

TFAEY-TGAEY 4160÷4320

Y-Pack FREECOOLING range



MacroSystem
170÷361 kW



Air-cooled water chillers in Freecooling mode and Freecooling NO-GLYCOL mode with axial fans.
Range with hermetic Scroll compressors and R410A refrigerant.

R410A



CE



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General Features

Conditions of use

The TFAETY – TFAESY units are air cooled water chillers in Freecooling mode with centrifugal fans in high efficiency and silenced versions.

The TGAETY – TGAESY units are air cooled water chillers in Freecooling NO-GLYCOL mode with centrifugal fans in high efficiency and silenced versions.

They are intended for use in conditioning plants or industrial processes where a supply of chilled water is required most of the year. Not suitable for drinking water.

The units are designed for outdoor installation.

The units comply with the following directives:

- o Machinery directive 98/37/EEC (MD)
- o Low voltage directive 2006/95/EEC (LVD)
- o Electromagnetic compatibility Directive 89/336/EEC (EMC);
- o Pressure equipment Directive 97/23/EEC (PED).

Guide to reading the code

"SERIES" code

"MODEL" code

T	F	A	E	T	Y	4	160÷320
Water production unit	Freecooling	Air-cooled	Scroll-type hermetic compressors	High efficiency	R410A refrigerant fluid	No. compressors	Approximate cooling capacity (in kW) (*)
	G			S			
	Freecooling NO-GLYCOL			Silenced			

(*) In the following conditions: air temperature 35°C, water temperature 7/12°C.

Available installations:

Standard:

Installation without pump on user side.

Pump:

P1 – Installation with pump.

P2 – Installation with increased static pressure pump.

DP1 – Installation with double pump, including an automatically activated pump in stand-by.

DP2 – Installation with increased static pressure double pump, including an automatically activated pump in stand-by.

Example: TFAETY 4160 DP1

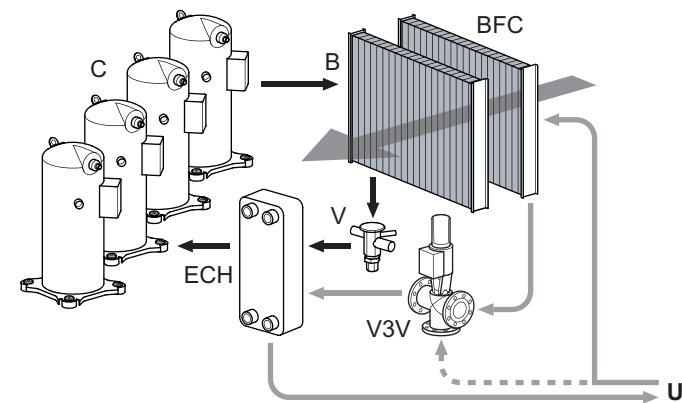
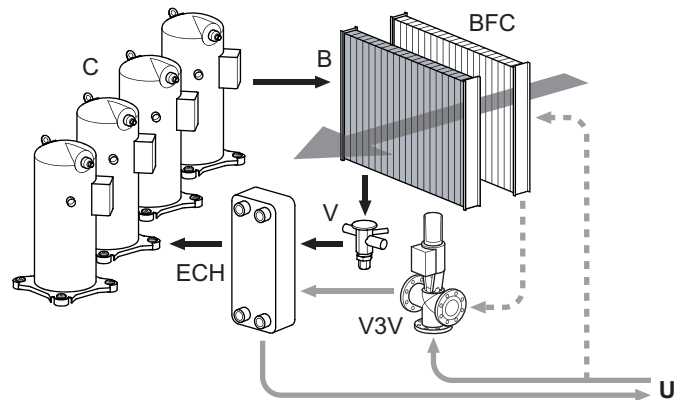
- o Water production unit in Freecooling mode;
- o Air cooled;
- o With 4 x hermetic Scroll compressors;
- o High efficiency unit;
- o With R410A refrigerant fluid;
- o Nominal cooling capacity of approximately 160 kW;
- o Installation with double standard pressure pump.

Freecooling system logic

Freecooling consists of the partial or total supply of cooling capacity as an alternative to the capacity produced by a traditional chiller. The unit is equipped with an additional water coil and when the external air temperature is at least 1°C less than the temperature of the water returning from the system, the coil can either pre-cool or fully cool it. The benefit of using a chiller that operates in Freecooling mode increases as the difference between the temperature of the water to cool and the external air temperature increases. The energy savings is a function of the thermal profile of the room where the chiller is installed and is directly proportional to its time of use. This selection becomes almost obligatory in applications where there is a conditioning request with a constant load equal to the nominal capacity of the chiller for the greater part of the year. Energy savings of approx. 30% are obtained on average in European regions, and reach even higher values at higher latitudes. These units have countless applications and involve both industrial processes as well as civil cooling, with special emphasis on shopping centres, CED rooms, industries dedicated to plastic moulding, food, etc. The Freecooling Y-PACK unit requires the use of glycol water or other similar solutions in order to prevent the formation of ice in the water coils, during the exchange with low temperature external air. The use of glycol can be avoided by selecting the NO-GLYCOL version. There are three typical operating modes:

Summer months - Freecooling OFF mode:

During the summer months and when the external air temperature is higher than the temperature of the water returning from the system, the Freecooling Y-PACK unit works like a traditional chiller, using the work of the compressors. In this mode, the additional water coil is not involved in the cooling process.

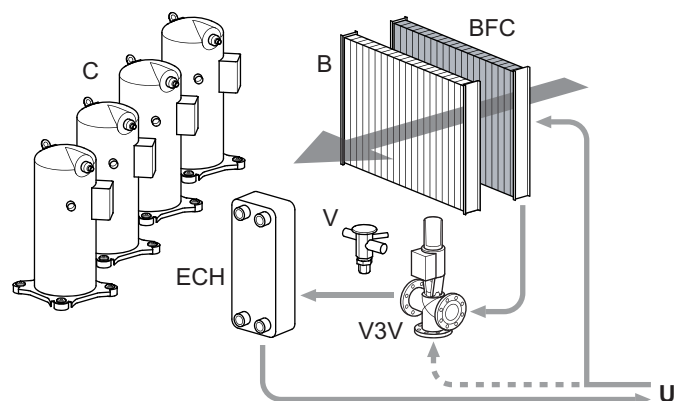


Between seasons - Freecooling ON mode:

In between seasons and when the temperature of the external air is lower than the temperature of the water returning from the system, the Freecooling Y-PACK unit works in the partial Freecooling mode. The water, thanks to the modulating 3-way valve, is cooled in the additional water coil and partially due to the work of the compressors. These are less involved in the cooling process as the temperature of the external air becomes lower. The regulation logic prefers energy savings and therefore the Freecooling mode is preferred in comparison to operation as a chiller.

Winter months - 100% Freecooling mode

During the winter months and when the external air temperature is enough to guarantee the full thermal load supplied by the compressors, the Freecooling Y-PACK unit works in 100% Freecooling mode. In this mode, the water is completely cooled in the additional water coil and the regulation is done by modulating the speed of the fans, thereby obtaining high efficiencies and considerable energy savings. When the temperature of the external air decreases to very low levels, fan regulation is integrated with a precise modulation of the flow of the water to be cooled, thanks to the modulating 3-way valve with which the chiller is equipped.



Freecooling NO-GLYCOL system logic

The Freecooling NO-GLYCOL system consists in the partial or total supply of cooling capacity alternatively to the capacity produced by a traditional chiller, but specifically in applications in which the use of ethylene glycol or other antifreeze solutions is not permitted in the system. The Freecooling NO-GLYCOL Y-PACK unit consists of an intermediate hydraulic circuit with ethylene glycol, which is directly coupled by means of a heat exchanger to the system where the water circulates without an antifreeze solution. The operating principle of the TGAEY unit is identical to the previously described TFAEY unit.

- | | | |
|---------------------------------------|-----------------------------------|---|
| B Coil | ECH Evaporator | — Refrigerant circuit |
| BFC Water coil for Freecooling | V Lamination valve | — Active hydraulic circuit |
| C Compressors | V3V Modulating 3-way valve | - - - Inactive hydraulic circuit |

New Y-Pack series

Energy-saving, reliable and versatile chillers

A complete, flexible range, with three shutter steps

New water chillers from 170 to 360 kW (*) in R410A, with four scroll compressors installed on two cooling circuits to obtain four steps of cooling and heating capacity, allowing for flexible regulation and greater efficiency when operating at partial loads. The efficiency of these units is also boosted by the innovative **AdaptiveFunction Plus** control logic, with which the range is equipped. This logic, developed by **RHOSS** in partnership with the University of Padua, optimises compressor activation and their operating cycles, as well as making it possible to obtain optimum comfort levels in all working conditions and the best performances in terms of energy efficiency during seasonal operation.

LOW CONSUMPTION chillers

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 chillers of an equivalent power with traditional control logic. This function is activated in the Freecooling OFF mode.

HIGH PRECISION chillers

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, Y-Pack 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, whilst still guaranteeing the reliability of the units over time and the good working order of the system.

Estimation of the system's thermal inertia

Y-Pack 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" function, which processes the information relating to the progress of the water temperatures, identifying the optimal value of the control parameters.

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.

Silent operation

Thanks to the 4 shutter steps and the condensation control, installed as standard on all units, the noise level is also reduced at partial loads. For example, during night operation, when the load is reduced but sensitivity to noise is at its peak, the control reduces the number of fan revolutions, the primary noise source in this type of unit, producing obvious benefits in terms of acoustic well-being.

(*) In the following conditions: condenser inlet air temperature 30°C; cooled mixture temperature (30% glycol) 10°C; differential temperature at evaporator 5°C.

AdaptiveFunction Plus

The new adaptive regulation logic, **AdaptiveFunction Plus**, is an exclusive **RHOSS** patent and the result of a long partnership with the University of Padua. The various algorithm processing and development operations were implemented and tested on units in the Y-PACK range in the **RHOSS**.p.A. Research&Development Laboratory by means of numerous test campaigns.

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 chillers 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.

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 considerable seasonal savings, or high water delivery temperature precision:

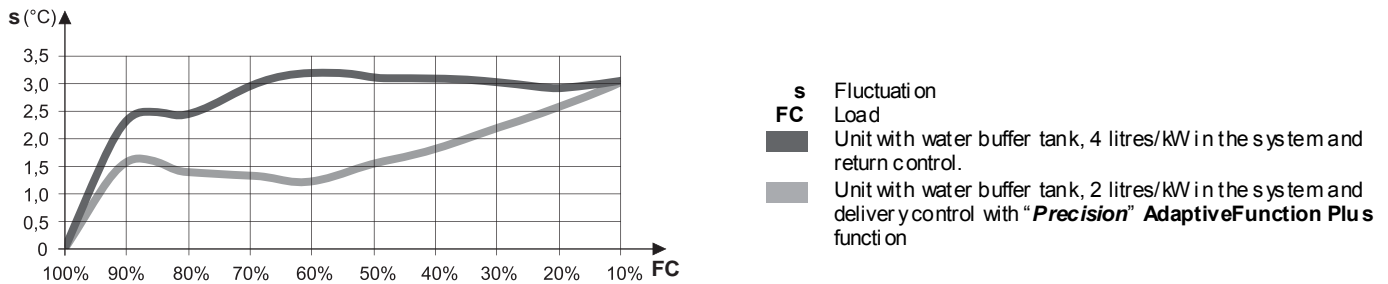
1. Low consumption chiller: "Economy" option

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) whilst 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! The option is only available in the Freecooling OFF mode.

2. High precision: "Precision" option

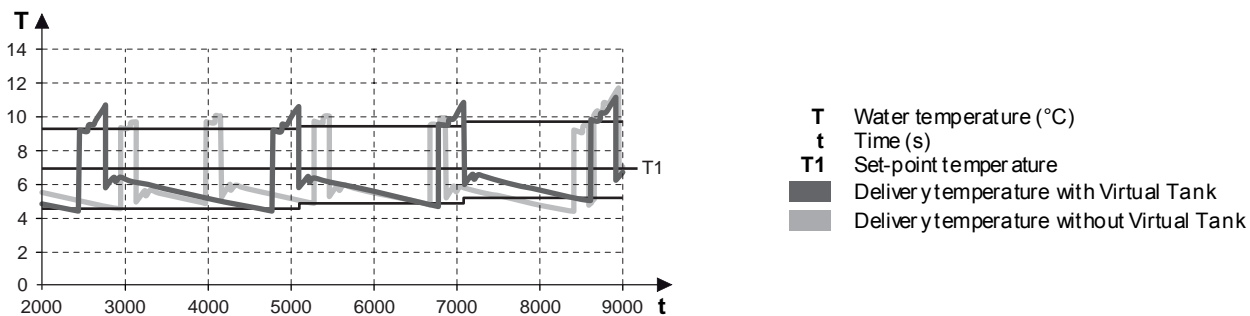
In this operating mode, the unit works at a fixed Set-point and, thanks to the delivery water temperature control and the evolved regulation logic, at a capacity of between 50% and 100%, it is possible to guarantee an average fluctuation from the water supply temperature of approximately $\pm 1.5^{\circ}\text{C}$ from the Set-point value compared to an average fluctuation over time of approximately $\pm 3^{\circ}\text{C}$ 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.



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 Y-Pack 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 Y-Pack 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.

Construction features

- Load-bearing structure and panels in galvanised and painted (RAL 9018) sheet steel; base in galvanised sheet steel.
- The structure consists of 2 sections:
 - sound-proofed technical compartment for housing the compressors, the electrical panel and the main components in the refrigerant circuit.
 - aeraulic compartment for housing the heat exchange coils, the plate heat exchangers and the motor-driven fans.
- Hermetic, Scroll-type rotary compressors, complete with internal thermal protection and crankcase heater activated automatically when the unit stops (as long as the power supply to the unit is preserved).
- Adequately insulated, brazed-welded plate water side heat exchanger in stainless steel. The Freecooling NO-GLYCOL chillers have an additional water-water exchanger and a electric circulation pump to separate the internal hydraulic circuit with a water-glycol mixture from the system side external glycol free circuit.
- Modulating 3-way valve (solo TFAETY-TFAESY) to divert the water flow originating from the system towards the Freecooling coil or directly towards the evaporator.
- The air-side heat exchanger comprised of a coil of copper pipes and aluminium fins divided into two sections: one dedicated to the condensation of the refrigerant gas and the other dedicated to cooling the water when operating in Freecooling mode.
- Motor-driven, spiral fans with external rotor, fitted with internal thermal protection and complete with protection grille.
- Proportional electronic device for the pressurised and continuous regulation of the fan rotation speed down to an external air temperature of -15°C when operating as a chiller.
- Victaulic type water connections.
- Differential pressure switch that protects the unit from any interruptions to the water flow (only TFAETY-TFAESY).
- Flow switch that protects the unit from any interruptions to the water flow (only TGAETY-TGAESY).
- Double refrigerant circuit in annealed copper pipe (EN 12735-1-2) complete with: cartridge drier filter, charge connections, manual reset safety pressure switch on the high pressure side, automatic reset safety pressure switch on the low pressure side, safety valve(s), filter shut-off valves, thermostatic expansion valve, liquid receiver, solenoid valve on the delivery line, electronic valve for controlling condensation when operating in Freecooling ON mode, liquid indicator, solenoid valve on the liquid line and inlet line insulation.
- Unit with IP24 level of protection.
- Compatible **iDRHOSS** control, with **AdaptiveFunction Plus** function.
- The unit is complete with the R410A refrigerant charge.
- The TGAETY-TGAESY Freecooling NO-GLYCOL units are supplied without the glycol mixture in the internal circuit, which must be added (30% glycol solution) by the installer.

Versions

- T** – High efficiency version.
- S** – Silenced version complete with soundproofed compressors, reduced speed fans. The fan speed is automatically increased with the external temperature increases considerably.

Available Installations

Standard:

Installation without pump on user side.

Pump:

P1 – Installation with pump.

P2 – Installation with increased static pressure pump.

DP1 – Installation with double pump, including an automatically activated pump in stand-by.

DP2 – Installation with increased static pressure double pump, including an automatically activated pump in stand-by.

The pump assembly also comes complete with: expansion tank, safety valve, manual air bleed and water side pressure gauge (only TFAETY-TFAESY).

In the case of an individual pump, the assembly also comes complete with an aspiration and delivery shut-off valve.

In the case of a double pump, the assembly also comes complete with a delivery non-return valve and an aspiration valve for each pump.

Electrical Panel

- Electrical board accessible by opening the front panel, conforming with current IEC norms, can be opened and closed with a suitable tool.
- Complete with:
 - electrical wiring arranged for power supply 400-3ph+N-50Hz;
 - auxiliary power supply 230V-1ph-50Hz drawn from the main power supply;
 - control power supply 12V-1ph-50Hz drawn from the main power supply;
 - general isolator for power supply, complete with door interlocking isolator;
 - automatic thermal overload switch to protect the compressors and the motor-driven fans;
 - protection fuse for auxiliary circuit;
 - power contactor for the compressors;
 - remote machine controls: ON/OFF;
 - remote machine controls: compressor operating light, general lock light;
 - thermostat-controlled ventilation of the electrical board for high temperatures (air in the electric board) and the activation of a heating element that is also thermostat-controlled for low temperatures (air in the electric board).
- 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 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 that 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;
 - compressor protection phase sequence monitor;
 - display of the programmed set-points via the display, of the water in/out temperatures via the display, of the condensation pressures; of the electrical voltage values in the three phases of the electrical circuit that powers the unit; of the alarms on the display; of the chiller function on the display;
 - user interface menu;
 - automatic pump operating time balance (DP1-DP2 installations);
 - automatic activation of the pump in standby in the event of an alarm (DP1-DP2 installations);
 - alarm code and description;
 - alarm history management (menu protected by manufacturer password).
 - The following is memorized for each alarm:
 - date and time of activation;
 - inlet/outlet water temperatures when the alarm intervened;
 - condensation pressure values at the time of the alarm.
 - alarm delay time from the switch-on of the connected device;
 - compressor status at moment of alarm;
 - Advanced functions:
 - Hi-Pressure Prevent with forced cooling capacity shuttering for high external temperatures;
 - configured for serial connection (KR S485, KFTT10, KRS232 and KUSB accessory);
 - possibility to have a digital input for remote management of the double set point (contact **RHOSS**.p.A. pre-sales);
 - possibility to have an analogue input for the scrolling set-point via a 4-20mA remote signal (contact **RHOSS**.p.A. pre-sales);
 - management of time periods and operation parameters with the possibility of daily/weekly operating programs;
 - 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** options);
 - scrolling set-point (**Economy** option).
- Note: in the Freecooling ON mode, set-point regulation is done only in precision mode.**

Accessories

Factory fitted accessories

P1 – Installation with pump.

P2 – Installation with increased static pressure pump.

DP1 – Installation with double pump, including an automatically activated pump in stand-by.

DP2 – Installation with increased static pressure double pump, including an automatically activated pump in stand-by.

RA – Evaporator antifreeze electric heater to prevent the risk of ice formation inside the exchanger when the machine is switched off (as long as the unit is not disconnected from the power supply) (only for TFAETY-TFAESY models).

RAE 1 – 27W antifreeze electric heater for motor-driven pump (available for P1-DP1 installations); to prevent the water contained in the pump from freezing when the machine is switched off (as long as the unit is not disconnected from the power supply) (only for TFAETY-TFAESY models).

RAE 2 – 27W antifreeze electric heater for double motor-driven pumps (available for P2-DP2 installations); to prevent the water contained in the pumps from freezing when the machine is switched off (as long as the unit is not disconnected from the power supply) (only for TFAETY-TFAESY models).

GM – Refrigerant circuit high and low pressure gauges.

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

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

CR – Power factor correction capacitors ($\cos \phi > 0.91$).

EEV – Electronic thermostatic valve.

RAP – Unit with copper/pre-painted aluminium coils.

BRR – Unit with copper/copper coils.

RRS – Unit with copper/tin-plated copper coils.

DSP – Double set-point via digital consensus (incompatible with the CS accessory).

CS – Scrolling set point via analogue signal 4-20 mA (incompatible with the DSP accessory). On the basis of the required values, it could be necessary to install the EEV accessory too.

RPB – Coil protection networks with accident prevention function (to be used as an alternative to the FMB accessory).

FMB – Mechanical filters to protect the coils, with leaf protection function (to be used as an alternative to the RPB accessory).

SFS – Soft-start device for reducing the start-up current during the start-up phase.

Note: the NO-GLYCOL TGAETY-TGAESY Freecooling units are equipped standard with larger antifreeze electric heaters (evaporator and water circuit). If the unit has been accessorised with pumps, also these will be fit standard with larger antifreeze electric heaters.

Accessories supplied loose

KSAM – Spring anti-vibration mountings.

KSA – Rubber anti-vibration mountings.

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

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

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).

KMDM – GSM 900-1800 modem kit to be connected to the unit for 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 assembly and remote management. The kit consists of a CD-Rom and hardware key.

Technical Data

Table "A": Technical Data

TFAETY model		4160	4180	4200	4230	4260	4290	4320
Freecooling OFF								
Nominal cooling capacity (*)	kW	178	202	224	251	286	326	361
E.E.R. (*)		3,31	3,41	3,27	3,20	3,34	3,20	3,09
Sound pressure (**)	dB(A)	65	67	67	69	69	70	70
Sound power level (***)	dB(A)	89	91	91	93	93	94	94
Scroll/step compressor	no.	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Circuits	no.	2	2	2	2	2	2	2
Fans	no. x kW	4 x 2	4 x 2	4 x 2	6 x 2	6 x 2	8 x 2	8 x 2
Fan nominal air flow	m ³ /h	78600	74400	74400	96900	102900	121600	121600
Water side heat exchanger water content	l	12	12	14	15	18	21	24
Water side nominal water flow (*)	m ³ /h	33,5	38	42,1	47,2	53,8	61,3	67,9
Nominal pressure drops, water side (*)	kPa	100	127	138	152	140	155	161
Residual static pressure P1 (*)	kPa	116	126	138	108	95	133	98
Residual static pressure P2 (*)	kPa	181	182	215	187	177	176	132
R410A refrigerant charge		See serial No. plate						
Polyester oil charge		See compressor plate						
Freecooling ON								
Freecooling cooling capacity ON (100%)	kW	178	202	224	251	286	326	361
E.E.R. Freecooling ON (100%)		22,25	25,25	28,00	20,92	23,83	20,38	22,56
Freecooling ON temperature (100%)	°C	0,3	1	0,4	0,7	0,9	0,4	-0,8
Freecooling ON cooling capacity (Ta 5°C)	kW	121,1	144,3	153,5	175,6	202,8	223,3	228,5
% cooling capacity (Ta 5°C)	%	68%	71%	69%	70%	71%	68%	63%
Electrical Data								
Freecooling OFF absorbed power (*) (●)	kW	53,8	59,3	68,4	78,5	85,6	102	117
Freecooling ON absorbed power (100%)	kW	8,0	8,0	8,0	12,0	12,0	16,0	16,0
Pump absorbed power (P1/DP1) / (P2/DP2)	kW	3,0 / 4,0	4,0 / 5,5	5,5 / 7,5	5,5 / 7,5	5,5 / 7,5	7,5 / 9,2	7,5 / 9,2
Electrical power supply	V-ph-Hz	400 – 3+N – 50						
Auxiliary power supply	V-ph-Hz	230 – 1+N – 50						
Control power supply	V-ph-Hz	24 – 1 – 50						
Nominal current (*) (●)	A	105	108	123	143	156	183	206
Maximum current (*) (●)	A	131	143	154	178	194	229	256
Starting current (*) (●)	A	300	333	344	407	424	483	510
Pump absorbed current (P1/DP1) / (P2/DP2)	A	6 / 8	8 / 11	11 / 15	11 / 15	11 / 15	15 / 18	15 / 18
Dimensions								
Height (a)	mm	2030	2030	2030	2030	2030	2030	2030
Width (b)	mm	2090	2090	2090	2090	2090	2090	2090
Length (c)	mm	4800	4800	4800	4800	5300	5300	5300
Exchanger inlet/outlet connections	Ø	3"	3"	3"	3"	3"	3"	3"

(*) In the following conditions: condenser inlet air temperature 30°C; cooled mixture temperature (30% glycol) 10°C; differential temperature at evaporator 5°C.

(**) Sound pressure level in dB(A), measured at a distance of 5 m from the unit, with a directionality factor of 2. The noise measurement refers to the units without pump.

(***) Sound power level in dB(A) on the basis of measurements made in compliance with the UNI EN-ISO 3744 standard and Eurovent 8/1. The noise measurement refers to the units without pump.

(●) The values do not include the user side motor-driven pump.

Note:

The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 22. The calculation of the E.E.R. does not account for the absorption of the user side pump.

With the external air temperature below 30°C and until the Freecooling start temperature, the machine reduces its noise level to a value that is below the nominal value indicated in the table.

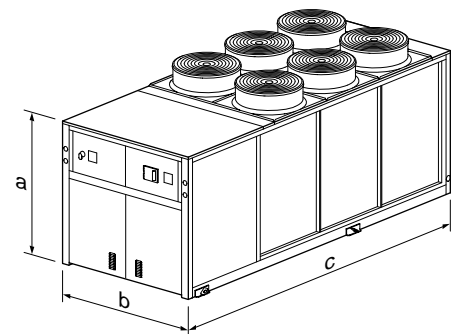


Table "A": Technical Data

TFAESY model		4160	4180	4200	4230	4260	4290	4320
Freecooling OFF								
Nominal cooling capacity (*)	kW	170	197	215	240	274	312	344
E.E.R. (*)		3,21	3,32	3,11	3,11	3,22	3,09	2,92
Sound pressure (**)	dB(A)	60	61	61	63	64	65	65
Sound power level (***)	dB(A)	85	86	86	88	89	90	90
Scroll/step compressor	no.	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Circuits	no.	2	2	2	2	2	2	2
Fans	no. x kW	4 x 1,25	4 x 1,25	4 x 1,25	6 x 1,25	6 x 1,25	8 x 1,25	8 x 1,25
Fan nominal air flow	m³/h	62800	58400	58400	72000	79800	92000	92000
Water side heat exchanger water content	l	12	12	14	15	18	21	24
Water side nominal water flow (*)	m³/h	32	37	40,4	45,1	51,5	58,7	64,7
Nominal pressure drop, water side (*)	kPa	91	117	123	139	128	138	145
Residual static pressure P1 (*)	kPa	134	143	158	128	116	161	129
Residual static pressure P2 (*)	kPa	199	200	234	206	197	208	167
R410A refrigerant charge		See serial No. plate						
Polyster oil charge		See compressor plate						
Freecooling ON								
Freecooling ON cooling capacity (100%)	kW	170	197	215	240	274	312	344
E.E.R. Freecooling ON (100%)		34,00	39,40	43,00	32,00	36,53	31,20	34,40
Freecooling ON temperature (100%)	°C	-1,3	-0,8	-1,5	-1,3	-1,1	-1,6	-3,0
Freecooling ON cooling capacity (Ta 5°C)	kW	104,3	124,7	130,3	147,3	170,2	188	191,1
% cooling capacity (Ta 5°C)	%	61%	63%	61%	61%	62%	60%	56%
Electrical Data								
Freecooling OFF absorbed power (*) (●)	kW	53,0	59,3	69,2	77,2	85,2	100,9	117,9
Freecooling ON absorbed power (100%)	kW	5,0	5,0	5,0	7,5	7,5	10,0	10,0
Pump absorbed power (P1/DP1) / (P2/DP2)	kW	3,0 / 4,0	4,0 / 5,5	5,5 / 7,5	5,5 / 7,5	5,5 / 7,5	7,5 / 9,2	7,5 / 9,2
Electrical power supply	V-ph-Hz	400 – 3+N – 50						
Auxiliary power supply	V-ph-Hz	230 – 1+N – 50						
Control power supply	V-ph-Hz	24 – 1 – 50						
Nominal current (*) (●)	A	102	105	121	137	151	176	202
Maximum current (*) (●)	A	131	143	154	178	194	229	256
Starting current (*) (●)	A	300	333	344	407	424	483	510
Pump absorbed current (P1/DP1) / (P2/DP2)	A	6 / 8	8 / 11	11 / 15	11 / 15	11 / 15	15 / 18	15 / 18
Dimensions								
Height (a)	mm	2030	2030	2030	2030	2030	2030	2030
Width (b)	mm	2090	2090	2090	2090	2090	2090	2090
Length (c)	mm	4800	4800	4800	4800	5300	5300	5300
Exchanger inlet/outlet connections	Ø	3"	3"	3"	3"	3"	3"	3"

(*) In the following conditions : condenser inlet air temperature 30°C; cooled mixture temperature (30% glycol) 10°C; differential temperature at evaporator 5°C.

(**) Sound pressure level in dB(A), measured at a distance of 5 m from the unit, with a directionality factor of 2. The noise measurement refers to the units without pump.

(***) Sound power level in dB(A) on the basis of measurements made in compliance with the UNI EN-ISO 3744 standard and Eurovent 8/1. The noise measurement refers to the units without pump.

(●) The values do not include the user side motor-driven pump.

Note:

The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 22. The calculation of the E.E.R. does not include pump consumption.

With the external air temperature below 30°C and until the Freecooling start temperature, the machine reduces its noise level to a value that is below the nominal value indicated in the table.

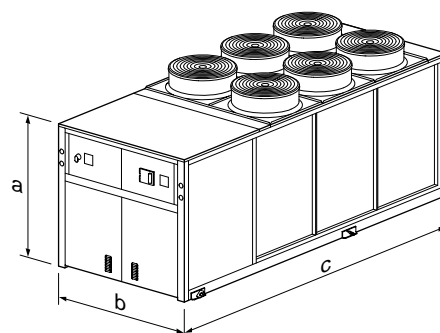


Table "A": Technical Data

TGAETY model		4160	4180	4200	4230	4260	4290	4320
Freecooling OFF								
Nominal cooling capacity (*)	kW	180	207	229	256	291	333	368
E.E.R. (*)		3,32	3,47	3,33	3,24	3,37	3,25	3,11
Sound pressure (**)	dB(A)	65	67	67	69	69	70	70
Sound power level (***)	dB(A)	89	91	91	93	93	94	94
Scroll/step compressor	no.	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Circuits	no.	2	2	2	2	2	2	2
Fans	no. x kW	4 x 2	4 x 2	4 x 2	6 x 2	6 x 2	8 x 2	8 x 2
Fan nominal air flow	m³/h	78600	74400	74400	96900	102900	121600	121600
Water side heat exchanger water content	l	12	12	14	15	18	21	24
Water side nominal water flow (*)	m³/h	31,0	35,6	39,4	44,0	50,1	57,3	63,3
Nominal pressure drops, water side (*)	kPa	102	133	125	141	124	139	149
Residual static pressure P1 (*)	kPa	129	136	119	129	126	166	132
Residual static pressure P2 (*)	kPa	193	195	172	207	206	215	172
R410A refrigerant charge	See serial No. plate							
Polyester oil charge	See compressor plate							
Freecooling ON								
Freecooling ON cooling capacity (100%)	kW	180	207	229	256	291	333	368
E.E.R. Freecooling ON (100%)		18,95	20,29	22,45	18,03	20,49	17,53	18,40
Freecooling ON temperature (100%)	°C	-2,9	-2,3	-2,9	-2,7	-2,4	-2,9	-4,1
Freecooling ON cooling capacity (Ta 5°C)	kW	100,6	119,7	128	144,7	167,3	186,1	192,7
% cooling capacity (Ta 5°C)	%	56%	58%	56%	57%	57%	56%	52%
Electrical Data								
Freecooling OFF absorbed power (*) (●)	kW	54,2	59,7	68,8	79	86,4	102,6	118,2
Freecooling ON absorbed power (100%)	kW	9,5	10,2	10,2	14,2	14,2	19,0	20,0
Pump absorbed power (P1/DP1) / (P2/DP2)	kW	3,0 / 4,0	4,0 / 5,5	4,0 / 5,5	5,5 / 7,5	5,5 / 7,5	7,5 / 9,2	7,5 / 9,2
Electrical power supply	V-ph-Hz	400 – 3+N – 50						
Auxiliary power supply	V-ph-Hz	230 – 1+N – 50						
Control power supply	V-ph-Hz	24 – 1 – 50						
Nominal current (*) (●)	A	106	108	124	143	157	184	208
Maximum current (*) (●)	A	131	143	154	178	194	229	256
Starting current (*) (●)	A	300	333	344	407	424	483	510
Pump absorbed current (P1/DP1) / (P2/DP2)	A	6 / 8	8 / 11	8 / 11	11 / 15	11 / 15	15 / 18	15 / 18
Dimensions								
Height (a)	mm	2030	2030	2030	2030	2030	2030	2030
Width (b)	mm	2090	2090	2090	2090	2090	2090	2090
Length (c)	mm	4800	4800	4800	4800	5300	5300	5300
Exchanger inlet/outlet connections	Ø	3"	3"	3"	3"	3"	3"	3"

(*) In the following conditions: Condenser inlet air temperature 30°C; chilled water temperature 10°C; temperature differential at evaporator 5°C.

(**) Sound pressure level in dB(A), measured at a distance of 5 m from the unit, with a directionality factor of 2. The noise measurement refers to the units without pump.

(***) Sound power level in dB(A) on the basis of measurements made in compliance with the UNI EN-ISO 3744 standard and Eurovent 8/1. The noise measurement refers to the units without pump.

(●) The values do not include the user side motor-driven pump.

Note:

The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 22. The calculation of the E.E.R. does not take pump absorption into account, whereas the calculation of the E.E.R. Freecooling ON (100%) takes the absorption of the internal circuit pump into account. With the external air temperature below 30°C and until the Freecooling start temperature, the machine reduces its noise level to a value that is below the nominal value indicated in the table.

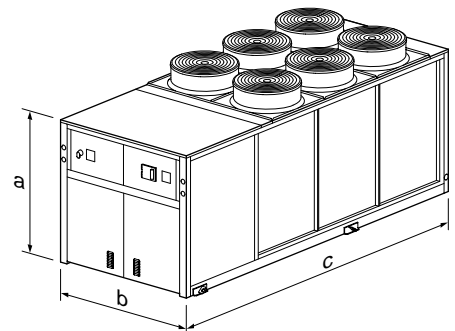


Table "A": Technical Data

TGAESY model		4160	4180	4200	4230	4260	4290	4320
Freecooling OFF								
Nominal cooling capacity (*)	kW	172	199	219	245	279	318	349
E.E.R. (*)		3,22	3,34	3,14	3,15	3,24	3,11	2,92
Sound pressure (**)	dB(A)	60	61	61	63	64	65	65
Sound power level (***)	dB(A)	85	86	86	88	89	90	90
Scroll/step compressor	no.	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Circuits	no.	2	2	2	2	2	2	2
Fans	no. x kW	4 x 1,25	4 x 1,25	4 x 1,25	6 x 1,25	6 x 1,25	8 x 1,25	8 x 1,25
Fan nominal air flow	m³/h	62800	58400	58400	72000	79800	92000	92000
Water side heat exchanger water content	l	12	12	14	15	18	21	24
Water side nominal water flow (*)	m³/h	29,6	34,2	37,7	42,2	48,0	54,7	60,0
Nominal pressure drops, water side (*)	kPa	91	117	112	129	110	125	130
Residual static pressure P1 (*)	kPa	148	160	144	147	147	190	164
Residual static pressure P2 (*)	kPa	211	222	200	224	227	242	209
R410A refrigerant charge	See serial No. plate							
Polyester oil charge	See compressor plate							
Freecooling ON								
Freecooling ON cooling capacity (100%)	kW	172	199	219	245	279	318	349
E.E.R. Freecooling ON (100%)		26,46	27,64	30,42	25,26	28,76	24,46	24,93
Freecooling ON temperature (100%)	°C	-4,6	-4,1	-4,9	-4,8	-4,5	-5,0	-6,3
Freecooling ON cooling capacity (Ta 5°C)	kW	87,8	104,2	110,1	123,8	143,1	159,1	163,9
% cooling capacity (Ta 5°C)	%	51%	52%	50%	51%	51%	50%	47%
Electrical Data								
Freecooling OFF absorbed power (*) (●)	kW	53,4	59,5	69,8	77,8	86,1	102,1	119,5
Freecooling ON absorbed power (100%)	kW	6,5	7,2	7,2	9,7	9,7	13,0	14,0
Pump absorbed power (P1/DP1) / (P2/DP2)	kW	3,0 / 4,0	4,0 / 5,5	4,0 / 5,5	5,5 / 7,5	5,5 / 7,5	7,5 / 9,2	7,5 / 9,2
Electrical power supply	V-ph-Hz	400 – 3+N – 50						
Auxiliary power supply	V-ph-Hz	230 – 1+N – 50						
Control power supply	V-ph-Hz	24 – 1 – 50						
Nominal current (*) (●)	A	102	105	122	138	153	178	204
Maximum current (*) (●)	A	131	143	154	178	194	229	256
Starting current (*) (●)	A	300	333	344	407	424	483	510
Pump absorbed current (P1/DP1) / (P2/DP2)	A	6 / 8	8 / 11	8 / 11	11 / 15	11 / 15	15 / 18	15 / 18
Dimensions								
Height (a)	mm	2030	2030	2030	2030	2030	2030	2030
Width (b)	mm	2090	2090	2090	2090	2090	2090	2090
Length (c)	mm	4800	4800	4800	4800	5300	5300	5300
Exchanger inlet/outlet connections	Ø	3"	3"	3"	3"	3"	3"	3"

(*) In the following conditions: Condenser inlet air temperature 30°C; chilled water temperature 10°C; temperature differential at evaporator 5°C.

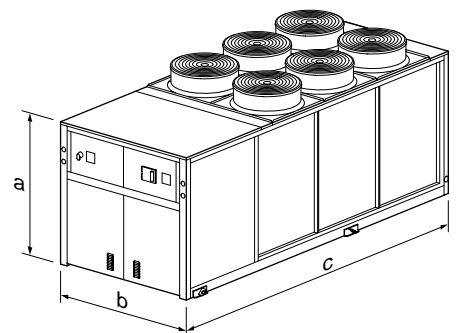
(**) Sound pressure level in dB(A), measured at a distance of 5 m from the unit, with a directionality factor of 2. The noise measurement refers to the units without pump.

(***) Sound power level in dB(A) on the basis of measurements made in compliance with the UNI EN-ISO 3744 standard and Eurovent 8/1. The noise measurement refers to the units without pump.

(●) The values do not include the user side motor-driven pump.

Note:

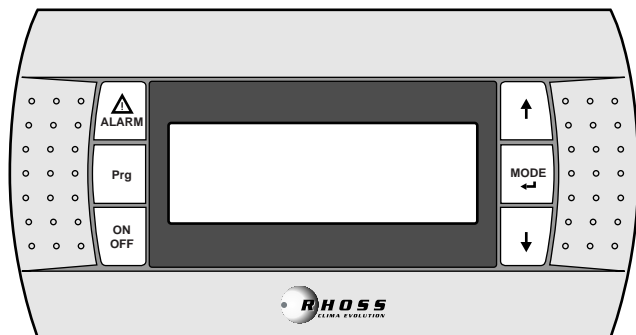
The values for available static pressure of the pumps and the pressure drops of the exchangers can be found on page 22. The calculation of the E.E.R. does not take pump absorption into account, whereas the calculation of the E.E.R. Freecooling ON (100%) takes the absorption of the internal circuit pump into account. With the external air temperature below 30°C and until the Freecooling start temperature, the machine reduces its noise level to a value that is below the nominal value indicated in the table.



Electronic controls

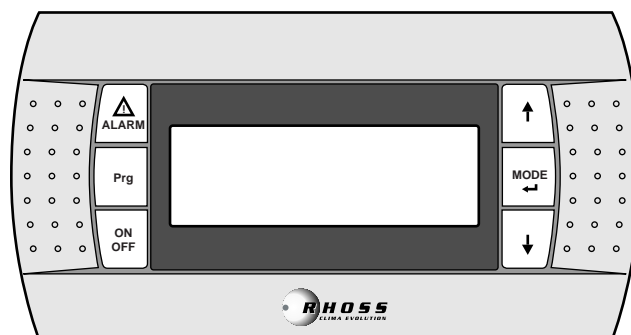
Electronic control


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 setpoints 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).





KTR – Remote keyboard


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. Makes it possible to set and manage the time bands.





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:
 for confirming the selected parameters.



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



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:
 for confirming the selected parameters.


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.

Serial Connection

Serial Connection

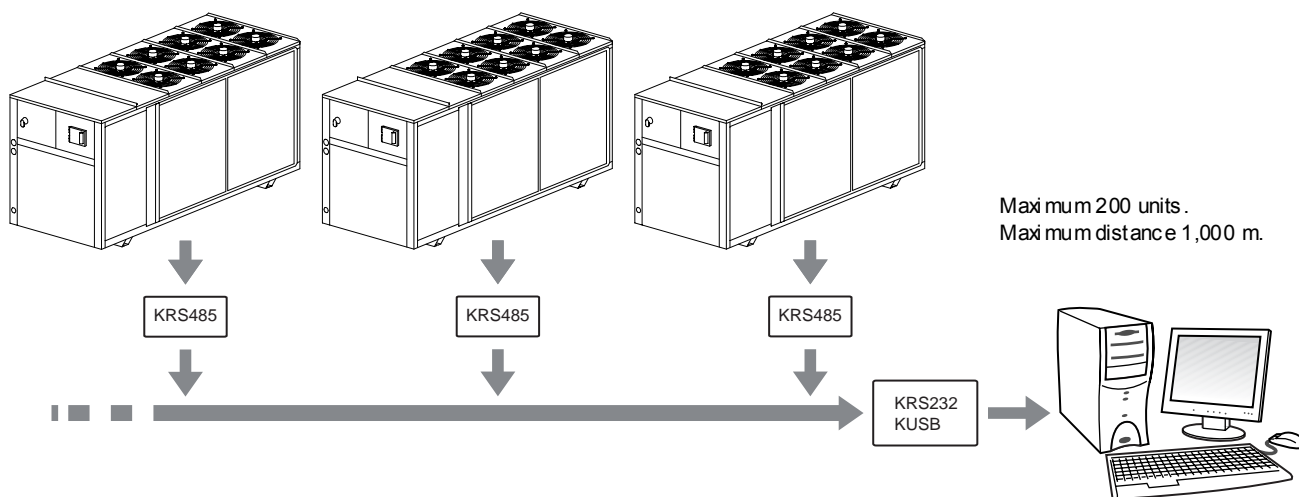
All units are equipped with electronic control that is set up interface with an external BMS via a serial communication line by means of the KRS485 serial interface accessory (proprietary protocol or ModBus® RTU) and the following converters.

- **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.



Performance

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

- For each model, Table “D” provides the cooling capacity (**QF**), the total absorbed electric power (**P**), on the basis of the evaporator outlet water temperature with constant temperature differences $\Delta T = 5^\circ C$;
- Within the operating limits, the values in Table “D” may permit you to interpolate performance. However, extrapolations are not permitted.
- Table “H” shows the values of the 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 useful static pressure of the pump (if present).

Example

- Design conditions for a TGAETY air-cooled chiller with installation P2:
 - Requested cooling capacity = 275 kW;
 - Temperature of water produced at evaporator = 13°C;
 - Temperature differential ΔT at the evaporator = 5°C
 - Inlet air temperature at condenser = 30°C.

Using the values indicated in table “D”, and supposing a temperature differential of $\Delta T = 5^\circ C$ at the evaporator, it can be seen that model TGAETY 4230 meets the requirement with:

QF = 277.4 kW; **P** = 80.8 kW (excluding the pump).

Graph “1” shows the pressure drop values Δpw of the evaporator.
 Δpw evaporator = 164 kPa;
 Graph “2” shows the residual static pressure values Δpr available on the machine outlet 173 kPa.

Calculation of the flow at different Δt :

For machines with **Pump** installations, it is important to check the performance of the pump if the unit has to operate with Δt other than the nominal one at the exchanger. The calculation of the water flow at Δt of other than 5°C can be achieved by applying the following formula:

$$G' = G \times \Delta t / \Delta t'$$

With G and G' expressed in m³/h and Δt and $\Delta t'$ in °C.

For example, in order to establish the flow G' of the TGAETY 4230 unit, operating with a temperature differential at the evaporator of $\Delta t' = 4^\circ C$ and knowing that in nominal conditions, with $\Delta t = 5^\circ C$, the flow **G** = 44.0 m³/h (table A Technical Data), we apply the formula indicated and obtain:

$$G' = 44.0 \times 5 / 4 = 55.0 \text{ m}^3/\text{h}$$

Using Graph “2” at the identified flow, the useful static pressure is equal to 109 kPa.

Performance data

Table "D": TFAETY cooling capacity in Freecooling OFF mode ($\Delta T = 5^\circ\text{C}$ at the evaporator)

Model	Tue (°C)	Ta (°C)											
		25		30		35		40		43		46	
		QF	P	QF	P	QF	P	QF	P	QF	P	QF	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4160	5	162,5	47,8	154,7	51,9	146,5	56,3	138,1	61,0	132,8	64,0	127,0	67,1
	7	171,9	48,5	163,9	52,6	155,2	57,0	146,3	61,7	140,9	64,8	134,6	67,9
	8	176,8	48,9	168,6	53,0	159,9	57,4	150,5	62,1	144,8	65,1	138,7	68,3
	10	186,4	49,7	178,0	53,8	169,0	58,1	159,4	62,9	153,4	65,9	147,2	69,1
	13	201,8	50,9	192,8	54,9	183,1	59,2	173,1	64,0	-	-	-	-
	15	212,3	51,7	202,7	55,6	192,8	59,9	182,3	64,7	-	-	-	-
4180	5	183,7	52,5	174,8	57,1	165,6	62,4	155,9	68,1	150,0	71,7	143,8	75,5
	7	194,5	53,3	185,3	58,0	175,9	63,2	165,6	68,9	159,6	72,5	153,2	76,3
	8	199,9	53,8	190,9	58,4	180,8	63,7	170,6	69,3	164,2	72,9	157,8	76,7
	10	211,8	54,6	202,0	59,3	191,6	64,6	180,8	70,1	174,3	73,8	167,4	77,5
	13	229,6	55,9	219,1	60,7	208,0	65,9	196,5	71,4	-	-	-	-
	15	241,9	56,8	230,8	61,5	219,4	66,7	207,7	72,3	-	-	-	-
4200	5	204,2	60,3	194,2	65,7	183,0	71,9	172,3	78,5	165,5	82,8	158,7	87,2
	7	216,5	61,3	205,8	66,8	194,6	72,9	183,0	79,5	176,1	83,8	169,1	88,2
	8	222,8	61,8	212,3	67,3	200,3	73,4	188,6	80,0	181,5	84,2	174,1	88,7
	10	236,0	62,9	224,0	68,4	212,5	74,4	199,9	81,1	192,6	85,3	185,0	89,7
	13	255,3	64,6	243,2	70,1	230,6	76,1	217,7	82,6	-	-	-	-
	15	268,9	65,8	256,2	71,3	243,3	77,3	229,8	83,8	-	-	-	-
4230	5	228,9	69,8	217,6	75,6	205,7	82,2	193,7	89,2	185,8	93,8	178,2	98,4
	7	242,8	70,9	230,6	76,8	218,3	83,3	205,6	90,2	197,5	94,7	189,3	99,4
	8	250,0	71,4	237,6	77,4	224,8	83,8	211,6	90,8	203,4	95,2	195,1	99,9
	10	263,8	72,6	251,0	78,5	238,1	84,9	224,2	91,9	215,7	96,3	206,8	100,9
	13	285,6	74,4	272,2	80,3	258,5	86,6	243,9	93,4	-	-	-	-
	15	300,8	75,6	286,7	81,4	272,3	87,8	256,7	94,6	-	-	-	-
4260	5	260,5	76,5	248,2	82,8	234,9	89,7	220,7	97,3	211,8	102,1	202,9	107,2
	7	275,9	77,6	262,9	83,9	248,7	90,8	234,1	98,4	225,0	103,2	215,1	108,3
	8	283,8	78,2	270,6	84,5	256,2	91,4	241,0	98,9	231,4	103,8	221,7	108,8
	10	300,4	79,3	286,0	85,6	271,2	92,6	255,1	100,1	245,2	104,8	234,8	109,8
	13	325,1	81,2	309,7	87,5	293,9	94,4	277,1	101,8	-	-	-	-
	15	342,2	82,4	326,0	88,7	309,8	95,6	291,8	103,1	-	-	-	-
4290	5	296,9	91,3	282,9	98,7	267,6	106,8	251,4	115,7	241,5	121,4	231,1	127,4
	7	314,5	92,6	300,0	99,9	283,5	108,2	266,8	117,0	256,2	122,7	245,2	128,6
	8	323,5	93,2	308,0	100,6	291,7	108,9	274,4	117,7	263,2	123,4	252,4	129,3
	10	341,9	94,7	326,0	102,0	308,8	110,2	290,1	119,1	278,7	124,8	267,6	130,6
	13	370,4	96,9	353,0	104,3	334,6	112,5	315,3	121,2	-	-	-	-
	15	389,3	98,5	371,5	105,9	351,8	114,1	332,0	122,8	-	-	-	-
4320	5	329,3	104,1	312,9	112,6	295,9	122,0	277,8	132,3	266,4	138,8	254,8	145,8
	7	348,8	105,7	331,5	114,3	313,5	123,7	294,5	134,0	282,7	140,4	270,3	147,3
	8	358,5	106,6	341,3	115,2	322,7	124,6	303,3	134,8	290,9	141,4	278,3	148,2
	10	378,8	108,3	361,0	117,0	341,3	126,5	320,4	136,6	307,6	143,2	294,6	149,9
	13	410,7	111,2	390,8	119,9	369,7	129,4	347,9	139,7	-	-	-	-
	15	432,0	113,3	411,1	122,0	389,0	131,5	366,1	141,7	-	-	-	-

Ta = Dry bulb outdoor air temperature

Tue = Evaporator mixture (30% glycol) outlet temperature (ΔT inlet/outlet = 5°C).

QF = Cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2\text{C/W}$).

P = Total absorbed electrical power (compressor and fan).

Note:

For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and shown in tables "A" to the total absorbed electrical power.

Table "D": TFAESY cooling capacity in Freecooling OFF mode ($\Delta T = 5^\circ C$ at the evaporator)

Model	Tue (°C)	Ta (°C)											
		25		30		35		40		43		46	
		QF	P	QF	P	QF	P	QF	P	QF	P	QF	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4160	5	155,6	46,7	148,0	50,9	140,0	55,4	131,8	60,2	126,4	63,3	121,0	66,5
	7	164,5	47,5	156,6	51,8	148,5	56,2	139,7	61,1	133,9	64,1	128,3	67,4
	8	169,2	48,0	161,0	52,2	152,7	56,7	143,5	61,5	137,9	64,6	132,0	67,8
	10	178,5	48,9	170,0	53,0	161,2	57,5	151,8	62,4	145,7	65,5	139,6	68,7
	13	192,5	50,2	184,0	54,3	174,3	58,7	164,5	63,6	-	-	-	-
	15	202,7	51,0	193,6	55,1	183,6	59,6	173,0	64,4	-	-	-	-
4180	5	179,5	52,0	170,7	56,9	161,3	62,4	151,8	68,3	145,9	72,0	139,8	75,9
	7	190,2	52,9	181,1	57,8	170,6	63,4	161,1	69,2	154,8	73,0	148,5	76,9
	8	195,6	53,4	186,1	58,3	176,0	63,8	165,8	69,7	159,4	73,4	153,0	77,3
	10	206,6	54,4	197,0	59,3	186,3	64,7	175,6	70,6	168,8	74,4	162,2	78,3
	13	223,8	55,9	213,0	60,9	202,2	66,2	190,8	72,0	-	-	-	-
	15	235,1	56,9	224,1	61,9	212,9	67,2	201,2	73,0	-	-	-	-
4200	5	197,0	60,3	186,6	66,0	176,0	72,4	165,4	79,3	158,7	83,7	151,7	88,4
	7	208,4	61,5	197,6	67,3	186,8	73,6	175,9	80,4	168,7	84,8	161,5	89,4
	8	214,5	62,1	203,4	67,9	192,4	74,2	181,0	81,0	174,0	85,4	166,7	90,0
	10	226,2	63,4	215,0	69,2	203,7	75,5	191,7	82,3	184,2	86,6	177,0	91,1
	13	244,8	65,4	233,1	71,1	220,7	77,4	208,2	84,2	-	-	-	-
	15	257,7	66,7	245,4	72,5	232,7	78,7	219,6	85,5	-	-	-	-
4230	5	219,9	67,9	208,8	74,0	197,1	80,6	184,9	87,8	177,4	92,4	169,6	97,2
	7	232,9	69,1	220,9	75,3	208,7	81,8	196,2	88,9	188,2	93,4	180,1	98,2
	8	239,3	69,8	227,1	75,9	215,0	82,4	202,0	89,5	193,9	94,0	185,7	98,8
	10	252,6	71,1	240,0	77,2	227,3	83,7	213,8	90,8	205,4	95,2	196,7	99,9
	13	273,1	73,2	259,9	79,2	246,0	85,7	232,0	92,7	-	-	-	-
	15	287,2	74,6	273,6	80,6	259,0	87,1	244,3	94,1	-	-	-	-
4260	5	250,8	75,3	238,7	81,8	225,2	89,0	210,9	96,9	202,2	101,9	193,3	107,1
	7	265,4	76,6	252,6	83,1	238,7	90,3	223,9	98,1	214,9	103,0	205,1	108,2
	8	272,8	77,3	259,8	83,8	245,2	91,0	230,6	98,7	221,1	103,6	211,2	108,8
	10	288,2	78,6	274,0	85,2	259,4	92,3	243,9	100,0	234,1	104,9	223,9	109,9
	13	311,8	80,7	297,0	87,3	280,6	94,5	264,1	102,1	-	-	-	-
	15	328,0	82,2	312,1	88,8	295,2	95,9	277,5	103,5	-	-	-	-
4290	5	285,9	89,3	272,0	96,9	256,5	105,3	240,8	114,5	230,6	120,3	220,4	126,4
	7	302,2	90,8	287,9	98,5	272,0	106,9	255,1	116,0	244,6	121,8	233,6	127,8
	8	311,0	91,5	295,7	99,2	279,5	107,7	262,4	116,8	251,4	122,5	240,7	128,5
	10	328,5	93,2	312,0	100,9	295,3	109,3	277,3	118,4	266,0	124,2	254,5	130,0
	13	355,0	95,7	337,8	103,5	319,2	111,9	300,0	121,0	-	-	-	-
	15	373,4	97,5	355,0	105,3	335,5	113,8	315,4	122,8	-	-	-	-
4320	5	315,3	103,8	299,5	112,8	282,7	122,6	264,8	133,2	253,4	140,0	242,3	146,9
	7	334,3	105,7	316,8	114,7	299,0	124,6	280,1	135,1	268,3	141,9	256,4	148,8
	8	343,3	106,7	325,9	115,8	307,8	125,6	288,2	136,3	275,8	142,9	263,7	149,8
	10	362,5	108,8	344,0	117,9	324,4	127,8	304,2	138,3	291,4	144,9	278,5	151,8
	13	391,6	112,1	371,4	121,3	351,0	131,2	328,9	141,7	-	-	-	-
	15	411,4	114,5	390,6	123,7	368,7	133,6	346,0	144,1	-	-	-	-

Ta = Dry bulb outdoor air temperature

Tue = Evaporator mixture (30% glycol) outlet temperature (ΔT inlet/outlet = $5^\circ C$).

QF = Cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2 C/W$).

P = Total absorbed electrical power (compressor and fan).

Note:

For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and shown in tables "A" to the total absorbed electrical power.

Table "D": TGAETY cooling capacity in Freecooling OFF mode ($\Delta T = 5^\circ\text{C}$ at the evaporator)

Model	Tue (°C)	Ta (°C)											
		25		30		35		40		43			
		QF	P	QF	P	QF	P	QF	P	QF	P	QF	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4160	5	164,8	48,2	156,6	52,3	148,3	56,6	139,4	61,3	133,9	64,3	128,1	67,4
	7	174,1	49,0	165,7	53,1	156,9	57,4	147,7	62,1	141,9	65,1	135,9	68,2
	8	178,9	49,4	170,4	53,5	161,5	57,8	152,0	62,5	146,0	65,5	139,9	68,6
	10	188,7	50,2	180,0	54,2	170,9	58,5	160,7	63,2	154,7	66,2	148,1	69,3
	13	204,0	51,4	195,0	55,3	184,8	59,6	174,2	64,3	-	-	-	-
	15	215,0	52,2	205,0	56,0	194,6	60,3	183,8	65,0	-	-	-	-
4180	5	188,7	53,0	179,4	57,6	169,8	62,8	159,4	68,5	153,6	72,0	147,1	75,8
	7	199,6	53,8	190,1	58,4	179,9	63,7	169,3	69,3	163,0	72,9	156,3	76,7
	8	205,7	54,2	195,8	58,8	185,1	64,1	174,4	69,7	168,0	73,3	160,9	77,1
	10	217,5	55,0	207,0	59,7	196,1	64,9	184,7	70,6	177,9	74,1	171,0	77,9
	13	235,6	56,4	224,4	61,1	213,1	66,2	201,0	71,8	-	-	-	-
	15	248,1	57,3	236,6	62,0	224,6	67,1	212,2	72,6	-	-	-	-
4200	5	209,4	60,6	198,6	65,9	187,3	72,0	175,9	78,6	168,8	82,8	161,6	87,3
	7	221,8	61,7	210,4	67,0	198,8	73,1	186,8	79,6	179,5	83,8	172,2	88,2
	8	228,2	62,2	216,6	67,6	204,6	73,6	192,4	80,1	185,0	84,3	177,2	88,7
	10	241,2	63,3	229,0	68,8	216,7	74,7	204,2	81,2	196,3	85,4	188,3	89,7
	13	261,2	65,1	248,5	70,6	235,4	76,5	222,1	82,9	-	-	-	-
	15	275,0	66,3	261,9	71,7	248,1	77,7	234,1	84,1	-	-	-	-
4230	5	234,2	70,2	222,1	76,0	209,9	82,5	196,8	89,5	188,8	93,9	180,8	98,6
	7	248,0	71,3	235,6	77,2	222,6	83,6	209,2	90,5	200,6	94,9	192,4	99,5
	8	254,9	71,9	242,3	77,8	229,2	84,1	215,5	91,0	206,9	95,4	198,1	100,0
	10	269,7	73,1	256,0	79,0	242,5	85,2	228,2	92,1	219,3	96,5	209,9	101,1
	13	291,7	75,0	277,4	80,8	263,0	87,1	247,7	93,8	-	-	-	-
	15	307,0	76,3	292,3	82,0	277,1	88,3	261,0	95,1	-	-	-	-
4260	5	265,7	77,2	252,5	83,4	238,4	90,4	223,7	97,9	214,3	102,8	204,8	107,8
	7	281,0	78,3	267,5	84,6	253,0	91,5	237,5	99,0	227,9	103,8	217,7	108,8
	8	289,4	79,0	275,2	85,2	260,1	92,1	244,3	99,6	234,6	104,4	224,3	109,4
	10	305,5	80,2	291,0	86,4	275,0	93,3	258,4	100,8	247,9	105,5	237,4	110,4
	13	330,8	82,1	314,8	88,4	298,1	95,3	280,4	102,6	-	-	-	-
	15	348,3	83,5	331,4	89,7	313,8	96,6	295,1	104,0	-	-	-	-
4290	5	304,2	91,8	289,0	99,0	273,1	107,0	256,0	115,9	245,4	121,5	234,7	127,4
	7	322,0	93,1	306,3	100,4	289,6	108,4	271,6	117,2	260,3	122,8	248,9	128,7
	8	331,1	93,8	314,8	101,1	297,8	109,1	279,6	117,9	268,2	123,5	256,2	129,3
	10	349,7	95,3	333,0	102,6	314,6	110,7	295,5	119,3	283,8	124,9	271,5	130,7
	13	378,8	97,6	359,9	105,0	340,9	113,0	320,6	121,7	-	-	-	-
	15	398,4	99,2	379,0	106,6	359,0	114,7	337,2	123,4	-	-	-	-
4320	5	336,7	105,1	319,7	113,6	301,9	122,9	282,8	133,1	270,9	139,7	258,8	146,3
	7	356,4	106,8	339,0	115,4	319,6	124,7	299,4	134,9	287,3	141,4	274,3	148,1
	8	366,6	107,7	348,3	116,3	328,7	125,6	308,3	135,8	295,4	142,3	282,3	149,0
	10	387,3	109,6	368,0	118,2	347,3	127,6	325,8	137,7	312,0	144,1	298,5	150,8
	13	419,7	112,6	398,5	121,2	376,4	130,7	352,8	140,7	-	-	-	-
	15	441,0	114,7	419,2	123,4	396,0	132,9	371,8	143,0	-	-	-	-

Ta = Dry bulb outdoor air temperature

Tue = Evaporator outlet water temperature (ΔT inlet/outlet = 5°C).

QF = Cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2\text{C/W}$).

P = Total absorbed electrical power (compressor and fan).

Note:

For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and shown in tables "A" to the total absorbed electrical power.

Table "D": TGAESY cooling capacity in Freecooling OFF mode ($\Delta T = 5^\circ\text{C}$ at the evaporator)

Model	Tue (°C)	Ta (°C)											
		25		30		35		40		43		46	
		QF	P	QF	P	QF	P	QF	P	QF	P	QF	P
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4160	5	158,0	47,1	150,0	51,3	141,9	55,8	133,0	60,6	127,5	63,6	121,9	66,8
	7	166,7	48,0	158,5	52,2	149,9	56,6	140,9	61,4	135,0	64,5	129,1	67,7
	8	171,4	48,4	163,0	52,6	154,0	57,0	144,9	61,9	139,1	64,9	133,0	68,1
	10	180,5	49,3	172,0	53,4	162,8	57,9	153,1	62,7	146,9	65,8	140,6	69,0
	13	195,0	50,6	185,8	54,6	176,2	59,1	165,9	64,0	-	-	-	-
	15	204,9	51,4	195,5	55,5	185,3	59,9	174,7	64,8	-	-	-	-
4180	5	182,2	52,1	173,0	57,0	163,5	62,4	153,6	68,2	147,2	71,9	141,1	75,7
	7	192,9	53,1	183,5	58,0	173,4	63,4	162,9	69,1	156,4	72,8	149,8	76,6
	8	198,5	53,6	188,4	58,5	178,2	63,8	167,5	69,5	161,2	73,2	154,3	77,1
	10	209,4	54,6	199,0	59,5	188,5	64,8	177,3	70,5	170,6	74,2	163,7	78,0
	13	226,7	56,1	215,6	61,1	204,4	66,3	192,8	72,0	-	-	-	-
	15	238,5	57,2	227,1	62,0	215,3	67,3	203,1	73,0	-	-	-	-
4200	5	200,8	60,9	190,1	66,6	179,3	72,8	168,1	79,7	161,4	84,0	154,3	88,6
	7	212,9	62,1	201,6	67,9	190,2	74,0	178,7	80,8	171,5	85,2	164,2	89,7
	8	218,7	62,8	207,3	68,5	195,8	74,7	183,8	81,4	176,5	85,8	169,1	90,3
	10	230,7	64,1	219,0	69,8	207,2	76,0	194,5	82,7	187,1	87,0	179,2	91,5
	13	249,4	66,1	237,2	71,8	224,6	78,0	211,1	84,7	-	-	-	-
	15	262,4	67,5	249,9	73,2	236,6	79,4	222,7	86,1	-	-	-	-
4230	5	225,2	68,4	213,2	74,6	201,0	81,0	188,4	88,1	180,5	92,7	172,5	97,4
	7	238,2	69,8	225,9	75,8	213,1	82,3	199,7	89,3	191,6	93,8	183,4	98,5
	8	244,5	70,4	232,0	76,5	219,4	83,0	205,5	89,9	197,3	94,4	188,6	99,0
	10	258,2	71,8	245,0	77,8	231,7	84,3	217,4	91,2	208,6	95,6	199,7	100,2
	13	278,8	73,9	265,0	79,8	250,8	86,3	235,5	93,2	-	-	-	-
	15	293,6	75,3	279,1	81,3	264,0	87,7	248,0	94,6	-	-	-	-
4260	5	255,8	76,1	242,8	82,7	229,3	89,8	214,7	97,6	205,4	102,4	195,8	107,6
	7	270,8	77,5	257,0	84,0	242,2	91,1	227,3	98,8	217,8	103,7	208,1	108,8
	8	278,1	78,2	264,1	84,6	249,5	91,8	233,9	99,5	223,9	104,3	214,1	109,4
	10	293,4	79,6	279,0	86,1	263,6	93,2	247,2	100,8	236,8	105,6	226,4	110,6
	13	317,5	81,8	301,6	88,3	284,7	95,4	267,1	103,0	-	-	-	-
	15	333,6	83,3	316,8	89,9	299,5	96,9	281,0	104,4	-	-	-	-
4290	5	292,1	90,3	277,1	98,0	261,3	106,3	244,9	115,4	234,4	121,2	223,8	127,2
	7	309,0	91,9	293,0	99,6	276,4	107,9	259,1	116,9	248,4	122,7	237,1	128,6
	8	317,8	92,7	301,7	100,4	284,4	108,8	266,4	117,8	255,1	123,5	243,6	129,4
	10	335,0	94,4	318,0	102,1	300,3	110,5	281,4	119,4	269,8	125,1	257,5	131,0
	13	362,3	97,1	344,1	104,8	324,8	113,2	304,6	122,1	-	-	-	-
	15	380,8	99,0	361,2	106,7	341,3	115,1	320,2	124,0	-	-	-	-
4320	5	321,3	105,2	304,4	114,2	286,3	124,0	267,9	134,6	256,4	141,3	244,1	148,2
	7	339,8	107,2	322,0	116,3	303,5	126,0	283,4	136,6	271,3	143,3	258,5	150,1
	8	349,1	108,2	331,1	117,3	311,7	127,1	291,4	137,6	278,6	144,3	266,2	151,2
	10	368,1	110,4	349,0	119,5	328,5	129,3	307,2	139,8	294,6	146,4	280,7	153,3
	13	397,7	113,9	377,3	123,0	354,9	132,9	332,6	143,3	-	-	-	-
	15	417,7	116,5	396,1	125,6	373,1	135,4	349,1	145,8	-	-	-	-

Ta = Dry bulb outdoor air temperature

Tue = Evaporator outlet water temperature (ΔT inlet/outlet = 5°C).

QF = Cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2\text{C/W}$).

P = Total absorbed electrical power (compressor and fan).

Note:

For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and shown in tables "A" to the total absorbed electrical power.

Table "D": TFAETY and TFAESY cooling capacity in Freecooling ON mode ($\Delta T = 5^\circ C$ at the evaporator)

TFAETY 4160					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-4,3	154,5	8,0	29,1	23
7	-2,4	163,7	8,0	30,8	25
10	0,3	178,0	8,0	33,5	28
15	4,6	202,7	8,0	38,1	35
TFAETY 4180					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-4,0	174,2	8,0	32,9	14
7	-1,9	185,0	8,0	34,9	15
10	1,0	202,0	8,0	38,0	17
15	5,6	230,2	8,0	43,3	21
TFAETY 4200					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-4,4	194,0	8,0	36,6	17
7	-2,4	205,8	8,0	38,7	18
10	0,4	224,0	8,0	42,1	20
15	4,8	255,9	8,0	48,1	25
TFAETY 4230					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-3,9	217,5	12,0	41,0	21
7	-2,0	230,6	12,0	43,4	23
10	0,7	251,0	12,0	47,2	26
15	5,0	286,1	12,0	53,8	32
TFAETY 4260					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-3,5	248,8	12,0	46,8	28
7	-1,7	263,5	12,0	49,5	30
10	0,9	286,0	12,0	53,8	34
15	5,0	326,2	12,0	61,2	42
TFAETY 4290					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-3,8	283,2	16,0	53,2	35
7	-2,1	300,6	16,0	56,5	38
10	0,4	326,0	16,0	61,3	43
15	4,3	372,8	16,0	69,7	53
TFAETY 4320					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-4,8	313,3	16,0	58,9	41
7	-3,2	332,8	16,0	62,4	45
10	-0,8	361,0	16,0	67,9	52
15	3,0	410,6	16,0	77,2	63

TFAESY 4160					
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-6,0	148,3	5,0	27,9	20
7	-4,0	156,4	5,0	29,5	22
10	-1,3	170,0	5,0	32,0	25
15	3,0	193,3	5,0	36,3	30
TFAESY 4180					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-6,0	171,4	5,0	31,2	14
7	-3,8	181,5	5,0	34,1	15
10	-0,8	197,0	5,0	37,0	17
15	3,8	223,8	5,0	41,2	20
TFAESY 4200					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-6,4	186,6	5,0	35,1	15
7	-4,4	198,4	5,0	37,2	16
10	-1,5	215,0	5,0	40,4	18
15	2,9	245,2	5,0	46,1	22
TFAESY 4230					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-6,0	209,3	12,0	39,3	19
7	-4,0	220,7	12,0	41,6	20
10	-1,3	240,0	12,0	45,1	23
15	2,9	274,3	12,0	51,4	28
TFAESY 4260					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-5,5	239,2	12,0	45,0	29
7	-3,7	253,1	12,0	47,5	31
10	-1,1	274,0	12,0	51,5	35
15	2,9	312,8	12,0	58,6	43
TFAESY 4290					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-5,8	272,6	16,0	51,2	33
7	-4,1	288,7	16,0	54,2	35
10	-1,6	312,0	16,0	58,7	40
15	2,2	356,4	16,0	66,6	49
TFAESY 4320					
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)	Δpw (kPa)
5	-7,0	300,5	16,0	56,4	39
7	-5,3	315,5	16,0	59,6	42
10	-3,0	344,0	16,0	64,7	48
15	0,7	390,6	16,0	73,3	58

Ta = 100% Freecooling dry bulb outdoor air temperature.

Tue = Evaporator mixture (30% glycol) outlet temperature (ΔT inlet/outlet = $5^\circ C$).

QF = 100% Freecooling cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2\text{C/W}$).

P = Total absorbed electrical power (fan).

G = Water side cooling capacity.

ΔPw = Additional Freecooling coil pressure drop.

Note:

For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and show in tables "A" to the total absorbed electrical power.

Table "D": TGAETY and TGAESY cooling capacity in Freecooling ON mode ($\Delta T = 5^\circ C$ at the evaporator)

TGAETY 4160				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,8	156,9	9,5	26,8
7	-5,2	165,8	9,5	28,4
10	-2,9	180,0	9,5	31,0
15	0,8	205,5	9,5	35,4
TGAETY 4180				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,3	179,1	10,2	30,7
7	-4,7	190,3	10,2	32,6
10	-2,3	207,0	10,2	35,6
15	1,6	236,4	10,2	40,9
TGAETY 4200				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,8	198,8	10,2	34
7	-5,2	210,4	10,2	36,1
10	-2,9	229,0	10,2	39,4
15	0,9	261,1	10,2	45,3
TGAETY 4230				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,5	222,2	14,2	38,1
7	-5,0	236,1	14,2	40,4
10	-2,7	256,0	14,2	44,0
15	1,0	291,7	14,2	50,5
TGAETY 4260				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,1	253	14,2	43,3
7	-4,6	267,9	14,2	45,9
10	-2,4	291,0	14,2	50,1
15	1,2	331,1	14,2	57,3
TGAETY 4290				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-6,4	288,6	19,0	49,5
7	-5,0	306,4	19,0	52,6
10	-2,9	333,0	19,0	57,3
15	0,5	379,8	19,0	65,6
TGAETY 4320				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-7,5	320,6	20,0	54,8
7	-6,1	338,9	20,0	58,2
10	-4,1	368,0	20,0	63,3
15	-0,9	419,9	20,0	72,5

TGAESY 4160				
Tue (°C)	Ta (°C)	Qf (kW)	P (kW)	G (m³/h)
5	-8,4	149,6	6,5	25,6
7	-6,9	158,8	6,5	27,2
10	-4,6	172,0	6,5	29,6
15	-0,9	195,5	6,5	33,8
TGAESY 4180				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-8,0	173	7,2	29,7
7	-6,5	183,6	7,2	31,5
10	-4,1	199,0	7,2	34,2
15	-0,3	227,6	7,2	39,2
TGAESY 4200				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-8,7	189,9	7,2	32,6
7	-7,2	201,8	7,2	34,6
10	-4,9	219,0	7,2	37,7
15	-1,2	249,6	7,2	43,2
TGAESY 4230				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-8,5	212,9	9,7	36,5
7	-7,0	225,6	9,7	38,8
10	-4,8	245,0	9,7	42,2
15	-1,2	278,8	9,7	48,2
TGAESY 4260				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-8,1	243	9,7	41,6
7	-6,6	256,6	9,7	44,1
10	-4,5	279,0	9,7	48,0
15	-1,0	316,7	9,7	54,8
TGAESY 4290				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-8,4	276,5	13,0	47,5
7	-7,0	292,5	13,0	50,3
10	-5	318,0	13,0	54,7
15	-1,6	359,9	13,0	62,4
TGAESY 4320				
Tue (°C)	Ta (°C)	Qfa (kW)	P (kW)	G (m³/h)
5	-9,6	305	14,0	52,2
7	-8,2	321,4	14,0	55,3
10	-6,3	349,0	14,0	60,0
15	-3,2	396,8	14,0	68,5

Ta = 100% Freecooling dry bulb outdoor air temperature.

Tue = Evaporator outlet water temperature(ΔT inlet/outlet = $5^\circ C$).

QF = 100% Freecooling cooling capacity (evaporator fouling factor of $0.35 \times 10^{-4} \text{ m}^2\text{C/W}$).

P = Total absorbed electrical power (fan and internal circuit pump).

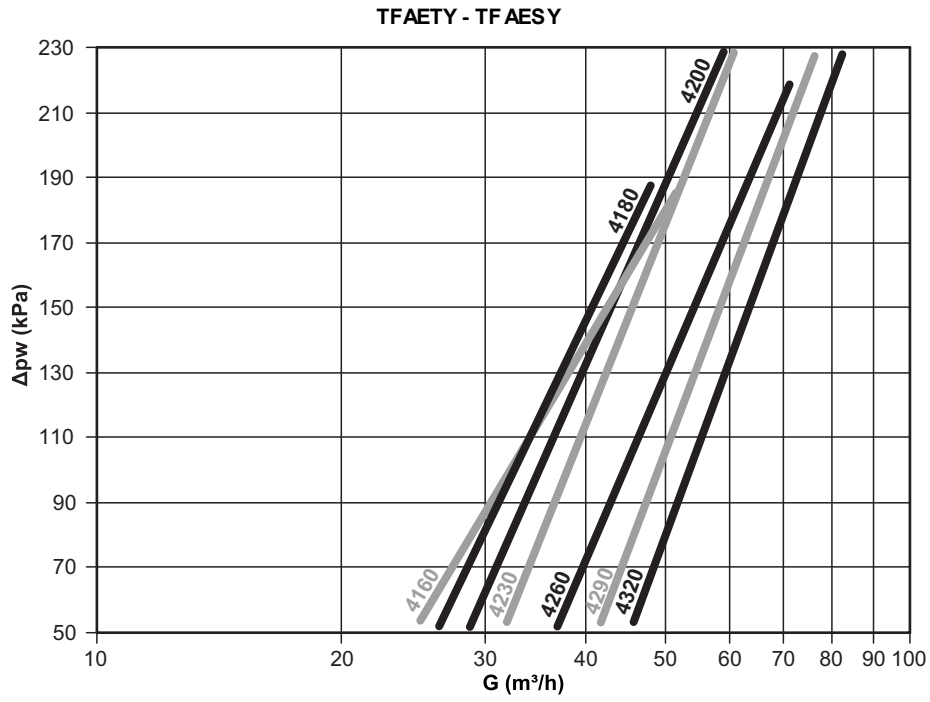
G = Water side cooling capacity.

Note:

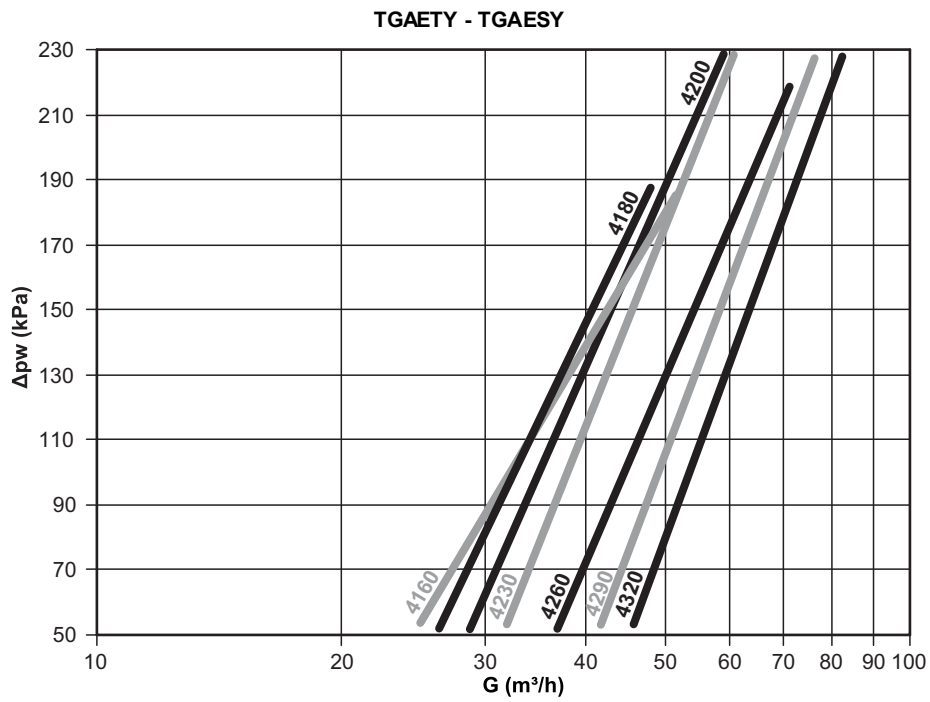
For the various PUMP versions, add the electrical power values absorbed by the motor-driven pumps and shown in tables "A" to the total absorbed electrical power.

Pressure Drops

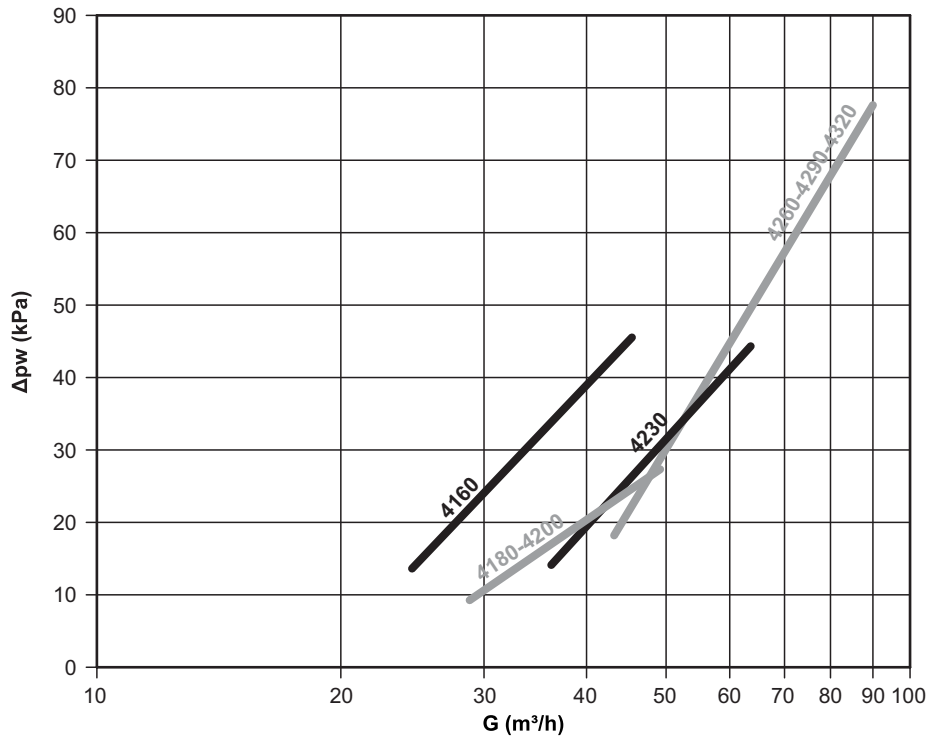
Graph "1": water side chiller pressure drops (heat exchanger and hydraulic circuit).



Graph "1": water side chiller pressure drops (heat exchanger and hydraulic circuit).



Graph "3": Additional Freecooling coil pressure drops



Calculation of Pressure Drops

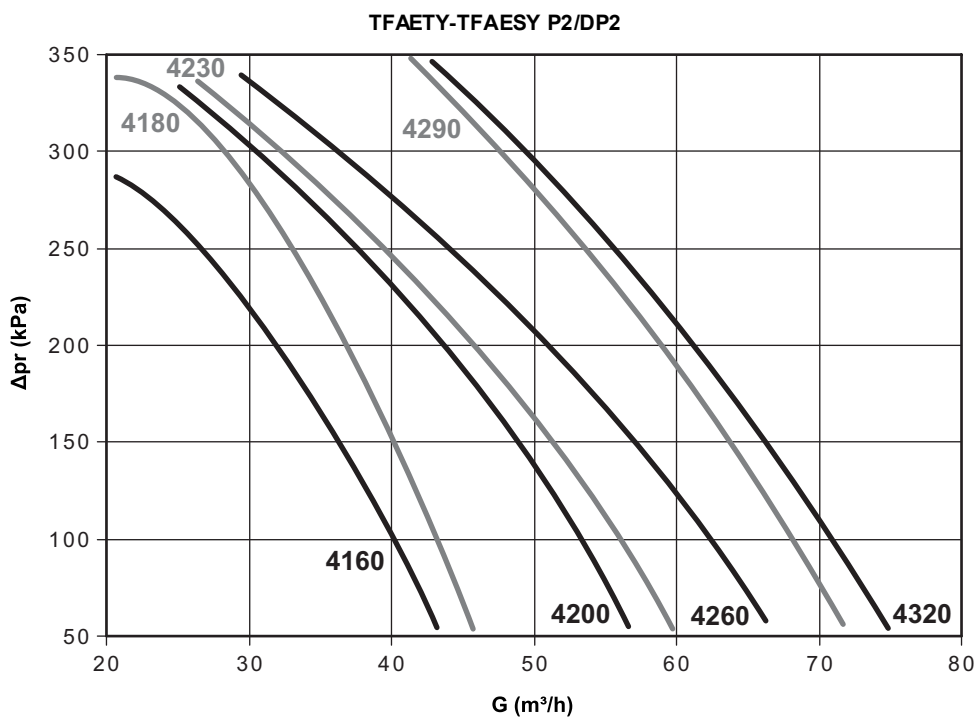
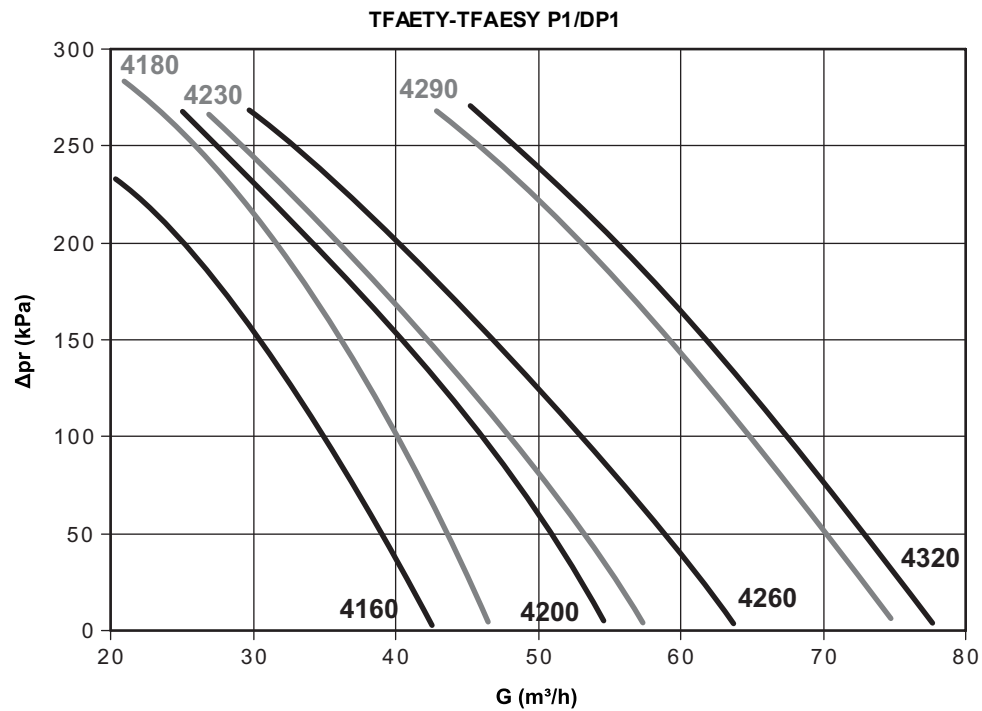
- The pressure drops of the TFAETY-TFAESY unit in Freecooling OFF mode are calculated using graph 1 or using the **RHOSS** selection software.
- The pressure drops of the TFAETY-TFAESY units in Freecooling ON mode are calculated by adding to the previous values the values from the additional Freecooling coil shown in graph 3 or by using the **RHOSS** selection software.
- The pressure drops of the TGAETY-TGAESY unit are calculated using graph 1 or using the **RHOSS** selection software.

Note:

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

TFAETY-TFAESY residual static pressures

Graphic "2": residual static pressures in Freecooling OFF operation

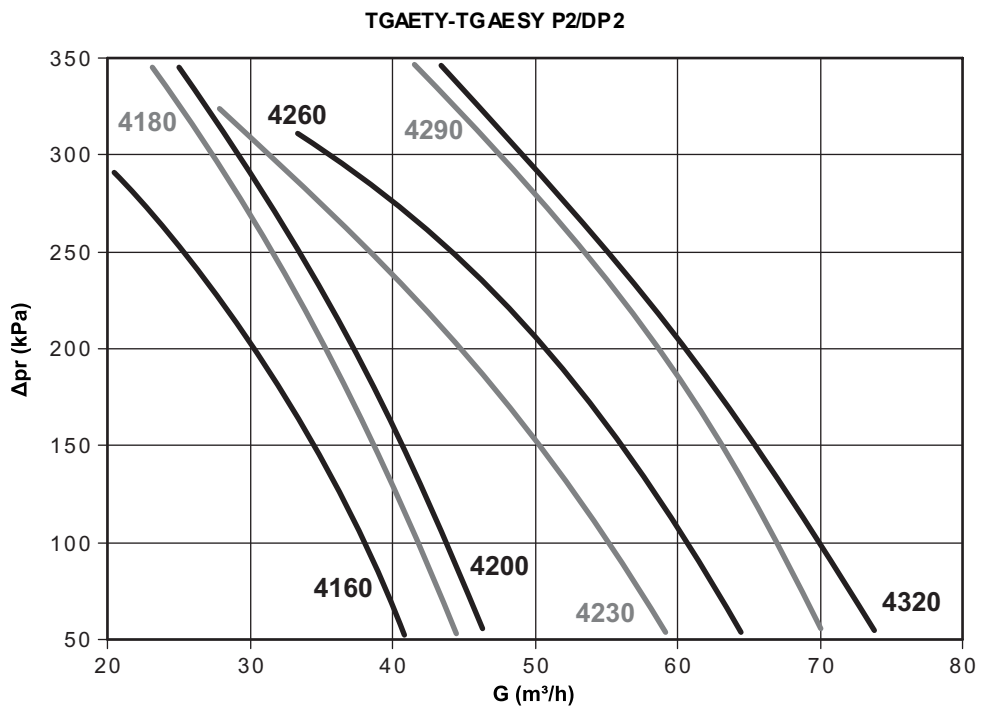
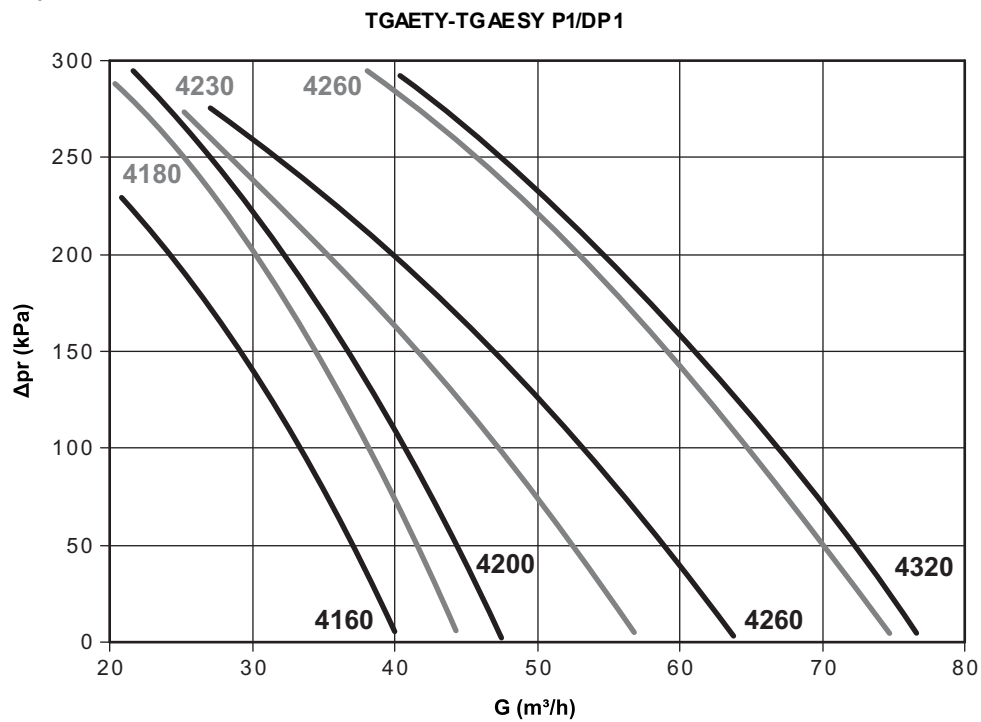


Calculation of residual static pressure

- The residual static pressure of the TFAETY-TFAESY units in Freecooling OFF mode is calculated using graph 2 or using the *RHOSS* selection on software.
- The residual static pressure of the TFAETY-TFAESY units in Freecooling ON mode is calculated by subtracting the pressure drops of the additional Freecooling coil shown in graph 3 from the previously calculated value.

TGAETY-TGAESY residual static pressures

Graph "2": residual static pressure.



Calculation of residual static pressure

- The residual static pressure of the TGAETY-TGAESY units is calculated using graph 2 or using the *RHOSS* selection software.

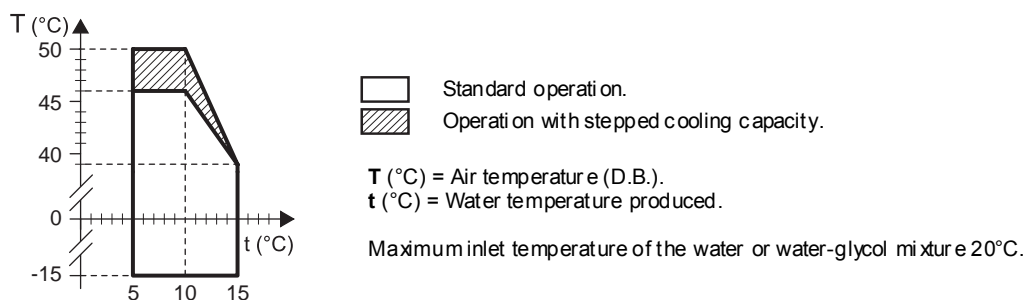
Power Levels and Sound Pressure

Model		Sound power level in dB by octave bands							Lw dB(A)	Pressure level in dB(A)		
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		Lp 10m	Lp 5m	Lp 1m
TFAETY TGAETY	4160	83	81	85	87	81	75	68	89	60	65	72
	4180	86	82	85	89	84	76	69	91	63	67	73
	4200	86	82	85	89	84	76	69	91	63	67	73
	4230	88	84	87	90	86	78	71	93	65	69	75
	4260	88	84	87	90	86	78	71	93	65	69	75
	4290	89	85	89	91	88	80	72	94	66	70	76
	4320	89	85	89	91	88	80	72	94	66	70	76
TFAESY TGAESY	4160	79	77	81	83	77	69	64	85	55	60	67
	4180	80	78	82	84	78	70	64	86	56	61	68
	4200	80	78	82	84	78	70	64	86	56	61	68
	4230	82	80	84	86	80	74	67	88	58	63	70
	4260	83	81	85	87	81	75	68	89	59	64	71
	4290	84	82	86	88	82	76	69	90	60	65	72
	4320	84	82	86	88	82	76	69	90	60	65	72

Lw Sound power level in dB(A) on the basis of measurements made in compliance with the UNI EN-ISO 3744 standard and Eurovent 8/1. The noise measurement refers to the units without pump.

Lp Sound pressure level in dB(A) in reference to the measurement and distance from the unit indicated in the table, with directionality factor of 2. The noise measurement refers to the units without pump.

Operating limits



Temperature differentials permitted through the exchangers

o Temperature differential at the evaporator $\Delta T = 3 - 8^\circ\text{C}$ (with all compressors on) for machines with "standard" installation. The maximum and minimum temperature differential for the "Pump" machines is linked to the pump performances, which must always be checked with the help of the graphs on page 25 or using the **RHOSS** selection software.

- o Minimum water pressure 0.5 Barg
- o Maximum water pressure 6 Barg.
- o Maximum water pressure on heat recovery and desuperheater 3 Barg.

Note:

For TGAETY and TGAESY versions, for evaporator outlet water of a temperature below 5°C , please contact the **RHOSS** s.p.A. pre-sales service before ordering.

Model	TFAETY	TGAETY	TFAESY	TGAESY
4160-4320	$T_{\max} = 46^\circ\text{C}$ (5) (2)	$T_{\max} = 46^\circ\text{C}$ (1) (2)	$T_{\max} = 40^\circ\text{C}$ (5) (3)	$T_{\max} = 40^\circ\text{C}$ (1) (3)
	$T_{\max} = 50^\circ\text{C}$ (5) (4)	$T_{\max} = 50^\circ\text{C}$ (1) (4)		

- (1) Water temperature (IN/OUT) $15/10^\circ\text{C}$.
- (2) Maximum external air temperature with unit in standard operation at full load and not silenced.
- (3) Maximum external air temperature with unit in silenced mode.
- (4) Maximum external air temperature with unit with shuttered cooling capacity.
- (5) Mixture temperature (30% glycol) (IN/OUT) $15/10^\circ\text{C}$.

Use of antifreeze solutions

o 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.

- o Table "H" shows the multipliers that allow the changes in performance of the units to be determined in proportion to the required percentage of ethylene glycol.
- o The multipliers refer to the following conditions: condenser inlet air temperature 35°C ; chilled water outlet temperature 7°C ; temperature differential at evaporator and condenser 5°C .
- o For different operating conditions, the same coefficients can be used as their variations are negligible.

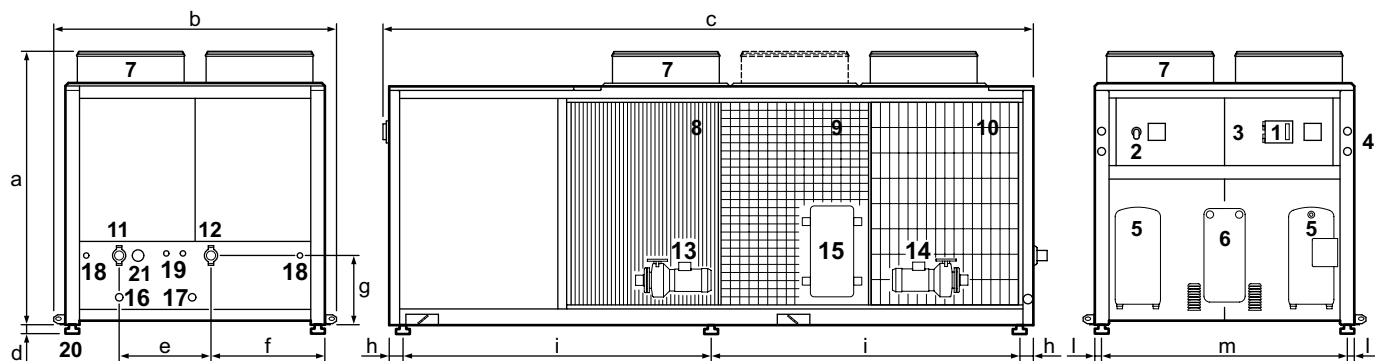
o The electric heater for the water side heat exchanger (RA accessory) and the motor-driven pump assembly (RAE accessory) prevents ice formation during winter breaks (as long as the unit is not disconnected from the power supply).

Table "H"

Glycol by weight	10 %	15 %	20 %	25 %	30 %
Freezing temperature $^\circ\text{C}$	-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 Δp_w	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 Δp_w = Correction factor of the pressure drop in the evaporator
 fc G = Correction factor of the glycol water flow to the evaporator

Dimensions and footprints



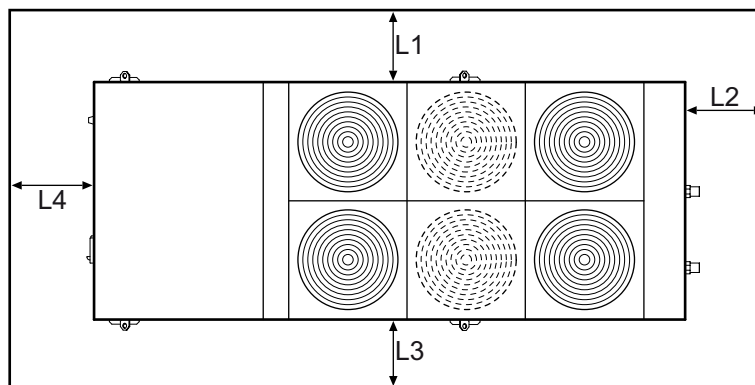
1. Control panel;
2. Isolator;
3. Electrical board;
4. Refrigerant circuit pressure gauges (GM accessory);
5. Compressor;
6. Evaporator;
7. Fan;
8. Finned coil;
9. Metal filter (FMB accessory);
10. Coil protection mesh (RPB accessory);
11. Water inlet;
12. Water outlet;
13. User side motor-driven pump (accessory);
14. Motor-driven pump (TGAETY – TGAESY);
15. Heat exchanger TGAETY-TGAESY;
16. Glycol mixture drain (TGAETY – TGAESY);
17. Glycol mixture supply (TGAETY – TGAESY);
18. Coil air vent;
19. TGAETY – TGAESY air vent;
20. Anti-vibration support (KSA/KSAM accessory);
21. Pressure gauge (TGAETY-TGAESY internal circuit) (TFAETY – TFAESY user side);

TFAETY-TFAESY-TGAETY-TGAESY

Model	a	b	c	d	e	f	g	h	i	l	m	
4160	mm	2030	2090	4800	80± 150	600	850	410	150	2220	50	1810
4180	mm	2030	2090	4800	80± 150	600	850	410	150	2220	50	1810
4200	mm	2030	2090	4800	80± 150	600	850	410	150	2220	50	1810
4230	mm	2030	2090	4800	80± 150	600	850	410	150	2220	50	1810
4260	mm	2030	2090	5300	80± 150	600	850	410	150	2470	50	1810
4290	mm	2030	2090	5300	80± 150	600	850	410	150	2470	50	1810
4320	mm	2030	2090	5300	80± 150	600	850	410	150	2470	50	1810

Model	4160	4180	4200	4230	4260	4290	4320
Inlet/outlet connections	Ø	3"	3"	3"	3"	3"	3"

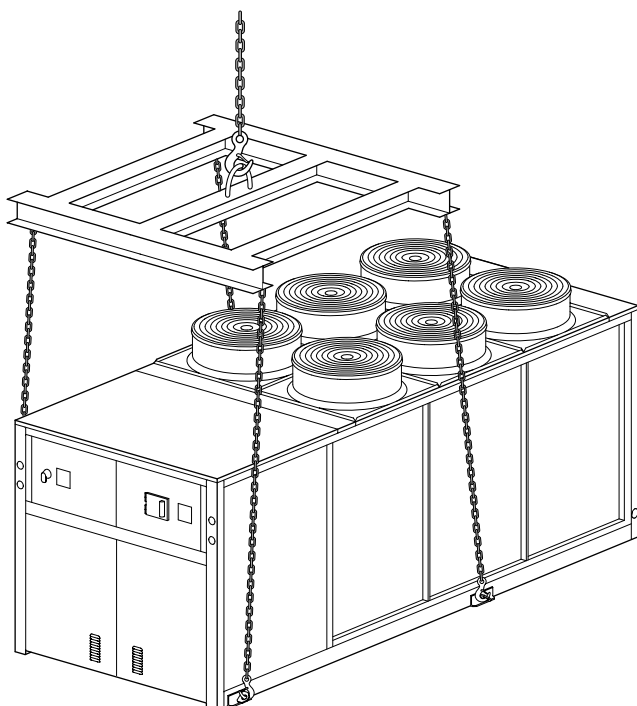
Clearances and positioning



Model	4160	4180	4200	4230	4260	4290	4320
L1 mm	2000	2000	2000	2000	2000	2000	2000
L2 mm	2000	2000	2000	2000	2000	2000	2000
L3 mm	2000	2000	2000	2000	2000	2000	2000
L4 mm	1500	1500	1500	1500	1500	1500	1500

Handling and storage

- The units 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 $-9\text{ }^{\circ}\text{C} \div 45\text{ }^{\circ}\text{C}$.
- During lifting and handling, make sure that the unit is horizontal at all times.



Installation and Connection to the System

- The unit is designed for outdoor installation.
- The unit is fitted with victaulic type water connections on the conditioning system water inlet and outlet as well as with carbon steel fittings for welding.
- Isolate the unit if installed in areas accessible to persons under 14 years of age.
- 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).
- Shut-off valves must be installed that isolate the unit from the rest of the system. Elastic connection joints and system/machine drain taps also need to be fitted.
- A metal mesh filter (with a square mesh measuring no more than 0.8 mm), of a suitable size and with suitable pressure drop, must be fitted on the unit return pipes.
- However it is installed, the coil inlet air temperature (ambient air) must remain within the set limits.
- The water flow through the heat-exchanger should not fall below a value corresponding to a temperature differential of $8\text{ }^{\circ}\text{C}$ (with all compressors on).
- 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.
- During long periods of inactivity, it is advisable to drain the water from the system.
- It is possible to avoid draining the water by adding ethylene glycol to the water circuit (see "Use of antifreeze solutions").
- The expansion tank is sized on the basis of the water content of the individual machine. Additional expansion tanks must be sized by the installer based on the system. In the case of models without a pump, the pump must be installed with the pump delivery towards the machine water inlet.

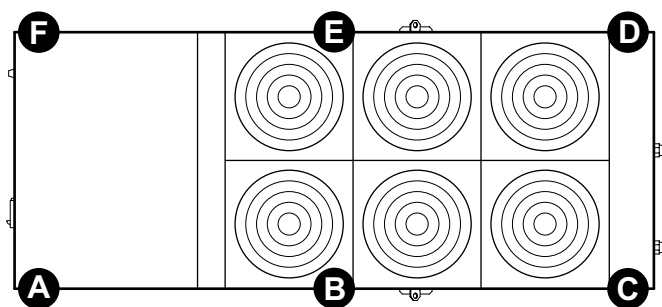
Note:

The space above the unit must be free from obstacles. If the unit is completely surrounded by walls, the distances specified are still valid, provided that at least two adjacent walls are not higher than the unit itself.

There must be a minimum gap of at least 3.5 m between the top of the unit and any obstacles above it.

If more than one unit is installed, the minimum distance between the finned coils should be at least 2 m.

Weight distribution



Model	Weight (*)						Total (*)	Total (**)	
	A	B	C	D	E	F			
TFAETY-TFAESY 4160	kg	468	428	342	344	425	463	2470	2370
TFAETY-TFAESY 4180	kg	599	501	363	367	499	591	2920	2820
TFAETY-TFAESY 4200	kg	632	517	364	369	515	623	3020	2920
TFAETY-TFAESY 4230	kg	652	534	377	382	532	643	3120	3020
TFAETY-TFAESY 4260	kg	714	580	404	406	574	702	3380	3230
TFAETY-TFAESY 4290	kg	755	604	414	416	599	742	3530	3380
TFAETY-TFAESY 4320	kg	764	613	420	423	608	752	3580	3430
TGAETY-TGAESY 4160	kg	474	454	381	370	437	454	2570	2470
TGAETY-TGAESY 4180	kg	614	536	409	401	519	591	3070	2970
TGAETY-TGAESY 4200	kg	644	553	414	405	535	619	3170	3070
TGAETY-TGAESY 4230	kg	663	570	428	419	552	638	3270	3170
TGAETY-TGAESY 4260	kg	722	594	421	415	579	699	3430	3280
TGAETY-TGAESY 4290	kg	762	619	433	426	603	737	3580	3430
TGAETY-TGAESY 4320	kg	771	628	439	433	612	747	3630	3480

(*) Weight of the units complete with all accessories and the water content.
 (**) Weight of the empty units with all accessories.

Water connections

Maximum 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 Data), multiplied by the coefficient expressed in l/kW. If the minimum content in the system is lower than the minimum indicated or calculated value, an additional tank should be installed. 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 minimum circuit water content is 2 l/kW

Example:

TFAETY 4320 Qf = 361 kW

If the unit envisages control **IDRH055** compatible with the **AdaptiveFunction Plus** function, the minimum system content must be:

Qf (kW) x 2 l/kW = 361 kW x 2 l/kW = 722 l.

Water data

Models		4160	4180	4200	4230	4260	4290	4320	
Safety valve	barg	6	6	6	6	6	6	6	
TFAETY-TFAESY	Exchanger water content	l	12	12	14	15	18	21	24
TGAETY-TGAESY	Exchanger water content	l	12	12	14	15	18	21	24

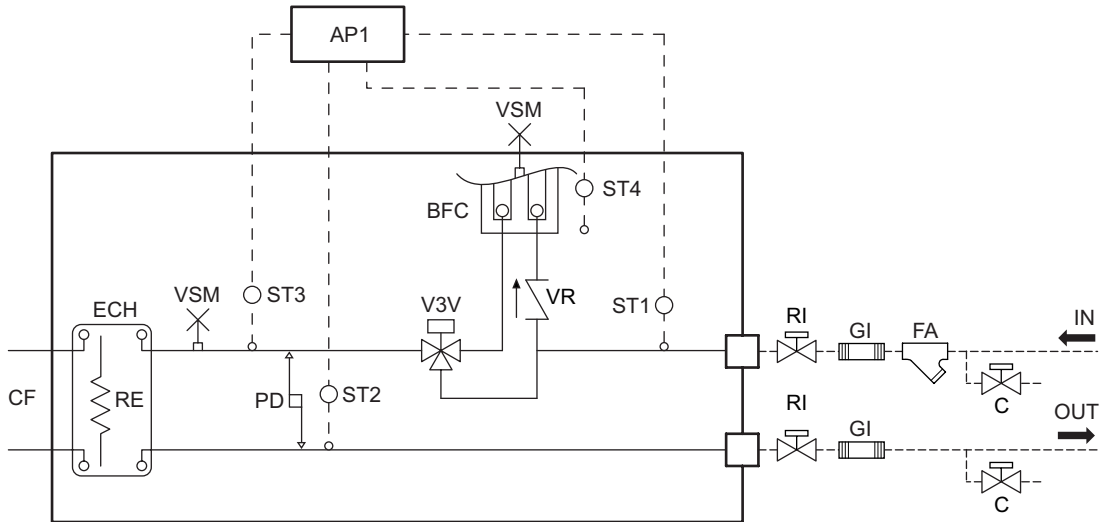
Expansion vessel technical data

Installation	P1-P2-DP1-DP2						
	4160	4180	4200	4230	4260	4290	4320
Capacity	l	12	12	12	12	12	12
Pre-charging	barg	2	2	2	2	2	2
Maximum expansion tank pressure	barg	6	6	6	6	6	6

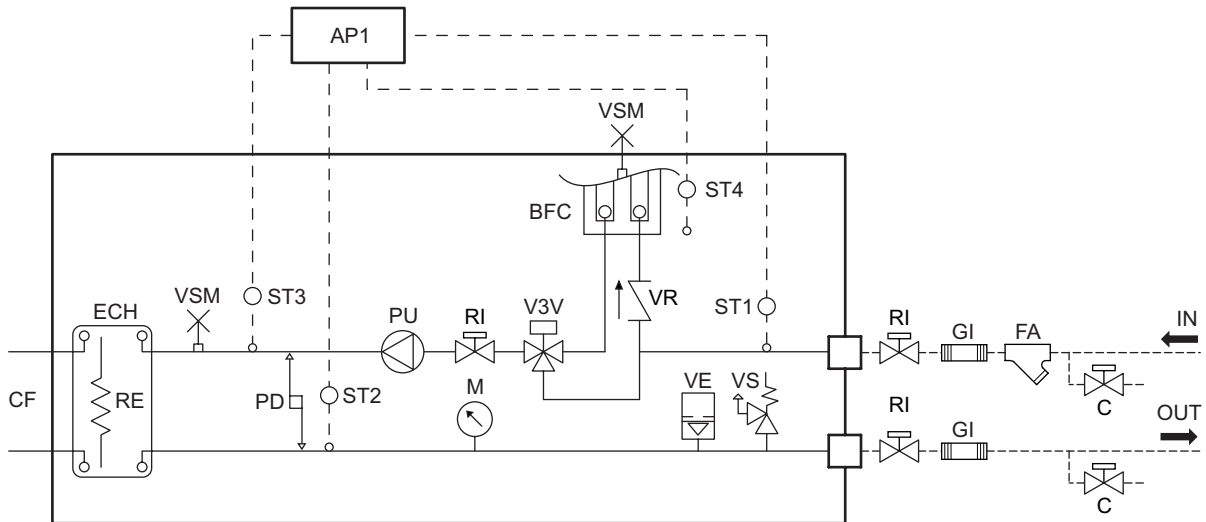
Model	TGAETY-TGAESY internal circuit						
	4160	4180	4200	4230	4260	4290	4320
Capacity	l	12	12	12	12	12	12
Pre-charging	barg	2	2	2	2	2	2
Maximum expansion tank pressure	barg	6	6	6	6	6	6

Water Circuits

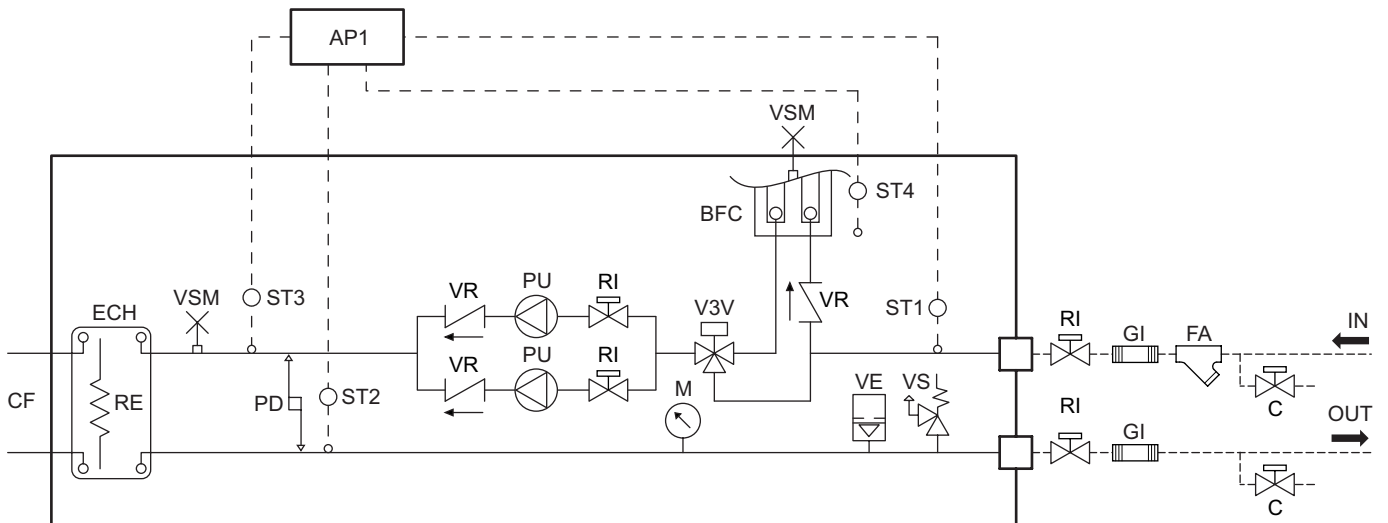
TFAETY - TFAESY Standard Installation



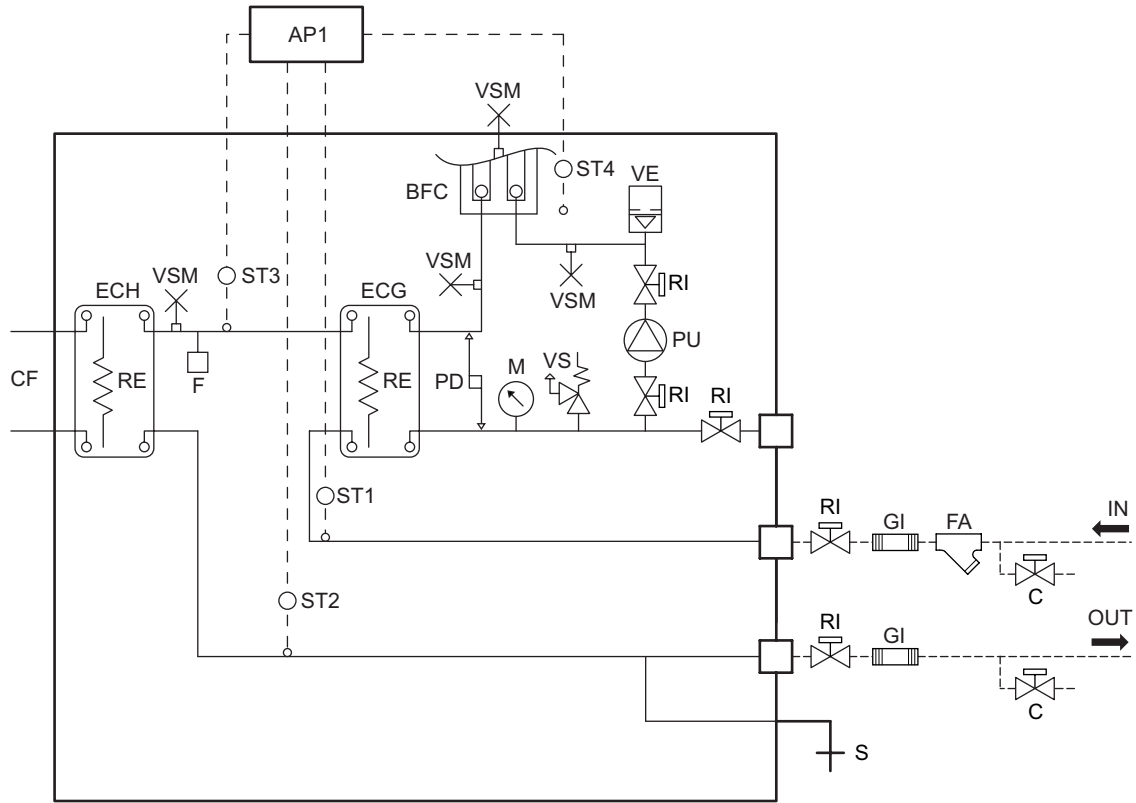
TFAETY - TFAESY Pump P1/P2 installation



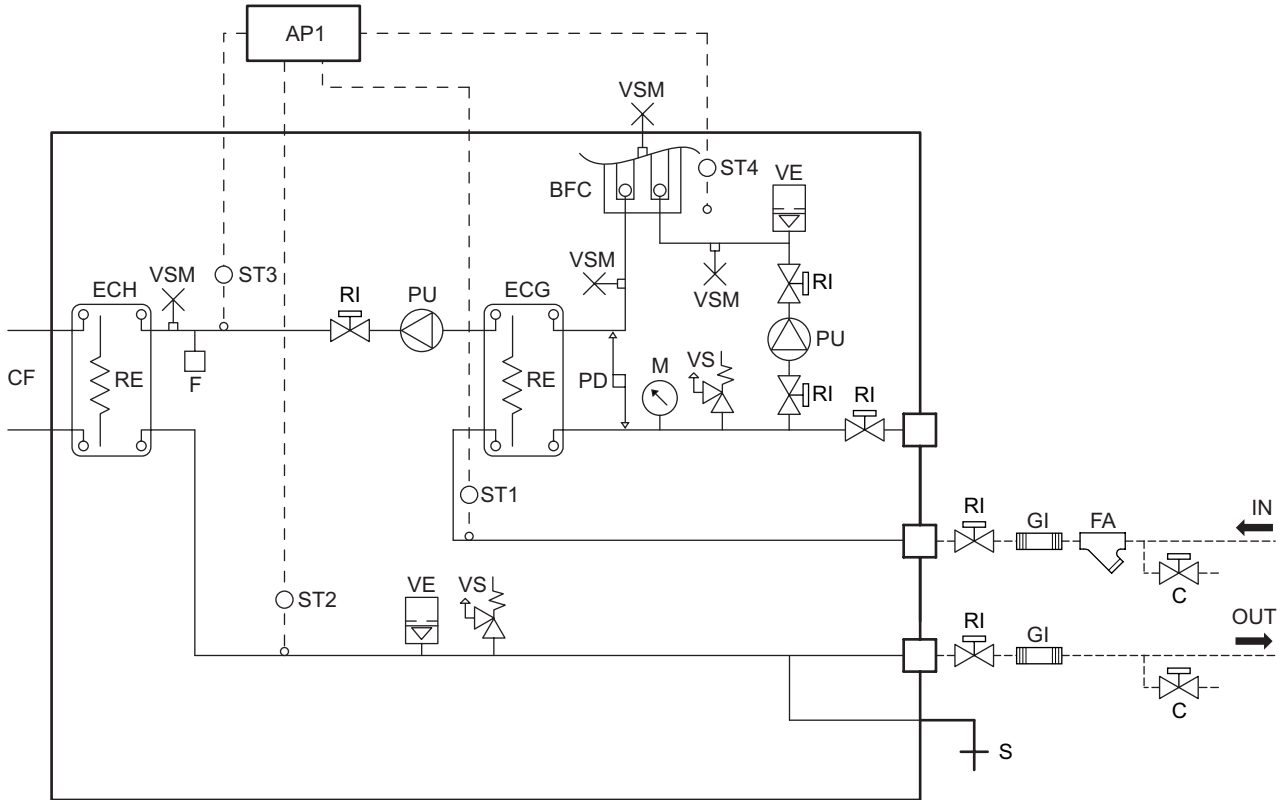
TFAETY - TFAESY Pump DP1/DP2 installation



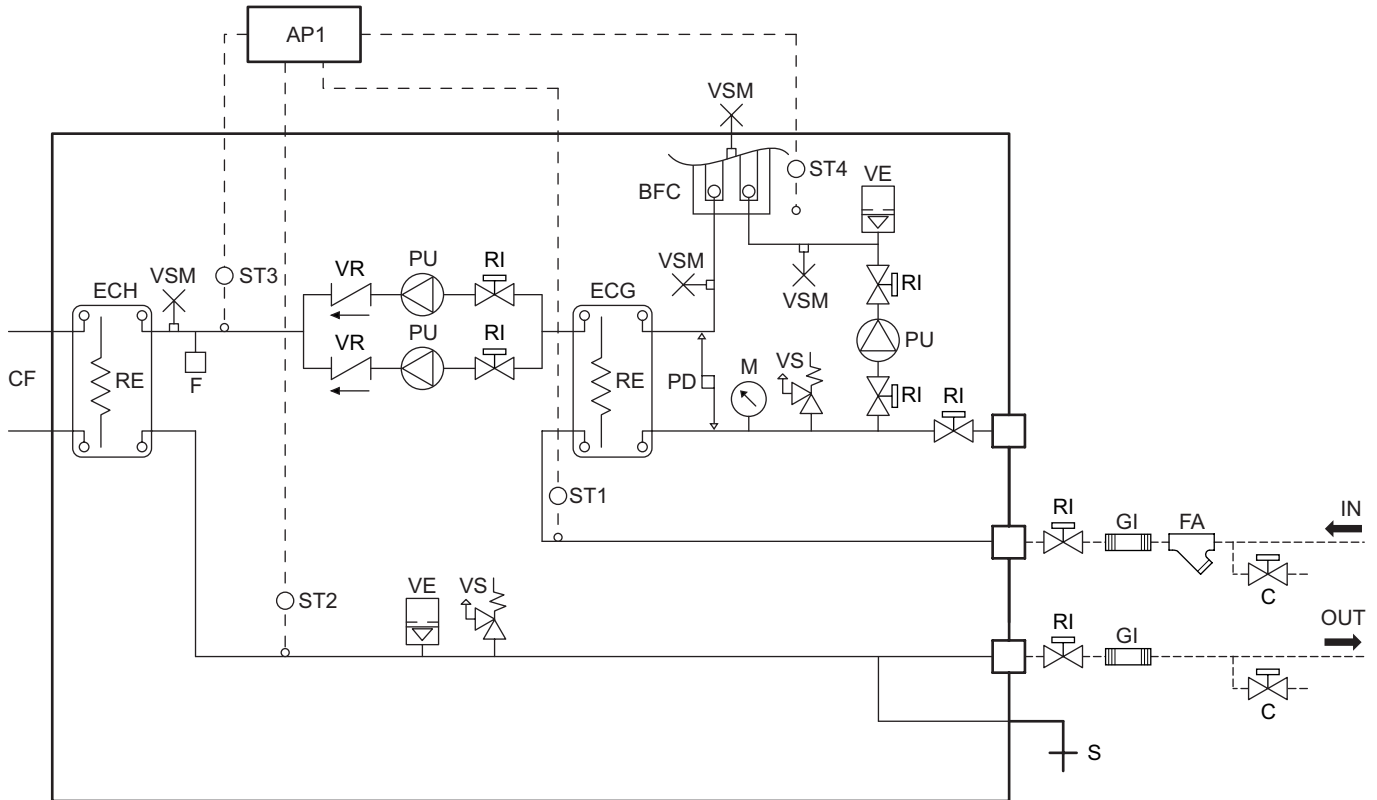
TGAETY - TGAESY Standard Installation



TGAETY - TGAESY Pump P1/P2 installation



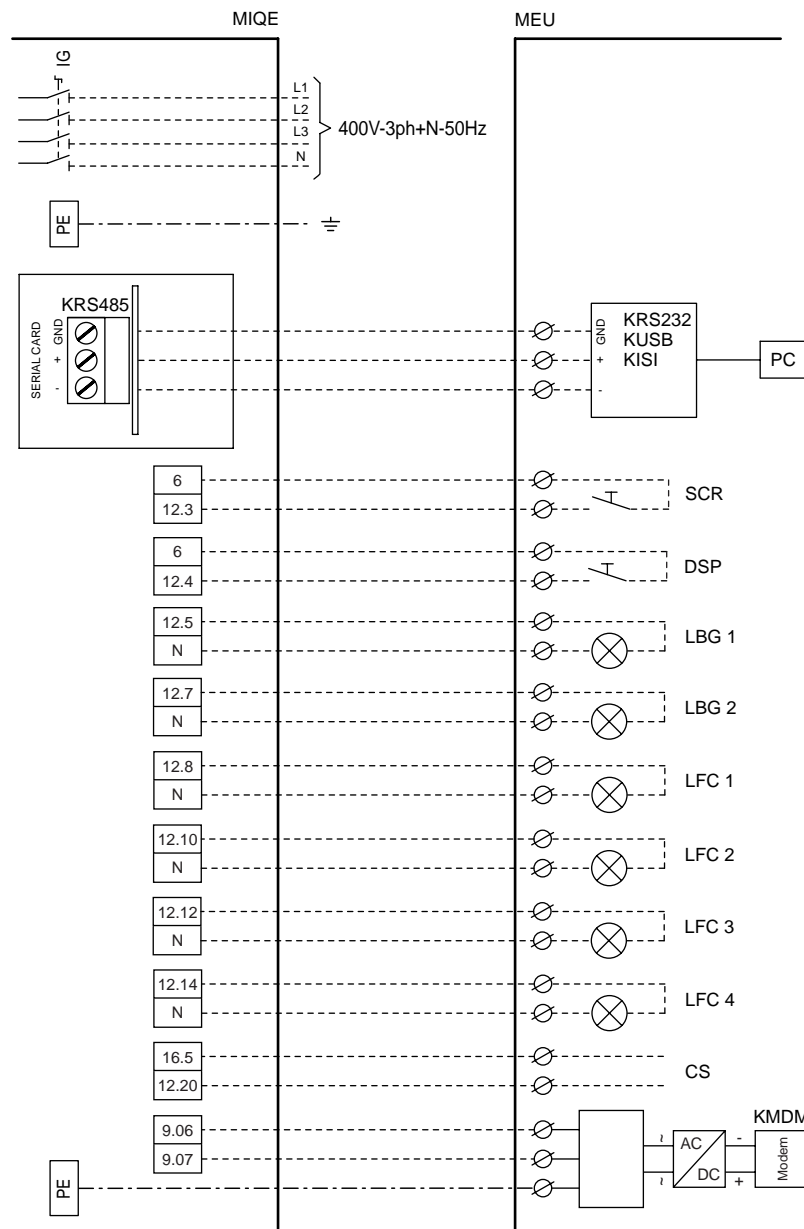
TGAETY - TGAESY Pump DP1/DP2 installation



- CF** Refrigerant circuit
- ECH** Plate evaporator
- ECG** Water/glycol and water solution exchanger
- RE** Evaporator antifreeze electric heater (accessory on TFAETY-TFAESY)
- PD** Water differential pressure switch
- F** Flow switch
- VSM** Manual bleed valve
- VS** Safety valve
- AP1** Electronic control
- ST1** Primary inlet temperature gauge
- ST2** Primary outlet temperature gauge
- working and antifreeze for Standard and Pump installations
- ST3** Evaporator inlet temperature probe
- ST4** Ambient temperature probe
- VE** Expansion tank
- FA** Mesh filter (installed by the installer)
- M** Pressure gauge
- PU** Pump
- VR** Check valve
- S** Water drain
- C** Charge/drain valve
- RI** Shut-off valve
- GI** Anti-vibration connection
- V3V** 3-way valve
- BFC** Freecooling coil
- Connections to be made by the installer

Electrical connections

- MIQE** Terminal board in electrical panel
- IG** General isolator;
- L1** Line 1;
- L2** Line 2;
- L3** Line 3;
- N** Neutral;
- PE** Earth terminal;
- KRS485** RS485 serial interface (accessory);
- KUSB** RS485/USB converter (accessory);
- KISI** CAN bus serial interface;
- J20** Connector for KRS485, KFTT10 and KISI accessory installation;
- MEU** External user terminal board;
- KRS232** RS485/RS232 converter (accessory);
- PC** Personal computer;
- SCR** Remote control selector (control with clean contact);
- DSP** Dual set-point selector (only available in combination with the EEV accessory);
- CP** Pump controls (consent at voltage 230 Vac, maximum load 2A AC1)
- CS** Scrolling set point via analogue signal 4-20 mA (incompatible with the DSP accessory);
- LBG 1-2** General lockout light (230 Vac voltage output);
- LFC 1-2-3-4** Compressor operating light 1-2-3-4 (230 Vac output voltage);
- KMDM** GSM 900-1800 modem kit;
- Connection to be made by the installer;



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

- o The electrical board is accessible from the front panel of the unit.
- o Connections must be made by skilled personnel in compliance with current standards and with the diagrams provided with the machine.
- o 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.
- o Earth connection is compulsory by law and safeguards the user while the machine is in use.

Note:
Specific terminals are provided for the **CS** and **DSP** accessories.

Cable section		4160	4180	4200	4230	4260	4290	4320
Line section	mm ²	70	70	95	95	120	150	150
PE section	mm ²	35	35	50	50	70	70	70
Remote control section	mm ²	1,5	1,5	1,5	1,5	1,5	1,5	1,5

TFAEY-TGAEY 4160÷4320

Y-Pack FREECOOLING range

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