

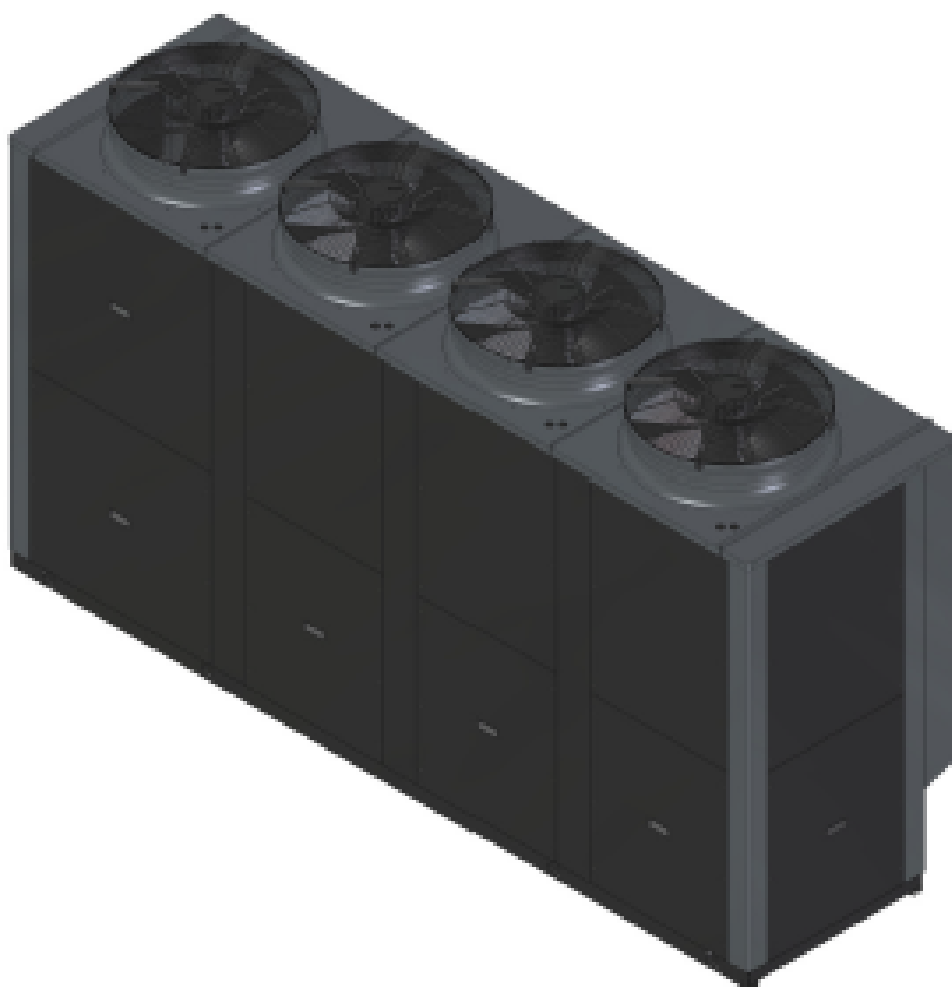
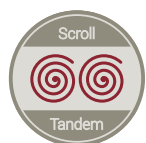
STREBEL

S-ASX-NT Range

Air Source Heat Pump

Models 60 - 70 - 80 - 90

Installation, Operating & Maintenance Manual



Please read and understand before commencing installation and leave the manual with the customer for future reference.



2026-07-23 V6

DECLARATION OF CONFORMITY

EU DECLARATION OF CONFORMITY

THE MANUFACTURER:

Strebel Ltd

Unit 10, Invincible Road, Farnborough, Hampshire, GU14 7QU.

HEREBY DECLARES:

Under its sole responsibility, that the equipment indicated below, bearing CE marking and supplied with this declaration, has been manufactured and tested in compliance with the directives:

Manufacturer	Strebel Ltd
Models	S-ASX-NT 60R Air to Water Heat Pump S-ASX-NT 70R Air to Water Heat Pump S-ASX-NT 80R Air to Water Heat Pump S-ASX-NT 90R Air to Water Heat Pump
Serial Number	22MMLLXXXX
Product Description	Air to Water Heat Pump
Machines Directive	2006/42/CE
PED Directive	2014/68/EU
EMC Directive	2014/30/EU
Low Voltage Directive	2014/35/EU
Energy Efficiency Directive	2012/27/EU
Ecodesign Directive	2009/125/CE
Conformity Assessment Procedure	Module A2

This declaration relates exclusively to the machinery in the state in which it was placed on the market and excludes components which are added and/or operation carried out subsequently by the final user.

The following harmonised standards have been applied to the EMC Directive 2014/30/EU:

- EN IEC 61000-3-11:2017: Electromagnetic Compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – equipment with input current > 16A up to and including 75A.
- EN IEC 61000-3-12:2011: Electromagnetic Compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16A up to and including 75A.
- EN IEC 61000-6-2:2019: Electromagnetic Compatibility (EMC) – Part 6-2: Generic standards – Immunity of industrial environments.
- EN IEC 61000-6-3:2021: Electromagnetic Compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial, and light industrial environments.
- EN IEC 61000-6-4:2019: Electromagnetic Compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments.

This Declaration of Conformity replaces all previous ones of the above models.

Date of Issue: 17th April 2026.

Place of Issue: 10 Invincible Road, Farnborough, Hampshire, GU14 7QU.

Signed by the manufacturer:



Print: Andy Parker

Position: Managing Director

The manufacturer disclaims any liability arising from the incorrect use of this manual.
The manufacturer reserves the right to make modifications and/or improvements to this manual
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GENERAL INFORMATION

GENERAL WARNING

MANUAL AND DOCUMENTATION - This manual provides all the information necessary for a correct installation and for a correct use and maintenance of the equipment. Before proceeding with the installation, carefully read this manual and follow the instructions contained therein.

The manufacturer declines all responsibility for any direct or indirect damage to persons or property deriving from failure to observe the information provided in this manual.

This manual and the wiring diagram supplied with the machine must be properly stored to be readily available for future reference in case of need.

ACCESS TO THE UNIT - Access to the unit must be allowed only to personnel trained in this type of unit and equipped with the necessary accident prevention protections. Furthermore, these personnel must be authorized by the owner of the unit and recognized by the manufacturer to operate.

The equipment may not be used by children under the age of 8 and by persons with reduced physical, sensory or mental abilities or lack of experience and skills unless they are supervised or instructed to use the equipment safely and they understand the related dangers. Children must not play with the equipment. Cleaning and maintenance by the user must not be carried out by the categories previously listed without supervision.

INSTALLATION - The equipment must be installed only and

exclusively by qualified personnel, in compliance with all current and applicable safety regulations in accordance with the national legislation of the country of installation.

USE - The appliance must be connected to a hydronic heating and/or cooling system. Any use other than that permitted or outside the operating limits mentioned in this manual is forbidden (unless previously agreed with the manufacturer).

FAILURES OR MALFUNCTIONS - Switch off the equipment in case of failure or malfunction. If the equipment needs to be repaired, please contact a specialized service centre recognized by the manufacturer and use original spare parts.

The manufacturer declines all responsibility deriving from electrical or mechanical tampering of the equipment which, if not authorised by the manufacturer, **MAKES THE WARRANTY VOID**.

The unit must be serviced by qualified personnel in compliance with all applicable and applicable safety regulations in accordance with UK legislation.

IDENTIFICATION OF THE UNIT - All units are supplied with the identification plate described below.

The serial number uniquely identifies the machine. In the event of a request for assistance, the user must always specify the model of the unit, the serial number and the year of manufacture, to trace the specific characteristics of the product and the assembled components and to correctly supply any spare parts.

Unit Data Plate

A					
S/N	B				
Model	C				
Code	D				
Power supply	E				
Max input current	[A]	F			
Standard	G	Heating		Cooling	
		A7W35		A35W7	
Capacity	[kW]	H		J	
	[kW]	I		K	
Power input		High		Low	
Max pressure	[bar]	L		M	
Refrigerant	[kg]	N		P	
	[tCO ₂ eq]	O		Q	
Weight	[kg]	R			
Sound pressure at 1 m		[dB(A)]		S	
Protection degree		T		U	
PED category	V	Manufactured by			
W		X			

A	Trademark
B	Serial number
C	Model
D	Code
E	Power supply
F	Maximum input current [A]
G	Reference standard
H	Capacity in heating mode at nominal condition * [kW]
I	Power input in heating mode at nominal condition * [kW]
J	Capacity in cooling mode at nominal condition * [kW]
K	Power input in cooling mode at nominal condition * [kW]
L	Maximum pressure on the high-pressure side [bar]
M	Maximum pressure on the low-pressure side [bar]
N	Quantity of refrigerant [kg]
O	Tonnes of equivalent CO ₂ [tCO ₂ eq]
P	Type of refrigerant
Q	Refrigerant GWP
R	Weight [kg]
S	Sound pressure level at 1 meter [dB(A)]
T	Type of protection
U	Protection level
V	PED category
W	PED certification body
X	Manufacturer

Nominal conditions *	Air - Water	Water - Water	Brine - Water
Heating	A7W35	W10W35	B0W35
Cooling	A35W7	W30W7	B30W7

DESCRIPTION

DESCRIPTION OF COMPONENTS

External structure

Basement, supporting structure and panels are made of galvanized and painted sheet steel to ensure good resistance to atmospheric agents. Accessibility to internal parts is possible removing frontal and lateral panels. In the units with low noise acoustic setting basement, main structure and panels are completely insulated to minimize noise emissions in the surroundings.

Refrigerant circuit

The hermetic scroll compressors are mounted on damper supports and is protected against over temperatures and over currents. Each compressor is equipped with an electrical heater, that keeps the compressor crankcase oil temperature high enough to prevent migration of refrigerant during winter stops and to evaporate any liquid present in the crankcase, to prevent possible liquid rushes on starting.

The heat exchanger on the plant side is a brazed stainless steel plates heat exchanger, properly insulated to avoid condensate generation and to minimize thermal losses, and protected by a differential pressure switch that detects low water flow. The heat exchanger on the source side is a finned coil with grooved copper pipes and hydrophilic aluminium fins with waved profile to increase the heat exchange coefficient. Under the coil a tray is installed that collect the condensate generated by the coil in heating mode.

The expansion device, an electronic expansion valve, allows the unit to adjust itself to the different operating conditions keeping steady the set superheating. The refrigerant circuit of each unit contains moreover solid core hermetic filter dryer to restrain

impurity and moisture residuals that could be present in the circuit. A high-pressure switch and pressure sensors to assure the compressor to operate inside the permitted limits. A 4-way reverse cycle valve to allow operating mode change reversing the refrigerant flow, liquid receiver to compensate the different refrigerant charge required in heating and in cooling mode, pressure connections equipped with pin, gasket and blind nut. All the pipes of the refrigerant circuit are properly insulated to avoid condensate generation and to minimize thermal losses.

The axial fans are equipped with a high efficiency electronically commutated (EC) motor and guarantee high efficiencies in all the operating conditions. The speed of the fans can be adjusted to reduce the noise during the night.

Hydraulic circuit

The hydraulic circuit is equipped with safety valve and manual air vents to assure deaeration of the hydraulic circuit inside the unit. All the pipes are thermally insulated to avoid condensate generation and minimize thermal losses. The hydraulic circuit can be equipped with a circulation pump with the possibility to choose different pump types as an option.

Electrical panel

It contains all the power, control and safety components necessary to guarantee the unit to work properly. The unit is managed by a microprocessor controller to which all the electrical loads and the control devices are connected. The remote user interface, to be installed indoor, allows to view and to modify, if necessary, all the parameters of the unit.

Standard Supply & Additional Options

Options		
Acoustic setting up (Standard Supply)	Low noise acoustic setting up	Allows to reduce the noise emitted by the unit by means of the refrigerant circuit vane acoustic insulation.
Plant side flow rate management	Standard Fixed Speed pump (Standard Supply)	Allows the circulation of the water on the plant side. With the fixed speed pump, to adjust the water flow rate dT, a commissioning valve will be required per ASHP
	High-head pump (Additional Option)	
Soft starter	(Standard Supply)	Reduces the compressor start current

Components supplied with the unit	
Remote user interface	Mandatory installation according to indications reported in "Control system" paragraph.
Outdoor air sensor	Mandatory installation according to indications reported in "Control system" paragraph.

DESCRIPTION

SAFETY FEATURES DESCRIPTION

The unit contains a flammable refrigerant that requires specific precautions to ensure the safety of the unit itself. Indeed, even though the unit is designed to minimize the risk of refrigerant leaks, it is not possible to exclude the possibility that a refrigerant leak may occur during the entire life of the unit. In such circumstances, to ensure the safety of the unit, it is necessary to ensure that the potentially flammable atmosphere that may be generated inside the unit does not come in contact with hot surfaces or ignition sources, and that such atmosphere is expelled from the unit and diluted into the external air.

The potential formation of a potentially flammable atmosphere outside the unit is a risk that must be assessed by the installer to apply all necessary precautions to make the installation site safe while complying with all applicable regulations.

Inside the unit, three zones can be identified:

- Technical compartment: contains the refrigeration circuit. (excluding the finned coil) and the hydraulic circuit.
- Ventilation compartment: contains the fans and the finned coil.
- Electrical compartment: contains the electrical panel.

Technical Compartment

The concentration of refrigerant inside the technical compartment is constantly monitored by a refrigerant leakage detector, appropriately calibrated to intervene before the refrigerant concentration can generate a potentially flammable atmosphere within the technical compartment. The sensor must be checked and eventually recalibrated periodically to ensure adequate protection of the unit.

If necessary, the leakage detector can activate an ATEX extraction fan that expels air from the technical compartment by drawing air directly from outside the unit, ensuring a refrigerant concentration below the flammability threshold. The filters on the air intake and discharge nozzles of the technical compartment must be periodically checked and cleaned to ensure adequate airflow.

The extraction fan is not suitable for ducting.

Ventilation Compartment

The ventilation compartment is directly in contact with the outside air. Therefore, any potential refrigerant leakage from the finned coil cannot generate a flammable atmosphere inside the unit. If the unit is operating, the airflow generated by the fans disperses and dilutes the refrigerant before its concentration can reach hazardous levels. If the unit is not operating, the refrigerant (which is heavier than air) tends to disperse downward around the unit or along the condensate drainage line generated by the coil.

Electrical Compartment

The electrical compartment is completely separated from the technical compartment and the ventilation compartment, creating a barrier that, although not airtight, strongly limits the diffusion of refrigerant from the technical compartment to the electrical compartment and makes the presence of a potentially flammable atmosphere around the electrical panel very unlikely.

The electrical panel is designed to prevent the possibility of refrigerant, coming from any internal point within the unit, from entering the panel. For this reason, none of the components contained in the electrical panel require ATEX certification.

All wiring between the electrical panel and internal components of the unit pass through tightly sealed connections.

All wiring between the electrical panel and external components of the unit (power cable, external component control, communication bus, etc.) must enter the panel through sealed connections passing exclusively through the electrical compartment. All electrical junctions or connections must be made exclusively within the electrical panel.

The cooling fans of the electrical panel (if present) draw air directly from the outside, maintaining the panel in positive pressure compared to the rest of the unit, avoiding the possible suction of refrigerant from other internal points in the equipment.

All units require a main power supply line and a secondary power supply line (this latest needed only for the activation of the refrigerant leakage sensor and the extraction fan of the technical compartment). The secondary power supply line can be derived from the main one or be completely independent and possibly connected to a UPS (check local regulations) to ensure the operation of safety devices even in the event of a main power failure. The safety management logic dictates that when the general switch of the unit is closed, only the refrigerant leakage sensor and possibly the extraction fan of the technical compartment are activated. At the end of the sensor startup procedure, if no potentially flammable atmosphere is detected in the technical compartment, the rest of the electrical panel is also powered via a safety contactor. If, during normal operation of the unit, the refrigerant leakage sensor detects a potentially flammable atmosphere, the safety contactor is opened, keeping only the sensor itself and the extraction fan active.

IDENTIFICATION CODE

S-ASX-NT	90	R	2	S	F	N	B	9
1	2	3	4	5	6	7	8	

1	Product range	
2	Model	
3	Operating mode	
	R	Heating and cooling (reversible on the refrigerant side)
	RD	Heating and cooling (reversible on the refrigerant side) with heat recovery (desuperheater)
4	Number of compressors	
5	Type of compressors	
	SF	Scroll compressors - Fixed speed
6	Power supply	
	M	230V - 1 - 50Hz
	N	400V - 3N - 50Hz
	T	400V - 3 - 50Hz
7	Acoustic setting up	
	B	Base
	S	Low noise
8	Refrigerant	
	9	R290

TECHNICAL DATA

EU reg 811/2013		60	70	80	90	
Efficiency class	AVERAGE climate High temperature application - 55°C	A++	A++	A++	A++	-
	AVERAGE climate LOW temperature application - 35°C	A++	A++	A++	A++	-
Seasonal efficiency	AVERAGE climate High temperature application - 55°C	130	130	131	130	%
	AVERAGE climate LOW temperature application - 35°C	159	159	160	160	%
SCOP	AVERAGE climate Very High temperature application - 65°C	3.01	3.01	3.03	3.03	-
	AVERAGE climate HIGH temperature application - 55°C	3.32	3.33	3.35	3.33	-
	AVERAGE climate MEDIUM temperature application - 45°C	3.53	3.54	3.57	3.56	-
	AVERAGE climate LOW temperature application - 35°C	4.05	4.06	4.08	4.07	-
P Design	COLDER climate High temperature application - 55°C	41	49	59	67	kW
	AVERAGE climate High temperature application - 55°C	48	58	69	79	kW
	WARMER climate High temperature application - 55°C	52	63	75	86	kW
	COLDER climate LOW temperature application - 35°C	43	52	62	71	kW
	AVERAGE climate LOW temperature application - 35°C	51	62	74	85	kW
	WARMER climate LOW temperature application - 35°C	57	69	83	95	kW

		60	70	80	90	
Refrigerant		R290				-
Refrigerant charge **		5	5	6.8	6.8	kg
Access categories as per EN378-1		General Access	General Access	Supervised Only	Supervised Only	
Compressors	Type	high temperature scroll				-
	n° of compressors	2				-
	oil charge	3.58	3.58	3.58	3.58	kg
Refrigerant circuits	n° of circuits	1				-
Power steps		0 - 50 - 100				%
Plant side heat exchanger	Type	stainless steel brazed plates				-
	n°	1				-
	Water volume	6.4	8.0	9.8	11.8	l
Source side heat exchangers	Type	finned coil with copper pipes and hydrophilic aluminium fins				-
	n°	1				-
	Frontal surface	2.46	2.46	3.28	3.28	m²
Fans	Type	axial EC				-
	n°	3	3	4	4	-
Nominal total air flow rate		20,000	21,400	26,800	28,400	m³/h
Hydraulic circuit	Max pressure	6				bar
	*Min pressure	0.3				bar
	*Min pressure with internal circulation pump	1.5				bar

** The refrigerant charge indicated in the table is only indicative. The exact refrigerant charge, to be considered for the risk assessment and the installation conformity declaration, is indicated in the data plate attached to the unit.

* Pressure should be measured at unit inlet, downstream of water filter. In the units with integrated circulation pump the minimum pressure indicated is necessary to guarantee at pump suction a pressure higher than the minimum value required to avoid cavitation problems (NPSH).

NOMINAL PERFORMANCES

HEATING		A	W	60	70	80	90	
A7W35	Heating capacity	7	35	55,1	66,7	79,9	91,0	kW
	Power input			12,7	15,3	18,2	20,8	kW
	COP			4,34	4,36	4,39	4,38	-
	Plant side water flow rate			9494	11509	13787	15704	l/h
	Plant side pressure drops			27	26	26	24	kPa
A7W45	Heating capacity	7	45	52,1	63,2	75,7	86,2	kW
	Power input			14,7	17,8	21,1	24,1	kW
	COP			3,54	3,55	3,59	3,58	-
	Plant side water flow rate			9023	10939	13104	14926	l/h
	Plant side pressure drops			24	24	23	22	kPa
A7W55	Heating capacity	7	55	49,1	59,6	71,4	81,3	kW
	Power input			16,1	19,5	23,2	26,5	kW
	COP			3,05	3,06	3,08	3,07	-
	Plant side water flow rate			5346	6481	7764	8843	l/h
	Plant side pressure drops			9	9	9	9	kPa
A7W65	Heating capacity	7	65	46,3	56,2	67,3	76,6	kW
	Power input			18,1	21,9	26,1	29,8	kW
	COP			2,56	2,57	2,58	2,57	-
	Plant side water flow rate			4050	4910	5882	6700	l/h
	Plant side pressure drops			5	5	6	5	kPa
A2W35	Heating capacity	2	35	44,6	54,0	64,7	73,7	kW
	Power input			12,3	14,9	17,7	20,2	kW
	COP			3,63	3,62	3,66	3,65	-
	Plant side water flow rate			7691	9324	11168	12721	l/h
	Plant side pressure drops			18	18	18	17	kPa
A2W45	Heating capacity	2	45	42,2	51,2	61,3	69,8	kW
	Power input			14,2	17,1	20,4	23,3	kW
	COP			2,97	2,99	3,00	3,00	-
	Plant side water flow rate			7316	8869	10624	12101	l/h
	Plant side pressure drops			16	16	16	15	kPa
A2W55	Heating capacity	2	55	39,9	48,4	57,9	66,0	kW
	Power input			15,5	18,8	22,4	25,6	kW
	COP			2,57	2,57	2,58	2,58	-
	Plant side water flow rate			4340	5262	6303	7179	l/h
	Plant side pressure drops			6	6	6	6	kPa
A2W65	Heating capacity	2	65	37,8	45,8	54,8	62,4	kW
	Power input			17,4	21,1	25,1	28,7	kW
	COP			2,17	2,17	2,18	2,17	-
	Plant side water flow rate			3300	4001	4792	5459	l/h
	Plant side pressure drops			4	4	4	4	kPa
A-2W35	Heating capacity	-2	35	40,7	49,4	59,1	67,3	kW
	Power input			12,0	14,5	17,3	19,7	kW
	COP			3,39	3,41	3,42	3,42	-
	Plant side water flow rate			7028	8520	10205	11625	l/h
	Plant side pressure drops			15	15	15	14	kPa
A-2W45	Heating capacity	-2	45	38,8	47,0	56,3	64,2	kW
	Power input			13,8	16,6	19,8	22,6	kW
	COP			2,81	2,83	2,84	2,84	-
	Plant side water flow rate			6722	8150	9762	11120	l/h
	Plant side pressure drops			14	14	14	13	kPa
A-2W55	Heating capacity	-2	55	36,9	44,7	53,6	61,0	kW
	Power input			15,0	18,2	21,7	24,8	kW
	COP			2,46	2,46	2,47	2,46	-
	Plant side water flow rate			4016	4869	5832	6643	l/h
	Plant side pressure drops			5	5	5	5	kPa
A-2W65	Heating capacity	-2	65	35,3	42,7	51,2	58,3	kW
	Power input			16,8	20,4	24,2	27,7	kW
	COP			2,10	2,09	2,12	2,10	-
	Plant side water flow rate			3082	3736	4476	5098	l/h
	Plant side pressure drops			3	3	3	3	kPa

NOMINAL PERFORMANCES

HEATING		A	W	60	70	80	90	
A-7W35	Heating capacity	-7	35	36,2	43,9	52,6	59,9	kW
	Power input			11,6	14,0	16,7	19,0	kW
	COP			3,12	3,14	3,15	3,15	-
	Plant side water flow rate			6258	7587	9088	10352	l/h
	Plant side pressure drops			12	12	12	11	kPa
A-7W45	Heating capacity	-7	45	34,8	42,2	50,5	57,5	kW
	Power input			13,2	16,0	19,0	21,7	kW
	COP			2,64	2,64	2,66	2,65	-
	Plant side water flow rate			6029	7309	8755	9972	l/h
	Plant side pressure drops			11	11	11	11	kPa
A-7W55	Heating capacity	-7	55	33,4	40,5	48,5	55,2	kW
	Power input			14,4	17,4	20,7	23,7	kW
	COP			2,32	2,33	2,34	2,33	-
	Plant side water flow rate			3634	4405	5277	6010	l/h
	Plant side pressure drops			4	4	5	4	kPa
A-7W65	Heating capacity	-7	65	32,3	39,1	46,9	53,4	kW
	Power input			16,1	19,4	23,2	26,5	kW
	COP			2,01	2,02	2,02	2,02	-
	Plant side water flow rate			2822	3421	4098	4667	l/h
	Plant side pressure drops			3	3	3	3	kPa

COOLING		A	W	60	70	80	90	
A35W7	Cooling capacity	35	7	46,9	57,0	68,3	77,8	kW
	Power input			15,1	18,3	21,7	24,8	kW
	EER			3,11	3,11	3,15	3,14	-
	Plant side water flow rate			8083	9816	11755	13386	l/h
	Plant side pressure drops			20	20	19	18	kPa
A35W18	Cooling capacity	35	18	61,9	75,3	90,2	103,0	kW
	Power input			16,3	19,8	23,5	26,9	kW
	EER			3,80	3,80	3,84	3,83	-
	Plant side water flow rate			10737	13039	15615	17781	l/h
	Plant side pressure drops			34	33	33	31	kPa
A25W7	Cooling capacity	25	7	52,6	63,9	76,5	87,2	kW
	Power input			12,9	15,6	18,5	21,2	kW
	EER			4,08	4,10	4,14	4,11	-
	Plant side water flow rate			9063	11007	13181	15009	l/h
	Plant side pressure drops			25	24	24	23	kPa
A25W18	Cooling capacity	25	18	68,1	82,7	99,1	113	kW
	Power input			14,2	17,2	20,4	23,2	kW
	EER			4,80	4,81	4,86	4,87	-
	Plant side water flow rate			11806	14338	17170	19552	l/h
	Plant side pressure drops			41	39	39	36	kPa

Data declared according to EN 14511. The data are related to units without options or accessories.

A7W35	= source:	air in 7°C db 6°C wb	plant:	water in 30°C out 35°C	A-7W35	= source:	air in -7°C db -8°C wb	plant:	water in 30°C out 35°C
A7W45	= source:	air in 7°C db 6°C wb	plant:	water in 40°C out 45°C	A-7W45	= source:	air in -7°C db -8°C wb	plant:	water in 40°C out 45°C
A7W55	= source:	air in 7°C db 6°C wb	plant:	water in 47°C out 55°C	A-7W55	= source:	air in -7°C db -8°C wb	plant:	water in 47°C out 55°C
A7W65	= source:	air in 7°C db 6°C wb	plant:	water in 55°C out 65°C	A-7W65	= source:	air in -7°C db -8°C wb	plant:	water in 55°C out 65°C
A2W35	= source:	air in 2°C db 1°C wb	plant:	water in 30°C out 35°C	A35W7	= source:	air in 35°C db	plant:	water in 12°C out 7°C
A2W45	= source:	air in 2°C db 1°C wb	plant:	water in 40°C out 45°C	A35W18	= source:	air in 35°C db	plant:	water in 23°C out 18°C
A2W55	= source:	air in 2°C db 1°C wb	plant:	water in 47°C out 55°C	A25W7	= source:	air in 25°C db	plant:	water in 12°C out 7°C
A2W65	= source:	air in 2°C db 1°C wb	plant:	water in 55°C out 65°C	A25W18	= source:	air in 25°C db	plant:	water in 23°C out 18°C
A-2W35	= source:	air in -2°C db -3°C wb	plant:	water in 30°C out 35°C					
A-2W45	= source:	air in -2°C db -3°C wb	plant:	water in 40°C out 45°C					
A-2W55	= source:	air in -2°C db -3°C wb	plant:	water in 47°C out 55°C					
A-2W65	= source:	air in -2°C db -3°C wb	plant:	water in 55°C out 65°C					

PERFORMANCES IN HEATING MODE

Model	Water outlet temperature	Tdb Twb	Outdoor air temperature												°C
			-20	-15	-7	-4	-2	0	2	7	12	20	35	42	
			-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	
60	70	Heating capacity	23,1	26,2	31,8	33,5	34,4	35,4	36,7	44,9	49,7	56,4	70,8	78,3	kW
		Power input	16,0	17,0	18,5	19,0	19,4	19,7	20,0	20,9	21,5	22,3	23,7	24,3	kW
		COP	1,44	1,54	1,72	1,76	1,77	1,80	1,84	2,15	2,31	2,53	2,99	3,22	-
	65	Heating capacity	22,9	26,2	32,1	34,1	35,1	36,2	37,6	46,2	51,3	58,4	73,7	81,6	kW
		Power input	14,8	15,7	17,1	17,6	18,0	18,3	18,6	19,4	20,0	20,7	21,9	22,5	kW
		COP	1,55	1,67	1,88	1,94	1,95	1,98	2,02	2,38	2,56	2,82	3,37	3,63	-
	60	Heating capacity	22,9	26,3	32,7	34,7	35,9	37,2	38,7	47,6	53,0	60,5	76,6	85,0	kW
		Power input	13,8	14,7	16,0	16,4	16,7	17,0	17,3	18,0	18,6	19,2	20,3	20,8	kW
		COP	1,66	1,79	2,04	2,12	2,15	2,19	2,24	2,64	2,85	3,15	3,77	4,09	-
	55	Heating capacity	23,0	26,6	33,3	35,5	36,8	38,2	39,8	49,1	54,8	62,7	79,7	88,4	kW
		Power input	13,0	13,8	15,0	15,4	15,7	15,9	16,2	16,8	17,3	17,9	18,9	19,3	kW
		COP	1,77	1,93	2,22	2,31	2,34	2,40	2,46	2,92	3,17	3,50	4,22	4,58	-
	50	Heating capacity	23,2	27,0	34,0	36,4	37,8	39,3	41,0	50,6	56,6	65,0	82,7	91,9	kW
		Power input	12,2	13,0	14,1	14,4	14,7	14,9	15,1	15,7	16,2	16,7	17,5	17,9	kW
		COP	1,90	2,08	2,41	2,53	2,57	2,64	2,72	3,22	3,49	3,89	4,73	5,13	-
	45	Heating capacity	23,5	27,5	34,8	37,3	38,8	40,4	42,2	52,1	58,5	67,2	85,7	95,2	kW
		Power input	11,5	12,2	13,2	13,6	13,8	14,0	14,2	14,7	15,1	15,5	16,3	16,6	kW
		COP	2,04	2,25	2,64	2,74	2,81	2,89	2,97	3,54	3,87	4,34	5,26	5,73	-
	40	Heating capacity	23,9	27,9	35,5	38,2	39,8	41,5	43,4	53,6	60,2	69,3	88,6	98,5	kW
		Power input	10,9	11,5	12,4	12,7	12,9	13,1	13,3	13,7	14,0	14,4	15,0	15,3	kW
		COP	2,19	2,43	2,86	3,01	3,09	3,17	3,26	3,91	4,30	4,81	5,91	6,44	-
	35	Heating capacity	24,2	28,4	36,2	39,0	40,7	42,5	44,6	55,1	61,9	71,3	91,4	102,0	kW
		Power input	10,3	10,8	11,6	11,9	12,0	12,2	12,3	12,7	13,0	13,3	13,7	13,9	kW
		COP	2,35	2,63	3,12	3,28	3,39	3,48	3,63	4,34	4,76	5,36	6,67	7,34	-
	30	Heating capacity	24,4	28,7	36,9	39,8	41,6	43,4	45,6	56,4	63,5	73,2	94,0	105,0	kW
		Power input	9,58	10,1	10,7	11,0	11,1	11,2	11,3	11,7	11,9	12,1	12,4	12,6	kW
		COP	2,55	2,84	3,45	3,62	3,75	3,88	4,04	4,82	5,34	6,05	7,58	8,33	-

Model	Water outlet temperature	Tdb Twb	Outdoor air temperature												°C
			-20	-15	-7	-4	-2	0	2	7	12	20	35	42	
			-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	
70	70	Heating capacity	28,0	31,7	38,5	40,6	41,7	43,0	44,5	54,4	60,3	68,3	85,8	94,8	kW
		Power input	19,4	20,5	22,3	23,0	23,4	23,8	24,2	25,2	26,0	27,0	28,6	29,3	kW
		COP	1,44	1,55	1,73	1,77	1,78	1,81	1,84	2,16	2,32	2,53	3,00	3,24	-
	65	Heating capacity	27,7	31,7	38,9	41,3	42,6	43,9	45,6	56,0	62,2	70,8	89,3	98,9	kW
		Power input	17,9	19,0	20,7	21,3	21,7	22,1	22,5	23,4	24,1	25,0	26,5	27,1	kW
		COP	1,55	1,67	1,88	1,94	1,96	1,99	2,03	2,39	2,58	2,83	3,37	3,65	-
	60	Heating capacity	27,7	31,9	39,6	42,1	43,5	45,1	46,9	57,7	64,3	73,4	92,9	103,0	kW
		Power input	16,7	17,8	19,3	19,9	20,2	20,6	20,9	21,8	22,4	23,2	24,5	25,1	kW
		COP	1,66	1,79	2,05	2,12	2,15	2,19	2,24	2,65	2,87	3,16	3,79	4,10	-
	55	Heating capacity	27,9	32,3	40,4	43,1	44,6	46,3	48,3	59,5	66,4	76,0	96,5	107,0	kW
		Power input	15,7	16,6	18,1	18,6	18,9	19,2	19,5	20,3	20,9	21,6	22,8	23,3	kW
		COP	1,78	1,95	2,23	2,32	2,36	2,41	2,48	2,93	3,18	3,52	4,23	4,59	-
	50	Heating capacity	28,2	32,8	41,3	44,1	45,8	47,6	49,7	61,3	68,6	78,7	100,0	111,0	kW
		Power input	14,8	15,7	17,0	17,4	17,7	18,0	18,3	19,0	19,5	20,1	21,2	21,6	kW
		COP	1,91	2,09	2,43	2,53	2,59	2,64	2,72	3,23	3,52	3,92	4,72	5,14	-
	45	Heating capacity	28,5	33,3	42,2	45,2	47,0	49,0	51,2	63,2	70,8	81,4	104,0	115,0	kW
		Power input	14,0	14,8	16,0	16,4	16,6	16,9	17,1	17,8	18,2	18,7	19,6	20,0	kW
		COP	2,04	2,25	2,64	2,76	2,83	2,90	2,99	3,55	3,89	4,35	5,31	5,75	-
	40	Heating capacity	28,9	33,9	43,1	46,3	48,2	50,3	52,7	65,0	73,0	84,0	107,0	119,0	kW
		Power input	13,2	13,9	15,0	15,3	15,6	15,8	16,0	16,5	16,9	17,4	18,1	18,4	kW
		COP	2,19	2,44	2,87	3,03	3,09	3,18	3,29	3,94	4,32	4,83	5,91	6,47	-
	35	Heating capacity	29,3	34,4	43,9	47,3	49,4	51,5	54,0	66,7	75,0	86,4	111,0	123,0	kW
		Power input	12,4	13,1	14,0	14,3	14,5	14,7	14,9	15,3	15,6	16,0	16,5	16,8	kW
		COP	2,36	2,63	3,14	3,31	3,41	3,50	3,62	4,36	4,81	5,40	6,73	7,32	-
	30	Heating capacity	29,6	34,8	44,7	48,2	50,4	52,7	55,3	68,3	76,9	88,8	114,0	127,0	kW
		Power input	11,6	12,2	13,0	13,2	13,4	13,6	13,7	14,1	14,3	14,6	15,0	15,1	kW
		COP	2,55	2,85	3,44	3,65	3,76	3,88	4,04	4,84	5,38	6,08	7,60	8,41	-

Data declared applying corrections according to EN 14511 and considering a ΔT of 5°C between water inlet and outlet of the unit. The data are related to units without options or accessories.

PERFORMANCES IN HEATING MODE

Model	Water outlet temperature	Tdb Twb	Outdoor air temperature												°C
			-20	-15	-7	-4	-2	0	2	7	12	20	35	42	
			-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	
80	70	Heating capacity	33,5	38,0	46,1	48,6	50,0	51,5	53,2	65,2	72,2	81,8	103,0	114,0	kW
		Power input	23,0	24,4	26,6	27,3	27,8	28,3	28,8	30,0	31,0	32,1	34,0	34,8	kW
		COP	1,46	1,56	1,73	1,78	1,80	1,82	1,85	2,17	2,33	2,55	3,03	3,28	-
	65	Heating capacity	33,2	38,0	46,6	49,4	51,0	52,6	54,6	67,0	74,5	84,8	107,0	118,0	kW
		Power input	21,3	22,7	24,7	25,4	25,8	26,3	26,7	27,8	28,7	29,7	31,5	32,2	kW
		COP	1,56	1,67	1,89	1,94	1,98	2,00	2,04	2,41	2,60	2,86	3,40	3,66	-
	60	Heating capacity	33,2	38,2	47,4	50,4	52,1	54,0	56,1	69,1	77,0	87,9	111,0	123,0	kW
		Power input	19,9	21,1	23,0	23,6	24,1	24,5	24,9	25,9	26,7	27,6	29,2	29,8	kW
		COP	1,67	1,81	2,06	2,14	2,16	2,20	2,25	2,67	2,88	3,18	3,80	4,13	-
	55	Heating capacity	33,4	38,7	48,4	51,6	53,5	55,5	57,8	71,2	79,6	91,0	116,0	128,0	kW
		Power input	18,7	19,8	21,5	22,1	22,5	22,9	23,3	24,2	24,9	25,7	27,1	27,7	kW
		COP	1,79	1,95	2,25	2,33	2,38	2,42	2,48	2,94	3,20	3,54	4,28	4,62	-
	50	Heating capacity	33,7	39,3	49,4	52,9	54,9	57,0	59,5	73,5	82,2	94,2	120,0	133,0	kW
		Power input	17,6	18,6	20,2	20,8	21,1	21,4	21,8	22,6	23,2	23,9	25,1	25,6	kW
		COP	1,91	2,11	2,45	2,54	2,60	2,66	2,73	3,25	3,54	3,94	4,78	5,20	-
	45	Heating capacity	34,2	39,9	50,5	54,2	56,3	58,7	61,3	75,7	84,8	97,4	124	138	kW
		Power input	16,6	17,6	19,0	19,5	19,8	20,1	20,4	21,1	21,7	22,3	23,3	23,7	kW
		COP	2,06	2,27	2,66	2,78	2,84	2,92	3,00	3,59	3,91	4,37	5,32	5,82	-
	40	Heating capacity	34,7	40,6	51,6	55,5	57,8	60,2	63,1	77,9	87,4	101,0	129	143	kW
		Power input	15,7	16,6	17,8	18,3	18,5	18,8	19,0	19,7	20,1	20,6	21,5	21,8	kW
		COP	2,21	2,45	2,90	3,03	3,12	3,20	3,32	3,95	4,35	4,90	6,00	6,56	-
	35	Heating capacity	35,1	41,2	52,6	56,7	59,1	61,7	64,7	79,9	89,8	104,0	133	148	kW
		Power input	14,8	15,5	16,7	17,0	17,3	17,5	17,7	18,2	18,6	19,0	19,6	19,9	kW
		COP	2,37	2,66	3,15	3,34	3,42	3,53	3,66	4,39	4,83	5,47	6,79	7,44	-
	30	Heating capacity	35,5	41,7	53,5	57,7	60,3	63,1	66,2	81,8	92,1	106,0	136	152	kW
		Power input	13,8	14,5	15,5	15,8	16,0	16,1	16,3	16,7	17,0	17,3	17,7	17,9	kW
		COP	2,57	2,88	3,45	3,65	3,77	3,92	4,06	4,90	5,42	6,13	7,68	8,49	-

Model	Water outlet temperature	Tdb Twb	Outdoor air temperature												°C
			-20	-15	-7	-4	-2	0	2	7	12	20	35	42	
			-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	
90	70	Heating capacity	38,2	43,3	52,5	55,4	56,9	58,6	60,6	74,2	82,2	93,2	117,0	129,0	kW
		Power input	26,3	27,9	30,4	31,2	31,8	32,4	32,9	34,3	35,4	36,6	38,8	39,8	kW
		COP	1,45	1,55	1,73	1,78	1,79	1,81	1,84	2,16	2,32	2,55	3,02	3,24	-
	65	Heating capacity	37,8	43,3	53,1	56,3	58,0	59,9	62,2	76,3	84,8	96,5	122,0	135,0	kW
		Power input	24,4	25,9	28,2	29,0	29,5	30,0	30,5	31,8	32,8	33,9	35,9	36,8	kW
		COP	1,55	1,67	1,88	1,94	1,97	2,00	2,04	2,40	2,59	2,85	3,40	3,67	-
	60	Heating capacity	37,8	43,6	54,0	57,4	59,4	61,5	63,9	78,6	87,6	100,0	127,0	140,0	kW
		Power input	22,8	24,2	26,3	27,0	27,5	28,0	28,4	29,6	30,5	31,5	33,3	34,1	kW
		COP	1,66	1,80	2,05	2,13	2,16	2,20	2,25	2,66	2,87	3,17	3,81	4,11	-
	55	Heating capacity	38,0	44,1	55,1	58,8	60,9	63,2	65,8	81,1	90,6	104,0	132,0	146,0	kW
		Power input	21,3	22,6	24,6	25,3	25,7	26,2	26,6	27,6	28,4	29,4	30,9	31,6	kW
		COP	1,78	1,95	2,24	2,32	2,37	2,41	2,47	2,94	3,19	3,54	4,27	4,62	-
	50	Heating capacity	38,4	44,7	56,3	60,2	62,5	65,0	67,8	83,6	93,6	107,0	137,0	152,0	kW
		Power input	20,1	21,3	23,1	23,7	24,1	24,5	24,9	25,8	26,5	27,3	28,7	29,2	kW
		COP	1,91	2,10	2,44	2,54	2,59	2,65	2,72	3,24	3,53	3,92	4,77	5,21	-
	45	Heating capacity	38,9	45,4	57,5	61,7	64,2	66,8	69,8	86,2	96,6	111	142	157	kW
		Power input	19,0	20,1	21,7	22,3	22,6	23,0	23,3	24,1	24,7	25,4	26,5	27,0	kW
		COP	2,05	2,26	2,65	2,77	2,84	2,90	3,00	3,58	3,91	4,37	5,36	5,81	-
	40	Heating capacity	39,5	46,2	58,8	63,2	65,8	68,6	71,8	88,7	99,5	114	146	163	kW
		Power input	17,9	18,9	20,4	20,9	21,2	21,5	21,8	22,5	23,0	23,6	24,5	24,8	kW
		COP	2,21	2,44	2,88	3,02	3,10	3,19	3,29	3,94	4,33	4,83	5,96	6,57	-
	35	Heating capacity	40,0	46,9	59,9	64,5	67,3	70,3	73,7	91,0	102,0	118	151	168	kW
		Power input	16,9	17,8	19,0	19,5	19,7	20,0	20,2	20,8	21,2	21,7	22,4	22,6	kW
		COP	2,37	2,63	3,15	3,31	3,42	3,51	3,65	4,38	4,81	5,44	6,74	7,43	-
	30	Heating capacity	40,4	47,5	61,0	65,8	68,7	71,8	75,4	93,2	105,0	121	155	173	kW
		Power input	15,8	16,6	17,7	18,0	18,2	18,4	18,6	19,1	19,4	19,7	20,2	20,4	kW
		COP	2,56	2,86	3,45	3,66	3,77	3,90	4,05	4,88	5,41	6,14	7,67	8,48	-

Data declared applying corrections according to EN 14511 and considering a **dT of 5°C** between water inlet and outlet of the unit. The data are related to units without options or accessories.

PERFORMANCES IN COOLING MODE

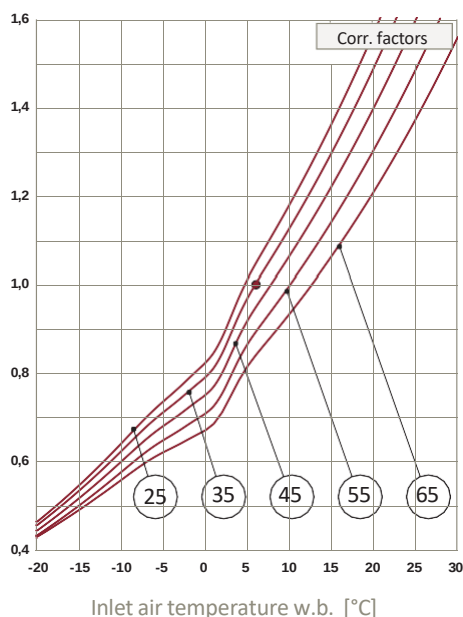
Model	Water outlet temperature	Tdb Twb	Outdoor air temperature								°C °C
			15 -	20 -	25 -	30 -	35 -	40 -	45 -	50 -	
60	18	Cooling capacity	71,5	70,1	68,1	65,4	61,9	57,6	52,2	45,7	kW
		Power input	12,6	13,3	14,2	15,2	16,3	17,7	19,2	21,0	kW
		EER	5,67	5,27	4,80	4,30	3,80	3,25	2,72	2,18	-
	12	Cooling capacity	64,3	63,0	61,1	58,5	55,1	50,9	45,7	39,3	kW
		Power input	12,0	12,7	13,5	14,5	15,7	17,1	18,6	20,4	kW
		EER	5,36	4,96	4,53	4,03	3,51	2,98	2,46	1,93	-
	7	Cooling capacity	55,6	54,4	52,6	50,1	46,9	42,8	37,8	31,6	kW
		Power input	11,3	12,0	12,9	13,9	15,1	16,5	18,0	19,8	kW
		EER	4,92	4,53	4,08	3,60	3,11	2,59	2,10	1,60	-
70	18	Cooling capacity	86,8	85,1	82,7	79,5	75,3	70,0	63,4	55,5	kW
		Power input	15,3	16,1	17,2	18,4	19,8	21,5	23,4	25,5	kW
		EER	5,67	5,29	4,81	4,32	3,80	3,26	2,71	2,18	-
	12	Cooling capacity	78,1	76,5	74,2	71,0	67,0	61,8	55,5	47,8	kW
		Power input	14,5	15,4	16,4	17,6	19,1	20,7	22,6	24,8	kW
		EER	5,39	4,97	4,52	4,03	3,51	2,99	2,46	1,93	-
	7	Cooling capacity	67,6	66,1	63,9	60,9	57,0	52,0	45,9	38,4	kW
		Power input	13,8	14,6	15,6	16,9	18,3	20,0	21,9	24,0	kW
		EER	4,90	4,53	4,10	3,60	3,11	2,60	2,10	1,60	-
80	18	Cooling capacity	104,0	102,0	99,1	95,2	90,2	83,8	76,0	66,5	kW
		Power input	18,1	19,1	20,4	21,8	23,5	25,5	27,7	30,3	kW
		EER	5,75	5,34	4,86	4,37	3,84	3,29	2,74	2,19	-
	12	Cooling capacity	93,6	91,6	88,9	85,1	80,2	74,0	66,4	57,2	kW
		Power input	17,3	18,2	19,5	20,9	22,6	24,6	26,9	29,4	kW
		EER	5,41	5,03	4,56	4,07	3,55	3,01	2,47	1,95	-
	7	Cooling capacity	81,0	79,1	76,5	72,9	68,3	62,3	55,0	46,0	kW
		Power input	16,3	17,3	18,5	20,0	21,7	23,7	26,0	28,5	kW
		EER	4,97	4,57	4,14	3,65	3,15	2,63	2,12	1,61	-
90	18	Cooling capacity	119	116	113	108	103,0	95,4	86,5	75,7	kW
		Power input	20,7	21,8	23,2	24,9	26,9	29,1	31,7	34,6	kW
		EER	5,75	5,32	4,87	4,34	3,83	3,28	2,73	2,19	-
	12	Cooling capacity	107,0	104,0	101,0	96,9	91,4	84,3	75,7	65,1	kW
		Power input	19,7	20,8	22,2	23,9	25,9	28,1	30,7	33,6	kW
		EER	5,43	5,00	4,55	4,05	3,53	3,00	2,47	1,94	-
	7	Cooling capacity	92,2	90,1	87,2	83,1	77,8	71,0	62,6	52,4	kW
		Power input	18,6	19,8	21,2	22,9	24,8	27,1	29,7	32,6	kW
		EER	4,96	4,55	4,11	3,63	3,14	2,62	2,11	1,61	-

Data declared applying corrections according to EN 14511 and considering a ΔT of 5°C between water inlet and outlet of the unit.
The data are related to units without options or accessories.

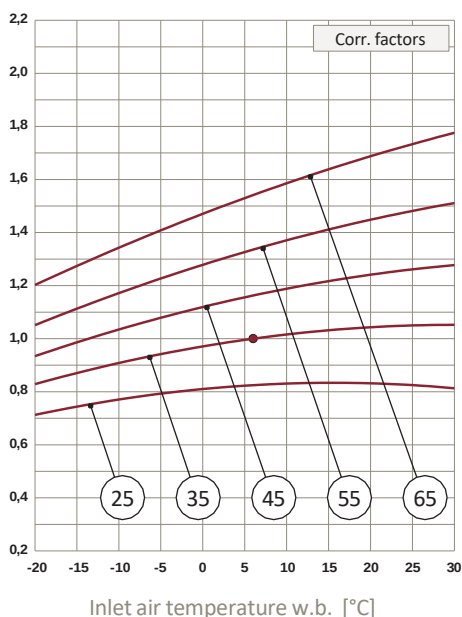
HEATING AND COOLING PERFORMANCES

HEATING Performances

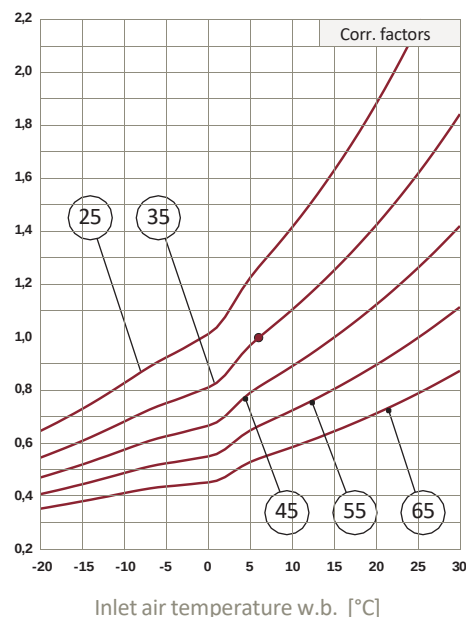
Heating capacity



Power input

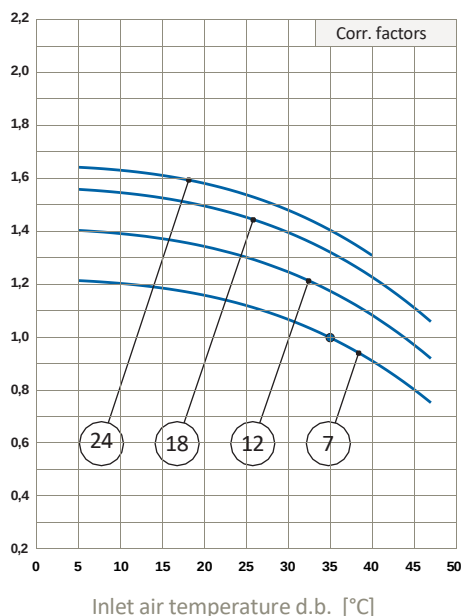


Efficiency - COP

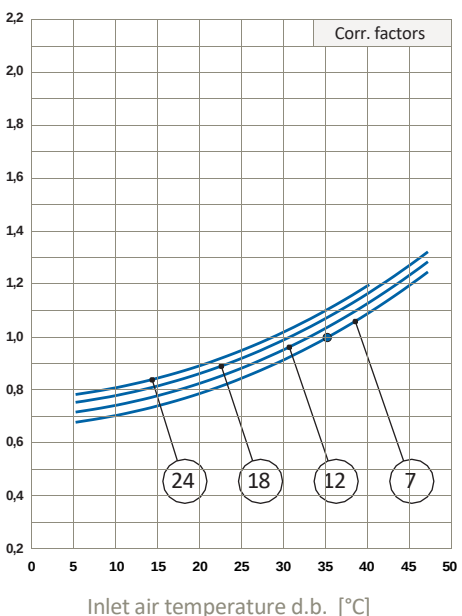


COOLING Performances

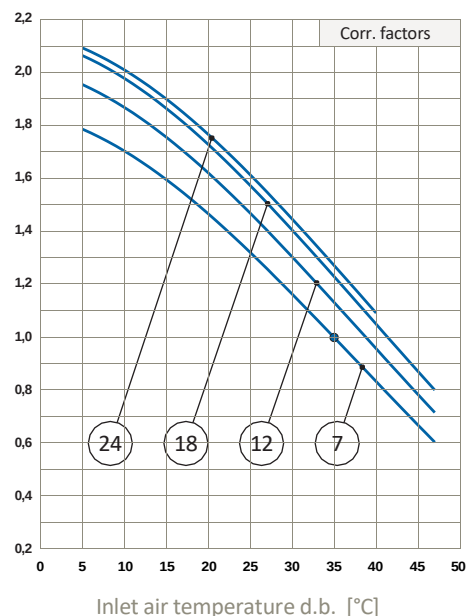
Cooling capacity



Power input



Efficiency - EER



The graphs provide the **corrective factors** to be applied to the **NOMINAL** performances to obtain the performances in the selected operating conditions. The curves are parameterized according to the outlet water temperature on the plant side with a ΔT equal to 5°C.

Nominal reference conditions :

Heating:
A7W35

Cooling:
A35W7

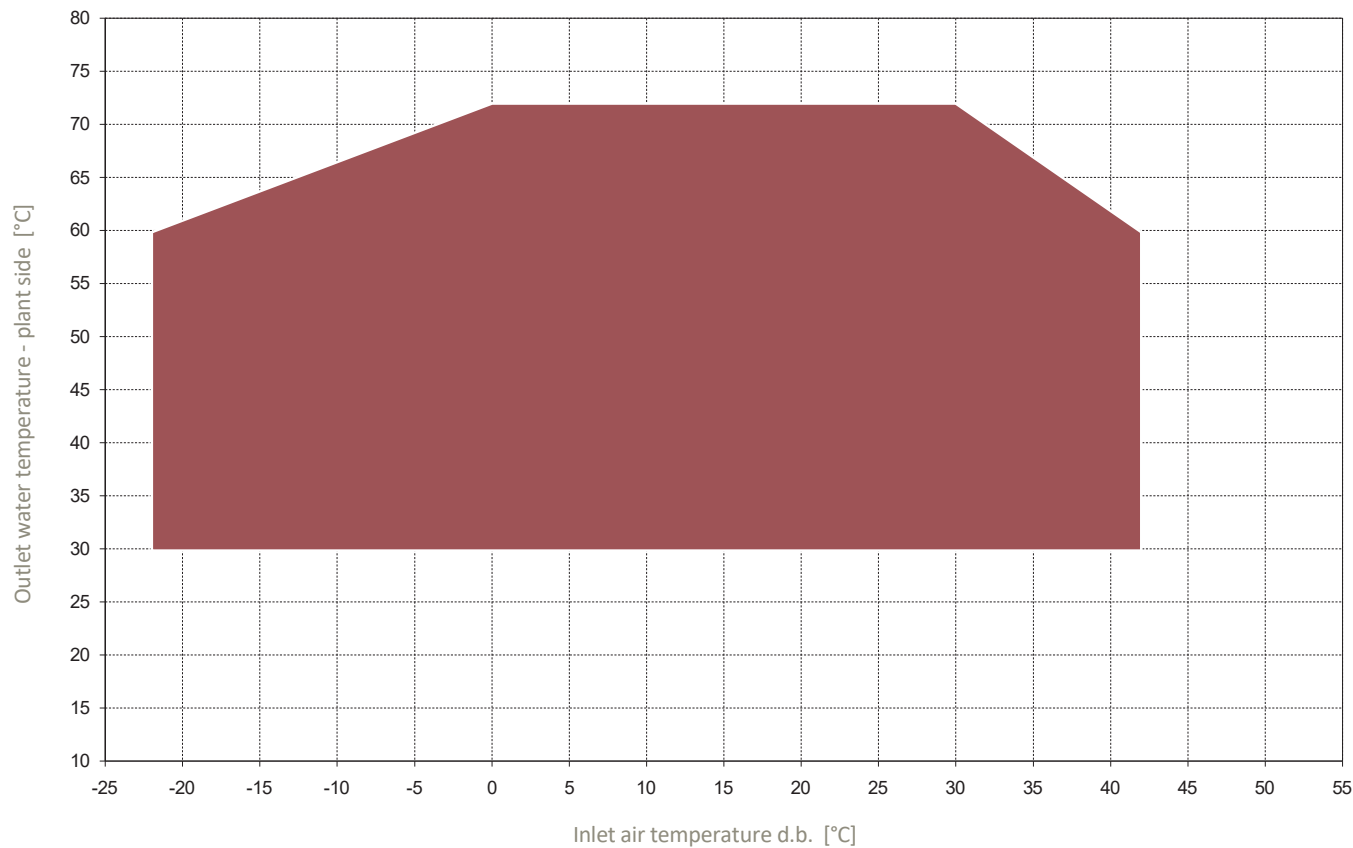
Source: Air in 7°C db 6°C wb
Plant: Water in 30°C out 35°C

Source: Air in 35°C db
Plant: Water in 12°C out 7°C

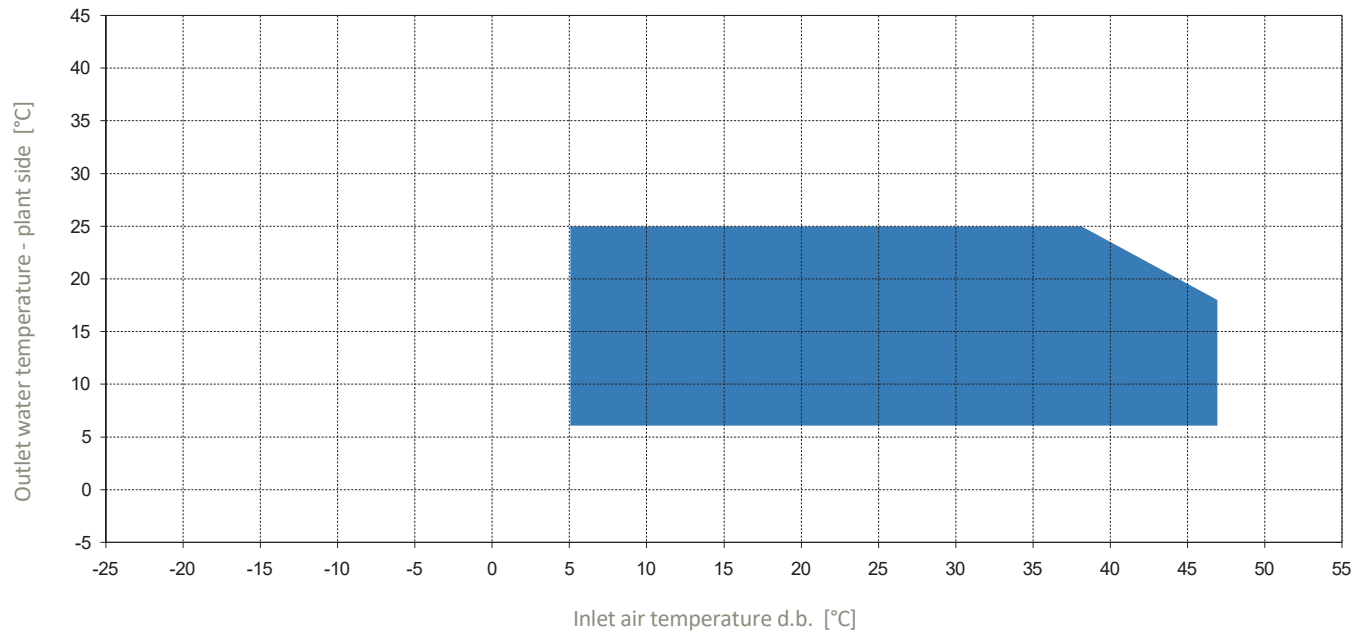
OPERATING RANGE

The graphs reported below show the operating area inside which the correct working of the unit is guaranteed.
The absolute maximum return temperature back to the S-ASX-NT ASHP range is 65°C.

HEATING



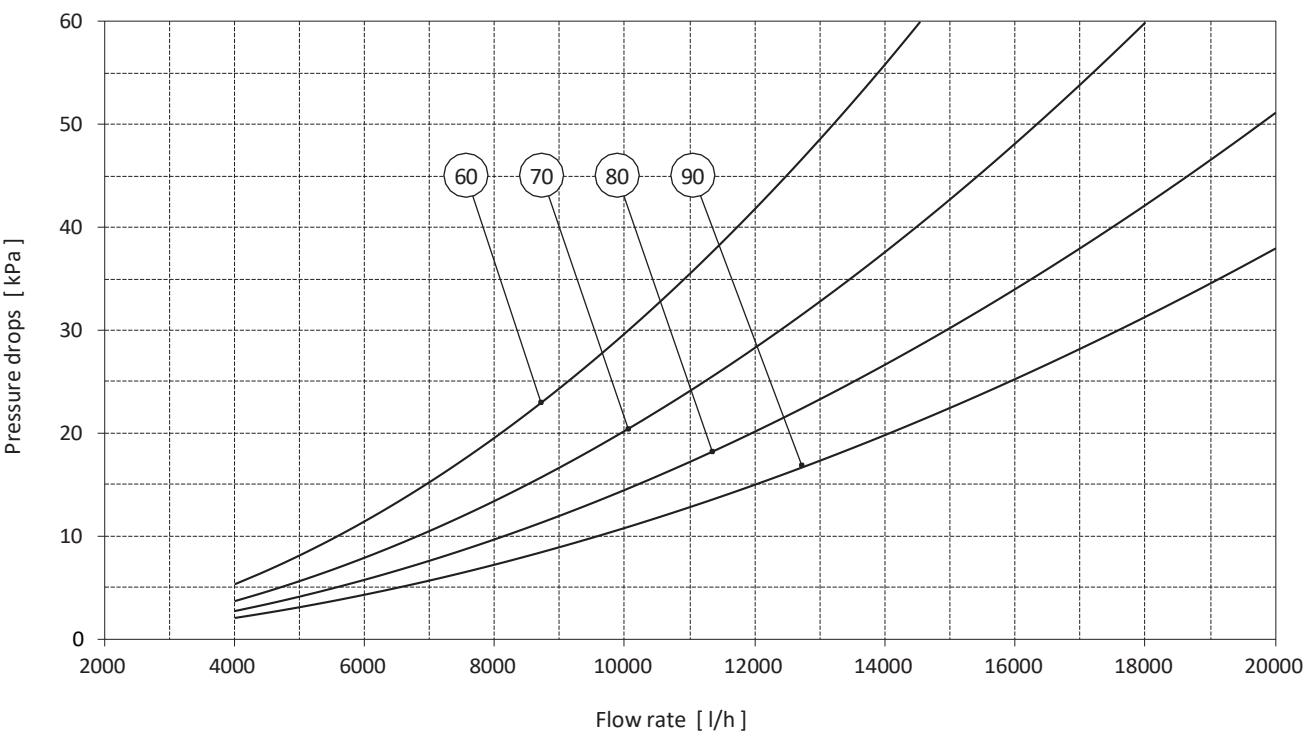
COOLING



Temperature difference between water inlet and outlet		Plant side	Source side	
ΔT max	Maximum value	10	-	°C
ΔT min	Minimum value	3	-	°C

HYDRAULIC PERFORMANCES

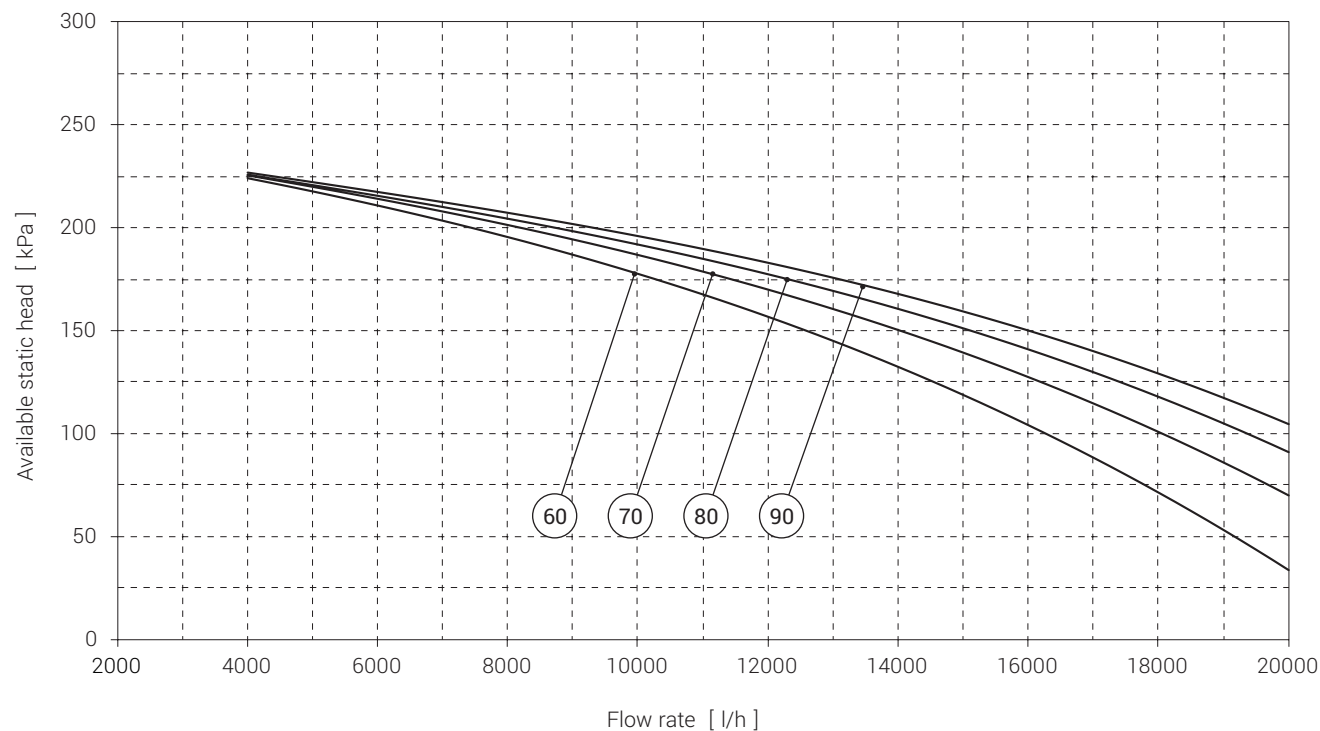
Plant Side Pressure Drops Through ASHP - Unit Without Options



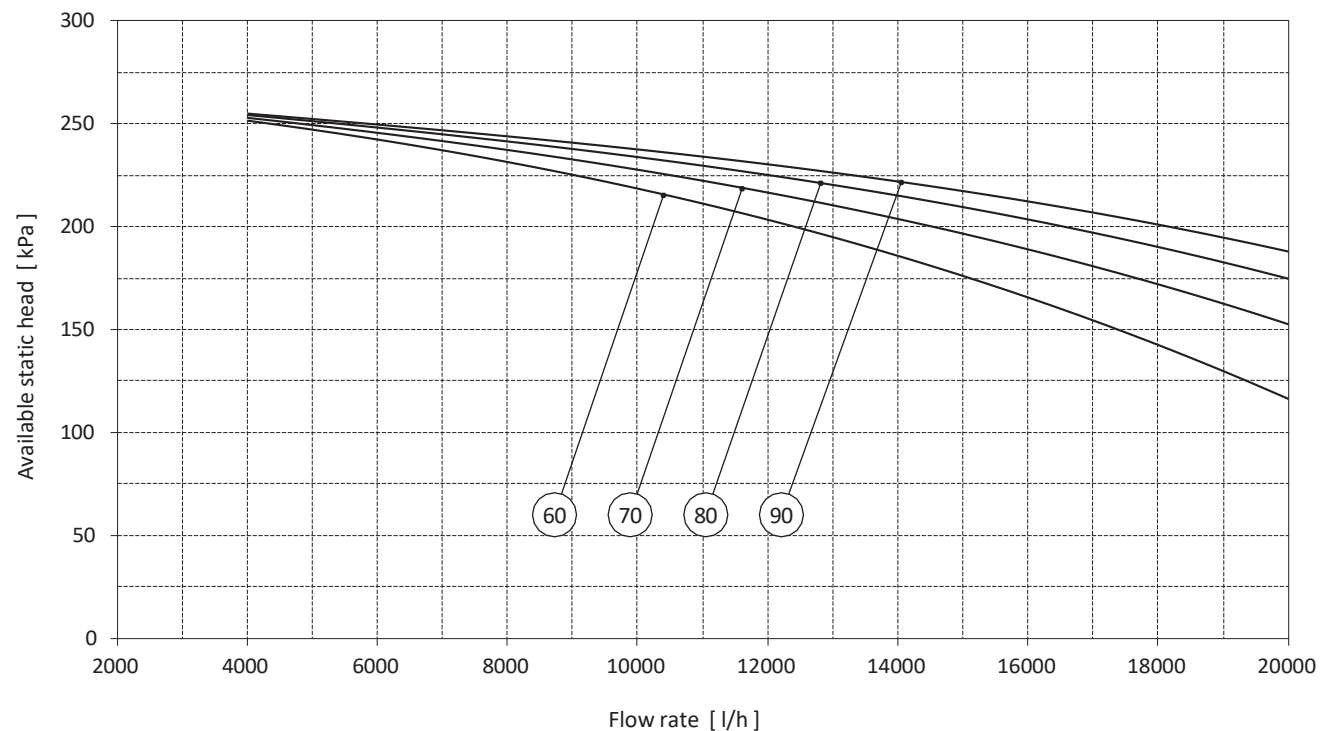
The graphs are referred to units operating with water at 10°C (density 1000 kg/m³).
In the graphs the water filter pressure drops are not taken into consideration.

HYDRAULIC PERFORMANCES

Plant Side Available Static Head - Standard Fixed Speed Pump (Standard Supply)



Plant Side Available Static Head - High Head Pump (Additional option)



Recommended water filter		60	70	80	90	
DN		50 (2")	50 (2")	50 (2")	50 (2")	-
Kvs		37	37	37	37	m³/h

OTHER TECHNICAL DATA

ACOUSTICS PERFORMANCE & DIMENSIONS

	Mod	Sound power levels [dB] by octave bands [Hz]								Sound power level		Sound pressure level		
		63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1m	5m	10m
Low noise	60	81,9	79,8	78,1	74,4	70,9	66,7	61,0	53,5	86	77	59	50	45
	70	82,3	80,2	78,5	74,8	71,3	67,1	61,4	53,9	86	77	60	50	45
	80	82,9	80,8	79,1	75,4	71,9	67,7	62,0	54,5	87	78	60	51	46
	90	83,8	81,7	80,0	76,3	72,8	68,6	62,9	55,4	87	78	61	52	47

Reference conditions

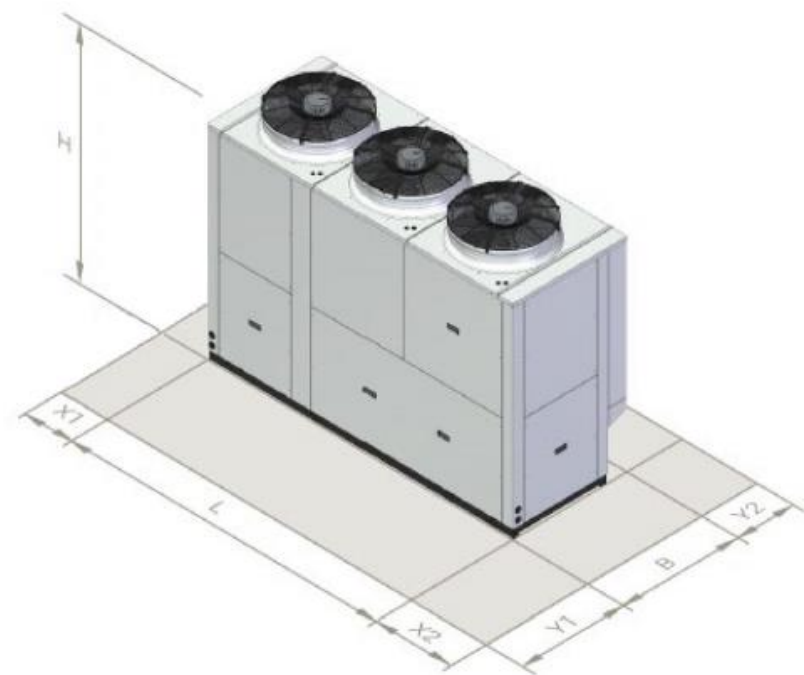
Performances related to units operating in heating mode at nominal conditions A7W35.

Unit placed in free field on reflecting surface (directional factor equal to 2).

The sound power level is measured according to ISO 3744 standard.

The sound pressure level is calculated according to ISO 3744 at various distances from the external surface of the unit.

DIMENSIONS & MAINTENANCE OPERATING AREA:



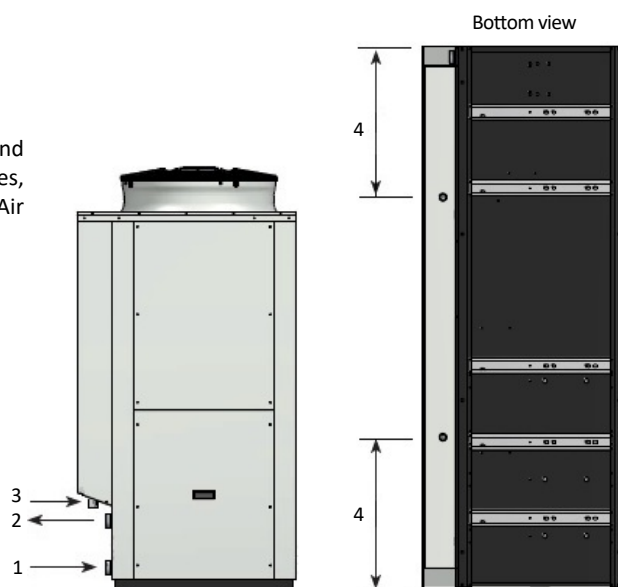
Overall dimensions					
	60	70	80	90	
L	2480	2480	3230	3230	mm
B	930	930	930	930	mm
H	1830	1830	1830	1830	mm
X1	200	200	200	200	mm
X2	500	500	500	500	mm
Y1	1000	1000	1000	1000	mm
Y2	500	500	500	500	mm

X1, X2, Y1, Y2 : Maintenance Operating Area

Transport dimensions					
	60	70	80	90	
L	2550	2550	3300	3300	mm
B	1000	1000	1000	1000	mm
H	2000	2000	2000	2000	mm

WARNING: The X1, X2, Y1 & Y2 maintenance operating area does not cover the required safety area clearances. This clearance is to ensure correct operation and allow for the appliance to be maintained. For the required safety area clearances, please see pages 19 - 22 and points 7 & 8 on page 26 under the "Open Air Installation."

Hydraulic fittings		60	70	80	90
1	Plant side INLET			G 2" M	
2	Plant side OUTLET			G 2" M	
3	Condensate waste outlet			G 1" M	
4	To centre of condensate waste			690mm	



OTHER TECHNICAL DATA - ATEX & SAFETY ZONES

R290 ASHP ATEX and Safety Zones

R290 refrigerant (propane) once released to atmosphere is a flammable heavier than air gas and suitable precautions around the unit(s) need to be taken in the unlikely event of an unplanned leak due to damage to the unit or a failed component.

Therefore, a suitable ATEX and safety zone around the Air Source Heat Pump(s) is required as per EN378. Within these two zones you must not have sources of ignition or openings into buildings, i.e. windows and doors, air intakes, or other electrical mechanical equipment which is not valid for the type of atmosphere. Stagnation or re-pooling of the R290 refrigerant must also be avoided. Therefore, there must be no drains or gullies leading to drains also within these safety zones.

To allow the dilution of any R290 refrigerant to a level below its lower flammability level the units must be placed outdoors in open air (Class III installation to EN 378-1).

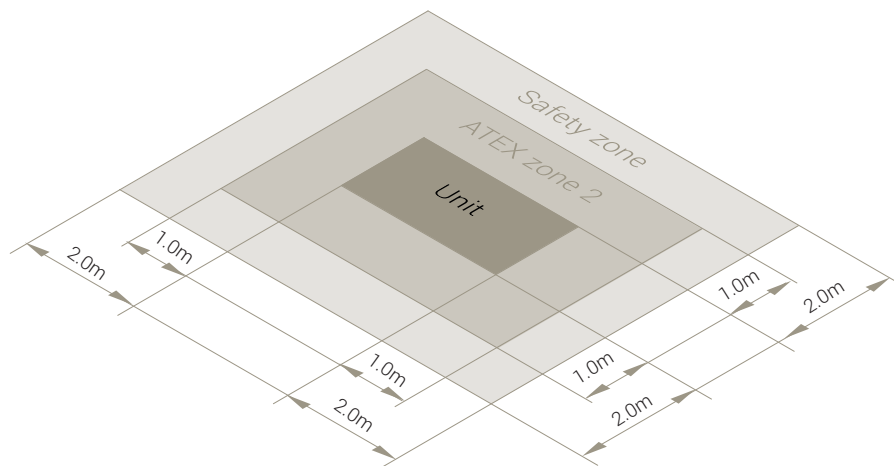
A standard open-air installation will have minimum physical objects around the unit(s) so that any air movement can flow over and around the installation and so dilute and disperse any leaked R290 quickly and safely.

It is also possible to install these units in a compound, but to meet the open-air installation definition; the compound needs to be open above the units and on at least one of the long sides also be open, with free air for at least 80% of that side elevation and if there is a barrier along that 80% side elevation i.e. louvres / or fencing, then there is a requirement for that barrier to have a free area of at least 75%.

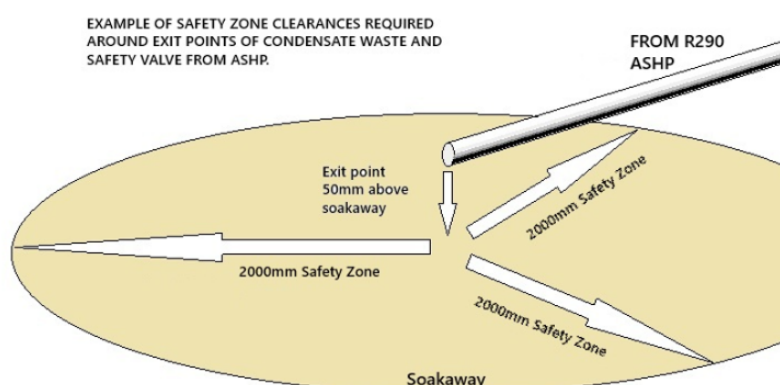
Where an open-air installation cannot be guaranteed, meaning that air flow around the installation can stagnate, leaked R290 may re-pool and travel beyond the perimeter of the safety zone depending on the topography of the installation i.e. falls towards drains. In this case advice from the Manufacturer must be sort.

Minimum Clearances - Single S-ASX-NT Installation

With a single S-ASX-NT installation, the below drawings shows the required ATEX zone (1 metre) and safety zone (2 metre) clearance.



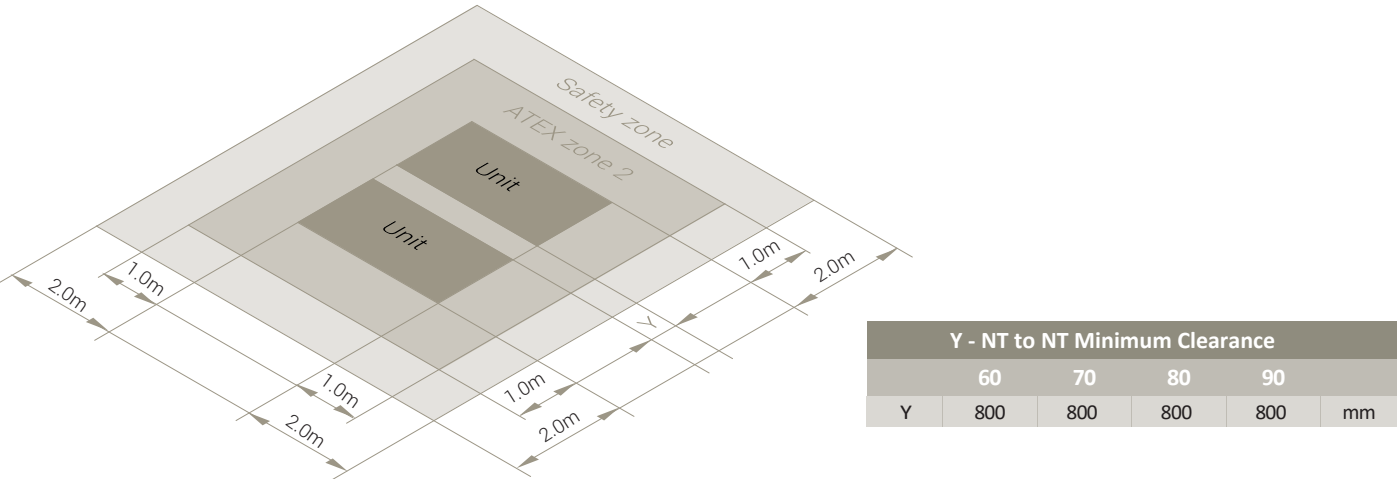
You must also ensure a safety zone area (2 metres) around the exit points of the internal pressure relief valve and the condensate drain pipework connect to the S-ASX-NTi ASHP - see below drawing.



OTHER TECHNICAL DATA - ATEX & SAFETY ZONES

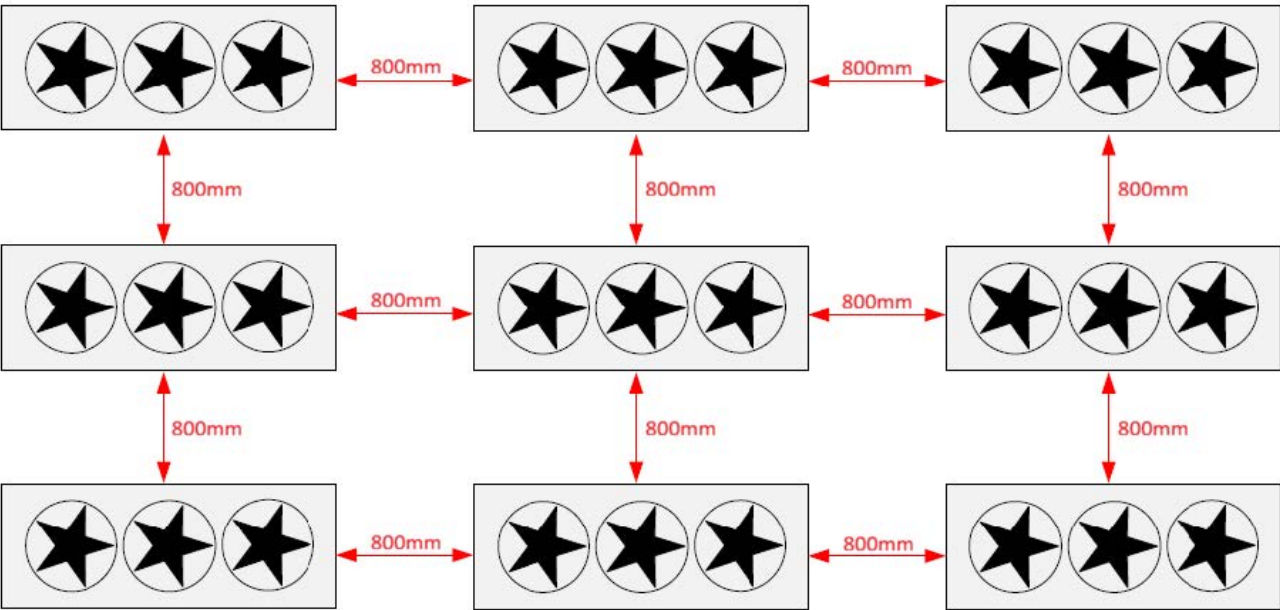
Minimum Clearances - S-ASX-NT to S-ASX-NT ASHP in Cascade

The below drawing shows the required minimum clearance around multiple S-ASX-NT ASHPs for ASHP to ASHP clearance, the ATEX zone (1.0 metre) and the safety area zone (2 metres).



- When two or more units are installed in cascade within the same cascade setup along with the cascade software activated:
- The ATEX zone 2 clearance (1.0 metre) and the safety zone clearance (2.0 metres) must be met considering the overall area occupied by ALL units in cascade.
 - Between the units, the clearance of the ATEX zone 2 and the safety zone is not required.
 - The required clearance between the units as shown by Y supersedes the maintenance clearance of Y1 = 1000mm.

The below drawing is a birds eye view showing the required minimum clearances between the S-ASX-NT ASHPs being installed in cascade within the same cascade system.



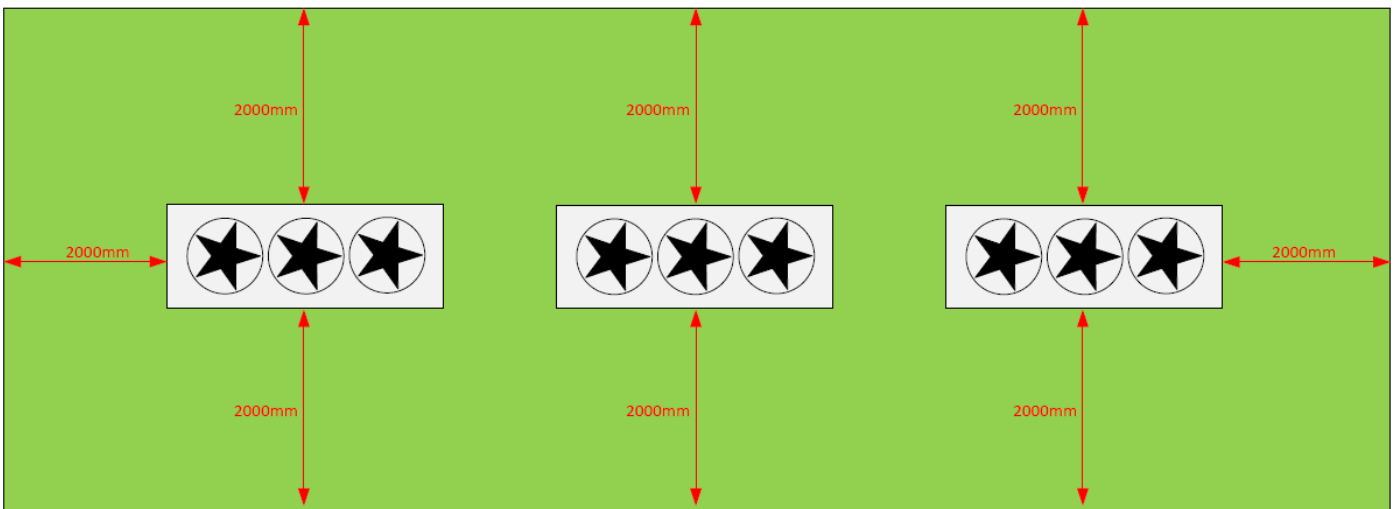
OTHER TECHNICAL DATA - ATEX & SAFETY ZONES

Safety Zone Clearance - For S-ASX-NT ASHPs

Within the safety zone, there **must not be** sources of ignition and all possible stagnations of refrigerant must be prevented. In addition to no ignition sources, the following must not be within this zone:

- Drains.
- Water harvesting systems.
- Any type of entries into buildings.
- Air Intakes.
- Other electrical mechanical equipment.

The below drawing is a birds eye view showing the required safety zone clearances around the S-ASX-NT ASHPs.



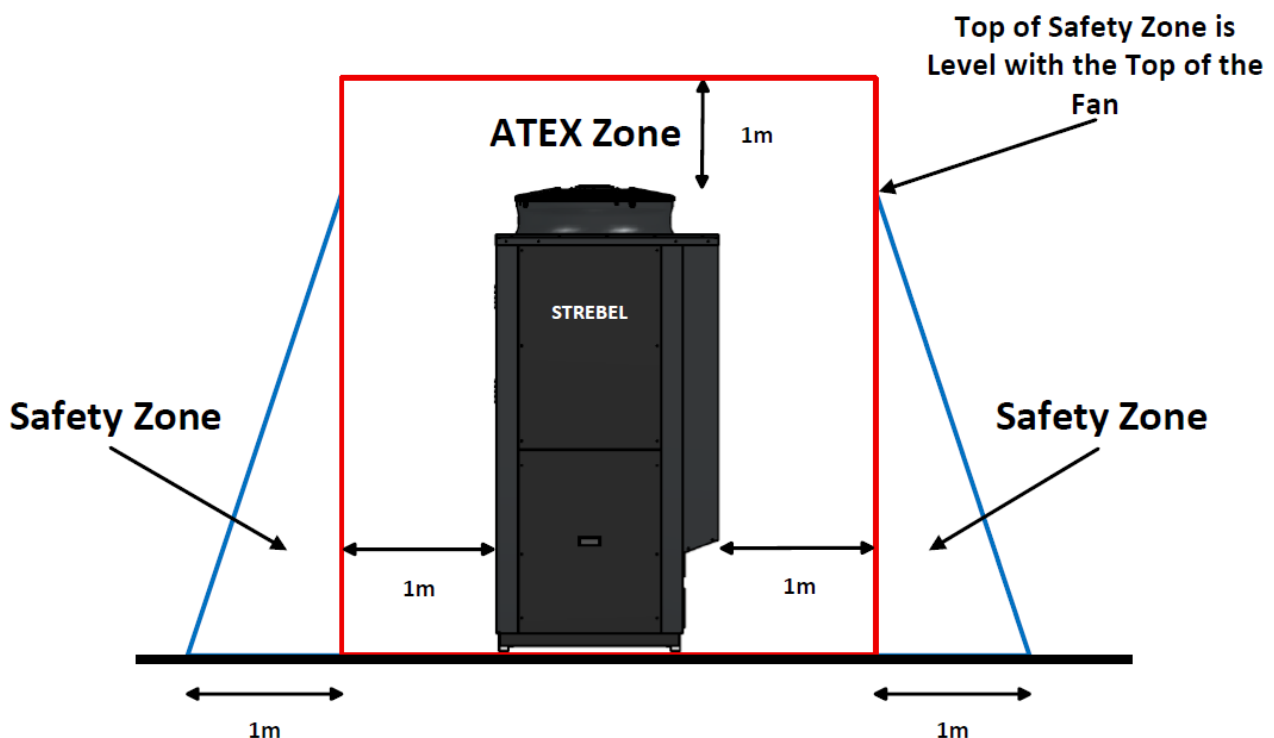
The below drawing is a side on view showing the required clearances for the ATEX zone and safety zone.

The ATEX zone is required around and above the S-ASX-NT ASHP - highlighted by the red lines.

The safety zone is required around the S-ASX-NT ASHP - highlighted by the blue lines.

The safety zone begins after the 1 metre ATEX zone inline with the top of the fan assemblies.

Due to the characteristics of R290 being heavier than air, the safety zone slopes away from the ASHP to ground level.



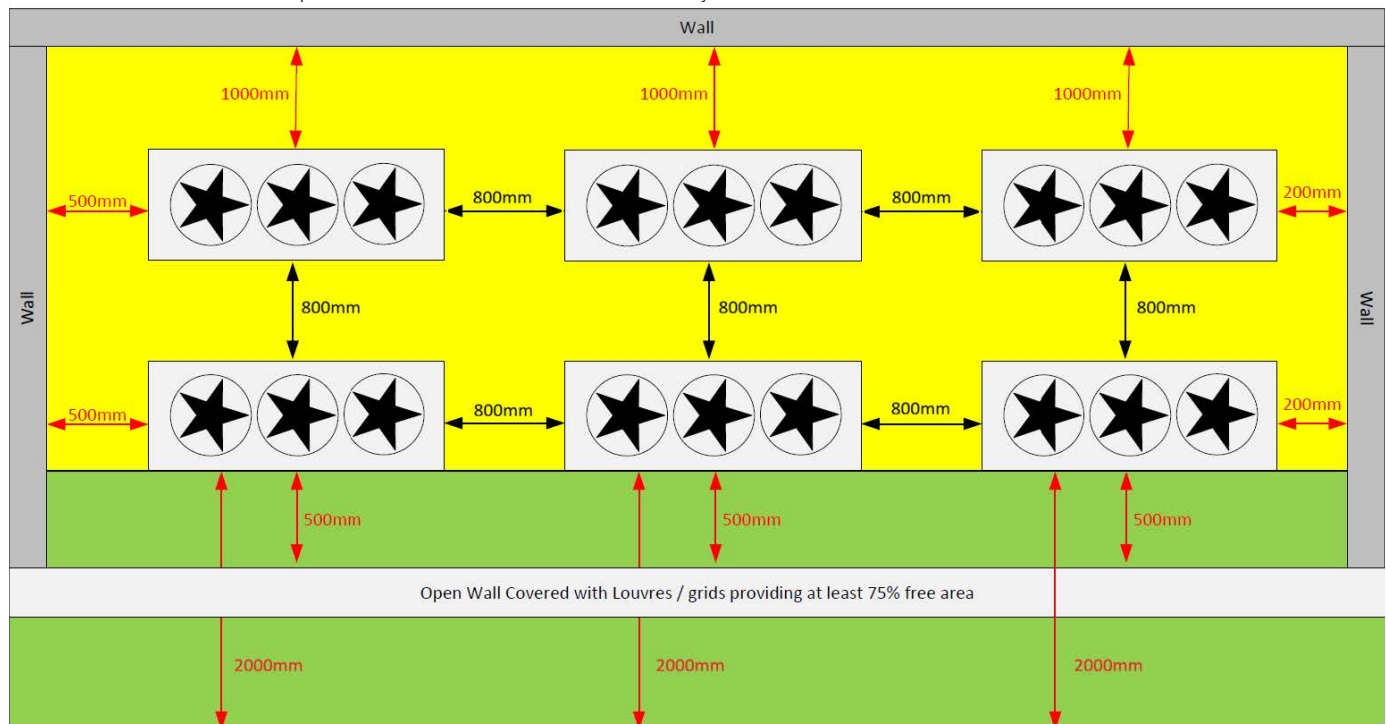
OTHER TECHNICAL DATA

Open Air Installation - S-ASX-NT ASHP

The S-ASX-NT ASHP range are designed for outdoor installation in open are (Class III installation to EN 378-1).

An open air installation can be defined as inside an outside open roof top compartment / room where at least one of the long walls is open to outside free air for at least 80% of the wall area and it is covered with louvres / grid providing for a free area of at least 75%.

See below installation example which includes the 2000mm safety zone.



*** The above drawing shows the S-ASX-NT ASHP in the orientation of the electrical panel facing the north wall.

Important Notes:

With this type of installation, the following must be in place as a minimum:

- The roof must be an open top with no restrictions (such as overhanging trees, building structures etc.) within 3 metres directly above the ASHP's.
- The surrounding walls must be a minimum of 1500mm higher than the S-ASX-NT ASHP (1830mm height + 1500mm = 3330mm).
- The minimum clearances between the ASHP's and the walls must match the operating / maintenance clearances as shown within this installation manual.
- A risk assessment is completed by a certified health and safety personnel to ensure of no risk of R290 refrigerant accumulated and stagnating in an area within this area.
- Clear and suitable signage is placed around the area for all the public to see. The key warning signs to include: Flammable gas, no entry to unauthorised personnel, no smoking or naked flames.

OTHER TECHNICAL DATA

Electrical Data

Unit Without Options			60	70	80	90	
	Power supply		400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	-
	FLA	Maximum total current input	48.9	54.9	68.5	74.5	A
	FLI	Maximum total power input	28.8	32.4	40.6	44.2	kW
	MIC	Maximum total start current with soft starter (standard)	90	103	124	139	A

Standard Supply

The below measurements are based on what is supplied as standard within each S-ASX-NT ASHP, which includes the internal primary shunt pump.

ASHP with Fixed Speed Pump (Standard Supply)			60	70	80	90	
	Power supply		400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	-
	FLA	Maximum total current input	52.7	58.7	72.3	78.3	A
	FLI	Maximum total power input	30.52	34.12	42.32	45.92	kW
	MIC	Maximum total start current with soft starter (standard)	90	103	124	139	A

Additional Option - High Head Non Modulating Pump

The only additional option available that will alter the electrical data is replacing the internal modulating shunt pump with a "high head" non modulating pump to overcome the resistance within the primary circuit which the standard modulating pump is unable to.

ASHP with High Head Pump (Additional Option)			60	70	80	90	
	Power supply		400V - 3 - 50Hz	400V - 3 - 50Hz	400V - 3 - 50Hz	400V - 3 - 50Hz	-
	FLA	Maximum total current input	55.3	61.3	74.9	80.9	A
	FLI	Maximum total power input	32.24	35.84	44.04	47.64	kW

The main power supply to each S-ASX-NT ASHP **MUST** be protected with a breaker external to the ASHP and rated to cover the above requirements (commonly rated to the next size up).

For example, with a S-ASX NT 70 with the standard fixed speed pump, the maximum draw off is 58.17A therefore the next size up for the breaker size would be 63A.

We would also recommend the type of breaker to be either a type C or D because of the type of electrical components used within air source heat pumps. Please see the "Electrical Connections" chapter for recommended cabling size.

Weights

Components Weight			60	70	80	90	
Options	Unit without options	R - Heating and cooling	636	642	775	782	kg
	Acoustic setting up	S - Low noise acoustic setting up	55	55	67	67	kg
	Pump Options	Modulating pump	34	34	36	36	kg
		High head pump	25	25	26	26	kg

Transport Weight			60	70	80	90	
Options	Unit without options	R - Heating and cooling	654	660	795	802	kg
	Acoustic setting up	S - Low noise acoustic setting up	55	55	67	67	kg
	Pump Options	Modulating pump	34	34	36	36	kg
		High head pump	25	25	26	26	kg

Operating Weight			60	70	80	90	
Options	Unit without options	R - Heating and cooling	650	657	800	809	kg
	Acoustic setting up	S - Low noise acoustic setting up	55	55	67	67	kg
	Pump Options	Modulating pump	36	36	39	39	kg
		High head pump	27	27	29	29	kg

TRANSPORT

UNIT TRANSPORTATION

General information

This paragraph provides some general information about the main transport regulation that must be applied when transport of the present equipment is carried out.

The manufacturer is in no way liable for incorrect, imprecise, or missing information in this paragraph, nor it is for damages, harms or incidents, even when serious, experienced by persons or property in connection with information that may be implicit in or inferred from this. Please refer to the applicable regulations for the complete list of provisions that must be applied.

The present equipment is a refrigerating machine whose transport must be carried out ensuring compliancy with all National and local regulations on transport, existing in all the countries through which the units are going to transit.

Main Directives and regulations that can be applied in Europe are:

- ADR (The Agreement concerning the International Carriage of Dangerous Goods by Road)
- IMDG Code (International Maritime Dangerous Goods) for transport by sea
- IATA (International Air Transport Association) for air carriage

These Directives and Regulations are updated periodically. A check must be made when the carriage is performed to guarantee the conformity to the currently applicable version.

The manufacturer shall notify the quantity and type of refrigerant filled in the unit(s) to the people in charge of organising the shipment to manage transport operations in conformity with the regulations above.

Transport by road: ADR directive

According to ADR, refrigerants are classified into Class 2 of dangerous goods, that includes:

- Class 2.1: flammable gases (A2L, A2, A3 refrigerants) which are considered all as flammable with no distinction between mild (2L), medium (2) or high (3) flammability.
- Class 2.2: non-flammable, non-toxic gases (A1 refrigerants)

According to the class of refrigerant filled in, the refrigerating machines can be classified in:

- UN 3358: Refrigerating machines containing flammable, non-toxic, liquefied gas, for 2.1 class refrigerants.
- UN 2857: Refrigerating machines containing non-flammable, non-toxic gases, for 2.2 class refrigerants.

The present equipment is a refrigerating machine filled with flammable refrigerants (A3), so classified as:
UN 3358: Refrigerating machines containing flammable, non-toxic, liquefied gas, for 2.1 class refrigerants.

ADR Directive specifies some special conditions when its provisions can be totally or partially exempted, that can be considered to meet less stringent requirements when the hauled units contain refrigerants.

- Full exemption related to quantities.
Refrigerating machines are not subject to the provisions of ADR if they contain less than 12 kg of refrigerant of class 2.2 per unit (special provision 119) or if they contain less than 12 kg of refrigerant of class 2.1 per unit (special provision 291). Anyway, the total amount of refrigerant carried out on a single transport unit must not exceed the same limit (1000 units) as calculated for the partial exemption conditions.
- Partial exemption related to quantities (ADR Directive 1.1.3.6) If the amount of refrigerant filled in each refrigerating unit exceeds 12 kg, if the total quantity of refrigerant carried out on a transport unit does not exceed the values of 1000 units calculated in accordance with 1.1.3.6.4 of ADR Directive, ADR provisions can be fulfilled under partial exemption conditions.

The total quantity of refrigerant expressed in units is a weighted calculation of the quantity of refrigerant contained in each unit, where class 2.2 refrigerants (A1) weight 1, and class 2.1 refrigerants (A2L, A3) weight 3.

Example: if a single transport unit includes 100kg of A1 refrigerant and 50kg of A3 refrigerant, the calculation brings to $100 \times 1 + 50 \times 3 = 250$ units below the limit of 1000 units, and a partial exemption ADR transport can be carried out.

Please refer to ADR Directive for a complete description of all ADR requirements, and information that must be included in transport documents.

Transport by sea: IMDG Code

IMDG Code uses the same classification of ADR for refrigerants and refrigerating units.

Refrigerating machines containing less than 12 kg of refrigerant of class 2.2 or class 2.1 per unit are exempt from IMDG code.

No partial exemption of IMDG provisions can be applied if the refrigerating units containing more than 12kg of refrigerant per unit, and IMO Declaration must be issued.

If the goods are hauled either totally or partially via ocean/sea freight, the Multimodal Dangerous Goods Form must be filled out.

Please refer to IMDG for a complete description of all requirements, and information that must be included in transport documents.



RECEIVING AND STORING

RECEIVING

Receiving operations must be carried out in specifically identified, duly ventilated areas, in conformity with the existing regulations, in which no flammable material and possible sources of ignition are present.

Inspection upon arrival

As soon as the unit is received verify accurately the correspondence of the load to what was ordered to make sure that all the material has been delivered. Check carefully that the load has not been damaged. In case of goods with visible damages inform promptly the haulage contractor reporting on the delivery note the phrase “Collected with reserves owing to evident damages”. Delivery ex works implies reimbursement of any damage on charge of the insurance company as established by law.

If refrigerant leaks are identified, the event must promptly be reported to the designated safety manager who shall take all necessary actions, as specified in the existing regulations, to secure the unit and shall provide for proper ventilation in addition to removing any sources of ignition if still present.

Safety instructions

Observe the safety regulations in force concerning the equipment to be used for unit handling or the operating formalities to follow.

Handling

Before handling the unit, check the weight of the unit, reported both on the data plate and on the technical documentation. Make sure the unit to be handled with care avoiding any kind of collision that could damage the operating parts of the unit. On the packaging of the unit are reported all the instructions necessary for a correct handling during storing and installation.

The unit is supplied on pallet or wood supports suitable for the transport. It is advisable to place protective material between the truck and the unit to avoid damages to the unit. Prevent the unit or parts of it from falling.

STORING

The units must be stored under safe conditions in conformity with the applicable regulations in force (some requirements may depend on the quantity of refrigerant contained in the unit). If requested suitable fire prevention measures must also be implemented.

The manufacturer shall in no way be liable for events resulting from storage and siting against applicable local standards and regulations.

All possible sources of ignition in the stocking area must be removed. Naked flames and heat sources must not be used near the stocked units.

Periodically check for refrigerant leaks in the stored unit. This inspection must be carried out by duly trained and authorised staff. Where leaks are identified, the event must promptly be reported to the designated safety manager who shall take all necessary actions to secure the area, as specified in the existing regulations. The leak testing process must be performed before starting any type of work on the unit.

The units must be stored in a dry place, repaired from sun, rain, sand or wind.

Do not stack the units.

Maximum temperature	=	47 °C
Minimum temperature	=	-22 °C
Humidity	=	90 %

Packaging removal

Before removing the packaging, a leak testing process must be performed.

Remove the packaging taking care not to damage the unit. Check for any visible damage.

Get rid of the packaging material sending them to specialize recycling centres (observe the regulations in force).

INSTALLATION SITE

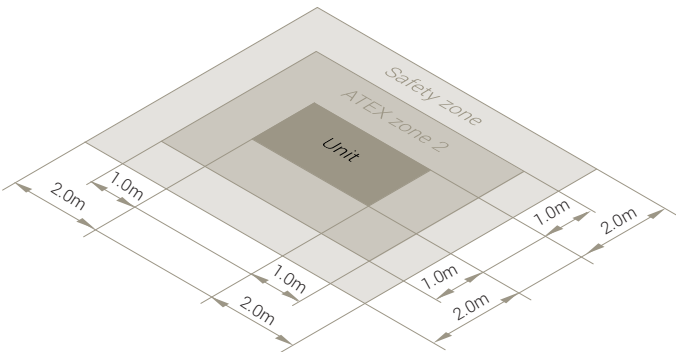
IMPORTANT

The unit must be installed according to the requirements of local regulations in force in the place of installation, in particular taking into account the category of occupation of the premises and the safety class of the refrigerant.

The following indications refers to the European standard EN378-1. Local regulations in force must also be considered and applied.

The units are designed for **outdoor installation in open air** (Class III installation according to EN378-1) where safety distances are guaranteed and natural ventilation is not hindered. EN378-1 defines specific access category that must be respected according to the safety class of the refrigerant (A3) and the refrigerant charge.

Refrigerant Charge	Access Category
Up to 5 kg	(a) General Access : Rooms, parts of buildings, building where sleeping facilities are provided, people are restricted in their movement, an uncontrolled number of people are present, any person has access without been personally acquainted with the necessary safety precautions
Up to 10 kg	(b) Supervised Access : Rooms, parts of buildings, buildings, where only a limited number of people may be assembled, some being necessarily acquainted with the general safety precautions of the establishment
more than 10 kg	(c) Authorized Access : Rooms, parts of buildings, buildings where only authorized persons have access, who are acquainted with general and special safety precautions of the establishment and where manufacturing processing or storage of material or products take place



Open Air Installation

The installation supervisor (customer, installer, consultant ...) must evaluate the features of the installation site in order to guarantee it can be classified as an open air installation site (class III according to EN 378-1). In particular the following factors must be evaluated to guarantee hazardous situations cannot arise in the event of a gas leak age.

- 1 - The positioning must guarantee that, in case of **refrigerant leaks** from the unit, the refrigerant must not be able to flow into enclosed spaces or other places where it could stagnate and create a flammable atmosphere or harming persons or property. Particular attention must be paid to ventilation fresh air openings, entry into buildings, drains, rainwater harvesting systems, technical room intakes...
- 2 - No sources of ignition must be present in the installation area.
- 3 - For open air installations where **stagnation** of refrigerant leakages may occur (for example installation in areas below the prevailing ground level or in the presence of parapets in roofs) an accurate risk assessment must be carried out applying all the precautions necessary to guarantee the safety of the installation.
- 4 - Where the unit is installed in the open air, but under a **shelter**, ventilation and a minimum clearance of 3m above the unit must be guaranteed.
- 5 - Installation is considered to be open air type if the installed unit is **inside a room** where at least one of the long walls is open to the outside air for at least 80% of the wall area (or equivalent if more than one wall must be outside) and it is covered with louvres/grids providing for a free area of at least 75%. Stagnation of refrigerant must be in any case evaluated and prevented.
- 6 - If **acoustic fencies** or other enclosures are installed around the unit, they must not create areas where leaks can stagnate and permit refrigerant diluition in the surroundings.
- 7 - The area around the unit is classified as "**Atex zone 2**". The extension of this area is 1.0 metre all around the unit. Inside this zone all the prescriptions of ATEX directive must be applied.
- 8 - Basing on the extension of the Atex zone 2 around the unit, a **safety area** of 2 metres all around the unit must be respected. Inside this area no ignition sources are allowed and all possible stagnations must be prevented. The following elements must NOT be present : drains, rainwater harvesting systems, air intakes, entry into buildings, technical room intakes, other electric mechanical equipment ... Refer to national or local regulations on this issue, where applicable.

POSITIONING / WATER QUALITY / GLYCOL

Before positioning the unit a **risk assessment of the installation area** must be carried out by the installation supervisor, considering the features of the installation site, the features of the unit and applying all the regulations in force. If necessary, a safety plan must be implemented to protect the safety of the people directly involved considering in particular local regulations about temporary worksites.

Location

Verify that the support surface can bear the weight of the selected unit and that it is perfectly horizontal.

Respect the minimum operating area and verify that the installation site is not subject to flooding.

In any case it is not advisable to place the unit near private offices, bedrooms or zones where very low noise levels are required.

Vibration Dampers (Mandatory Installation)

In order to limit the vibrations transmitted by the unit it is possible to place, between the unit base and the support surface, a strip of hard rubber or, if a higher level of insulation is required, vibration dampers (supplied with ASHP as standard). Moreover in order to guarantee to avoid vibration propagation along the hydraulic pipes flexible pipes are suggested.

Installation in Saline Environments

The unit is NOT suitable for installation in saline environments despite having hydrophilic aluminium coils that provide greater resistance to corrosion than natural aluminium coils. To increase the protection in such environments, special surface protection treatments are required on the coil (contact presales service for further information).

Installation in Areas Subject to Snow

In case of heavy snow, the coil may become clogged and require manual cleaning to restore normal operation. In environments with frequent snowfalls, consider protecting the coil from snow accumulation by raising the heat pump from the ground and/or installing protective caps.

Frost Protection

In case of outdoor installation or in an environment where the air temperature can drop below 0°C, it is necessary to protect the fluid contained in the hydraulic circuit from the risk of freezing. The control system of the unit includes a series of algorithms that ensure the protection of the unit.

If the unit is not electrically powered for long periods of time and with external temperatures below 0°C, it is however necessary to empty the hydraulic circuit to prevent it from freezing.

Alternatively, it is possible to use a mixture of water and glycol with an adequate concentration according to the minimum expected outdoor air temperature (see paragraph "Hydraulic connections").

Reference Values for the System Water

The characteristics of the water used in the system must comply with the values indicated in the table. Otherwise warranty rights will be lost.

Reference values		
pH	7,5 ... 9,0	-
Total hardness	0,5 ... 15	°f
Electric conductivity	< 800	µS/cm
Cl ⁻	< 50	ppm
Fe ³⁺	< 0,5	ppm
Other components	< 0,1	ppm

Use of Water and Glycol Solutions

The unit can work with solutions of water and ethylene or propylene glycol up to 30% concentration by volume. Using water and glycol solutions the performance of the unit compared to operation with water will be reduced. It is therefore recommended to use the percentage of glycol strictly necessary to protect the unit down to the minimum expected outdoor air temperature.

Glycol

Based against a selection of Glycol in the 30% mix will have the following impacts compared to water:

- Specific heat capacity: 3.85 kJ/kg·K (vs 4.18 for water) = 0.92 factor
- Density: 1.025 kg/L (vs 1.00) = 1.025 factor
- Viscosity: 2.5 mPa·s (vs 0.65) = 3.8× increase

Design Implications

1. Pump selection: Increases head by 15-20% for viscosity.
2. Heat exchanger: De-rates capacity by 8-12%.
3. Buffer vessel: Increases volume by 15 - 25% from the minimum water content to maintain thermal inertia.
4. Expansion vessel: Size for 6% expansion (vs 4% for water).

As data sheet COP is calculated to EN14511 any modifications to published COP will only be indicative (as it's not possible to test to the EN14511 methodology using Glycol mix). Having said that it is fair to assume, based on the Specific Heat Reduction and increased viscosity, a reduction in COP of circa 10% as well as a reduction in Output of the same – compared to water only.

Connections

Hydraulic Connections

To design properly the hydraulic system respect the local safety regulations in force.

The hydraulic circuit (on the plant side) must be equipped with a safety valve. To maintain the circuit under pressure a self-filling group, that automatically fills the circuit, can be installed.

It is MANDATORY to install a water FILTER on each ASHP inlet in order to avoid the entrance of foreign substances, otherwise warranty rights are lost. The filter must guarantee a degree of protection at least equal to the one of a mesh filter with hole diameter of 1 mm.

Calibration of Water Flow Rate

It is always necessary to guarantee a proper water flow rate through the plate heat exchanger of the unit.

Each appliance comes with an internal fixed speed shunt pump sized to overcome the resistance of ASHP PHE and flow to a hydraulic separator, such as a thermal store or direct to an indirect DHW cylinder - there is requirement for a commissioning valve per ASHP.

To protect the ASHP, each appliance is installed with a differential water pressure switch that locks the unit if the water flow is too low. The water flow rate values at which the differential pressure switch trips are indicated in the table below (with clean heat exchanger).

It is MANDATORY to install non return valve on each ASHP inlet pipework (return pipework).

Recommendations for the Hydraulic Plant

Prepare the pipes with the minimum possible number of bends in order to minimize pressure losses, and suitably support them to prevent excessive stresses at the connections of the unit. Install shut-off valves near the components that need maintenance, to allow their replacement without having to drain the system. Install automatic air vents in the highest part of the circuit to vent the air.

Make sure there are no leaks before insulating the pipes and filling the system.

In order to avoid condensate generation in cooling mode insulate all the pipes using steam barrier type material.

In closed vessel systems, the installation of an adequate expansion vessel is recommended to compensate for the thermal expansion of the water.

It is MANDATORY for a multiple ASHP installation they they must be installed on a reverse return setup on the primary circuit.

Condensate Drain

All the units are equipped with a drain for the condensate generated by the finned coil during normal heating operation. The connection of the drain is mandatory to avoid the accumulation of water around the unit and the possible formation of ice sheets.

Since refrigerant leaks from the finned coils may flow out through condensate pipework, do not duct the drainage pipe into pits or downpipes or other openings. It is possible to install a combination of a wet trap and an air admittance valve on the condensate pipework run. Please note: 2 Metre safety zone is required around the air admittance valve. It is also possible to install the the condensate waste without a wet trap or admittance valve to an external soak away, terminating approximately 50mm above, a 2 metre safety zone would also be required around the point of termination. **Wet traps or air admittance valves are not supplied by Strebel.**

MINIMUM Water Volume of the System

It is recommended to check that the minimum amount of water available for the unit operation, regardless of the state of the system (closing/opening of the distribution circuits) does not fall in any operating condition below 10 litres per kW of nominal heating capacity.

In this way it is possible to guarantee a sufficient stability of the water temperature and avoid to generate situations that are potentially dangerous for the unit or in any case not very comfortable for the user.

Venting Valve (As Supplied) - MANDATORY

The installation must take additional precautions to prevent **refrigerant leakages** into the hydraulic circuit via the heat exchanger from reaching occupied spaces (as requested for open air installation - class III).

The venting valve must be installed on the flow pipe to each NT ASHP to discharge the refrigerant safely into the atmosphere. It is recommended to install the device as near as possible to the S-ASX-NT ASHP.

Please note: The clearance around the venting valve must match the S-ASX-NT safety zone = 2000mm.

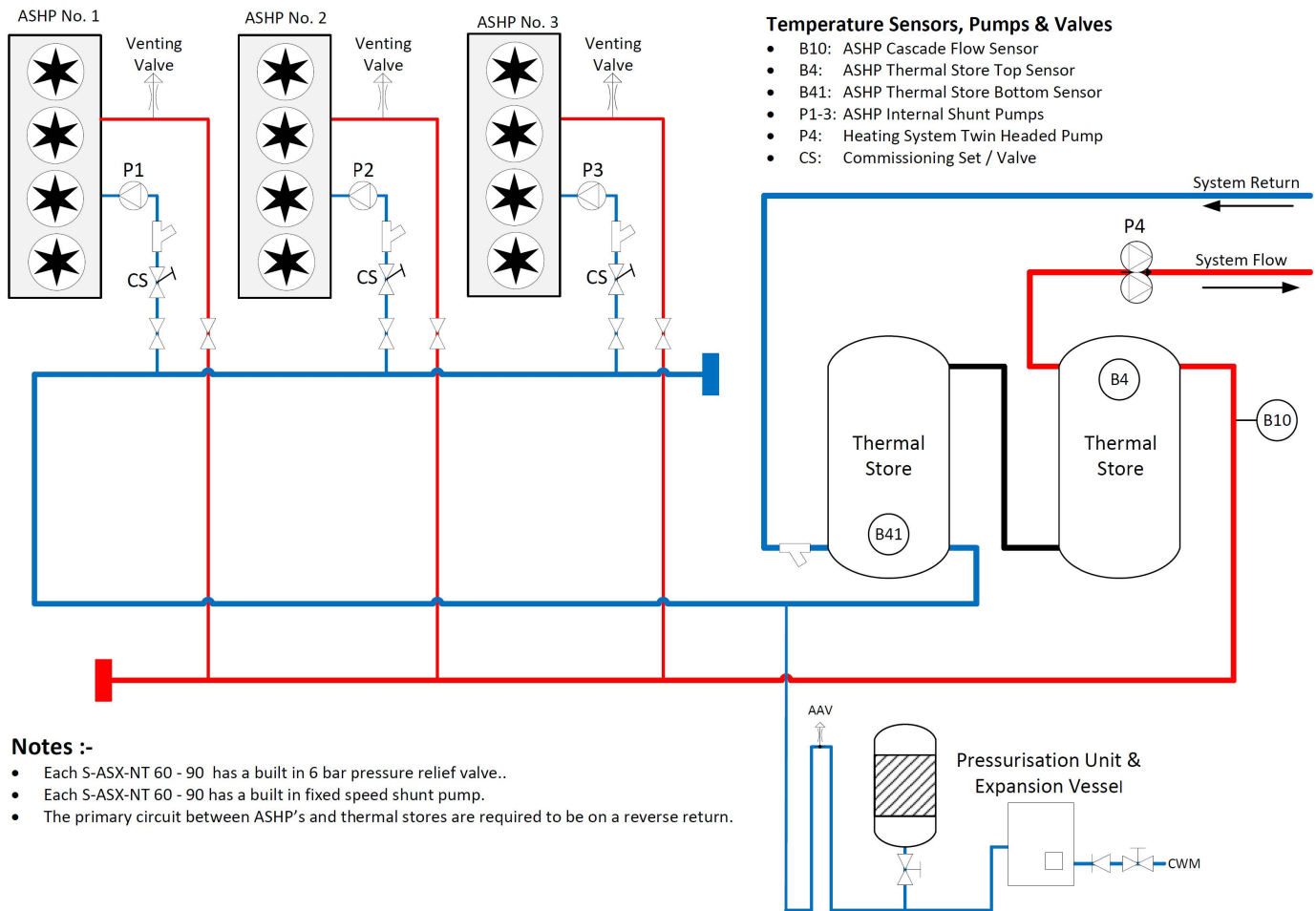
Safety Valve Termination

A 2 metre safety zone is required at the point of the safety valve termination. The safety valve must not terminate in such a way that accumulation and stagnation of refrigerant can occur.

Differential pressure switch threshold	60	70	80	90	
Water flow rate	3000	3600	4300	5000	l/h

Connections

Approved ASHP Setup - Heating Only



Primary Circuit

The primary circuit is known as the circuit starting from the S-ASX-NT air source heat pump(s) to the thermal store.

With each S-ASX-NT ASHP having an internal fixed speed shunt pump, there is a requirement to install components to influence / set the primary flow rate, such as commissioning sets within the primary circuit.

Primary Pipework Sizing

The primary pipework as mandatory requires to be sized to a 5°C dT flow rate based on the ASHP(s) full output at the required flow temperature with the outside air temperature at 7°C, and it is recommended to follow the guidance of CIBSE for selecting pipework sizes which is currently as follows:

1. Pipework velocities to be 0.75 to 1.15 m/sec for 15 – 50mm diameter pipework.
2. Pipework velocities to be 1.25 to 3.0m/sec for 50mm+ diameter pipework.
3. Pipework pressure drop to be 360 pa/m maximum.
4. End of system component pressure drop of 28kPa maximum (thermal store).

Multiple Thermal Stores

Where multiple thermal stores are installed, the requirement is to install the thermal stores in series as shown in the above schematic.

The total volume of the thermal stores as a minimum must be sized to the total ASHP's **nominal** output (based on the required flow temperature with the outside air temperature at 7°C) multiplied by 10 litres. For example, the nominal output of 2 x S-ASX-NT 80's at A7W65 is 134.0kW (67.0kW each) multiplied by 10 is 1,340 litres = Nearest match is 1500 litres (Strebel TSE 1500/3).

The thermal store with the flow pipework installed (primary and secondary system) must have the B4 temperature sensor fitted and the thermal store with the return pipework installed (primary and secondary system) must have the B41 temperature sensor fitted.

Connections

Electrical Connections

The electrical wirings must be carried out by qualified personnel according to the regulations in force at the installation time in the country of installation.



Before starting any work on the electrical circuit make sure that the unit power supply line is disconnected at the start.
N.B. Refer to the electrical diagram enclosed in the unit

Power Supply System

The power cables of the unit power supply line must be connected to :

- For **single phase** power supply : **230V - 1 - 50Hz**
from a single phase voltage system provided with neutral conductor and separated earth wire :
 $V = 230\text{ V} \pm 10\%$ $f = 50\text{ Hz}$
- For **three phase** power supply : **400V - 3N - 50Hz**
From a symmetrical three phase voltage system with neutral conductor and separated earth wire :
 $V = 400\text{ V} \pm 10\%$ $f = 50\text{ Hz}$
- For **three phase** power supply : **400V - 3 - 50Hz**
from a symmetrical three phase voltage system with separated earth wire :
 $V = 400\text{ V} \pm 10\%$ $f = 50\text{ Hz}$

The units are shipped completely factory wired and arranged for the connection to the power supply.

The power cables must enter the unit through the holes on the lateral structure of the unit and must be connected to the power supply terminals of the unit.

Unit Power Supply

The power supply cables must have an adequate section for the power absorbed by the unit and must be chosen in conformity with the regulations in force. **Design the power supply line always referring to the total FLI and FLA values of the unit, taking into account the selected options and the installed accessories.**

It is necessary to provide an adequate earth connection. The manufacturer cannot be considered responsible for any damage caused by inadequate or faulty grounding.

It is recommended to use cables with a section NOT LOWER than that shown in the table, in any case respecting the regulations in force.

It is recommended to keep the supply line as short as possible.

Upstream Protection

An automatic switch suitable for ensuring protection against overcurrents and indirect contacts must be installed upstream each power supply line.

Coordination between line switch must be carried out observing the regulations in force on electrical safety, regarding the type of installation and the installation ambient conditions.

Connections Available for the User

The electrical board of the unit contains some terminals dedicated to the connection of external switches or probes. Carry out all the necessary connections in order to realize the desired plant following the instructions reported in the section "Inputs and Outputs".

ATTENTION

Carry out all the connections outside the unit avoiding the power cables and the probe cables to be coupled.

Secondary Power Supply (230v - 1PH - 50Hz)

All units require a main 3PH power supply line and a secondary 1PH power supply line which is required for the activation of the refrigerant leakage sensor and the extraction fan of the technical compartment).

The secondary power supply line can be supplied from one of the phases from the 3 phase main supply within the ASHP or can be completely independent and possibly connected to a UPS unit (check local regulations) to ensure the operation of safety devices for a period of time even in the event of a main power failure.

S-ASX-NT ASHP Range		60	70	80	90	
Three phase	Power supply	400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	400V - 3N - 50Hz	-
	MINIMUM recommended section	16,0	16,0	25,0	25,0	mm ²

START UP

PRELIMINARY CHECKS

The following operations must be carried out only by properly qualified and trained personnel with the help of suitable equipment (see "Maintenance" paragraph). To make the contractual warranty effective, start-up must be carried out by authorized service centres.

Before calling the service centre it is advisable to make sure that all the installation steps have been completed (positioning, electrical connections, hydraulic connections...) and the risk assessment of the installation (if needed) has been completed by the installation supervisor.

Preliminary checks before turning on,

1. Verify that:
 - The unit has not suffered visible damages due to transport or positioning.
 - The unit is placed on a horizontal surface able to bear its weight.
 - The minimum operating area is respected.
 - The ambient conditions comply with the provided operating limits.
 - The hydraulic and electrical connections have been carried out correctly.
 - The hydraulic circuit has been charged and vented.
 - No leakage is present around the unit inside the defined safety area.
2. Disconnect the power supply line at the start and verify that:
 - The unit power supply line complies with the regulations in force.
 - The screws fastening the electrical cables to the components inside the electrical panel of the unit are well tightened (vibrations during transport phases could have caused some loosening)
3. Connect the unit power supply line and verify that:
 - The voltage of the power supply line complies with the nominal one of the unit.
 - For three phase power supply units, the unbalance between the phases is lower than 2% (a higher value produces an excessive current input on one or more phases causing possible damages to the electrical components of the unit)

NOTE: Example of phase unbalance calculation

- Read the value of the three line voltages using a voltmeter:
line voltage between phases L_1 and L_2 : $V_{1-2} = 390$ V
line voltage between phases L_2 and L_3 : $V_{2-3} = 397$ V
line voltage between phases L_3 and L_1 : $V_{3-1} = 395$ V
- Calculate the difference between the maximum and minimum value of the measured line voltages:
$$\Delta V_{\max} = \max(V_{1-2}; V_{2-3}; V_{3-1}) - \min(V_{1-2}; V_{2-3}; V_{3-1}) =$$
$$= V_{2-3} - V_{1-2} = 397 - 390 = 7 \text{ V}$$
- Calculate the average line voltage value:
$$\Delta_{\text{average}} = (V_{1-2} + V_{2-3} + V_{3-1}) / 3 = (390 + 397 + 395) / 3 = 394 \text{ V}$$
- Calculate the percentage unbalance value:
$$\Delta V_{\max} / V_{\text{average}} \times 100 = 7 / 394 \times 100 = 1,78 \% < 2 \%$$

UNIT START UP

Set date and time:

- Select menu "Service" (⚙)
- Select "Regional settings"
- Modify "Time" and "Date"

To activate the unit in heating or cooling mode enable one of the available digital contacts in order to require the unit to work:

- VK1: Heating request
- VK2: Cooling request

In order to set the set point associated to each request see paragraph "Main functions".

In order to trigger domestic hot water tank charging, select menu "Domestic hot water" (🔌) and set operating mode as "On". Verify that the nominal set point is lower than the temperature read by the control system.

Verify if an active request is present for the heat pump:

- Select menu "Info" (📊)
- Select page "Heat pump"
- Verify the "Setpoint" value:
 - If no numeric value is displayed (--°C) means that no request is present that require the heat pump to work.
 - Verify again the set point selected for the active request.
 - If a numeric value is displayed means that a request is active, and the heat pump is going to start.

Wait the unit and the compressor to start (symbol  on the status bar). Verify that the water temperature on the outlet and inlet of the unit are correct for the active request. Wait that the active request is satisfied and verify that no alarms are tripped (indicated by the symbol  on the status bar).

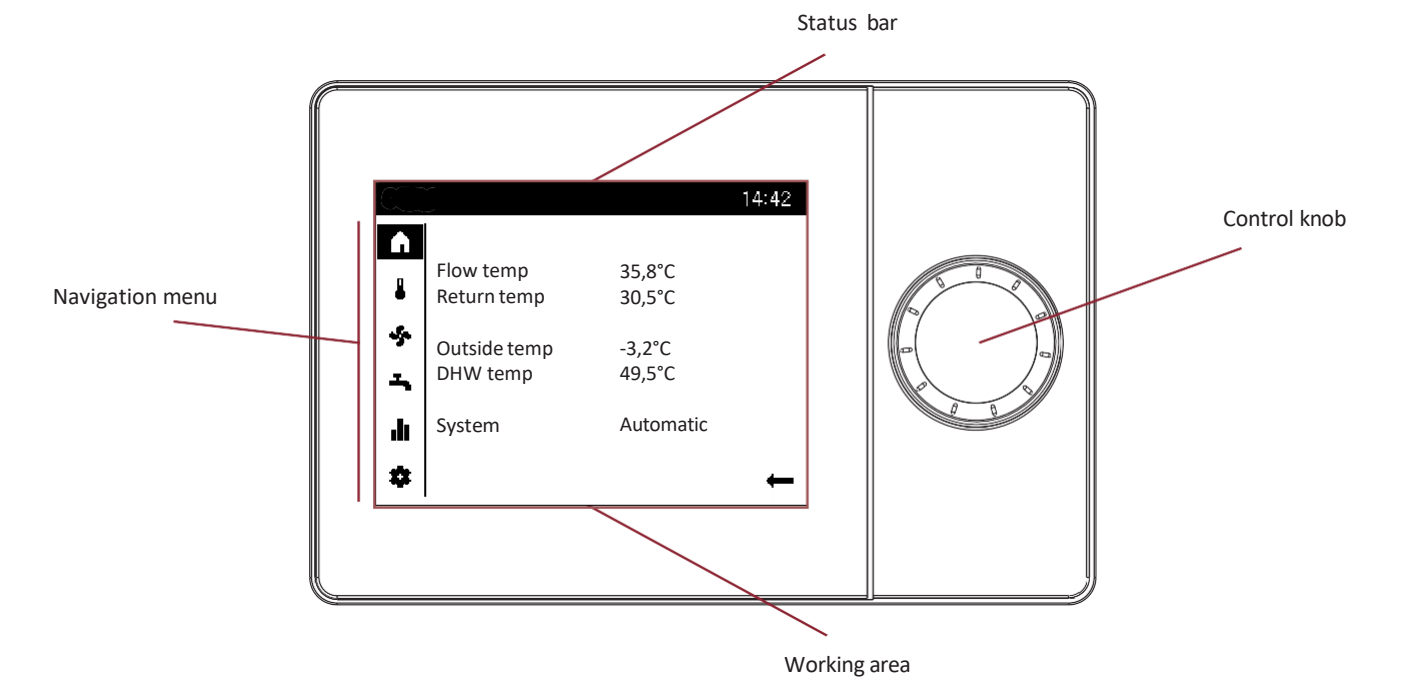


COMPRESSOR CARTER ELECTRICAL HEATER

The heat pump control system manages the activation of an electrical heater placed around the compressor that is activated in order to keep the temperature of the oil contained in the compressor carter high enough to avoid any liquid strokes or poor lubrication at start-up.

In the case of startups with outdoor air temperature below 0°C, it is recommended to power up the unit at least 8 hours before starting the compressor.

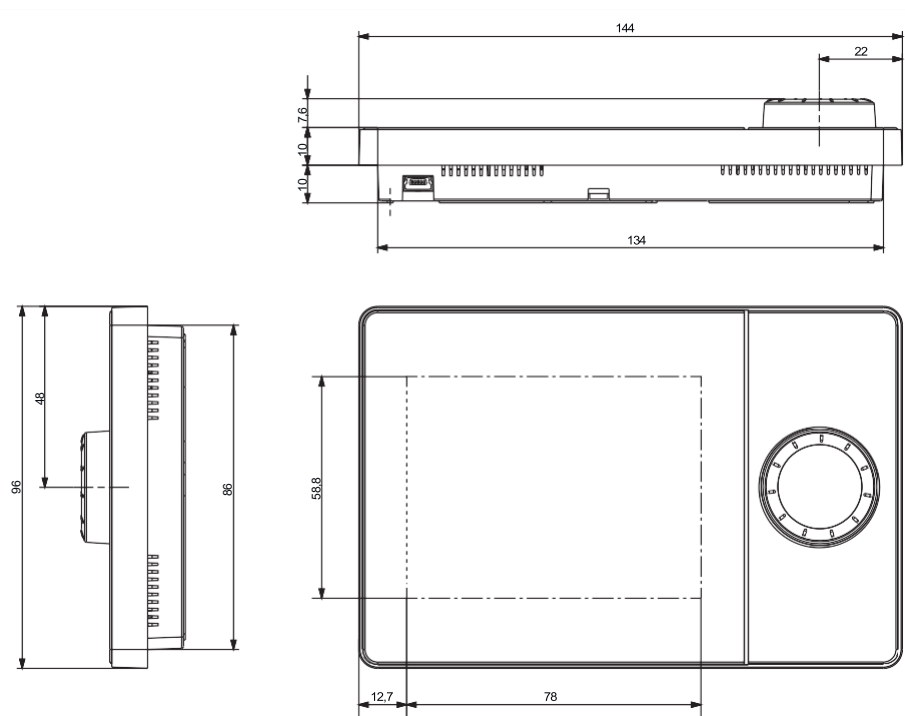
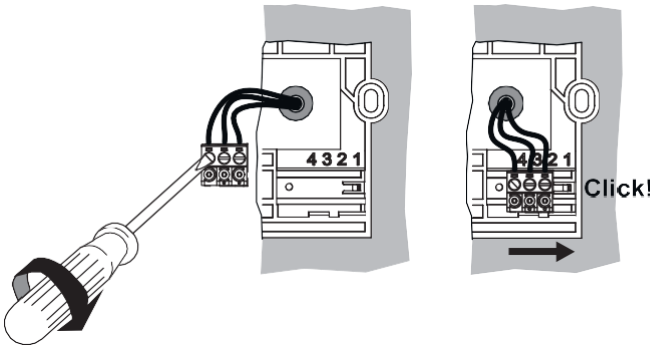
CONTROL SYSTEM



USER INTERFACE

The unit can be managed by means of the remote user interface, equipped with a “push and roll” control knob that allows to navigate inside the different menus and to visualize and modify all the parameters.

The remote user interface is suitable for wall installation.



1	G+ (DC +12V)
2	CL- (GND)
3	CL+ (BSB)

Connect the remote user interface to the unit controller using a 3-wire cable with a minimum section of 0,5 mm² and a maximum length of 200 meters. The remote user interface communicates with the unit controller via the BSB communication bus (see paragraph “Inputs and Outputs” for details on the connection).

CONTROL SYSTEM

Temperature Sensors

Each unit can be equipped with temperature sensors to be placed outside the unit to monitor the temperature of the various points of the system necessary to enable the management of these components.

It is recommended to install these sensors in such a way that the detected temperature is as correct as possible, possibly using immersion wells, conductive paste or insulating tapes.

The characteristic curve of the temperature sensors used is shown in the table.

To check if the probe is working properly, check the correspondence between the actual temperature and the electrical resistance value (measured by a multi-meter).

T [°C]	R [Ω]	T [°C]	R [Ω]	T [°C]	R [Ω]
-30	175203	50	3605	130	298
-25	129289	55	2989	135	262
-20	96360	60	2490	140	232
-15	72502	65	2084	145	206
-10	55047	70	1753	150	183
-5	42158	75	1481	155	163
0	32555	80	1256	160	145
5	25339	85	1070	165	130
10	19873	90	915	170	117
15	15699	95	786	175	105
20	12488	100	677	180	95
25	10000	105	586	185	85
30	8059	110	508	190	77
35	6535	115	443	195	70
40	5330	120	387	200	64
45	4372	125	339		

If it is necessary to lengthen the probe, use a copper cable with a minimum section not less than that shown in the table.

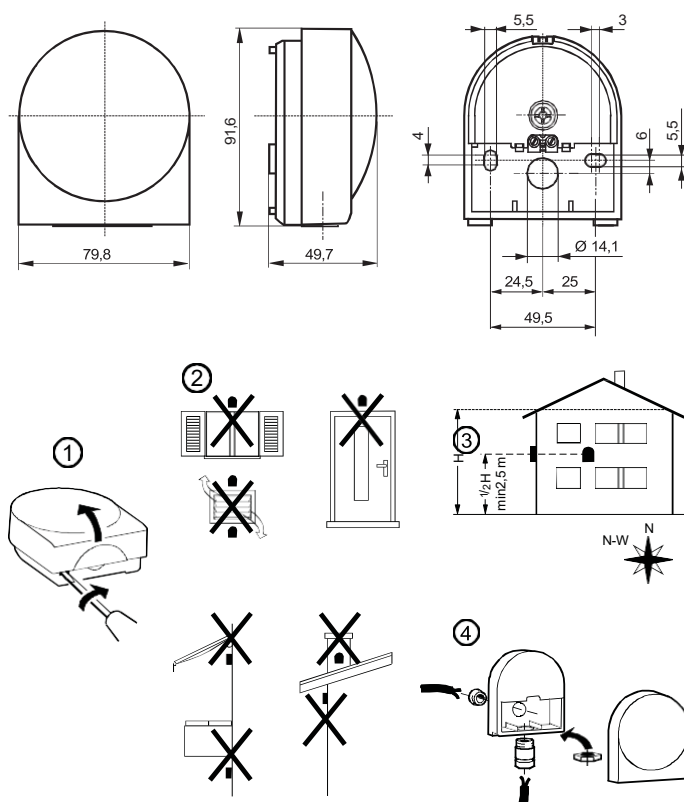
Maximum length (m)	40	60	80	120
Minimum section	0,5	0,75	1,0	1,5

Outdoor Air Sensor

Each unit is supplied with an outdoor air temperature sensor that must be installed outdoor and connected to the heat pump controller (input B9).

The sensor is used to enable the antifreeze protection function and to calculate the flow temperature set point according to the climatic curves set for the heating and cooling circuits.

Follow the instructions reported below to install properly the sensor.



CONTROL SYSTEM

Navigation Menu

The navigation menu consists of a series of icons arranged vertically on the left side of the display.

Navigation within the menu is done by moving the cursor, represented by a frame that wraps the icon above the selected element, by turning the control knob. The information shown on the display updates according to the selected menu. By pressing the knob, the cursor enters the selected menu by positioning itself on the editable items displayed in the work area.

Menu “End user”

The menu visible when the control is started is the menu dedicated to the end user. It is always possible to return the display to this menu by keeping the knob pressed for a few seconds. However, after 8 minutes of inactivity, the device automatically returns to the home page.

Only menus associated with enabled functions are displayed.

	Home	Plant status
	Heating Cooling zones	Heating and cooling circuits status
	Domestic hot water	Domestic hot water status
	Info	Messages: errors / events Heat pump status Operating plant status
	Settings	Settings: date, time, language Special operations Login to “Expert” menu

Menu “Expert”

Besides the “End user” menu, an “Expert” menu is available which allows access to a greater number of information and settings. To access this menu, from the “End user” menu, enter the Settings menu  and select the “Expert” item in the working area. A menu appears prompting you to select a user type and set a password if required.

User	Password
End user	-
Commissioning	-
Engineer	-
OEM	Reserved

Once logged into the “Expert” menu, the navigation menu is updated, and new menus are displayed.

	Diagnostics	Diagnostics and tests for the plant
	Maintenance	Control and regulation functions through access to the complete parameter list
	Info	Messages: errors / events Heat pump status Operating plant status
	Settings	Settings: date, time, language Special operations Login to “Expert” menu

Status Bar

The status bar shows the following information:

-	Date
-	Time
	Active alarm
	Active compressor / Active supplementary source
	Active maintenance

CONTROL SYSTEM



Menu “Expert” - Diagnostics

The following functions are available in the “Diagnostics” menu:

- **Test input/output**
It allows to force the activation of the controller outputs and view the status of all the inputs.
To activate the digital outputs (QX) use parameter 7700 and select the output corresponding to the load to be activated (see table “Inputs and Outputs”).
To activate the analogue outputs (UX) use the parameter corresponding to the analogue output corresponding to the load to be activated (see table “Inputs and Outputs”).
To activate the electronic valves directly managed by the controller (WX), use the parameter corresponding to the output corresponding to the valve to be activated (see table “Inputs and Outputs”).
- **Communication**
Allows to view the parameters relating to communication on the LPB bus (communication with other controllers in cascade)
- **Simulation**
Allows to simulate the value read by the outdoor air sensor.
- **Source**
Allows to view all the available information on the operating status of the heat generators managed by the controller (heat pump, solar panels, additional generators ...)
- **Consumer**
It allows to view all the information available on the operating status of the system (distribution circuits, accumulations, DHW, external air temperature ...)
- **Error history**
Allows you to view the history of the last 10 alarms.
- **Version**
Allows to view the firmware version of the controller and of the remote user interface.



Menu “Expert” - Maintenance

The following functions are available in the “Maintenance” menu:

- **Complete parameter list**
Provides access to the list of all the parameters of the controller. The visibility of the parameters depends on the type of user with whom the menu was accessed.
After a change in the configuration of the unit, it is necessary to exit and re-enter the complete parameter list to allow it to be updated and to display or hide the menus relevant to the new configuration. During this operation, which may last a few minutes, the message “Operator unit being refreshed” appears on the display.

- **Commissioning Wizard**
Provides a guide to the user interface configuration and to the system configuration (NOT necessary).
- **Refresh Operator Unit**
Allows to update the main screens of the end user menu to adapt them to the new configuration set in the parameter’s menu. This line appears automatically only if a refresh is required.

Complete Parameter List

All the parameters of the controller can be visualized and modified within the complete parameter list, accessible via the “Expert-Maintenance” menu.

The parameters are grouped into different submenus and are all identified by a numerical code. Each submenu can consist of several pages indicated at the top right under the status bar. The menus that are not relevant depending on the configuration of the heat pump and the system are automatically hidden.

Menu	Parameters
Time of day and date	1 - 6
Operator section	20 - 70
Time program heating circuit 1	500 - 516
Time program cooling circuit 2	520 - 536
Hourly Schedule 4 / ACS	560 - 576
Heating circuit 1	700 - 900
Cooling circuit 2	1201 - 1269
Domestic hot water	1600 - 1680
Consumer circuit 1 (VK1)	1854 - 1880
Consumer circuit 2 (VK2)	1904 - 1930
Heat pump	2776 - 3080
Supplementary source	3690 - 3755
Buffer	4705 - 4831
Domestic hot water tank	5007 - 5179
Configuration	5700 - 6298
LPB system	6600 - 6650
Fault (Alarms)	6710 - 6820
Service / Special operations	7070 - 7226
Configuration extension modules	7300 - 7512
Input / output test	7700 - 7952
State	8000 - 8070
Diagnostics heat generation	8395 - 8586
Diagnostics consumers	8700 - 9058

CONTROL SYSTEM

Main Functions

Management by means of Digital Inputs

The unit can be managed by means of digital inputs:

- VK1: Heating request (fixed set point)
When the input is active the heat pump is activated in heating mode with a fixed set point on the water outlet (par 1859).
- VK2: Cooling request (fixed set point)
When the input is active the heat pump is activated in cooling mode with a fixed set point on the water outlet (par 1909).

NB. Each digital input generates an independent request. If several digital inputs are active at the same time, the requests are combined each other to obtain a single request to be forwarded to the heat pump. Heating requests always have priority over cooling ones.



Heating and cooling circuits

The heat pump controller can manage heating and cooling distribution circuits with the possibility to define:

- climatic curves
- daily and weekly timetables

HEATING

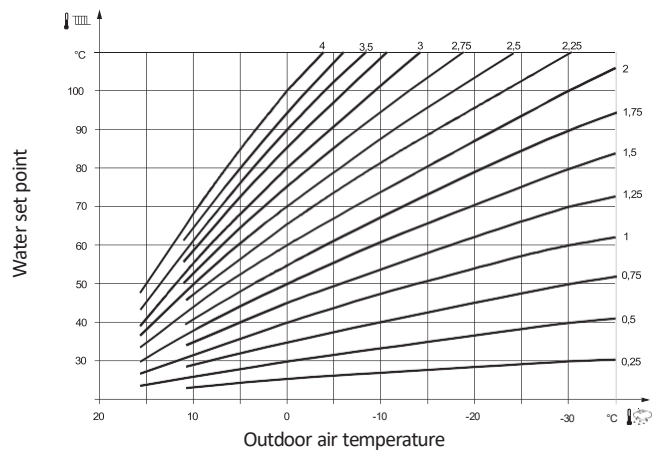
The temperature set point of the water to be sent to the heating circuit terminals is calculated as a function of the outdoor air temperature through a parameterizable climatic curve.

The climatic curve is defined by two parameters:

- Slope (par 720): defines the shape of the climatic curve as indicated in the graph.
- Displacement (par 721): allows you to vertically translate the curve defined by the selected slope.

The climatic curve is defined for an ambient set point of 20°C. If this set point is changed, the set point of the water to be sent to the terminals is changed accordingly.

The set point calculated by the climatic curve is however limited between a minimum (par 740) and a maximum (par 741) value.



Par	Description	Default value
720	Heating curve slope	0,80
721	Heating curve displacement	0,0 °C
740	Flow temp setpoint min	25 °C
741	Flow temp setpoint max	70 °C

CONTROL SYSTEM

COOLING

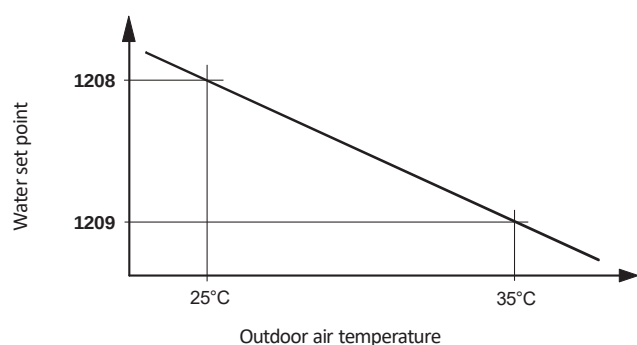
The temperature set point of the water to be sent to the cooling circuit terminals is calculated as a function of the outdoor air temperature through a parameterizable climatic curve.

The climatic curve is defined by two parameters:

- Set point at 25°C (par 1208): defines the water set point at an outdoor air temperature of 25°C
- Set point at 35°C (par 1209): defines the water set point at an outdoor air temperature of 35°C

The climatic curve is defined for an ambient set point of 25°C. If this set point is changed, the set point of the water to be sent to the terminals is changed accordingly.

The minimum value of the set point calculated by the climatic curve is however limited (par 1223 and par 1224).



Par	Description	Default value
1208	Flow temp setpoint at 25°C	16 °C
1209	Flow temp setpoint at 35°C	16 °C
1223	Flow temp setpoint min at 25°C	6 °C
1224	Flow temp setpoint min at 35°C	6 °C

SPACE HEATING/COOLING BUFFER WATER TANK

The controller of the unit allows to manage the temperature of an inertial storage tank that acts as a hydraulic circuit breaker between the distribution circuits (heating and cooling) and the heat generators (heat pump and possible boiler) by means of two temperature probes to be positioned in the upper (B4) and lower (B41) part of the storage tank.

All the heating and cooling requests are combined and generate a set point for the buffer storage tank. If this set point is not satisfied, a heating or cooling request is sent to the available generators.

Both probes are considered to evaluate the achievement of the set point. For the lower probe it is possible to consider a different set point by setting a differential (parameter 4735) compared to the set point calculated for the upper probe in order to take advantage of any stratification within the tank.

Par	Description	Default value
4735	Setpoint reduction B42/B41	0 °C



Supplementary Source

The heat pump controller can manage the integration of a supplementary heat generator (boiler) for both heating and domestic hot water production.

If the heat pump is not able to satisfy the requests autonomously, a digital output (K32) is activated which can be used to enable a supplementary heat generator.

Par	Description	Default value
2910	Release above outside temp	---
3700	Release below outside temp	---

It is possible to limit the enabling of the supplementary generator and also of the heat pump, depending on the outdoor air temperature in order to create a bivalent system.

The supplementary source can be enabled below a settable outdoor air temperature (parameter 3700) while the heat pump can be enabled above a settable outdoor air temperature (parameter 2910). In the temperature range in which both generators are enabled, the heat pump has priority and the supplementary source is activated only in integration, if necessary.



Condensate Coil Tray Electrical Heater

The heat pump controller can manage the activation of an electrical heater or a heating cable to be placed on the condensate tray or in the drainpipe to prevent ice formations from obstructing the draining during winter.

When the outdoor air temperature falls below 2°C, a digital output (K41) is activated during the defrost cycles and remains active for up to 3 minutes after the end of the cycle.

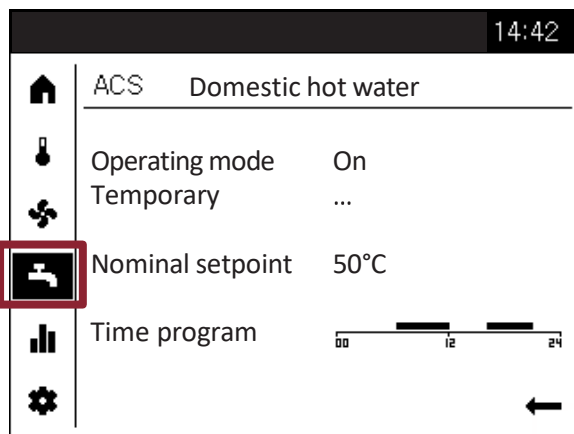
CONTROL SYSTEM



Domestic Hot Water

The heat pump controller can manage domestic hot water production. To enable this function, a temperature sensor (B3) must be placed on the domestic hot water storage tank and connected to the unit controller (see paragraph “Inputs and outputs”).

When the function is enabled in the “End user” navigation menu, the associated icon appears which allows to directly set the operating mode, the nominal set point and, if needed, the time program for domestic hot water. All the other parameters about domestic hot water function can be modified by entering the complete parameter list in the “Domestic hot water” menu.



By setting the operating mode to “On” the heat pump will keep the storage tank temperature close to the nominal set point activating a three way valve (Q3) to divert the flow of the heat pump from the heating / cooling circuits towards the domestic hot water storage tank.

Par	Description	Default value
1600	Operating mode	Off
1610	Nominal set point	50 °C
1612	Reduced set point	40 °C
1620	Release	24 h/day

Usually, the domestic hot water function is enabled 24 hours a day with nominal set point. It is possible to alternate the storage tank set point between the nominal and the reduced one setting a daily and weekly time program dedicated to the domestic hot water function. To enable this function, set parameter 1620 to “Time program 4 / DHW”.

After a refresh of the operator unit, the line related to the domestic hot water time program will become selectable and editable.

It is possible to manage the anti-legionella function to periodically perform heating cycles of the domestic hot water storage tank up to a higher temperature than the nominal set point.

Before enabling this function, it is recommended to check that the heat pump, possibly with the integration of the additional heat generator, can reach the set point temperature set for the cycle.

All the parameters about anti legionella function can be modified by entering the complete parameter list in the “Domestic hot water” menu.

Par	Description	Default value
1640	Legionella funct	Off
1641	Legionella funct periodcally	3 days
1642	Legionella funct weekday	Monday
1644	Legionella funct time	05.00
1645	Legionella funct setpoint	65 °C
1646	Legionella funct duration	30 min

To enable the function, set parameter 1640 to the value:

- Periodically: the cycle is performed at fixed intervals of days. The interval is defined by parameter 1641.
- Fixed weekday: the cycle is performed on the day of the week defined by parameter 1642.

The anti-legionella cycle begins, on the scheduled day, at the time indicated by parameter 1644. The temperature of the domestic hot water storage tank is increased up to the required set point (parameter 1645) and maintained for the required period (parameter 1646).

DISCHARGING PROTECTION VALVE

The controller of the unit allows to manage, besides the three-way valve (Q3) which diverts the flow of hot water between heating and domestic hot water storage tank, also another three-way valve (Q33) to be installed downstream of the first one to avoid to send water inside the storage tank that is not hot enough to heat the storage tank.

Use of the digital output Q33

The three-way valve Q33 can be controlled via a digital output (two position valve). The controller opens the three-way valve only when the heat pump flow temperature (B21) is higher than the storage temperature (B3).

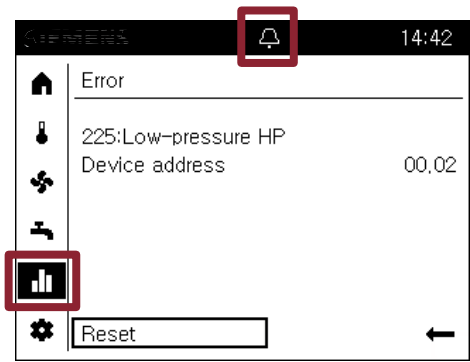
Use of the analogue output Q33 and sensor B36

The three-way valve Q33 can be controlled via an analogue output (modulating valve). The controller adjusts the opening of the three-way valve in order to keep the storage tank charging temperature (B36) higher than the storage tank temperature (B3).

CONTROL SYSTEM

Alarms

When an alarm is active the alarm symbol appears on the status bar. The details of the alarm are visible in the INFO menu.



To reset the alarm:

- Select "Reset" with the control knob
- Press the control knob and the text changes to "Confirm"
- Press the control knob again to reset the alarm

Alarm Output

When an alarm is active, a digital output of the controller of the unit (K10 / K46) is activated which can be used to communicate to an external device the presence of an active alarm (see paragraph "Inputs and outputs"). The alarm output is deactivated when the alarm is reset. It is possible to deactivate only the alarm output (without resetting the alarm) via parameter 6710 (accessible from the complete parameter list).

Alarms Log

To see the Alarm log enter the "Fault" menu (parameters 6800-6819). The controller stores the last 10 events. The last event is stored deleting the oldest one. As soon as an alarm is triggered, the Alarm log stores the event with the following information:

1	Alarm number (history)
2	Time and date of the alarm
3	Alarm code
4	Alarm description

Alarm Reset

- There are three groups of alarms according to the type of reset:
- Manual reset (M): when the alarm is no more active it is necessary to reset it manually. It is advisable to verify accurately the cause that originated the alarm and to make sure that the problem has been solved before restarting the unit.
 - Automatic reset (A): as soon as the alarm is no more active, the unit is automatically reset.
 - Automatic reset with events (R) : the alarm is automatically reset only if the number of events in an hour is less than a fixed threshold. Otherwise, a manual reset is required.

CONTROL SYSTEM

Alarms Table

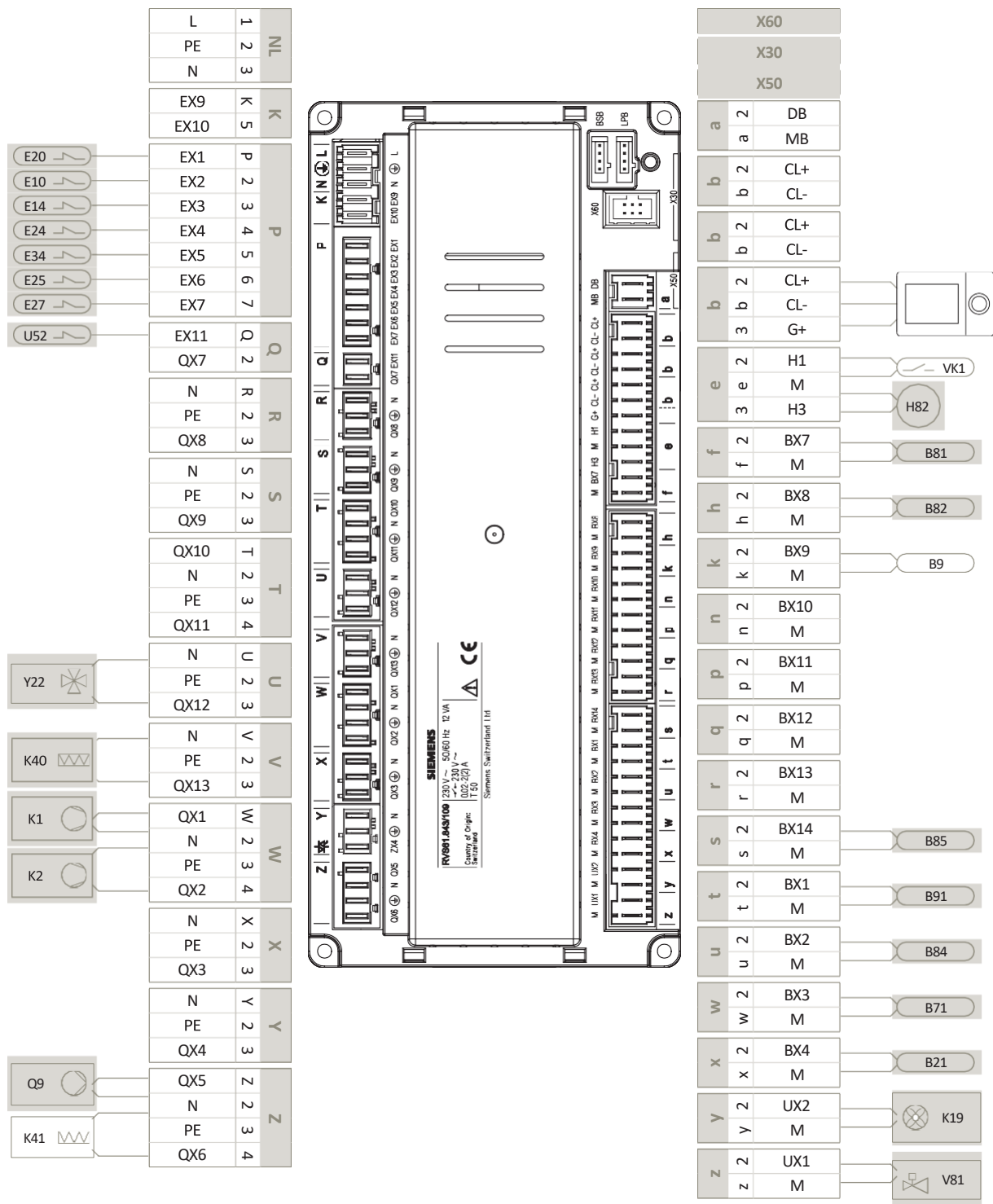
Code	Description	Reset	Input	Unit locked	Solution
10	Outdoor air temperature sensor	A	B9	No	Verify sensor connection
33	User side heat pump outlet temperature sensor	A	B21	No	Verify sensor connection
35	Source side heat pump inlet temperature sensor	A	B91	Yes	Verify sensor connection
36	Compressor 1 outlet temperature sensor	A	B81	No	Verify sensor connection
37	Compressor 2 outlet temperature sensor	A	B82	No	Verify sensor connection
39	Evaporator temperature sensor (coil)	A	B84	Yes	Verify sensor connection
44	User side heat pump inlet temperature sensor	A	B71	No	Verify sensor connection
50	DHW tank sensor 1 sensor	A	B3	No	Verify sensor connection
70	Buffer tank sensor 1 sensor	A	B4	No	Verify sensor connection
71	Buffer tank sensor 2 sensor	A	B41	No	Verify sensor connection
83	BSB short circuit	A	-	No	Verify connection cable with remote user interface and extension modules
84	BSB address collision	A	-	No	Verify configuration of remote user interface and extension modules
106	Source temperature too low	M	-	Yes	Verify sensor B91 connection Verify if the outdoor air temperature is inside the operating range
107	High temperature compressor 1 outlet	R	-	Yes	Verify sensor B81 connection Verify refrigerant leaks
108	High temperature compressor 2 outlet	R	-	Yes	Verify sensor B82 connection Verify refrigerant leaks
134	Phase sequence controller alarm	R	E20	Yes	Verify presence and sequence of power supply phases
138	Heat pump control sensor missing	A	-	Yes	Verify if all the sensors are connected and that the value read is reasonable Verify the configuration of all the inputs (see table "Inputs/Outputs")
146	Configuration error	A	-	No	Verify configuration parameters
201	Frost protection alarm	M	B21	Yes	Verify sensor B21 connection Verify that the unit can work on a water volume high enough to guarantee a proper unit working (see paragraph "Hydraulic connections")
204	Fans thermal protection	R	E14	Yes	Verify fans connection and their thermal protection inside the electrical panel of the unit
222	High pressure	R	H83	Yes	Verify the setting of the maximum water outlet temperature (according to the ,IT value adopted) Verify expansion valve connection (V81) Verify high pressure sensor connection (H83)
223	High pressure on start heating circuit	M	H83	Yes	
224	High pressure on start DHW	M	H83	Yes	
225	Low pressure	R	H82	Yes	Verify refrigerant leaks with a refrigerant leak detector If the alarm appears in cooling mode verify the water temperature, the set point adopted, and that the unit can work on a water volume high enough to guarantee a proper unit working (see paragraph "Hydraulic connections")

CONTROL SYSTEM

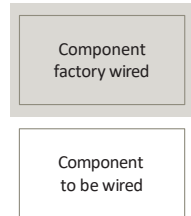
Code	Description	Reset	Input	Unit locked	Solution
247	Defrost alarm	R	-	Yes	Verify coil status and, if frozen, force a defrost cycle (parameter 7153) Verify refrigerant leaks with a refrigerant leak detector
320	DHW charging temperature sensor	A	B36	Yes	Verify sensor connection
324	BX sensors with the same function	A	-	No	Two inputs are configured in the same way Verify BX inputs configuration
325	BX sensors with the same function on extension modules	A	-	No	
330	BX1 no function	A	-	No	Sensor connected but not configured Verify input configuration
331	BX2 no function	A	-	No	
332	BX3 no function	A	-	No	
333	BX4 no function	A	-	No	
335	BX21 no function	A	-	No	
336	BX22 no function	A	-	No	
356	User side flow switch	R	E24	Yes	Flow lack on the user side heat exchanger Verify that the system is well vented Verify pump connection Verify if the water filter is clean
358	Soft starter compressor 1 alarm	R	E25	Yes	Verify soft starter status Verify that the power supply voltage is inside the recommended limits (see paragraph "Electrical connections"). The alarm trips also to indicate a too low voltage power supply.
361	Sensor B91 missing	A	-	No	Verify sensor connection
363	Sensor B84 missing	A	-	No	Verify sensor connection
373	Extension module 3	A	-	No	Verify connection between main controller and extension modules
447	BX6 no function	A	-	No	Sensor connected but not configured Verify input configuration
452	H1 no function	A	-	No	Input connected but not configured Verify input configuration
453	H3 no function	A	-	No	
457	BX7 no function	A	-	No	Sensor connected but not configured Verify input configuration
462	BX8 no function	A	-	No	
463	BX9 no function	A	-	No	
464	BX10 no function	A	-	No	
465	BX11 no function	A	-	No	
466	BX12 no function	A	-	No	
467	BX13 no function	A	-	No	
468	BX14 no function	A	-	No	
469	HX21 no function	A	-	No	Input connected but not configured Verify input configuration
470	HX22 no function	A	-	No	
476	Compressor inlet temperature sensor	A	B85	Yes	Verify sensor connection
477	Evaporating pressure sensor	A	H82	Yes	Verify sensor connection
480	EVI inlet temperature sensor	A	B86	Yes	Verify sensor connection
481	Evaporating EVI pressure sensor	A	H86	Yes	Verify sensor connection
483	Soft starter compressor 2 alarm	R	E27	Yes	Verify soft starter status
488	Condensing pressure sensor	A	H83	Yes	Verify sensor connection
491	Maximum evaporating temperature	R	-	Yes	In heating mode: verify if the outdoor air temperature is inside the allowed operating range In cooling mode: verify if the water temperature is inside the allowed operating range
495	Modbus no communication	A	-	No	Verify Modbus port configuration
500	Modbus configuration error	A	-	No	
505	Expansion valve	M	-	Yes	Verify expansion valve connection (V81)

CONTROL SYSTEM

Inputs and Outputs



CONTROL SYSTEM

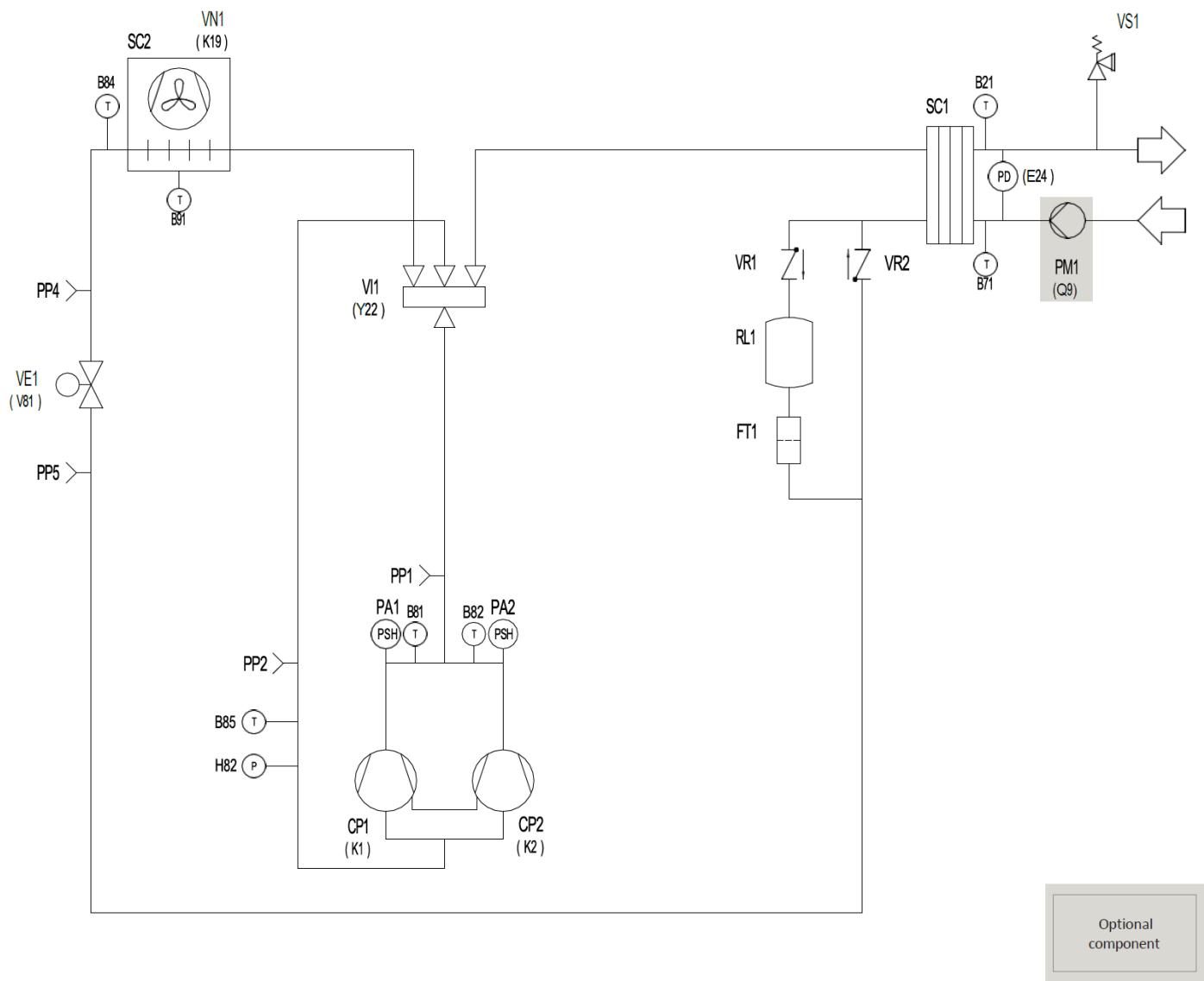


CONTROL SYSTEM

Inputs and Outputs Table

	ID	Use	Description	Features	To be wired
Analog inputs	BX1	B91	Source side air inlet temperature	NTC	-
	BX2	B84	Coil temperature	NTC	-
	BX3	B71	User side water inlet temperature	NTC	-
	BX4	B21	User side water outlet temperature	NTC	-
	BX7	B81	Compressor 1 outlet temperature	NTC	-
	BX8	B82	Compressor 2 outlet temperature	NTC	-
	BX9	B9	Outdoor air temperature	NTC	x
	BX10	-	-	NTC	-
	BX11	-	-	NTC	-
	BX12	-	-	NTC	-
	BX13	-	-	NTC	-
	BX14	B85	Compressor inlet temperature	NTC	-
	BX21 mod3	-	-	NTC	-
	BX22 mod3	-	-	NTC	-
Analog / digital inputs	H1	VK1	Heating request	voltage free digital input	x
	H3	H82	Compressor inlet pressure	ratio metric sensor 0-5 V	-
	H21 mod3	-	-	ratio metric sensor 0-5 V	-
	H22 mod3	VK2	Cooling request	voltage free digital input	x
Digital inputs	EX1	E20	Phase sequence controller alarm	230 Vac digital input	-
	EX2	E10	High pressure switch	230 Vac digital input	-
	EX3	E14	Fans thermal protection	230 Vac digital input	-
	EX4	E24	User side flow switch	230 Vac digital input	-
	EX5	E34	Electronic expansion valve driver alarm	230 Vac digital input	-
	EX6	E25	Soft starter compressor 1 alarm	230 Vac digital input	-
	EX7	E27	Soft starter compressor 2 alarm	230 Vac digital input	-
	EX9	-	-	230 Vac digital input	-
	EX10	-	-	230 Vac digital input	-
	EX11	U52	User pump inverter alarm	230 Vac digital input	-
	EX21 mod 3	-	-	230 Vac digital input	-
Analog outputs	UX1	V81	Electronic expansion valve	0-10 Vdc	-
	UX2	K19	Fans	0-10 Vdc	-
	UX21 mod3	Q9	User side pump	0-10 Vdc	-
	UX22 mod3	-	-	0-10 Vdc	-
	WX21 mod3	-	-	unipolar EEV	-
Digital outputs	QX1	K1	Compressor 1	2A - 230 Vac	-
	QX2	K2	Compressor 2	2A - 230 Vac	-
	QX3	-	-	2A - 230 Vac	-
	ZX4	-	-	2A - 230 Vac	-
	QX5	Q9	User side pump	2A - 230 Vac	-
	QX6	K41	Condensate tray electrical heater	2A - 230 Vac	x
	QX7	-	-	2A - 230 Vac	-
	QX8	-	-	2A - 230 Vac	-
	QX9	-	-	2A - 230 Vac	-
	QX10	-	-	2A - 230 Vac	-
	QX11	-	-	2A - 230 Vac	-
	QX12	Y22	Cycle reversing valve	2A - 230 Vac	-
	QX13	K40	Compressor carter electrical heater	2A - 230 Vac	-
	QX21 mod3	-	-	2A - 230 Vac	-
	QX22 mod3	-	-	2A - 230 Vac	-
	QX23 mod3	K81	Electronic expansion valve driver enables	voltage free digital output	-

OPERATING DIAGRAM



CP	Compressor
SC1	User side heat exchanger
SC2	Source side heat exchanger
PA	High pressure switch
RL	Liquid receiver
VE	Expansion valve
VI	Cycle reversing valve
VR	Non return valve

VT	Shut off valve
FT	Filter
VN	Fan
PM	Pump
PD	Differential pressure switch
PP	Pressure intake
HX	Pressure sensor
BX	Temperature sensor

CASCADE MANAGEMENT

If multiple heat pumps are installed in a system, then **STREBEL** recommends installing them utilising the built-in cascade management system in order to optimise the efficiency of the heat pumps along with the complete system. When using the integrated cascade control, a maximum of 16 heat pumps can be controlled. When using the cascade control, the demand signal, temperature sensors, DHW three-way valve and any immersion heaters need to wire back to the 'Master' heat pump.

Cascade management is a function already embedded in the controller of each heat pump and allows to coordinate the operating mode of more units (up to 16) in heating, cooling, and domestic hot water production. It is possible to use inside the same cascade heat pumps of different capacity.

The heat pumps are activated in a sequence according to the thermal requests coming from the plant with a logic which integrate during the time the difference between the required set point and the temperature actually reached. A common flow temperature sensor (B10) is required for an optimized cascade management.

The heat pump activation sequence changes automatically according to the operating hours of each heat pump in order to guarantee a balanced use of all the units. As an alternative it is possible to define a fixed activation sequence or exclude from the automatic rotation the first or the last heat pump to be used.

If double compressor units are used in the cascade, the first compressor of each heat pump is activated in sequence, and after that, if necessary, also the second compressor is activated, in order to optimize the part load efficiency of each unit.

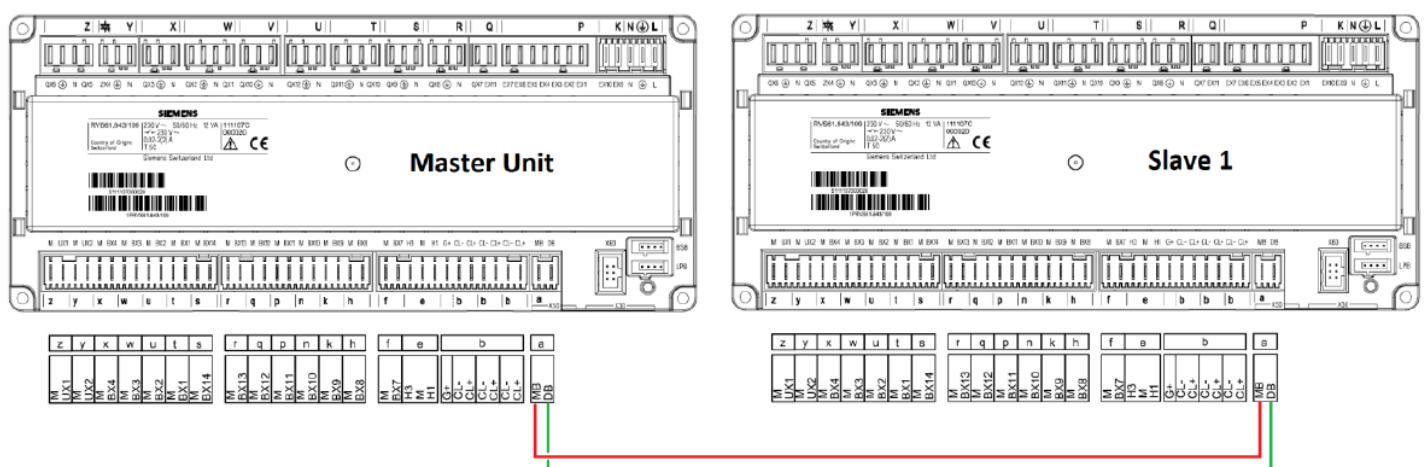
The defrost cycles of the heat pumps are moreover managed in order to avoid more units to defrost at the same time.

All the heat pumps share the same outdoor air temperature sensor that can be connected to any of the heat pumps of the cascade.

The heat pumps in cascade communicate by means of a 2-wire bus (LPB bus). Each heat pump has its own address on the bus. The heat pump with address 1 is conventionally called "master" even if in reality each heat pump becomes master in rotation.

Cascade Wiring

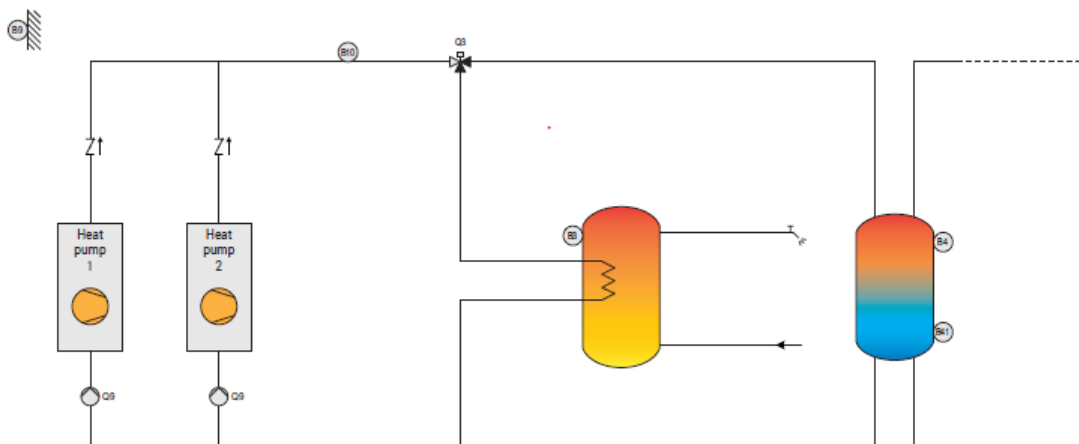
The cascade wiring needs to be completed by a qualified electrician, Using terminals MB & DB on each heat pump main controller, daisy chain the together as shown below.



If a third heat pump is to be added, daisy chain the same terminals from "slave 1" and so on.

CASCADE MANAGEMENT

The following setup is for a 2 x S-ASX-NT 60 – 90 cascade setup:

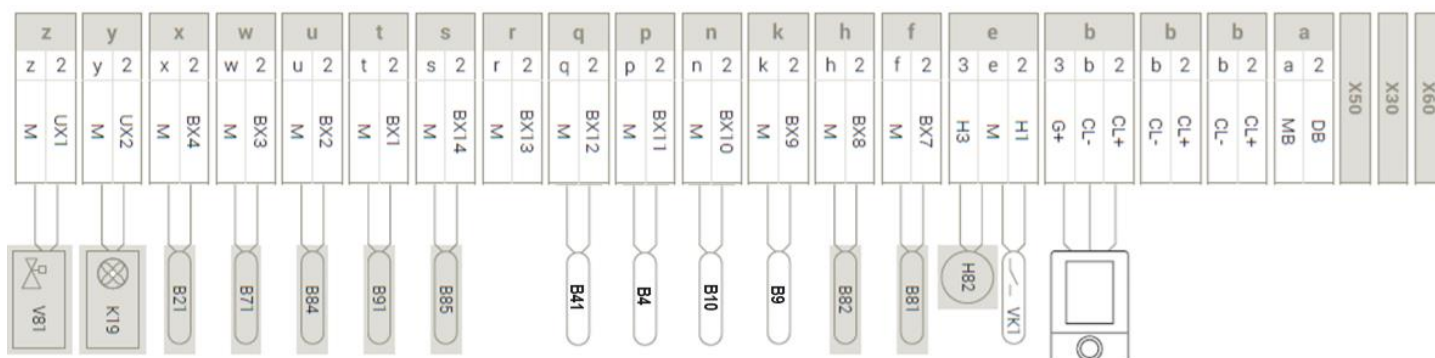
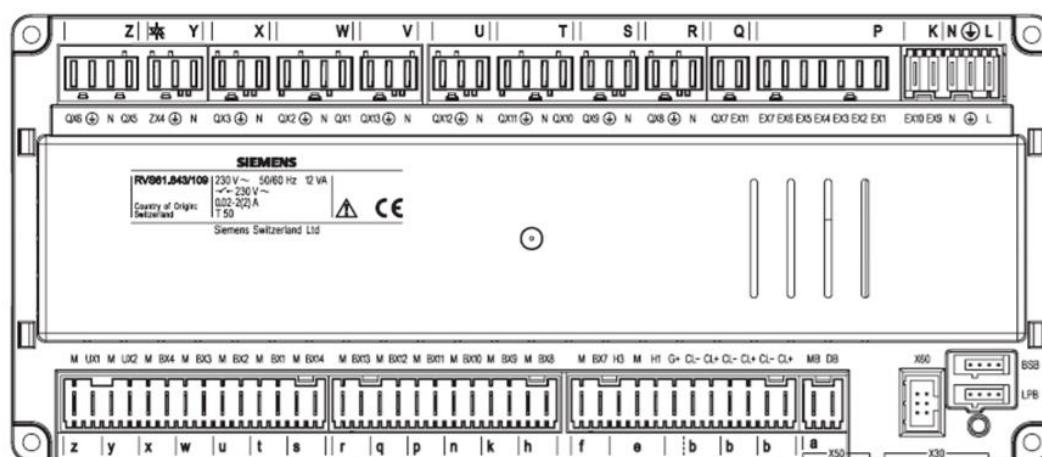


Drawing Number	Part Description
B9	Outside Air Temperature Sensor
B10	Common Flow Temperature Sensor
Q3	DHW Three Way Valve
B3	DHW Tank Temperature Sensor
B4	Thermal Store / Buffer Vessel Flow Temperature Sensor
B41	Thermal Store / Buffer Vessel Return Temperature Sensor

Master Heat Pump Wiring

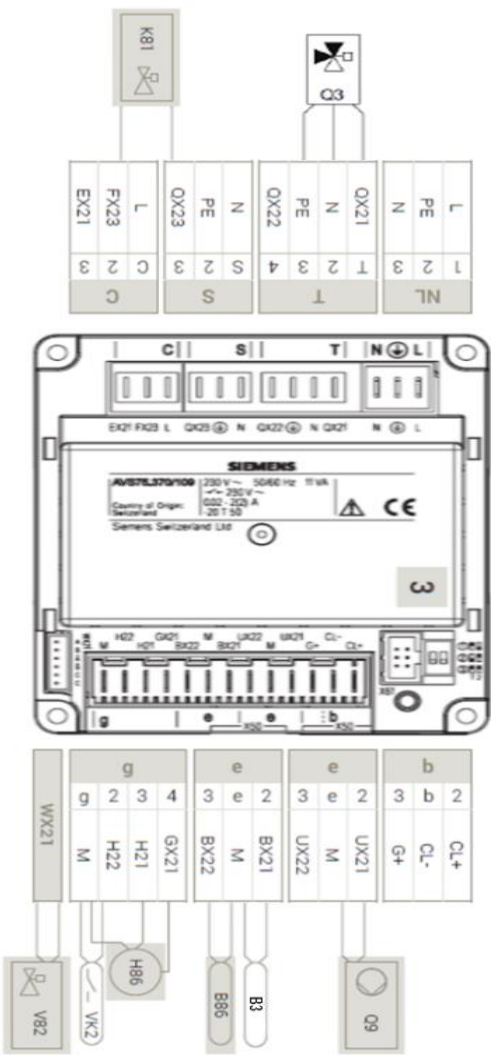
The following two wiring diagram shows the required wiring to the “master” heat pump to the sensors and the DHW three-way valve shown in the above setup.

Diagram 1: Main Controller within Master ASHP

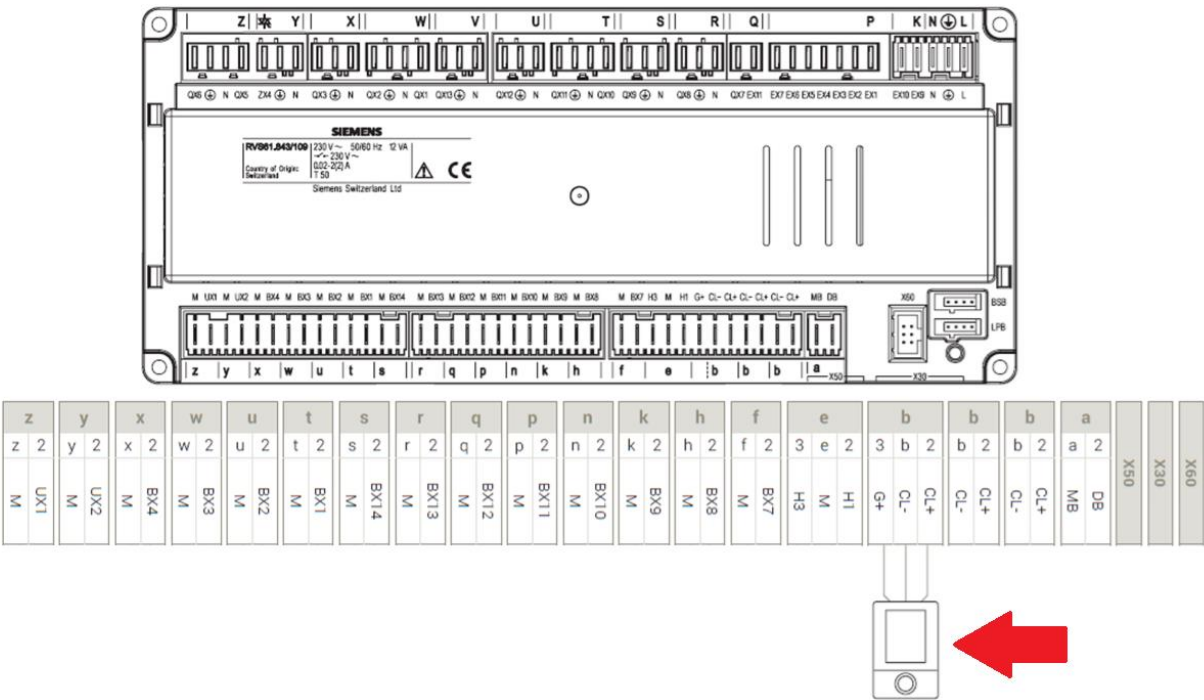


CASCADE MANAGEMENT

Diagram 2: The pre-fitted AVS75.370 Extended Module Within Master ASHP – Addressed as 3



Slave Heat Pump Wiring
Although no additional sensors are required within the “slave” heat pumps, the user controller **is required** to be installed.



MAINTENANCE

IMPORTANT

BEFORE CARRYING OUT MAINTENANCE OR CLEANING OPERATIONS MAKE SURE THE UNIT POWER SUPPLY IS DISCONNECTED. ANY ORDINARY OR EXTRAORDINARY MAINTENANCE OPERATION MUST BE CARRIED OUT BY SPECIALIZED AND AUTHORISED PERSONNEL IN ORDER TO ENSURE COMPLIANCE WITH THE SAFETY REGULATIONS IN FORCE.

This section is extremely important for the efficient operation of the unit during the years. A few operations carried out periodically can avoid the need to call specialized personnel. The operations to be carried out do not require particular technical knowledge and consist of simple checks of the components of the unit.

Contact an authorized service centre if maintenance is required.

Requirements - Risk analysis

Before starting work, a risk analysis of the maintenance and repair activities must be carried out, with the involvement of the installation safety manager, to identify the work area and to define the safety procedures to be implemented, based on the work type in order to prevent risks of damage to property or harm to persons.

The responsibility for the procedures above shall be vested on staff that carry out the risk analysis who must be qualified, competent and trained.

The manufacturer shall not be liable for damages or incidents experienced by persons or properties due to a wrong or missing risk analysis.

The safety procedures should consider by way of non-exhaustive example the following points.

- All safety instructions provided in the instruction manuals for unit operation and maintenance must be respected.
- Before starting a work on the unit, no potentially flammable atmospheres must be present.
- Provision must be made for suitable fire extinguishers with the type of flammable agent to be extinguished.
- The working area should be defined for each individual installation, taking into account the ATEX 2 zone and the safety zone around the machine (as already identified during installation of the equipment).
- The working area should be properly ventilated and monitored by suitable leak detectors.
- The work area must be clearly fenced off and provided with appropriate signs.
- No flammable materials and ignition sources should be present in the working area.
- Make sure that no flammable atmosphere can be created as a consequence of any maintenance activity.
- Make sure that leaking refrigerant don't flow into pits, downpipes, directly on people or near openings that are used for the ventilation of enclosed spaces, near fresh air inlets, doors or similar openings, or close to ignition sources.

Operators

Staff involved in maintenance operation on the present equipment must:

- Be compliant with all the applicable Regulations in terms of certification of individuals and companies.
- Conform Regulations regarding the competence of technical operators, the safety requirements for managing flammable refrigerants and units including flammable refrigerants.
- Be compliant also with national and/or local regulations.
- Follow manufacturer instructions and safety guidelines provided in the operation and maintenance instruction manual.
- Be duly and specifically trained according to the work activity to be carried out on the present equipment.
- Be compliant with PED Directive in case of brazing.
- Be correctly equipped with all necessary PPE (Personal protective Equipment) selected depending on the work activity to be carried out.
- Wear anti-static clothing, suitable with the type of activity you need to perform.

Equipment and tools

Personal protective equipment must be always worn, as required by the relevant operations. Proper equipment and tools must be used to perform all the maintenance and repair tasks safely and effectively.

Before carrying out any maintenance or repair work the following point should be considered.

- Make sure that the staff is equipped with the complete equipment suitable to work with A3 refrigerants and in flammable / explosive atmospheres.
- Make sure that the equipment is completely matching the provisions of general, national, and local regulations in use.
- Make sure that technicians are trained in the proper use of these tools and follow all safety precautions during maintenance and repair activities and all prescription provided by general, national, and local regulations in use.
- Ensure that all equipment and tools are in good working condition and properly calibrated before use. The competent manager is responsible for keeping the equipment in good condition and for verifying that it is in proper working order, as instructed by the equipment manufacturer.
- Follow manufacturer instructions and safety guidelines when using any equipment or tools.

To prevent the formation of electrostatic discharges resulting from differences in potential, the operator must make sure that all pieces of equipment and the instruments connected to the unit have the same potential as the unit.

It is strictly prohibited to use tools or instruments or perform operations that could give rise to ignition sources, for example, the use of drills, powered screwdrivers, saws or similar tools.

Such devices may only be used outside the working zone and at a safe distance from the unit, and from cylinders or other containers used to store flammable refrigerants, or when the refrigerating circuit has been completely drained of refrigerant and purged and there are no refrigerant containers or leaks near the working area.

MAINTENANCE

F-Gas Integrity Test - Mandatory Requirement

For safe operation of the S-ASX-NT ASHP, each ASHP will require a F-Gas integrity test once every 12 months.

This test will need to be completed using a certified A3 refrigerant leak detector suitable for R290 and have a sensitivity rating of no more than 3g/year.

If a leak is found, the ASHP must be isolated hydraulically and the refrigerant recovered.

S-ASX-NT Gas Leak Detector Sensor & Inlet / Extract Fan Test - Mandatory Requirement

For safe operation of the S-ASX-NT ASHP, each ASHP will require a gas leak detector sensor & extract fan test once every 12 months.

This test will need to be completed by spraying a small amount of R290 (bump test) around the internal gas leak sensor whilst the ASHP is in standby. The extract fan within the refrigeration circuit should activate simulating the removal of the R290 from the refrigeration compartment and the air inlet fan within the electrical compartment will deactivate to prevent any R290 from being drawn in.

If either the sensor does not detect the leak or either fans operate as required, the ASHP must be isolated until rectified.

Routine Maintenance - Mandatory Requirement

For a good, safe and long-time operation of the S-ASX-NT ASHP, the requirement is to carry out maintenance / servicing of the ASHP once every 12 months..

Structure

To prevent noises and strange vibrations to rise make sure that the various steel parts are well fastened together and that the inspection panels are properly fixed to the unit.

In case of oxidation, treat the parts of the unit affected with paints, suitable to avoid or reduce the problem.

Hydraulic Plant

Visually check that the hydraulic plant is leak free and is pressurized. Verify that there is no air in the circuit (acting on the air vents). Verify that the filters in the plant are clean.

Electrical Plant

Verify that the power supply cable that connects the unit to the distribution panel is not affected by cuts, cracks or alterations that could compromise the insulation. Contact an authorized service center if maintenance is required. After a first period of time from the first start up and at every stop or seasonal start up carefully check that each electrical connection is well fixed.

Fans

Verify that the fans are well fixed to the protective grilles and to the structure of the unit. Check any unbalance of the fans pointed out by anomalous vibrations and noise.

Finned Coil

Verify that the surface of the coil is clean. Remove all the impurities (leaves, dirt, dust..) using a brush or a compressed air jet. If the aluminum fins are damaged comb the coil with a special tool until the damage is completely eliminated. Verify that during the defrosting cycles the drainage of the water from the coil occurs properly and that the drainage fitting is not clogged. If the flow is not correct, with low outdoor temperature, a layer of ice could be generated and the operating of the unit could be compromised.

Service and Repair

Not ordinary maintenance, service and repair activities must be carried out only by highly qualified operators who have specific knowledge on the unit.

Before performing repair operations power to the unit must be cut out and all the panels of the unit should be open. Tests during unit operation must be carried out with all the safety devices active.

If components in the refrigerant circuit need to be repaired or replaced, the operation must be carried out in compliance with the relevant PED category and with standard EN378-2. It is forbidden to carry out braze welding, repairs, replacements, drilling, installation procedures..., on units containing flammable refrigerants if the work is to be carried out within the ATEX 2 zone defined for the unit or within the working area.

No flammable agents and ignition sources should be present in the working area. Flammable refrigerant must be recovered from all the circuits if the required operations may cause the presence of naked flames, sparks and other sources of ignition. The work area should be monitored by refrigerant detecting systems before, during and after use of naked flames, which are admitted for repair work to be performed after exhausting the machine.

Strebel Service Offer

Our Service department can be contacted either by phone on 01276 685422 or email to technical@strebel.co.uk to arrange the service of the S-ASX-NT's to our manufacturer instructions, complete F-Gas integrity test, a gas leak detector and fan inlet / extract test as a combined package

SAFETY

Accessing the Unit

The access to the unit must be granted exclusively to qualified personnel trained to operate on this type of units and provided with the necessary protection equipment. Moreover, such personnel, to operate, must be authorized by the owner of the unit and recognized by the manufacturer.

Residual Risks

The units are designed and manufactured in such a way as to minimize the risks for people and the place where the units are installed. The residual risks, which are impossible to eliminate during the design process and which are beyond the manufacturer's control, are described below together with the indications necessary for their neutralization. The residual risks are a potential source of danger for people, so the given indications must be scrupulously adopted.

Unit Disposal

To dispose of the unit, it is necessary to contact qualified personnel.

The unit contains refrigerant gas and lubricating oil. During the scrapping, such fluids must be recovered as well as any other part of the machine, and disposed of according to the national and local regulations in force in the country where the unit is installed. The unit must not be abandoned when scrapped.

The unit contains electrical and electronic equipment that cannot be disposed of through normal urban collection channels. These appliances must also be disposed of separately according to the national and local regulations in force in the country where the unit is installed.

The unit packaging must also be disposed / recycled according to the national and local regulations in force in the country in which the unit is installed.



Residual risk	Precautions	
GENERAL RISKS The unit contains components that can cause damage to people or property in the event of contact. The compressor can create burns in the event of contact. The pipes of the refrigeration circuit can cause burns or frost burns in case of contact or refrigerant leakage. Contact with live parts of the electrical circuit can cause burns and / or electric shock. Contact with the finned batteries can cause cutting injuries. The unit has moving parts such as fans that can cause damage to people or property in the event of contact.	Make the area where the unit is installed accessible only to authorized personnel. Verify that any intervention on the unit is carried out by qualified technical personnel, respecting all current and applicable safety regulations in accordance with the national legislation of the country of installation. Always wear the personal protective equipment required by current and applicable safety regulations in accordance with the national legislation of the country of installation. Use protective gloves to avoid contact with the compressor, parts of the cooling circuit and finned batteries. Switch OFF the power supply line to the unit before performing any operation inside the unit. Do not remove the guards for moving parts before checking them for shutdown and taking precautions to prevent them from operating. Check that all the protections provided on the equipment are correctly fitted before starting the unit	
HANDLING Handling of the unit, if not carried out with all the necessary protections and with the necessary caution, could cause the unit to fall or overturn, with consequent potential serious damages to people or things, and / or to the equipment itself.	Handle the equipment according to the instructions in this manual, and in accordance with local regulations.	
INSTALLATION An incorrect installation can cause damage due to people or things.	Make sure that the installation is carried out by qualified technical personnel, respecting all the safety regulations in force and applicable in accordance with the national legislation of the country of installation to avoid malfunctions and damage to the equipment, people or things. Check that the unit is installed in a place suitable for the use for which it was intended, indicated in this manual. Comply with all applicable and applicable regulations for the place of installation of the unit, in accordance with the national legislation of the country of installation. The assessment of the fire risk relative to the place of installation and the relative assessment that any fire protection systems near the unit are suitable is the responsibility of the user. Check the positioning and anchoring of the unit. The installation site must be adequate to support the weight of the equipment. Anchoring must be carried out in such a way as to prevent falls and overturning. Make the installation area accessible only to authorized personnel. Check that all the closing and protection panels of the unit are always properly mounted and fixed.	

SAFETY

Residual risk	Precautions	
ELECTRIC CONNECTIONS The connection of the unit to the electrical network carried out incorrectly may result in electric shocks, electric shocks, burns, intoxication, fires.	Verify that the installation is carried out by qualified technical personnel, respecting all current and applicable safety regulations in accordance with the national legislation of the country of installation and the indications provided in this manual for the electrical connection. Verify that the sizing of cables and protections is adequate to the characteristics of the equipment. Check the ground connection. Check the correct installation of the protections on the unit to avoid contact with live parts. Disconnect the power supply line and verify that no potentially live parts are present before removing shields and guards from the equipment, in case of maintenance or before performing any operation inside the unit.	 
REFRIGERANT The unit contains FLAMMABLE refrigerant gas under pressure as indicated in this manual. Refrigerant leakage may occur due, as an example not exhaustive, to the intervention of adequately prepared safety guards, incorrect installation or movement ... The refrigerant leakage could stagnate and create a flammable atmosphere inside or outside the unit.	Any operation on the parts under pressure must be performed by qualified technical personnel properly trained on the use of flammable refrigerants. Check that the unit is installed in a place suitable for the use for which it was intended, indicated in this manual. Comply with all applicable and in force regulations for the place of installation of the unit, in accordance with the national legislation of the country of installation. Do not place flammable substances or materials in or near the unit. Near the unit it is forbidden to use naked flames and smoke. In case of refrigerant leakage, consult the "safety data sheet" of the refrigerant given in this manual. In case of need of intervention on the refrigeration circuit, carry out the disposal and / or recovery of the refrigerant as indicated by the regulations in force in accordance with the national legislation of the country of installation. Only carry out brazing or welding activities on clean or empty pipes, without lubricant oil residues. Do not bring flames or other sources of heat near pipes containing refrigerating liquid. When the rules in force require the installation of fire-fighting systems near the machine, check that these are suitable for extinguishing fires on electrical equipment and on the lubricating oil of the compressor and the coolant, as specified on the safety data sheets of these fluids (for example, a CO2 extinguisher). The installation supervisor is responsible for preparing the risk assessment of the installation taking into account all the possible risks including the risk of fire at the place of installation (for example, calculating the fire load) considering the whole life cycle of the unit and all the possible situations (lack of power supply, maintenance, repair activities...)	 
HYDRAULIC PARTS Improper installation of hydraulic connections can result in water leaks with damage to people or property, and short circuits in the electrical parts of the unit.	Verify that the installation is carried out respecting the instructions provided in this manual for the hydraulic connection and respecting all current and applicable safety regulations in accordance with the national legislation of the country of installation. Do not exceed the maximum allowable pressure (PS) of the hydraulic circuit shown in this manual.	
TRANSPORT AND STORAGE The unit is loaded with refrigerant gas under pressure. Improper transport can cause damage to the unit and damage to the refrigerant circuit with loss of refrigerant.	During transport and storage check that the unit is kept within the temperature limits specified in this manual. Comply with regulations for transporting equipment under pressure. During the installation of the unit, check for leaks in the circuit.	

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SECTION 1: Identification of the substance or mixture and of the company/firm

1.1 Product identifier

Product type:

Substance

Commercial name:

Other names:

Propane

Name of the substance:

Propane

INCI nomenclature:

Propane

CAS number:

74-98-6

EEC number:

200-827-9

Index number:

601-003-00-5

Registration number:

01-2119486944-21-XXXX

1.2 Relevant identified uses of the substance and of the mixture and contraindications

Relevant identified uses:

Industrial use:

Production, distribution, formulation, use as functional fluid.

Professional use:

Use as fuel, use as functional fluid.

Consumer:

Use as fuel.

Contraindications:

It is recommended to use the substances / mixture only in the cases indicated previously. No other uses are recommended unless an evaluation has been conducted, prior to the start of the said use, that demonstrates that the risks associated with such uses are under control.

1.3 Information on the supplier of the safety data sheet

Name of Business:

General Gas S.r.l.

Address:

Via Aosta, 5 - Cernusco sul Naviglio - 20063 MILANO

City / Country:

☎ +39 02 92141835 📠 +39 02 92141841

Phone:

+39 335 5644288

Director:

✉ m.migliaccio@gas-tec.it

e-mail:

1.4 Emergency telephone number

+39 335 5644288

✉ m.migliaccio@gas-tec.it

Note:

See Section 16 for a list of poison control centres in Italy

SECTION 2: Indication of hazards

2.1 Classification of the substance and of the mixture

Classification according to the (EC) n. 1272/2008 [EU-GHS / CLP] regulation

Flammable gas, cat. 1 A: H220

Liquefied gas under pressure: H280

Adverse physicochemical effects on human health and the environment

High concentration of asphyxiating gas. Extremely flammable. Cryogenic gas. When in contact with the skin, it can cause cold burns or frostbite. Vapours can form an inflammable and explosive atmosphere. High concentrations of vapours can cause: migraines, nausea, dizziness. Rapid accidental evaporation of liquid can cause cold burns.

Classification according to the (EC) n. 1272/2008 [EU-GHS / CLP] regulation

Hazard pictograms (CLP):





GHS02 (Flammable gases, hazard category 1 A)

GHS04 (Gas under pressure: liquefied gas)

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Description of first aid measures in case of ingestion:

or in case of damage caused by high pressure jets, transfer the patient to a specialist health centre. In the case of cold burns that involve the eyes, prepare for the immediate hospitalization of the victim.
Liquid product: Not considered as a probable source of exposure. Symptoms of frostbite may occur on the lips and on the mouth in case of contact with the product in liquid form. Consult a doctor / medical service immediately.

4.2 Main symptoms and effects, both acute and delayed

Symptoms / side effects in case of inhalation:

Exposure to high concentrations of vapours, particularly in closed environments or in poorly ventilated areas, can cause irritation to the respiratory tract, nausea, discomfort and dizziness. The lack of oxygen due to exposure to high concentrations can cause asphyxia.

Symptoms / wounds in case of contact with the skin:

Contact with the liquid can cause cold burns.

Symptoms / wounds in case of contact with the eyes:

Contact with eyes may cause slight transient irritation.

Symptoms / wounds in case of ingestion:

Not applicable.

Symptoms / wounds in case of intravenous administration:

No information available.

Chronic symptoms:

None to be highlighted, according to the current classification criteria.

4.3 Indication of any need to immediately consult a doctor or the need for special treatments

In case of injuries caused by high pressure, immediately transfer the victim to the hospital. Do not wait for symptoms to appear. Immediately begin artificial respiration if breathing has stopped. Administer oxygen if necessary.

SECTION 5: Fire fighting measures

5.1 Fire fighting

Suitable extinguishing agent:

In the event of large fires: fractionated water jet, atomised water, foam.
In case of small fires: dry chemical powder, carbon dioxide, foam.

Unsuitable fire fighting mediums:

Avoid the simultaneous use of foam and water on the same surface, as water destroys the foam. Do not use direct water jets on the burning product.

5.2 Special hazards deriving from the substance or mixture

Fire hazard:

Highly Flammable Gas.

Explosion hazard:

Vapours are heavier than air, they can expand over the ground and form an explosive atmosphere. Heat can cause increased pressure in tanks exposed to fire, resulting in an explosion of closed containers, spreading of the fire and a risk of burns and injury.

Combustion products:

Incomplete combustion generates carbon monoxide and carbon dioxide, poisonous to animals, and other toxic gases, oxygenated compounds (aldehydes, etc.).

5.3 Recommendations for fire-fighters

Precautionary measures in case of fire:

If security conditions permit, stop or contain the leak at the source. Do not attempt to extinguish the fire until the leak has been contained, or you are sure someone is already taking the necessary actions.

Instructions for extinction:

Keep undamaged containers away from the danger area. If this can be done without danger. Use water jets to cool surfaces and containers exposed to flames or heat. If the fire cannot be controlled, evacuate the area.

Special equipment for fire-fighters:

In the event of a fire or in confined or poorly ventilated spaces, wear a garment complete with fireproof protection and a self-contained breathing apparatus with a positive pressure face mask. Personal protective equipment for fire-fighters (see also section 8). EN 443, EN 469, EN 659.

Other information (fire fighting):

In case of fire, do not dispose of waste water, residual product and other contaminated materials, but collect separately and treat appropriately.

SECTION 6: Measures in case of accidental leak

6.1 Personal precautions, protective equipment and emergency procedures

General measures:

If security conditions permit, stop or contain the leak at the source. Avoid direct contact with the leaked material. Make sure to stay upwind. In case of large spills, warn residents of the area downwind of the spill. Eliminate all ignition sources if the safety conditions allow (e.g. electricity, sparks, fires, torches). Use only spark-proof tools. Gas / vapours heavier than air. They can accumulate in enclosed spaces, particularly at or below ground level. Sensors can be used to detect flammable gases or vapours.

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CLP warning:

Hazard

H220 - Highly Flammable Gas.

H280 - Contains gas under pressure; may explode if heated.

P102 - Keep out of reach of children.

P210 - Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.

P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped without risk.

P381 - In case of leakage, eliminate all ignition sources.

P410 + P403 - Store in a well-ventilated place and keep away from sunlight.

Safety advice (CLP):

None.

Other:

General Directions:

Not Applicable - Classified as dangerous according to (EC) n. 1272/2008

2.2 Other hazards

Physical / Chemical:

A static charge may accumulate if the material slides or is shaken and can be ignited by an electrostatic discharge.

Health:

Simple asphyxiating gas in normal temperature and pressure conditions. In the event of accidental leakage, the liquid evaporates quickly absorbing heat, and the rapid cooling of any surfaces in contact with the liquid can cause cold burns. Accidental contact or prolonged exposure to vapours can cause redness and irritation of the eyes. Exposure to high concentrations of vapours, particularly in closed environments or in poorly ventilated areas, can cause irritation to the respiratory tract, nausea, discomfort and dizziness.

Environment:

None.

Contaminants:

None.

This substance / mixture does not meet the PBT criteria of REACH, annex XIII.

This substance / mixture does not meet the vPvB criteria of REACH, annex XIII.

SECTION 3: Composition / information about ingredients

3.1 Substance

Name of the substance	CAS Num.	EINECS Num.	REACH Num.	% (m/m)	Classification according to the (EC) n. 1272/2008 [EU-GHS / CLP] regulation
Propane	74-98-6	200-827-9	01-2119486944-21-XXXX	≥ 99.5	Flammable gas, cat. 1 H220 Gas under pressure H280
1.3-Butadiene	106-99-0	203-450-8	N/A	<0.1	Flam. gas, cat. 1 H220; Gas under pressure H280; Carc. 1A, H350; Mutag. 1B, H340;

The GWP of the substances used is as follows: Propane 3

The product can also be denaturated with 0.1% m/m of trans-1,3,3,3-tetrafluoroprop-1-ene (HFO1234ze) (CAS 29118-24-9 / EINECS 471-480-0) - GWP = 1

3.2 Mixtures

Not applicable.

SECTION 4: First aid measures

4.1 Description of first aid measures

Description of first aid measures in case of inhalation:

Gaseous product: Take the victim to an uncontaminated area. If the victim is breathing: Take the person to a well-ventilated area, keep them warm and allow them to rest. Keep in a lateral safety position. If breathing is difficult, give oxygen if possible, or provide assisted ventilation. Consult a doctor if breathing difficulties persist. If the victim is unconscious and is not breathing: ensure there are no obstacles preventing the victim from breathing and perform artificial respiration by competent personnel. If necessary, perform an external cardiac massage and consult a doctor. A large quantity of vapours can lead to a lack of oxygen in the atmosphere. In this case, use a self-contained breathing apparatus only.

Description of first aid measures in case of contact with the skin:

Liquid product: Rinse the skin with plenty of water. Consult a doctor immediately if irritation, swelling or redness develops and persists. Rapid accidental evaporation of liquid can cause cold burns. In the presence of frostbite symptoms, such as whitening or redness of the skin or a burning or tingling sensation, do not rub, massage or compress the injured area. Consult a specialist doctor or transfer the victim to a hospital. Rinse gently with water for a few minutes. Remove contact lenses, if present, and if the situation allows the operation to be carried out easily. In case of irritation, blurred vision or persistent swelling, consult a medical specialist. In the presence of persistent symptoms of frostbite, such as pain, tingling, tearing or photophobia,

Description of first aid measures in case of contact with the eyes:

4.2 Description of first aid measures

Not applicable.

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6.1.1 For those who do not intervene directly

Protection measures:

See Section 8.

Emergency procedures:

Evacuate any personnel not involved from the area where the leak occurred. Notify emergency teams. Except in the case of small leaks, the feasibility of interventions must always be evaluated and approved, if possible, by qualified and competent personnel in charge of managing the emergency.

6.1.2 For those who do intervene directly

Protection measures:

Small spills: normal antistatic work clothing is generally appropriate. Large spills: total protection garment resistant to chemicals and made of antistatic material. Work gloves (preferably half-arm gloves) that provide adequate resistance to chemical agents. If there is a risk of contact with the liquefied product, the gloves must be thermally insulated in order to avoid cold burns. Gloves made of PVA (polyvinyl alcohol) are not water resistant and are not suitable for emergency use. Antistatic and non-slip safety shoes or boots, resistant to chemicals. Protection measures: Protective goggles and / or face protection devices if there is a risk of splashing or contact with the eyes. Respiratory protection: It is possible to use a half mask or a full mask equipped with filter(s) for organic vapours (AX), or a self-contained breathing apparatus, according to the extent of the leak and the predictable level of exposure. In the event that the situation cannot be fully assessed or if there is a risk of oxygen deficiency, use only a self-contained breathing apparatus.

Emergency procedures:

Notify the competent authorities in accordance with the regulations in force.

6.2 Environmental precautions

Stop the leak at the source if you can do so without risk. If this is not the case, use a pulverised water spray to keep the concentration of gas clouds under control and to help them escape into the atmosphere. Prevent the product from ending up in drains, rivers or other bodies of water. Avoid the dispersion of the gas in places where its accumulation could be dangerous (drains, depressions, etc.).

6.3 Methods and materials for containment and remediation

Methods for containment:

Allow the product to evaporate, favouring its dispersion. Being heavier than air, vapours can spread at considerable distances at ground level, explode or catch fire, and return to the source. Inside buildings or confined spaces, ensure proper ventilation. If in water: The spillage of liquid product in the water will presumably result in a rapid and complete evaporation. Isolate the area and prevent the risk of fire / explosion for boats and other structures, taking into account the direction and speed of the wind, until the product is completely dispersed.

Cleaning methods:

None specified.

Other information (accidental leak):

The recommended measures are based on the most likely leakage scenarios for this product. Local conditions (wind, air or water temperature, direction and speed of waves and currents) can significantly influence the choice of action to be taken. Therefore, consult local experts if necessary.

6.4 Reference to other sections

For more information, see section 8: "Exposure control - individual protection".

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Precautions for safe handling:

Risk of explosive mixture of vapours and air. Ensure that all provisions regarding the management and storage facilities of flammable products are correctly observed. Do not use electrical appliances (mobile phones, etc.) that are not approved for use, according to the risk characteristics of the area. Take precautionary measures against static electricity. Ensure the grounding of the container, tanks and equipment during receipt and transfer. Gas / vapours heavier than air. Pay particular attention to accumulation in wells and confined spaces. Keep away from heat / sparks / open flames / hot surfaces. No smoking. Use only bottom loading for tanks, in accordance with relevant European legislation. Do not use compressed air during filling, draining or handling operations. Use and store outside or in a well-ventilated area only. Before starting any type of intervention in a confined space (e.g. tunnels), check the atmosphere and check the oxygen content and the degree of flammability. Empty containers may contain combustible product residues. Do not perforate, cut, sand, weld, braise, burn or incinerate containers or empty drums that have not been cleaned.

Hygiene measures:

Avoid contact with eyes and skin. Do not breathe in the vapours. Use appropriate personal protective equipment if necessary. Keep away from food and drink. Do not eat, drink or smoke during use.

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7.2 Conditions for safe storage, including any incompatibilities	
Storage conditions:	Store in a dry and well-ventilated place. No smoking. Keep away from open flames, hot surfaces and sources of ignition. The vapours are heavier than air, and can spread at ground level. Pay particular attention to accumulation in wells and confined spaces.
Incompatible products:	Keep away from: strong oxidizers.
Storage temperature:	<50°C
Storage place:	The structure of the storage area, the characteristics of the tanks, the equipment and the operating procedures must comply with the relevant European, national or local legislations. The cleaning, inspection and maintenance activities of the internal structure of the storage tanks must be carried out by qualified and correctly equipped personnel, as established by national, local, or company regulations. For maintenance and storage activities, empty tanks must be cleaned and filled with inert gas (e.g. nitrogen). Before accessing storage tanks and starting any type of intervention in a confined space (e.g. tunnels), carry out adequate examination, check the atmosphere and check the oxygen content, as well as the degree of flammability.
Packaging and containers:	Store only in the original container or in a container suitable for the type of product. Keep containers tightly closed and properly labelled. Cylinders must not be stored near other cylinders that contain compressed oxygen. Empty containers may contain combustible product residues. Do not weld, braze, puncture, cut or incinerate empty containers unless they have been properly cleaned / emptied.
Packaging materials:	Use mild steel and stainless steel for containers and linings. Some synthetic materials may not be suitable for containers or linings based on the characteristics of the material and the intended uses. Check the compatibility with the manufacturer, according to the specific conditions of use.
7.3 Specific end uses	
No information available.	
SECTION 8: Exposure control / individual protection	
8.1 Control parameters	
Exposure limit values:	ACGIH 2010: TLV® - TWA: 1,000 ppm (Alkanes, C1-C4)
Control methods (monitoring):	The monitoring procedures must be selected on the basis of the indications established by the competent local authorities or by national labour contracts. Refer to Legislative Decree 81/2008 on best industrial hygiene practices.
8.2 Exposure control	
Technical control measures:	Reduce to a minimum any exposure. Before accessing storage tanks and starting any type of intervention in a confined space (e.g. tunnels), carry out adequate examination, check the atmosphere and check the oxygen content, as well as the degree of flammability.
Personal protective equipment (for industrial or professional use):	Full mask (for the conditions of use, see: "Respiratory protection"). Protective visor. Safety goggles. Protective clothing. Gloves. Safety shoes.
	    
Hand protection:	In case of possible contact with the skin, use gloves resistant to hydrocarbons, lined with brushed cotton. Presumably adequate materials: nitrile (NBR) or PVC with a protection index of at least 5 (permeation time ≥240 min). If there is a risk of contact with the liquefied product, the gloves must be thermally insulated in order to avoid cold burns. Use gloves in compliance with the conditions and limits set by the manufacturer. Replace gloves immediately if there are cuts, holes or show any other sign of deterioration. In this case, refer to the UNI EN 374 standard.
Eye protection:	In case of possible contact with the eyes, use safety goggles or other protection measures (face shield). In this case, refer to the UNI EN 166 standard.
Skin and body protection:	Work clothes with long sleeves. For the definition of the characteristics and performances according to the risks of the work area, refer to the UNI EN 340 standards and to the other applicable UNI-EN-ISO standards. Antistatic and non-slip safety shoes or boots, resistant to chemicals. Remove contaminated clothing and shoes.
Respiratory protection:	Regardless of other possible actions (adjustments of the installations, operating procedures and other means to reduce the exposure of workers), it is strongly advised to use individual protection adapted to the needs of the workforce. In ventilated or outdoor environments: in the event of product handling in the absence of suitable vapour containment systems, use masks or half-masks with a hydrocarbon vapour filter

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10.4 Conditions to avoid	
Keep away from strong oxidizers. Keep away from open flames, hot surfaces and sources of ignition. Avoid the accumulation of electrostatic charges.	
10.5 Incompatible materials	
Strong oxidizers.	
10.6 Hazardous decomposition products	
Under normal conditions of storage and use, hazardous decomposition products should not be produced. Thermal decomposition can produce: Toxic vapours.	
SECTION 11: Toxicological information	
Acute toxicity:	Not classified (conclusive data but not sufficient for classification) (depending on the composition).
Oral (LD ₅₀):	There is no data available.
Inhalation (LC ₅₀):	Rat.: 1443 mg/l (Propane) (15 min; Clark and Tiston 1982)
Inhalation (LC ₅₀):	Rat.: 800,000 ppm (Propane) (15 min; Clark and Tiston 1982)
Cutaneous (LD ₅₀):	There is no data available.
Skin corrosion / skin irritation:	Not classified (conclusive data but not sufficient for classification). Tests are not necessary, as the substance is a flammable gas (REACH Annex XI, #2). Contact with the liquid can cause cold burns. pH: Not applicable.
Serious eye damage / eye irritation:	Not classified (conclusive data but not sufficient for classification) Tests are not necessary, as the substance is a flammable gas (REACH Annex XI, #2). pH: Not applicable.
Respiratory or s n sensitization:	Not classified (conclusive data but not sufficient for classification). Tests are not necessary, as the substance is a flammable gas (REACH Annex XI, #2). This product does not contain significant amounts of substances classified by the European Union as sensitizers (in any case, <0.1% p).
Germ cell mutagenicity:	Not classified (conclusive data but not sufficient for classification). (OECD 474). (OECD 471 - Ames test). This product contains <0.1% p of 1.3 butadiene (EINECS 203-450-8) (notes K - Annex VI Reg (EC) 1272/2008). Not mutagenic.
Carcinogenicity:	Not classified (conclusive data but not sufficient for classification) (depending on the composition). This product contains <0.1% p of 1.3 butadiene (EINECS 203-450-8). According to EU criteria this product must be considered as non-carcinogenic.
Reproductive toxicity:	Not classified (conclusive data but not sufficient for classification). (EPA OPPPTS 870.3465) (Huntingdon Life Sciences, 2009). (EPA OPPPTS 870.3650) (CS - Huntingdon Life Sciences, 2010). Experimental tests provided negative results.
Specific target organ toxicity (STOT) - single exposure:	Not classified.
Specific target organ toxicity (STOT) - repeated exposure:	Not classified.
Danger in case of suction:	Not classified.
Possible harmful effects on humans and possible symptoms:	None predictable at room temperature. Contact with liquids, containers and distribution lines containing propane should be avoided in order to prevent cold burns. The lack of oxygen due to exposure to high concentrations can cause asphyxia.
Other information:	None.
SECTION 12: Ecological information	
12.1 Toxicity	
Ecology - general:	The dispersion in the environment can however lead to the contamination of the environmental matrices (air). Use according to good working practices and avoid dispersing the product in the environment.
Ecology - air:	In case of dispersion in the environment, the constituents of the product evaporate in the atmosphere, where they undergo rapid degradation processes by the hydroxyl radicals. This phenomenon can contribute to the formation of photochemical smog, but depends on complex interactions with other pollutants, and

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(AX) (EN 136/140/145). Combined filtering device (DIN EN 141). In confined spaces (e.g. inside tanks): the use of respiratory protection devices (half-masks, masks, respiratory devices) must be evaluated according to the work activity, the expected duration and the intensity of exposure. For the characteristics, refer to the 02/05/2001 Decree. If exposure levels cannot be determined or estimated with a good level of certainty or if an oxygen deficiency is likely to occur, use a self-contained breathing apparatus only. A large quantity of LPG (liquefied petroleum gas) vapours can lead to a lack of oxygen in the atmosphere. In this case, use a self-contained breathing apparatus only.	
Thermal protection:	None under normal use conditions.
Atmosphere exposure control:	Do not dispose of the product in the environment.
Limitation and control of consumer exposure:	It must always be handled in a closed system. Ensure adequate ventilation.
8.3 Hygiene measures	
General protective and hygiene rules of the worker:	Avoid contact with eyes and skin. Avoid breathing in vapours or mists. Wash with soap and water (if possible neutral soap); do not use irritant products or solvents that remove the sebaceous lining of the skin. Do not reuse contaminated clothing.
SECTION 9: Physical and chemical properties	
9.1 Essential physical and chemical properties	
Molecular mass:	Not applicable.
Colour:	Colourless.
Scent:	Odourless.
Odour threshold:	There is no data available on the preparation itself / on the compound itself.
pH:	Not applicable.
Fusion point:	-187°C - -138°C (depending on the composition)
Boiling point:	-42°C - -0.5°C (depending on the composition)
Flash point:	-104°C - -60°C (depending on the composition)
Evaporation rate in relation to butyl acetate:	Data not available.
Flammability (solid, gas):	Data not available.
Lower / higher flammability or explosive limits in air:	1.5% vol - 9.5% vol (depending on the composition)
Vapour pressure:	<1550 kPa
Solubility:	Water: 53.5 mg/l (depending on the composition)
Ignition temperature:	287°C - 537°C (depending on the composition)
Kinematic viscosity:	Data not available.
Explosive properties:	Data not available.
Oxidising properties:	Data not available.
9.2 Other information	
VOC content:	≥90% (EU, CH, USA)
Gas group:	Press. Gas (Liq.)
The aforementioned data (9.1 - 9.2) are typical values and do not constitute specifications.	
SECTION 10: Stability and reactivity	
10.1 Reactivity	
The mixture does not present further dangers linked to reactivity in relation to those reported in the subsequent subtitles.	
10.2 Chemical stability	
Stable product in relation to its intrinsic characteristics.	
10.3 Possibility of dangerous reactions	
No dangerous reactions are to be expected (in normal conditions of storage and handling). Contact with strong oxidants (such as peroxides and chromates) may cause a fire hazard. A mixture with nitrates or other strong oxidants (such as chlorates, perchlorates and liquid oxygen) can generate an explosive mass. Sensitivity to heat, friction and shock cannot be assessed in advance.	

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Ecology – water:	on local atmospheric conditions.			
LC ₅₀	24.11 mg/l (96h, fish)			
LC ₅₀	46.6 mg/l (48h Daphnia sp.)			
EC ₅₀	11.89 mg/l (96h, seaweed)			
12.2 Persistence and degradability				
Persistence and degradability:	Data not available.			
Biodegradation:	Data not available.			
12.3 Possibility of bio-accumulation				
Log Pow:	1.09 - 2.8 (depending on the composition).			
Possibility of bio-accumulation:	Data not available.			
12.4 Mobility in the soil				
Mobility in the soil:	Not applicable due to the physical state of the product.			
Ecology - soil:	Data not available.			
12.5 Results of PBT and vPvB assessment				
This substance / mixture does not meet the PBT criteria of REACH, annex XIII.				
This substance / mixture does not meet the vPvB criteria of REACH, annex XIII.				
PBT-vPvB assessment:	The components of this preparation do not meet the criteria for a classification as PBT or vPvB. From an environmental point of view, the product must be considered as "non-persistent", according to the criteria of the reg. REACH, Annex XIII (point 1.1).			
12.6 Other adverse effects				
ODP (Ozone Depletion Potential):	0 years. As a standard, trichlorofluoromethane (R-11) is used as a reference point, with an ODP value of 1.0.			
GWP (Global Warming Potential):	3 years. It expresses the contribution to the greenhouse effect caused by a gaseous emission into the atmosphere. All molecules have a potential in relation to the CO ₂ molecule, which has a potential of 1 and acts as a reference point.			
SECTION 13: Considerations for disposal				
In the case of disposal, the substance as such, pursuant to Directive 2008/98/EC, must be classified as hazardous waste: - HP3 - "Flammable".				
13.1 Waste treatment methods				
Procedure for the method of waste treatment:	The product as such is not specifically regulated. Dispose of empty containers and waste safely.			
Disposal recommendations:	Code(s) of the European Waste Characterisation (Decision 2001/118/EC): 16 05 04* (gases in pressure containers [including halons] containing dangerous substances). The EWC code provided is only a general indication, based on the original composition of the product and its intended use. It is up to the user to choose the most appropriate EWC code, based on the actual use of the product and any alterations or contaminations.			
Additional information:	Empty containers may contain combustible product residues. Do not perforate, cut, sand, weld, braise, burn or incinerate containers or empty drums that have not been cleaned. Dispose of empty uncleaned containers safely, according to the Legislative Decree 152/2006 and subsequent amendments and additions.			
Ecology - waste: EURL (EWC):	The product as such does not contain halogenated compounds. 16 05 04* gases in pressure containers [including halons] containing hazardous substances.			
SECTION 14: Transport information				
According to the requirements of ADR / IMDG / IATA / ADN / RID				
ADR	IMDG	IATA	ADN	RID
14.1 UN numbers				
1978	1978	1978	1978	1978
14.2 UN shipping name				
Propane	Propane	Propane	Propane	Propane
14.3 Transport hazard class(es)				
2.1	2.1	2.1	2.1	2.1 (+13)

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REFRIGERANT SAFETY CARD

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14.4 Packaging group

Not applicable

Not applicable

Not applicable

Not applicable

Not applicable

14.5 Environmental hazards

Dangerous for the environment: No

Dangerous for the environment: No

Dangerous for the environment: No

Dangerous for the environment: No

Dangerous for the environment: No

14.6 Special precautions for users

Special precautions for shipping:

Ground transportation

ADR transport regulations:

Classification code (UN):

Transport category (ADR):

Hazard No. (Kiemler No.):

Tunnel restriction code (ADR):

Sea transportation

IMDG transport regulations:

EmS-No. (Fire rating):

EmS-No. (Spill):

Stowage category (IMDG):

Air transport

Regulated by ICAO transport:

Quantities exempt on passenger and cargo aircrafts (IATA):

Inland waterway transport

Transport regulations (ADN):

Classification code (ADN):

Exempt quantities (ADN):

Railway transport

RID transport regulations:

Classification code (RID):

Exempt quantities (RID):

Transport category (RID):

Hazard No. (RID):

14.7 Transport in bulk according to Annex II of Marpol 73/78 and the IBC code

IBC code:

SECTION 15: Regulatory information

15.1 Legislative and regulatory provisions on health, safety and the environment specific to the substance or mixture

The following restrictions apply pursuant to Annex XVII of Regulation (EC) No. 1907/2006 (REACH):

1.3-Butadiene:

28. Substances listed in Part 3 of Annex VI of Regulation (EC) No. 1272/2008 classified as carcinogenic category 1A or 1B (table 3.1) or carcinogenic category 1 or 2 (table 3.2) and reported as follows: carcinogenic category 1A (table 3.1) / category 1 carcinogens (table 3.2) listed in the Appendix 1, category 1B carcinogens (table 3.1) / category 2 carcinogens (table 3.2) listed in Appendix 2

1.3-Butadiene:

29. Substances listed in Part 3 of Annex VI of Regulation (EC) No. 1272/2008 classified as mutagenic category 1A or 1B (table 3.1) or mutagenic category 1 or 2 (table 3.2) and reported as follows: mutagenic category 1A (table 3.1) / category 1 mutagens (table 3.2) listed in the Appendix 3, category 1B mutagens (table 3.1) / category 2 mutagens (table 3.2) listed in Appendix 4

1.3-Butadiene:

40. Substances classified as flammable gases of category 1 or 2, flammable liquids of category 1, 2 or 3, flammable solids of category 1 or 2, substances and mixtures which, in contact with water, release

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flammable gases of category 1, 2 or 3, category 1 pyrophoric liquids or category 1 pyrophoric solids, even if not included in Part 3 of Annex VI, of Regulation (EC) No. 1272/2008.

No ingredients are in the REACH Candidate List (>0.1% m/m) and in the REACH list annex XIV.

Applicable European Union legislation:

Regulation (EC) No. 1907/2006 of the European Parliament and of the Council, of 18 December 2006, related to the registration, evaluation, authorisation and restriction of chemical substances (REACH). (et sequens), Regulation (EC) No. 1272/2008 of the European Parliament and of the Council of 16 December 2008 related to the classification, labelling and packaging of substances and mixtures, which amends and repeals Directives 67/548/EEC and 1999/45/EC, and amends regulation (EC) No. 1907/2006 (et sequens). Directives 89/391/EEC, 89/654/EEC, 89/655/EEC, 89/656/EEC, 90/269/EEC, 90/270/EEC, 90/394/EEC, 90/679/EEC, 93/88/EEC, 95/63/EC, 97/40/EC, 98/24/EC, 99/38/EC, 99/92/EC, 2001/45/EC, 2003/10/EC and 2003/18/EC (Improvement of the safety and health of workers in the workplace) Directive 92/85/EC (Measures to encourage the improvement of health and safety at work for pregnant workers, of workers who have recently given birth or are breastfeeding) Directive 98/24/EC (Protection of the health and safety of workers against the risks deriving from chemical agents during work). Directive 2012/18/EC (Control of major-accident hazards involving dangerous substances). The product, by composition or characteristics, falls within the criteria defined in Annex I. Refer to the Directive (or national laws) for details on the requirements relating to the volume of product stored on a specific site. Directive 2004/42/EC (limitation of emissions of volatile organic compounds).

National standards:

Legislative Decree 81/2008, relating to the "Implementation of Article 1 of the Law of 3 August 2007, concerning the protection of health and safety in the workplace". Legislative Decree 105/2015 (adoption of Directive 2012/18/EC for the control of major-accident hazards involving dangerous substances). Legislative Decree 152/06: "Environmental regulations", and subsequent amendments and additions to Legislative Decree 151/2001 (Consolidated text of the legislative provisions on the protection and support of maternity and paternity).

SECTION 16: Other information

Indication of modifications:

All sections have been updated. Section 2 updated in accordance to Regulation (UE) n.521/2019.

Abbreviations and acronyms:

N/A = not available
N/A = not applicable.

ADN

European agreement on the international transport of dangerous goods via inland waterways

ADR

The European Agreement Concerning the International Carriage of Dangerous Goods

ACGIH

American Conference of Governmental Industrial Hygienists

BCF

Bioconcentration factor

CLP calculator

Regulation concerning classification, labelling and packaging: Regulation (EC) No. 1272/2008

DMEL

Derived minimal effect level

DNEL

Derived no-effect level

EC50

Effective concentration for 50% of the tested population (median effective concentration)

IARC

International Agency for Research on Cancer

IATA

International Air Transport Association

IMDG

International Maritime Dangerous Goods Code

LC50

Lethal concentration for 50% of the tested population (median lethal concentration)

LD50

Lethal dose that determines the death of 50% of the tested population (median lethal dose)

LOAEL

Lowest-observed-adverse-effect level

NOAEC

No Observed Adverse Effect Concentration

NOAEL

No Observed Adverse Effect Level

NOEC

No Observable Effect Concentration

OECD

Organisation for Economic Co-operation and Development

PBT

Persistent, bio-accumulative and toxic

PNEC

Predicted No Effect Concentration

REACH

Registration, Evaluation, Authorisation and Restriction of Chemicals, Regulation (EC) No. 1907/2006

RID

Regulations concerning the International Carriage of Dangerous Goods by Rail

SDS

Safety Data Sheet

STP

Sewage treatment plant

vPvB

very Persistent and very Bio-accumulating

Data sources:

This Safety Data Sheet is based on the characteristics of the components / additives, according to the

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Professional training tip:

information provided by the original suppliers.
Provide adequate training to professional operators for the use of Personal Protective Equipment (PPE), based on the information contained in this safety data sheet.

Other information:

Do not use the product for purposes other than those indicated by the manufacturer.
Container under pressure: Protect against sunlight and do not expose to temperatures exceeding 50°C. Do not perforate or burn, even after use. Do not spray on a flame or an incandescent body.

List of poison control centres in Italy:

Ancona:

University hospital pharmacovigilance centre - from 7.30 a.m. to 1.30 p.m.

Via Trento, 10 / A Torrette (Ancona) Phone: +0039 7218102

Bologna:

Ospedale Maggiore - 24/7

Via Largo Negriscoli 2
Phone: +0039 516478955

Catania:

Garibaldi Hospital - 24/7

Piazza Santa Maria di Gesù, 6
Phone +0039 957594120 - +0039 957594032

Cesena:

Maurizio Bufalini Hospital - 24/7

Viale Ghisotti
Phone: +0039 547352612

Chieti:

Santissima Annunziata Hospital - 24/7

Via dei Vestini, 1
Phone: +0039 871551219

Florence:

Careggi Hospital - 24/7

Viale Pieraccini, 17
Phone +0039 557947819

La Spezia:

Sant'Andrea Civil Hospital - 24/7

Via Vittorio Veneto, 197
Phone +0039 187533297 - +0039 187533376

Lecce:

Presidium Hospital No.1 - 24/7

Vito Fazzi plant Piazza Muratore, 1 Phone +0039 832351105

Naples:

Cardarelli Hospital - 24/7

Via Candrelli, 9
Phone: +0039 817472870

Pavia:

National Centre for Toxicological Information Salvatore Maugeri Foundation
IRCCS Work and Rehabilitation Clinic - 24/7

Via Salvatore Maugeri, 10
Phone: +0039 38224444

Pordenone:

Civil Hospital - 24/7

Via Montersale, 24
Phone: +0039 434550301

Reggio Calabria:

Reunited Hospital - 24/7

Via G. Melacrino, 1
Phone: +0039 965811624

Rome:

A. Gemelli Polyclinic - 24/7

Largo Agostino Gemelli, 8
Phone: +0039 63054343

Rome:

Umberto I Polyclinic - 24/7

Viale del Policlinico
Phone: +0039 649978020

Turin:

Anaesthesia and resuscitation institute

Via Achille Mario Dogliotti
Phone: +0039 116637637

Trieste:

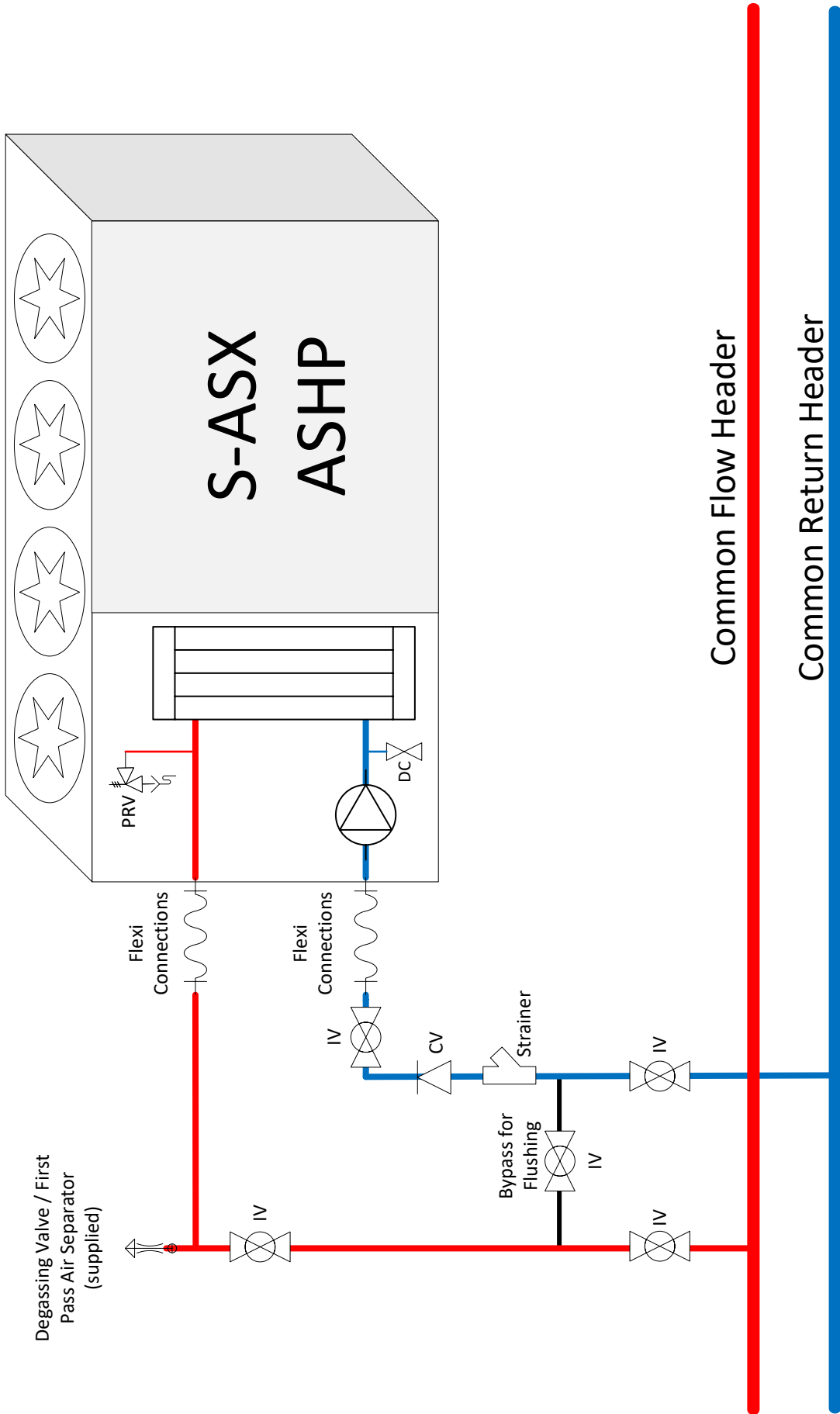
Admission and Casualty Department, IRCCS Burlo Garofalo

Via dell'Istria 65/1
Phone: +0039 403785373

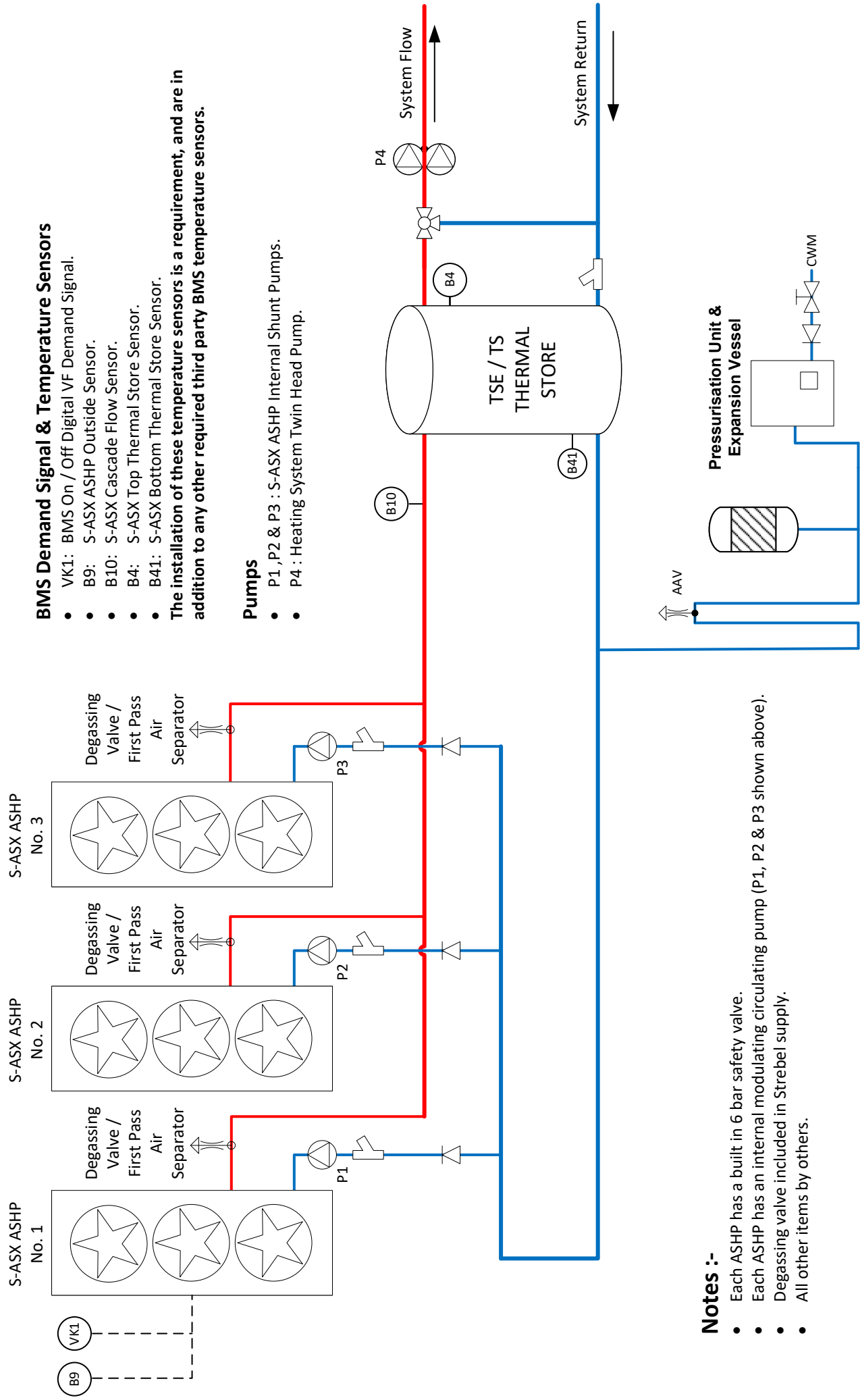
11

S-ASX R290 & R454B ASHP – Recommended Individual Pipework Setup

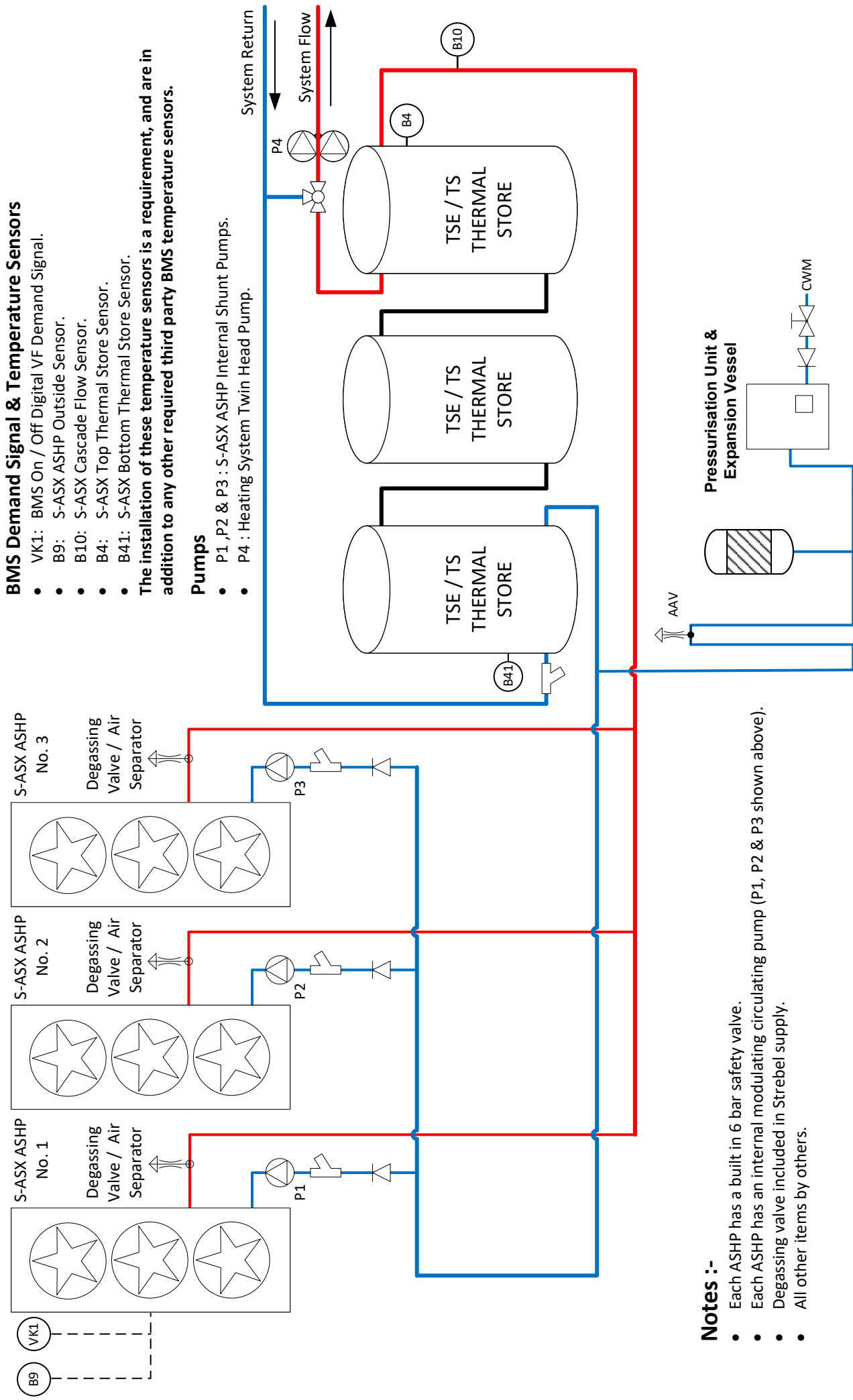
Note: Degassing valve and all internal ASHP components shown are included in Strebel supply. All other items by others.



3 x S-ASX ASHP (R290 & R454B) in Cascade – 1 x Thermal Stores in Series



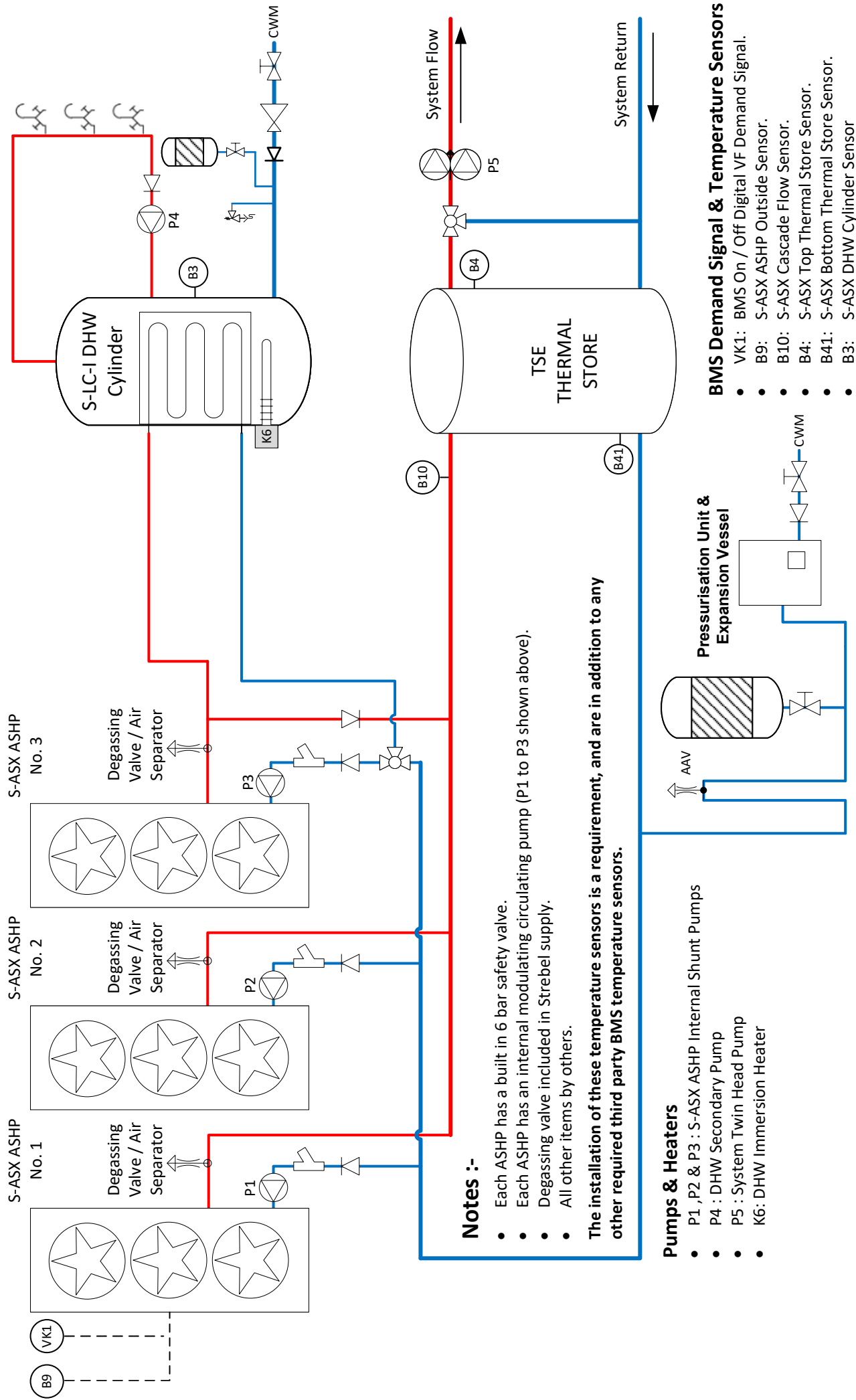
3 x S-ASX ASHP (R290 & R454B) in Cascade – 3 x Thermal Stores in Series



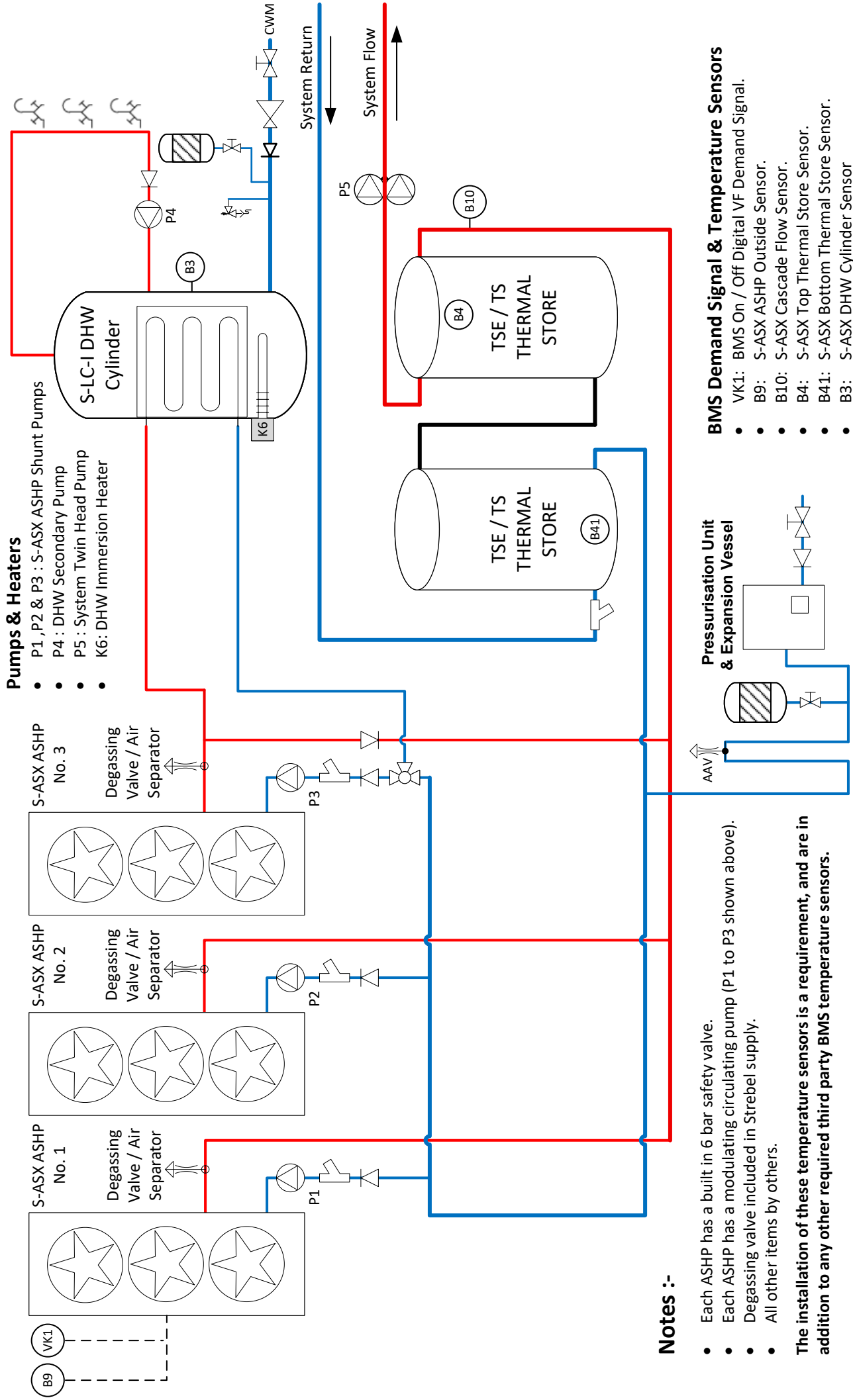
Notes :-

- Each ASHP has a built in 6 bar safety valve.
- Each ASHP has an internal modulating circulating pump (P1, P2 & P3 shown above).
- Degassing valve included in Strebel supply.
- All other items by others.

3 x S-ASX ASHP (R290 & R454B) in Cascade – 1 x TS & Dedicated DHW



3 x S-ASX ASHP (R290 & R454B) in Cascade – Multiple TS & Dedicated DHW



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FLUES – ACCESSORIES.