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## E-RATIONAL ORC-4000

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BEP Europe (Burke E. Porter, [www.bepco.com](http://www.bepco.com)) - through its Energy & Infrastructure Division – “E-Rational” ([www.e-rational.net](http://www.e-rational.net)) is delivering a cost-effective solution to convert low temperature heat into clean energy power without emissions. Our state-of-the-art **Organic Rankine Cycle (ORC)** technology combined with the usage of industrial grade components makes E-Rational’s ORCs user-friendly, robust and economically viable.

E-Rational’s ORC machine has been designed for a maximized combined uptime and efficiency with a minimized operational and maintenance cost. This resulted in a containerized modular machine, CE-compliant, with plug-and-play connections for easy installation.

The ORC-4000 machine absorbs up to 4,000 kW (13.65 MMBTU/h) thermal heat in a temperature range between 80°C and 150°C (176 F – 302 F). The ORC units are heat powered by hot water, thermal oil or low pressure steam coming from:

- ✓ Waste heat flows from industrial processes, e.g. cooling cycles from chemical plants, glass-, steel-, & food- industry, power plants, etc..
- ✓ Unused heat in District Heating networks
- ✓ Biomass furnaces and CHP/COGEN or biogas installations
- ✓ Geothermal wells

Depending on the operating conditions, E-Rational’s ORC-4000 series are offered with different types of expander-generator sets with typical outputs ranging from 250 kWe to 500 kWe.



<b>ORC-4000</b>		<b>Containerized modular Organic Rankine Cycle machine</b>	
Generator type	Asynchronous, 2 pole, 3 phase, 400V, 50-60 Hz		
Generator Power Range	250kWe - 315kWe - 370kWe - 400kWe - 450kWe – 500 kWe		
Expander	E-Rational (single screw, radial inflow)		
Heat Exchangers	Plate heat exchangers		
Applied EG-Norms:	<ul style="list-style-type: none"> <li>✓ Machine directive 2006/42/EG</li> <li>✓ EMC Directive 2004/108 EG</li> <li>✓ Low voltage directive 2006/95/EG</li> <li>✓ Pressure Equipment Directive 97/23/EG</li> </ul>		
Electrical Enclosures	IP55		
Control system	PLC, Web Based Remote Monitoring		
Dimensions (L x W x H)	12,192mm x 2,438mm x 2,896 mm	40' x 8' x 9'6"	
Operating Mass (kg)	±26,000 kg	±57,300 Lbs	
Operating Conditions (ambient temperature)	-20°C to +50°C	-4 F to 122 F	
Temperature Heat input	80°C - 150°C	176 F – 302 F	
Maximum heat input	4,000 kWth	13.65 MMBTU/h	
Heat source	<ul style="list-style-type: none"> <li>✓ Hot water</li> <li>✓ Thermal oil</li> <li>✓ Low Pressure steam</li> </ul>		
ORC working Fluid (depending on conditions)	<ul style="list-style-type: none"> <li>✓ Honeywell r245fa®</li> <li>✓ Solkatherm SES36®</li> </ul>		
Hydraulic connection heat source	2 Flanges DN300 PN16		
Hydraulic connection cooling	2 Flanges DN300 PN16		
Cooling system	<ul style="list-style-type: none"> <li>✓ Cold water</li> <li>✓ Cooling tower</li> <li>✓ Air cooler</li> </ul>		
Housing	Outdoor installation possible		
Noise level	<75 dB at 10 m		
Emissions	<ul style="list-style-type: none"> <li>✓ No Emission</li> <li>✓ No fuel consumption</li> </ul>		

**TYPICAL PERFORMANCES**

**HEAT SOURCE: Hot water 3,500 kWth – 150 m<sup>3</sup>/h (11.9 MMBTU/h - 660 GPM)**  
**COOLING: Cold water**

Temperature heat source	Gross power production		
	Cold water out 20°C (68 F)	Cold water out 30°C (86 F)	
90°C 194 F	266 kWe	228 kWe	
100°C 212 F	298 kWe	259 kWe	
110°C 230 F	326 kWe	291 kWe	
120°C 248 F	403 kWe	364 kWe	
130°C 266 F	434 kWe	396 kWe	
140°C 284 F	450 kWe	450 kWe	

**HEAT SOURCE: Low Pressure Steam 3,500 kWth - 5.4 Tons/h - 1.75 kg/s (11.9 MMBTU/h - 11,905 Lbs/h)**  
**COOLING: Cold water out 20°C (68°F)**

Steam Pressure		Saturated Steam Temperature		Gross power production
1.5 bara	21.76 psi	111°C	232 F	346 kWe
2.0 bara	29.01 psi	120°C	248 F	378 kWe
2.8 bara	40.61 psi	131°C	268 F	413 kWe
4.0 bara	58.02 psi	143°C	289 F	450 kWe