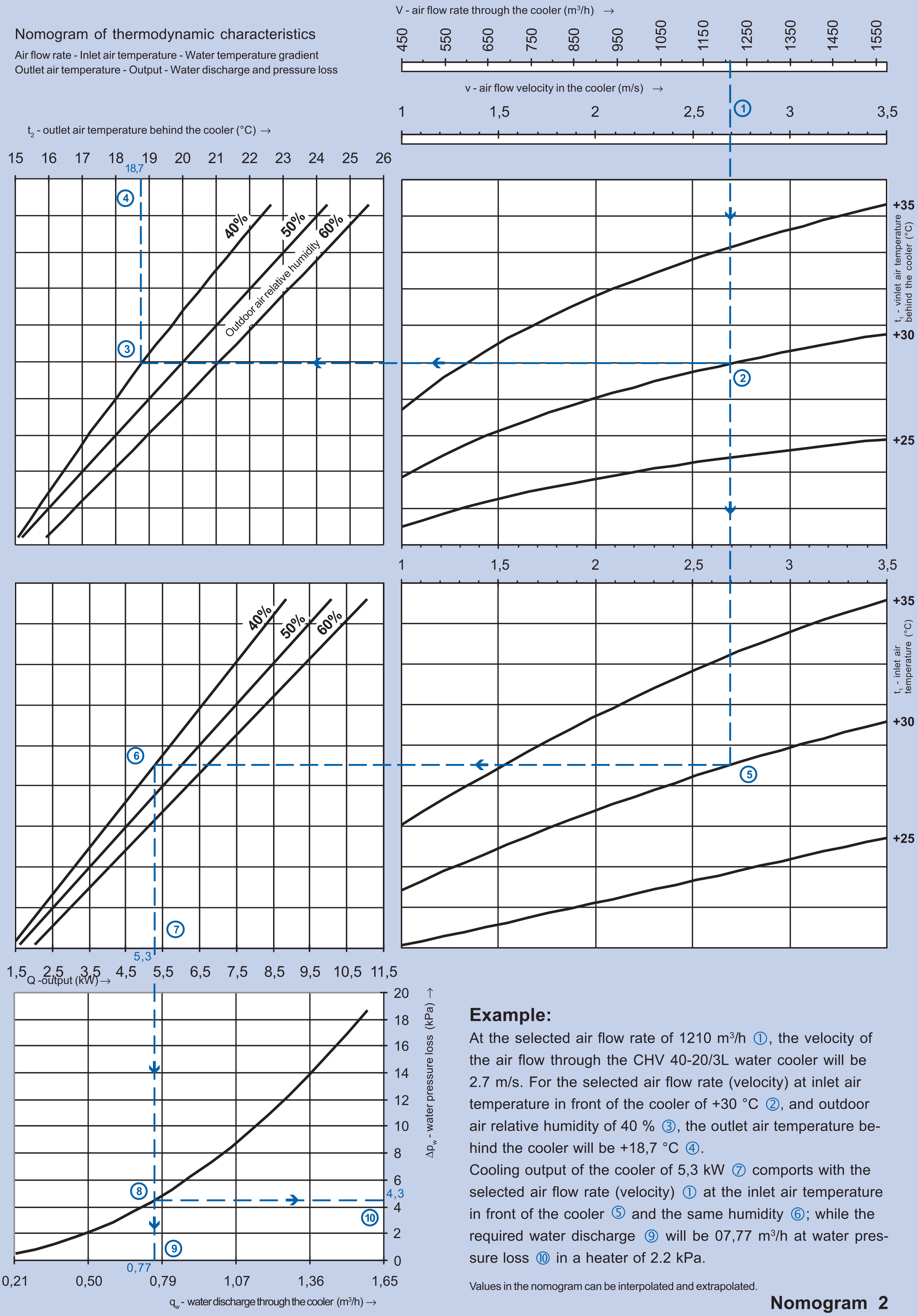
Values in the nomogram can be interpolated and extrapolated.

Nomogram 1

CHV 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 CHV 40-20/3L water 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 +18,7 °C ④.

Cooling output of the cooler of 5,3 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 07,77 m³/h at water pressure loss ⑩ in a heater of 2.2 kPa.

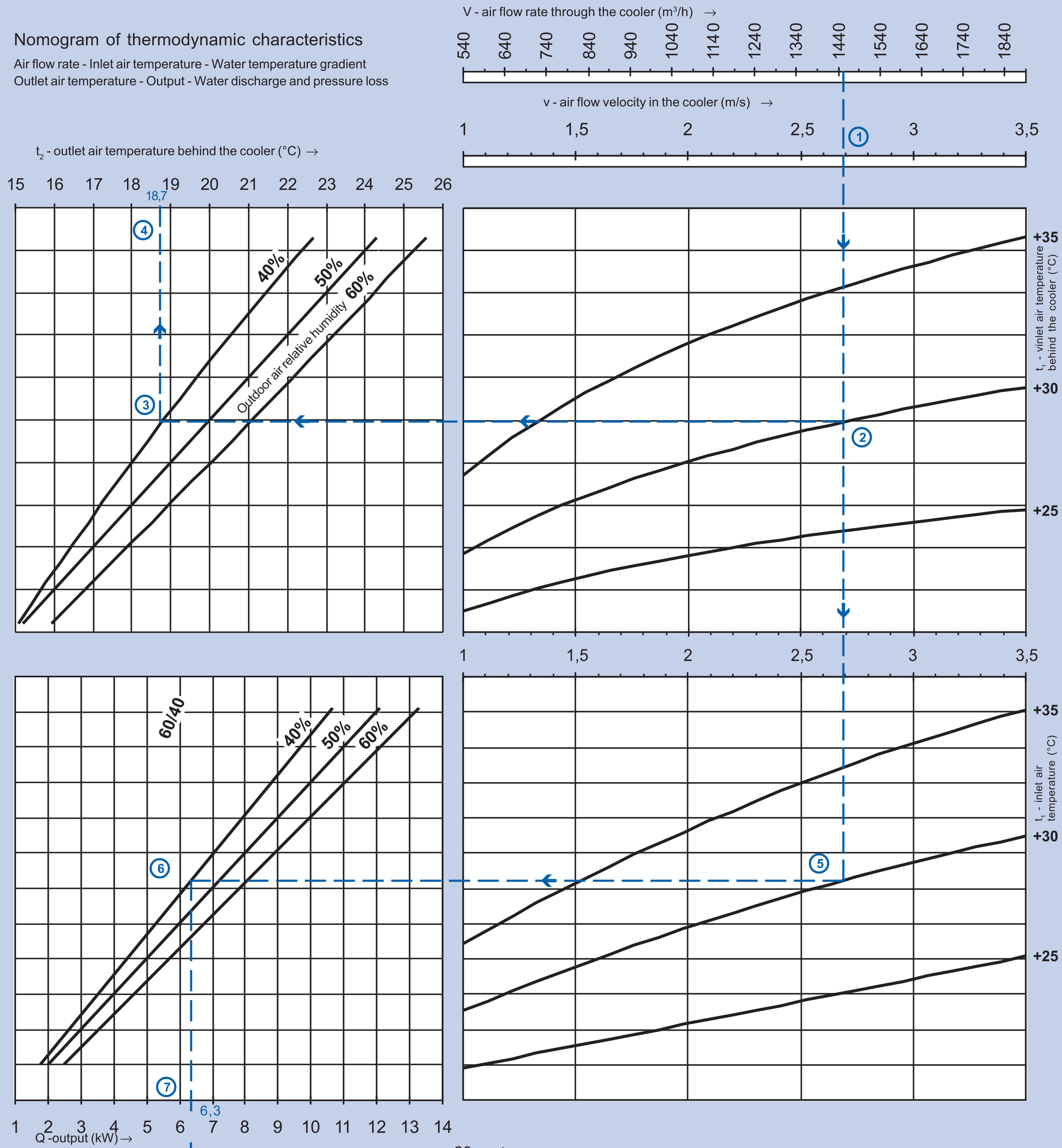
Values in the nomogram can be interpolated and extrapolated.

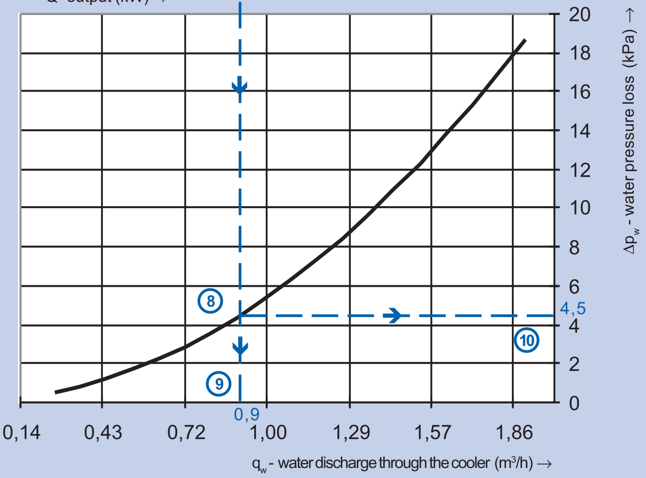
Nomogram 2

CHV 50-30 / 3L

Nomogram of thermodynamic characteristics

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





Example:

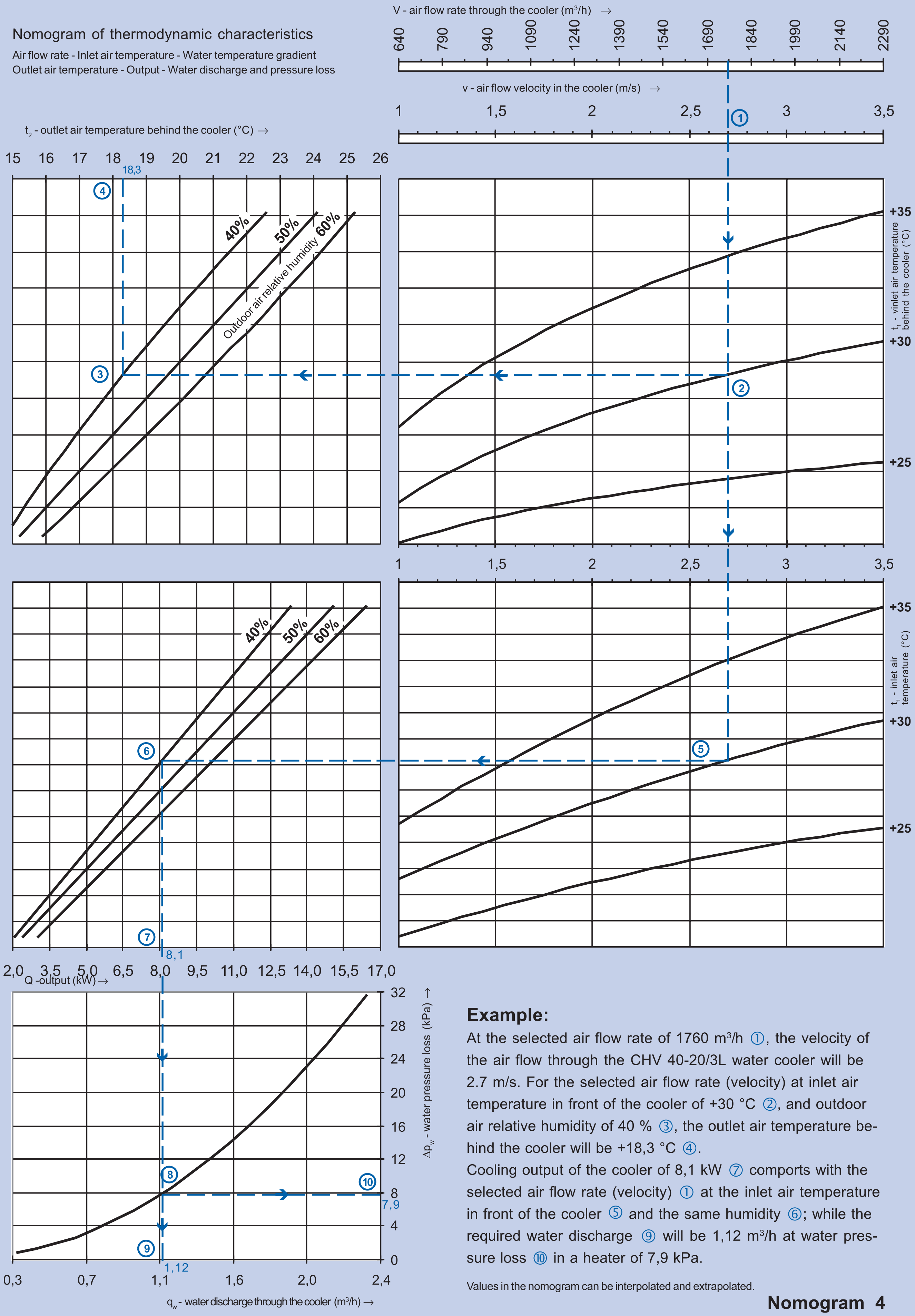
At the selected air flow rate of 1450 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water cooler will be 2.7 m/s. For the selected air flow rate (velocity) at inlet air temperature in front of the cooler of +30 °C ②, and outdoor air relative humidity of 40 % ③, the outlet air temperature behind the cooler will be +18,7 °C ④.

Cooling output of the cooler of 6,3 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 0,9 m³/h at water pressure loss ⑩ in a heater of 4,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 3

CHV 60-30 / 3L



Example:

At the selected air flow rate of 1760 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water 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 +18,3 °C ④.

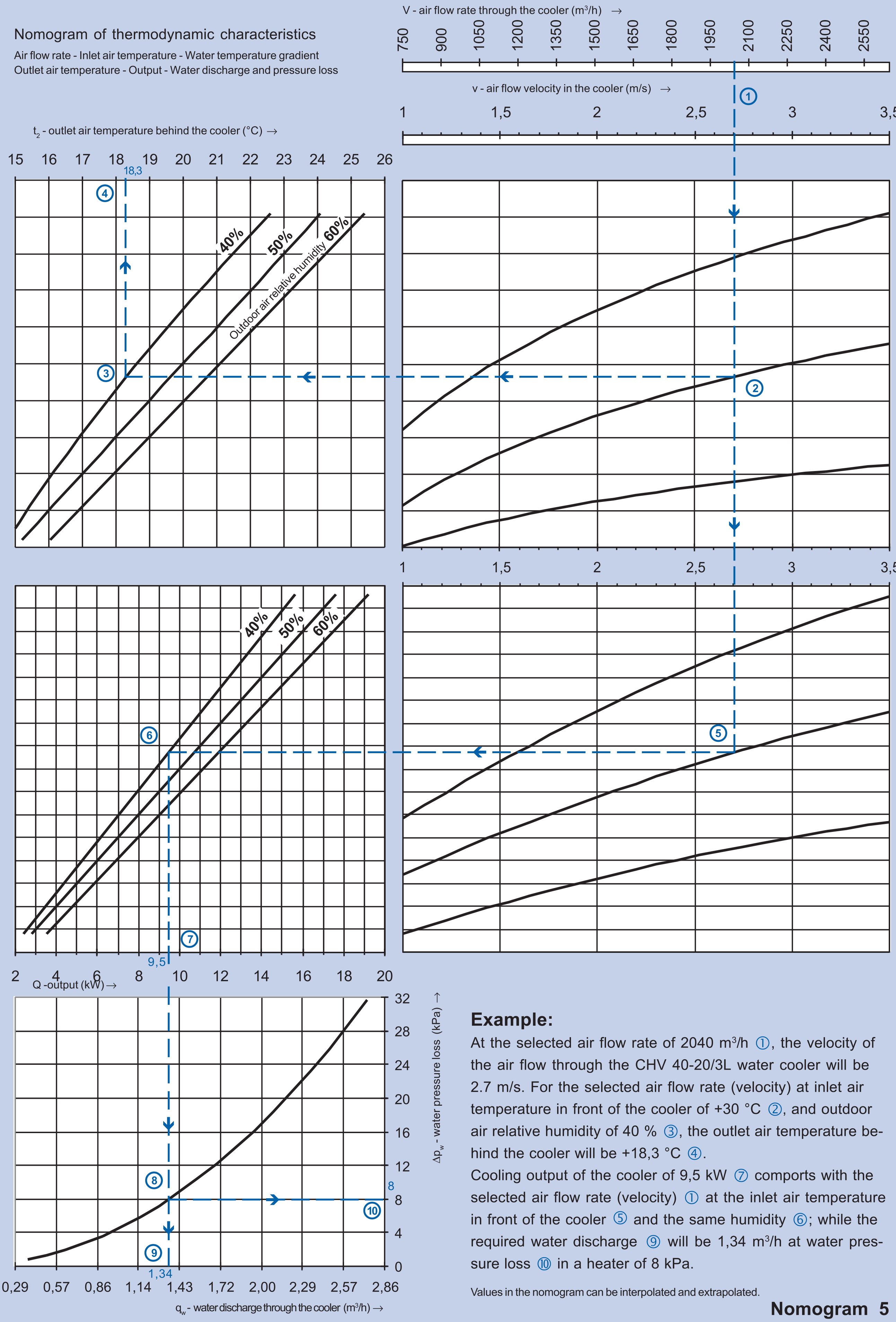
Cooling output of the cooler of 8,1 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,12 m³/h at water pressure loss ⑩ in a heater of 7,9 kPa.

Values in the nomogram can be interpolated and extrapolated.

Nomogram 4

CHV 60-35 / 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 2040 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water 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 +18,3 °C ④.
Cooling output of the cooler of 9,5 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,34 m³/h at water pressure loss ⑩ in a heater of 8 kPa.

Values in the nomogram can be interpolated and extrapolated.

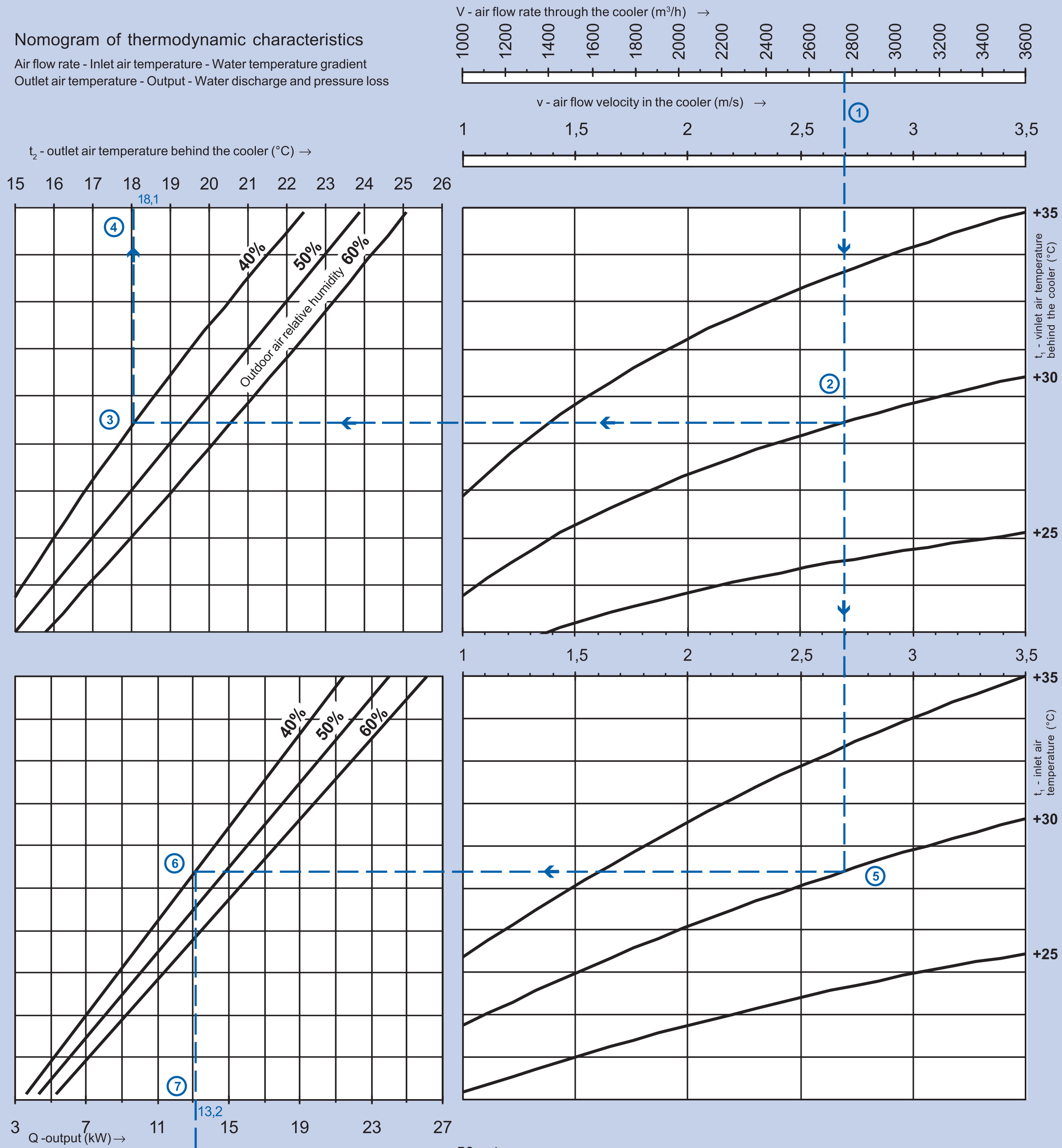
Nomogram 5

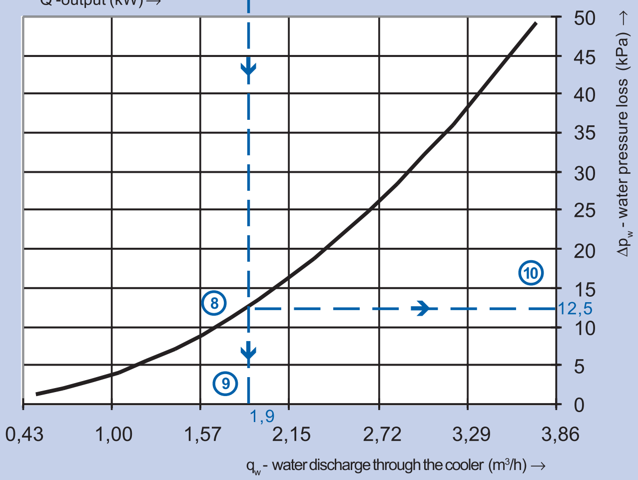
Ventilátory RP
Ventilátory RQ
Ventilátory RO
Ventilátory RS
Regulátory ...
El. ohřívače EO..
Vodní ohřívače VO
Směšovací uzly SUMX
Vodní chladiče CHV
Přímé chladiče CHF
Rekuperátory HRV
Příslušenství ...

CHV 70-40 / 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 2760 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water 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 +19.6 °C ④.

Cooling output of the cooler of 13,2 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 1,9 m3/h at water pressure loss ⑩ in a heater of 12,5 kPa.

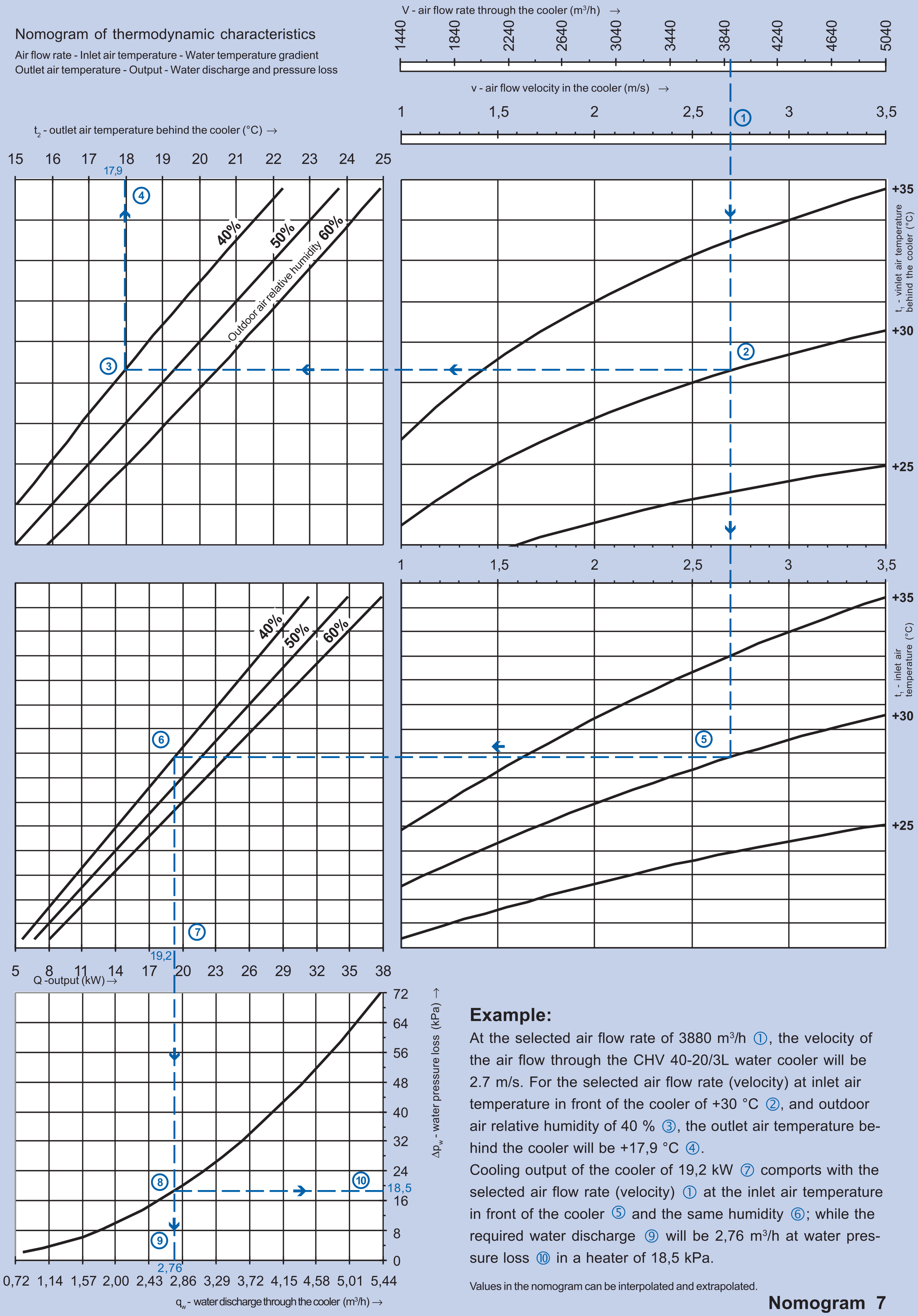
Values in the nomogram can be interpolated and extrapolated.

Nomogram 6

CHV 80-50 / 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 3880 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water 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 19,2 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 2,76 m³/h at water pressure loss ⑩ in a heater of 18,5 kPa.

Values in the nomogram can be interpolated and extrapolated.

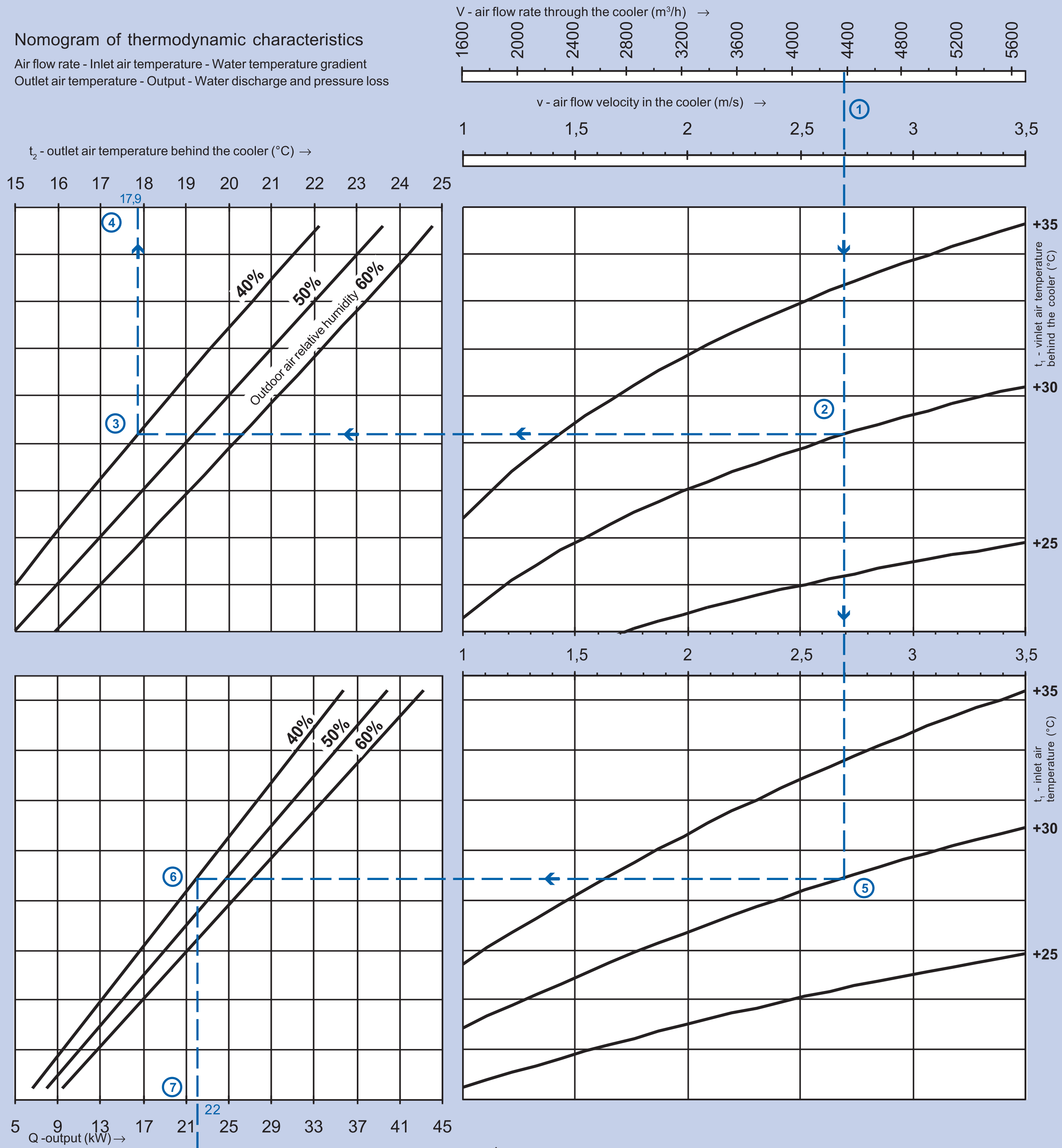
Nomogram 7

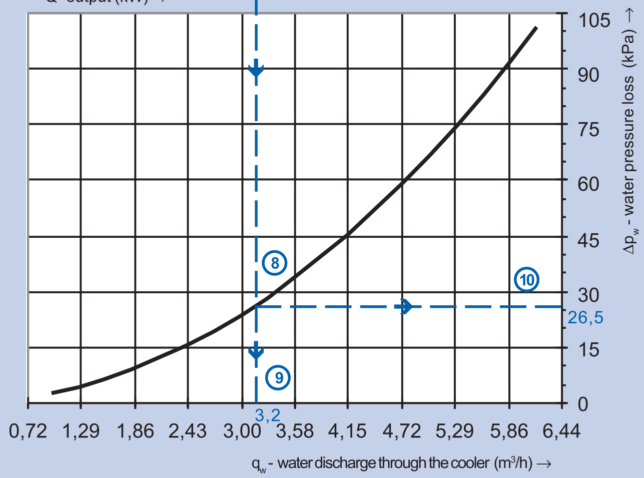
Ventilátory RP
Ventilátory RQ
Ventilátory RO
Ventilátory RS
Regulátory ...
El. ohřívače EO..
Vodní ohřívače VO
Směšovací uzly SUMX
Vodní chladiče CHV
Přímé chladiče CHF
Rekuperátory HRV
Příslušenství ...

CHV 90-50 / 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 4380 m³/h ①, the velocity of the air flow through the CHV 40-20/3L water 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 22 kW ⑦ comports with the selected air flow rate (velocity) ① at the inlet air temperature in front of the cooler ⑤ and the same humidity ⑥; while the required water discharge ⑨ will be 3,2 m³/h at water pressure loss ⑩ in a heater of 26,5 kPa.

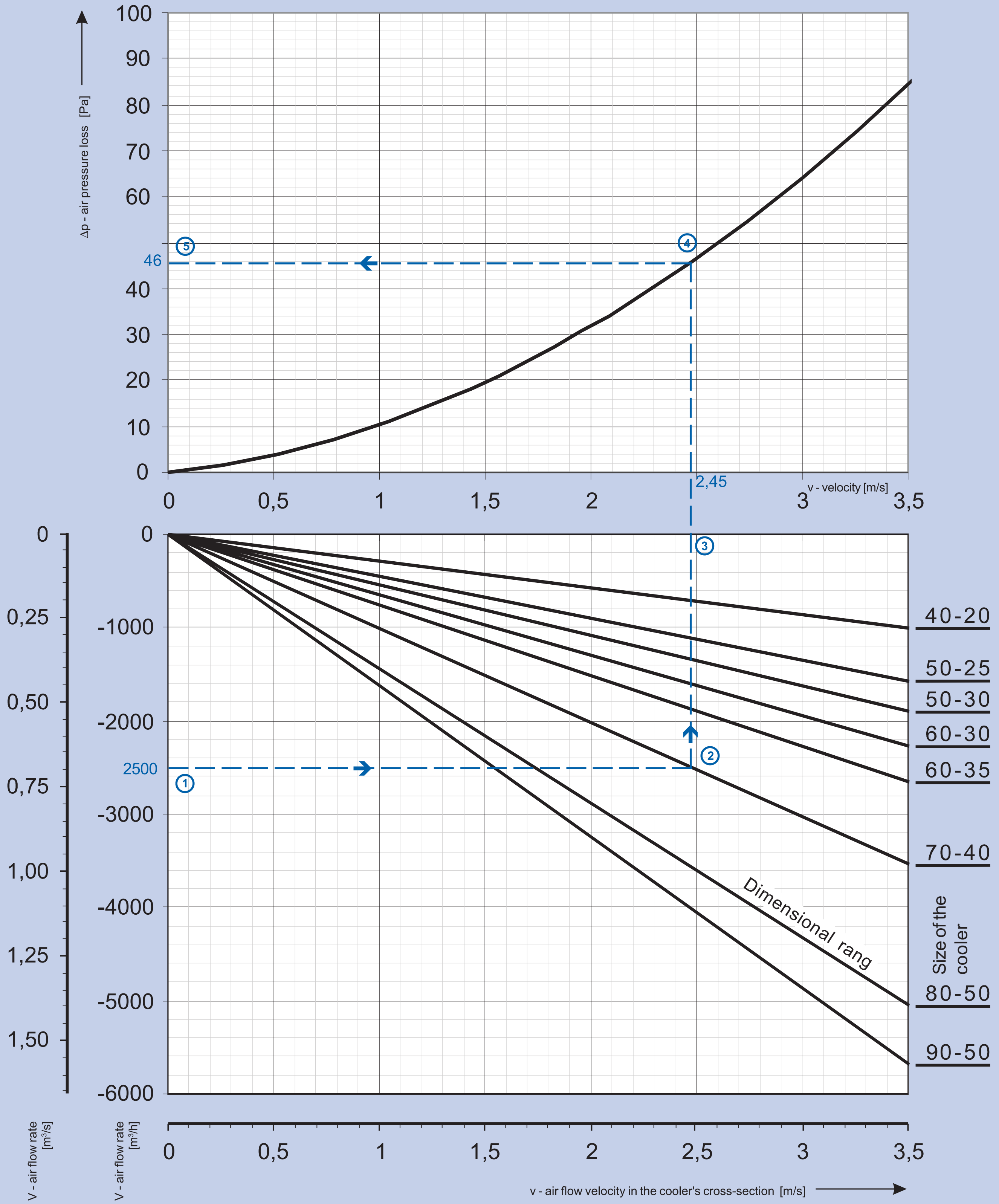
Values in the nomogram can be interpolated and extrapolated.

Nomogram 8

Air Pressure Losses in CHV Water Coolers

Nomogram of air pressure losses for all CHV water coolers

The nomogram of pressure losses is valid for all CHV water 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 dimensional ranges.



The nomogram of pressure losses is valid for all CHV water 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 CHV 70-40 3L water cooler will be 2.45 m/s. The cooler's air pressure loss for the above-mentioned air flow rate will be 46 Pa.

Installation, Service and Maintenance

Installation

- CHV water coolers and mixing sets, as well as other Vento elements and equipment, are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the cooler and accessories. The installation and commissioning may only be performed by a specialized assembling company licensed in accordance with generally valid regulations.
- The cooler must be checked carefully before its installation, especially if it was stored for a longer time. It is necessary to check parts for damage, and in particular whether the pipes, cooler vanes and header pipes, insulation of conductors of the mixing set pump and actuator are in good condition.
- If water is used as the cooling medium, the cooler can then be situated only in an indoor environment where the temperature is maintained above freezing point.
- Outdoor use is not recommended. It is allowed only if antifreeze solution is used as the cooling medium (mostly ethylene glycol solution concentrated depending on the temperature). However, the temperature limit of the used actuating mechanism of the mixing set must be taken into account.

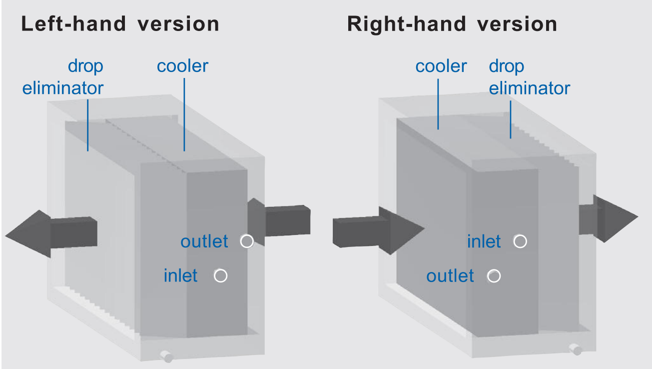
CHV Water Coolers

- There is no need for individual suspensions to install the water 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.
- Water coolers can work only in the horizontal position, in which condensate draining and air venting of the cooler are possible.
- To allow faster air venting while filling the system with water, remove the upper cover of the cooler, and loosen the knurled screw on the TACO valve by one or two turns. After finishing the filling of the system, tighten the knurled screw firmly. The valve will then work automatically.
- During the first air venting, a couple of water drops can leak through the air-venting valve. This will not happen again during normal operating conditions.
- When cleaning the TACO valve inside, it is necessary to replace the swelling parts (rings and inserts). The TACO valve is equipped with a back valve so there is no need to drain the heater.
- **Warning:** The following antifreeze solutions can be used as heating media:
  - water and ethylene glycol (Antifrogen N)
  - water and 1.2 - ethylene glycol (Antifrogen L)

  However, the cooler's parameters must be calculated using AeroCAD software
- When connecting the mixing set hoses or air-venting valve, be careful. Do not use excessive force, otherwise the pipes situated between the header pipes and the sidewall of the cooler could be damaged.
- The counter-current connection of the cooler is needed to achieve maximum output.

All calculations and nomograms are valid for the counter-current connection of the coolers.
- An air filter must be installed in front of the cooler to protect it from fouling.
- If the cooler is covered by a ceiling, it is necessary to ensure access to the entire cooler to enable checking and service; especially air-venting valves need regular checking.

Figure 7 - Side arrangement of the cooler



Before operating the air-handling unit or after being out of operation for a longer period, it is necessary to fill the siphon via the plastic plug with water. The air-handling unit can also be equipped with a siphon with a disconnecting trap and a ball valve (only negative pressure sections). This type of siphon need not be filled with water before putting it into operation.

Mixing Sets

Installation instructions included in the section "Mixing Sets" on page 182 (except the anti-freeze correlations) are fully valid for installation of the mixing sets with CHV coolers.

Installation, Service and Maintenance

Troubleshooting

When activating the air-handling system, you could face some undesirable situations. The following text includes the most common problems and their possible causes:

Permanently high output air temperature

- Low cooling water discharge rate or pressure in the cooling circuit
- High temperature of the water in the cooling circuit
- High air temperature adjusted in the control system
- Low speed of the pump in the SUMX mixing set
- Clogged screen in the SUMX mixing set
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Aerated pump (resp. entire system)
- Incorrect design of the CHV and SUMX assembly

Permanently low output air temperature

- High cooling water discharge rate and pressure in the cooling circuit
- Low air temperature adjusted in the control system
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Incorrect design of the CHV and SUMX assembly

The output air temperature fluctuates

- High cooling water discharge rate and pressure in the cooling circuit
- The three-way valve and SUMX mixing set actuator are incorrectly adjusted.
- Incorrect design of the CHV and SUMX assembly

Operation, Maintenance and Service

The water cooler and mixing set require regular maintenance at least at the beginning and end of the heating season. During operation, it is necessary to check proper air venting and water leakage, respectively rising pressure losses in the water piping or air duct (due to fouling). It is necessary to supervise pump and actuator operation, and keep the mixing set's filters clean.