Appendix to the original operating instructions

WP Max-HiQ & WP Max-LoQ

As of 2026-01

ratiotherm
Smart Energy Systems

INFORMATION

These operating instructions are part of the technical documentation for the device in accordance with:

- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
- Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of Member States relating to the making available on the market of pressure equipment

These operating instructions are intended for the operator and must be handed over to personnel who come into contact with the device. The operator must ensure that the information contained in the operating instructions and the accompanying documents is read and understood.

NOTE

If in any doubt, consult the operating instructions, which must be kept in a known and easily accessible place.
The manufacturer accepts no liability for damage to persons, animals, objects or the device itself caused by:

- improper use,
- non-compliance,
- insufficient attention

the safety criteria contained herein or by:

- modification of the device,
- use of unsuitable spare parts.

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For better readability, the generic masculine form is used in this original operating manual. The personal designations used refer to all genders.

As of: 7 October 2024

TABLE OF CONTENTS

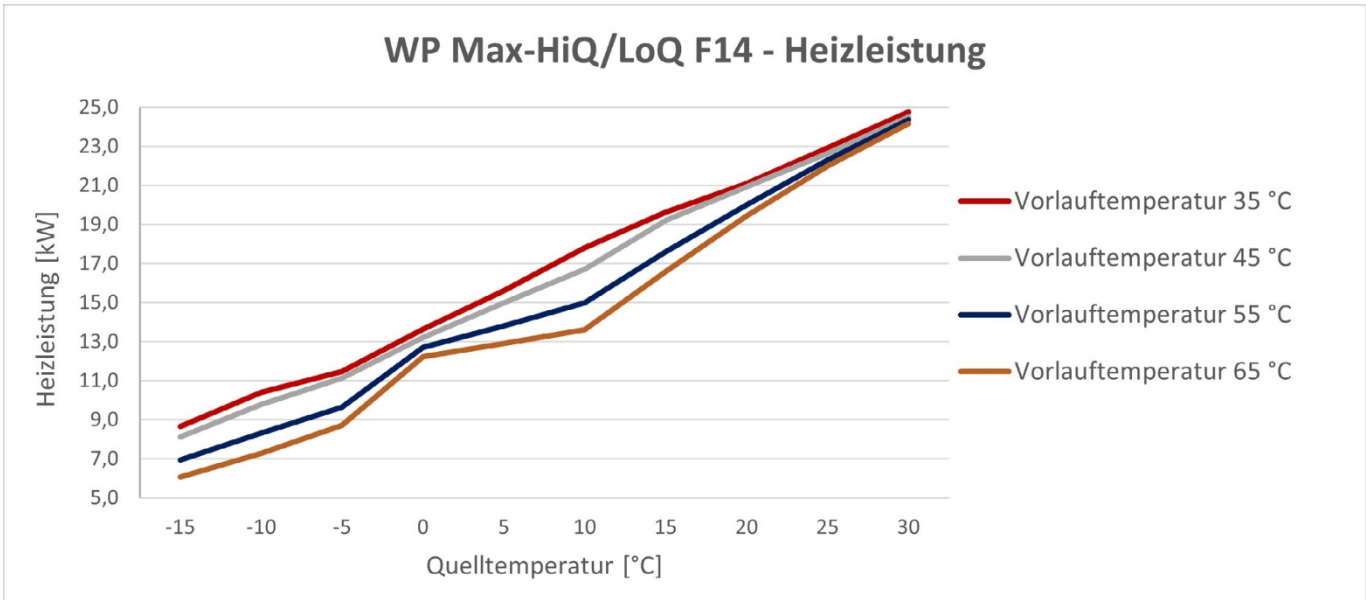
1. PERFORMANCE TABLES

PERFORMANCE DATA

WP Max-HiQ F14, WP Max-LoQ F14

COP, heating capacity and power consumption

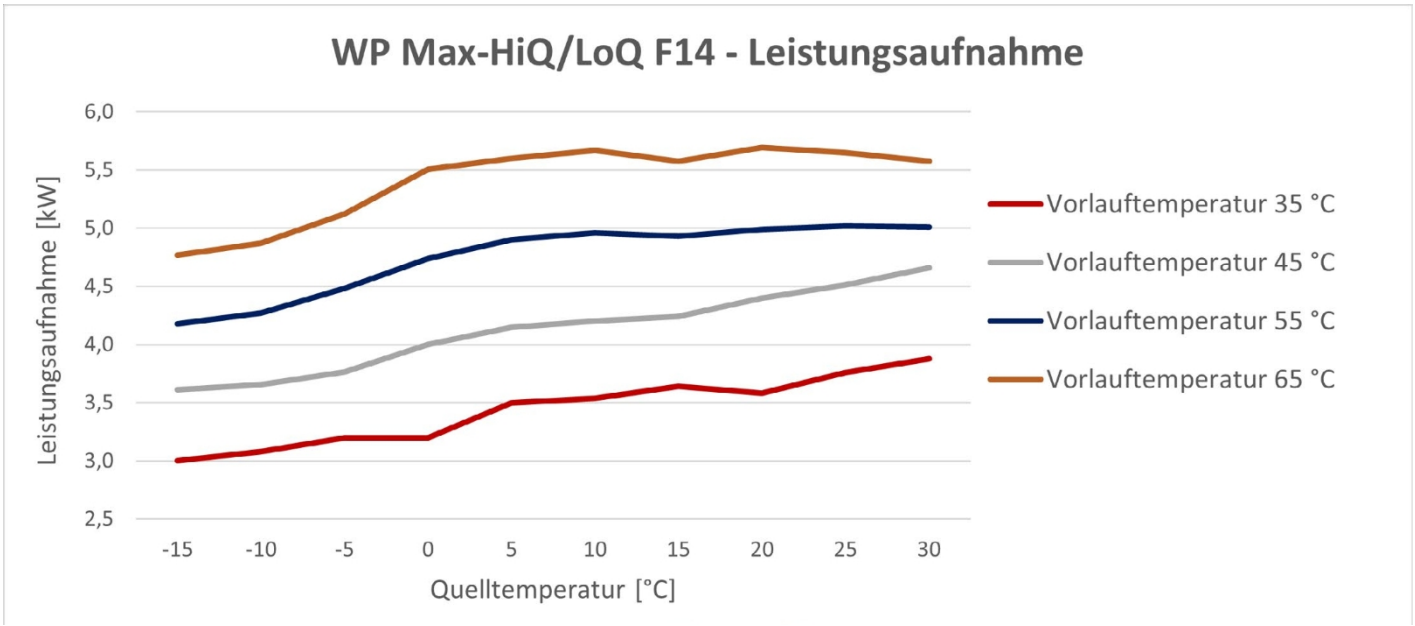
Source temperature	Heating capacity in kW				Power consumption in kW				COP			
	Flow temperature				Flow temperature				Flow temperature			
	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C
-15 °C	8.67	8.14	6.94	6.08	3.00	3.61	4.18	4.77	2.89	2.25	1.66	1.28
-10 °C	10.40	9.77	8.32	7.29	3.08	3.66	4.27	4.87	3.38	2.67	1.95	1.50
-5 °C	11.48	11.14	9.64	8.72	3.20	3.76	4.48	5.12	3.59	2.96	2.15	1.70
0 °C	13.65	13.23	12.70	12.23	3.20	4.00	4.74	5.51	4.27	3.31	2.68	2.22
5 °C	15.60	15.00	13.80	12.90	3.50	4.15	4.90	5.60	4.46	3.61	2.82	2.30
10 °C	17.80	16.72	15.00	13.60	3.54	4.20	4.96	5.67	5.03	4.00	3.02	2.40
15 °C	19.63	19.20	17.60	16.59	3.64	4.24	4.93	5.58	5.46	4.53	3.57	2.97
20 °C	21.10	20.92	20.00	19.45	3.58	4.40	4.99	5.70	5.89	4.88	4.01	3.42
25 °C	22.93	22.64	22.30	21.99	3.76	4.51	5.02	5.65	6.32	5.24	4.44	3.89
30 °C	24.76	24.50	24.36	24.16	3.88	4.66	5.01	5.58	6.75	5.60	4.89	4.33

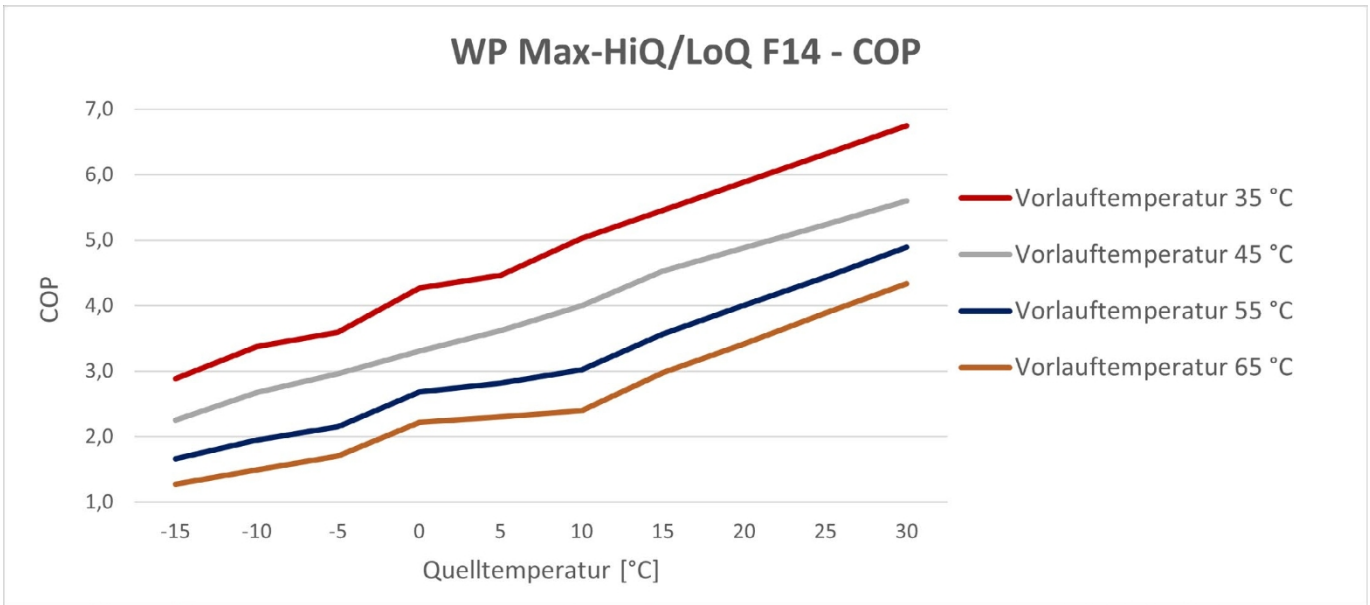


PERFORMANCE DATA

WP Max-HiQ F14, WP Max-LoQ F14

COP, heating capacity and power consumption



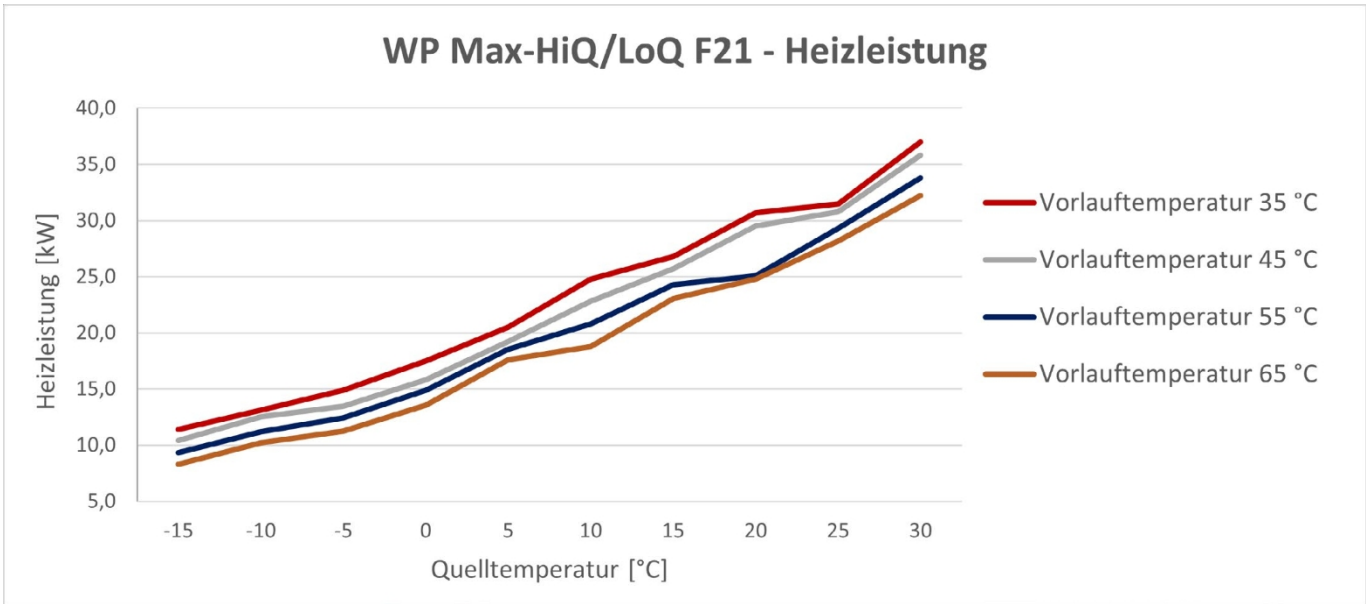


PERFORMANCE DATA

WP Max-HiQ F21, WP Max-LoQ F21

COP, heating capacity and power consumption

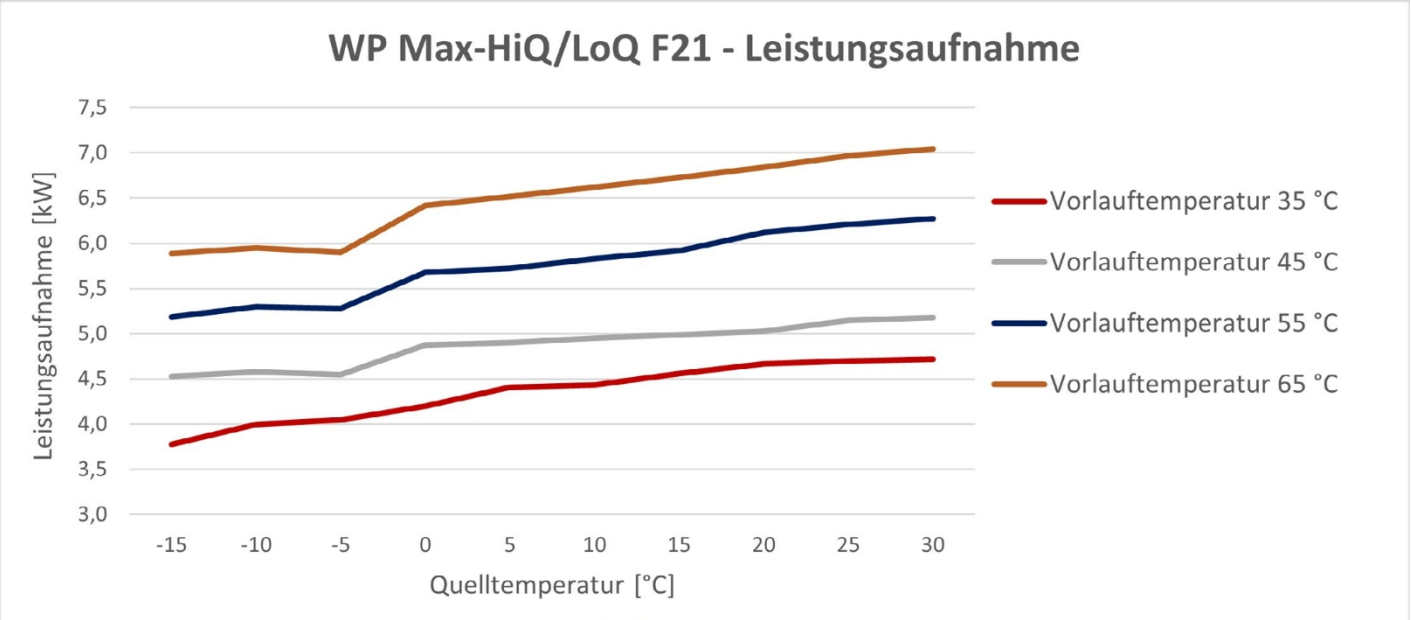
Source temperature	Heating capacity in kW				Power consumption in kW				COP			
	Flow temperature				Flow temperature				Flow temperature			
	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C
-15 °C	11.39	10.43	9.34	8.31	3.78	4.53	5.18	5.89	3.02	2.30	1.80	1.41
-10 °C	13.12	12.53	11.19	10.23	3.99	4.58	5.30	5.95	3.29	2.74	2.11	1.72
-5 °C	14.88	13.49	12.45	11.24	4.05	4.55	5.28	5.90	3.68	2.96	2.36	1.91
0 °C	17.50	15.85	14.88	13.56	4.20	4.88	5.68	6.42	4.17	3.25	2.62	2.11
5 °C	20.51	19.23	18.56	17.58	4.41	4.90	5.72	6.52	4.65	3.92	3.24	2.70
10 °C	24.80	22.80	20.80	18.80	4.43	4.95	5.83	6.62	5.60	4.61	3.57	2.84
15 °C	26.80	25.70	24.30	23.05	4.56	4.99	5.92	6.73	5.88	5.15	4.10	3.42
20 °C	30.70	29.50	25.10	24.80	4.67	5.03	6.12	6.84	6.57	5.86	4.10	3.63
25 °C	31.50	30.80	29.30	28.20	4.70	5.15	6.21	6.97	6.70	5.98	4.72	4.05
30 °C	37.00	35.80	33.80	32.20	4.72	5.18	6.27	7.05	7.84	6.91	5.39	4.57

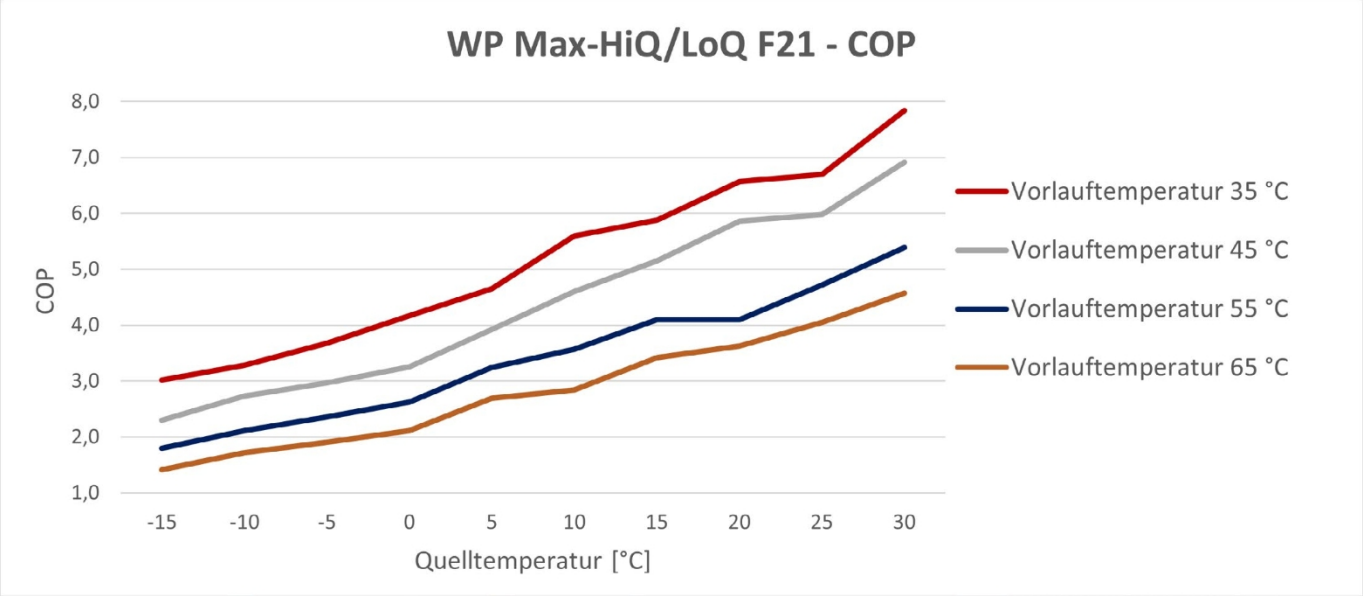


PERFORMANCE DATA

WP Max-HiQ F21, WP Max-LoQ F21

COP, heating capacity and power consumption



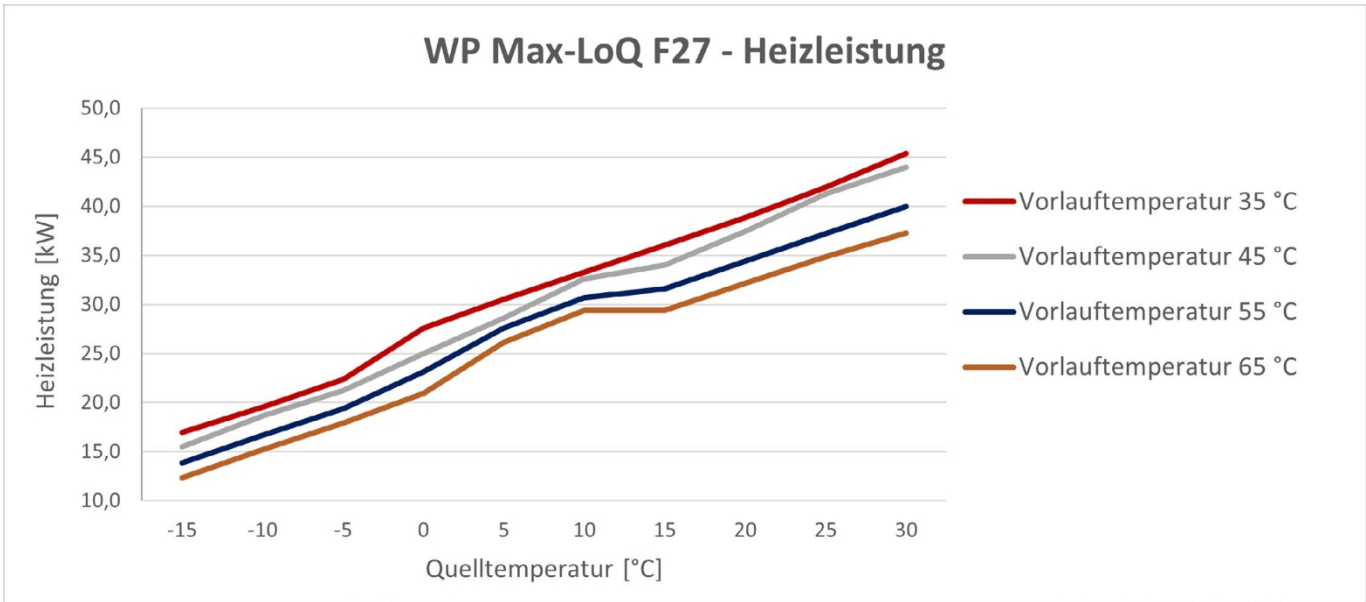


PERFORMANCE DATA

WP Max-LoQ F27

COP, heating capacity and power consumption

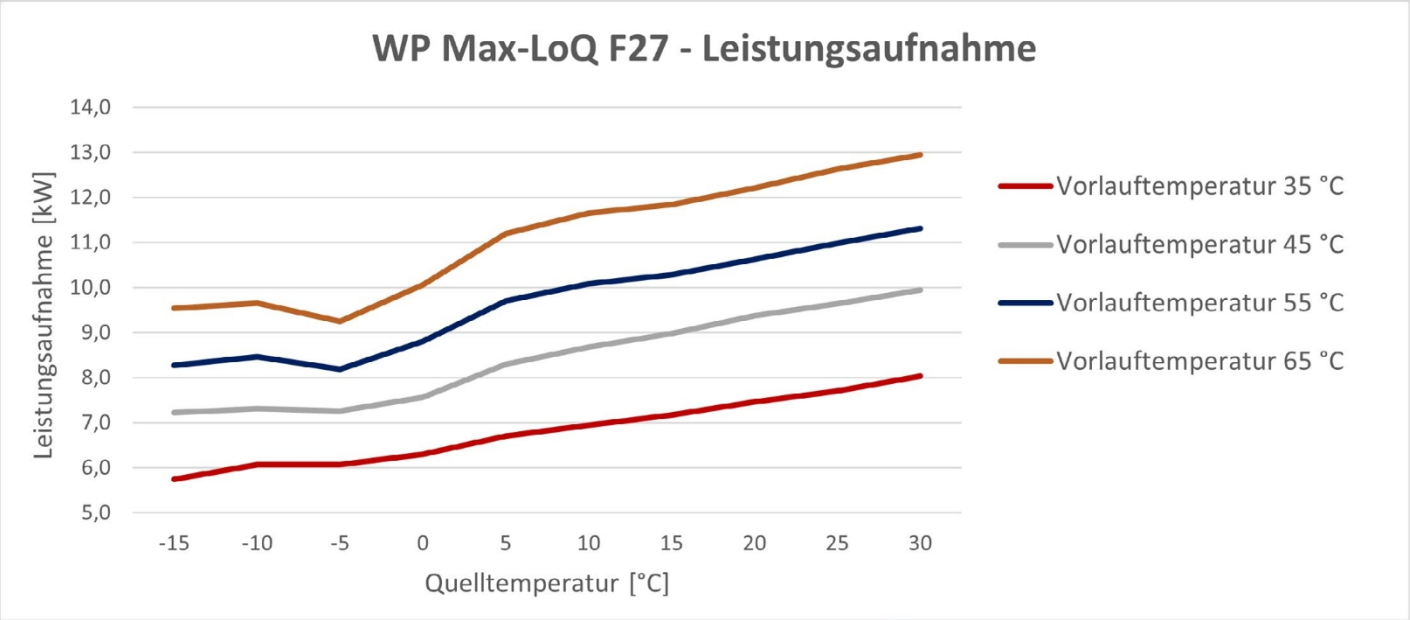
Source temperature	Heating capacity in kW				Power consumption in kW				COP			
	Flow temperature				Flow temperature				Flow temperature			
	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C	35 °C	45 °C	55 °C	65 °C
-15 °C	16.94	15.51	13.89	12.36	5.74	7.22	8.27	9.54	2.95	2.15	1.68	1.30
-10 °C	19.52	18.63	16.65	15.21	6.07	7.31	8.46	9.65	3.21	2.55	1.97	1.58
-5 °C	22.37	21.26	19.40	17.91	6.07	7.27	8.19	9.25	3.69	2.93	2.37	1.94
0 °C	27.58	24.98	23.17	20.96	6.30	7.57	8.81	10.06	4.35	3.30	2.63	2.08
5 °C	30.50	28.60	27.60	26.15	6.70	8.30	9.70	11.20	4.55	3.43	2.83	2.33
10 °C	33.28	32.60	30.70	29.41	6.94	8.68	10.08	11.65	4.90	3.76	3.05	2.52
15 °C	36.06	34.01	31.60	29.37	7.18	8.98	10.29	11.85	5.35	4.00	3.07	2.48
20 °C	38.84	37.46	34.40	32.18	7.46	9.37	10.63	12.22	5.82	4.31	3.36	2.63
25 °C	41.93	41.26	37.20	34.84	7.70	9.64	10.99	12.64	6.23	4.65	3.67	2.76
30 °C	45.37	44.00	39.98	37.29	8.04	9.95	11.31	12.95	6.55	4.89	3.97	2.88

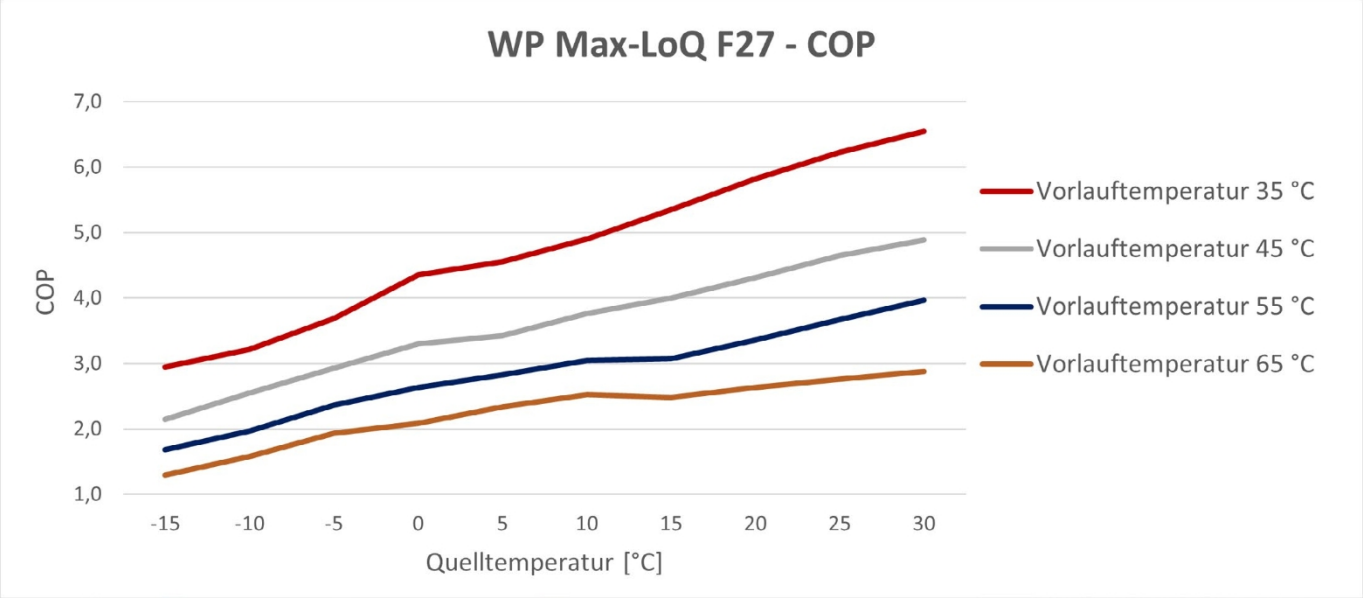


PERFORMANCE DATA

WP Max-LoQ F27

COP, heating capacity and power consumption





Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-HiQ/LoQ F14		
Air/water heat pump ☐		Water/water heat pump ☑		Brine/water heat pump ☐	
Equipped with additional heating unit				No (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature 35 °C**	**55 °C**	
Class for space heating energy efficiency η_s		Cold	A	A	
		medium	A	A+++	
		warm	A+++	A+++	
Space heating energy efficiency η_s		cold	217.7	172.2	%
		Average	230.5	181.6	
		warm	250.7	212.3	
Seasonal coefficient of performance SCOP		cold	5.64	3.65	
		Average	5.96	4.74	
		warm	6.47	5.51	
Heat output P_{rated}		cold	28.91	25.46	kW
		Medium	17.80	15.00	
		warm	12.30	8.46	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	17.91	15.18	kW
		COP1	5.14	3.23	
Operating point 2	$_{Dew\ point}$ = 2 °C	P2	12.30	8.46	kW
		COP2	5.94	4.99	
Operating point 3	$_{Outdoor\ temperature}$ = 7 °C	P3	6.91	5.58	kW
		COP3	6.71	5.42	
Operating point 4	$T_{outside}$ = 12 °C	P4	5.80	5.70	kW
		COP4	7.25	6.33	
Bivalence temperature/min. operating temp.	T_{biv} /TOL = -10 °C	P5	17.80	15.0	kW
		COP5	5.03	3.02	
Power consumption - consumption values					
Temperature controller from $P_{TempOFF}$				48.0	W
Standby mode $P_{Stand\text{-}by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				M	
Hot water energy efficiency η_{WH}				121.57	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				3.86	kWh
Annual electricity consumption AEC				842.16	kWh

Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-HiQ/LoQ F14		
Air/water heat pump ☐		Water/water heat pump ☐		Brine/water heat pump ☑	
Equipped with additional heating unit				No (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature** 35 °C	55 °C	
Class for space heating energy efficiency η_s		cold	A	A	
		medium	A	A++	
		warm	A	A	
Space heating energy efficiency η_s		cold	160.4	126.4	%
		medium	166.7	138.5	
		warm	164.1	160.1	
Seasonal coefficient of performance SCOP		cold	4.21	3.36	
		Average	4.37	3.66	
		warm	4.30	4.20	
Heat output P_{rated}		cold	18.67	16.06	kW
		Medium	12.83	11.75	
		warm	6.99	7.44	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	11.37	10.67	kW
		COP1	3.84	2.73	
Operating point 2	$T_{Dew\ point}$ = 2 °C	P2	6.99	7.44	kW
		COP2	4.36	3.63	
Operating point 3	$T_{Dew\ point}$ = 7 °C	P3	4.89	4.69	kW
		COP3	4.98	4.35	
Operating point 4	$T_{outside}$ = 12 °C	P4	3.04	3.55	kW
		COP4	4.29	4.78	
Bivalence temperature/min. operating temp.	T_{biv} /TOL = -10 °C	P5	12.83	11.75	kW
		COP5	4.37	3.66	
Power consumption - consumption values					
Temperature controller off $P_{TempOFF}$				48.0	W
Standby mode $P_{Stand-by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				M	
Hot water energy efficiency η_{WH}				135.07	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				1.76	kWh
Annual electricity consumption AEC				380.12	kWh

Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-HiQ/LoQ F21		
Air/water heat pump ☐		Water/water heat pump ☑		Brine/water heat pump ☐	
Equipped with additional heating unit				No (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature** 35 °C	55 °C	
Class for space heating energy efficiency η_s		cold	A	A	
		medium	A	A	
		warm	A+++	A+++	
Space heating energy efficiency η_s		cold	225.3	161.2	%
		medium	234.5	179.9	
		warm	236.1	195.0	
Seasonal coefficient of performance SCOP		cold	5.83	4.23	
		Average	5.96	4.52	
		warm	6.57	5.07	
Heat output P_{rated}		cold	31.29	27.65	kW
		Medium	21.46	18.81	
		warm	11.78	10.21	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	19.0	16.74	kW
		COP1	5.33	3.59	
Operating point 2	$_{Dew\ point}$ = 2 °C	P2	11.78	10.21	kW
		COP2	6.08	4.49	
Operating point 3	$_{Outdoor\ temperature}$ = 7 °C	P3	11.54	10.48	kW
		COP3	6.46	5.06	
Operating point 4	$T_{outside}$ = 12 °C	P4	9.94	9.32	kW
		COP4	6.73	5.83	
Bivalence temperature/min. operating temperature	T_{biv}/TOL = -10 °C	P5	21.46	18.81	kW
		COP5	5.03	3.25	
Power consumption - consumption values					
Temperature controller from $P_{TempOFF}$				65.0	W
Standby mode $P_{Stand\text{-}by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				L	
Hot water energy efficiency η_{WH}				130.89	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				3.59	kWh
Annual electricity consumption AEC				782.19	kWh

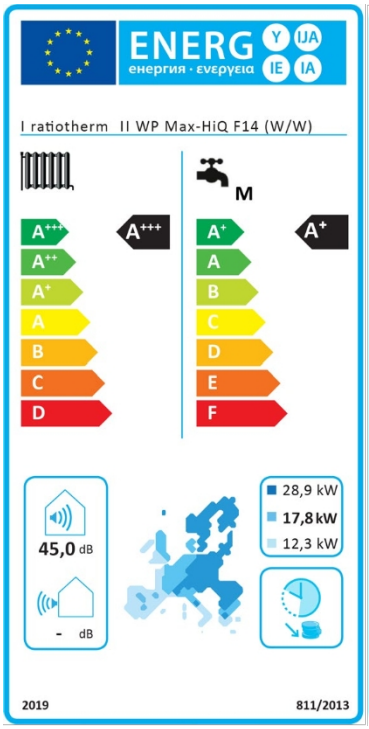
Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-HiQ/LoQ F21		
Air/water heat pump ☐	Water/water heat pump ☐		Brine/water heat pump ☑		
Equipped with additional heating unit				No (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature** 35 °C	55 °C	
Class for space heating energy efficiency η_s		cold	A	A	
		medium	A	A++	
		warm	A	A+++	
Space heating energy efficiency η_s		cold	163.7	126.57	%
		average	166.10	138.91	
		warm	150.5	163.35	
Seasonal coefficient of performance SCOP		cold	4.29	3.37	
		Average	4.35	3.67	
		warm	3.96	4.46	
Heat output P_{rated}		cold	23.81	24.10	kW
		Medium	16.00	17.62	
		warm	8.70	11.15	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	14.33	16.01	kW
		COP1	4.19	2.73	
Operating point 2	$T_{Dew\ point}$ = 2 °C	P2	8.64	11.15	kW
		COP2	4.59	3.63	
Operating point 3	$T_{Dew\ point}$ = 7 °C	P3	5.57	7.04	kW
		COP3	4.32	4.35	
Operating point 4	$T_{outside}$ = 12 °C	P4	4.20	5.32	kW
		COP4	4.12	4.78	
Bivalence temperature/min. operating temp.	T_{biv} /TOL = -10 °C	P5	16.01	17.62	kW
		COP5	3.97	3.67	
Power consumption - consumption values					
Temperature controller from $P_{TempOFF}$				48.0	W
Standby mode $P_{Stand-by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				L	
Hot water energy efficiency η_{WH}				134.13	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				3.50	kWh
Annual electricity consumption AEC				763.27	kWh

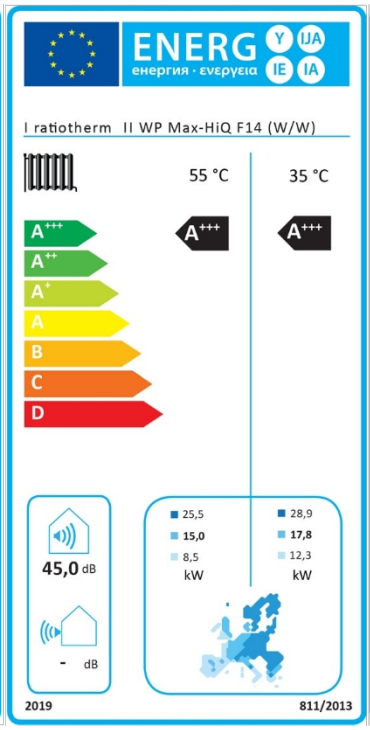
Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-LoQ F27		
Air/water heat pump ☐		Water/water heat pump ☑		Brine/water heat pump ☐	
Equipped with additional heating unit				No (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature** 35 °C	55 °C	
Class for space heating energy efficiency η_s		Cold	A	A	
		medium	A	A+++	
		warm	A+++	A+++	
Space heating energy efficiency η_s		cold	229.1	172.4	%
		medium	240.0	187.1	
		warm	286.0	253.7	
Seasonal coefficient of performance SCOP		cold	5.93	4.51	
		Average	6.30	4.86	
		warm	7.35	6.54	
Heat output P_{rated}		cold	47.84	44.71	kW
		Medium	32.00	30.80	
		warm	19.97	18.10	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	29.29	28.80	kW
		COP1	5.05	3.64	
Operating point 2	$_{Dew\ point}$ = 2 °C	P2	18.97	18.10	kW
		COP2	6.24	4.82	
Operating point 3	$_{Outdoor\ temperature}$ = 7 °C	P3	12.84	12.2	kW
		COP3	7.05	5.70	
Operating point 4	$T_{outside}$ = 12 °C	P4	9.80	9.60	kW
		COP4	7.49	6.91	
Bivalence temperature/min. operating temp.	T_{biv} /TOL = -10 °C	P5	32.4	32.37	kW
		COP5	6.33	4.96	
Power consumption - consumption values					
Temperature controller from $P_{TempOFF}$				112.0	W
Standby mode $P_{Stand\text{-}by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				L	
Hot water energy efficiency η_{WH}				201.43	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				2.35	kWh
Annual electricity consumption AEC				508.26	kWh

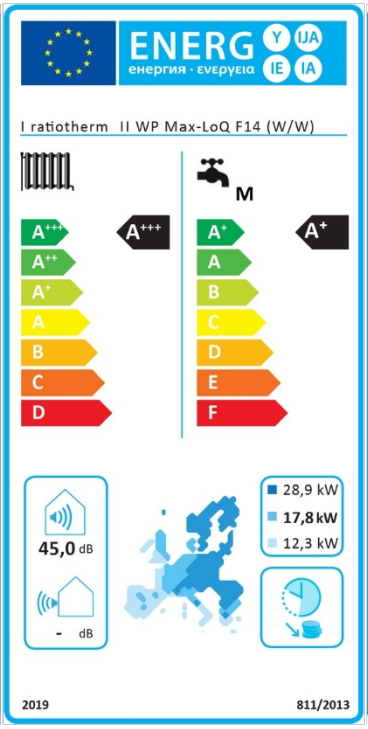
Product data sheet in accordance with EU Regulation No. 811/2013					
Model			WP Max-LoQ F27		
Air/water heat pump ☐	Water/water heat pump ☐		Brine/water heat pump ☑		
Equipped with additional heating unit				no (opt.)	
Combination heater				yes	
Heating mode		**Climate zone**	**flow temperature** 35 °C	55 °C	
Class for space heating energy efficiency η_s		cold	A	A	
		medium	A	A++	
		warm	A	A+++	
Space heating energy efficiency η_s		cold	160.6	127.2	%
		medium	166.9	140.5	
		warm	163.1	175.4	
Seasonal coefficient of performance SCOP		cold	4.21	3.38	
		Average	4.37	3.71	
		warm	4.28	4.59	
Heat output P_{rated}		cold	36.17	30.98	kW
		Medium	24.75	22.66	
		warm	13.48	14.34	
Power points					
Operating point 1	$T_{outside}$ = -7 °C	P1	21.93	20.58	kW
		COP1	3.84	2.73	
Operating point 2	$T_{Dew\ point}$ = 2 °C	P2	13.48	14.34	kW
		COP2	4.36	3.63	
Operating point 3	$T_{Dew\ point}$ = 7 °C	P3	9.43	9.05	kW
		COP3	4.98	4.35	
Operating point 4	$T_{outside}$ = 12 °C	P4	5.86	6.84	kW
		COP4	4.29	4.78	
Bivalence temperature/min. operating temp.	T_{biv} /TOL = -10 °C	P5	24.75	22.66	kW
		COP5	4.28	3.72	
Power consumption - consumption values					
Temperature controller from $P_{TempOFF}$				93.0	W
Standby mode $P_{Stand-by}$				11.0	
Switched off P_{Off}				11.0	
Heating tape $P_{Heating\ tape}$				0	
Energy label – hot water preparation					
Load profile				L	
Hot water energy efficiency η_{WH}				149.96	
Class for hot water energy efficiency η_{WH}				A	
Daily electricity consumption Q_{elec}				3.13	kWh
Annual electricity consumption AEC				682.69	kWh

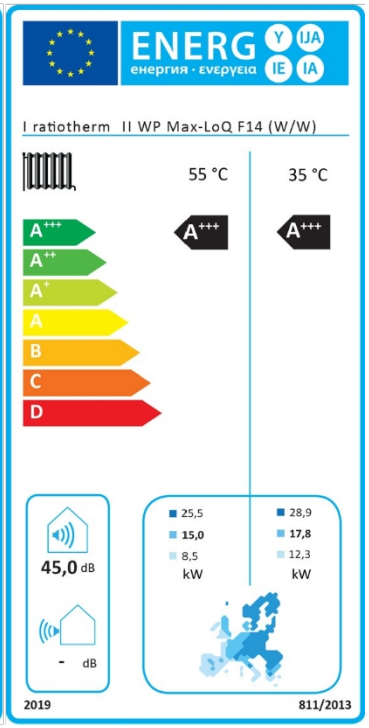
3. EU ENERGY LABEL

3.1 F14 - WATER/WATER

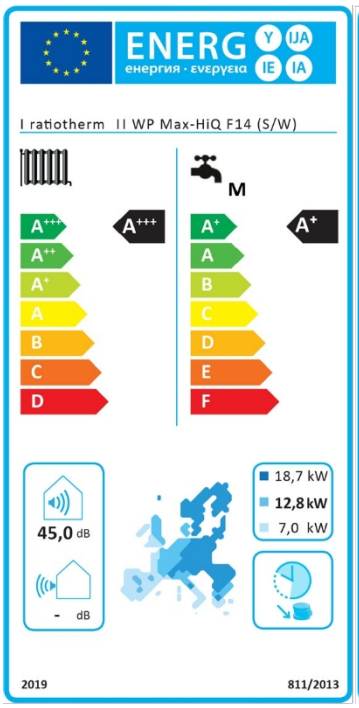


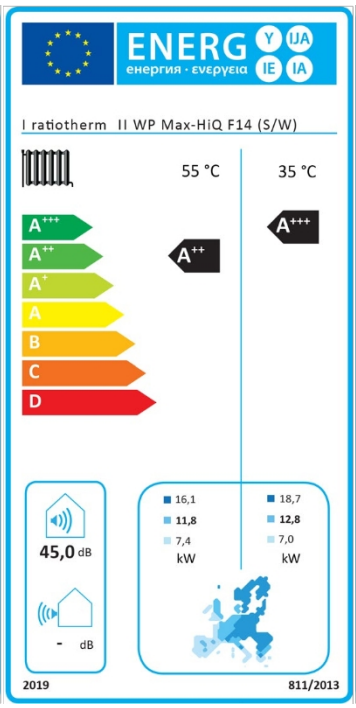


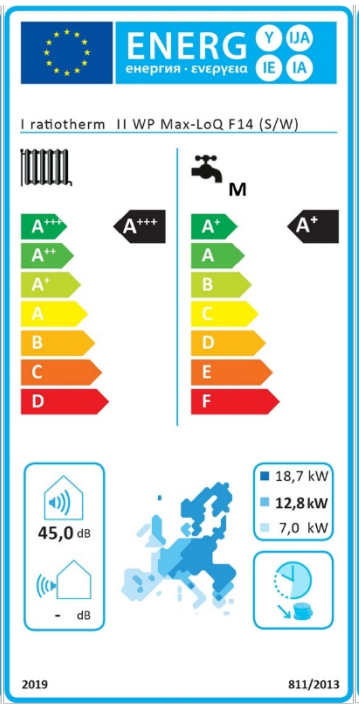


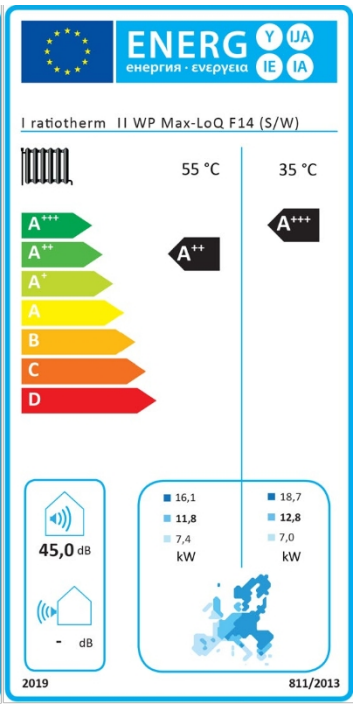


3.2 F14 - BRINE/WATER

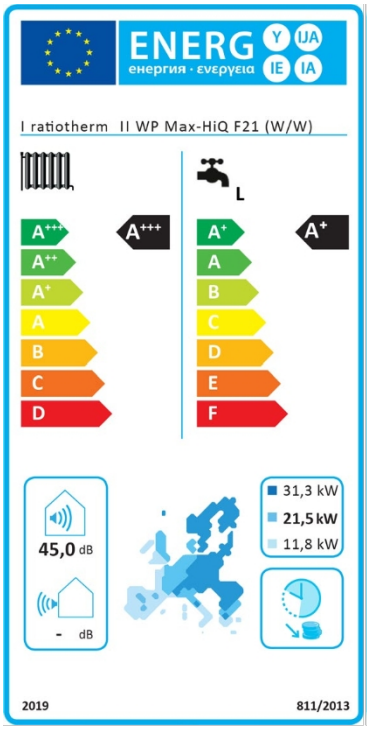


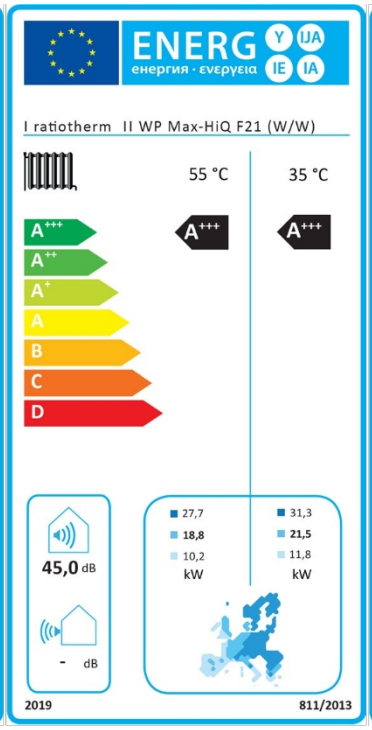


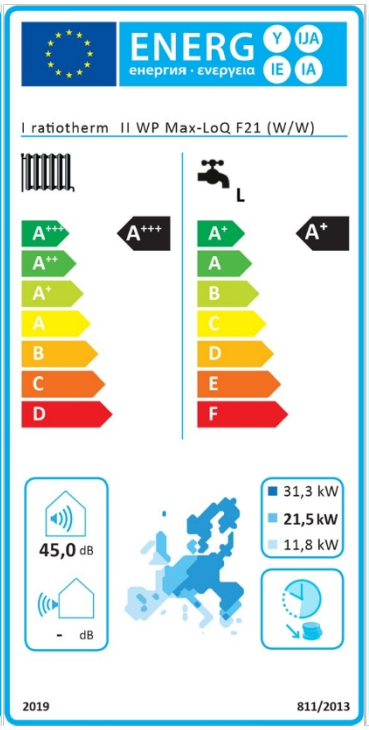


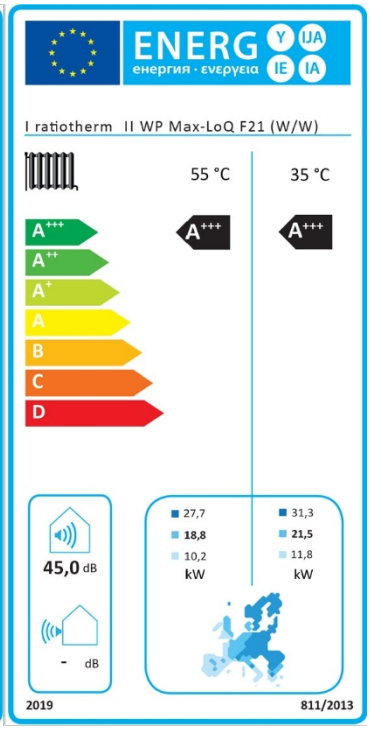


3.3 F21 - WATER/WATER

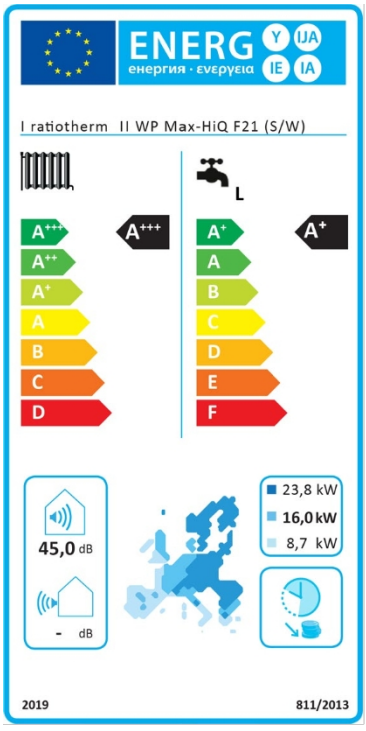


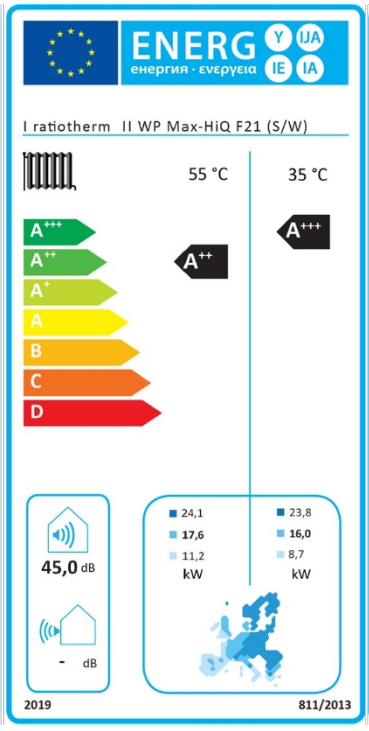


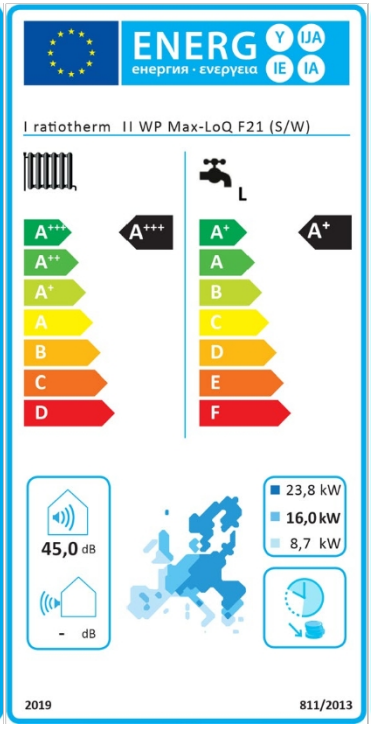


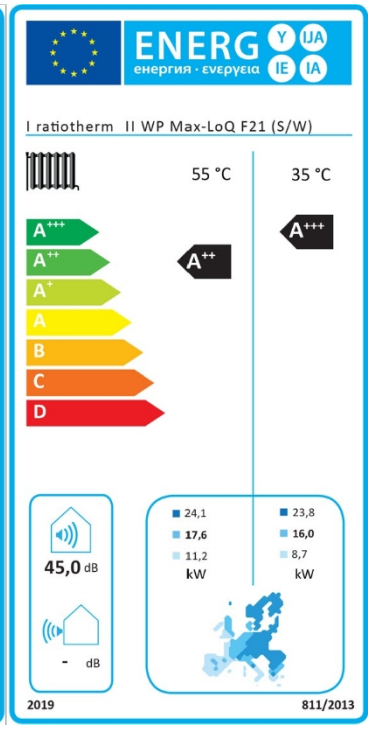


3.4 F21 - BRINE/WATER

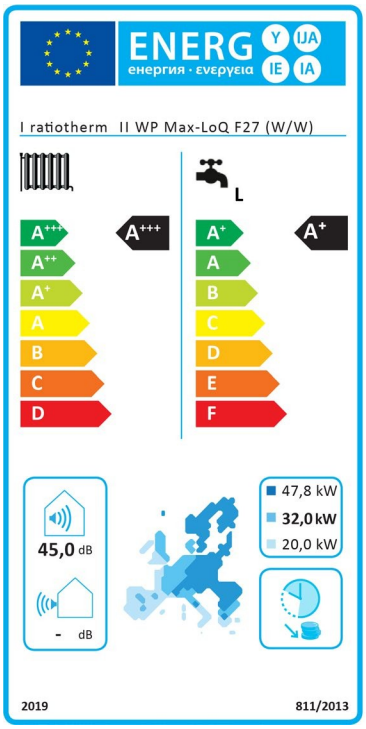


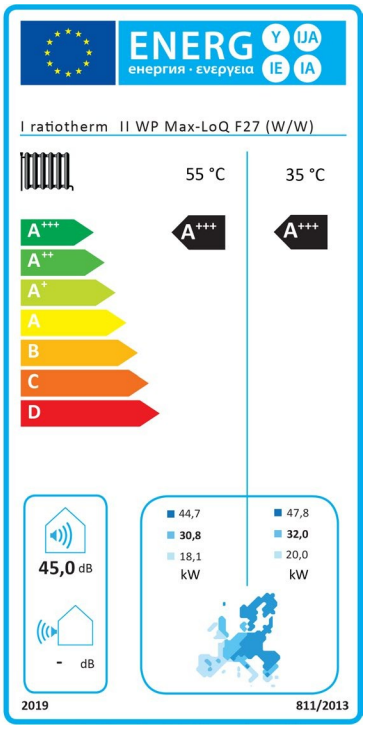




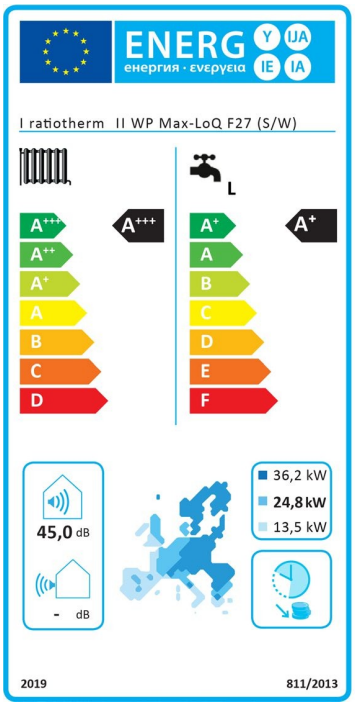


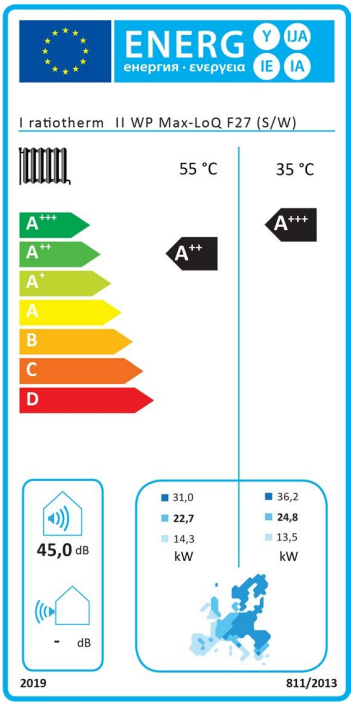
3.5 F27 - WATER/WATER





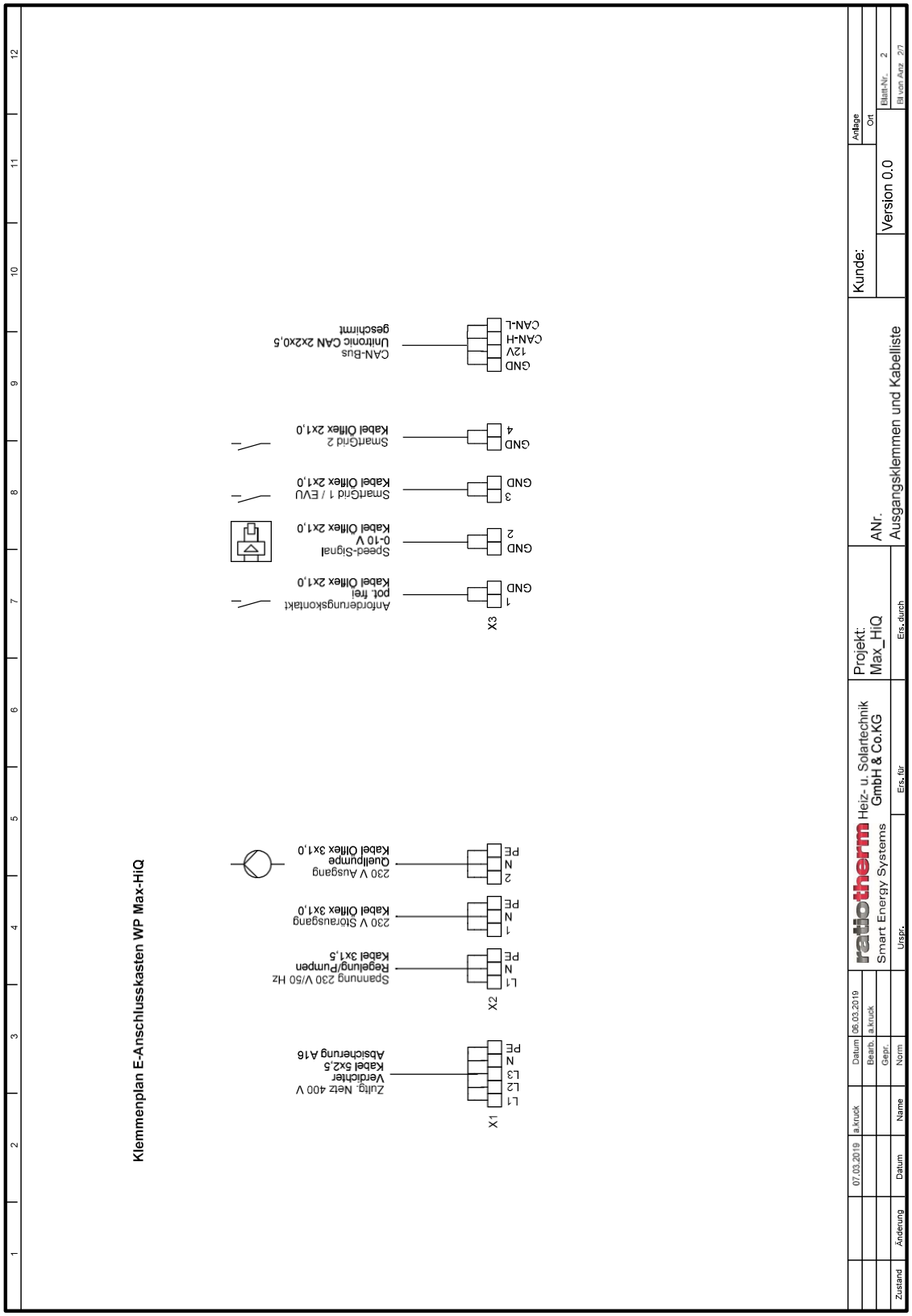
3.6 F27 - BRINE/WATER



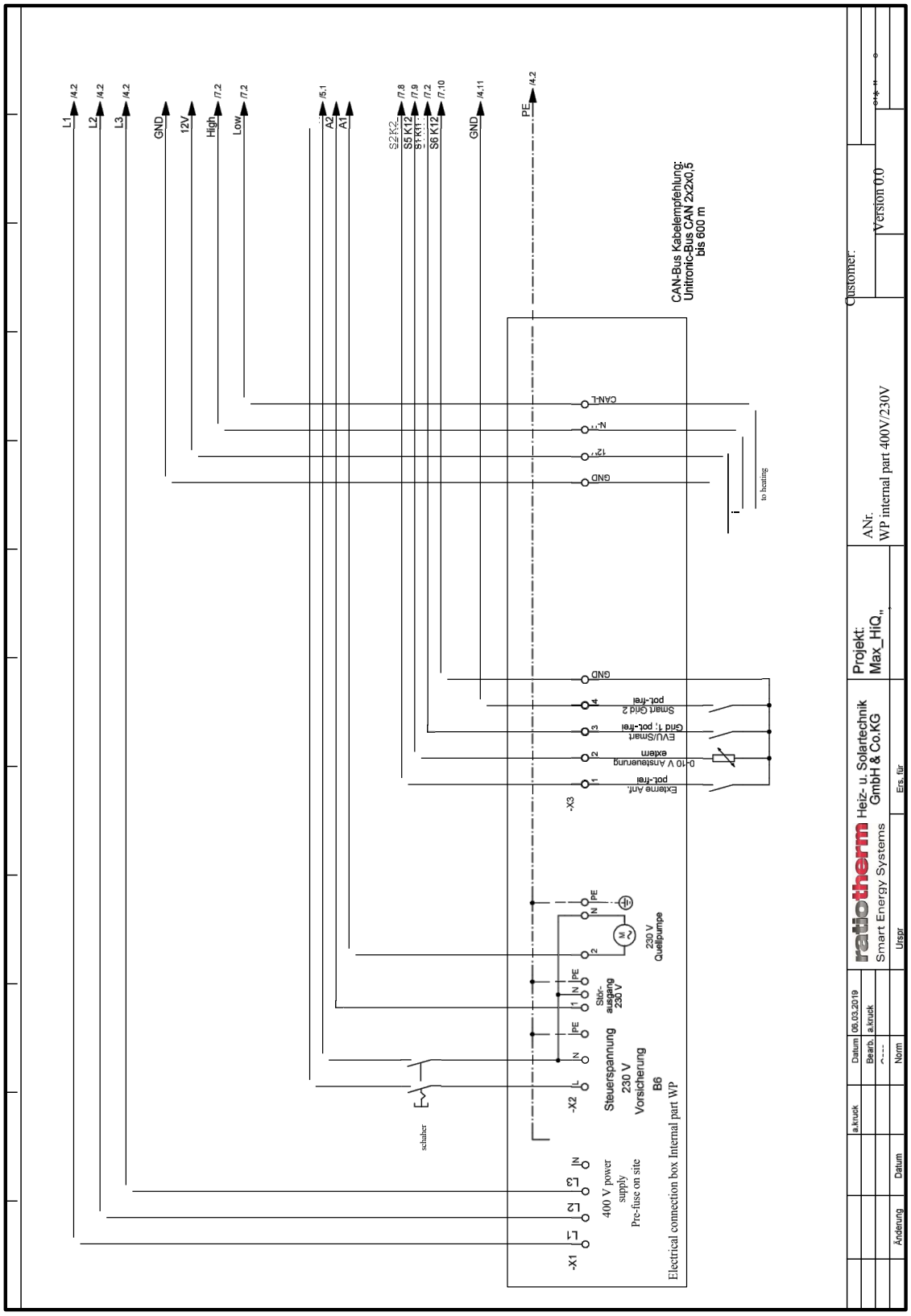


4. ELECTRICAL PLAN

4.1 OUTPUT TERMINALS AND CABLE LIST



WP INTERNAL PART 400
4.2 V/230 V



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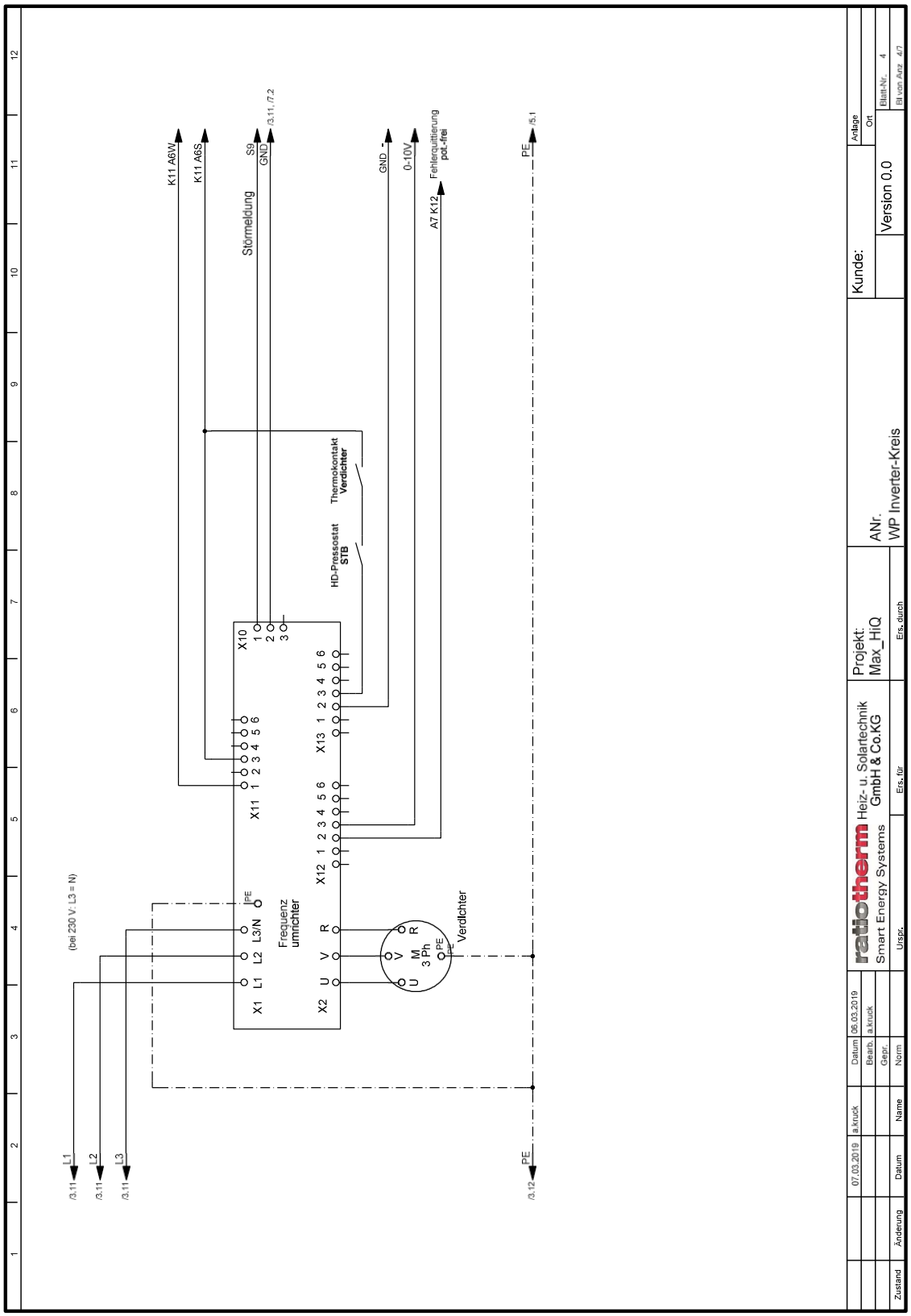
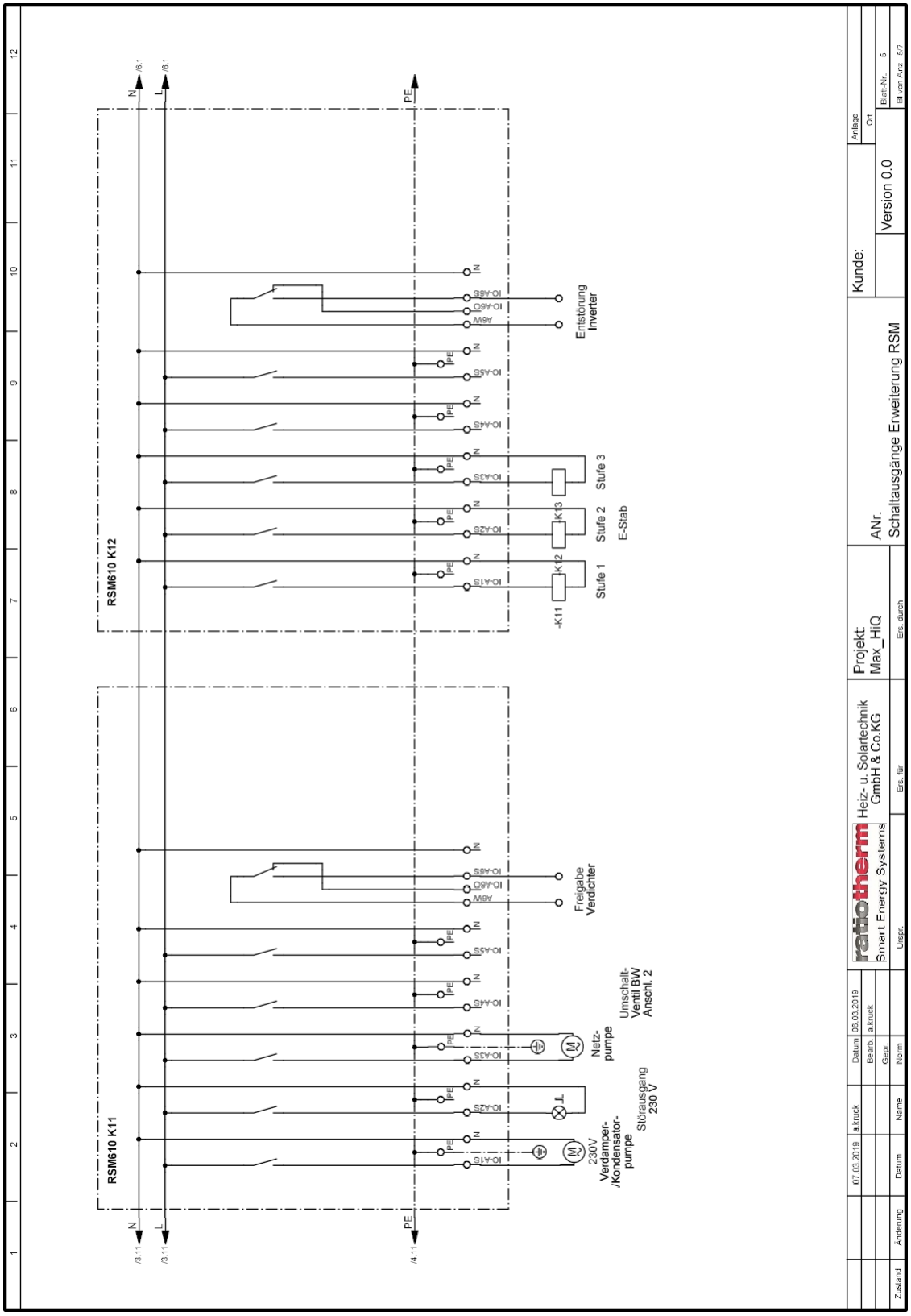
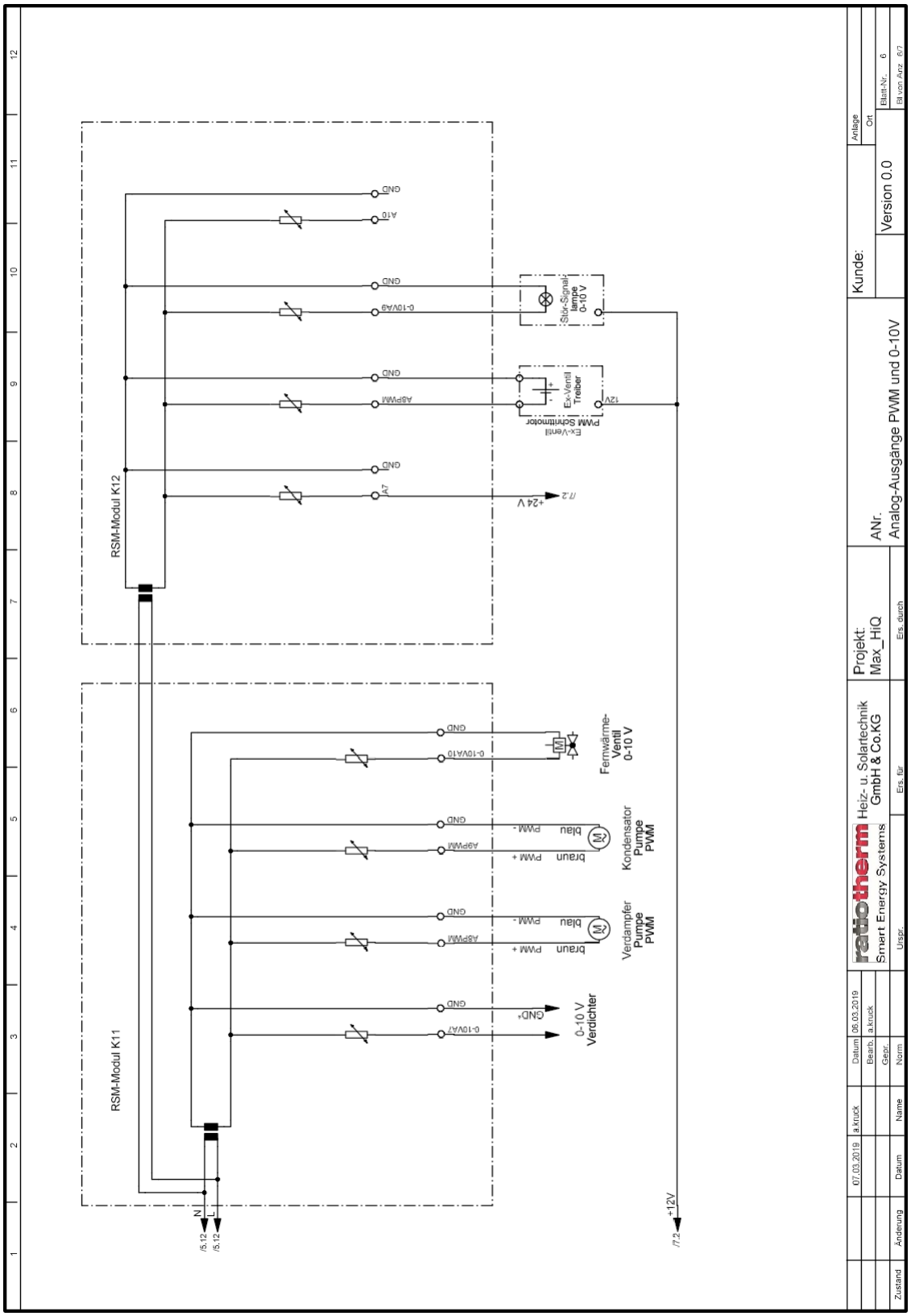
4.3 WP INVERTER CIRCUIT



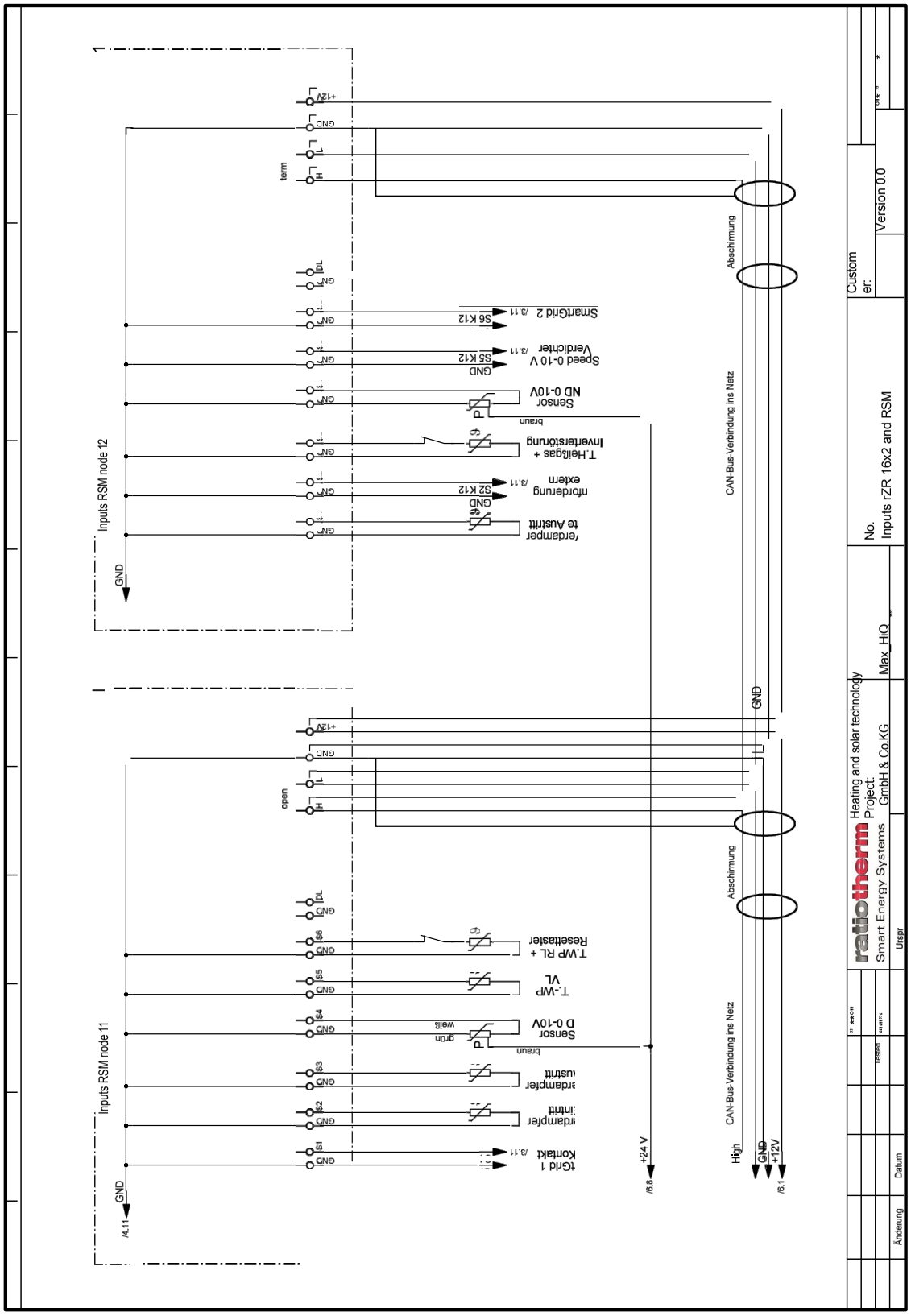
4.4 SWITCHING OUTPUTS EXTENSION RSM



4.5 ANALOGUE OUTPUTS PWM 0-10 V



4.6 INPUTS rZR 16x2 AND RSM



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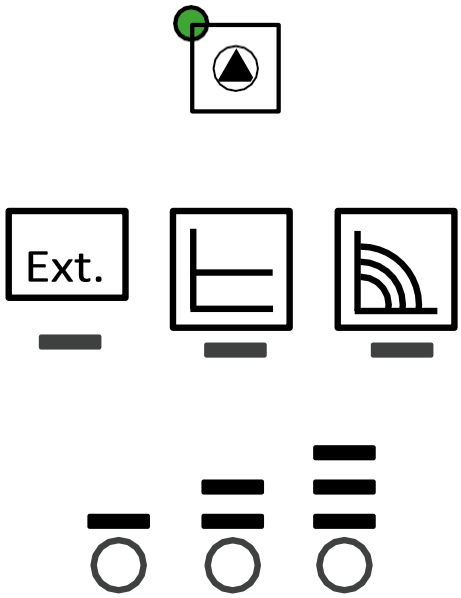
5. PUMP WILO-PARA STG

Technical

Connection voltage	1 ~ 230 V +10 %/-15 %, 50/60 Hz
Protection class	IP X4D
Energy efficiency index EEI	see type plate (6)
Medium temperatures at max. ambient temperature	-20 °C to +95 °C (heating/GT) -10 °C to +110 °C (ST)
Ambient temperature	0 °C to +70 °C
Max. operating pressure	10 bar (1000 kPa)
Minimum inlet pressure at +95 °C/+110 °C	0.5 bar/1.0 bar (50 kPa/100 kPa)

Indicator lights (LEDs)



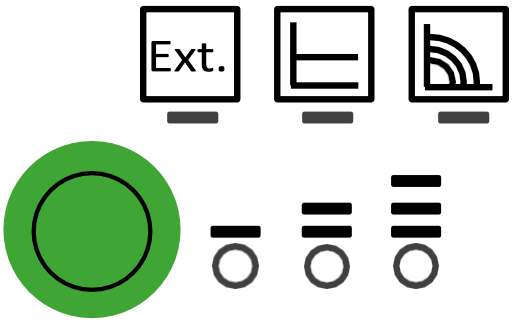
Signal indicator

- LED lights up green during normal operation
- LED lights up/flashes in case of malfunction
-

Display of the selected control mode
PWM, Δp-c and constant speed

Display of the selected characteristic curve (I, II, III) within the control type

Control button



Press

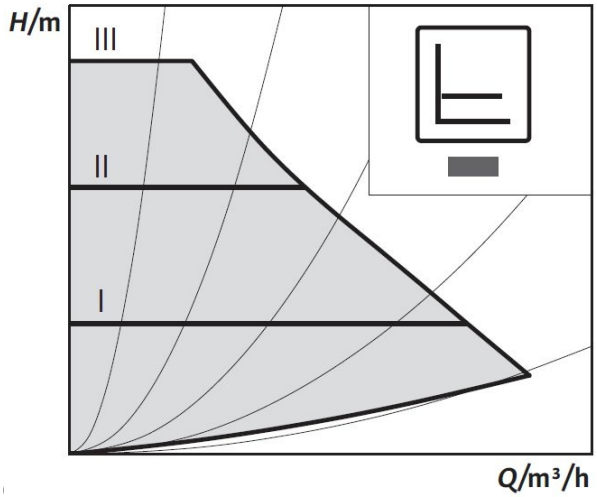
- Select control mode
- Select characteristic curve (I, II, III) within the control type

Press and hold

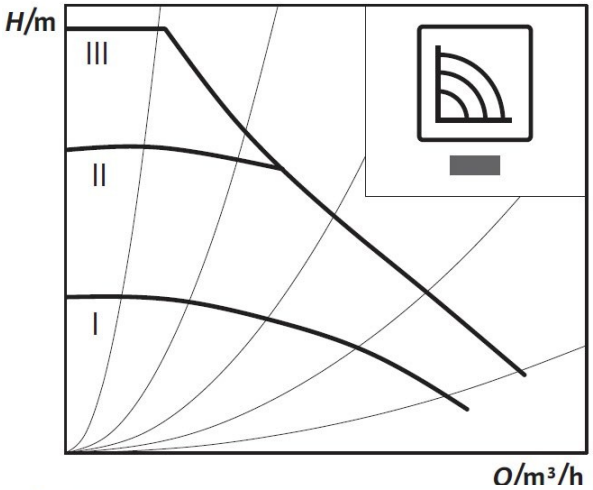
- Activate venting function (press for 3 seconds)
- Activate manual restart (press for 5 seconds)
- Lock/unlock button (press for 8 seconds)

CONTROL MODES AND FUNCTIONS

Constant differential pressure Δp-c (I, II, III)



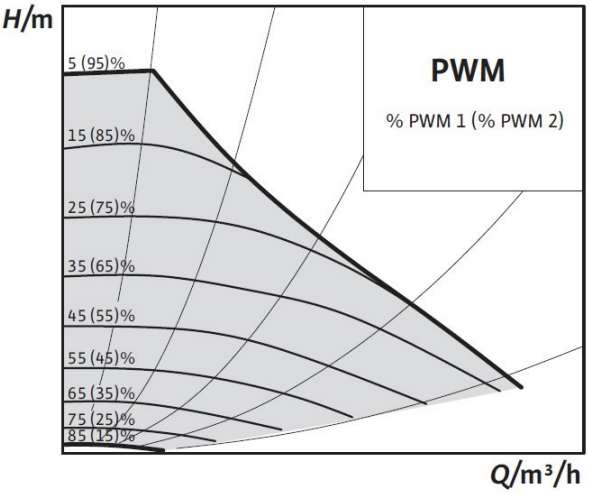
Recommended for underfloor heating systems, large-diameter pipes, all applications without variable pipe network characteristics (e.g. storage tank charging pumps) and single-pipe heating systems with radiators.
The control keeps the set delivery head constant regardless of the delivered volume flow.
Three predefined characteristic curves (I, II, III) to choose from.



Recommended for systems with unchanging system resistance that require a constant volume flow.
The pump runs at three preset fixed speed levels (I, II, III).

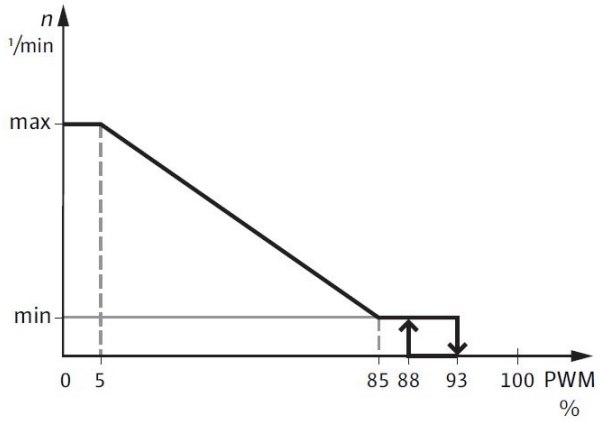
NOTE

Factory setting:
Constant speed, characteristic curve III



The required setpoint/actual value comparison is performed by an external controller for regulation purposes. A PWM signal (pulse width modulation) is supplied to the pump as a control variable via a separate cable with plug.

The PWM signal generator sends a periodic sequence of pulses (the duty cycle) to the pump in accordance with DIN IEC 60469-1.

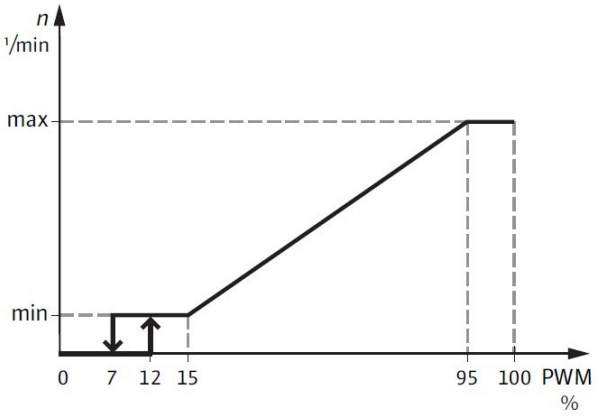


iPWM 1 mode (heating application):

In iPWM 1 mode, the pump speed is controlled depending on the PWM input signal. Behaviour in the event of a cable break: If the signal cable is disconnected from the pump, e.g. due to a cable break, the pump accelerates to maximum speed.

PWM signal input [%]

> 5:	Pump runs at maximum speed
5 - 85:	The speed of the pump decreases linearly from n_{max} to n_{min}
85 - 93:	Pump runs at minimum speed (operation) 85 - 88: Pump runs at minimum speed (start-up) 93 - 100: Pump stops (standby)



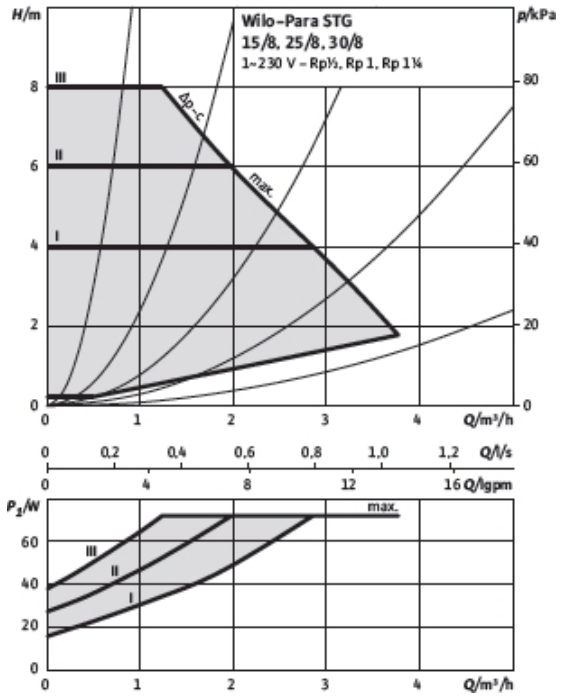
iPWM 2 mode:

In iPWM 2 mode, the pump speed is controlled depending on the PWM input signal. Behaviour in the event of a cable break: If the signal cable is disconnected from the pump, e.g. due to a cable break, the pump stops.

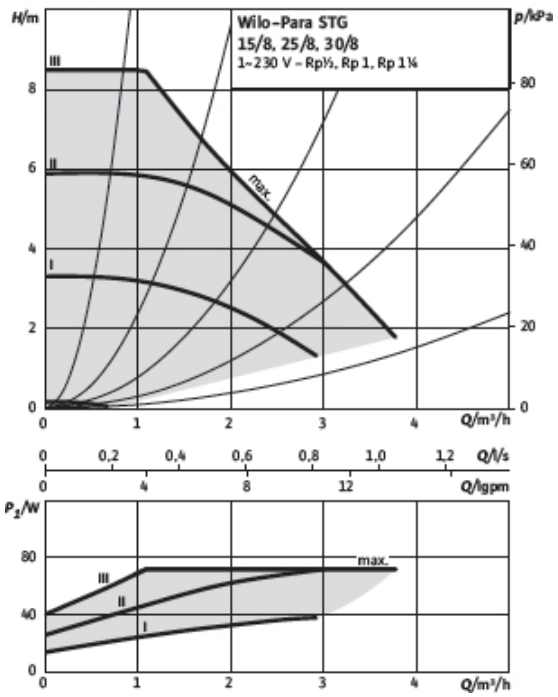
PWM signal input [%]

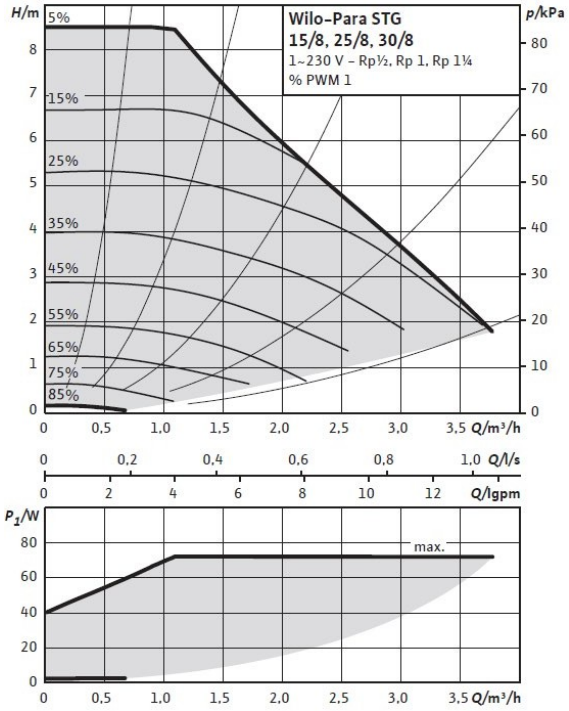
0 - 7:	Pump stops (standby)
7 - 15:	Pump runs at minimum speed (operation) 12 - 15: Pump runs at minimum speed (start-up) 15 - 95: The speed of the pump increases linearly from n_{min} to n_{max}
> 95:	Pump runs at maximum speed

Δp-c (constant)



Constant speed I, II, III





Vent

The venting function is activated by pressing and holding (3 seconds) the control button and automatically vents the pump. The heating system is not vented during this process.

Manual restart

A manual restart is activated by pressing and holding (5 seconds) the control button and unblocks the pump if necessary (e.g. after a prolonged period of inactivity during the summer months).

Key lock

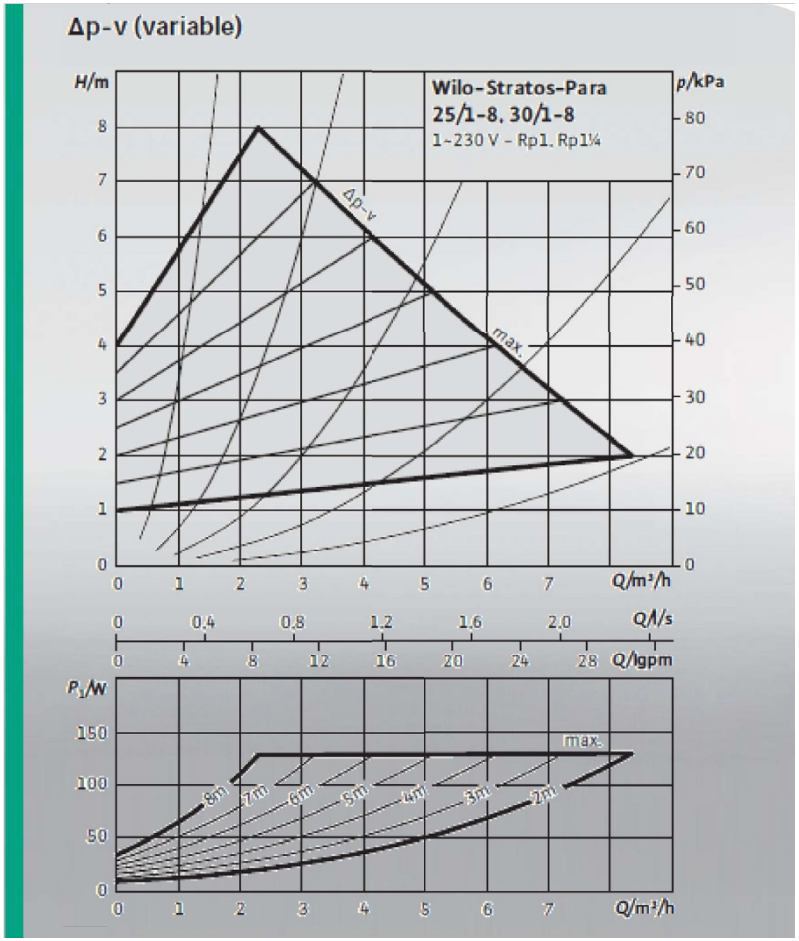
The key lock is activated by pressing and holding (8 seconds) the control button and locks the settings on the pump. It protects against unwanted or unauthorised adjustment of the pump.

Stratos PARA **/1-8

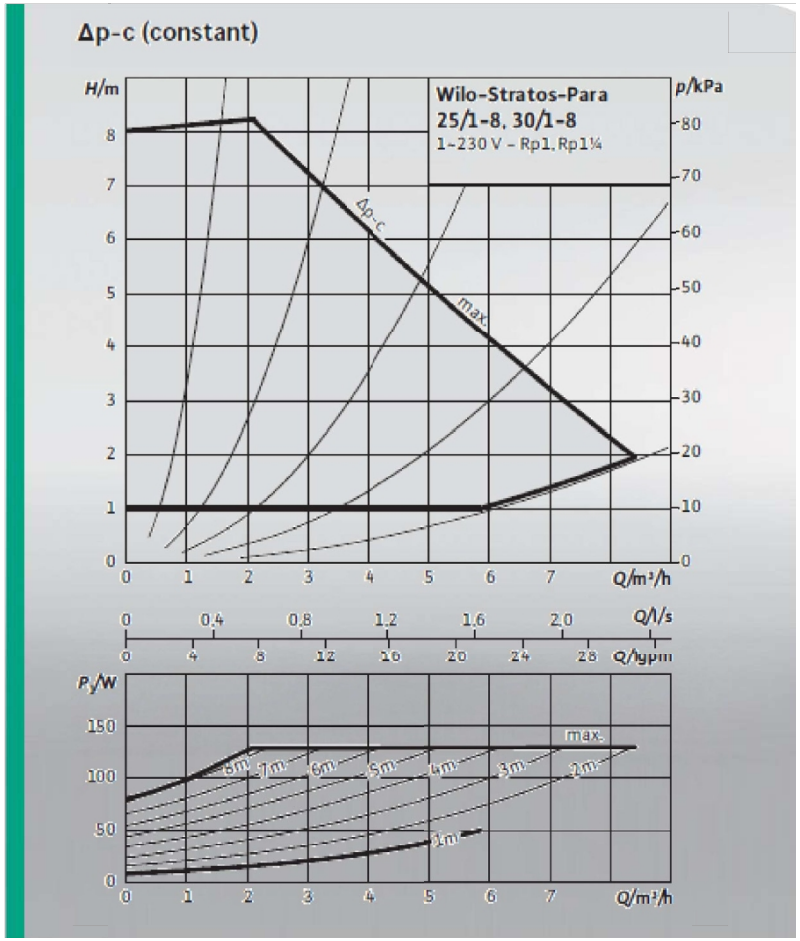
Field of application Heating/Geothermal/Solar

Stratos PARA 25/1-8 T1	
Stratos PARA	**Electronically controlled high-efficiency pump**
25	Threaded connection DN 25
1	1-8 = delivery head in [m] at Q = 0 m³/h
T	The pump is controlled by Red Knob technology P-Δv, for variable differential pressure ΔP-c, for constant differential pressure Control input “Analog in 0 … 10V” with cable Break detection Collective fault signal SSM

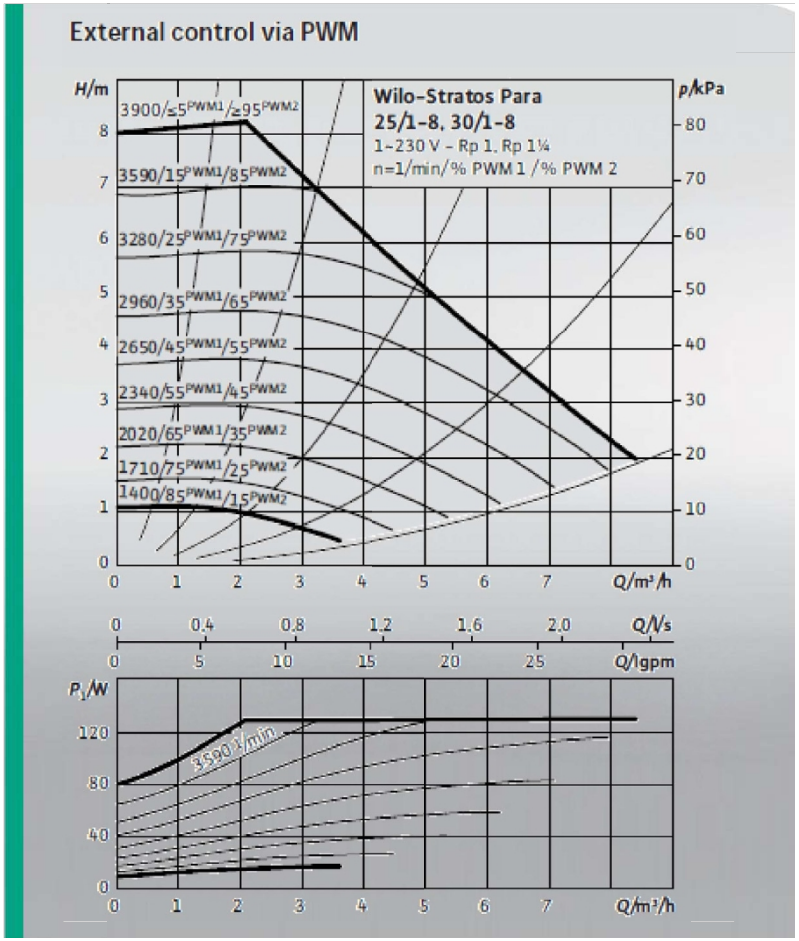
Hydraulic operational area Δp -v (variable)



Hydraulic operational area Δp -c (constant)



Hydraulic operational area external control PWM



7. HEATING ELEMENT TRIATHERM 9 kW (OPTIONAL)

USER NOTES:

1. The heating of the screw-in heating element is indicated by the green operating LED lighting up.
The tank water temperature can be adjusted continuously using the temperature selector or according to the three marked main stages, depending on your hot water requirements.
This enables "energy-conscious" operation of the screw-in heating element.

Position 1.5:	The left stop does not result in a zero position or switch-off of the device, but rather a frost protection position (approx. 9°C +/- 6K).
Position 4:	approx. + 40 °C, lukewarm For normal use at the washbasin
Position 6:	approx. + 60 °C, moderately hot water, limescale formation Very low throughout the entire hot water system
Position 8:	approx. + 75 °C, hot water Only for particularly high hot water requirements

The temperature specifications refer to the water temperature directly at the screw-in heater. The outlet temperatures at the boiler may vary due to different boiler geometries or different installation positions of the screw-in heating element.

2. If the water contains a high level of calcium, limescale will build up on the heaters between the immersion pipe and the heating element. This limescale build-up causes the switching points of the temperature controller and safety temperature limiter to shift. This results in the heater switching on and off uncontrollably.

No warranty can be given for damage caused by limescale deposits on the heating element.

3. Cleaning agents, water treatment agents (or other chemicals) can attack and damage the tubular heating elements (material: Incoloy 825) or the solder joints of the screw-in heating element. Before using these substances, consult the manufacturer of these cleaning agents if necessary.
Corrosion of the heating rods or solder joints can also be caused by the local water quality (chlorides, iron oxide, etc.) or the pipe system (contamination, iron oxide, ingress of other suspended solids).

No guarantee can be given for damage caused by the above circumstances.

4. The screw-in heating element is equipped with a **safety temperature limiter (STB)** in accordance with VDE, which responds at a storage temperature of **98 °C – 8 K** (tolerance range).

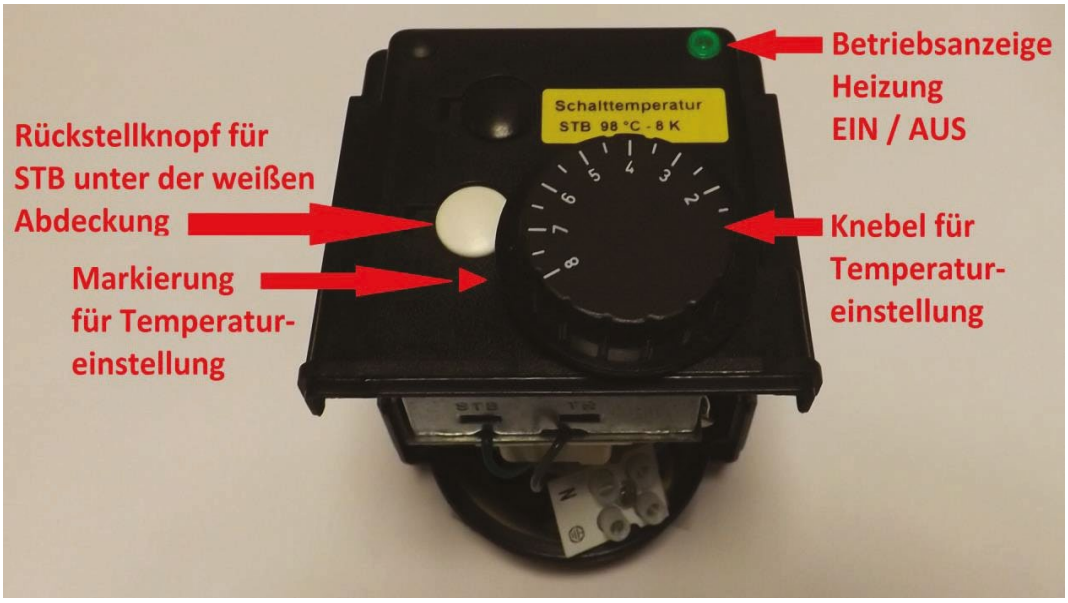
As of December 2018

Please therefore ensure that you reduce the maximum storage tank temperature to such an extent that the STB is not triggered by the solar system or other heat sources. Also ensure that the boiler for reheating is set to a flow temperature that prevents the storage tank from heating up to 90 °C.

This safety function (STB) must be manually unlocked again!

To do so, proceed as follows:

- Disconnect from the power supply!
- Remove the cap cover / remove the cover (white) over the reset button.
- Unlock the safety function by pressing the reset button firmly, while holding the regulator/limiter in place by hand.



5. **"Dry heating"** caused by a lack of water and the resulting excessive temperatures damage the thermostat capillaries. Other protective functions must be selected as water shortage safety devices.

We recommend replacing the thermostat after such an event!

As of December 2018

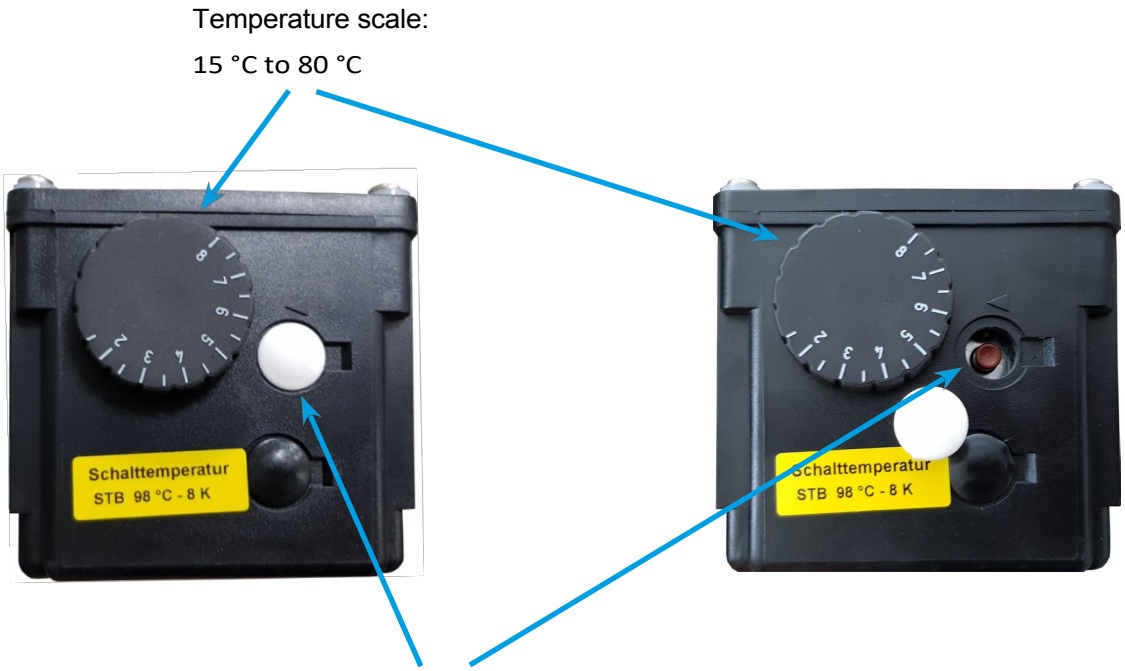
6. Water may drip from the drain pipe of the pressure relief device. This pipe must be left open to the atmosphere.
Furthermore, the pressure relief device must be operated regularly to remove limescale deposits and to ensure that it is not blocked.

7. If a fault occurs during use, you can call a **specialist installer**.
Please do not attempt to repair faults yourself. For professionals, it often only takes a few simple steps to get your screw-in heater working again.

8. We generally recommend having your system **inspected annually** by a specialist company. This inspection should include at least the following:
   - Checking the electrical connection and function of the thermostat
   - Visual inspection of the tubular heating elements for limescale or other abnormalities

Only if the water is very hard is it necessary to descale the heating elements at shorter intervals. The installation of a water softener or a temperature reduction, as described in point 1, is recommended.

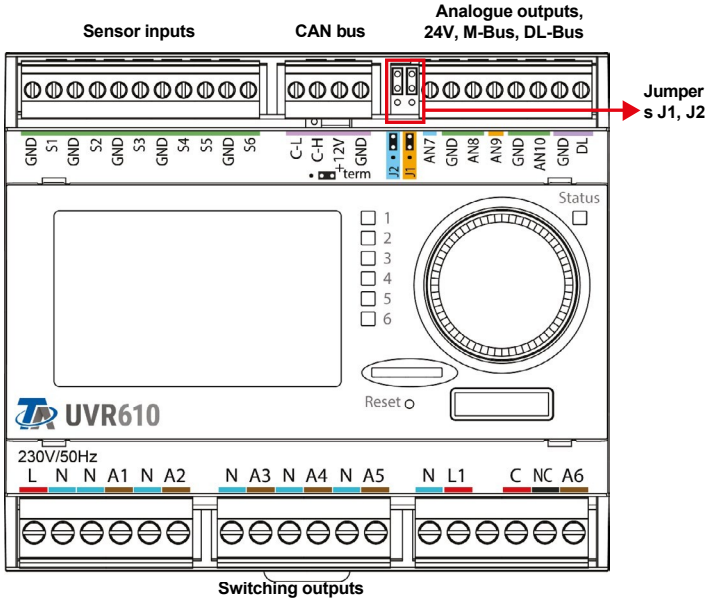
Use with water hardness > 14° dH is not recommended!



8. TECHNICAL DATA UVR 610

Terminal diagram

View of the top of the housing with terminals



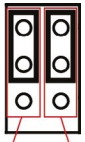
Mains:

L... Outer conductor (phase)
N... Neutral conductor

Outputs:

C... Root
A1 - A6... Normally open
NO NC... Normally closed **A6**
N... Neutral conductor
L1... Output external conductor/phase

Jumper position J1 and J2



Jumper **J2** changes the function of analogue output **A7** to a 24 V output for supplying external devices. In the position shown (top), the analogue output is active.

Jumper **J1** changes the function of analogue output **A9** to an M-Bus interface. In the position shown (top), the analogue output is active.

J2 J1 connection

The controller has a built-in power supply unit and is powered by this. The mains connection must therefore be **230V 50Hz**; this voltage is also switched through by the output relays. The built-in power supply unit also supports the power supply of the CAN bus.

Technical data UVR610S

All inputs	Temperature sensors of types PT1000, KTY (2 kΩ/25˚C), KTY (1 kΩ/25˚C), PT100, PT500, Ni1000, Ni1000TK5000 and room sensors RAS or RASPT room sensors, GBS01 radiation sensor, THEL thermocouple, RFS humidity sensor, RES01 rain sensor, pulses **max. 10 Hz** (e.g. for VSG volume flow sensor), voltage **up to 3.3V DC**, resistance (1-100 kΩ), and as digital inputs
inputs 5, 6	additional voltage 0-10 V DC
Outputs 1 - 5	Relay outputs, normally open contacts
Output 6	Relay changeover contact NO/NC - **potential-free**
Outputs 7 - 10	Analogue outputs 0-10V (max. 20mA) or PWM (10V/1kHz) in 1000 steps each (= 0.01V or 0.1% per step) or expansion option as switching outputs with additional relay modules
Max. switching capacity	Relay outputs: 230V / 3A each
M-Bus	M-Bus input for up to 4 M-Bus meters (= 4 unit loads)
24V	Power supply for external 24V devices, max. 6W in total with the 12V devices
Max. bus load (DL bus)	100
CAN bus	Standard data rate 50 kbit/s, adjustable from 5 to 500 kbit/s
Differential temperatures	with separate switch-on and switch-off difference
Threshold values	with separate switch-on and switch-off differential or with fixed hysteresis
Temperature measuring range	PT100, PT500, PT1000: -200.0˚C to +850˚C with a resolution of 0.1K All other temperature sensors: -49.9˚C to +249.9˚C with a resolution of 0.1K
Temperature accuracy	Typ. 0.4K, max. ±1K in the range from 0 to 100˚C **for PT1000 sensors**
Resistance measurement accuracy	max. 1.6% at 100kΩ (measured variable: resistance, process variable: resistance)
Voltage accuracy	Typ. 1%, max. 3% of the maximum measuring range of the input
Accuracy of 0-10V output	max. -2% to +6%
Dimensions W x H x D	107 x 95 x 64 mm
Connection	100 - 230V, 50 - 60 Hz, (outputs A1 – A5 and device jointly fused with 6.3A fast-acting fuse) (output A6 only fused when live; see "**Output 6 live**" on page 16)
Max. cable cross-section Power supply	2.5 mm²
Power consumption	1.0 - 1.9 W depending on the number of active switching outputs
Protection class	IP10
Protection class	II - Protective insulation ⧈
Permissible ambient temperature	+5 to +45˚C

Subject to technical changes and typographical errors. These instructions are only valid for devices with the corresponding firmware version. Our products are subject to continuous technical progress and further development, so we reserve the right to make changes without prior notice.

9. ERROR CODES: INVERTEK FREQUENCY CONVERTER

Error codes	No	Description	Recommended corrective action
no-FLt	0	No error	Not required
Ol - b	01	Brake channel over current	Condition of the external brake resistor and the connection (Ver- wiring).
OL - br	02	Overload of the braking resistor	The inverter has shut down due to a fault to prevent damage damage to the braking resistor.
O - I	03	Overcurrent at output	Momentary overcurrent at the converter output. Excessive load or shock load on the motor
I _t-trP	04	Motor thermally overloaded (I2t)	After provision, >100% of the value in P-08 was provided, a fault shutdown was triggered for a certain period of time to prevent motor damage.
PS-trP	05	Power stage Fault shutdown	Check for short circuits in the motor and connection cables.
O - volt	06	DC link overvoltage	Check whether the supply voltage is within the permitted tolerance for the converter. If the error occurs during deceleration or stopping, increase the deceleration time in P-04 or install a suitable braking resistor and activate the dynamic braking function with P-34.
U - volt	07	DC link undervoltage	The incoming supply voltage is too low. This fault occurs routinely when the power to the inverter is switched off. If this happens during operation, check the input voltage and all components in the supply line for the mains supply. converter.
O - t	08	Overtemperature of the heat sink	The inverter is too hot. Check that the ambient temperature around the converter is within its specifications. Ensure that sufficient cooling air can circulate around the converter. Increase the enclosure ventilation if necessary. Ensure that sufficient cooling air can enter the converter and that the lower inlet vents and upper exhaust vents are not blocked or obstructed.
U - t	09	Under-temperature	This fault occurs when the ambient temperature is below -10°C. To start the inverter, this value must be increased to above -10°C .
P - dEF	10	The factory default parameters have been loaded.	
E-tr iP	11	External fault shutdown	E-Trip requested at digital input 3. A normally closed contact has opened for some reason. If a motor thermostat is connected, check whether the motor is overheating. motor is connected, check whether the motor is too hot.
SC - ObS	12	Optibus communication loss	Check the communication connection between the drive and external devices. Ensure that each drive in the network has its own address.
Flt - dc	13	DC ripple too high	Check that all incoming supply phases are present and symmetrical.
P-LOSS	14	Error due to loss of input phase	Check that all incoming supply phases are present and symmetrical.
h 0 - I	15	Overcurrent at output	Check for short circuits in motor and connection cables.

Error codes	No.	Description	Suggested remedy
th - Flt	16	Defective thermistor on heat sink	
dAtA - F	17	Internal memory error (IO)	Press the stop button. If the error persists, please contact your supplier.
4 - 2O F	18	4-20 mA signal lost	Check the analogue input connection(s).
DATA - E	19	Internal memory error (DSP)	Press the stop button. If the error persists, please contact your supplier.
F - Ptc	21	Error with motor PTC thermistor input	Overtemperature of the connected motor thermistor, check the wiring connections and the motor.
FAn - F	22	Cooling fan error (only IP66)	Check/replace the cooling fan.
O - HEAT	23	Internal inverter temperature too high	Ambient temperature of the converter too high, check whether adequate cooling is provided. measured cooling is provided.
AtF - O1	40	Autotune error	The motor parameters measured by Autotune are incorrect. Check the motor cable and connections for continuity. Check that all three phases of the motor are present and symmetrical.
AtF - O2	41		
AtF - O3	42		
AtF - O4	43		
AtF - O5	44		
SC - FOI	50	Error due to Modbus communication error Check the incoming Modbus RTU connection cable.	Check the incoming Modbus RTU connection cable. Check that at least one register within the timeout limit set in P-36 Index 3.
SC - FO2	51	Error shutdown due to loss of CANopen communication	Check the incoming CAN connection cable. Check whether the cyclic communications take place within the timeout limit set in P-36 Index 3.

Safety data sheet

Complies with Regulation (EC) No. 1907/2006 (REACH) including Amendment Regulation (EU) 2015/830

Tetrafluoroethane (R 134a)

Date of issue: 23/03/2016 Replaces: Revision date: 11/03/2020 Version: 12.0

SDS reference: 14

Warning

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

1.1. Product identifier

Trade name : Refrigerant R134a (tetrafluoroethane)

Safety data sheet no. : 14

Chemical name : Tetrafluoroethane (R 134a)
CAS No. : 811-97-2
EC No.: 212-377-0
EC index no. : –

Registration No. : 01-2119459374-33

Chemical formula : C2H2F4

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

Relevant identified uses : Industrial and professional. Conduct a risk assessment before use.
Test gas / calibration
gas. Laboratory use.
Contact your supplier for further information on uses.

Uses not recommended : Consumer applications.

1.3. Details of the supplier providing the safety data sheet

Company name : TYCZKA INDUSTRIE-GASE GmbH
Landzungenstrasse 17 D-
68159 Mannheim
0621/180090
www.tig.de

Email address (of the competent person) : sdb@tig.de

1.4. Emergency number

Emergency number : 0800/1809555

SECTION 2: Potential hazards

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Physical hazards	Gases under pressure: Liquefied gas	H280

2.2. Labelling elements

Safety data sheet
Complies with Regulation (EC) No. 1907/2006 (REACH) including Amendment Regulation (EU) 2015/830
Tetrafluoroethane (R 134a)
Date of issue: 23/03/2016 Replaces: Revision date: 11/03/2020 Version: 12.0
SDS Reference: 14

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :

GHS04

Signal word (CLP) : Warning

Hazard statements (CLP) : H280 - Contains gas under pressure; may explode if heated.

Precautionary statements (CLP)

- Storage : P403 - Store in a well-ventilated place.

2.3. Other hazards

: Asphyxiating in high concentrations.
Contact with the liquid may cause cold burns/frostbite.

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Tetrafluoroethane (R 134a)	(CAS No.) 811-97-2 (EC No.) 212-377-0 (EC index no.) – (Registration No.) 01-2119459374-33	100	Pressurised gas (Liq.), H280

Contains no other components or impurities that affect the classification of this product.

For the full text of the hazard statements, see Section 16.

3.2. Mixtures : Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

- Inhalation : The victim must be taken to fresh air using a self-contained breathing apparatus. Keep warm and calm. Consult a doctor. If breathing has stopped, perform cardiopulmonary resuscitation.
- Skin contact : For cold burns, rinse with water for at least 15 minutes. Cover with a sterile dressing. Consult a doctor.
If liquid is spilled: Rinse with water for at least 15 minutes.
- Eye contact : Immediately rinse eyes with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a possible route of exposure.

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

High concentrations can cause suffocation. Symptoms may include loss of mobility and consciousness. The victim does not notice the suffocation. Low concentrations can cause narcotic effects. Symptoms may include dizziness, headache, nausea and coordination problems.
See section 11.

4.3. Indications for immediate medical attention or special treatment

: None.

SECTION 5: Firefighting measures

5.1. Extinguishing agent

- Suitable extinguishing media : Water spray or water mist.
- Unsuitable extinguishing media : Water jet unsuitable for extinguishing.

5.2. Special hazards arising from the substance or mixture

Special risks : Exposure to fire may cause the container to burst/explode.

Hazardous combustion products : When exposed to fire, thermal decomposition can produce the following toxic and/or corrosive substances:
Carbon monoxide.
Hydrogen fluoride.
Carbonyl fluoride.

5.3. Firefighting information

Specific methods : Adapt firefighting measures to the fire in the surrounding area. Pressure vessels may burst if exposed to direct fire or heat radiation from fire. Cool endangered pressure vessels with water spray from a protected position.
Do not allow contaminated extinguishing water to enter drains and sewers. If possible, stop the gas leak.
Use water spray or water mist to suppress smoke. Remove containers from the area of the fire if this can be done safely.

Special protective equipment for the fire brigade : Use self-contained breathing apparatus.
Standard protective clothing and equipment (self-contained breathing apparatus) for firefighters.
Standard EN 137 - Self-contained breathing apparatus with full face mask.
Standard EN 469 - Protective clothing for firefighters. Standard EN 659 - Protective gloves for firefighters.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

: Attempt to stop the gas leak. Evacuate the area.
When entering the area, use self-contained breathing apparatus unless the atmosphere is proven to be safe.
Ensure adequate ventilation.
Prevent entry into sewers, basements, work pits or other places where accumulation could be dangerous.
Observe local emergency plan.
Stay on the windward side.

6.2. Environmental protection measures

: Try to stop the gas leak.

6.3. Methods and material for containment and cleaning up

: Ventilate the area.

6.4. Reference to other sections

: See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Protective measures for safe handling

Safe handling of the substance : Do not inhale gas.
Avoid product release into the atmosphere.
Handle the substance in accordance with standard industrial hygiene and safety instructions.
Only experienced and appropriately trained persons should handle gases under pressure
Handling.
Provide safety valve(s) in gas systems.
Ensure that the entire gas system has been (and is regularly) checked for leaks before use.
Do not smoke when handling the product.
Protect eyes, face and skin from liquid splashes.
Only use equipment that is suitable for this product and the intended pressure and temperature. If in doubt, consult the gas supplier.

Safe handling of the pressurised gas cylinder. Prevent water from entering the gas container.
Follow the gas supplier's operating instructions. Prevent backflow into the gas container.
Protect gas cylinders from mechanical damage; do not drag, roll, push or drop them.
Always use a cylinder trolley or other suitable handcart to transport gas cylinders, even over short distances.
Do not remove the valve cap until the cylinder has been placed against a wall, on a laboratory bench or on a cylinder stand and is ready for use.
If the user notices any difficulties in operating the cylinder valve, discontinue use and contact the supplier.
Never attempt to repair valves or safety pressure relief devices on the container.
Damage to these devices must be reported to the supplier immediately.
Keep the valve connections on the container clean and free of contamination, especially oil and water.
Replace the sealing caps or nuts and the valve protection cap as soon as the container is disconnected from the system.
Close the valve of the container after each use and after emptying, even if it is still connected.
Do not attempt to transfer gas from one gas cylinder or container to another. Never use flames or electric heating devices to increase the pressure in the container.
The product label serves to identify the contents of the gas cylinder and must not be removed or defaced.
Store containers in an upright position and secure them against falling over.

7.2. Conditions for safe storage, taking into account incompatibilities

: All regulations and local requirements for the storage of containers must be observed.
Do not store the containers under conditions that accelerate corrosion.
A valve protection cage should be provided or the valve protection cap should be fitted. Store containers upright and secure them against falling over.
Stored cylinders should be checked regularly for leaks and correct storage conditions.
Store containers at less than 50°C in a well-ventilated place.
Containers should be stored in a location free from fire hazards and away from sources of heat and ignition.
Keep away from combustible materials.

7.3. Specific end uses

: None.

SECTION 8: Exposure controls/personal protection

8.1. Parameters to be monitored

Tetrafluoroethane (R 134a) (811-97-2)		
OEL: Occupational exposure limit(s)		
Germany	AGW (8h) - Germany [mg/m³] TRGS 900	4200 mg/m³
	AGW (8h) - Germany [ppm] TRGS 900	1000 ppm
	Peak limitation / exceedance factor AGW - Germany TRGS 900	8

Tetrafluoroethane (R 134a) (811-97-2)	
DNEL: Derived No Effect Level (workers)	
Long-term - systemic effect, inhalation	14000 mg/m

Tetrafluoroethane (R 134a) (811-97-2)	
PNEC: Predicted No Effect Concentration	
Freshwater	0.1 mg/l
Seawater	0.01 mg/l
Aquatic intermittent	1 mg/l
Sediment, freshwater	0.75 mg/kg dry weight
Microorganisms in sewage treatment plants (STP)	73

8.2. Exposure limits and monitoring

8.2.1. Suitable technical control measures

: Provide general and local exhaust ventilation.
Pressurised systems should be checked regularly for leaks. Ensure that concentrations of the product in the ambient air are sufficiently below the occupational exposure limit.
Use oxygen detectors if asphyxiating gases may be emitted. Consider work clearance procedures, e.g. during maintenance work.

8.2.2. Individual protective measures, e.g. personal protective equipment

A risk assessment should be prepared and documented for all work areas, covering all risks associated with the use of the product and specifying the necessary personal protective equipment. The following recommendations should be taken into account:
Protect eyes, face and skin from liquid splashes.
Select personal protective equipment that complies with EN/ISO standards.

• Eye/face protection : Wear safety goggles with side protection.
Wear safety goggles with side shields or full-face goggles when performing decanting, filling and sealing operations.
Wear full-face goggles and face protection when carrying out decanting work or filling and sealing activities.
Standard EN 166 - Personal eye protection - Requirements.

• Skin protection

- Hand protection : Wear work gloves when handling pressure vessels and pressurised gas cylinders.
Protective gloves against mechanical risks.

- Other protective measures : Wear safety footwear when handling pressurised gas cylinders/pressure vessels.
Standard EN ISO 20345 - Personal protective equipment - Safety footwear.

• Respiratory protection : Use self-contained breathing apparatus or a compressed air line with mask in the event of an oxygen-deficient atmosphere.
Standard EN 137 - Self-contained breathing apparatus with full face mask.

• Thermal hazards : Wear cold-insulating gloves when transferring liquids or connecting and disconnecting equipment.
Standard EN 511 – Cold-insulating gloves.
None required.

8.2.3. Limitation and monitoring of environmental exposure

: Observe national emission regulations. For further information on specific methods of waste gas treatment, see Section 13.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

• Physical state at 20°C / 101.3kPa : Gas.
• Colour : Colourless.
Odour : Ethereal.

LC50 inhalation rat (ppm)	567,000 ppm/4h

Safety data sheet
Complies with Regulation (EC) No. 1907/2006 (REACH) including Amendment Regulation (EU) 2015/830
Tetrafluoroethane (R 134a)
Date of issue: 23/03/2016 Replaces: Revision date: 11/03/2020 Version: 12.0
SDS reference: 14

Odour threshold	: Odour perception is subjective and not suitable for warning of overexposure.
pH	: Not applicable.
Molar mass	: 102 g/mol
Melting point	: -101 °C
Boiling point	: -26.1 °C
Flash point	: Not applicable to gases and gas mixtures.
Critical temperature [°C]	: 101 °C
Evaporation rate (ether=1)	: Not applicable to gases and gas mixtures. Ignition
limits	: Not flammable.
Vapour pressure [20 °C]	: 4.7 bar(a)
Vapour pressure [50°C]	: 13.2 bar(a)
Relative density, gas (air=1)	: 3.6
Solubility in water	: 1930 mg/l
Distribution coefficient n-octanol/water [log Kow]	: 0.94
Ignition temperature	: Not applicable.
Viscosity [20°C]	: Not applicable.
Explosive properties	: Not applicable.
Oxidising properties	: None.

9.2. Other information

Other information : Gas/vapours are heavier than air. They may accumulate in confined spaces, particularly at floor level or in low-lying areas.

SECTION 10: Stability and reactivity

10.1. Reactivity

: No hazards due to reactivity except those described in the following subsections.

10.2. Chemical stability : Stable under normal conditions.

10.3. Possibility of dangerous reactions : None.

10.4. Conditions to avoid : None under the recommended conditions of use and storage (see Section 7).

10.5. Incompatible materials : Moisture.
Further information on material compatibility: see ISO 11114.

10.6. Hazardous decomposition products : Under normal conditions of use and storage, no hazardous decomposition products are generated.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : The criteria for classification are not met.
As long as occupational exposure limits are observed, toxicological effects are not expected.

Corrosive/irritant effect on the skin : No effects of the product are known.

Serious eye damage/irritation : No effects of the product known.

Respiratory/skin sensitisation	: No effects of the product are known.
Mutagenicity	: No effects of the product are known.
Carcinogenicity	: No effects of the product known.
Reproductive toxicity: Fertility	: No effects of the product known.
Reproductive toxicity: Foetus	: No effects of the product known.
Specific target organ toxicity after single exposure	: No effects of the product known.
Specific target organ toxicity after repeated exposure	: No known effects of the product.
Aspiration hazard	: Not applicable to gases and gas mixtures.

SECTION 12: Environmental information

12.1. Toxicity

Assessment	: The criteria for classification are not met.
EC50 48h - Daphnia magna [mg/l]	930 mg/l
EC50 72h - Algae [mg/l]	No data available.
LC50 96 hours - fish [mg/l]	450

12.2. Persistence and degradability

Assessment	: Not readily biodegradable. No data available.

12.3. Bioaccumulation potential

Assessment	: Due to the low log Kow value (log Kow < 4), bioaccumulation of the substance is not expected. See Section 9.

12.4. Mobility in soil

Assessment	: No data available.
Assessment	: Due to its high volatility, it is unlikely that the product will cause soil or water contamination.

12.5. Results of PBT and vPvB assessment

Assessment	: Not classified as PBT or vPvB.

12.6. Other adverse effects

Effect on the ozone layer	: None.
Global warming potential [CO2=1]	: 1300
Impact on global warming	: May contribute to the greenhouse effect if released in large quantities. Contains greenhouse gas(es) listed in the Kyoto Protocol. Quantity: See bottle label.

SECTION 13: Disposal considerations

13.1. Waste treatment procedures

Consult gas supplier regarding exhaust gas treatment. Consult gas supplier if advice is required. Do not release into the atmosphere.
Do not allow to escape into areas where the accumulation of gas could be dangerous.
Ensure that emission values comply with local regulations or operating permits

are complied with.
For further information on waste disposal, see the EIGA Code of Practice Doc 30/10 "Disposal of gases" available at http://www.eiga.eu.

TYCZKA INDUSTRIE-GASE

Safety data sheet

Complies with Regulation (EC) No. 1907/2006 (REACH) including Amendment Regulation (EU) 2015/830

Tetrafluoroethane (R 134a)

Date of issue: 23/03/2016 Replaces: Revision date: 11/03/2020 Version: 12.0

SDS reference: 14

List of hazardous waste (Commission Decision 2000/532/EC, as amended)	: 14 06 01: Chlorinated/fluorinated hydrocarbons.

13.2. Additional information

: None.

SECTION 14: Transport information

14.1. UN number

UN No. : 3159

14.2. Proper UN shipping name

Transport by road/rail (ADR/RID) : 1,1,1,2-TETRAFLUOROETHANE (GAS AS REFRIGERANT R 134a)

Transport by air (ICAO-TI / IATA-DGR) : 1,1,1,2-TETRAFLUOROETHANE

Transport by sea (IMDG) : 1,1,1,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)

14.3. Transport hazard classes Labelling

:

lammable, non-toxic gases

Transport by road/rail (ADR/RID)

Class	: 2
Classification code	: 2A
Hazard No.	: 20
Tunnel restriction code	: C/E - Transport in tanks: Not permitted through tunnels of categories C, D and E. Other transport: Transit prohibited through Category E tunnels

Transport by air (ICAO-TI / IATA-DGR)

Class/Division Subsidiary risk(s)	: 2.2

Transport by sea (IMDG)

Class/Division Subsidiary risk(s)	: 2.2
Emergency plan (EmS) – Fire	: F-C
Emergency plan (EmS) - Leakage	: S-V

14.4. Packaging group

Transport by road/rail (ADR/RID) : Not applicable

Air transport (ICAO-TI / IATA-DGR) : Not applicable Sea transport (IMDG)
: Not applicable

14.5. Environmental hazards

Transport by road/rail (ADR/RID) : None.

Transport by air (ICAO-TI / IATA-DGR) : None. Transport by

sea (IMDG) : None.

14.6. Special precautions for the user Packaging instruction(s)

Transport by road/rail (ADR/RID) : P200
Air transport (ICAO-TI / IATA-DGR)
Passenger and cargo aircraft : 200
Cargo aircraft only : 200
Transport by sea (IMDG) : P200

Special transport measures : If possible, do not transport in vehicles whose cargo area is not separated from the driver's cab .
The driver must be aware of the potential hazards of the load and must know what to do in the event of an accident or emergency.
Before transport:
- Ensure adequate ventilation.
- Secure the container.
- The cylinder valve must be closed and tight.
- The valve lock nut or cap (if fitted) must be correctly secured.
- The valve protection device (if present) must be correctly fastened.

14.7. Bulk cargo transport in accordance with Annex II of the MARPOL Convention 73/78 and in accordance with the IBC Code

: Not applicable.

SECTION 15: Regulatory information

15.1. Regulations on safety, health and environmental protection/specific legal provisions for the substance or mixture

EU regulations

Restrictions on use : None.
Seveso III Directive 2012/18/EU : Not listed.

National regulations

National legislation : Observe all national/local regulations. Water hazard
class (WGK) : 1 - Slightly hazardous to water
Identification no. : 2350

15.2. Substance safety assessment

: A chemical safety assessment (CSA) has been carried out.

SECTION 16: Other information

Revision notes : Revised safety data sheet in accordance with Regulation (EU) No. 2015/830.

Training information : The risk of suffocation is often overlooked and must be emphasised when instructing employees. Container is pressurised.

Further information : This safety data sheet has been prepared in accordance with applicable European directives. It applies to all countries that have incorporated these directives into their national legislation. Classification in accordance with the procedures and calculation methods specified in Regulation (EC) No. 1272/2008 (CLP) .

Full text of H and EUH statements

TYCZKA INDUSTRIE-GASE
Safety data sheet
Complies with Regulation (EC) No. 1907/2006 (REACH) including Amendment Regulation (EU) 2015/830
Tetrafluoroethane (R 134a)
Date of issue: 23/03/2016 Replaces: Revision date: 11/03/2020 Version: 12.0
SDS Reference: 14

Press. Gas (Liq.)	Pressurised gases: Liquefied gas
H280	Contains gas under pressure; may explode if heated.

DISCLAIMER : Before using the product in any new process or experiment, a careful investigation of material compatibility and safety should be carried out. The information in this document does not constitute contractual assurances of Product properties.
They are based on the current state of knowledge.

End of document

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)

R 513A

Print date 04.04.2023
Processing date 04.04.2023
Version 3.0
Replaces version dated 02.05.2020 (2.0)

GERLING HOLZ+CO the chemical gas specialist

* SECTION 1: Identification of the substance or mixture and of the company

1.1 Product identifier Trade name/designation R

513A **Item no(s).** 0091

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

* **Use of the substance/mixture**
Refrigerant

1.3 Details of the supplier providing the safety data sheet Supplier

GHC Gerling, Holz & Co. Handels GmbH
Ruhrstraße 113
D-22761 Hamburg
Telephone +49 40 853 123 0
Emailhamburg@ghc.de
Website www.ghc.com

Department providing information:
GHC Gerling, Holz & Co. Handels GmbH Telephone
+49 40 853 123 0

Email (expert):
msds@ghc.de

*** 1.4 Emergency number**

DE: Poison Information Centre Mainz	+49 6131 19240
BE: Poison Control Centre	+32 70 245 245
AT: Poison Information Centre (VIZ)	+43 1 406 43 43

* SECTION 2: Possible hazards

2.1 Classification of the substance or mixture

Classification according to regulation (EC) No. 1272/2008 [CLP]	Classification procedure
Pressurised gas (Liq.), H280	

Hazard statements for physical hazards
H280 Contains gas under pressure; may explode if heated.

*** 2.2 Labelling elements**

*** Labelling according to Regulation (EC) No. 1272/2008 [CLP] Hazard pictograms**

GHS04

Signal word
Warning

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

Safety advice
P403 Keep in a well-ventilated place.

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)

R 513A

Print date 04.04.2023
Processing date 04.04.2023
Version 3.0 (en)
Replaces version dated 02.05.2020 (2.0)

GERLING HOLZ+CO the chemical gas specialist

* **Additional hazard characteristics**
EIGA0357 Asphyxiating in high concentrations. EIGA0787
Contains fluorinated greenhouse gases.
Please return containers with residual pressure.
Only remove from the liquid phase.

*** 2.3 Other hazards**

* **Possible harmful effects on humans and possible symptoms**
Gas/vapours are heavier than air. They may accumulate in enclosed spaces, especially at floor level or in low-lying areas. Inhalation of gas/vapour in high concentrations may cause cardiac arrhythmia. Contact with the liquid may cause cold burns/frostbite.

* **Other adverse effects**
The substance/mixture does not contain any components that exhibit endocrine-disrupting properties in quantities of 0.1% or more according to REACH Article 57(f) or Commission Delegated Regulation (EU) 2017/2100 or Commission Delegated Regulation (EU) 2018/605.

* **Results of PBT and vPvB assessment**
The substance/mixture does not contain any components that meet the PBT/vPvB criteria of the REACH Regulation, Annex XIII, in quantities of 0.1% or more.

* SECTION 3: Composition/information on ingredients

3.1 Substances

Not applicable

*** 3.2 Mixtures**

Hazardous ingredients	CAS No.	EC No.	Substance name	Concentration	Classification according to ATE Regulation (EC) No. 1272/2008 [CLP]	SCL/ M/
	754-12-1	468-710-7	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	55 - 57 % by weight	Flam. Gas 1B; H221 ATE (inhalation) Compressed gas (Liq.); H280	Gases): > 405000 ppm
	811-97-2	212-377-0	1,1,1,2-Tetrafluoroethane (R 134a)	43 - 45 wt%	Pressurised gas (Liq.); H280	

REACH No.	Substance name
01-0000019665-61	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)
01-2119459374-33	1,1,1,2-Tetrafluoroethane (R 134a)

* **Note**
The wording of the H and EUH statements is given in Section 16.

* SECTION 4: First aid measures

*** 4.1 Description of first aid measures**

General
Remove contaminated, soaked clothing immediately.
Consult a doctor if symptoms persist. First aiders: Protect yourself!

After inhalation
Move the affected person to fresh air and keep them warm and calm.
In case of respiratory arrest Resuscitate with a resuscitation bag (Ambu bag) or ventilator. Consult a doctor.

After skin contact
If the substance comes into contact with the skin, rinse with warm water.
In case of frostbite, rinse with plenty of water. Do not remove clothing.
In case of cold burns, rinse with lukewarm (not hot) water for at least 15 minutes. Leave any frozen clothing in place and thaw with lukewarm water. Cover with a sterile dressing. Consult a doctor.

* **After eye contact**
Rinse cautiously with water for several minutes, protecting the uninjured eye. Remove contact lenses, if present and easy to do. Continue rinsing. Consult a doctor.

After swallowing
Ingestion is not considered a possible route of exposure.

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

* **Symptoms**
The following symptoms may occur in the event of massive exposure:
Loss of consciousness Cardiac
arrhythmia Dizziness
Nausea Headache

* **Effects**
Continued inhalation of decomposition products may lead to pulmonary oedema.

4.3 Indications for immediate medical attention or special treatment

Information for the doctor
Symptomatic treatment. Administer antidote.
Do not administer any drugs from the adrenalin-ephedrine group.

* SECTION 5: Firefighting measures

* **5.1 Extinguishing media**

* **Suitable extinguishing media**
The product itself does not burn. Extinguishing measures should be tailored to the surrounding fire.
Extinguishing powder
Water spray Alcohol-resistant
foam Carbon dioxide (CO_2)

Unsuitable extinguishing media
Full water jet

5.2 Special hazards arising from the substance or mixture Hazardous

combustion products
In case of fire, dangerous gases may be formed. Carbon monoxide
Carbon dioxide (CO_2) Hydrogen
fluoride Carbonyl fluoride

* **5.3 Firefighting information**

* **Special protective equipment for firefighting**
Wear self-contained breathing apparatus and chemical protection suit.

* **Additional information**
If possible, close gas valves and move containers to a safe place.
Use water spray to protect people and cool containers in the danger zone. Exposure to fire may cause the container to burst/explode.
Dispose of fire residues and contaminated extinguishing water in accordance with local regulations.

* SECTION 6: Accidental release measures

* **6.1 Personal precautions, protective equipment and emergency procedures**

* **Personnel not trained for emergencies** Use
personal protective equipment. Leave the
danger zone.
Keep people away and stay on the windward side.

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)
R 513A

GERLING HOLZ+CO
the chemical gas specialist

Emergency personnel
Personal protection by wearing a tightly sealed chemical protection suit and self-contained breathing apparatus. Be aware of the spread of the gas, especially on the ground (heavier than air) and in the direction of the wind.
Bring people to safety.

* **6.2 Environmental protection measures**

If possible, stop the gas leak.
Do not allow to enter the ground/soil.
Do not allow to enter the sewage system or waterways.

* **6.3 Methods and material for containment and cleaning up**

* **For containment**
If necessary, secure leaking pressure vessels using a recovery container. Prevent the liquid from spreading over a large area (set up barriers, cover drains). Limit the spread of the gas (water spray).

* **For cleaning**
Allow to evaporate.
Ensure adequate ventilation.

* **6.4 Reference to other sections**

Disposal: see Section 13
Personal protective equipment: see Section 8

* SECTION 7: Handling and storage

* **7.1 Precautions for safe handling**

* **Precautions**
Use only in well-ventilated areas.
Only transfer and handle the product in a closed system. Take the usual preventive fire protection measures.
Do not heat the containers above 50 °C.
The operating pressure in the vessel must not exceed the saturation vapour pressure of the pure product at a temperature of 50 °C.
Secure gas cylinders against tipping over.
The valve protection device must be correctly attached.
The valve lock nut or lock plug (if present) must be correctly fastened. Open valves slowly to avoid pressure surges.
Prevent backflow into the gas container. Prevent water from entering the gas container.
No water on valves, flanges and other equipment parts.
Flush pipes and fittings with inert gases – unsuitable: water, solvents.

* **General industrial hygiene information**
Do not eat, drink, smoke or sniff at the workplace. Wash hands before breaks and at the end of work.
Remove contaminated clothing and protective equipment before entering eating areas.

* **7.2 Conditions for safe storage, taking into account incompatibilities**

* **Requirements for storage rooms and containers**
All regulations and local requirements for the storage of containers must be observed. Keep containers tightly closed in a well-ventilated place.
Do not heat containers above 50 °C. Secure gas cylinders against tipping over.
Only use containers that are specifically approved for the product. For information on suitable materials for containers and valves, see ISO 11114.

Storage class
2A Gases (excluding aerosol containers and lighters)

* **Substances to be avoided**
Do not store together with explosive substances.
Do not store together with flammable liquids. Do not store together with flammable solids.
Do not store together with pyrophoric and self-heating substances.
Do not store together with oxidising liquids or oxidising solids.
Do not store together with acutely toxic liquids or acutely toxic solids. Do not store together with infectious substances.
Do not store together with radioactive substances.
Do not store together with food or animal feed.

* **7.3 Specific end uses**

* **Recommendation**
Use in accordance with Regulation (EU) No. 517/2014 on fluorinated greenhouse gases.
An exposure scenario (ES) is not required.

* SECTION 8: Exposure controls/personal protective equipment

* **8.1 Parameters to be monitored**

* **Occupational exposure limits**

CAS No	EC No.	Working substance	Occupational exposure limit
811-97-2	212-377-0	Norflurane	1000 [ml/m³(ppm)] 4200 [mg/m³] Peak limit8(II) DFG, Y TRGS 900
616-220-0		2,3,3,3-Tetrafluoropropene	200 [ml/m³(ppm)] 950 [mg/m³] Peak limitation2(II) DFG, Y TRGS 900
811-97-2	212-377-0	1,1,1,2-Tetrafluoroethane	1000 [ml/m³(ppm)] 4200 [mg/m³] Short-term (ml/m³) 4000 Short-term (mg/m³) 16800 AT: Limit Values Ordinance

* **DNEL for workers**

CAS No.	Working substance	DNEL value	DNEL type	Comment
811-97-2 inhalation	1,1,1,2-Tetrafluoroethane (R 134a)	13936 mg/m³	Long-term (systemic)	Extrapolation factor 7.5, repeated dose toxicity.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	950 mg/m inhalation	Long-term (systemic)	Extrapolation factor 1, repeated dose toxicity.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	186400 mg/m³	acute inhalation (systemic)	Extrapolation factor 5

* **DNEL Consumer**

CAS No.	Working substance	DNEL value	DNEL type	Comment
811-97-2 inhalation	1,1,1,2-Tetrafluoroethane (R 134a)	2476 mg/m³	Long-term (systemic)	Extrapolation factor 15, repeated dose toxicity.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	113.1 mg/m³ inhalation	Long-term (systemic)	Extrapolation factor 2, repeated dose toxicity.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	186400 mg/m³	acute inhalation (systemic)	Extrapolation factor 5

* **PNEC**

CAS No.	Working substance	PNEC value	PNEC type	Comment
811-97-2	1,1,1,2-Tetrafluoroethane (R 134a)	0.01 mg/L	Water bodies, seawater	Extrapolation factor 10000, assessment factor.
811-97-2	1,1,1,2-Tetrafluoroethane (R 134a)	0.1 mg/L	Water bodies, fresh water	Extrapolation factor 1000, assessment factor.

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)

R 513A
Print date 04/04/2023
Processing date 04.04.2023
Version 3.0 (en)
Replaces version dated 02.05.2020 (2.0)

the chemical gas specialist

CAS No.	Working substance	PNEC value	PNEC type	Comment
811-97-2	1,1,1,2-Tetrafluoroethane (R 134a)	0.75 mg/kg Dry weight	Sediment, fresh water	
811-97-2	1,1,1,2-Tetrafluoroethane (R 134a)	1 mg/L	Water bodies, periodic Release	Extrapolation factor 100, assessment factor.
811-97-2	1,1,1,2-Tetrafluoroethane (R 134a)	73 mg/L	Sewage treatment plant (STP)	Extrapolation factor 10, assessment factor.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	0.01 mg/L	Water bodies, seawater	Extrapolation factor 10000, assessment factor.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	0.1 mg/L	Water bodies, fresh water	Extrapolation factor 1000, assessment factor.
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	0.151 mg/kg dry weight	Sediment, seawater	
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	1 mg/L	Water bodies, periodic release	Extrapolation factor 100
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	1.49	Soil	
754-12-1	2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)	1.51 mg/kg dry weight	Sediment, fresh water	

* **8.2 Exposure controls and monitoring Appropriate engineering controls**

Technical measures to prevent exposure
Only transfer and handle the product in a closed system.

* **Personal protective equipment**

Eye/face protection
Safety goggles in accordance with EN 166, with additional face shield in case of increased risk.

* **Hand protection**
Protective gloves in accordance with EN 388:
Chromate-free leather

Body protection:
Safety shoes with steel toe caps (class S3).
Body-covering work clothing; in case of increased risk, chemical-resistant protective suit.

Respiratory protection

Keep self-contained breathing apparatus available for emergencies. Respiratory protection is required for:

High concentrations Respiratory protection in accordance with EN 137. Do not use filter devices.
During rescue and maintenance work in storage containers, use self-contained breathing apparatus due to the risk of suffocation from displacement of atmospheric oxygen.

* **Thermal hazards**
Use cold-resistant protective equipment.

* **Limitation and monitoring of environmental exposure**

* **Comment**
Prevent release into the environment.

* SECTION 9: Physical and chemical properties

* **9.1 Information on basic physical and chemical properties**

Physical state
Gaseous / pressure liquefied.

Colour
colourless

* **Odour**
Faint ether-like

Safety-related basic data

	Value	Method	Source, comment
Odour threshold:			Not determined
Melting point/freezing point			Not applicable
Boiling point or boiling start and	-29.2 °C Boiling range Pressure 1013 hPa		
Flammability			None
Lower and upper explosion limits			None
Flash point			Not applicable
Ignition temperature			Not determined
Decomposition temperature used as intended.			No decomposition when intended use.
pH			Not applicable
Viscosity			Not applicable
Solubility	Water solubility		Not determined
Distribution coefficient n-octanol/water (log value)			Not applicable
Vapour pressure	7063.6 hPa (25°C)		
Density and/or relative density			Not applicable
Relative vapour density	3.83 (25°C)		Air = 1
Particle properties			Not applicable

* **9.2 Other information**

* **Information on physical hazard classes**

* **Gases under pressure**

Safety parameters

	Value	Method, result	Source, comment
Critical temperature	96.5 °C		

* **Other information**
Vapours are heavier than air.

* SECTION 10: Stability and reactivity

* **10.1 Reactivity**

The product is not flammable in air at ambient temperature and pressure. At elevated pressure, it may become flammable in the presence of air, oxygen or other oxidising agents.

* **10.2 Chemical stability**

The mixture is chemically stable under the recommended storage, use and temperature conditions.

* **10.3 Possibility of hazardous reactions**

Must not be mixed with air or oxygen.
Fire and explosion hazard with strong oxidising agents, alkali and alkaline earth metals.

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)
R 513A

* **10.4 Conditions to avoid**

Heat sources / heat – risk of bursting.
Ignition sources, open flames, red-hot metal surfaces, etc.

* **10.5 Incompatible materials**

Alkali metals Alkaline earth metals Powdered metals

Oxidising agent, strong

10.6 Hazardous decomposition products

When handled and stored properly, we are not aware of any hazardous decomposition products.

* SECTION 11: Toxicological information

11.1 Information on hazard classes within the meaning of Regulation (EC) No 1272/2008

* **Acute toxicity**

* **Animal data**

	Effective dose	Method, evaluation	Source, comment
Acute oral toxicity			Study not technically feasible.
Acute dermal toxicity			Study not technically feasible.
Acute inhalation toxicity	CAS No. 754-12-1 2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf) Acute inhalation toxicity (gas) LC50: > 405000 ppm Species Rat Exposure time 4 h	OECD 403	

* **Assessment/classification**
Based on the available data, the classification criteria are not met.

* **Corrosive/irritant effect on the skin**

* **Other information**
Study not technically feasible.

* **Serious eye damage/irritation**

* **Other information**
Study not technically feasible.

* **Respiratory sensitisation**

* **Other information**
No data available

* **Skin sensitisation**

* **Other information**
Study not technically feasible.

* **Germ cell mutagenicity**

	Value	Method	Result / Assessment	Comment
In vitro mutagenicity/genotoxicity		OECD 473	Negative	Information refers to the main component.
In vivo mutagenicity/genotoxicity		OECD 474	negative	Data refer to the main component.

* **Assessment/classification**
Based on the available data, the classification criteria are not met.

* **Carcinogenicity**

* **Assessment/classification**
No data available

* **Reproductive toxicity**

Animal data

	Value	Method	Result/evaluation	Comment
Reproductive toxicity	inhalation NOAEC 50000 ppm Species Rat	OECD 416		Information refers to the main component.

* **Specific target organ toxicity after single exposure**

* **STOT SE 1 and 2**

* **Assessment/classification**
Based on the available data, the classification criteria are not met.

* **Specific target organ toxicity after repeated exposure**

* **Animal data**

	Effective dose	Method	Specific effects:	Affected organs:	Source, Remarks
Inhalation-specific target organ toxicity (repeated exposure)	NOAEL(C): > 50,000 ppm Species Rat				Information refers to the main components.

* **Assessment/classification**
Based on the available data, the classification criteria are not met.

* **Aspiration hazard**

* **Assessment/classification**
Study not technically feasible.

11.2 Information on other hazards

Symptoms related to physical, chemical and toxicological properties

* **Additional information**
Inhalation of gas/vapour in high concentrations may cause cardiac arrhythmia. Inhalation causes narcotic effects/intoxication.

* **Other information**

The product has not been tested. The statement is derived from the properties of the individual components.

* SECTION 12: Environmental information

* **12.1 Toxicity**

* **Aquatic toxicity**

	Effective dose	Method, evaluation	Source, comment
Acute (short-term) fish toxicity	LC50: > 197 mg/L Species Cyprinus carpio (carp) Test duration 96 h	OECD 203	Information refers to the main component.
Chronic (long-term) fish toxicity	Not determined		

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)

R 513A

04.04.2023
04/04/2023
3.0 (en)
02.05.2020 (2.0)

the chemical gas specialist

	Effective dose	Method, evaluation	Source, comment
Acute (short-term) toxicity to crustaceans	EC50 > 100 mg/L Species Daphnia magna (water flea) Test duration 48 h	OECD 202	Information refers to the main component.
Chronic (long-term) toxicity to aquatic invertebrates	Not determined		
Acute (short-term) toxicity to algae and cyanobacteria	EC50 > 100 mg/L Species Pseudokirchneriella subcapitata Test duration 72 h	OECD 201	Data refer to the main component.
Chronic (long-term) toxicity For algae and cyanobacteria	Not determined		
Toxicity to other aquatic plants/organisms	Not determined		
Toxicity to microorganisms	Not determined		

* **12.2 Persistence and degradability**

	Value	Method	Source, comment
Biological degradation	Degradation rate < 5% Test duration 28 d	OECD 301F/ ISO 9408/ EEC 92/69/V, C.4-D	CAS No. 754-12-1 2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf)
Biological degradation	Degradation rate 3% Test duration 28 days	OECD 301 D	CAS No. 811-97-2 1,1,1,2-Tetrafluoroethane (R 134a)

* **Assessment/classification**
Not readily biodegradable (according to OECD criteria)

* **12.3 Bioaccumulation potential**

* **Assessment/classification**
Based on the n-octanol/water distribution coefficients of the individual components of the mixture, accumulation in organisms is not expected.

* **12.4 Mobility in soil**

	Value	Distribution	Transport type	Method	Comment
Half-life in soil	CAS No. 811-97-2 1,1,1,2-Tetrafluoroethane (R 134a) 37.26 L/kg			KOC value	
Half-life in soil	CAS No. 754-12-1 2,3,3,3-Tetrafluoroprop-1-ene (R 1234yf) < 18			KOC value	

* **12.5 Results of PBT and vPvB assessment**

The substance/mixture does not contain any components that meet the PBT/vPvB criteria of the REACH Regulation, Annex XIII, in quantities of 0.1% or more.

* **12.6 Endocrine-disrupting properties**

	Effective dose	Method, evaluation	Source, comment
Endocrine-disrupting properties			See section 2.3

* **12.7 Other adverse effects**

	Value	Method	Source, comment
Ozone depletion potential (ODP):	0		
Global warming potential (GWP)	632		

* **Additional ecotoxicological information**

* **Additional information**
The product has not been tested. The information is derived from the individual components of the mixture.

* SECTION 13: Disposal considerations

* **13.1 Waste treatment methods Waste codes/waste designations**

according to EAK/AVV

Waste code Product	Waste designation
140601	Chlorofluorocarbons, HCFCs, HFCs

* **Proper disposal / Product**
Disposal in accordance with Directive 2008/98/EC on waste and hazardous waste. Prevent release into the environment. Do not dispose of via wastewater.
Return to suppliers: Mandatory take-back in accordance with Section 25 KrWG in conjunction with Section 4(2) ChemKlimaschutzV.

Proper disposal / packaging
Portable pressure equipment (emptied, residual pressure): Return to the supplier.

* SECTION 14: Transport information

	Land transport (ADR/RID)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
14.1 UN number or ID number	UN 1078	UN 1078	UN 1078
14.2 Proper UN shipping name	GAS AS A REFRIGERANT, N.O.S.	REFRIGERANT GAS, N.O.S.	Refrigerant gas, n.o.s.
14.3 Transport hazard classes		2.2	2.2
14.4 Packaging group	-	-	-
14.5 Environmental hazards	No	No	No

14.6 Special precautions for users
The protective measures listed in sections 6, 7 and 8 of the safety data sheet must be observed.

14.7 Bulk transport by sea in accordance with IMO instruments
No transport as bulk cargo.

Land transport (ADR/RID)

UN number or ID number	UN 1078
Proper UN shipping name	GAS AS A REFRIGERANT, N.A.G.
Transport hazard classes	2.2
Danger label	2.2
Classification code	2A
Packaging group	-
Environmental hazards	No
Limited quantity (LQ)	120 ml
Special provisions	274, 582, 662
Tunnel restriction code	C/E

Safety data sheet in accordance with Regulation (EC) No. 1907/2006 (REACH)
R 513A
Print date 04/04/2023
Processing date 04.04.2023
Version 3.0
Replaces version dated 02.05.2020 (2.0)

* **Sea transport (IMDG)**

UN number or ID number	UN 1078
Proper UN shipping name	REFRIGERANT GAS, N.O.S.
Transport hazard classes	2.2
Packaging group	-
Environmental hazards	No
Limited quantity (LQ)	120 ml
Marine pollutant	No
EmS	F-C, S-V

Air transport (ICAO-TI / IATA-DGR)

UN number or ID number	UN 1078
Proper UN shipping name	Refrigerant gas, n.o.s.
Transport hazard classes	2.2
Packaging group	-
Environmental hazards	No

* SECTION 15: Regulatory information

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

* **EU regulations**

* **Information on employment restrictions**
Observe restrictions on employment in accordance with the Maternity Protection Directive (92/85/EEC) for pregnant women or nursing mothers. Observe restrictions on employment in accordance with the Youth Employment Protection Act (94/33/EC).

* **Other EU regulations**

* **Please note:**
Regulation (EU) No 517/2014 on fluorinated greenhouse gases.
Regulation (EU) 2015/2068 determining, pursuant to Regulation (EU) No 517/2014, the form of labelling for products and equipment containing fluorinated greenhouse gases.
Regulation (EU) 2015/2067 establishing, pursuant to Regulation (EU) No 517/2014, certification requirements for stationary refrigeration, air conditioning and heat pump equipment and refrigeration units in refrigerated road vehicles and trailers containing F-gases.
Existing national and local laws regarding chemicals must be observed.

* **Directive 2010/75/EU on industrial emissions [Industrial Emissions Directive] VOC**

VOC value ≥ 99%

* **National regulations**

Accident Regulation
Major Accidents Ordinance, Annex I "Applicability of the Ordinance": not mentioned.

* **Technical Instructions on Air Quality Control (TA-Luft)**
Chapter 5.2.5 "Organic Substances" TA Luft

* **Water hazard class (WGK)** slightly hazardous to water (WGK 1)
Classification according to AwSV

Information on employment restrictions
Observe employment restrictions for young people (§ 22 JArbSchG, Germany). Observe employment restrictions for pregnant women and nursing mothers (§§ 4 and 6 MuSchG, §§ 4 and 5 MuSchRiV).

Other regulations, restrictions and prohibitions
TRBS 3145 / TRGS 745 "Mobile pressurised gas containers – filling, storage, internal transport, emptying" TRGS 407 "Activities involving gases – risk assessment"
TRGS 510 "Storage of hazardous substances in portable containers" BGI 648
(formerly ZH 1/409) "Fluorinated hydrocarbons"
Use in accordance with the Chemicals Climate Protection Ordinance (ChemKlimaschutzV).

* **15.2 Substance safety assessment**

Substance safety assessments have been carried out for substances in this mixture.

* **SECTION 16: Other information**

Important literature references and data sources
Information from our suppliers and data from the "GESTIS Substance Database" and the "Registered Substances" database of the European Chemicals Agency (ECHA) were used to compile this safety data sheet.

* **Classification of mixtures and assessment method used in accordance with Regulation (EC) No. 1272/2008 [CLP]**
The mixture was classified by the manufacturer.

* **Additional information**
The information is based on our current knowledge and serves to describe the product with regard to the safety precautions to be taken. It does not constitute a guarantee of the properties of the product described.

Wording of H and EUH statements (number and full text)

H221	Flammable gas.
H280	Contains gas under pressure; may explode if heated.

Change notes
* Data changed from previous version

Lubrizol

EMKARATE(TM) RL 32-3MAF

Preparation in accordance with EU Regulation No. 453/2010 of the Commission.

Section 1	Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

EMKARATE(TM) RL 32-3MAF

Synonyms None

1.2 Relevant identified uses of the substance or mixture and (uses advised against) Relevant identified uses (see Section 7.3 for information on REACH-registered uses) Cooling lubricants.

1.3 Details of the supplier of the safety data sheet

CPI Engineering Services
2300 James Savage Rd.
Midland, MI 48642
Telephone: 989-496-3780
Fax: 989-496-0316

Email EUSDS@lubrizol.com (Lubrizol safety data sheets are available at www.mylubrizol.com)

1.4 Emergency

TRANSPORT EMERGENCIES PLEASE REPORT TO CHEMTREC. CALL NUMBER: (+1) 703-527-3887 (outside the USA), 1-800-424-9300 (within the USA)

Section 2	POTENTIAL HAZARDS

2.1 Classification of the substance or mixture (EC) No 1272/2008

This product does not meet the classification requirements of current European legislation.

67/548/EC or 1999/45/EC

This product does not meet the classification requirements of current European legislation.

For a full text of the R and H statements: See Section 16

2.2 Label elements (EC) No 1272/2008

Not applicable.

Supplementary label information

None

2.3 Other hazards

None identified.

Section 3	COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

(EC) No 1272/2008

This material does not contain any ingredients that must be disclosed under the regulatory hazard criteria according to the legislation of this country.

67/548/EC or 1999/45/EC

Taking into account the relevant legal regulations, no hazardous properties are known for this product.

ECHA list numbers 600, 700, 800 and 900 have no legal significance; they are purely technical identifiers and are displayed for information purposes only.

Section 4	FIRST AID MEASURES

4.1 Description of first aid measures Skin contact

Wash with soap and water. If irritation develops, medical attention is required. Wash contaminated clothing before reuse.

Eye contact

Rinse with water for at least 30 minutes. Seek medical attention if eye irritation develops or persists.

Inhaled

Move the exposed person to fresh air if harmful effects are observed.

Ingestion

DO NOT INDUCE VOMITING. Seek medical attention immediately.

Advice for first aiders

When administering first aid, always protect yourself against direct contact with chemicals or blood-borne diseases by wearing gloves, face masks and safety goggles. After administering first aid, wash exposed skin with soap and water.

4.2 The most important symptoms and effects, both acute and delayed

See Section 11.

4.3 Indication for immediate medical attention and necessary special treatment

Note for the doctor: Symptomatic treatment required.

Section 5	FIRE-FIGHTING MEASURES

5.1 Extinguishing media

CO2, dry chemical, foam, water spray, water mist.

5.2 Special hazards arising from the substance or mixture

Keep substance away from heat, sparks, ignition flames, static electricity and open flames. See Section 10 for further information.

5.3 Advice for fire-fighters

Wear fully protective firefighting clothing, including self-contained breathing apparatus with full face protection, coat, trousers, gloves and shoes. Do not use water jet. Use water to cool containers exposed to fire.

Section 6	MEASURES IN THE EVENT OF ACCIDENTAL RELEASE

6.1 Personal precautions, protective equipment and emergency procedures

Personal protective equipment must be worn. If the spill has occurred in a confined space or poorly ventilated area, the area must be ventilated.

6.2 Environmental precautions

Preventative measures must be taken to prevent entry into drains and waterways.

6.3 Methods and material for containment and clean-up

Collect the free liquid for recycling and/or disposal. The remains of a liquid can be absorbed with an inert material.

6.4 Reference to other sections

See sections 8 and 13 for further information.

Section 7	HANDLING AND STORAGE

7.1 Precautions for safe handling

Keep away from possible sources of ignition. Keep container closed when not in use. After finishing work, wash skin and, if necessary, contaminated clothing thoroughly. Wash contaminated clothing before reuse. The empty container contains residues of the product that may exhibit the hazardous properties of the product. Dispose of packaging or containers in accordance with local, regional, national and international regulations.

Pump temperature

Undetermined

Maximum temperature for handling the material

Undetermined

Maximum loading temperature

Undetermined

7.2 Conditions for safe storage, including incompatibilities

Do not store near sources of ignition. Store in a cool, dry, well-ventilated area. Keep container tightly closed. Store only in the original container. See Section 10 for incompatible materials.

Maximum storage temperature

Undetermined

7.3 Specific end use(s)

End uses are listed in an attached exposure scenario, where necessary.

Section 8	EXPOSURE CONTROLS/PROTECTIVE EQUIPMENT

8.1 Control parameters

Not known.

Other exposure limits

Contains synthetic-based raw material. In conditions where mist may be generated, comply with the recommended PEL (permissible exposure limit) of 5 mg/m3 and STEL (short-term exposure limit) of 10 mg/m3.

8.2 Exposure controls

Process with adequate ventilation.

Eye/face protection

Safety goggles.

Skin protection

Neoprene gloves.

A long-sleeved shirt is recommended. Wear a chemical-resistant apron if contact with the product is possible. Wash contaminated protective clothing before reuse.

Respiratory protection

If the recommended exposure limit is exceeded, use a respirator with a cartridge for organic vapours. Before entering enclosed spaces or poorly ventilated areas, and when cleaning large areas contaminated by spilled product, wear a self-contained breathing apparatus.

Hygiene

Wash hands thoroughly after handling the product.

Exposure controls for environmental protection

See Section 6 for details.

Section 9	PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties Form/colour

Clear to yellow liquid.

Odour	Mild
Odour threshold	Undetermined
pH	Undetermined
Melting/freezing point	Undetermined
Boiling point	Undetermined
Boiling point range	Undetermined
Flash point	240 °C, 464 °F COC (typical)
Evaporation rate	Not applicable.
Flammability (solid, gas)	
Lower flammability or Explosion limit	Not determined
Upper flammability or Explosion limit	Not determined
Vapour pressure	Undetermined
Vapour density	Undetermined
Relative density	0.98 (20 °C)
Bulk density	Undetermined
Solubility in water	Easily soluble.
Other solubilities	Undetermined
Partition coefficient: n-octanol/water	Undetermined
Spontaneous ignition temperature	Not determined
Decomposition temperature	Undetermined
Viscosity	31.2 centistokes (40 °C) 5.6 centistokes (100 °C)
Explosive properties	This product is not known to be explosive.
Oxidation properties	The material is a non-oxidising substance.

9.2 Further information

Freezing point	-56 °C, -69 °F

The above data are typical values and do not constitute a specification.

Section 10	STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2-10.6.

10.2. Chemical stability

The product is normally stable at moderately elevated temperatures and pressures.

10.3 Possibility of hazardous reactions

Does not occur.

10.4 Conditions to avoid

Undetermined

10.5 Incompatible materials

Strong acids. Strong bases. Oxidising agents.

10.6 Hazardous decomposition products

Smoke, carbon monoxide, carbon dioxide, aldehydes and other products of incomplete combustion.

Section 11	TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects Acute toxicity

Oral

The LD50 value (rats) is greater than 2000 mg/kg. These statements are based on data for components of the material or for similar materials.

Dermal

The LD50 value (rabbits) is greater than 2000 mg/kg. These statements are based on data for components of the material or for similar materials.

Inhalation

There is no data available to indicate that inhalation of the product or its components poses a risk of poisoning.

Skin corrosion/irritation

Not expected to cause immediate skin irritation. These statements are based on data for components of the material or for similar materials. Prolonged or repeated contact may cause skin inflammation.

Serious eye damage/irritation

Not expected to cause eye irritation. These statements are based on data for components of the material or for similar materials.

Respiratory tract irritation

If the substance is present as a fine mist or vapours are produced by heating, contact may cause irritation of the mucous membranes and upper respiratory tract. These statements are based on data for components of the material or for similar materials.

Respiratory or skin sensitisation Skin

No data is available to indicate whether the product or component is a skin sensitiser.

Respiratory

There is no information available indicating that the product or its components may have a sensitising effect on the respiratory tract.

Germ cell mutagenicity

There is no information available to indicate that the product or any of its components present in quantities above 0.1% have a mutagenic or genotoxic effect.

Carcinogenic effect

There is no evidence to suggest that any of the components present in concentrations greater than 0.1% could have carcinogenic potential.

Reproductive toxicity

There is no information available to indicate that the product or its components present in concentrations above 0.1% could cause reproductive toxicity.

STOT, repeated exposure

There is no data available to conclude that the product or components present in concentrations greater than 1% could cause cause chronic health hazards.

Further information

No other health hazards are known.

Section 12	ECOLOGICAL INFORMATION

12.1 Toxicity

Freshwater fish

Undetermined

Freshwater invertebrates

Undetermined

Algae

Undetermined

Saltwater fish

Undetermined

Saltwater invertebrates

Undetermined **Bacterial**

Undetermined

12.2 Persistence and degradability

Not applicable.

12.3 Bioaccumulative potential

Not applicable.

12.4 Mobility in soil

Not applicable.

12.5 Results of PBT and vPvB assessment

Not available

Other adverse effects

Unknown.

Section 13	To be observed during disposal.

13.1 Wastewater treatment procedures

All disposal practices must comply with relevant local, regional, national and international regulations. Dispose of packaging or containers in accordance with local, regional, national and international regulations.

Section 14	TRANSPORT INFORMATION

14.1 UN Number

ADR/RID	Not regulated.
ICAO	Not regulated.
IMDG	Not regulated.

14.2 Proper UN shipping name

ADR/RID	Not regulated.
ICAO	Not regulated.
IMDG	Not regulated.

14.3 Transport hazard class(es)

ADR/RID	Not regulated.
ICAO	Not regulated.
IMDG	Not regulated.

14.4 Packaging group

ADR/RID	Not regulated.
ICAO	Not regulated.
IMDG	Not regulated.

14.5 Environmental hazards

ADR/RID	Not applicable.
ICAO	Not applicable.
IMDG	Not applicable.

14.6 Special precautions for users

Check classification regulations before shipping material at elevated temperatures.

14.7 Bulk cargo transport in accordance with Annex II Marpol 73/78 and IBC Code

Not determined.

Section 15	REGULATIONS

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

Australia	All components comply with the requirements for the registration of chemical substances in Australia.
Canada	This material contains a component that has been reported to Environment Canada and is eligible for inclusion in the Domestic Substances List (DSL).
China	All components of this product are listed in the Inventory of Existing Chemical Substances in China.
EEC	For information on the status of this product in compliance with REACH regulations, please visit Lubrizol.com/REACH or email REACH_MSDS_INQUIRIES@Lubrizol.com.
Japan	All components have METI and MOL numbers in Japan.
Korea	All components comply with the requirements in Korea.
New Zealand	All components comply with the reporting requirements for chemical substances in New Zealand.
Philippines	All components comply with the Philippines Toxic Substances and Hazardous and Nuclear Waste Control Act of 1990 (RA 6969).
Switzerland	All ingredients comply with Swiss regulations on environmentally hazardous substances.
Taiwan	May require registration prior to sale in Taiwan.
USA	All components of this material are listed in the US TSCA Inventory or are exempt.

German water hazard classes

WGK = 1 according to the Water Hazard Directive VwVwS of 17 May 1999.

15.2 Chemical safety assessment

No chemical safety assessment has been carried out.

Section 16	OTHER INFORMATION

Prepared by

Product Safety and Compliance Department (440-943-1200)

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HMIS Codes

Health	Fire	Reactivity
1	1	0

Relevant R phrases

Not applicable.

Relevant hazard statements

Undetermined

Revision notes

Section: 15 Australia.	Changed: 26 November 2012
Section: 15 WGK.	Changed: 23 July 2013

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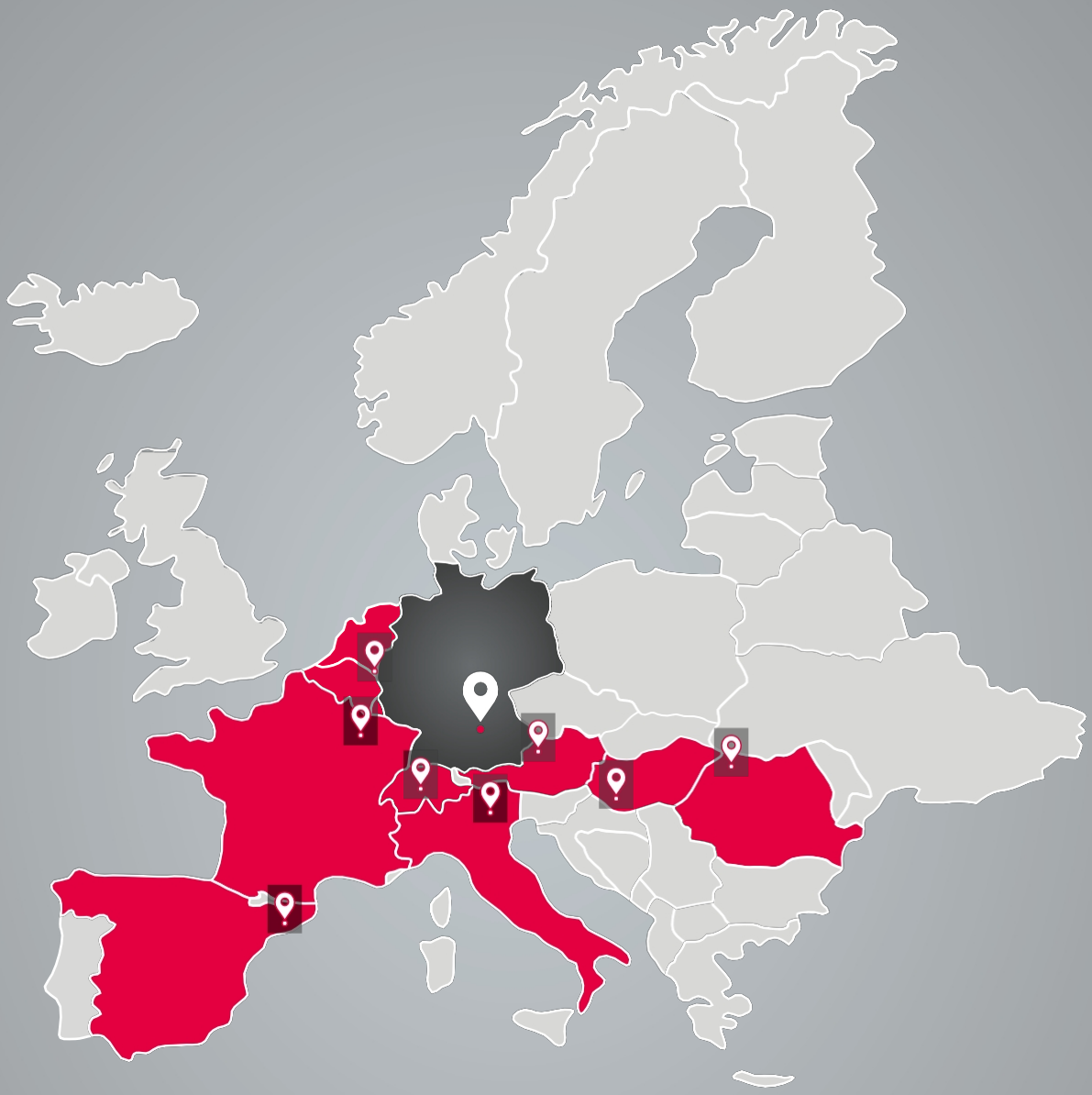

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