



THERMO-TEC[®]
KLIMAGERÄTE



XVW

**Water-cooled chillers or heat pumps
Air-conditioning, industrial and process control applications**

USER MANUAL

Process-chillers with inverter-driven screw compressors
HFO R1234ze or HFC R134a refrigerants

XVW

Water-cooled chillers or heat pumps Air-conditioning, industrial and process control applications



WARNING

BEFORE USING THE CHILLER READ THIS MANUAL CAREFULLY.



WARNING

Declaration of conformity

The declaration of conformity is attached individually to documents on the unit, generally placed inside the electric panel.

Dear Customer,

Whilst thanking you for having chosen a product of ours, we are pleased to provide this manual for optimal use of our product for better work results.

Please read the recommendations described in the following pages carefully and keep the manual available to personnel who will be responsible for managing and maintaining the chiller.

Our company is at your complete disposal for any and all questions that you should require both in the chiller starting phase and at any time of its utilisation.

Our Technical Department is at your disposal for any assistance and spare parts you may require, especially during routine or special maintenance.

Please find our contact details below for a more rapid service:

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1 - GENERAL DESCRIPTION

1.1 PRECAUTIONS FOR USE

The operating rules contained in this manual are solely applicable for the units Model:

XVW

The instructions manual must be read and used as follows:

- every unit operator and maintenance technician must carefully read the entire manual and comply with that stipulated therein;
- the employer is obliged to ensure that the operator satisfies the aptitude requisites for unit operation and has carefully read the manual;
- read the instructions manual carefully and consider it an integral part of the unit;
- the instructions manual must be readily available to the operating personnel and maintenance technicians;
- keep the manual throughout the life of the unit;
- ensure any update received is included in the text;
- hand the manual to any other user or subsequent owner of the unit;
- use the manual in such a way so as not to damage the contents;
- for no reason whatsoever are parts of the manual to be removed, torn or rewritten;
- store the manual away from humidity and heat;
- if the manual is lost or partially damaged and therefore the contents can no longer be read entirely, it is advisable to request a new manual from the manufacturer.

Pay utmost attention to the following symbols and their meaning. Their purpose is to highlight specific information such as:



WARNING

With reference to additional information or suggestions for the unit to be used correctly.



DANGER

With reference to dangerous situations that could arise while using the unit, in order to guarantee personal safety.



WARNING

With reference to dangerous situations that could arise while using the unit, in order to prevent damaging objects and the unit itself.

1.2 PREAMBLE

The operating rules described in this manual are an integral part of the unit supply.

These rules are also intended for the previously trained operator specifically to operate this type of unit and contain all the necessary and indispensable information for operating safety and optimal, proper use of the unit.

Hurried and incomplete training leads to improvisation, which is the cause of many accidents.

The following recommendations must be read carefully before starting work and strictly complied with:

- the operator must always have the instructions manual at their disposal;
- plan each operation carefully;
- before starting work, make sure the safety devices function correctly and you have no doubts on how they work; otherwise, do not start-up the unit;
- strictly comply with the precautions regarding specific risks referred to in this manual;
- preventive and thorough maintenance guarantees constant enhanced unit operating safety. Never delay repairs and always have them carried out solely by qualified personnel; only original spare parts are to be used.

1.3 LIABILITY

The MANUFACTURER cannot be held liable for any personal accident or damage to property, which may arise from:

- failure to comply with the instructions provided in this manual regarding unit management, use and maintenance;
- violent actions or incorrect manoeuvres when performing maintenance on the unit;
- alterations made to the unit without prior written authorisation from the MANUFACTURER;
- incidents beyond the normal and proper use of the unit.

In any case, if the user attributes the incident to a defect in the unit, they must prove that the damage caused was a main and direct consequence of this “defect”.



WARNING - When installing or servicing the chiller, you must strictly follow the rules provided in this manual, comply with the directions on the units and take all such precautions as are necessary.

- The fluids pressurised in the cooling circuit and the presence of electrical components may cause hazardous situations during installation and maintenance work.
- Therefore, only qualified personnel may perform work on the unit.
- THE UNIT MUST ONLY BE COMMISSIONED BY QUALIFIED PERSONNEL, AUTHORISED BY THE COMPANY PLACING IT ON THE MARKET (SEE ATTACHMENT).
- FAILURE TO COMPLY WITH THE RULES STIPULATED IN THIS MANUAL AND ANY ALTERATION TO THE UNIT WITHOUT PRIOR AUTHORISATION WILL IMMEDIATELY MAKE THE WARRANTY NULL AND VOID.
- Before performing any work on the unit, ensure it has been disconnected from the power supply.
- Only original spare parts must be used for repairs or maintenance operations. THE MANUFACTURER declines all liability for damage deriving from non-compliance with the above-mentioned points.
- The unit is covered by the warranty according to the contractual agreements upon sale.
- However, the warranty is rendered null and void if the regulations and user instructions stipulated in this manual are not complied with.

1.4 INTENDED USE

These machines are designed to cool-heat water and solutions containing up to 35% glycol (percentage by weight) in civil, industrial and technological air-conditioning systems.

Their use is recommended within the functioning limits carried in this manual, or else the warranty attached to the sales contract would cease.

Any other use is to be considered inappropriate and the manufacturer declines all liability for any damage caused to persons, property or the unit that may derive from such use.



DANGER

- Place the unit in environments where there is no risk of explosion, corrosion or fire.
- Make sure that the unit receives a suitable volume of air both in intake and in delivery.
- Improper use could cause serious consequences to the unit.
- All routine and special maintenance operations must be performed with the unit off and

the power supply disconnected.

- Wait about 30 minutes after switching the unit off before performing any maintenance in order to prevent burns.



WARNING

- Before performing any work on the unit, each operator must be perfectly aware of how the unit and its controls work and must have read and understood all the technical information in this manual.

- It is forbidden to use the unit in conditions or for purposes other than those stipulated in this manual and THE MANUFACTURER cannot be liable for faults, issues or accidents due to non-compliance with this prohibition.
- Do not repair the high pressure pipes with welding.
- It is prohibited to tamper with, alter or modify, even partially, the systems or equipment referred to in the instructions manual, particularly the guards provided and symbols regarding personal safety.
- It is also prohibited to operate in any way other than that stipulated or disregard required safety operations.
- Safety guidelines together with general information provided in this manual are particularly important.

1.5 OPERATING LIMITS

Operating limits of XVW chillers or heat pumps in relation to the outlet water temperature and water dew point. For details please contact the local HiRef dealer.

It is possible to produce water at temperatures below 5°C and as low as -10°C using glycol solutions that lower the freezing point according to the following table:

Minimum produced water temperature °C	5	2	-1	-5	-10
Percentage in weight of glycol %	0 %	10 %	15%	25 %	30 %
Mixture freezing temperature	0	-4	- 8	-14	-18

Given an equal volumetric flow rate of water, pressure drops will depend on the percentage of glycol, as shown in the following table:

Percentage in weight of glycol %	0 %	10 %	15%	25 %	30 %
Pressure drop change	0 %	+12%	+21%	+43%	+55%

- thermal carrier: fluid water or mixture glycol+water water and antifreeze mixtures max. 35%
- maximum water operating pressure =10 bar
- Maximum operating P – High pressure side = 18 bar-g versions D-Z, 20 bar-g versions K, 14 bar-g versions C-W
- Maximum operating ambient T = 45°C
- Minimum operating T = -10°C
- Maximum operating P – Low pressure side = 14.0 bar-g (*)
- Supply voltage: = +/- 5% of rating plate voltage
- Maximum stocking T = + 50°C
- Minimum stocking T = -10°C (limit imposed by the built-in electronic components)

(*) this value can be reached only in storage conditions and determines the refrigerant saturation pressure of 16.5 bar-g on the low pressure side of the circuit, a value which in fact defines the limits.

EVAPORATOR WATER FLOW RATE

The nominal flow rate is based on a temperature differential of 5° C between inlet and outlet water, in relation to the cooling capacity provided at the nominal water temperatures. Always refer to the conditions of unit technical selection. The maximum allowed flow rate is associated to the maximum input velocity inside the heat exchanger. Higher flow rate values cause big pressure drops.

The minimum allowed flow rate is associated to the trigger of the safety devices and to ensure turbulent water flow.



WARNING

-It is mandatory to install a metal filter on the inlet water circuit of condenser and evaporator, or else the warranty attached to the sales contract would be nullify. The metal filter has to be provided by the client or it's available as option in the unit supply.

1.6 IDENTIFICATION OF THE UNIT

Each unit features a nameplate affixed to the frame.

MANUFACTURER DATA	
CE 0398	
Modello - Model	XVW702DO
Matricola - Serial number	HF1101026990
Date of production	
Categoria PED/ CE 97/23 Category	IV
Procedura di valutazione conformità - Conformity module	B+D
Massima pressione esercizio - Max working pressure (PS) [bar-g]	20
Max pressione esercizio lato bassa pressione (carcassa compr.)	
Max working pressure low pressure side (compr. shell) [bar-g]	14
Max temp. di stoccaggio - Max storage temperature [°C]	50
Max temp. funzionamento - Max ambient working temperature [°C]	45
Minimum ambient working temp. [°C]	-10
Potenza frigorifera nominale - Nominal Cooling Capacity [kW]	-
Potenza nominale in riscaldamento - Nominal Heating Capacity [kW]	-
Refrigerante - Refrigerant (ASHRAE 15/1992)	R134a
Refrigerant charge [kg]	86
Peso a vuoto - Empty weight [kg]	5360
Taratura press. lato ALTA - HIGH pressure Switch Set [bar-g]	18
Taratura press. lato BASSA - LOW pressure Switch Set [bar-g]	0.5
*Taratura valvola sicurezza refrigerante HP	
Safety valve refrigerant Set HP [bar-g]	20
*Taratura valvola sicurezza refrigerante LP	
Safety valve refrigerant Set LP [bar-g]	14
Alimentazione - Power supply	400/3/50+N
Potenza assorbita Nominale - Nominal power input [kW]	201
Corrente nominale - Nominal absorbed current [A]	333
Corrente massima - Full load ampere FLA [A]	468
Corrente di spunto - Starting Current LRA [A]	543
Schema elettrico - Wiring diagram	HF620A1252S rev./
Schema frigorifero - Refrigeration diagram	HF630A0218 rev./

1.7 GENERAL INSTRUCTIONS



WARNING

- This manual must be read very carefully before transporting, installing, using or servicing the unit.

- It must be stored carefully in a place that is known by the user of the unit, managers and operators in charge of transport, installation, use, maintenance, repairs and final dismantling.

- This manual indicates the intended use of the unit and provides instructions regarding transport, installation, assembly, adjustment and use. It provides information regarding maintenance, ordering spare parts, the presence of residual risks and personnel training.
- It should be noted that the use and maintenance manual can never replace adequate user experience. This manual represents a reminder of the main operations to be performed by operators who have received specific training, for example by attending training courses held by the manufacturer, with reference to particularly demanding maintenance operations.
- This manual is to be considered an integral part of the unit and must be stored near the unit in a special container until the unit is eventually demolished. Request a new copy from the manufacturer if it is lost or deteriorated.
- Ensure all users have thoroughly understood the user instructions as well as the meaning of any symbols on the unit.
- Potential accidents can be prevented by following these technical instructions with reference to the Machinery Directive 2006/42/EC and subsequent amendments.
- In any case, always comply with the national safety regulations.
- Do not remove or damage the safety devices, labels and notices, especially those imposed by law.
- Adhesive labels intended for safer use are applied to the unit, therefore it is very important to replace them should they become illegible.
- This manual reflects the the state of the art at the time the unit is sold and cannot be considered inadequate merely due to subsequent updates based on new experience.
- The MANUFACTURER has the right to update the production and manuals, without being obliged to update previous production and manuals, except for exceptional cases.
- Please call the telephone numbers found in this manual for any requests for updates of the use and maintenance manual or supplements, which are to be considered an integral part of the manual.
- Contact THE MANUFACTURER for further information and to submit any proposals on how to improve the manual.
- THE MANUFACTURER kindly asks you to report the address of the new owner in case of transfer of the unit, in order to facilitate forwarding any supplements of the manual to the new user.

2 - SAFETY REQUIREMENTS

2.1 GENERAL SAFETY RULES

2.1.1 Thoroughly know the unit

The unit must only be used by qualified personnel, who is obliged to be aware of the lay-out and function of all the controls, instruments, indicators, warning lights and various plates.

2.1.2 Wear protective clothing

Every operator must use personal protective equipment such as gloves, helmet, safety goggles, safety shoes and noise protection ear muffs.



2.1.3 Use safety equipment

Place a first aid kit and a fire extinguisher near the unit. The extinguisher must always be fully loaded. Use it according to the Standards in force.



2.1.4 Maintenance and inspection warning signs

Apply an "UNDER INSPECTION" sign on all sides of the unit. Carefully check the unit according to the list of operations specified in this manual.



2.2 GENERAL PRECAUTIONS

The Machinery Directive 2006/42/EC provides the following definitions (attachment 1,1.1.1):

HAZARDOUS AREA: any zone within and/or around machinery in which an exposed person is subject to a risk to their health or safety.

EXPOSED PERSON: any person wholly or partially in a danger zone.

OPERATOR: the person or persons in charge of installing, operating, adjusting, maintaining, cleaning, repairing or moving machinery.



WARNING

- It is mandatory to read and comply with the instructions provided in this use and maintenance manual before performing any operation or maintenance on the unit.

It is too late to do so while working: Persons may be seriously injured and property seriously damaged if operations are performed incorrectly or the unit is not used as intended.

- The employer must provide all operators with accurate details regarding the risk of accidents, especially those deriving from noise, the personal protective equipment provided and the general accident prevention regulations implemented by international laws or regulations or those applicable in the country of use.

All the operators must comply with international accident prevention regulations and those applicable in the country of use in order to prevent potential accidents.

Please note that the European Union has issued certain Directives regarding health and safety of workers, among which: Directive 89/391/EEC, 89/686/EEC, 89/654/EEC, 89/655/EEC, 89/656/EEC, 86/188/EEC, 92/58/EEC and 92/57/EEC, which every employer is obliged to comply with and enforce.

- Before performing any work on the unit, each operator must be perfectly aware of how the unit and its controls work and must have read and understood all the information in this manual.



WARNING

It is forbidden to tamper with or replace parts of the unit not expressly authorised by the MANUFACTURER.

Using accessories, consumables or spare parts other than those recommended by the MANUFACTURER and/or stipulated in this manual can constitute a risk for the operators and/or damage the unit.

Any alteration to the unit that is not specifically authorised by the MANUFACTURER relieves the manufacturing company from any civil or criminal liability.



WARNING

- It is strictly prohibited to remove or tamper with any safety device.

- All routine and special maintenance operations together with any installation must be performed with the unit off and the power supply disconnected.

- Once the unit is cleaned, the operator must ensure there are no worn or damaged parts or others that are not fastened securely; otherwise, a maintenance technician must be asked to intervene.

Particular attention must be paid to the integrity of the pressurised pipes or other components subject to wear. Also make sure there are no leaking fluids or hazardous substances.

Should there be any leak, the operator is prohibited from restarting the unit before having resolved the problem. In the event these issues are observed, the operator must affix a sign on the unit before moving away, thereby indicating that maintenance is in progress and it is prohibited to start it up.

- It is prohibited to use flammable fluids to clean the unit.
- Periodically check the state of the plates and if necessary, replace them.
- The operator's workplace must be kept clean, tidy and free from objects that could hinder movements.
- The operators must not perform awkward operations, in uncomfortable positions, that could affect their balance.
- The operators must pay attention to risks of clothing and/or hair being caught or entangled in moving parts. It is recommended to use a cap to hold long hair.
- Chains, bracelets and rings can also pose a hazard.
- The workplace must be adequately lit up for the intended operations. Insufficient or excessive lighting can pose risks.
- The instructions, accident prevention regulations and warnings provided in this manual must always be complied with.

2.2.1 Safety precautions

The units have been designed and built according to the current state of the art and the technical rules in force relating to fluid chillers, for cooling water or water and anti-freeze mixtures, for air-conditioning, industrial and process control application. Applicable laws, provisions, regulations, decrees and directives to such machinery have been complied with. The materials used and the parts of equipment, as well as production procedures, quality and control assurance comply with the highest standards of safety and reliability.

Unit performance, continuous operation and durability are maintained by using the units for the purposes specified in this user manual, handling them with due care and performing thorough maintenance and up-to-standard service.

2.2.2 Accident prevention safety

The MANUFACTURER cannot be held liable for accidents caused when using the unit, due to the user not complying with laws, provisions, regulations and standards in force regarding fluid chillers.

2.2.3 Operational safety

THE MANUFACTURER cannot be held liable in case of malfunctions and damage if the unit:

- is used for purposes other than those intended;
- is not handled and maintained according to the operating rules specified in this manual;
- is not serviced regularly and continuously as prescribed or non-original spare parts are used;
- is either modified or a component is replaced without written authorisation from the MANUFACTURER, especially when the efficiency of the safety systems is intentionally reduced or eliminated;
- is used beyond the temperature limits allowed.

2.2.4 Residual risk areas



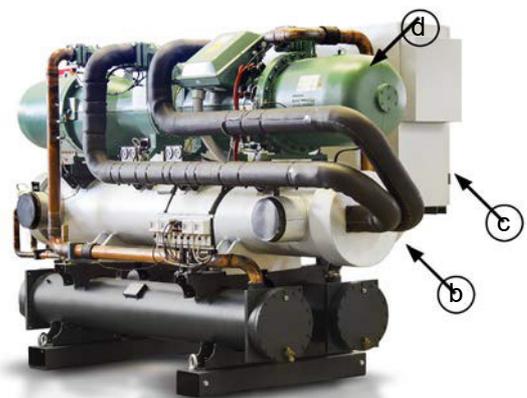
DANGER

It has not been possible to eliminate or protect with guards certain residual risks found in some areas of the unit during the design phase, due to specific features of the unit.

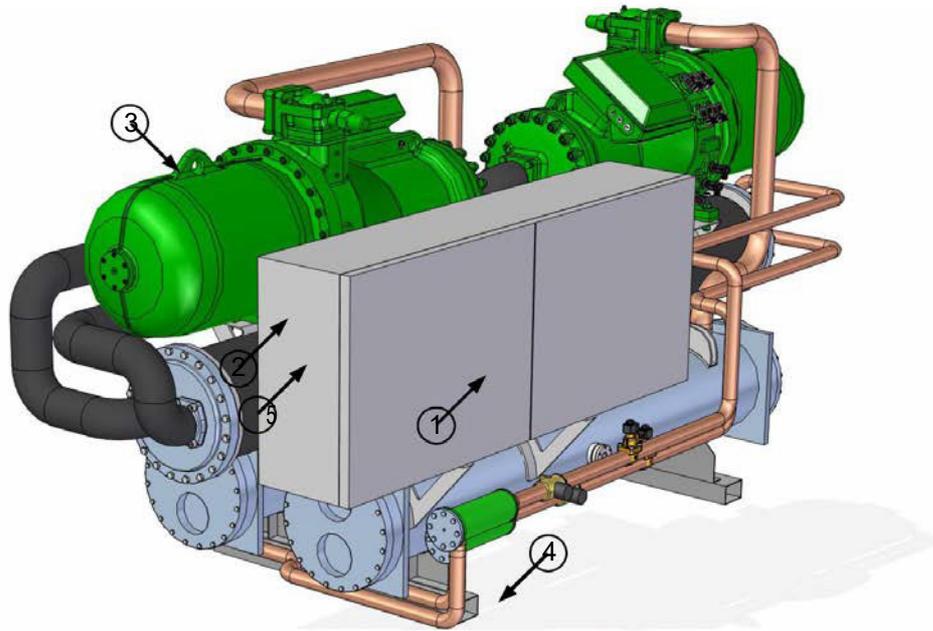
Each operator must be aware of the residual risks on this unit in order to prevent potential accidents.

Residual risk areas:

- a Fire hazard.
- b Risk of explosion due to the presence of pressurised circuits.
- c Risk of pollution due to the presence of refrigerant in the circuit.
- d Risk of burns due to the presence of very hot surfaces.



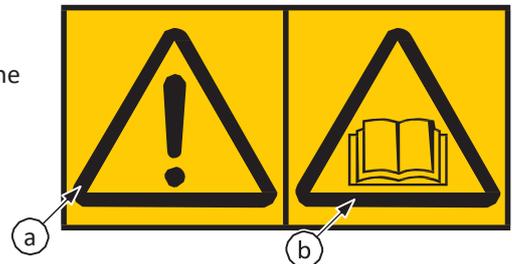
2.3 POSITION OF SAFETY PLATES



2.3.1 Description of the safety plates

1

- a Warning of danger due to the user not being aware of all the functions of the unit and the associated risks.
- b Read the use and maintenance manual carefully before operating the unit.



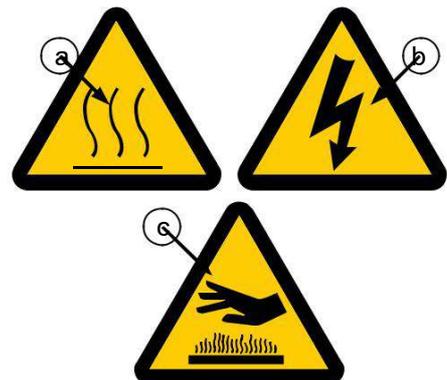
2

Power supply rating plate.



3

- a Danger hot parts.
- b Electric voltage hazard.
- c Scalding hazard.



4

Anchoring points for lifting.

**5**

Liquid refrigerant.

R134a

R1234ze

2.4 GENERAL SAFETY RULES

2.4.1 Care and maintenance

Many accidents and damage are due to maintenance errors, such as:

- lack of water in the circuit;
- incorrect percentage of refrigerant in the circuit;
- inadequate refrigerant;
- failure to keep the unit area clean;
- circuit inefficiency (pipe connections, pipe tightening, screws, etc.). Maintenance must be performed carefully even for personal safety. Never delay repairs.

Only specialised or authorised personnel must perform repairs.

Always comply with the following safety standards, even when you are completely familiar with all the operating elements:

- Always keep the unit and its surrounding area clean.
- Before starting work check that the safety devices are in perfect working condition.
- Ensure that no unqualified or unauthorised persons enter the unit area.

2.4.2 Fire extinguisher and first aid

- Ensure the fire extinguisher is in place.
- Periodically verify that the fire extinguishers are loaded and all operators know how to use them.
- It is important to know where the first aid kit is kept.
- Periodically verify that the first aid kit is equipped with disinfectant, bandages, medicine, etc.
- It is important to know what to do in the event of fire.
- Ensure the emergency telephone numbers are readily available and nearby.

If a fire breaks out, use the fire extinguisher according to the relative regulations in force.

Contact the fire brigade.



WARNING

The owner of the property where the unit is installed is responsible for providing the fire extinguisher.

2.5 MAINTENANCE PRECAUTIONS

2.5.1 Tools

Only use tools recommended by the unit manufacturer, in order to prevent personal injury, do not use worn or damaged, poor quality or makeshift tools.



WARNING

Tools that are not specified or that are modified without permission will void the manufacturer's liability for the damage caused.

2.5.2 Personnel

Routine maintenance specified in this manual must only be performed by authorised and trained personnel. Contact the MANUFACTURER for maintenance or repairs not specified in this manual.

2.5.3 Keeping the unit clean

Stains of oil and grease and scattered tools or broken parts are hazardous as persons can slip or fall. Always keep the unit area clean and tidy.

Do not use diesel or petroleum to clean the unit as they leave an oily layer that increases dust adhesion, and neither solvents must be used (even if weak) as they damage the paint and increase the formation of rust.

If a jet of water penetrates the electrical equipment the contacts oxidise and the unit may malfunction. Therefore, do not use jets of water or steam on sensors, connectors or any electrical part.

2.5.4 Warning signs

Switch the unit off before performing any maintenance. Serious or fatal injury could be caused if other persons start-up the unit and activate the control buttons while maintenance is performed.

Warning signs must be placed around the unit before performing any maintenance in order to prevent such risks.



2.6 REFRIGERANT SAFETY LOGICS

In case the unit is charged with an A2L classified refrigerant, (low flammable refrigerant), the following logics are applied.

2.6.1 Refrigerant leakage safety chain

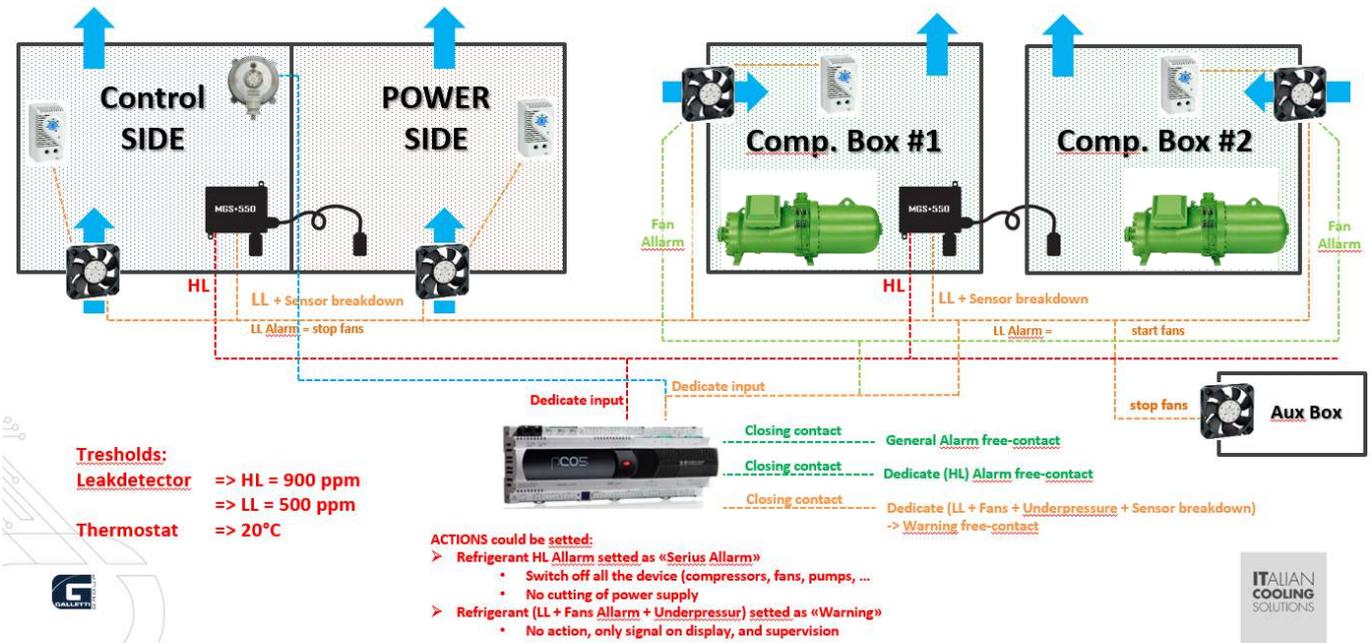
In case the unit is charged with an A2L classified refrigerant, (low flammable refrigerant), the following safety chain is applied.

The unit is provided with one refrigerant leakage sensor inside each compressor box (if present) and inside all separated sections of the electrical box.

Each sensor is set on two different concentration thresholds. The threshold is depending on refrigerant type, and listed in the table below:

Refrigerant	Classification	Low level threshold	High level threshold
R1234ze	A2L	500 ppm	900 ppm

The following image and table describe the safety chain EVENT → ACTION → SIGNAL



EVENT	ACTION	SIGNAL
Compressor box fan alarm/fault	No actions	Dedicated warning signal
Underpressure inside electrical panel alarm/fault	No actions	Dedicated warning signal
Low level alarm	No actions	Dedicated warning signal
Refrigerant sensor fault	No actions	Dedicated warning signal
High level alarm	Switch off all the unit	General serious alarm + Dedicated serious alarm

2.6.2 Electrical box fans management

The unit is provided with integrated radial fans installed and wired inside the two different electrical box sections. The fans are installed on inlet mouth and keep the electrical box pressurized. The radial type fans allow to connect a duct to the electrical box air inlet. The duct provides clean air for electrical components cooling, in order to avoid any contamination with eventual refrigerant leakage inside installation room.

Available pressure head of each fan:

- Fan installed on power side (inverter): 350 Pa
- Fans installed on control side: 250 Pa

The fans are management by the unit controller according to the following logic:

- The fans are activated/deactivated according to thermostats installed inside the electrical box sections. The fans are started when the thermostats detect a temperature value higher than the set (25°C). The fans are stopped when the thermostats detect a temperature value lower than the set (25°C).
- In case one of the refrigerant sensors detect an High Level alarm (High threshold concentration), the radial fans are started at maximum speed, independently from thermostats signal

In case the cooling air for electrical box can be polluted by refrigerant, it is necessary to blow the cooling air inside the electrical box using an external fan installed on the initial mouth of the duct.

3 - DESCRIPTION AND TECHNICAL DATA

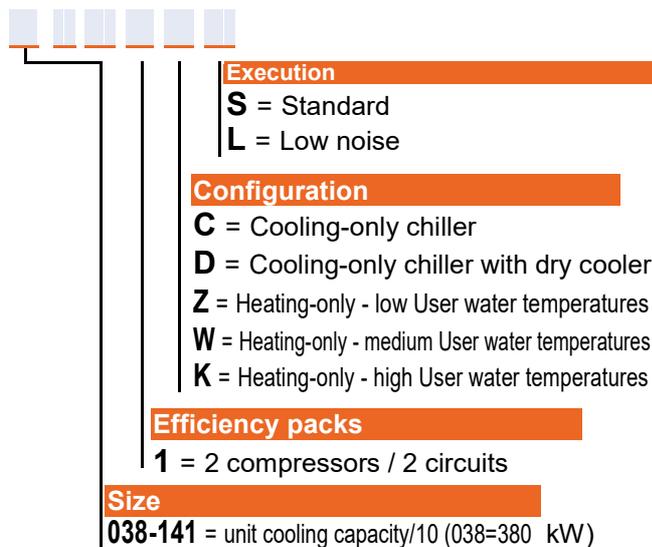
3.1 THE SERIES

3.1.1 Cooling-only or heating-only

The XVW series of water-condensing chillers/heat pumps includes this range of models:

- XVW C water-water chillers – cold water only (cooled by evaporative turret or well)
- XVW D water-water chillers – cold water only (cooled by Dry-Cooler)
- XVW Z water-water heat pump - only heating - low User water temperatures
- XVW W water-water heat pump - only heating - medium User water temperatures
- XVW K water-water heat pump - only heating - high User water temperatures

XVW chillers and heat pumps are available in versions with different acoustic designs (“S” standard , “L”, low noise).



XVW unit configuration example:
XVW0381CL

3.1.2 Structure

All XVW units have a self-supporting base. The unit features an exclusive design which lends it an attractive appearance. This characteristic, together with the extensive use of soundproofing material – an optional feature of low-noise models – reduces noise to exceptionally low levels.

3.1.3 Cooling circuit

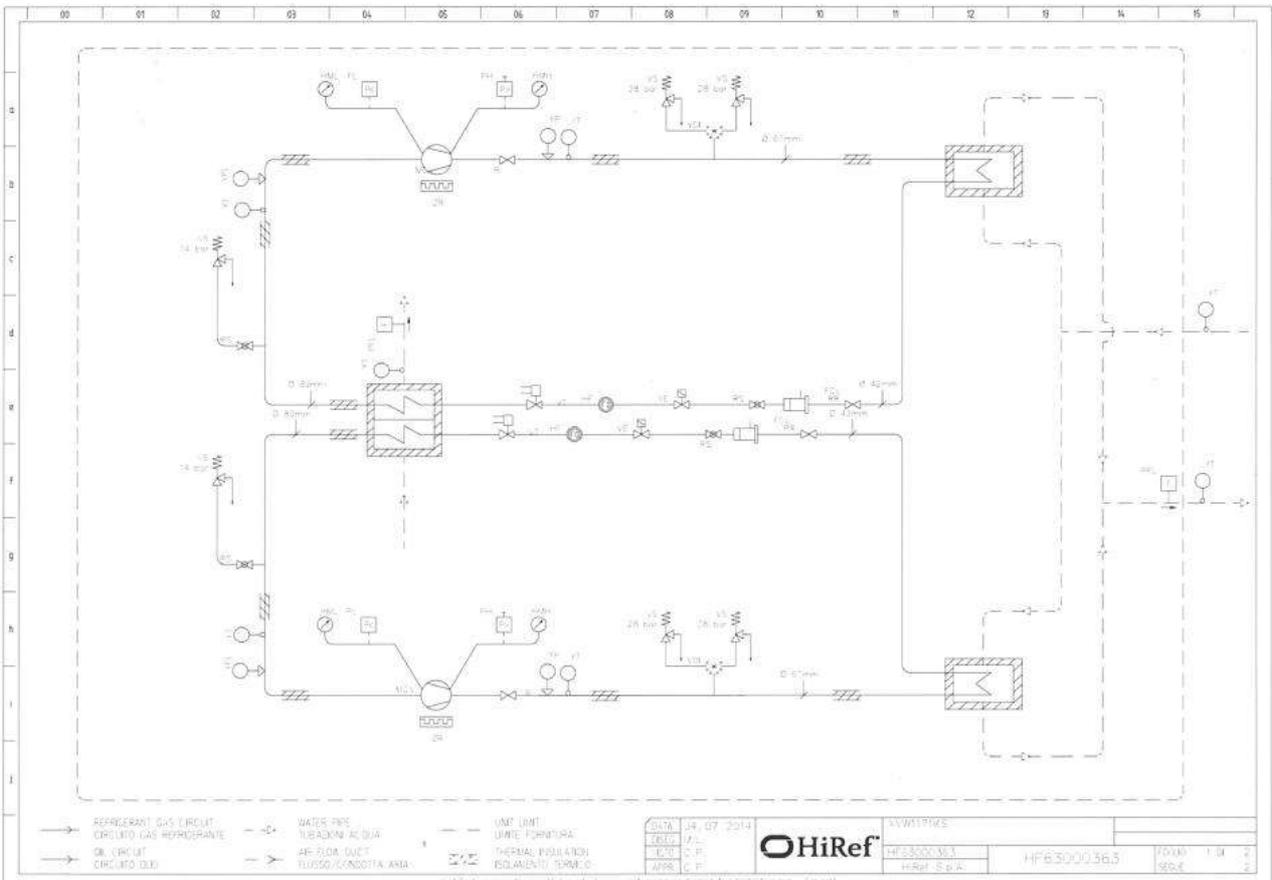
The entire cooling circuit is built in the manufacturer factory using only components of the finest quality brands and processes conforming to the specifications of Directive 97/23 for brazing. The chillers are built with a single cooling circuit using only components supplied by leading international manufacturers

Compressor: n° 2 semi-hermetic double screw compressor optimized for refrigerant R314a. Integrated oil separator. Integrated protection module with thermistor, oil sensor. POE oil charge included. Sectioning taps on discharge
Evaporator : n°1 double circuit DX shell and tube evaporator, optimized for maximize the heat transfer capacity (pure countercurrent of the flows) using R134a. Insulation included on the delivery. Victaulic connection on water side. Electronic expansion valve for each circuit

Security device : High pressure switch with fixed set and manually restart, low pressure switch with fixed set and manually restart. Paddle flow switch with manually restart. Compressors thermal protection (magnetothermal as option)

Electric panel : PLC controller, one power supply with door lock switch. Magneto-thermal protection for auxiliary. IP55 protection grade.

XVW - VERSIONS: COOLING-ONLY, HEATING- ONLY



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
a	MC	COMPRESSORE SCROLL COMPRESSOR	VD	VALVOLA A TRE VIE THREE WAY VALVE	PLC	PRESOSTATO BASSA PRESSIONE FUNZIONALE LOW PRESSURE SWITCH	HF	SPA PASCIZIONE LIQUORI LIQUID SIGHT GLASS	VRA	VALVOLA DI PRESSIONE ACQUA WATER SAFETY VALVE						
b	MCS	COMPRESSORE SCROLL SCROLL COMPRESSOR	VDW	VALVOLA A 3 VIE ACQUA THREE WAY WATER VALVE	FDC	PRESOSTATO DIFFERENZIALE OLIO OIL PRESSURE SWITCH	HL	SPA LIVELLO LIQUORI LIQUID LEVEL SIGHT GLASS	VF	VALVOLA A FARFALLA BUTTERFLY VALVE						
c	MCV	COMPRESSORE A VITE SCREW COMPRESSOR	RS	SUBNETTO A SFERA BALL VALVE	PFL	FLUSSOSTATO ACQUA WATER FLOW SWITCH	HM	MANOMETRO MANOMETER	VSA	VALVOLA SICUREZZA ACQUA WATER SAFETY VALVE						
d	MCP	COMPRESSORE SEMIAUTOMATICO SEMI-AUTOMATIC COMPRESSOR	RR	RUBINETTO ROTAZIONE ROTALOCK VALVE	PV	SENSORE LIVELLO LIQUORI LIQUID LEVEL SWITCH	HMH	MANOMETRO ALTA PRESSIONE HIGH PRESSURE MANOMETER	AE	VASO D'ESPANSIONE EXPANSION VESSEL						
e	MCE	COMPRESSORE ERMETICO HERMETIC COMPRESSOR	RC	RUBINETTO A CAPPILLOTTA VALVE	YPH	TRASDUTTORE ALTA PRESSIONE HIGH PRESSURE PROBE	HML	MANOMETRO BASSA PRESSIONE LOW PRESSURE MANOMETER	RSA	RUBINETTO A SFERA ACQUA WATER BALL VALVE						
f	MP	POMPA ACQUA WATER PUMP	SL	RICEVITORE DI LIQUORI LIQUID RECEIVER	YPL	TRASDUTTORE BASSA PRESSIONE LOW PRESSURE PROBE	HMD	MANOMETRO OLIO OIL MANOMETER	-	-						
g	MV	VENTILATORE FANS	SD	RICEVITORE OLIO OIL RECEIVER	YT	SONDA TEMPERATURA TEMPERATURE PROBE	HMW	MANOMETRO ACQUA WATER MANOMETER	-	-						
h	VS	VALVOLA DI SICUREZZA SAFETY VALVE	SP	SEPARATORE OLIO OIL SEPARATOR	EC	CONDENSATORE CONDENSER	NO	REGOLATORE MECCANICO LIVELLO OLIO OIL LEVEL REGULATOR	-	-						
i	VR	VALVOLA DI PRESSIONE SHUTOFF VALVE	SA	SEPARATORE LIQUORI LIQUID SEPARATOR	ECV	CONDENSATORE AD ARIA AIR CONDENSER	NDE	REGOLATORE ELETTRONICO LIVELLO OLIO ELECTRONIC OIL LEVEL REGULATOR	-	-						
j	VT	VALVOLA TERMOSTATICA EXPANSION VALVE	FD	FILTRO DEGRASSANTE REFRIGERANT FILTER	ECF	CONDENSATORE A FASCIO TUBERIO ...	ZT	TUBO ANTIRIBRANTE ...	-	-						
k	VTW	VALVOLA TERMOSTATICA ACQUA THERMOSTATIC WATER VALVE	FDA	FILTRO DEGRASSANTE A CARTRIDGE CARTRIDGE FILTER	ECP	CONDENSATORE A PIASTRE PLATE CONDENSER	ZR	RESISTENZA CARATTER CRAMIC HEATER	-	-						
	VTE	VALVOLA ESPANSIONE ELETTRONICA ELECTRONIC EXPANSION VALVE	FO	FILTRO OLIO OIL FILTER	EE	EVAPORATORE EVAPORATOR	ZS	SILENZIATORE MUFFLER	-	-						
	VTL	VALVOLA INIEZIONE LIQUORI LIQUID INJECTION VALVE	PH	PRESOSTATO ALTA PRESSIONE SICUREZZA SAFETY HIGH PRESSURE SWITCH	EEV	EVAPORATORE AD ARIA AIR EVAPORATOR	ZA	ATTACCO CARICA GAS CONNECTION	-	-						
	VTG	VALVOLA INIEZIONE GAS CALDO HOT GAS INJECTION VALVE	PL	PRESOSTATO BASSA PRESSIONE SICUREZZA SAFETY LOW PRESSURE SWITCH	EEF	EVAPORATORE A FASCIO TUBERIO ...	SPV	Presostato alta pressione High pressure switch	-	-						
	VE	VALVOLA SICUREZZA SAFETY VALVE	PHV	PRESOSTATO ALTA PRESSIONE FUNZIONALE HIGH PRESSURE SWITCH	EEP	EVAPORATORE A PIASTRE PLATE EVAPORATOR	VDP	VALVOLA DIFFERENZIALE PRESSIONE PRESSURE VALVE SWITCH	-	-						

XVW - VERSIONS: COOLING-ONLY, HEATING- ONLY

3.1.4 XVW C-D technical data table

		381	441	541	651	801	931	1051	1171	1171	1411
Cooling Capacity*	kW	372	432	536	647	793	923	1049	1169	1262	1401
Compressors' Power Input	kW	77.7	88.6	108.3	135	164.8	185.1	207.8	234.9	264.1	293.0
EER*	-	4.79	4.88	4.95	4.79	4.81	4.99	5.05	4.98	4.78	4.78
User side Water Flow	m ³ /h	63.9	74.4	91.7	110.8	135.8	158	180.4	200	216.3	240.17
Source side Water Flow	m ³ /h	77.0	89.2	110.3	133.9	164	189.8	215.2	240.4	261.4	294.6
Compressors/refrigerating circuits	-	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Sound power level (standard version)**	dB(A)	91	91	95	96	96	96	96	97	98	102
Sound power level (low noise version)**	dB(A)	87	87	91	92	92	92	92	93	94	98

* Water temperatures User side 12/7°C, water temperatures source side 30/35°C according to Eurovent standards

** Base unit without options

		341	481	581	701	831	941	1051	1131	1211
Cooling Capacity*	kW	332	472	579	696	822	935	1042	1127	1236
Compressors' Power Input	kW	95.9	133.2	170.6	201.2	225.7	262.7	295.8	336	360.2
EER*	-	3.46	3.54	3.39	3.46	3.64	3.56	3.52	3.35	3.43
User side Water Flow	m ³ /h	56.8	8038	99.1	119.2	140.7	160.5	178.5	193	211.9
Source side Water Flow	m ³ /h	73.3	103.6	128.4	153.7	179.4	205.1	229.1	250.6	294.7
Compressors/refrigerating circuits	-	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Sound power level (standard version)**	dB(A)	91	97	96	96	96	97	98	99	103
Sound power level (low noise version)**	dB(A)	87	83	82	82	82	83	84	85	89

* Water temperatures User side 12/7°C, water + 35% eth. glycol temperature source side 40/45°C according to Eurovent standards

** Base unit without options

3.1.5 XVW Z-W technical data table

		441	501	621	751	911	1061	1201	1341	1461	1631
Heating Capacity*	kW	432	498	613	745	909	1052	1191	1332	1451	1621
Compressors' Power Input	kW	78	88	108	134	163	184	207	233	263	292
COP*	-	5.56	5.63	5.69	5.56	5.57	5.72	5.76	5.72	5.52	5.54
User side Water Flow	m ³ /h	74.2	85.7	105.5	128.2	156.3	181.0	204.9	229.0	249.5	278.8
Source side Water Flow	m ³ /h	63.9	74.4	91.7	110.8	135.8	158.0	180.4	200.0	216.3	240.9
Compressors/refrigerating circuits	-	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Sound power level (standard version)**	dB(A)	91	91	95	96	96	96	96	97	98	102
Sound power level (low noise version)**	dB(A)	87	87	91	92	92	92	92	93	94	98

* Water temperatures User side 30/35°C, water temperatures source side 10/5°C

** Base unit without options

XVW - VERSIONS: COOLING-ONLY, HEATING- ONLY

		411	581	721	861	1001	1141	1281	1391	1541
Heating Capacity*	kW	407	577	712	856	995	1137	1271	1389	1531
Compressors' Power Input	kW	94	130	166	196	219	256	287	328	354
COP*	-	4.33	4.44	4.28	4.37	4.54	4.45	4.44	4.23	4.33
User side Water Flow	m ³ /h	70.1	99.2	122.5	147.1	171.2	195.6	218.7	239.0	263.3
Source side Water Flow	m ³ /h	56.8	80.8	99.1	119.2	140.7	160.5	178.5	193.0	212.0
Compressors/refrigerating circuits	-	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Sound power level (standard version)**	dB(A)	91	97	96	96	96	97	98	99	103
Sound power level (low noise version)**	dB(A)	87	83	82	82	82	83	84	85	89

* Water temperatures User side 40/45°C, water temperatures source side 10/5°C

** Base unit without options

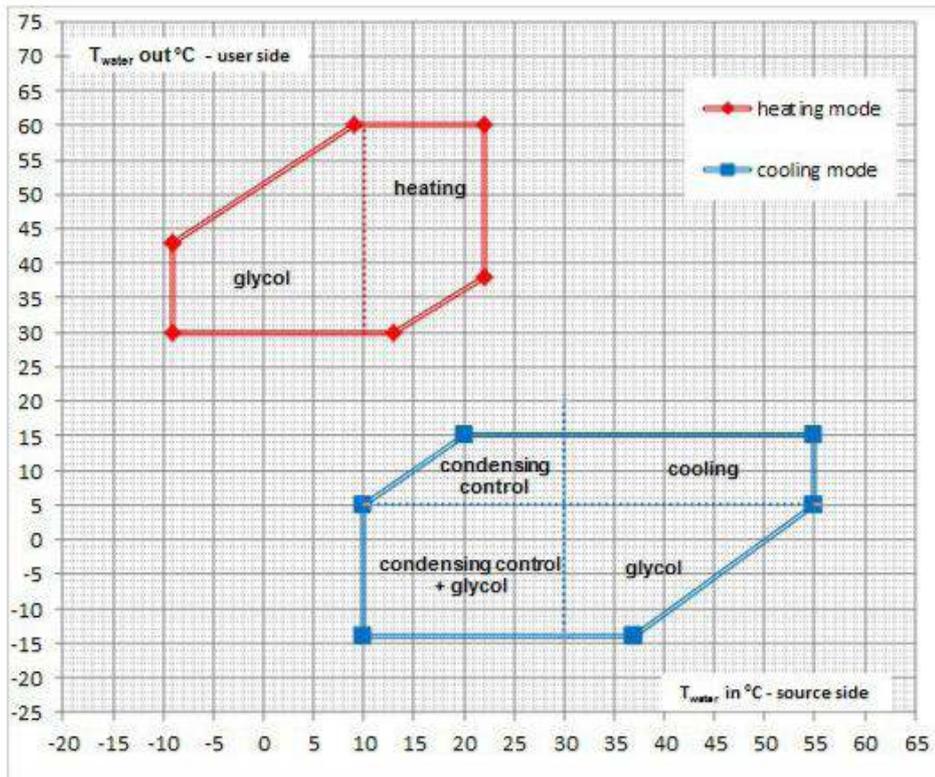
3.1.6 XVW K technical data table

		411	581	751	771	871	1001	1151	1311	1441
Heating Capacity*	kW	415	585	722	767	869	1002	1144	1303	1435
Compressors' Power Input	kW	146	206,8	259,2	260,4	294,8	332,6	373,8	422	496
COP*	-	2,84	2,83	2,79	2,94	2,95	3,01	3,06	3,09	2,89
User side Water Flow	m ³ /h	71.3	100.5	124.2	131.8	149.5	172.3	196.8	224.1	246.9
Source side Water Flow	m ³ /h	47.4	66.4	81.6	89.0	101.1	118.0	134.6	154.7	165.4
Compressors/refrigerating circuits	-	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Sound power level (standard version)**	dB(A)	91	97	96	96	96	97	98	99	103
Sound power level (low noise version)**	dB(A)	87	93	92	92	92	93	94	95	99

* Water temperatures User side 60/65°C, water temperatures source side 15/10°C

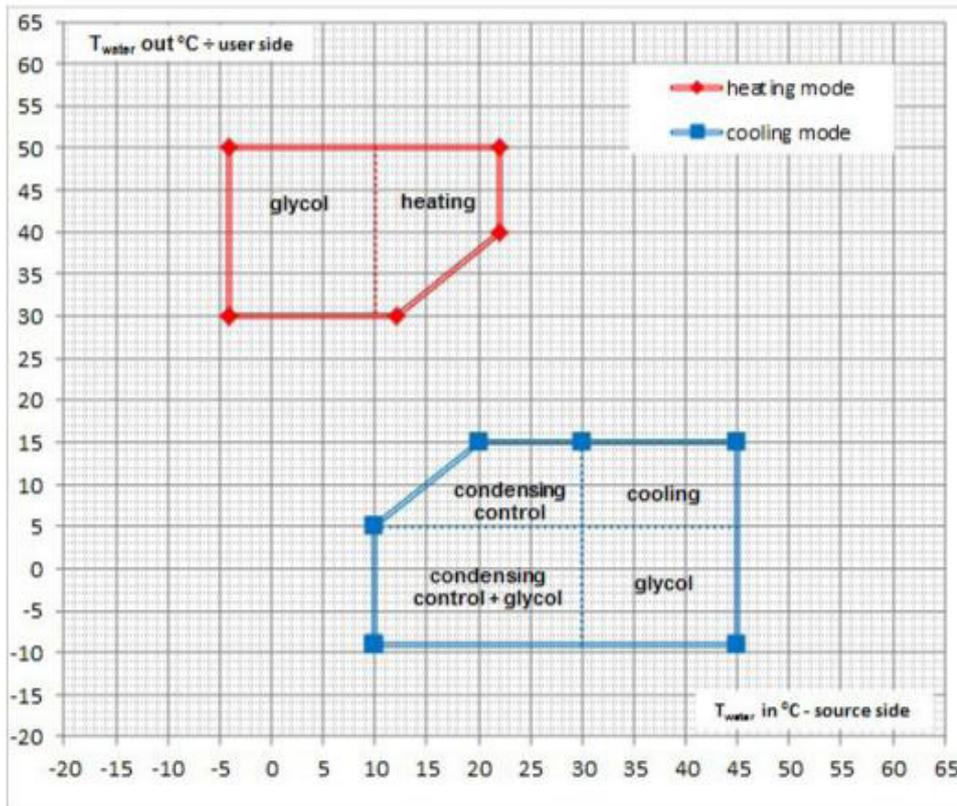
** Base unit without options

3.1.7 XVW D-W operation restrictions

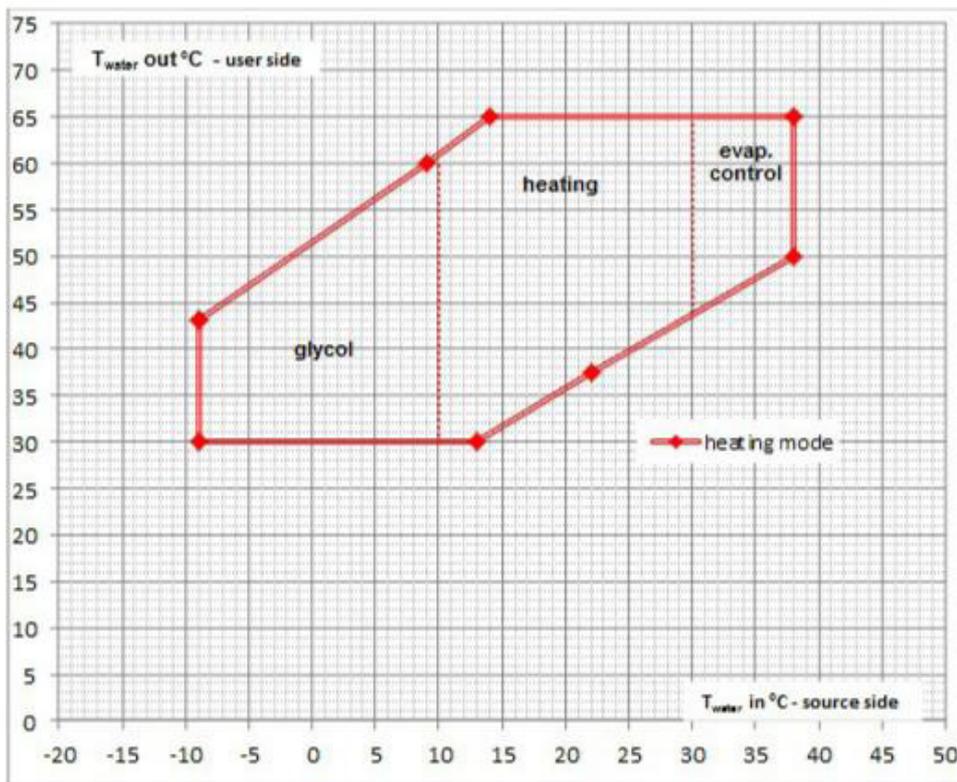


XVW - VERSIONS: COOLING-ONLY, HEATING- ONLY

3.1.8 XVW C-Z operation restrictions

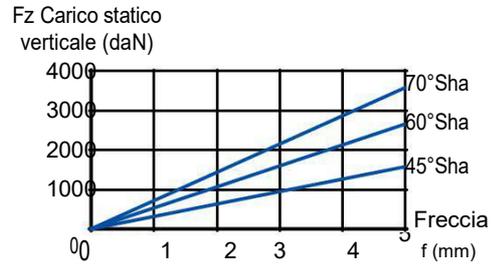
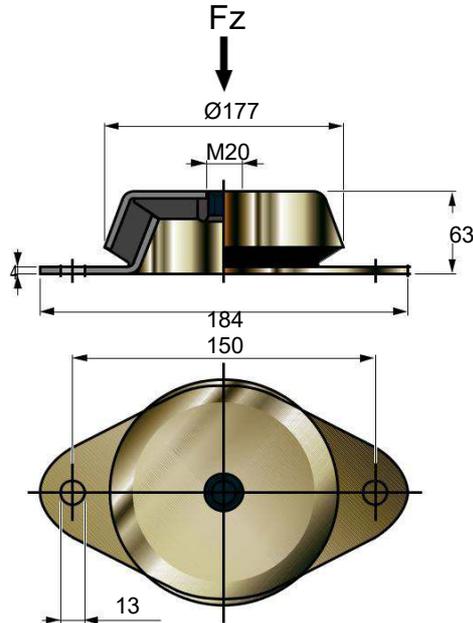


3.1.9 XVW K operation restrictions



Rubber anti-vibration devices

Upon request, XVW units can be fitted with the rubber anti-vibration devices with a hardness value of 70°Shore:



°ShA	45	60	70
Fz max amm. (daN)	1000	1500	2100

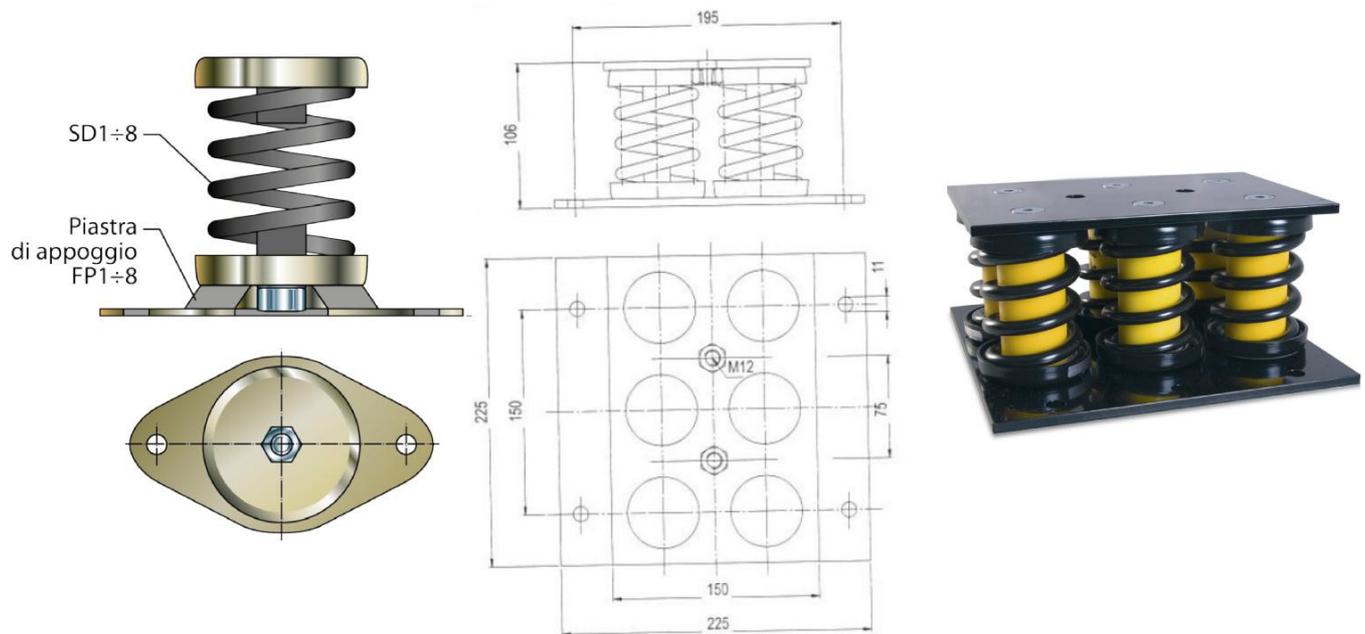


Spring anti-vibration devices

Upon request, XVW units can be fitted with the spring anti-vibration devices below:

Item	Nominal loads
ISOTOP BL 6	848 ÷ 1580 kg

The natural frequency (ne) varies from 4 to 6 Hz (230 ÷ 360 cycles/min.).



WARNING For the exact position of every pin please refer to the dimensional drawing enclosed.

4 - INSPECTION, TRANSPORT AND POSITIONING

4.1 INSPECTION

The machine left the factory in perfect conditions, however when receiving the unit verify its integrity. Immediately report any damage to the carrier and write it down on the Delivery Note before signing it.

The manufacturer or its agent must be promptly notified of the extent of the damage.

The Customer must submit a written report describing any significant damage.

- commissioning report,
- wiring diagram,
- warranty certificate and list of service centres,
- check the integrity of the documents accompanying the unit and of this manual.

4.2 LIFTING AND CONVEYANCE

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. Be very careful when transporting it inside rooms. Do not use the unit components as anchors.

The unit must be lifted using the four lifting eyes located on the base frame of the unit.

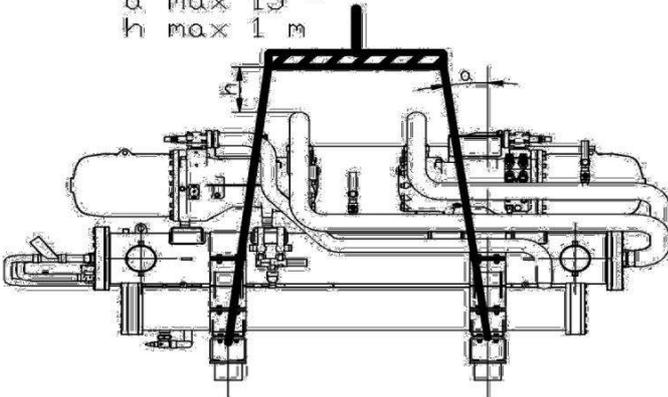
Use ropes or belts long enough to extend beyond the height of the machine. Place spacer bars and boards on top of the unit to avoid damaging the sides and the top of the unit. The rectangular holes are provided for the attachment of vibration damping supports (optional).



a eyebolts

BILANCINO QUADRILATERO DI SOLLEVAMENTO /
LIFTING FOUR SIDED BAR

α max 15°
h max 1 m



WARNING

During all lifting operations make sure the unit is firmly anchored, to prevent it from tilting or falling.

4.3 UNPACKING

The packaging must be carefully removed to prevent damaging the unit. The packaging consists of various materials: wood, cardboard, nylon, etc.

It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.

4.4 SITING

Pay attention to the following aspects when choosing the best place to install the unit and the relative connections:

- size and origin of water pipes;
- location of power supply;
- accessibility for maintenance or repairs;
- solidity of the supporting surface;
- right ventilation in the area (taking account the maximum ambient working temperature)

It is advisable to place a rigid rubber strip between the base frame and the supporting surface.

Whenever more effective insulation is required, it is recommended to use vibration-damping rubber or spring supports. In the case of installation on roofs or intermediate storeys, the unit and pipes must be insulated from walls and ceilings by placing rigid rubber joints in between and using supports that are not rigidly anchored to the walls. If the unit is to be installed in proximity to private offices, bedrooms or areas where noise levels must be kept down, it is advisable to conduct a thorough analysis of the sound field generated and verify its compatibility with the local laws in force.

5 – INSTALLATION



WARNING

The unit has to be installed inside a service room, certified as a Machinery Room according to the EN378-2016:

Machinery Room Requirements for A2L refrigerants:

- Install an A2L flammable rated air monitor capable of detecting the refrigerant(s) used in concentrations up to the 25% LFL and activate external alarm reachable from outside of the equipment room.
- Route relief valve discharge headers and purge units outdoors, away from all air intakes to building or per local codes and regulations.
- Install local exhaust to ventilate the work area in the event that the air monitor alarm point is exceeded per local codes and regulations.
- Avoid any contact between refrigerant and surfaces at temperature > 80% auto ignition
- Provide escape in case of refrigerant charge > volume x practical limit

Refer to the complete EN 378-21016 for complete description.

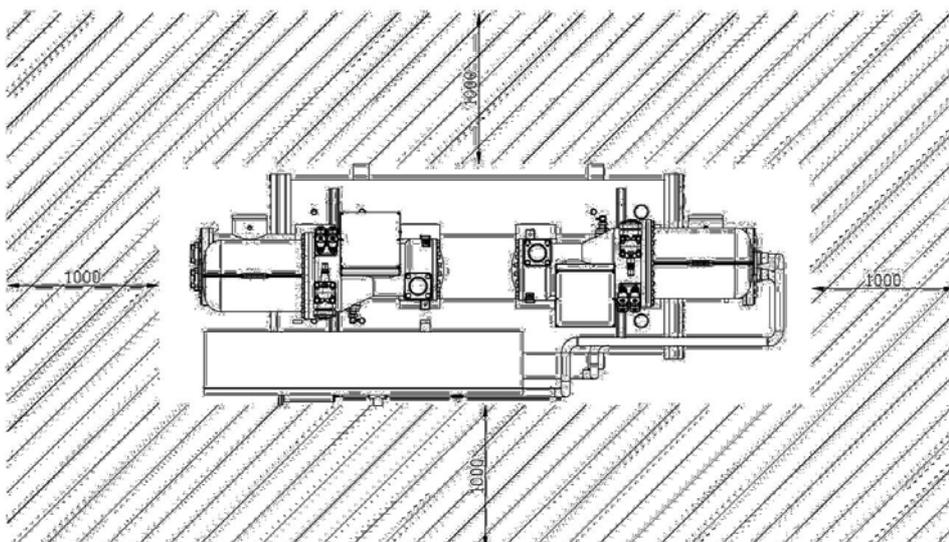
5.1 INSTALLATION CLEARANCE REQUIREMENTS

In the case of units with a remote condenser, the plumbing and cooling connections are provided on the top of the unit. This allows the chiller to be placed practically against the rear wall. It is nonetheless of fundamental importance to assure the following service spaces:

- back side: min. 1 metres (except the 2 last sizes)
- electric control board side: min. 1.0 metre to guarantee access for inspection and/or maintenance of cooling components
- lateral part: min. 1 metre for extraordinary maintenance and for the water piping connection
- top side: min. 1.0 metre for adequate connection to the external hydraulic and cooling piping.

In some special applications these quote can be changed according to the technical office.

Top view of the unit



5.2 GENERAL RECOMMENDATION FOR WATER CONNECTIONS

- Fit the piping to the cooler with flexible joints to dampen vibrations and to compensate thermal expansion. These units are all configured for installation of the water inlet-outlet pipes outside the unit (on the rear) and these pipes are supplied as a standard accessory at no extra cost for the customer.

It is recommended to install the following components on the piping:

- pair of quick connect couplings with pipe section to be welded (a) (optional that may be selected from the price list). They facilitate the operations of connecting to the plumbing system, greatly speeding up installation.
- temperature and pressure indicators for routine maintenance and inspections of the unit. Pressure control on the water side allows expansion vessel operation to be checked and any water leaks in the system to be detected in advance.
- sumps on inlet and outlet piping for measuring temperatures, and for directly viewing the operating temperatures. Temperature readings can in any case be obtained from the microprocessor installed on the unit.
- regulating valves (gate valves) for isolating the unit from the water circuit.
- mandatory metal net filter (inlet piping) with mesh no larger than 1 mm, to protect heat exchanger from slag or impurities inside the piping.

If the machine is combined with processing cycles, it is a good idea to install a decoupling heat exchanger (which can be inspected), in order to prevent likely operation blocks and/or plate evaporator breakages.



5.3 WATER CONNECTION TO EVAPORATOR



WARNING

It is extremely important that the water inlet is connected at the height of the “Water Inlet” sign.

If not, the evaporator would be exposed to the risk of freezing, since the anti-freeze thermostat would not be able to perform its function. Furthermore, in the cooling mode, countercurrent circulation would not be activated.

The dimensions and position of plumbing connections are shown in the dimension tables in this manual.



WARNING

- The water circuit must guarantee a constant nominal flow rate of water (+/- 15%) to the evaporator in all operating conditions.

- A standard feature of XVW units is a device for controlling the flow rate (paddle flow switch) in the water circuit in the immediate vicinity of the evaporator.

Any tampering with this device will immediately invalidate the warranty.

It is compulsory to install a metal filter with a mesh smaller less 1mm on the inlet water pipe.

- It is strongly recommended to install a safety valve in the water circuit. In the event of serious equipment faults (e.g. fire) it will enable water to be drained from the system, thereby preventing possible bursts. Always connect the drain outlet to a pipe with a diameter at least as large as that of the valve opening and direct it toward an area where the discharge of water cannot harm people.



DANGER

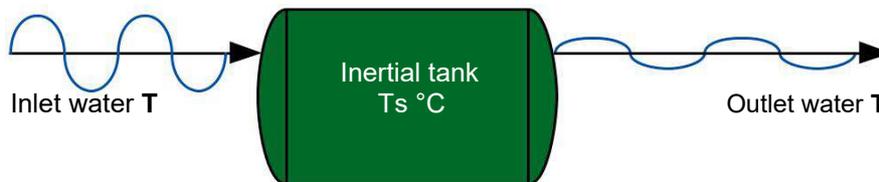
Never perform hydraulic connection operations with open flames near or inside the unit.

XVW - VERSIONS: COOLING-ONLY, HEATING- ONLY

The compressors often work intermittently, since the chilling requirements of the user generally do not coincide with the output of XVW unit. In systems containing little water, in which the thermal inertia is low, verify that the water content of the delivery section (to users) satisfies the equation below:

$$V = \frac{C_c \times \Delta T}{\rho \times Sh \times \Delta T \times N_s}$$

V	= water content in user section	[m ³]
Sh	= specific heat of the fluid	[J/(kg/°C)]
ρ	= density of the fluid	[kg/m ³]
ΔT	= minimum times between 2 start-ups of the compressors	[s]
ΔT	= permitted difference in water T	[°C]
C _c	= Cooling Capacity	[W]
N _s	= N° of capacity control steps	



5.4 PROCEDURE FOR FILLING THE TANK



WARNING

The tank is not designed to withstand vacuum pressures greater than -0.15 Bar. For this reason, make sure that the pressure on the pump intake side, where the expansion vessel is positioned, is always above 0.5 Bar with pump running. This helps reduce the risk of cavitation.

It is extremely important that the installer follows and verifies this procedure step-by-step to prevent the risk of tank implosion or pump cavitation:

- Drain the expansion vessel until the pressure reaches 0.5 bar
- Fill the system and pressurise it to approximately + 1 Bar in pump suction (pump stopped)
- Bleed the system
- Check the pump suction pressure (approximately 1 Bar) and start up the system
- Stop the pump after 15-30 minutes and repeat the procedure from step c) until you can no longer hear any noises caused by the presence of air in the system.

5.5 SAFETY DEVICES ON THE HIGH PRESSURE SIDE

Cooling circuit safety devices are provided on each refrigerant circuit according to the volumetric capacity of the compressors installed, the PED category of the machine, the layout of the refrigerant circuit as prescribed by Directive 97/23 (PED); in particular, with respect to equipment design, this Directive requires manufacturers to abide by the technical standard nearest to the type of object produced; in the case of chillers designed for air-conditioning or liquid cooling systems, standard UNI EN 378-2 is taken into consideration.

According to this standard, two security relief valves connected to an exchange cock are insert on the high pressure side of each refrigerant circuit and setted at the maximum PS pressure on high pressure side. Another single security relief valve is insert on the low pressure side of each refrigerant circuit and setted at the maximum PS pressure on low pressure side. The high pressure side and low pressure side maximum pressure value PS represent the upper limit pressure of the components installed on the machine; this pressure value can't reach during normal operation of the machine. For more detail refer to the refrigerant scheme of the unit.

During the normal operation the high pressure on the discharge side of the compressor is limited by the high pressure switch, setted on the maximum working pressure of the compressor, that depends on the model of the unit and is lower than PS x 0.9, in compliance with standard UNI EN 378-2

6 - ELECTRIC CONNECTIONS

6.1 GENERAL INFORMATION


DANGER

Before carrying out any operation on electrical parts, make sure that the power supply is disconnected.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.

The power connection is made by means of a three-core cable plus neutral and earth cable or single -core cables (one per phase) + earth according to the minimum cross section sizes specified in the wiring diagram, which is an integral part of the documentation accompanying the chiller; the diagram code also appears on the rating plate inside the compressor compartment.


WARNING

The size of the cable and line protections must conform to the specifications provided in the wiring diagram.

The supply voltage may not undergo fluctuations exceeding $\pm 5\%$ and the unbalance between phases must always be below 2%.


WARNING

The machine must operate within the above values, or the warranty will be invalidated.

Carry out the electrical connections following the wiring diagram provided with the unit, as well as current regulations.

Electrical connections and preliminary checks:

- Put on the main switch, turn the $\frac{1}{2}$ -turn locking screws of the electric enclosure and open it.
- Insert the power cable 400/3/50+N through the hole provided on the left side of the unit (after first removing and making a hole in the aluminium square based on the diameter of the electric cable) and secure it with a cable gland.
- Connect the power supply and earthing wire to the terminals of the main switch.
- Open the fuse carriers F1 and F2 (or Q1 and Q2 for the motor overload cutouts) of the compressors to prevent them from starting up in the wrong direction in the event of an incorrect phase sequence.
- Switch on the power supply by turning the main switch (QS) to ON.
- Verify whether the phase sequence R-S-T is correct by checking, on the phase sequence relay situated in the middle of the electric control board, that the green power on LED and yellow LED indicating the correct sequence both light up; if this does not occur, disconnect the chiller power supply from the external distribution panel and swap over two phases; then repeat the operation. **IN NO CASE SHOULD YOU TAMPER WITH THE WIRING DOWNSTREAM FROM THE MAIN SWITCH** since this may alter the correct sequence of other devices, e.g. pump(s).
- Close the fuse carriers F1 and F2 of the compressors
- Close the electric enclosure and lock it by means of the $\frac{1}{2}$ - turn locks.

An earth connection is required by law. The installer must connect the earthing wire with the earthing terminal on the electric panel (yellow and green wire).

The power supply to the control circuit is shunted from the power line through an insulating transformer situated on the electric control board.

The control circuit is protected by suitable fuses.

A standard feature of all units is a phase sequence relay that verifies the correct phase sequence; this is necessary to assure that the chiller is completely functional before enabling the compressor/s to start-up.

6.2 FLOW SWITCH ON THE WATER SIDE

All the XVW units are fitted with a paddle flow switch (a) to protect the evaporator as standard. This is installed in series with the water and electrical circuits and wired.

6.3 REMOTE CONTROLS

If you wish to include a remote control for switching the unit on and off, you must remove the jumper between the contacts indicated in the wiring diagram and connect the remote ON/OFF control to the terminals themselves [see annexed wiring diagram].

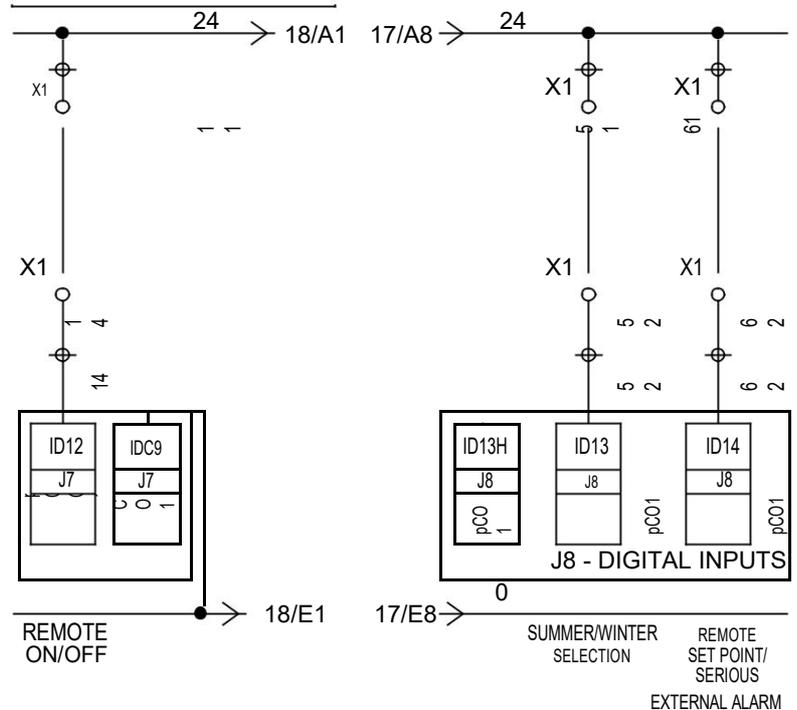


WARNING All remote controls work with a very low voltage (24 Vac) supplied by the insulating transformer on the electric control board.

6.4 REMOTE SUMMER-WINTER SWITCHING

If you wish to include a remote control for switching the unit between the summer and winter operating modes, you must remove the jumper between the contacts indicated in the wiring diagram and connect the remote switching control to the terminals themselves [see annexed wiring diagram]. The switching modalities are different according to the type of microprocessor control, i.e. whether it is the basic or advanced type: the detailed instructions are below (see relevant wiring diagram) and in the microprocessor operating manual, an integral part of the documentation supplied.

pCO (available for all models)



7 - START-UP

7.1 PRELIMINARY CHECKS

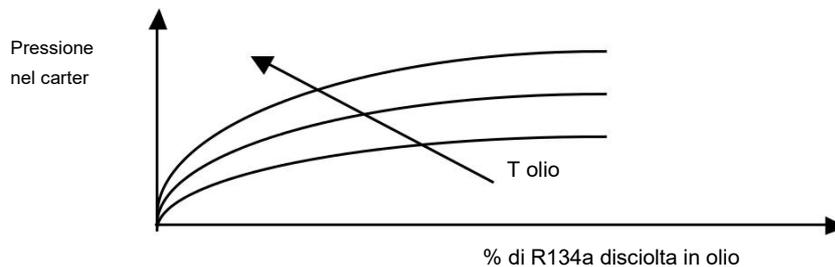
- Check that all the valves in the cooling circuit are open (liquid line).
- Check that the electrical connections have been made properly and that all the terminals are securely tightened. This check should also be included in a periodic six-month inspection.
- Check that the voltage at the RST terminals is $400\text{ V} \pm 5\%$ and make sure the yellow indicator light of the phase sequence relay is on. The phase sequence relay is positioned in the middle right part of the electric control board; if the sequence is not duly observed, it will not enable the machine to start.
- Make sure there are no refrigerant leaks that may have been caused by accidental impacts during transport and/or installation.
- Check the power supply to the crankcase heating elements, where present.



WARNING

The heating elements must be turned on at least 12 hours before the unit is started. This function is carried out automatically when the main switch is off. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

- To verify whether the heating elements are working properly, check the lower part of the compressors: it should be warm or in any case at a temperature 10 -15°C higher than the ambient temperature.



The diagram illustrates the characteristic [Charles' law] of gas to dissolve in a liquid in proportion to the pressure and the simultaneous contrasting action of the temperature: with constant pressure, an increase of the oil temperature decreases the quantity of refrigerant dissolved significantly, thus ensuring the maintenance of the desired lubrication characteristics. At the same time it should be observed that a slight foaming [1-5 mm] of the oil at start up (pressure drop => decrease in % of solubility) is normal and will not compromise the system's reliability.

- Check that the plumbing connections have been properly made according to the indications given on the plates to be found on the unit itself (proper inlet and outlet connections).
- Make sure that the water circuit is duly bled to completely eliminate the presence of air: fill the circuit gradually and open the air vent valves on the top part, which the installer should have set in place.

7.2 STARTING OPERATION

Before starting the chiller, turn the main switch (a) off, select the operating mode desired from the control panel [red button = heating, green button = cooling] and press the "ON" button on the control panel.

The unit will start up if enabled:

- By the safety devices of the water circulation pump/s
- by the flow switch (or differential pressure switch)
- by the T sensor measuring the temperature of the water returning from the system [chiller inlet]
- and no alarms have been triggered

Start-up:

- Check that all external cocks of the water circuit are open and water flows properly (the flow alarm should not be triggered).
- Put the main switch in the ON position.
 - The pump will start immediately.
 - After 60 seconds the compressor will start.
- Check the water temperature differential (12-7°C to be detected by means of a thermometer on the inlet and outlet water pipes of the unit).
- Check that there are no leaks on the refrigerant side and water side.



WARNING

If the unit fails to start up, check whether the set point has been set on the desired values.



WARNING

You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season). To turn off the unit temporarily follow the directions provided in the section "Stopping the Unit".

7.3 CHECKS DURING OPERATION

- Check the correct sequence of the phases via the phase sequence relay (a) in the electric panel: if it is incorrect, disconnect and invert the two phases entering the unit. Never attempt to modify internal electrical connections: any undue modifications will render the warranty null and void.



WARNING

All the three-phase devices on the unit, compressor, water pump and fans (some versions) have a set direction of rotation and were harmonized in the factory.

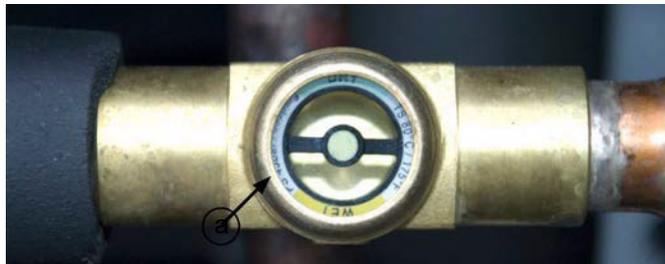
- Check that the temperature of the water entering the evaporator (returning from the system) is close to the setpoint value entered. How long it will take to reach full operating capacity depends on the starting conditions, system size and load conditions.

7.4 CHECKING THE REFRIGERANT LEVEL

After a few hours of operation, check that the liquid indicator light (a) has a green ring: yellow indicates the presence of humidity in the circuit. In such a case the circuit must be dehumidified by qualified personnel.

- Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up.
- A few minutes after the compressors have started up, check that the end-of-condensation temperature shown on the pressure gauge (refer to the pressure gauge scale for the refrigerant R134a, marked with the initials D.P. - Dew Point) is about 3-8 °C (depending on the type of unit and charging conditions) higher than the temperature of the water entering the condenser.

- Also check that the end-of-evaporation temperature shown on the pressure gauge (refer to the pressure gauge scale for the refrigerant R134a, marked with the initials D.P. - Dew Point) is about 3.5 – 5.0 °C lower than the temperature of the water leaving the evaporator.
- Make sure the superheating of the refrigerant fluid is limited to between 5 and 8 °C. To do this:
 - 1 read the temperature indicated by a contact thermometer placed on the compressor intake pipe;
 - 2 read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant R134a, marked with the initials D.P. (Dew Point).
The degree of superheating is given by the difference between the temperatures thus determined.
- Make sure that the subcooling of the refrigerant fluid is limited to between 4 and 6°C. To do this:
 - 1 read the temperature indicated by a contact thermometer placed on the condenser outlet pipe;
 - 2 read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant R134a, marked with the initials B.P. (Bubble Point).
The degree of subcooling is given by the difference between the temperatures thus determined.



WARNING

- All XVW units are charged with HFC R134a: Any top-ups must be made by specialised personnel using the same type of refrigerant, exclusively in the liquid phase.

- The refrigerant R134a requires “POE” polyolester oil of a type approved by the compressor manufacturer. For no reason should a mineral oil be introduced into the oil circuit.

7.5 EXPANSION VALVE

An electronically controlled expansion valve (a) is installed as a standard feature on all XVW units. If correctly parameterised and controlled by the software, this device has the ability to render the operation of the cooling circuit highly efficient and this will have the ultimate effect of decreasing the power intake of the system when a sudden change occurs in the thermal load. With a traditional expansion valve there is a transient time of 2 to 3 minutes before a condition of equilibrium is reached.

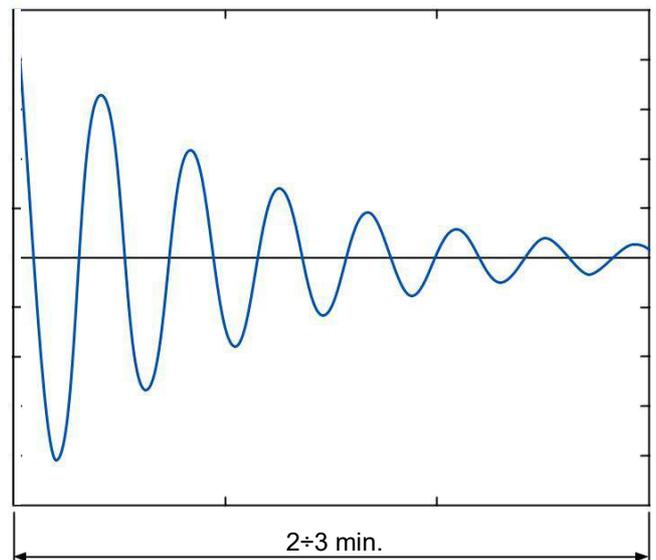
Example:

- A compressor switches off
- The evaporation temperature increases
- Superheating decreases
- The valve closes
- The refrigerant flow rate decreases
- The cooling capacity decreases
- The evaporation temperature decreases ...and so on...

Proactive action of an Electronic Expansion Valve:

In the event of a compressor on/off request:

- The electronic driver pre-positions the valve at a point very near the final equilibrium point
- A status of equilibrium is quickly reached with small adjustments
- The electronic expansion valve becomes an active, rather than passive, component within the system
- The transient time is greatly reduced
- Overall the system is more efficient, with higher E.E.R. and therefore greater savings



7.6 STOPPING THE UNIT

The unit can be stopped by pressing the "OFF" button on the front panel, by turning off the main switch (a), or via the specific commands on the LCD user interface.



WARNING

To stop the unit do not disconnect it using the main switch: this device must only be used to disconnect the unit from the power supply without current flow, i.e. when the unit is switched OFF.

Moreover, if you completely disconnect the unit from the electricity supply, the crankcase heating elements will receive no power, thereby jeopardising the integrity of the compressor the next time the unit is started.

8 - CONTROL DEVICE CALIBRATION

8.1 GENERAL INFORMATION

All the control devices are set and tested in the factory before the unit is dispatched. However, after the unit has been in service for a reasonable period of time you can perform a check on the operating and safety devices. The settings are shown in Tables I and II.



DANGER

All the servicing operations performed on the control equipment must be carried out EXCLUSIVELY BY QUALIFIED PERSONNEL: incorrect calibration values can cause serious damage to the unit and to people.

Many of the operating parameters and system settings are configured by means of the microprocessor control and are protected by passwords.

TABLE I – SETTING OF CONTROL DEVICES

XVW C/D SERIES			
CONTROL DEVICE		SET POINT	DIFFERENTIAL
Service thermostat	°C	8	4

XVW K/W/Z SERIES			
CONTROL DEVICE		SET POINT	DIFFERENTIAL
Service thermostat K	°C	61	4
Service thermostat W	°C	41	4
Service thermostat Z	°C	31	4

TABLE II – SETTING OF SAFETY - CONTROL DEVICES

XVW C-D-K-W-Z SERIES				
CONTROL DEVICE		ACTIVATION	DIFFERENTIAL	RE-ACTIVATION
Anti-freeze thermostat	°C	+4	2	Automatic
Maximum pressure switch IV PED	bar-g	20/18/14*	-/+ 0.7	Manual
Max admissible PS	bar-g	HP28/LP14	-/+ 0.7	-
Minimum pressure switch	bar-g	1.4/0.7*	+1.0	Automatic
Minimum time lapse between two start-ups of the same compressor	s	900/600*	-	-
Flow switch alarm delay	s		20	--
Low pressure alarm delay	s		1	--
* depends on the model				

8.2 | MAXIMUM PRESSURE SWITCH

The high pressure switch stops the compressor when the outlet pressure exceeds the set value.



WARNING

Do not attempt to change the setting of the maximum pressure switch. Should the latter fail to trip in the event of a pressure increase, the pressure relief valve will open.”.



WARNING

During this operation, if the safety device fails to trip, the second cascade- connected pressure switch will step in to shut down the unit; in any case, however, you should be ready to shut off the unit as directed in the section "Stopping the Unit" – also see section "How to fill the tank".

The high pressure switch must be manually reset; this is possible only when the pressure falls below the set differential (see Table II).

8.3 | MINIMUM PRESSURE SWITCH

The low pressure switch stops the compressor when the intake pressure falls below the set value for more than 120 seconds. The switch is automatically reset when the pressure rises above the set differential (see Table II).

8.4 | SERVICE THERMOSTAT FUNCTION

This device permits to enable and disable the compressors' operation as a function of the reading of the inlet water temperature of the chilling unit [return from the system]. For further details, refer to the microprocessor control section in the manual.

8.5 | ANTI-FREEZE THERMOSTAT FUNCTION

The antifreeze probe is located at the evaporator outlet and stops the compressor when the temperature goes below the set limit value. Together with the flow switch and low pressure switch, this device protects the evaporator from the risk of freezing as a result of faults in the water circuit. For further details, refer to the microprocessor control section in the manual.

8.6 | ANTI-RECYCLE TIMER FUNCTION

The function of the timer is to prevent excessively frequent compressor starts and stops. This device imposes a minimum time lapse of 600/900 seconds between two compressor starts. For further details, refer to the microprocessor control section in the manual.



WARNING

Never change the delay time set by default: incorrect values could cause serious damage to the unit.

9 - MAINTENANCE AND PERIODIC CHECKS

9.1 WARNINGS



DANGER

- For safety reasons concerning installation, the right measures and precautions should be taken to prevent the ambient temperature from rising above 55°C whether the machine is switched off.

- All the operations described in this chapter **MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL**.
- Before carrying out any work on the unit or accessing internal parts, make sure you have disconnected it from the mains electricity supply.
- The upper part and outlet pipe of the compressor may reach temperatures as high as 110°C. Be especially careful when working in the surrounding area while the unit is running.
- For the safety of the person conducting maintenance work on the XVW units it is compulsory to turn the main switch off before performing said maintenance work.

Front of the XVW unit



9.2 GENERAL INFORMATION

It is a good idea to carry out periodic checks to ensure that the unit is working properly:

- Check the efficiency of all the control and safety devices as previously described.
- Check the terminals on the electric control board and compressor terminal boards to ensure that they are securely tightened. The movable and fixed contacts of the circuit breakers must be periodically cleaned and replaced whenever they show signs of deterioration.
- Check the refrigerant level by means of the liquid level indicator (every 6 months).
- Check the oil levels through the windows provided on the compressor crankcases (every 6 months).
- Check the water circuit for leaks (every 6 months).
- If the unit needs to be taken out of service for long periods of time, remove the water from the pipes and the heat exchanger. This operation is essential if during the time the unit is out of service ambient temperatures below the freezing point of the liquid used are expected (typical seasonal operation).
- Check the filling of the water circuit, bleeding air from the circuit by means of the valves situated in the highest points.
- Check the efficiency of the flow switch or differential pressure switch.
- Check the heating elements, where present, of the compressor crankcases.
- Clean the metal mesh filters mounted externally on the water pipes.
- Check the humidity indicator on the liquid level indicator (green=dry, yellow=humid); if the indicator is not green as shown on the indicator sticker, replace the filter (every 6 months).
- Check that the noise emissions of the unit are regular (every 6 months) and more specifically that no vibrations and/or knocking can be detected.

9.3 REPAIRING THE COOLING CIRCUIT



WARNING

While performing repairs on the cooling circuit or maintenance work on the compressors, make sure the circuit is left open for as little time as possible. Even if briefly exposed to air, ester oils tend to absorb large amounts of humidity, which results in the formation of weak acids.

If the cooling circuit has undergone any repairs, the following operations must be carried out:

- seal test;
- emptying and drying of the cooling circuit;
- refrigerant load.



WARNING

If the system has to be drained, always recover the refrigerant present in the circuit using suitable equipment; the refrigerant should be handled exclusively in the liquid phase.

9.4 SEAL TEST

Fill the circuit with anhydrous nitrogen supplied from a tank with a pressure-reducing valve until the pressure rises to 10 bar.



WARNING

During the pressurisation phase, do not exceed the pressure setting of the safety valves; otherwise you will cause the latter to open.

The presence of any leaks must be determined using special leak detectors. Should any leaks be detected during the test, empty out the circuit before repairing the leaks with suitable alloys.



DANGER

Do not use oxygen in the place of nitrogen as a test agent, since this could cause a risk of explosion as well as the certainty of extensive oxidisation in high-temperature areas.

9.5 HARD VACUUM AND DRYING THE COOLING CIRCUIT

To achieve a hard vacuum in the cooling circuit it is necessary to use a pump capable of generating a high degree of vacuum, i.e. 15 Pa of absolute pressure with a capacity of approximately 10 m³/h. If such a pump is available, one evacuation will normally suffice to achieve an absolute pressure of 15 Pa.

If there is no such vacuum pump available, or whenever the circuit has remained open for long periods of time, you are strongly recommended to adopt the triple evacuation method. This method is also recommended when there is a presence of humidity within the circuit.

The vacuum pump should be connected to the inlets. The procedure to be carried out is as follows:

- Evacuate the circuit until you reach an absolute pressure of at least 35 Pa. At this point inject nitrogen into the circuit until you reach a relative pressure of about 1 bar.
- Repeat the step described above.
- Carry out the step described above for the third time, but in this case attempting to reach the hardest vacuum possible.

Using this procedure you can easily remove up to 99% of pollutants

9.6 CHARGING WITH R134a REFRIGERANT



DANGER

It is recommended to read the safety data sheet (MSDS) before using R-134a.
TOXICITY

R-134a can be safely used in all applications for which it is intended, according to the processed data of the "Program for Alternative Fluorocarbon Toxicity Testing" (PAFT1).
LEAKS

The area must be immediately evacuated if there is a constant leak of R-134a gas. The gases concentrate near the floor, thereby restricting the availability of oxygen. Once evacuated, the area must be ventilated with fans or blowers in order to circulate the air at floor level.

FLAMMABILITY

According to the 34 ASHRAE Standard, R-134a is classified in safety group A1, i.e. it is not flammable at 1 atm of pressure (101.3 kPa) and 18°C.

CATEGORY

The refrigerant is a non hazardous category II fluid.

- Connect the tank of refrigerant gas to the male 1/4 SAE inlet situated on the liquid line after discharging a little gas to eliminate air in the connection pipe.
- Carry out the charging operation with the refrigerant in liquid form until you reach 75% of the total charge.
- Then connect to the inlet on the intake line and complete the charging process with the refrigerant in liquid form until no more bubbles can be seen on the liquid level indicator and the operating parameters specified in the section "Checking the refrigerant level" have been reached.



WARNING

A unit that was originally charged with R134a in the factory cannot be charged with other refrigerants.

9.7 ENVIRONMENTAL PROTECTION

The law [reg. EC 2037/00] that regulates the use of stratospheric ozone depleting substances and greenhouse gases bans disposal of refrigerant gases in the environment and requires whoever is in their possession to collect them and, at the end of their useful life, return them to the dealer or take them to a suitable waste collection facility. The refrigerant HFC R134a is not harmful to the ozone layer but is included among the substances responsible for the greenhouse effect and thus falls within the scope of the aforesaid regulations.



WARNING

Therefore, special care should be taken when carrying out maintenance work to minimise refrigerant leaks.

10 - DECOMMISSIONING THE UNIT



When the unit has reached the end of its working life and must be removed and replaced, a number of measures must be followed:

- the refrigerant gas it contains should be recovered by specialised personnel and sent to a waste collection facility;
- the lubricating oil in the compressors should also be recovered and sent to a waste collection facility;
- the structure and the various components, if unusable, must be dismantled and divided according to their industry sector: this is particularly true for copper and aluminium, present in conspicuous quantity in the machine. This will facilitate the work carried out in the waste collection, disposal and recycling facilities and minimise the environmental impact of such processes.



WARNING

- Should the unit, or a part of it, be decommissioned, the parts liable to cause any hazard must be rendered harmless.
- Remember that whenever a part is replaced and the used part must be disposed of separately, always refer to the relative laws in force.

Please note it is mandatory to register the loading and unloading of special and toxic-harmful waste. Special and toxic-harmful waste must be collected by authorised companies.

Special and toxic-harmful waste must be disposed of in compliance with the applicable laws in the user's country. Dismantle the unit according to the requirements imposed by law in force in the user's country. Before demolishing the unit, ask the relative Authority to perform an inspection and issue a report.

Lastly, scrap the unit in compliance with the applicable laws in the user's country.



WARNING

Qualified personnel must dismantle and demolish the unit.

11 - TROUBLESHOOTING

On the next pages you will find a list of the most common causes that may cause the chilling unit to fail or malfunction. They are listed according to the easily identifiable symptoms.



DANGER

With regard to possible remedies, take extreme care in the handling operations to be carried out: excessive confidence may cause serious accidents to inexperienced people, so it is advisable, once the cause has been detected, to ask for our assistance or that of a qualified technician.

ANOMALY	Analysis of the possible causes	Corrective action
The unit does not start.	No electrical power supply.	Check its presence both on the primary and auxiliary circuit.
	The circuit board is not powered. There are alarms present.	Check the protections. Check the microprocessor panel for the presence of alarms, eliminate their cause and restart the unit.
	Incorrect phase sequence.	Reverse two phases in the primary power line after disconnecting them upstream from the unit.
The compressor is noisy.	The compressor is rotating in the wrong direction.	Check the phase sequence relay. Reverse the phases on the terminal board after disconnecting the unit and contact the manufacturer.
High pressure anomaly.	Insufficient water flow rate if heat pump is operating.	Check the water at the condenser inlet
		Check the condensation control device [optional].
		Check the pressure drops of the water circuit and/or the correct operation of the pump [rotation direction].
	Air in the circuit, detected by air bubbles on the flow indicator and sub-cooling values reaching over 5°C.	Drain and pressurise the circuit and check for leaks. Drain the circuit slowly [more than 3 hours] up to 15 Pa and then recharge in the liquid phase. Discharge circuit.
Unit too loaded detectable by sub-cooling greater than 8 °C. Clogged thermostatic valve and / or filter. Such faults may occur in the presence of low pressure.	Check the temperatures upstream and downstream from the valve and filter and replace them if necessary.	
Low condensation pressure.	Faulty transducers.	Check the setting of the condensation control device [opt.].
	Water T too low	Check the condensation control.
Low evaporation pressure.	Low water flow rate.	Check whether the pumps are rotating in the right direction. Check the water system for pressure drops..

ANOMALY	Analysis of the possible causes	Corrective action
Low evaporation pressure.	Malfunctioning of thermostat valve.	Warming the bulb with your hand, check whether the valve opens and adjust it if necessary. If it does not respond, replace it.
	Clogged filter.	Pressure drops upstream and downstream from the filter should not exceed 2°C. If they do, replace the filter.
	Low condensation T.	Make sure the condensation control works properly [if present].
	Low refrigerant load.	Check the refrigerant level by measuring the degree of subcooling; if it is below 2°C replenish the charge.
The compressor does not start.	Internal thermal protector tripped.	Check the status of the thermal contact in models equipped with protection modules. Identify the causes after restarting.
	The circuit breakers or line fuses have been tripped by a short circuit.	Pinpoint the cause by measuring the resistance of the individual windings and the insulation from the casing before restoring power.
	Intervention of HP or LP switches.	Check the microprocessor, eliminate the causes.
	The phases in the distribution cabin have been inverted.	Check the phase sequence relay.
High evaporation pressure.	Water T too high.	Check the thermal load and/or efficiency of the thermostat function.
		Check the efficiency of the thermostatic valve.

12 – REFRIGERANT SAFETY DATA SHEET

12.1 R1234ze

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name :	Solstice® ZE Refrigerant
SDS-number	16095
Type of product	Substance
Remarks	SDS according to Art. 31 of Regulation (EC) 1907/2006.
Chemical name	trans-1,3,3,3-Tetrafluoroprop-1-ene
CAS-No.	29118-24-9
REACH Registration Number	01-0000019758-54

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the Substance/Mixture Refrigerant

Uses advised against none

1.3. Details of the supplier of the safety data sheet

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

REGULATION (EC) No 1272/2008

Gases under pressure Liquefied gas

H280 Contains gas under pressure; may explode if heated.

2.2. Label elements

REGULATION (EC) No 1272/2008

Hazard pictograms



Signal word : Warning

Hazard statements : H280 Contains gas under pressure; may explode if heated.

Precautionary statements : P260 Do not breathe dust/ fume/ gas/ mist/vapours/ spray.

Precautionary statements : P280 Wear protective gloves/ eye protection/face protection.

Precautionary statements : P284 In case of inadequate ventilation wear respiratory protection.

Precautionary statements : P308 + P313 IF exposed or concerned: Get medical advice/ attention.

Precautionary statements : P410 + P403 Protect from sunlight. Store in a well-ventilated place.

2.3. Other hazards

Warning! Container under pressure.

SECTION 3: Composition/information on ingredients

3.1. Substance

Chemical name	CAS-No.Index-No. REACH Registration Number EC-No	Classification 1272/2008	Concentration	Remarks
trans-1,3,3,3- Tetrafluoroprop-1-ene	29118-24-901- 0000019758-54 471-480- 0	Press. Gas ; H280	1	1*

1* - For specific concentration limits see Annexes of 1272/2008

3.2. Mixture

Not applicable

Occupational Exposure Limit(s), if available, are listed in Section 8.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice:	First aider needs to protect himself. Move out of dangerous area. Keep warm and in a quiet place. Show this safety data sheet to the doctor in attendance. Take off all contaminated clothing immediately.
Inhalation:	If inhaled, remove to fresh air. Get medical attention if irritation develops and persists. Rapid evaporation of the liquid may cause frostbite. If there is evidence of frostbite, bathe
Sk in contact:	(do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Call a physician if irritation develops or persists.
Eye contact:	Immediately flush eye(s) with plenty of water. Call a physician immediately.
Ingestion:	Ingestion is unlikely because of the physical properties and is not expected to be hazardous. As this product is a gas, refer to the inhalation section.

4.2. Most important symptoms and effects, both acute and delayed

no data available

4.3. Indication of any immediate medical attention and special treatment needed

no data available

See Section 11 for more detailed information on health effects and symptoms.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Water mist

Dry powder

Foam

Carbon dioxide (CO₂)

Contents under pressure.
 Heating will cause pressure rise with risk of bursting
 Cool closed containers exposed to fire with water spray. Product is not combustible under normal conditions.
 However, this material can ignite when mixed with air under pressure and exposed to strong ignition sources.
 Do not allow run-off from fire fighting to enter drains or water courses.
 Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Some risk may be expected of corrosive and toxic decomposition products.
 Fire may cause evolution of: Hydrogen fluoride
 Carbon oxides
 Carbonyl halides
 Halogenated compounds

5.2. Special hazards arising from the substance or mixture

5.3. Advice for firefighters

Wear full protective clothing and self-contained breathing apparatus. Exposure to decomposition products may be a hazard to health. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. In the event of fire, cool tanks with water spray.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Provide adequate ventilation. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Avoid skin contact with leaking liquid (danger of frostbite). Use personal protective equipment. Keep people away from and upwind of spill/leak.

6.2. Environmental precautions

Prevent further leakage or spillage if safe to do so. The product evaporates readily. Prevent spreading over a wide area (e.g. by containment or oil barriers).

6.3. Methods and materials for containment and cleaning up

Do not direct water spray at the point of leakage. Allow to evaporate.

6.4. Reference to other sections

For personal protection see section 8.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling:

Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Exhaust ventilation at the object is necessary.

Advice on protection against fire and explosion:

Do not spray on a naked flame or any incandescent material. Keep away from direct sunlight. Fire or intense heat may cause violent rupture of packages. Vapours may form explosive mixtures with air. The product is not easily combustible.

Hygiene measures:

Avoid breathing vapours, mist or gas. Keep working clothes separately.

7.2. Conditions for safe storage, including any incompatibilities

Further information on storage conditions : Keep containers tightly closed in a cool, well-ventilated place. Keep only in the original container at temperature not exceeding 50°C Keep away from direct sunlight.

Advice on common storage: Do not store together with: Oxidizing agents

7.3. Specific end use(s) no additional data available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits:

Components	Basis / Value type	Value / Form of exposure	Exceeding Factor	Remarks
trans-1,3,3,3-Tetrafluoroprop-1-ene	HONEYWELL TWA	800 ppm		We are not aware of any national exposure limit.

TWA - Time weighted average

DNEL/ PNEC-Values

Component	End-use / Impact	Exposure duration	Value	Exposure routes	Remarks
trans-1,3,3,3-Tetrafluoroprop-1-ene	Workers /Long-term systemic effects		3902 mg/m3	Inhalation	
trans-1,3,3,3-Tetrafluoroprop-1-ene	Consumers/Long-term systemic effects		830 mg/m3	Inhalation	

Component	Environmental compartment / Value	Remarks
trans-1,3,3,3-Tetrafluoroprop-1-ene	Fresh water: 0,1 mg/l	Assessment factor: 1000

8.2. Exposure controls

Occupational exposure controls

The Personal Protective Equipment must be in accordance with EN standards:respirator EN 136, 140,149; safety glasses EN 166; protective suit: EN 340, 463, 468, 943-1, 943-2; gloves EN 374, 511;safety shoes EN-ISO 20345. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace. Avoid inhalation of vapour or mist.

Engineering measures Local exhaust

Personal protective equipment

Respiratory protection: In case of insufficient ventilation wear suitable respiratory equipment. Self-contained breathing apparatus (EN 133)

Hand protection: Protective gloves against cold (EN 511). Gloves must be inspected prior to use. Replace when worn.

Eye protection: Goggles

Skin and body protection: Wear suitable protective equipment. Protective footwear

Environmental exposure controls Handle in accordance with local environmental regulations and good industrial practices

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Form	Liquefied gas
Colour	colourless
Odour	slight ether-like
Boiling point/boiling range	-19 °C
Flash point	Not applicable
Auto-ignition temperature	368 °C
Lower explosion limit	No LEL and UEL was assigned at standard testing conditions, 20°C. Exhibits flame limits at temperatures in excess of 28° C.
Upper explosion limit	No LEL and UEL was assigned at standard testing conditions, 20°C. Exhibits flame limits at temperatures in excess of 28° C.
Vapour pressure	4.271 hPa at 20 °C
Vapour pressure	11.152 hPa at 54,4 °C
Density	1,17 g/cm ³ at 21,1 °C
pH	neutral
Water solubility	0,373 g/l
Partition coefficient: n-octanol/water	log Pow 1,6
Relative vapour density	4 (Air = 1.0)

9.2 Other Information

no additional data available

SECTION 10: Stability and reactivity

10.1. Reactivity Stable under normal conditions.

10.2. Chemical stability Hazardous decomposition products formed under fire conditions. To avoid thermal decomposition, do not overheat.

10.3. Possibility of hazardous reactions Hazardous polymerisation does not occur.

10.4. Conditions to avoid Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Can form a combustible mixture with air at pressures above atmospheric pressure.

10.5. Incompatible materials Reactions with alkali metals.

10.6. Hazardous decomposition products Halogenated compounds
Carbon oxides Hydrogen fluoride Carbonyl halides

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute oral toxicity: Not applicable
Study technically not feasible.

Acute dermal toxicity: no data available
Study technically not feasible.
LC0

Acute inhalation toxicity: Species: Rat
Value: > 207000 ppm
Exposure time: 4 h
Method: OECD Test Guideline 403

Skin irritation: Species: Rabbit
Result: No skin irritation
Method: OECD Test Guideline 404

Eye irritation: no data available
Study technically not feasible.

Respiratory or skin sensitisation: Species: human
Result: Does not cause skin sensitisation.
Species: Rat
Application Route: Inhalation
Exposure time: 90 d

Repeated dose toxicity: NOEL: 5000 ppm
Method: OECD Test Guideline 413
Note: Subchronic toxicity

Carcinogenicity: Note: no data available
Test Method: Chromosome aberration test in vitro

Germ cell mutagenicity: Cell type: Human lymphocytes
Result: negative
Method: OECD Test Guideline 473
Test Method: Ames test
Result: negative

Germ cell mutagenicity: Test Method: Mutagenicity (in vivo mammalian bone-marrow cytogenetic test, chromosomal analysis) Species: Mouse
Cell type: Micronucleus
Application Route: Inhalation Method: OECD
Test Guideline 474
Result: negative

Reproductive toxicity: Test Type: Two-generation study
Method: OECD Test Guideline 416
Species: Rat
Route of Application: Inhalation
General Toxicity - Parent: NOEL: > 20.000 ppm
General Toxicity F1: NOEL: > 20.000 ppm

Aspiration hazard: Method: OECD Test Guideline 414
Species: Rat
Route of Application: Inhalation
General Toxicity Maternal: NOEC:
Developmental Toxicity : NOAEC: 15.000 ppm
no data available

Other information: Cardiac Sensitization (dog): No effects

SECTION 12: Ecological information

12.1. Toxicity

Toxicity to fish: LCO
static test
Species: Cyprinus carpio (Carp)
Value: > 117 mg/l
Exposure time: 96 h
Method: OECD Test Guideline 203

Toxicity to aquatic plants : NOEC
Growth rate Species: Algae Value: > 170 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201

Toxicity to aquatic plants : NOEC
Biomass Species: Algae
Value: > 170 mg/l
Exposure time: 72 h
Method: OECD Test Guideline 201

Toxicity to aquatic invertebrates : EC50 static test
Species: Daphnia magna (Water flea)
Value: > 160 mg/l
Exposure time: 48 h
Method: OECD Test Guideline 202

12.2. Persistence and degradability

Biodegradability: aerobic
Result: Not readily biodegradable.

12.3. Bioaccumulative potential

No bioaccumulation is to be expected (log Pow <= 4).

12.4. Mobility in soil

no data available

12.5. Results of PBT and vPvB assessment

no data available

12.6. Other adverse effects

no data available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Product: Dispose according to legal requirements. Contact manufacturer.
Packaging: Legal requirements are to be considered in regard of reuse or disposal of used packaging materials
Further information: Provisions relating to waste: EC Directive 2006/12/EC; 2008/98/EEC Regulation No. 1013/2006

For personal protection see section 8.

SECTION 14: Transport information

ADR/RID

UN Number 3163
Description of the goods LIQUEFIED GAS, N.O.S.
(TRANS-1,3,3,3-TE TRAF LUOROPROP-1-ENE) 2
Class
Classification Code 2A
Hazard Identification Number 20
ADR/RID-Labels 2.2
Environmentally hazardous no

IATA

UN Number 3163
Description of the goods Liquefied gas, n.o.s. (trans-1,3,3,3-Tetrafluoroprop-1-ene)
Class 2.2
Hazard Labels 2.2

IMDG

UN Number 3163
Description of the goods LIQUEFIED GAS, N.O.S. (TRANS-1,3,3,3-TE TRAF LUOROPROP-1-ENE)
Class 2.2
Hazard Labels 2.2
EmS Number F-C, S-V
Marine pollutant no

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Other inventory information

US. Toxic Substances Control Act
On TSCA Inventory

Australia. Industrial Chemical (Notification and Assessment) Act
On the inventory, or in compliance with the inventory

Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL) All components of this product are on the Canadian DSL

Japan. Kashin-Hou Law List
On the inventory, or in compliance with the inventory

Korea. Toxic Chemical Control Law (TCCL) List
On the inventory, or in compliance with the inventory

Philippines. The Toxic Substances and Hazardous and Nuclear Waste Control Act
Not in compliance with the inventory

China. Inventory of Existing Chemical Substances
On the inventory, or in compliance with the inventory

New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand
On the inventory, or in compliance with the inventory

15.2 Chemical safety assessment

A Chemical Safety Assessment has been carried out.

SECTION 16: Other information

Text of H-statements referred to under heading 3

trans-1,3,3,3-Tetrafluoroprop-1-ene	H280	Contains gas under pressure; may explode if heated.
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Further information

All directives and regulations refer to amended versions.

Vertical lines in the left hand margin indicate a relevant amendment from the previous version.

Abbreviations:

EC European Community

CAS Chemical Abstracts Service

DNEL Derived no effect level

PNEC Predicted no effect level

vPvB Very persistent and very bioaccumulative substance

PBT Persistent, bioaccumulative and toxic substance

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. Final determination of suitability of any material is the sole responsibility of the user.

This information should not constitute a guarantee for any specific product properties.

1. Identification of the Substance/Mixture and of the Company/Undertaking

Product name	:	HFC-134a,
Type of product	:	Substance
Chemical Name	:	Norflurane
EC-N°.	:	212-377-0
Registration number	:	01-2119459374-33
Use of substance/mixture	:	Refrigerant Propellant Heat transfer fluid
Uses advised against	:	none

2. Hazards Identification

Classification 67/548/EC or 1999/45/EC : This substance is not classified as dangerous according to Directive 67/548/EEC.

Classification according to EC N° 1272/2008 (SGH-CLP)

Gases under pressure Liquefied gas
H280 Contains gas under pressure; may explode if heated.

Label elements REGULATION (EC) No 1272/2008

Hazard pictograms :

Signal word	:	Warning
Hazard statements	:	H280 Contains gas under pressure; may explode if heated.
Precautionary statements	:	P410 + P403 Protect from sunlight. Store in a wellventilated place.

DIRECTIVES 67/548/EEC or 1999/45/EC

Not a hazardous substance or mixture according to EC-directives 67/548/EEC or 1999/45/EC.
The product does not need to be labelled in accordance with EC directives or respective national laws.

Additional label elements

Special labelling of certain products : Contains fluorinated greenhouse gases covered by the Kyoto Protocol.

Potential health effects

Skin	:	Rapid evaporation of the liquid may cause frostbite.
Eyes	:	May irritate eyes.
Ingestion	:	Unlikely route of exposure.
Inhalation	:	High vapour concentrations can cause headaches, dizziness, drowsiness, and nausea, and may lead to unconsciousness. May cause cardiac arrhythmia.
Chronic Exposure	:	None known.
Further information	:	Warning! Container under pressure.

Potential environmental effects : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

3. Composition/Information on Ingredients**Chemical characterization**

Chemical Name	:	Norflurane
CAS-No.	:	811-97-2
EC-No.	:	212-377-0
Registration number	:	01-2119459374-33
Occupational Exposure Limit(s), if available, are listed in Section 8.		

For the full text of the R-phrases/ H-statements mentioned in this Section, see Section 16.

4. First Aid Measures

- Inhalation : Remove to fresh air. Artificial respiration and/or oxygen may be necessary.
Call a physician immediately.
- Skin contact : Rapid evaporation of the liquid may cause frostbite.
In case of contact with liquid, thaw frosted parts with water, then remove clothing carefully.
Wash with plenty of water Consult a physician.
Take off contaminated clothing and shoes immediately.
Wash contaminated clothing before re-use.
- Eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
- Ingestion : As this product is a gas, refer to the inhalation section.
Do not induce vomiting without medical advice.
Never give anything by mouth to an unconscious person.
Call a physician immediately.
- Further information : Do not give adrenaline or similar drugs.
See Section 11 for more detailed information on health effects and symptoms.

5. Firefighting Measures

- Suitable extinguishing media** : The product is not flammable.
ASHRAE 34
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
- Specific hazards during firefighting** : Possibility of generating hazardous reactions during a fire due to the presence of F and Cl groups.
Heating will cause pressure rise with risk of bursting
Cool closed containers exposed to fire with water spray.
This product is not flammable at ambient temperatures and atmospheric pressure. However, this material can ignite when mixed with air under pressure and exposed to strong ignition sources.
- Special protective equipment for firefighters** : Wear full protective clothing and self-contained breathing apparatus.
- Further information : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

6. Accidental Release Measures

- Personal precautions** : Immediately contact emergency personnel.
Wear personal protective equipment.
Unprotected persons must be kept away.
Ensure adequate ventilation. In case of insufficient ventilation wear suitable respiratory equipment.
- Environmental precautions** : Prevent further leakage or spillage if safe to do so.
The product evaporates readily.

For personal protection see section 8.

7. Handling and Storage

Handling

- Advice on safe handling : Open drum carefully as content may be under pressure.
The product should only be used in areas from which all naked lights and other sources of ignition have been excluded.
Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C.
Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material. Do not use in areas without adequate ventilation.
Contaminated equipment (brushes, rags) must be cleaned immediately with water.
- Hygiene measures : Provide adequate ventilation. When using do not eat or drink.

Storage

Further information on storage conditions : Store in original container. Keep away from direct sunlight.

8. Exposure Controls/Personal Protection

Occupational exposure limits

Components	Basis	Value type	Control parameters	Exceeding Factor	Form of exposure	Remarks
Norflurane	EH40 WEL	TWA	4.240 mg/m ³ 1.000 ppm	Exceeding Factor	Form of exposure	Remarks

TWA - time weighted average

Occupational exposure controls

The Personal Protective Equipment must be in accordance with EN standards:respirator EN 136, 140, 149; safety glasses EN 166; protective suit: EN 340, 463, 468, 943-1, 943-2; gloves EN 374, safety shoes EN-ISO 20345.

Environmental exposure controls

Handle in accordance with local environmental regulations and good industrial practices.

Personal protective equipment

Respiratory protection	:	Remarks: In case of insufficient ventilation wear suitable respiratory equipment.
Hand protection	:	Glove material: Viton (R) Break through time: > 480 min Glove thickness: 0,7 mm Vitoject® 890 Heat insulating gloves Remarks: Supplementary note: The specifications are based on information and tests from similar substances by analogy. Due to varying conditions (e.g.temperature or other strains) it must be considered that the usage of a chemical protective glove in practice may be much shorter than the permeation time determined in accordance with EN 374. Since actual conditions of practical use often deviate from standardised conditions according EN 374 the glove manufacturer recommends to use the chemical protective glove in practice not longer than 50% of the recommended permeation time. Manufacturer's directions for use should be observed because of great diversity of types. Suitable gloves tested according EN 374 are supplied e.g. from KCL GmbH, D-36124 Eichenzell, Vertrieb@kcl.de
Eye protection	:	Safety glasses with side-shields conforming to EN166 Face-shield
Skin and body protection	:	Protective footwear
DNEL/ PNEC-Values		
No DNEL-data available.		
No PNEC data available.		

9. Physical and Chemical Properties

Form	:	Liquefied gas
Colour	:	colourless
Odour	:	weak
molecular weight	:	102,02 g/mol
Melting point/range	:	-101 °C
Boiling point/boiling range	:	-26,2 °C
Flash point	:	not applicable
Flammability (solid, gas)	:	no data available
Ignition temperature	:	> 750 °C
Lower explosion limit	:	no data available
Upper explosion limit	:	no data available
Vapour pressure	:	5.915 hPa at 21,1 °C
Vapour pressure	:	14.713 hPa at 54,4 °C

Density	9	:	1,2 g/cm ³
pH		:	neutral Water
solubility		:	1,5 g/l
Partition coefficient: noctanol/water		:	log Pow 1,06 The product is more soluble in octanol.
Relative vapour density		:	3,5
Evaporation rate		:	> 1 Method: Compared to CCl ₄ .

10. Stability and Reactivity

Conditions to avoid	:	Heating will cause pressure rise with risk of bursting. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Do not spray on a naked flame or any incandescent material.
Materials to avoid	:	oxidising substances. Possible incompatibility with alkali sensitive materials. Powdered metals.
Hazardous decomposition products	:	Halogenated compounds Hydrogen fluoride Carbonyl halides Carbon oxides
Stability	:	>250 °C

11. Toxicological information

Acute oral toxicity	:	not applicable
Acute dermal toxicity	:	no data available
Acute inhalation toxicity	:	LC50 Species: rat Value: > 500000 ppm Exposure time: 4 h
Skin irritation	:	no data available
Eye irritation	:	no data available
Sensitisation	:	no data available

12. Ecological Information

Ecotoxicity effects

Toxicity to fish	:	no data available
Toxicity to aquatic plants	:	no data available
Acute toxicity to aquatic invertebrates	:	no data available

Further information

Additional ecological information	:	Accumulation in aquatic organisms is unlikely.
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13. Disposal Considerations

Product	:	Offer surplus and non-recyclable solutions to a licensed disposal company. Refer to manufacturer/supplier for information on recovery/recycling.
Waste key for the unused product	:	Classification: 14.06.01
Further information	:	Provisions relating to waste: EC Directive 2006/12/EC; 91/689/EEC Regulation No. 1013/2006
For personal protection see section 8.		

14. Transport Information

ADR/RID

UN Number	:	3159
Description of the goods	:	1,1,1,2-TETRAFLUOROETHANE
Class	:	2

Classification Code : 2A
Hazard identification No : 20
ADR/RID-Labels : 2.2
Environmentally hazardous : no

IATA

UN Number : 3159
Description of the goods : 1,1,1,2-Tetrafluoroethane
Class : 2.2
Hazard Labels : 2.2

IMDG

UN Number : 3159
Description of the goods : 1,1,1,2-TETRAFLUOROETHANE
Class : 2.2
Hazard Labels : 2.2
EmS Number : F-C, S-V
Marine pollutant : no

15. Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

Ozone Depletion Potential : 0
Global warming potential (GWP) : 1.430
Other regulations : EU Regulation 842/2006/E

16. Other Information

This Material Safety Data Sheet was written in accordance to the current European policies, and it is applicable to all the countries that have translated the policies within their national legislation.

The information contained in this sheet is based on our knowledge at the time of the last version. The user must make sure the information is complete and suitable for the specific use of the product. This document is not to be considered a warranty for any specific propriety of the product. Since the use of the product is not under our direct control, the user must observe on his/her own responsibility current laws and policies about hygiene and safety. We do not take any responsibility for any improper use.

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