

# Tetris SKY

200÷700 kW



## General

Chillers and reversible heat pumps with hermetic scroll compressors and plate heat exchanger. Extended range, versatile applications.

## Configurations

Standard: Chiller version

HP: reversible heat pump version

SLN: super low noise version

/LN: silenced unit

/DS: execution featuring a desuperheater

/DC: execution with recovery condenser

## Strengths

- ▶ Conforming with Ecodesign Reg. 2281, tier 2
- ▶ High efficiency and compact dimensions
- ▶ High output water temperature: up to 58°C
- ▶ Extended Limits in Heat Pump mode: down to -15°C of minimum external air temperature
- ▶ R32 refrigerant with Low GWP
- ▶ New High efficiency fans already compliant with future step of Erp. Regulation
- ▶ BlueThink advanced control with integrated web server. Multilogic function and Blueeye® supervision system. (options)
- ▶ Flowzer: inverter driven pumps (options)

**BlueBox**   
by Swegon



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## **Tetris SKY**

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# Tetris SKY

Tetris SKY is a large range of high efficiency chillers and reversible heat pumps featuring hermetic scroll compressors and an air source, suitable for both comfort and process applications. Chiller versions can produce chilled water from -8 ° C up to 20 ° C, with external temperatures from -20 ° C up to + 52 ° C. Heat Pump versions could produce water up to 58°C and work with minimum air temperature of -15°C The entire range is characterised by high compactness and a reduced refrigerant charge. Tetris SKY uses low GWP refrigerants that have a low environmental impact.

## REFRIGERANT

Chiller models from the Tetris Sky series are available with refrigerant R32.

Acronym "R7" indicates the need to use refrigerant R32 and it shows that the refrigerant has a GWP level below 700.

Refrigerant R32 (GWP=677\*)

The refrigerant consists in pure gas.

R32 is classified as a Group 1 fluid under PED.

It is also classified as A2L under the ASHRAE Standard 34, i.e.

- non-toxic;
- mildly flammable.

(\*) GWP (AR5), pursuant to IPCC V, evaluated over a span of 100 years.

## STRUCTURE

The structure of the unit is made of galvanized sheet-iron coated with polyester powder in RAL 5017/7035 at 180°C, which makes it highly resistant to weather conditions.

All screws and bolts are stainless steel.

## COMPRESSORS

### Tetris SKY R7 - Tetris SKY HP R7

The compressors are hermetic, orbiting spiral scroll compressors connected in tandem or trio, with either one or two circuits. They are provided with thermal overload protection by internal Klixon® or external Kriwan® module (depending on the model) and with oil equalization line. All the compressors are fitted as standard with crankcase heater.

## SOURCE-SIDE HEAT EXCHANGER

### (for chiller unit)

The exchangers are made with microchannel aluminium coils.

Thanks to continuous research in the alloys field, and sophisticated production methods, microchannel coils are made using specific aluminium alloys for the tubes and for the fins. This allows the effects of galvanic corrosion to be drastically reduced to always ensure protection of the tubes that confine the refrigerant. Tubes and fins are also subjected to SilFLUX coating processes (or equivalent) or have zinc added to further increase their corrosion resistance.

The use of microchannel coils, as opposed to conventional copper/aluminium coils, reduces the total weight of the unit and reduces the refrigerant charge.

Options are available for installation in environments with a particularly aggressive atmosphere or in coastal or highly industrialized areas. See section: "Description of accessories".

### (for HP units)

The exchangers are made with finned pack coils with copper tubes and aluminium fins.

The coils have an increased fin pitch to reduce frost formation and to facilitate the outflow of condensed water during defrosting.

Options are available for installation in environments with a particularly aggressive atmosphere or in coastal or highly industrialized areas. See section: "Description of accessories".

## FANS

The fans are axial fans, directly coupled to a 6-pole electric motor, with integrated thermal overload protection (Klixon®) and IP 54 protection rating.

The fan includes the shroud, designed to optimize its efficiency and reduce noise emission to a minimum, and the safety guard.

The control manages the speed of the fans through a phase cutting speed adjuster, in order to optimize the operating conditions and efficiency of the unit.

The fan speed regulator is supplied standardly.

This control also has the effect of reducing the noise level of the unit: in fact, the typical conditions under which the control will be modulating the speed of the fans are those of the night, spring and autumn.

For units equipped with EC fans (option), the same function is carried out using the electronically commutated motor of the fans.

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## USER-SIDE HEAT EXCHANGER

The exchanger is a braze-welded stainless steel plate heat exchanger, insulated with a shroud of closed-cell insulating material.

The exchanger is also equipped with thermostat-controlled anti-freeze heater to protect it from ice formation when the unit is not running.

## REFRIGERANT CIRCUIT

Each refrigerant circuit of the basic unit comprises:

- valve on the liquid line
- 4-way reversing valve (applies to HP versions only)
- valve on delivery line (applies to HP versions only)
- liquid receiver (only HP version)
- charging sockets
- liquid sight glass
- replaceable solid cartridge dehydrator filter
- electronic expansion valve
- high and low pressure switches

The pipes of the circuit and the exchanger are insulated with extruded closed-cell expanded elastomer.

## ELECTRICAL CONTROL PANEL

The electrical control panel is made in a painted galvanized sheet-iron box with forced ventilation and IP54 protection rating.

The electrical control panel of the basic unit comprises:

- main disconnect switch
- automatic circuit breakers for compressors with fixed calibration
- fuses for protecting the fans and auxiliary circuits
- fan contactors
- phase-cutting fan speed adjuster
- thermal magnetic circuit breakers for pumps (if present)
- phase monitor
- potential-free general alarm contacts
- single potential free operating contacts for compressors, fans and pumps (when present)
- digital input for general ON/OFF
- summer/winter selection by digital input (only for HP units)
- external air temperature probe
- microprocessor controller with display accessible from the outside

All the electrical cables inside the panel are numbered and the terminal board dedicated to the customer's connections is coloured orange so that it can be quickly identified in the panel.

Unit power supply is 400V/3~/50Hz:

## CONTROL BLUETHINK

The unit is supplied as standard with an advanced controller.

The control allows the following functions:

- water temperature adjustment, with control of the water entering the user-side heat exchanger
- freeze protection
- compressor timings
- automatic rotation of compressor starting sequence
- recording of the log of all machine inputs, outputs and states
- automatic rotation of compressor starting sequence
- recording of the alarm log
- RS485 serial port with Modbus protocol
- Ethernet serial port with Modbus protocol and integrated web server preloaded web page
- digital input for general ON/OFF
- digital input for Summer/Winter selection

For further details on available functions and on displayed information, refer to the specific documentation of the controller.

By default, the serial connections present as standard are enabled only for reading from BMS. Enabling of writing from BMS is to be requested when ordering.

### Main functions of the webserver (only for units with advanced control)

As standard, the Bluethink controller integrates a webserver with a preloaded web page that is accessed via password.

The web page allows the following functions to be carried out (some of these are available only for users with advanced level rights):

- display of the main functions of the unit such as unit serial n°, size, refrigerant
- display of the general status of the machine: water inlet and outlet temperatures, external air temperature, mode (chiller or heat pump), evaporating and condensing pressures, suction and discharge temperatures
- display of the status of compressors, pumps, expansion valves
- display in real time of the graphs of the main quantities
- display of the graphs of logged quantities
- display of alarm log
- management of users on several levels
- remote ON/OFF
- remote set point change
- remote time band change
- remote summer winter mode selection

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## Human-Machine Interface

The control has a graphic display that allows the following information to be displayed:

- water inlet and outlet temperature
- set temperature and differential set points
- description of alarms
- hour meter of operation and number of start-ups of the unit, the compressors and the pumps (if present)
- high and low pressure values, and relevant condensing and evaporating temperatures
- external air temperature
- superheating at compressor suction.

## Management of defrost cycles

### (only for HP units)

For defrost management, the control of the unit uses a sliding intervention threshold, depending on the pressures inside the unit and the external air temperature. By putting together all this information, the control can identify the presence of ice on the coil and activates the defrosting sequence only when necessary, so as to maximize the energy efficiency of the unit.

Sliding management of the defrost threshold ensures that, as the absolute humidity of outdoor air decreases, the frequency of the defrost cycles gradually decreases because they are carried out only when the ice formed on the coil actually penalizes performance.

The defrost cycle is fully automatic: during the initial stage, a defrost is carried out by cycle reversal with the fans stopped. As soon as the frost on the coil has molten to a suitable level, the unit resumes operation in heat pump mode.

## OPTIONS

### /DC: unit with total recovery condenser

In addition to the set-up of a chiller only unit, /DC units comprise:

- a heat recovery condenser for recovering 100% of the condensation heat on each refrigerant circuit. The exchanger is a brazed plate heat exchanger; for dual circuit units, the heat exchangers are to be manifolded outside the unit (by the customer)
- temperature probe at the inlet of the heat recovery heat exchanger; for dual circuit units, the probe is supplied with the unit and is to be positioned on the heat exchanger inlet manifold (by the customer)
- liquid receiver for each refrigerant circuit with system for emptying the refrigerant from the condensing coil
- potential free contact in the electrical control panel for activation of recovery.

When required by the system, through the closing of a contact, the control automatically manages activation of recovery. Recovery management is carried out through a control on the temperature of the return water. The control also automatically manages safety deactivation of recovery if the condensing pressure becomes too high, and changes to using the condensing coils.

This option is not available for /HP units

### /DS: unit with desuperheater

/DS units comprise (for each refrigerant circuit) an exchanger for condensation heat recovery of up to 20% (depending on size, version and operating conditions), placed in series with the condensing coil. The exchanger is a braze-welded plate heat exchanger. For multi-circuit units, the exchangers are to be manifolded outside the unit (by the customer).

The desuperheater can be used during operation in cooling mode. However, it can also be used in heating mode on condition that the following measures are taken:

- a valve (either 2- or 3-way) must be installed on the desuperheater water circuit;
- the valve must be monitored using a temperature control system;
- the valve must be operated to regulate the temperature of the input water into the desuperheater = IWTds.

First, enter the unit heating setpoint, which corresponds to the temperature of water delivered to the heating unit = LWTu\_Heating. Then set the condition below:

- $IWTds > LWTu\_Heating + 10 [K]$

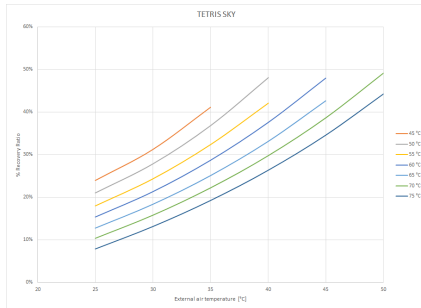
The valve, the control systems and their installation, setup operations, etc. are the responsibility of the client. If heat recovery is not required during operation in heat pump mode, or where the above requirements are not met, the water circuit of the desuperheater must be shut off. Desuperheater operation in heat pump mode reduces the heating capacity transferred from the unit to the user's hydronic circuit. When a desuperheater is fitted, irrespective of it running in either cooling or heating mode, the max. temperature of water delivered to the heating unit (LWTu\_Heating) is reduced, as described in the section "Operating limits".

An illustrative graph is shown below in which, as the ambient temperature changes, ( $T_{air}$ ) and as the temperature of the water leaving the heat recovery heat exchanger changes, ( $T_{w,out DS}$ ), the percentage of recovered heat is shown as an indication (Recovery ratio).

Condensation heat recovery is a function of size, version and operating conditions.

The percentage of recovered heat is calculated as the ratio between recovered heat flow to the desuperheater and the heat flow to the condenser under nominal conditions, therefore evaporator inlet-outlet water temperature 12-7°C.

In the following graph, a constant temperature delta of 5°C between water inlet and outlet at the heat recovery heat exchanger has been considered.



### **/HAT: unit for high external air temperatures**

The unit with /HAT option adopts an electrical control panel made using specific components to withstand high temperatures, special cables and oversize protection parts.

This enables the unit to work with external air temperatures of over 46°C as indicated in the section on operating limits;

operation is guaranteed with external air temperature up to 52°C.

For higher temperatures up to about 55°C, a set-up with air conditioning of the electrical control panel is necessary; the unit works in capacity reduction mode. The feasibility of this set-up must be assessed: please contact our sales department.

### **/LN: silenced unit**

In the unit with /LN option, all the compressors are enclosed in a compartment that is fully soundproofed with sound absorbing material and soundproofing material.

### **/SLN: super low noise unit**

Unit versions SLN are characterised by the use of a soundproofed compressor compartment, fans with a speed adjuster, and a reduced air flow rate. The speed reduction of the fans is such that, under nominal operating conditions, the air flow rate and noise level are lower than those of the basic version of the unit.

In any case, the use of the speed adjuster to reduce the air flow rate allows rotation of the fans at maximum speed when external air temperature conditions are particularly critical and therefore guarantees the same operating limits as the high efficiency version.

Also, for SLN/HP version units working in heat pump mode, the fans always operate at 100% speed and therefore guarantee the same performance levels as the high efficiency versions.

## **HYDRAULIC MODULES**

All units can be fitted with hydraulic module in various configurations:

- /1P: hydraulic module with one pump
- /2P: hydraulic module with two pumps
- /1PS: hydraulic module with one pump and buffer tank
- /2PS: hydraulic module with two pumps and buffer tank

The following are also available:

- modules /1Pr, /2Pr, /1PrS e /2PrS that have pumps with reduced available discharge head
- modules /1PG, /2PG, /1PGS and /2PGS that have pumps with High lift suitable for operating with glycol up to 50%

For the hydraulic modules it is also possible to add an expansion tank for balancing system possible over-pressures ("VAES" option)

Hydraulic modules with one pump have:

- one pump

Hydraulic modules with two pumps have:

- two pumps
- a check valve on the delivery side of each pump

In the version with 2 pumps, these are always with one on standby while the other is working. Switching over between the pumps is automatic and is done by time (to balance the hours of operation of each one) or in the event of failure.

Hydraulic modules with tank also have:

- a gate valve at the inlet of the pump or the suction manifold
- a tank with drain valve and air valve

Refer to the table of configurations that are not possible to check for availability of specific set-ups.

All the hydraulic circuit components are fully insulated, except for:

- drain valves
- venting valves
- tank plugs
- safety valves
- probe pockets



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## CONTROLS AND SAFETY DEVICES

All the units are fitted with the following control and safety components:

- user-side water temperature probe
- antifreeze probe on the user side heat exchanger
- high pressure switch with manual reset
- low pressure safety device with automatic reset, for a limited number of occurrences, managed by the controller
- compressor overtemperature protection
- fan overtemperature protection
- differential flow switch

## TESTING

All the units are factory-tested and supplied complete with oil and refrigerant.

## PACKAGING

The unit is made and shipped on a wooden pallet that allows the unit to be handled using a forklift truck.

The unit is wrapped in a protective transparent polyethylene stretch film.

## CERTIFICATIONS AND REFERENCE STANDARDS

The manufacturer has implemented and keeps the Management Systems listed below and it is certified against them:

- Quality Management System according to standard UNI EN ISO 9000;
- Environmental Management System according to standard UNI EN ISO 14000;
- Health and Safety Management System according to standard BS OHSAS 18000 (as converted into UNI EN ISO 45000).

These management systems ensure that the company puts in place any and all actions and initiatives to define and monitor the standards defined by its Management, which are stated in its Quality, Environmental and Safety policies.

To meet the safety requirements, the unit was designed and manufactured in compliance with the directives and product regulations below:

- PED Directive: safety criteria to be followed when designing pressure equipment;
- Machinery Directive: safety criteria to be followed when designing machinery;
- Low Voltage Directive: safety criteria to be followed when designing electrical machine parts;
- Electromagnetic Compatibility Directive: electromagnetic compatibility criteria to be followed when designing electrical machine parts;
- WEEE Directive: criteria for product management at the end of its life cycle as waste with a view to environmental protection.

The units are manufactured, tested and checked with reference to the European standards specified in the Declaration of CE Conformity, in accordance with the requirements and procedures of our Quality System.

The installation, use and storage of units featuring mildly flammable refrigerants (A2L pursuant to standard ASHRAE 34), such as R32 and R454B, must meet the European standards and regulations and the local laws, where applicable.

For further details, please refer to the "Instruction manual for operation and maintenance".

### Responsibilities and obligations exclusive to the installer:

- to carry out a specific risk assessment according to the European regulations/standards above and/or the local laws in order to define the necessary measures for conformity;
- to comply with the requirements and to take the measures resulting from the outcomes of the risk assessment, pursuant to the relevant regulations and standards.

# TECHNICAL SPECIFICATIONS

## TETRIS SKY R7 [R32]

			21.2	24.2	27.3	31.3	37.3
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	199.6	237.2	273.9	311.8	361
Total absorbed power	(1)	kW	62	79.8	86.5	104.3	116.5
EER	(1)		3.22	2.97	3.17	2.99	3.1
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	2/1	2/1	3/1	3/1	3/1
Minimum capacity reduction step	(7)	%	39	50	28	24	33
Refrigerant charge CH (MCHX)	(3)	kg	19	19	25	25	31
Refrigerant charge CH (Cu/Al)	(3)	kg	21	21	28	28	34
<b>Fans</b>							
Quantity		n°	3	3	4	4	5
Total air flow rate CH (MCHX)		m³/h	58029	58029	77372	77372	96715
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	34.3	40.8	47.1	53.7	62.1
Pressure drop CH	(1)	kPa	30	33	32	34	42
<b>Noise levels</b>							
Sound power level cooling	(4)	dB(A)	91	93	92	93	95
Sound pressure level cooling	(6)	dB(A)	59	61	60	61	63
Sound power level of vers. LN cooling	(4)	dB(A)	87	87	88	90	90
Sound pressure level of vers. LN cooling	(6)	dB(A)	55	55	56	58	58
<b>Dimensions and weights**</b>							
Length		mm	2693	2693	2693	2693	3838
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	1634	1710	1854	1945	2360

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories

## TETRIS SKY R7 [R32]

			26.4	28.4	30.4	34.4	38.4
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	245.2	272.7	293	331	372.5
Total absorbed power	(1)	kW	77.9	87.9	97.3	106.2	115.6
EER	(1)		3.15	3.1	3.01	3.12	3.22
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	4/2	4/2	4/2	4/2	4/2
Minimum capacity reduction step	(7)	%	25	22	25	18	17
Refrigerant charge CH (MCHX)	(3)	kg	26	26	26	32	38
Refrigerant charge CH (Cu/Al)	(3)	kg	36	36	36	45	53
<b>Fans</b>							
Quantity		n°	4	4	4	5	6
Total air flow rate CH (MCHX)		m³/h	77372	77372	77372	96715	116058
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	42.2	46.9	50.4	57	64.1
Pressure drop CH	(1)	kPa	40	37	43	41	42
<b>Noise levels</b>							
Sound power level cooling	(4)	dB(A)	90	90	90	92	93
Sound pressure level cooling	(6)	dB(A)	58	58	58	60	61
Sound power level of vers. LN cooling	(4)	dB(A)	86	86	86	86	87
Sound pressure level of vers. LN cooling	(6)	dB(A)	54	54	54	54	55
<b>Dimensions and weights**</b>							
Length		mm	2693	2693	2693	3838	3838
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	1895	1915	1936	2408	2450

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories

## TETRIS SKY R7 [R32]

			40.4	44.4	47.5	50.6	54.6
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	392.7	432.4	464.5	498.2	534.9
Total absorbed power	(1)	kW	122.6	139.6	146.2	153.7	171.1
EER	(1)		3.2	3.1	3.18	3.24	3.13
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	4/2	4/2	5/2	6/2	6/2
Minimum capacity reduction step	(7)	%	19	18	16	15	14
Refrigerant charge CH (MCHX)	(3)	kg	38	38	44	50	50
Refrigerant charge CH (Cu/Al)	(3)	kg	53	53	61	70	70
<b>Fans</b>							
Quantity		n°	6	6	7	8	8
Total air flow rate CH (MCHX)		m³/h	116058	116058	135401	154744	154744
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	67.6	74.4	79.9	85.7	92
Pressure drop CH	(1)	kPa	44	22	26	30	29
<b>Noise levels</b>							
Sound power level cooling	(4)	dB(A)	93	93	93	94	95
Sound pressure level cooling	(6)	dB(A)	61	61	61	62	63
Sound power level of vers. LN cooling	(4)	dB(A)	87	88	88	90	90
Sound pressure level of vers. LN cooling	(6)	dB(A)	55	56	55.5	57.5	57.5
<b>Dimensions and weights**</b>							
Length		mm	3838	3838	4992	4992	4992
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	2473	2620	3152	3180	3275

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
  - (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
  - (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
  - (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
  - (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
  - (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
  - (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
  - (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories
- \*\* Basic unit without included accessories

## TETRIS SKY R7 [R32]

			60.6	64.6	70.6	72.6
<b>Cooling</b>						
Refrigeration capacity	(1)	kW	588	636.8	675.1	712.7
Total absorbed power	(1)	kW	183.2	196.1	212.9	228.8
EER	(1)		3.21	3.25	3.17	3.12
Eurovent efficiency class	(1)		-	-	-	-
<b>Compressors</b>						
Compressors/Circuits		n°	6/2	6/2	6/2	6/2
Minimum capacity reduction step	(7)	%	13	12	11	17
Refrigerant charge CH (MCHX)	(3)	kg	56	62	62	62
Refrigerant charge CH (Cu/Al)	(3)	kg	78	87	87	87
<b>Fans</b>						
Quantity		n°	9	10	10	10
Total air flow rate CH (MCHX)		m³/h	174087	193430	193430	193430
<b>User-side heat exchanger</b>						
Quantity		n°	1	1	1	1
Water flow rate CH	(1)	m³/h	101.2	109.6	116.2	122.6
Pressure drop CH	(1)	kPa	29	28	32	36
<b>Noise levels</b>						
Sound power level cooling	(4)	dB(A)	96	97	97	98
Sound pressure level cooling	(6)	dB(A)	64	65	65	66
Sound power level of vers. LN cooling	(4)	dB(A)	91	92	92	93
Sound pressure level of vers. LN cooling	(6)	dB(A)	58.5	59.5	59.5	60.5
<b>Dimensions and weights**</b>						
Length		mm	6136	6136	6136	6136
Depth		mm	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476
Operating weight		kg	3722	3776	3876	3932

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511  
(2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511  
(3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.  
(4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.  
(5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.  
(6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.  
(7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.  
(8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories  
\*\* Basic unit without included accessories

## TETRIS SKY R7 SLN [R32]

			21.2	24.2	27.3	31.3	37.3
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	188.5	221.3	258.5	291.4	339.6
Total absorbed power	(1)	kW	65.3	85.2	91.1	111.4	123.5
EER	(1)		2.89	2.6	2.84	2.62	2.75
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	2/1	2/1	3/1	3/1	3/1
Minimum capacity reduction step	(7)	%	39	50	28	24	33
Refrigerant charge CH (MCHX)	(3)	kg	19	19	25	25	31
Refrigerant charge CH (Cu/Al)	(3)	kg	21	21	28	28	34
<b>Fans</b>							
Quantity		n°	3	3	4	4	5
Total air flow rate CH (MCHX)		m³/h	38448	38448	51264	51264	64080
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	32.4	38.1	44.5	50.1	58.4
Pressure drop CH	(1)	kPa	26	30	29	32	39
<b>Noise levels</b>							
Sound power lev. SLN vers.	(4)	dB(A)	84	86	85	86	88
Sound pressure lev. SLN vers.	(6)	dB(A)	52	54	53	54	56
<b>Dimensions and weights**</b>							
Length		mm	2693	2693	2693	2693	3838
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	1724	1800	2003	2095	2510

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories

## TETRIS SKY R7 SLN [R32]

			26.4	28.4	30.4	34.4	38.4
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	234.5	258.5	275.9	311.8	352.1
Total absorbed power	(1)	kW	79.6	91.3	102.3	108.7	115.7
EER	(1)		2.95	2.83	2.7	2.87	3.04
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	4/2	4/2	4/2	4/2	4/2
Minimum capacity reduction step	(7)	%	25	22	25	18	17
Refrigerant charge CH (MCHX)	(3)	kg	26	26	26	32	38
Refrigerant charge CH (Cu/Al)	(3)	kg	36	36	36	45	53
<b>Fans</b>							
Quantity		n°	4	4	4	5	6
Total air flow rate CH (MCHX)		m³/h	51264	51264	51264	64080	76896
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	40.4	44.5	47.5	53.7	60.6
Pressure drop CH	(1)	kPa	37	34	38	37	38
<b>Noise levels</b>							
Sound power lev. SLN vers.	(4)	dB(A)	84	84	84	84	85
Sound pressure lev. SLN vers.	(6)	dB(A)	52	52	52	52	53
<b>Dimensions and weights**</b>							
Length		mm	2693	2693	2693	3838	3838
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	2045	2065	2086	2558	2600

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories

## TETRIS SKY R7 SLN [R32]

			40.4	44.4	47.5	50.6	54.6
<b>Cooling</b>							
Refrigeration capacity	(1)	kW	374.1	409.2	441.6	475	508
Total absorbed power	(1)	kW	126.6	145.5	151.2	158.1	177.6
EER	(1)		2.96	2.81	2.92	3.01	2.86
Eurovent efficiency class	(1)		-	-	-	-	-
<b>Compressors</b>							
Compressors/Circuits		n°	4/2	4/2	5/2	6/2	6/2
Minimum capacity reduction step	(7)	%	19	18	16	15	14
Refrigerant charge CH (MCHX)	(3)	kg	38	38	44	50	50
Refrigerant charge CH (Cu/Al)	(3)	kg	53	53	61	70	70
<b>Fans</b>							
Quantity		n°	6	6	7	8	8
Total air flow rate CH (MCHX)		m³/h	76896	76896	89712	102528	102528
<b>User-side heat exchanger</b>							
Quantity		n°	1	1	1	1	1
Water flow rate CH	(1)	m³/h	64.4	70.4	76	81.7	87.4
Pressure drop CH	(1)	kPa	40	20	23	27	27
<b>Noise levels</b>							
Sound power lev. SLN vers.	(4)	dB(A)	85	86	86	88	88
Sound pressure lev. SLN vers.	(6)	dB(A)	53	54	54	56	56
<b>Dimensions and weights**</b>							
Length		mm	3838	3838	4992	4992	4992
Depth		mm	2260	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476	2476
Operating weight		kg	2623	2770	3362	3390	3485

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories



## TETRIS SKY R7 SLN [R32]

			60.6	64.6	70.6	72.6
<b>Cooling</b>						
Refrigeration capacity	(1)	kW	560.1	607.2	641.5	673.8
Total absorbed power	(1)	kW	188.8	201.6	220.5	239.2
EER	(1)		2.97	3.01	2.91	2.82
Eurovent efficiency class	(1)		-	-	-	-
<b>Compressors</b>						
Compressors/Circuits		n°	6/2	6/2	6/2	6/2
Minimum capacity reduction step	(7)	%	13	12	11	17
Refrigerant charge CH (MCHX)	(3)	kg	56	62	62	62
Refrigerant charge CH (Cu/Al)	(3)	kg	78	87	87	87
<b>Fans</b>						
Quantity		n°	9	10	10	10
Total air flow rate CH (MCHX)		m³/h	115344	128160	128160	128160
<b>User-side heat exchanger</b>						
Quantity		n°	1	1	1	1
Water flow rate CH	(1)	m³/h	96.4	104.5	110.4	115.9
Pressure drop CH	(1)	kPa	27	26	29	32
<b>Noise levels</b>						
Sound power lev. SLN vers.	(4)	dB(A)	89	89	89	90
Sound pressure lev. SLN vers.	(6)	dB(A)	57	57	57	58
<b>Dimensions and weights**</b>						
Length		mm	6136	6136	6136	6136
Depth		mm	2260	2260	2260	2260
Height		mm	2476	2476	2476	2476
Operating weight		kg	3932	3986	4086	4142

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
- (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories

\*\* Basic unit without included accessories

## TETRIS SKY HP R7 [R32]

			26.4	28.4	34.4
<b>Cooling</b>					
Refrigeration capacity	(1)	kW	246.5	270.7	302.5
Total absorbed power	(1)	kW	74.9	84.3	100.2
EER	(1)		3.29	3.21	3.02
Eurovent efficiency class	(1)		-	-	-
<b>Heating</b>					
Heating capacity	(2)	kW	259.3	284.6	326.3
Total absorbed power	(2)	kW	78.4	85.4	97.7
COP	(2)		3.31	3.33	3.34
Eurovent efficiency class	(2)		-	-	-
<b>Compressors</b>					
Compressors/Circuits		n°	4/2	4/2	4/2
Minimum capacity reduction step	(7)	%	22	25	22
Refrigerant charge HP	(3)	kg	42	42	42
<b>Fans</b>					
Quantity		n°	6	6	6
Total air flow rate HP		m³/h	117984	117984	117984
<b>User-side heat exchanger</b>					
Quantity		n°	1	1	1
Water flow rate CH	(1)	m³/h	42.4	46.6	52.1
Pressure drop CH	(1)	kPa	33	26	39
Water flow rate HP	(2)	m³/h	44.6	48.9	56.1
Pressure drop HP	(2)	kPa	34	30	32
<b>Noise levels</b>					
Sound power level cooling	(4)	dB(A)	90	90	92
Sound pressure level cooling	(6)	dB(A)	58	58	60
Sound power level of vers. LN cooling	(4)	dB(A)	87	87	88
Sound pressure level of vers. LN cooling	(6)	dB(A)	55	55	56
<b>Dimensions and weights**</b>					
Length		mm	3838	3838	3838
Depth		mm	2260	2260	2260
Height		mm	2476	2476	2476
Operating weight		kg	2612	2642	2780

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511  
(2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511  
(3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.  
(4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.  
(5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.  
(6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.  
(7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.

\*\* Basic unit without included accessories

## TETRIS SKY HP R7 [R32]

			38.4	40.4	44.4
<b>Cooling</b>					
Refrigeration capacity	(1)	kW	351.5	395.3	423
Total absorbed power	(1)	kW	110.5	127.5	142.9
EER	(1)		3.18	3.1	2.96
Eurovent efficiency class	(1)		-	-	-
<b>Heating</b>					
Heating capacity	(2)	kW	379	420.5	459.1
Total absorbed power	(2)	kW	114.5	127.6	139
COP	(2)		3.31	3.3	3.3
Eurovent efficiency class	(2)		-	-	-
<b>Compressors</b>					
Compressors/Circuits		n°	4/2	4/2	4/2
Minimum capacity reduction step	(7)	%	19	17	25
Refrigerant charge HP	(3)	kg	56	56	56
<b>Fans</b>					
Quantity		n°	8	8	8
Total air flow rate HP		m³/h	157312	157312	157312
<b>User-side heat exchanger</b>					
Quantity		n°	1	1	1
Water flow rate CH	(1)	m³/h	60.5	68	72.8
Pressure drop CH	(1)	kPa	38	44	23
Water flow rate HP	(2)	m³/h	65.2	72.3	79
Pressure drop HP	(2)	kPa	41	44	23
<b>Noise levels</b>					
Sound power level cooling	(4)	dB(A)	94	94	94
Sound pressure level cooling	(6)	dB(A)	62	62	62
Sound power level of vers. LN cooling	(4)	dB(A)	90	90	90
Sound pressure level of vers. LN cooling	(6)	dB(A)	58	58	58
<b>Dimensions and weights**</b>					
Length		mm	4992	4992	4992
Depth		mm	2260	2260	2260
Height		mm	2476	2476	2476
Operating weight		kg	3366	3500	3670

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
- (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
- (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
- (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
- (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
- (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
- (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.

\*\* Basic unit without included accessories

## TETRIS SKY HP R7 SLN [R32]

			26.4	28.4	34.4
<b>Cooling</b>					
Refrigeration capacity	(1)	kW	240.7	265.1	293.7
Total absorbed power	(1)	kW	75.6	85.4	102.6
EER	(1)		3.19	3.11	2.86
Eurovent efficiency class	(1)			-	
<b>Heating</b>					
Heating capacity	(2)	kW	259.3	284.6	326.3
Total absorbed power	(2)	kW	78.4	85.4	97.7
COP	(2)		3.31	3.33	3.34
Eurovent efficiency class	(2)			-	
<b>Compressors</b>					
Compressors/Circuits		n°		4/2	
Minimum capacity reduction step	(7)	%	22	25	22
Refrigerant charge HP	(3)	kg		52	
<b>Fans</b>					
Quantity		n°		6	
Total air flow rate HP		m³/h		78660	
<b>User-side heat exchanger</b>					
Quantity		n°		1	
Water flow rate CH	(1)	m³/h	41.4	45.6	50.5
Pressure drop CH	(1)	kPa	32	29	30
Water flow rate HP	(2)	m³/h	44.6	48.9	56.1
Pressure drop HP	(2)	kPa	34	30	32
<b>Noise levels</b>					
Sound power lev. SLN vers.	(4)	dB(A)		84	86
Sound pressure lev. SLN vers.	(6)	dB(A)		52	54
<b>Dimensions and weights**</b>					
Length		mm		3838	
Depth		mm		2260	
Height		mm		2476	
Operating weight		kg	2754	2762	2932

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12/7°C. Values compliant with standard EN 14511
  - (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
  - (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
  - (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
  - (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
  - (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
  - (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
  - (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories
- \*\* Basic unit without included accessories

## TETRIS SKY HP R7 SLN [R32]

			38.4	40.4	44.4
<b>Cooling</b>					
Refrigeration capacity	(1)	kW	343.6	384.4	411.3
Total absorbed power	(1)	kW	112.1	130.6	146.6
EER	(1)		3.07	2.94	2.81
Eurovent efficiency class	(1)			-	
<b>Heating</b>					
Heating capacity	(2)	kW	379	420.5	459.1
Total absorbed power	(2)	kW	114.5	127.6	139
COP	(2)		3.31		3.3
Eurovent efficiency class	(2)			-	
<b>Compressors</b>					
Compressors/Circuits		n°		4/2	
Minimum capacity reduction step	(7)	%	19	17	25
Refrigerant charge HP	(3)	kg		68	
<b>Fans</b>					
Quantity		n°		8	
Total air flow rate HP		m³/h		104880	
<b>User-side heat exchanger</b>					
Quantity		n°		1	
Water flow rate CH	(1)	m³/h	59.1	66.1	70.8
Pressure drop CH	(1)	kPa	39	41	21
Water flow rate HP	(2)	m³/h	65.2	72.3	79
Pressure drop HP	(2)	kPa	41	44	23
<b>Noise levels</b>					
Sound power lev. SLN vers.	(4)	dB(A)		88	
Sound pressure lev. SLN vers.	(6)	dB(A)		56	
<b>Dimensions and weights**</b>					
Length		mm		4992	
Depth		mm		2260	
Height		mm		2476	
Operating weight		kg	3518	3652	3820

CH: chiller unit; HP: heat pump unit; MCHX: unit with microchannel coils

- (1) External air temperature of 35°C and user-side heat exchanger water inlet-outlet temperature of 12-7°C. Values compliant with standard EN 14511
  - (2) Outside air temperature 7°C DB, 6°C WB; condenser inlet/outlet water temperature 40/45°C. Values compliant with standard EN 14511
  - (3) Theoretical values referred to the basic unit. The amount of gas actually charged in the unit may differ.
  - (4) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.
  - (5) unit operating at nominal operating capacity, with no accessories of any kind, with external air temperature of 7°C (6°C WB) and user-side heat exchanger water inlet/outlet temperature of 40/45°C. Values obtained from measurements carried out in accordance with standard ISO 3744.
  - (6) Values obtained from the sound power level (conditions: note 4), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.
  - (7) Approximate value. The minimum capacity reached by the unit depends on the operating conditions. The value shown may not be suitable for calculating the minimum volume of water: to do this, consult the "Minimum water content in the system" section.
  - (8) Former Eurovent's seasonal efficiency index. Value not certified by Eurovent from 2019. Reference: base unit, without any accessories
- \*\* Basic unit without included accessories

# ECODESIGN

## INTRODUCTION

The Ecodesign/ErP Directive (2009/125/EC) lays down new standards for more efficient energy use.

The Directive contains various regulations; as regards chiller products and heat pumps, the regulations of interest are the following:

- Regulation 2013/813, for small heat pumps ( $P_{\text{design}} \leq 400$  kW)
- Regulation 2016/2281, for chillers and heat pumps with  $P_{\text{design}} > 400$  kW
- Regulation 2013/811, for heat pumps with  $P_{\text{design}} \leq 70$  kW.

The last-mentioned regulation (2013/811) regards the labelling (Ecolabel certification) of small heat pumps.

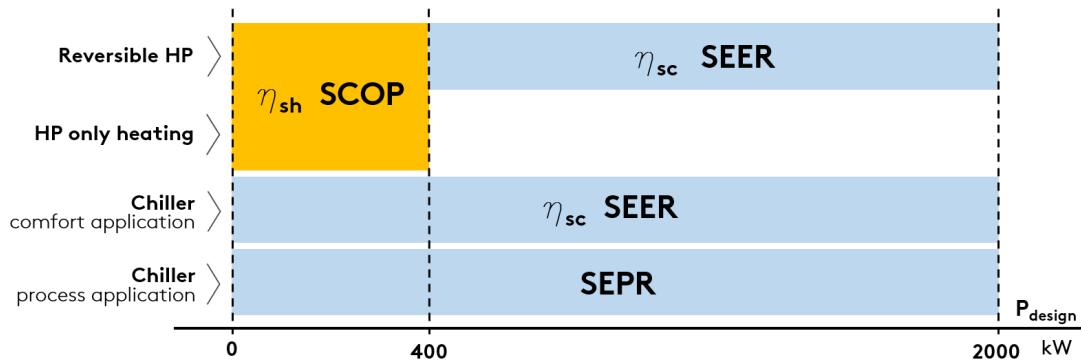
The other two regulations (2013/813 and 2016/2281) set seasonal efficiency targets that the products must comply with to be sold and installed in the European Union (essential requirement for CE marking).

These efficiency limits are defined through ratios, which are respectively:

- $\eta_{\text{sh}}$  (SCOP), with reference to regulation 2013/813
- $\eta_{\text{sc}}$  (SEER) for comfort applications and SEPR for process applications, with reference to regulation 2016/2281.

As regards regulation 2016/2281, with effect from 1st January 2021, the required minimum efficiency limit will be raised (Tier 2) from the current threshold (Tier 1).

The figure below schematically illustrates the correspondence between product and reference energy ratio.



Some notes and clarifications:

For comfort applications, regulation 2016/2281 sets the  $\eta_{\text{sc}}$  (SEER) ratio in two different operating conditions:

- SEER calculated with machine inlet/outlet water temperature of 12/7°C (low temperature application),
- SEER calculated with machine inlet/outlet water temperature of 23/18°C (medium temperature application).

The minimum efficiency requirement is the same, but can be met at condition 12/7°C or at condition 23/18°C, depending on the application envisaged for the machine.

Regulation 2013/813 distinguishes two different types: at low temperature and at medium temperature.

The following refer to the application at low temperature: (low temperature application) all heat pumps whose maximum delivery temperature for heating purposes is lower than 52°C with source at temperature of -7°C and -8°C wet bulb (air-water unit) or inlet 10°C (water-water unit), at the reference design conditions for an average climate. For these, the efficiency ratio is "low temperature application" (outlet water temperature 35°C).

For all the other heat pumps, the efficiency ratio is related to "medium temperature application" (outlet water temperature 55°C).

The ratios must be calculated according to the reference European heating season in average climatic conditions.

The minimum efficiency requirements set by the regulations are indicated below.

REGULATION 2016/2281, comfort application

TYPE OF UNIT		MINIMUM REQUIREMENT			
		Tier 1		Tier 2 (2021)	
SOURCE	P <sub>design</sub>	η <sub>sc</sub> [%]	SEER	η <sub>sc</sub> [%]	SEER
air	< 400kW	149	3,8	161	4,1
air	≥ 400kW	161	4,1	179	4,55
water	< 400kW	196	5,1	200	5,2
water	≥ 400kW and < 1500kW	227	5,875	252	6,5
water	≥ 1500kW	245	6,325	272	7

REGULATION 2016/2281, process application

TYPE OF UNIT		MINIMUM REQUIREMENT	
		Tier 1	Tier 2 (2021)
SOURCE	P <sub>design</sub>	SEPR	SEPR
air	< 400kW	4,5	5
air	≥ 400kW	5	5,5
water	< 400kW	6,5	7
water	≥ 400kW and < 1500kW	7,5	8
water	≥ 1500kW	8	8,5

REGULATION 2013/813

SOURCE	APPLICATION	MINIMUM REQUIREMENT	
		η <sub>sh</sub> [%]	SCOP
air	low temperature application	125	3,2
water	low temperature application	125	3,325
air	medium temperature application	110	2,825
water	medium temperature application	110	2,95

The conformity of the product must be checked according to the type of application, whether comfort or process, and at the required outlet water temperature.

The two schematic tables below, respectively for comfort application and for process application, indicate the reference of the required conformity according to the type of product and the set point temperature (reference to regulations 2016/2281 and 2013/813).

Important note: for mixed comfort and process applications, the reference application for conformity is the comfort application.

#### COMFORT APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
<b>Chiller</b>	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
<b>Heat pumps (reversible and only heating) Pdesign≤400kW</b>		SCOP/ηsh	2013/813
<b>Reversible heat pumps Pdesign&gt;400kW</b>	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
<b>Heat pumps only heating Pdesign&gt;400kW</b>		-	-

- = exemption from Ecodesign

#### PROCESS APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
<b>Chiller</b>	≥ +2°C , ≤ 12°C	SEPR	2016/2281
	> 12°C	-	-
	> -8°C , < +2°C	-	-

- = exemption from Ecodesign

Some specifications and notes follow.

#### EC fans:

The only option that positively affects the performance of the unit, by increasing its seasonal energy efficiency ratio, is the VEC accessory.

A unit equipped with EC fans has a higher SEER (ηsc) than the configuration with standard fans.



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## TETRIS SKY R7 SERIES

With specific reference to the Tetris SKY R7 range, below is a list of relevant regulations relating to the different units in their various configurations.

- chiller version: regulation 2016/2281
- HP version: regulation 2013/813 (For Units with  $P_{design} \leq 400$  kW)-regulation 2016/2281 (For Units with  $P_{design} > 400$  kW).

The tables below give information on the conformity of the units and the seasonal energy performance ratios with regard to the reference regulation.

Basic unit without included accessories

## TETRIS SKY R7 [R32]

			21.2	24.2	27.3	31.3	37.3
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	199.6	237.2	273.9	311.8	361
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	185.8	165.8	190.2	178.2	184.6
SEER	(1)		4.72	4.22	4.83	4.53	4.69
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	197.4	173.4	202.6	192.6	195.8
SEER	(1)		5.01	4.41	5.14	4.89	4.97
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

			26.4	28.4	30.4	34.4	38.4
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	245.2	272.7	293	331	372.5
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	173.8	170.6	169.4	183.4	181
SEER	(1)		4.42	4.34	4.31	4.66	4.6
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	183.4	188.2	188.2	194.2	195.4
SEER	(1)		4.66	4.78	4.78	4.93	4.96
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

## TETRIS SKY R7 [R32]

			40.4	44.4	47.5	50.6	54.6
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	392.7	432.4	464.5	498.2	534.9
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	185.4	187.4	188.6	188.6	188.2
SEER	(1)		4.71	4.76	4.79	4.79	4.78
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	199.8	202.2	204.6	205.4	204.2
SEER	(1)		5.07	5.13	5.19	5.21	5.18
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

			60.6	64.6	70.6	72.6	
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	588	636.8	675.1	712.7	
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	193	191	189.8	189	
SEER	(1)		4.9	4.85	4.82	4.8	
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	210.6	208.2	206.6	204.6	
SEER	(1)		5.34	5.28	5.24	5.19	
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

## TETRIS SKY SLN R7 [R32]

			21.2	24.2	27.3	31.3	37.3
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	188.5	221.3	258.5	291.4	339.6
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	179.4	162.6	184.6	168.2	177
SEER	(1)		4.56	4.14	4.69	4.28	4.5
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	192.2	171.8	198.2	184.2	189.4
SEER	(1)		4.88	4.37	5.03	4.68	4.81
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

			26.4	28.4	30.4	34.4	38.4
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	234.5	258.5	275.9	311.8	352.1
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	167	164.6	164.6	179.4	179
SEER	(1)		4.25	4.19	4.19	4.56	4.55
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	177.8	174.2	174.2	192.2	193
SEER	(1)		4.52	4.43	4.43	4.88	4.9
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

## TETRIS SKY SLN R7 [R32]

			40.4	44.4	47.5	50.6	54.6
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	374.1	409.2	441.6	475	508
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	176.6	179.4	180.6	184.6	183
SEER	(1)		4.49	4.56	4.59	4.69	4.65
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	188.6	191.4	193.8	198.6	196.6
SEER	(1)		4.79	4.86	4.92	5.04	4.99
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	Y
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	-
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	Y

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

			60.6	64.6	70.6	72.6	
<b>REGULATION 2016-2281</b>							
Pdesign	(1)	kW	560.1	607.2	641.5	673.8	
<b>COMFORT</b>							
<b>Standard Unit</b>							
$\eta_{sc}$	(1)	%	188.6	186.6	184.6	181	
SEER	(1)		4.79	4.74	4.69	4.6	
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	
<b>Unit with EC fans (VEC)</b>							
$\eta_{sc}$	(1)	%	203.4	201.4	199	193.8	
SEER	(1)		5.16	5.11	5.05	4.92	
Compliance Tier 2 (2021)	(1)		Y	Y	Y	Y	
<b>PROCESS</b>							
SEPR	(2)		-	-	-	-	
Compliance Tier 2 (2021)	(2)		Y	Y	Y	Y	

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.
- (2) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

## TETRIS SKY HP R7 [R32]

			26.4	28.4	34.4
<b>REGULATION 2013/813</b>			-		
Pdesign	(1)	kW	155.8	170.5	202.2
<b>COMFORT</b>					
<b>Standard Unit</b>					
$\eta_{sh}$	(1)	%	156.2	155.4	155.8
SCOP	(1)		3.98	3.96	3.97
<b>Unit with EC fans (VEC)</b>					
$\eta_{sh}$	(1)	%	167.4	166.6	167
SCOP	(1)		4.26	4.24	4.25

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 30/35°C, Average climate profile, with reference to regulation 2013/813 and norm EN 14825.
- (2) Energy efficiency class with reference to regulation 2013/811 (low temperature applications).

## TETRIS SKY HP R7 [R32]

			38.4	40.4	44.4
<b>REGULATION 2013/813</b>			-		
Pdesign	(1)	kW	226.7	240.1	265.2
<b>COMFORT</b>					
<b>Standard Unit</b>					
$\eta_{sh}$	(1)	%	155.8	155	157
SCOP	(1)		3.97	3.95	4
<b>Unit with EC fans (VEC)</b>					
$\eta_{sh}$	(1)	%	166.6	166.2	168.2
SCOP	(1)		4.24	4.23	4.28

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 30/35°C, Average climate profile, with reference to regulation 2013/813 and norm EN 14825.
- (2) Energy efficiency class with reference to regulation 2013/811 (low temperature applications).

## TETRIS SKY HP R7 SLN [R32]

			26.4	28.4	34.4
<b>REGULATION 2013/813</b>			-		
Pdesign	(1)	kW	240.7	265.1	293.7
<b>COMFORT</b>					
<b>Standard Unit</b>					
$\eta_{sh}$	(1)	%	156.2	155.4	155.8
SCOP	(1)		3.98	3.96	3.97
<b>Unit with EC fans (VEC)</b>					
$\eta_{sh}$	(1)	%	167.4	166.6	167
SCOP	(1)		4.26	4.24	4.25

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 30/35°C, Average climate profile, with reference to regulation 2013/813 and norm EN 14825.
- (2) Energy efficiency class with reference to regulation 2013/811 (low temperature applications).

## TETRIS SKY HP R7 SLN [R32]

			38.4	40.4	44.4
<b>REGULATION 2013/813</b>			-		
Pdesign	(1)	kW	343.6	384.4	411.3
<b>COMFORT</b>					
<b>Standard Unit</b>					
$\eta_{sh}$	(1)	%	155.8	155	157
SCOP	(1)		3.97	3.95	4
<b>Unit with EC fans (VEC)</b>					
$\eta_{sh}$	(1)	%	166.6	166.2	168.2
SCOP	(1)		4.24	4.23	4.28

Y = unit in compliance with Ecodesign at the indicated condition. N = unit not in compliance with Ecodesign at the indicated condition: it can be installed only in non-EU countries.

- (1) User-side heat exchanger water inlet/outlet temperature 30/35°C, Average climate profile, with reference to regulation 2013/813 and norm EN 14825.
- (2) Energy efficiency class with reference to regulation 2013/811 (low temperature applications).

## INSTALLATION ADVICE

The units described in this document are, by nature, strongly affected by the characteristics of the system, the working conditions and the installation site.

Remember that the unit must be installed by a qualified and skilled technician, and in compliance with the national legislation in force in the destination country.

The installation must be done in such a way that it will be possible to carry out all routine and non-routine maintenance operations.

Before starting any work, you must carefully read the "Installation, operation and maintenance manual" of the machine and do the necessary safety checks to prevent any malfunctioning or hazards.

We give some advice below that will allow you to increase the efficiency and reliability of the unit and therefore of the system into which it is inserted.

### Water characteristics

To preserve the life of the exchangers, the water is required to comply with some quality parameters and it is therefore necessary to make sure its values fall within the ranges indicated in the following table:

<b>Total hardness</b>	2,0 ÷ 6,0 °f
<b>Langelier index</b>	- 0,4 ÷ 0,4
<b>pH</b>	7,5 ÷ 8,5
<b>Electrical conductivity</b>	10 ÷ 500 µS/cm
<b>Organic elements</b>	-
<b>Hydrogen carbonate (HCO<sub>3</sub><sup>-</sup>)</b>	70 ÷ 300 ppm
<b>Sulphates (SO<sub>4</sub><sup>2-</sup>)</b>	< 50 ppm
<b>Hydrogen carbonate / Sulphates (HCO<sub>3</sub><sup>-</sup>/SO<sub>4</sub><sup>2-</sup>)</b>	> 1
<b>Chlorides (Cl<sup>-</sup>)</b>	< 50 ppm
<b>Nitrates (NO<sub>3</sub><sup>-</sup>)</b>	< 50 ppm
<b>Hydrogen sulphide (H<sub>2</sub>S)</b>	< 0,05 ppm
<b>Ammonia (NH<sub>3</sub>)</b>	< 0,05 ppm
<b>Sulphites (SO<sub>3</sub>), free chlorine (Cl<sub>2</sub>)</b>	< 1 ppm
<b>Carbon dioxide (CO<sub>2</sub>)</b>	< 5 ppm
<b>Metal cations</b>	< 0,2 ppm
<b>Manganese ions (Mn<sup>++</sup>)</b>	< 0,2 ppm
<b>Iron ions ( Fe<sup>2+</sup> , Fe<sup>3+</sup>)</b>	< 0,2 ppm
<b>Iron + Manganese</b>	< 0,4 ppm
<b>Phosphates (PO<sub>4</sub><sup>3-</sup>)</b>	< 2 ppm
<b>Oxygen</b>	< 0,1 ppm

Installation of water filters on all the hydraulic circuits is obligatory.

The supply of the most suitable filters for the unit can be requested as accessory. In this case, the filters are supplied loose and must be installed by the customer following the instructions given in the installation, operation and maintenance manual.

### Glycol mixtures

With temperatures below 5°C, it is mandatory to work with water and anti-freeze mixtures, and also change the safety devices (anti-freeze, etc.), which must be carried out by qualified authorised personnel or by the manufacturer.

<b>Liquid outlet temperature or minimum ambient temperature</b>	°C	0	-5	-10	-15	-20	-25	-30	-35	-40
<b>Freezing point</b>	°C	-5	-10	-15	-20	-25	-30	-35	-40	-45
<b>Ethylene glycol</b>	%	6	22	30	36	41	46	50	53	56
<b>Propylene glycol</b>	%	15	25	33	39	44	48	51	54	57

The quantity of antifreeze should be considered as % on weight



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## Minimum water content in the system

For correct operation of the unit, it is necessary to ensure a buffering on the system such as to comply with the minimum operating time considering the greater between the minimum OFF time and the minimum ON time. In short, these contribute to limiting the number of times the compressors are switched on per hour and to preventing undesired deviations from the set point of the delivered water temperature.

Larger amounts of water are in any case always preferable, because they allow a smaller number of starts and switch-offs of the compressors, less wear of them and an increase in the efficiency of the system as a consequence of a reduction in the number of transients.

It should also be pointed out that, for air-water units working in heat pump mode, the minimum amount of water must consider the need of the unit to carry out defrosting. Having an adequate buffering volume will allow prevention of too high drifts of the delivered water temperature at the end of the defrost cycle.

The following experimental formula allows to calculate the minimum water volume of the plant. Formula refers to unit operation in cooling mode and is also valid for heating mode if defrosting cycles are not taken in account.

$$V_{min} = \frac{P_{tot} \cdot 1.000}{N} \cdot \frac{300}{\Delta T \cdot \rho \cdot c_p} + P_{tot} \cdot 0,25$$

where

$V_{min}$  is the minimum water content of the system [l]

$P_{tot}$  is the total cooling capacity of the machine [kW]

N: number of capacity reduction steps

$\Delta T$ : differential allowed on the water temperature. Unless otherwise specified, this value is considered to be 2.5K

$\rho$ : density of the heat-carrying fluid. Unless otherwise specified, the density of water is considered

$c_p$ : specific heat of the heat-carrying fluid. Unless otherwise specified, the specific heat of water is considered

Considering the use of water and grouping together some terms, the formula can be re-written as follows:

$$V_{min} = \frac{P_{tot}}{N} \cdot 17,2 + P_{tot} \cdot 0,25$$

N is equal to the number of compressors installed in the unit.

For units with inverter compressor:

- N=3 for units with just one inverter-controlled compressor
- N=6 for units with 2 compressors of which one is controlled by inverter

In case of installation in cold climates where the unit has to perform defrosting cycles, it is suggested to use higher water content than that calculated with previous formula; due to very high volumes needed to completely compensate the negative effect of defrost on produced water temperature, are usually accepted higher temperature deviations than typical values accepted for cooling-only unit.

Water content necessary to balance defrost cycle effect on produced water temperatures, depends on various factors:

- type of system
- compressors and circuits number
- maximum temporary acceptable temperature difference from set-point
- Quantity of defrost cycles necessary to proper functioning of the unit (depending on external and working conditions)
- compressors and circuits number

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## Installation site

To determine the best installation site for the unit and its orientation, you should pay attention to the following points:

- compliance with the clearance spaces indicated in the official dimensional drawing of the unit must be guaranteed so as to ensure accessibility for routine and non-routine maintenance operations
- you should consider the origin of the hydraulic pipes and their diameters because these affect the radiuses of curvature and therefore the spaces needed for installing them
- you should consider the position of the cable inlet on the electrical control panel of the unit as regards the origin of the power supply
- if the installation includes several units side by side, you should consider the position and dimensions of the manifolds of the user-side exchangers and of any recovery exchangers
- if the installation includes several units side by side, you should consider that the minimum distance between units is 3 metres
- you should avoid all obstructions that can limit air circulation to the source-side exchanger or that can cause recirculation between air supply and intake
- you should consider the orientation of the unit to limit, as far as possible, exposure of the source-side exchanger to solar radiation
- if the installation area is particularly windy, the orientation and positioning of the unit must be such as to avoid air recirculation on the coils. If necessary, we advise making windbreak barriers in order to prevent malfunctioning.

Once the best position for the unit has been identified, you must check that the support slab has the following characteristics:

- its dimensions must be proportionate to those of the unit: if possible, longer and wider than the unit by at least 30 cm and 15/20cm higher than the surrounding surface
- it must be able to bear at least 4 times the operating weight of the unit
- it must allow level installation of the unit: although the unit is installed on a horizontal base, make slopes in the support surface to convey rain water or defrost water to drains, wells or in any case to places where it cannot generate an accident hazard due to ice formation. All heat pump version units are equipped with discharge manifolds for the condensed water; these can be manifolded to facilitate condensate discharge.

The units are designed and built to reduce to a minimum the level of vibration transmitted to the ground, but it is in any case advisable to use rubber or spring anti-vibration mounts, which are available as accessory and should be requested when ordering.

The anti-vibration mounts must be fixed on before positioning the unit on the ground.

In the event of installation on roofs or intermediate floors, the pipes must be isolated from the walls and ceilings.

It is advisable to avoid installation in cramped places, to prevent reverberations, reflections, resonances and acoustic interactions with elements outside the unit.

It is essential that any work done to soundproof the unit does not affect its correct installation or correct operation and, in particular, does not reduce the air flow rate to the source-side exchanger.

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## Installations that require the use of treated coils

If the unit has to be installed in an environment with a particularly aggressive atmosphere, coils with special treatments are available as options.

- e-coated microchannel coils (accessory not available for HP units)
- coils with anti-corrosion treatment (accessory available only for HP units or with Cu/Al coil)

A description of the individual accessories is available in the "Description of accessories" section.

The type of coil treatment should be chosen with regard to the environment in which the unit is to be installed, through observation of other structures and machinery with exposed metal surfaces present in the destination environment.

The cross observation criterion is the most valid method of selection currently available without having to carry out preliminary tests or measurements with instruments. The identified reference environments are:

- coastal/marine
- industrial
- urban with a high housing density
- rural

Please note that in cases where different conditions co-exist, even for short periods, the choice must be suitable for preserving the exchanger in the harsher environmental conditions and not in conditions between the worst and best situation.

Particular attention must be given in cases where an environment that is not particularly aggressive becomes aggressive as a consequence of a concomitant cause, for example, the presence of a flue outlet or an extraction fan.

We strongly suggest choosing one of the treatment options if at least one of the points listed below is verified:

- there are obvious signs of corrosion of the exposed metal surfaces in the installation area
- the prevailing winds come from the sea towards the unit
- the environment is industrial with a significant concentration of pollutants
- the environment is urban with a high population density
- the environment is rural with the presence of organic discharges and effluents

In particular, for installations near the coast, the following instructions apply:

- **for installations between 1 and 20 km from the coast of units with microchannel coil, we strongly recommend using the accessory "E-coated microchannel coils"**
- **for installations between 1 and 20 km from the coast of reversible units or units with Cu/Al coils, is strongly recommended using the accessory "Coil treated with anti-corrosion paints"**
- **for distances within a kilometre of the coast, we strongly recommend using the accessory "Coil treated with anti-corrosion paints" for all units**

To protect the exchangers from corrosion and ensure optimal operation of the unit, we advise following the recommendations given in the user, installation and maintenance manual for cleaning the coils.

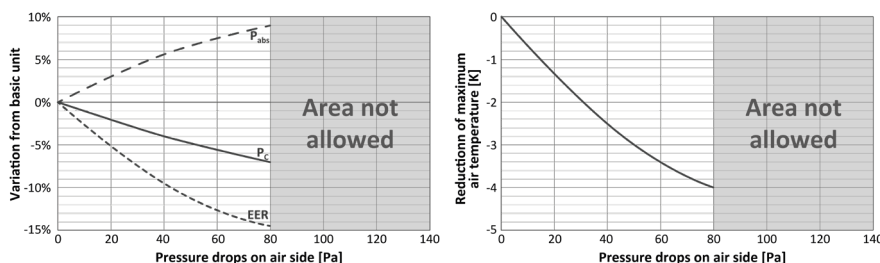
## Aeraulic head losses and options available for the ventilating section

With the exception of units for which oversize fans are required, as standard, the units are designed considering that, at the nominal air flow rate, the fans work with null available pressure.

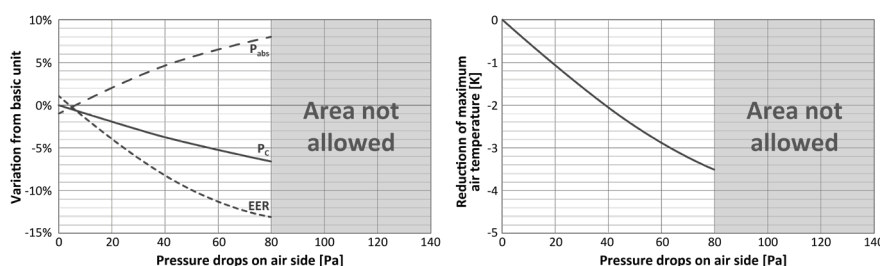
If there are obstacles to free air flow, you should consider the additional aeraulic head losses that will cause a reduction of the air flow rate and a consequent deterioration of performance.

The following diagrams show the trend of cooling capacity (PC), EER, total absorbed power (Pabs) and reduction of the maximum external air temperature in chiller operating mode, depending on the aeraulic head losses that the fans will have to overcome.

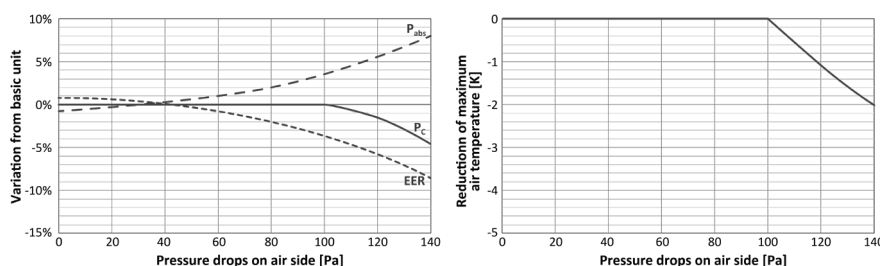
### AC fans (Ø 800)



### EC fans (Ø 800)



### Oversize EC fans (Ø 800)



The indicated values are for the standard machine, without accessories, with AC fans and in any case in the absence of air recirculation.

Example: supposing you expect there to be obstacles that will generate an estimated aeraulic head loss of 60Pa. In this case, there are 3 possibilities:

- use the unit with standard AC fans: compared to ideal conditions, the output power will be reduced by about 5.5%, the total absorbed power will increase by about 7.5%, the EER will be reduced by about 12.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 3.4K compared to the nominal limit
- use the unit with EC fans: compared to the unit with AC fans working in ideal conditions, the output power will be reduced by about 5%, the total absorbed power will increase by about 6.5%, the EER will be reduced by about 11.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 2.8K compared to the nominal limit
- use the unit with oversize EC fans: compared to the unit with AC fans working in ideal conditions, the output power of the unit will be unchanged, the total absorbed power will increase by about 1%, the EER will be reduced by about 2% and the maximum external air temperature will remain the one shown in the diagram of the operating limits.



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