



## Cooling unit CU-EMA+

The CU-EMA+ cooler unit is designed specifically for maritime applications. It is certified for **operation on ships and offshore units** and is type approved by **DNV-GL** and **Lloyd's Register**. The special design features allow the CU-EMA+ cooler unit to also be used in high vibration environments (e.g. on ships) up to an acceleration of 0.7 g.

The **Annex VI of the MARPOL convention** governs the prevention of air pollution from ships. To ensure compliance with sulphur oxides limits, e.g. desulphurisation units (SO<sub>x</sub> scrubbers) are used on ships. The TC-Kit+ cooler used in the CU-EMA+ impresses when used in systems for monitoring this sulphur emission due to the **particularly low wash out effects of sulphur dioxide (SO<sub>2</sub>)**, which has also been established by the DNV-GL.

The innovative design allows the CU-EMA+ **to be installed close to the sample gas** sampling point. No further heated line is required from this point to the additional conditioning. This reduces costs and makes the CU-EMA+ not only interesting for use on ships, but also for stationary systems, e.g. for measuring flue gas emissions in power plants.

Type tested for use on ships according to **LR** and **DNV-GL**

Certified for high vibration environments up to 0.7 g

Use near the sampling point eliminates the use of heated lines

Low wash out effects confirmed by **DNV-GL**

2 heat exchangers (glass or PVDF) in series

Adjustable outlet dew point and alarm thresholds

Protection class IP44

Optional port for test gas and instrument air

Optional connection for heated line



**Overview**

The CU-EMA+ cooler was designed specifically for the requirements of gas conditioning for continuously measuring emissions in maritime applications. Dividing the unit into an internal and external section achieves the IP rating required under the standard without requiring venting the interior. The series connection of the heat exchangers will cool in two cycles to minimise wash out effects.

The exact item number of the model defined by you is determined by the model code in the category ordering information.

The gas cooler comes standard with peristaltic pump and moisture detector. Additional components which every conditioning system should feature can optionally be connected:

- Connection for adding instrument air to purge the system,
- Solenoid valve for adding test gas,
- Heated line connection and regulation,
- metric/US style external connections.

Here the approach is to simplify creating a complete system in a cost-efficient way through pre-installed components with hoses connected. We further paid attention to easy access to wear parts and consumables.

**Description of functions**

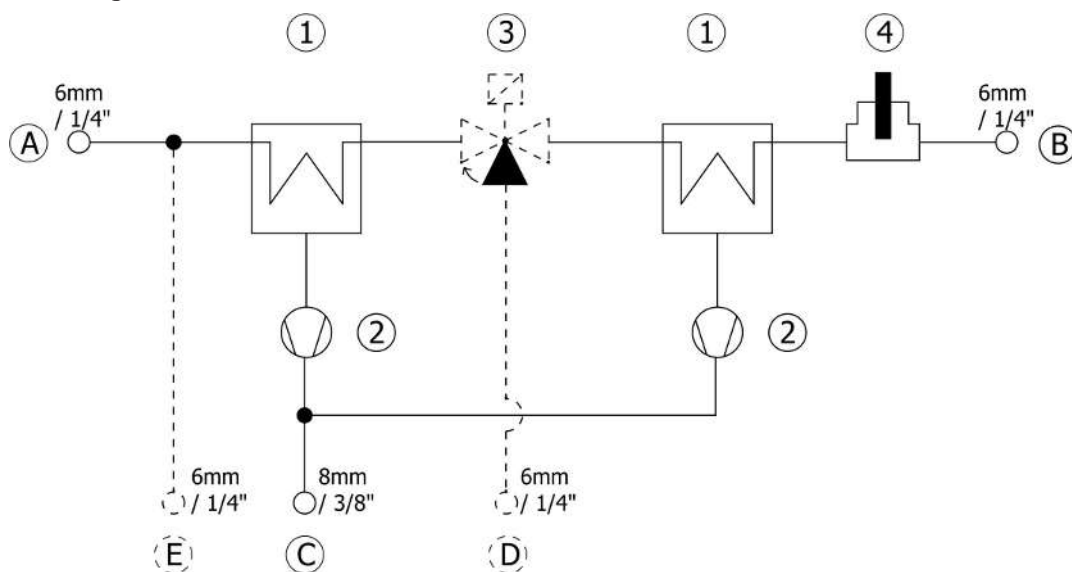
The sample gas cooler is controlled by a microprocessor.

The programmable display shows the block temperature in the selected display unit (°C/°F) (factory preset °C). Application-specific settings can easily be configured guided by the menu, using the 5 buttons. For one, this applies to the target outlet dew point, which can be set from 2 to 20 °C (36 to 68 °F) (factory setting 5 °C/41 °F).

And then the warning thresholds can be adjusted for low and excess temperature. These are set relative to the outlet dew point  $\tau_a$  setting. For the low temperature the range is  $\tau_a - 1$  to  $- 3$  K (at a minimum 1 °C cooling block temperature), for the excess temperature the range is  $\tau_a + 1$  to  $+ 7$  K. The factory settings for both values are 3 K.

The flashing and an LED on the display unit plus the potential-free contact indicate the warning range has been overrun or underrun (e.g. after switching on) plus the potential-free contact.

**Flow Diagram**



A Sample gas input	1 Cooler unit
B Sample gas output	2 Condensate pumps
C Condensate output	3 Solenoid valve for adding test gas (optional)
D Test gas input (optional)	4 Moisture detector
E Instrument air input (optional)	

## Technical Data

Technical Data	
Type tested:	<b>DNV GL</b> rules for classification Ships, offshore units, and high speed and light craft Certificate no.: TAA00002RE  <b>Lloyd's Register</b> Type Approval System, Test Specification Number 1 - March 2019 Certificate no.: LR2008137TA
Ambient categories as per DNVGL-CG-0339:	Temperature: A Humidity B Vibration A EMC A Housing: B
Environmental categories as per LR:	ENV1, ENV2

## Switch cabinet

Dimensions (h x w x d):	19.7 x 19.7 x 11.8 in
Material	Sheet steel, RAL 7035, single door
Degree of protection	IP44
Weight	68.3 lb

## Climatic conditions

Ambient temperatures:	41 °F ... 122 °F
Storage temperatures:	-4 °F ... 104 °F

## Cooler Data

Ready for operation	after max. 10 minutes
Gas output dew temperature preset: adjustable:	41 °F 36 °C...68 °F
Static dew point stability: throughout the specification range:	+ - 0.1 K + - 1.5 K
Inlet dew point max.:	158 °F Gas input temperature on heat exchanger max. 284 °F
Rated cooling capacity (at 77 °F):	104 Btu/h

## Other data

Gas connections:	see flow diagram
Parts in contact with media:	PVDF, stainless steel, PTFE, Norprene, Viton, epoxy resin

## Electrical data

Supply:	115 VAC/230 VAC, 50/60Hz, 16A, cable clamps, cable cross-section 1.5...2.5 mm <sup>2</sup> shielded
Cooler: (power supply + peristaltic pump)	230 VAC. 300 VA
Status contact cooler, moisture and optional regulated heated line	max. 230 VAC, 24 VDC, 2 A, 50 VA, cable clamps, cable cross-section 0.75...2.5 mm <sup>2</sup> shielded
Max. additional consumers (e.g. heated probe)	115 VAC/230 VAC, 800 VA, cable clamps, cable cross-section 1.5...2.5 mm <sup>2</sup>
Transfer clamps (e.g. status contact heated probe)	Cable clamps, cable cross-section 0.75...2.5 mm <sup>2</sup>

**Technical Data - Options**

**Controller for heated line**

Temperature, preset:	356 °F
adjustable:	104 °F ... 392 °F
Flow:	max. 115 VAC/230 VAC 1600 VA cable clamps, cable cross-section 1.5...2.5 mm <sup>2</sup>
Sensor type:	Pt100, 2-wire
Connection:	Cable clamps, cable cross-section 0.5...2.5 mm <sup>2</sup>

**Self-regulating heated line**

Flow:	max. 115 VAC/230 VAC 1600 VA cable clamps, cable cross-section 1.5...2.5 mm <sup>2</sup>
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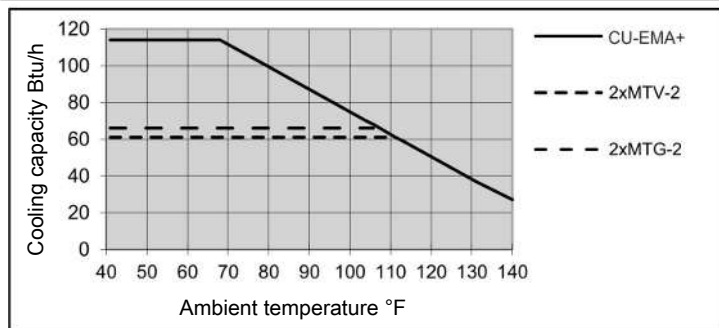
**Test gas solenoid valve**

Flow:	Activated with customer power via 230 VAC relay (Attention: cannot be activated with 115 VAC) or 24 VDC, cable clamps, cable cross-section 0.75...2.5 mm <sup>2</sup>
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**Outlet**

**Two heat exchangers**

<b>Model CU-EMA+</b>	
Rated cooling capacity (at 77 °F)	104 btu/h
max. ambient temperature	131 °F
Dew point fluctuations	
static	± 0.1 K
in the entire specification range	± 1.5 K
Temperature difference between heat exchangers	
	< 0.5 K



Remark: The limit curves for the heat exchangers MTV-2 and MTG-2 apply at a dew point of 122 °F. Depending on the installation version, the cooling capacity curve may vary.

**Heat exchanger description**

The energy content of the sample gas and the required cooling capacity of the gas cooler is determined by three parameters: gas temperature  $\vartheta_G$ , dew point  $\tau_e$  (moisture content) and volume flow  $v$ . The outlet dew point rises with increasing energy content of the gas. The following limits for the maximum flow are specified for a standard operating point of  $T_e = 104$  °F and  $\vartheta_G = 158$  °F. The maximum flow  $v_{max}$  in NI/h of cooled air indicated, so after moisture has condensed. Values may differ for other dew points and gas inlet temperatures. However, the physical facts are so vast we decided to omit the illustration. Please contact our experts for clarification or refer to our calculation program.

Heat exchanger overview

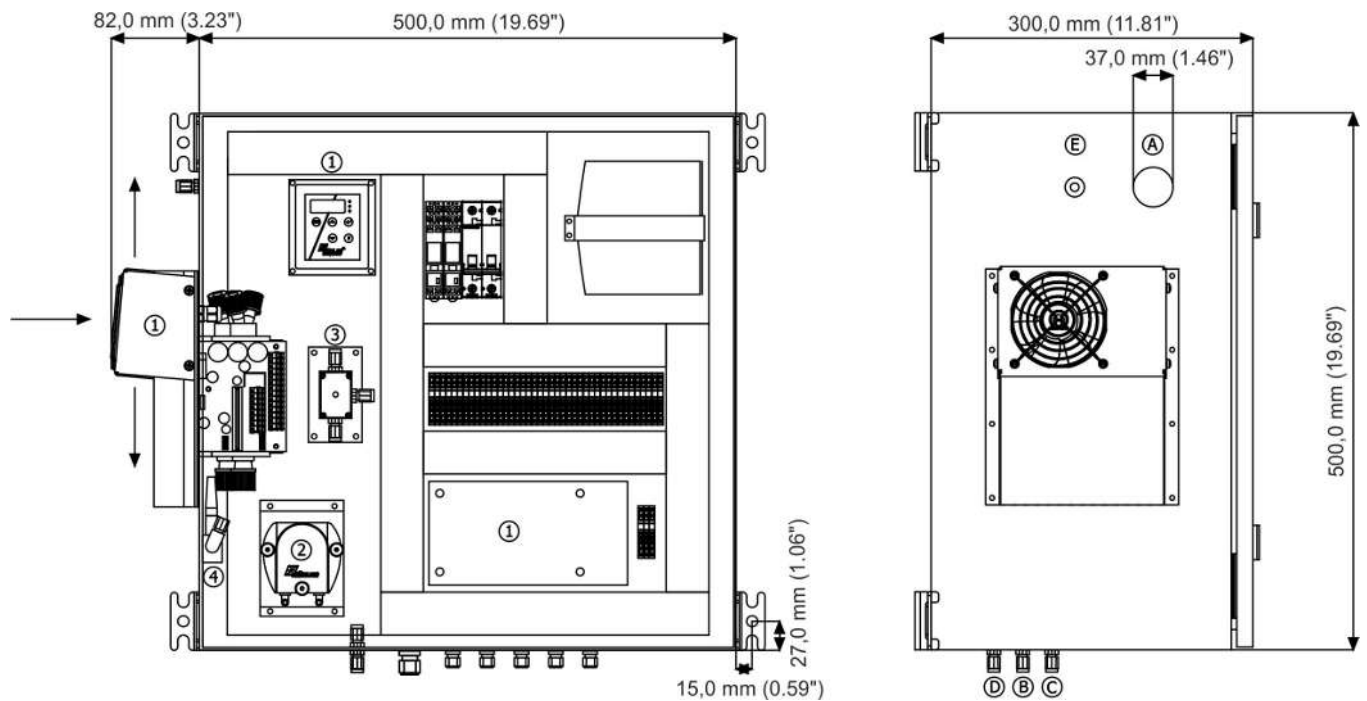
Heat exchanger	2x MTG-2	2x MTV-2 2x MTV-2-I <sup>2)</sup>
Version / Material	Glass	PVDF
Flow rate $v_{max}$ <sup>1)</sup>	3.5 lpm	3.2 lpm
Inlet dew point $\tau_{e,max}$ <sup>1)</sup>	158 °F	158 °F
Gas inlet temperature $\vartheta_{G,max}$ <sup>1)</sup>	284 °F	284 °F
Max. Cooling capacity $Q_{max}$	76 Btu/h	62 Btu/h
Gas pressure $p_{max}$	44 psi	29 psi
Pressure drop $\Delta p$ ( $v=150$ L/h)	0.27 psi	0.26 psi
Dead volume $V_{tot}$	2.3 cu. in.	2.2 cu. in.
Gas connections (metric)	GL14 (6 mm) <sup>3)</sup>	DN 4/6
Gas connections (US)	GL14 (1/4") <sup>3)</sup>	1/4"-1/6"
Condensate out connection (metric)	GL18 (8 mm) <sup>3)</sup>	G1/4
Condensate out connection (US)	GL18 (8 mm) <sup>3)</sup>	NPT 1/4"

<sup>1)</sup> Max. cooling capacity of the cooler must be considered

<sup>2)</sup> Models marked I have NPT threads or US tubes, respectively.

<sup>3)</sup> Gasket inside diameter

Dimensions



1 Sample gas cooler and analyser	A Sample gas input (6 mm / 1/4")
2 Peristaltic Pump	B Sample gas output (6 mm / 1/4")
3 Solenoid valve for adding test gas (optional)	C Condensate output (6 mm / 3/8")
4 Moisture detector	D Test gas input (optional) (6 mm / 1/4")
	E Instrument air input (optional) (6 mm / 1/4")

Ordering instructions

Cooler with Two In-Line Heat Exchangers

The item number is a code for the configuration of your unit. Please use the following model code:

4496	2	8	2	2	0	X	1	X	X	2	0	0	X	0	0	X	X	X	Product Characteristics
<b>Cooler (with 2 in-line heat exchangers)</b>																			
CU-EMA+: Ambient temperature 122 °F																			
<b>Certifications</b>																			
Standard applications – CE																			
<b>Supply voltage</b>																			
115 VAC, 50/60 Hz																			
230 VAC, 50/60 Hz																			
<b>Heat exchanger</b>																			
Glass, 2 x MTG-2, metric																			
Glass, 2 x MTG-2-I, US																			
PVDF, 2 x MTV-2, metric																			
PVDF, 2 x MTV-2-I, US																			
<b>Peristaltic Pumps</b>																			
CPdouble with hose nipple, angled																			
<b>Moisture detector</b>																			
without moisture detector																			
1 moisture detector with adapter																			
<b>Options</b>																			
Without option																			
Instrument air purging connection																			
Solenoid valve for test gas																			
Instrument air purging connection and solenoid valve for test gas																			
<b>Heated line</b>																			
no heated line																			
ready for self-regulating heated line																			
-																			
-																			
-																			
ready for regulated heated line																			
5 m regulated heated line *																			
8 m regulated heated line *																			
10 m regulated heated line																			
15 m regulated heated line																			

\*for 115 VAC only these lengths available

Spare parts and accessories

Item no.	Description
44922420102	Peristaltic pump CPdouble and replacement tube
41111000	Moisture detector and flow cell, various models
9148000182	Solenoid valve, 24 VDC
9120020143	230 VAC relay for controlling the solenoid valves
9120020139	24 VDC relay for controlling the solenoid valve
9110000018	Microfuse 500 mA delayed action, 5x20 mm
9110000032	Microfuse 63 mA delayed action, 5x20 mm
9110000067	Microfuse 8 A delayed action, 5x20 mm