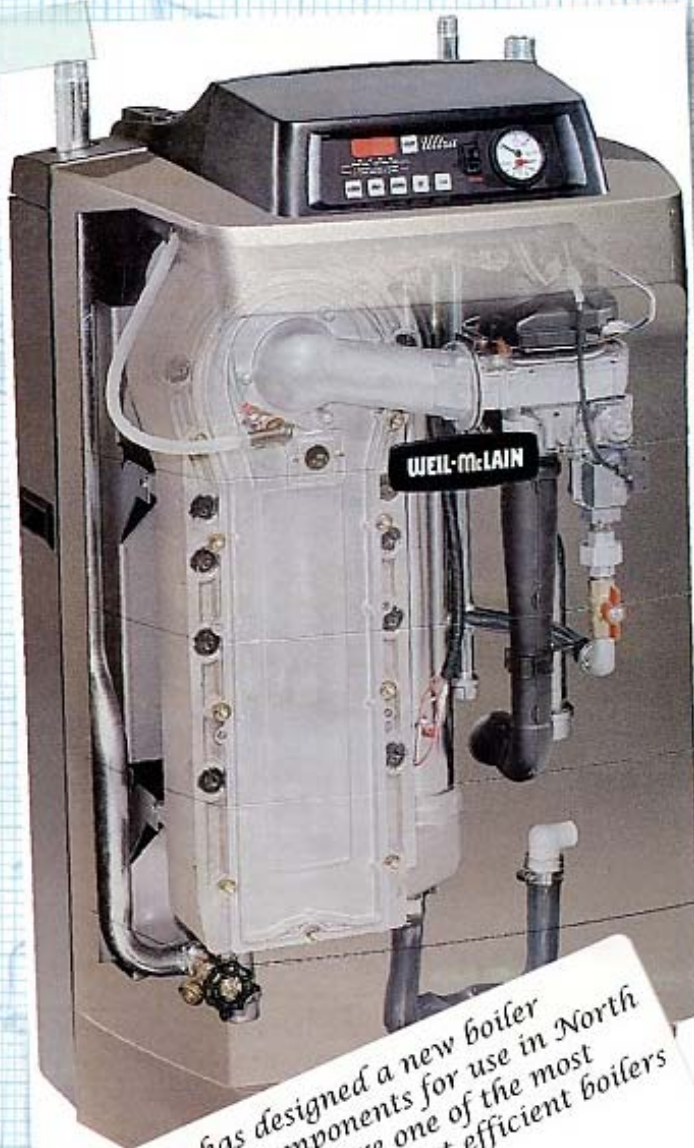


# WEIL-McLAIN<sup>®</sup> with PhD PRECISION HYDRONIC DATA technology<sup>®</sup>

PhD, Precision Hydronic Data, is an intelligent system that delivers Precision Hydronic heating and domestic hot water needs while maximizing efficiency by measuring and responding to the Data parameters of your heating system.

PhD technology is built around proven, engineered components that have been in operation for many years. Key components include:

- ◆ Combustion control components:
  - ◆ Negative-regulated gas valve that Precisely delivers gas to the boiler.
  - ◆ Venturi mixing body that Precisely mixes air and gas for high efficiency.
  - ◆ Variable speed motor that matches combustion output to heating needs.
  - ◆ Boiler intelligence with a control that maintains proper, efficient and Precise Hydronic heat via inputs of all system Data.
- ◆ Mono-block aluminum heat exchanger with demonstrated successful service for over 15 years.
- ◆ Pre-mix burner used for many years in top-of-the-line boilers.



Weil-McLain has designed a new boiler combining these components for use in North America. The results are one of the most advanced, most reliable, most efficient boilers available.

**Ultra**  
with PhD PRECISION HYDRONIC DATA technology<sup>®</sup>



[weil-mclain.com](http://weil-mclain.com)



## Key features of breakthrough PhD technology:

### Intelligent combustion control

#### Variable Firing Rate

On-off cycling in an appliance has drawbacks. Most heating appliances operate in two modes, on and off. Boilers are sized by installing contractors and engineers to deliver heat for the 'worst case' conditions. By definition, the boiler has too much heating capacity most of the time. Since Hydronic heating systems have the advantage of zoning to provide heat only to spaces that require it, the boiler is probably 'too big' nearly all of the time. When a boiler is too big it puts more heat into the Hydronic system than it needs. This causes the boiler to shut off when the high temperature limit setting is reached. The pump keeps running and the heat remaining in the Hydronic distribution system is transferred into the living space. As this happens the system temperature drops below the limit setting and the boiler restarts. This process continues, on, off, on, off....



The *Ultra* boiler with PhD technology has the capability to modulate the firing rate, down to 20% of the input. This allows the boiler to run longer and Precisely meet the heating requirements. This intelligent operating management system has important advantages:

- Each time the boiler starts and stops, relays open and close, motors and valves start and stop. This is the most 'stressful' part of their operation. Fewer starts and stops result in longer boiler and component life.
- Fewer cycles means lower operating cost.

With variable firing rates, efficiency can increase. Boiler efficiency is simply the amount of heat produced from the fuel that is transferred to the Hydronic distribution system. It is not the heat lost out of the ventilation system.

So how does variable firing rate increase efficiency?

When the *Ultra* Boiler changes the firing rate to meet heating demand, the heat exchanger surface area per BTU goes up, therefore efficiency goes up. Keep in mind that this is true as long as combustion air and fuel are mixed properly. Lower technology combustion systems do not properly control the amount of air that is used for combustion. Reduced firing rates that do not control the proper ratio of air and fuel are actually less efficient at lower firing rates due to the increased excess air. PhD technology Precisely measures the system Data and maintains an optimal air-and-fuel ratio at all firing rates, which in turn maximizes efficiency.

System temperature also affects efficiency. As system temperature goes down, efficiency is gained. PhD technology Precisely measures the outside temperature and the system temperature, adjusting the firing rate to maintain the minimum water temperature required to meet the heat demand.

PhD technology does it all. The boiler Precisely measures outdoor temperature, water inlet temperature and water outlet temperature, while remembering the duration of the last operation cycle. Using this Data, the optimum firing rate is chosen. The result is the best system operation possible with maximum efficiency.

With PhD technology, the homeowner benefits from the lowest operating costs available along with a longer-life boiler. In fact, the *Ultra* Boiler operating at 90° F inlet temperature has a LTAAE (Low Temperature Application Annual Efficiency) of 98%... the highest in the world.

low-fire



high-fire





## Proven air and gas flow sensing technology

The same Data collected to optimize efficiency allows for simpler design and operation. **PhD technology** uses an advanced combination of combustion control components. The gas valve is combined with a venturi air fuel mixing body.

- Without air flow, gas is not pulled into the mixing body, eliminating the need for a pressure switch and simplifying operation and troubleshooting.
- Fuel changes become a snap. Simply install the fuel orifice supplied with the *Ultra*. This changes the operation from natural gas to propane in a few minutes with no other adjustments.
- No product changes, adjustments, or kits are required for high-altitude applications. **PhD technology**, again Precisely measuring Data, adjusts for changes in air density at higher altitudes.



## Proven water temperature sensing technology

**PhD technology** Precisely measures the water temperature Data going into and out of the heat exchanger or 'block'.

- This allows the high-limit control and operating temperature to be Precisely measured. No additional limit device is needed.
- Low water and low flow protection is also provided.
  - If the flow is restricted, **PhD technology** reduces the firing rate until operation is satisfactory. The amount of heat available is lowered, but this is superior to most flow measurement shut-off devices that simply turn the boiler off, running the risk of no heat in the winter.
  - If the water temperature sensors indicate no water is present, **PhD technology** shuts down the boiler, preventing damage.

## Outdoor reset with supply temperature boost

With the included outdoor temperature sensor installed, **PhD technology** will regulate the target system temperature, based on the outdoor temperature. The colder it is outside, the warmer the supply temperature will be. **PhD technology** will increase the target temperature 18°F after 10 minutes of continuous operation. This 'boost' in temperature enables the control to adjust the target temperature dramatically for larger heating loads. The boosted target temperature is then reduced 2°F for each minute after the call for heat ends, allowing the control to return to a 'standard' target temperature for the next heat demand. The result is a Precise target temperature setting for fast and comfortable heat delivery.



## Continuous system monitoring

System problems are handled intelligently by **PhD technology**.

- ♦ Soft lockout. Some conditions warrant display, but only temporary system shutdown, such as if the target temperature is exceeded or ignition is not achieved on the first try. **PhD technology** will display this information, but will continue to operate the boiler.
- ♦ Hard lockout. Other conditions are severe enough to warrant shutdown of the boiler until corrected and the boiler is manually reset. These include the boiler failing to light after five tries or the outlet water temperature exceeding 210°F.

## Alarm functionality

A kit is available that includes an alarm module, wiring harness, and bracket that provides relay contacts that close on any hard lockout. With this additional equipment, **PhD technology** can remotely indicate if a problem has occurred.

## Freeze protection

Even if the thermostat is set back or heat is turned off at the thermostat, **PhD technology** senses if the temperature is too low and then cycles the boiler to prevent freeze-ups. If the water temperature drops below 45°F, the circulator is turned on. If the water temperature drops below 37°F, the boiler fires. Once the system temperature exceeds 50°F, the boiler and circulator turn off.

## Sealed combustion

The combustion process requires air and fuel to mix. Most common heating appliances use air from the living space. As this air is pulled from the living space, it not only causes drafts, but much more cold air is pulled in than is needed for combustion. Additionally, when wind is blowing, the pressure difference between the wind blowing on the side of the building and the vent causes cold air to come into the living space. This reduces the 'building efficiency,' increasing fuel bills and sacrificing comfort.

Sealed combustion has an additional air pipe connected from the outside of the building to the boiler.

- ♦ Less cold air infiltration increases 'building efficiency'.
- ♦ Air from inside the house may contain material that can damage the boiler. Detergents, spray cans, bleach and many other materials contain chlorine and other halogens that can form destructive acids inside the boiler. Air drawn in from the outside eliminates this inside contamination, increasing the life of the boiler.
- ♦ Air inlets are a source of noise in the living space. Sealed combustion is quieter.





## More domestic hot water at lower cost

PhD technology operates the boiler at reduced firing rates to maximize efficiency and running time. Also, when the domestic hot water tank has a heat demand, the boiler circulator is shut down and the boiler supply goes to maximum, providing priority for hot water and faster response. Part of the *Ultra* line is the *Ultra* PLUS indirect-fired water heater. This offers many advantages over a separate, gas-fired water heater.

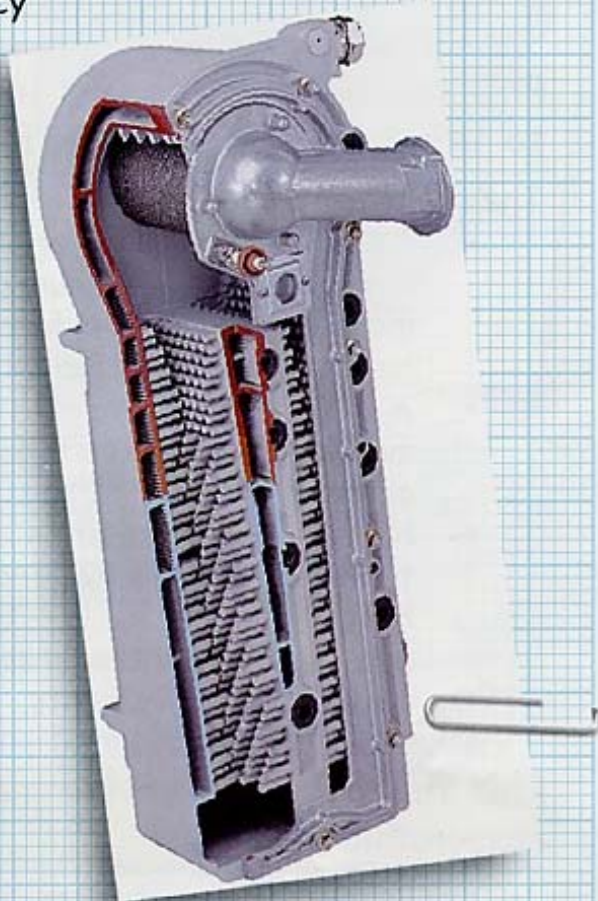
- More domestic hot water when you need it
- Much more efficient than typical high-efficiency water heaters
- Longer life than typical water heaters

## Summer/winter switch

For summer operation to meet domestic hot water demands, an external switch can be installed. When set to 'summer,' the boiler operates to a fixed setpoint, optimizing performance for providing domestic hot water.

## Advanced mono-block cast aluminum heat exchanger

- PhD technology uses a low-mass aluminum heat exchanger with less water. This reduces the input required to heat up the boiler.
  - When the boiler heats up faster, it can provide heat to the system more quickly. This is especially important when the boiler is combined with an *Ultra* PLUS water heater. More hot water is available more quickly with PhD technology.
  - Stand-by losses are less with a low-mass product, reducing heating bills.
- Radiant-friendly design. The *Ultra* is designed for low-temperature radiant applications. In fact, the lower the system temperature, the more efficient PhD technology becomes. The combination of radiant and an *Ultra* PLUS water heater is one of the most efficient and comfortable systems available. Set the control limit for low temperature radiant heating. With domestic priority, the PhD system knows to increase the firing rate and take care of the hot water demand.
- The heat exchanger was designed in conjunction with one of the most experienced design firms in the world, having specialized in high efficiency aluminum heat exchanger design for over 15 years.
  - The cast aluminum heat exchanger is designed to operate in low-temperature condensing mode.
  - This mono-block design eliminates the need for seals between sections.





## Advanced PhD technology blower motor

The blower motor used in the *Ultra* combined with the *Ultra* boiler's high-efficiency offers many advantages. High efficiency means lower flue temperatures.

- Low flue temperatures allow the use of common inexpensive PVC or ABS materials. These materials are readily available and are easy to cut and glue.
- The high capacity blower motor provides high static pressure. Vent runs of up to 100 equivalent feet are possible, some of the longest in the industry. If you have a difficult installation location, these long vent runs can save a job.

## PhD technology uses the jacket to bring air to the *Ultra* Boiler

The advantages are:

- Cold air circulates over the outside of the aluminum casting, increasing heat transfer to the heating system. Efficiency goes up.
- A sealed system isolates air and motor noise. The installation is quieter.
- No fiberglass insulation is needed to insulate the jacket from the heat exchanger.
- Low jacket temperatures mean low clearance requirements.



## PhD technology is environmentally responsible

- High-efficiency boilers burn less fuel to do the heating job. At up to 98% efficiency (in low-temperature applications), the *Ultra* boiler is one of the most efficient. Less fuel means less greenhouse gases are produced. The difference between the production and exhaust of greenhouse gases from an 82% efficient appliance compared to the *Ultra* boiler can equal the loss of 15 full-grown trees.
- Ultra low NOx production. PhD technology provides much cleaner combustion, and the proven high-tech burner produces less NOx. The *Ultra* boiler exceeds all current environmental codes.



PhD PRECISION HYDROGEN DATA technology

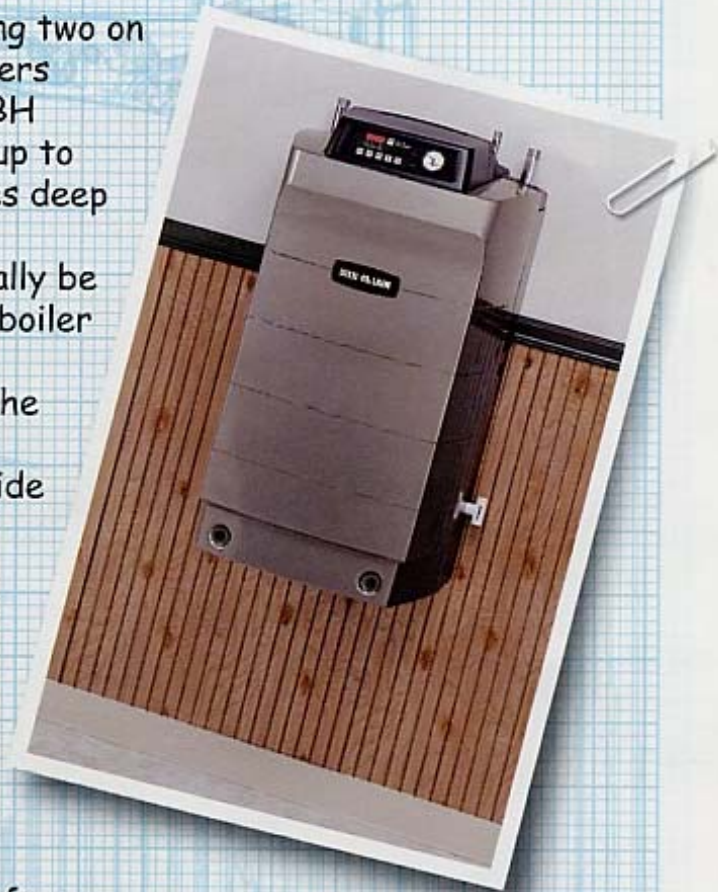
[www.weil-mclain.com](http://www.weil-mclain.com)



## Installation and service features

PhD technology has the installer in mind:

- Small footprint. *Ultra* boilers are designed to minimize floor space. All the piping and connections are on the top of the boiler. You can place the *Ultra* boiler in a 'nook' that is only a few inches wider than the boiler. The jacket opens from the front, allowing access to all service needs.
- If floor space is unavailable, hang it on the wall. An inexpensive wall mount kit is available. The *Ultra* boiler has been designed to easily convert all water and gas piping to bottom outlets.
- Dual mounting is ideal for multiple boiler installations. Put two on the floor and hang two on the wall above them. Four *Ultra* 230 boilers installed in this fashion provide a 920 MBH system with variable firing, efficiencies up to 98%, in a floor space as small as 24 inches deep and 4 feet wide.
- PhD technology allows the *Ultra* to literally be installed without opening the jacket. The boiler comes pre-wired and all the piping and electrical connections are on the top of the boiler.
- A service receptacle is provided on the side of the *Ultra*. The service switch on the front of the unit turns off power to the boiler, but not to the service receptacle. You have power for a trouble light, voltmeter or other small tools. Additionally, you do not need to run special wiring for a condensate pump, simply plug it in.
- Diagnostic capabilities.
  - Fixed high-fire and low-fire settings for troubleshooting and testing.
  - PhD technology provides full internal error checking and will display all error codes and lockouts through the display. In addition, all sensor readings can also be monitored through the display to aid in troubleshooting.



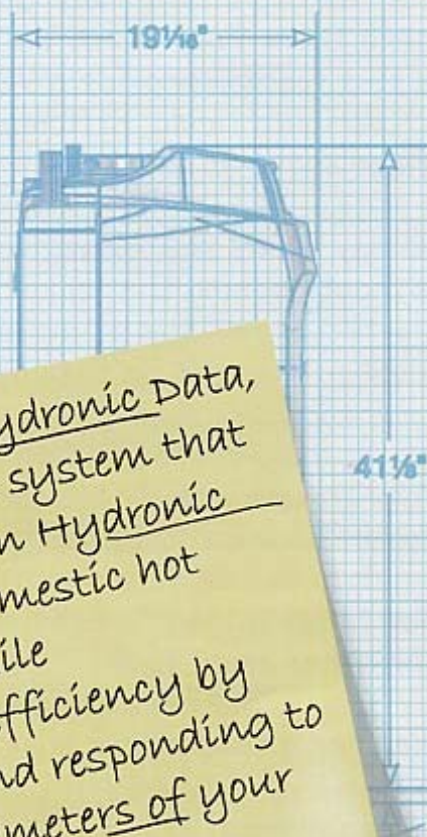
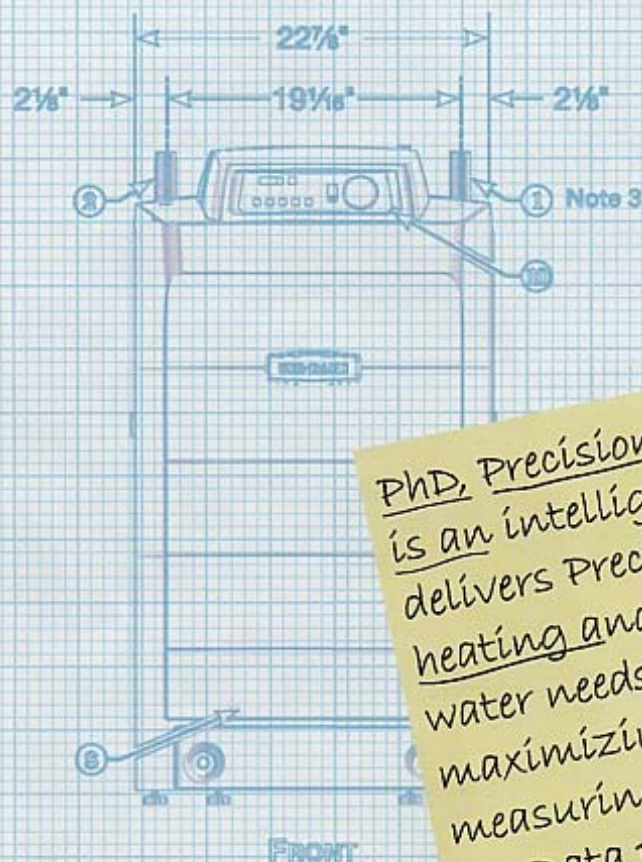
## Future of PhD technology

Being the best is good, but Weil-McLain is committed to making this technology even better. Future developments will allow the contractor to communicate with the boiler, to learn what is happening - and more importantly, what has happened - within the boiler system, thus determining the quickest path for troubleshooting the system and making the operation more efficient.

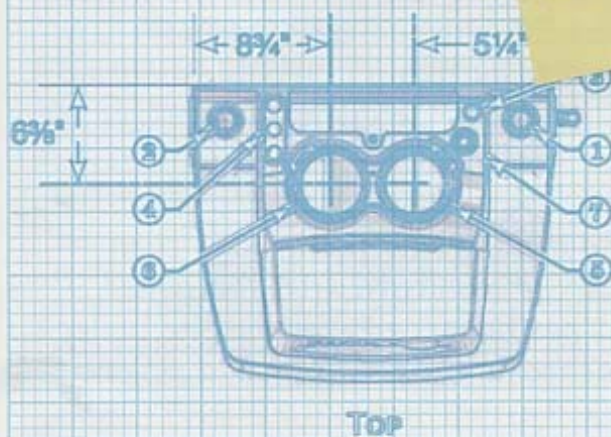




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