

LAARS Technical Discussion: VARI-PRIME™ Control

Total boiler operating efficiency is a primary focus in the effort to reduce building energy use around the world. The US Department of Energy estimates that heating within both residential and commercial buildings uses 20 to 25% of the total energy consumed in the US each year.*

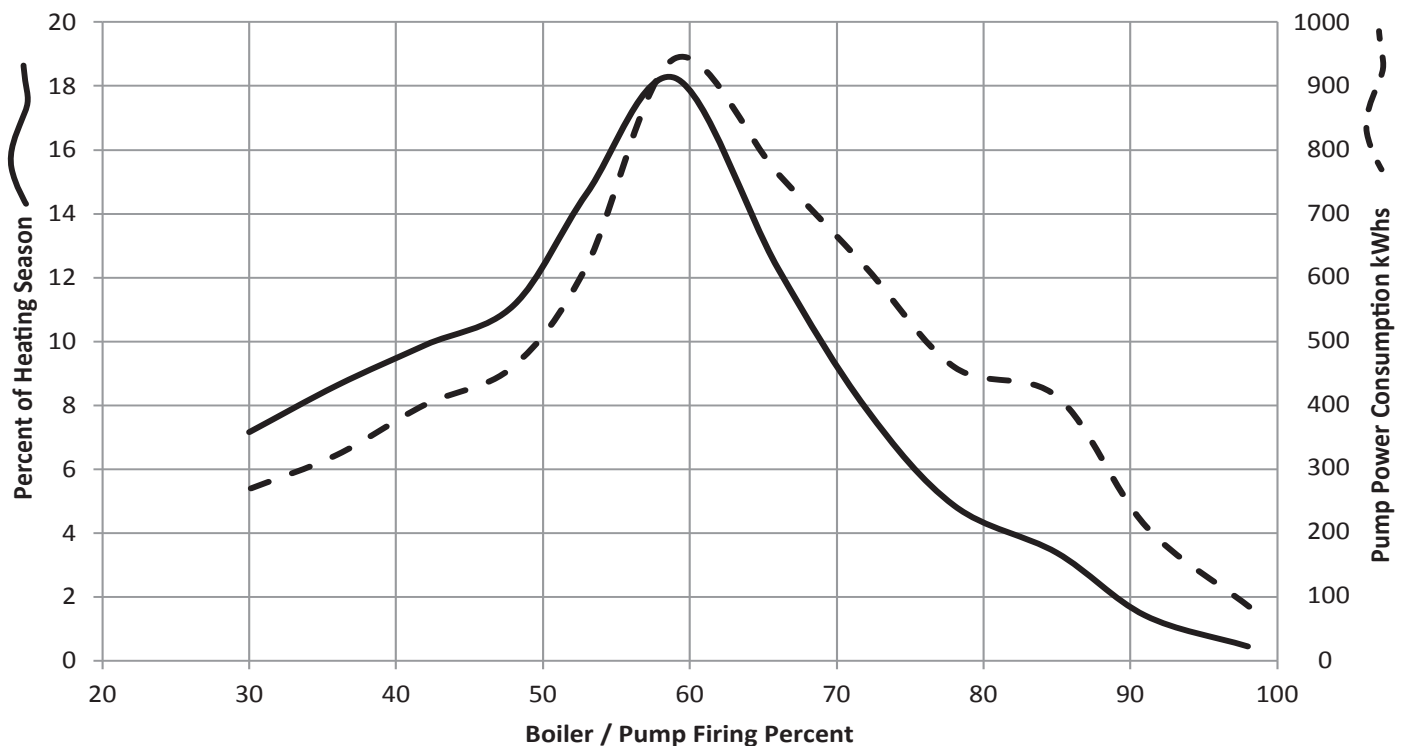
In order to increase efficiency and reduce waste of finite fossil fuel resources, boiler manufacturers developed fully modulating and condensing boilers that do an excellent job of maximizing both boiler electrical (blower) and combustion efficiency. However, there is a third component to installed boiler efficiency that is often overlooked: The boiler pump. A large savings opportunity exists by using a variable speed boiler pump that is load matched to a modulating boiler's combustion system.

The Laars VARI-PRIME™ pump control is the answer to maximizing boiler pump savings. VARI-PRIME™ control logic operates in tandem with Laars modulating boiler combustion controls and the variable speed pumps and drivers that are available on the market today. By bridging that gap and load matching boiler and pump operation, total boiler installed efficiency is realized. It is also the critical component that protects the boiler's heat exchanger by ensuring the variable speed boiler pump remains in phase with the boiler's combustion modulation.

VARI-PRIME™ : Savings at Work

Heating Load Profile

Typical for Niagara Falls, NY, Heating Season Sept 1 - April 30



A typical heating load profile for western New York shows a commercial boiler and variable speed pump rate vs. the variable speed pump's power consumption and kWhs used over an entire heating season. As is evident in the graph, a boiler only fires at full rate for a very small fraction of the year. All other times throughout the heating season the boiler fires at a much lower level.

* US Department Of Energy: Energy Efficiency Trends in Residential and Commercial Buildings Report

VARI-PRIME™ : Savings at Work

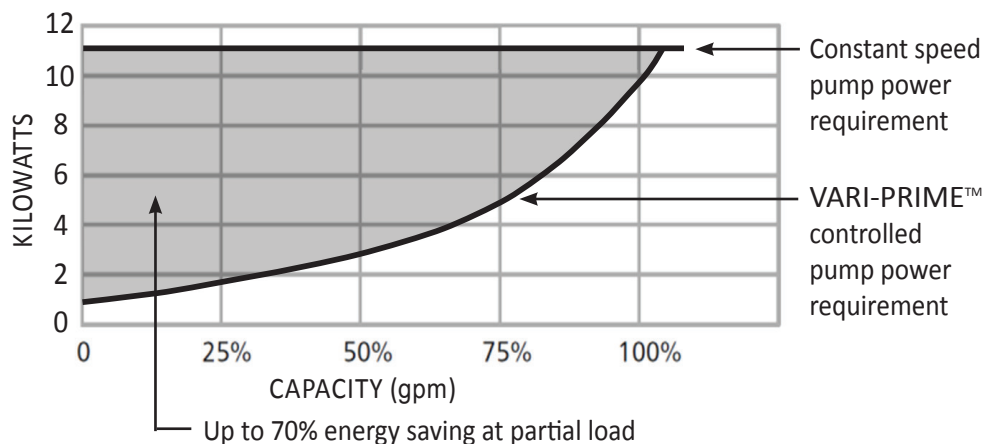
In traditional boiler installations, boiler pumps are sized to match the flow required for boilers firing at full rate. In that scenario, pumps will run at full speed every time the boilers fire, regardless of the actual flow required by the boilers.

A VARI-PRIME™ installation, in conjunction with a variable speed pump, will track the heating profile curve and dramatically reduce the electrical usage of the boiler pump. That's because a variable speed pump's power consumption can drop by as much as 50% with only a 20% reduction in speed.

In this example, the variable speed pump's efficiency and watt usage rate was calculated for each point of operation based on the Heating Load Profile graph (other side) and is shown in the table to the right**. A traditional boiler pump installation in this example would use 18,773 kWh of electricity over the entire heating season. As can be seen, the VARI-PRIME™ configuration reduces the electricity used to a small 5,540 kWh over the same time period. This is a savings of 70%!

Based on today's energy costs vs. the cost of installing a variable speed pump system over a constant speed pump, one can expect a payback within one to two years depending on size of system, heating profile and regional energy costs.

VARI-PRIME™ controls come standard on Laars MagnaTherm condensing modulating boilers and is available as an optional package on the Laars NeoTherm condensing boiler line.



Boiler Output	Percent of Boiler Firing Rate	Percent of Run Time	VARI-PRIME™ Variable Flow kWh
2,850,000	100	0%	---
2,793,000	98	0.4%	82
2,593,500	91	1.3%	208
2,422,500	85	3.1%	411
2,223,000	78	4.5%	458
2,052,000	72	7.3%	614
1,881,000	66	11.3%	762
1,681,500	59	16.7%	943
1,510,500	53	13.4%	617
1,368,000	48	10.2%	459
1,197,000	42	9.1%	399
1,026,000	36	7.9%	320
855,000	30	6.6%	266
Total Energy Consumed with Traditional Constant Speed System			18,773 (kWh)
Total Energy Consumed with VARI-PRIME™ System			5,540 (kWh)
Total Boiler Pump Energy Savings with VARI-PRIME™ System			13,233 (kWh)
Average Cost per kWh in US***			\$0.107
Annual VARI-PRIME™ Electrical Cost Savings			\$1,417

** A Laars 3,000,000 BTU/hr MagnaTherm Boiler with on-board VARI-PRIME™ controls in conjunction with a Xylem SSH pump and Hydrovar drive package was used in this example.

*** Source: US Energy Information Administration, 2013