CoolTeg Plus XC40

AC-TXC Direct expansion Air-conditioning unit with integrated compressor

Application

CoolTeg Plus XC40 is a revolutionary air-conditioning unit specifically designed for installation between IT racks in data centers. Each unit contains a powerful compressor, driving a built-in refrigerant circuit, along with an extremely high cooling capacity. CoolTeg units fit perfectly onto Conteg racks - having the same design, material, color and suitable dimensions, creating a uniform and comprehensive row. Generally, these units may be combined with any cabinets.

Our new generation of air-conditioning units operates on the direct evaporation principle. Each includes a frequency driven compressor, evaporator, electronic expansion valve, fans and complex control system. They are linked to outdoor units (condensers) with refrigerant piping. XC40 units are available in many dimensional variants, corresponding to the height and depth of the surrounding racks. CoolTeg plus units can be installed either in open or closed hot and cold aisles. Their main task is transferring heat load from the data center while supplying cold air at precise temperature, humidity and airflow to servers.

Compared to commercial split systems, CoolTeg units allow precise temperature control of exhaust air, along with an immediate reaction to cooling capacity requests, many times higher airflow, exactly corresponding to server requests. Moreover, all CoolTeg Plus units adjust humidity in the server room. A separated condenser allows operation in ambient air temperatures of up to 55 °C.

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Benefits

- High cooling capacity of compressor circuit (up to 42 kW)
- Built-in latest generation frequency-driven scroll compressor, reacting instantly to actual cooling capacity request
- Fluent cooling capacity control ranging from 20 to 100%
- Electronic expansion valve for maximal effectiveness and thermodynamic stability of entire circle
- Separated condenser allows cooling in extremely high ambient temperatures (up to 55 °C)
- Condenser can be designed and customized according to climatic, space and acoustic conditions
- All important and critical components of refrigerant circuit are inside the building, so not exposed to outside environment (freezing or high temperatures, rain, snow, dust, etc.)
- Compatible with Conteg racks - having the same design, material, shape and dimensions
- Radial EC fans with very low power consumption at partial load and fluent air flow control
- Modern control and communication
- Specially designed evaporator uses 100 % of compressor power
- Remarkably high EER (3.4, in relation to inside air temperature of 35 °C, and outside air temperature of 35 °C)
- Communication protocols: ModBus, SNMP, etc.
- Suitable for open or closed hot and cold aisles, without need of a raised floor
- Shut-off valve on refrigerant piping for quick and easy maintenance
- Double high-pressure and low-pressure security facilities
- Electronic oil management system (TraxOil) provides oil level monitoring and active oil level balancing of compressor oil chamber to ensure the compressor safety
- Stainless-steel condensate pan located under the evaporator
- Water level sensor in condensate pan
- Solenoid valve prevents spontaneous refrigerant flow, allowing easy winter startup

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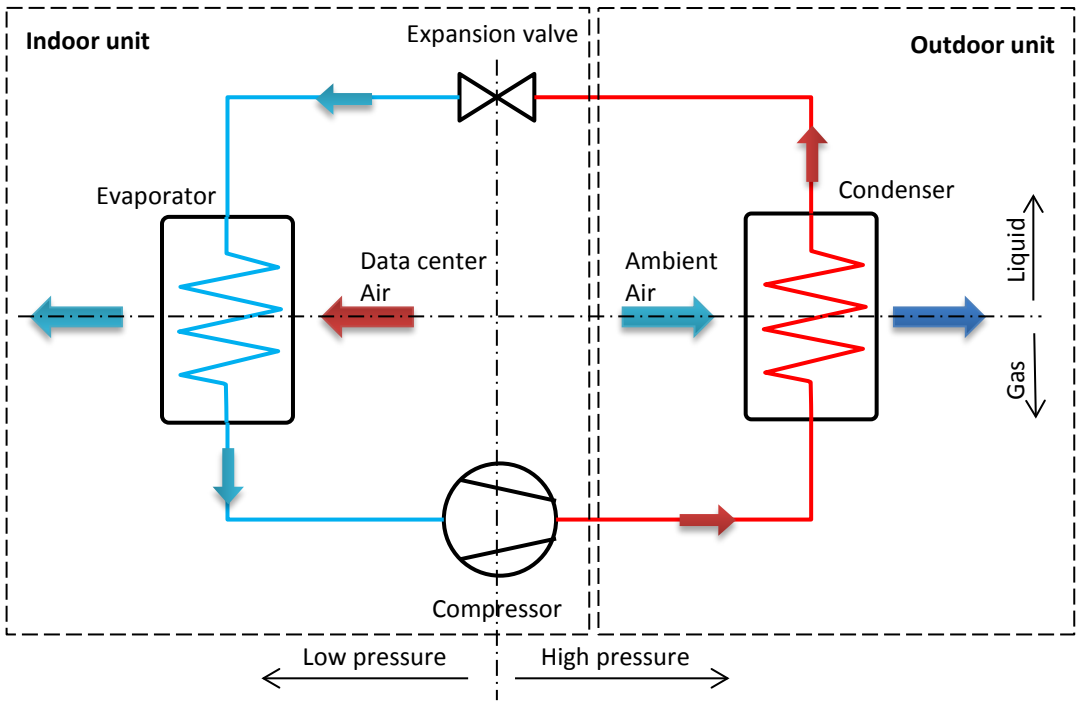
Function

The CoolTeg Plus XC40 is an air/refrigerant heat exchanger employing the direct evaporation principle, efficiently transferring the heat load of both servers and other IT devices to the ambient air. Compressed refrigerant vapor is moved to a condenser (located outside the data center), where it changes to a liquid, releasing its heat to the ambient air. Refrigerant then flows into an expansion valve, decreasing its pressure before evaporating (in indoor CoolTeg Plus unit) due to heat gains from the data center's hot air, whereby the compressor sucks up the evaporated refrigerant and the whole process begins again (circuit shown below). The indoor unit includes an expansion valve, evaporator and compressor. The external condenser is placed outside the building.



Pic. 1: *Refrigerant circuit scheme*

Heat exchanger - evaporator

The evaporator is constructed of copper tubing and aluminum fins for maximum effectiveness. Fin's hydrophilic surface keeps droplets of condensate on the heat exchanger's surface, so they drain into the pan.

Compressor

A highly effective scroll compressor equipped with BPM (Brushless Permanent Magnet) motor is integrated directly into each CoolTeg Plus XC40 unit. It compress refrigerant vapor and transport it throughout the refrigerant circuit. Compressor speed is driven by an inverter, maintaining requested cooling capacity within ranges of 20 – 100 %. The compressor is fixed by dampers (silent blocks) to avoid vibration transfer to the unit frame. Connection between the compressor and refrigerant piping is via anti-vibration joints.

Expansion valve

Operated by an actuator, the electronic expansion valve (or EEV) allows precise control of superheated refrigerant vapor. Refrigerant flow is controlled by needle stroke. The EEV changes its opening according to a pressure and temperature probe, located behind the evaporator. Due to high needle sensitivity, the operation remains economical even with fluctuating heat loads.

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Condensate pan
A stainless-steel condensate pan, positioned at the bottom of the unit, collects water, which then flows to the drainage piping. Condensate gathered on the cold surface of the heat exchanger flows down into the pan. The bottom of the pan is tilted. The lowest point ends by G 3/8" short pipe with an external thread for easy assembly of drainage hose. Water can be rejected by gravity drainage or (optionally) by a condensate pump. The unit is equipped with a standard water level sensor.

Fans
Fans transfer air through the air-conditioning unit from the hot zone to the cold zone. We use highly efficient radial fans with step-less speed controlled EC motors to maintain airflow according to the actual request. The control logic is based on the temperature or pressure difference between cold and hot zones. In case of pressure control accessory, the upper fan is controlled to keep proper airflow according to the IT devices request, two lower fans keep temperature difference. Total maximal airflow is 9 000 m^3/h. Any failure is reported to the controller and signaled by LED lights.

Filters
Filters are installed for air filtration and internal component protection against intrusion of unwanted objects. The unit is equipped with three separate G4-class zick-zack filters, made of synthetic material in paper frames. They are fixed to the unit with brackets, allowing easy replacement and ecological incineration. Any clogging is detected by differential pressure switch and indicated on a display.

Air side sensors
Each unit is equipped with two temperature sensors on the suction side (up and down), two temperature sensors on the exhaust side (up and down), one relative humidity sensor on the suction side and one relative humidity sensor on the exhaust side. The controller evaluates the data being measured (maximum or weighted average), which changes both fan speed and compressor speeds.

Refrigerant side sensors
For proper refrigerant circuit operation, the unit is equipped with a wide range of pressure and temperature sensors located in the refrigerant circuit. Temperature and pressure sensors located behind the evaporator (on the low pressure side) provide information about the temperature and pressure of the superheated vapor. EEV is driven according to the evaluated superheating. A pressure sensor behind the compressor (on the high pressure side) sends a request to the controller, increasing or decreasing the condenser fan speed.

The sensors mentioned above (along with the temperature sensor behind the compressor) also serve as safety sensors ensuring proper functioning of the compressor in the operation envelope, which keep EEV limits between LOP and MOP. In order to ensure maximum safety, the refrigerant circuit is fitted with two additional independent (low and high pressure) sensors, which shut down the entire unit if limits are exceeded.

TraxOil sensor (on the refrigerant side) scans oil level in the compressor ensuring the correct amount of oil in the compressor. In case of small amount of oil in compressor, TraxOil ensures the oil transport from discharge to suction side.

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Electro-box

As the unit's control center, the electro-box ensures electrical power supply, functionality, control logic, safety and communication between grouped units. The electro-box contains a circuit breaker for the fans, one for the controller and another for the compressor. The condenser is not powered by the indoor unit. The controller (delivered with preinstalled Conteg software) manages all cooling unit functions. According to values set by the user, the controller changes both indoor and outdoor unit (condenser) fan speed, compressor speed, EEV opening and electronic accessories. Accessible from the rear side of the unit, the electro-box includes terminals for digital inputs and outputs (unit operation notification, warning, emergency OFF switch, remote unit operation authorization, external firefighting alarm, etc.), eventually along with a pressure control sensor. The main power switch is located on the front of the electro-box.

Condenser

The CoolTeg Plus XC40 is designed to be linked with a remote condenser, allowing selection and optimization directly according to climatic, spacing or acoustics requests. Ambient air temperature can reach up to 55 °C (See the list of *Recommended* condensers). The condenser has to be equipped with a liquid receiver on site. Our CoolTool selection software can assist you in making the right choice. Alternatively, please contact our Cooling department for further information.

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Unit connection

Power supply

The power supply cable must be connected with the terminals in the electro-box (housed within the indoor unit). The power supply must be: 3 phases; 400 V; 50/60 Hz; 25 A.

Refrigerant piping connection

Both indoor and outdoor units must be connected via copper refrigerant piping. This system uses ecological refrigerant R410A. The piping dimension at the liquid line is 22 mm, and 28 mm at the gas line. Maximum piping length is 60 m, with a maximum elevation of 20 m. If the condenser is under the unit, the maximum elevation is only 10 m. Maximum length and elevation must be strictly respected. Piping must be fitted with a siphon every 4 meters in height. Please contact our technicians for individual cases. Each unit's piping ends come equipped with ball valves, allowing refrigerant circuit closing for easy maintenance.

Pic. 2: *Ball valve*

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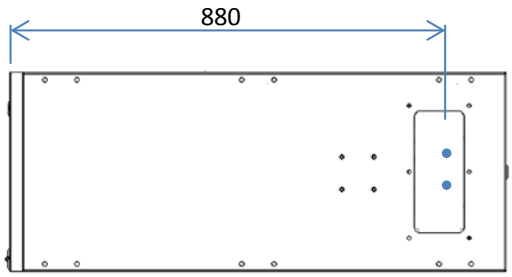
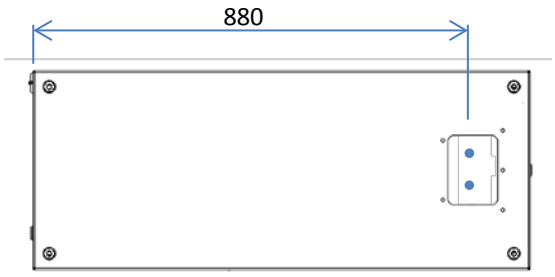
Connection diameters

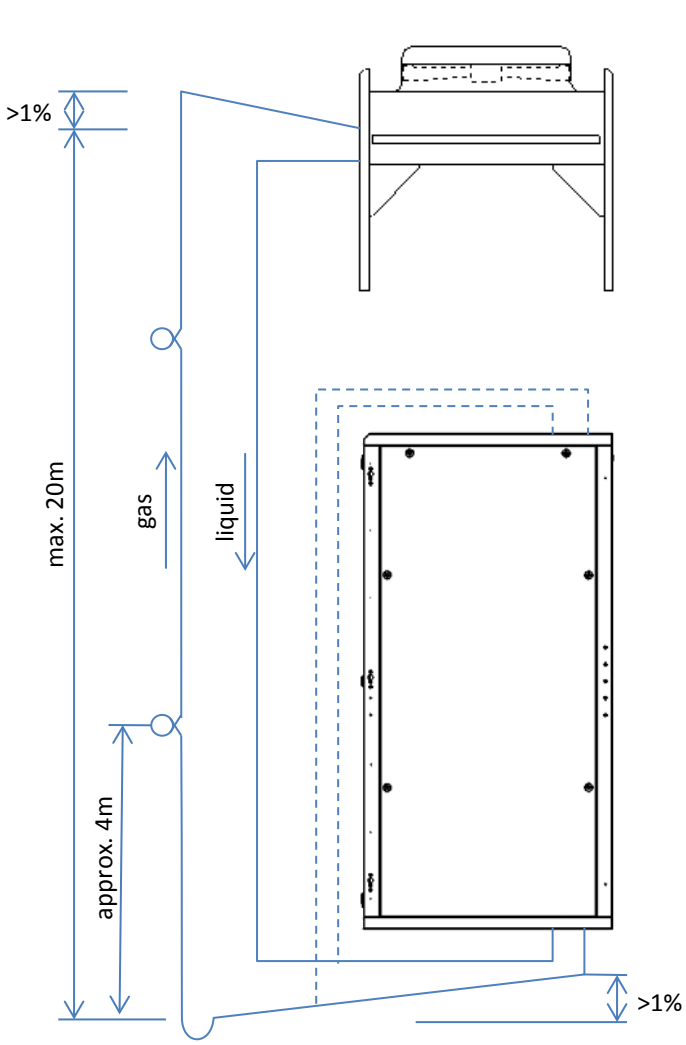
Top connection

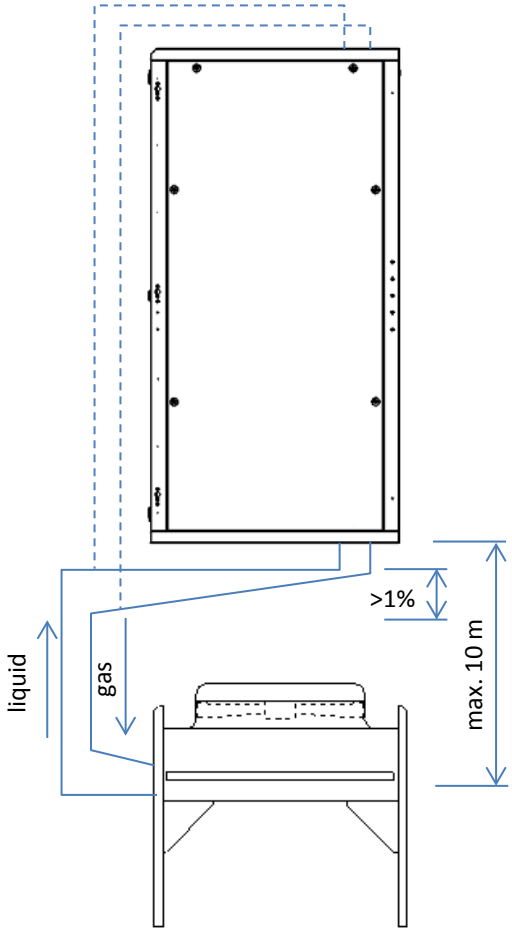


Bottom connection



Piping distance





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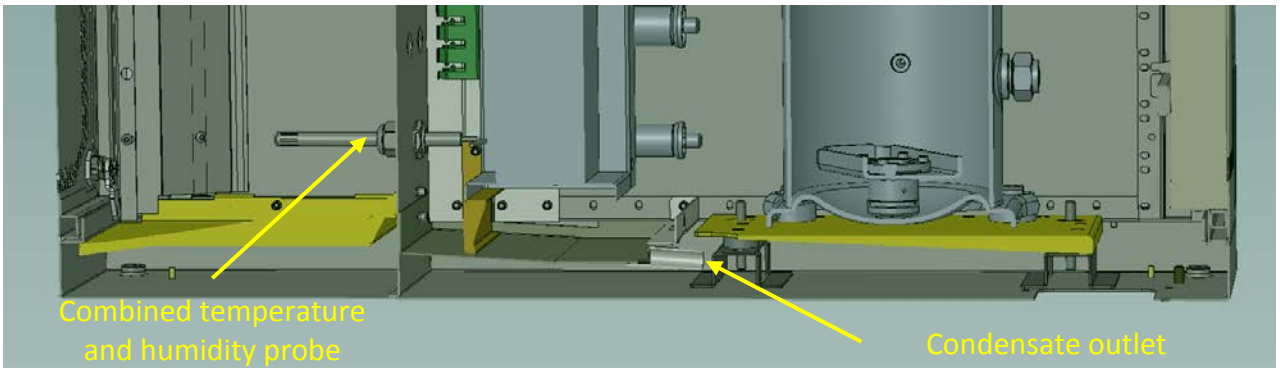
Condensate drainage

Each unit must be positioned horizontally, and be connected to the drainage system. Condensate is removed by either gravity or condensate pump through the syphon (not included in delivery). The condensate tank outlet has a G 3/8” external thread (external diameter 18 mm).



Operation limits of indoor unit

Air temperature from +4 °C to +50 °C
Relative humidity from 10 % to 80 %
The air passing through the unit must not contain aggressive or corrosive substances, or an excessive amount of solid particles.

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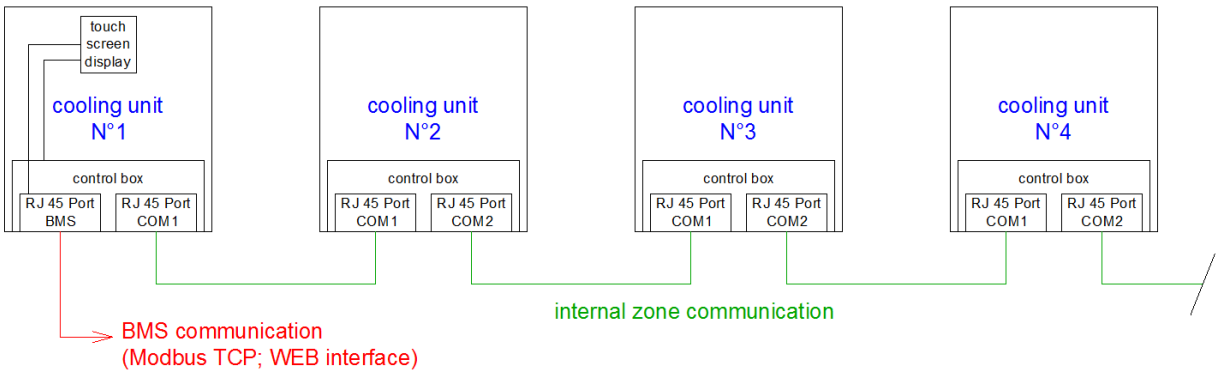
Communication

CoolTeg Plus XC40 units can communicate within individual zones. Each unit's electronic board includes two identical communication ports: COM1 and COM2 (RJ45 socket), allowing unit connection within a group. User can manage the units by 4.3" color touch-screen display, positioned in the front door, allowing the user to both switch-on and set its parameters. The unit can be also controlled by button (service) display. This kind of display can be connected to a port situated at the bottom of the electro-box.

Wiring diagram – series connection



Each controller includes RS485 connector for easy BMS communication via ModBus RTU (a protocol allowing both continuously reliable and accurate remote control of the air-conditioning units) and a port for SNMP card (pCO Web).

Accessories

Pressure Control

This accessory enables fan speed control of the entire CoolTeg group, based on the pressure difference between hot and cold zones. Users can adjust the desired overpressure in cold zone. Lower overpressure means the ICT has increased airflow, so all connected units will automatically increase their upper fan speed to provide the required amount of air. The remaining two fans are controlled to keep perfect conditions of refrigerant circuit. It is recommended that CoolTeg Plus units retain a slight overpressure (2 Pa) in cold zone. Pressure control ensures the correct pressure (generated by CoolTeg Plus fans on the servers) in contained cold/hot aisles. This solution extends server lifetime and reduces power consumption.

Condensate pump

The condensate pump is positioned at the rear side of the unit (above the condensate pan) and bracketed to the frame, with a suction pipe situated in the lowest part of the condensate pan. If the condensate sensor detects water, the pump switches on and pumps water toward the drainage pipes.

SNMP Communication card (pCO Web)

Designed for direct unit connection to (LAN) data networks, the card supports real-time unit monitoring via standard web browser (WEB server) or SNMP. The extending card is intended for communication via TCP/IP protocol, allowing monitoring via web server, Modbus TCP or BACnet.

Humidifier

Steam humidifier keeps required relative humidity in the data center. Maximum steam production capacity is 3 kg per hour and is driven by PID controller in range of 20 to 100%. Humidifier produces pressure-less water steam by electrodes placed in water cylinder and distributes the steam to the air behind heat exchanger. Humidifier is powered separately by 230 V, 50 Hz, 9.8 A (2.25 kW). For power connection, use cable 3x1.5 mm^2 with C14 terminal.

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Control function

Each CoolTeg Plus unit has an independent programmable PID controller (housed in the electro-box) which changes fan speed (airflow), compressor speed (amount of refrigerant) and expansion valve opening (refrigerant overheat) while driving the electronic accessories. Controller also evaluates measured values from temperature, humidity and pressure probes.

Temperature set-point in cold zone

User can adjust air temperature set-point of the cold zone. The compressor changes speed according to the difference between required and actual air temperature, measured in the cold zone. Refrigerant evaporation temperature can be set using the service menu. Admin can also set the compressor's working range from 20 up to 100 %.

Set point - pressure difference

We recommend using a fan speed control based on the pressure difference for projects with perfectly mechanically separated hot and cold zones. The upper fan of CoolTeg Plus unit changes speed to keep the set pressure difference between hot and cold zones, while the other two fans keep the set temperature difference. Users can select an overpressure ranging from -10 to +10 Pa, as well as limitations for maximal and minimal fan speeds. As the controller does not include a differential pressure meter, an additional accessory is necessary for this function, the aim of which is to keep balanced airflow within the entire system (cooling units and IT devices), thus avoiding long-term server degradation due to under- or overpressure.

Set point - temperature difference

Fans change speed to ensure optimal temperature difference between hot and cold zone, the aim of which is to keep balanced airflow within entire system (cooling units and IT devices). User can set the required temperature difference and limits for maximal and minimal fan speeds. We recommend this approach for projects without mechanical separation of hot and cold zones, where pressure difference measurement is impossible. User selects the logic by which the unit will be driven (temperature difference or pressure difference).

Communication

Each unit can be equipped with 4.3" color touch-screen display, positioned at the unit's front door. One display can control up to 16 units in one zone. The display includes an USB port and two Ethernet ports, allowing remote control and monitoring via building management system. The USB port is used mainly for simple software update and historical data downloads. Zone functions (such as standby management and overload start) are also available. Each display includes a web-server, supporting access via IP address. Communication functions via TCP/IP protocol, allowing remote access.

Up to 16 units can be connected to form a group, communicating via pLAN protocol. Units are connected via straight-through network cable (ports COM1 and COM2), controlling the group from a single unit display. Set-point sharing is also possible.

In addition to the (SNMP) extension cards mentioned above, which can be installed in each controller and allow supervision via superior system, the unit is equipped with dry contacts for basic status signalization (ON/warning/emergency OFF). The unit comes prepared for basic input connection, such as operation permit or external fire alarm.

Technical data

CoolTeg Plus XC40

		CoolTegXC40
Unit type		AC-TXC-42-40...
Outdoor unit		AC-CONDx-xx-xx/EcoCool
Basic information		
Cooling system		Direct expansion
Architecture (1)		Open or closed
Nominal cooling capacity (2)	kW	42,2
Nominal net cooling capacity (3)	kW	39,1
Power supply	V/f/Hz	400 / 3 / 50
Fan power consumption (max)	kW	3,1
Compressor power consumption (max)	kW	12,3
Nominal current (4)	A	22,7
Maximum current (5)	A	25,3
Circuit breaker (6)	A	0,5+6+25
Recommended superior circuit breaker	A	32
Nominal airflow (7)	m^3/h	9 000
Number of radial fans	pcs	3
Fans motor type	-	EC
Air filter class	-	G4
Dimensions		
Height	mm (U)	1978 (42U), 2111 (45U), 2245 (48U)
Width	mm	400
Depth	mm	1000 or 1200
Weight – depth 1000 mm, height 42/45/48U	kg	262/270/278
Weight – depth 1200 mm, height 42/45/48U	kg	274/284/294
Piping connection dimensions		
Piping connection dimension - liquid	mm	16
Piping connection dimension - gas	mm	22
Maximum piping length	m	60
Max. piping elevation (unit under condenser)	m	20
Max. piping elevation (unit above condenser)	m	10

Notes

(1)… CoolTeg Plus units can be used either independently (in rack rows) or integrated in a Modular closed loop system (MCL) = a closed-architecture system of racks and air-conditioning units. Unit type is determined by a key.

(2)… Cooling capacity is changed by the controller according to actual request. Nominal cooling capacity is calculated at 35 °C without condensation (air humidity below dew point), evaporating refrigerant temperature of 10 °C, a condensing temperature of 45 °C and clean filters.

(3)… Net cooling capacity is the total capacity reduced by fan heat load, which is the available cooling capacity of the unit.

(4)… Nominal current: fans 4.6 A, compressor 17.8 A, controller 0.3 A

(5)… Maximum current: fans 4.8 A, compressor 20.2 A, controller 0.3 A

(6)… Circuit breakers: fans 3-C6 (400V/6A), compressor 3-C25 (400V/25A), controller 1-B0.5 (230V/0.5A). Main switch is dimensioned at 32 A. Recommended superior circuit breaker must be minimally 32 A as well.

(7)… Airflow is automatically changed by controller; the nominal airflow matches the nominal cooling capacity.

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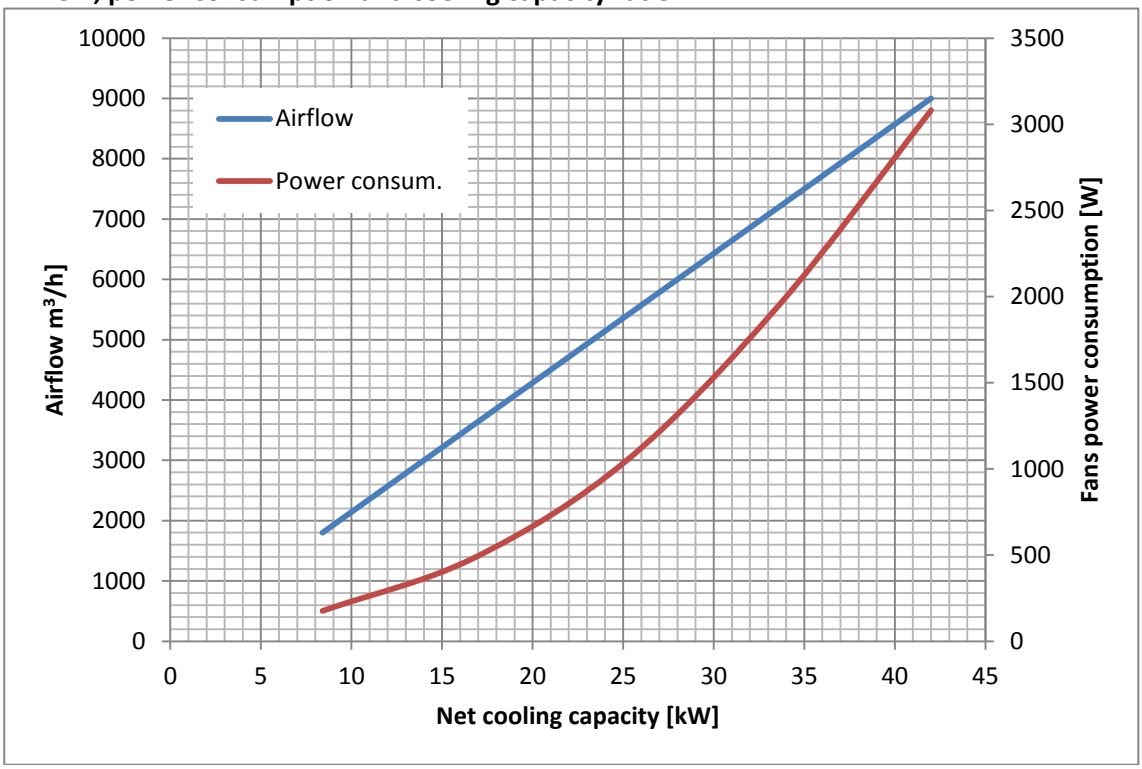
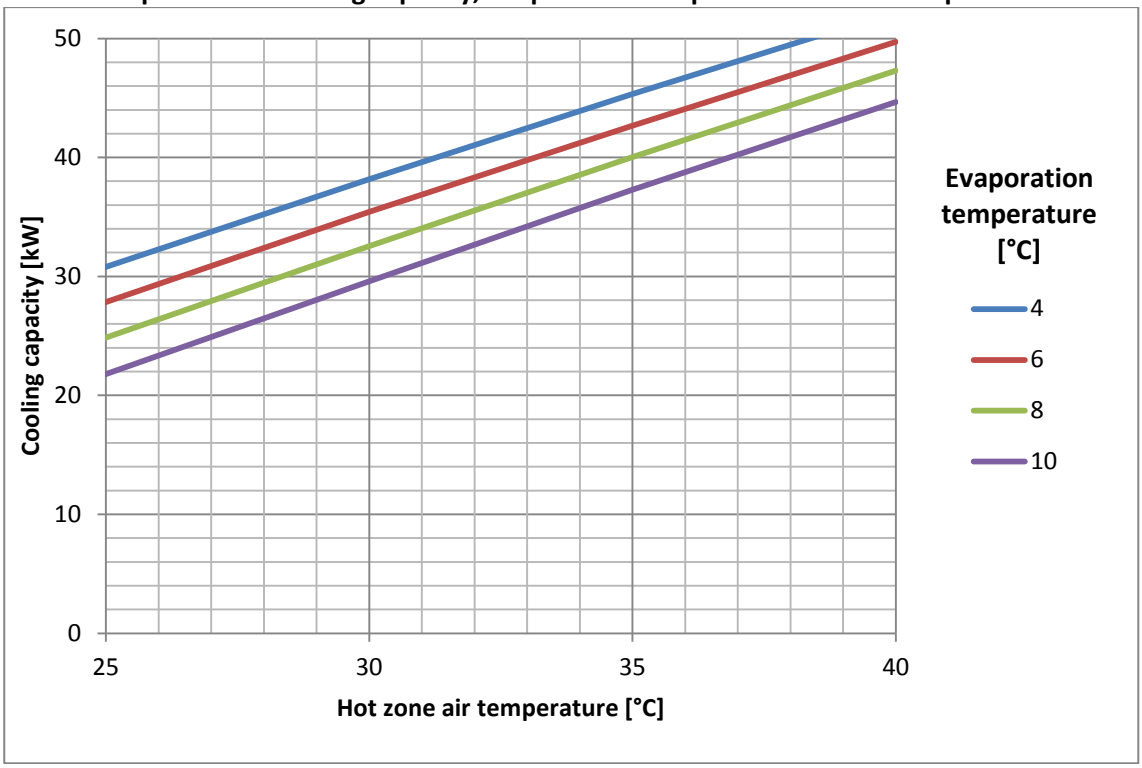
Cooling capacity diagram

Airflow, power consumption and cooling capacity ratio



Relationship between cooling capacity, evaporation temperature and air temperature in hot zone



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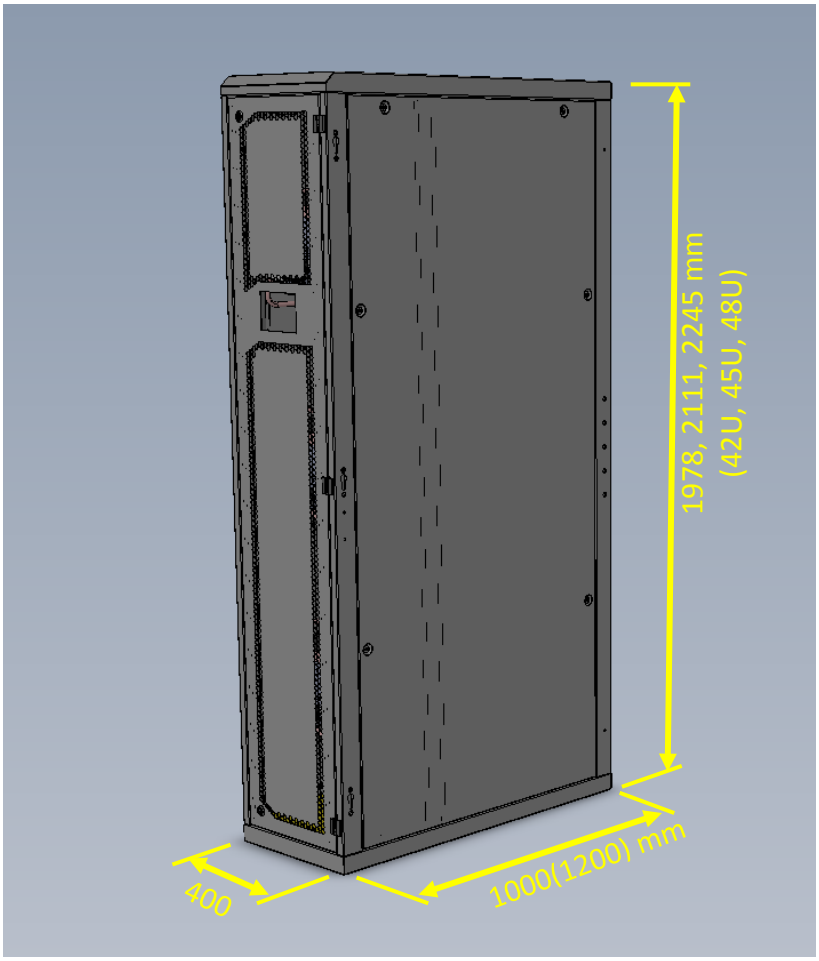
3D model



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Recommended condensers

Outdoor air-cooled condensers transfer data center heat load into ambient environment. Total condenser cooling capacity corresponds with the sum of the CoolTeg Plus XC40 cooling capacity and its compressor power consumption.

The indoor unit is designed to cooperate with the widest field of air-cooled condensers. Customers can choose the condenser to perfectly match their requirements. To ensure proper operation, the condenser must contain fans with continuous speed control. The indoor unit evaluates needed cooling capacity and sends a signal (0-10 V) to increase or decrease condenser fan speed. The CoolTeg Plus XC40 contains operating permission control of condenser.

The table below shows the recommended condenser types which cooperate with CoolTeg Plus XC40. They are sorted by maximum ambient air temperature.

Plumbing company has to deliver liquid receiver in proper size for the current ambient conditions. Liquid receiver is not a standard part of air-cooled condensers.

Air-cooled condensers – fins and tube

Dimensions

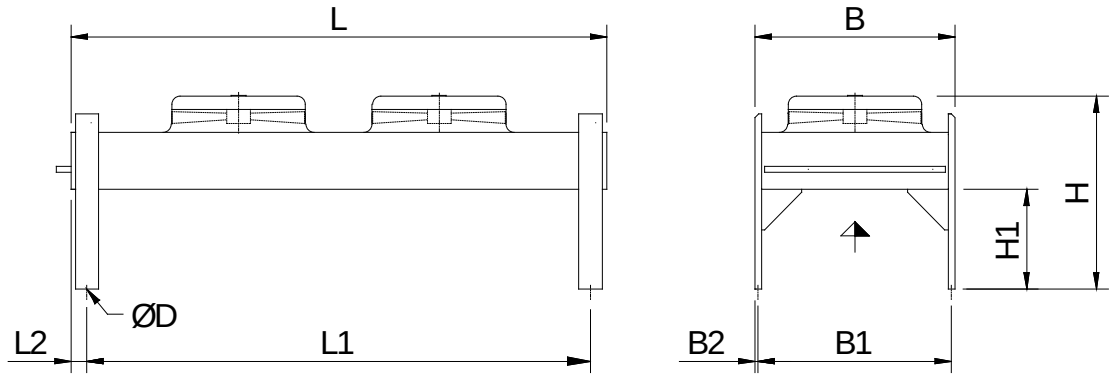
Max. temp.	Conteg P/N	Length	Width	Height	Weight
35 °C	AC-COND2-35	1,9 m	0,8 m	1,0 m	153 kg
45 °C	AC-COND2-45	2,5 m	1,1 m	1,0 m	218 kg
55 °C	AC-COND2-55	2,8 m	0,9 m	1,0 m	204 kg

Sound power level and Sound pressure level in 10 m

Max. temp.	Conteg P/N	Lw(A)	Lp(A) 10m
35 °C	AC-COND2-35	81 dB	50 dB
45 °C	AC-COND2-45	82 dB	50 dB
55 °C	AC-COND2-55	74 dB	43 dB

Electrical data

Max. temp.	Conteg P/N	Fans	f/V/Hz	A	kW
35°C	AC-COND2-35	2	3/400/50-60	0,85	1,05
45°C	AC-COND2-45	2	3/400/50-60	0,85	0,98
55°C	AC-COND2-55	3	3/400/50-60	0,80	1,44



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Air-cooled condensers – micro channel

Dimensions

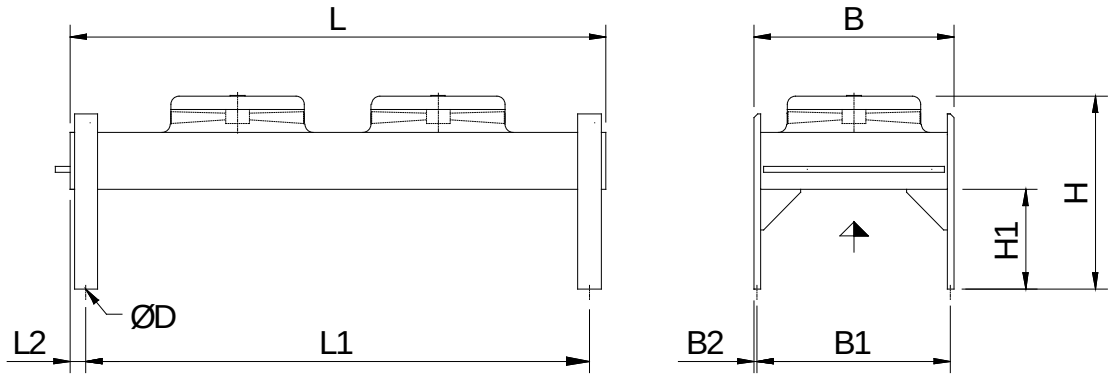
Max. temp.	Conteg P/N	Length	Width	Height	Weight
35 °C	AC-COND3-35	2,4 m	1,1 m	1,0 m	152 kg
45 °C	AC-COND3-45	2,4 m	1,1 m	1,0 m	174 kg
55 °C	AC-COND3-55	3,6 m	1,1 m	1,0 m	210 kg

Sound power level and Sound pressure level in 10 m

Max. temp.	Conteg P/N	Lw(A)	Lp(A) 10m
35 °C	AC-COND3-35	72 dB	40 dB
45 °C	AC-COND3-45	81 dB	49 dB
55 °C	AC-COND3-55	74 dB	42 dB

Electrical data

Max. temp.	Conteg P/N	Fans	f/V/Hz	A	kW
35 °C	AC-COND3-35	2	3/400/50-60	0,92	1,05
45 °C	AC-COND3-45	2	3/400/50-60	1,43	1,93
55 °C	AC-COND3-55	3	3/400/50-60	0,68	1,09



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