Hoval

Cooling of data centres

ServeCool

Design handbook

Hoval | Responsibility for energy and environment

ServeCool SWP

Air-conditioning unit for indirect free cooling with fresh air in combination with adiabatic and mechanical cooling

1 Use

1.1 Intended use

ServeCool SWP is an air-conditioning unit for cooling data centres. It cools the IT environment indirectly with high-efficiency plate heat exchangers. This means the air in the server room is completely separated from the fresh air outside, which eliminates the possibility of dust or variations in fresh air humidity affecting highly sensitive IT equipment. The system uses the interaction of different resources for cooling with minimal energy consumption depending on the current environmental conditions:

- Indirect free cooling with fresh air
- Indirect adiabatic cooling
- Mechanical aftercooling via cooling coil (for covering load peaks)

The ServeCool SWP is suitable for use in data centres with one hundred to several thousand square metres of air-conditioned IT area. The system's cooling power can be scaled up as required simply by connecting several units in series.

Intended use also includes compliance with the operating instructions. Any usage over and above this use is considered to be not as intended. The manufacturer can accept no liability for damage resulting from improper use.

1.2 User group

The unit may only be installed, operated and serviced by authorised and trained specialist personnel who are familiar with the unit and aware of the risks involved.

2 Construction and operation

The ServeCool SWP has been specially designed for energy-efficient cooling of data centres. It fulfils the following functions:

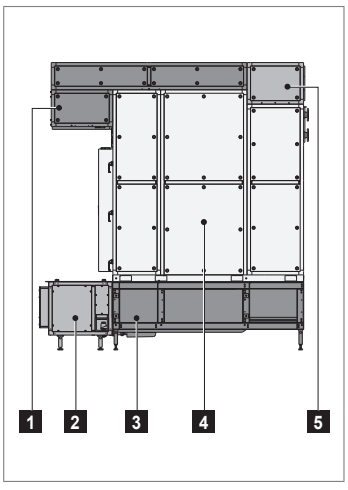
- Cooling in recirculation operation with connection to on site water supply and on site chilled water system (optional to on site heat pump)
- Filtering of the fresh air and the extract air
- Waste heat utilisation

The unit cools in recirculation operation, which means it draws in extract air from the server room, cools it and blows it back into the room as supply air. Depending on the current temperature and humidity conditions, various cooling processes will be taking place simultaneously:

Indirect free cooling with fresh air
The unit draws in cool fresh air. This flows through the two plate heat exchangers, thereby cooling the supply air flow, and is then blown back outside.

Indirect adiabatic cooling
The evaporative cooling (adiabatic system) is operating: water is sprayed into the fresh air flow. Evaporation of the water cools the air; the cooling capacity is transferred to the supply air via the plate heat exchanger.
A circulating water pump integrated in the unit supplies the adiabatic system with water. This means the spray nozzles are independent from the supply pressure of the water supply in the building.

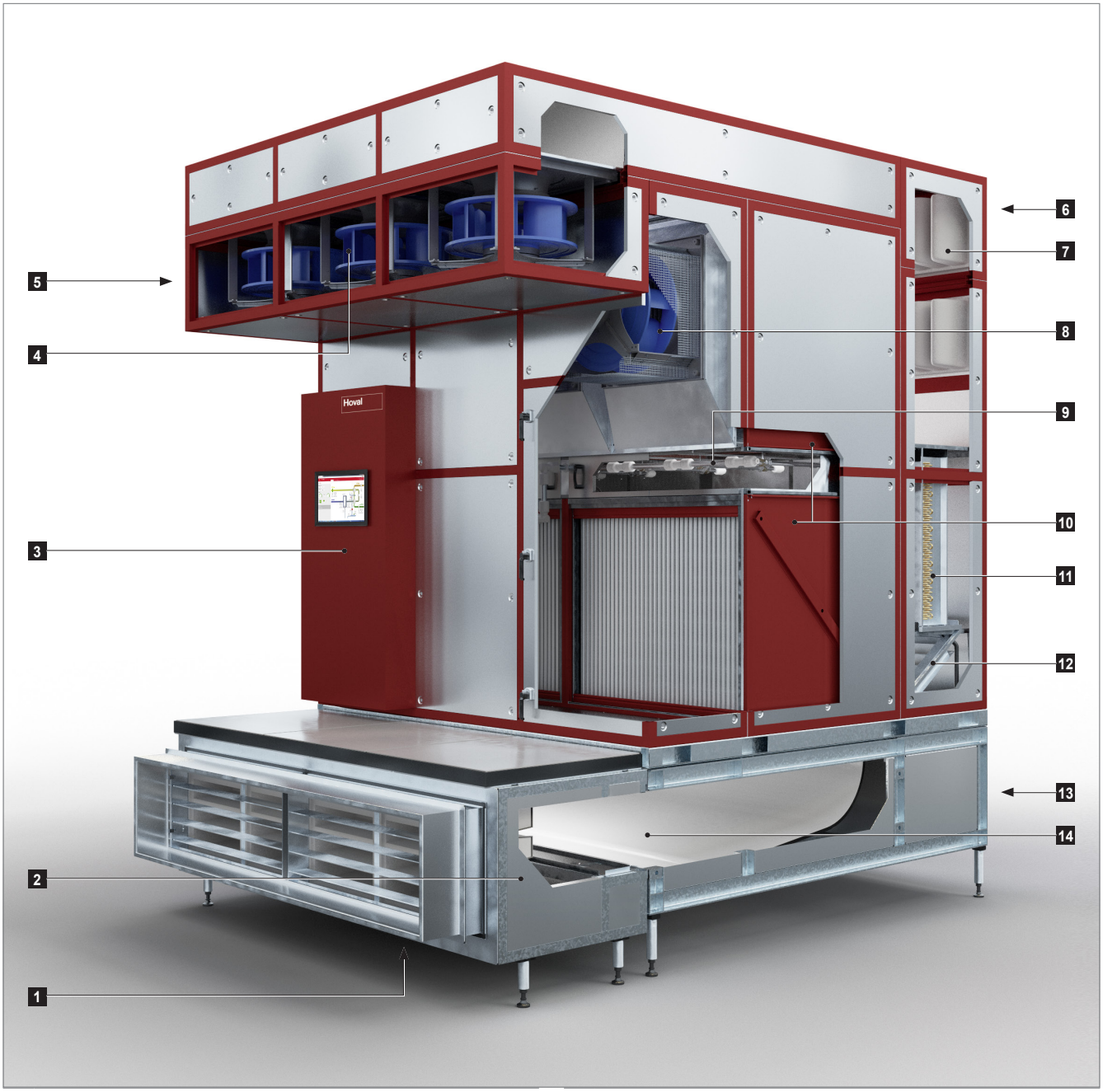
Mechanical aftercooling
The supply air undergoes mechanical aftercooling in order to cover load peaks.



1	Exhaust air box
2	Fresh air box
3	Base frame
4	Tower
5	Extract air box

Fig. A1: Components

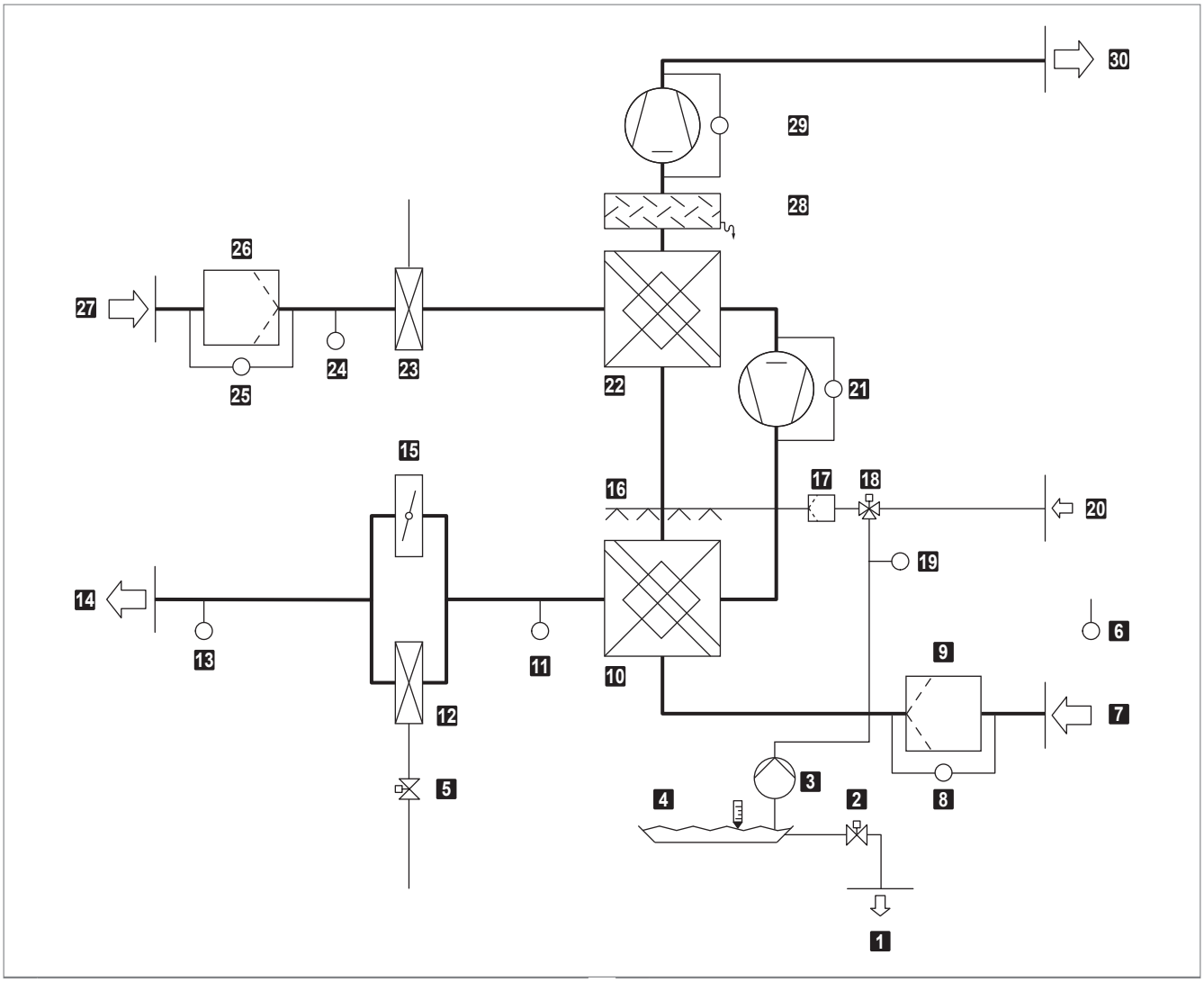
2.1 Construction



1	Drain valve with drain	8	Supply air fans
2	Fresh air box	9	Spray nozzles
3	Control box	10	Plate heat exchangers
4	Exhaust air fans	11	Cooling coil
5	Exhaust air duct connection	12	Bypass damper
6	Extract air duct connection	13	Supply air duct connection
7	Extract air filter	14	Adiabatic pump and trough

Fig. A2: ServeCool SWP construction

2.2 Function diagram



1	Drain adiabatic system	16	Spray nozzles
2	Drain valve	17	Water filter
3	Adiabatic pump	18	Feed valve
4	Trough with liquid level switch	19	Conductance measurement
5	Cooling valve (option)	20	Water supply adiabatic system
6	Fresh air combination sensor (temperature, humidity)	21	Supply air fan with flow rate measurement
7	Fresh air	22	Plate heat exchanger 2
8	Filter monitoring fresh air	23	Water coil for waste heat utilisation on the extract air side (optional)
9	Fresh air filter	24	Extract air combination sensor (temperature, humidity)
10	Plate heat exchanger 1	25	Filter monitoring extract air
11	Energy monitoring combination sensor (temperature, humidity)	26	Extract air filter
12	Chilled water cooling coil (mechanical aftercooling or waste heat utilisation on the supply air side)	27	Extract air
13	Supply air combination sensor (temperature, humidity)	28	Drop separator
14	Supply air	29	Exhaust air fan with flow rate measurement
15	Bypass damper with actuator	30	Exhaust air

Fig. A3: Function diagram

2.3 Operating modes

The ServeCool control system controls the unit according to demand and depending on the operating conditions. The integrated unit controller or higher-level building management system allow the following operating modes to be specified:

Operating mode	Description	Use
Summer operation	The unit uses the following cooling processes depending on the temperature and moisture conditions: ■ Indirect free cooling with fresh air ■ Indirect adiabatic cooling ■ Mechanical aftercooling (for covering load peaks) The chiller for supplying the cooling coil and the water supply are in operation.	During the hot season
Winter operation	The unit uses the following cooling processes depending on the temperature and moisture conditions: ■ Indirect free cooling with fresh air ■ Mechanical aftercooling (for covering load peaks) The chiller for supplying the cooling coil is in operation. There is no need for a water supply.	During the cold season and in transitional periods

Table A1: Operating modes

3 Technical data

3.1 Application limits

Fresh air temperature	min.	°C	-30
	max.	°C	45
Extract air temperature	max.	°C	45
Supply air temperature	min.	°C	15

Table A2: Application limits in operation

3.2 Electrical connection

Supply voltage	V AC	3 × 400
Permitted voltage tolerance	%	± 10
Frequency	Hz	50
Current consumption [1)]	A	37.0
Power consumption [1)]	kW	25.6
1) Reference: ServeCool unit in standard design at nominal air flow rate		

Table A3: Electrical connection

3.3 Air flow rate

Nominal air flow rate supply air	m³/h	25750
Nominal air flow rate fresh air	m³/h	22000

Table A4: Air flow rate

3.4 Air filtration

Filter	Fresh air	Extract air
Class acc. to ISO 16890	ISO ePM_{10} 65 %	ISO coarse 60 %
Factory setting of differential pressure switches	350 Pa	200 Pa

Table A5: Air filtration

3.5 Sound level

Sound pressure level (at a distance of 5 m) [1]		dB(A)	65
Total sound power level [2]		dB(A)	87
Octave sound power level	63 Hz	dB	52
	125 Hz	dB	70
	250 Hz	dB	77
	500 Hz	dB	81
	1000 Hz	dB	82
	2000 Hz	dB	80
	4000 Hz	dB	77
	8000 Hz	dB	72

1) with hemispherical radiation in a low-reflection environment (enveloping surface process)
2) determined by intensity process

Table A6: Sound level (fresh air, discharge side)

Notice
To reduce the noise level at night, the speed of the exhaust air fans can be limited to an adjustable set value.

3.6 Cooling capacity

Cooling capacity	Total	120 kW
	Free and adiabatic cooling	108 kW
	Mechanical	12 kW
Operating point	Extract air conditions	38 °C / 18 %rh
	Supply air conditions	24 °C / 40 %rh
	Fresh air conditions	35 °C / 22 %rh
Cooling coil data (chilled water)	Supply/return temperature	14/20 °C
	Water quantity	1873 l/h
	Water pressure drop	0.44 kPa

Table A7: Cooling capacity

3.7 Waste heat utilisation

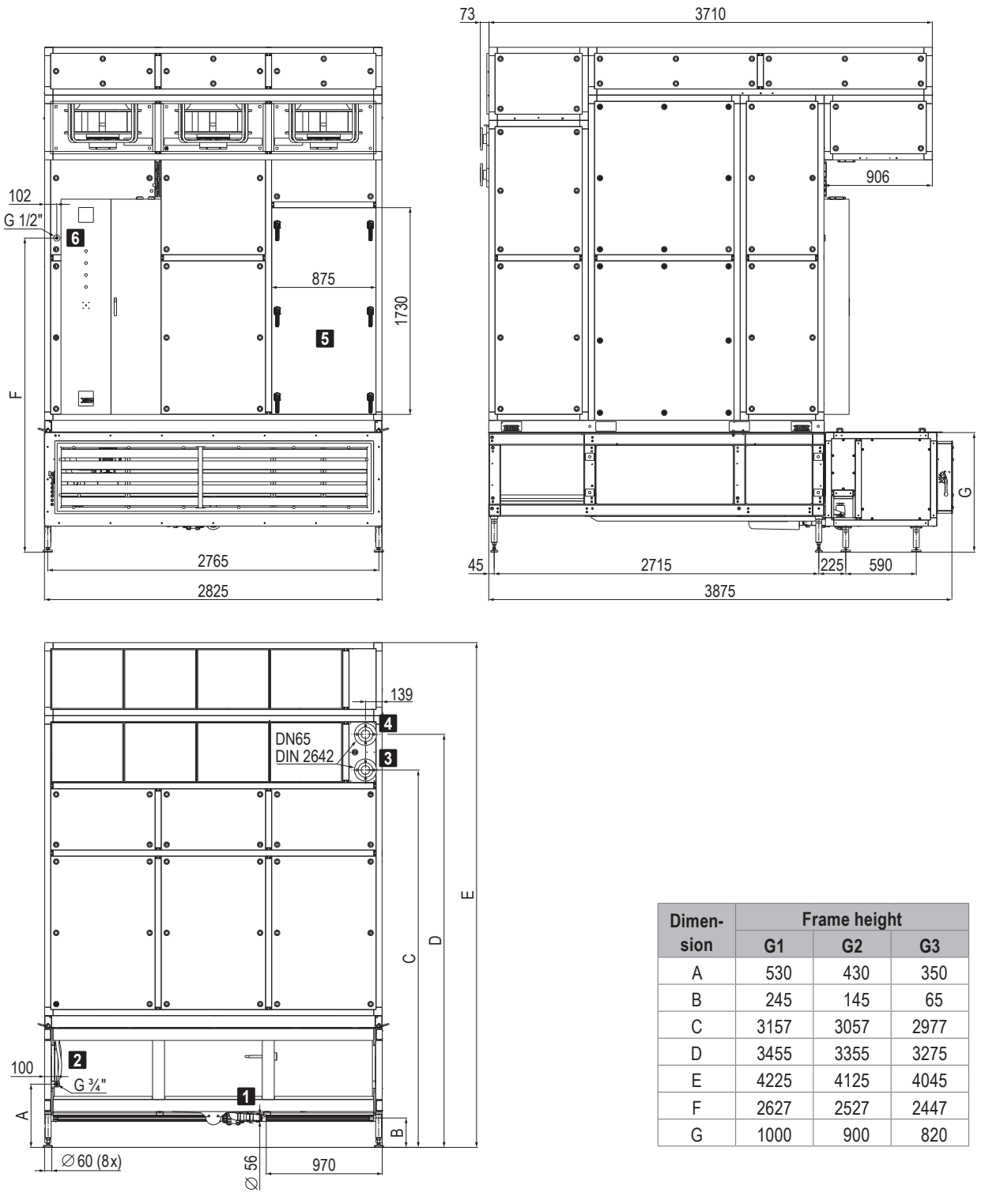
t_{inlet}	Flow/return	Q	m_W	t_S
°C	°C	kW	l/h	°C
26	12 / 17	52.5	9000	19.8
28	12 / 17	62.7	10800	20.6
30	12 / 17	72.8	12600	21.3
32	12 / 17	82.8	14400	22.1

Legend:
t_{inlet} = Supply air temperature at the coil inlet
Q = Utilisable waste heat
m_W = Water quantity
t_S = Supply air temperature to the server room

Reference: Nominal air flow rate 25750 m³/h
Rel. extract air humidity 25 %
Air side pressure drop 66 Pa

Table A8: Waste heat utilisation on the supply air side

3.8 Dimensions

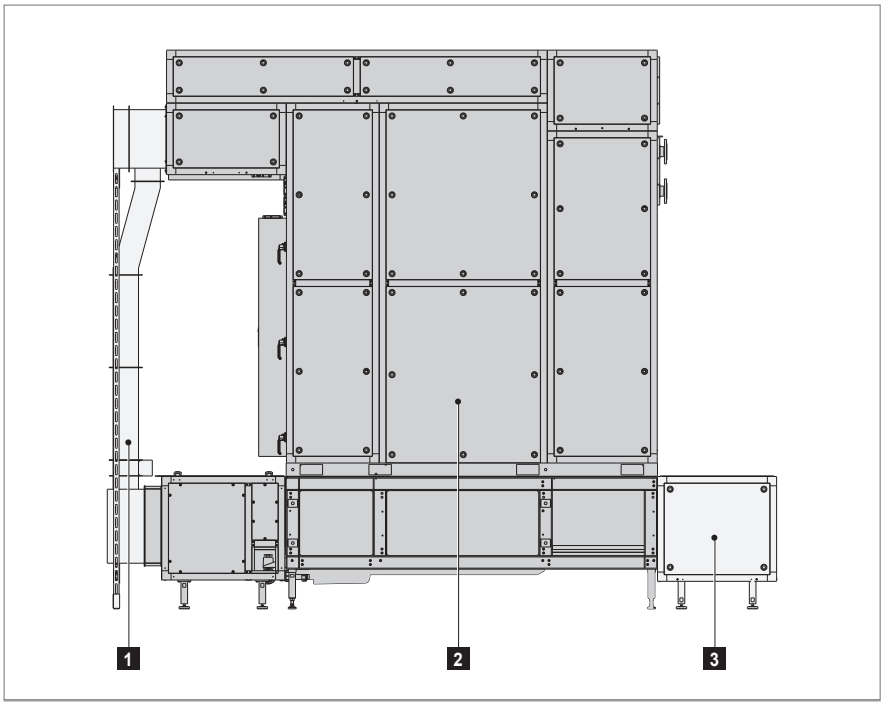


Dimension	Frame height		
	G1	G2	G3
A	530	430	350
B	245	145	65
C	3157	3057	2977
D	3455	3355	3275
E	4225	4125	4045
F	2627	2527	2447
G	1000	900	820

1 Drain adiabatic system	3 Cooling coil return	5 Tower access door
2 Condensate connection	4 Cooling coil flow	6 Water supply adiabatic system

Fig. A4: Dimensional drawing (dimensions in mm)

3.9 Weights



1	Condensation Prevention System (option)
2	ServeCool unit
3	Supply air box (option)

Fig. A5: Components

Components	ServeCool unit, consisting of:		
	– Base frame, tower, extract air box, exhaust air box	kg	3615
	– Fresh air box (supplied separately)	kg	350
	Unit in standard design, total	**kg**	**3965**
	Condensation Prevention System (option)	kg	230
	Supply air box (option)	kg	187
Water capacity	Chilled water cooling coil	kg	40
	Trough	kg	250
Total		**kg**	**4672**

Table A9: Weights

4 Specification texts

4.1 ServeCool SWP

Innovative air-conditioning unit for recirculation cooling in data centres subject to a high temperature load. The unit uses various cooling processes: indirect free cooling with fresh air via high-performance plate heat exchanger is supplemented by indirect adiabatic cooling as well as mechanical cooling.

The ServeCool SWP consists of the following components:
- Base frame
- Tower
- Extract air box
- Fresh air box
- Exhaust air box
- Control system
- Optional components

Base frame

Support frame construction of galvanized steel sections, welded and bolted; fitted with eyelets for crane transport and installation on site.

The base frame contains:

Trough
Fibre-glass-reinforced, insulated plastic trough with liquid level switch for monitoring the level, including integrated drain and emergency overflow.

Adiabatic pump
Configured as high-performance centrifugal pump with fully demineralised water-resistant plastic housing and open impeller. Configuration with stainless steel shaft without seal, only mounted in the motor.

Feet
Adjustable feet for levelling and aligning the device on uneven surfaces.

Tower

Support frame construction of stainless-steel sections, welded.
Panel construction set up in supporting frame of aluminium sections, connected together and bolted; with insulation made of water-expanded polyurethane. The casing complies with air leakage class L3 acc. to EN 1886 and fire protection class B-s3, d0 acc. to EN 13501-1:2002.

The tower contains:

Supply air fans
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motors, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; infinitely variable (3 pieces).

2 crossflow plate heat exchangers
In waterproof design for indirect free cooling of the supply air for data centres. Exchanger package consists of epoxy-coated aluminium plates with pressed-in spacers. The plates are connected by a double fold, which gives several times the material thickness at the air entry and exit. The corners of the exchanger package are cast into the extruded aluminium hollow sections of the casing with a sealing compound to form a water-tight seal. The stainless steel side walls have a high-quality paint coating and are bolted flush with the above and sealed to make them water-tight. Thus the exchangers are resistant to pressures up to 2500 Pa.
Accumulating condensate is collected in a stainless-steel channel and drained to the condensate connection by a hose trap. The crossflow plate heat exchangers are Eurovent-certified and achieve efficiency class H1 to EN 13053.

Drop separator
Prevents droplets from being carried along with the air stream and thus protects the exhaust air fans from moisture.

Adiabatic system
Spray humidifier comprising pipes and tangential full cone nozzles, made of a fully demineralised water-resistant plastic, mounted in a stainless-steel frame; activated by a valve with actuator and limit switches; pressure-resistant up to 16 bar (corresponding to DIN EN 12201-2). The connection system is certified according to DVGW guidelines. A fine water filter is installed in the supply line to the tangential full cone nozzles.

Cooling coil
Cold water coil made of copper pipes and aluminium fins with collecting channel for condensate drain made from stainless steel; drainage via hose trap to the condensate connection; condensation drainage on site.
Used for mechanical aftercooling of the supply air and/or for waste heat utilisation on the supply air side (utilisation of the extracted heat with a heat pump).

Bypass damper
Lamellar damper for directing the supply air flow through the cooling coil or the bypass; including actuator with open/closed feedback. The damper fulfils leakage class 2 according to DIN EN 1751. Channelling the air through the bypass minimises the air-side pressure drop when no mechanical cooling is required.

Access opening
Tower access door: large access opening for easy access to the supply air fans, the crossflow plate heat exchangers and to the components of the adiabatic system for maintenance.

Control box with unit controller as part of the ServeCool control system
- Control box made of sheet steel, powder-coated with textured paint in Hoval red (RAL 3000).
- Unit controller wired ready-to-connect for the following components:
  - Supply air fans
  - Flow rate measurement supply air fans
  - Exhaust air fans
  - Flow rate measurement exhaust air fans
  - Feed valve
  - Drain valve
  - Conductance measurement
  - Adiabatic pump
  - Liquid level switch
  - Cooling valve
  - Bypass damper actuator
  - Extract air combination sensor (temperature, humidity)
  - Energy monitoring combination sensor (temperature, humidity)
  - Supply air combination sensor (temperature, humidity)
  - Fresh air combination sensor (temperature, humidity)
  - Filter monitoring extract air
  - Filter monitoring fresh air
- Volt-free signalling contacts
- Pre-wired network connection to spring-type terminals
- Network connection socket with pre-laid Cat.6A patch cable pre-installed in control box
- Accessible cable feed-through system, consisting of plate and inserts

Extract air box

Support frame construction of aluminium sections, attached and bolted, insulated panel construction.

The extract air box contains:

Extract air filter
Configured as a ISO coarse 60% bag filter, including differential pressure switches for filter monitoring.

Fresh air box

Support frame construction of aluminium sections, attached and bolted, insulated panel construction; fitted with eyelets for crane transport and assembly on site. For directly connecting the fresh air intake to the ServeCool unit; equipped with adjustable feet for adapting to the frame height.

The fresh air box contains:

Fresh air filter
Designed as compact filter of class ISO ePM_{10} 65 %, including differential pressure switch for filter monitoring.

Fresh air damper
For closing the fresh air opening during maintenance work.

Exhaust air box horizontal

Support frame construction of aluminium sections, attached and bolted, insulated panel construction.

The exhaust air box contains:

Exhaust air fans
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motors, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; infinitely variable (3 pieces).

Options for the unit

Cold water coil with cooling valve
Non-pressure dependent compensating and control valve as automatic combination valve for control and hydraulic balancing, comprising linear control valve, pressure controller with integrated diaphragm and actuator; adapted to the cold water coil; supplied loose for installation on site.

Direct evaporator
Evaporator coil, consisting of seamless copper pipes with pressed-on, optimised and profiled aluminium fins, with collecting channel for condensate drainage made of stainless steel; drainage via hose trap to the condensate connection; condensate drainage on site.

High pressure fans
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motors, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; infinitely variable (3 pieces); in high-pressure design to compensate for external pressure drops or to supply larger volumes of air.

Frame height
Modified height of the base frame for adapting to the structure of the false floor (820 mm or 900 mm).

Exhaust air box vertical
Modified design of the exhaust air box for blowing the exhaust air vertically upwards.

Extract air filter AM
Configured as ISO ePM$_{10}$ 65 % compact filter instead of ISO coarse 60 %, for optimised filtering of the recirculated air.

Condensation Prevention System
Patented system to prevent condensation in the circulating air flow. Mixed air duct made from Sendzimir-galvanised sheet steel; insulated in the area in direct contact with fresh air; with 1 P30 flange each for exhaust air and fresh air duct connection; includes 2 dampers with continuous actuators; mixed air duct supported on site by mounting rails.

Supply air box
Support frame construction of aluminium sections, attached and bolted, insulated panel construction; fitted with eyelets for crane transport and assembly on site. For direct air supply into the server room; equipped with adjustable feet for adapting to the frame height.

Water coil on extract air side
Water coil made of copper pipes and aluminium fins with collecting channel for condensate drain made from stainless steel; drainage via hose trap to the condensate connection; condensation drainage on site.
Used for waste heat utilisation on the extract air side (utilisation of the extracted heat with a heat pump).

ServeCool control system

Control system for the energy-optimised operation of Hoval ServeCool, designed as a decentralised system, with the following main features:

- Unit controller integrated in the control box for autonomous and individual control of each unit, with continuous measurement of all relevant parameters and alarm management. The unit controller has the following properties:
  - CPU: Cortex A8; 1 GHz
  - Ethernet transfer rate: 10/100 Mbit/s
  - Linux operating system with PREEMPT_RT patch
  - Programming compliant with IEC 61131-3
  - Extra storage via SD card
  - Bus connection: 2 x Ethernet (configurable), RS-232/485
  - Communication: Modbus TCP master/slave, Ethernet
  - Ethernet protocols: DHCP, DNS, NTP, FTP, FTPS, HTTP
- ServeCool is equipped with an automatic source changeover switch. In the event of a fault within one of the two supply lines, this switches the current path.
  Make: Socomec ATyS p M
- Power supply unit with buffer module to ensure a regulated, uninterrupted 24 V supply, with maintenance-free capacitor-based power storage.
- Visualisation and intuitive operation of the unit via the integrated web application with graphical user interface (web GUI), which enables fast access to the individual data points via structured grouping. Any web browser can be used for access via the interface directly on the unit.
- Selector switch for manual switchover between local operation and BMS operation.
- Combination sensors (temperature, humidity): 4…20 mA interfaces with monitoring of the life zero point for low breakdown susceptibility.
- When carrying out maintenance, the building infrastructure (Ethernet) is not required as ServeCool has its own service port on the control panel which is not connected to the building network.

- The following control functions are performed by the unit controller:
  - Control of the supply air temperature with extract air temperature limiting and fixed setting of the supply air volume flow
  - External enabling: Connection for an external signal to shut the plant down (e.g. in the event of a fire)
  - Control of the adiabatic circuit
- Units are fully pre-wired, tested and ready to be connected
- Electrical documentation supplied in the control box

Options for the control system

Control of refrigeration system type 1
Control of the cooling valve pre-wired to terminal, using the following signals:
- Analog output 0-10 V Output specification
- Analog input 0-10 V Output feedback

Control of refrigeration system type 2
Control of the chiller or heat pump pre-wired to terminal, using the following signals:
- Analog output 0-10 V Output specification
- Analog input 0-10 V Output feedback
- Digital output Enabling (Volt-free)
- Digital input Operating signal (24 V)
- Digital input Fault message (24 V)
- Digital input Limitation signal (24 V)

Source changeover incl. refrigeration
The automatic source changeover switch has an additional output that reports to the subordinate ATS of the refrigeration system which power source is currently supplying the load.
- Digital output Mains preselection (Volt-free)

Redundant power supply units
Parallel operation of 2 power supply units, decoupled via a redundancy module to ensure an uninterrupted 24 V supply.

Zone control panel

Control panel with zone controller for higher-level control of several ServeCool units and for integration into the building management system, consisting of:
- Zone control panel, made of coated sheet steel (light grey RAL 7035).
- Zone controller wired to terminal blocks ready-to-connect for the following components:
  - Temperature and humidity sensors installed in the server room
  - Differential pressure sensors
  - Digital signals
  - Digital releases
- BMS interface via Modbus TCP
- Volt-free signalling contacts
- Pre-wired network connection to spring-type terminals, design for 2 power supplies
- Power supply units and redundancy module for power supply
- Schuko socket outlet
- 2 mains isolators
- Network switch
- Maintenance-free industrial mini PC
- Operating unit in the control panel front, consisting of:
  - 21" touch panel
  - LED display, power supply available

Technical data

- Nominal air flow rate supply air: _____ m³/h
- Nominal air flow rate fresh air _____ m³/h
- Cooling capacity: _____ kW
  - at supply air temperature: _____ °C
  - at supply air humidity: _____ %rh
  - at fresh air temperature: _____ °C
  - at fresh air humidity: _____ %rh

Dimensions

- ServeCool (footprint x height): 3875 × 2825 × 4225 mm
- Maintenance area supply air side: 2825 × 1000 mm
- Maintenance area fresh air side: 2825 × 1200 mm

Weight

ServeCool: 4672 kg

Electrical connection

- Supply voltage: 3 × 400 VAC / 50 Hz
- Current consumption: max. 37 A
- Power consumption: max. 25.6 kW

Sound data

- Sound pressure level at 5 m distance from unit: 65 dB(A)
- Total sound power level: 87 dB(A)

Plate heat exchanger

- Fresh air temperature at free cooling limit: _____ °C
- Fresh air relative humidity: _____ %rh
- Extract air temperature: _____ °C
- Extract air relative humidity: _____ %rh
- Temperature efficiency dry fresh air side/extract air side at nominal air flow rate: _____ / _____ %
- Pressure drop fresh air side/extract air side at nominal air flow rate: _____ / _____ Pa

Technical data cooling coil

- Cooling capacity, total: _____ kW
- Cooling capacity, sensitive: _____ kW
- Flow/return: _____ / _____ °C
- Supply air temperature: _____ °C
  - for inlet temperature: _____ °C
  - with rel. inlet humidity: _____ %rh
- Operating pressure: _____ kPa

Options

1 Type code

SWP - 25 . CR . SV / G1 . FH . AG / CP . ZK . WZ / SC . AW . Q . NP

Unit type

SWP	ServeCool SWP

Unit size

25	Size 25

Coil

--	Without
CR	Cold water coil (standard)
CV	Cold water coil with cooling valve
DX	Direct evaporator

Fans

SV	Standard fans (standard)
HV	High pressure fans

Frame height

G1	Frame height 1000 mm (standard)
G2	Frame height 900 mm
G3	Frame height 820 mm

Exhaust air box

FH	Exhaust air box horizontal (standard)
FV	Exhaust air box vertical

Extract air filter

AG	Extract air filter ISO coarse 60 % (standard)
AM	Extract air filter ISO ePM_{10} 65 %

Condensation Prevention System

--	Without (standard)
CP	Condensation Prevention System

Supply air box

--	Without (standard)
ZK	Supply air box

Waste heat utilisation on extract air side

--	Without (standard)
WA	Water coil on extract air side

Control system

SC	System control for ServeCool

Control of refrigeration system

--	Without (standard)
A1	Control of refrigeration system type 1
A2	Control of refrigeration system type 2

Source changeover

Q1	Source changeover (standard)
Q2	Source changeover incl. refrigeration

Power supply

NP	Power supply unit with buffer module (standard)
RN	Redundant power supply units

Table B1: Type code

2 Cold water coil with cooling valve

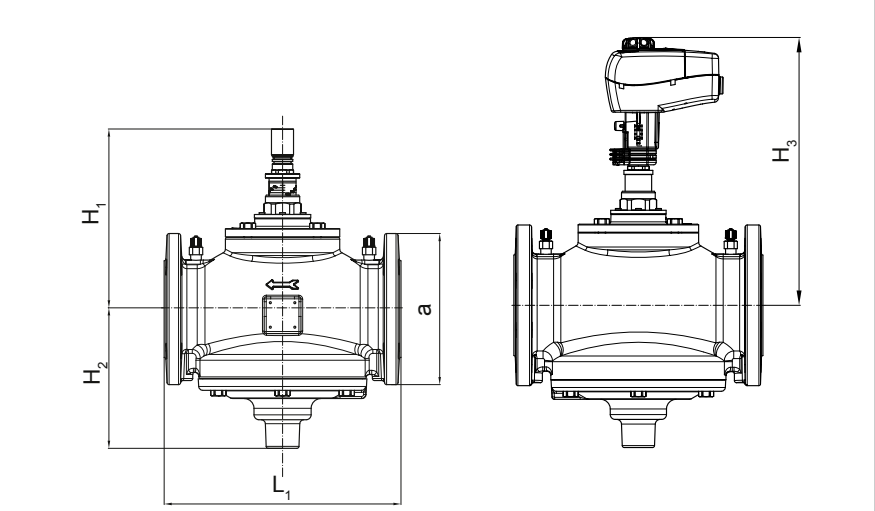
An optional non-pressure-dependent compensating and control valve is available to match the standard cold water coil:

- Linear control valve
- Pressure regulator with integrated diaphragm
- Actuator

The valve is used as an automatic combination valve for control and hydraulic balancing. The valve authority is 100 % (a = 1). There is no change in the linear characteristic, irrespective of the settings or the pressure conditions.

Control voltage	0…10 V
Throughflow rate	20000 l/h

Table B2: Cooling valve technical data



DN	L_1	H_1	H_2	H_3	a	Weight
	mm				(EN 1092-2)	kg
65	290	233	172	373	185	38

Fig. B1: Dimensional drawing cooling valve

3 Direct evaporator

Instead of the cold water coil, an optional direct evaporator is available for connection to an on-site heat pump. The connecting pipes must be provided by the customer.

Control of heat pump (Option A2)		
Output specification	analog	0…10 V
Output feedback	analog	0…10 V
Enabling	digital	Volt-free
Operating signal	digital	24 V
Fault message	digital	24 V
Limitation signal	digital	24 V

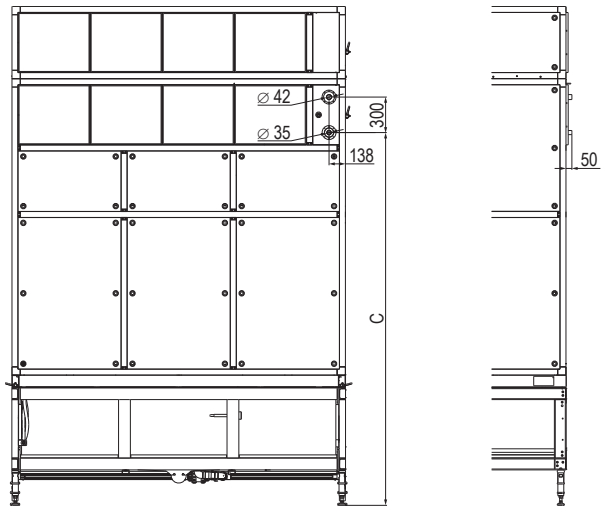
Source changeover (option Q2)		
Mains preselection	digital	Volt-free

t_{inlet}	t_S	Q	t_o
°C	**°C**	**kW**	**°C**
28	24	34.7	19.5
30	24	51.5	18.5
32	24	65.5	17.5
34	24	82.3	16.5

Legend: t_{inlet} = Supply air temperature at the coil inlet; Q = Total cooling capacity; t_S = Supply air temperature to the server room; t_o = Evaporation temperature

Reference: Nominal air flow rate 25750 m³/h; Rel. extract air humidity 25 %; Air side pressure drop 86 Pa; Refrigerant R410A

Table B3: Cooling capacity direct evaporator



Frame height	**G1**	**G2**	**G3**
Dimension C	3155	3055	2975

Fig. B2: Connection dimensions direct evaporator (dimensions in mm)

4 High pressure fans

High-pressure fans are EC fans with a higher available pressure to compensate for external pressure drops or to supply larger volumes of air. They replace the standard fans.

Nominal air flow rate	m³/h	30000
Supply voltage	V AC	3 × 400
Frequency	Hz	50
Current consumption	A	55
Power consumption	kW	34

Table B4: Technical data

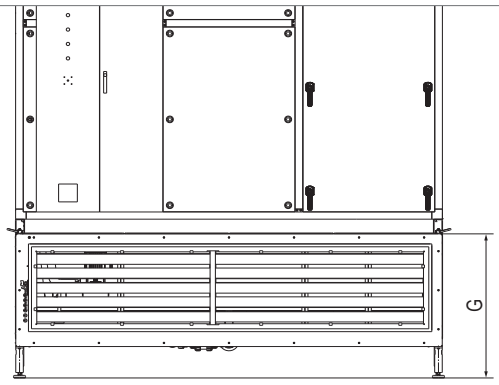
Sound pressure level (at a distance of 5 m) [1]		dB(A)	71
Total sound power level [2]		dB(A)	93
Octave sound power level	63 Hz	dB	64
	125 Hz	dB	76
	250 Hz	dB	84
	500 Hz	dB	88
	1000 Hz	dB	88
	2000 Hz	dB	85
	4000 Hz	dB	82
	8000 Hz	dB	74

1) with hemispherical radiation in a low-reflection environment (enveloping surface process)
2) determined by intensity process

Table B5: Sound level (fresh air, discharge side)

5 Frame height

The base frame can be supplied in 3 versions to adapt the ServeCool unit to the structure of the false floor.

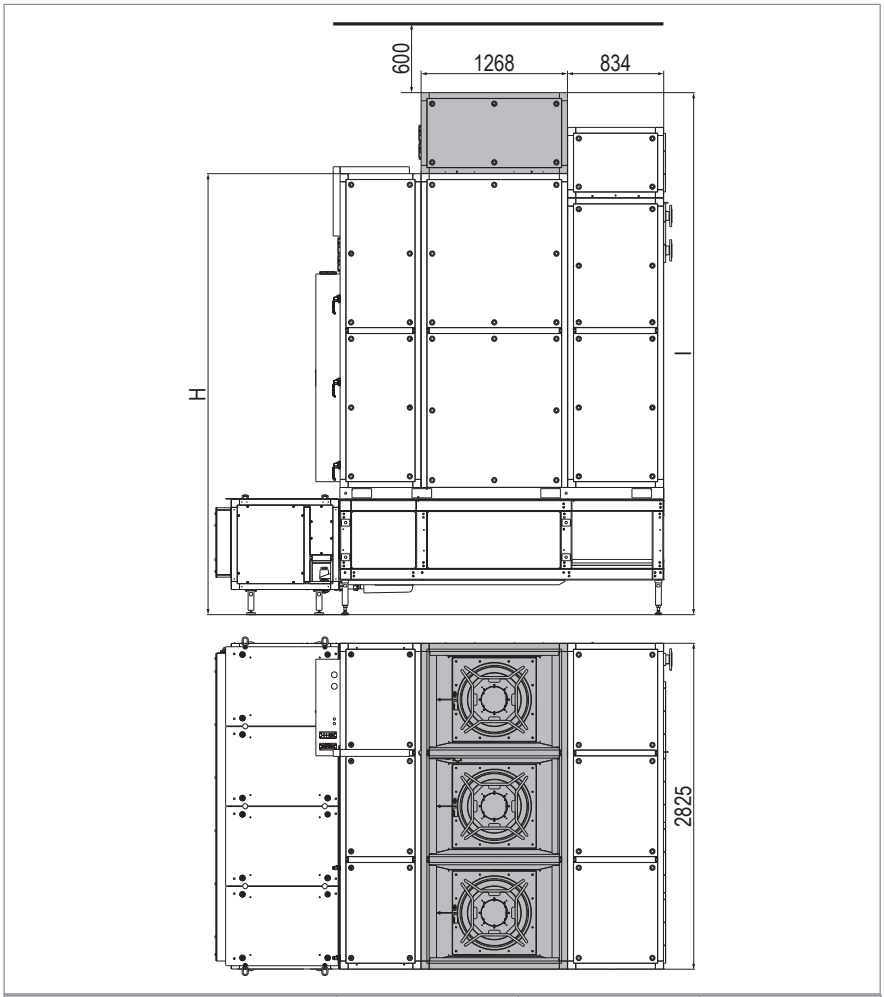


Frame height	G1	G2	G3
Dimension G	1000	900	820

Table B6: Dimensional drawing frame height (dimensions in mm)

6 Exhaust air box vertical

To adapt to local conditions, the exhaust air box is also available in a vertical design. The exhaust air is then blown vertically upwards.
The weight of the unit is reduced by 140 kg.



Frame height	G1	G2	G3
Dimension H	3821	3721	3641
Dimension I	4523	4423	4343

Fig. B3: ServeCool unit with exhaust air box in vertical design (dimensions in mm)

7 Extract air filter

An ultrafine dust filter is installed for filtering the extract air (replaces the standard filter).

Filter class	ISO ePM_{10} 65 %
Filter monitoring factory setting	250 Pa

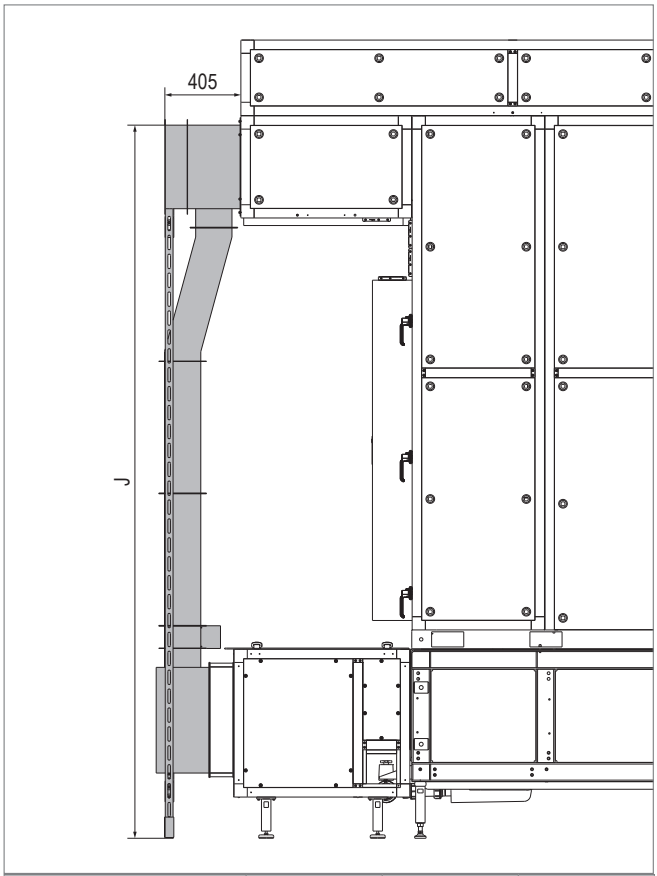
Table B7: Extract air filter technical data

8 Condensation Prevention System

On request, ServeCool can be fitted with a Condensation Prevention System. The patented system is controlled automatically and prevents humidity in the circulating air from condensing even when fresh air temperatures are very low. Free cooling can therefore be used throughout the year without the costly rehumidification of the supply air. The following components are installed:

- Mixed air duct with 2 dampers incl. actuator for mixing exhaust air with fresh air

Notice
The Condensation Prevention System can only be used in combination with an exhaust air box in horizontal design.

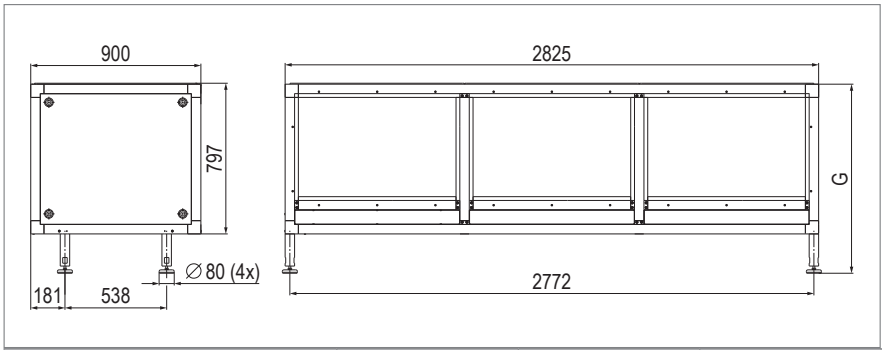


Frame height	G1	G2	G3
Dimension J	3775	3675	3595

Fig. B4: ServeCool unit with Condensation Prevention System (dimensions in mm)

9 Supply air box

An optional supply air box is available for direct air supply into the server room. The air duct produced in panel design must be attached to the supply air duct connection of the ServeCool unit on site. Adjustable feet allow easy adaptation to the rack height.



Frame height	G1	G2	G3
Dimension G	1000	900	820

Fig. B5: Dimensional drawing supply air box (dimensions in mm)

10 Water coil on extract air side

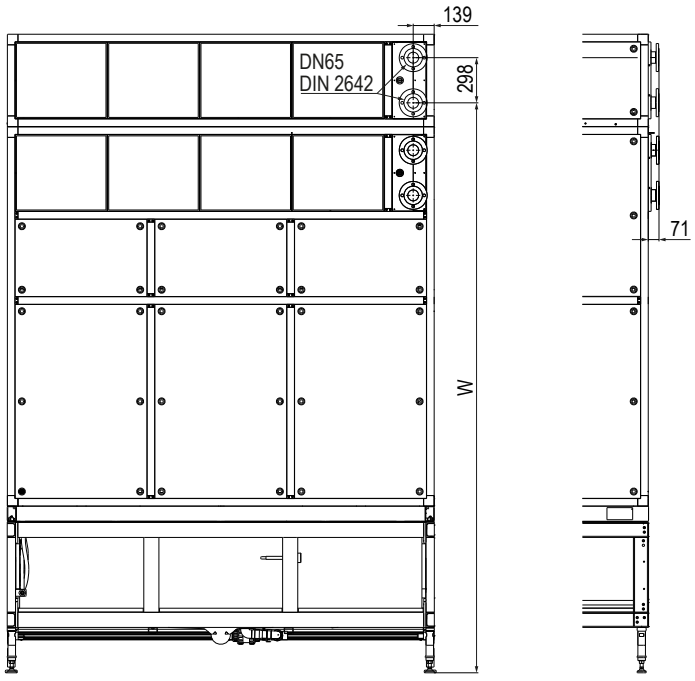
As an option, a water coil can also be installed on the extract air side of the ServeCool unit. This allows heat to be extracted from the warm extract air from the data centre for further use. The coil must be connected on site.

t_{inlet}	Flow/return	Q	m_W
°C	°C	kW	l/h
33	22 / 28	31.3	4500
35	22 / 30	33.3	3600
38	22 / 33	35.9	2880

Legend:
t_{inlet} = Extract air temperature at the coil inlet
Q = Utilisable waste heat
m_W = Water quantity

Reference:
Nominal air flow rate 25750 m³/h
Rel. extract air humidity 25 %
Air side pressure drop 76 Pa

Table B8: Waste heat utilisation on extract air side



Frame height	G1	G2	G3
Dimension W	3769	3669	3589

Fig. B6: Connection dimensions water coil on extract air side (dimensions in mm)

Notice
You will find a description of the options for the control system in part D 'Control systems' of this handbook.

Transport and installation

1 Installation

Base frame, tower, extract air box and exhaust air box are delivered fully assembled on a pallet. The fresh air box is supplied separately.

The following guidelines are important when preparing for installation:

- A crane is required for lifting and transporting the components. A suitable lifting traverse is included with the delivery.
- For transport to the installation site and for precise positioning, it is necessary to have a transport trolley with articulated steering, turntable and drawbar (max. height 110 mm).
- Follow the installation instructions included.

1.1 Installation site

- The unit must be erected at an inside location that is protected against frost.
- Install the unit horizontally.
- Ensure that the installation surface is of sufficient load-bearing capacity. The weight of the unit is distributed over the adjustable feet (see Fig. C1).
- Position the unit in accordance with the airflow direction.
- The unit must be accessible and connecting lines must be able to be dismantled for maintenance and servicing work.
- A flat surface is required for transporting the unit to the installation site using the heavy-duty rollers.

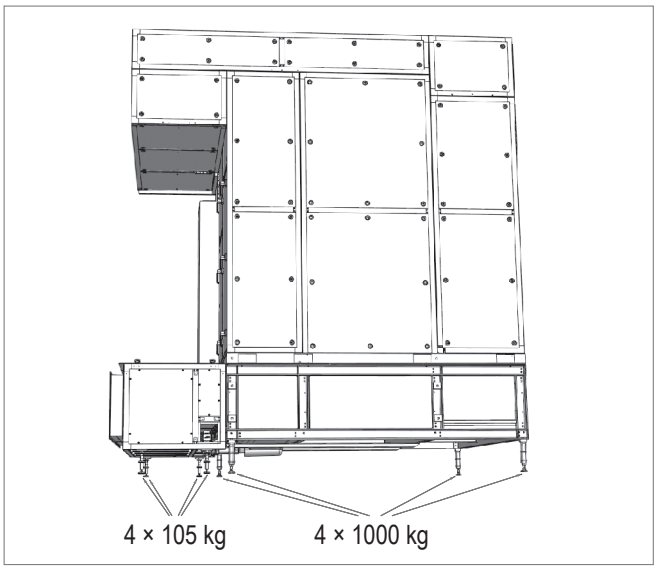


Fig. C1: Load distribution

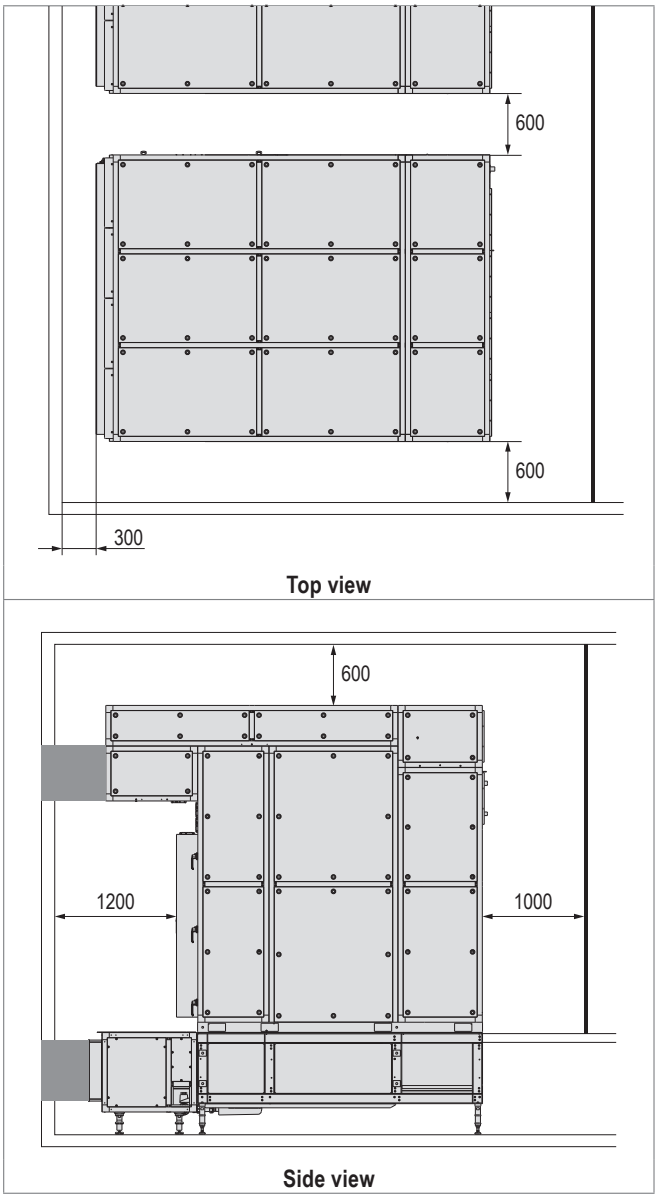


Fig. C2: Space requirements for maintenance and servicing (minimum clearances in mm)

1.2 Connecting the air ducts

- Connect the ServeCool unit to fresh air and exhaust air ducts installed on site.
  - The unit must not be subjected to the weight of the ducts. Suspend the ducts from the ceiling or support them on the floor.
- The connection to extract air and supply air ducts installed on site depends on the specific conditions of the plant. Ideally, the unit will draw the extract air directly from the server room and blow air back into the false floor directly.
- If you connect an extract air duct: Install inspection openings for filter changes (dimensions of the extract air filters: 592 × 490 × 500 mm).
- Connect the air ducts via the compensators so they are free of tension and vibrations.
- Insulate the fresh air duct, including the compensators, up to the building entry point.

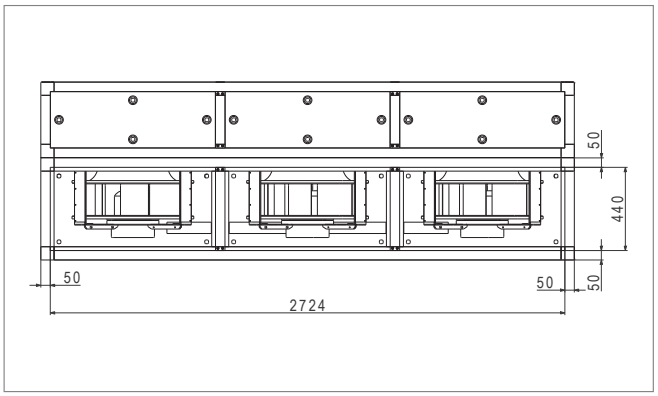


Fig. C3: Dimensional drawing exhaust air duct (dimensions in mm)

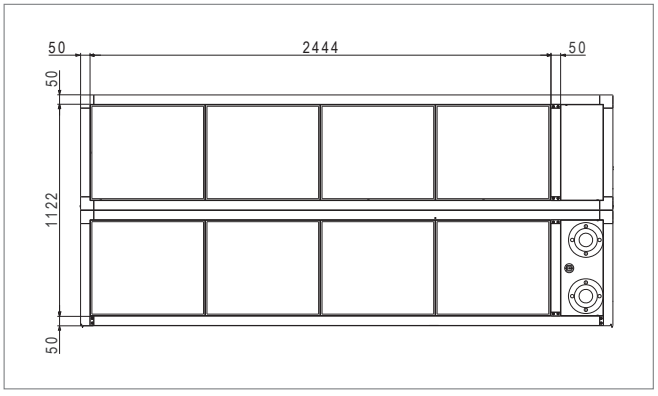
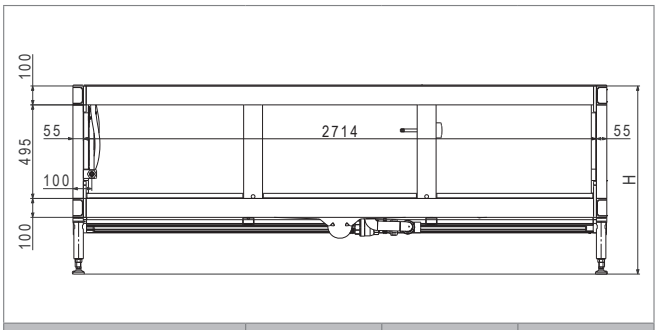
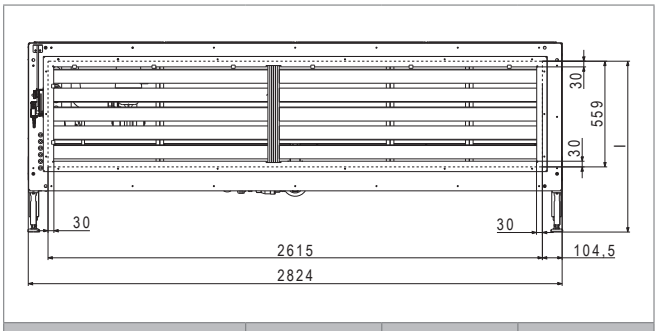


Fig. C4: Dimensional drawing extract air duct (dimensions in mm, inspection opening for filter changes)



Frame height	G1	G2	G3
Dimension H	995	895	815

Fig. C5: Dimensional drawing supply air duct (dimensions in mm)



Frame height	G1	G2	G3
Dimension l	904	804	724

Fig. C6: Dimensional drawing fresh air duct (dimensions in mm)

2 Hydraulic installation

2.1 Cooling coil

- Connect the cooling coil in accordance with the hydraulic diagram.
- Depending on local conditions, check whether compensators for linear expansion are required for the supply and return lines and/or articulated connections are required for the units.
- Insulate the hydraulic lines.

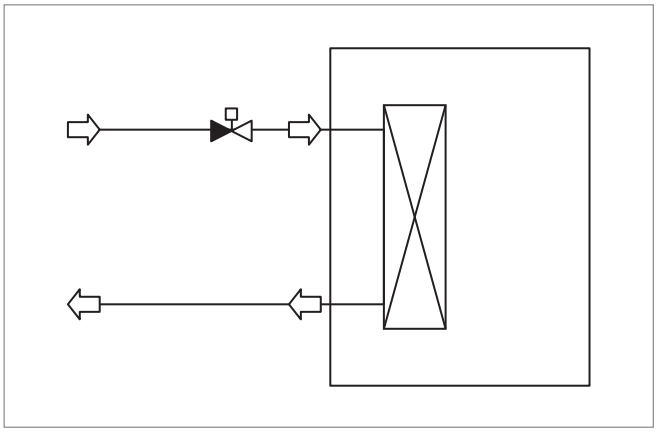


Fig. C7: Connection of the cooling coil

2.2 Condensate connection

Condensate arising in the unit must be removed via a condensate-proof line.

- Dimension the slope and cross-section of the condensate line so that no condensate backflow takes place.
- Make sure that the condensate can drain off freely.
- Make sure that the condensate produced is drained in compliance with local regulations.
- The unit already includes a trap function, so there is no need to provide this function externally.
- Fill the traps (plate heat exchanger and cooling coil) with water before commissioning, after each cleaning operation and after an extended downtime.

Technical data	
Condensate connection	G ¾" internal thread
Condensate quantity	max. 7 kg/h

Table C1: Condensate connection

2.3 Adiabatic system

Notice
Comply with national regulations on drinking water protection. Decouple the adiabatic system from the drinking water system to prevent backflow, force-back or suck-back of impurities into the drinking water.

Water supply

- Connect the ServeCool unit to the water supply.
- Use suitable materials for the supply line (recommended: stainless steel, PE or PVC).
- Depending on local conditions, check whether a compensator and/or articulated connection for linear expansion is required for the supply line.

Technical data		
Supply pressure	Recommendation	2 bar
	max.	4 bar
Supply line connection		G ½" internal thread

Table C2: Water supply

Supply pressure	0.5	1	2	3	4	bar
Volume flow	360	511	720	878	1136	l/h

Table C3: Water flow through adiabatic system

Drain

- Dimension the slope and cross-section of the discharge pipe so that there is no backing-up of water.
  - Discharge pipe connection: Ø 56 mm
- Connect the discharge pipe via a trap.
- Fill the trap with water before commissioning, after each cleaning operation and after an extended downtime.
- Make sure that the water can drain off freely.

2.4 Water quality

The adiabatic cooling requires a demineralised water supply. Hoval recommends the use of rainwater in a storage system.

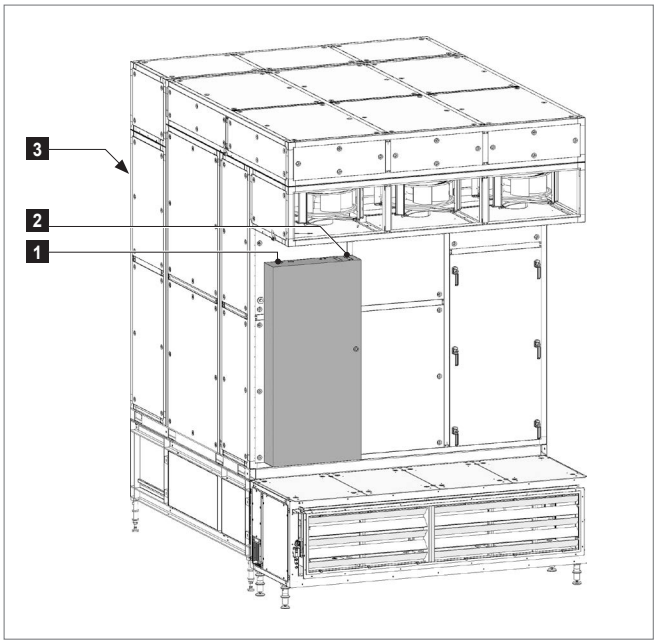
Recommended guidance values for the composition of the circulation water:

Appearance		clear, colourless, without sediment	
pH value			7 - 8.5
Electric conductance at 20 °C		µS/cm	< 250
Total hardness	GH	°dH	< 1
Chloride	Cl^-	g/m³	< 20
Sulphate	SO^{2-}_4	g/m³	< 20
Iron	Fe	mg/l	≤ 0.1
Copper	Cu	mg/l	< 1
Colony count		CFU/ml	< 1000
Legionella		CFU/100 ml	< 100
Concentration figure			5 - 10

Table C4: Composition of the circulation water

3 Electrical installation

- Observe the relevant regulations (e.g. EN 60204-1).
- Choose the dimensions of the cable cross sections in line with the applicable regulations.
- Route signal and bus lines separately from mains cables.
- Carry out the electrical installation according to the wiring diagram.
- Secure all connections against working loose.
- Use the enclosed cables to establish equipotential bonding for the on-site air ducts.

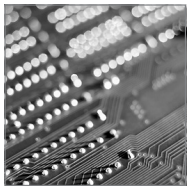


1 Cable feedthrough for power supply
2 Cable feedthrough for communication
3 Cable feedthrough for cooling valve (option)

Fig. C8: Electrical installation

Designation	Cable	Comments
Supply 1	5 × ... mm²	Introduction position 1 using the enclosed cable glands
Supply 2	5 × ... mm²	Introduction position 1 using the enclosed cable glands
Connection of zone control panel	CAT6a	Introduction position 2 using the enclosed connection box
Collective fault signal	6 × ... mm²	Volt-free contact
Operating signal		Volt-free contact
External enabling		24 V DC
Cooling valve (option)	4 × 0.75 mm² ÖLFLEX® CLASSIC 110	Introduction position 3 via an accessible cable feedthrough

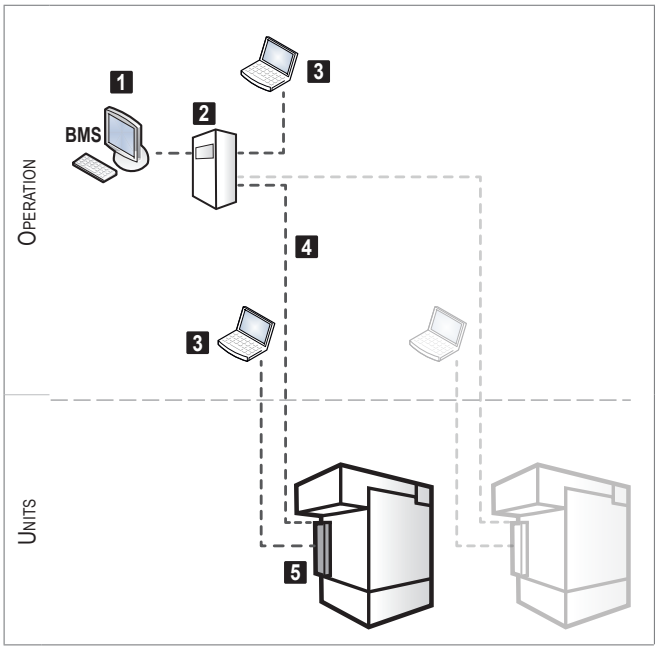
Table C5: Cable list for on-site connections



Control system

1 System structure

The ServeCool control system controls the ServeCool units fully automatically. Depending on the ambient conditions, it controls the interplay between the individual cooling processes and thus ensures demand-driven operation with optimised use of energy.



1	Building management system
2	Zone control panel with zone controller
3	Web browser
4	Modbus IP
5	Control box with unit controller

Table D1: System structure

1.1 Basic principles

A unit controller is installed in the control box of each ServeCool unit for individual control. It controls the unit according to demand depending on the operating conditions and set value specifications.

The following operating and display elements are installed in the control box front panel.
- Operation indicator light
- Illuminated pushbutton Fault
- Control mode selector switch (Local mode | BMS mode)
- Ethernet port (RJ45)
- Main switch

3 volt-free signalling contacts are available for a higher-level system:
- Operating signal
- Collective fault signal
- External enabling

Fig. D1: Control box on the unit

A zone controller is installed in the zone control panel for higher-level control of several ServeCool units that cool the same server room (see chapter 6).

1.2 Operation

Operation via web browser
The web visualisation of the ServeCool control system can be displayed on any web browser. The operator terminal is a computer connected to the Ethernet port in the control box front panel.

The web visualisation offers the following functions:
- Display and setting of operating modes
- Display of temperatures and humidities
- Display and setting of set values and control parameters
- Display and handling of alarms and maintaining an alarm log
- Differentiated password protection for various operator levels

Integration into the building management system (BMS)
The ServeCool control system can be easily integrated into the building management system. The data is exchanged via the BMS interface in the zone control panel.

1.3 Control mode

2 different control modes are available in the control system:

Local mode	The unit controller operates autonomously according to the specifications from the internal memory.
BMS mode	The unit controller operates according to the specifications from the building management system.

The following set values can be specified independently of one another:
- Supply air temperature
- Supply air volume flow
- Enabling

Switching between local mode and BMS mode is done via the selector switch on the control box or via a software switch.

Notice
The local mode is particularly useful in the event of a failure of the building management system: Unit control with the local setpoint set ensures full cooling capacity.

2 Control functions

2.1 Supply air temperature control

The unit controller controls the supply air temperature. Depending on the current operating mode (winter | summer) and the temperature and moisture conditions, it controls the interplay of the following components:
- Exhaust air fans for indirect free cooling
- Water circuit for adiabatic cooling
- Cooling valve and position of the bypass damper for mechanical cooling

2.2 Extract air temperature limiting

Extract air temperature limiting reduces the set value for the supply air temperature to an adjustable minimum value depending on the current extract air temperature. This allows the system to react quickly to any hot spots in the server room by providing additional cooling capacity.

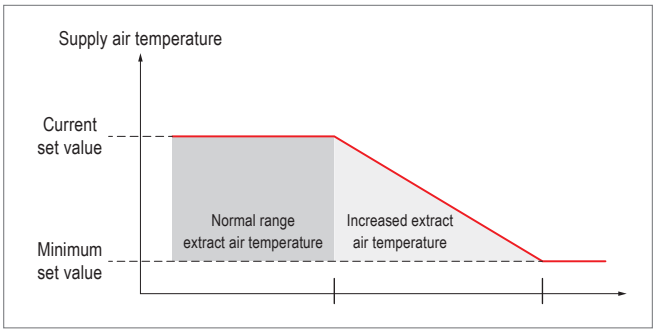


Fig. D2: Extract air temperature limiting

2.3 Supply air volume flow

The unit controller controls the speed of the supply air fans according to the specified set value.

3 Safety functions

3.1 Source changeover

For redundant power supply, it is possible to switch over between two alternative electrical power supply pathways. The switchover time between the two power supplies can be adjusted in seconds. The switchover only takes place if the phase sequence check and phase monitoring enable the switching.

A power supply unit with buffer module is installed to bridge short-term mains interruptions during source changeover. The maintenance-free capacitor-based power storage device ensures a regulated, uninterrupted 24 V supply.

3.2 External enabling

Connection possibility for an external signal to switch off the system (e.g. in case of fire).

3.3 Operation in the event of communication failure

In the event of a communication failure, the ServeCool unit continues to run without interruption with the last valid set values from the zone. The supply air temperature control remains fully functional.

3.4 Process monitoring

Limits can be set for every value measured by the temperature/humidity combination sensors and for the value calculated for absolute humidity. The cooling process can be monitored on the basis of these values.

3.5 Operation in the event of pump failure

In the event of a pump failure, the ServeCool unit can either
- continue operation without adiabatic cooling or
- provide adiabatic cooling in emergency mode, i.e. the water runs off directly after spraying (→ high water consumption).

4 Control options

4.1 Control of refrigeration system type 1

For ServeCool units equipped with a cold water coil, the components required to control the cooling valve are installed in the control box.
- Analog output 0-10 V Output specification
- Analog input 0-10 V Output feedback

4.2 Control of refrigeration system type 2

For ServeCool units equipped with a cold water coil or direct evaporator, the components required to control the chiller or heat pump are installed in the control box.
- Analog output 0-10 V Output specification
- Analog input 0-10 V Output feedback
- Digital output Enabling (Volt-free)
- Digital input Operating signal (24 V)
- Digital input Fault message (24 V)
- Digital input Limitation signal (24 V)

The entire cooling circuit is controlled by the chiller or heat pump.

4.3 Source changeover incl. refrigeration

The automatic source changeover switch has an additional output that signals to the subordinate ATS of the on-site chiller or heat pump which power source is currently supplying the load.
- Digital output Mains preselection (Volt-free)

4.4 Redundant power supply units

To bridge short-term mains interruptions during source changeover, 2 power supply units are installed, which are decoupled via a redundancy module. If one of the two power supply units fails, the load continues to be supplied by the second power supply unit.
(This option replaces the power supply unit with buffer module.)

5 Alarms and monitoring

The ServeCool control system monitors itself. All alarms are registered in the alarm list and displayed by the visualisation on the web browser or in the building management system. A full alarm list is available on request.

6 Zone control panel

The zone control panel contains the zone controller for higher-level control of several ServeCool units and an interface for connecting the system to the building management system. A touch panel for visualising and operating the zone is installed in the front panel.

The zone controller:

- is connected to each ServeCool unit and to the touch panel via network communication
- processes the measured values of the sensors distributed throughout the room as well as all digital inputs and outputs of the zone
- controls the temperature and pressure in the server room and specifies the set values for the supply air temperature and volume flow for the individual ServeCool units.

The zone control panel forms the interface to the building management system, but Hoval's internal visualisation can also be used via the touch panel.

Fig. D3: Zone control panel

System design

1 Design calculation

Use the web-based design tool 'SECA Online' to quickly and reliably design ServeCool air conditioning systems for data centres. Based on meteorological data for the planned location and the required cooling capacity, it calculates all data that is crucial for dimensioning the plant. In doing so, it makes it possible to simulate and compare different scenarios with regard to redundancy of the cold supply.

1.1 Operation of SECA Online

Registering

- In your web browser, open the page SECA Online (seca.hoval.com).
- Enter the data to create your customer account.
- After successful registration you will receive an e-mail with a password.
- Log in and complete your profile.

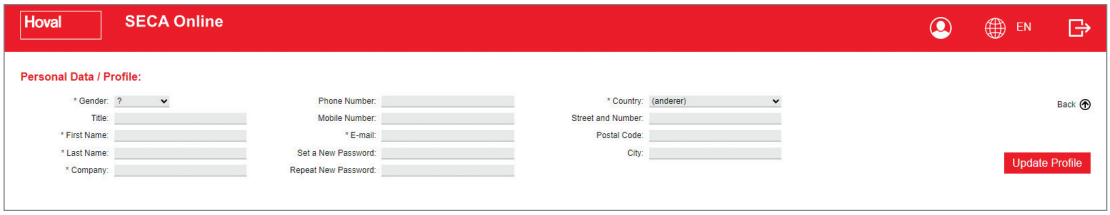


Fig. E1: SECA Online profile

Creating a project

- Click on 'Add new project'.
- Enter the project name and select the heat load and temperatures.
- Define the electricity price and the water price.
- Click on 'Show stations map' to select a weather station near the project location.
- Click on 'Save project'.

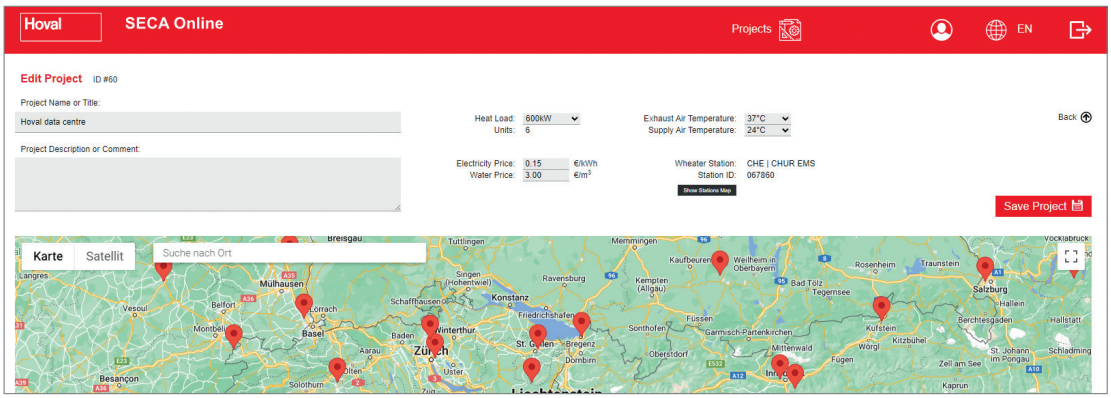
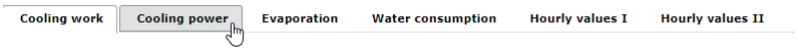


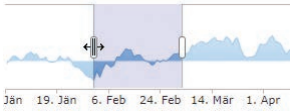
Fig. E2: Creating a project

Showing charts

- Click on 'Show charts' in the projects overview to display detailed data for the entire year.
- Click on the various tabs to display the results.



- Click on the icon to download the water consumption or hourly values as an Excel file.
- Drag the ends of the year axis to adjust the time period displayed.



- Click on 'Devices N' to increase the number of devices to N+1.

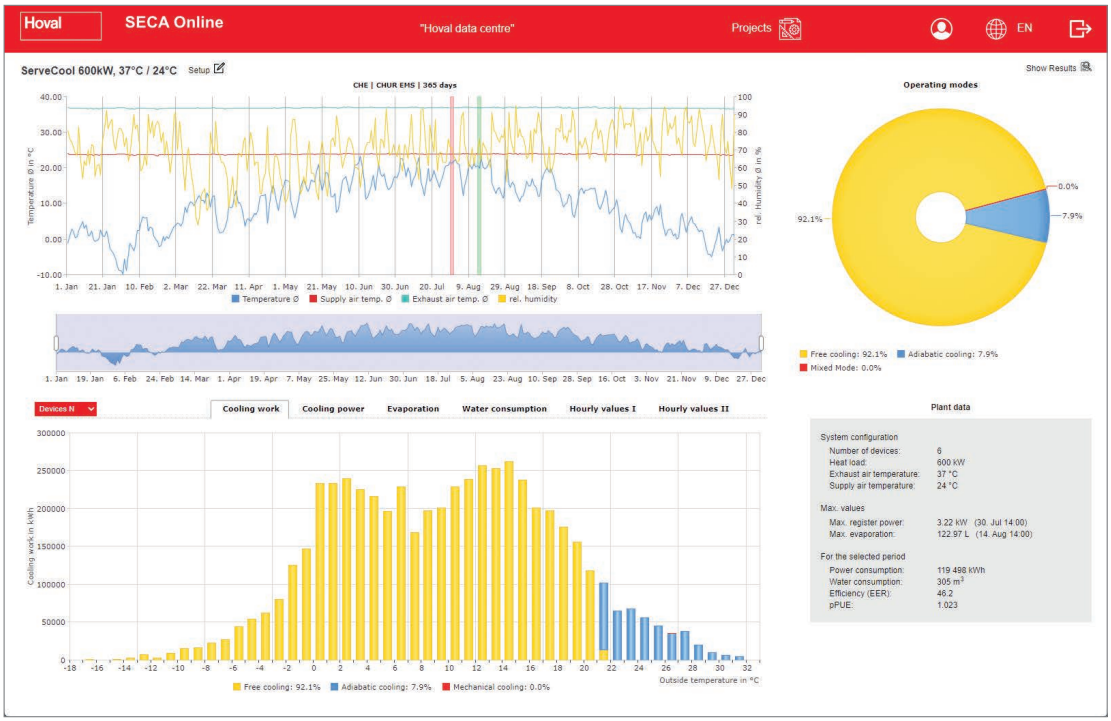


Fig. E3: Charts

Design data sheet

- Click on 'Show results' to display the design data sheet, which you can print out or save as a PDF file.

1.2 Positioning

The ServeCool units are positioned at the end of the server room in a line of technological equipment. The supply air is distributed throughout the room via the false floor, and the extract air is extracted from under the ceiling. The cold aisle containment prevents the supply air from mixing with the extract air, thereby guaranteeing efficient air conditioning.

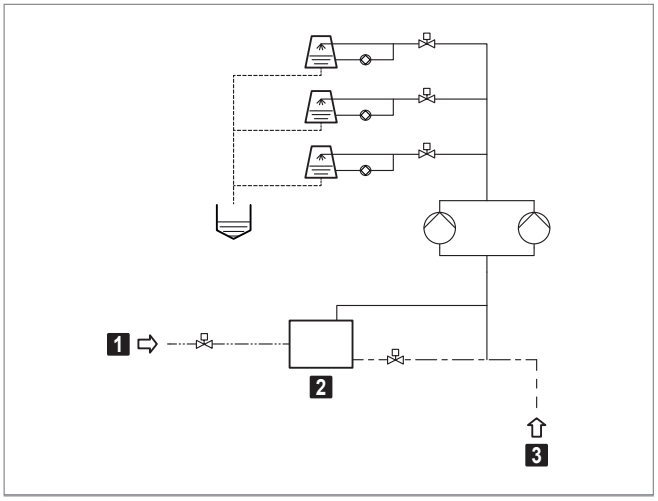
Fig. E4: Positioning

1.3 Water treatment

The adiabatic cooling requires a demineralised water supply. The following options are available:

- Using rainwater in a storage system
- Water treatment using a reverse osmosis system which pumps into separately installed water tanks

To provide a reserve, a storage tank is installed for the maximum daily consumption. For the purposes of redundancy, the storage tank is equipped with a municipal water supply.



1 Water supply (demineralised)
2 Storage tank
3 Municipal water supply

Fig. E5: On site water treatment

2 Maintenance schedule

Activity	Interval
Change the filters (extract air filter, fresh air filter)	When the 'Filter' alarm is displayed, at least annually
Change filter mats in the ServeCool control box and in the zone control panel	Annually
Check the total colony count of the circulating water using Dip slides	Every 3 months (during the cooling period)
Drain and clean the adiabatic system, clean the water filter, check the function of the discharge and trap	Every 6 months (before and after the cooling period)
Comprehensive functional check and cleaning of the unit (fans, actuators, adiabatic pump, spray nozzles, cooling valve, drop separator ...)	Annually

Table E1: Maintenance schedule

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Hoval

Hoval is one of the leading international companies for heating and indoor climate solutions. Drawing on more than 75 years of experience and benefiting from a close-knit team culture, the Hoval Group delivers exciting solutions and develops technically superior products. This leadership role requires a sense of responsibility for energy and the environment, which is expressed in an intelligent combination of different heating technologies and customised indoor climate solutions.

Hoval also provides personal consultations and comprehensive customer service. With around 2500 employees in 15 companies around the world, Hoval sees itself not as a conglomerate, but as a large family that thinks and acts globally.
Hoval heating and indoor climate solutions are currently exported to more than 50 countries.

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