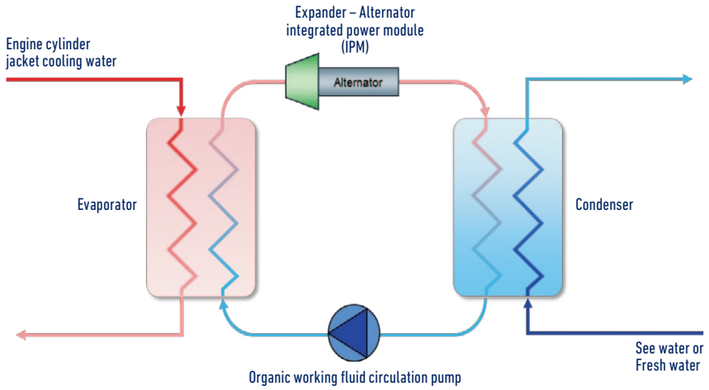
Hot water carrying engine waste heat generates additional power on board

WORK ORGANIC

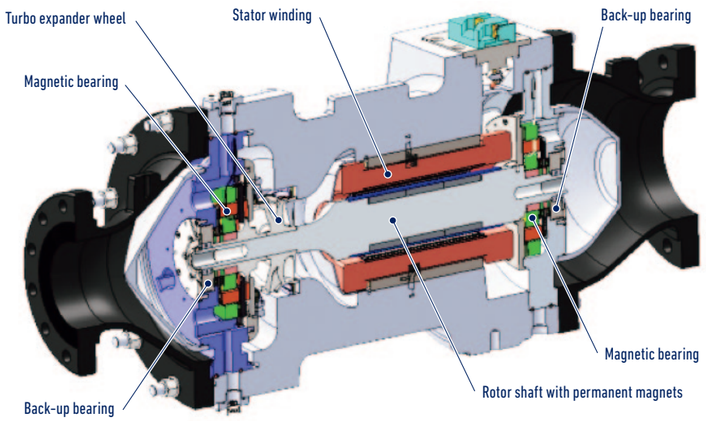
Cooling water from the two-stroke diesel engine has thousands kilowatt of heat but difficult to convert it to electric power because of its low temperature as lower than 100 degree C or boiling point of water, and therefore it has been wasted to the ocean.
Mitsubishi new waste heat recovery system uses synthetic organic working fluid, instead of water, and it has low flush point of 15 degree C. Therefore, the working fluid can be vaporized by the heat of engine cooling water, and can drive turbine generator to make electric power.



System diagram

UNIQUE DESIGN OF IPM

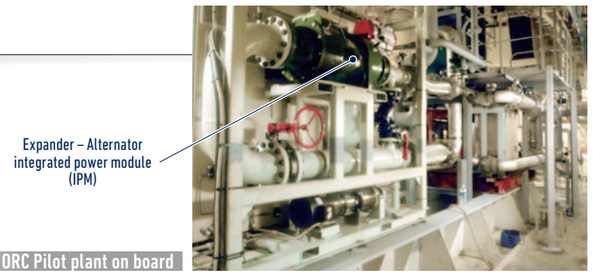
High efficiency turbo expander turbine converts the cooling water heat into rotating kinetic energy. The expander turbine rotor is directly integrated with permanent magnet alternator in a hermetically sealed housing and supported by friction free magnetic bearings. Expanded gas after the turbine cools the alternator by flowing the gap between stator and rotor, so that no external cooling is required.



Cross section of IPM

PROVEN ON BOARD

A pilot plant of marine ORC was installed or retrofitted on a large container ship in April 2016. Performance and reliability have been proven on the sea.

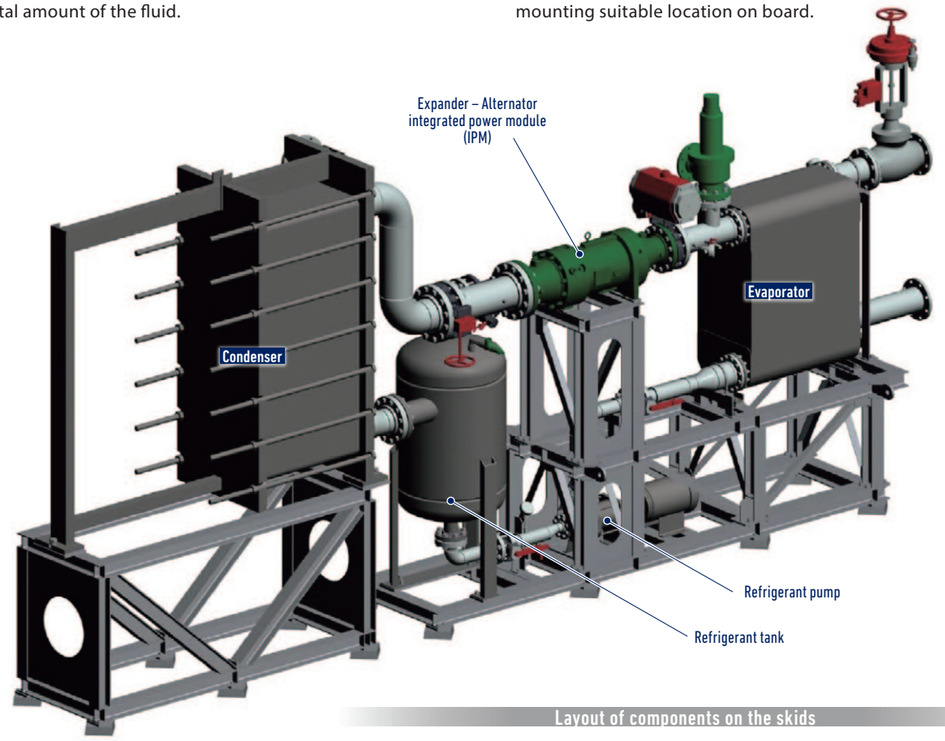


ORC Pilot plant on board

OPTIMIZED LAYOUT

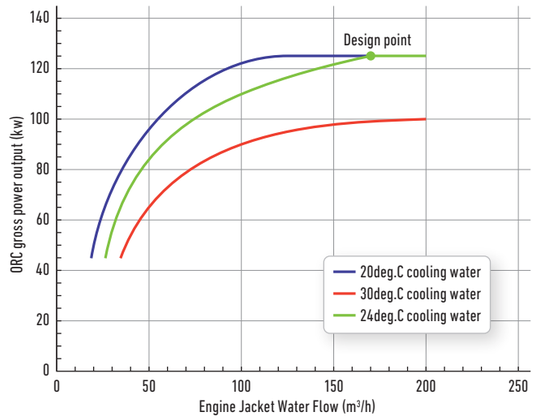
Based on the facts MHI-MME has learned from the first pilot plant installation, new layout of the system has been developed to minimize not only foot print but also pressure losses, cost and total amount of the fluid.

Integrated power module, fluid tank, pump and evaporator are mounted on a common skid with minimum length of the pipes, and condenser on a separate skid frame has flexibility of mounting suitable location on board.



Layout of components on the skids

ESTIMATED OUTPUT POWER



PARTICULARS

Net output power (kW)	115
Output voltage (V)	380 to 480
Frequency (Hz)	50/60
Width x Length x Height (m)	1.3 x 7.5 x 3.5
Dry weight (kg)	8,600
Cooling water	Sea water or fresh water
Working fluid (Refrigerant)	R245fa
Hot water temperature (℃)	75 to 95
Hot water amount (t/h)	150 to 200
Cooling water temperature (℃)	5 to 30
Cooling water amount (t/h)	150 to 250
Rated alternator speed (rpm)	24,500
Bearing type	Active controlled magnetic
Alternator type	Permanent magnet synchronous
Expander type	Single stage radial