

STREBEL

S-ASX-NTVi Range

Air Source Heat Pump

Models 80 - 120

Installation, Operating & Maintenance Manual



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

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-NTVi 80R Air to Water Heat Pump S-ASX-NTVi 120R 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: 01st May 2026.

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

Signed by the manufacturer:



Print: Andy Parker

Position: Managing Director

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The manufacturer reserves the right to make modifications and/or improvements to this manual
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Table of Contents

General Information	4
General Warning	4
Unit Data Plate	4
Description	5
Description of Components	5
Options.....	5
Safety Features Description.....	6
Identification Code.....	7
Technical Data	8
Nominal Performances	9
S-ASX-NTVi 80 - Nominal Performances in Heating Mode	11
S-ASX-NTVi 120 - Nominal Performances in Heating Mode	12
Heating and Cooling Performances – Parametric Curves	13
Operating Range	14
Hydraulic Performances	15
Other Technical Data	16
Acoustic Performances / Overall Dimensions & Clearances	16
ATEX & Minimum Clearances.....	17
Safety Zone Clearances.....	19
Electrical Data & Weights.....	20
Transport	21
Transport of the ASHP	21
Receiving and Storing.....	22
Receiving.....	22
Storing.....	22
Installation Site	23
Open Air Installation	23
Positioning / Water Quality / Glycol	25
Connections.....	26
Hydraulic Connections	26
ASHP Basic Schematic – Example of CH Operation	27
Primary Circuit.....	27
Electrical Connections.....	28
Start Up	29
Preliminary Checks	29
Unit Start Up	29
Control System	30
User Interface.....	30
Temperature Sensors.....	31
Outdoor Air Sensor	31
Navigation Menu.....	32
Complete Parameter List	33
Main Functions	34
Alarms	37
Alarms Table	38
Maintenance	40
Safety.....	42
Refrigerant Safety Card	44
Schematic Appendix - Common Installation Examples	47
Technical Data Appendix - Min / Max Heating Performance	52

General Information

General Warnings

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, this personnel must be authorised by the owner of the unit and recognised 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 center recognised 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, **THE WARRANTY IS VOID.**

The unit must be serviced by qualified personnel in compliance with all applicable and applicable safety regulations in accordance with the national legislation of the country of installation.

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, so as to trace the specific characteristics of the product and the assembled components and to correctly supply any spare parts.

Unit Data Plate

A				CE	
S/N	B				
Model	C				
Code	D				
Power supply	E				
Max Current Input [A]	F				
Standard	G	Heating A7W35		Cooling A35W7	
Capacity	[kW]	H	J		
Power input	[kW]	I	K		
Max pressure	[bar]	High	L	Low	M
Refrigerant	[kg]		N		P
	[tCO ₂ eq]		O		Q
Weight	[kg]	R			
Sound pressure at 1m	[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 [barg]
- M Maximum pressure on the low pressure side [barg]
- N Quantity of refrigerant [kg]
- O Tonnes of equivalent CO₂ [tCO₂eq]
- P Type of refrigerant
- Q Refrigerant GWP
- R Weight [kg]
- S Sound pressure level at 1 metre [dB(A)]
- T Type of protection
- U Protection level
- V PED category
- W PED certification body
- X Manufacturer

Nominal conditions *	Air - Water
Heating	A7W35
Cooling	A35W7

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 in order to minimize noise emissions in the surroundings.

Refrigerant Circuit - Hermetically Sealed Circuits

Each unit is equipped with two or three completely independent refrigerant circuits.

The hermetic **scroll inverter** compressors are equipped with BLDC direct current motor and are mounted on damper supports and protected against over-temperatures and over-currents.

Each compressor is equipped with an electrical heater, that keep the compressor crankcase oil temperature high enough to prevent migration of refrigerant during winter stops and to evaporate any liquid present in the crankcase, in order to prevent possible liquid rushes on starting.

Each compressor is equipped with vapour and liquid injection and is placed on an economized refrigerant circuit with plate heat exchanger and electronic expansion valve dedicated to the injection.

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 whatever water flow lack. The heat exchanger on the source side is a finned coil with grooved copper pipes and hydrophilic aluminum 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 super-heating. 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, high pressure switch and pressure sensors in order to assure the compressor to operate inside the permitted limits, 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

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 in order to reduce the noise during the night. The fans of each circuit are independent from the other circuits in order to optimize the efficiency at part loads.

Hydraulic Circuit

The hydraulic circuit is equipped with safety valve and manual air vents in order 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.

Options

Standard Supply & Additional Options		
Acoustic Setting Up	Low noise acoustic setting up (Standard Supply)	Allows to reduce the noise emitted by the unit by means of the refrigerant circuit vane acoustic insulation.
Plant Side Flow Rate Management	Modulating Pump (Standard Supply)	Allows the circulation of the water on the plant side. With the modulating pump is possible to adjust the water flow rate in order to keep constant the temperature difference between inlet and outlet.
	High Head Pump (Additional Supply)	

Controls Communication for BMS - Supplied as Standard	
Hard Wired Communication	ASHP main controller accepts hard wired signals such as digital on / off & 0-10V heat demand signal from BMS.
Modbus BMS Communication	Controls interface supplied as standard to allow for onsite BMS Modbus communication.
BACnet BMS Communication	Controls interface supplied as standard to allow for onsite BMS BACnet communication.

Components Supplied with the Unit – Mandatory Installation	
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.
6mm Temp Sensors	Mandatory Installation: To be installed to Thermal Store(s) & DHW Cylinder(s) in addition to any BMS sensors.

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 minimise 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 into 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 in order 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 circuits (excluding the finned coil) and 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 re-calibrated 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-NTVi120R3SVNB9

1

23

45

678

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	
	SV	Scroll compressors - Variable 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		80	120	
Efficiency class	AVERAGE climate Low Temperature Application - 35°C	A++	A++	-
	AVERAGE climate High Temperature Application - 55°C	A++	A++	-
Seasonal efficiency η_s	AVERAGE climate Low Temperature Application - 35°C	162	162	%
	AVERAGE climate High Temperature Application - 55°C	131	132	%
SCOP	AVERAGE climate Low Temperature Application - 35°C	4.14	4.14	-
	AVERAGE climate Medium Temperature Application - 45°C	3.59	3.60	-
	Average climate High Temperature Application - 55°C	3.36	3.36	-
	AVERAGE climate Very High Temperature Application - 65°C	3.02	3.02	-
P design	AVERAGE climate Low Temperature Application - 35°C	98	147	kW
	AVERAGE climate Medium Temperature Application - 45°C	100	150	kW
	Average climate High Temperature Application - 55°C	102	152	kW
	AVERAGE climate Very High Temperature Application - 65°C	104	156	kW

		80	120	
Refrigerant (GWP)		R290 (GWP = 3)		-
Refrigerant charge - Access Categories EN 378 **		2 x 4.8kg - General Access	3 x 4.8kg - General Access	kg
Compressors	Type	High temperature scroll inverter BLDC with vapour and liquid injection		-
	n° of compressors	2	3	-
	oil charge	2.8	2.8	kg
Refrigerant circuits	n° of circuits	2	3	-
Compressor modulation		35 - 100		%
Plant side heat exchangers	Type	stainless steel brazed plates		-
	n°	2	3	-
	Water volume	6.0	9.0	l
Source side heat exchangers	Type	Finned coil with copper pipes and hydrophilic aluminum fins		-
	n°	4	6	-
	Total frontal surface	4.0	6.0	m²
Fans	Type	Axial EC		-
	n°	2	3	-
Nominal total air flow rate		32200	48300	m³/h
Hydraulic circuit	Max pressure	6		bar
	Min pressure *	0.3		bar
	Min pressure with integrated 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 dataplate 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 in order to avoid cavitation problems (NPSH).

NOMINAL Performances

	HEATING	A	W	80	120	
A7W35	Heating capacity	7	35	79,9	120	kW
	Power input			17,4	26,0	kW
	COP			4,59	4,62	-
	Plant side water flow rate			13785	20677	l/h
	Plant side pressure drops			19	19	kPa
A7W45	Heating capacity	7	45	80,8	121	kW
	Power input			21,6	32,4	kW
	COP			3,74	3,73	-
	Plant side water flow rate			13997	20996	l/h
	Plant side pressure drops			20	20	kPa
A7W55	Heating capacity	7	55	82,1	123	kW
	Power input			26,0	38,9	kW
	COP			3,16	3,16	-
	Plant side water flow rate			8938	13407	l/h
	Plant side pressure drops			9	9	kPa
A7W65	Heating capacity	7	65	84,0	126	kW
	Power input			32,1	48,1	kW
	COP			2,62	2,62	-
	Plant side water flow rate			7345	11017	l/h
	Plant side pressure drops			6	6	kPa
A2W35	Heating capacity	2	35	67,3	101	kW
	Power input			17,4	26,1	kW
	COP			3,87	3,87	-
	Plant side water flow rate			11630	17445	l/h
	Plant side pressure drops			14	14	kPa
A2W45	Heating capacity	2	45	68,4	103	kW
	Power input			21,7	32,5	kW
	COP			3,15	3,17	-
	Plant side water flow rate			11858	17787	l/h
	Plant side pressure drops			15	15	kPa
A2W55	Heating capacity	2	55	69,9	105	kW
	Power input			26,0	39,0	kW
	COP			2,69	2,69	-
	Plant side water flow rate			7607	11410	l/h
	Plant side pressure drops			7	7	kPa
A2W65	Heating capacity	2	65	71,9	108	kW
	Power input			32,1	48,2	kW
	COP			2,24	2,24	-
	Plant side water flow rate			6286	9429	l/h
	Plant side pressure drops			5	5	kPa
A-2W35	Heating capacity	-2	35	63,1	94,6	kW
	Power input			17,4	26,1	kW
	COP			3,63	3,62	-
	Plant side water flow rate			10897	16346	l/h
	Plant side pressure drops			13	13	kPa
A-2W45	Heating capacity	-2	45	64,3	96,4	kW
	Power input			21,7	32,5	kW
	COP			2,96	2,97	-
	Plant side water flow rate			11143	16714	l/h
	Plant side pressure drops			13	13	kPa
A-2W55	Potenza termica	-2	55	65,9	98,8	kW
	Potenza assorbita			26,1	39,1	kW
	COP			2,52	2,53	-
	Portata acqua lato impianto			7170	10755	l/h
	Perdite di carico lato impianto			6	6	kPa
A-2W65	Potenza termica	-2	65	68,0	102	kW
	Potenza assorbita			32,2	48,2	kW
	COP			2,11	2,12	-
	Portata acqua lato impianto			5946	8919	l/h
	Perdite di carico lato impianto			4	4	kPa

NOMINAL Performances

	HEATING	A	W	80	120	
A-7W35	Heating capacity	-7	35	57,5	86,3	kW
	Power input			17,5	26,2	kW
	COP			3,29	3,29	-
	Plant side water flow rate			9941	14911	l/h
	Plant side pressure drops			11	11	kPa
A-7W45	Heating capacity	-7	45	58,9	88,3	kW
	Power input			21,7	32,6	kW
	COP			2,71	2,71	-
	Plant side water flow rate			10212	15318	l/h
	Plant side pressure drops			11	11	kPa
A-7W55	Heating capacity	-7	55	60,7	91,0	kW
	Power input			26,1	39,1	kW
	COP			2,33	2,33	-
	Plant side water flow rate			6603	9904	l/h
	Plant side pressure drops			5	5	kPa
A-7W65	Heating capacity	-7	65	63,0	94,4	kW
	Power input			32,2	48,3	kW
	COP			1,96	1,95	-
	Plant side water flow rate			5505	8258	l/h
	Plant side pressure drops			4	4	kPa

	COOLING	A	W	80	120	
A35W7	Cooling capacity	35	7	62,7	94,1	kW
	Power input			20,2	30,2	kW
	EER			3,10	3,12	-
	Plant side water flow rate			10794	16183	l/h
	Plant side pressure drops			12	12	kPa
A35W18	Cooling capacity	35	18	82,9	124	kW
	Power input			21,8	32,6	kW
	EER			3,80	3,80	-
	Plant side water flow rate			14339	21496	l/h
	Plant side pressure drops			21	21	kPa
A25W7	Cooling capacity	25	7	70,3	105	kW
	Power input			17,2	25,7	kW
	EER			4,09	4,09	-
	Plant side water flow rate			12104	18146	l/h
	Plant side pressure drops			15	15	kPa
A25W18	Cooling capacity	25	18	91,1	137	kW
	Power input			18,8	28,2	kW
	EER			4,85	4,86	-
	Plant side water flow rate			15767	23638	l/h
	Plant side pressure drops			25	25	kPa

Data declared according to EN 14511. The data are related to units working at the **nominal frequency**, 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						

S-ASX-NTVi 80 - Nominal Performances in Heating Mode

Model		Water outlet temperature	Outdoor air temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
80	Nominal	78	Heating capacity	-	-	66,8	70,0	71,6	73,4	75,3	87,2	93,5	101,0	114,0	119,0	kW
			Power input	-	-	47,2	47,2	47,2	47,2	47,2	47,2	47,2	47,1	47,1	47,1	kW
			COP	-	-	1,42	1,48	1,52	1,56	1,60	1,85	1,98	2,14	2,42	2,53	-
		75	Heating capacity	-	56,2	65,7	68,9	70,6	72,3	74,3	86,3	92,6	100,0	113,0	118,0	kW
			Power input	-	43,8	43,8	43,8	43,8	43,8	43,8	43,8	43,7	43,7	43,7	43,6	kW
			COP	-	1,28	1,50	1,57	1,61	1,65	1,70	1,97	2,12	2,29	2,59	2,71	-
		70	Heating capacity	49,3	54,3	64,1	67,3	69,0	70,8	72,8	84,9	91,2	98,9	112,0	117,0	kW
			Power input	38,6	38,7	38,7	38,7	38,7	38,7	38,7	38,7	38,6	38,6	38,5	38,5	kW
			COP	1,28	1,40	1,66	1,74	1,78	1,83	1,88	2,19	2,36	2,56	2,91	3,04	-
		65	Heating capacity	47,7	52,8	62,7	65,9	67,7	69,5	71,6	83,7	90,1	97,9	111,0	116,0	kW
			Power input	34,2	34,2	34,3	34,3	34,3	34,2	34,2	34,2	34,2	34,2	34,1	34,1	kW
			COP	1,39	1,54	1,83	1,92	1,97	2,03	2,09	2,45	2,63	2,86	3,26	3,40	-
		60	Heating capacity	46,2	51,4	61,5	64,8	66,6	68,5	70,6	82,8	89,2	97,1	110,0	115,0	kW
			Power input	30,4	30,4	30,4	30,4	30,4	30,4	30,4	30,4	30,4	30,3	30,2	30,2	kW
			COP	1,52	1,69	2,02	2,13	2,19	2,25	2,32	2,72	2,93	3,20	3,64	3,81	-
		55	Heating capacity	45,0	50,3	60,5	63,9	65,7	67,6	69,7	82,0	88,5	96,4	110,0	115,0	kW
			Power input	27,1	27,1	27,1	27,1	27,1	27,1	27,1	27,1	27,0	27,0	26,9	26,9	kW
			COP	1,66	1,86	2,23	2,36	2,42	2,49	2,57	3,03	3,28	3,57	4,09	4,28	-
		50	Heating capacity	43,8	49,3	59,7	63,1	65,0	66,9	69,0	81,3	87,9	95,9	109,0	115,0	kW
			Power input	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,2	24,1	24,1	24,0	24,0	kW
			COP	1,81	2,04	2,47	2,61	2,69	2,76	2,85	3,36	3,65	3,98	4,54	4,79	-
		45	Heating capacity	42,8	48,4	58,9	62,4	64,3	66,2	68,4	80,8	87,4	95,4	109,0	114,0	kW
			Power input	21,7	21,7	21,7	21,7	21,7	21,7	21,7	21,6	21,6	21,6	21,5	21,4	kW
			COP	1,97	2,23	2,71	2,88	2,96	3,05	3,15	3,74	4,05	4,42	5,07	5,33	-
		40	Heating capacity	41,9	47,5	58,2	61,7	63,7	65,7	67,9	80,3	87,0	95,0	109,0	114,0	kW
			Power input	19,4	19,5	19,5	19,5	19,5	19,4	19,4	19,4	19,4	19,3	19,2	19,2	kW
			COP	2,16	2,44	2,98	3,16	3,27	3,39	3,50	4,14	4,48	4,92	5,68	5,94	-
		35	Heating capacity	41,0	46,7	57,5	61,1	63,1	65,1	67,3	79,9	86,6	94,7	108,0	114,0	kW
			Power input	17,4	17,5	17,5	17,5	17,4	17,4	17,4	17,4	17,3	17,3	17,2	17,2	kW
			COP	2,36	2,67	3,29	3,49	3,63	3,74	3,87	4,59	5,01	5,47	6,28	6,63	-
		30	Heating capacity	40,0	45,9	56,9	60,5	62,5	64,5	66,8	79,4	86,1	94,3	108,0	113,0	kW
			Power input	15,5	15,6	15,6	15,6	15,5	15,5	15,5	15,5	15,4	15,4	15,3	15,3	kW
			COP	2,58	2,94	3,65	3,88	4,03	4,16	4,31	5,12	5,59	6,12	7,06	7,39	-

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.

S-ASX-NTVi 120 - Nominal Performances in Heating Mode

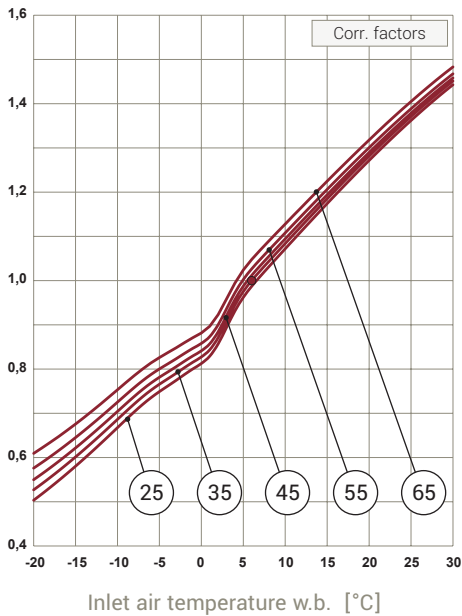
Model		Water outlet temperature	Outdoor air temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
120	Nominal	78	Heating capacity	-	-	100,0	105,0	107,0	110,0	113,0	131,0	140,0	152,0	171,0	179,0	kW
			Power input	-	-	70,8	70,8	70,8	70,7	70,7	70,7	70,7	70,6	70,5	70,5	kW
			COP	-	-	1,41	1,48	1,51	1,56	1,60	1,85	1,98	2,15	2,43	2,54	-
		75	Heating capacity	-	84,2	98,5	103,0	106,0	108,0	111,0	129,0	139,0	150,0	170,0	177,0	kW
			Power input	-	65,6	65,7	65,7	65,6	65,6	65,6	65,6	65,6	65,5	65,4	65,4	kW
			COP	-	1,28	1,50	1,57	1,62	1,65	1,69	1,97	2,12	2,29	2,60	2,71	-
		70	Heating capacity	74,0	81,5	96,1	101,0	103,0	106,0	109,0	127,0	137,0	148,0	168,0	176,0	kW
			Power input	57,9	58,0	58,0	58,0	58,0	58,0	58,0	57,9	57,9	57,8	57,7	57,7	kW
			COP	1,28	1,41	1,66	1,74	1,78	1,83	1,88	2,19	2,37	2,56	2,91	3,05	-
		65	Heating capacity	71,5	79,1	94,0	98,9	102,0	104,0	107,0	125,0	135,0	147,0	166,0	174,0	kW
			Power input	51,3	51,4	51,4	51,4	51,4	51,3	51,3	51,3	51,2	51,2	51,0	51,0	kW
			COP	1,39	1,54	1,83	1,92	1,98	2,03	2,09	2,44	2,64	2,87	3,25	3,41	-
		60	Heating capacity	69,3	77,1	92,2	97,2	99,9	103,0	106,0	124,0	134,0	146,0	165,0	173,0	kW
			Power input	45,5	45,6	45,6	45,6	45,6	45,6	45,5	45,5	45,5	45,4	45,3	45,2	kW
			COP	1,52	1,69	2,02	2,13	2,19	2,26	2,33	2,73	2,95	3,22	3,64	3,83	-
		55	Heating capacity	67,4	75,4	90,7	95,8	98,6	101,0	105,0	123,0	133,0	145,0	164,0	172,0	kW
			Power input	40,6	40,6	40,7	40,6	40,6	40,6	40,6	40,5	40,5	40,4	40,3	40,2	kW
			COP	1,66	1,86	2,23	2,36	2,43	2,49	2,59	3,04	3,28	3,59	4,07	4,28	-
		50	Heating capacity	65,7	73,9	89,5	94,6	97,4	100,0	104,0	122,0	132,0	144,0	164,0	172,0	kW
			Power input	36,3	36,3	36,3	36,3	36,3	36,3	36,2	36,2	36,1	36,1	35,9	35,9	kW
			COP	1,81	2,04	2,47	2,61	2,68	2,75	2,87	3,37	3,66	3,99	4,57	4,79	-
		45	Heating capacity	64,2	72,5	88,3	93,5	96,4	99,3	103,0	121,0	131,0	143,0	163,0	171,0	kW
			Power input	32,5	32,6	32,6	32,5	32,5	32,5	32,5	32,4	32,4	32,3	32,1	32,1	kW
			COP	1,98	2,22	2,71	2,88	2,97	3,06	3,17	3,73	4,04	4,43	5,08	5,33	-
		40	Heating capacity	62,8	71,3	87,3	92,6	95,5	98,5	102,0	120,0	130,0	142,0	163,0	171,0	kW
			Power input	29,2	29,2	29,2	29,2	29,2	29,1	29,1	29,1	29,0	28,9	28,8	28,7	kW
			COP	2,15	2,44	2,99	3,17	3,27	3,38	3,51	4,12	4,48	4,91	5,66	5,96	-
		35	Heating capacity	61,4	70,0	86,3	91,6	94,6	97,6	101,0	120,0	130,0	142,0	162,0	170,0	kW
			Power input	26,1	26,2	26,2	26,2	26,1	26,1	26,1	26,0	26,0	25,9	25,7	25,7	kW
			COP	2,35	2,67	3,29	3,50	3,62	3,74	3,87	4,62	5,00	5,48	6,30	6,61	-
		30	Heating capacity	60,0	68,8	85,3	90,7	93,7	96,8	100,0	119,0	129,0	141,0	162,0	170,0	kW
			Power input	23,3	23,3	23,3	23,3	23,3	23,3	23,2	23,2	23,1	23,0	22,9	22,8	kW
			COP	2,58	2,95	3,66	3,89	4,02	4,15	4,31	5,13	5,58	6,13	7,07	7,46	-

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.

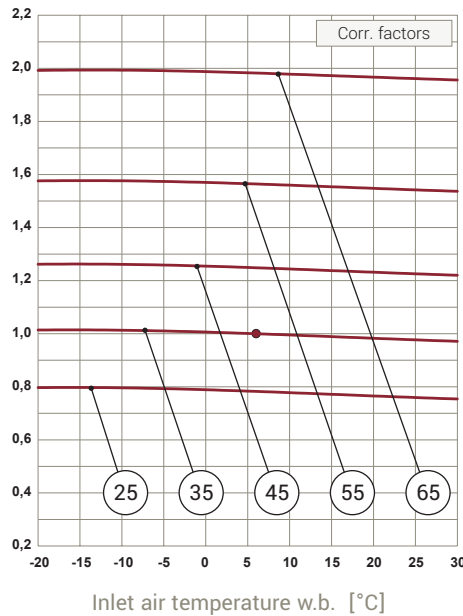
Heating and Cooling Performances

HEATING performances

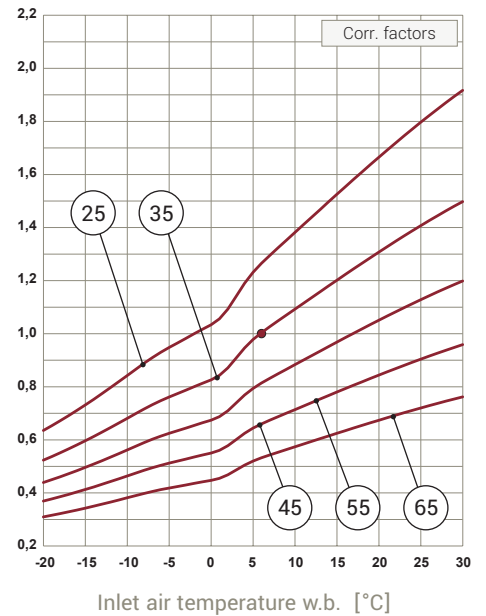
Heating capacity



Power input

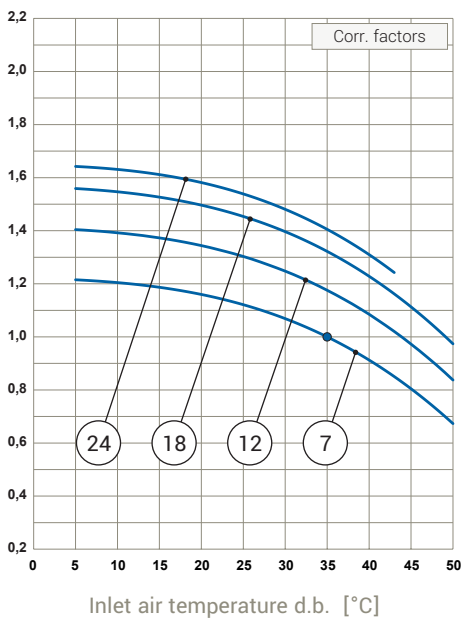


Efficiency - COP

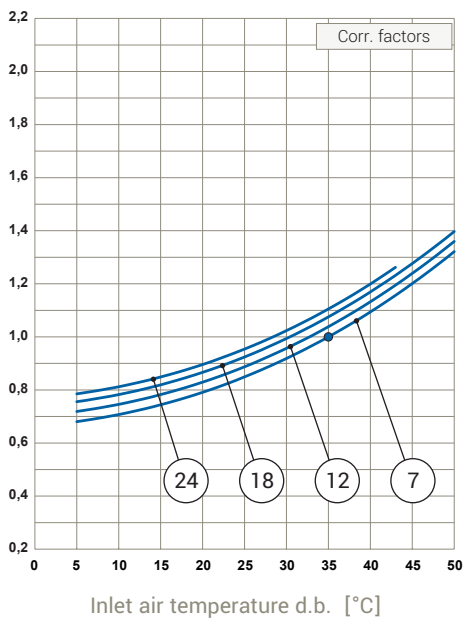


COOLING performances

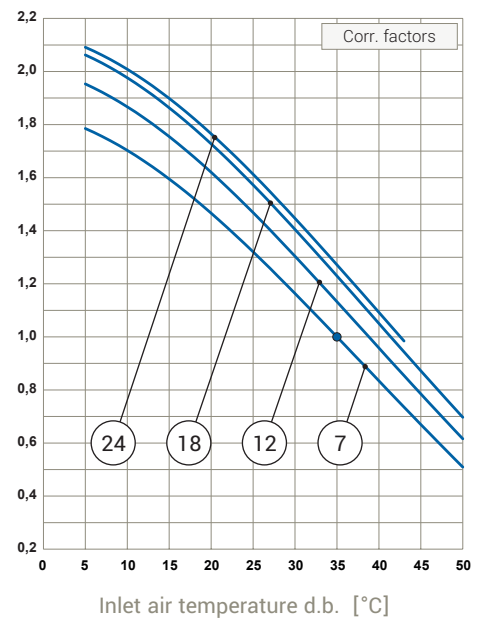
Cooling capacity



Power input



Efficiency - EER



The graphs provide the **corrective factors** to be applied to the NOMINAL performances in order to obtain the performances in the selected operating conditions. The curves are parameterized according to the outlet water temperature on the plant sidewith 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

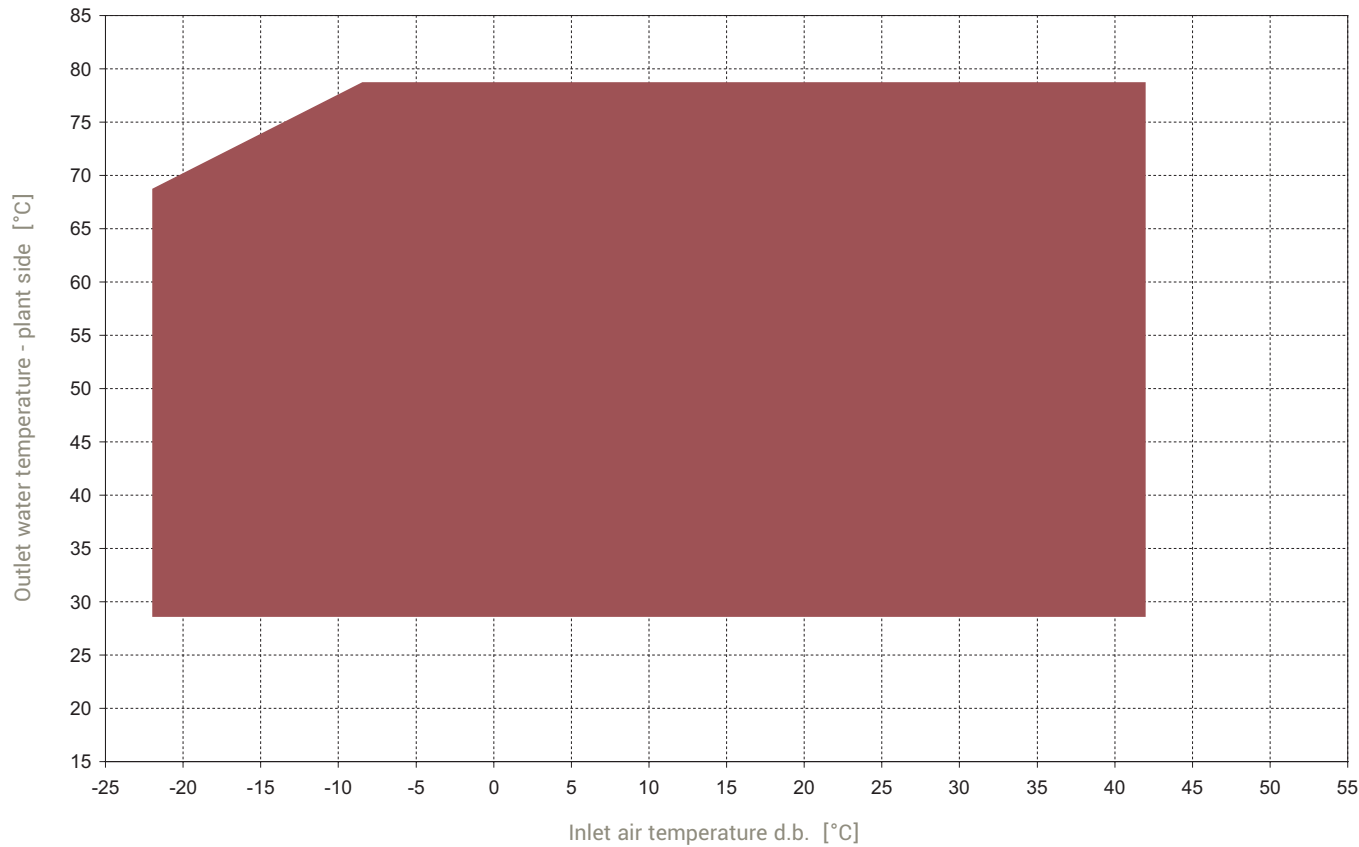
source : air in 35°C db
plant : water in 12°C out 7°C

Operating Range

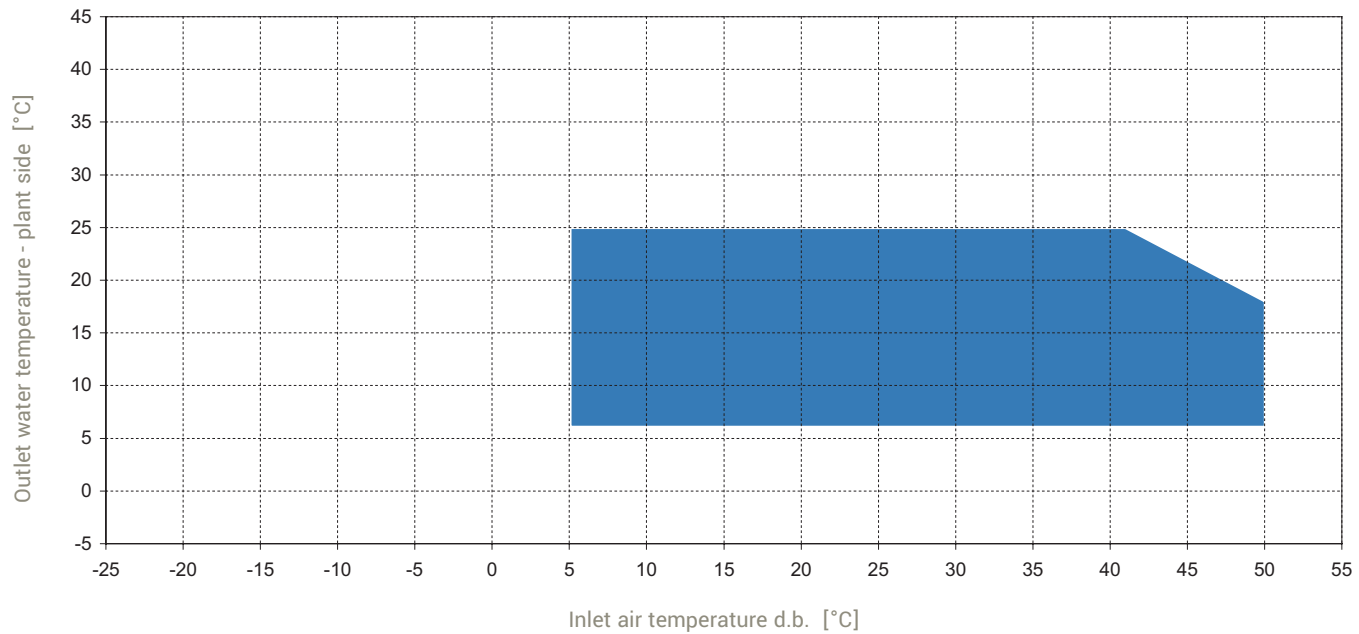
The graphs reported below show the operating area inside which the correct working of the unit is guaranteed.

Absolute maximum return temperature back to the ASHP is 73°C.

HEATING



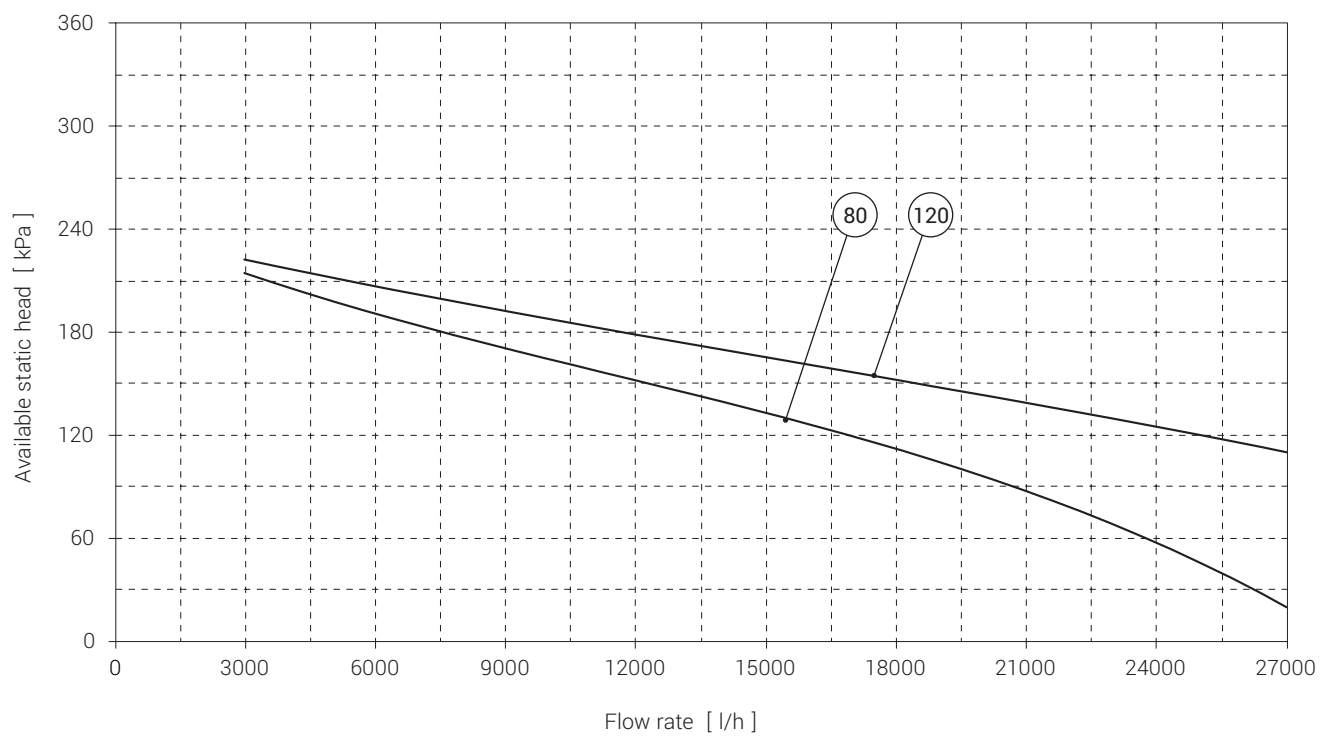
COOLING



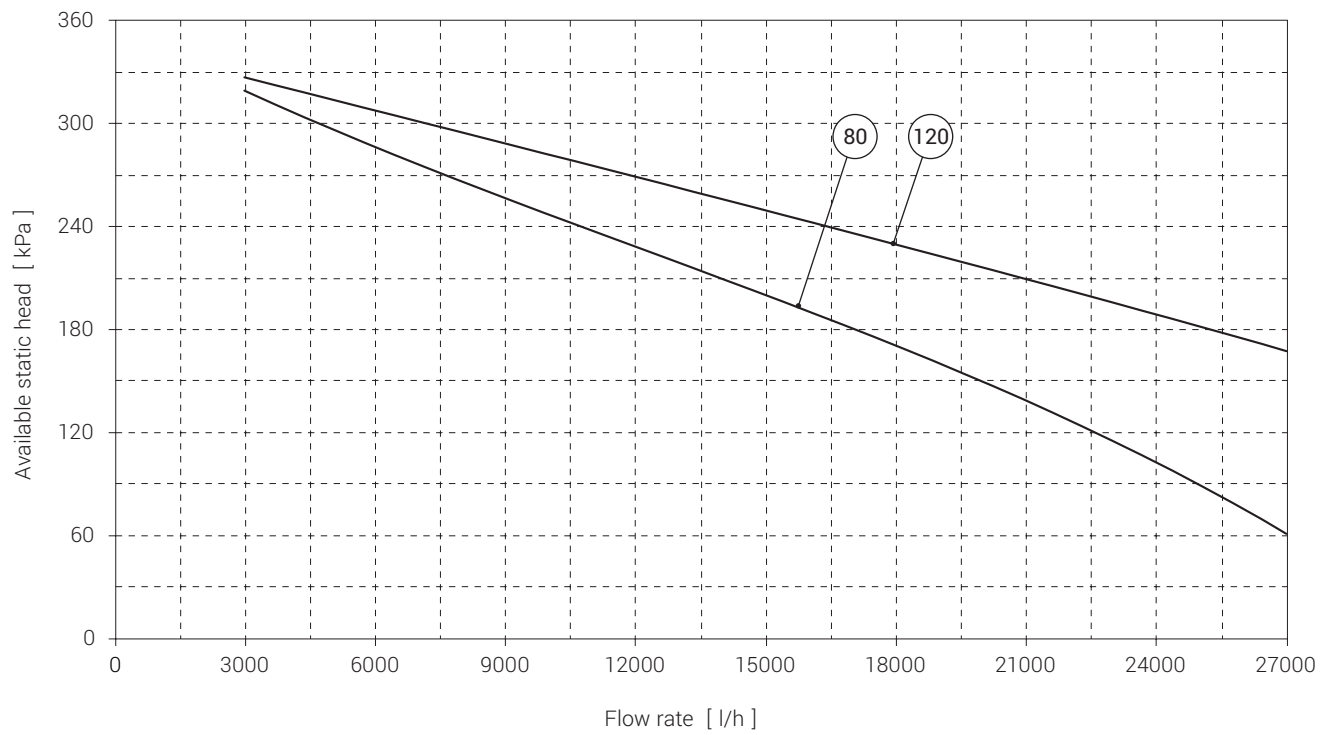
Temperature difference between water inlet and outlet		Plant side	Source side	
ΔT max	Maximum value	10	-	°C
ΔT min	Minimum value	3	-	°C

HYDRAULIC Performances

Available Static Head after ASHP - Modulating Pump (Standard Supply)



Available Static Head after ASHP - High Head Pump (Additional Option)



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.

Recommended water filter		80	120	
DN		50 (2")	65 (2"1/2)	-
Kvs		37	54	m³/h

Other Technical Data

Acoustic Performances

	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
	80	84,9	82,8	81,1	77,4	73,9	69,7	64,0	56,5	89	80	61	53	48
	120	87,2	85,1	83,4	79,7	76,2	72,0	66,3	58,8	91	82	63	55	50

Reference conditions

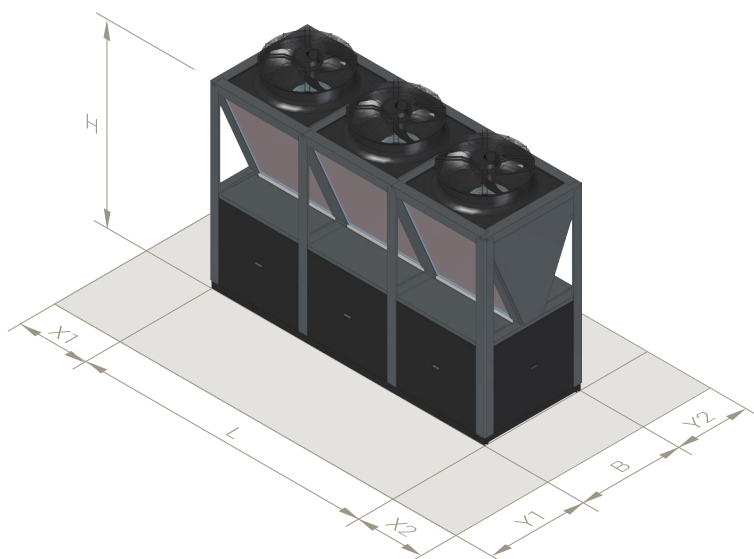
Performances related to units operating in heating mode at nominal conditions A7W35.

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.

Overall Dimensions



Overall Dimensions			
	80	120	
L	2260	3330	mm
B	1190	1190	mm
H	2490	2490	mm
X1	1000	1000	mm
X2	1000	1000	mm
Y1	600	600	mm
Y2	600	600	mm

X1, X2, Y1, Y2 : maintenance & operating area

Transport Dimensions			
	80	120	
L	2310	3380	mm
B	1240	1240	mm
H	2570	2570	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 ATEX and safety zone clearances, please see the ATEX & safety zone chapter starting on the next page.

Hydraulic Flow & Return Connections

The S-ASX-NTVi hydraulic flow and return connections are installed to the same compartment where the internal modulating pump is fitted. The connection size and type is shown as below.

Hydraulic fittings		80	120
1	Plant side INLET	2" VIC	2"1/2 VIC
2	Plant side OUTLET	2" VIC	2"1/2 VIC

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).

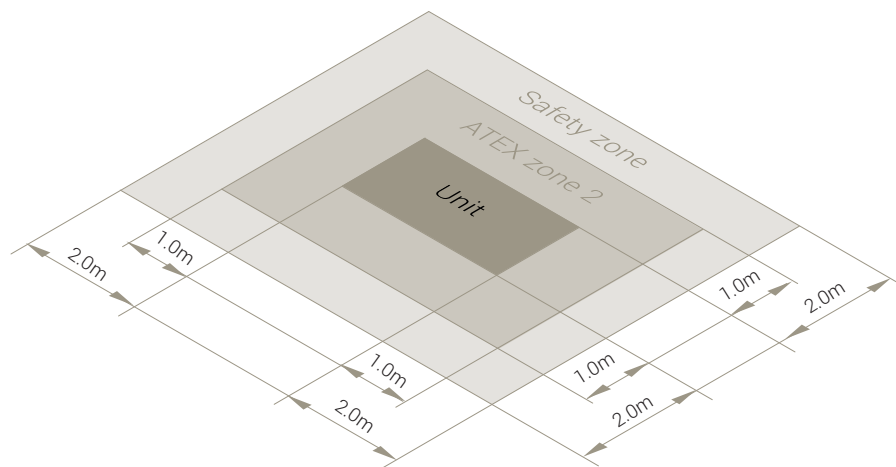
A standard open-air installation will have minimum physical objects around the unit(s) so that any air movement can flow over and around the installation and so dilute and disperse any leaked R290 quickly and safely.

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-NTVi Installation

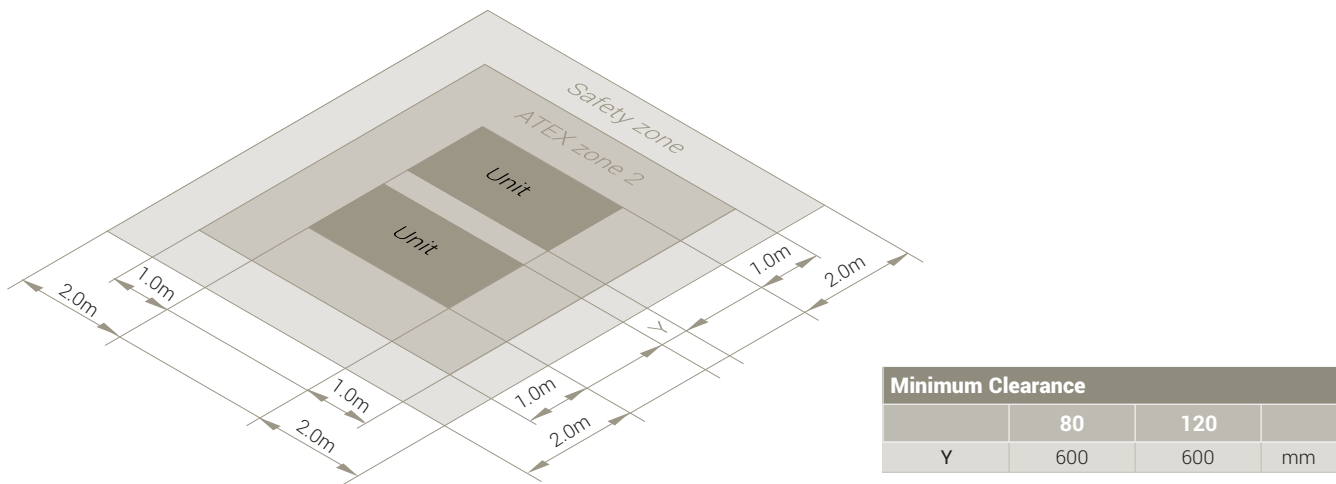
With a single S-ASX-NTVi installation, the below drawings shows the required ATEX zone (1 metre) and safety zone (2 metre) clearance.



Other Technical Data - ATEX & Safety Zones

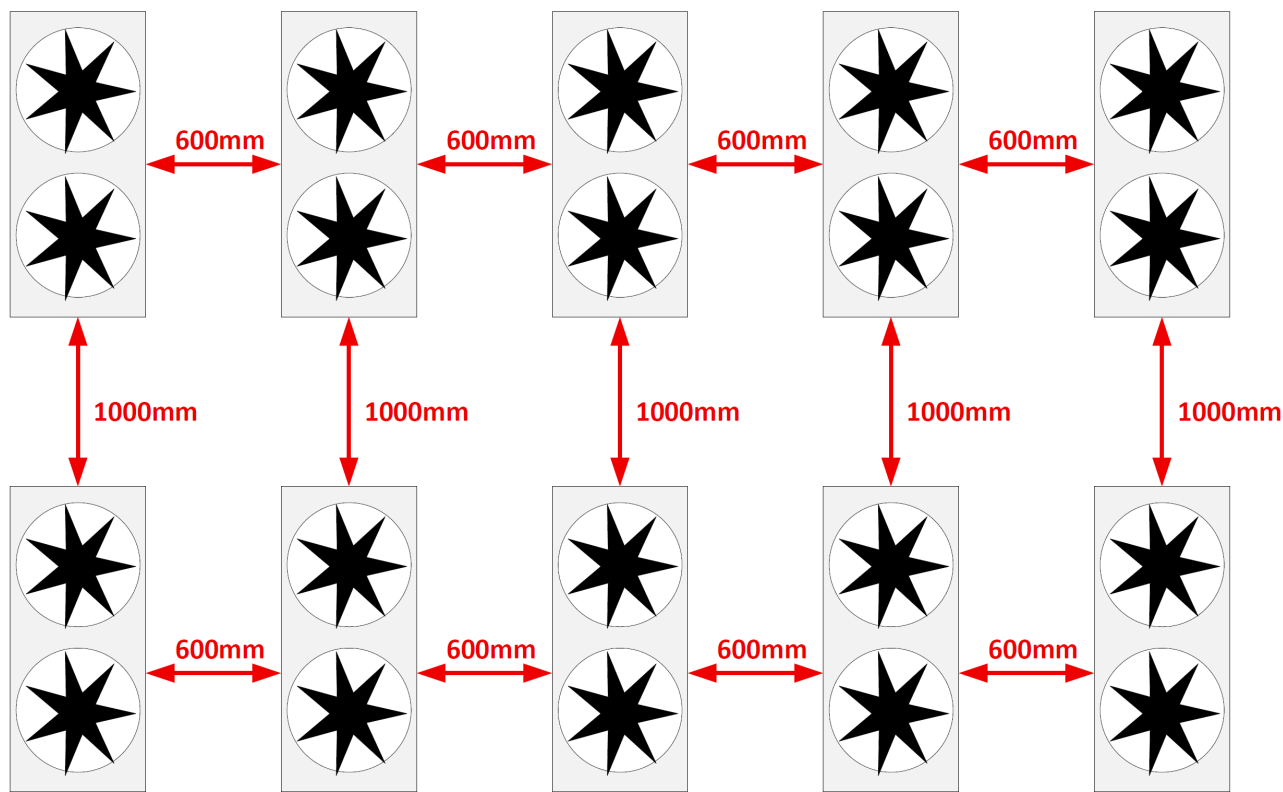
Minimum Clearances - S-ASX-NTVi to S-ASX-NTVi ASHP in Cascade

The below drawing shows the required minimum clearance around multiple S-ASX-NTVi ASHPs for both 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 must meet the maintenance clearance of Y1 & Y2 = 600mm.

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



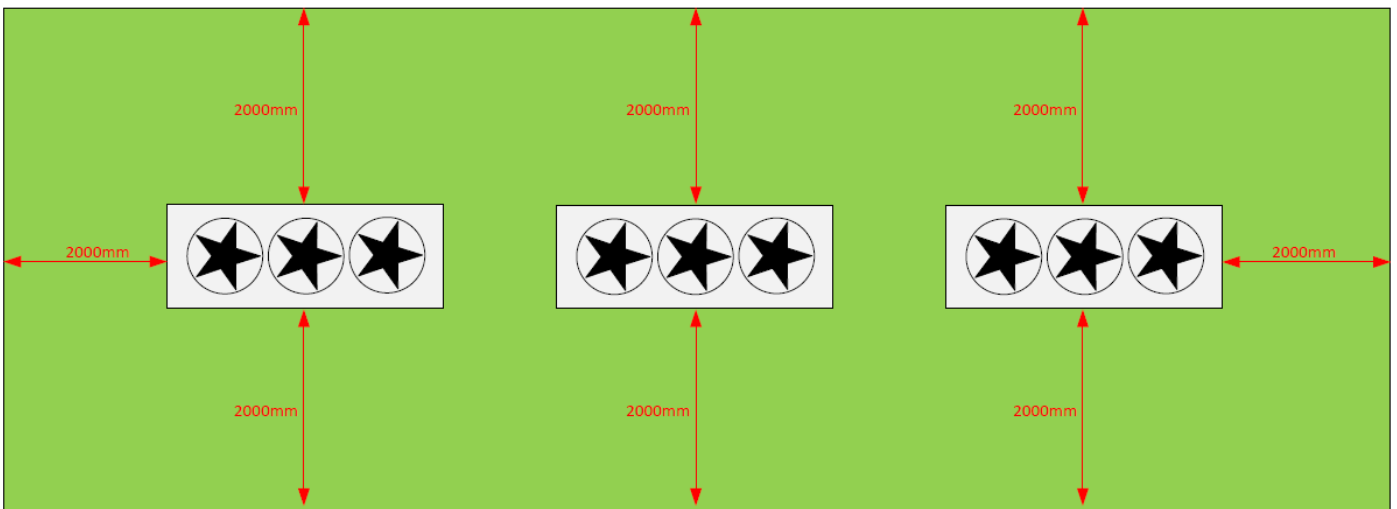
Other Technical Data - ATEX & Safety Zones

Safety Zone Clearance - For S-ASX-NTVi 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-NTVi ASHPs.



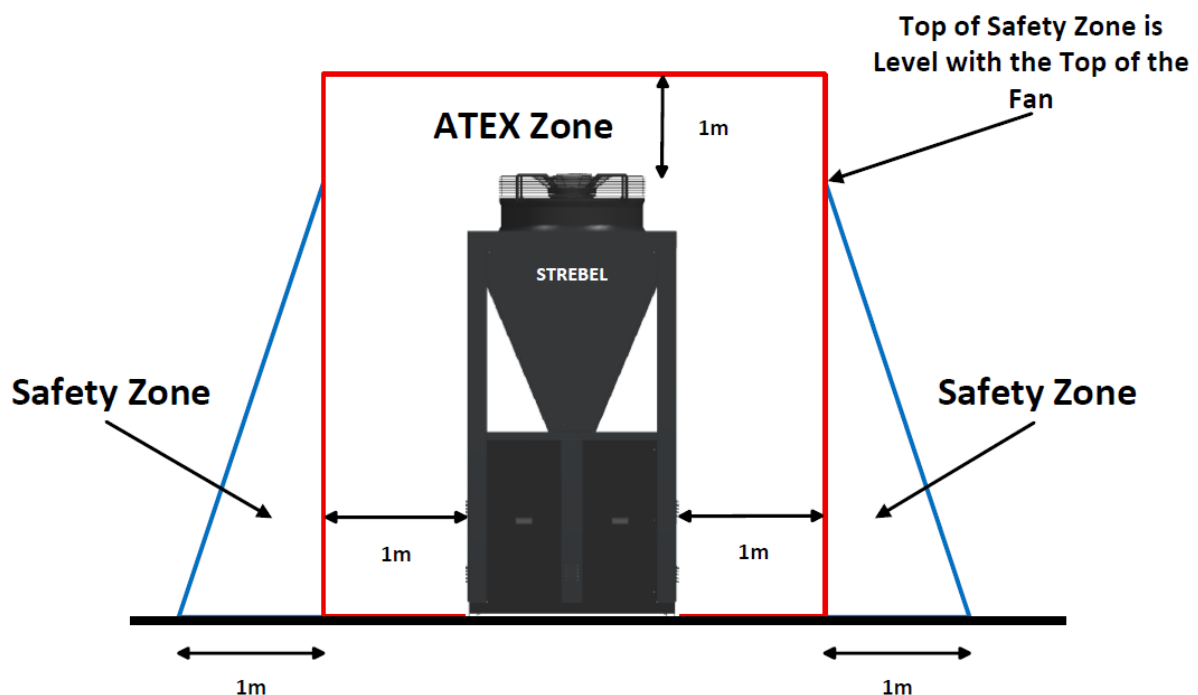
The below drawing is a side on view showing the required clearances for the ATEX zone and safety zone.

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

The safety zone is required around the S-ASX-NTVi 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

Electrical Data

Standard Supply

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

	Modulating pump (standard supply)	80	120	
	Power supply	400V - 3 - 50Hz	400V - 3 - 50Hz	-
	FLA Maximum total current input	102	151.1	A
	FLI Maximum total power input	64.12	95.32	kW

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.

	Option : High head pump (optional)	80	120	
	Power supply	400V - 3 - 50Hz	400V - 3 - 50Hz	-
	FLA Maximum total current input	104.6	153.7	A
	FLI Maximum total power input	65.84	97.04	kW

The main power supply to each S-ASX-NTVi 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-NTVi 80 with the standard modulating pump, the maximum draw off is 102A therefore the next size up for the breaker size would be 125A.

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	80	120	
	ASHP without Options R - Heating and cooling	910	1382	kg
Options	Acoustic Setting Up S - Low noise acoustic setting up	75	110	kg
	Internal Shunt Modulating shunt pump - Standard	36	54	kg
	Pump Option High head shunt pump - Additional	26	39	kg

	Transport Weight	80	120	
	ASHP without Options R - Heating and cooling	930	1412	kg
Options	Acoustic Setting Up S - Low noise acoustic setting up	75	110	kg
	Internal Shunt Modulating shunt pump - Standard	36	54	kg
	Pump Option High head shunt pump - Additional	26	39	kg

	Operating Weight	80	120	
	ASHP without Options R - Heating and cooling	927	1407	kg
Options	Acoustic Setting Up S - Low noise acoustic setting up	75	110	kg
	Internal Shunt Modulating shunt pump - Standard	39	58	kg
	Pump Option High head shunt pump - Additional	29	43	kg

Transport

Transport of the Unit

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 compliance 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** (Accord européen relatif au transport international des marchandises Dangereuses par Route): the European 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 As these Directives and Regulations are updated periodically, a check must be made when the carriage is performed to guaran-tee the conformity to the currently applicable version.
The manufacturere shall notify the quantity and type of refrige-rant filled in the unit(s) to the people in charge of organising the shipment in order for them 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 to 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 bring 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 that 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.

Check on Receiving

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 down.

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 specialized recycling centres (observe the regulations in force).

Installation Site

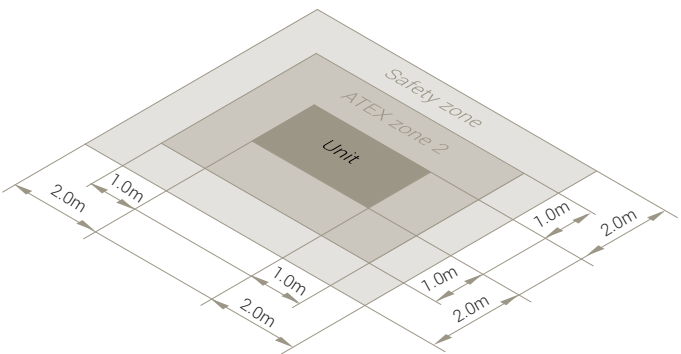
IMPORTANT

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.

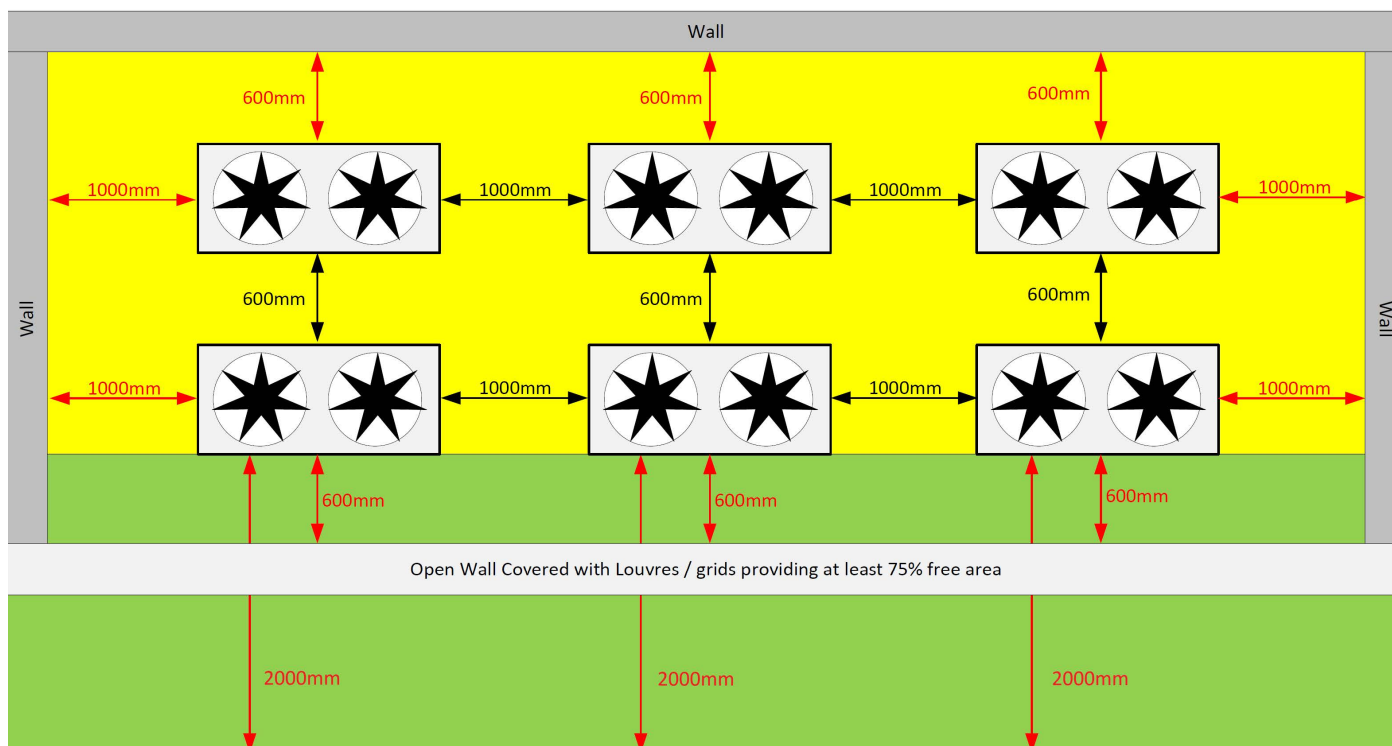
Installation Site

Open Air Installation - S-ASX-NTVi ASHP

The S-ASX-NTVi ASHP range are designed for outdoor installation in open air (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 shows 6 x S-ASX-NTVi ASHP's in cascade and includes the 2000mm safety zone.



The above drawing shows the S-ASX-NTVi ASHP in the orientation of the electrical panel facing either the east or west 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-NTVi ASHP (2490mm height + 1500mm = 3990mm).
- 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.

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 8% 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 modulating 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 no requirement for a commissioning valve (only required with high head non modulating pump).

The modulating pump minimum and maximum speeds can be adjusted, as well as the dT within the ASHP controller (see paragraph "Control system").

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 (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.

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).

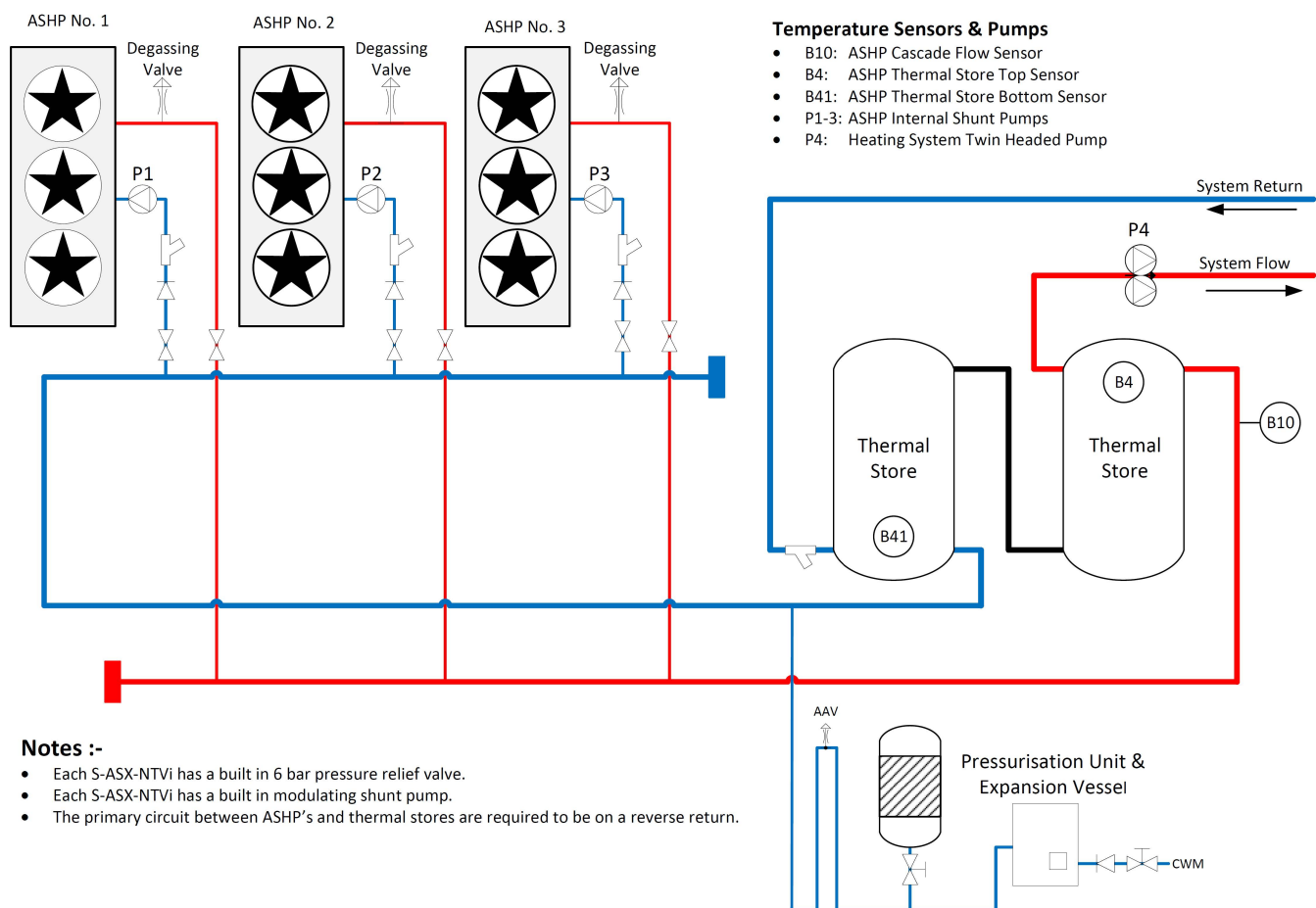
The venting valve must be installed on the flow pipe from each NTVi ASHP to discharge the refrigerant safely into the atmosphere. It is recommended to install the device as near as possible to the S-ASX-NTVi ASHP.

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

Differential pressure switch threshold	80	120	
Water flow rate	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-NTVi air source heat pump(s) to the thermal store.

With each S-ASX-NTVi ASHP having an internal modulating shunt pump, there is no requirement to install any components to influence the primary flow rate such as commissioning sets within the primary circuit. This will prevent the correct operation of the modulating pumps leading to the incorrect flow rate being achieved through the ASHP's and possible non warranty failures.

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 A7W35 multiplied by 10 litres. For example, the nominal output of 2 x S-ASX-NTVi80 at A7W35 is 159.8kW (79.9kW each) multiplied by 10 is 1598 litres = Nearest match is 2000 litres (Strebel TS2000).

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-NTVi ASHP		80	120	
Three phase	Power supply	400V - 3N - 50Hz	400V - 3N - 50Hz	-
	MINIMUM recommended section	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 centers.

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 an 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 has been carried out correctly.
 - The hydraulic circuit has been charged and vented.
 - No leakage are 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 : $V_{1-2} = 390 \text{ V}$
line voltage between phases L_2 and L_3 : $V_{2-3} = 397 \text{ V}$
line voltage between phases L_3 and L_1 : $V_{3-1} = 395 \text{ V}$
- 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 "Set point" value :
 - If no numeric value is displayed ($--^{\circ}\text{C}$) 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).

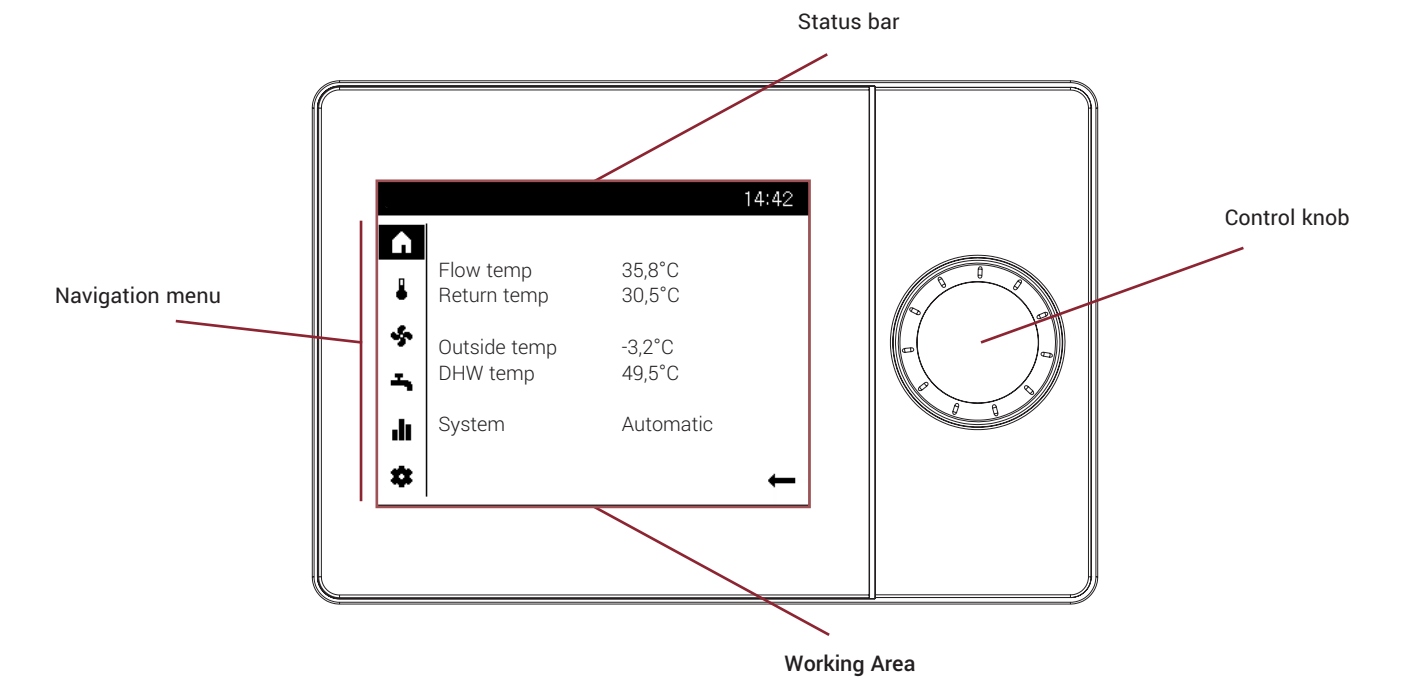


Compressor Carter Electrical Heater

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.

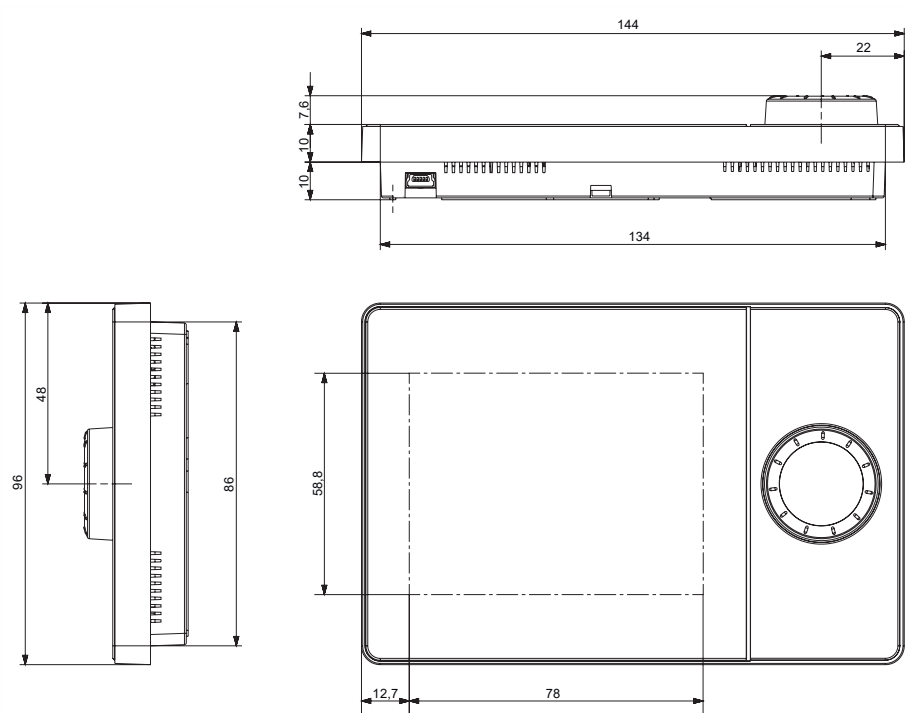
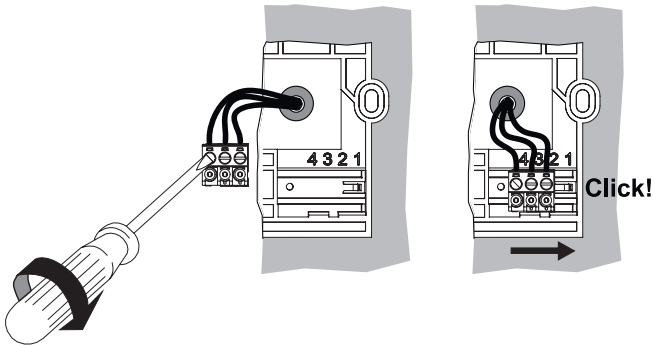
Control System



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 and is required to be installed within the installation plinthroom.



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 metres. 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 multimeter).

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.

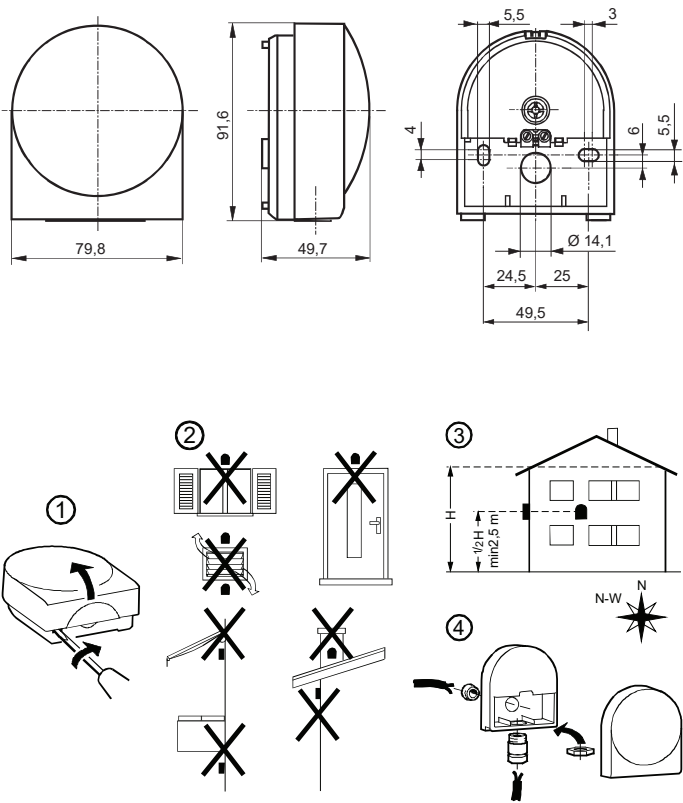
Maximum length	40	60	80	120
Minimum section	0,5	0,75	1,0	1,5

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	Messagges : errors / events Heat pump status Operating plant status
	Settings	Settings : date, time, language Special operations Login to “Expert” menu

Menu “Expert”

Besides the “Enduser” menu, an “Expert” menu is available which allows access to a greater number of information and settings. To access this menu, from the “Enduser” 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
Enduser	-
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	Messagges : 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 informations :

-	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 analog outputs (UX) use the parameter corresponding to the analog 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 parameters 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
Time program 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 hest 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 coling 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 time tables

HEATING

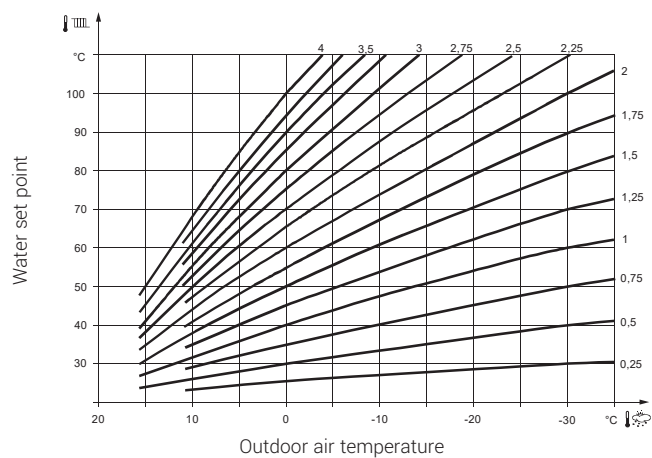
The temperature set point of the water to be sent to the **heating circuit** terminals is calculated as a function of the outdoor air temperature through a parameterizable climatic curve.

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

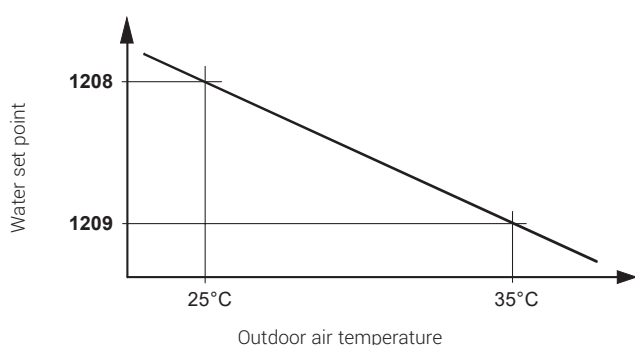
The temperature set point of the water to be sent to the **cooling circuit** terminals is calculated as a function of the outdoor air temperature through a parameterizable climatic curve.

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 setp at 25°C	16 °C
1209	Flow temp setp at 35°C	16 °C
1223	Flow temp setp min at 25°C	6 °C
1224	Flow temp setp 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 drain pipe to prevent ice formations from obstructing the draining during winter.

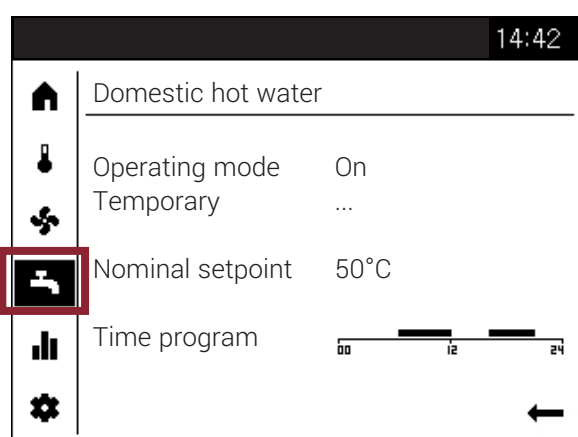
When the outdoor air temperature falls below 2°C, a digital output (**K41**) is activated during the defrost cycles and remains active for up to 3 minutes after the end of the cycle.

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 "Enduser" 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/giorno

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).

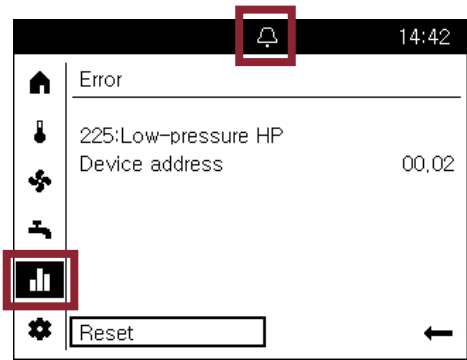
Use of the analog output Q33 and sensor B36

The three way valve Q33 can be controlled via an analog 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 informations :

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
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
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 sensor 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 ΔT 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")
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

Control System

Code	Description	Reset	Input	Unit locked	Solution
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
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
441	BX31 no function	A	-	No	Sensor connected but not configured Verify input configuration
442	BX32 no function	A	-	No	
443	BX33 no function	A	-	No	
444	BX34 no function	A	-	No	
452	H1 no function	A	-	No	Input connected but not configured Verify input configuration
453	H3 no function	A	-	No	
454	H31 no function	A	-	No	
455	H32 no function	A	-	No	
456	H33 no function	A	-	No	
469	HX21 no function	A	-	No	
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
488	Condensing pressure sensor	A	H83	Yes	Verify sensor connection
491	Maximum evaporating temperature	R	-	Yes	In heating mode : verify if the outdoor air temp 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)

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 AUTHORIZED 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 center 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, down-pipes, 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 worn at all times, as required by the relevant operations. Proper equipment and tools must be used in order 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 flammable refrigerants (A2L or A3) 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-NTVi 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-NTVi Gas Leak Detector Sensor & Inlet / Extract Fan Test - Mandatory Requirement

For safe operation of the S-ASX-NTVi 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 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-NTVi 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-NTVi'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 can not 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.	

44

GeneralGas®

MATERIAL SAFETY DATA SHEET
In compliance with Regulation (EU) No. 830/2015

GG_G81
Revision date: November 2016
Pag. 3 of 11
Revision date: october 2020

KRYOM® 290

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.

Unsuitable fire fighting mediums:

In case of small fires: dry chemical powder, carbon dioxide, foam.
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 unopened 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.

	MATERIAL SAFETY DATA SHEET In compliance with Regulation (EU) No. 830/2012
	GG, GF, GR Revision date: November 2016 Page 4 of 11 Revision date: october 2020
	KRYON® 290
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 do so without risk. This is not the case, use a pulverised water spray to keep the concentration of gas below 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	
Procedures 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: Other information (accidental leak):	None specified. 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, braze, 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.

Refrigerant Safety Card

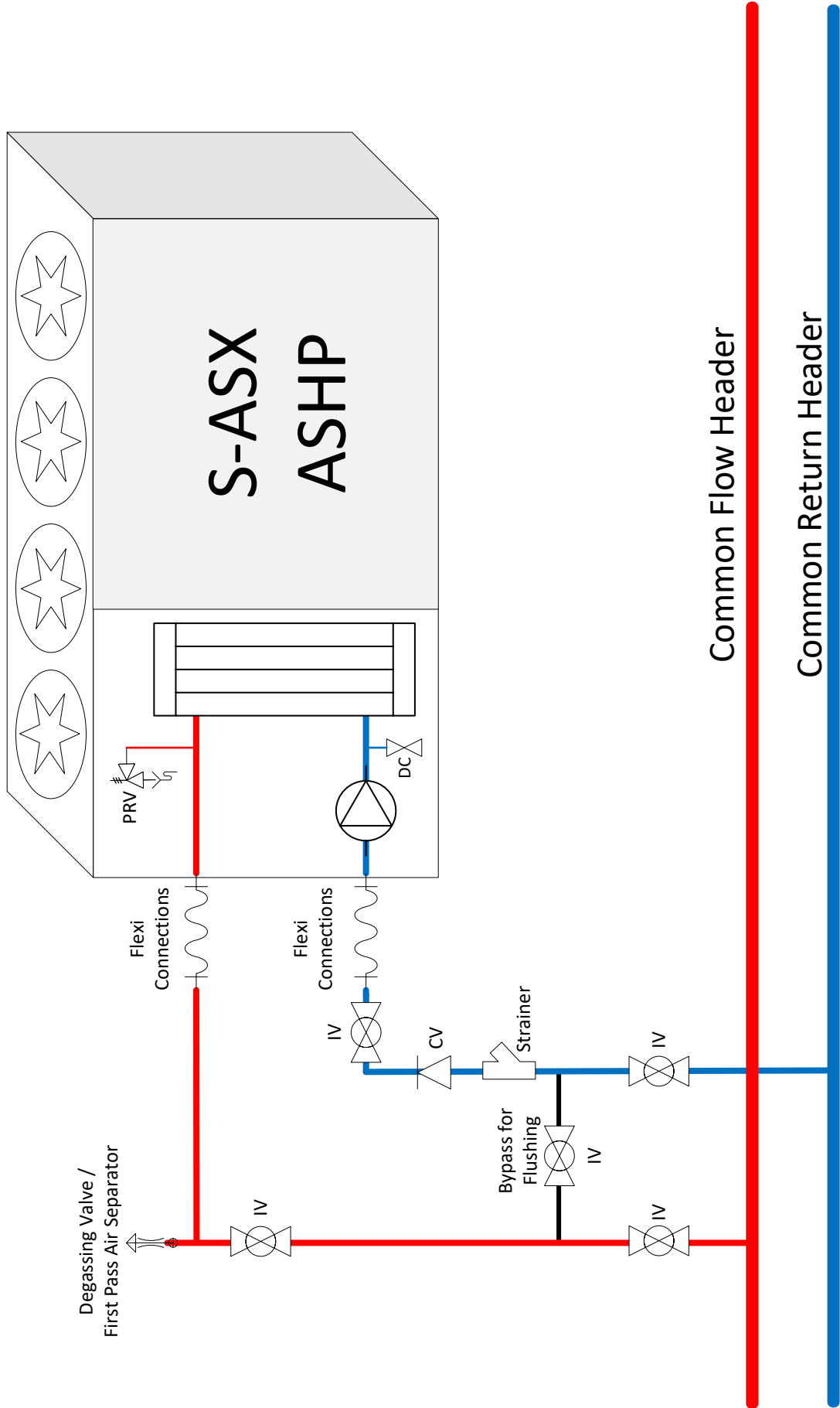
GeneralGas® MATERIAL SAFETY DATA SHEET In compliance with Regulation (EU) No. 830/2015 GG_GF 081 Revision date: November 2016 Page 5 of 11 Revision date: october 2020	
KRYON® 290	
7.2 Conditions for safe storage, including any incompatibilities Storage conditions: Store in a dry and well-ventilated place. 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	
5	
GeneralGas® MATERIAL SAFETY DATA SHEET In compliance with Regulation (EU) No. 830/2015 GG_GF 081 Revision date: November 2016 Page 7 of 11 Revision date: october 2020	
KRYON® 290	
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: Oral (LD₅₀): Not classified (conclusive data but not sufficient for classification) (depending on the composition). Inhalation (LC₅₀): There is no data available. Inhalation (LC₅₀): Rat.: 1443 mg/l (Propane) (15 min; Clark and Tiston 1982) Cutaneous (LD₅₀): Rat.: 800,000 ppm (Propane) (15 min; Clark and Tiston 1982) 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 skin 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) (Huntington Life Sciences, 2009). (EPA OPPPTS 870.3650) (CS - Huntington 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: 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	

GeneralGas® MATERIAL SAFETY DATA SHEET In compliance with Regulation (EU) No. 830/2015 GG_GF 081 Revision date: November 2016 Page 6 of 11 Revision date: october 2020	
KRYON® 290	
(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. 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.	
6	
GeneralGas® MATERIAL SAFETY DATA SHEET In compliance with Regulation (EU) No. 830/2015 GG_GF 081 Revision date: November 2016 Page 8 of 11 Revision date: october 2020	
KRYON® 290	
Ecology - water: on local atmospheric conditions.	
LC₅₀: 24,11 mg/l (96h, fish)	
LC₅₀: 46,6 mg/l (48h Daphnia sp.)	
EC₅₀: 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 CO₂ 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 2001/18/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, braze, 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. The product as such does not contain halogenated compounds.	
Ecology - waste: 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	
14.2 UN shipping name Propane Propane Propane Propane	
14.3 Transport hazard class(es) 2.1 2.1 2.1 2.1 2.1 (+13)	

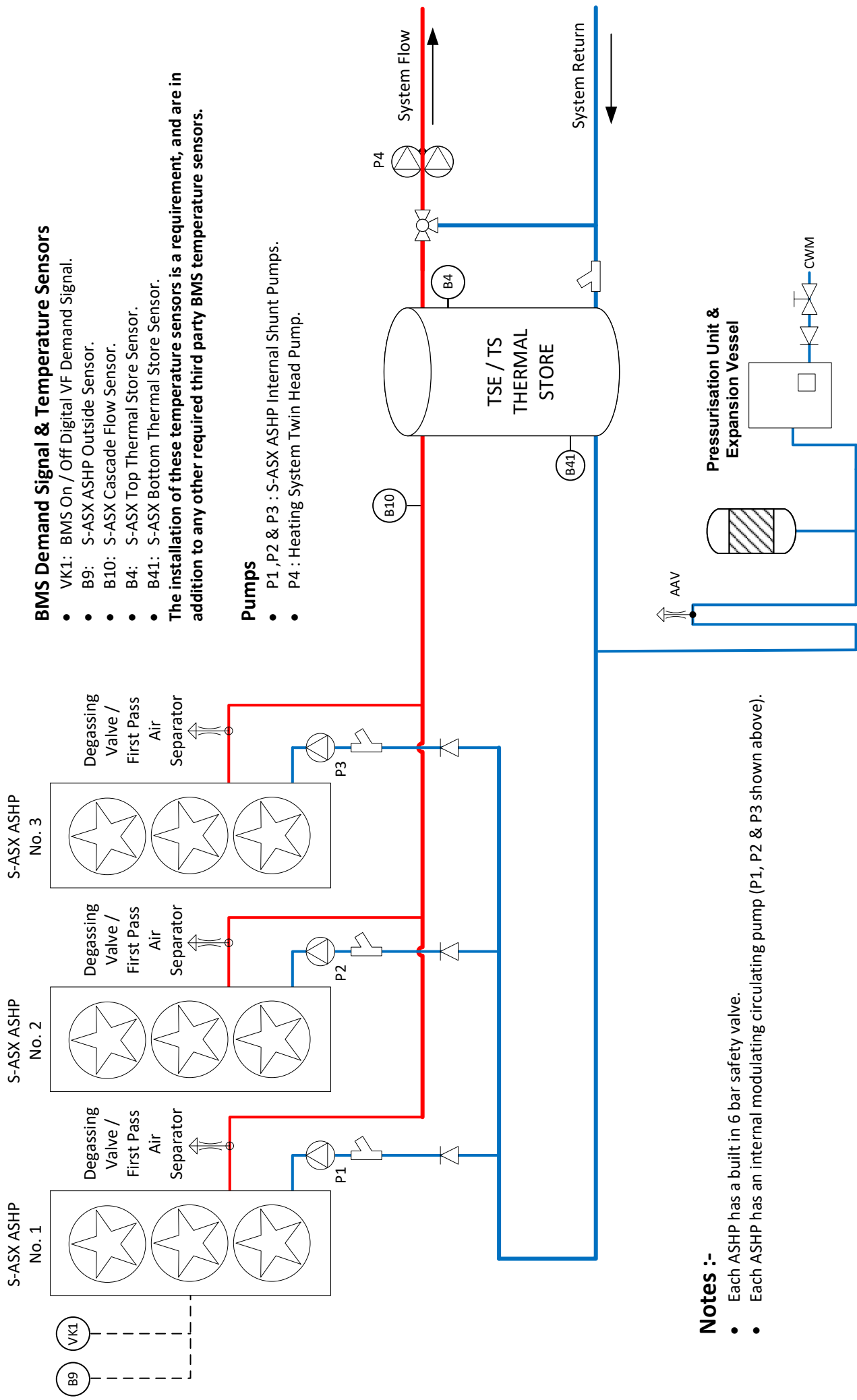
46

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 Negrirol 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 Ghirotti Phone: +0039 547352612
Chieti:	Santissima Annunziata Hospital - 24/7	Via del Vestini, 1 Phone: +0039 871551219
Firenze:	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	Via Fazzi piazza Plaza Muratore, 1 Phone +0039 832351105
Naples:	Cardarelli Hospital - 24/7	Via Cardarelli, 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 Monterealle, 24 Phone: +0039 434550301
Reggio Calabria:	Reunited Hospital - 24/7	V. 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 116637357
Trieste:	Admission and Casualty Department, IRCCS Burlo Garofalo	Via dell'Istria 65/I Phone: +0039 40385373

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



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

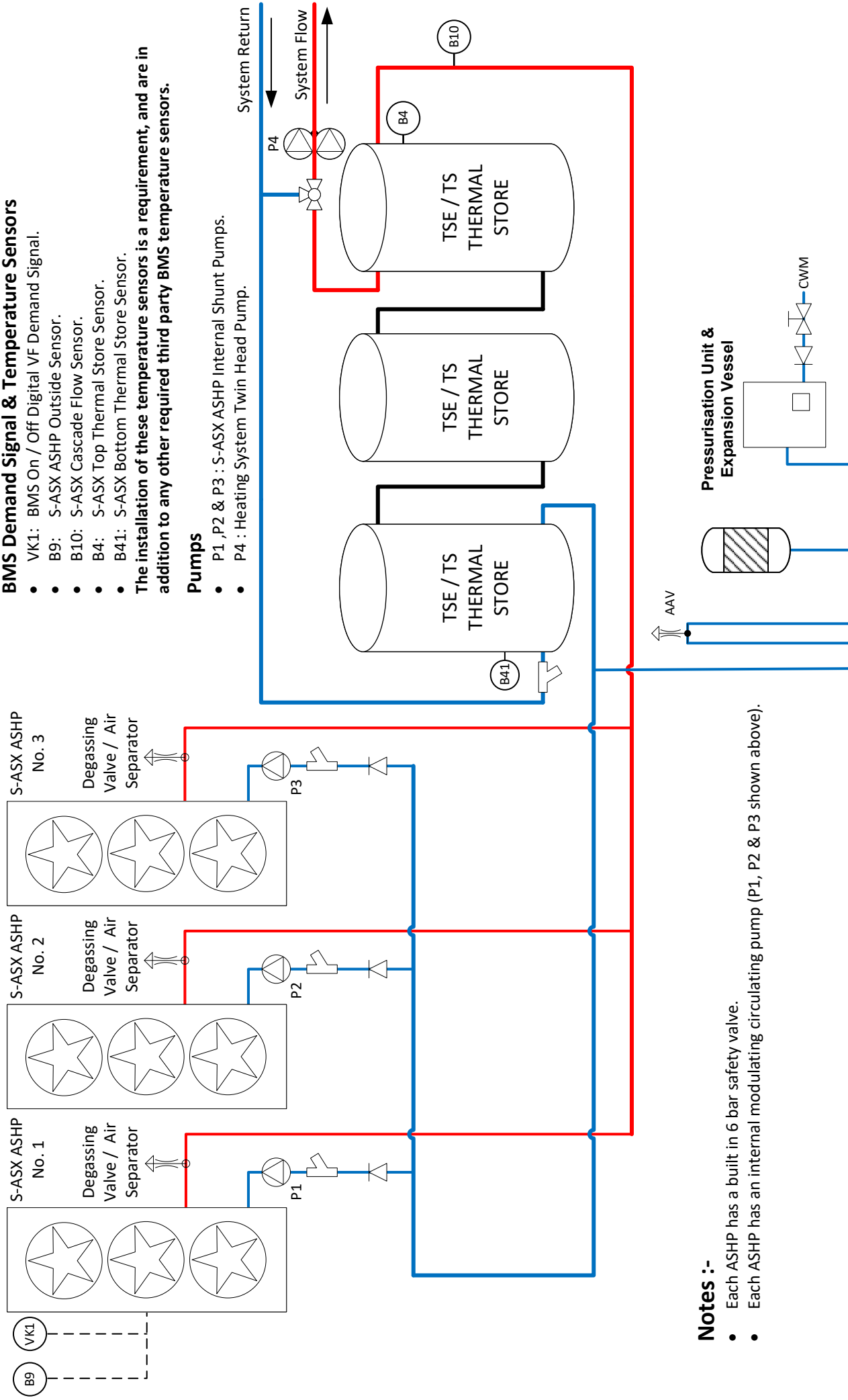
BMS Demand Signal & Temperature Sensors

- VK1: BMS On / Off Digital VF Demand Signal.
- B9: S-ASX ASHP Outside Sensor.
- B10: S-ASX Cascade Flow Sensor.
- B4: S-ASX Top Thermal Store Sensor.
- B41: S-ASX Bottom Thermal Store Sensor.

The installation of these temperature sensors is a requirement, and are in addition to any other required third party BMS temperature sensors.

Pumps

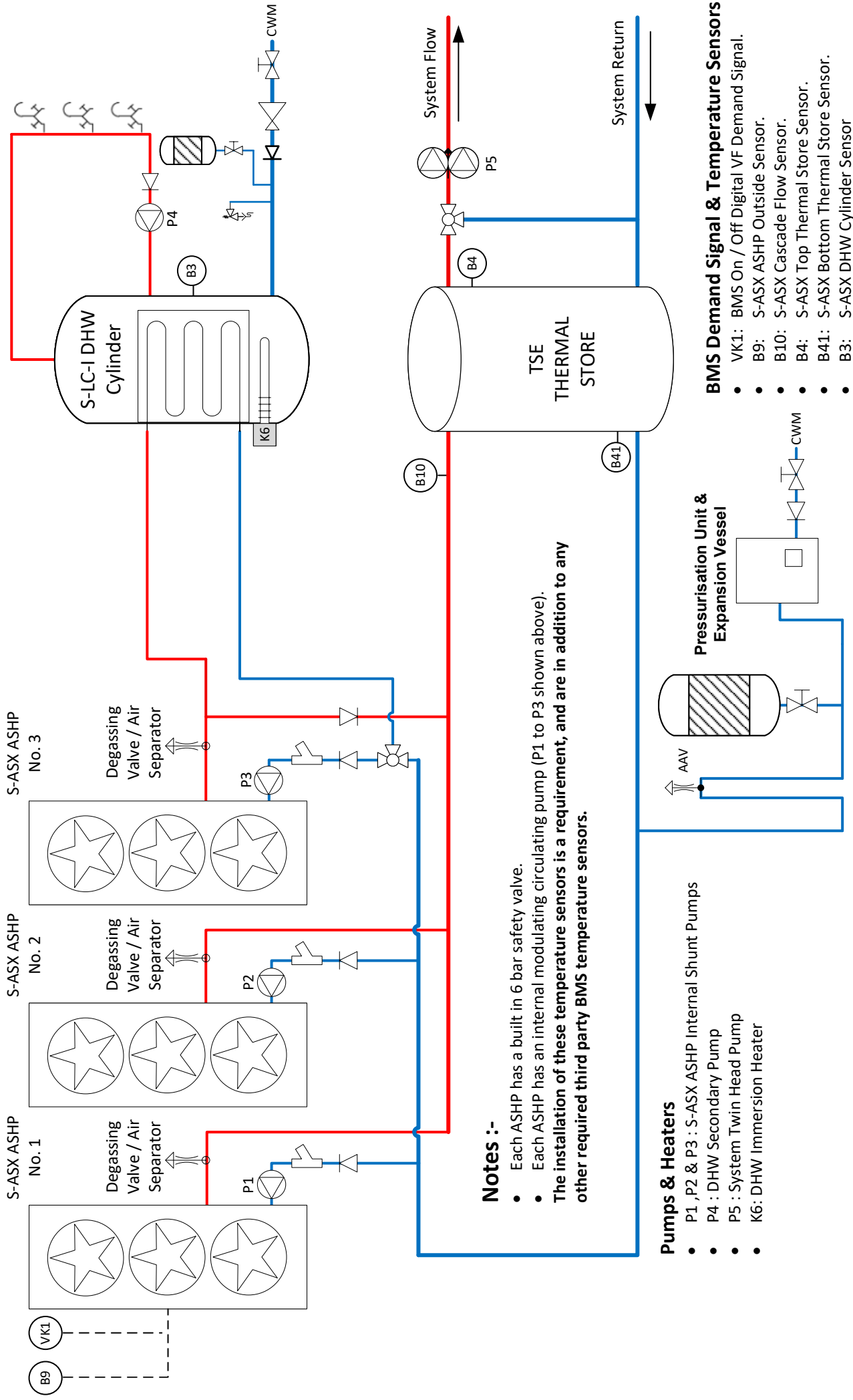
- P1 ,P2 & P3 : S-ASX ASHP Internal Shunt Pumps.
- P4 : Heating System Twin Head Pump.



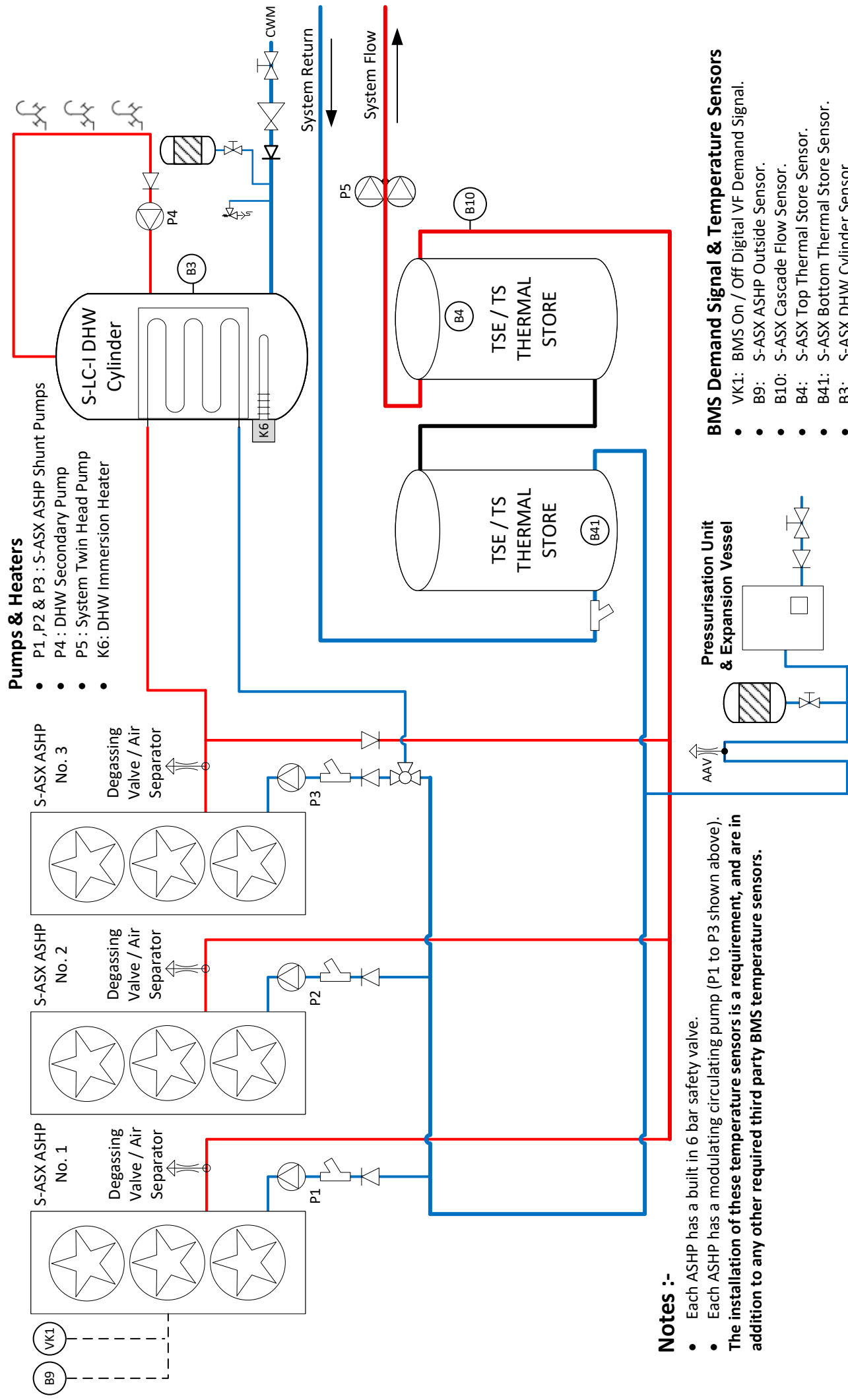
Notes :-

- Each ASHP has a built in 6 bar safety valve.
- Each ASHP has an internal modulating circulating pump (P1, P2 & P3 shown above).

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



Notes :-

- Each ASHP has a built in 6 bar safety valve.
 - Each ASHP has a modulating circulating pump (P1 to P3 shown above).
- The installation of these temperature sensors is a requirement, and are in addition to any other required third party BMS temperature sensors.

S-ASX-NTVi 80 - Min / Max Performances in Heating Mode

Only use the nominal output to size ASHP - the minimum / maximum output is for performance information.

Model		Water outlet temperature	Outdoor Air Temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
80	Minimum Output	78	Heating capacity	-	-	30,8	32,2	33,0	33,8	34,7	40,1	43,0	46,5	52,4	54,8	kW
			Power input	-	-	20,0	20,0	20,0	20,0	20,0	20,0	20,0	20,0	19,9	19,9	kW
			COP	-	-	1,54	1,61	1,65	1,69	1,74	2,00	2,15	2,33	2,63	2,75	-
		75	Heating capacity	-	25,8	30,2	31,7	32,5	33,3	34,2	39,7	42,6	46,1	52,0	54,4	kW
			Power input	-	18,6	18,6	18,6	18,6	18,6	18,6	18,6	18,5	18,5	18,5	18,5	kW
			COP	-	1,39	1,62	1,70	1,75	1,79	1,84	2,13	2,30	2,49	2,81	2,94	-
		70	Heating capacity	22,7	25,0	29,5	31,0	31,8	32,6	33,5	39,0	42,0	45,5	51,5	53,9	kW
			Power input	16,4	16,4	16,4	16,4	16,4	16,4	16,4	16,4	16,4	16,3	16,3	16,3	kW
			COP	1,38	1,52	1,80	1,89	1,94	1,99	2,04	2,38	2,56	2,79	3,16	3,31	-
		65	Heating capacity	22,0	24,3	28,9	30,3	31,2	32,0	32,9	38,5	41,5	45,0	51,0	53,4	kW
			Power input	14,5	14,5	14,6	14,5	14,5	14,5	14,5	14,5	14,5	14,5	14,4	14,4	kW
			COP	1,52	1,68	1,98	2,09	2,15	2,21	2,27	2,66	2,86	3,10	3,54	3,71	-
		60	Heating capacity	21,3	23,7	28,3	29,8	30,7	31,5	32,5	38,1	41,0	44,6	50,7	53,1	kW
			Power input	12,9	12,9	12,9	12,9	12,9	12,9	12,9	12,9	12,8	12,8	12,8	12,7	kW
			COP	1,65	1,84	2,19	2,31	2,38	2,44	2,52	2,95	3,20	3,48	3,96	4,18	-
		55	Heating capacity	20,7	23,2	27,9	29,4	30,3	31,1	32,1	37,7	40,7	44,3	50,4	52,8	kW
			Power input	11,5	11,5	11,5	11,5	11,5	11,5	11,5	11,5	11,4	11,4	11,3	11,3	kW
			COP	1,80	2,02	2,43	2,56	2,63	2,70	2,79	3,28	3,57	3,89	4,46	4,67	-
		50	Heating capacity	20,2	22,7	27,5	29,0	29,9	30,8	31,8	37,4	40,5	44,1	50,2	52,6	kW
			Power input	10,3	10,3	10,3	10,3	10,3	10,3	10,2	10,2	10,2	10,2	10,1	10,1	kW
			COP	1,96	2,20	2,67	2,82	2,90	2,99	3,12	3,67	3,97	4,32	4,97	5,21	-
		45	Heating capacity	19,7	22,3	27,1	28,7	29,6	30,5	31,5	37,2	40,2	43,9	50,1	52,5	kW
			Power input	9,2	9,2	9,2	9,2	9,2	9,2	9,2	9,2	9,1	9,1	9,0	9,0	kW
			COP	2,14	2,42	2,94	3,12	3,22	3,32	3,43	4,06	4,40	4,82	5,54	5,82	-

Model		Water outlet temperature	Outdoor Air Temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
80	Maximum Output	78	Heating capacity	-	-	81,2	85,0	87,1	89,2	91,6	106,0	114,0	123,0	139,0	145,0	kW
			Power input	-	-	65,7	65,7	65,7	65,7	65,7	65,7	65,7	65,6	65,6	kW	
			COP	-	-	1,24	1,29	1,33	1,36	1,39	1,61	1,74	1,87	2,12	2,21	-
		75	Heating capacity	-	68,2	79,9	83,7	85,8	87,9	90,3	105,0	113,0	122,0	138,0	144,0	kW
			Power input	-	60,9	61,0	61,0	61,0	61,0	61,0	61,0	60,9	60,9	60,8	60,8	kW
			COP	-	1,12	1,31	1,37	1,41	1,44	1,48	1,72	1,86	2,00	2,27	2,37	-
		70	Heating capacity	60,0	66,0	77,9	81,8	83,9	86,1	88,5	103,0	111,0	120,0	136,0	142,0	kW
			Power input	53,8	53,8	53,9	53,9	53,9	53,9	53,8	53,9	53,8	53,8	53,7	53,7	kW
			COP	1,12	1,23	1,45	1,52	1,56	1,60	1,64	1,91	2,06	2,23	2,53	2,64	-
		65	Heating capacity	57,9	64,1	76,2	80,1	82,3	84,5	87,0	102,0	110,0	119,0	135,0	141,0	kW
			Power input	47,6	47,7	47,7	47,7	47,7	47,7	47,7	47,7	47,6	47,6	47,5	47,5	kW
			COP	1,22	1,34	1,60	1,68	1,73	1,77	1,82	2,14	2,31	2,50	2,84	2,97	-
		60	Heating capacity	56,2	62,5	74,8	78,8	81,0	83,2	85,8	101,0	108,0	118,0	134,0	140,0	kW
			Power input	42,3	42,4	42,4	42,4	42,4	42,3	42,3	42,3	42,3	42,2	42,1	42,1	kW
			COP	1,33	1,47	1,76	1,86	1,91	1,97	2,03	2,39	2,55	2,80	3,18	3,33	-
		55	Heating capacity	54,6	61,1	73,5	77,6	79,9	82,2	84,8	99,6	108,0	117,0	133,0	140,0	kW
			Power input	37,7	37,7	37,8	37,8	37,7	37,7	37,7	37,7	37,6	37,6	37,5	37,4	kW
			COP	1,45	1,62	1,94	2,05	2,12	2,18	2,25	2,64	2,87	3,11	3,55	3,74	-
		50	Heating capacity	53,3	59,9	72,5	76,7	78,9	81,3	83,9	98,9	107,0	117,0	133,0	139,0	kW
			Power input	33,7	33,7	33,8	33,7	33,7	33,7	33,7	33,7	33,6	33,6	33,5	33,4	kW
			COP	1,58	1,78	2,14	2,28	2,34	2,41	2,49	2,93	3,18	3,48	3,97	4,16	-
		45	Heating capacity	52,0	58,8	71,6	75,8	78,1	80,5	83,2	98,2	106,0	116,0	132,0	139,0	kW
			Power input	30,2	30,2	30,3	30,2	30,2	30,2	30,2	30,2	30,1	30,0	29,9	29,9	kW
			COP	1,72	1,95	2,36	2,51	2,59	2,67	2,75	3,25	3,52	3,87	4,41	4,65	-

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.

S-ASX-NTVi 120 Min / Max Performances in Heating Mode

Only use the nominal output to size ASHP - the minimum / maximum output is for performance information.

Model		Water outlet temperature	Outdoor Air Temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
120	Minimum Output	78	Heating capacity	-	-	46,1	48,3	49,4	50,6	52,0	60,2	64,5	69,8	78,6	82,1	kW
			Power input	-	-	30,1	30,1	30,0	30,0	30,0	30,0	30,0	29,9	29,9	29,8	kW
			COP	-	-	1,53	1,60	1,65	1,69	1,73	2,01	2,15	2,33	2,63	2,76	-
		75	Heating capacity	-	38,8	45,4	47,5	48,7	49,9	51,3	59,5	63,9	69,1	78,0	81,6	kW
			Power input	-	27,9	27,9	27,9	27,9	27,9	27,9	27,8	27,8	27,8	27,7	27,7	kW
			COP	-	1,39	1,63	1,70	1,75	1,79	1,84	2,14	2,30	2,49	2,82	2,95	-
		70	Heating capacity	34,1	37,5	44,2	46,4	47,6	48,9	50,3	58,5	62,9	68,2	77,2	80,8	kW
			Power input	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,6	24,5	24,5	24,4	24,4	kW
			COP	1,39	1,52	1,80	1,89	1,93	1,99	2,04	2,38	2,57	2,78	3,16	3,31	-
		65	Heating capacity	32,9	36,4	43,3	45,5	46,7	48,0	49,4	57,7	62,2	67,5	76,5	80,1	kW
			Power input	21,8	21,8	21,8	21,8	21,8	21,8	21,8	21,7	21,7	21,7	21,6	21,6	kW
			COP	1,51	1,67	1,99	2,09	2,14	2,20	2,27	2,66	2,87	3,11	3,54	3,71	-
		60	Heating capacity	31,9	35,5	42,5	44,7	46,0	47,3	48,7	57,1	61,6	66,9	76,0	79,6	kW
			Power input	19,3	19,4	19,4	19,4	19,4	19,3	19,3	19,3	19,3	19,2	19,1	19,1	kW
			COP	1,65	1,83	2,19	2,30	2,37	2,45	2,52	2,96	3,19	3,48	3,98	4,17	-
		55	Heating capacity	31,0	34,7	41,8	44,1	45,4	46,7	48,1	56,6	61,1	66,5	75,6	79,2	kW
			Power input	17,2	17,3	17,3	17,2	17,2	17,2	17,2	17,2	17,1	17,1	17,0	17,0	kW
			COP	1,80	2,01	2,42	2,56	2,64	2,72	2,80	3,29	3,57	3,89	4,45	4,66	-
		50	Heating capacity	30,3	34,0	41,2	43,5	44,8	46,2	47,6	56,1	60,7	66,1	75,3	79,0	kW
			Power input	15,4	15,4	15,4	15,4	15,4	15,4	15,4	15,3	15,3	15,2	15,2	15,1	kW
			COP	1,97	2,21	2,68	2,82	2,91	3,00	3,09	3,67	3,97	4,35	4,95	5,23	-
		45	Heating capacity	29,6	33,4	40,7	43,1	44,4	45,7	47,2	55,8	60,3	65,8	75,1	78,7	kW
			Power input	13,8	13,8	13,8	13,8	13,8	13,8	13,8	13,8	13,7	13,6	13,5	13,5	kW
			COP	2,14	2,42	2,95	3,12	3,22	3,31	3,42	4,07	4,40	4,84	5,56	5,83	-

Model		Water outlet temperature	Outdoor Air Temperature													
			Tdb	-20	-15	-7	-4	-2	0	2	7	12	20	35	42	°C
			Twb	-21	-16	-8	-5	-3	-1	1	6	10	15	24	28	°C
120	Maximum Output	78	Heating capacity	-	-	122,0	127,0	131,0	134,0	137,0	159,0	170,0	184,0	208,0	217,0	kW
			Power input	-	-	98,6	98,6	98,5	98,5	98,5	98,5	98,4	98,4	98,2	98,2	kW
			COP	-	-	1,24	1,29	1,33	1,36	1,39	1,61	1,73	1,87	2,12	2,21	-
		75	Heating capacity	-	102,0	120,0	125,0	129,0	132,0	135,0	157,0	169,0	183,0	206,0	216,0	kW
			Power input	-	91,4	91,4	91,4	91,4	91,4	91,4	91,4	91,3	91,2	91,1	91,0	kW
			COP	-	1,12	1,31	1,37	1,41	1,44	1,48	1,72	1,85	2,01	2,26	2,37	-
		70	Heating capacity	89,9	99,0	117,0	123,0	126,0	129,0	133,0	155,0	166,0	180,0	204,0	213,0	kW
			Power input	80,6	80,7	80,8	80,8	80,8	80,7	80,7	80,7	80,6	80,6	80,4	80,3	kW
			COP	1,12	1,23	1,45	1,52	1,56	1,60	1,65	1,92	2,06	2,23	2,54	2,65	-
		65	Heating capacity	86,9	96,2	114,0	120,0	123,0	127,0	130,0	153,0	164,0	178,0	202,0	212,0	kW
			Power input	71,4	71,5	71,6	71,5	71,5	71,5	71,5	71,4	71,4	71,3	71,1	71,0	kW
			COP	1,22	1,35	1,59	1,68	1,72	1,78	1,82	2,14	2,30	2,50	2,84	2,99	-
		60	Heating capacity	84,2	93,7	112,0	118,0	121,0	125,0	129,0	151,0	163,0	177,0	201,0	210,0	kW
			Power input	63,4	63,5	63,6	63,5	63,5	63,5	63,4	63,4	63,3	63,2	63,1	63,0	kW
			COP	1,33	1,48	1,76	1,86	1,91	1,97	2,03	2,38	2,58	2,80	3,19	3,33	-
		55	Heating capacity	81,9	91,6	110,0	116,0	120,0	123,0	127,0	149,0	161,0	176,0	200,0	209,0	kW
			Power input	56,5	56,6	56,6	56,6	56,6	56,5	56,5	56,5	56,4	56,3	56,1	56,0	kW
			COP	1,45	1,62	1,94	2,05	2,12	2,18	2,25	2,64	2,85	3,13	3,57	3,73	-
		50	Heating capacity	79,9	89,8	109,0	115,0	118,0	122,0	126,0	148,0	160,0	175,0	199,0	209,0	kW
			Power input	50,5	50,6	50,6	50,6	50,5	50,5	50,5	50,4	50,3	50,2	50,1	50,0	kW
			COP	1,58	1,77	2,15	2,27	2,34	2,42	2,50	2,94	3,18	3,49	3,97	4,18	-
		45	Heating capacity	78,0	88,1	107,0	114,0	117,0	121,0	125,0	147,0	159,0	174,0	198,0	208,0	kW
			Power input	45,3	45,3	45,4	45,3	45,3	45,2	45,2	45,2	45,1	45,0	44,8	44,7	kW
			COP	1,72	1,94	2,36	2,52	2,58	2,68	2,77	3,25	3,53	3,87	4,42	4,65	-

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.

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