

How the direct boiler feed solution saves money

Grundfos to boiler feed systems: Lose the control valve!

Standard boiler feed systems incorporate a control valve, bypass and oversized pumps. Grundfos takes a unique, direct approach to make installation cheaper and cut annual operation costs by almost 60 per cent.



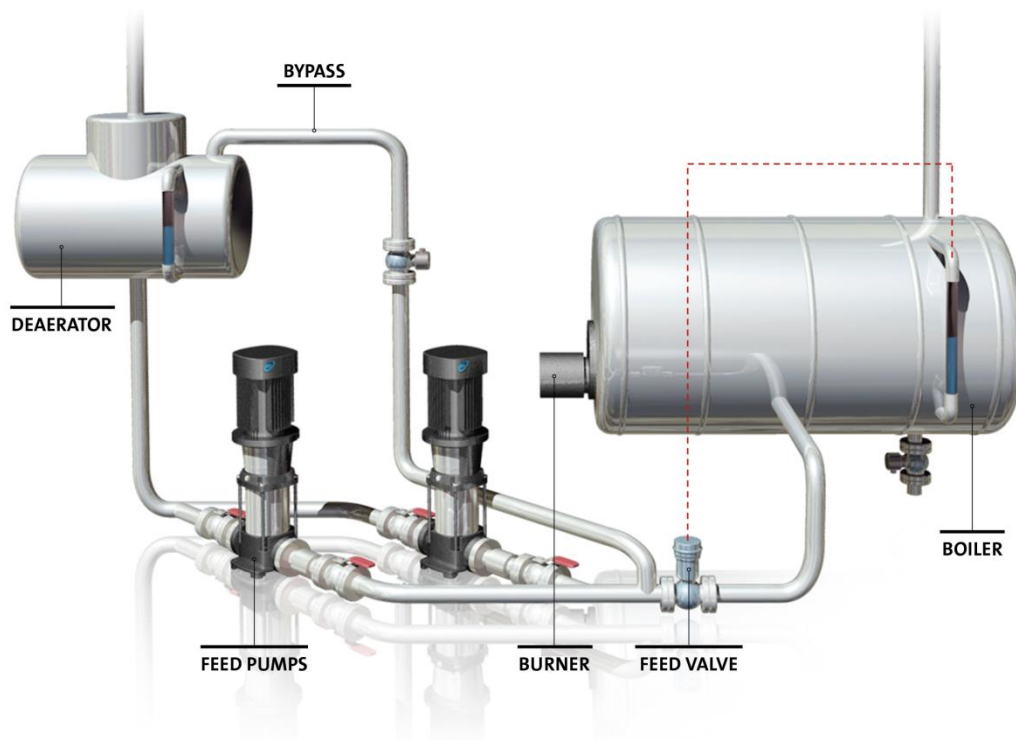
Technical analysis

Grundfos engineers have developed a unique boiler feed system that does not require a feed valve and thus yields huge savings on installation and operation for customers.

The benefits and drawbacks of feed-valve controlled systems

In boiler feed systems via a feed valve (see Figure 1), the water level is controlled by the valve, which in turn is controlled by a level sensor positioned on the boiler. The feed valve controls the water intake, which is adjusted according to steam consumption. This, however, requires that the feed pump is set to 'continuous operation'.

Figure 1: Boiler feed via feed valve



“Undoubtedly, this system operates smoothly and has the benefit of being applicable to steam boilers of all sizes,” says Søren Mortensen, Application Manager for Grundfos Industrial Solutions. “As the amount of water fed into the boiler is proportionate to steam consumption, the risk of over-boiling is minimal, and steam quality remains high due to a constant level in the boiler. A boiler feed via a feed valve with variable speed pumps offers the same advantages plus energy savings on pump operation.”

However, Søren Mortensen identifies three significant drawbacks to these valve-controlled boiler feed systems:

- The feed valve is expensive to buy and maintain.
- Pressure loss across the feed valve means a larger feed pump is needed than would be necessary with a more efficient method.
- The necessary bypass means excess flow and it costs more money to pump that excess water.

“In more advanced and expensive installations, you add a valve on the bypass so that you can shut off the bypass when it’s not necessary,” adds Søren Mortensen. “This adds cost.”

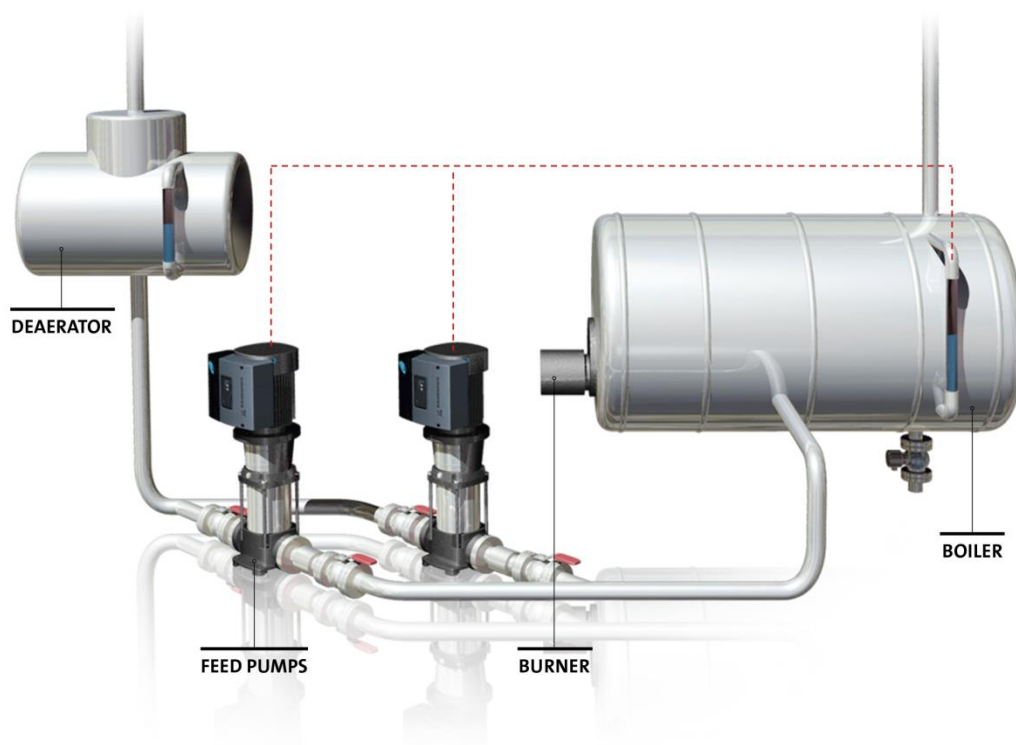
The direct approach

To address these issues, Grundfos took an intelligent, system-oriented approach as part of its [Grundfos iSOLUTIONS program](#).

“We developed the idea of direct feed by looking at the boiler as just an open tank with huge pressure that we had to maintain at a certain level,” says Søren Mortensen. “We thought about the system first and how to get rid of feed valves by using sensors within the system to control the pumps.”

The result was a streamlined system (see Figure 2) in which the water level in the boiler is controlled directly by means of variable speed pump without the use of a feed valve. A level sensor positioned on the boiler serves to control water intake according to steam consumption and a constant water level is thus maintained.

Figure 2: Boiler feed with variable speed pumps without feed valve



“As with feed valve-controlled systems, the valve-free set-up works efficiently with all types and sizes of boilers to minimise the risk of over-boiling,” says Søren Mortensen. “However, while valve-controlled systems suffer from pressure loss across the feed valve, this problem is solved by the direct approach.”

Valve-free savings

Most importantly for customers, the energy-efficiency gains and consequent financial savings of the valve-free solution are considerable as illustrated by the test data below (see Figure 3):

Figure 3: Annual energy expenses with Grundfos direct boiler feed are significantly less than those incurred by boiler feed system with a control valve.

Simple Load profile	100%	1,500 hours/year
	50%	4,000 hours/year
	25%	2,500 hours/year
BOILER FEED WITH CONTROL VALVE	10.2 kW á 1500 hours	15,300 kWh
	7.2 kW á 4000 hours	28,800 kWh
	6.1 kW á 2500 hours	15,350 kWh
Total:		59,450 kWh
Energy expenses	59,450 kWh á 0.05 €/kWh	2972.50 €/year
GRUNDFOS DIRECT BOILER FEED	5.9 kW á 1,500 hours	8,850 kWh
	3.9 kW á 4,000 hours	15,720 kWh
	3.0 kW á 2,500 hours	7,525 kWh
Total:		32,095 kWh
Energy expenses	32,095 kWh á 0.05 €/kWh	1604.75 €/year

The starting point is feeding a steam boiler at a pressure of 10 bar and 12 tons/hour. The power consumption in both cases is from a Grundfos CR pump – direct boiler feed is a CRE15-8 and with control valve it is a CR15-14. Source: Grundfos

“As we can see,” says Søren Mortensen, “the loss of pressure across the feed valve means a boiler feed with this component requires far more power to run at the same level – in this example, 59,450 kWh compared to 32,095 kWh, or 85 per cent more.”

Consequently, the annual energy expenses with Grundfos direct boiler feed are shown to be 46% less than with a valve-controlled system. The cost of valve maintenance adds a further €1,000 per year to the cost of a boiler feed with a valve, raising total annual expenses to €3,972.50, more than double the yearly operational cost of direct boiler feed.

Indeed, the money saved in just one year with Grundfos direct boiler feed would cover the cost of buying the expensive (€1,500-€2,000) feed valve with electrical actuator for the valve-controlled boiler used in this experiment, as Søren Mortensen points out.

Cheaper installation

A boiler feed system without a feed valve and bypass means reduced installation costs.

“With direct feed, the pump will also be smaller than a pump with a feed valve because there is no pressure loss via the valve,” adds Søren Mortensen. “How small a pump can be will depend on pressure, flow and the mandatory safety factors, but it will always be smaller with direct feed, and therefore cheaper.”



Image: For boilers without a valve or bypass, a streamlined system reduces installation and maintenance costs, according to Søren Mortensen, Grundfos Application Manager.

“Installation costs vary across the world, but the higher the pressure, the more expensive the feed valve required. So when higher pressure is required, the savings will be even greater with direct feed.”

Direct feed is not applicable when there are multiple boilers sharing a common feed line, though.

“The pump can only react to one sensor signal,” explains Søren Mortensen. “This situation tends to arise with old factories – for instance, breweries, slaughter houses, dairies, etc. – who produced little steam when they started up, but as they grew they put in another boiler and then another connected to a single feed line. In these cases, we can supply a feed-valve solution. But wherever possible, we offer the direct feed system, which is far more efficient and cheaper to run.”

Summary

For boilers with their own feed line, the advantages of Grundfos direct boiler feed are significant. Without a valve or bypass, a streamlined system reduces installation and maintenance costs.

By eliminating the problem of pressure loss via the feed valve, one can use smaller, cheaper pumps, nearly halving the amount of energy required to power the pumps. These energy-efficiency gains mean a steep fall in annual operation costs.

About Grundfos iSOLUTIONS

Grundfos iSOLUTIONS is a system approach. Grundfos iSOLUTIONS combine the full spectrum of the Grundfos offering, including standard and integrated pumps with controls, sensors and variable frequency drives to create the intelligent solution covering your system demands. This drives down the total cost of ownership of your pump system, while raising the bar in efficient performance.

[Read more about Grundfos iSOLUTIONS](#)