

General Requirements for Inverter Water Supply

1. General

Most types of inverter are water-cooled and require water quality and supply to be constant to allow for continuous and effective cooling.

The water composition has a significant effect on the running of the inverter. The water quality must therefore be tested before the inverter is used.

The connections should preferably be made from copper, stainless steel or plastic. Iron tubing should not be used for the water supply to the inductors or inverters.

2. Water quality

The quality of the water in a closed circuit can degrade as time passes. INDUCTOHEAT recommends that the water in the cooling system is checked regularly, as described in the maintenance chapter in the inverter operating instructions. This ensures that the water quality is monitored and can be altered if necessary. If you need any further help or information, INDUCTOHEAT will be pleased to assist you.

Please see the inverter operating instructions for the exact water specification for the inverter.

In general, the water used should be about the same quality as drinking water. It should be clean, visually clear and unclouded, free from sediment and chemically neutral.

Units for water hardness:

1 German degree	= 1.25	English degrees	
	= 1.78	French degrees	
	= 0.178	mmol/l	
	= 17.84	ppm (mg CaCO ₃ /l)	= 17.84 mg CaCO ₃ /l
	= 10.0	mg CaO/l	
	= 7.14	mg Ca ²⁺ /l	
	= 7.14	MgO/l	



The following specifications must be met:

Inlet temperature **20 – 35 °C**

The minimum inlet temperature must be above the dew point (cf. point 4). The maximum inlet temperature should not exceed 25 °C.

pH value **6.5 – 8.5**
Total hardness **8.5 °dH (max)**

Example values:

max. pH value 7.8 for a total hardness of 8 °dH
max. pH value 8.1 for a total hardness of 6 °dH
max. pH value 8.3 for a total hardness of 4 °dH

Maximum quantities of permitted additives for scale prevention:

Organic matter 14.0 mg/l (max.)
Iron content 0.3 mg/l (max.)
Phosphate content 20.0 mg/l (max.)

Maximum quantities for chemical substances:

Aggressive carbonic acid must not be detected
Ammonia must not be detected
Nitrate must not be detected
Nitrite 1.0 mg/l (max.)
Iron 0.3 mg/l (max.)
Manganese 0.05 mg/l (max.)
Chloride 150 mg/l (max.)
Sulphate 250 mg/l (max.)

Electrical conductivity **200 µS/cm (nominal)**
600 µS/cm (max)

Recooling equipment must be used if the above values cannot be guaranteed in the network; otherwise any warranty claims for water-cooled inverter components will be excluded.

To prevent damage to the fittings in the cooling system, it is vital that the ppm value of chloride in the water is not higher than the ppm of water hardness. The values given above are the maximum permitted values.

Deionised water should only be used for cooling the inverter if it is in conjunction with a comprehensive monitoring regime of the system's conductivity and pH levels.

The specifications above must be met. In addition, regular maintenance is required to maintain the water quality.

3. Agents (e.g. anti-freeze)

If the inverter is installed or stored in a location where the temperature could fall below 1 °C, an agent must be added to the cooling system to prevent it from freezing. If such steps are needed, please contact INDUCTOHEAT before going ahead. Only pure monoethylene glycol should be used and it is vital that the quantities recommended by INDUCTOHEAT are observed.

Adding too much or the wrong type of agent to the cooling system could severely impair the performance of the cooling system and may result in components being severely damaged or cause them to fail.

4. Condensation

If, at the place where the inverter is installed, the water inlet temperature is lower than the ambient temperature, regular checks need to be made to see whether condensation is forming inside the inverter housing. Steps must be taken to prevent condensation. If condensation has formed, the inverter can no longer be used. The cause must be found and corrected.

If the inverter does continue to be used it can lead to components being severely damaged or cause them to fail, eventually destroying the inverter.

In the following table, dew point temperature is compared to ambient temperature and humidity.

Example: Where the air temperature is 25 °C and humidity is 50 %, the coolant temperature must be above 13.9 °C to avoid condensation.

Where the air temperature is 25 °C and humidity is 75 %, the coolant temperature must be above 20.3 °C to avoid condensation.

These examples show that condensation is highly dependent on the humidity.

As a rule of thumb for Europe, at a medium relative humidity level the coolant may not be more than 10 °C cooler than the air temperature.

Air temperature (°C)	Dew point temperature (°C) in comparison to air temperature (°C) and relative humidity (%)															
	Relative humidity (%)															
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
2															0.5	1.3
4												0.0	0.9	1.7	2.5	3.3
6											1.0	1.9	2.8	3.7	4.5	5.3
8									0.7	1.9	2.9	3.9	4.8	5.6	6.5	7.3
10			-6.0	-4.2	-2.6	-1.2	0.1	1.4	2.6	3.7	4.8	5.8	6.7	7.6	8.4	9.2
12			-4.5	-2.6	-1.0	0.4	1.9	3.2	4.5	5.7	6.7	7.7	8.7	9.6	10.4	11.2
14			-2.9	-1.0	0.6	2.3	3.7	5.1	6.4	7.5	8.6	9.6	10.6	11.5	12.4	13.2
15			-2.2	-0.3	1.5	3.2	4.7	6.1	7.3	8.5	9.6	10.6	11.6	12.5	13.4	14.2
16			-1.4	0.5	2.4	4.1	5.6	7.0	8.2	9.4	10.5	11.6	12.6	13.5	14.4	15.2
17			-0.6	1.4	3.3	5.0	6.5	7.9	9.2	10.4	11.5	12.5	13.5	14.5	15.3	16.2
18			0.2	2.3	4.2	5.9	7.4	8.8	10.1	11.3	12.5	13.5	14.5	15.4	16.3	17.2
19			1.1	3.2	5.1	6.8	8.3	9.8	11.1	12.3	13.4	14.5	15.5	16.4	17.3	18.2
20			1.9	4.1	6.0	7.7	9.3	10.7	12.0	13.2	14.4	15.4	16.4	17.4	18.3	19.2
21		0.3	2.8	5.0	6.9	8.6	10.2	11.6	12.9	14.2	15.3	16.4	17.4	18.4	19.3	20.2
22		1.1	3.7	5.9	7.8	9.5	11.1	12.5	13.9	15.1	16.3	17.4	18.4	19.4	20.3	21.2
23		1.9	4.5	6.7	8.7	10.4	12.0	13.5	14.8	16.1	17.2	18.3	19.4	20.3	21.3	22.2
24		2.8	5.4	7.6	9.6	11.3	12.9	14.4	15.8	17.0	18.2	19.3	20.3	21.3	22.3	23.1
25	0.5	3.6	6.2	8.5	10.5	12.2	13.9	15.3	16.7	18.0	19.1	20.3	21.3	22.3	23.2	24.1
26	1.3	4.5	7.1	9.4	11.4	13.2	14.8	16.3	17.6	18.9	20.1	21.2	22.3	23.3	24.2	25.1
28	3.0	6.1	8.8	11.1	13.1	15.0	16.6	18.1	19.5	20.8	22.0	23.2	24.2	25.2	26.2	27.1
30	4.6	7.8	10.5	12.9	14.9	16.8	18.4	20.0	21.4	22.7	23.9	25.1	26.2	27.2	28.2	29.1
32	6.2	9.5	12.2	14.6	16.7	18.6	20.3	21.8	23.3	24.6	25.8	27.0	28.1	29.2	30.2	31.1
35	8.7	12.0	14.8	17.2	19.4	21.3	23.0	24.6	26.1	27.4	28.7	29.9	31.0	32.1	33.1	34.1
40	12.8	16.2	19.1	21.6	23.8	25.8	27.6	29.2	30.7	32.1	33.5	34.7	35.9	37.0	38.0	39.0