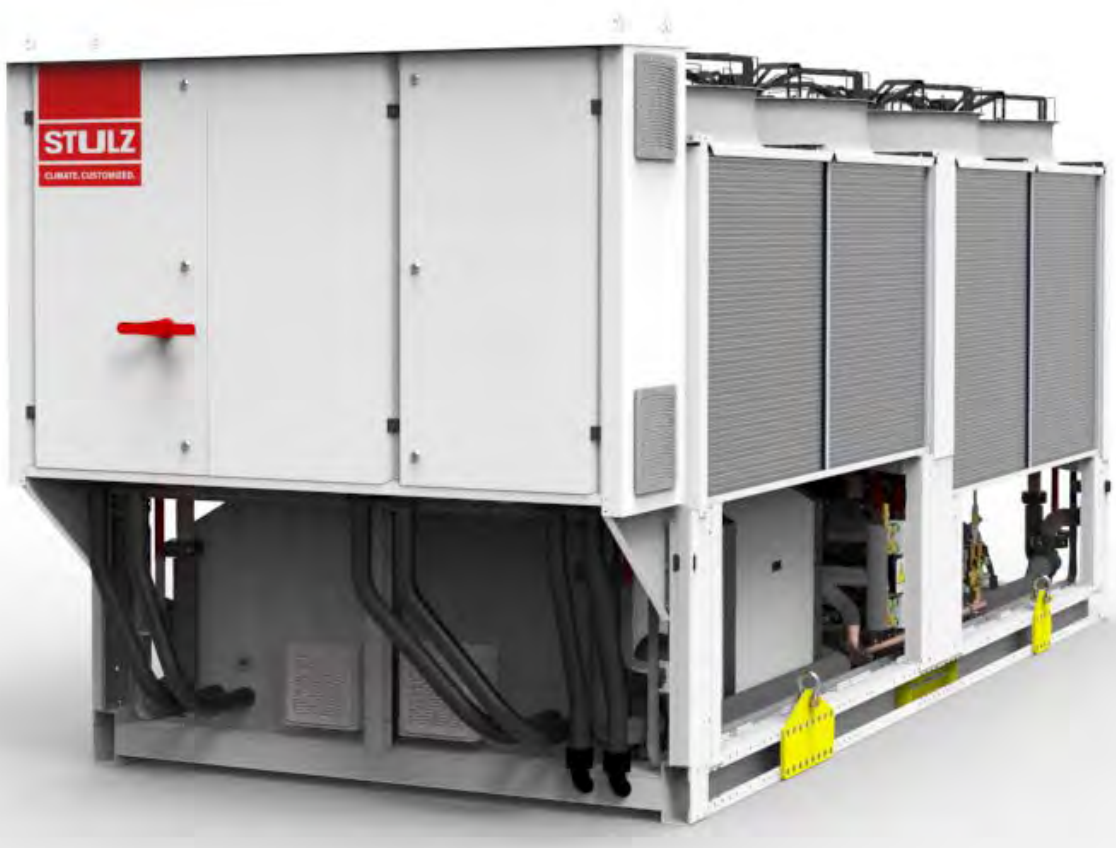
STULZ

CLIMATE. CUSTOMIZED.



CyberCool Explorer WSI
Full inverter compressors

Original instructions

Air cooled liquid chillers, Refrigerant A2L
400V / ~3 / 50Hz

Index i09
Issue 06.2025

ABOUT STULZ

Since it was founded in 1947, the STULZ company has evolved into one of the world's leading system suppliers of air-conditioning technology.
Since 1974 the group has seen continual international expansion of its air conditioning technology business, specialising in A/C for data centres and telecommunications installations.
STULZ has ten production plants (2 in Germany, Italy, the USA, Great Britain, Spain, 2 in China, Brazil and India) and twenty subsidiaries (in Germany, France, Italy, Great Britain, Belgium, Brazil, the Netherlands, New Zealand, Mexico, Austria, Poland, Spain, Singapore, China, India, Indonesia, South Africa, Sweden, Australia and the USA).
The company also co-operates with sales and service partners in over 140 other countries, and therefore boasts an international network of air-conditioning specialists.

STULZ S.p.A.
via Torricelli, 3
37067 Valeggio Sul Mincio
Verona - Italy

CyberCool Explorer WSI – High quality liquid chiller made in Italy

Dear Customer,

Thank you for purchasing a STULZ chiller.
It is the result of many years of research and design studies, as well as a fine matching of materials and technologies to obtain a high quality chiller.
The CE mark guarantees that the STULZ products fulfil the requirements of the European Machinery Directive for safety.
The level of quality is permanently checked at every phase, from design to production and makes STULZ products synonymous of SAFETY, QUALITY and RELIABILITY.

For any questions or requests concerning products by STULZ SpA, please contact our **Aftersales** at

telephone	0039 045 6331615
fax	0039 045 6331635
email	aftersales@stulz.it

Or visit our website for more information about our products and services:
www.stulz.it

Table of Contents

1. Introduction 7
1.1 Introduction 7
1.2 Warranty 7
1.3 Safety 8
1.3.1 Symbols used in the manual 8
1.3.2 Labels 8
1.3.3 Safety Instructions 10
1.3.4 Handling refrigerants 10
1.3.5 Safety and environmental requirement 11
2. Residual risk 12
2.1 Transport and installation 12
2.2 Start-up 13
2.3 Operation 13
2.4 Maintenance 13
2.5 Dismantling 14
2.6 Safety Data 14
3. Transport/ Storage 15
3.1 Delivery of units 15
3.2 Storage 16
3.3 Transport 16
3.3.1 Transport protection 16
4. Description 18
4.1 Type Code 18
4.2 Intended use 19
4.3 Chiller Design 19
4.3.1 General 19
4.3.2 Versions 19
4.3.3 Refrigerant Circuit 20
4.3.4 Compressor 21
4.3.5 Evaporator 21
4.3.6 Condenser 22
4.3.7 Economiser 22
4.3.8 Condenser fans 22
4.3.9 Electrical and control cabinet 23
4.3.10 Sensors 23
4.3.11 SEC.blue electronic controller 24
4.4 Piping diagrams 26
4.4.1 Legend 26
5. Technical Data 27
5.1 Application limits 27
5.1.1 Storage conditions 27
5.1.2 Operating conditions 27
5.2 Chilled water quality 29
5.2.1 Glycol correction factors 29
5.3 Hydronic group 30
5.4 Head pressure available 32

5.5 Technical data ... 34
5.5.1 Sound spectra ... 41
5.6 Dimensional drawings ... 54
5.7 Electrical connection data ... 59
6. Installation ... 60
6.1 Positioning ... 60
6.2.1 Minimum distance from obstacles or other chillers ... 63
6.2.2 Installation distance of several units ... 63
6.3 Special requirements for installation ... 64
6.4 External water circuit ... 67
6.4.1 Water connection ... 70
6.4.2 Pumps management ... 70
6.5 Filling and bleeding air ... 71
6.6 Electrical connection ... 72
6.7 Opening the electric cabinet ... 74
6.8 Position of the electrical connections ... 74
6.8.1 Backup battery for TCE ... 75
6.9 Pump control ... 75
6.9.1 System with external pump ... 76
7. Commissioning ... 78
7.1 Preparation ... 78
7.2 First Startup ... 79
7.2.1 Oil pre-heating ... 79
7.2.2 Commissioning of the chilled water circuit ... 79
7.2.3 Commissioning of the refrigerant circuit ... 80
8. Maintenance ... 82
8.1 Safety instructions ... 82
8.1.1 Warning notes ... 82
8.2 Maintenance intervals ... 83
8.3 Refrigerant Circuit ... 84
8.3.1 Refrigerant charge ... 84
8.3.2 Quantity ... 84
8.3.3 Tightness of refrigerant circuit ... 84
8.3.4 Purity ... 84
8.3.5 Exchange of filter drier ... 85
8.3.6 HP switch ... 85
8.3.7 LP switch ... 85
8.3.8 Safety valve ... 85
8.3.9 Expansion valve ... 86
8.3.10 Compressor ... 86
8.4 Air circuit ... 88
8.4.1 Condenser ... 88
8.4.2 Condenser Fan ... 88
8.4.3 Filter ... 88
8.5 Evaporator circuit ... 88
8.5.1 Tightness ... 89
8.5.2 Evaporator ... 89
8.5.3 Differential pressure switch ... 89

8.5.4 Flow switch 89
8.6 Electric circuit 89
8.6.1 Powerboard 89
8.6.2 Fan 90
8.6.3 Pump 90
8.7 Unit in general 92
9. Malfunction 92
10. Dismantling and disposal 95
11. Options 96
11.1 Start with UPS 96
11.2 Automatic Transfer Switch (Double power line) 99
11.2.1 Turn on the unit 99
11.2.2 Turn off the unit 100
11.2.3 Maintenance mode 100
11.3 Energy meter 102
11.4 Anti-freeze resistance on evaporator 105
11.5 Electronic flow switch (for evaporator) 105
11.6 Increment of evaporator insulation 105
11.7 Suction-side shut-off valve on compressor 105
11.8 Containerisation 105

1. Introduction

1.1 Introduction

These operating instructions contain basic information which is to be complied with for installation, operation and maintenance. They must therefore be read and complied with by the fitter and the responsible trained staff/operators before assembly and commissioning. All procedures detailed in the manual, including tasks for installation, commissioning and maintenance must only be performed by suitable trained and qualified personnel. They must be permanently available at the place where the system is used.

The manufacturer will not be liable for any injury or damage caused by incorrect installation, commissioning, operation or maintenance resulting from a failure to follow the procedures and instructions detailed in the manual.

INFORMATION

An informative document on the REACH Regulation is available. Please view it on web site https://www.stulz.com/fileadmin/user_upload/Final_images/STULZ_IT/REACH-Statement-EN.pdf

1.2 Warranty

The warranty is limited to free replacement and shipping of any faulty part, or sub-assembly which has failed due to poor quality or manufacturing errors. All claims must be supported by evidence that the failure has occurred within the warranty period, and that the chiller has been operated within the designed parameters specified.

All warranty claims must specify the model and serial number of the chiller. This information is printed on the name plate, fitted on the door from the electrical cabinet.
The warranty will be invalid in case of any modification on the chiller which is not written approved from STULZ.

To claim any warranty purpose the following conditions need to be satisfied:
The initial startup of the chiller has to be carried out by trained personnel authorized from STULZ.
Only STULZ approved spare parts and liquids are allowed to be used.
All scheduled maintenance operations described in this manual must be performed accordingly by trained and qualified personnel.
Not fulfilling at least one these conditions will automatically void the warranty.

1.3 Safety

1.3.1 Symbols used in the manual

DANGER	Risk of death or injury to the operator
WARNING	Risk of damage to the unit
INFORMATION	Important information, use note
ESD CAUTION	Risk of damage to electronic components

1.3.2 Labels

Evaporator drain.
Location: next to the taps to empty the evaporators.

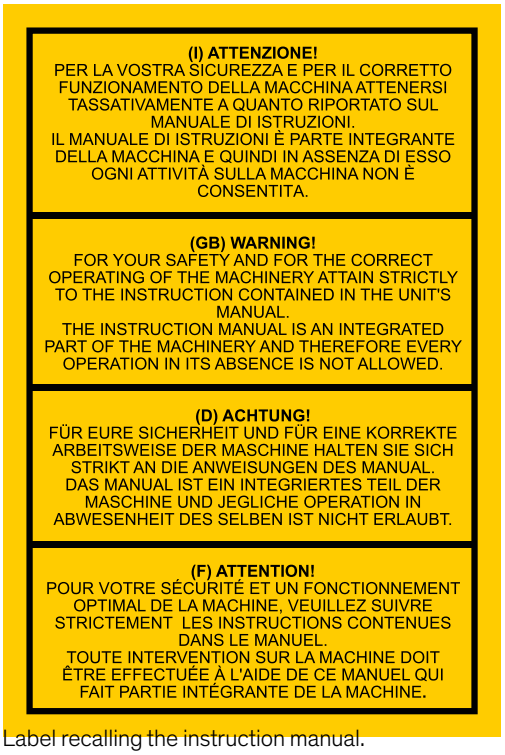
Entrance of the hydraulic circuit of the chiller (inlet of the chiller).
Location: next to the inlet fitting of the hydraulic circuit.

Exit of the hydraulic circuit of the chiller (outlet of the chiller).
Location: next to the outlet fitting of the hydraulic circuit.

Hot surface.
Location: in the proximity of the input / output pipes of condensers (under the protective casing) and on the compressors. With equipped antifreeze option, even in the proximity of the heaters around the evaporator and the steel hydraulic piping.

Lifting point.
Location: near the lifting points on the base frame of the unit.

Flammable material
Location: near the nameplate and on the package.



Label recalling the instruction manual.
Location: on the side of the powerboard.

Refrigerant Gas 1234ze

Location: on the electrical cabinet, on the left side.

Discharge of the safety valves of the chiller.

Location: in the proximity of the refrigerant discharges of the safety valves.

Connecting hole for external earthing.

Location: on the base frame, close to properly designed holes.

The chiller is identified by the **nameplate** shown on the left.

The identification nameplate also shows the serial number of the unit, it is important to know the label as it is essential to get assistance or any information concerning the unit described in this manual.

Location: on the side of the powerboard.

STULZ

Manufactured by STULZ S.p.A.
Via E. Torricelli 3, 37067
Valeggio sul Mincio (VR)

CE

REFRIGERATORE DI LIQUIDO - LIQUID COOLER - KUHLANGE - REFROIDISSEUR DE LIQUIDE

MODELLO - MODEL - TYP - MODELE	**WS - - - - - - - - - - - - _1Z**
SERIE - SERIES - SERIE - SERIE	**N°**
ORDINE - ORDER - ORDER - COMMANDER	**OP:**
DATA - DATE - DATUM - DATE	**- -/ - -/- - - -**
Alimentazione principale - Main power supply - Netzstromversorgung - Alimentation principale F.L.A.	**400/460V 3 ~ 50/60Hz - - /- - A**
Resa nom. - Cooling cap. - Kaelteleistung- Puissance nom.	**- - - kW (W0L32)**
Refrigerante tipo - Refrigerant type - Kaeltemittel - Refrigerant type	**- - - - - - - - - kg**
Min/Max temp. Stoccaggio - Min/Max temp. Storage - Min/Max temp. Lagerung - Min/Max temp. Stockage	**/ 50,0 °C**
PS HP/PS LP	**- - - bar / - - - bar**
TS Min/TS Max	**-10 °C / 85 °C**
CAT PED	**I**
Modulo di valutazione - Evaluation Module - Bewertungsklause - Module d'évaluation	**A**
Peso a vuoto - Unladen weight - Leergewicht - poids à vide	**- - - kg**

CO2 Eq.= 3,37 Tonn.

MADE IN ITALY

Contiene gas fluorurati a effetto serra - Contains fluorinated greenhouse gases - Enthalt fluorierte Treibhausgase - Contient des gaz a effet de serre fluores

GWP: R134a=1430, R407C=1774, R410A=2088, R1234ze=7, R513A=631 | Gas added kg

Symbol	Description
CE	Units built in accord to the EC directives
0496	Reference number of the Technical File notified to Approval Authority
EAC	Units comply with EurAsian Conformity directives
Double Power Supply	Double power supply (only if this option is present)
Rated Voltage	Voltage - Phases - Frequency of the power supply
F.L.A.	Maximum Absorbed current of the Main Power Supply considering the toughest condition at the operating limit of the unit
Auxiliary Power Supply	Voltage - Phases - Frequency of the auxiliary power supply
F.L.A. (Auxiliary Power Supply)	Maximum Absorbed current of the Auxiliary power supply considering the toughest condition at the operating limit of the unit
Cooling Cap.	Rated Cooling Capacity with water temperature 12 - 30°C
Refrigerant Type	Refrigerant type used
Kg	Refrigerant gas charge
Min/Max temp. Storage	Maximum and minimum storage temperature (unit not powered)
PS HP/PS LP	Maximum working pressure permitted on the high pressure side and minimum working pressure permitted on the low pressure side.
TS Max. / TS Min.	Maximum and minimum temperature reached by the operating components of the refrigerant circuit
CAT PED	Category complying with the Pressure Equipment Directives
Evaluation module	Conformity evaluation module according to the Pressure Equipment Directives
Weight	Unladen mass of the unit (without packing, but with the refrigerant charge
CO2 Eq.	Tons of Equivalent CO2 according to the F-Gas directives (573/2024)
According to Kyoto Protocol	According to Kyoto Protocol
Empty Space	Empty for additional refrigerant charge added on the installation site

1.3.3 Safety Instructions

INFORMATION

This cooling unit contains fluorinated greenhouse gas covered by the Kyoto protocol

In these STULZ chillers the refrigerant R1234ze is used. Refrigerants are volatile or highly volatile fluorinated hydrocarbons which are liquefied under pressure. They are incombustible and not hazardous to health when used as intended.

DANGER

- Works have to be carried out by competent staff only
- Observance of the regulations for accident prevention
- Stay out of danger when lifting and setting off the unit
- Secure the unit to avoid the risk of overturning
- Safety devices may not be bypassed
- Respect the corresponding EN- and IEC standards for the electrical connection of the unit and observe the conditions of the power supply companies
- Switch off the voltage from the unit when working on it
- The unit must be earthed

WARNING

- The unit may only be used to cool water according to the Stulz specification.
- Observe the national regulations of the country where the unit will be installed
- The refrigerant circuit contains refrigerant and refrigerating plant oil, observe professional disposal for maintenance and when setting the unit out of service
- Cooling water additives have an acidic effect on skin and eyes, wear safety glasses and safety gloves
- Observe personal protective equipment when working on the refrigerant circuit

INFORMATION

- Respect material compatibility in the whole hydraulic circuit
- The male triangular wrench is to be placed in a visible location in the immediate vicinity of the unit

1.3.4 Handling refrigerants

The unit must be installed in the environment according to the requirements specified in section 6.3. According to EN 378, refrigerants are divided in groups in respect of health and safety. The refrigerant R1234ze used in this chiller belongs to the A2L fluid (mildly flammable) and is classified Group PED 2.

In order to properly manage the refrigerant is needed to respect the following:
- Adherence to the regulations by law and guide-lines
- Execution only by competent staff
- Responsibility for correct disposal of refrigerant and system parts is incumbent on the operator
- Refrigerants could cause asphyxia when inhaled in high concentrations. The symptoms could include lose of mobility and consciousness.

- Do not use direct flames or electro warming devices near the chiller to increase the pressure of the refrigerant.
- A2L refrigerants are not flammable at atmospheric pressure and ambient temperature in air. In case of pressurization with air or oxygen, the mixture may get flammable. A potentially explosive atmosphere can be created at the release of refrigerants. So smoking and open fire is strictly prohibited.
- For refrigerant R1234ze: In case of exposure to fire, hydrogen fluoride can be produced by thermal decomposition. Hydrogen fluoride has an acid effect on skin, eyes and mucous membranes.
- The refrigerant is heavier than air and accumulates near the ground.
- The room is to be evacuated immediately if high concentrations of refrigerant suddenly occur. The room may only be entered again after adequate ventilation.
- If unavoidable work is required in the presence of a high concentration of refrigerant, breathing apparatus must be worn. This does not mean simple filter masks. Comply with breathing protection data sheet.
- Safety glasses and safety gloves are to be worn.
- Do not eat, drink or smoke at work.
- Liquid refrigerant must not get onto the skin (risk of freezing).
- Only use in well ventilated areas.
- Do not inhale refrigerant vapours.
- Warn against intentional misuse.
- It's absolutely essential to comply with the first aid measures if accidents occur.
- Remove refrigerant from the system before performing any welding or brazing works.
- Weld and braze chiller systems without refrigerants only in suitably ventilated rooms.
- If the system emits a pungent smell this means that the refrigerant has decomposed due to overheating. Immediately leave the room and return only after it has been suitably ventilated or when wearing a gas mask for acid gases.
- HFO Refrigerants contribute to the global warming and with this to climate changes. The hydrofluoric-olefins must therefore be disposed of in accordance with the regulations, i.e. only by companies specially qualified and licensed as recognised disposal companies for refrigerants.

1.3.5 Safety and environmental requirement

The following requirements relate to the operation of refrigerating plants within the European Community.

- The used components must correspond to the pressure equipment guide-line 2014/68/UE and EN 378 part 1-4.
- Independent of the design, the equipment and inspection before the delivery, also the operator of such plants has duties according to EN 378 and national regulations.
- This concerns the installation, the operation and the repeated inspection:
- Installation: according to EN 378
- Operation: Determination of emergency measures (accidents, malfunctions)
  Creation of an abbreviated instruction and notification (template page)

  1. A unit protocol must be kept.
  2. To be stored in the proximity of the unit
  3. Access for competent staff in case of repairs and repeated inspection must be ensured.
- Repeated inspection: according to EN 378
  The operator is responsible for the execution.

The operator must ensure that all maintenance, inspection and assembly work is carried out by authorised and qualified specialist staff who have made an in-depth study of the operating

instructions. It is absolutely essential to comply with the procedure for shutting down the system described in the operating instructions. Before maintenance work, the unit must be switched off at the main switch and a warning sign displayed to prevent unintentional switching-on. Functionality of safety devices must be kept during the whole life cycle of the unit. In order to perform this task, please follow the prescription given in the chapter paragraph 7.

First aid measures

- If health problems occur during or after handling hydrofluoric-olefins, a doctor is to be consulted immediately. The doctor is to be informed that the work involved the use of HFOs.
- In the case of acute effects, wear breath apparatus to transport the casualty is to fresh air as quickly as possible, keeping the victim warm and laying on the ground.
- The casualty must never be left unsupervised.
- In case of contact of the liquefied gas with the skin, sign of freezing, apply warm water to the concerned part. Do not rub the skin. The doctor is to be informed immediately.
- Only if the casualty stops to breath, initiate mouth-to-mouth resuscitation immediately.
- If the casualty is unconscious or very dazed he or she must not be given any liquid.
- Splashes of HFOs in the eyes can be removed by an assistant by blowing air or using a fan. Then rinse with water for about 15 minutes. The casualty needs to see a doctor as quick as possible. If the medical assistance is not available, wash the eyes for another 15 minutes.

Independent conversion and manufacture of replacement parts

The system may only be converted hydrofluoric-olefins or modified after consultation with STULZ. Original replacement parts and replacement parts/accessories authorised by STULZ are an aid to safety.

Unacceptable operating methods

The operating safety of the system is only guaranteed when it is used as intended. The limit values stipulated in the technical data must not be exceeded under any circumstances.

2. Residual risk

2.1 Transport and installation

Area	Danger	Risk	Preventative measures
Under the unit	Faulty lifting system of the unit causing its fall.	Bruises, trauma.	Keep away from the danger area while handling the unit
Beside the unit	Support of the unit unstable or inadequate causing its tipping.	Bruises, trauma.	Make sure the unit support is adequate to its weight, is stable and level. Wear protective equipments (helmet, gloves, safety shoes)
In the lower part of the unit	Sharp edges, built-in parts	Cuts, contusions, burns, formation of acid vapours	Keep away from the danger area while handling the unit. Wear protective equipments (helmet, gloves, safety shoes)
Electrical box	Connection cable under voltage, sharp edge of openings for the cable introduction	Electric shock, cable damage at positioning	Check and make sure the unit is de-energized. Stand on isolated ground. Take care that sharp edges are always protected by rubber grommets. Wear protective equipments (helmet, gloves, safety shoes)

2.2 Start-up

Area	Danger	Risk	Preventative measures
In the lower part of the unit, refrigerant piping	Defective filling line for refrigerant, leaks in the refrigerant piping, closed stop valves, defective safety valve	Discharge of refrigerant under high pressure, burns in case of contact to the skin, formation of acid vapours with open flames	Open stop valves. Wear safety glasses and gloves
In the lower part of the unit, water piping	Leaks in the water lines, closed stop valves	Discharge of water under high pressure, contact with the skin of ethylene glycol, irritation of eyes and respiratory system by glycol vapours, increased risk of electric shock in combination with electricity, risk of slipping	Open stop valves. Wear rubber gloves, ethylene glycol is adsorbed by the skin Avoid swallowing water with glycol additives
Electrical box	Short circuit	Electric arc, acid vapours	Re-tighten terminal connections, Wear protective gloves

2.3 Operation

Area	Danger	Risk	Preventative measures
In the lower part of the unit, refrigerant piping	Leaks in the refrigerant piping, defective safety valve/high pressure switch, fire	Discharge of refrigerant under high pressure, explosion of pipe sections, formation of acid vapours with open flames	In case of fire wear protective mask
Hot gas line	The line can take a temperature up to 70°C	Burn in case of contact to the skin	Wear safety gloves. Cover lower arms with clothing
Electrical supply	Falsely dimensioned cables or protection devices	Short-circuit, fire, acid vapours	Correctly design supply cables and protection elements. Wear protective mask
Top of the unit	Fans without AxiTop diffusor.	Shearing, cuts.	If AxiTop diffusor option is not installed, install protective devices of the fans.

2.4 Maintenance

Area	Danger	Risk	Preventative measures
At the lower part of the unit, refrigerant piping	Leaks in the refrigerant piping, defective safety valve/high pressure switch	Discharge of refrigerant under high pressure, burns in case of contact to skins, formation of acid vapours with open flame	Wear safety glasses and gloves
Pressure lines, compressor	Heat	Burns in case of contact to the skin	Wear safety gloves. Avoid contact to hot unit parts
Fin heat exchanger, air side	Sharp edges, fins	Injuries by cutting	Wear safety gloves
Electrical box	Live components, supposed to be voltage-free	Electric shock	1. Disconnect mains 2. Prevent reconnection 3. Test for absence of harmful voltages 4. Cover or close off nearby live components To energize apply these procedures in reverse order. Wait for the time indicated at paragraph 8.1 after the off position of the main switch, before start doing any operation in the electric cabinet.

2.5 Dismantling

Area	Danger	Risk	Preventative measures
Refrigerant piping	Soldering off or cutting the refrigerant pipes still under pressure	Discharge of refrigerant under high pressure, burns in case of contact to the skin	Depressurized pipes before disconnecting them. Wear safety glasses and gloves
Water piping	Unscrewing the water pipes still under pressure	Discharge of water under high pressure, contact with the skin of ethylene glycol, increased risk of electric shock in combination with electricity, risk of slipping	Drain of cooling water by drain valve. Wear rubber gloves
Electrical box	Live electrical supply cable	Electric shock	Check de-energized state of the supply before dismantling, wear safety gloves

2.6 Safety Data

Safety data of the refrigerant		
1. Product identification	Chemical Name	trans-1,3,3,3-Tetrafluoroprop-1-ene (R1234ze)
	Recommended use	Refrigerant
2.Composition/ Information on Ingredients	CAS N°	29118-24-9
	EC N°	471-480-0
	Registration N°	01-0000019758-54

⚠ WARNING

Please, refer to the specific “Safety Data Sheet” of the refrigerant

Safety data of the oil		
1. Identification of the substance / preparation	Identification of preparation	BITZER BSE170 lubricant oil
	Product Description	Polyol Ester
	Product Code	11867339 Ester
	Intended use	Synthetic refrigeration compressor oil
	Company Name	CPI Corporation Pty Ltd 148 Old Pittwater Road, Brookvale NSW 2100, Australia
2. Hazards identification	Hazard Classification:	Non hazardous substance. Non-dangerous good. No special warning labels are required. Does not contain any hazardous ingredients at or above regulated thresholds
		The product contains no known carcinogens. Classified in accordance with Approved Criteria for Classifying
	Hazardous Substances NOHSC:	1008 and according to Australian Dangerous Goods Code.
	Note:	This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

⚠ WARNING

Please, refer to the specific “Safety Data Sheet” of lubricant oil

3. Transport/ Storage

3.1 Delivery of units

To assure a persistent quality and reliability, all chillers are tested and inspected before leaving the factory. The chillers are completely assembled when shipped and contain refrigerant under pressure. It is also possible to ship the chillers without refrigerant gas. In this case the refrigerant is substituted be nitrogen.

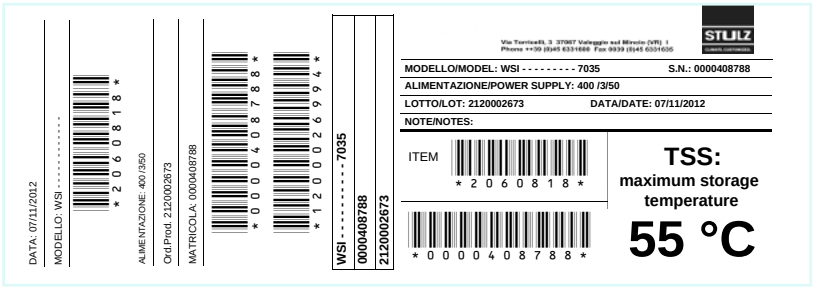
The chiller units must always be transported upright.

INFORMATION

The refrigerant circuit is filled with R1234ze refrigerant ready to use

The chiller is labelled as follows:

- STULZ Logo
- STULZ order number
- Type of unit
- Packing piece – content
- Warning symbols



INFORMATION

- Due to the pre-filled refrigerant, the unit is marked as transport of dangerous goods
- The refrigerant is non-toxic and non-flammable (only relative to the transport phase)
- For special shipping indication, please contact the corresponding sales department
- Special transport regulations must be checked country specifically

INFORMATION

When delivery is accepted, the unit is to be checked against consignment papers for completeness and checked for external damage which is to be recorded on the consignment papers in the presence of the freight forwarder.

- You receive the consignment papers with the delivery of the chiller
- The shipment is made ex works, in case of shipment damages, please assert your claim directly towards the carrier.

3.2 Storage

If you put the unit into intermediate storage before the installation, the following measures have to be carried out to protect the unit from damage and corrosion:

- Make sure that the water connections are provided with protective hoods. If the intermediate storage exceeds 2 months, we recommend filling the pipes with nitrogen.
- The temperature at the storage point should not be higher than 55°C and not lower than –5°C, and the site should not be exposed to direct sunlight. The transport temperature cannot be lower than the storage temperature.
- The storage point must be indoor.
- The unit should be packaged before the storage to avoid the risk of damage and corrosion.
- The unit should be stored in a location with minimum activity to reduce the risk of accidental physical damage.
- A periodic inspection is highly recommended. If your chiller contains refrigerant gas during the storage period you also have to consider the current F-Gas regulations and EN 378.

⚠ WARNING

If the chiller remains switched off in thermal equilibrium with the environment, unless specifically received at the time of ordering, the storage conditions listed above must be observed.

3.3 Transport

The STULZ chillers can be lifted and moved by lifting devices with ropes or belts. There are lifting plates attached to the base frame for this purpose. The lifting plates are standard wise supplied and installed on the chiller. In case of shipping in container, the plates can be removed to save movement space. Check the specific manual to re-install the plates.
The drawings on the following pages show the dimensions for the lifting points and the position of the centre of gravity.

i INFORMATION

The rope forces are higher than the weight forces according to the geometry. Due to the risk of scratching the side planking we advise not to use chains.

⚠ WARNING

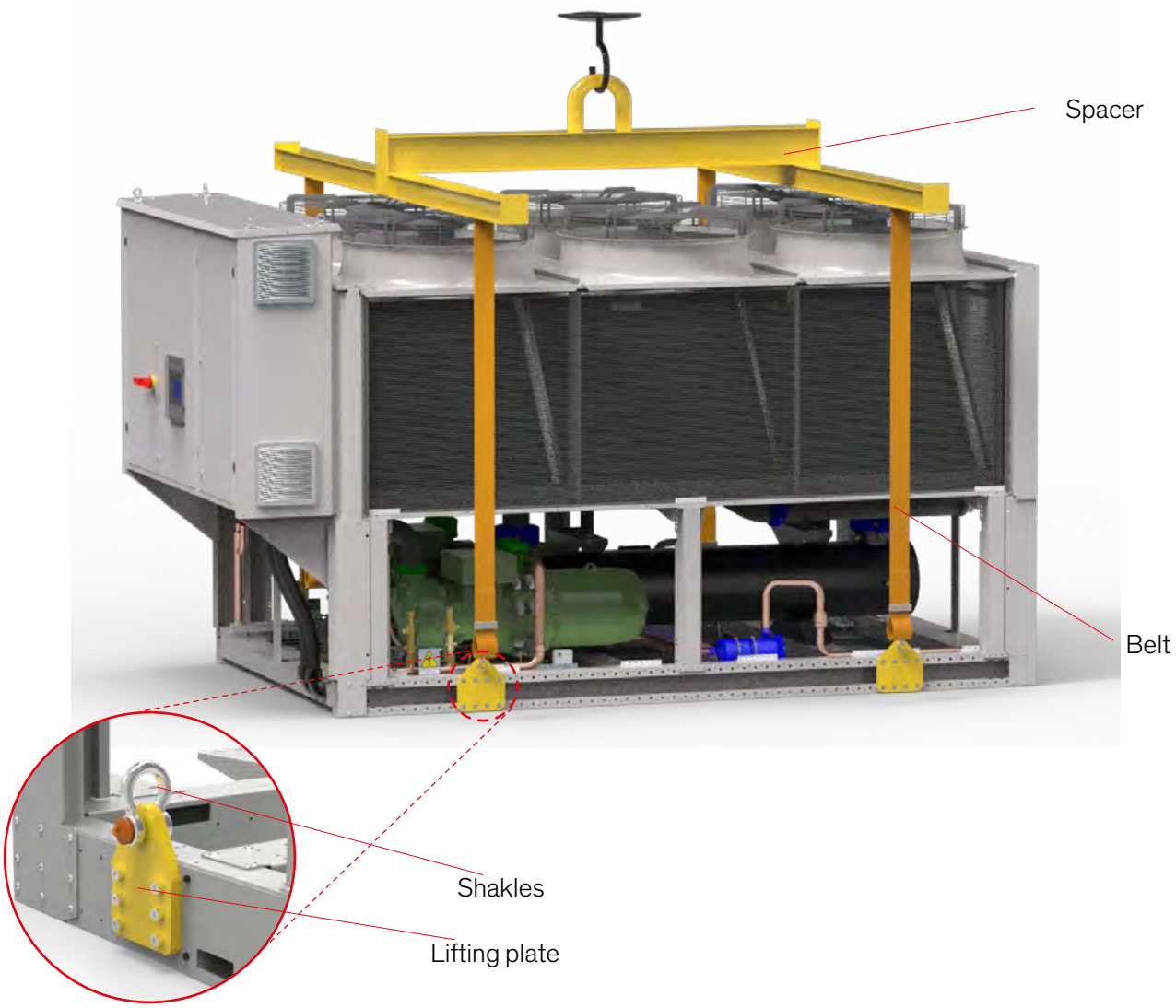
All the chillers are designed to be lifted and moved with empty hydraulic circuit

3.3.1 Transport protection

The standard packaging of the chiller is bubble wrap around the chiller.

⚠ WARNING

The standard packaging is not suitable for transport by sea or by air


Spacer
Belt
Shakles
Lifting plate

4. Description

4.1 Type Code

The type code represents the variant of your chiller unit and can be found on the nameplate located on the inner side of the electric cabinet. You can decode the type code by the following table.

INFORMATION

Please be aware that not every combination of these values is possible.

1°digit	W	**Air Cooled Screw**
2°digit	S	
3°digit	I	**Configuration** **I** Only cooling + inverter compressor + EC fans **J** Free cooling + inverter compressor + EC fans **K** Only cooling + inverter compressor + AC fans
4°digit	0	**Cooling Capacity** **11** 110 HP **28** 280 HP (ECO) **42** 420 HP **16** 160 HP **30** 300 HP **48** 480 HP **18** 180 HP **32** 320 HP (ECO) **56** 560 HP **22** 220 HP **36** 360 HP **64** 640 HP (ECO) **70** 700 HP (ECO)
5°digit	9	
6°digit	2	**Refrigerant gas** **3** R1234ze
7°digit	2	**Evaporation Water Outlet Temperature** **1** Water temperature leaving evaporator HT **2** Water temperature leaving evaporator STANDARD **3** Water temperature leaving evaporator BRINE
8°digit	M	**Version** **M** Standard coils not treated **N** Anti-corrosion treated coils **F** F&T not treated **G** F&T anti-corrosion treated coils **B** Only cooling -20°C standard coils not treated **C** Only cooling -20°C anti-corrosion treated coils **R** Only cooling -20°C F&T not treated **V** Only cooling -20°C F&T anti-corrosion treated coils **X** Special aeraulic circuit (special fans, special HE, special painting…)
9°digit	N	**Noise Level** **N** Standard **S** Super Low Noise **L** Low Noise
10°digit	A	**Power Supply** **A** 400V / ~3 / 50Hz **B** 460V / ~3 / 60Hz
11°digit	0	**Hydraulic Circuit** **0** No pumps **A** 1 pump P1- strong **1** 1 pump P1-standard fluid **B** 2 pumps P1- strong **2** 2 pumps P1-standard fluid **C** 1 pump P2 - strong **3** 1 pump P2-standard fluid **D** 2 pumps P2 - strong **4** 2 pumps P2-standard fluid **E** 1 pump inverter P1 - strong **5** 1 pump inverter P1 - standard fluid **F** 2 pump inverter - strong **6** 2 pumps inverter - standard fluid **G** 1 pump inverter P2 - strong **7** 1 pump inverter P2 - standard fluid **H** 2 pumps inverter - strong **8** 2 pumps inverter P2 - standard fluid **X** Special hydronic circuit
12°digit	0	**Energy Efficiency** **0** Standard **F** Free Cooling Boost **A** Adiabatic PAD system **G** Adiabatic PAD system + Partial heat recovery **D** Partial heat recovery
13°digit	0	**Options** (change accordingly to the selected options)
14°digit	0	
15°digit	0	

4.2 Intended use

This chiller is intended for the chilled water production and for the chilled water control. The chiller is designed for outdoor installation on the roof of a building or at the ground level. Any use beyond this is not intended. STULZ is not liable for any damage resulting from such misuse. The operator alone bears the risk. The chiller must not be used for the warming of water.

4.3 Chiller Design

4.3.1 General

The chiller consists of two separate refrigerant circuits with one semi-hermetic screw compressors in each circuit, a single shell & tube evaporator, air cooled condensers and an electronic expansion valves in each refrigerant circuit.
After assembling the chiller each unit is pressure tested, evacuated and fully factory charged with R1234ze and oil in each of the independent refrigerant circuits. The end of line test also includes an operational test with water flowing through the evaporator to ensure that each refrigerant circuit operates correctly.

4.3.2 Versions

The standard version for air cooled chillers with screw compressors has a unit designation which takes the following pattern: WSI _ _ _ 2 CN _ . There is one more version which will be described in the following.

Free Cooling Version
The free cooling version is available for all the sizes. This Version additionally contains free cooling coils positioned directly in front of the condensers and therefore in W-shape.
During free cooling mode two motor-driven 2-way-valve directs the water volume completely through the free cooling coils.

Low noise version
With the low noise version of the Explorer WSI chillers you have the possibility to reduce the noise emissions. Low-noise versions feature the same size and components as standard versions: the reduction is obtained with compressor encapsulation. Noise due to the compressor operation is reduced by the installation of a powder painted galvanised sheet metal compartment, in the same colour as the chiller. The compartment is internally insulated with a polyester textile fibre panel coupled to a vibration damper, for a total thickness of 46mm. Wall-to-wall membranes guarantee the continuity of acoustic insulation. The compartment provides access to the compressors main components.
To reduce the noise emitted by the compressors they are installed in a completely insulated compressor compartment.
For safety reasons, related to the type of refrigerant used (A2L - slightly flammable), the compressor compartment is ventilated by means of two preassembled fans (in redundancy) located on the front side, under the electrical panel, and an air outlet grille on the rear panel. One of the two fans will always be in operation from the moment the unit is connected to the mains and the 230V ac emergency line.

HT High temperature version
The HT version is suitable for outlet water temperatures higher than +15°C.
The limits of WSI chillers can be extended (see Par. ***) up to:
- Ambient air temperature: +45°C;
- Outlet fluid temperature: +25°C.

High Temperature versions have the same size as standard versions.

4.3.3 Refrigerant Circuit

Two independent refrigerant circuits are provided. Each circuit uses copper refrigerant pipes that are formed on computer controlled bending machines where possible to reduce the number of single point of failures and to provide a reliable and leak resistant system.
An electronic expansion valve is also a part of the standard equipment as well as a filter dryer with replaceable cartridge and a sight glass with humidity indication. Also is present: liquid line shut-off device (function performed by electronic expansion valve with ultracap), non-return valve in compressor´s discharge line integrated in the compressor, compressor's discharge valve, liquid line shut-off valve, refrigerant line sight glass with humidity indicator, drier filter with replaceable cartridge, economizers on the following models: 280-320-640-700.
Each refrigerant circuit disposes of the following safety devices:

Low pressure switch
A low pressure switch is installed in each cooling circuit. It will be activated when the pressure inside the cooling circuit drops down to 0.2 barg. The compressors of the circuit will be turned off and an alarm signal is shown on the electronic control display. The pressure switch needs to be reset manually.

High pressure switch
A high pressure switch is installed in each cooling circuit. It will be activated when the pressure inside the cooling circuit exceeds 18 barg. The compressors of the circuit will be turned off and an alarm signal is shown on the electronic control display. The pressure switch needs to be reset manually.

Safety valve
One or more safety valves are installed in each cooling circuit. They are positioned on the pressure side of the compressor. The safety valves will be activated when the pressure in the cooling circuit exceeds the max. value of 24 barg. (Whether the chiller is operating or not.) In this case the safety valves open and the refrigerant will exit.

Safety valve at low pressure side
One or more safety valve is positioned in the low pressure side. It will be activated when the pressure exceeds the max. value of 15 bar. (Whether the chiller is operating or not.) In this case the safety valve opens and the refrigerant will exit.

⚠ DANGER

Always keep the tap, upstream of the safety valve, in open position, to allow the working of the safety valve.

4.3.4 Compressor

The chiller has semi-hermetic screw compressors equipped with an integrated frequency inverter. The frequency inverter controls the speed of the compressor motor and adapts the Vi (internal volume ratio) slider to avoid losses of compression job and increase the efficiency of the system.
The single compressor can be partialized step less, with continuous cooling power capacity control from 25 to 100%. In each unit there is one compressor per cooling circuit and can be separately switched on, off and partialized.
The compressor contains a crankcase heater.
The compressors mounted on the WSI ERP range are provided as standard of: an oil sight glass to visually check the oil level inside the compressor, an electric oil level sensor, connected to the SEC. blue electronic control, oil heating resistor, to keep the oil temperature within the limits imposed by the manufacturer, oil temperature sensor (PTC), winding temperature sensor (PTC), frequency inverter temperatures and voltage supply controls, an integrated oil filter (no maintenance required), refrigerant gas shut-off valve on compressor outlet, electrical box IP54 with girdle clamp for signal cable electrical connection and passage and anti-vibration mounts.

In the electrical cabinet, the compressors electrical supply line is protected and equipped by:
- Thermal protection: triplet of fuses and magnetothermal manual reset.
- RFI filter: to eliminate the interference in the radio frequency range which are emitted by the FI to the power network and wich can be radiated by the electrics lines
- Line reactor: to avoid power electrical network pollution

4.3.5 Evaporator

The Explorer WSI is equipped with a shell & tube heat exchanger made with copper pipes and steel shell. Fully insulated with 10 mm of thermal insulator.
Victaulic® connections as standard in the inlet and outlet of the water circuit.

Plate type evaporator
The WSI110-160 units are equipped with a single-circuit brazed stainless steel plate evaporator. Optimised for R1234ze refrigerant gas and thermally insulated by means of a special 10mm weather and UV resistant thermal insulation.

Shell & Tube evaporator
The WSI180-700 units are equipped with a direct expansion shell & tube evaporator with refrigerant inside the piping and chilled water outside.
The heat exchanger is a single pass type to provide almost perfect countercurrent heat exchanger, with painted steel shell and copper pipes, manufactured with double refrigerant circuit and single water circuit. Optimised for refrigerant gas R1234ze. Thermally insulated on the outside through specific 10 mm thermal insulation, atmospheric agents and UV-resistant.

The evaporator antifreeze safety is guaranteed by:
- Antifreeze temperature sensor (PTC), managed by the SEC.blue electronic control.
- Differential pressure switch to check load losses inside the evaporator.

4.3.6 Condenser

Micro-Channel Condensers, entirely made of long-life aluminium (HA9153A) and installed with longitudinal “W”-shape geometry (mod.160-700) or “V” “-shape (mod.110), with specially designed and selected angles to maximise air-to-refrigerant-gas thermal exchange efficiency. The Micro-Channel cataphoresis treatment is available for the base and free cooling version as option.
The advantages of adopting Micro-Channel condensers compared to tube condensers with .aluminium fins and copper tube are:

- Better heat transfer to ensure greater yield per unit of surface.
- Lightweight: reduced support structures.
- Less air-side load loss. Reduced air-side load losses up to 30%, resulting in a reduced noise level.
- Reduced internal volume, with up to 30% reduction in the refrigerant gas load.
- Resistance to high pressures (until 45 bar).
- Long life thanks to the specific aluminium alloy used.
- Environment-friendly: fully recyclable as only aluminium is used.

4.3.7 Economiser

Available for models WSI280, WSI320, WSI640, WSI700, in standard version.
Thanks to the use of a refrigerant-refrigerant brazed plate heat exchanger, it’s possible to increase the subcooling of each refrigerant circuit. Such solution allows an increase of the cooling capacity delivered by the chiller with the same power consumption. The exchanger is located between the condenser and the electronic expansion valve. The economiser installation includes:

- Compressor with refrigerant gas injection valve.
- Stainless steel brazed plate exchanger.
- Shut-off valves.
- Thermostatic expansion valve.
- Solenoid shut-off valves.
- Liquid warning light.

4.3.8 Condenser fans

The air flow through the condensing coils is ensured by axial fans that force the air passage from the longitudinal side of the chiller through the condensers and push the overheated air upwards.

- Chiller version: the standard fans are of an axial type with GreenTech EC brushless motor (AC available as option), diameter Ø 910mm. Speed is adjusted through a specific phase-cutting module operated by the SEC.blue electronic control depending on the refrigerant gas condensing temperature.
- Freecooling version: the standard fans are of an axial type with GreenTech EC brushless diameter Ø 910mm.

Fan management is independent for each refrigerant circuit and varies according to the chiller operating mode: Chiller, Mix, Free Cooling. Each fan is provided with:

- 5-blade impeller made of robust UV and corrosion resistant composite material, with clockwise rotation direction (viewed from rotor).
- Optimised inlet ring and integrated diffuser for maximum efficiency and low noise.
- Upper protection grid made of phosphate steel coated with black plastic.
- Electrical box with IP54 protection degree (EN 60529).
- Maintenance-free ball bearings.
- Working range: -40 ÷ +60°C.

Standard fans can not be ducted.

4.3.9 Electrical and control cabinet

Electrical cabinet installed on the short side of the chiller, with components and construction in accordance with European regulations CEI EN 60204-1, CEI EN 61000-6-2/4 and EMC 2014/30/UE. Triple leaf metal frame with lock and “double-bit 3-5” key, IP44 degree of protection for outdoor installation. Short-circuit current protection: 10kA.
The electrical cabinet comes with all components installed, connected, tested as well as calibrated and ready to operate. The cabinet is divided into two sections, accessible through separate doors:

- Doors 1 and 2: high voltage section (power supply).
- Door 3: Low voltage section (signals and control).

The passage of power cables is accessible through painted, removable and drillable aluminium plates at the bottom of the electrical cabinet.

- Ventilation grids are installed to ensure stable temperature conditions inside the electrical cabinet.
- To check the correct rotation of phases, a phase sequence relay connected to the SEC.blue electronic control is delivered as standard.
- The secondary power supply is 230V single phase, through a special transformer inside the electrical cabinet.
- Spring-type control circuit terminal board.
- Relays for voltage monitoring.
- Fuses and breaker switchfor compressors and fans.
- Compressors protection with internal thermal overload.
- RFI filter to eliminate the interference in the radio frequency range which are emitted by the FI to the power network and wich can be radiated by the electrics lines.
- Line reactor to avoid power electrical network pollution.
- Electronic controller.
- Remote ON/OFF terminals.
- Terminals for cumulative alarm block.
- Power supply 400V/3ph/50Hz.

With a closed electrical cabinet, the following can be accessed: general disconnector with door lock, lockable in the “0” position and touch-screen graphic display of the SEC.blue electronic control, to view and change all chiller settings. The display is protected by a transparent openable panel with IP65 degree of protection. Quick Start allows a fast restoring of the full cooling capacity of the chiller, in case of electrical blackout.

4.3.10 Sensors

The following sensors are installed in the chiller as standard for each refrigerant circuit:

For each circuit:

- High and low pressure switch ⇨ to guarantee the safety
- High and low pressure transducer ⇨ to manage the compressors and the TCE
- Sensor for suction gas temperature (PTC) ⇨ to manage the TCE

Chilled water circuit:

- Sensor for inlet and outlet water temperature (PTC) ⇨ to manage the set-point
- Differential pressure switch ⇨ to guarantee the safety of the unit
- Sensor for freezing temperature (PTC) ⇨ to guarantee the safety of the unit

Air Temperatures:

- Sensor for outdoor temperature (PTC) ⇨ to manage the free cooling and compressors

4.3.11 SEC.blue electronic controller

The WSI ERP range is supplied with the SEC.blue control and 7" colour touch-screen display, specifically designed by STULZ. The components managed by the control are:

- Refrigerant circuits: independent operation of the circuits and maximisation of their efficiency.
- Free Cooling: automatic switch-over of the Mix-Mode and Free Cooling chiller modes. Management of 2-way valves for mixing fluid on air-water coils during Mix mode.
- Compressors: start, shutdown and capacity speed control; control of the operating limits indicated by the manufacturer.
- Fans: start, shutdown and speed rotation control. Fans are independently controlled between the two refrigerant circuits, with priority being given to the condensing temperature.
- Electronic expansion valves: opening, closing, capacity control.
- Fluid side pump(s) (if any): start, shutdown, redundancy. If two pumps are installed, the electronic control will manage their operation independently maintaining similar operating hours and overcoming any malfunctions by activating a backup pump.

The electronic board includes the following as standard:

- Ethernet port on RJ45 connector, for communication with HTTP, SNMP, ModBus TCP protocols and software update.
- RS485m port for communication with ModBus RTU and Sequencing protocols.
- MicroSD slot for storing event history and for software updates.
- On-Off input (clean contact) to change the status of the chiller from ON to Stand-By.
- 4÷20mA input for controlling the chiller set-point. Operating limits that can be set via software.
- On-Off output (clean contact), for alarm/pre-alarm signals.
- The following outputs that can be set via software are also available: 5 On-Off outputs (clean contact) for alarms/pre-alarms.

The following functions are available as standard in the SEC.blue control:

- History of the Alarms stored in the control and displayed in a menu.
- Alarm and unit status reporting via e-mail.
- Integrated web server monitoring (requiring internet connection).
- Unloading: capacity control of compressors at high temperatures to maintain condensing pressure within the limits imposed by postponing the chiller shutdown.
- Antifreeze: handling of resistors and pumps to prevent ice formation in the hydraulic circuit and in the electrical panel.
- Timing: check of the operating hours of each component. The control gives start-up priority to components working less.
- Quick start: quick restart of the chiller after a power outage.
- Handling of multiple units connected by a special line:
- Sequencing: connection of multiple chillers to handle components as one unit. You can connect up to 10 units, dividing them into 5 work zones.
- Emergency Cooling: sequential activation of the chillers set in the same area until the entire thermal load required by the user is covered. Limit of units to be operated, defined by a specific software parameter.
- Redundancy: alternate activation of chillers to ensure continuity of service even when a chiller is malfunctioning.

A chiller operation is fully displayed on the user interfaces: integrated web server, accessible from the computer via the Ethernet port. Dialogue via HTTP protocol. 7" colour touch-screen display with TFT screen. The display is mounted on the electrical cabinet door and can be accessed from the

outside. The menus provided with synoptic tables allow easy understanding of the displayed data. The tree structure of the options menu speeds up the change of the required settings.
The software is divided into 3 levels of access:

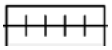
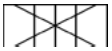
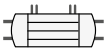
- User, with the ability to view and edit the main variables of the unit.
- Service: advanced access for authorised personnel by STULZ to perform maintenance on the unit.
- Manufacturer: full access to the parameters of the unit. Only available for STULZ.

INFORMATION

To get more information about the SEC.blue please refer to the separate controller manual

4.4 Piping diagrams

4.4.1 Legend

Nomenc.	Symbol	Meaning	Nomenc.	Symbol	Meaning
BC		Condenser	**SL**		Liquid detector
CO		Compressor	**SV**		Tank discharge
DT		Pressure transducer	**TCE**		Electronic expansion valve
ECO		Economizer	**TCM**		Mechanical thermostatic valve
EV-ST		Shell and tube evaporator	**TT**		Temperature transmitter
FG		Refrigerant filter	**VCG**		Charge gas valve
M		Motor	**VSC**		Safety valve with spring return
PDZAL		Low pressure switch	**VSG**		Gas safety valve
PSL		Pressure limiter, low	**VC**		Condenser fan
PZH		High pressure switch			Refrigerant line
RG		Gas ball valve			Actuating line
RU		Valve			

INFORMATION

The piping diagram is supplied together with the unit.

5. Technical Data

5.1 Application limits

The STULZ Explorer WSI units are provided for operations within the following ranges:

Type of network		TT; TN-S
Voltage		400 V / 3ph / 50Hz ; PE
Voltage Tolerance		± 10 %
Frequency Tolerance		± 1 %
Rated ultimate short- circuit breaking capacity		10 kA
Temperature difference (at conditions W7L35)		4 - 8 K
Max. glycol content	ethylenic	40 %
	propilenic	40 %

Setting of the safety devices	
High pressure limiter	18 barg
Low pressure switch	0.2 barg
High pressure safety valve	24 barg
Low pressure valve	15 barg

DANGER

Install upstream of the chiller adequate protection against indirect contact, respecting the requirements of CEI 64-8, unless other specification by local regulations.

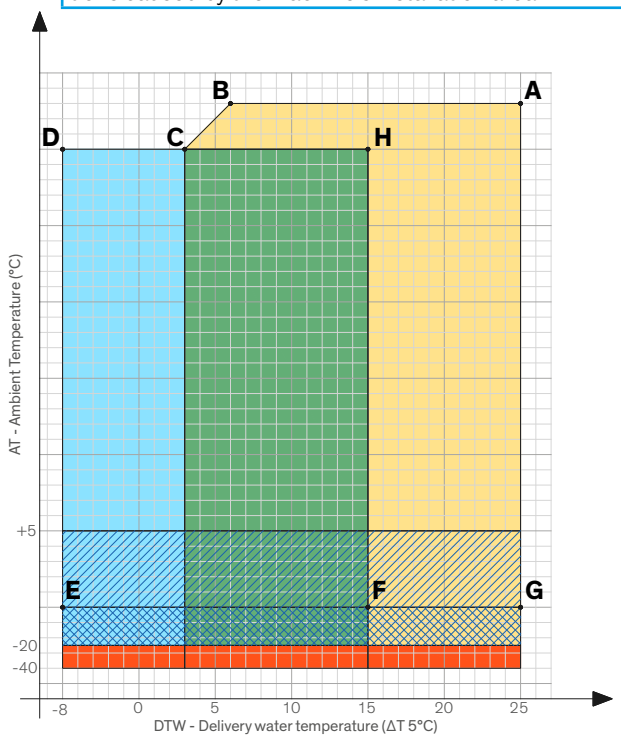
5.1.1 Storage conditions

Temperature	-5°C ÷ +45°C
Humidity	5 ÷ 95 % rel. h.

5.1.2 Operating conditions

INFORMATION

Each value refers to the machine reference system. Warmer ambient temperatures may occur due to local interactions caused by the machine's installation area.



Min outdoor temperature	-10°C	(optionally -20°C)
	-20°C	
Max outdoor temperature	+45°C	
Min chilled water inlet temp.	-5°C	
Max chilled water inlet temp.	+15°C	(optionally +25°C)
Max chilled water pressure	10 bar	

- Standard Version
- Standar Version + heating elements + glycol
- Standar Version + heating elements + glycol + wind stop
- Low temperature version (LT)
- LT version + heating elements + glycol
- LT version + heating elements + glycol + wind stop
- High temperature version (HT)
- HT version + heating elements + glycol
- HT version + heating elements + glycol + wind stop

Standard and HT version @50 Hz

	STD			STD			STD	STD
STD	A	B	C	D	E	F	G	H
WSI 110	45	45	45	42	-10	-10	-10	45
WSI 160	45	45	45	42	-10	-10	-10	45
WSI 180	45	45	45	45	-10	-10	-10	45
WSI 220	45	45	45	43	-10	-10	-10	45
WSI 280	45	45	45	44	-10	-10	-10	45
WSI 300	45	45	45	43	-10	-10	-10	45
WSI 320	45	45	45	44	-10	-10	-10	45
WSI 360	45	45	45	45	-10	-10	-10	45
WSI 420	45	45	45	42	-10	-10	-10	45
WSI 480	45	45	45	43	-10	-10	-10	45
WSI 560	45	45	45	43	-10	-10	-10	45
WSI 640	45	45	45	42	-10	-10	-10	45
WSI 700	45	45	45	43	-10	-10	-10	45

Values refer to full load operation (compressor 100%).
Above this temperature the chiller will continue to operate but will enter unloading mode.

Freecooling and Freecooling HT version @50 Hz

	HT			STD			HT	STD
STD	A	B	C	D	E	F	G	H
WSI 110	45	45	45	42	-10	-10	-10	45
WSI 160	45	45	45	42	-10	-10	-10	45
WSI 180	45	45	45	44	-10	-10	-10	45
WSI 220	45	45	45	42	-10	-10	-10	45
WSI 280	45	45	45	43	-10	-10	-10	45
WSI 300	45	45	45	42	-10	-10	-10	45
WSI 320	45	45	45	43	-10	-10	-10	45
WSI 360	45	45	45	44	-10	-10	-10	45
WSI 420	45	45	45	41	-10	-10	-10	45
WSI 480	45	45	45	43	-10	-10	-10	45
WSI 560	45	45	45	42	-10	-10	-10	45
WSI 640	45	45	45	41	-10	-10	-10	45
WSI 700	45	45	45	42	-10	-10	-10	45

Values refer to full load operation (compressor 100%).
Above this temperature the chiller will continue to operate but will enter unloading mode.

5.2 Chilled water quality

INFORMATION

The following limits for the water circuit may not be exceeded

DANGER

For outlet water temperatures lower or equal to +5°C and environments with temperatures lower than 0°C, use non freezing mixture approved by STULZ

Feature		Minimum value	Maximum value
pH(*)		7,0	8,0
Total hardness(*)	°F	13	35
Conductivity(*)	µS/cm	200	350
Alcalinity (HCO3)(*)	mg/L	200	300
(*) Considering water at temperature +20°C			

DANGER

The chiller must not be used in conditions outside the limits specified in the nameplate

5.2.1 Glycol correction factors

INFORMATION

In case glycol has to be added, the technical data described in this paragraph shall be adjusted according to the coefficients shown in the following table.

		Percentage of ethylene glycol			Percentage of propylene glycol	
		20%	30%	40%	30%	40%
Freezing temperature	[°C]	-8.9	-15.6	-23.4	-12.2	-20.6
Cooling capacity	Correction factors on the technical data sheets	0.990	0.984	0.977	0.974	0.962
Power consumption		0.997	0.996	0.994	0.993	0.989
Flow of fluid to be cooled		1.033	1.068	1.117	1.017	1.040
Pressure drop on the fluid to be cooled side		1.16	1.30	1.48	1.23	1.37

WARNING

It's necessary to use a glycol percentage such that the fluid doesn't freeze at minimum ambient temperature.

5.3 Hydronic group

The units can be fitted with these hydronic modules:
- With terminals (ON/OFF or modulating); the hydronic module allows the control of the external pumps with unit controller logic.
- With pumps (fixed or variable speed); the hydronic module includes the pumps and main water circuit components, that optimize hydraulic and electrical installation space, time and costs. These are end-suction pumps.

For the hydronic modules with only terminals, the components are:
- Terminals for external pumps control (only relays or relays + 0-10V signal).
- Differential pressure switch (on heat exchanger).
- Drain valve (on heat exchanger).

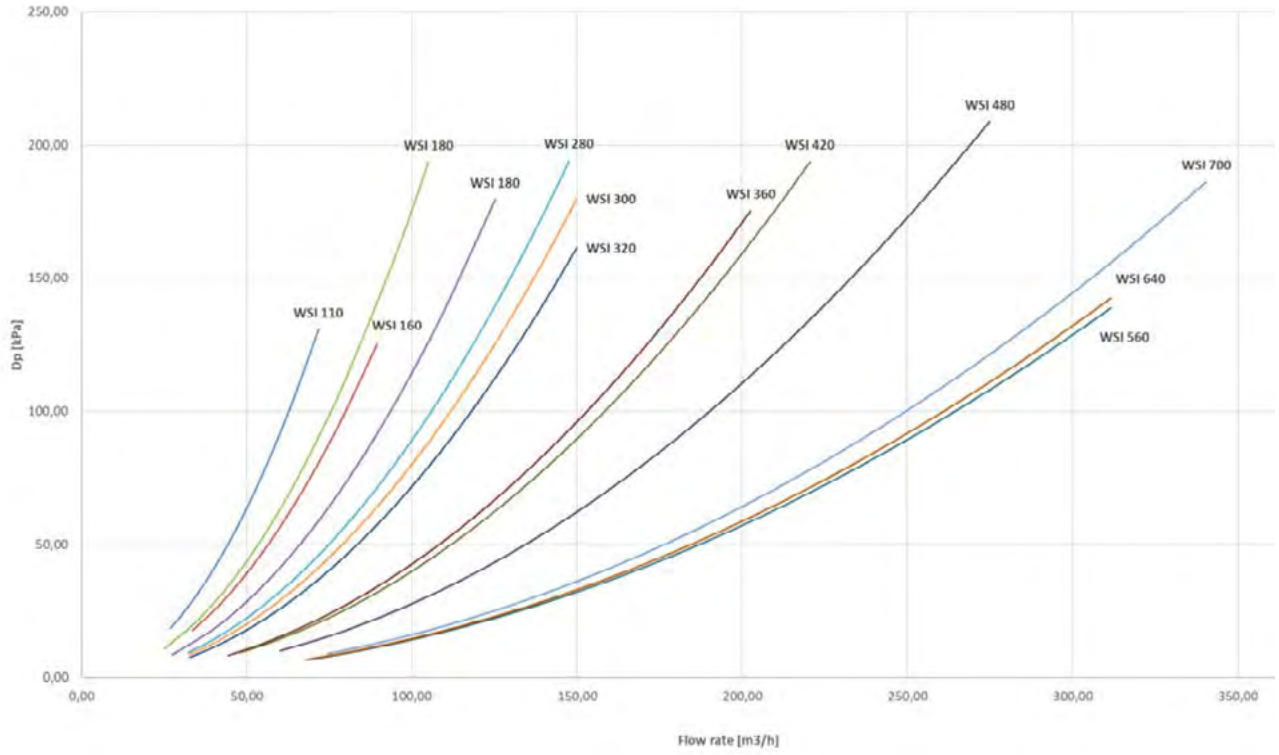
For the hydronic modules with pumps, the components are:
- 2 pumps, 2 or 4 poles, low or high head, fixed speed or variable speed (inverter).
- Suction pump and discharge valves.
- One-way valve (Clapet type for in-line pumps).
- Purge valve.
- Drain plug.
- Differential pressure switch (on heat exchanger).
- Drain valve (on heat exchanger).

Pumps are controlled in duty/standby, with running hours equalization and changeover on device failure.
The electrical panel of the unit is protected with fuses and contactors with thermals cut-out.
Suction, volute and discharge of each pump and all the water pipes are covered with an insulation lining.
The hydronic group is protected by an enclosure.

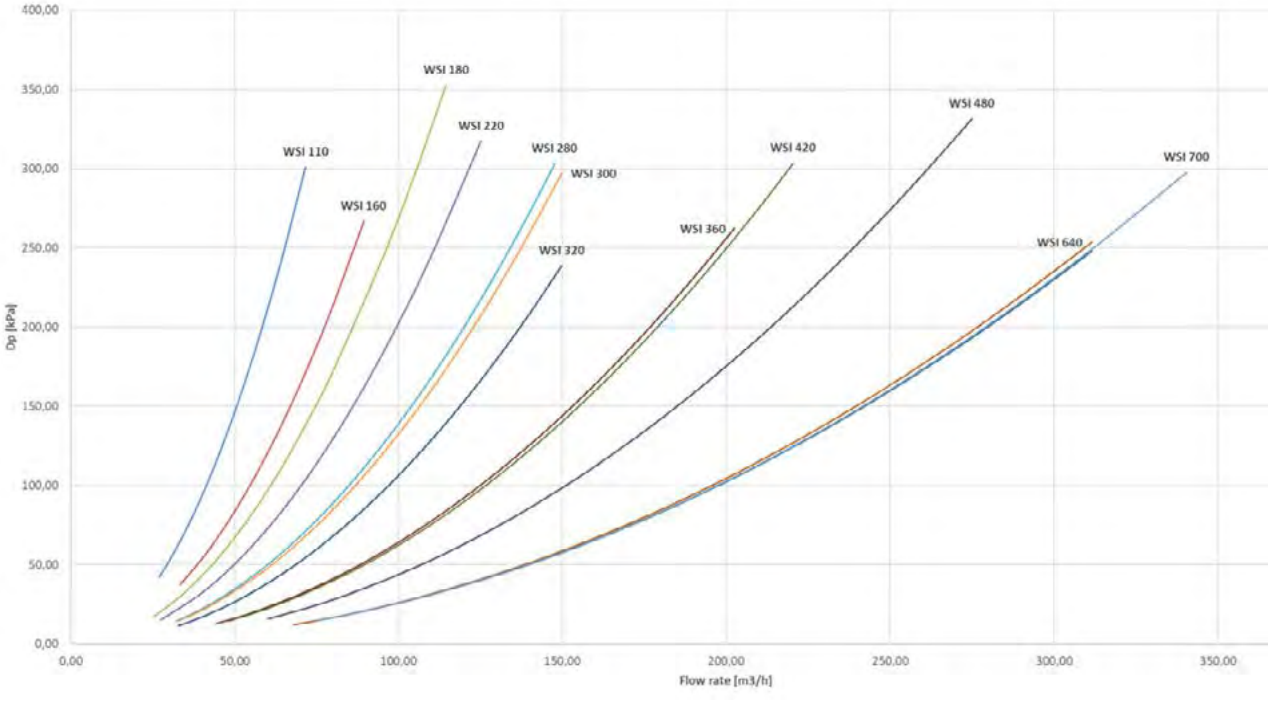
Variable frequency pump
The drives, one for each pump, are installed with a dedicated enclosure.
The fast-response speed control and the advanced auto-tuning function ensure safe and accurate operation in any condition.
To reach more energy saving, there is optimum control of the excitation current that maximizes motor efficiency.

With the following graphs you will find the pressure drops for the standard chiller.

Only Cooling - Without pump - Pure water

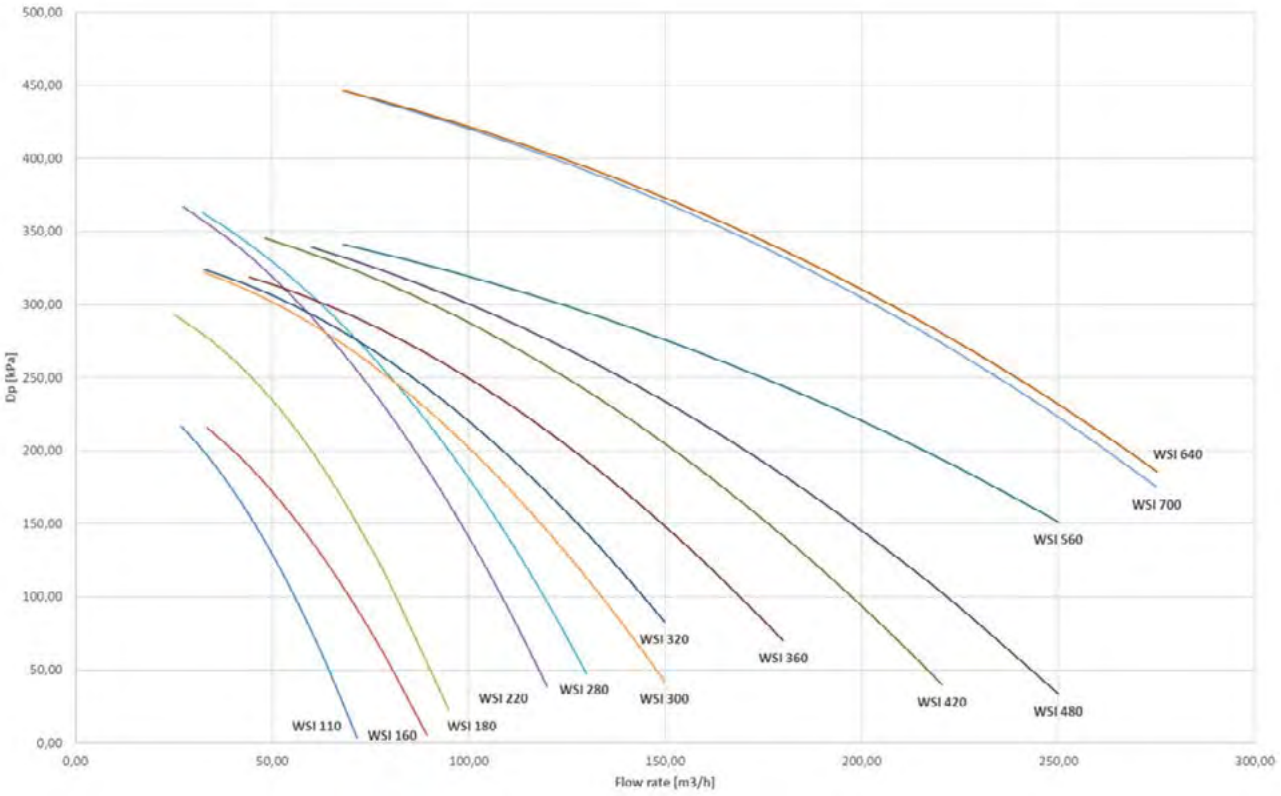


Free Cooling Version - Without pump - Water+EG 30%

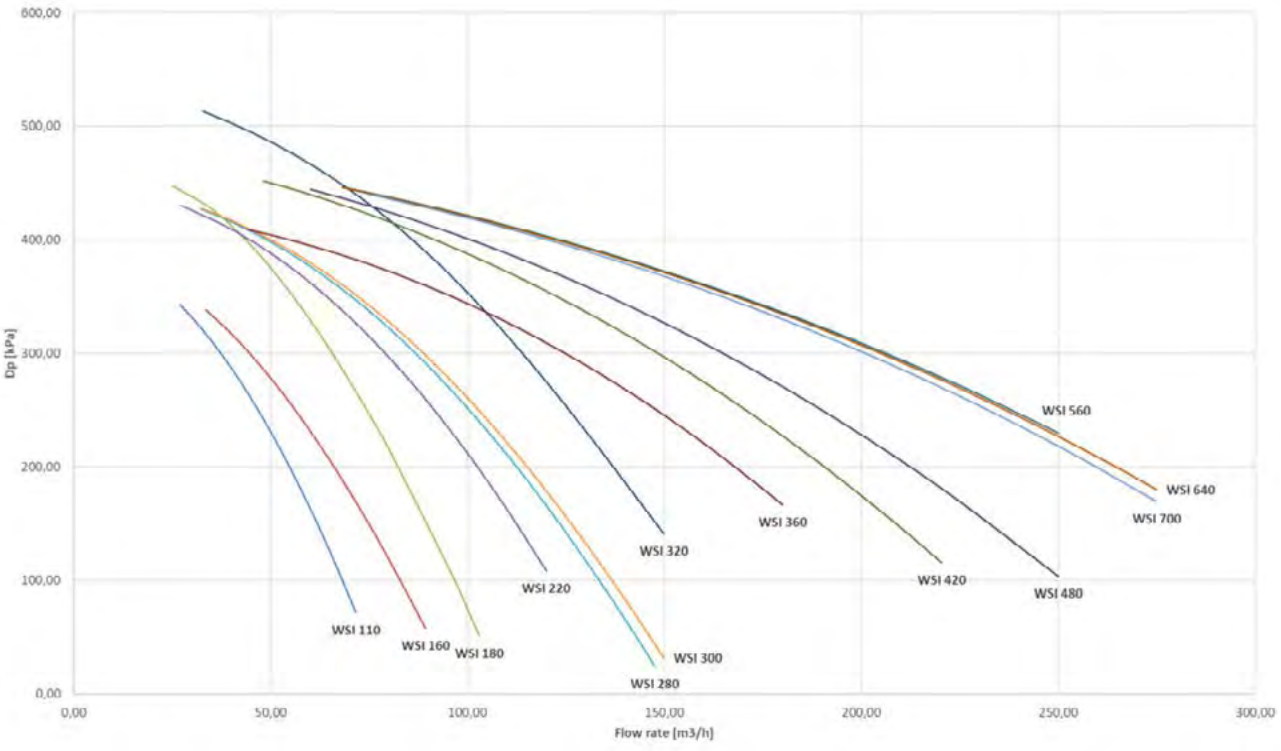


5.4 Head pressure available

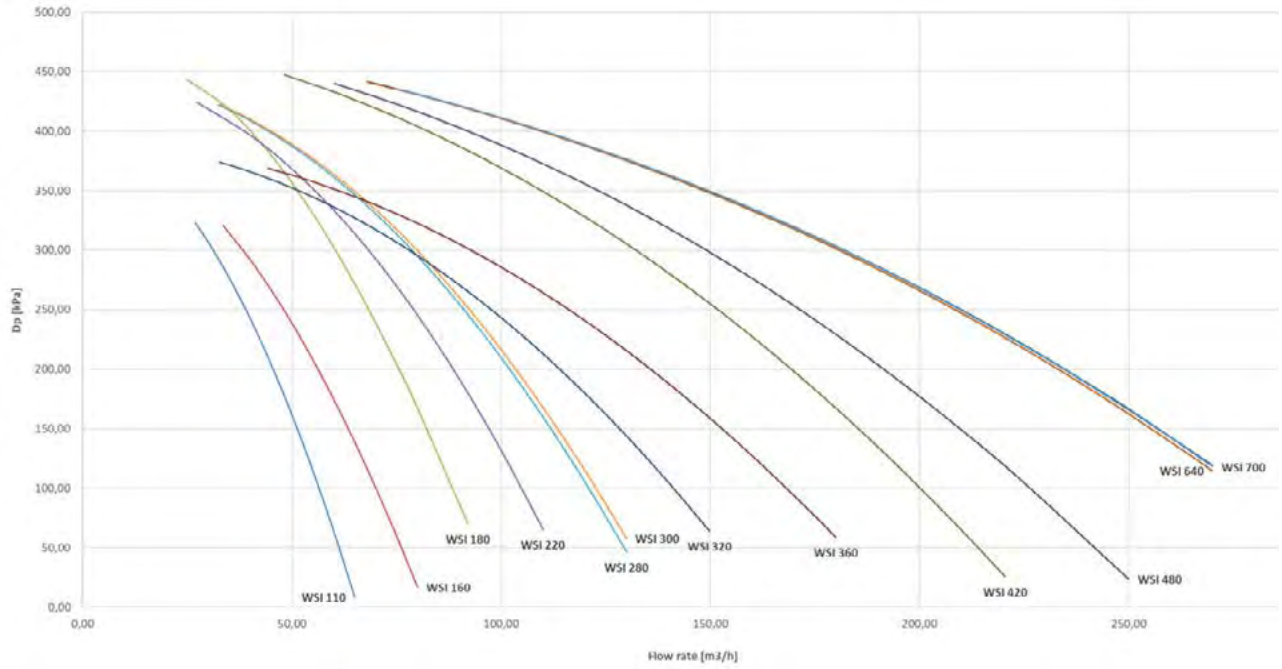
Only Cooling - P1 pump - Pure water



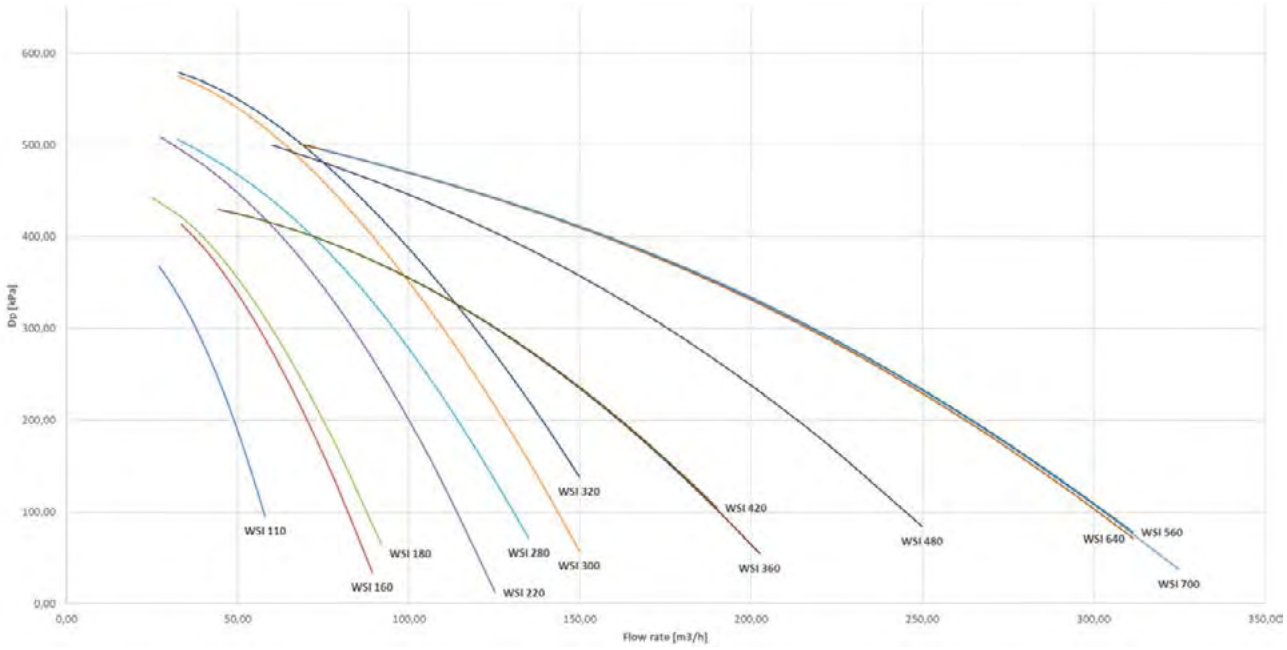
Only Cooling - P2 pump - Pure water



Free cooling - P1 pump - Water+EG 30%



Free cooling - P2 pump - Water+EG 30%



5.5 Technical data

	Standard EC Units		WSI 110	WSI 160	WSI 180	WSI 220	WSI 280	WSI 300
GENERAL	Cooling Capacity	kW	214	267	352	448	509	565
	Power Consumption W7/L35	kW	69	87	112	140	155	177
	Working limits ambient temperature	C	-10/+45	-10/+45	-10/+45	-10/+45	-10/+45	-10/+45
	Working limits water outlet temperature	C	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25
	Refrigerant gas	Type	R1234ze					
	Power supply	V/ph/Hz	400 / 3 / 50					
	Second Power supply	Vac	230	230	230	230	230	230
	Max power consumption	kW	138	177	213	275	280	354
	Max adsorbed current	A	232	276	363	463	471	551
	Starting current	A	32	36	43	263	271	311
	Height x Width x Depht	mm	2485×1140×4360	2485×2280×3205	2485×2280×4330		2485×2280×5875	
	Noise Level	dB(A)	58,9	61,4	61,6	61,9	63,8	64,4
COMPRESSOR	Hydraulic Circuit	n	1	1	1	1	1	1
	Compressors	n	1	1	1	2	2	2
	Parzialization	%	12,5….100					
	Max power consuptions	kW	130	167	198	260	260	334
	Max adsorbed current	A	220	260	340	440	440	520
	Power consumption W7/L35	kW	62,4	79	101,5	124,8	139,6	158
	Absorbed current W7/L35	A	106,5	131,6	165,8	213	235,6	263,2
EC FANS	Axial fan	n	3	4	6	6	8	8
	Fan Flow	m3/h	82026	109368	164052	164052	218736	218736
	Power consuption	kW	7,65	10,2	15,3	15,3	20,4	20,4
	Max adsorbed current	A	11,7	15,6	23,4	23,4	31,2	31,2
	Power consumption W7/L35	kW	6,4	8,6	12,9	12,9	17,2	17,2
	Absorbed current W7/L35	A	10	13	20	20	27	27
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol					
	Inlet Temperature	°C	12	12	12	12	12	12
	Outlet Temperature	°C	7	7	7	7	7	7
	Water Flow	m3/h	37	46	61	77	88	97
	Pressure drops	Kpa	11	15	35	43	39	47
	Water connections	Inches	3"	4"	4"	5"	5"	5"
F.C.	Cooling Capacity W10(see below)A30	kW	245	306	407	516	580	649
	Temperature at total FC	°C	-0,5	0,2	1,4	-1,0	0,6	-0,5
	Flow of fluid to be cooled	m3/h	47	58	78	96	107	119
	Evaporator Pressure Drop	kPa	23	30	70	84	75	93
	Coils Pressure Drop	kPa	66	59	47	69	50	61
	Cooling Capacity W10(see below)A35	kW	233	291	387	488	554	616
	Temperature at total FC	°C	0,2	1,0	1,8	-0,4	1,2	0,0
	Flow of fluid to be cooled	m3/h	45	56	74	91	103	113
	Evaporator Pressure Drop	kPa	21	27	63	76	69	85
	Coils Pressure Drop	kPa	60	54	43	63	47	56
EER	EER		3,10	3,07	3,14	3,20	3,28	3,19
	SEPR		6,03	5,76	5,90	6,20	6,28	6,09

	Standard EC Units		WSI 320	WSI 360	WSI 420	WSI 480	WSI 560	WSI 640	WSI 700
GENERAL	Cooling Capacity	kW	638	703	853	942	1094	1205	1265
	Power Consumption W7/L35	kW	195	223	264	301	359	380	379
	Working limits ambient temperature	C	-10/+45	-10/+45	-10/+45	-10/+45	-10/+45	-10/+45	-10/+45
	Working limits water outlet temperature	C	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25
	Refrigerant gas	Type	R1234ze						
	Power supply	V/ph/Hz	400 / 3 / 50						
	Second Power supply	Vac	230	230	230	230	230	230	230
	Max power consumption	kW	360	427	531	536	621	621	626
	Max adsorbed current	A	559	727	887	895	1042	1042	1050
	Starting current	A	319	407	487	495	572	572	580
	Height x Width x Depht	mm	2485×2280 x6955	2485×2280 x8080	2485×2280 x8080	2485×2280 x9582	2485×2280 x10707	2485×2280 x10707	2485×2280 x11830
	Noise Level	dB(A)	66,3	63,6	62,9	63,0	66,2	68,1	68,1
COMPRESSOR	Hydraulic Circuit	n	1	1	1	1	1	1	1
	Compressors	n	2	2	2	2	2	2	2
	Parzialization	%	12,5….100						
	Max power consuptions	kW	334	396	500	500	580	580	580
	Max adsorbed current	A	520	680	840	840	980	980	980
	Power consumption W7/L35	kW	175,8	203	232	260,8	315,8	335,8	335,8
	Absorbed current W7/L35	A	290,4	331,6	385,6	430	520	552	552
EC FANS	Axial fan	n	10	12	12	14	16	16	18
	Fan Flow	m3/h	273420	328104	328104	382788	437472	437472	492156
	Power consuption	kW	25,5	30,6	30,6	35,7	40,8	40,8	45,9
	Max adsorbed current	A	39	46,8	46,8	54,6	62,4	62,4	70,2
	Power consumption W7/L35	kW	21,5	25,8	25,8	30,1	34,4	34,4	38,6
	Absorbed current W7/L35	A	34	40	40	47	54	54	60
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol						
	Inlet Temperature	°C	12	12	12	12	12	12	12
	Outlet Temperature	°C	7	7	7	7	7	7	7
	Water Flow	m3/h	110	121	147	162	188	207	218
	Pressure drops	Kpa	60	35	52	41	30	40	46
	Water connections	Inches	6"	6"	6"	6"	8"	8"	8"
F.C.	Cooling Capacity W10(see below) A30	kW	727	799	967	1067	1234	1351	1434
	Temperature at total FC	°C	0,5	1,4	-0,5	0,1	0,0	-1,0	-0,2
	Flow of fluid to be cooled	m3/h	134	146	179	197	226	246	162
	Evaporator Pressure Drop	kPa	116	67	99	78	57	74	87
	Coils Pressure Drop	kPa	50	42	61	56	57	67	60
	Cooling Capacity W10(see below) A35	kW	696	759	919	1013	1173	1291	1371
	Temperature at total FC	°C	1,0	1,8	0,1	0,6	0,5	-0,4	0,2
	Flow of fluid to be cooled	m3/h	128	139	170	187	215	235	250
	Evaporator Pressure Drop	kPa	107	61	90	70	52	68	80
	Coils Pressure Drop	kPa	46	38	56	52	52	61	55
EER	EER		4,09	4,06	4,02	3,87	3,79	3,73	3,98
	SEPR		6,06	6,04	6,11	6,19	6,26	6,15	6,04

	Standard EC Units		WSI 720 HT
GENERAL	Cooling Capacity W25-20L35	kW	1855
	Power Consumption W25-20L35	kW	452,39
	Working limits ambient temperature	C	-10 / +45
	Working limits water outlet temperature	C	+15 / +25
	Refrigerant gas	Type	R1234ze
	Power supply	V/ph/Hz	400 / 3 / 50
	Second Power supply	Vac	230
	Max power consumption	kW	631
	Max adsorbed current	A	1058
	Starting current	A	588
	Height x Width x Depht	mm	2485×2280×13370
	Noise Level	dB(A)	70,3
COMPRESSOR	Hydraulic Circuit	n	1
	Compressors	n	2
	Parzialization	%	12,5….100
	Max Power Consumption	kW	580
	Max Absorbed current	A	980
	Power Consumption W25-20L35	kW	412,51
	Absorbed current W25-20L35	A	628
EC FANS	Axial fan	n	20
	Fan Flow	m^3/h	546840
	Power Consumption	kW	51
	Max Absorbed current	A	78
	Power Consumption W25-20L35	kW	42,9
	Absorbed current W25-20L35	A	66,7
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol
	Inlet Temperature	°C	25
	Outlet Temperature	°C	20
	Water Flow	m3/h	319
	Pressure drops	Kpa	117
	Water connections	Inches	8"
EER	EER		4,10

	Free Cooling EC Units		WSI 110	WSI 160	WSI 180	WSI 220	WSI 280	WSI 300
GENERAL	Cooling Capacity	kW	212	265	348	442	508	558
	Power Consumption W7/L35	kW	72	90	116	146	164	184
	Working limits ambient temperature	C	-20/+45	-20/+45	-20/+45	-20/+45	-20/+45	-20/+45
	Working limits water outlet temperature	C	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25
	Refrigerant gas	Type	R1234ze					
	Power supply	V/ph/Hz	400 / 3 / 50					
	Second Power supply	Vac	230	230	230	230	230	230
	Max power consumption	kW	138	177	213	275	280	354
	Max adsorbed current	A	232	276	363	463	471	551
	Starting current	A	32	36	43	263	271	311
	Height x Width x Depht	mm	2485×1140×4360	2485×2280×3205	2485×2280×4330		2485×2280×5875	
	Noise Level	dB(A)	58,9	61,4	61,6	61,9	63,8	64,4
COMPRESSOR	Hydraulic Circuit	n	1	1	1	1	1	1
	Compressors	n	1	1	1	2	2	2
	Parzialization	%	12,5….100					
	Max power consuptions	kW	130	167	198	260	260	334
	Max adsorbed current	A	220	260	340	440	440	520
	Power consumption W7/L35	kW	62,4	79	101,5	124,8	139,6	158
	Absorbed current W7/L35	A	106,5	131,6	165,8	213	235,6	263,2
EC FANS	Axial fan	n	3	4	6	6	8	8
	Fan Flow	m3/h	80796	107728	161592	161592	215456	215456
	Power consuption	kW	7,65	10,2	15,3	15,3	20,4	20,4
	Max adsorbed current	A	11,7	15,6	23,4	23,4	31,2	31,2
	Power consumption W7/L35	kW	6,4	8,6	12,9	12,9	17,2	17,2
	Absorbed current W7/L35	A	10	13	20	20	27	27
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol					
	Inlet Temperature	°C	12	12	12	12	12	12
	Outlet Temperature	°C	7	7	7	7	7	7
	Water Flow	m3/h	36	46	60	76	87	96
	Pressure drops	Kpa	93	79	112	136	118	139
	Water connections	Inches	3"	4"	4"	5"	5"	5"
F.C.	Cooling Capacity W10(see below)A30	kW	245	306	407	516	580	649
	Temperature at total FC	°C	-0,5	0,2	1,4	-1,0	0,6	-0,5
	Flow of fluid to be cooled	m3/h	47	58	78	96	107	119
	Evaporator Pressure Drop	kPa	23	30	70	84	75	93
	Coils Pressure Drop	kPa	66	59	47	69	50	61
	Cooling Capacity W10(see below)A35	kW	233	291	387	488	554	616
	Temperature at total FC	°C	0,2	1,0	1,8	-0,4	1,2	0,0
	Flow of fluid to be cooled	m3/h	45	56	74	91	103	113
	Evaporator Pressure Drop	kPa	21	27	63	76	69	85
	Coils Pressure Drop	kPa	60	54	43	63	47	56
EER	EER		3,80	3,83	3,88	3,82	4,30	3,84
	SEPR		6,78	6,66	6,41	6,90	6,94	6,71

	Free Cooling EC Units		WSI 320	WSI 360	WSI 420	WSI 480	WSI 560	WSI 640	WSI 700
GENERAL	Cooling Capacity	kW	641	696	842	933	1085	1202	1268
	Power Consumption W7/L35	kW	204	231	273	312	370	392	392
	Working limits ambient temperature	C	-20/+45	-20/+45	-20/+45	-20/+45	-20/+45	-20/+45	-20/+45
	Working limits water outlet temperature	C	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25	-5/+25
	Refrigerant gas	Type	R1234ze						
	Power supply	V/ph/Hz	400 / 3 / 50						
	Second Power supply	Vac	230	230	230	230	230	230	230
	Max power consumption	kW	360	427	531	536	621	621	626
	Max adsorbed current	A	559	727	887	895	1042	1042	1050
	Starting current	A	319	407	487	495	572	572	580
	Height x Width x Depht	mm	2485×2280 x6955	2485×2280 x8080		2485×2280 x9582	2485×2280 x10707		2485×2280 x11830
	Noise Level	dB(A)	66,3	63,6	62,9	63,0	66,2	68,1	68,1
COMPRESSOR	Hydraulic Circuit	n	1	1	1	1	1	1	1
	Compressors	n	2	2	2	2	2	2	2
	Parzialization	%	12,5….100						
	Max power consuptions	kW	334	396	500	500	580	580	580
	Max adsorbed current	A	520	680	840	840	980	980	980
	Power consumption W7/L35	kW	175,8	203	232	260,8	315,8	335,8	335,8
	Absorbed current W7/L35	A	290,4	331,6	385,6	430	520	552	552
EC FANS	Axial fan	n	10	12	12	14	16	16	18
	Fan Flow	m3/h	269320	323184	323184	377048	430912	430912	484776
	Power consuption	kW	25,5	30,6	30,6	35,7	40,8	40,8	45,9
	Max adsorbed current	A	39	46,8	46,8	54,6	62,4	62,4	70,2
	Power consumption W7/L35	kW	21,5	25,8	25,8	30,1	34,4	34,4	38,6
	Absorbed current W7/L35	A	34	40	40	47	54	54	60
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol						
	Inlet Temperature	°C	12	12	12	12	12	12	12
	Outlet Temperature	°C	7	7	7	7	7	7	7
	Water Flow	m3/h	109	120	145	160	186	205	215
	Pressure drops	Kpa	135	103	149	132	96	119	129
	Water connections	Inches	6"	6"	6"	6"	8"	8"	8"
F.C.	Cooling Capacity W10(see below)A30	kW	727	799	967	1067	1234	1351	1434
	Temperature at total FC	°C	0,5	1,4	-0,5	0,1	0,0	-1,0	-0,2
	Flow of fluid to be cooled	m3/h	134	146	179	197	226	246	162
	Evaporator Pressure Drop	kPa	116	67	99	78	57	74	87
	Coils Pressure Drop	kPa	50	42	61	56	57	67	60
	Cooling Capacity W10(see below)A35	kW	696	759	919	1013	1173	1291	1371
	Temperature at total FC	°C	1,0	1,8	0,1	0,6	0,5	-0,4	0,2
	Flow of fluid to be cooled	m3/h	128	139	170	187	215	235	250
	Evaporator Pressure Drop	kPa	107	61	90	70	52	68	80
	Coils Pressure Drop	kPa	46	38	56	52	52	61	55
EER	EER		3,90	3,87	3,84	3,70	3,64	3,58	3,81
	SEPR		6,60	6,52	6,77	6,70	6,97	6,64	6,74

	Free Cooling EC Units		WSI 720 HT
GENERAL	Cooling Capacity W25-20L35	kW	1834,7
	Power Consumption W25-20L35	kW	466,01
	Working limits ambient temperature	C	-20 / +45
	Working limits water outlet temperature	C	+15 / +25
	Refrigerant gas	Type	R1234ze
	Power supply	V/ph/Hz	400 / 3 / 50
	Second Power supply	Vac	230
	Max power consumption	kW	631
	Max adsorbed current	A	1058
	Starting current	A	588
	Height x Width x Depht	mm	2485×2280×13370
	Noise Level	dB(A)	70,3
COMPRESSOR	Hydraulic Circuit	n	1
	Compressors	n	2
	Parzialization	%	12,5….100
	Max Power Consumption	kW	580
	Max Absorbed current	A	980
	Power Consumption W25-20L35	kW	420,65
	Absorbed current W25-20L35	A	640
EC FANS	Axial fan	n	20
	Fan Flow	m3/h	538640
	Power Consumption	kW	51
	Max Absorbed current	A	78
	Power Consumption W25-20L35	kW	42,9
	Absorbed current W25-20L35	A	66,7
HYDRAULIC	Coolant Liquid	Type	Water - max 40% glicol
	Inlet Temperature	°C	25
	Outlet Temperature	°C	20
	Water Flow	m3/h	316
	Pressure drops	Kpa	236
	Water connections	Inches	8"
F.C.	Temperature at total FC (Cooling Capacity W25-20L35)	°C	8,8
	Evaporator Pressure Drop	kPa	88,1
	Coils Pressure Drop	kPa	87
EER	EER		3,94

Evaporator water (in/out) 12/7 °C; condenser air (in) 35 °C;
Sound power level measured according to EN 9614. The data refers to the standard unit (without options), at full load, at nominal conditions Sound pressure level (non-binding data) obtained from sound power level according to EN ISO 3744 and declared at the following conditions: at 10 m distance from unit, in free field, with the unit positioned on a reflective base, with the unit operating at nominal conditions and at full load, for the standard unit (without options). Pump contribution is not considered.
*In case of applications with an output fluid temperature below +5 °C, please contact the manufacturer.

(1) - Estimated weight for standard units without options, without pumps and without free cooling.

For free cooling units:
30% Glycol-Water solution. Evaporator solution IN/OUT= 15/10 °C; Condenser air 30 °C
Sound power level measured according to EN 9614. The data refers to the standard unit (without options), at full load, at nominal conditions Sound pressure level (non-binding data) obtained from sound power level according to EN ISO 3744 and declared at the following conditions: at 10 m distance from unit, in free field, with the unit positioned on a reflective base, with the unit operating at nominal conditions and at full load, for the standard unit (without options). Pump contribution is not considered.
* In case of applications with output fluid temperature below 0°C, please contact the manufacturer

5.5.1 Sound spectra

	WSI 110									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	56,8	58,8	64,1	82,0	94,7	87,9	78,8	68,1
	Total sound power (LwA)	dB(A)				95,8				
	Sound pressure @10m (LpA)	dB(A)	24,8	26,8	32,1	50,0	62,7	55,9	46,8	36,1
	Total sound pressure@10m (LpA)	dB(A)				63,8				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	51,4	53,4	58,7	76,6	89,3	82,5	73,4	62,7
	Total sound power (LwA)	dB(A)				90,4				
	Sound pressure @10m (LpA)	dB(A)	19,4	21,4	26,7	44,6	57,3	50,5	41,4	30,7
	Total sound pressure@10m (LpA)	dB(A)				58,4				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	60,8	63,3	67,1	82,4	94,8	88,0	78,2	69,7
	Total sound power (LwA)	dB(A)				95,9				
	Sound pressure @10m (LpA)	dB(A)	28,8	31,3	35,1	50,4	62,8	56,0	46,2	37,7
	Total sound pressure@10m (LpA)	dB(A)				63,9				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	55,4	57,9	61,7	77,0	89,4	82,6	72,8	64,3
	Total sound power (LwA)	dB(A)				90,5				
	Sound pressure @10m (LpA)	dB(A)	23,4	25,9	29,7	45,0	57,4	50,6	40,8	32,3
	Total sound pressure@10m (LpA)	dB(A)				58,5				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	61,7	63,9	67,1	82,4	94,8	88,0	78,2	69,8
	Total sound power (LwA)	dB(A)				95,9				
	Sound pressure @10m (LpA)	dB(A)	29,7	31,9	35,1	50,4	62,8	56,0	46,2	37,8
	Total sound pressure@10m (LpA)	dB(A)				63,9				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	56,3	58,5	61,7	77,0	89,4	82,6	72,8	64,4
	Total sound power (LwA)	dB(A)				90,5				
	Sound pressure @10m (LpA)	dB(A)	24,3	26,5	29,7	45,0	57,4	50,6	40,8	32,4
	Total sound pressure@10m (LpA)	dB(A)				58,5				

	WSI 160									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	58,9	60,5	70,5	85,0	93,6	91,6	82,1	69,5
	Total sound power (LwA)	dB(A)				96,2				
	Sound pressure @10m (LpA)	dB(A)	26,9	28,5	38,5	53,0	61,6	59,6	50,1	37,5
	Total sound pressure@10m (LpA)	dB(A)				64,2				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	53,2	54,8	64,8	79,3	87,9	85,9	76,4	63,8
	Total sound power (LwA)	dB(A)				90,6				
	Sound pressure @10m (LpA)	dB(A)	21,2	22,8	32,8	47,3	55,9	53,9	44,4	31,8
	Total sound pressure@10m (LpA)	dB(A)				58,6				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	62,4	64,7	71,6	85,3	93,7	91,6	81,7	71,0
	Total sound power (LwA)	dB(A)				96,3				
	Sound pressure @10m (LpA)	dB(A)	30,4	32,7	39,6	53,3	61,7	59,6	49,7	39,0
	Total sound pressure@10m (LpA)	dB(A)				64,3				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	56,7	59,0	65,9	79,6	88,0	85,9	76,0	65,3
	Total sound power (LwA)	dB(A)				90,6				
	Sound pressure @10m (LpA)	dB(A)	24,7	27,0	33,9	47,6	56,0	53,9	44,0	33,3
	Total sound pressure@10m (LpA)	dB(A)				58,6				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	63,2	65,3	71,6	85,3	93,7	91,6	81,7	71,2
	Total sound power (LwA)	dB(A)				96,3				
	Sound pressure @10m (LpA)	dB(A)	31,2	33,3	39,6	53,3	61,7	59,6	49,7	39,2
	Total sound pressure@10m (LpA)	dB(A)				64,3				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	57,5	59,6	65,9	79,6	88,0	85,9	76,0	65,5
	Total sound power (LwA)	dB(A)				90,6				
	Sound pressure @10m (LpA)	dB(A)	25,5	27,6	33,9	47,6	56,0	53,9	44,0	33,5
	Total sound pressure@10m (LpA)	dB(A)				58,6				

	WSI 180									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	69,4	73,0	78,1	93,2	91,8	94,1	83,9	70,5
	Total sound power (LwA)	dB(A)				98,1				
	Sound pressure @10m (LpA)	dB(A)	37,4	41,0	46,1	61,2	59,8	62,1	51,9	38,5
	Total sound pressure@10m (LpA)	dB(A)				66,1				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	64,5	68,1	73,3	88,3	86,9	89,2	79,0	65,7
	Total sound power (LwA)	dB(A)				93,3				
	Sound pressure @10m (LpA)	dB(A)	32,5	36,1	41,3	56,3	54,9	57,2	47,0	33,7
	Total sound pressure@10m (LpA)	dB(A)				61,3				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	70,0	73,5	78,4	93,2	92,0	94,1	83,5	72,3
	Total sound power (LwA)	dB(A)				98,2				
	Sound pressure @10m (LpA)	dB(A)	38,0	41,5	46,4	61,2	60,0	62,1	51,5	40,3
	Total sound pressure@10m (LpA)	dB(A)				66,2				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,2	68,7	73,6	88,4	87,1	89,2	78,6	67,5
	Total sound power (LwA)	dB(A)				93,3				
	Sound pressure @10m (LpA)	dB(A)	33,2	36,7	41,6	56,4	55,1	57,2	46,6	35,5
	Total sound pressure@10m (LpA)	dB(A)				61,3				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	70,3	73,7	78,4	93,2	92,0	94,1	83,5	72,5
	Total sound power (LwA)	dB(A)				98,2				
	Sound pressure @10m (LpA)	dB(A)	38,3	41,7	46,4	61,2	60,0	62,1	51,5	40,5
	Total sound pressure@10m (LpA)	dB(A)				66,2				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,4	68,8	73,6	88,4	87,1	89,2	78,6	67,6
	Total sound power (LwA)	dB(A)				93,3				
	Sound pressure @10m (LpA)	dB(A)	33,4	36,8	41,6	56,4	55,1	57,2	46,6	35,6
	Total sound pressure@10m (LpA)	dB(A)				61,3				

	WSI 220									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	59,8	61,9	67,1	85,0	97,7	90,9	81,8	71,1
	Total sound power (LwA)	dB(A)				98,9				
	Sound pressure @10m (LpA)	dB(A)	27,8	29,9	35,1	53,0	65,7	58,9	49,8	39,1
	Total sound pressure@10m (LpA)	dB(A)				66,9				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	54,4	56,4	61,6	79,5	92,3	85,4	76,4	65,6
	Total sound power (LwA)	dB(A)				93,4				
	Sound pressure @10m (LpA)	dB(A)	22,4	24,4	29,6	47,5	60,3	53,4	44,4	33,6
	Total sound pressure@10m (LpA)	dB(A)				61,4				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	63,8	66,3	70,1	85,4	97,8	91,0	81,2	72,7
	Total sound power (LwA)	dB(A)				98,9				
	Sound pressure @10m (LpA)	dB(A)	31,8	34,3	38,1	53,4	65,8	59,0	49,2	40,7
	Total sound pressure@10m (LpA)	dB(A)				66,9				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	58,4	60,9	64,6	79,9	92,3	85,5	75,7	67,2
	Total sound power (LwA)	dB(A)				93,4				
	Sound pressure @10m (LpA)	dB(A)	26,4	28,9	32,6	47,9	60,3	53,5	43,7	35,2
	Total sound pressure@10m (LpA)	dB(A)				61,4				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	64,7	66,9	70,1	85,4	97,8	91,0	81,2	72,8
	Total sound power (LwA)	dB(A)				98,9				
	Sound pressure @10m (LpA)	dB(A)	32,7	34,9	38,1	53,4	65,8	59,0	49,2	40,8
	Total sound pressure@10m (LpA)	dB(A)				66,9				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	59,2	61,4	64,6	79,9	92,3	85,5	75,7	67,4
	Total sound power (LwA)	dB(A)				93,4				
	Sound pressure @10m (LpA)	dB(A)	27,2	29,4	32,6	47,9	60,3	53,5	43,7	35,4
	Total sound pressure@10m (LpA)	dB(A)				61,4				

	WSI 280									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	61,4	63,5	68,7	86,9	99,7	92,9	83,6	72,8
	Total sound power (LwA)	dB(A)				100,8				
	Sound pressure @10m (LpA)	dB(A)	29,4	31,5	36,7	54,9	67,7	60,9	51,6	40,8
	Total sound pressure@10m (LpA)	dB(A)				68,8				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	55,9	58,0	63,1	81,4	94,2	87,4	78,1	67,3
	Total sound power (LwA)	dB(A)				95,3				
	Sound pressure @10m (LpA)	dB(A)	23,9	26,0	31,1	49,4	62,2	55,4	46,1	35,3
	Total sound pressure@10m (LpA)	dB(A)				63,3				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,2	67,7	71,5	87,3	99,8	93,0	83,0	74,3
	Total sound power (LwA)	dB(A)				100,9				
	Sound pressure @10m (LpA)	dB(A)	33,2	35,7	39,5	55,3	67,8	61,0	51,0	42,3
	Total sound pressure@10m (LpA)	dB(A)				68,9				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	59,7	62,2	66,0	81,7	94,3	87,4	77,5	68,8
	Total sound power (LwA)	dB(A)				95,4				
	Sound pressure @10m (LpA)	dB(A)	27,7	30,2	34,0	49,7	62,3	55,4	45,5	36,8
	Total sound pressure@10m (LpA)	dB(A)				63,4				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	66,1	68,3	71,5	87,3	99,8	93,0	83,0	74,4
	Total sound power (LwA)	dB(A)				100,9				
	Sound pressure @10m (LpA)	dB(A)	34,1	36,3	39,5	55,3	67,8	61,0	51,0	42,4
	Total sound pressure@10m (LpA)	dB(A)				68,9				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	60,5	62,8	66,0	81,8	94,3	87,4	77,5	68,9
	Total sound power (LwA)	dB(A)				95,4				
	Sound pressure @10m (LpA)	dB(A)	28,5	30,8	34,0	49,8	62,3	55,4	45,5	36,9
	Total sound pressure@10m (LpA)	dB(A)				63,4				

	WSI 300									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	61,9	63,5	73,5	88,0	96,6	94,6	85,1	72,5
	Total sound power (LwA)	dB(A)				99,3				
	Sound pressure @10m (LpA)	dB(A)	29,9	31,5	41,5	56,0	64,6	62,6	53,1	40,5
	Total sound pressure@10m (LpA)	dB(A)				67,3				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	56,2	57,9	67,8	82,4	90,9	88,9	79,4	66,8
	Total sound power (LwA)	dB(A)				93,6				
	Sound pressure @10m (LpA)	dB(A)	24,2	25,9	35,8	50,4	58,9	56,9	47,4	34,8
	Total sound pressure@10m (LpA)	dB(A)				61,6				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,4	67,7	74,6	88,3	96,7	94,6	84,7	74,0
	Total sound power (LwA)	dB(A)				99,3				
	Sound pressure @10m (LpA)	dB(A)	33,4	35,7	42,6	56,3	64,7	62,6	52,7	42,0
	Total sound pressure@10m (LpA)	dB(A)				67,3				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	59,8	62,1	68,9	82,6	91,0	88,9	79,0	68,3
	Total sound power (LwA)	dB(A)				93,6				
	Sound pressure @10m (LpA)	dB(A)	27,8	30,1	36,9	50,6	59,0	56,9	47,0	36,3
	Total sound pressure@10m (LpA)	dB(A)				61,6				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	66,2	68,3	74,6	88,3	96,7	94,6	84,7	74,2
	Total sound power (LwA)	dB(A)				99,3				
	Sound pressure @10m (LpA)	dB(A)	34,2	36,3	42,6	56,3	64,7	62,6	52,7	42,2
	Total sound pressure@10m (LpA)	dB(A)				67,3				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	60,5	62,6	68,9	82,6	91,0	88,9	79,0	68,5
	Total sound power (LwA)	dB(A)				93,6				
	Sound pressure @10m (LpA)	dB(A)	28,5	30,6	36,9	50,6	59,0	56,9	47,0	36,5
	Total sound pressure@10m (LpA)	dB(A)				61,6				

	WSI 320									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	63,5	65,1	75,3	90,0	98,6	96,6	86,9	74,2
	Total sound power (LwA)	dB(A)				101,2				
	Sound pressure @10m (LpA)	dB(A)	31,5	33,1	43,3	58,0	66,6	64,6	54,9	42,2
	Total sound pressure@10m (LpA)	dB(A)				69,2				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	57,7	59,4	69,6	84,2	92,8	90,8	81,2	68,4
	Total sound power (LwA)	dB(A)				95,5				
	Sound pressure @10m (LpA)	dB(A)	25,7	27,4	37,6	52,2	60,8	58,8	49,2	36,4
	Total sound pressure@10m (LpA)	dB(A)				63,5				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	66,7	68,9	76,3	90,2	98,6	96,6	86,6	75,5
	Total sound power (LwA)	dB(A)				101,3				
	Sound pressure @10m (LpA)	dB(A)	34,7	36,9	44,3	58,2	66,6	64,6	54,6	43,5
	Total sound pressure@10m (LpA)	dB(A)				69,3				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	60,9	63,2	70,5	84,4	92,9	90,8	80,8	69,8
	Total sound power (LwA)	dB(A)				95,5				
	Sound pressure @10m (LpA)	dB(A)	28,9	31,2	38,5	52,4	60,9	58,8	48,8	37,8
	Total sound pressure@10m (LpA)	dB(A)				63,5				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	67,4	69,5	76,3	90,2	98,6	96,6	86,6	75,7
	Total sound power (LwA)	dB(A)				101,3				
	Sound pressure @10m (LpA)	dB(A)	35,4	37,5	44,3	58,2	66,6	64,6	54,6	43,7
	Total sound pressure@10m (LpA)	dB(A)				69,3				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	61,7	63,7	70,5	84,4	92,9	90,8	80,8	69,9
	Total sound power (LwA)	dB(A)				95,5				
	Sound pressure @10m (LpA)	dB(A)	29,7	31,7	38,5	52,4	60,9	58,8	48,8	37,9
	Total sound pressure@10m (LpA)	dB(A)				63,5				

	WSI 360									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	72,4	76,0	81,1	96,2	94,8	97,1	86,9	73,6
	Total sound power (LwA)	dB(A)				101,1				
	Sound pressure @10m (LpA)	dB(A)	39,4	43,0	48,1	63,2	61,8	64,1	53,9	40,6
	Total sound pressure@10m (LpA)	dB(A)				68,1				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	67,5	71,1	76,3	91,3	89,9	92,2	82,1	68,7
	Total sound power (LwA)	dB(A)				96,3				
	Sound pressure @10m (LpA)	dB(A)	34,5	38,1	43,3	58,3	56,9	59,2	49,1	35,7
	Total sound pressure@10m (LpA)	dB(A)				63,3				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	73,1	76,5	81,4	96,2	95,0	97,1	86,5	75,3
	Total sound power (LwA)	dB(A)				101,2				
	Sound pressure @10m (LpA)	dB(A)	40,1	43,5	48,4	63,2	62,0	64,1	53,5	42,3
	Total sound pressure@10m (LpA)	dB(A)				68,2				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	68,2	71,7	76,6	91,4	90,1	92,2	81,6	70,5
	Total sound power (LwA)	dB(A)				96,3				
	Sound pressure @10m (LpA)	dB(A)	35,2	38,7	43,6	58,4	57,1	59,2	48,6	37,5
	Total sound pressure@10m (LpA)	dB(A)				63,3				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	73,3	76,7	81,4	96,2	95,0	97,1	86,5	75,5
	Total sound power (LwA)	dB(A)				101,2				
	Sound pressure @10m (LpA)	dB(A)	40,3	43,7	48,4	63,2	62,0	64,1	53,5	42,5
	Total sound pressure@10m (LpA)	dB(A)				68,2				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	68,4	71,8	76,6	91,4	90,1	92,2	81,6	70,7
	Total sound power (LwA)	dB(A)				96,3				
	Sound pressure @10m (LpA)	dB(A)	35,4	38,8	43,6	58,4	57,1	59,2	48,6	37,7
	Total sound pressure@10m (LpA)	dB(A)				63,3				

	WSI 420									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	69,5	76,9	77,1	89,2	97,5	88,1	91,9	77,5
	Total sound power (LwA)	dB(A)				99,4				
	Sound pressure @10m (LpA)	dB(A)	36,5	43,9	44,1	56,2	64,5	55,1	58,9	44,5
	Total sound pressure@10m (LpA)	dB(A)				66,4				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	64,2	71,6	71,8	83,9	92,2	82,8	86,6	72,2
	Total sound power (LwA)	dB(A)				94,1				
	Sound pressure @10m (LpA)	dB(A)	31,2	38,6	38,8	50,9	59,2	49,8	53,6	39,2
	Total sound pressure@10m (LpA)	dB(A)				61,1				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	70,8	77,4	77,9	89,5	97,6	88,4	91,7	78,3
	Total sound power (LwA)	dB(A)				99,6				
	Sound pressure @10m (LpA)	dB(A)	37,8	44,4	44,9	56,5	64,6	55,4	58,7	45,3
	Total sound pressure@10m (LpA)	dB(A)				66,6				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,5	72,1	72,6	84,2	92,3	83,1	86,4	73,0
	Total sound power (LwA)	dB(A)				94,3				
	Sound pressure @10m (LpA)	dB(A)	32,5	39,1	39,6	51,2	59,3	50,1	53,4	40,0
	Total sound pressure@10m (LpA)	dB(A)				61,3				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	71,1	77,5	77,9	89,5	97,6	88,4	91,7	78,4
	Total sound power (LwA)	dB(A)				99,6				
	Sound pressure @10m (LpA)	dB(A)	38,1	44,5	44,9	56,5	64,6	55,4	58,7	45,4
	Total sound pressure@10m (LpA)	dB(A)				66,6				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,8	72,2	72,6	84,2	92,3	83,1	86,4	73,1
	Total sound power (LwA)	dB(A)				94,3				
	Sound pressure @10m (LpA)	dB(A)	32,8	39,2	39,6	51,2	59,3	50,1	53,4	40,1
	Total sound pressure@10m (LpA)	dB(A)				61,3				

	WSI 480									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	69,6	77,0	77,2	89,3	97,5	88,2	91,9	77,6
	Total sound power (LwA)	dB(A)				99,5				
	Sound pressure @10m (LpA)	dB(A)	36,6	44,0	44,2	56,3	64,5	55,2	58,9	44,6
	Total sound pressure@10m (LpA)	dB(A)				66,5				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	64,4	71,7	71,9	84,0	92,3	83,0	86,7	72,4
	Total sound power (LwA)	dB(A)				94,2				
	Sound pressure @10m (LpA)	dB(A)	31,4	38,7	38,9	51,0	59,3	50,0	53,7	39,4
	Total sound pressure@10m (LpA)	dB(A)				61,2				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	71,0	77,5	78,0	89,6	97,6	88,5	91,8	78,5
	Total sound power (LwA)	dB(A)				99,6				
	Sound pressure @10m (LpA)	dB(A)	38,0	44,5	45,0	56,6	64,6	55,5	58,8	45,5
	Total sound pressure@10m (LpA)	dB(A)				66,6				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	65,8	72,3	72,8	84,3	92,4	83,2	86,5	73,3
	Total sound power (LwA)	dB(A)				94,4				
	Sound pressure @10m (LpA)	dB(A)	32,8	39,3	39,8	51,3	59,4	50,2	53,5	40,3
	Total sound pressure@10m (LpA)	dB(A)				61,4				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	71,4	77,6	78,0	89,6	97,6	88,5	91,8	78,6
	Total sound power (LwA)	dB(A)				99,6				
	Sound pressure @10m (LpA)	dB(A)	38,4	44,6	45,0	56,6	64,6	55,5	58,8	45,6
	Total sound pressure@10m (LpA)	dB(A)				66,6				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	66,2	72,4	72,8	84,4	92,4	83,2	86,5	73,4
	Total sound power (LwA)	dB(A)				94,4				
	Sound pressure @10m (LpA)	dB(A)	33,2	39,4	39,8	51,4	59,4	50,2	53,5	40,4
	Total sound pressure@10m (LpA)	dB(A)				61,4				

	WSI 560									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	61,9	65,5	76,7	95,8	95,0	96,4	91,1	80,2
	Total sound power (LwA)	dB(A)				101,1				
	Sound pressure @10m (LpA)	dB(A)	28,9	32,5	43,7	62,8	62,0	63,4	58,1	47,2
	Total sound pressure@10m (LpA)	dB(A)				68,1				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	56,9	60,5	71,7	90,8	90,0	91,4	86,1	75,2
	Total sound power (LwA)	dB(A)				96,0				
	Sound pressure @10m (LpA)	dB(A)	23,9	27,5	38,7	57,8	57,0	58,4	53,1	42,2
	Total sound pressure@10m (LpA)	dB(A)				63,0				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	67,4	70,4	77,8	95,9	95,3	96,4	90,9	80,8
	Total sound power (LwA)	dB(A)				101,2				
	Sound pressure @10m (LpA)	dB(A)	34,4	37,4	44,8	62,9	62,3	63,4	57,9	47,8
	Total sound pressure@10m (LpA)	dB(A)				68,2				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	62,3	65,4	72,8	90,9	90,2	91,4	85,9	75,8
	Total sound power (LwA)	dB(A)				96,1				
	Sound pressure @10m (LpA)	dB(A)	29,3	32,4	39,8	57,9	57,2	58,4	52,9	42,8
	Total sound pressure@10m (LpA)	dB(A)				63,1				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	68,3	71,0	77,8	95,9	95,3	96,4	90,9	80,9
	Total sound power (LwA)	dB(A)				101,2				
	Sound pressure @10m (LpA)	dB(A)	35,3	38,0	44,8	62,9	62,3	63,4	57,9	47,9
	Total sound pressure@10m (LpA)	dB(A)				68,2				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	63,3	66,0	72,8	90,9	90,2	91,4	85,9	75,8
	Total sound power (LwA)	dB(A)				96,1				
	Sound pressure @10m (LpA)	dB(A)	30,3	33,0	39,8	57,9	57,2	58,4	52,9	42,8
	Total sound pressure@10m (LpA)	dB(A)				63,1				

	WSI 640									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	62,1	66,5	78,5	97,8	96,9	98,4	93,0	82,0
	Total sound power (LwA)	dB(A)				103,0				
	Sound pressure @10m (LpA)	dB(A)	29,1	33,5	45,5	64,8	63,9	65,4	60,0	49,0
	Total sound pressure@10m (LpA)	dB(A)				70,0				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	57,0	61,3	73,3	92,6	91,8	93,2	87,8	76,9
	Total sound power (LwA)	dB(A)				97,9				
	Sound pressure @10m (LpA)	dB(A)	24,0	28,3	40,3	59,6	58,8	60,2	54,8	43,9
	Total sound pressure@10m (LpA)	dB(A)				64,9				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	67,4	70,7	79,2	97,8	97,1	98,4	92,9	82,4
	Total sound power (LwA)	dB(A)				103,1				
	Sound pressure @10m (LpA)	dB(A)	34,4	37,7	46,2	64,8	64,1	65,4	59,9	49,4
	Total sound pressure@10m (LpA)	dB(A)				70,1				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	62,3	65,6	74,1	92,7	91,9	93,2	87,7	77,3
	Total sound power (LwA)	dB(A)				97,9				
	Sound pressure @10m (LpA)	dB(A)	29,3	32,6	41,1	59,7	58,9	60,2	54,7	44,3
	Total sound pressure@10m (LpA)	dB(A)				64,9				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	68,4	71,3	79,2	97,8	97,1	98,4	92,9	82,5
	Total sound power (LwA)	dB(A)				103,1				
	Sound pressure @10m (LpA)	dB(A)	35,4	38,3	46,2	64,8	64,1	65,4	59,9	49,5
	Total sound pressure@10m (LpA)	dB(A)				70,1				

FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	63,2	66,1	74,1	92,7	91,9	93,2	87,7	77,3
	Total sound power (LwA)	dB(A)				97,9				
	Sound pressure @10m (LpA)	dB(A)	30,2	33,1	41,1	59,7	58,9	60,2	54,7	44,3
	Total sound pressure@10m (LpA)	dB(A)				64,9				

	WSI 700									
SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	62,1	66,5	78,5	97,8	96,9	98,4	93,0	82,0
	Total sound power (LwA)	dB(A)				103,0				
	Sound pressure @10m (LpA)	dB(A)	29,1	33,5	45,5	64,8	63,9	65,4	60,0	49,0
	Total sound pressure@10m (LpA)	dB(A)				70,0				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
AC	Sound power (LwA)	dB(A)	57,0	61,4	73,3	92,7	91,8	93,2	87,9	76,9
	Total sound power (LwA)	dB(A)				97,9				
	Sound pressure @10m (LpA)	dB(A)	24,0	28,4	40,3	59,7	58,8	60,2	54,9	43,9
	Total sound pressure@10m (LpA)	dB(A)				64,9				

SC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	67,4	70,7	79,2	97,8	97,1	98,4	92,9	82,4
	Total sound power (LwA)	dB(A)				103,1				
	Sound pressure @10m (LpA)	dB(A)	34,4	37,7	46,2	64,8	64,1	65,4	59,9	49,4
	Total sound pressure@10m (LpA)	dB(A)				70,1				

SC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	62,3	65,6	74,1	92,7	92,0	93,3	87,7	77,3
	Total sound power (LwA)	dB(A)				98,0				
	Sound pressure @10m (LpA)	dB(A)	29,3	32,6	41,1	59,7	59,0	60,3	54,7	44,3
	Total sound pressure@10m (LpA)	dB(A)				65,0				

FC	**Noise data**									
STD	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	68,4	71,3	79,2	97,8	97,1	98,4	92,9	82,5
	Total sound power (LwA)	dB(A)				103,1				
	Sound pressure @10m (LpA)	dB(A)	35,4	38,3	46,2	64,8	64,1	65,4	59,9	49,5
	Total sound pressure@10m (LpA)	dB(A)				70,1				

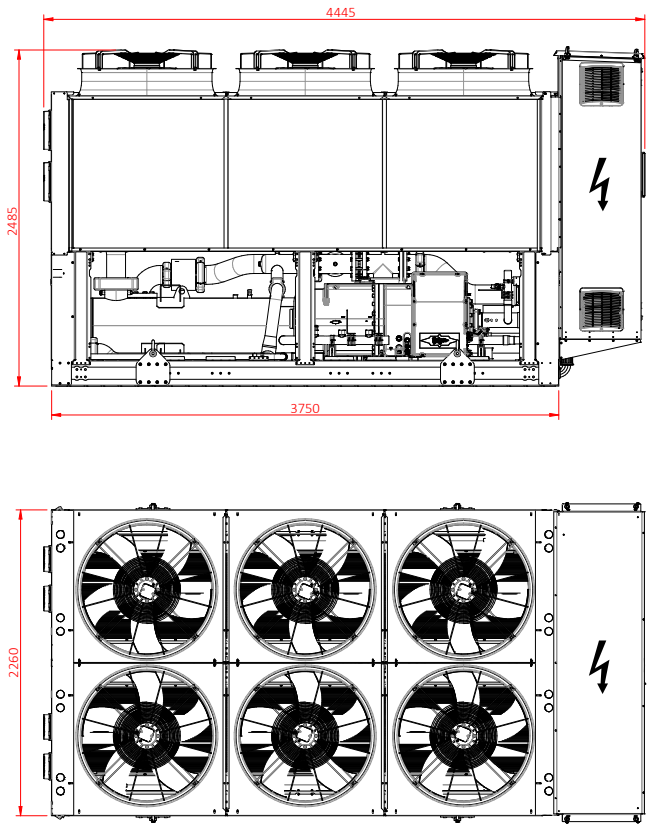
FC	**Noise data**									
LN	Frequency	[Hz]	63	125	250	500	1000	2000	4000	8000
EC	Sound power (LwA)	dB(A)	63,3	66,2	74,1	92,7	92,0	93,3	87,7	77,3
	Total sound power (LwA)	dB(A)				98,0				
	Sound pressure @10m (LpA)	dB(A)	30,3	33,2	41,1	59,7	59,0	60,3	54,7	44,3
	Total sound pressure@10m (LpA)	dB(A)				65,0				

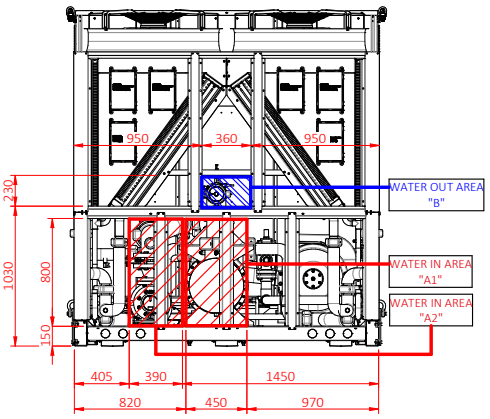
5.6 Dimensional drawings

WS110, WSI160, WSI180

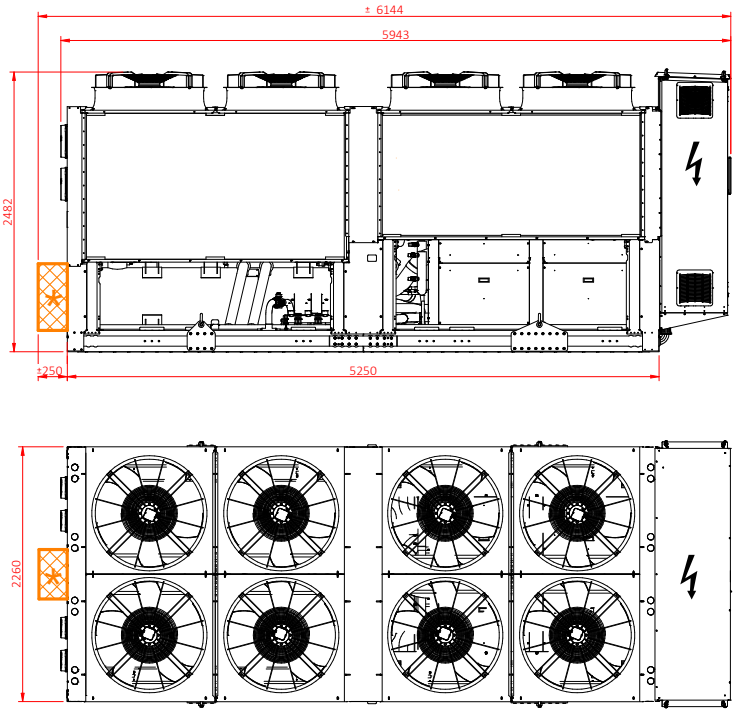
TBD

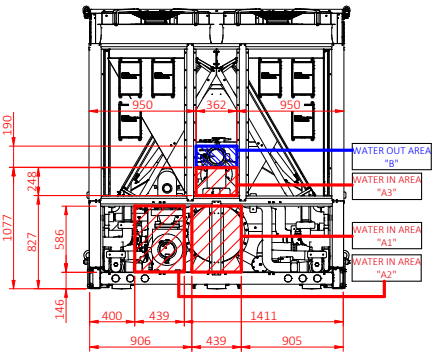
WSI220





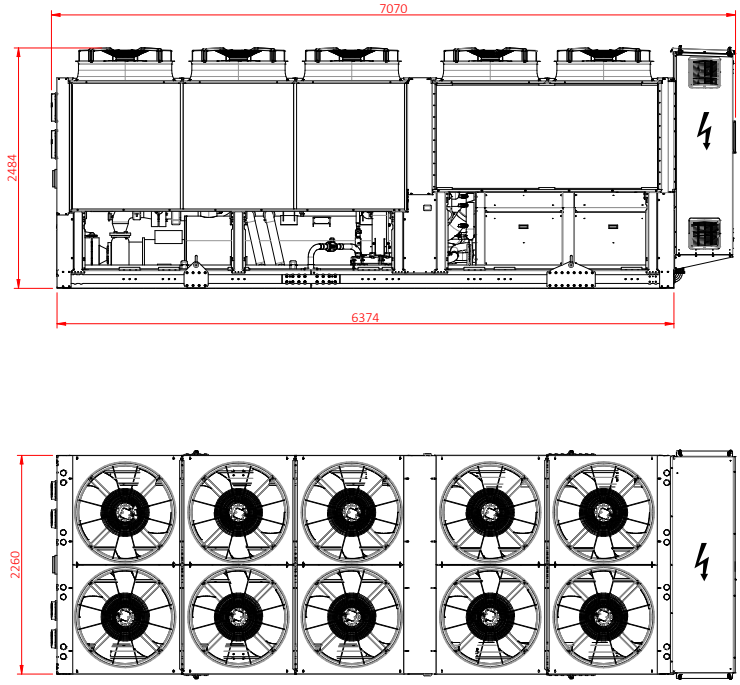
WSI280, WSI300

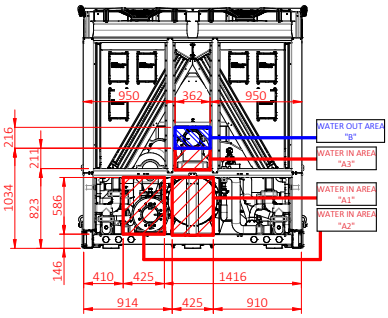




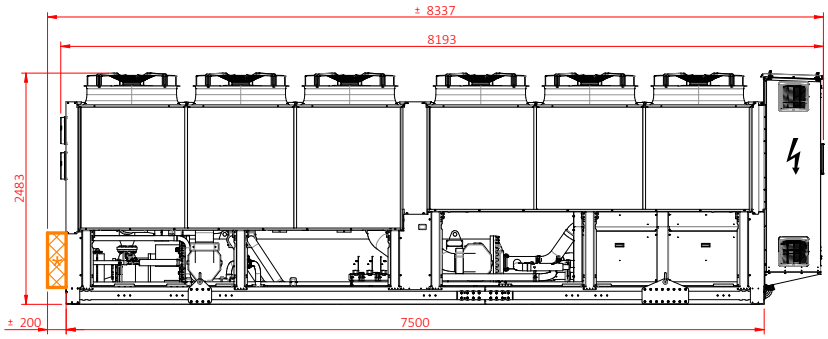
* extra distance for configurations with 2 pumps

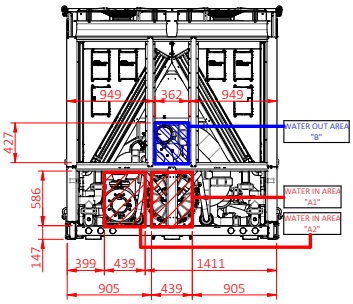
WSI320

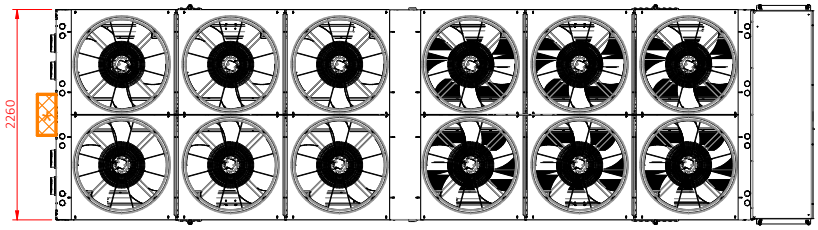




WSI360, WSI420

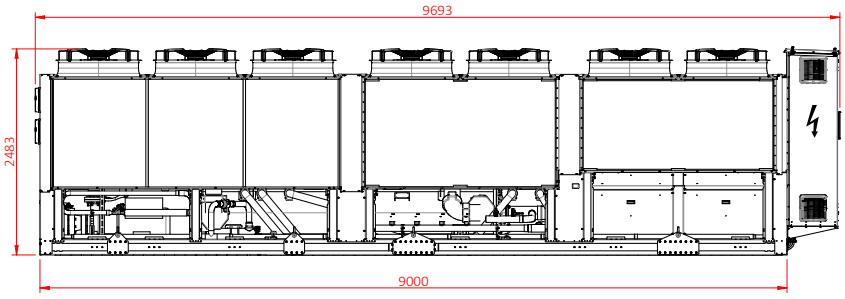


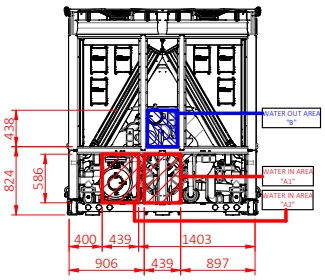


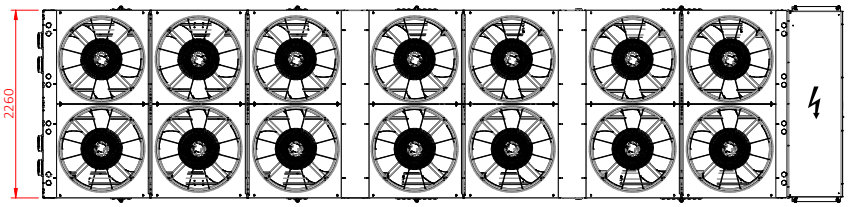


* extra distance for configurations with 2 pumps

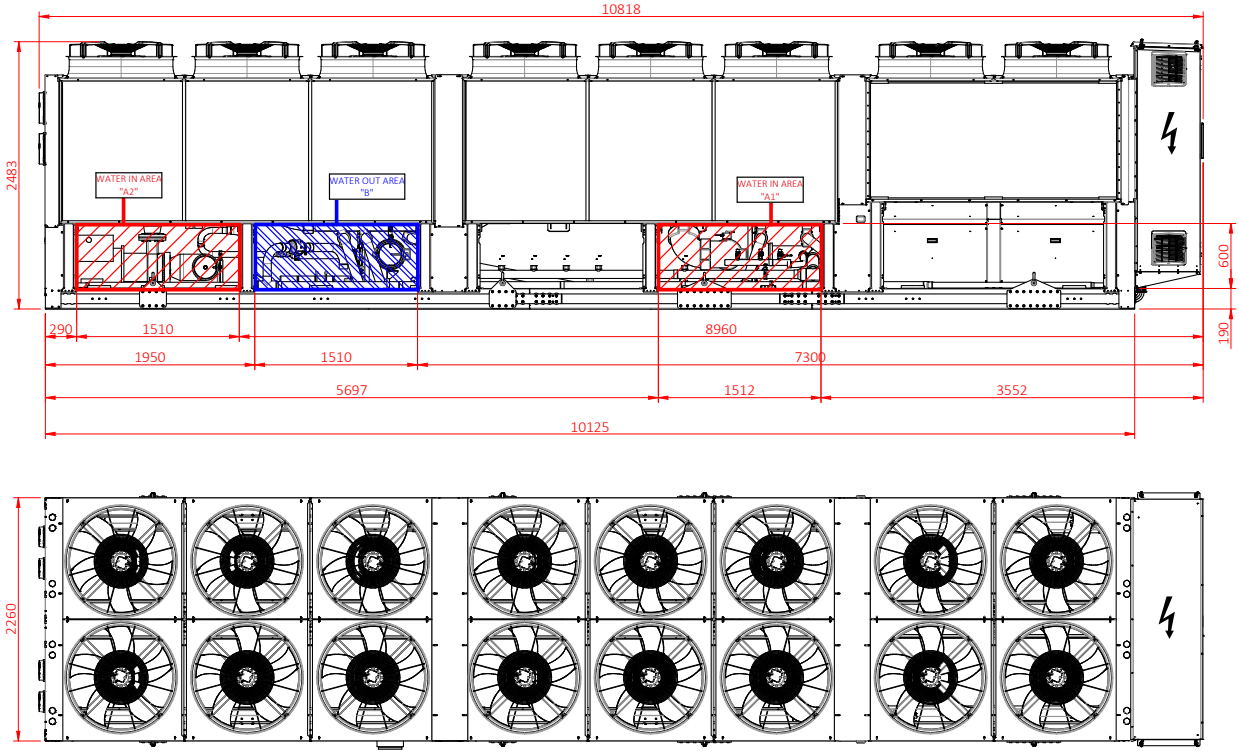
WSI480



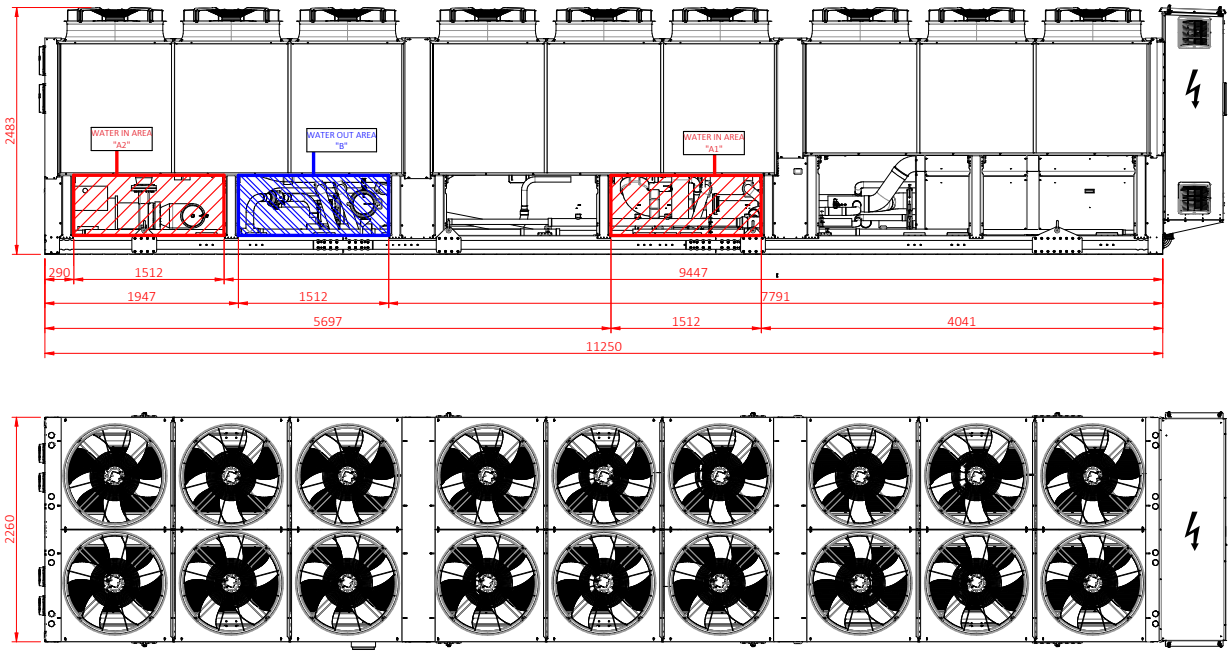




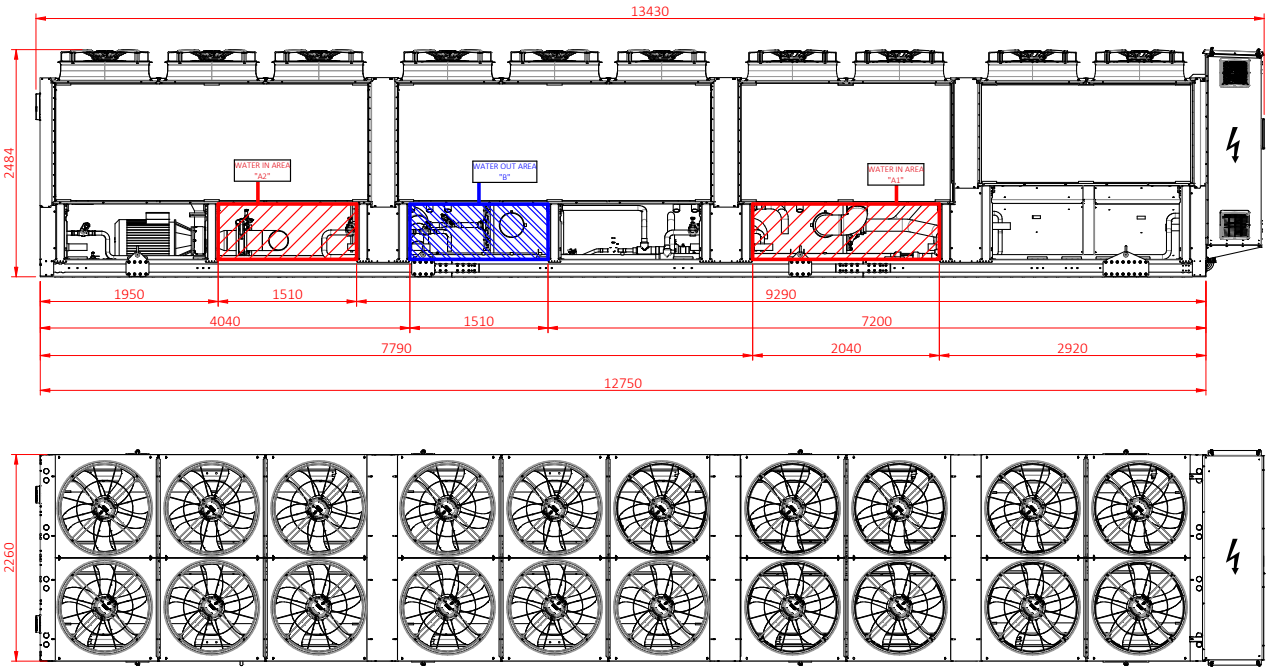
WSI560, WSI640



WSI700



WSI720



5.7 Electrical connection data

Common input section on the general lock door switch and signals connector.

	Input lug size	
Model	**General lock door**	**Signal**
WSI 110	See Wiring Diagram of the unit	Terminal Block
WSI 160		Terminal Block
WSI 180		Terminal Block
WSI 220		Terminal Block
WSI 280		Terminal Block
WSI 300		Terminal Block
WSI 320		Terminal Block
WSI 360		Terminal Block
WSI 420		Terminal Block
WSI 480		Terminal Block
WSI 560		Terminal Block
WSI 640		Terminal Block
WSI 700		Terminal Block

6. Installation

6.1 Positioning

DANGER

Requirements with regard to A2L refrigerants
For installation in a or above a catchment area, the catchment area must be monitored for gas leaks. The assessment of the area adjacent to the chiller is the responsibility of the installer and in compliance with national regulations.
In case of an increased installation on roof of buildings, it must be checked whether a lightning protection is necessary. This is also dependent of the explosion zone classification.

INFORMATION

Respect the relevant requirements for installation according to national regulations and EN 378.

Check that the installation site is appropriated for the unit weight, which you can read in the technical data in “5.5 Technical data”. The chiller unit is designed for outdoor installation on a horizontal level base. For an even weight distribution, a base plate made of concrete is necessary.

- The unit should not be placed, related to the wind direction, behind heat emitting devices (e.g. chimneys) or sources of dirt and airborne chemicals (e.g. exhalation outlet hoods). Greasy and floating particles contained in the air are otherwise deposited at the condenser fins and reduce the heat transmission.
- Installation sites, which are subject to heavy snow-drifts, are unsuitable in the same way as sites where inundations can take place and a high sun exposure is present.
- For locations where outer influences might affect the airflow, an enclosure or louvre is recommended. Please consider negative impacts on the airflow by near obstacles.
- Further make sure that the site does not encourage a short-circuit of air from the air discharge to the condenser intake by aerodynamically disadvantageous conditions.
- If the unit is installed near walls or vertical obstacles, please make sure these do not exceed the maximum height of 1.10 m.
- When selecting the installation site take into account the necessary clearances for the maintenance and the air flow. Keep a clearance of 1.5 m to the back of the unit, 1.5 m to the left and right side and at least 2.5 m to the electrical cabinet.
- Above the fans a clearance of 5 m is required.
- If the unit is positioned in an area which is accessible to unauthorized persons, it is recommended to take steps for preventing vandalism and accidental damage.
- To avoid possible noise and vibration transmission the use of anti vibration mounts (option) is recommended.

After installing the chiller check its horizontal alignment using a spirit level.

6.2. Requirements for the user

The units must be installed in safe locations, outdoors only, in areas reasonably free from obstacles to ventilation.
They must also be installed in locations with no other explosion hazards, if necessary subject to the rules and regulations concerning the issue of the CPI (or equivalent protocol in force in the country of installation), in environments that comply with local building regulations.
The machines must be connected to electrical installations made in accordance with the technical standards in force.

⚠ DANGER

The outlet of the safety valve must be conveyed to a point that is reasonably far from the machine itself, at a height of more than 5m from the ground.

In areas classified as hazardous by the machines in question, and taking into account the national regulations of the country of use, it is necessary to:

- Avoid installing equipment not suitable for the classified area.
- Avoid naked flames, sparks and hot work.
- Avoid sources of ignition due to processes that can generate remote triggers (ionising and non-ionising radiation).
- Avoid direct and indirect effects of lightning.
- Avoid electrostatic charges.
- Avoid interference with elements that could be dangerous, such as sewers, openings in the ground, underground rooms, power lines, flammable deposits, railways, motorways, etc.).

For this last aspect, we propose the spacing criterion proposed by Proklima.
As the refrigerant gas used is heavier than air, even a small gas leak, which in itself is not dangerous, can cause a build-up of gas if it infiltrates underground and forms pockets.
A certain 'safe' distance should also be designated from refrigeration systems located outdoors in order to minimise the possibility of flammable concentrations entering places occupied by humans (e.g. through windows, ventilation openings, where people may gather outdoors, etc.). However, outdoor wind speeds tend to be quite high (compared to indoor environments) even when the air seems 'still', so the amount of flammable mixture should also be adjusted to take account of the additional dispersion provided by the surrounding air.

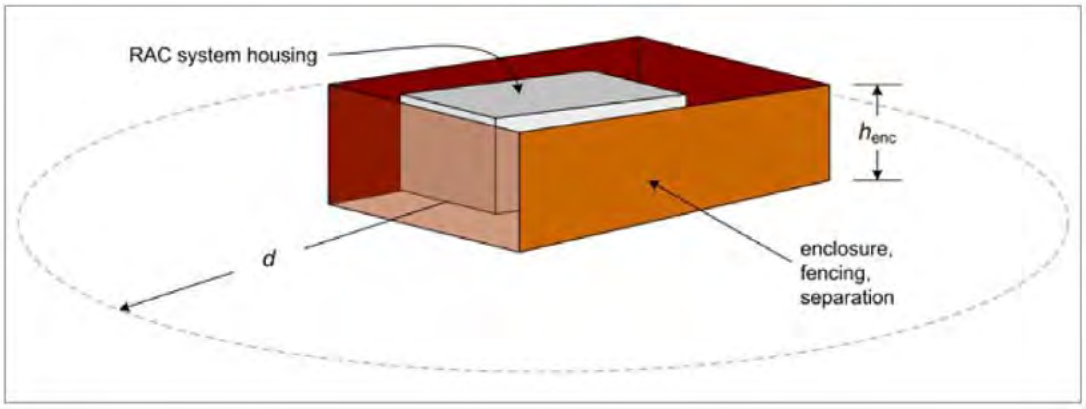
The document drawn up by Proklima (Guidelines for the safe use of hydrocarbon refrigerants) provides a formula for calculating the minimum distance from manholes, drains, smoking areas, open flames, etc..

Using this approach, the minimum 'safe' distance d (m) can be approximated by the following equation, according to the situation shown in the figure:

$$d = c_w \times \sqrt{\frac{M_r}{\pi\, h_{enc}\, (LFL)}}$$

Where M is the refrigerant charge per circuit (kg) and h_{enc} is the height (m) of the walls surrounding the system. Note that the distance of the wall from the unit is not particularly relevant (as long as it is within the 'safe' distance) and if there is no wall, the height of the unit housing can be used for

the calculation. The constant cw is a function of the local airflow conditions. For example, if the equipment is located in a fairly sheltered area, such as beyond or between buildings, $c_w = 0.5$, whereas if the system is located in an exposed position, such as on a roof, $c_w = 0.25$. However, it is always necessary to assess the specific situation on a case-by-case basis.



In this specific case:

a. M = 6 kg (for single circuit units) and M = 12 kg (for double circuit units)
b. $h_{enc} = 1$ m
c. $c_w = 0.5$
d. LFL = 0.038 kg/mc

Therefore, the minimum safety distance is equal to:
- Single circuit units: d = 3.55 m → d = 4 m
- Double circuit units: d= 5.0 m → d = 5.5 m

Note: In case of stricter national regulations, follow those regulations.

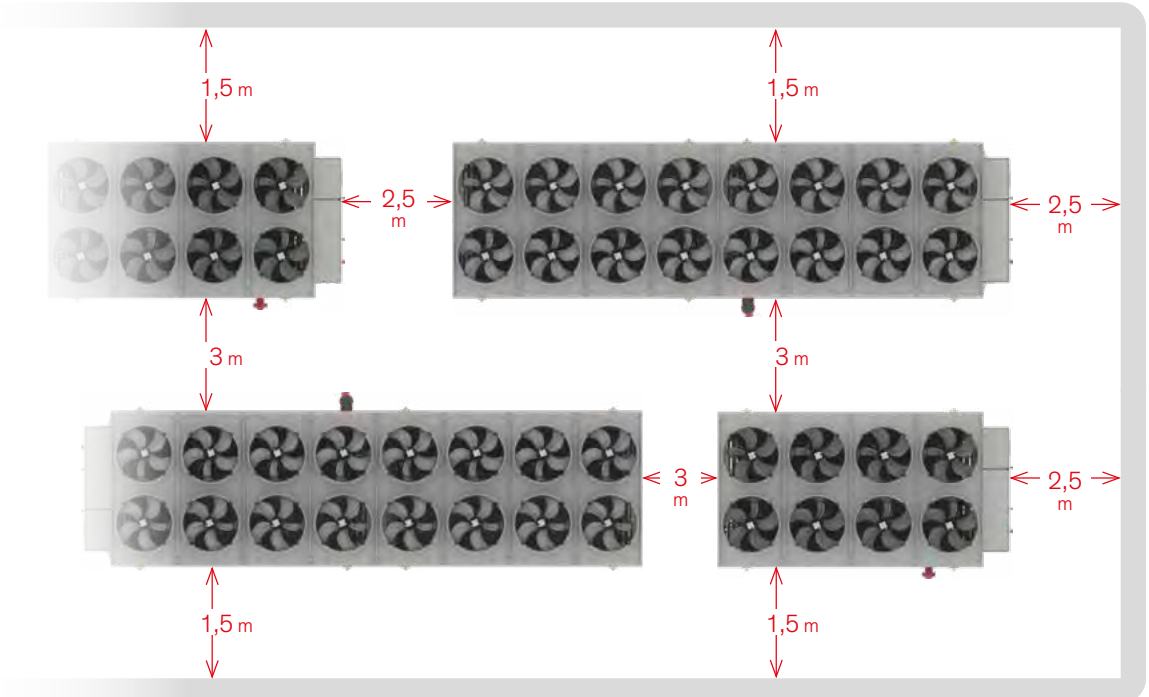
6.2.1 Minimum distance from obstacles or other chillers

The free space, indicated by red areas, is required to allow correct access to the unit for maintenance and replacement of components.

INFORMATION

The minimum distance must be guaranteed from any kind of obstacles: pipes, walls, other unit, etc.

6.2.2 Installation distance of several units



6.3 Special requirements for installation

⚠ DANGER

An unsuitable location of the unit can cause danger to persons, object and environment. Please follow the prescription of this manual before the installation of the unit.

- Access permitted only for instructed personnel doing the maintenance.
- Adequate ventilation must be ensured.
- Free flames not permitted. Only welding, brazing or similar activity are permitted if an adequate ventilation is ensured.
- It must ensured an adequate ventilation for normal operation and emergency.

Possible ignition sources on the installation site

According to Annex K of the EN 378-2: 2016, see in the table below which types of ignition sources are usually relevant to evaluate for refrigeration systems.

Relevance of ignition sources from EN 1127			
Clause in EN1127–1	**Ignition sources listed in EN 1127–1**	**Usually relevant to evaluate for refrigeration systems under normal operation**	**Examples**
5.1	Hot surfaces	Yes	Electrical heaters
5.2	Flames and hot gases	Yes	Gas heaters
5.3	Mechanically generated sparks	Yes	During service
5.4	Electrical apparatus	Yes	Electrical sparks from opening circuits
5.5	Stray electric currents and cathodic corrosion protection	No	-
5.6	Static electricity	Yes	Large plastic surfaces
5.7	Lightnin	No	It is highly unlikely that lightnin will hit at the same time as a leak is occurring
5.8	Radio frequency (RF) electromagnetic waves from 104Hz to 3 × 1 011 Hz	No	-
5.9	Electromagnetic waves from 3 × 1 011 Hz to 3 × 1 015 Hz	No	-
5.10	Ionizing radiation	No	-
5.11	Ultrasonics	No	-
5.12	Adiabatic compression and shock waves	No	An air compressors takig air from the vicinity of a leak
5.13	Exothermic reactions, including self - ignition of dusts	No	-

- As protection against overpressure, the refrigerant circuit is equipped with one or more safety valves on the high and low pressure side of the compressor.
- The outlets of the safety valves must be routed to a point reasonably far away from the machine itself at a minimum height of 5m from the chiller's installation level.

(1) The dimensioning of the canalization of each safety valve must be done according the standard EN 13136:2013. See below a guide line for the dimensioning, from the paragraph 7.4 of the regulation EN13136:2013 and that cannot be substitutive of the regulation itself:

Pressure losses in the downstream line (line between safety valve and atmosphere)
The pressure loss (P_1-P_2) in the downstream line shall not exceed $0,10 \times P_0$

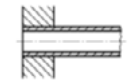
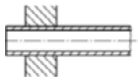
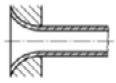
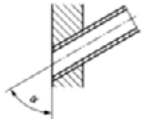
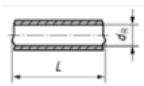
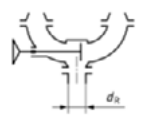
The downstream pressure loss is given by P_1-P_2 and:

$$p_1 = \sqrt{0{,}064 \times \zeta \times \left[\frac{A_c}{A_{out}} \times C \times K_{dr} \times K_b \times p_o \right]^2 + p_2^2}$$

Where:

- P_1 = inlet pressure to discharge line [bar abs]
- P_2 = outlet pressure to discharge line, equal to atmospheric pressure i.e. 1,013 [bar abs]
- A_c = minimum calculated flow cross-section area [mm^2]
- A_{out} = cross-section area of valve outlet pipe [mm^2]
- K_{dr} = Kd x 0,9 , reduced discharge coefficient
- K_b = theoretical capacity correction factor for sub-critical flow
- C = expansion rate as a function of the k coefficient in the isentropic equation for the refrigerant fluid
- P_0 = actual pressure downstream of the safety valve during discharge of the entire flow [bar abs]
- ζ = sum of the of pressure loss coefficients ζ_n of the piping. The coefficients ζ_n refer to:
  - pipe element losses, bends
  - losses along the piping

See table below of EN 13136:2013.

Pressure loss coefficients of a single component ζ_n			
Pipe elements		Flush connection	Very sharp edged $\zeta_n = 0{,}5$ Broken edge $\zeta_n = 0{,}25$
		Inserted connection	Very sharp edged $\zeta_n = 1$ Broken edge $\zeta_n = 0{,}56$
		Flared connection	According to the radius: Between $\zeta_n = 0{,}005$ and $\zeta_n = 0{,}06$ Normally $\zeta_n = 0{,}05$ is used
		Angled flush connection	$\zeta_n = 0{,}5 + 0{,}3 \cos\alpha + 0{,}2 \cos^2\alpha$
		Pipe bend 90°	$R = 2D_R$ $\zeta_n = 0{,}3$ $R = 3D_R$ $\zeta_n = 0{,}25$ $R = 4D_R$ $\zeta_n = 0{,}23$ $R = 5D_R$ $\zeta_n = 0{,}18$
		Straight pipe	$\zeta_n = \lambda \times \frac{L}{d_R}$ Steel pipe $\lambda = 0{,}02$
		Valves and changeover valves	$\zeta = 2{,}592 \times \left[\frac{A_R}{K_{VS}} \right]^2 \times 10^{-3}$ $A_R = \frac{\pi \times d_R^2}{4}$ K_{VS} or ζ shall be indicated by the manufacturer

Where in STULZ WSI series:

	WSI 280
P0 [bar abs] - high pressure side (condenser) side (condenser)	27,4
P0 [bar abs] - low pressure side (evaporator) side (condenser)	18,6
Ac [mm²] single valve /total for each refrigerant circuit - high pressure side(condenser)	114,5/343,4
N° valves of high pressure side for circuit	3
Ac [mm²] single valve /total for each refrigerant circuit - low pressure side (evaporator)	62,8/125,7
N° valves of low pressure side for circuit	2
C	2,48
K_{dr}	0,86
K_b	1

EXAMPLE: check of the discharge pipe for single WSI360 safety valve on the high pressure side (condenser)

Suppose the discharge pipe is 42 with the following characteristics:
- d_{out} = 39 [mm] , inside pipe diameter of outlet tube
- A_{out} = 1194 [mm2] , inside pipe cross-section area of outlet tube
- L = 5000 [mm] , pipe length
- 90° elbow with bending radius, R, equal to three times external diameter of pipe

The following information is taken from Table A.4 in standard EN 13136:2013:
- ξ 1 (elbow) = 0.25
- ξ 2 (length) = λ x L/ d_{out} = 0,02 × 5000/39 = 2,56 - where λ =0,02 for steel pipe
- ξ T = ξ1 + ξ2 = 0,25 + 2,56 = 2,81

The pressure loss is given by:

$$p_1 = \sqrt{0{,}064 \times 2{,}81 \times \left[\frac{114{,}47}{1194} \times 2{,}48 \times 0{,}86 \times 1 \times 27{,}4\right]^2 + 1{,}0^2} = 2{,}58 \quad \text{[bar]}$$

The pressure loss (P_1-P_2) in the downstream is admissible because it is lower than the value of 0,10 x P_0
P_1-P_2 = 2,58-1,0 = 1,58 is lower than 0,10 × P_0 = 0,10 × 27,4 = 2,74

			WSI110		WSI160		WSI180		WSI220		WSI280		WSI300		WSI320		WSI360	
High pressure side	External diameter	[mm]	42	54	42	54	42	54	42	54	42	54	42	54	42	54	42	54
	Internal diameter	[mm]	39	50	39	50	39	50	39	50	39	50	39	50	39	50	39	50
	Lenght	[m]	5,6	24,5	5,6	24,5	5,6	24,5	5,6	24,5	5,6	24,5	10	40	10	40	10	40
	Curves	[n]	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Maximum equivalent length	[m]	8,0	27,5	8,0	27,5	8,0	27,5	8,0	27,5	8,0	27,5	12,4	43,0	12,4	43,0	12,4	43,0
Low pressure side	External diameter	[mm]	35	42	35	42	35	42	35	42	35	42	35	42	35	42	35	42
	Internal diameter	[mm]	32	39	32	39	32	39	32	39	32	39	32	39	32	39	32	39
	Lenght	[m]	17,5	50,5	17	49,5	18,5	52	18,5	52	18,5	52	18,5	52	18,5	52	18,5	52
	Curves	[n]	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Maximum equivalent length	[m]	19,4	52,9	18,9	51,9	20,4	54,4	20,4	54,4	20,4	54,4	20,4	54,4	20,4	54,4	20,4	54,4

			WSI420		WSI480		WSI560		WSI640		WSI700	
High pressure side	External diameter	[mm]	42	54	42	54	42	54	42	54	42	54
	Internal diameter	[mm]	39	50	39	50	39	50	39	50	39	50
	Lenght	[m]	5,6	24,5	5,6	24,5	5,6	24,5	5,6	24,5	5,6	24,5
	Curves	[n]	4	4	4	4	4	4	4	4	4	4
	Maximum equivalent length	[m]	8,0	27,5	8,0	27,5	8,0	27,5	8,0	27,5	8,0	27,5
Low pressure side	External diameter	[mm]	35	42	35	42	35	42	35	42	35	42
	Internal diameter	[mm]	32	39	32	39	32	39	32	39	32	39
	Lenght	[m]	15	43,5	15	43,5	15	43,5	18,5	52	18,5	52
	Curves	[n]	4	4	4	4	4	4	4	4	4	4
	Maximum equivalent length	[m]	16,9	45,9	16,9	45,9	16,9	45,9	20,4	54,4	20,4	54,4

Safety valve

Keep the area around the vent clear.
Use the cover to protect against rainwater ingress.
Provide collection siphons and condensate/water/gas drain valves on exhaust manifolds.

6.4 External water circuit

The evaporator water circuit of the chiller contains an evaporator, a differential pressure switch, temperature sensors in the inlet and outlet and vent valves.

For a detailed overview, please take a look at the circuit diagram in chapter “4.4 Piping diagrams”. On the evaporator side a frost protection sensor measures the temperature of the liquid and reports it to the controller in which a threshold for an antifreeze alarm is defined. This value is adjusted on 4°C in the factory. Below this water inlet temperature it releases a frost protection management by the controller, which may lead to an antifreeze alarm. The adjusted value of 4°C can be modified and has to be adapted to the local conditions (glycol content).
If the water temperature passes under 5°C or if the outside temperature is less than 2.5°C, we recommend to add the following quantities of Ethylene glycol (indicated as percentage of weight of the water quantity):

Ethylenic glycol	
External temp.	**%**
from +3 to -10°C	20
from -10 to -15°C	28
from -15 to -20°C	35
from -20 to -25°C	40

INFORMATION

Establish the required water/glycol mixture outside of the chilled water circuit and fill the circuit later.

WARNING

Do not add any other fluids or additives to the filling liquid except those provided. Do not mix any products and/or additives of different brands

For additional freeze protection at low ambient temperatures consider using the optional electrical heaters. The following additional components are necessary for the external hydraulic circuit:

⚠ DANGER

Degasser; over 500 kg it's mandatory, install air-water separation valve, vent the valve in a safety place and calculate the zone. Under 500 kg, install the valve. Please note that if no gas separation is foreseen, switch from a system installed in a class III location to a class I or II location by activating charge limits.

- Suitable connection pipes according to the drawings in this chapter.
- Stop off valves upstream the chiller to be able to take the chiller unit out of the chilled water circuit in case of repair works without having to drain the entire circuit.
- Air relief valve at the highest point of the circuit.
- Filling valve at the lowest point of the circuit.
- Mesh strainer in the chilled water inlet with mesh size of 870 µm.
- An appropriate insulation of the pipework to prevent condensate formation.

If the chiller is not provided with the following components, the external hydraulic circuit must be equipped with them additionally:

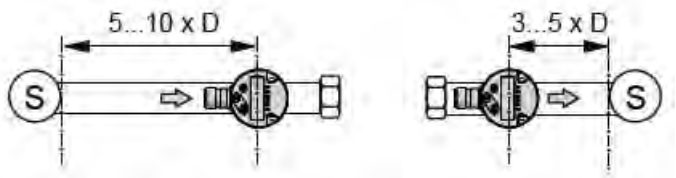
- Circulating pump with sufficient delivery height according to the minimum and maximum flow rates and corresponding pressure drop which can be found in chapter "5.5 Technical data".
- Expansion tank with safety valve to ensure a possibility of expansion for the liquid at temperature variations. The expansion tank must be dimensioned in such a way that the water circuit volume can increase by 2% without draining off liquid through the safety valve.
- Storage tank as an accumulator for heat energy to reduce the on/off cycles of the compressor. A storage tank is recommended if the water volume of the water circuit is less than 10 liters/kW cooling capacity. The storage tank should be lined out with thermic insulation.

⚠ WARNING

The heat load should not be less than half the minimum cooling capacity of the unit.

⚠ WARNING

In addition to the differential pressure switch, a flow switch must be installed (if it's not ordered as an option of the unit) in the inlet of the hydraulic circuit as an additional protection device for the evaporator, measuring whether the fluid is circulating. The flow switch must be installed according to the requirements of the manufacturer of the unit and must be set at the minimum Q_U indicated in the technical data (in manual part 2).
In the installation of the flow switch, it's recommended to use the same outlet diameter form the evaporator and it's recommended to leave the piping as straight as possible, long at least 5 diameters before, if the flow switch in mounted at the input, while at least 3 diameters after, if the flow switch is mounted at the output.



D = Diameter of the pipe; S = Interferences

If the flow switch is not installed, the unit doesn't start. For more information check the electrical drawing of the unit in manual part 2. Please note that if the flow switch is not installed, the guarantee on the product will be invalidated.

WARNING

General parameters	
Parameter	**Setting**
uni	m^3/h
dAP	3sec
MEdI	H_2O o GLYC (rif. 35% ethylene glycol)
ModE	LIQ

Chiller-dependent parameters	
Parameter	**Setting**
Rp1	Minimum expected flow (see „Technical data“)
SP1	Minimum expected flow increased by 15%
DiA	Internal pipe diameter (mm or inch)
CGA	Reading offset: corrects the reading on the flow switch to match the value on a flow meter calibrated using the flow rate value Rp1

The flow switch is used to detect a low flow and protect the evaporator; an error of 3% in the flow rate is allowed.

DANGER

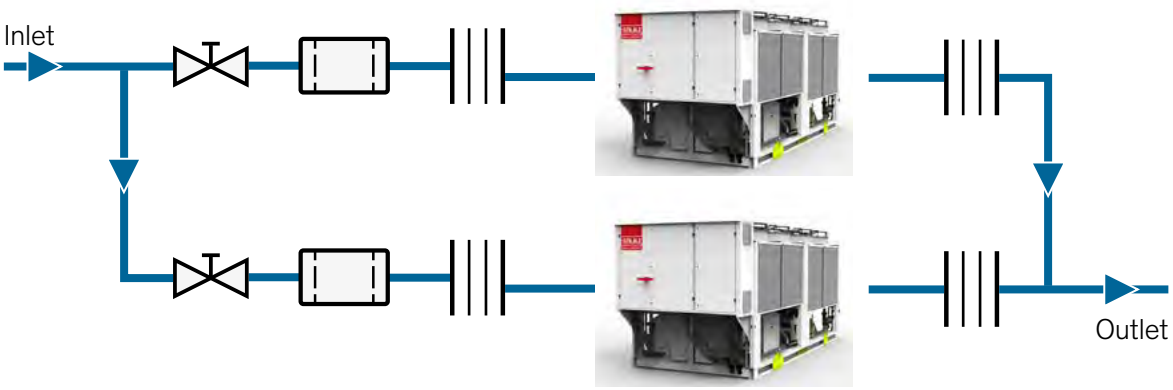
The discharge of the safety valve must be positioned in a proposed area so that the leaving fluid will not endanger persons.

Evaporator drain connection of the safety valves	3/4" G male

Another criterion for the external water circuit is the water quality. Please check chapter “5.2 Chilled water quality” at page 29 for detailed information about water quality requirements. The most sensible component in respect of pollution and corrosion is the evaporator, whose heat transmission ability decreases in this case. The water should be free from solid particles. For this purpose we recommend the installation of a fine mesh strainer upstream the evaporator. Furthermore, the installation of pipe compensator in the chilled water inlet and outlet are recommended.

Symbol	Meaning	Symbol	Meaning
	Water line		Pipe compensator
	Water shut-off valve		Mesh strainer

If you connect two or more chillers in parallel, we recommend installing regulating valves to keep the pressure drop of each unit equally high.



For connecting the units to the external system remove the protective hoods from the water pipes.

6.4.1 Water connection

INFORMATION

To avoid any misunderstandings: the designation "water inlet" and "water outlet" are chosen, seen from the chiller. At the water outlet, the chilled water is provided from the chiller.

The connection piping should consist of P235 or similar steel, as the water piping in the chiller, to avoid the risk of corrosion at the transition to the external piping. The connection is carried out in the shape of Victaulic® connections.
We recommend the following good practice:

- install a water bypass to be able to carry out work at the chiller (without having to disconnect it from the pipework)
- connect the pipe with adequate supports, so that it weight is not borne by the chiller
- install adequate anti-vibration pipe joints to avoid the transmission of structure-borne noise
- in the evaporator side, insulate the pipes of the external system, if they come into contact with external air, to prevent the influence of heat from the ambient air as well as possible

WARNING

The connection piping must be connected to the chilled water lines of the chiller free of mechanical stress.

INFORMATION

For the dimensions and positions of the hydraulic connections, see “5.6 Dimensional drawings” at page 54

WARNING

Before doing water filling, be sure that drain valves are closed.

The position of drainages is identified with the following label: 

6.4.2 Pumps management

The unit can manage the pumps on both evaporator and condenser side (ON-OFF and Alarm signals, no power supply). STULZ suggests to connect the pumps to the unit’s electrical board.
It’s recommended to switch on the pumps before the unit is switched on in order to feel the correct temperatures on the plant (minimum time 20 seconds).
It’s mandatory to continue to pump the water after the unit is switched off (remote ON/OFF) in order to prevent freezing of the evaporator (minimum time 120 seconds).
The previous prescriptions are valid also if the pump is not totally managed by the unit or suitable for an external command to the chiller.

INFORMATION

The evaporating process continues also after the switching off of the compressor.

The logic described above is always enabled if the pumps are directly connected to the unit; otherwise the customer has to manage properly the pumps assuring post-pumping after the unit is switched off.

WARNING

In the case of an inverter external to the pump and if the unit's storage exceeds 12 months, calculated from the date of manufacture of the machine (shown on the label), the status of the capacitors must be checked via the operator panel on the inverter. Energize but do not start the unit: if DC-link is less than 1.41 × Umains, leave the inverter connected for a few minutes. If DC-link remains below 1.41 × Umains, contact Service.

6.5 Filling and bleeding air

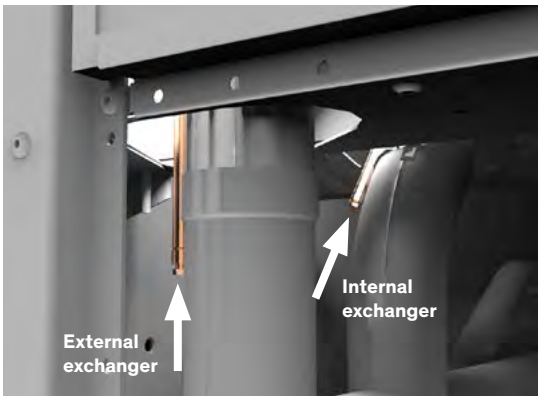
Open the vent valves. The location of the vent valves is identified with the label “Air Vent”. In some cases the valves are already opened and the vent caps are inside a bag near the electrical cabinet. A standard chiller provides vent valves at the evaporator and condensers.
Check whether the stop valves in the supply line are open . Connect the pump for filling the circuit to the provided filling point. See the exact location of the filling point in the hydraulic scheme.
Begin filling the water circuit. As soon as liquid comes out of a vent valve for several seconds, this can be closed.

WARNING

If the planned filling of water contains glycol, connect filling hoses to the vent valves, to catch the discharging mixture and dispose of it separately.

WARNING

Once the circuit is filled, the freeze protection function is essential. Check if the circulation pumps are supplied with power and if they are properly connected to the controller. Furthermore, make sure that the valves of all pumps are set OPEN.



6.6 Electrical connection

⚠ WARNING

The electric cables must be only connected by an authorized specialist.
The connection terminals are designed for copper cables.

- Ensure that the electric cables are de-energized and the unit is turned off.
- Ensure an appropriate isolation of all sources of supply to the unit.
- The unit must dispose of an effective earthing.
- These units are provided for 400V/3Ph/50 Hz.
- No additional controls should be installed in the control panel.
- According to EN 60204 the operator is responsible to install current protection devices between the supply conductors and the power supply connection of the unit.
- Consider local regulations for the electrical wiring.

⚠ WARNING

The leakage current through the PE terminals exceeds 10 mA. Consider adequate cross-sectionl area of the protective conductor according EN 60204.

⚠ WARNING

Do not touch electronic components, without taking care of protective ESD measures.

⚠ WARNING

Under -5°C, the chillers must be under tension to protect the electrical, refrigerating and hydraulic part.

⚠ DANGER

ATTENTION: In case of main switch, the power supply cables between the connection terminals of the customer and the main switch are always under voltage also if the main switch is open.
The supply cables are identified with the symbol below (high voltage).

⚠ DANGER

In the case of a sound-proof compressor compartment, the safety concept when working with A2L refrigerants requires that the power supply to the components inside the compressor compartment is interrupted as soon as both flushing fans in the compressor compartment fail or the power supply to the 230V ac safety line fails. The operator must use the pre-alarm and alarm contacts shown in the circuit diagram for the fault signalling circuit.

If there is a soundproof compartment for compressors, a separate 230V ac power supply is required to manage the safety components.

⚠ WARNING

A residual current device (RCD) must be used on the unit upstream supply line. Be sure to use 300mA type B device.
The protective earth conductor system must be checked during commissioning and at regular intervals during operation.
As with variable frequency drives, residual current devices cannot provide personal safety while operating the device.

DANGER

If an active filter needs to be installed, this must be agreed with Stulz SPA

WARNING

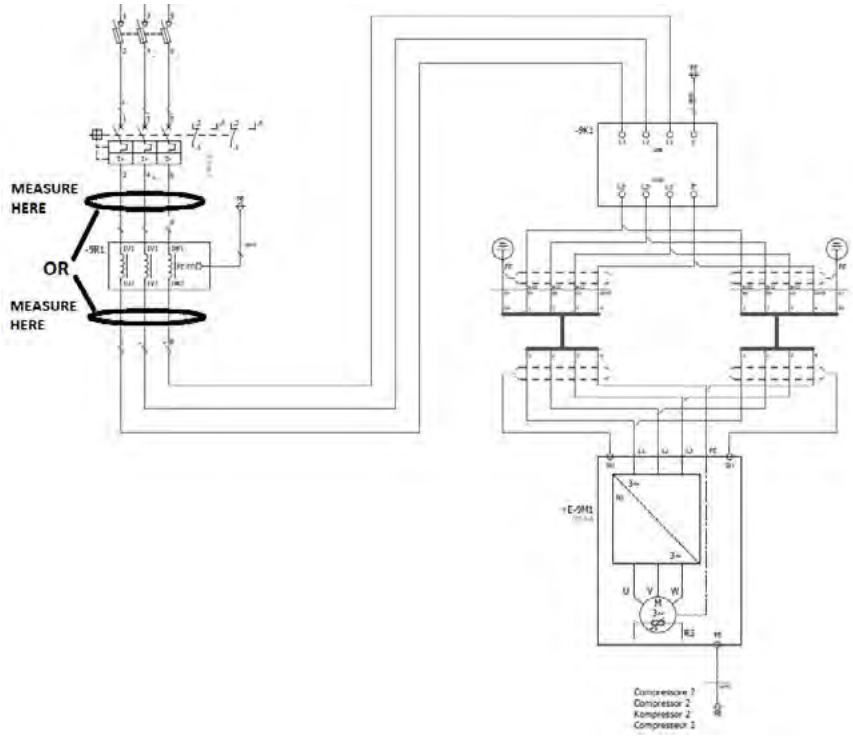
Main supply with active harmonic filter system

In order to ensure the lifetime of the frequency inverter, the THDi for the compressor at full load should not exceed the values specified in the following table.

Unit Size	CSV.24 (127 kW)	CSV.25 (161 kW)	CSV.26 (198 kW)	CSV.37 (252 kW)	CSV.38 (289 kW)
Max. THDi when the compressor operates most of the time at high load conditions	68%	55%	43%	50%	43%
Max. THDi when the compressor operates most of the time (> 80 %) with a power consumption less than 80 % of the max. power of the FI	68%	65%	53%	60%	53%

Table 1: Limits for THDi to Frequency Inverter mains terminals

Typically, the active harmonic filters determine and show the actual THDi. The one in the direction of the mains supply as well as the one the compressor gets confronted with. Thereby it is relatively easy to carry out the required tests. Alternatively, the THDi can be measured by using a power quality analyzer as shown in the following picture.
Where present, the measurement must be taken on both compressors.



6.7 Opening the electric cabinet

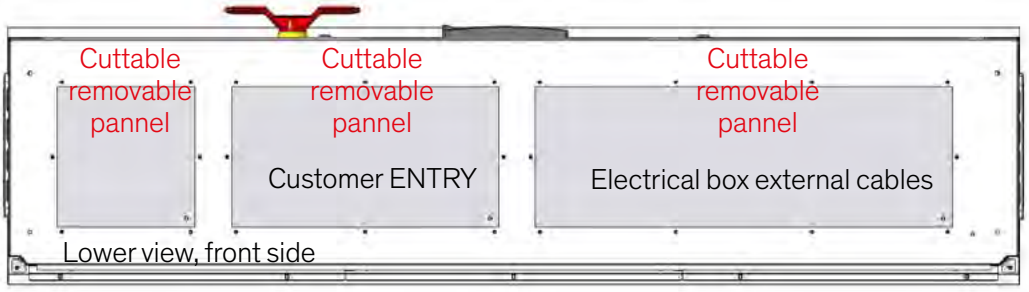
The switched ON main switch prevents opening the doors of the power section (2 doors). Only, if the main switch is in position "0" you can open the doors of the power section.
The doors of the electric cabinet can be opened by the key which is delivered with the chiller.

Double bit 3-5 key

6.8 Position of the electrical connections

The electrical connection lines can be introduced into the electric cabinet from the bottom. The position of the opening for the wires can be adjusted within the range of the panel shown in the following views.

Electrical box external cables



The power supply system on site and the pre-fuses must be designed for the total current of the unit (“5.5 Technical data”). Make sure that the power supply corresponds to the indications on the rating plate and that the tolerances according to the “5.1 Application limits” at page 27 are not exceeded.

Route the electric cable into the electric cabinet from below and connect the PE conductor at the PE rail and the three phases to the main switch, in accordance with the wiring diagram (part of the unit documentation). Use a cable gland on the bottom panel to fix the cable.

If the installation of the chiller can introduce a different potential from the main earth collector, provide an equipotential connection with the ground PE. Use screw with a minimum diameter Ø 8 mm, located in the connection hole for external earthing that is on the base of the chiller and identified with its symbol. The cable must contain a terminal lug.

The asymmetry of phase between the conductors may amount to 2% maximal.

To determine the asymmetry of phase measure the voltage difference between the phase conductors (L1-L2, L2- L3, L1-L3) and calculate the average value of the measured voltages. With a voltage supply of 400V/3Ph/50 Hz, the maximum deviation to the average value of the voltages may not exceed 8 V .

⚠ WARNING

Make sure that the phase rotation is correct, the rotating field has to turn right!

Alternatively, you can check the phase rotation by using the controller. For this, close the electrical cabinet and turn the main switch to position I. If the phase rotation is incorrect, the controller display shows an alarm symbol and the unit does not start.
After fixing the phase rotation, make sure that the unit is turned OFF.
The electronic control board provides digital outputs for alarm signals and status of the unit. The assignment of outputs to different alarms and status data can be configured in the controller unit. The default configuration is shown in the specific wiring diagram of the unit.

i INFORMATION

The digital inputs of the controller board are disabled by default. If needed, enable them in the software. For more information please check the controller manual.

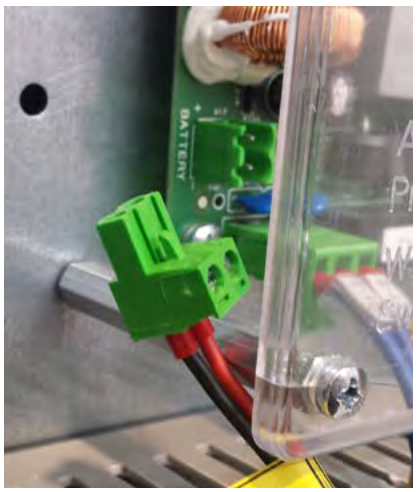
6.8.1 Backup battery for TCE

In case of power failure the electronic thermostatic valve closes, to avoid the refrigerant fluid return in the compressors. To guarantee this functionality, a battery is installed in the electrical cabinet and the connection have to be completed during the first start up.

The two wires have to be connected to the electronic board OB1 (check the electrical scheme to identify the electronic board). A specific label is installed on the wires.

⚠ WARNING

Do not leave the battery connected if the unit have to be de-energized for long time.



AT FIRST START-UP CONNECT CABLE 21-7 AND 21-8 FROM BATTERY -21G2 TO PIN X17 OF ELECTRONIC BOARD OB1 (-21K2)

6.9 Pump control

The unit's microprocessor controls internal and external pumps, as well as monitoring a pump alarm.

6.9.1 System with external pump

Choose a power switch and a contactor in respect of the pump capacity.

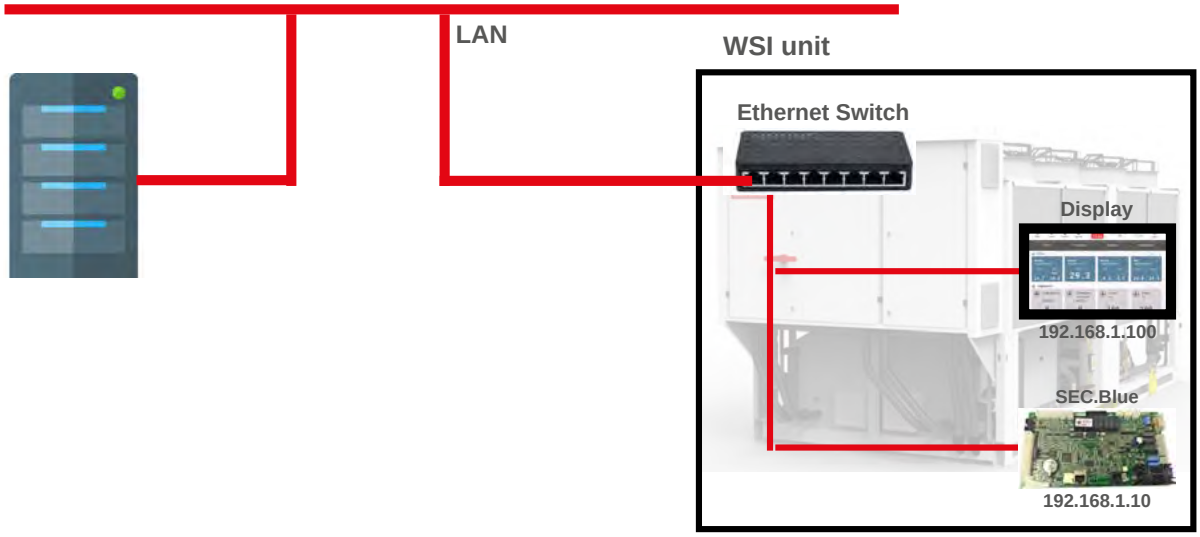
WARNING

If you do not explicitly order the load outlet option, the power to the external pumps cannot be supplied by the main switch on the unit as the main switch is only designed for the current consumption of the standard unit itself. The pump must be individually provided with safety elements.

Design the wiring between the controller and the contactor with reference to the connection diagram for the controller and the wiring between the pump and power switch according to the manufacturer's notes.

6.10. Connection of the unit to the LAN

See in the picture below how to connect a single unit to the network LAN of the customer.

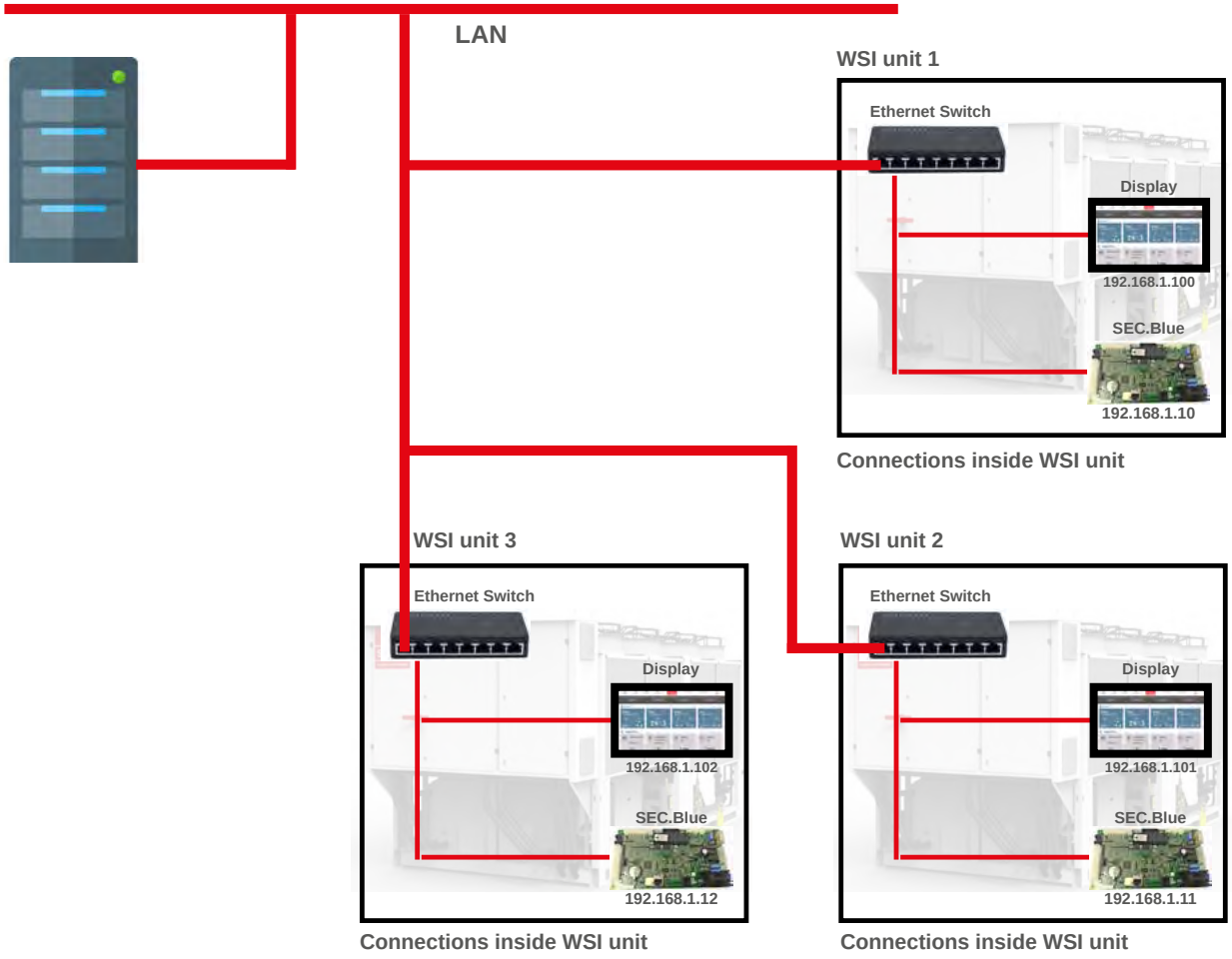


Connections inside WSI unit

INFORMATION

In case of one unit connected to the customer LAN, the WSI unit is already configured; the default values are shown in the picture above.

See in the picture below the connection of more than one unit to the network LAN of the customer.



INFORMATION

In case of more than one unit connected to the LAN, the first unit is already configured but the other units must be setting.
For each unit is necessary to change the IP address of the display and the IP address of SEC. Blue board.
For more informations about the changing of the IP Address, please refer to User manual of the controller of WSI units.

7. Commissioning

⚠ WARNING

- The unit must be installed and connected in accordance with the chapter “6 Installation” at page 60, before initial commissioning.
- Only authorized personnel must commission the unit

7.1 Preparation

⚠ WARNING

- Power supply of the customer must be switched off
- Check that the unit main-switch is in OFF position

Inspect for visible damages which can affect proper operation of the chiller, and in particular:
- check for transport/handling/installation damages
- check that all components are installed in a proper way and are correctly fixed
- check if the insulations are correctly installed and without damages
- corrosions
- verify that all documents are available (manual part I°, part II° and electronic controller manual)

Check the refrigerant circuit: connect your own gauges and check the tightness of the refrigerant circuits according to the outside temperature of the refrigerant pressure. In case of leakage please contact the manufacture

Check compressor oil level see “8.3.10 Compressor” at page 86

Check correct power connection cabling. Be sure that all the connections are correctly installed and fixed (see “6.6 Electrical connection” at page 72). Verify the earth connections (see “6.8 Position of the electrical connections” at page 74).

⚠ WARNING

If the compressor soundproofing compartment is present, check that the 230V ac connection on the emergency line is present (see wiring diagram in Part II of the manual). Before connecting main and emergency supply lines, ensure that there are no refrigerant leaks inside compressor compartment.

Check water system. Verify the flow direction is according the IN/OUT connections on the refrigerator (see “5.6 Dimensional drawings” at page 54).
- check the hydraulic connection
- check if the water system is filled up with water/glycol and the glycol concentration according to the “6.4 External water circuit” at page 67
- ensure that all valves are open
- check if there is a water filter in the inlet of the unit, its size and cleanness.

7.2 First Startup

- Open the electrical compartment door of the unit using the key provided.
- Check whether all power switches and control-circuit fuses in the electrical section of the unit are switched OFF.
- Re-tighten all screw connections in the electric cabinet.
- Verify the smooth function of the contactors.

⚠ WARNING

All power switches are already set or adjusted by the manufacturer. Do not turn the adjustment screw.

- Switch on the control-circuit fuses. The compressor power switches may not be switched on.
- Switch on the chiller unit at the master switch

The crankcase heater and the controller are now supplied with power, so you can use it for adjustments.

⚠ WARNING

If there is a soundproofed compressor compartment, ensure that the fans are working properly. In case of a compartment ventilation system alarm, ensure there is no refrigerant leakage into the compressor compartment before restoring power.

7.2.1 Oil pre-heating

To pre-heat the oil, the chiller must be supplied with voltage, the circuit breakers of the compressors must be switched off for safety reasons. In normal operation of the chiller, the oil heater is always in operation when the compressor is switched off. The control (Start/Stop key on the controller) should also remain switched off during the oil pre-heating.

According to the specification of the compressor manufacturer the oil must have a minimum temperature of 20°C and be at least 20 K above the ambient temperature. Above an ambient temperature of 10°C the oil pre-heating should be launched 8 hours before the first start of the compressor. Below an ambient temperature of 10°C, the chiller requires an oil pre-heating time of 24 hours.

Below an air ambient temperature of -5 ° C, the side of the compressor where the oil separator is located, should be insulated. The insulation can be removed 10 minutes after the compressor start.

7.2.2 Commissioning of the chilled water circuit

⚠ WARNING

Ensure that the water system has been sufficiently filled and that all stop valves are open.

With external pump:

- check the sense of rotation and start the pump
- check that the water flow guaranteed by the pump respect the nominal flow rate indicated in the data sheet of the chiller

- check that the inlet-outlet temperature difference (ΔT) is between 4 and 8K, at conditions W7L35 (with all the compressors running at the maximum power)
- check the correct functionality of the differential pressure switch or the flow switch turning off the pump and check if the chiller is turned off
- keep the pump running for 8 hours and clean the implemented filter (recommended part of the external circuit) after this lapse of time

With internal pump:

- check at the pressure gauge that the pressure delivered by the pump is aligned to the data sheet of the chiller and the pump is working within its performance curve limits
- check the correct functionality of the differential pressure switch or the flow switch turning off the pump (use the contactor in the electrical cabinet) and checking if the chiller is turned off
- keep the pump running for 8 hours and clean the implemented filter (recommended part of the external circuit) after this lapse of time

7.2.3 Commissioning of the refrigerant circuit

- Switch on the circuit breakers of the compressors.
- Adjust the desired set point of the water temperature in the controller
- Start the chiller unit by pressing the Start/Stop-key on the controller.
- Check after 20 minutes operation, whether gas bubbles are visible in the sight glass of the liquid line. If this is the case, refrigerant might have escaped by a leak.
  Check the circuit on leakages, eliminate them and fill the circuit with R1234ze in accordance to the chapter “8. Maintenance”.
- Check the current consumption of the compressors comparing it with the values in the technical data.
- Check the oil level at compressors respects the right level. The oil sight glass is installed at the compressor. The oil level should be between the lower quarter and the upper quarter of the sight glass.
- Connect gauges at the high pressure and low pressure side and verify by reading the pressures, that the saturation temperatures for evaporation (low pressure side) and condensation (high pressure side), which correspond to the measured pressures, are within the following tolerances during the operation.
  High pressure side: max. 18 K above the air intake temperature of the condenser
  Low pressure side: 3 to 7 K below the chilled water flow temperature
  The pressure gauges feature a scale on the innermost ring indicating the saturation temperatures belonging to the pressures.

Example:
Measured on the high pressure side: 9.6 bar (rel.) (= 10.6 bar abs.) corresponding saturation temperature at the dew point according to scale for R1234ze: 52,5°C measured air intake temperature at the condenser: 35°C

$$t_{cond} - t_{air} = 52.5°C - 35°C = 17.5\ K \Rightarrow \text{ok}$$

measured on the low pressure side: 1.6 bar (rel.) (= 2.6 bar abs.) corresponding saturation temperature at the dew point according to scale for R1234ze: 5.0°C measured flow water temperature at the evaporator outlet: 12°C

$$t_{flow} - t_{evap} = 12°C - 5{,}0°C = 7\ K \Rightarrow \text{ok}$$

If the tolerances (18 K at the condenser, 7 K at the evaporator) are exceeded, there is a problem of heat transmission. The probable cause is the pollution of the heat exchange surfaces. Also the super-heating may be set too high.

Compressor operation

According to the compressors manufacturer specifications the following present parameters must be kept:

Value description	Time
Minimum runtime of compressor:	300s
Maximum start / hour	12 start/h

Area	Cause	Danger	Safety note
Compressors compartment	Refrigerant pipe leaks and compartment flushing fans not in operation	Formation of a potentially explosive atmosphere. Danger of explosion in the presence of a spark.	Operation of the chiller is stopped. The components inside the compartment are de-energised. A serious alarm signal is brought to the terminal board. Qualified personnel must check that there are no leaks in the compartment and then restore power.
	Losses from refrigerant pipes in case of main power failure (400V)	Formation of a potentially explosive atmosphere. Danger of explosion in the presence of a spark.	Once the machine is installed and connected to the power supply, the operation of at least one of the two compartment cleaning fans must be ensured at all times. A separate 24 VDC supply line for powering the safety system is required.
In areas below the chiller or around the chiller if the chiller stands below the surrounding ground level.	Leaks in the refrigerant piping. → No release of an alarm	Formation of gas accumulation. Risk of suffocation for human beings.	No installation next to vents, doorways, floor flaps. Installation below ground level only with external gas detection.
		Low probability of formation of a potentially explosive atmosphere. Danger of explosion in the presence of a spark.	Installation below ground level only with external gas detection. Instruction of the operating personnel with regard to smoking ban and ban of open flames.

8. Maintenance

8.1 Safety instructions

All maintenance work is to be carried out under strict compliance with the country-specific accident prevention regulations. In particular we refer to the accident prevention regulations for electrical installations, refrigerating machines and equipment. Non-compliance with the safety instructions can endanger people and the environment.
Maintenance work is only to be carried out on the units by authorized and qualified specialist staff.

⚠ WARNING

Work on the system must always only be carried out when it is shut down. To do this, the unit must be switched off at the controller and at the master switch. A "DO NOT SWITCH ON" warning sign must be displayed.

⚠ DANGER

Mortal danger by electric hazard
This appliance is powered by multiple sources (p.e. UPS): before carrying out maintenance work, separate the alternating current source and the battery to switch the appliance off.

⚠ DANGER

With VSD compressors, wait five minutes after the OFF position of the main switch before start doing any operation in the electrical cabinet. (Discharges of the capacitors)

⚠ DANGER

Mortal danger by electric hazard
When the master switch is switched on and the controller is stopped, the power contractors are live, even if the components are not operating.
At the fan contractor, dangerous voltage occurs. Do not open the unit within the first 5 minutes after disconnection of all phases. Due to the EC fans dangerous charges of > 50 µC can occur for a short time between AC line terminals and PE after disconnection.

Live electrical components and power factor corrections are to be switched to de-energized and checked to ensure that they are in the de-energized state.
Some verifications must be effected with the unit in operation (measuring the current, pressures, temperatures). In such a case the unit must only be switched on at the master switch after all mechanical connections have been carried out.

8.1.1 Warning notes

- When the master switch is turned ON and the controller is stopped the power contactors are live, even if the components are not operating.
- At the fan contactors, dangerous voltages occur. Do not open the unit within the first 5 minutes after disconnection of all phases. Be sure that the unit is being isolated.
- The electronics housing of the fan motor can get hot.
- The fans have an overrun time after the unit is stopped. (Risk of injury)

8.2 Maintenance intervals

Description	Six month	One year	Five year
Refrigerant circuit			
Check the sigh glass	●		
Oil level in of the compressors	●		
Operation of the heaters on the compressor crankcases	●		
Check for leak (Interval suggested, not mandatory. According to F-Gas Directive 573/2024)	●		
Tightness of the refrigerant circuit	●		
Check the high pressure safety switch		●	
Check the high pressure and low pressure switch		●	
Check the safety valve		●	●
Substitute the pressure relief valve (Directive 2014/68/EC)			●
Check that there are no obstructions and obstacles to the air flow on both the intake and exhaust air grilles of the compressor compartment (if present)	●		
Discharge valves collectors	●		
Air circuit			
Clean the W-modules	●		
Check the mounting, operation and balancing of fans	●		
Water circuit			
Clean the water filter	●		
Check the level of the fluid to be cooled	●		
Check the presence of air	●		
Check and repair any leaks	●		
Check and repair the fault insulation of pipes	●		
Check the connections	●		
Check the efficiency of the differential pressure switch	●		
Check the efficiency of the flow switch	●		
Check the cleanliness of the evaporator water side	●		
Electric circuit			
Check for abnormal consumption	●		
Check the tightness of all terminals	●		
Check the cleanliness and integrity of the contactors	●		
Check the connections of the pressure switches	●		
Unit in general			
Check the absence of abnormal vibration	●		
Check the absence of abnormal noise	●		

⚠ DANGER

Very little routine maintenance is necessary to keep the unit in reliable operating order and protect its moving parts. This maintenance, however, must be performed at the prescribed maintenance intervals. Failure to perform due maintenance both decreases the intended life and efficiency of the unit and also invalidates guarantee coverage. If the unit works in particularly dirty environment, like an ambient with conductive dust, it's necessary to increase maintenance frequency. Product intended life time is variable and dependent on the application (eg. On/Off cycling due to load variability, annual working hours, cleaning of exchange fluids, operating temperatures, etc.).

8.3 Refrigerant Circuit

8.3.1 Refrigerant charge

To be checked: sight glass, LP switch
An insufficient charge causes the formation of bubbles in the sight glass (at full load) or in extreme cases the triggering of the LP switch. An operation with an insufficient refrigerant quantity over a longer period leads to a reduction of cooling capacity and to high super-heating temperatures, which have a disadvantageous effect on the compressor lifetime. If a leak is detected:

- evacuate all the refrigerant gas and dispose it according to the national regulation
- repair the leak
- do a pressure test by nitrogen
- extract the nitrogen by the vacuum pump (not by the compressor!) to approximately 10 Pa.
- ()fill with refrigerant gas according to name plate of the chiller for type and weight

INFORMATION

The refrigerant must be charged in a liquid state.

DANGER

Danger of explosion!
During the filling with R1234ze, passing through the explosion limits is possible.
Smoking, open flames and sources of ignition are forbidden.

8.3.2 Quantity

To be checked: charge of refrigerant
An overfilling of the circuit makes the condensation pressure rise and by that the power consumption of the compressor increases. In the extreme case the HP-switch triggers.

8.3.3 Tightness of refrigerant circuit

To be checked: pipes, connections, valves
After repairing a leak, the refrigeration circuit must be checked on tightness within one month. The following information must be recorded by the operator in writing:

- quantity and type of the used refrigerant
- refilled refrigerant quantity
- recycled refrigerant quantity
- companies or persons which have carried out maintenance
- dates and results of inspections

8.3.4 Purity

To be checked: sight glass, filter drier
Bubbles in the sight glass indicate that the charge is unsufficient or that the filter drier is clogged. A pollution of the filter drier, whose origin task is to clear the refrigerant from impurities and humidity, can be detected by a temperature difference upstream and downstream the filter drier. Compare the colour indicator in the centre of the sight glass with the outer ring scale.

- Green or purple to blue ⇨ ok
- Yellow or rose to red ⇨ humidity critical

With too much humidity in the circuit, the expansion valve can freeze. In addition to this the compressor oil, which comes in touch with the refrigerant, takes up humidity and loses its ability to lubricate.
Take an oil sample, determine the humidity content and exchange the oil in case of excessive humidity content. In this case the refrigerant must be completely evacuated and recharged by new refrigerant according to the above described evacuation instruction.

8.3.5 Exchange of filter drier

To be checked: filter drier, shut-off valve RU1-RG2
To exchange the filter drier it is sufficient to evacuate the pipe section in which the filter drier is installed.
Close the shut-off valve (RU1 or RU2, see “4.4 Piping diagrams” at page 26). The expansion valve is closed when the compressors are switched off. By the service valve on the lid of the filter drier, you can evacuate the refrigerant from the section now.

Remove eight M8 screws at the front side of the filter and pull out the cartridge. Introduce a new cartridge and refill the evacuated refrigerant. Open the shut off valves RU1 and RU2.

8.3.6 HP switch

To be checked: high pressure switch
When the **High Pressure** limiter triggers, the compressor is switched off without delay. Before the restart and after the elimination of the error, the HP switch must be reset by pressing the reset button.

HP switch with reset button

A check of the tripping function of the high pressure limiter (e.g. by cutting down the condenser fan and forcing a high pressure) is not possible without changing the action value, as there are, on behalf of the SEC.blue electronic controller, further monitoring functions via the high pressure sensor, which intervenes in the compressor control (high pressure management, compressor envelope control). A change of the action value (e.g. by reduction), however, bears the risk that this one is not exactly readjusted after the check has been executed. The scale on the case does not provide sufficient accuracy.

8.3.7 LP switch

To be checked: low pressure switch, shut-off valves RU1-RU2
Check the correct function of the low pressure switch by stepwise closing the shut-off valve RU1-RU2 on the refrigerant circuit, while the compressors are running. Check by means of the low pressure gauge in the compressor section, whether the low pressure switch trips at 0,2 bar. When the LP switch trips, the compressor is switched off without delay.

8.3.8 Safety valve

The evaluations of the safety valves must be done in accordance with the national regulations. Where there are no criteria in national regulations, please refers to the following information inside

EN 378-4:

- The safety valves are checked in accordance with EN 378-2: 2016 paragraphs 6.3.4.3.1, 6.3.4.3.4 e 6.3.4.3.5 and submitted tightness test every year.
- The safety valves are recalibrated or substituted every five years.

8.3.9 Expansion valve

The refrigerant circuit is equipped with a electronic expansion valve, which controls the super-heating in the evaporator. The super-heating is adjusted to 7 K at the factory and may not be modified. Check the super-heating set-point.
Check the super-heating by the SEC.blue electronic controller. If the super-heating is for a longer time below 3 K or above 10 K, the function of the expansion valve is faulty.
Compare the suction gas temperature measured by the valve sensor, with the value of a reference sensor at the suction line. If the super-heating still diverges significantly from the set-point and you can find no deviation at the verifications, probably the control module of the valve is defective and must be replaced.
The expansion valve can freeze, if the humidity in the refrigerant circuit is excessive. Check the sight glass.

⚠ WARNING

Do not thaw by soldering flame, danger of explosion! Thaw with moist warm cloth. Check the sight glass.

8.3.10 Compressor

To be checked: compressor, crankcase heater
In the screw compressor, there are three main components which require inspection and maintenance. The integrated oil filter is maintenance-free.

Pressure relief valve

The pressure relief valve has a response pressure difference of 28 bar and is maintenance-free. Repeated opening of the valve due to abnormal operating conditions, however, may result in steady leakage. This can be detected by a reduced output and a high discharge gas temperature. If is this the case, replace the valve.

Check valve

To protect the compressor against reverse rotation during standstill a check valve is installed under the discharge shut-off valve resp. below the pipe connection. If the compressor runs in reverse direction for more than approximately 5 sec. after the cut-off, the valve may be defective and must be replaced. A reverse rotation of the compressor can be detected by an abnormal sound.

Roller bearing

The screw compressors are equipped with fatigue endurable roller bearings. The bearings can be checked by means of a sound analysis. If the bearings must replaced, also the rotors, the housing and the discharge flange should be checked visually. In case of severe scores or abnormal abrasion, a major overhaul of the compressor or its replacement is advisable.

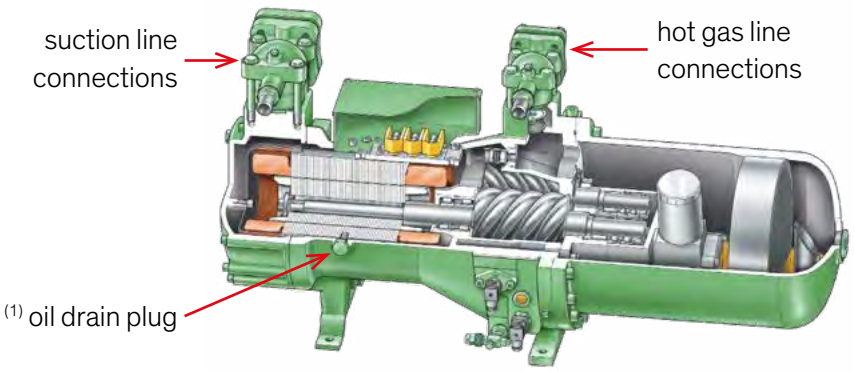
Component	Inspection interval	Replacement interval
Pressure relief valve	only if damage is suspected	100.000 h
Check valve	5.000 h *	20.000 ... 40.000 h
Roller bearing	10.000 h	50.000 h

* at least yearly checked

Oil level

Check the oil level at the oil sight glass. During unit idleness the oil level should not be below the lower quarter (bottom line) and not rise above the upper line during operation.

Oil heater



Check the oil heater function by switching off the fuse for the oil heater in the electric cabinet and by measuring the ohmic resistance at the terminals in the electric cabinet. For the 300W heater the ohmic resistance should approximately be 180 Ohm and 260 Ohm for the 200W heater.

Oil filling

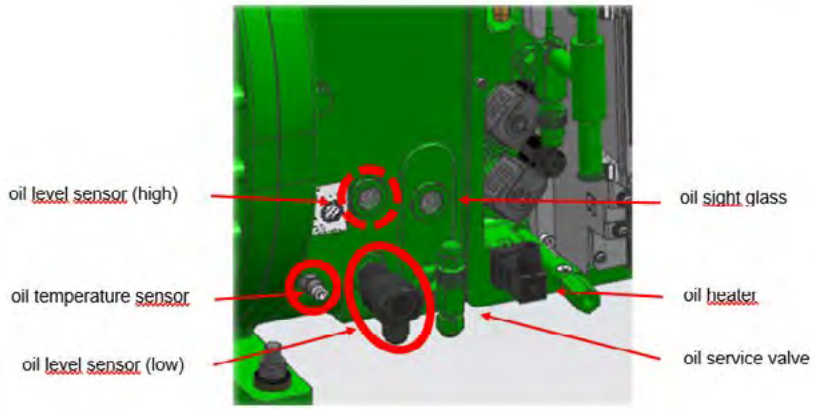
Contact technical support for the requirements of the oil used;

- never mix different oil types!
- clean the piping completely before changing the oil type.

Topping up of up to 20-30% of the total quantity of oil contained in the compressor is allowed. For larger quantities, contact technical support.

If there have been losses of oil, these must be replaced by topping up oil.

1. Take a clean, dry, transparent container (with volume calibration) and fill it with at least twice the amount of the required oil.
2. Shut off the compressor on the discharge side and on the suction side.
3. Evacuate the refrigerant from the compressor and collect it, until atmospheric pressure is reached. Only if a completely oil change is required, drain the oil in the compressor through the oil drain plug (1) into a collecting device and dispose it according to the regulations in force.
4. Connect the clean oil container by a pipe to the oil service valve (2) in the lower middle section of the compressor.
5. Open the oil service valve and lift the oil container so that the oil flows into the compressor by gravity.
6. Fill in the required quantity of oil. Ensure that the supply line is always below the oil level. (to avoid the introduction of air bubbles in the pipe)
   The oil level should be in the lower quarter of the oil sight glass (3).
7. Close the oil service valve, open the shut-off valves of the compressor and recharge the collected refrigerant into the refrigerant circuit.



8.4 Air circuit

8.4.1 Condenser

To be checked: condenser coils
The air-cooled condenser consists of a microchannel coil with aluminium fins. Through the microchannel coil flows outside air which is eventually polluted. Particles of polluted air may settle at the fins and reduce the heat transmission the same as raise the air resistance. This could probably identified by a increase of the fan current.
The heat exchanger can be cleaned by pressurized air or steam blasting (maximum 2 bar) which has to be blown to the normal air flow direction along the fins.

⚠ WARNING

- Do not bend the fins during such an operation, in order not to limit the exchange efficiency and increase the pressure drop on the air side.
- Do not use chemicals, these could cause corrosion at the coils.

8.4.2 Condenser Fan

To be checked: fans
The bearings of the fans are lifetime lubricated and do not need maintenance. Check the operation current. An increased operation current indicates either a higher air resistance by a clogged condenser coil or a winding short circuit in the fan motor.

8.4.3 Filter

To be checked: air filters
The filters (optional) are made of metal, therefore they can be washed with water, once removed from their seats.

8.5 Evaporator circuit

- Be sure that the cooling medium respect the limits and specifications required (see “5.2 Chilled water quality” at page 29).

- Check the cleanliness and wash with water if deemed necessary
- Check for any leaks and for proper tightening of fittings
- Check the presence of air in the water circuit. In case bleed the circuit following the instructions given in paragraph “6.5 Filling and bleeding air” at page 71

8.5.1 Tightness

Check the water circuit visually for tightness. Beyond that a level indication at the storage tank, if existent, can give information about changes of the water quantity. A lack of water in the circuit is replaced by air, which reduces the heat capacity of the chilled water circuit and is detrimental to the pump.

8.5.2 Evaporator

To be checked: evaporator, inlet/outlet/antifreeze probes
Check the water side pollution of the tube evaporator by comparing the chilled water inlet temperature to the chilled water outlet temperature. If the difference is less than 3 K, it indicates a limited heat transmission and thus pollution.
Another possibility to verify this consists in the comparison of the chilled water outlet temperature with the saturated evaporation temperature (by measuring the suction pressure at the low pressure side of the compressor). If this difference exceeds 7 K, the evaporator is probably polluted.
In this case the evaporator has to be cleaned chemically by authorized staff.
In case of exchanging the antifreeze heater in the evaporator the water glycol mixture must be evacuated and collected.

8.5.3 Differential pressure switch

To be checked: differential pressure switch
Check the correct function of the differential pressure switch by stepwise closing a shut-off valve on the inlet of the cooling water circuit, while the compressors are not running.

8.5.4 Flow switch

To be checked: flow switch
Check the intervention by simulating a lack of flow in the hydraulic circuit.

8.6 Electric circuit

To be checked: power board, electric components, motor
- Check for any faults in the current consumption of the engines.

8.6.1 Powerboard

The powerboard is provided with a forced cooling system consisting of two ventilated grids with filter. Check for proper operation of the fans and the efficiency of the filters. If necessary, proceed replacing the faulty parts.

8.6.2 Fan

If the chiller is not operated for a long period and it's installed in a dry environment, the fan must be started up and operated at maximum speed for one hour at least every 4 months. If the chiller is not operated for a long period and it's installed in a damp environment, the fan must be started up and run at maximum speed for 3 hours once a month to move the bearings and allow any condensate that may have formed to evaporate.

8.6.3 Pump

⚠ DANGER

If it's required to change the pump, it's necessary to section off the entire chiller upstream and downstream to avoid dangerous unintentional openings.
The valves inside the chiller are used to section off the circuit and prevent excessive draining of the system.
Operations must be carried out by qualified personnel.

There are 3 possible scenarios:

1. Chiller with butterfly valves upstream and downstream of the pump:
   - Disconnect all supplies.
   - Disconnect the pump electrically.
   - Close the valves upstream and downstream of the pump.

   ⚠ WARNING

   DO NOT OPEN THE JOINTS DIRECTLY, but purge the water from the sectioned area using the spigots with a tap on the pipe.
   If water continues to flow out, the valves are not sealed: it's necessary to bleed water from the entire system.

   - Disconnect the pump hydraulically.
   - Plug the pipework with blind flanges or Victaulic plugs with bleed/vent.
   - Proceed to change.
   - Before removing plugs from pipes, purge any drawn water.

   ⚠ WARNING

   If water continues to escape, the valves do not seal: it's necessary further sectioning outside the chiller.

   - Then perform the steps in reverse way.

2. Free cooling chiller with selector inside the electrical box 'FC valves forced override' + with upstream butterfly valve and no butterfly valve downstream of the pump
   - Disconnect all supplies.
   - Open the electrical box and move the 'FC valves forced override' switch to the ON position.
   - Close the electrical box and restore power.
   - Wait 5 minutes to allow the valves to section the circuit.
   - Disconnect all supplies.
   - Disconnect the pump electrically.

- Close the valve upstream of the chiller.

⚠ WARNING

Do not open the joints directly,but purge the water from the sectioned area using the spigots with a tap on the pipe.
If water continues to flow out the free cooling sectioning procedure has not been carried out correctly: repeat the procedure.
If water continues to flow out, the valves do not seal: it is necessary to purge the water from the entire system.

- Disconnect the pump hydraulically.
- Plug the pipework with blind flanges or Victaulic plugs with bleed/vent.
- Proceed to change.
- Before removing the plugs from the piping, bleed off any drawn water.

⚠ WARNING

If water continues to escape, the valves do not seal: it's necessary to purge the water from the entire system

- Then perform the steps in reverse way.

3. Freecooling chiller without selector inside the electrical box "FC valves forced override" + with butterfly valve upstream and no butterfly valve downstream of the pump.
   - Set the CHILLER to OFF mode.
   - Check which of the two freecooling valves is not closed: reverse rotation either by changing from Y1→Y2/Y2→Y1 or using the Belimo app.
   - Check that the valve closes.
   - Wait 5 minutes.
   - Disconnect all supplies.
   - Disconnect the pump electrically.
   - Close the valve upstream of the chiller.

⚠ WARNING

Do not open the joints directly,but purge the water from the sectioned area using the spigots with a tap on the pipe.
If water continues to flow out, the free cooling sectioning procedure has not been carried out correctly: repeat the procedure.
If water continues to flow out, the valves do not seal: it is necessary to purge the water from the entire system.

   - Disconnect the pump hydraulically.
   - Plug the pipework with blind flanges or Victaulic plugs with bleed/vent.
   - Proceed to change.
   - Before removing the plugs from the piping, bleed off any drawn water.

⚠ WARNING

If water continues to escape, the valves do not seal: it's necessary to purge the water from the entire system

   - Then perform the steps in reverse way.

8.7 Unit in general

To be checked: whole the chiller

- Clean the unit's inside with a vacuum cleaner. Clean pipes simplify the search for leaks.
- Check the pipes, the compressor and the condenser for a tight seat. Vibrations of pipes and circuit components can result in leaks.
- Check also the insulation of the water piping. Condensing air humidity on cold water pipes means a loss of cooling capacity.
- Check for loose parts that cause an increase in noise and vibration.

9. Malfunction

Problem	Possible cause	Recommended action
Generals		
The chiller does not start up and the electronic control is off	No power supply	Restore power supply
	Main switch open	Move the main switch to position I
	No power supply to the electronic control	Check the voltage of the power cables to the control. Restore or repair the wiring
	Electric control faulty	Contact the Stulz service centre
The control works but the display is off	Cable between control and display disconnected	Reconnect the cable
	Cable between control and display broken	Replace the cable
	Faulty display	Contact the Stulz service centre
The control works but the chiller does not start up	Missing external enabling signal (stand-by state displayed)	Restore the signal wiring. Provide the external enabling signal
	Failures prevent the unit from working	Check any alarms on the display (see below). Contact the Stulz service centre
	Electric control faulty	Contact the Stulz service centre
Display alarms		
CP *X* thermic	*X* compressor fault	Replace the compressor
	Failure of the power supply circuit of the *X* compressor (cables, remote control switch, ...)	Replace the faulty component
	Failure to the thermal breaker of the *X* compressor	Replace the protection device
Fan *X* thermic	Faulty *X* fan	Replace the fan
	Failure of the power supply circuit of the *X* fan (cables, remote control switch, ...)	Replace the faulty component
	Failure to the thermal breaker of the *X* fan	Replace the protection device
Pump *X* thermic	*X* pump failure	Replace the pump
	Failure of the power supply circuit of the *X* pump (cables, remote control switch, ...)	Replace the faulty component
	Failure to the thermal breaker of the *X* pump	Replace the protection device
TCE *X* winding	Failure of the motor winding of the *X* electronic expansion valve	Replace the expansion valve
TCE *X* serial communication	Problems in the communication between electronic control and *X* expansion valve	Contact the Stulz service centre

Problem	Possible cause	Recommended action
High press. group *X*	Power supply failure/ failure of a condensing fan of *X* circuit	Repair the power supply to the fan/replace the fan
	Faulty speed control of condensing fans of *X* circuit	Lack of signal from the electronic control: restore wiring or replace the electronic control or replace the phase cut control module.
		Faulty signal from the electronic control: contact the Stulz service centre
		Failure of the phase cut control module: replace
	Dirty condenser/air filter (optional) of the *X* circuit	Clean the condenser/air filter (optional)
	Air recirculation on the condenser of *X* circuit	Remove obstacles close to the condenser. Comply with the clearances indicated in paragraph 6.2.1
	Faulty high pressure switch of *X* circuit	Contact the Stulz service centre
	Clogged filter-drier of the *X* circuit	Through the fluid level sight glass of the circuit X check for moisture or bubbles in the refrigerant. Contact the Stulz service centre
	Excessive refrigerant gas charge resulting from a circuit *X* top up after a repair	Contact the Stulz service centre
	Outside air temperature beyond the limits permitted	Contact the Stulz service centre
Low press. group *X*	Leaks of refrigerant in the circuit *X*	Contact the Stulz service centre
	Faulty low pressure switch of *X* circuit	Contact the Stulz service centre
	Clogged filter-drier of the *X* circuit	Through the fluid level sight glass of the circuit *X* check for moisture or bubbles in the refrigerant. Contact the Stulz service centre
	Partially closed tap on the fluid line of *X* circuit	Completely open the tap
	Failure to the expansion valve of the *X* circuit	Contact the Stulz service centre
	Frozen expansion valve of the *X* circuit	Check moisture through the fluid level sight glass of the *X* circuit Contact the Stulz service centre
	Low flow of fluid to be cooled	Check the fluid level in the storage tank and, if necessary, top up
		Check for hydraulic circuit problems (failure of pumps, closed taps...). Repair if necessary
High disch. temp. *X*	Too high temperature of the compressor refrigerant flow	See the alarm “High press. group *X*”
	Wrong calibration of the discharge temperature probe of the *X* circuit	Check with a reference thermometer. Contact the Stulz service centre for re-calibration
High/max temperature	Insufficient cooling capacity compared to the thermal load	Reduce the thermal load or increase the number of chillers
	Dirty filter of the fluid to be cooled	Clean the filter
	Dirty evaporator	Contact the Stulz service centre
	Poor calibration of the temperature probe on the water flow	Check with a reference thermometer. Contact the Stulz service centre for re-calibration
	Poor refrigerant charge on one or both circuits	Contact the Stulz service centre
	Failure of one or more compressors	Check to see if other alarms appear on the display. Contact the Stulz service centre
	Low amount of fluid to be cooled	Check the fluid level in the storage tank and, if necessary, top up
Low/min temperature	Low flow of fluid to be cooled	Check for hydraulic circuit problems (failure of pumps, closed taps...). Repair if necessary
	Poor calibration of the temperature probe on the water flow	Check with a reference thermometer. Contact the Stulz service centre for re-calibration
	Malfunction of the antifreeze heaters (optional)	Check and repair or replace
	Inadequate fluid to be cooled to the minimum outdoor temperature	Contact the Stulz service centre to defrost the evaporator. Add glycol in the fluid to be cooled in a proportion suitable for the outdoor temperature.
Evap. fluid flow	Low flow of fluid to be cooled	Check for hydraulic circuit problems (failure of pumps, closed taps...). Repair if necessary
	Air in the hydraulic circuit	Repair leaks, fill and vent the system
	Failure of the differential pressure switch or of the flow gauge (optional)	Check and if needed repair the wiring or replace the component
X probe	*X* temperature probe/wrong pressure calibration	Contact the Stulz service centre for re-calibration
	X temperature probe/ disconnected or faulty pressure	Reconnect or replace the probe
S13 comm. error	Abnormal communication between the electronic control and the expansion board of I/O controls	Contact the Stulz service centre
S13 software version	The software version with which the expansion board of I/O controls is programmed do not comply with that of the control	Contact the Stulz service centre

Problem	Possible cause	Recommended action
Upd setup S13 failed	Error in writing a parameter on the expansion board of I/O controls by the electronic control	Contact the Stulz service centre
Wrong phase	Lack of or too low voltage of one or more phases	Check and take appropriate measures to restore the power supply to the limits permitted
	Wrong phase sequence	Invert two phases in the connection of the main power supply to the chiller
Presence of the compressor compartment		
The compressor doesn't start	Both fans don't work	Check by qualified personnel for leaks in the compartment. Check the status of the fans and the chain of safety circuit devices.
	230V ac emergency power supply line failure	Check that the 230V ac connection on the emergency line is present (see electrical drawing on manual part II).
Alarms compressor compartment		
Warning	One fan doesn't work	Check main switch position on. Check fan status and associated safety circuit.
Serious alarm	Both fans don't work Possible gas leakage 230V ac emergency power supply line failure	Check by qualified personnel for leaks in the compartment. Check the status of the fans and the chain of safety circuit devices.

⚠ DANGER

In the event of a compartment ventilation system alarm, make sure there are no refrigerant leaks inside compressor compartment, before restoring main and secondary supplies.

Alarms compressor compartment

For a correct restart of the unit and reset of the alarm shown in the photo, disconnect the unit from the main switch and organize a leakage check inside the compressor compartment, made by specialised personnel.
Then:

- Check the state of cleanliness of the fan intake and compartment air outlet grilles.
- Check the state of the electrical connections of the fans.
- Once the absence of leaks and the correct status of the fans have been detected, the unit can be restarted.

10. Dismantling and disposal

The decommissioning of the chillers must be carried out by experienced and qualified personnel for the operations required.

⚠ DANGER

EXPLOSION HAZARD: in carrying out any operation specified in this chapter avoid any open flames near the refrigerant pipes when the cooling system is under pressure.
Do not bring open flames near damaged or perforated pipes as the refrigerant gas vapours, mixed with the oil of the compressor, may ignite producing toxic gases.

1. Turn the chiller to the SYSTEM OFF mode by touching the ON-OFF button on the touch screen.
2. Turn the main switch to 0.
3. Disconnect the power supply from the power cables and prevent any voltage reset.
4. Open the protective panels of the powerboard and disconnect the power cables.
5. Drain the cooling circuit recovering both the refrigerant and the lubricating oil.

⚠ WARNING

Do not dispose of the cooling gas into the atmosphere. The cooling gas must be recovered by a qualified refrigerator technician and, if not reused, sent to an authorized disposal centre.
Even the PVE oil of the compressor must be recovered and sent to an authorized disposal centre. Since the oil forms a mixture with the refrigerant it can not be disposed of as common lubricating oil.

6. Unplug the unit from the water circuit after closing the shut-off valves and drain the water from the hydraulic circuit of the chiller.

⚠ WARNING

If you use water additives (glycol), even water must be recovered and disposed of safely, avoiding to disperse it into the environment or into the sewage system.

7. handle the unit as described in paragraph “3.3 Transport” at page 16
8. Dispose of the unit according to local regulations on disposal and safety regulations in force at the installation site. It is advisable to contact a specialized recycling company. Basically, the unit contains the following raw materials: aluminium (exchangers and condensers); copper (exchangers, refrigerant pipes and electric cables), galvanized steel and iron (evaporator and condensers, panels and metal frames); rubber (water pipes).

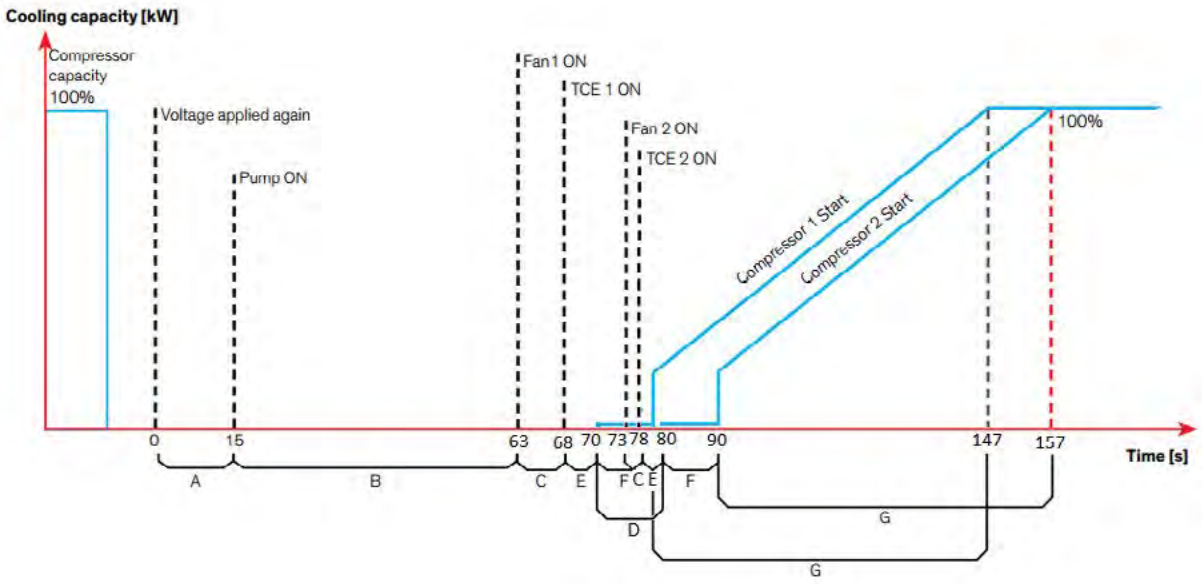
11. Options

Here are reported the specific information regarding **Installation**, **Commissioning** and **Maintenance** for the options available on the chiller.

11.1 Start with UPS

The start with UPS option allows the entire cooling capacity of the chiller to be restored by resetting the power supply in the event of a power failure and protect the compressors from close starts. This is available when the options 'Separate power supply per controller' or 'UPS per controller' are selected.
Find below a graph with the reboot sequence.

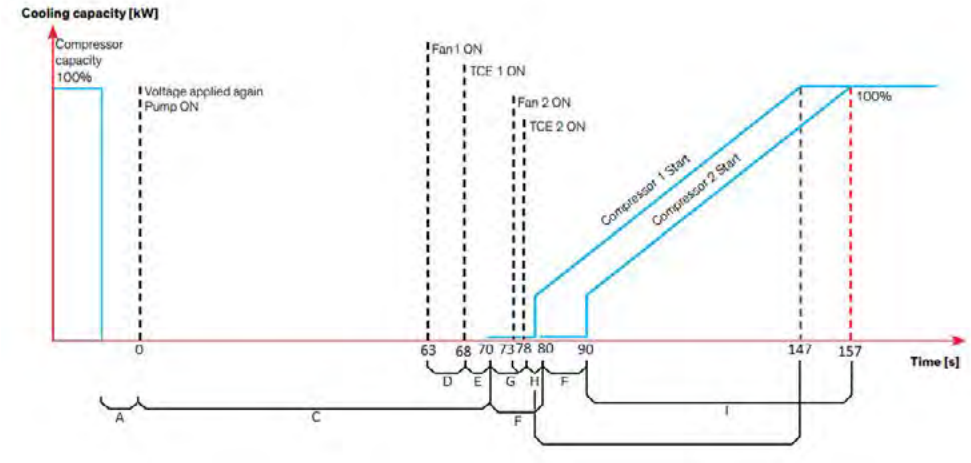
Standard reboot sequence (without start with UPS option)



A	Board starting time
B	OFF time of the compressors, which is also respected at first start up
C	Pre-ventilation time, for both circuit 1 and circuit 2
D	Delay time between two compressors start
E	Pre-opening time of the EEV valve
F	Starting compressor time at min %
G	Starting compressor time, to go from min % to 100%

In this case the end user is responsible for controlling the minimum time between 2 consecutive compressor starts (300s).
Since the minimum OFF time of the compressors and the max number of starting per hour could not be monitored, this scenario can be apllied when a black out could happen rarely and when a back up generator it is not present.

Reboot sequence (with UPS start option)



A	Power Outage interval, example more than 2 min (wrost case)	F	Delay of compressors starting
C	Time delay for capacitor recharge (**)	G	Fan circuit 2 pre run time
D	Fan circuit 1 pre run time	H	TCE 2 pre opening time
E	TCE 1 pre opening time	I	Loading time from min% to 100% (*)

(*) It depends on different type of compressor
(**) It depends on the power outlage interval

In this case the controller can monitor the min start to start time and the max number of starting per hour in order to guarantee the reliability of the unit and avoid the compressors start if the time are not passed.
This scenario is mandatory when a black out could often happen or when a back up generator is applied since there is the risk the unit is disconnected at least twice: once the main power get lost and generator is switched on, and once the main power come back (generator off).

Installation

INFORMATION

The use of the device is permitted only with type of network with neutral conductor connected to earth.

INFORMATION

At first start is necessary to connect two wires from the Battery to the Electronic Board.

Check the electrical wiring diagram and the label on the chiller to correctly activate the UPS system.

Commissioning

- Be sure that the installation operation are correctly completed
- Check that all the connections are complying the electrical diagram

Maintenance

WARNING

The orange wires in the electrical cabinet are under tension also with main switch in OFF position. Before maintenance work, separate the alternating current source and the battery to switch the appliance off.

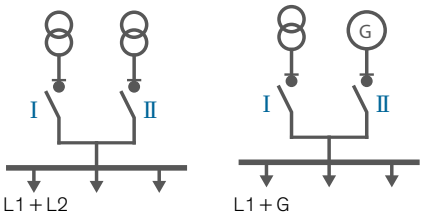
- clean all the ventilation slots
- in case of malfunctions, please contact the STULZ staff.

INFORMATION

If a operation is required on the electronic controller main-board, is necessary to open the specific switch to cut out the electricity.

11.2 Automatic Transfer Switch (Double power line)

With this option is possible to connect two different power lines to the chiller: the second line can be a generator.
All the device are installed in the electrical cabinet. The control panel is accessible from the outside of the electrical cabinet.



The components involved are:
- Control panel ATS.
- Motorized change-over switches.

Available only for units up to-20°C

DANGER

In the electrical cabinet, the orange wires and the component individuate with the symbol on side, remains under tension also in OFF position and with doors open.

DANGER

The operation in Manual mode is not allowed. In Manual mode the interblock for the doors is not activated: all the components remains live also with the doors open.

11.2.1 Turn on the unit

After the end of the operation to connect the two power line to the chiller, follow the procedure:
1. Move the selector on the ATS from position “Manual” to “Auto”.
2. Check that the “Power” and “LINE 1” leds on the Control Panel ATS device are ligthed (for units up to-20°C).

   INFORMATION

   With the doors opened, the chiller is forced in OFF position
3. Close the doors of the electrical cabinet.
4. Verify that the selector on the door is in AUT position (only for units with freecooling at -40°C).
5. Press the button AUTO to activate the control panel ATS power supply (for units up to-20°C).
6. Use the display of the electronic controller to start the cooling.

AUTO MODE:
- Activates the remote control inputs and the ATS controller automation.
- Inhibits the padlocking facility.
- Inhibits the insertion of the manual operation handle when in AUT Mode.

AUTO Mode position is inhibited when padlocked or when the handle for manual operation is inserted into the ATS.

11.2.2 Turn off the unit

To turn off the chiller follow the procedure:
1. Turn off the chiller operation by pressing off on the electronic controller.
2. Press the button O of the control panel ATS to turn off the power supply (for units up to-20°C).

INFORMATION

If a door of the left side is opened the unit will be forced in Off position. When the door will be closed the unit restart automatically.

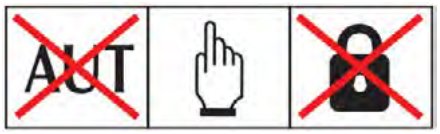
11.2.3 Maintenance mode

To be sure that none reactivate the unit during the maintenance, is necessary to put a safety block to the ATS.
Follow the procedure:
1. Shut down the unit as described in the chapter "11.2.2 Turn off the unit" at page 100 .
2. Move the selector on the ATS in position "Manual".

WARNING

The Manual mode is allowed only for the Maintenance.
In Manual mode, the interblock for the doors is not activated: all the components remains live also with the doors open.

MANUAL MODE: (Not Padlocked)
- Inhibits the control inputs.
- Allows to insert the handle for emergency manual operation.
- Allows padlocking when in O Position (With the handle for manual operation removed)



3. Insert the handle in the switch panel and check that is on position "O".

4. Ensure that the emergency manual operation handle is not inserted into the location hole (remove if inserted).
5. Pull the padlocking mechanism outwards to reveal the slot.

MANUAL MODE: (Padlocked)
- Inhibits the control inputs.
- Inhibits insertion of the emergency handle.
- Allows padlocking when in O Position.

To restart the operation mode:

1. Remove the padlock.
2. Move the selector on the ATS in position “Auto”.
3. Close the electrical cabinet.
4. Turn on the unit as described in paragraph “7. Commissioning”.

The switching sequence can be summarized in following steps:
Source 1: the source connected to source 1 sensing on the switch will become the preferred source and the transfer switch will automatically transfer to this source as long as it is available and the timers are respected.

INFORMATION

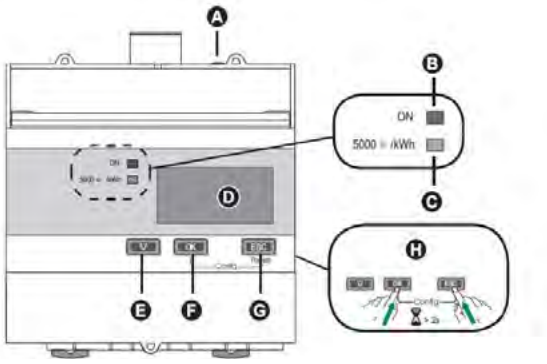
Other settings are available. Please contact STULZ S.p.A. to verify and perform the new setting.

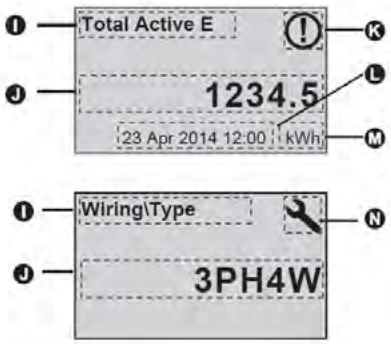
11.3 Energy meter

It's installed inside the electrical cabinet of the chiller. It's at indirect insertion via current transformers.
The LCD display is helpful for the instantaneous reading of the current and voltage values of three phases. The sliding of the data is easy using frontal buttons placed under the display and protected from unauthorized use by a frontal cover.

The integral function of register of events allows to keep track of the parameters of the energy meter and it reports directly on the touch-screen display installed of the door of the electrical cabinet. The measured parameters are:
• Supply voltage: average on three phases.
• Absorbed current: average on three phases.
• Frequency.
• Total active power.
• Power factor.
• Absorbed energy.

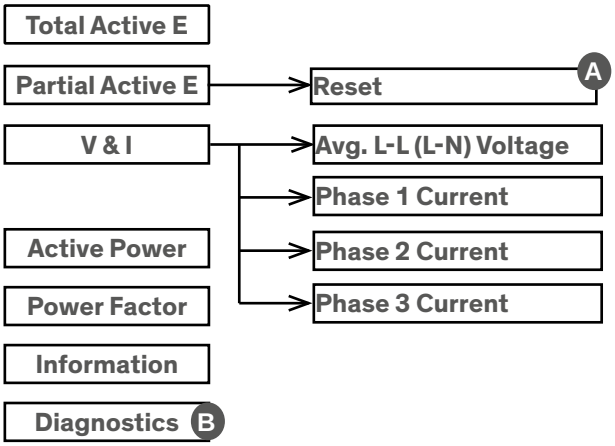
The energy meter has the following advantages:
• Possibility of external interface through Ethernet port of SEC.blue.
• Measurement accuracy: 0,5%.





A	Communications LED (iEM3250)
B	Status LED: on / off / error
C	Status LED: on / off / error
D	Display for measurement and configuration
E	Scroll through screens or a list of options
F	Confirm entry or access more screens
G	Cancel and go back to previous screen
H	Press and hold OK + ESC to enter configuration mode
I	Measurement / Parameter
J	Value / Setting
K	Icon indicating date / time are not set
L	Date and time
M	Units
N	Configuration mode icon

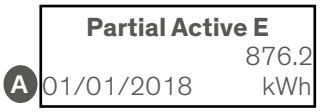
Visualization of data screens



A	Reset of all energy measurements except the total energy active
B	The diagnostic screen is visualized when there are specific events

Reset the store energy using the display

1. See the screen 'Partial Active E' or 'Partial Reactive E'. The screen shows the data of the last reset.



A	Data of last reset

2. Press and hold 'ESC'. The reset screen appears.
3. Press 'OK' to confirm the reset.

Operation LEDs

OFF	ON, not counting	ON, counting	Internal error, counting is stopped1	Abnormal, counting continues1 (flashing)	Troubleshooting

Communication LEDs

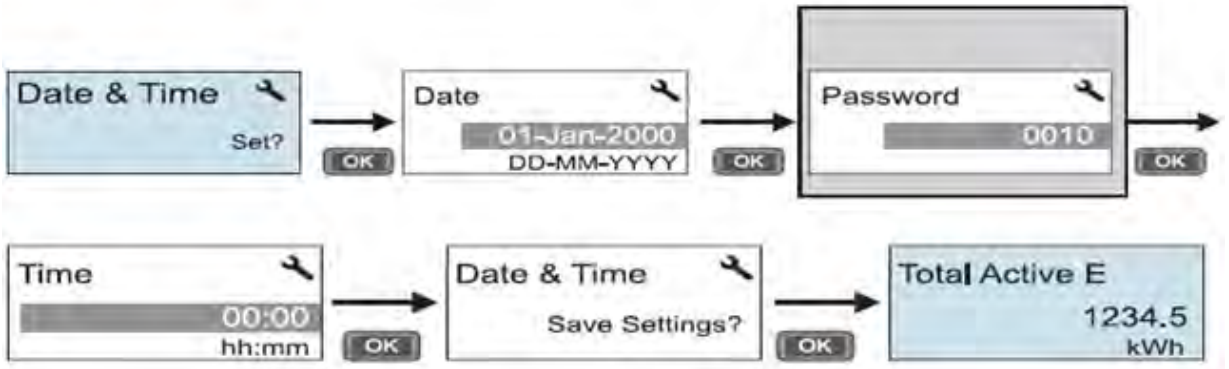
OFF: inactive

Flashing: active

First setting of the clock

See below how to set the clock at the first commissioning or after a power supply shut off.

To set the clock during normal operation, see the section of device configuration.

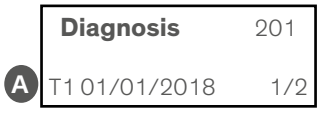


It's not requested to set data and time when the counter is ON. It's possible to log into configuration mode to set data and time.

This icon appears when the clock has not been set

Diagnostic screen

The diagnostic screen lists all the present diagnostic codes.
Note that this screen appears only if there is a specific event.



A	Diagnostic code
B	Present events

1. Press the down arrow to scroll the screens of main data visualization up to the diagnostic screen.
2. Press the down arrow to scroll every present event.

Diagnostic codes

Diagnostic code[1]	Description	Possible solution
-	LCD display is not visible.	Check and adjust LCD contrast
-	Push buttons do not function.	Restart the energy meter by powering off and powering on again
101	Metering stops due to an EEPROM error.	Press OK to display total energy consumption. Enter configuration mode and implement Reset Config
102	Metering stops due to a lack of a calibration table	Press OK to display total energy consumption. Enter configuration mode and implement Reset Config
201	Metering continues. Mismatch between frequency settings and frequency measurements.	Correct the frequency settings according to the nominal frequency of the power system
202	Metering continues. Mismatch between wiring settings and wiring inputs.	Correct the wiring settings according to the wiring inputs.
203	Metering continues. Phase sequence reversed.	Check the wire connections and correct the wiring settings if needed
204	Metering continues. Total active energy negative due to incorrect voltage and current conditions.	Check wire connections
205	Metering continues. Date and Time have been reset due to a loss of power.	Set the Date and Time
207	Metering continues. Abnormal internal clock function.	Restart the energy meter by powering off and powering on again then reset the date and time

[1] Not all codes apply to all models

11.4 Anti-freeze resistance on evaporator

The immersion heaters, managed by SEC.blue controller, prevent the icing of chilled water in case the chiller is not running. At certain ambient temperatures and water temperatures, STULZ is recommending the use of ethylene or propylene glycol.

- Power: 170 or 250 W each.
- Power supply: mono-phase 230 V

Maintenance: Check every 6 months the proper operation of the resistances.

11.5 Electronic flow switch (for evaporator)

It allows the constant monitoring of the fluid circulation in the chilled water circuits. It's installed in the unit's pipes and electrically connected to the SEC.blue controller. It reports an eventual absence of fluid circulation, to avoid the freezing of the evaporator.
The flow switch is set on the minimum flow allowed by the exchangers, reported in this manual.

11.6 Increment of evaporator insulation

The increment of the thickness of the thermal insulation to 20 mm (standard is 10 mm) on the evaporator. This option is recommended when the produced chilled water temperature is below 5 °C.

11.7 Suction-side shut-off valve on compressor

Shut-off valve close the refrigerant circuit before the compressor. In combination with the shut-off valve on the discharge-side (standard), it is possible to isolate the compressor from the refrigerant circuit to make maintenance much easier.
Due to the very small pressure drop of the valve, the performance of the chiller is not affected.

- Certified for HFO-refrigerant R1234ze.

11.8 Containerisation

The size of WSI Explorer chillers enable them to be shipped in containers (rental not included) for the all the sizes. The container transport option includes:

- Chiller FCA delivery (Free Carrier. Standard place: Valeggio s/m, Verona, Italy);
- Additional units for slipping/pulling the unit out of the container. In particular, the following items are added to WSI Explorer chiller:
  - Equipment to handle the unit and load it into the container;
  - Loading of container onto carrier means.

11.9. Flanged connection Victaulic®

Flanged connection used for hydraulic connections between the chiller and the hydraulic circuit of the customer. The surfaces to be coupled should not have any deformity, waves, scratches or deep carvings, with particular attention to not have coupling interference. If correctly installed, the gasket is not visible from outside. The gasket is specifically designed for the application on hydraulic piping, insuring an hermetic connection without losses.

The connection eliminates the presence of sharp edges and the concentration of stresses, with the possibility to work with work pressure and higher load capacity of the flanged adapters.
This accessory is supplied for:

- Connection chilled water inlet;
- Connection chilled water outlet.

11.9.1. Safety

⚠ WARNING

- Read and unterstand all instruction before attempting to install this products
- Depressurize and drain the piping system before attempting to install, remove or adjust this product.
- Wear safety glasses, hardhat and foot protection.

11.9.2. Check pipe/mating component ends

The outside surface of the pipe/mating component, between the groove and the pipe/mating component end, must be smooth and free from indentations, projections (including weld seams), and roll marks to ensure a leak-tight seal. All oil, grease, loose paint, dirt, and cutting particles must be removed. Measurements taken across grooved pipe/mating component ends must not exceed the maximum allowable flare diameter. Refer to current Victaulic grooving specifications for the maximum allowable flare diameter.

11.9.3. Check gasket

Check the gasket to make sure it is suitable for the intended service. The colour code identifies the gasket grade.

⚠ WARNING

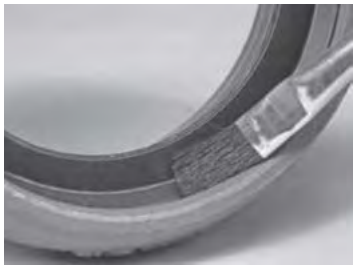
Always use a compatible lubricant to prevent the gasket from pinching or tearing during installation.

11.9.4. Lubricate gasket

Apply a thin coat of Victaulic Lubricant or silicone lubricant only to the sealing lips of the gasket interior.

i INFORMATION

The gasket exterior is supplied with a factory-applied lubricant, so there is no need to remove the gasket from the housings to apply additional lubricant to the exterior surface.



11.9.5. Assemble joint

Assemble the joint by inserting the grooved end of a pipe/mating component into each opening of the coupling. The ends of the grooved pipe/mating components must be inserted into the coupling until contact with the center leg of the gasket occurs. A visual check is required to ensure the coupling keys align with the grooves in the pipe/ mating components.

INFORMATION

The coupling may be rotated to ensure the gasket is seated properly.

WARNING

Victaulic QuickVic Flexible Couplings contain a centring feature at the bolt pads. It is important to tighten the nuts evenly by alternating sides until metal-to-metal contact occurs at the bolt pads. The middle section of the bolt pad mating surface must be in full metal-to-metal contact to ensure a flexible joint.

11.9.6. Tighten nuts

Tighten the nuts evenly by alternating sides until metal-to-metal contact occurs at the bolt pads. The middle section of the bolt pad mating surfaces must be in full metal-to-metal contact to ensure a properly assembled joint. Make sure the housings' keys engage the grooves completely during tightening.

INFORMATION

It is possible to bring the outside sections of the bolt pads into metal-to-metal contact without having metal-to-metal contact at the middle section of the bolt pad mating surfaces. Even tightening of the nuts is required to bring the entire bolt pad sections into metal-to-metal contact.

In addition, it is important to tighten the nuts evenly by alternating sides to prevent gasket pinching. An impact wrench or standard socket wrench can be used to bring the bolt pads into metal-to-metal contact.

11.9.7. Inspection

Visually inspect the bolt pads at each joint to ensure metal-to-metal contact is achieved across the entire bolt pad section.

STULZ Top Service – more than fast emergency assistance

Advice | Maintenance | Implementation | Test Center | Technical | Climate Customized | Service-Portal

For general questions about our products and services, you can reach us on weekdays from 8 – 18 at phone 0039 045 6331615.

Or contact directly our representative in your area:

HEADQUARTERS HAMBURG GERMANY
Tel. +49 040 / 5585-238
service-hamburg@stulz.de

OTHER AREAS on
www.stulz.com

STULZ S.P.A. ITALY
Valeggio sul Mincio (VR)
Tel. +39 045 / 6331615
aftersales@stulz.it