# Expand the Possibilities

# Front End Loading

SMART SYSTEM™

SMART TOUCH™

- Maximize Seasonal Efficiency
- Built-In — Requires No Additional Boiler or BMS Controls
- Lower Up-Front Equipment Cost
- Lochinvar Proven Performance

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

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# Front End Loading

***A boiler or water heater plant comprised of condensing and non-condensing appliances is a great way to lower up front investment while reaping the benefits of high efficiency modulating, condensing appliances.***

***Until now achieving a budget friendly Front End Loading System has required an external control that can be both expensive and complicated to setup and service. Lochinvar's Smart System™ now has the ability to achieve this Front End Loaded or "Hybrid" system with no need for additional add-on controls. Crest, Knight, Copper-Fin II and Power Fin Boilers as well as Armor and Copper Fin II Water Heaters can communicate through their built-in cascade to provide a front end loaded plant.***

***Think of the possibilities, Crest Boilers Communicating with Copper-Fin II or Power-Fin Boilers or Armor Water Heaters Communicating with Copper-Fin II Water Heaters using their standard controls.***

## Equipment Savings

***For Example let's use Copper-Fin II and Crest Boilers in a commercial heating application with a demand of 4,000,000 BTU/Hr.***

The load could be met using two (2) FBN2000 Crest Boilers

*or*

One (1) Crest FBN2000 could be paired with one or more (1+) Copper-Fin II Boilers to significantly lower the up front equipment cost.

*Please contact your local sales agent to discuss equipment combinations to meet specific job requirements.*

## Sequence of Operation

SMART SYSTEM™ SMART TOUCH™

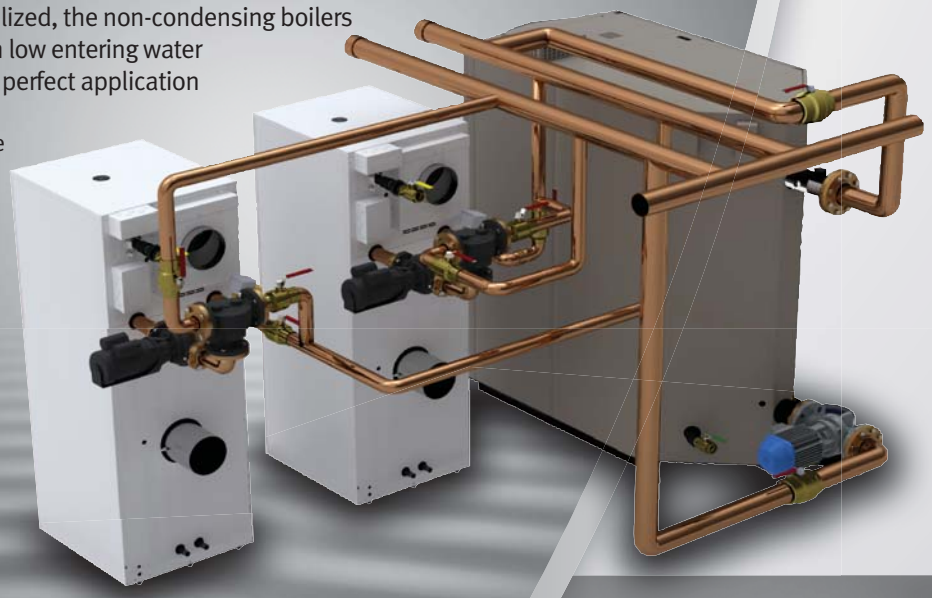
Lochinvar's Smart System and Smart Touch is the key. In order to maximize the efficiency of the equipment in a front end loading installation the condensing boilers will be brought online first. Non-condensing boilers will be enabled only when demand significantly increases.

If there are boilers of differing input the smallest condensing boiler(s) in the plant will act as the lead. Once the load is greater than the capacity of the small condensing boiler(s) the cascade will enable larger condensing and non-condensing boiler(s) sequentially to meet the load. By using the small boiler(s) as the lead it allows fractional loads to be met with the precise amount of boiler power.

## Water Piping

When utilizing the Front End Loading Capabilities of the Lochinvar Smart System it is necessary to pipe the boilers utilizing a Primary/Secondary arrangement. The use of Primary/Secondary piping allows the boilers, no matter what make or model, to operate without system flow interference.

When outdoor reset is utilized, the non-condensing boilers should be protected from low entering water temperatures. This is the perfect application for Lochinvar's LTV valve. (See Low Temperature Valve literature for details)



## Seasonal Loads and Efficiency

*Building heating load is variable and is based on many factors including outdoor temperature. As the outdoor temperature drops the heating load increases, conversely, as the outdoor temperature rises building heating load decreases. Typically the heating plant is sized for the coldest temperature that will be seen during the course of the year, but as the Figure 1 shows the coldest temperatures occur infrequently throughout a heating season. Why design a boiler plant for such an infrequent situation?*

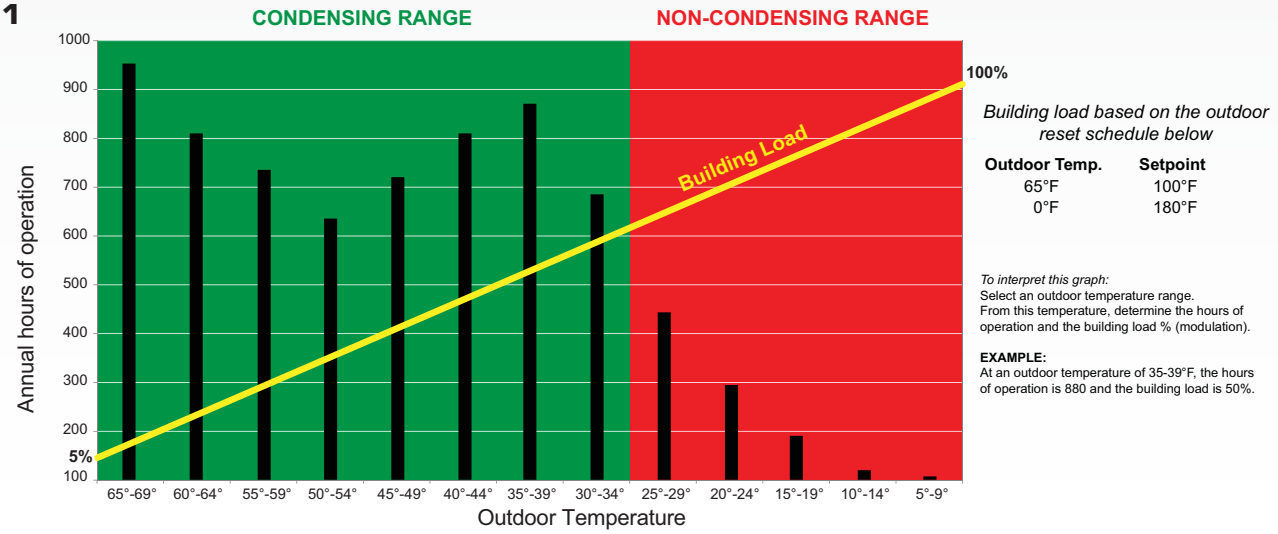
Designing a boiler plant with Front End Loading allows the plant to be sized to precisely meet the most frequent loads with maximum efficiency. In the example shown 90% of yearly heating hours occur when the outside temperature is above 30°F. This means that 90% of the time the heating loads can be met with cooler water temperatures and with a fraction of the boiler plant capacity. By utilizing a front end loaded system and outdoor reset, boiler efficiency can be maximized by operating condensing boilers during times of fractional load and bringing on non-condensing boilers as load increases.

Additionally, **Figure 1** shows that approximately 950 heating hours per year require less than 10% of the maximum boiler plant capacity. With Front End Loading and the Smart System's ability to mix boilers of different sizes exceptional boiler turndown and maximum efficiency can be achieved no matter how large or small the building load.

Outdoor reset is designed to lower heating water temperatures as the outdoor temperature rises and load decreases. By utilizing the outdoor reset built into each Smart System control, boiler efficiency will be maximized. Please reference the efficiency chart in **Figure 2**. As the chart indicates, boiler efficiency is driven primarily by entering water temperature; modulation rate is also a contributing factor. Keeping in mind that 90% of all heating hours typically require water temperatures in the condensing range it makes sense that a front end loading system with condensing boiler(s) be utilized to maximize boiler efficiency.

## Outdoor Reset Curve

**Fig. 1**

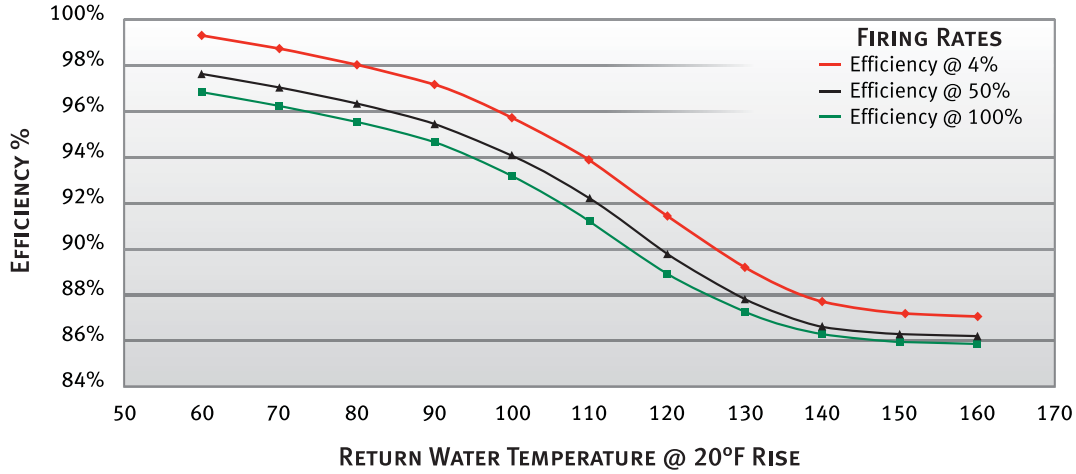



*90% of hours are in condensing range*
*60% of load is met by condensing temperatures*
*40% of boiler plant capacity will be used less than 20% of the time*

Chart based on historical weather data in the North Eastern U.S.

## Efficiency Chart

**Fig. 2**



## Maximize Turndown

The Smart System has the capability to maximize seasonal efficiency and meet minimal loads effectively during shoulder seasons such as the Spring and Fall. This is possible because the control has the ability to communicate with boilers of not only different efficiencies, but also different BTU/Hr inputs.

***For example let's assume that a building has a design day heating load of 800,000 BTU/Hr.***
This demand can easily be met with (2) non condensing Copper-Fin II,
CHN401's with a minimum input of 250,000 BTU/HR each. The total turndown for this boiler plant is 3.2:1.

If one of the Copper-Fin II boilers was replaced with a Knight, KBN400, Condensing Boiler with 5:1 turndown the minimum BTU/Hr input of the boiler plant would decrease from 250,000 to 80,000.

That is a turndown increase of 6.8:1, for a total plant turndown of 10:1.

See the combinations below for complete capabilities.

## Current equipment selection combinations include:

With this feature there are some limitations as to the combinations of heaters that can be utilized in a front end loaded system. Please refer to the charts below for equipment selection combinations or configurations.

### Different Size Knight or Armor

| KNIGHT Input (MBH) | Will Work With These Inputs (MBH) |
|---|---|
| 50/55 | 50 - 155 |
| 80/85 | 50 - 285 |
| 105/110 | 50 - 285 |
| 150/155 | 50 - 500 |
| 199/210 | 80 - 700 |
| 285 | 80 - 800 |
| 399 | 150 - 800 |
| 500 | 150 - 800 |
| 600 | 199 - 800 |
| 700 | 199 - 800 |
| 800 | 285 - 800 |

### Knight/Armor with Copper Fin II

| KNIGHT/ARMOR Input (MBH) | Will Work With These Copper Fin II Inputs (MBH) |
|---|---|
| 50/55 | - |
| 80/85 | - |
| 105/110 | - |
| 150/155 | - |
| 199/210 | - |
| 285 | - |
| 399 | 400 - 990 |
| 500 | 400 - 1800 |
| 600 | 400 - 1800 |
| 700 | 400 - 1800 |
| 800 | ALL |

### Different Size Copper Fin II

| Copper-Fin II Input (MBH) | Will Work With These Copper Fin II Inputs (MBH) |
|---|---|
| 400 | All |
| 500 | All |
| 650 | All |
| 750 | All |
| 990 | All |
| 1260 | All |
| 1440 | All |
| 1800 | All |
| 2070 | All |

### Crest with Power-Fin

| Crest Input (MBH) | Will Work With These Power-Fin Inputs (MBH) |
|---|---|
| 1500 | ALL |
| 2000 | ALL |
| 2500 | ALL |
| 3000 | ALL |
| 3500 | ALL |
| 4000 | ALL |
| 5000 | 750-2000 |

### Crest with Copper-Fin II

| Crest Input (MBH) | Will Work With These Copper-Fin II Inputs (MBH) |
|---|---|
| 1500 | ALL |
| 2000 | ALL |
| 2500 | ALL |
| 3000 | ALL |
| 3500 | ALL |
| 4000 | ALL |
| 5000 | ALL |

### Crest with Knight

| Crest Input (MBH) | Will Work With These KNIGHT Inputs (MBH) |
|---|---|
| 1500 | 80 - 800 |
| 2000 | 105 - 800 |
| 2500 | 199 - 800 |
| 3000 | 199 - 800 |
| 3500 | 285 - 800 |
| 4000 | 500 - 800 |
| 5000 | 700 - 800 |

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