WARE
ALL WAYS STEAM
THE GRIME
WINTER 2024 Newsletter

Warm Up to Heat Tracing

By Steve Taylor

You may have noticed that the weather is turning colder lately. That means you need to start thinking about what's going to happen to your boiler when the really cold weather hits, especially if it's a rental boiler. Boilers are all about heat, and the last thing you want is any sort of ice in or around them. It's important, then, to know about heat tracing, and why it's crucial for your boiler's performance and longevity.

NOTHING NICE ABOUT ICE

If ice is allowed to form in your boiler, a lot of bad things can happen. Ice in the pipes will cause the water supply to slow down and eventually stop, which means your boiler won't have any feedwater coming in. Since water expands as it freezes, ice can also cause pipes to stretch, crack, or break. Unfortunately, that kind of damage isn't always as obvious as a visible crack. If a pipe gets strained or stretched without cracking, it's essentially just a weak spot waiting to turn into something worse down the line.

If a boiler vessel is ever allowed to ice completely, that's pretty much a worst-case scenario. An iced boiler is done for, end of story. It needs complete replacement, because the drums or pressure vessel have probably been stretched. Which means if it's put under pressure again, it could very well fail or vent hot steam into the operating area.

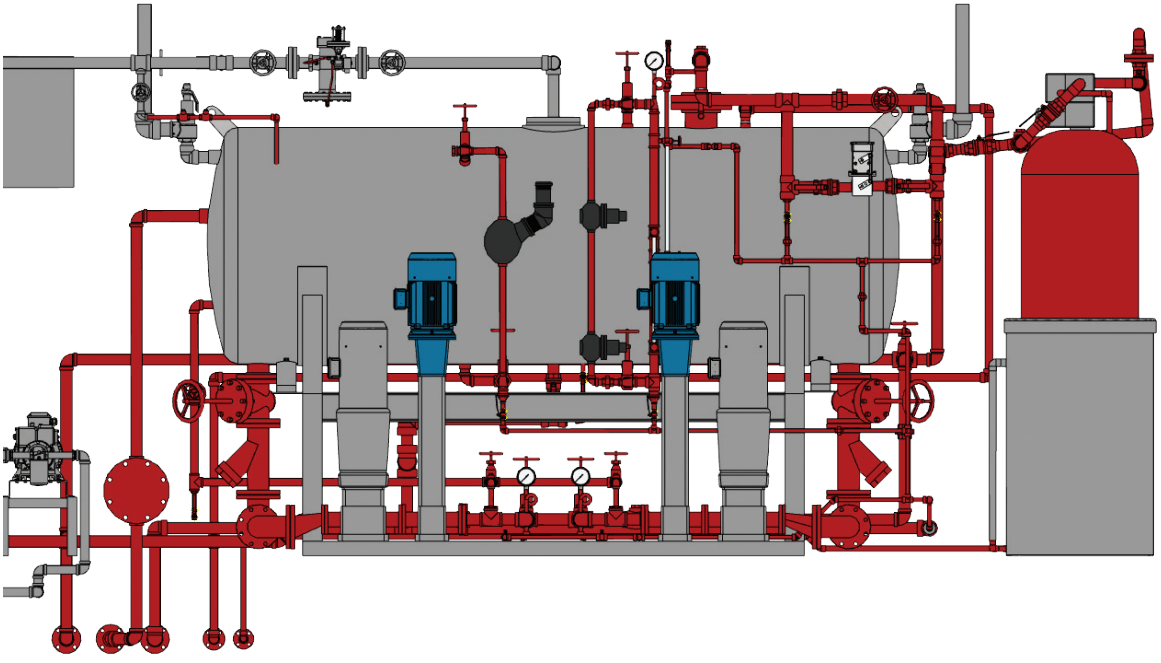
THE HEAT IS ON

Heat tracing involves putting warming strips along your boiler's exposed pipes to keep them warm enough so ice cannot form. It's used in conjunction with insulation to keep your pipes free from ice all winter long. The heat tracing generates the heat, the insulation holds it in, and the boiler keeps working.

The warming strips used for heat tracing are basically resistor strips that use electricity to generate heat similar to an electric blanket or the burner on an electric stove. For proper heat tracing, several different resistor strips are used in conjunction, each with its own thermostat. To avoid wasting heat and electricity, the strips aren't turned up very high, they're usually just kept warm enough to keep the ice from forming, somewhere around 45 degrees. Because honestly, as long as the water can move about freely, it's going to get a lot more heat once it hits the boiler.

INSULATION ISN'T ENOUGH

While insulating your pipes is extremely important, it won't completely protect you from ice. Insulation doesn't generate heat, it only holds heat in. Coats and jackets keep humans warm because our bodies generate heat that our warm clothing can capture and reflect back to us. But if we're talking about the supply pipes on your boiler, there's no heat to speak of. If there's no heat to begin with, the insulation has nothing to hold on to, so it won't prevent ice from forming as the temperature drops. That's why heat tracing is so important.



In most situations, the insulation used in conjunction with heat tracing takes the form of fiberglass with an aluminum jacket. In emergency situations, a layer of plastic can be used in lieu of aluminum for short periods of time, until weather permits time for the installation of the more permanent aluminum jacket.

OUT OF CONTROL

It's not just your pipes that can be affected by cold weather. Controls can freeze, too. And when that happens, it's like your

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THE PATH TO STEAM AND BACK

By Jude Wolf

There's a lot going on inside your boiler. Fuel is burned to create heat, that heat is used to turn water into steam, that steam does work at the end processes, and then the steam condenses into water and goes back into the cycle to do it all over again. But in a modern boiler system, there are a lot of other steps along the way as the water makes its way through the cycle. Advances in boiler technology over the years help optimize heat use to squeeze every last bit of steam out of every energy dollar, and do things to the water that help your boiler last longer and work more efficiently. Here's how it all works together.

SOFT START

Water first enters your boiler system from the supply line, however, it doesn't go straight into the vessel. First, it has to be properly treated. Even the cleanest water still has some dissolved solids in it, usually iron, calcium, magnesium, and other impurities, that can be bad news for the longevity and performance of your boiler. If those solids aren't removed before the water hits the vessel, they will react with the oxygen in the air and the water to form scale and corrosion.

If allowed to build up, that scale will start to act like an insulator, hampering the heat transfer between the water side and fire side. Without efficient heat transfer, your boiler will have to work harder and burn more fuel to make steam. That ends up costing you more in fuel. What's more, scale can also cause inconsistent heating on the surface of your vessel, because some parts will be more insulated that others. Over time, that uneven heating will start to stress the metal of the vessel, which will eventually cause it to fail.

FIRST STEP, SOFTEN WATER

The corrosion caused by those impurities is just as bad, because it will eat the metal on the vessel's surface, and all the valves, pipes, and fittings throughout your boiler. That can lead to leaks, cracks, and premature failure. The first stop in the water's journey through the boiler, therefore, is the water softener.

Inside the water softening system, the water passes through a tank full of resin beads that are all coated with sodium. As the water mixes with the sodium-covered beads, it undergoes a process known as "ion exchange" whereby the naturally positively charged calcium, magnesium, and iron basically swap places with the sodium. Since the iron, magnesium, and calcium adhere to the negatively-charged resin beads, they end up staying in the water softener, and don't end up in your boiler vessel. Voila, longer boiler life and better performance.

NEXT STOP: RECOVERY

Once it's left the water softener, the water's next stop is the recovery unit. A recovery unit is used to extract any latent heat out of water that's already been through the steam cycle, using that reclaimed heat to pre-heat the incoming water so the fire side doesn't have to work as hard to get the water up to steam temperatures. Not every system has a recovery unit, but those that do will operate more efficiently and use less energy over time to make steam.

DEAERATION STATION

The water then makes its way to the deaerator. The deaerator's function is to remove any excess gases, especially oxygen, that may be suspended in the water. Those gases are bad because they can react with the metal in your boiler to cause oxidation (corrosion), which will shorten the boiler's useable life.

Inside the deaerator, the water is heated by low-pressure steam to help it expand and release some of the gases. The water is also stripped of excess gas by undergoing either spray or cascade deaeration, each of which uses a different physical method to knock the excess gas loose. Spray-type deaerators blast the water into a fine mist, so the trapped gases can escape and be vented away. Cascade-type deaerators spread the water into a fine film and let it drip through a series of tiny holes to remove the excess gas. In addition to mechanical deaeration, the water can also undergo chemical deaeration through the use of an oxygen scavenger, which is a chemical treatment that removes any remaining gas through chemical reaction.

Because low-pressure steam is part of the deaeration process, the deaerator also serves as another preheating step before the water makes its way to the vessel. Any extra heat that the water picks up is less heat that the fire side has to produce to turn the water into steam, and by the time it leaves the deaerator, that water will be hot enough to boil. However, because it's under pressure, it won't boil.

CHEM 101

While the water is in the DA, the addition of chemicals does a lot of things to help the boiler work better, and work longer, like scavenging any remaining oxygen, and adjusting the pH and alkalinity. Additional chemicals are added in this tank, or on the water's way to the boiler for keeping dissolved solids in suspension so they can't settle on the inside of the vessel and create buildup.

PUMP IT UP

Once the water leaves the deaerator, it's ready to actually enter the boiler as feedwater. However, because the boiler is hot, the water inside is under pressure. Gravity or supply line pressure won't be enough to overcome the pressure inside the vessel, which is why pumps are used to force the water into the boiler, and keeping dissolved solids in suspension so they can't settle on the inside of the vessel and create buildup.

ECONOMIZER

Before it actually hits the vessel, many boiler systems will pass the water through an economizer, which is another preheating method that reclaims heat from the exhaust stack to further heat the water before the fire side gets to work on it.

KEEP IT LEVEL

When the water is finished in the economizer, it's ready to enter the vessel. However, the water doesn't just flow into the vessel at full blast, because that would flood the boiler and increase the chances of water being sucked into the steam head along with the steam. If condensed water ends up passing through the steam outlet (a process called "carryover"), it can make its way through the steam pipes and destroy the work processes that the steam is supposed to serve. That's why the water level inside the vessel is carefully maintained for optimal steam production, and additional water is only added when it's needed.

The addition of water is controlled by a level control head that uses a series of valves to pump additional water into the vessel only when it's needed. There's also a check valve inline that only flows one way, so once the water enters the vessel it won't be forced back out again by the pressure inside.

CONDENSATION: THE END OF THE ROAD

Once the water has been converted into steam and made its way through the steam head to the work processes, it will dissipate the heat that it's been carrying all this time. As it cools, it will condense from steam back into liquid water. The boiler system is a closed

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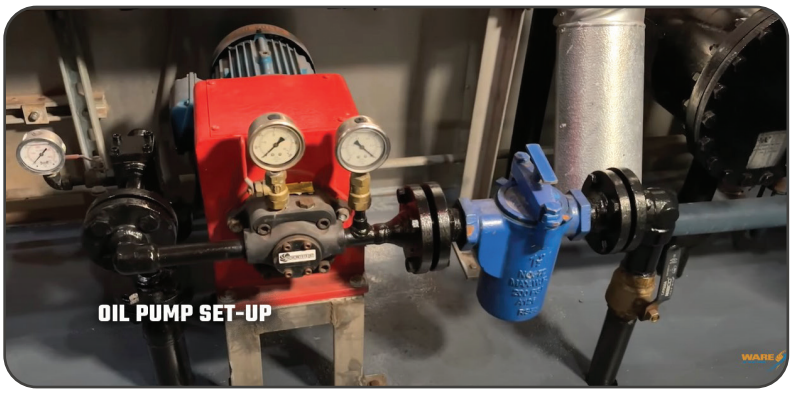
OILER BOILER

By Steve Taylor

Boilers have been around for a long time. There are a lot of reasons for that, from the efficiency with which they move heat to their overall reliability. But today, we're going to focus on another reason they're so popular, and that's the flexibility with which they can operate. Every boiler needs heat to do its job, but that heat can come from a variety of sources.

Most modern boilers use propane or natural gas to get the job done. It's abundant, and it burns clean. However, some boiler locations don't have access to gas fuels. That's where another popular source of combustion comes in: oil. Oil burners work the same way as gas burners, in that they turn fossil fuel into heat, heat into steam, and steam into work. Some boilers are even set up with a control system that allows them to use gas or oil at will, but typically, a boiler is set up for one or the other.


OIL PUMP SET-UP

SEE THE LIGHT

One of the easiest ways to tell if a boiler is oil-fired or gas fired is to look at the flame. While gas burners tend to generate a light blue or nearly translucent flame, an oil-burner flame is going to be darker and more reddish yellow in color. Oil burners also tend to look different at low fire, generating smaller rolling fingers of flame that look more like a candle instead of a lighter flicker.

TANKS A LOT

Another difference between oil and gas burners is the way their fuel is delivered. Boilers that use natural gas can usually get their fuel from a utility line if they're located in a residential or industrial area. However, you aren't going to find oil supply lines anywhere, which is why #2 oil-fired boilers have to have a supply tank from which they can draw. For smaller oil boiler systems, the tank can be found in the boiler room itself. Larger boilers need more fuel, though, which is why they'll usually be connected to larger tanks located outside the structure that the boiler occupies.

PRESSURE, PUMPS, AND PURITY

While gas-fired boilers rely on the pressure of the gas to keep the supply coming, oil isn't kept under pressure. Consequently, oil-fired boilers rely on a pump to keep the burners supplied. By delivering the oil under pressure, these pumps not only keep it moving through the system, they also supply enough pressure to cause the oil to spray out in a fine mist, almost like a gas, when it reaches the burner. Since it's in a fine spray, the oil mixes with air more readily, ignites more thoroughly, and burns more cleanly.

Some boiler systems include an additional air atomizing system to help spread the oil into an even finer mist. Other systems have air atomizers that have a really neat capability built into them; once the boiler is at sufficient pressure, some air atomizing systems can switch over to using a small amount of boiler steam to help create the fine mist, making it a sort of self-sustaining process that doesn't require an external source of pressurized air once the boiler is under pressure.

In every well-designed oil-fired boiler, you're going to find another important feature: an inline filtration component. That filter is in place to remove any impurities before the oil reaches the pump because while the oil supply is generally clean and free of debris, there are some exceptions. When a new boiler system is being built or refurbished, the pipes and associated hardware through which the oil will travel can inadvertently get a lot of unwanted junk and debris in them during the construction process. Stuff like dust, dirt, gravel, metal shavings, and other construction materials that you don't want clogging up your pumps or your burners down the line.

New construction isn't the only source of impurities in the oil, either. Simply refilling the tank can stir up a lot of collected sediment, sludge, and other debris that has settled over time. That's why it's important to have a clean filtration system in place during initial startup. In fact, before the boiler starts, it's a good idea to run the pumps a few times, then remove the filter and clean it before the boiler is fired up. Fortunately, maintaining the filtration system is usually a simple process. The most common filtration method is a mesh strainer mounted in-line before the pumps. This strainer not only gets the job done, it's also fairly easy to pull out and clean during regular boiler shutdown and maintenance.

WATCH THE GAUGES

You can't exactly look inside the pipes or pumps while your oil-fired boiler is running. So, how do you know if the filter is getting clogged? Simple. You look at the gauges. The pump gauges will tell you the amount of suction they're creating, and the pressure at which the oil is pumping into the boiler. If the suction numbers start to climb, that means the pump is having to work harder to pull the oil through the filter. That's why it's important to record and remember the suction pressure the pump is generating when the filter is clean. That's your baseline for normal operation. If that suction starts to increase over time, that's a good indicator that your filter needs some attention.

GEL TELL

Increased suction pressure can also be an indication that the fuel oil is starting to gel due to cold weather. If you have an external supply tank and the temperature is at or below freezing, the oil can start to thicken. Then your pump is doing the equivalent of trying to drink a milkshake through a straw. If this starts to happen, it's time to supplement your fuel oil with an additive that prevents cold-related gelling. Otherwise, your pump will have to work a lot harder, and your boiler could end up getting starved for fuel and start misfiring as the pump tries to move the thicker oil through.

Some supply tanks are actually heated, though, which keeps the oil flowing freely even as the cold weather sets in. Heating the tank will use extra electricity, but heating means you don't have to worry about additives, and can have consistent performance all year long because the oil stays thin and usable. If the temperatures aren't too severe, a tank can be wrapped in an insulating blanket rather than being electrically heated, but that solution is dependent on the climate in which the boiler will be operating.

FUEL IT UP

In case you've never used an oil-fired boiler before, it's important to know that we're not talking about something like 10w40 or axle grease. Modern oil-burning boilers use #2 fuel, which is very close to diesel fuel on a molecular level. However, diesel and #2 are not totally identical. Each one is optimized for the specific type of application in which it will be used. Since diesel fuel is found predominantly in internal combustion engines, it contains a series of additives that are designed to reduce exhaust emissions and add some lubricity and performance when used as an engine fuel. #2 also has additives, but since it's used for a different purpose, namely to generate heat in stationary applications, the additives in #2 are designed primarily to improve burning efficiency and reduce soot buildup.

Because of the difference in intended applications, you'll also find a difference in the sulfur content of diesel and #2 oil. Diesel fuel has lower amounts of sulfur in it to lower the emissions coming out of various tailpipes and exhaust stacks on cars, trucks, ships, and farm equipment all over the world. However,

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NEW AND USED LIST

ALL EQUIPMENT LISTED IS FOR SALE OR LEASE AND SUBJECT TO AVAILABILITY

Unit	HP/PPH	Year	Manf.	Fuel	Type	PSI	Ctrl.
796	82,500	2016	Victory Energy Faber	(Low NOx) G/#2	Steam	350	IRI
797	82,500	2016	Victory Energy Faber	(Low NOx) G/#2	Steam	350	IRI
767	75,000	2011	Victory Energy	(Low NOx) G/#2	Steam/SH	750/750	IRI
747	75,000	2000	B&W	(Low NOx) G/#2	Steam/SH	750/750	IRI
791	75,000	2016	Victory Energy	(Low NOx) G/#2	Steam/SH	750/750	IRI
709	60,000	1979	Zurn	(Low NOx) G/#2	Steam	500	IRI
741	60,000	1979	Zurn	G/#2	Steam	550	IRI
795	40,000	1986	Cleaver Brooks	Gas	Steam	260	IRI
SWVB4	2500	2021	Victory Energy	(Low Nox) G/#2	Steam	250	UL/CSD-1
SWVB3	1500	2021	Victory Energy	(Low Nox) G/#2	Steam	250	UL/CSD-1
SSB-56	1200	2021	Victory Energy	(Low NOx) G/#2	Steam	250	UL/CSD-1
634	800	1972	York-Shipley	G/#2	Steam	150	IRI
620	800	1975	York-Shipley	G/#2	Steam	250	IRI
SSB-72	800 XID	2023	Victory Energy	(Low NOx) G/#2	Steam	250	UL/CSD-1
SSB-67	600 XID	2023	Victory Energy	(Low NOx) G/#2	Steam	250	UL/CSD-1
SB-139	500	2001	Cleaver Brooks	G/#2	Steam	150	
SB-277	400	2023	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD1
SB-138	350	1994	Cleaver Brooks	G/#2	Steam	150	
SSB-71	300 XID	2023	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD-1
SSB-70	250	2023	Victory Energy	(Low Nox) G/#2	Steam	150	UL/CSD-1
SB-278	250	2023	Victory Energy	(Low Nox) G/#2	Steam	150	UL/CSD-1
SB-148	200	1995	Kewanee	Gas	Steam	325	IRI
SB-264	200	2022	Victory Energy	G/#2	Steam	150	UL/CSD-1
SB-273	200	2022	Victory Energy	G/#2	Steam	150	UL/CSD-1
SB-146	200	1995	Kewanee	Gas	Steam	325	IRI

TURN THE PAGE FOR MORE EQUIPMENT

NEW AND USED LIST continued

ALL EQUIPMENT LISTED IS FOR SALE OR LEASE AND SUBJECT TO AVAILABILITY

Unit	HP/PPH	Year	Manf.	Fuel	Type	PSI	Ctrl.
SB-267	175	2022	Victory Energy	G/#2	Steam	150	UL/CSD-1
SSB-53	175 XID	2020	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD-1
SB-280	150	2023	Victory Energy	G/#2	Steam	150	UL/CSD1
SSB-66	150	2023	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD1
SB-279	150	2018	Victory Energy	G/#2	Steam	150	UL/CSD-1
SB-274	100	2022	Victory Energy	G/#2	Steam	150	UL/CSD-1
SB-275	100	2022	Victory Energy	G/#2	Steam	150	UL/CSD1
SB-276	100	2022	Victory Energy	G/#2	Steam	150	UL/CSD1
SSB-60	100	2022	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD1
SB-271	70	2022	Victory Energy	G/#2	Steam	150	UL/CSD-1
SB-272	70	2016	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD-1
SSB-64	70	2022	Victory Energy	(Low Nox) G/#2	Steam	150	UL/CSD-1
SB-283	50	2024	Victory Energy	G/#2	Steam	150	UL/CSD-1
SSB-68	50	2023	Victory Energy	(Low NOx) G/#2	Steam	150	UL/CSD-1
SB-268	10	2017	Lattner	Gas	Steam	150	

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Boiler 2024 May 1 – 3, 2024
Denver, CO - Booth 501

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Warm up to heat tracing pg 1

boiler is operating blind. Without accurate input from the sensors, thermostats, float switches, or other monitoring systems, the boiler won't know if there's enough water in the vessel, or if the right amount of fuel or air is flowing where it's supposed to. At the very least, that will throw off your efficiency. It could also lead to your boiler overheating, or a loss of steam capacity.

DO YOU NEED HEAT TRACING?
If you live anywhere that the temperate can get below freezing, and any part of your boiler is exposed to the outside elements, you need heat tracing. This definitely applies to rental boilers, because they're not usually part of the structure in which they're used. They sit outside in the cold, often with exposed pipes and fittings, and it only takes a few hours at below-freezing temperatures for the damage to start.

If you are using a packaged rental boiler, they're self-enclosed and have their own ambient heating for the internal components, so heat tracing isn't as crucial. However, the supply lines to a packaged rental boiler must be heat traced, because they aren't getting any of the heat from the boiler enclosure. If your rental boiler doesn't have an enclosure, you definitely need heat tracing for all of the boiler's piping, and the supply piping, too.

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HEAT TRACING AND INSULATING

WE'RE HERE TO HELP
If you need your boiler heat traced, WARE literally has you covered. Our experts are here to help you get ready and stay ready for winter, so your boiler can keep running even when the mercury plummets. Of course, if there's anything else you need, from parts to service to maintenance to training, we're here to help with that, too. Just let us know.

The path to steam and back pg 2

loop (as much as possible) however, so that condensed water will be redirected back to the beginning of the cycle, where it will enter the feedwater supply after giving up any heat in the form of flash steam to the deaerator.

If you'd like a more in-depth, hands-on explanation of the journey that water takes through a boiler, consider taking a few classes online or in-person from WARE's Boiler University. You'll learn the whole process inside and out from real experts with years of experience in boiler technology. Of course, if there's anything else you need that's steam related, from boiler maintenance to new or rental boilers to parts and services, WARE is always here to help.

Watch WAREboilers channel
OIL IN BURNERS

Oiler Boiler pg 3

since #2 oil is typically used in boiler rooms, furnaces, and other fixed-in-place applications that have more thorough and complex exhaust systems, it's allowed to have a higher sulfur content.

You can tell another difference between #2 oil and diesel just by looking at them. Since they're designed for different end applications, they're manufactured in two different colors to help tell them apart. Diesel is clear or pale yellow, while #2 oil is dyed red. That way, it's easier to make sure each one is used only for its intended purpose.

The truth is, #2 and diesel are actually interchangeable to an extent. In an emergency, a #2 boiler can run on diesel. However, because of those additives you read about just now, it's not ideal to run diesel in a #2 boiler. Performance and efficiency will be different, as will the amount of soot and residue that builds up over time. So while it can be done on a short-term basis in emergency situations, it's best to stick to the fuel your boiler was designed for.

THE TAX MAN
As an interesting aside, another difference between diesel and #2 is the cost per gallon, and that distinction has to do with the way each one is taxed. Since diesel and #2 are technically used for different purposes, they each have a different set of tax regulations that apply to them. Remember, they're almost functionally identical, but the government doesn't quite see it that way. Since diesel is used primarily in transportation, it is subject to road taxes that are tacked on to help pay for maintaining roads, highways, bridges, and other parts of the infrastructure. But since #2 isn't technically used to transport things, it doesn't get slapped with any road taxes. That makes it cheaper per gallon than diesel, which is why it has remained a viable source of boiler fuel over the years. That's also why diesel engines are sometimes inspected to make sure there's no red dye in the fuel, and that nobody is trying to circumvent the taxes they're supposed to pay by using a cheaper alternative.

WARE IS THERE
If you'd like to know more about oil-fired boilers, consider taking a few classes at WARE's Boiler University either online or in person. If you already have an oil-fired boiler and you think it needs inspection or maintenance, WARE has you covered there, too. Our technicians have extensive experience in gas and oil boilers, and can help you keep yours running at its best. Whatever you need, remember, we're here to help.

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HOW DOES A MODERN BOILER ROOM REALLY WORK?

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