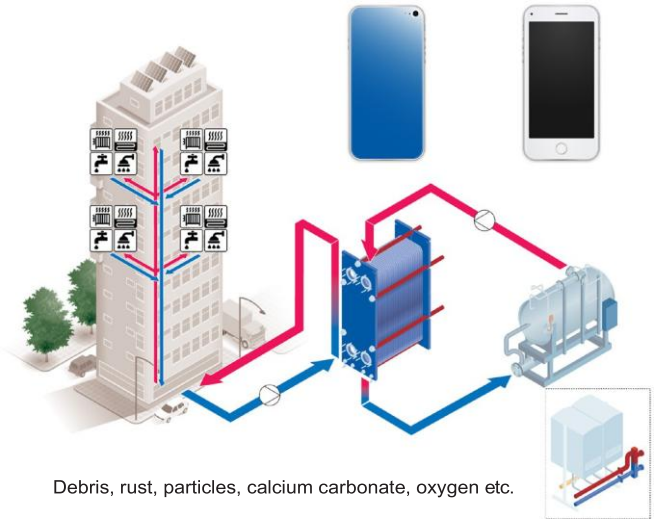
Boiler protection with gasketed plate heat exchangers

Be it new or retrofit, boilers are a major investment in communal living and need protection. Gasketed plate heat exchangers (GPHE) installed between the boiler and the point of use, do exactly that. Protection of the new boiler from harm caused by fouling, debris, calcium carbonate and oxygenated water from the dwelling side.

Without protection, the layer of calcium carbonate scale on the boiler heat transfer surfaces increases fuel costs, exhaust gases released and an overall negative impact to the environment. A boiler with a gasketed plate heat exchanger, is like a smart phone with cover for protection.



Debris, rust, particles, calcium carbonate, oxygen etc.

Sustainability with Alfa Laval gasketed plate heat exchanger protecting the boiler

1. Save with protection from debris

Debris, rust particles, solid matter and calcium carbonate break off's enter the boiler tubes or boiler heat exchanger and block the flow passage increasing electricity costs in pumping. This is especially a concern with small flow passages in cascade boiler heat exchangers, which are difficult to access and maintain.

Alfa Laval GPHE's are fast and easy to open, clean or flush from debris.

2. Save with protection from $CaCO_3$

With Monobloc type, a coating of scale will build up inside the tubes leading to higher fuel costs from resistance in heat transfer. A 1 mm coating is approximately 12% higher fuel bills. With a Cascade type, a coating will build up between the narrow boiler heat exchanger channels. This will result in high fuel costs.

However, another major concern is the growth of deposit over the years, baking rock hard with the high flame temperatures of >1,000°C and eventually crack the SS heat exchanger due to thermal expansion and contraction. Replacement is costly at 80% of the boiler price which does not help sustainability.

In hard water regions, 40% of the installations require costly replacement of the boilers SS heat exchanger within a few years.

Calcium carbonate will attach itself to the hottest surfaces, the hotter the more. Alfa Laval GPHEs restrict the calcium carbonate formation from going to the difficulty of cleaning the boiler. With high turbulence and high velocities, lower temperatures than the boiler flame (1,000°C) and perfect flow distribution across the plate with Alfa Laval CurveFlow™ technology, there will be even less buildup of CaCO3 with Alfa Laval compared to others.

3. Protection from static pressure

Tall building heights cause increased static pressure which the boiler is subject to.

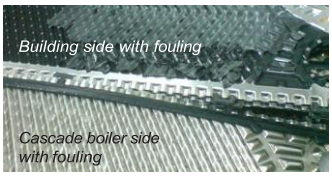
An Alfa Laval GPHE can work as an interceptor with up to 25 bar on the building side and lowest design pressure on the boiler side. Savings in Capital Expenditures (CAPEX) of boiler construction materials and automation helps sustainability.

4. Protection from non-oxygen barrier floor tubing

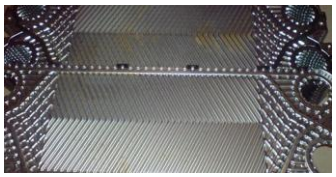
Oxygen permeation is a cause for corrosion in plant equipment due to oxygenated water. Oxygen enters the system at the usage point from radiator flushing or air venting. This will oxidize the water leading to corrosion of the boiler tubes with ferrous oxide. Care must be taken to assure that each component in the system is nonferrous (meaning that it contains no iron).

The Alfa Laval GPHE plates of stainless steel alloy 316 material can easily withstand the harm from corrosive oxygenated water allowing the use of 25% less expensive non-oxygen barrier PEX (Polyethylene Crosslink) pipes for floor heating.

With fast and easy maintenance and access to all surfaces, buildup of calcium carbonate can be mechanically removed within a few hours.



Before cleaning


After cleaning

Boiler protection with an Alfa Laval GPHE is like taking an insurance policy for the boiler. Protects from harm and operation will be lifelong as new for a little as 10% of the investment of the boiler price.

5. Fuel savings

Building A and Building B are equivalent in construction, in the same compound estate, having independent but identical boilers. Tap water heating is via electric heaters per apartment. There is no solar heating available.

Building A has installed an Alfa Laval T5-M GPHE as protection for the gas fired boiler. The debris, oxygen and scale are contained in the building closed loop and does not enter the boiler. The boiler loop has less water and remains clean lifelong. The GPHE is easily maintained annually removing all fouling and scale formation. There is less scale formation as the hard water in the building loop is only subject to 80-90°C and not the flame 300-600°C. Boiler efficiency is maintained at 85%.

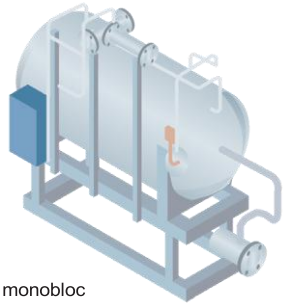

Building A's natural gas heating bill is on average 2,470 euro per year.

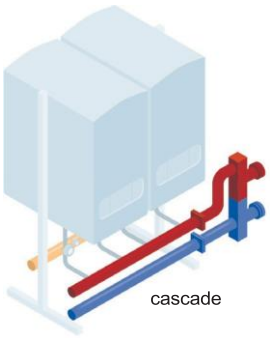
Building B has the heating water of the building circuit, going directly to the boiler. The scale (CaCO3) normally dissolved in cold water is subject to hot flame temperatures of 300-600°C precipitating a lot more from the water. This scale attaches to boiler hot heat transfer surfaces and bakes to a rock hard formation. Boiler efficiency reduced to 75%.


Building B's natural gas heating bill is on average 3,211 euro per year, 30% more!

Boiler comparisons

How water boiler configuration can be a traditional monobloc single large boiler or smaller cascade boilers either wall hung or free-standing, working in parallel.


monobloc


cascade

	Monobloc*	cascade*
Installation	Floor	Floor or wall
Fuel	Coal, LPG, NG	NG
Heat transfer material	Carbon steel shells Carbon steel tubes	Corrugated 316 or 316Ti plate, diagonal or radial
Applications	Large buildings, hospitals, universities, factories	Domestic, offices, dwellings
Types	Water tube or fire tube	Cascade parallel
Operating pressure	3-5 bar	>6 bar
Advantages	Robust, lower Capital Expenditures (CAPEX), plug leaking tubes	SS heater, lower hold-up volume, faster response, flue gas condenses further reheats water 109% efficiency
Disdvantages	Size, footprint, low efficiency, heat losses with radiation and flue gas	Smaller orifices or gap between plates, blockage risks, can only replacement of heat exchanger
Calcium Carbonate effects ($CaCO_3$)	Coating on inner surfaces of tubes, increasing fuel costs	Baking inside SS heat exchanger gap, cracking heat exchanger with thermal expansion
Efficiency	60-70%	109% condensing boiler

* Selection of either in an installation depends on fuel type, capacity need, space available, partial loads etc.

▼ PRACTICAL TIPS

1. Installing an Alfa Laval gasketed plate heat exchanger will provide lower water temperature needed for floor heating applications. The limitation in temperature is due to plastic, PEX floor heating pipes and health and safety issues.
2. The design pressure limitations of cast iron boiler is a maximum of 4 bar.
3. A gasketed plate heat exchanger to a boiler is protection, like a cover for a smart phone.
4. Installation of a balance tank can be avoided, reducing investment costs with an Alfa Laval gasketed plate heat exchanger installed to protect the boiler.