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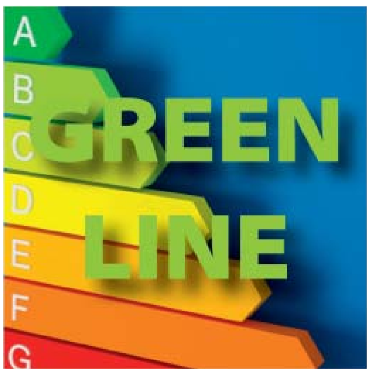
TCHEY-THHEY 105÷112
Comby-Flow range

Water cooled water chillers and heat pumps units with environmentally friendly refrigerant R410A.
Range with hermetic Scroll compressors.



Contents

General Features

Intended Conditions of Use

TCHEY units are monobloc water-cooled water chillers with water-cooled condensation.
THHEY units are packaged heat-pumps with reversible refrigerant cycle and water evaporation/condensation.

They are suitable in air conditioning installations where it is necessary chilled water (TCHEY) or chilled and hot water (THHEY), not for human consumption.
The units are designed for indoor installation.

The units comply with the following directives:
- Machinery Directive 2006/42/EEC (MD);
- Low voltage directive 2006/95/EEC (LVD);
- Electromagnetic compatibility Directive 2004/108/EEC (EMC);
- Pressure equipment Directive 97/23/EEC (PED).

Guide to reading the code

"SERIES" code **"MODEL" code**

T	C / H	H	E	Y	P	1	05÷12
Water production unit	C: Cooling only; H: Heat pump	Water cooling	Scroll-type hermetic compressors	R410A refrigerant fluid	With circulating pump	No. compressors	Approximate cooling capacity (in kW)

Note:
An inertial storage tank (accessory KA) is available separately.

Example: TCHEY 112
- Cold water only unit;
- Water cooling;
- 1 hermetic Scroll compressor;
- Without circulating pump;
- R410A refrigerant fluid;
- Nominal cooling capacity of approximately 12 kW.

Control logic

AdaptiveFunction Plus

TCHEY-THHEY 105÷112 with control IDRHOSS

The new **AdaptiveFunction Plus** adaptive regulation has been exclusively patented by *RHOSS* S.p.A. It is the result of a long partnership with the *University* of *Padua*. The various algorithm development operations were implemented and validated on units in the Comby-Flow range in the *RHOSS* S.p.A. Research&Development Laboratory using numerous test campaigns. The innovative control logic **AdaptiveFunction Plus** allows to obtain optimal comfort levels in all working conditions and the best possible performance in terms of energy efficiency during seasonal operation. **AdaptiveFunction Plus** provides a comfort and energy saving guarantee!

LOW ENERGY CONSUMPTION water chillers and heat pumps

The **AdaptiveFunction Plus** "**Economy**" function combines comfort with low energy consumption. In fact, by adjusting the set-point value, it optimises compressor operation on the basis of the actual working conditions.
It is thus possible to achieve significant seasonal energy savings compared to water chillers and heat pumps of an equivalent power with traditional control logic.

HIGH PRECISION water chillers and heat pumps

By using the **AdaptiveFunction Plus** "**Precision**" function, it is possible to achieve as little fluctuation as possible, at partial capacities, in terms of the average set-point water temperature delivered to the users.

Guaranteed reliability, even with water in the pipes only

Thanks to the "**Virtual Tank**" function, Comby-Flow units with **AdaptiveFunction Plus** can operate in systems with a low water content of down to 2 litres/kW, even without the presence of a water buffer tank, while still guaranteeing the reliability of the units over time and the good working order of the system.

Estimation of the system's thermal inertia

Comby-Flow units with **AdaptiveFunction Plus** are able to estimate the characteristics of the thermal inertia that regulates the system dynamics. This is possible thanks to the "**ACM Autotuning**" which processes the information relating to the progress of the water temperatures, identifying the optimal value of the control parameter.

Continuous system autodiagnosis

The estimation function is always active and makes it possible to adapt the control parameters quickly to every change in the water circuit and thus in the system water contents.

Objectives

- To guarantee optimal unit operation in the system in which it is installed. ***Evolved adaptive logic.***
- To obtain the best performance from a chiller in terms of energy efficiency at full and partial capacities. ***Low consumption chiller.***

Operating logic

In general, the actual control logics on water chillers/heat pumps do not consider the characteristics of the system in which the units are installed; they usually regulate the return water temperature and are positioned so as to ensure the operation of the chillers, giving less priority to the system requirements.
The new **AdaptiveFunction Plus** adaptive logic counters these logics with the objective of optimising the chiller operation on the basis of the system characteristics and the effective thermal load. The controller regulates the delivery water temperature and adjusts itself, as and when required, to the relative operating conditions using:

- the information contained in the return and delivery water temperature to estimate the working conditions thanks to a particular mathematical formula;
- a special adaptive algorithm that uses this estimate to vary the values and the start-up and switch-off limit values of the compressors; the optimised compressor start-up management guarantees a precision water supply to the user, reducing the fluctuation around the set-point value.

AdaptiveFunction Plus - Main functions

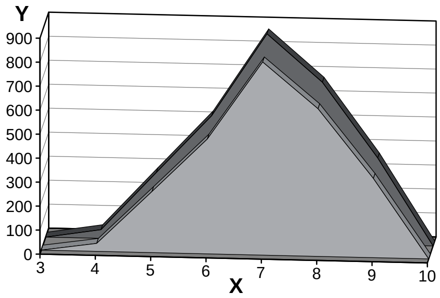
Efficiency or Precision

Thanks to the evolved control, it is possible to run the chiller on **two different regulation settings** to obtain the best possible performance in terms of energy efficiency, and thus considerable seasonal savings, or high water delivery temperature precision:

1. Low consumption chiller: Economy" option

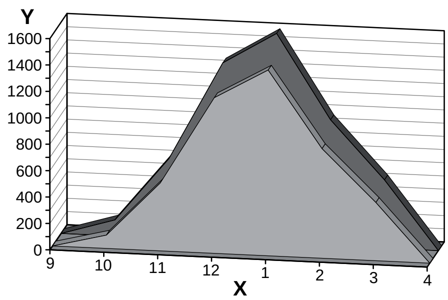
It is well known that chillers work at full capacity for just a very small percentage of their operating time, while they work at partial capacity for most of the season. Therefore, the power they need to supply generally differs from the nominal design power, and operation at partial capacity has a noticeable effect on seasonal energy performance and consumption.
This makes it necessary to run the unit so that it is as efficient as possible at partial capacity. The controller therefore ensures that the water delivery temperature is as high as possible (when operating as a chiller) or as low as possible (when operating as a heat pump) while compatible with the thermal loads, meaning that it is on a sliding scale, unlike in traditional systems. This prevents energy wastage linked to the maintenance of pointlessly onerous temperature levels for the chiller, ensuring that the ratio between the power to be supplied and the energy to be used to produce it is always at an optimum level.
Finally the right level of comfort is available to everyone!

Summer season: a unit that operates with a sliding set-point enables seasonal energy savings of around 8% compared to a traditional unit that operates with a fixed set-point.



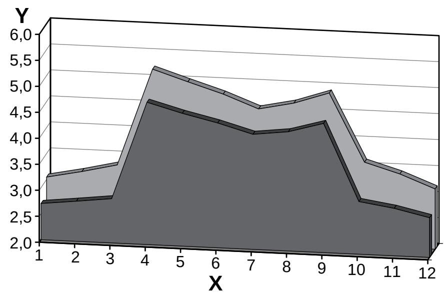
X Year divided into months (1 January, 2 February, etc.).
Y Energy consumption (kWh).
Unit with fixed set-point
Unit with sliding set-point

Winter season: a unit that operates with a sliding set-point enables seasonal energy savings of around 13% compared to a traditional unit that operates with a fixed set-point. Calculations carried out demonstrate that seasonal consumption is equivalent to that of a **CLASS A** machine.



X Year divided into months (1 January, 2 February, etc.).
Y Energy consumption (kWh).
Unit with fixed set-point
Unit with sliding set-point

Annual: efficiency over the annual operation of the unit in heat pump mode.
AdaptiveFunction Plus, with the "***Economy***" function, enables the chiller assembly to operate energy-saving programmes while still providing the required level of service.



X Year divided into months (1 January, 2 February, etc.).
Y Energy efficiency kWh supplied / kWh absorbed.
Unit with fixed set-point
Unit with sliding set-point

*Analysis performed by comparing the operation of a Comby-Flow heat pump unit with **AdaptiveFunction Plus** logic that operates with a fixed set-point (7°C in the summer and 45°C in the winter) or with a sliding set-point (range between 7 and 14 °C in the summer, range between 35 and 45°C in the winter) for an office building in Milan.*

The Seasonal Efficiency Index PLUS

The University of Padua has developed the seasonal efficiency index ESEER+, which takes the adaptation of the chiller set-points to different partial load conditions into account. This, therefore, characterises the seasonal behaviour of the chiller with **Adaptive Function Plus** compared to the more traditional ESEER index.
The ESEER+ index can therefore be used for a quick evaluation of seasonal energy consumption of units with **Adaptive Function Plus**, instead of more complex analyses conducted on the plant-system which are usually difficult to complete.

Simplified method for calculating energy saving with Adaptive Function Plus

The dynamic analyses used to calculate the energy consumption of chillers in a building/system are generally too elaborate to be used for a quick comparison of different refrigerant units, inasmuch as they require a range of data that is not always available.
For a quick estimate of what the energy savings could be with a unit equipped with Adaptive Function Plus software compared to a machine with traditional control, we suggest using a simplified method based on the following formulae:

$$E= \frac{0.54 \times N \times C}{ESEER+}$$

E power absorbed by chiller equipped with Adaptive Function Plus software (kWh)
N number of chiller operating hours
C nominal cooling capacity of the chiller (kW)
ESEER+ average seasonal efficiency of chiller equipped with Adaptive Function Plus software

$$E= \frac{0.54 \times N \times C}{ESEER}$$

E power absorbed by chiller equipped with Adaptive Function Plus software (kWh)
N number of chiller operating hours
C nominal cooling capacity of the chiller (kW)
ESEER (European seasonal EER) European average seasonal energy efficiency

Therefore in two units at the same nominal cooling capacity and the same number of working hours but equipped with different controls, the higher the absorbed power the lower the seasonal efficiency. In order to simplify matters, here is an example comparing a traditional control Rhoss unit to one with Adaptive Function Plus control:

Example:

Model TCHEY 107 equipped with traditional control:
Nominal cooling capacity = 6.8 kW
N = 8 hours/day x (5 months x 30 days/month) = 1200 hours
ESEER = 3.76

$$E= \frac{0.54 \times 1200 \times 6.8}{3,76} = \mathbf{1,172\ kW/h}$$

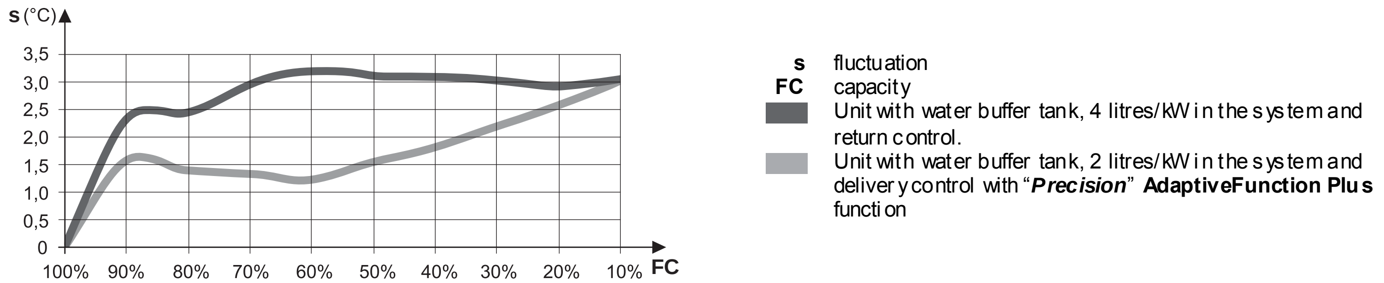
Model TCHEY 107 equipped with control software **Adaptive Function Plus**:
Nominal cooling capacity = 6.8 kW
N = 8 hours/day x (5 months x 30 days/month) = 1200 hours
ESEER+ = 4.25

$$E= \frac{0.54 \times 1200 \times 6.8}{4,25} = \mathbf{1,037\ kW/h}$$

The obtainable energy savings with **Adaptive Function Plus** is therefore **12%**.

2. High precision: "Precision" option

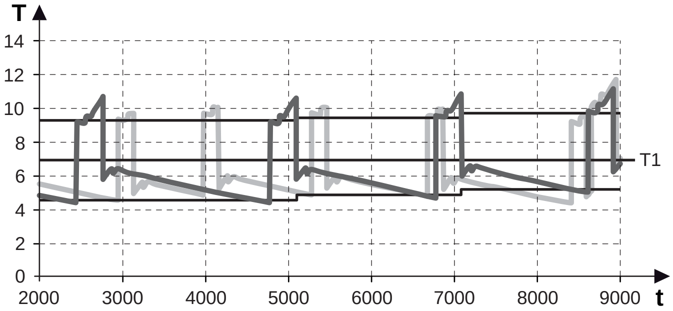
In this operating mode, the unit works at a fixed set-point and, thanks to the delivery water temperature control and the evolved regulation logic, at a capacity of between 50% and 100% it is possible to guarantee an average fluctuation from the water supply temperature of approximately ± 1.5°C from the set-point value compared to an average fluctuation over time of approximately ± 3°C, which is normally obtained with standard return control. The "**Precision**" option thus guarantees precision and reliability for all those applications that require a regulator that guarantees a more accurate constant water supply temperature, and where there are particular damp control requirements. However, in process applications it is always advisable to use a water buffer tank or a greater system water content to guarantee higher system thermal inertia.



*The chart illustrates the fluctuations of the water temperature from the set value for the various capacities, demonstrating how a unit with delivery control and the **AdaptiveFunction Plus** "**Precision**" function guarantees greater water supply temperature precision*

Virtual Tank: guaranteed reliability, even with water in the pipes only

A low water content in the system can cause the chiller units/heat pumps to be unreliable and can generate system instability and poor performance. Thanks to the **Virtual Tank** function, this is no longer a problem. The unit can operate in systems with just **2 litres/kW** in the pipes given that the control is able to compensate for the lack of inertia specific to a water buffer tank, "muffling" the control signal, preventing the compressor from switching on and off in an untimely fashion and reducing the average fluctuation of the set-point value.



T Water temperature (°C)
t Time (s)
T1 Set-point temperature
Delivery temperature with Virtual Tank
Delivery temperature without Virtual Tank

*The chart shows the various chiller outlet temperatures considering a capacity of 80%. We can observe how the temperatures of the unit with **AdaptiveFunction Plus** logic and the **Virtual Tank** function is far less varied and more stable over time, with average temperatures closer to the working set-point compared to a unit without the **Virtual Tank** function. Moreover, we can see how the unit with **AdaptiveFunction Plus** logic and the **Virtual Tank** function switches the compressor on less often over the same period of time, with obvious advantages in terms of energy consumption and system reliability.*

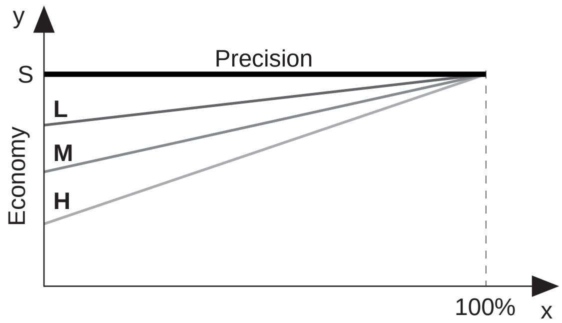
ACM Autotuning compressor management

AdaptiveFunction Plus enables the Comby-Flow units to adapt to the system they are serving, so as to always identify the best compressor operating parameters in the different working conditions.
During the initial operating phases, the special “**Autotuning**” function enables the Comby-Flow unit with **AdaptiveFunction Plus** to estimate the thermal inertia characteristics that regulate the system dynamics. The function, which is automatically activated when the unit is switched on for the first time, executes a number of set operating cycles, during which it processes the information relative to the water temperatures. It is thus possible to estimate the physical characteristics of the system and to identify the optimal value of the parameters to be used for the control.
At the end of this initial auto-estimate phase, the “**Autotuning**” function remains active, making it possible to adapt the control parameters quickly to every change in the water circuit and thus in the system water contents.

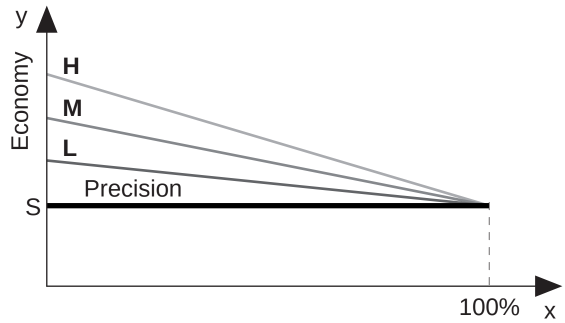
Set-point Compensation

The Economy function enables the chiller assembly to operate energy-saving programmes while still providing the required level of comfort.
This function controls the maximum limit with sliding Set-point, modifying the Set-point value according to the actual system thermal load; when the load decreases during summer months the Set-point increases, while when the load decreases during winter months the Set-Point decreases.
This function is destined for cooling applications, and is designed to control energy consumption while always respecting the real demands of the system capacity. Within the Economy option it is possible to select one of three diverse Set-point adaptation curves depending on the type of system.

"Economy" function in Winter mode



"Economy" function in Summer mode

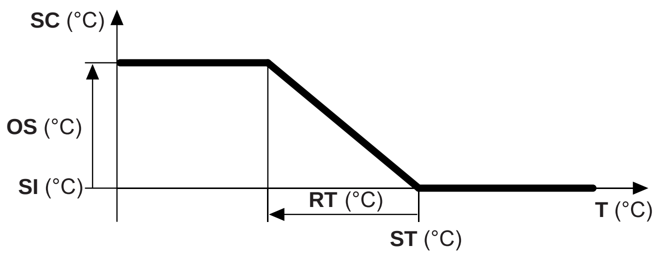


x	Load percentage (%)
y	Set-point (°C)
S	Value of Set-point set by user
L	Use in buildings with very unbalanced loads.
M	Intermediate situation between L and H (default).
H	Use in buildings with very similar loads. High efficiency.

x	Load percentage (%)
y	Set-point (°C)
S	Value of Set-point set by user
L	Use in buildings with very unbalanced loads.
M	Intermediate situation between L and H (default).
H	Use in buildings with very similar loads. High efficiency.

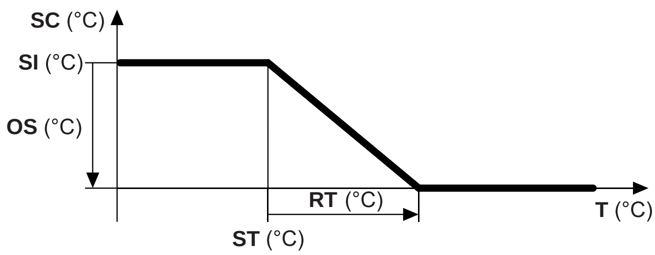
As an alternative to modification of the Set-point according to the real system load (Economy option), it is possible to compensate the set-point based on the temperature of the outdoor air by purchasing the KEAP accessory.
This function modifies the Set-point value based on the temperature of the outdoor air. Based on this value, the set-point is calculated by adding (winter cycle) or subtracting (summer cycle) an offset value to the Set-point set (see example below).
This function is activated both in winter mode as well as in summer mode. The function is activated only when a KEAP accessory is present.

Winter cycle



OS = 8°C
RT = 25°C
ST = 20°C

Summer cycle



OS = 8°C
RT = 15°C
ST = 15°C

T (°C)	Outdoor air temperature
SC (°C)	Calculated Set-point temperature
OS (°C)	Offset Set-point (calculated value)
SI (°C)	Set-point set
RT (°C)	Outdoor air temperature Set-point compensation
ST (°C)	Outdoor temperature set

It is possible to decide whether to activate the function in both functioning modes or only in one. If the Set-point compensation is enabled in relation to the outdoor temperature, the Economy option is automatically disabled.
However, it is possible to decide to enable the set-point compensation in one cycle and enable the Economy function in the other cycle.

Standard constructional features

○ Structure in galvanised and RAL 9018 painted steel plate, coated on the inside with sound-absorbing material.
○ Scroll-type hermetic rotary compressors complete with internal thermal protection.
○ Plate type heat-exchangers in stainless steel with closed-cell expanded polyurethane foam insulation complete with anti-freeze elements.
○ Differential pressure switch on main heat exchanger for models TCHEY; on heat exchanger and on rejection device for models THHEY.
○ Male threaded hydraulic connections.
○ Refrigerant circuit realized with mild copper tubes (EN 12735-1-2) and welded with silver alloy. Complete with: reversing valve (THHEY), filter drier, thermostatic valve (2 for models THHEY), non-return valves (THHEY), high pressure switch.
○ Rejection circuit realized with mild copper tube (EN 12735-1-2) and welded with silver alloy. Complete with: manual air vent and drain valve.
○ Primary circuit realized with mild copper tube (EN 12735-1-2) and welded with silver alloy. Complete with: manual air vent, drain valves, safety valves (6 Barg), gauge, expansion tank calculated for 28l for models 105-107 and 56l for models 109-112 e filling valve on rejection device side to primary circuit.
○ Unit with IP21 level of protection.
○ Possibility to select two controls:
• iDRHOSS compatible, with ***AdaptiveFunction Plus*** function.
○ The unit is complete with the R410A refrigerant charge.

Pump Versions

The TCHEYP and THHEYP include in the primary side am integrated circulating pump inside the machine.

Electrical Panel

Option with compatible iDRHOSS control

○ Electrical panel accessible by opening the front panel, conforming with current IEC norms, can be opened and closed with a suitable tool.
○ Complete with:
• electrical wiring set up for power supply voltage (230-1ph-50Hz for single-phase models 105-107-109-112, 400V-3ph+N-50Hz for tri-phase models 107-109 112);
• auxiliary power supply 230V-1ph-50Hz drawn from the main power supply;
• general isolator, complete with door interlocking isolator;
• automatic compressor protection switch;
• protection fuse for auxiliary circuit;
• compressor power contactor;
• remote unit control.
○ Programmable electronic board with microprocessor, controlled by the keyboard inserted in the machine.
○ This electronic board performs the following functions:
• Regulation and management of the outlet water temperature set points; of cycle reversal (THHEY); of the safety timer delays; of the circulating pump; of the compressor and system pump hour-run meter; of the electronic anti-freeze protection which cuts in automatically when the machine is switched off; and of the functions which control the operation of the individual parts making up the machine;
• complete protection of the unit, automatic emergency shutdown and display of the alarms which have been activated;
• phase sequence monitor to protect the compressor (for three-phase models only)
• unit protection against low or high phase power supply voltage;
• visual indication of the programmed set points via the display; of the in/out water temperature via the display; of the alarms via the display; and of cooling/heat-pump operating mode via display;
• self-diagnosis with continuous monitoring of machine operation;
• user interface menu;
• alarm code and description;
• alarm history management (menu protected by manufacturer password).
○ The following is memorized for each alarm:
• date and time of intervention (if the KSC accessory is present);
• alarm code and description;
• inlet/outlet water temperatures when the alarm intervened;
• alarm delay time from the switch-on of the connected device;
• compressor status at moment of alarm;
○ Advanced functions:
• configured for serial connection (KRS485, KFTT10, KRS232 and KUSB accessory);
• possibility to have a digital input for remote management of the double set point;
• possibility to have an analogue input for the scrolling set-point via a 4-20mA remote signal (contact *RHOSS* S.p.A. pre-sales);
• configured for management of time bands and operating parameters with the possibility of daily/weekly operating programmes (KSC accessory);
• check-up and monitoring of scheduled maintenance status;
• testing of the units assisted by computer;
• self-diagnosis with continuous monitoring of the functioning of the unit.
○ Set-point regulation via the ***Adaptive Function Plus*** with two options:
• fixed set-point (***Precision*** option);
• scrolling set-point (***Economy*** option).

Accessories

Factory fitted accessories

VP – Pressure valve, for TCHEY models only, that modulates the water flow rate to the condenser, maintaining the condensation pressure constant. This is generally useful when the machine is run with a set point that is greatly inferior to the design value, without adjusting for the actual amount of heat to be rejected, the water flow rate and/or the condenser inlet water temperature; when the city or tower water (where allowed in compliance with the local national legislation) coming into the condenser has a temperature of less than 15°C (the temperature differential ΔT allowed for city water through the condenser can range from 12 to 18°C); when the water coming into the condenser is less than 25°C with ΔT less than 12°C (the temperature differential ΔT allowed for water through the condenser can range from 5 to 15°C) the temperature of the condenser outlet water must not however exceed 52°C (*see operating limits*).

VPS – Pressure valve and solenoid hydraulic bypass valve only for models THHEY. Hydraulic solenoid valve installed hydraulically parallel to the pressure valve (see accessory VP). In chiller operating mode, the solenoid valve is closed. This allows the water to flow through the pressure valve which will then perform its function of flow rate adjustment. In heat pump operating mode it is completely opened. This offsets the function of the pressure valve.

HPH – The HPH accessory can be installed only in versions without a circulating pump and without the VP accessory. Set-up for operation of cooling only units (TCHEY) as heat pump by means of inversion on the water circuit for the production of hot water for civil and industrial use. This must be handled as a special feature by our pre-sales office.

DSP – Double set-point via digital consensus (not compatible with the CS accessory), only for models with compatible iDRHOSS control and ***Precision*** option.

CS – Sliding set-point via 4-20 mA analogue signal (incompatible with the DSP accessory) envisaged for models with compatible iDRHOSS control and the ***Precision*** option only. This must be handled as a special feature by our pre-sales office.

Accessories supplied separately

KSA - Rubber anti-vibration mountings.

KA – Inertial storage tank of 20 l (models 105-107) and 30 l (models 109-112) located under the unit complete with expansion tank, safety valve (6 Barg), charge/drainage valve and automatic air vent valve.

KTC – External pipes for water connection between unit and storage tank.

KFA – Water filter.

KRAA - Antifreeze heater on storage tank.

KRS232 – RS485/RS232 serial converter for interconnection between RS485 serial network and supervision systems with serial connection to PC via RS232 serial port (RS232 cable provided).

KUSB – RS485/USB serial converter for interconnection between RS485 serial network and supervision systems with serial connection to PC via USB port (USB cable provided).

Accessories supplied separately with compatible iDRHOSS control

KTR - Remote keypad for control at a distance with rear illuminated LCD display (same functions as the one built into the machine).

KPBY – Low pressure switch.

KRIT – Supplementary electric heater for heat pump.

KEAP – External air sensor for Set-point compensation (incompatible with CS accessory).

KVDEV – 3-way diverter valve for managing the production of domestic hot water.

KSC - Clock board to display date/time and to regulate the machine with daily/weekly start/stop time bands, with the possibility to change the set-points.

KRS485 – RS485 serial interface card to create dialogue networks between cards (maximum of 200 units at a maximum distance of 1,000) and building automation, external supervision systems or *RHOSS* S.p.A. supervision systems (supported protocols: proprietary protocol; Modbus® RTU).

KFTT10 – FTT10 serial interface card for connection to supervision systems (LonWorks® system compliant with Lonmark® 8090-10 protocol with chiller profile).

KISI – CAN bus serial interface (Controller Area Network compatible with evolved hydronic system iDRHOSS for integrated comfort management (protocol supported CanOpen®).

KMDM – GSM 900-1800 modem kit to be connected to the unit or the management of the parameters and any alarm signals on a remote basis. The kit consists of a GSM modem with relative RS232 card. It is necessary to purchase a SIM data card, not supplied by *RHOSS* S.p.A.

KRS – *RHOSS* S.p.A. supervision software for unit monitoring and remote management. The kit consists of a CD-Rom and hardware key.

Technical Data

Table "A": Technical Data

Model TCHEY		**105**	**107**	**109**	**112**
Nominal cooling capacity (*)	kW	5,4	6,8	9,3	12,0
Power consumption at condenser (*)	kW	6,8	8,6	11,7	15,1
E.E.R.		3,46	3,20	3,39	3,33
E.S.E.E.R.		3,54	3,76	3,95	3,91
E.S.E.E.R.+		4,00	4,25	4,46	4,34
Sound power level (*)	dB(A)	57,1	59,1	59,3	61,1
Scroll/step compressor	n°	1	1	1	1
Circuits	n°	1	1	1	1
Evaporator nominal water flow (*)	l/h	932	1171	1603	2064
Evaporator nominal pressure drops (*)	kPa	28,6	19,7	20,3	21,8
Nominal pump external static pressure at evaporator (*) (▲)	kPa	47,0	54,7	82,2	78,2
Condenser nominal water flow (*)	l/h	1165	1490	2012	2603
Condenser nominal pressure drops	kPa	42,7	30,4	30,6	33,1
Water contents of heat exchangers (condenser/evaporator)	l	0,28/0,28	0,45/0,45	0,58/0,58	0,76/0,76
R410A refrigerant charge		See serial No. plate			
Polyester oil charge		See compressor plate			
Electrical Data					
Absorbed power (*)	kW	1,56	2,12	2,74	3,60
Circulating pump absorbed power (▲)	kW	0,25	0,25	0,40	0,40
Electrical power supply	V-ph-Hz	230-1-50	230-1-50 / 400-3+N-50		
Auxiliary power supply	V-ph-Hz	230-1-50	230-1-50	230-1-50	230-1-50
Circulating pump absorbed current (▲)	A	1,1	1,1	1,8	1,8
Nominal current (without circulating pump)	A	6,4	9,4 / 2,4	12,2 / 2,9	17,3 / 4,5
Maximum current (without circulating pump)	A	13,2	16,8 / 6,6	21,8 / 7,4	28,2 / 9,0
Starting current	A	61	82 / 35	97 / 48	136 / 64
Dimensions					
Width (L)	mm	585	585	660	660
Height (H)	mm	535	535	535	535
Depth (P)	mm	386	386	420	420
Water connections	Ø	1"GM	1"GM	1"GM	1"GM

(*) In the following conditions: Condenser input and output water temperature 30-35°C; chilled output water temperature 7°C; temperature differential at evaporator 5°C.

(▲) Only in versions with circulating pump (P).

E.S.E.E.R. (European Seasonal EER) European average seasonal energy efficiency.
E.S.E.E.R. + with AdaptiveFunction Plus logic.

Note:
The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 16.

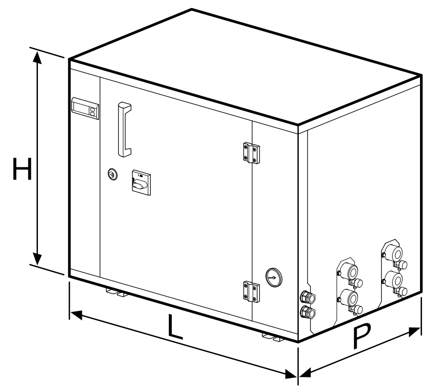


Table "B": Technical data

Model THHEY		**105**	**107**	**109**	**112**
Nominal heating capacity (**)	kW	6,5	8,2	10,8	13,9
Nominal cooling capacity (*)	kW	5,4	6,8	9,3	12,0
E.E.R.		3,46	3,20	3,39	3,33
E.S.E.E.R.		3,54	3,76	3,95	3,91
E.S.E.E.R.+		4,00	4,25	4,46	4,34
C.O.P. (**)		3,18	2,84	3,05	3,17
Sound power level (*)	dB(A)	57,1	59,1	59,3	61,1
Scroll/step compressor	n°	1	1	1	1
Circuits	n°	1	1	1	1
Condenser nominal water flow	l/h	1124	1411	1856	2384
Condenser nominal pressure drops	kPa	42,7	30,4	30,6	33,1
Condenser nominal pressure drops (**)	kPa	40,1	27,6	26,4	28,3
Nominal external static pressure at condenser (**) (▲)	kPa	34,6	45,6	74,7	69,7
Evaporator nominal water flow (**)	l/h	1165	1490	2012	2603
Evaporator nominal pressure drops (*)	kPa	28,6	19,7	20,3	21,8
Evaporator nominal pressure drops (**)	kPa	42,7	30,4	30,6	33,1
Water contents of heat exchangers (condenser/evaporator)	l	0,28/0,28	0,45/0,45	0,58/0,58	0,76/0,76
R410A refrigerant charge		See serial No. plate			
Polyester oil charge		See compressor plate			
Electrical Data					
Absorbed power in winter operation (**)	kW	2,04	2,88	3,54	4,38
Absorbed power in summer operation (*)	kW	1,56	2,12	2,74	3,60
Circulating pump absorbed power (▲)	kW	0,25	0,25	0,40	0,40
Electrical power supply	V-ph-Hz	230-1-50	230-1-50 /400-3+N-50		
Auxiliary power supply	V-ph-Hz	230-1-50	230-1-50	230-1-50	230-1-50
Circulating pump absorbed current (▲)	A	1,1	1,1	1,8	1,8
Nominal current (summer operation) (without circulating pump)	A	6,4	9,4 / 2,4	12,2 / 2,9	17,3 / 4,5
Nominal current (winter operation) (without circulating pump)	A	8,8	13,1 /4,4	16,3 / 6,0	21,4 / 7,5
Maximum current (without circulating pump)	A	13,2	16,8 / 6,6	21,8 / 7,4	28,2 / 9,0
Starting current	A	61	82 / 35	97 / 48	136 / 64
Dimensions					
Width (L)	mm	585	585	660	660
Height (H)	mm	535	535	535	535
Depth (P)	mm	386	386	420	420
Water connections	Ø	1"GM	1"GM	1"GM	1"GM

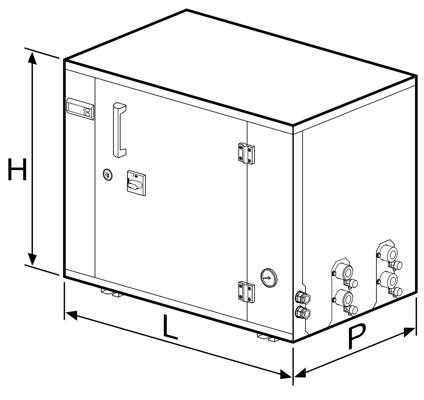
(*) In the following conditions: Condenser input and output water temperature 30-35°C; chilled output water temperature 7°C; temperature differential at the evaporator 5°C.

(**) In the following conditions: Evaporator input water temperature 10°C at the nominal water flow rate as in summer operation; hot water input/output temperature at condenser 40/45°C at nominal flow rate.

(▲) Only in versions with circulating pump (P).

E.S.E.E.R. (European Seasonal EER)
European average seasonal energy efficiency.
E.S.E.E.R. + with AdaptiveFunction Plus logic.

Note:
The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 20.
The calculations of the C.O.P., E.E.R and E.S.E.E.R do not hold account of the absorption of the pumps.



Energy efficiency at partial loads - ESEER index

○ The E.E.R. index represents an estimate of the energy efficiency of the cooling unit in nominal design conditions. In reality, the operating time of a chiller in nominal conditions is usually less than the operating time in partial load conditions.

○ The E.S.E.E.R. (European Seasonal E.E.R.) is an index that estimates the average seasonal energy efficiency of the cooling unit in four load and water temperature conditions. Generally, two water chillers with the same E.E.R. may have different E.S.E.E.R. values. In fact, for a water cooling unit, the average energy efficiency depends on design choices and on the temperature of inlet water at the condensing heat exchanger.

○ The E.S.E.E.R. energy index, introduced by the European community (Project E.E.C.C.A.C. - Energy Efficiency and Certification of Central Air Conditioners), is characterized by the water temperatures (see table "**C**") and by the energy weights that are assigned to the four load conditions considered in the calculation: 100%, 75%, 50% and 25%.

$$ESEER = \frac{3xEER_{100\%} + 33xEER_{75\%} + 41xEER_{50\%} + 23xEER_{25\%}}{100}$$

where EER100% EER75% EER50% EER25% represent the efficiencies of the cooling unit in the four load conditions and at the temperatures indicated in table "**C**".
The data is calculated using Eurovent method. The consumption of the circulation pump (if present) is not included.

Table "C": load and temperature conditions

	Inlet water temperature at condenser
Load	**E.S.E.E.R.**
100%	30°C
75%	26°C
50%	22°C
25%	18°C

○ Table "**D**" shows the E.E.R. and E.S.E.E.R. values for each model. The high values of energy efficiency at partial loads were achieved thanks to optimisation of the heat exchangers.

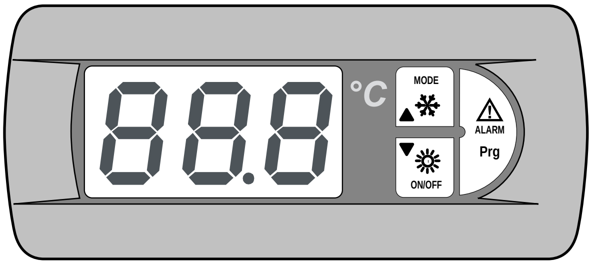
Table "D": EER – ESEER for TCHEY - THHEY

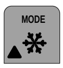
Model	E.E.R.	E.S.E.E.R.
105	3,46	3,54
107	3,20	3,76
109	3,39	3,95
112	3,33	3,91

Electronic controls

Compatible IDRHOSS control

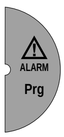
The keyboard with display makes it possible to view the operating temperature and all the unit process variables, as well as providing access to setting parameters for the operating set-points and allowing their modification. For purposes of technical assistance, it allows password-protected access to the unit's management parameters (access for authorised personnel only).





SUMMER LED - MODE, UP key:
indicates that the unit is running in cooling mode. This key makes it possible to select the unit operating mode (summer or winter cycle) and also allows the user to run up through the list of parameters, the values displayed and any alarm codes.

WINTER LED – key ON/OFF, DOWN
Indicates that the unit is running in heating mode. This key makes it possible to switch the unit on and off and also allows the user to run down through the list of parameters, the values displayed and any alarm codes.



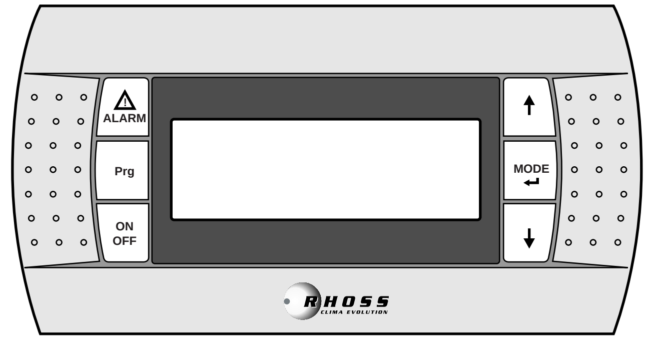
ALARM LED – Prg, ALARM key
When on, it indicates the presence of at least one alarm situation in the machine. This key makes it possible to programme the machine, display the alarm codes and reset the same.

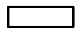
Display
Displays all the parameters (i.e. outlet water temperature, etc.), any alarm codes and the resource statuses.

POWER SUPPLY LED
Indicates the presence of the power supply when the machine is switched off. If the regulation temperature is displayed and flashing, it means that the requested compressor is stationary due to the safety time delays.

KTR – Remote keypad for compatible IDRHOSS control

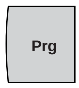
The remote keyboard with display (KTR) allows the remote control and display of all of the unit's digital and analogue process variables. It is therefore possible to control all the machine functions directly in the room. It allows setting and management of time periods (if KSC accessory is included).



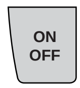


DISPLAY:
displays the numbers and the values of all the parameters (i.e. outlet water temperature etc.), any alarm codes and all the resource statuses by means of strings.

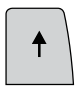
ALARM key:
makes it possible to display the code and reset any alarms.



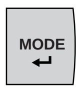
PRG key:
makes it possible to programme the machine's fundamental operating parameters.



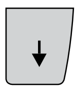
ON/OFF key:
makes it possible to switch the unit on and off.



UP key:
used to scroll through the list of parameters, statuses and any alarms; makes it possible to modify set points.



MODE - ENTER key:
makes it possible to switch from chiller to heat pump operation and vice versa.



DOWN key.
used to scroll through the list of parameters, statuses and any alarms; makes it possible to modify set points.

Note:
The temporary presence of two devices, on-board machine keyboard and remote keyboard, will cause the on-board machine terminal to be disabled. Three dashes (**- - -**) will be displayed on the interface on the machine, indicating the presence of the remote keypad (KTR).

Serial Connection

Serial connection for compatible iDRHOSS control

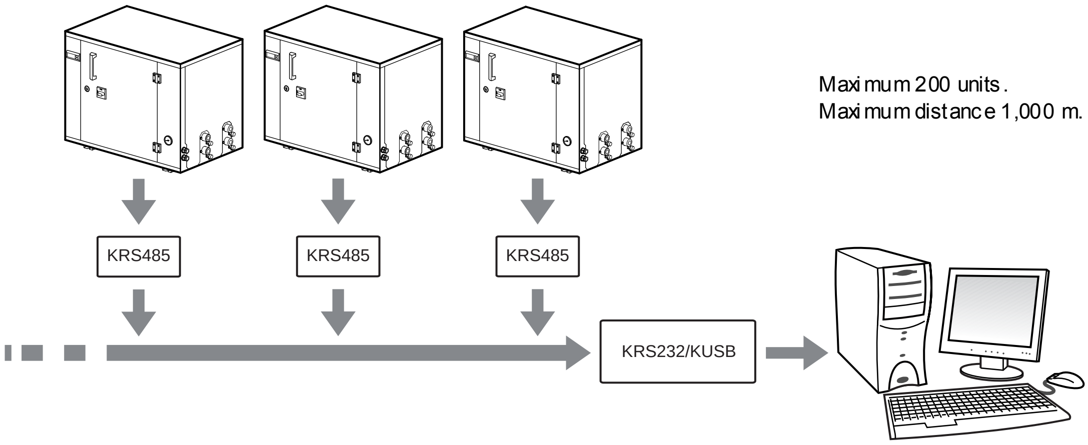
All units are equipped with electronic control that is set up interface with an external BMS via a serial communication line by means of the KRS485 serial interface accessory (proprietary protocol or ModBus® RTU) and the following converters.

- **KRS232** – RS485/RS232 converter for connection to supervision systems;
- **KUSB –** RS485/USB converter for connection to supervision systems.
- The FTT10 LonWorks® compatible interface is also available.

Supervision

In general, a supervision system allows access to all unit functions, such as:

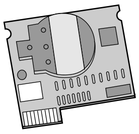
- Making all settings which are accessible through the keyboard;
- Reading all process variables of the inputs and outputs, whether digital or analogue;
- Reading the various alarm codes which are present, and resetting them as necessary.



Maximum 200 units.
Maximum distance 1,000 m.

KSC – Clock card

Insertion of the clock card (KSC) favours flexible and efficient use of the unit, showing the date/time and allowing management of the machine in daily or weekly start/stop time periods, with the possibility to change set-points. The time periods can be set and managed from the keyboard.



Example of display

Performance

Choice of a chiller or heat pump and use of the performance tables

○ Table "**E**" provides, for each model, the cooling capacity (**QF**), the total absorbed electrical power (**P**) and the heating capacity to be rejected (**QT**), based on the condenser and evaporator outlet water temperatures with constant temperature differentials **ΔT** = 5°C. The value of **QT** is also the value of the heating capacity available for use in the winter cycle.
○ Table "**H**" provides, for each model in the summer cycle, the values **QF**, **P** and **QT**, based on the city and tower water temperature at the outlet of the condenser with temperature differential **ΔT** = 12°C and based on water temperature for use at the evaporator outlet with temperature differential **ΔT** = 5°C.
○ Within operating limits, the values in tables "**E**" and "**H**" may permit interpolations of performance but extrapolations are not permitted.
○ Tables "**F**", "**G**" and "**I**" show the performance corrective coefficients upon variation of the temperature differential **ΔT** between water inlet and outlet at the exchangers.
○ Table "**M**" shows the values of corrective coefficients to be applied to the nominal values if water with glycol is used.
○ Graph "**1"** shows the pressure drop values of the exchangers (with respect to the indicated temperature differentials).
○ Graph "**2**" indicates the residual static pressure of the circulating pump (if present).
○ Table "**L**" contains the octave band and total values for sound power for the single models in the basic version.

Example

○ Design conditions for a water cooling chiller:
- Required cooling capacity = 10,3 kW;
- Temperature of water produced at evaporator = 10°C;
- Temperature differential **ΔT**at the evaporator = 5°C;
- Inlet temperature at condenser = 30°C.

Using the values indicated in table "**E**", and supposing a temperature differential **ΔT**=5°C at the condenser, it can be seen that model TCHE 109 meets the requirement with:
QF=10.4 kW; **P**=2.69 kW;
QT=12.7 kW.
The water flow rates, **G**, to be sent to the exchangers are obtained using the following formulae:
G (l/h) evaporator =
(**QF**x860)÷**ΔT**=(10.4x860)÷5=1789 (l/h);
G (l/h) condenser =
(**QT**x860)÷**ΔT**=(12.7x860)÷5=2184 (l/h).
Graph "**1**" provides the values for pressure drops Δpw respectively for the evaporator and the condenser:
Δpw evaporator = 25 kPa;
Δpw condenser = 35 kPa.
To reduce the water flow rate to the condenser, it is necessary to increase the temperature differential **ΔT**. Therefore, hypothetically working with **ΔT** at the condenser equal to 10°C, with the same condenser outlet water temperature **Tuc** = 35°C the new condenser inlet water temperature is:
Inlet temperature at condenser =
35°C –10°C = 25°C.
The corrective coefficients **kct QF** and **kct P** in table "**F**" are used to calculate the new values for **QFI**, **PI** and hence for **QTI**:
QFI=**QF** x **kct QF**=10.4x1.016= 10.6 kW;
PI=**P** x **kct P**=2.69x0.969=2.6 kW;
QTI=(**QFI**+**PI**) x 0.97=(10.6+2.6)x0.97=12.8 kW.
The new water flow rates G to be sent to the exchangers are obtained using the following formulae:
GI (l/h) evaporator =
(10.6x860)÷5=1823 (l/h);
GI (l/h) condenser =
(12.8x860)÷10=1100 (l/h).
The new pressure drops can be obtained using the following simplified formulae:
ΔpwI evaporator =
Δpw x (**GI** ÷ **G**)²=25x(1823÷1789)²=26 kPa;
ΔpwI condenser =
Δpw x (**GI**÷**G**)²=35x(1100÷2184)²=9 kPa.

Performance data

Table "E": TCHEY-THHEY performance data (ΔT = 5°C at the condenser; ΔT = 5°C at the evaporator)

Model	Tue (°C)	Tuc (°C)																	
		30			35			40			45			50			52		
		QF	QT	P	QF	QT	P	QF	QT	P	QF	QT	P	QF	QT	P	QF	QT	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
105	-6	3,5	4,9	1,5	3,3	4,9	1,7	-		-	-	-	-	-	-	-	-	-	-
	-2	4,1	5,3	1,4	3,8	5,2	1,6	3,5	5,2	1,9	-	-	-	-	-	-	-	-	-
	1	4,5	5,7	1,4	4,3	5,7	1,6	3,9	5,5	1,8	3,6	5,5	2,1	3,2	5,4	2,4	-	-	-
	5	5,4	1,4	5,0	1,6	4,7	1,8	4,3	2,0	3,9	2,3	3,8	2,4	5,4	1,4	5,0	1,6	4,7	1,8
	7	5,7	6,9	1,4	5,4	6,8	1,6	5,0	6,6	1,8	4,7	6,5	2,0	4,3	6,4	2,3	4,1	6,3	2,4
	10	6,3	7,4	1,3	6,0	7,3	1,5	5,6	7,1	1,7	5,2	7,0	2,0	4,8	6,9	2,3	4,6	6,8	2,4
	13	7,0	8,1	1,3	6,6	7,9	1,5	6,2	7,7	1,7	5,8	7,6	2,0	5,3	7,3	2,2	-	-	-
	16	7,7	8,7	1,3	7,3	8,5	1,5	6,8	8,2	1,7	6,3	8,0	1,9	5,8	7,8	2,2	-	-	-
	18	8,1	9,1	1,3	7,7	8,9	1,5	7,2	8,6	1,7	6,8	8,4	1,9	6,2	8,1	2,1	-	-	-
	23	9,4	10,3	1,2	9,0	10,1	1,4	8,4	9,7	1,6	7,8	9,3	1,8	7,2	9,0	2,1	-	-	-
107	-6	3,7	5,4	1,9	3,4	5,4	2,2	-	-	-	-	-	-	-	-	-	-	-	-
	-2	4,7	6,4	1,9	4,3	6,3	2,2	3,9	6,2	2,5	-	-	-	-	-	-	-	-	-
	1	5,4	7,1	1,9	5,1	7,0	2,1	4,7	7,0	2,5	4,2	6,8	2,8	3,7	6,8	3,3	-	-	-
	5	6,7	1,9	6,2	2,1	5,7	2,4	5,2	2,8	4,7	3,2	4,5	3,4	6,7	1,9	6,2	2,1	5,7	2,4
	7	7,3	8,9	1,9	6,8	8,6	2,1	6,3	8,4	2,4	5,8	8,3	2,8	5,2	8,1	3,2	5,0	8,1	3,4
	10	8,2	9,7	1,8	7,7	9,5	2,1	7,2	9,3	2,4	6,6	9,1	2,8	6,0	8,9	3,2	5,7	8,8	3,4
	13	9,3	10,8	1,8	8,7	10,5	2,1	8,1	10,2	2,4	7,5	10,0	2,8	6,8	9,7	3,2	-	-	-
	16	10,4	11,8	1,8	9,8	11,5	2,1	9,1	11,2	2,4	8,4	10,9	2,8	7,6	10,4	3,1	-	-	-
	18	11,2	12,6	1,8	10,5	12,2	2,1	9,8	11,8	2,4	9,0	11,4	2,8	8,2	11,0	3,1	-	-	-
	23	13,3	14,6	1,8	12,5	14,2	2,1	11,6	13,6	2,4	10,7	13,0	2,7	9,7	12,4	3,1	-	-	-
109	-6	5,8	8,1	2,5	5,4	8,0	2,8	-	-	-	-	-	-	-	-	-	-	-	-
	-2	6,8	9,0	2,5	6,4	8,9	2,8	6,0	8,9	3,2	-	-	-	-	-	-	-	-	-
	1	7,7	9,8	2,4	7,3	9,8	2,8	6,8	9,6	3,1	6,3	9,6	3,6	5,8	9,5	4,0	-	-	-
	5	9,1	2,4	8,6	2,8	8,1	3,2	7,5	3,6	6,9	4,2	6,6	4,4	9,1	2,4	8,6	2,8	8,1	3,2
	7	9,9	11,9	2,4	9,3	11,6	2,7	8,7	11,4	3,1	8,1	11,3	3,6	7,4	11,1	4,0	7,1	11,0	4,2
	10	11,0	13,0	2,4	10,4	12,7	2,7	9,7	12,4	3,1	9,0	12,2	3,6	8,2	11,8	4,0	7,9	11,7	4,2
	13	12,2	14,2	2,4	11,5	13,8	2,7	10,8	13,5	3,1	10,0	13,1	3,5	9,2	12,8	4,0	-	-	-
	16	13,5	15,4	2,4	12,7	14,9	2,7	11,9	14,6	3,1	11,1	14,2	3,5	10,2	13,8	4,0	-	-	-
	18	14,4	16,2	2,3	13,6	15,8	2,7	12,8	15,4	3,1	11,9	14,9	3,5	10,9	14,5	4,0	-	-	-
	23	16,8	18,5	2,3	15,9	18,0	2,7	15,0	17,6	3,1	14,0	17,0	3,5	12,9	16,3	3,9	-	-	-
112	-6	7,3	10,2	3,2	6,9	10,3	3,7	-	-	-	-	-	-	-	-	-	-	-	-
	-2	8,7	11,5	3,2	8,2	11,4	3,6	7,6	11,4	4,2	-	-	-	-	-	-	-	-	-
	1	9,9	12,6	3,1	9,3	12,5	3,6	8,7	12,5	4,2	8,0	12,4	4,8	7,3	12,5	5,6	-	-	-
	5	11,7	3,1	11,1	3,6	10,5	4,2	9,8	4,8	9,0	5,6	8,7	5,9	11,7	3,1	11,1	3,6	10,5	4,2
	7	12,7	15,3	3,1	12,0	15,1	3,6	11,2	14,9	4,2	10,4	14,7	4,8	9,5	14,6	5,5	9,1	14,6	5,9
	10	14,2	16,8	3,1	13,4	16,5	3,6	12,6	16,3	4,2	11,7	16,0	4,8	10,7	15,7	5,5	10,3	15,6	5,8
	13	15,8	18,3	3,1	15,0	18,0	3,6	14,0	17,7	4,2	13,0	17,3	4,8	12,0	17,0	5,5	-	-	-
	16	17,6	20,2	3,2	16,6	19,7	3,7	15,6	19,2	4,2	14,5	18,7	4,8	13,4	18,3	5,5	-	-	-
	18	18,8	21,3	3,2	17,8	20,9	3,7	16,7	20,4	4,3	15,5	19,7	4,8	14,3	19,2	5,5	-	-	-
	23	22,2	24,7	3,3	20,9	24,0	3,8	19,7	23,3	4,3	18,3	22,5	4,9	17,0	21,7	5,4	-	-	-

Tue = Evaporator outlet water temperature (ΔT inlet/outlet = 5 °C).
Tuc = Condenser outlet water temperature (ΔT inlet/outlet = 5 °C).
QF = Cooling capacity (evaporator fouling factor of 0.35 X 10^{-4} m²C/W).
QT = Heating capacity (evaporator fouling factor of 0.35 X 10^{-4} m²C/W).
P = Electrical power absorbed.

Note:
With evaporator outlet water temperature (**Tue**) between -6 and 4°C the calculation was made considering a 6% water and glycol solution 30%.

Nominal conditions of summer operation
Evaporator inlet/outlet water 12°C/7°C, condenser inlet/outlet water 30°C/35°C.

Nominal conditions of winter operation
Condenser inlet/outlet water 40°C/45°C, evaporator inlet water 10°C, water flow rate as for summer operation.

Table "F": corrective coefficients ΔT of water at condenser
For ΔT of the water at the condenser different from 5°C (ΔT minimum 5°C and ΔT maximum 15°C), with the same outlet water temperature (respectively 30°C, 35°C, 40°C, 45°C, 50°C and 52°C), apply the following corrective coefficients to the data in table "**E**".

Table "F"

ΔT	kct QF	kct P
5°C	1,000	1,000
10°C	1,016	0,969
15°C	1,030	0,940

ATTENTION!
For water at the inlet to the condenser at less than 25°C and ΔT less than 12°C, it is advisable to install the pressure valve accessory (VP or VPS).

Table "G": corrective coefficients ΔT of water at evaporator
For temperature differentials ΔT of the water at the evaporator different from 5°C, with the same outlet water temperature (respectively from -6 to 23 °C), apply the following corrective coefficients to the data in table "**E**".

Table "G"

ΔT	kct QF	kct P
3°C	0,97	0,99
5°C	1,00	1,00
8°C	1,01	1,01

QT = (**QF** + **P**) x 0.97

ATTENTION!
The temperature differential ΔT of the inlet and outlet water temperature at the evaporator should be between 3°C and 8°C.

Table "H": TCHEY-THHEY performance data in the summer cycle
(condensation with city water with ΔT = 12°C at the condenser and with ΔT = 5°C at the evaporator)

Model	Tue (°C)	Tuc (°C)								
		24 (*)			27			30		
		QF	QT	P	QF	QT	P	QF	QT	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW
105	5	5,8	6,8	1,2	5,6	6,7	1,3	5,4	6,5	1,3
	7	6,2	7,1	1,1	6,0	7,0	1,2	5,8	6,9	1,3
	10	6,8	7,7	1,1	6,6	7,6	1,2	6,4	7,5	1,3
	13	7,5	8,3	1,1	7,3	8,2	1,2	7,1	8,1	1,3
	16	8,2	9,0	1,1	8,0	8,9	1,2	7,8	8,8	1,3
	18	8,7	9,5	1,1	8,5	9,3	1,1	8,2	9,1	1,2
107	5	7,2	8,5	1,6	7,0	8,4	1,7	6,8	8,3	1,8
	7	7,9	9,2	1,6	7,6	9,0	1,7	7,4	8,9	1,8
	10	8,9	10,2	1,6	8,6	10,0	1,7	8,4	9,9	1,8
	13	10,0	11,2	1,5	9,7	11,1	1,7	9,4	10,9	1,8
	16	11,2	12,3	1,5	10,9	12,2	1,7	10,5	11,9	1,8
	18	12,1	13,2	1,5	11,7	13,0	1,7	11,3	12,7	1,8
109	5	9,8	11,4	2,0	9,5	11,3	2,2	9,3	11,3	2,3
	7	10,6	12,2	2,0	10,3	12,1	2,2	10,0	11,9	2,3
	10	11,8	13,4	2,0	11,5	13,2	2,1	11,1	13,0	2,3
	13	13,1	14,6	2,0	12,7	14,4	2,1	12,3	14,2	2,3
	16	14,5	16,0	2,0	14,1	15,7	2,1	13,7	15,5	2,3
	18	15,5	17,0	2,0	15,0	16,6	2,1	14,6	16,4	2,3
112	5	12,3	14,5	2,6	12,1	14,5	2,8	11,8	14,4	3,0
	7	13,3	15,4	2,6	13,0	15,3	2,8	12,7	15,2	3,0
	10	14,9	17,0	2,6	14,6	16,9	2,8	14,3	16,9	3,1
	13	16,7	18,7	2,6	16,3	18,5	2,8	15,9	18,4	3,1
	16	18,6	20,6	2,6	18,1	20,3	2,8	17,7	20,2	3,1
	18	19,9	21,8	2,6	19,4	21,5	2,8	18,9	21,3	3,1

Tue = Evaporator outlet water temperature (ΔT inlet/outlet = 5 °C).
Tuc = Condenser outlet water temperature (ΔT inlet/outlet = 12 °C).
QF = Cooling capacity (evaporator fouling factor of 0.35 X 10^{-4} m²°C/W).
QT = Heating capacity (evaporator fouling factor of 0.35 X 10^{-4} m²°C/W).
P = Electrical power absorbed.

Table "I": corrective coefficients ΔT of city water at condenser
For ΔT of city water other than 12°C, with the same inlet water temperature (respectively 12°C, 15°C and 18°C), apply the following corrective coefficients to the data in table "**H**".

Table "I"

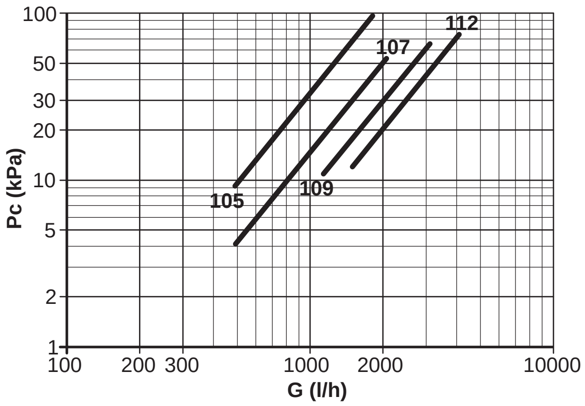
ΔT	kct QF	kct P
12°C	1,000	1,000
15°C	0,980	1,040
18°C	0,975	1,050

ATTENTION!
It's possible to use city water at the condenser with inlet temperature between 21°C and 18°C and with ΔT minimum 12°C and ΔT maximum 18°C.
When the water at the inlet to the condenser is less than 15°C, it is advisable to install the pressure valve accessory (VP or VPS).

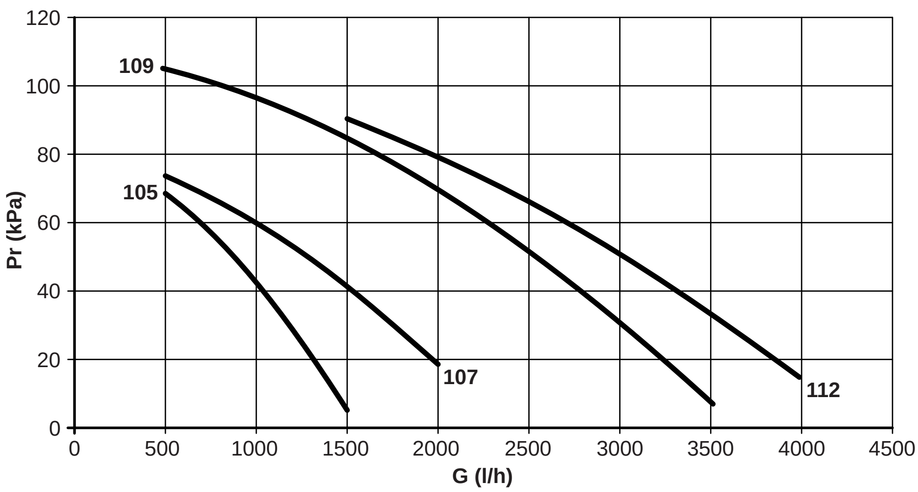
(*) Provide for installation of the pressure valve accessory (VP or VPS).

Pressure drops and residual static pressure

Graph "1": pressure drops, exchangers TCHEY-THHEY 105÷112



Graph "2": TCHEYP-THHEYP 105÷112 useful static pressure



Calculation of Pressure Drops

○ The water flow rate at the exchanger is calculated according to the following formula:

○ G = (Q x 0.86) : ΔT

- Where:

G (l/h) = water flow rate at the exchanger;
Q (kW) = exchanged power, which may be QF (for the evaporator) or QT (for the condenser), depending on the exchanger in question;
ΔT (°C) = temperature differential.

○ Pressure drops can be obtained from the graph alongside, or calculated using the following formulae:

○ $\Delta pw = \Delta pw_{nom} \times (G : G_{nom})^2$

- Where:

Δpw_{nom} (kPa) = nominal pressure drop at the exchanger in question (table on *Technical data*):
G (l/h) = water flow rate at the exchanger in question;
G_{nom} (l/h) = nominal water flow rate at the exchanger in question (table on *Technical data*).

Note:
For all machines, in any case refer to the admissible operating limits and thermal differences (ΔT).

Calculation of residual static pressure
The residual static pressure values can be obtained from graph "**2**" based on measured flow rates.

G = Water flow rate
Pc = Pressure drops
Pr = Residual static pressure

Sound power level

Table "L": Levels sound power in dB by octave band and total sound power level in dB(A).

Model	105	107	109	112
125 Hz	50,8	51,3	51,4	54,2
250 Hz	40,8	42,4	43,1	46,2
500 Hz	48,2	51,6	51,8	53,2
1000 Hz	52,6	54,6	54,8	56,2
2000 Hz	51,0	52,9	53,1	55,2
4000 Hz	40,6	43,5	44,2	45,1
8000 Hz	28,4	29,5	29,7	30,8
Lw(*)	57,1	59,1	59,3	61,1
Lp (**)	49,1	51,1	51,3	53,1

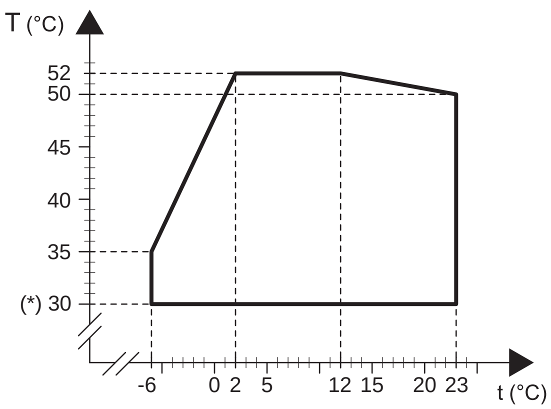
Lw = Total sound power level in dB(A).
Lp = Sound pressure level in dB(A).

(*) Sound power level emitted in nominal summer operating conditions: evaporator inlet/outlet water 12°C / 7°C, condenser inlet/outlet water temperature 30°C / 35°C.

(**) The sound pressure level refers to measurement in free field at a distance of 1 m from the unit, with a directionality factor Q=2.

Operating limits

TCHEY-THHEY 105÷112



T (°C) = Condenser outlet water temperature
t (°C) = Evaporator outlet temperature

(*) Only the water output on the rejection side, working with well/aqueduct water, can drop to 24°C. Contact the pre-sales office for such conditions.

Temperature differentials permitted through the exchangers
- Temperature differential at the evaporator ΔT = 3 ÷ 8°C
- Temperature differential at the condenser (table "**E**"): ΔT = 5 ÷ 15°C
- Temperature differential at the condenser (city water - table "**H**"): ΔT = 12 ÷ 18°C.

ATTENTION !
- Water at the inlet to the condenser at less than 25°C and ΔT less than 12°C: it is advisable to install the pressure valve accessory (VP or VPS).
- When the water at the inlet to the condenser is less than 15°C (the temperature differential ΔT permitted for city water through the condenser can range from 12 to 18°C) it is advisable to install the pressure valve accessory (VP or VPS).

Maximum evaporator inlet water temperature 28°C.
Maximum condenser inlet water temperature 47°C.

- Minimum water pressure 0.5 Barg.
- Maximum water pressure 6 Barg.

Note:
For evaporator outlet water at less than 5°C or geothermal applications with temperatures below 5°C, contact *RHOSS* S.p.A. pre-sales service before ordering.

Use of antifreeze solutions

- The use of ethylene glycol is recommended if you do not wish to drain the water from the water system during the winter pause, or if the unit has to supply chilled water at temperatures lower than 5 °C. The addition of glycol changes the physical properties of the water and consequently the performance of the unit. The proper percentage of glycol to be added to the system can be obtained from the most demanding operating conditions from those shown below.
- Table "**M**" shows the multipliers which allow the changes in performance of the units to be determined in proportion to the required percentage of ethylene glycol.
- The multipliers refer to the following conditions: condenser inlet water temperature 30 °C, chilled water outlet temperature 7 °C, evaporator / condenser temperature differential 5 °C.
- For different operating conditions, the same coefficients can be used as their variations are negligible.

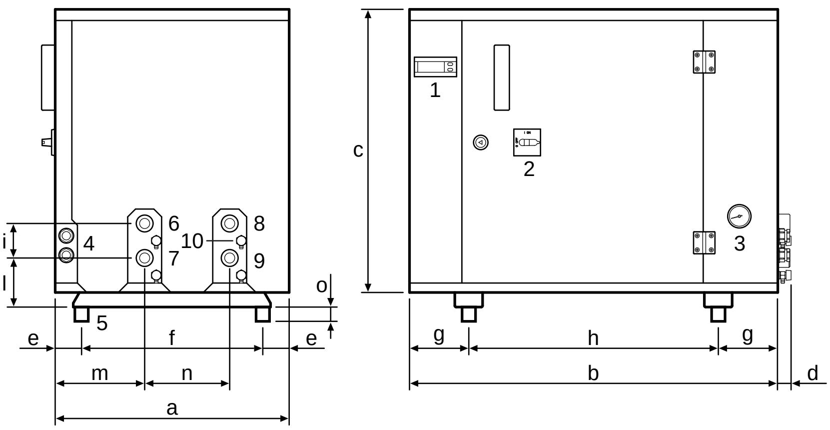
Table "M"

Glycol by weight	10 %	15 %	20 %	25 %	30 %
Freezing temperature °C	-5	-7	-10	-13	-16
fc QF	0,991	0,987	0,982	0,978	0,974
fc P	0,996	0,995	0,993	0,991	0,989
fc Δpw	1,053	1,105	1,184	1,237	1,316
fc G	1,008	1,028	1,051	1,074	1,100

fc QF = Cooling capacity correction factor.
fc P= Correction factor for the absorbed electrical power.
fc Δpw= Correction factor of the pressure drop in the evaporator
fc G = Correction factor of the glycol water flow to the evaporator

Dimensions and footprints

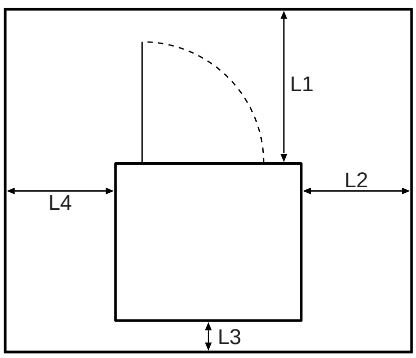
Dimensions and footprints TCHEY-THHEY 105÷112



1. Control panel;
2. Isolator;
3. Water gauge for heating/conditioning (primary);
4. Power supply inlet;
5. Antivibration mountings (KSA accessory);
6. System water inlet for heating/conditioning (primary);
7. Water outlet for heating/conditioning (primary);
8. Rejection device inlet;
9. Rejection device outlet;
10. Water drain.

Model		a	b	c	d	e	f	g	h	i	l	m	n	o
105	mm	386	585	535	24	31	324	105	375	62	88	161	153	20
107	mm	386	585	535	24	31	324	105	375	62	88	161	153	20
109	mm	420	660	535	24	48	324	105	450	62	88	161	153	20
112	mm	420	660	535	24	48	324	105	450	62	88	161	153	20

Clearances and positioning



Model		105	107	109	112
L1	mm	700	700	700	700
L2	mm	150	150	150	150
L3	mm	30	30	30	30
L4	mm	500	500	500	500

Weights

Model		105	107	109	112
TCHEY	kg	70	75	83	86
TCHEYP	kg	75	80	90	93
THHEY	kg	74	79	87	90
THHEYP	kg	78	83	94	97

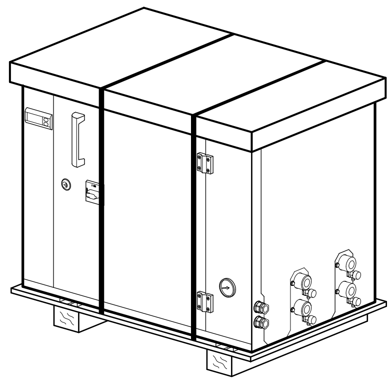
The weights refer to units without water

Installation

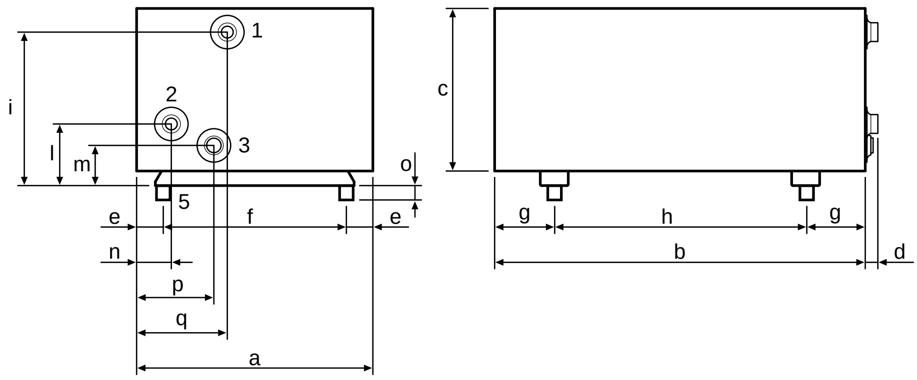
- The unit is intended for indoor installation. If outdoor installation is required, contact our pre-sales office.
- The unit is equipped with male threaded water connections.
- The unit must be positioned to comply with the minimum recommended clearances, bearing in mind the access to water and electrical connections.
- The unit can be equipped with anti-vibration mountings on request (KSA).
- We recommend installing isolating valves that isolate the unit from the rest of the system.
- It is obligatory to install the low-pressure drop mesh filter (KFA) on each water inlet of the unit.
- The unit may not be installed on brackets or shelves.
- Correct installation and positioning includes levelling the unit on a surface capable of bearing its weight.

Handling

- The unit should be handled with care to avoid damage to the external structure and to the internal mechanical and electrical components.
- Do not stack the units.
- The temperature limits for storage are - 9 °C ÷ 45 °C.

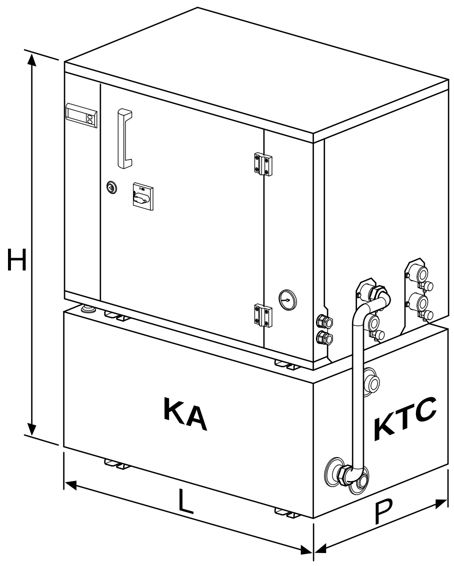


Dimensions and footprints of KA and KTC accessories



1. Water inlet;
2. Water outlet;
3. Water drain.

Model		a	b	c	d	e	f	g	h	i	l	m	n	o	p	q
105	mm	386	585	318	24	31	324	105	375	276	111	72	20	61	137	161
107	mm	386	585	318	24	31	324	105	375	276	111	72	20	61	137	161
109	mm	420	660	318	24	48	324	105	375	276	111	72	20	61	137	161
112	mm	420	660	318	24	48	324	105	375	276	111	72	20	61	137	161



KA: Storage tank accessory.
KTC: Connection pipes accessory

KA accessory technical data

Model		105	107	109	112
Water content	l	20	20	30	30
Expansion tank	l	0,5	0,5	1,0	1,0
Safety valve calibration	kPa	600	600	600	600
Maximum admissible pressure	kPa	600	600	600	600
Water connection dimensions	Ø	1”GM	1”GM	1”GM	1”GM
Drain connection dimensions	Ø	½”GF	½”GF	½”GF	½”GF
L	mm	585	585	660	660
P	mm	386	386	420	420
H	mm	853	853	853	853
Weight (*)	kg	28	28	33	33

(*) The weights refer to the accessory without water

Water Circuits

TCHEY-THHEY minimum water circuit content

In order for the units to operate properly, minimum water content must be guaranteed in the water system. The minimum water content is established on the basis of the unit's nominal cooling capacity (table A *Technical Date*), multiplied by the coefficient expressed in l/kW.

Range	Adjustment type	Control	Specific capacity
TCHEY-THHEY105÷112	*AdaptiveFunction Plus*	iDRHOSS	2 l/kW

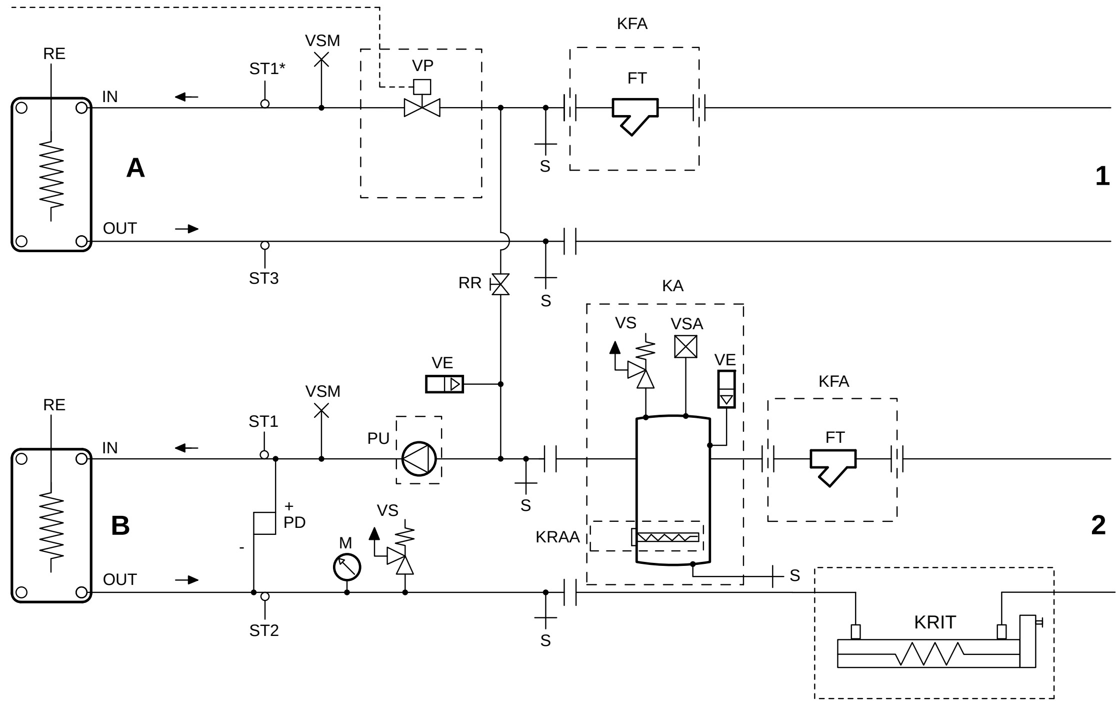
Example: TCHEY 112
The reference capacity to be taken into consideration when calculating the water content on the primary side, is the cooling capacity in design conditions. If, for example, it coincides with the nominal conditions (Qf=12 kW), a minimum volume of water must be guaranteed, calculated as follows:

If the unit envisages control iDRHOSS with ***AdaptiveFunction Plus***, the minimum system content should be:

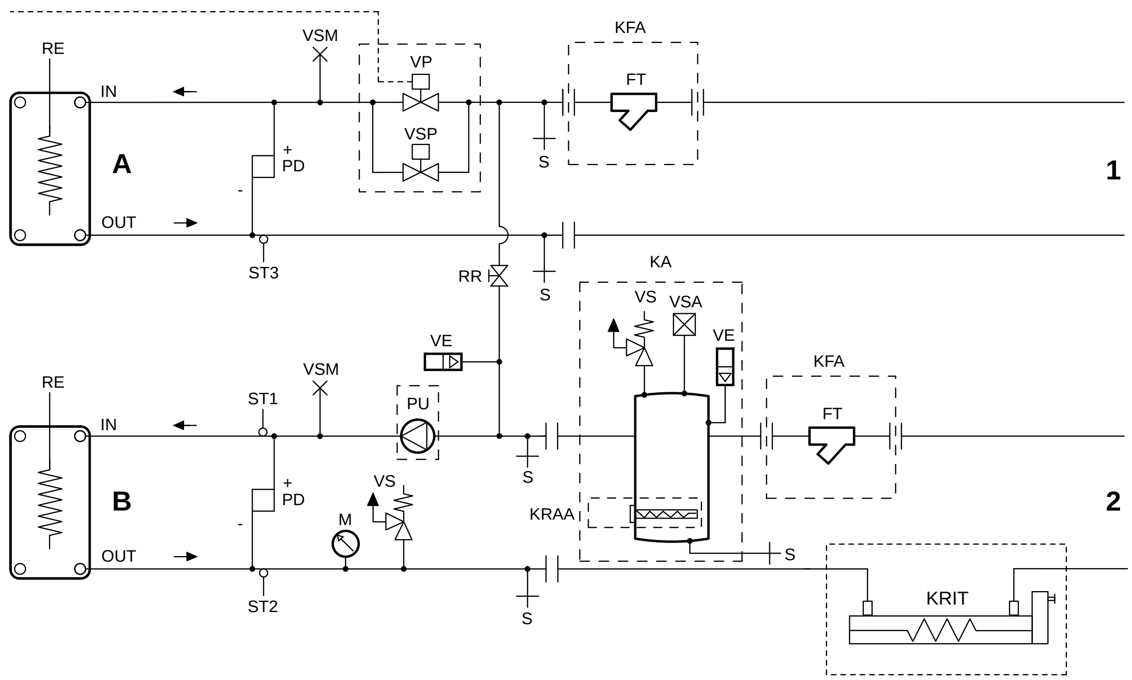
Qf (kW) x 2 l/kW = 12 kW x 2 l/kW = 24 l

For design conditions that differ from the nominal conditions, the power data must be found using Tables "D", which provide a clear list of the power values that can be obtained at conditions other than nominal conditions. When doing the calculation, we recommend always referring to the maximum envisaged power (for THHEY, in heating mode also).

TCHEY water circuit



THHEY water circuit



A = Condenser/evaporator/rejection device;
B = Evaporator/condenser;
1 = External net (rejection device);
2 = Heating/conditioning system (primary);

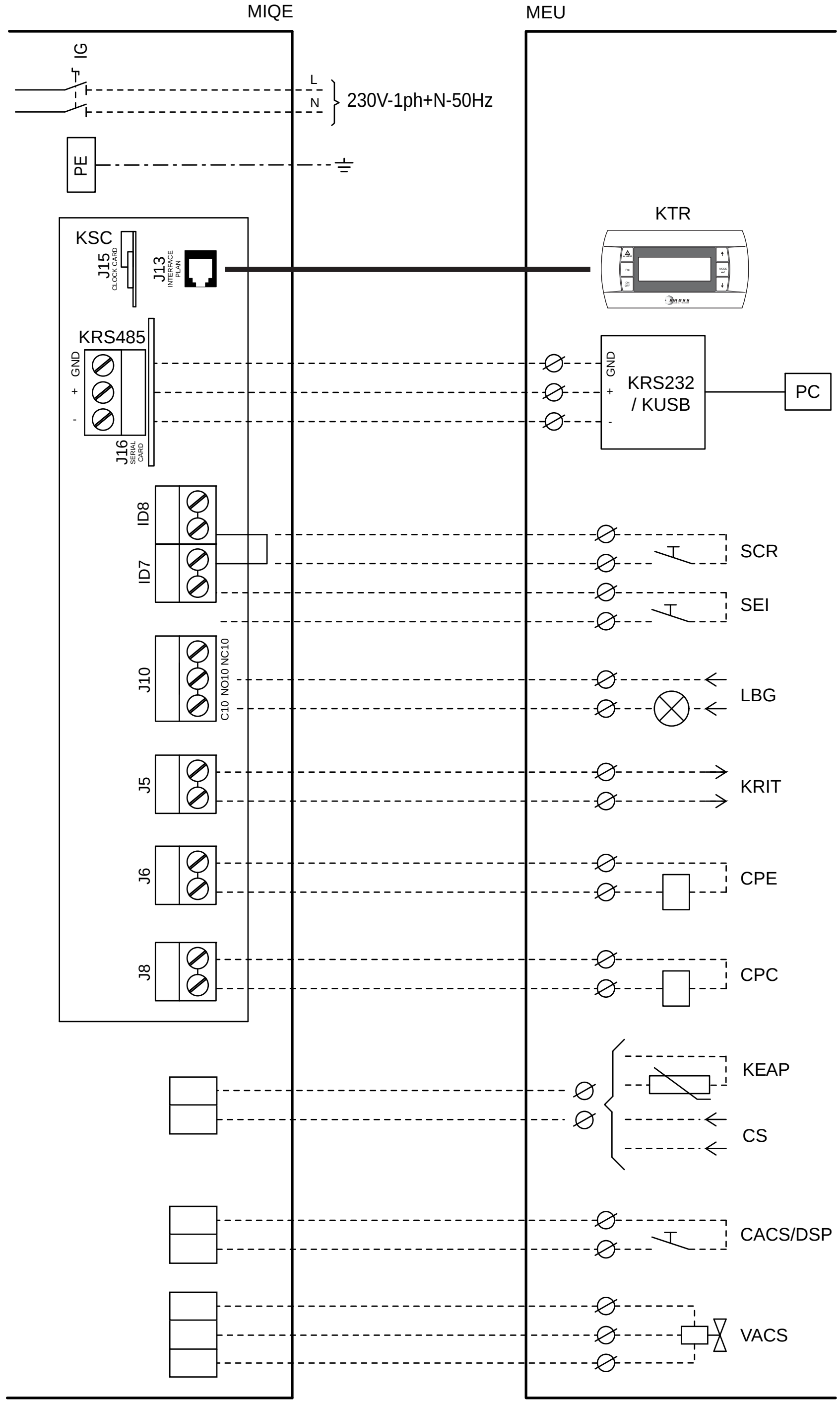
KFA = Net filter accessory;
KA = Storage tank accessory;
KRAA = Storage tank heater accessory;

RE = Evaporator antifreeze heater;
VSM = Manual bleed valve;
PD = Water differential pressure switch;
VP = Pressure valve (factory-fitted accessory);
VSP = Solenoid valve (factory-fitted accessory);
VSA = Automatic bleed valve;
S = Water drain;
VS = Safety valve;

M = Pressure gauge;
VE = Expansion tank;
PU = Circulating pump;
RR = Filling valve;
FT = Net filter;
ST1 = Primary inlet temperature sensor;
ST1* = Present only in versions HPH;
ST2 = Primary outlet temperature sensor;
ST3 = Rejection device outlet temperature sensor;
KRIT = Supplementary electric heater (accessory)

Electrical connections with compatible IDRHOSS control

TCHEY-THHEY 105÷112
Electrical power supply 230V – 1ph – 50Hz



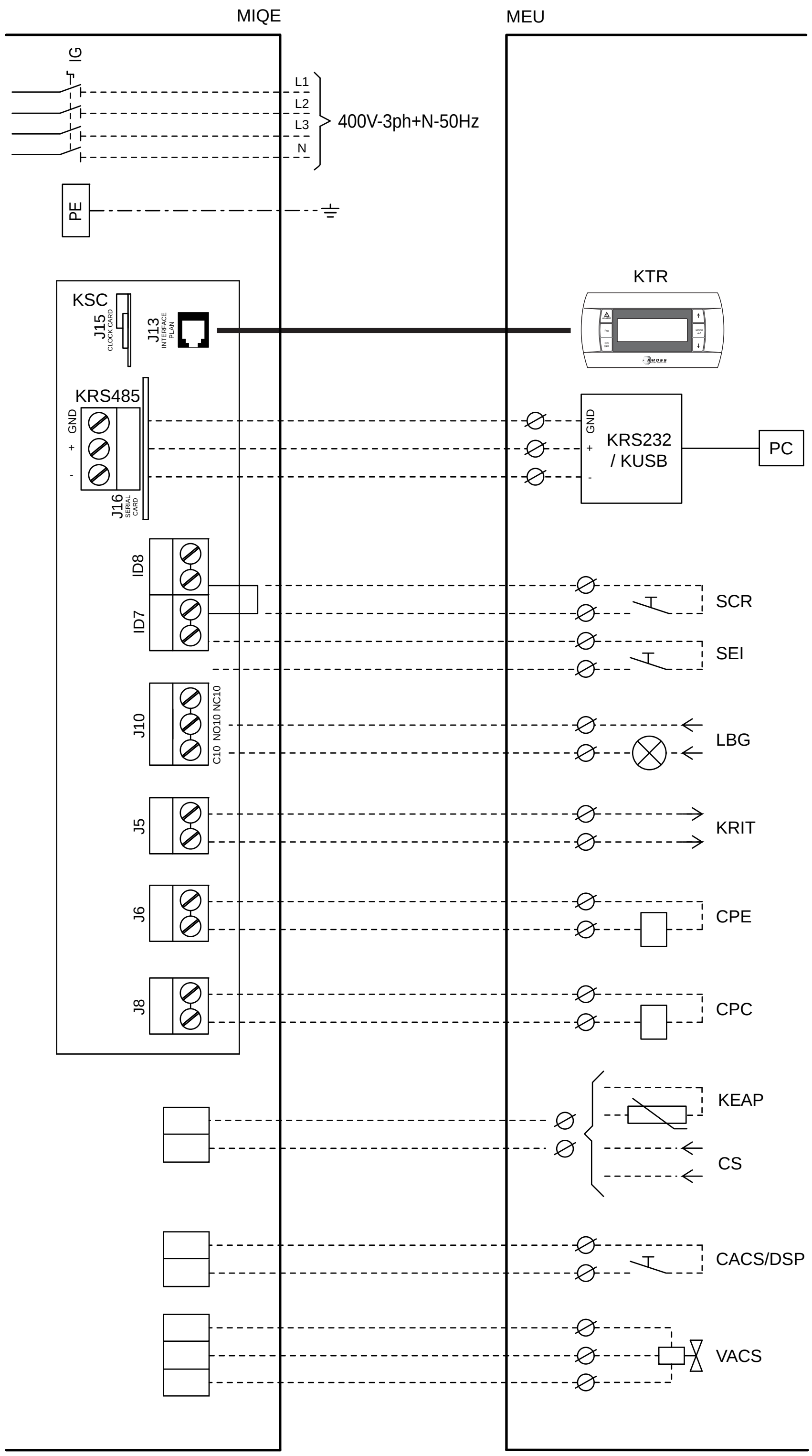
MIQE Electrical board internal terminal board;
IG General isolator;
L Line;
N Neutral;
PE Earth terminal;
KSC Clock card (accessory);
KRS485 RS485 serial interface (accessory);
J13 6-way telephone connector (RJ12);
J15 Connector for KSC accessory installation;
J16 Connector for KRS485, KFTT10 and KISI accessory installation;
MEU External user terminal board;
KTR Remote keyboard (accessory);
KRS232 RS485/RS232 converter (accessory);
KUSB RS485/USB converter (accessory);
PC Personal computer;
SCR Remote control selector (control with clean contact);
SEI Summer/Winter selector (control with clean contact);
LBG General lock light (230 Vac, maximum load 0,5 A AC1);
KRIT KRIT Command (supplementary electric heater for heat pump) (230 Vac, maximum load 0,5 A AC 1).
CPE Evaporator pump control for standard installation (consensus at voltage 230Vac, maximum charge 0,5A AC1);
CPC Condenser pump control (consensus at voltage 230Vac, maximum charge 0,5A AC1);
KEAP External air sensor for compensation of Set-point.
CS Scrolling set-point by means of the 4-20 mA analogue signal (incompatible with the DSP accessory). Needs to be handled as a special accessory by our pre-sales office;
CACS Consent VACS (control with clean contact);
DSP Double set-point by means of digital consensus (incompatible with the CS and CACS accessory);
VACS 3-way diverter valve for managing the production of domestic hot water (KVDEV) (230 Vac, maximum load 0,5 A AC1);
- - - - Connection to be made by the installer;
___ 6 wire telephone cable (maximum distance 50 m, for greater distances contact *RHOSS* S.p.A. customer service).

○ The electrical panel is accessible from the front panel of the unit.
○ Connections must be made by skilled personnel in compliance with current standards and with the diagrams provided with the machine.
○ Always install a general isolator in a protected area near the unit with a delayed characteristic curve of suitable capacity and breaking capacity. Make sure the general isolator includes a 3 mm minimum opening distance between contacts.
○ Earth connection is compulsory by law and safeguards the user while the machine is in use.

ATTENTION !
The following diagrams only show the connections to be made by the installer.

Cable section		**105**	**107**	**109**	**112**
Line section	mm²	4	6	6	10
PE section	mm²	4	6	6	10
Remote control section	mm²	1,5	1,5	1,5	1,5

TCHEY-THHEY 107÷112
Electrical Power Supply 400V – 3ph + N – 50Hz



MIQE Electrical board internal terminal board;
IG General isolator;
L1 Line 1;
L2 Line 2;
L3 Line 3;
N Neutral;
PE Earth terminal;
KSC Clock card (accessory);
KRS485 RS485 serial interface (accessory);
J13 6-way telephone connector (RJ12);
J15 Connector for KSC accessory installation;
J16 Connector for KRS485, KFTT10 and KISI accessory installation;
MEU External user terminal board;
KTR Remote keyboard (accessory);
KRS232 RS485/RS232 converter (accessory);
KUSB RS485/USB converter (accessory);
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VACS 3-way diverter valve for managing the production of domestic hot water (KVDEV) (230 Vac, maximum load 0,5 A AC1);
- - - - Connection to be made by the installer;
___ 6 wire telephone cable (maximum distance 50 m, for greater distances contact *RHOSS* S.p.A. customer service).

○ The electrical panel is accessible from the front panel of the unit.
○ Connections must be made by skilled personnel in compliance with current standards and with the diagrams provided with the machine.
○ Always install a general isolator in a protected area near the unit with a delayed characteristic curve of suitable capacity and breaking capacity. Make sure the general isolator includes a 3 mm minimum opening distance between contacts.
○ Earth connection is compulsory by law and safeguards the user while the machine is in use.

ATTENTION !
The following diagrams only show the connections to be made by the installer.

Cable section		107	109	112
Line section	mm²	2,5	2,5	4
PE section	mm²	2,5	2,5	4
Remote control section	mm²	1,5	1,5	1,5

K20104EN ed.3 04.11 - 000 - Stampa:

TCHEY-THHEY 105÷112
Comby-Flow range

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