

Auramarine Cooling Units (ACU)



1 General

1.1 ACU operating principle

Operating vessels in MARPOL Annex VI Sulphur Emission Control Areas (SECAs) requires vessels to use low sulphur fuels or scrubber systems. The low sulphur fuels, such as Marine Gas Oil (MGO) generally have a low viscosity and do not usually fill the minimum viscosity requirements of main engines. The viscosity of the MGO can be increased by cooling the oil with the ACU-series fuel oil coolers.

In Auramarine Cooling Units (ACU) the cooling water is delivered to this unit from separate Auramarine Chiller Cooling (ACC) unit or it can be delivered from ship's LT-water or sea water cooling system. The heat from the MGO fuel is transferred to the cooling water in the unit's heat exchanger.

The ACU modules have in-built mixing function control valve, which controls the cooling water flow (LT-water models) or MGO flow (Seawater models) based on the fuel outlet temperature. With this control the response in the fuel temperature is immediate and accurate. Unit temperature controller is factory set with temperature ramp (2°C / min) and the in-built thermal shock prevention can be taken into use with simple electrical connections to the changeover system (by wire) or can be taken into use in manual mode (local control).

1.2 Installation of ACU

The ACU shall be installed in the engines fuel system in such a way that the ACU will be able to ensure adequate viscosity of the fuel oil (MGO, or other low viscosity fuel). Depending on the position of the ACU in the booster circulation, different heat transfer characteristics can be attained, leading to different cooling water flow needed and a different resulting waterside pressure drop. Also the pressure drop at the fuel side of the ACU will be different whether ACU is installed at engine outlet, or engine inlet. The pressure drop must meet the requirements of the pumping system.

The interfaces (fuel oil and cooling water) to the unit are shown in the general arrangement drawing, please see list of referenced documents.

The electrical connections are shown in the electric drawings.

Only the seawater model (SW-model) is suitable for seawater. NOTE: LT-water models are not to be used in seawater systems.

Product	Cooling media	Heat exchanger type	Max fuel flow (m3/h)	Max water flow (m3/h)
ACU-M-2-T-TU-G-LT	LT water*	Tube	8	16,5
ACU-M-3-T-TU-G-LT			13	16,5
ACU-M-7-T-TU-G-LT			18	28
ACU-M-2-T-TU-G-SW	Seawater or LT-water*		8	11,9
ACU-M-3-T-TU-G-SW			13	11,9
ACU-M-7-T-TU-G-SW			18	24
ACU-M-4-T-PL-S-LT	LT water*	Plate	12	16
ACU-M-8-T-PL-S-LT			16,5	22
ACU-M-15-T-PL-S-LT			26	35
ACU-M-4-T-PL-S-SW	Seawater or LT-water*		12	12
ACU-M-8-T-PL-S-SW			16,5	16
ACU-M-15-T-PL-S-SW			26	30

Explanation of the name of the module (ACU-X₁-X₂-X₃-X₄-X₅-X₆):
 -ACU= Auramarine Cooler Unit
 -X₁=M (Marine)
 -X₂=2 to 15 (Model number)
 -X₃=T (Temperature controlled)
 -X₄,X₅=Heat exchanger identifier
 -X₆=SW (Seawater model) or LT (Fresh water model)
 * LT water= Fresh water or 20% Glycol-Water mixture

Table 1. Available standard ACU units.

2 Technical data

MGO fuel standard	ISO8217:2012 DMA (2-6cSt at 40°C)
Unit controller cooling mode temperature set point factory setting	40°C (unless otherwise specified in project specific data)
Cooling media	Sea-water or LT water*
Unit controller temperature ramp factory setting	2°C / min
Control voltage	230 VAC, internally transformed
Supply voltage	230V/380V/400V/440V/450V/480V/690V 50/60Hz
Design pressure max.	Oil side 16 bar, water side 10 bar
Design temperature:	100°C (maximum operating temperature))

3 Main components

Position	Denomination
B101	Heat exchanger , plate or tube type
V202	Mixing valve , Temperature control, electrically actuated, PN16
F201	Orifice , (only for fresh water models) -Flow balancing
T101	Temperature sensor -PT 100
TI	Thermometer , liquid pillar type, scale in °C
PI	Pressure gauges - Ø 63 mm, glycerine filled
	scale bar+kPa/kg/cm ² +psi

4 Control panel, materials, miscellaneous

Control panel	<ul style="list-style-type: none"> - IP54 - Insulation resistance tested
Inputs for Automatic changeover functions in ACU (Not in use when unit is on manual mode)	<ul style="list-style-type: none"> - Main fuel line ACU by-pass valve limit switch signal as potential free contact - ACU by-pass line temperature signal (mA signal, 4-20mA, 0-200°C), for temperature ramp start in temperature control mode in changeover situation - MGO to HFO changeover signal as potential free contact (optional) - Low viscosity signal for cooler as potential free contact (optional)
Inputs for ACU heat exchanger forced by-pass (direct driving of mixing valve actuator)	<ul style="list-style-type: none"> - High viscosity signal as potential free contact (optional) - Fuel system on HFO mode signal as potential free contact (optional) - Changeover system supply voltage on signal as potential free contact (optional)
Outputs	<ul style="list-style-type: none"> - Temperature process value signal (linear mA signal, 4-20mA, 0-200°C) - Temperature alarm (combined low temperature and high temperature) signal as potential free contact - Cooler control valve on full by-pass –signal as potential free contact - Unit running
Frame	<ul style="list-style-type: none"> - Bolted sheet metal construction - 1" threaded female connection at frame for draining of leakages
Painting system	<ul style="list-style-type: none"> - ISO 12944-5; 2007 A2.06 EP120/2-FeSa2½ (frame and pipes)
Pipes	<ul style="list-style-type: none"> - Seamless carbon steel P235GH, EN10217 or equal - Welding according to ISO 5817 C - Water side pipes insulated with?
Connecting flanges	<ul style="list-style-type: none"> - EN 1092-1 PN16/40, counter flanges, gaskets, bolts and nuts included (excluding seawater models water connections)
Valves	<ul style="list-style-type: none"> - Ball valves, nominal pressure class min. 16 bar
Name plates	<ul style="list-style-type: none"> - English, stainless steel, on piping and components
Max module dimensions	<ul style="list-style-type: none"> - 1500x1900x580 mm
Max module weight	<ul style="list-style-type: none"> - ~550 kg