ENERGY BLADE 3K4

# Energy Blade Installation Instructions

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# Contents



# General information

Carefully read these instructions before installation and commissioning. Save these instructions for future reference.

# Scope of these instructions

These instructions describe the function, installation and filling of Energy Blades for use in a closed loop, water collector, ground source heat pump installation and commissioning. Other components of a heat pump system such as the circulation pumps, pipe, fittings and valves, heat pumps, operating heat transfer fluids, and buffer tanks are required to make the complete system. They are not described in this manual and the instructions for these other components should be observed. Due skill and care is required to design the complete system of which an Energy Blade is just a part.

These instructions are intended for specialist system installers.

## Product information

The Energy Blade is a stainless steel , water-immersible heat exchanger specifically intended for use in closed-loop ground-source heat pumps systems. It is used for transferring energy from rivers, streams, lakes or ponds to the heat transfer fluid (glycol, anti-freeze) used by ground source heat pumps.

## Designated use

The Energy Blade may only be used as specified in this manual. Improper use invalidates warranty claims.

- Do not over-tighten the connections to the Energy Blade. When tightening fittings and connections always use two wrenches, one on the fitting and the other to counteract the torque applied to the fitting.
- Energy Blades must be installed submerged in a body of water with the individual plates vertical and the manifold at the top.
- Energy Blades may stand on the floor of the river or lake. In this case they must be supported above the silt or mud on skids, a frame structure, or on legs or by other means.
- Energy Blades may also be hung from a mounting frame or other structure such as a pier or jetty as described in this manual. They must be secured and protected suitably for the conditions.
- The body of water must be large enough to supply the energy loads required.
- Energy Blades are made from 304 stainless steel and are only suitable for fresh water applications.
- The glycol used should be non-toxic. We recommend propylene glycols such as Sentinel R500.

# Warranty

Energy Blades are thoroughly tested as part of the manufacturing process. Any defect discovered on delivery must be reported immediately to your supplier to arrange replacement.

Once installed Energy Blades are warranted against manufacturing defects for 1 year from invoice date provided the Energy Blades have been installed by professional installers in accordance with guidance and installation manuals, and the original purchase cost has been paid in full. Claims under this warranty must be made within 7 days of discovery of the defect or failure. The warranty does not cover:

- Damage in transit, storage or installation
- Damage in use by objects in the water
- Fair wear-and-tear, wilful damage, negligence, or abnormal working conditions
- Alterations or repairs without the supplier's prior written permission
- Failure to install and use according to these instructions

The warranty does not cover the cost of shipping, dismantling or reconstruction in the place of installation. Statutory rights of a buyer acting as a consumer are not affected.

# Safety instructions

The design, installation and commissioning of heat pump systems incorporating Energy Blades requires a range of skills and competencies. In the UK the Microgeneration Certification Scheme (MCS) provides a certification framework that certifies organisations competent to install these systems.

The following must be observed during installation and commissioning:

- Relevant local and national regulations
- Accident prevention and health and safety of employees and the public
- Instructions and safety precautions in this manual

**WARNING**: Energy Blades weigh about 85kg when empty. Suitable equipment and qualified staff should be used to handle and install them.

**WARNING**: Personal injury and damage may be caused by over pressure. Energy blades are pressure tested to pressures greater than 10 bar. They should not be pressurised by fluids to levels greater than the maximum working pressure specified in this manual. The system should be protected by suitable pressure relief valves. Energy Blades should never be pressurised by air.

**NOTICE**: Care should be taken to store and carry Energy Blades keeping the blades vertical. Failure to observe this and the application of excessive loads and twisting forces should be avoided when handling the device and will invalidate the warranty.

**NOTICE**: Energy Blades should only be filled with aqueous solutions of glycol as specified in this manual. Filling with other substances will invalidate the warranty. Use of glycols of a lower percentage may lead to freezing in some circumstances and prejudice the system performance and damage components. Use of glycols of a higher percentage than recommended will increase the pressure loss at a given flow rate and may adversely affect the system performance or require redesign of the circulation pump.

# Assembly and installation

## Positioning

The plates can be stood horizontally on the floor of the lake, pond or river with the blades vertical and the manifold at the top. The unit should rest on a suitable skid made of stainless steel or wood to lift the plates off the surface of the lake/river and to stop them from sinking into the silt.

The unit may also be hung from a supporting structure made of steel , wood or another material that will not cause corrosion of the plates. Hangers from the support structure may be bolted to the 8mm holes on the edge of the plates. The load should be shared between at least 8 supporting holes.

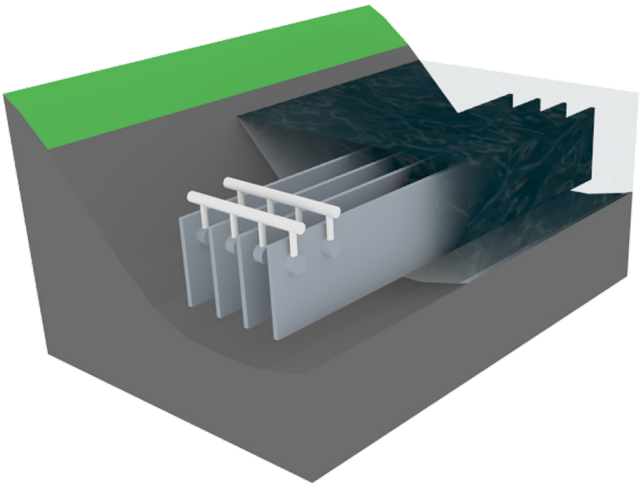
The Energy Blades are not designed to support additional loads other than their own weight and the fluid content. Additional weight loads should not be imposed. Care should be taken to avoid twisting or wrenching the manifold connections during installation.

In fast flowing water care should be taken to ensure that the Energy Blades are anchored so that they will not be displaced.

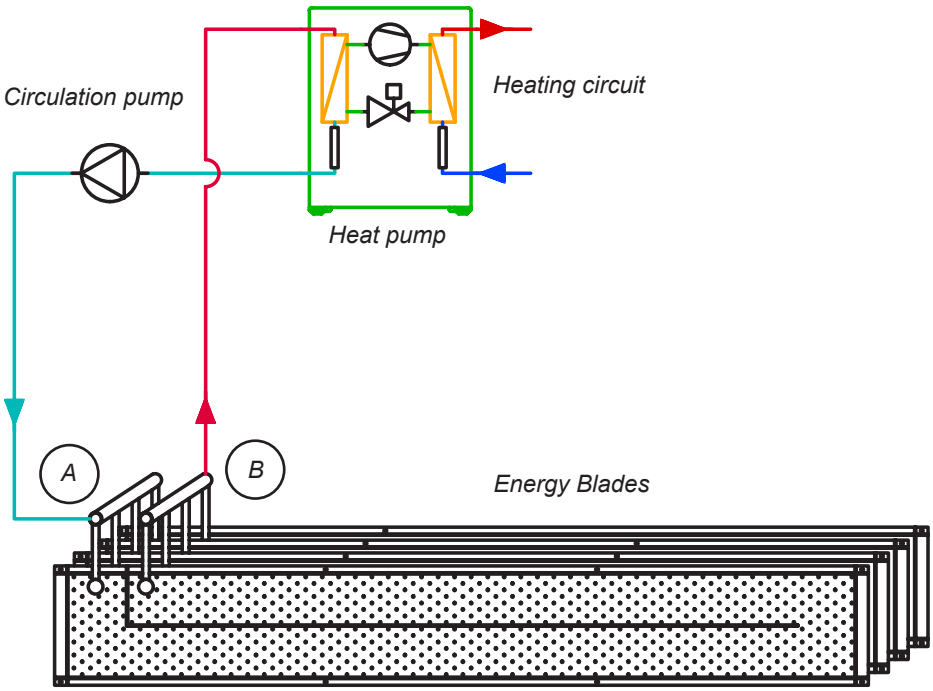
It may also be necessary to protect Energy Blades from debris being washed downstream.

Energy Blades are suitable for use in fresh water. They should not be used in brackish water, sea water or other corrosive environments.

Energy Blades are intended to be used and will perform best when fully submerged in water. Accumulation of silt, weed or debris will adversely affect the performance. We recommend Energy Blades should be inspected periodically so that silt and debris can be cleared. We recommend an annual check and clearance wherever possible.



## Connection diragram




## Connections

The flow connection from the heat pump must be connected to the manifold side A (see diagram). This connects to the lower fluid path on the plates.

The return connection to the heat pump must be connected to the manifold side B (see diagram). This connects to the upper fluid path on the plates.

The flow connection and the return connection must come from opposite ends of the manifold (See diagram).

Unused tails of the manifold should be sealed with end-stops.

Two flow connections and two return connections are provided to give flexibility in connection and to enable cascading multiple units. The limit on the number of units that can be cascaded is the pressure drop. Two units may be a suitable limit.

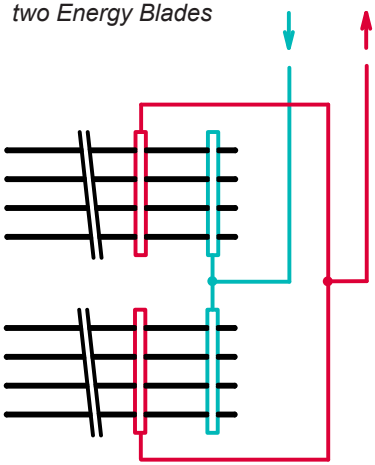
Fittings for connections should be in brass or stainless steel. We recommend steel or brass to plastic adaptors before continuing the flow and return pipe work in MDPE plastic pipe of a diameter suitable to support the flow rate.

Air-vents should be connected in the threaded holes. If the manifold will be submerged these should not be automatic air-vents.

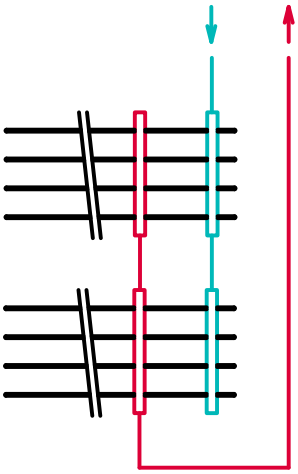
## Connecting multiple Energy Blade units

Diagrams below show some options for connecting multiple Energy Blades.

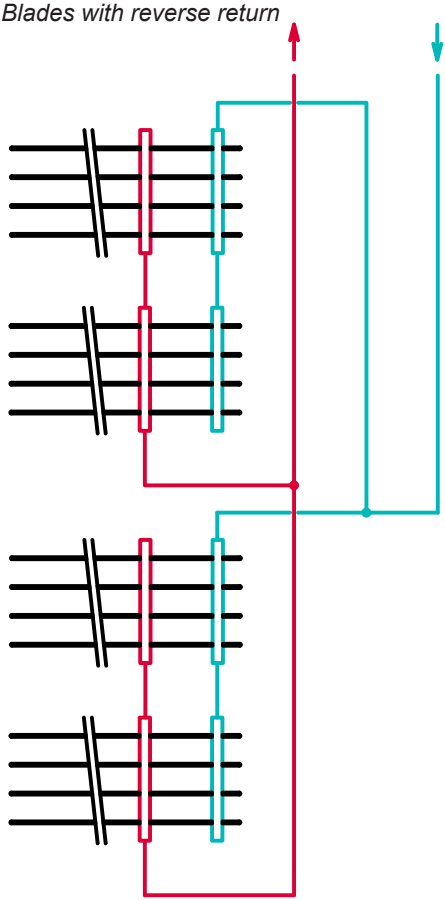
*Preferred method for connecting two Energy Blades*



*Alternate method for connecting two Energy Blades*



*Connecting four or more Energy Blades with reverse return*



## Filling and flushing

The system can be filled and flushed either before or after positioning. Where the manifold will be submerged, it is preferable to flush the system before it is submerged so that air vents can be used to clear accumulated air. Provided the connections have been made as described above and the Energy Blades are installed horizontally, flushing the system of air is normally a straightforward process of circulating the operating fluid until the air is purged.

The system should be filled to a static pressure of 1 to 1.5 bar. In any case the maximum design pressure of the system should not exceed the maximum rated pressure of the Energy Blade. As with any pressurised hydraulic system suitable expansion vessels and pressure relief valves according to applicable regulations should be included in the design.

# Design and Commissioning

## Design conditions

A single Energy Blade (set of four) has been designed to run with a flow rate of 1.2 l/s to give a design flow-return temperature spread of around 3°C and an acceptable pressure loss when using 25% by volume propylene glycol. The actual temperature spread at this flow rate will depend on the capacity of the heat pump that is attached.

If a lower or higher flow rate is achieved in practice, the flow-return spread will vary. The performance of the system will not be substantially affected provided the range of flow rates does not fall much below 0.9 l/s. If it exceeds the design value the main effect will be to increase the pressure drop in the system, possibly requiring a larger circulation pump.

For two Energy Blades connected in series the flow rates should be doubled.

Energy Blades can be combined with other types of heat collector such as boreholes or horizontal ground loops. Designing the hydraulic system to ensure a balanced flow through each collector requires suitable design and techniques for measurement and commissioning.

## Commissioning

Commissioning an Energy Blade system consists of ensuring that:

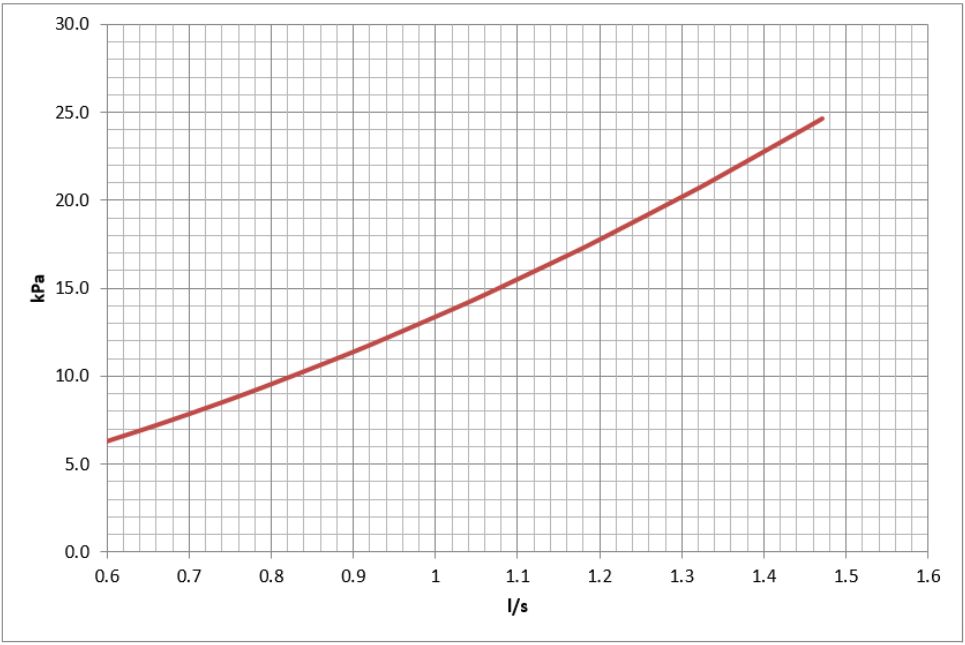
- Air is flushed from the system
- The system holds pressure
- Pressure relief valves are installed and function
- Suitable expansion vessels are installed and have been set to the correct pressure

When the system is switched on the flow rate in the Energy Blades can be measured. If that is not possible the flow and return temperature spread should be checked to make sure it is in the expected design range. If the spread is lower than required the pump speed should be increased or the pressure losses in the system are too high.

The temperature of the heat transfer fluid flowing to the heat pump from the Energy Blade should exceed 0°C at all times even when the water temperature is at itsminimum. This is a requirement of current MCS installation standards. If the return temperature is too low, the system is extracting too much energy given the water flow conditions. Remedial action is to reduce the energy demand or to increase the number of Energy Blades or other heat collectors in the system.

# Pressure loss vs Flow rate

Propylene Glycol R500, 25% aqueous solution by volume at 20°C



# Notes

# Technical Data

| | | |
|---|---|---|
| Dimensions | Length | 3000 mm |
| | Width | 785 mm |
| | Blade spacing | 200 mm |
| | Blade height | 492 mm |
| | Assembly height | 603 mm |
| | Pipe connections | 1 ½ " BSP (male) |
| | Air vent fittings | 3/8 " BSP (female) |
| | Approximate liquid volume | 35 l |
| | Heat exchange surface area (approx) | 11.8 $m^2$ |
| | Heat transfer coefficient † | 200 - 400 $W/m^2/K$ |
| | Heat transfer to glycol based on water flow conditions | Standing 8kW<br>Typical 15kW<br>Fast flowing 20kW |
| | | |
| Operating data | Maximum permissible pressure | 6 bar |
| | Maximum temperature | 95°C |
| | Minimum temperature | -10°C |
| | Maximum glycol concentration | 50% |
| | Minimum glycol concentration | To avoid freezing |
| | Recommended flow rate | 1.2 l/s |
| | Pressure drop at recommended flow rate<br>(25% propylene glycol at 1.2 l/s) | < 25kPa |
| | | |
| Equipment | Mounting holes | Φ 8mm |
| | | |
| Materials | Stainless steel 3042B | 18 gauge |
| | Empty weight (approx) | 85 kg |
| | Propylene glycol: 25% recommended | Sentinel R500C or other equivalent |
| | Ethylene glycols at similar concentration are also useable | |

† Depends on water flow conditions