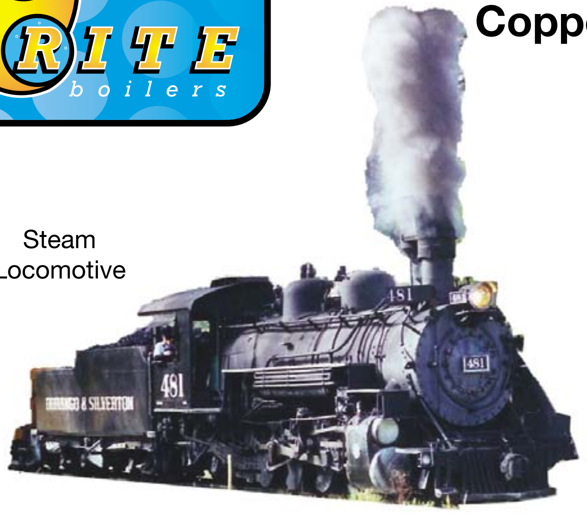
PERFORMANCE ***You can trust***

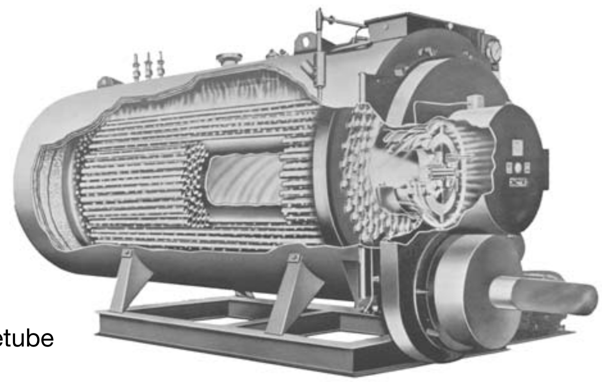
EFFICIENCY ***You can maintain***

EXPERIENCE ***You can depend on***

Firetube, Watertube, or Cast Iron?
Copper Fin, Bent Tube or Straight Tube?

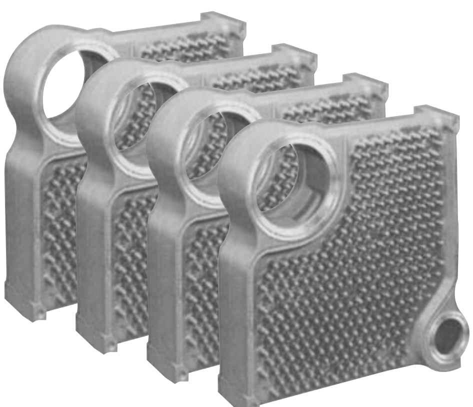


Steam Locomotive

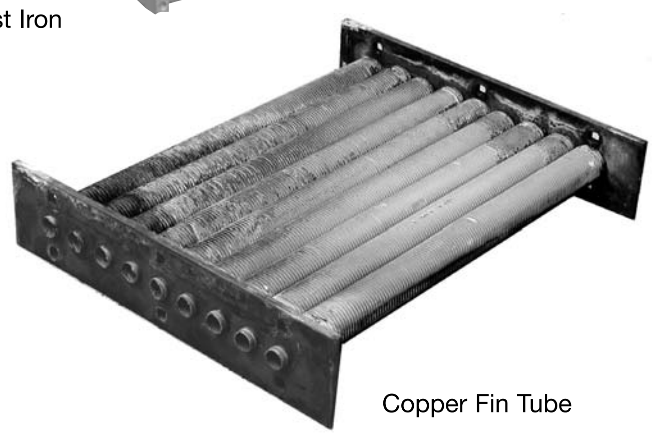


Firetube

Bent Tube



Cast Iron



Copper Fin Tube

These are some of the decisions faced when choosing a boiler. Making an intelligent choice starts with asking the right questions: What are the basic design differences? What is the boiler's efficiency when new and more importantly – can this efficiency be maintained? Which boiler will have the lowest operating cost and the longest service life and why?

Did you know that some current designs go back well over a hundred years? Today's firetube boilers, for example, are descendants of the old steam powered locomotive boilers that once crisscrossed America. As the industrial and commercial boiler markets grew in the early part of the 20th Century, one notable improvement over the firetube boiler was the bent tube boiler. Because bent tubes could flex, they could withstand the "shock" of cold feedwater better than firetubes. But cold feedwater created another problem for both these types of boilers: oxygen corrosion. This helped popularize cast iron boilers which had better resistance to oxygen corrosion than steel. However, cast iron's low tensile strength also limited its use primarily to low pressure commercial and residential applications.

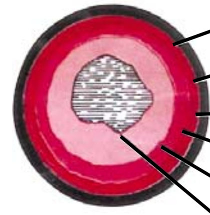
Today many of the challenges and assumptions that earlier boiler manufacturers faced no longer exist. Steam traps, de-aerators, and water treatment have largely eliminated cold feedwater problems. The old "minimum square feet of heating surface" rule has shrunk from 10 square feet per boiler horsepower in 1900 to around 5 square feet by 1960. And steam boilers themselves have been largely replaced by water heating boilers for comfort heat and other low temperature process applications. But one very big problem for all boilers still remains: ***SCALE***.

Also called "lime", "mud", or "sludge", it occurs when dissolved solids in water settle out in a boiler. Making matters worse, these solids tend to drop out of suspension and plate onto the hottest heat transfer surfaces, forming a cement–like barrier of insulation that leads to overheated metal surfaces and ultimately metal fatigue. It's the familiar process that ends the life of most residential hot water heaters.

ENERGY LOSS DUE TO SCALE DEPOSITS			
Scale Thickness in Inches	Fuel Loss % of Total Use		
	Scale type		
	"Normal"	High Iron	Iron Plus Silica
1/64	1.0	1.5	3.5
1/32	2.0	3.1	7.0
3/64	3.0	4.7	—
1/16	3.9	6.2	—

Source: National Institute of Standards and Technology

ADDITIONAL FUEL REQUIRED DUE TO SCALE



A BOILER TUBE SHOWING EXTRA FUEL REQUIRED DUE TO SCALE OF VARIOUS THICKNESSES.

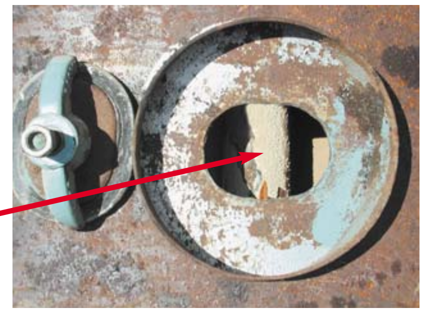
- Scale 1/50 in. thick approximately 5% additional fuel required
- Scale 1/25 in. thick approximately 10% additional fuel required
- Scale 1/16 in. thick approximately 15% additional fuel required
- Scale 1/8 in. thick approximately 30% additional fuel required
- Scale 1/4 in. thick approximately 66% additional fuel required
- Scale 1/2 in. thick approximately 150% additional fuel required

Source: Cooper Tools

As the charts show, this widely recognized problem has a devastating effect on boiler efficiency and operating costs. No matter how impressive a new boiler's start-up efficiency is, scale can quickly knock it down—driving up fuel costs until major boiler repairs or replacement are unavoidable. So, how easy is it to keep some common boiler designs clean and operating at peak efficiency year after year? Let's take a look:

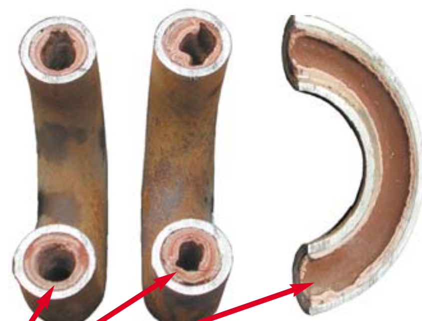
You'll find it's virtually impossible for a person to get inside a firetube boiler to clean out scale. Cast iron boilers offer no access. The "U" bends in bent tube boilers not only create natural traps for scale to collect, but compound this problem by keeping scale hidden from view as well. And copper fintube boiler manufacturers require an exact flow rate of 7 feet per second if you want to insure their tubes from scaling *or eroding.* "Well", you ask, "Did anybody design a heavy-duty boiler with fast and effective waterside access?"

Shortly after World War II, a new type of boiler appeared on the market. With a heat exchanger consisting of two headers with removable endplates and a connecting bank of inclined "see-through" tubes, this boiler was designed to remove scale with ease. The Horizontal Inclined Watertube Boiler, as it came to be called, proved to have many other advantages as well.

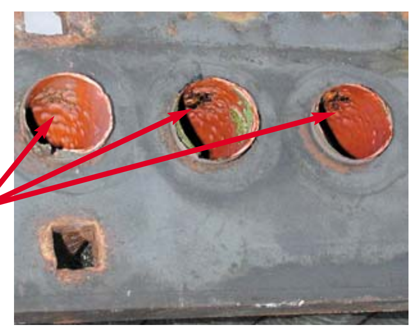


Firetube (Scale)

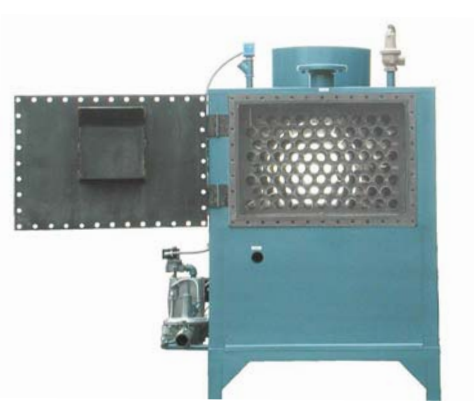
Cast Iron (Scale)



Bent Tube (Scale)



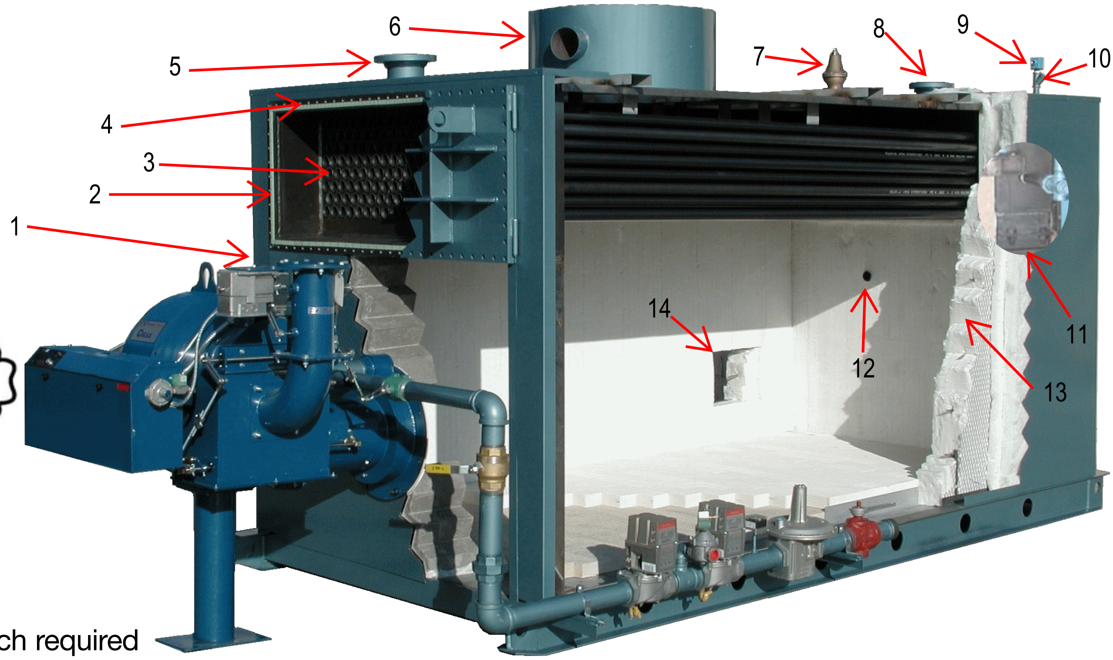
Copper Fin Tube (Scale) (Erosion)



Rite Engineering began manufacturing this type of boiler in 1952. Fifty years and over 25,000 boilers later, Rite is more committed than ever to engineering and packaging *performance you can trust and efficiency you can maintain.*

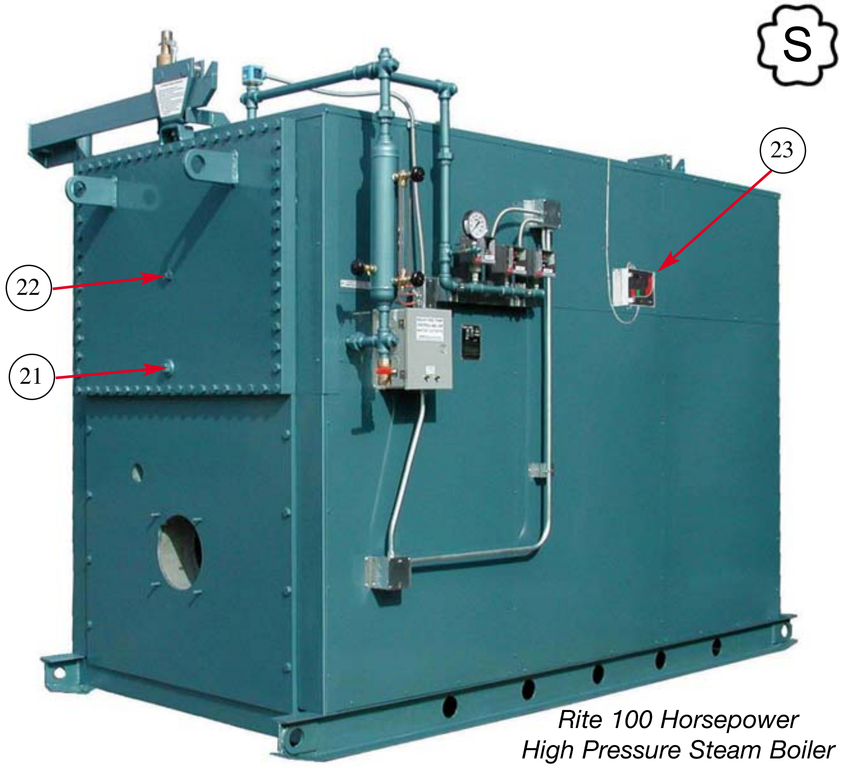
WATER BOILER ADVANTAGES

- 11-300 Boiler Horsepower
- M.A.W.P. to 160 PSI
- ΔT to 100° F
- Supply Water to 240° F
- No minimum flow rate or flow switch required
- No “runaround” pump required
- ΔP less than 3’ head
- 25 Year Thermal Shock and Tube Erosion Warranty
- 80% and 83% *maintainable* efficiency models available
- Atmospheric or Power Burner Fired



Cutaway of a Rite 7 Million BTU Hot Water Boiler Power burner fired

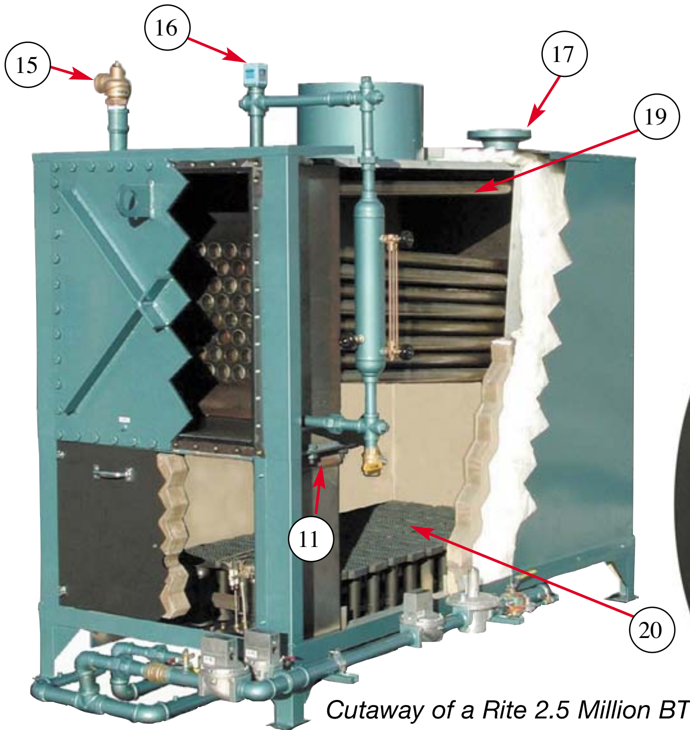
1. Front firebox inspection viewport.
2. Removable front and rear headplates. Available with hinges for weightless operation.
3. 2” See-through tubes for quick and easy inspection and maintainance. Tubing is non-proprietary and widely available from competitive sources. Replacement costs are many times less than proprietary bent tubes.
4. Headplate flanges are drilled and tapped for smooth gasket surfaces. No flange welded studs to corrode away or interfere with hinged headplates or flange clean-up.
5. Hot water supply connections are ANSI 150# flanged over 2”.
6. Round stack outlet with built-in stack supports. Single stacks available on Atmospheric fired boilers up to 7500 MBH input.
7. ASME safety relief valve.
8. Hot water return connection is standard on top for easier field piping and to avoid blocking the rear headplate.
9. Float or probe type low water cut-off.
10. Air elimination fitting.



Rite 100 Horsepower High Pressure Steam Boiler (Power burner removed for clarity)

HIGH PRESSURE STEAM & HIGH TEMPERATURE HOT WATER BOILER ADVANTAGES

- 9.5 - 250 Boiler Horsepower
- M.A.W.P. to 325 PSI
- Temperatures to 400°F
- Steams in about 5 minutes from a cold start
- 99% Steam Quality under steady load conditions
- No Steam Baffles or Separators required
- Extra Thick Shell and Tubesheet resist corrosion
- Hinged Headplates available for easy waterside access
- No Handhole or Manhole Assemblies
- 25 Year Thermal Shock Warranty
- Nominal 80% *maintainable* efficiency
- Atmospheric or Power Burner Fired



Cutaway of a Rite 2.5 Million BTU
Low Pressure Steam Boiler
Atmospheric burner fired

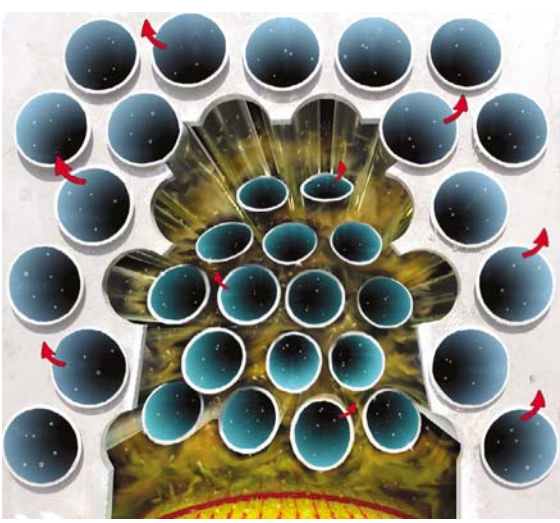
LOW PRESSURE STEAM BOILER ADVANTAGES

H

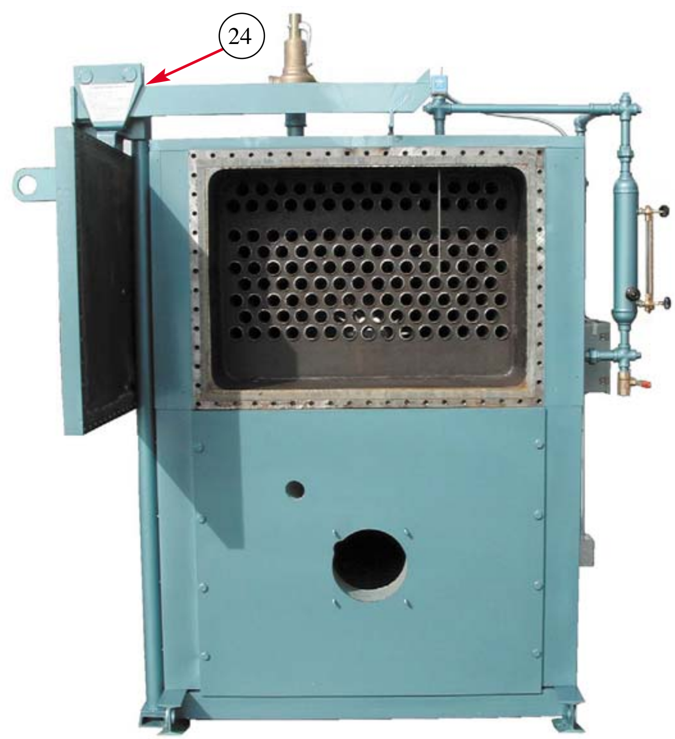
- 11-300 Boiler Horsepower
- M.A.W.P. 15 PSI
- Steams in about 5 minutes from a cold start
- 99% Steam Quality under steady load conditions
- No Steam Baffles or Separators required
- Thick Shell and Tubesheet resist corrosion
- Hinged Headplates available for complete and easy waterside access
- 25 Year Thermal Shock Warranty
- Atmospheric or Power Burner Fired
- Nominal 80% *maintainable* efficiency

11. Floating head assembly relieves stress caused by “thermal shock”.
12. Rear firebox inspection viewport.
13. Refractory and insulation.
14. Firebox access door.
15. ASME rated pop safety valve.
16. Primary low water cut-off probe.
17. Steam supply.
18. Steam column featuring self-indicating low water cut-off and pump control probes.
19. Steam final pass “superheat” tubes.
20. Heavy duty cast iron upshot burners provide whisper quiet, maintenance free operation.
21. Waterside inspection/blowdown connection.
22. Surface blowdown connection.
23. Draft gauge.
24. Hinged headplate.

THE KEY TO GOOD HEAT TRANSFER



Our self-baffled tube bundle keeps hot combustion gasses *pinballing* through the heat exchanger to reduce laminar gas flow and maximize heat transfer efficiency.



Rite 100 Horsepower High Pressure Steam Boiler with Hinged Headplates (Power burner removed for clarity)

S

THERMAL SHOCK BUSTERS

"Thermal shock" can happen to any boiler when pressure vessel metal expands (heats up) or contracts (cools down). This is caused by normal burner on-off cycling or by inadvertent slugs of cold feedwater or stratification of varying water temperatures in the vessel itself. Severe mechanical stress can occur if parts of the pressure vessel expand and contract at different rates or if these movements are restrained. Depending on the type of boiler, the end result can range from tubes loosening or warping, tube-sheet-to-shell weld cracks, cast iron cracking or broken stay-rods.

Because the coefficient of expansion of metal increases with temperature, a boiler with clean heat transfer surfaces, such as the tubes, will experience less stress than a similarly constructed boiler that is scaled up. Furthermore, boilers that are designed with*out* expansion joints or made from brittle metals are more susceptible to stress than those which allow for movement and are manufactured using more ductile material.

So what did the engineers at ***RITE*** do to outsmart the forces of thermal shock? They began by designing a pressure vessel that promoted turbulent water flow and natural circulation in order to prevent stratification. Secondly, by limiting the forces of expansion and contraction to a single uniform tube bundle, they eliminated the rigidity and opposing stresses that welded shells, Morison (furnace) tubes and stay-rods impose on other types of boilers. Third, by specifying that the pressure vessel be made of low carbon steel, they made it far more ductile and able to survive sudden pressure and temperature changes than boilers made from cast metal. And by making the tubes straight and cleanable, they made it easy to minimize the expansion rate of the heating surfaces too.

"But with straight tubes, how does ***RITE*** accommodate normal tube expansion and contraction?" Good question. After all, a clean steel tube 12 feet long (the longest we use) will grow by about 1/4 inch in a hot water boiler when going from 60° to 200°F ✻. The following photographs illustrate our engineers' deceptively simple solution: An expansion joint consisting of a pair of heavy duty lineal slides that allow one of the header boxes to move freely in either direction as the tubes expand and contract. How effective is it? Our normally conservative engineers have written a most liberal **25 year Thermal Shock Warranty** around it.

✻ *Based on 100° F average tube temperature above the saturation temperature, coefficient of expansion formula for steel tubes is: .000007 x Length (144") x △T (240° F) = .2419".*

Fig. 1 Angle irons with oval slots are paired with angle irons with round holes.

Fig. 2 View showing oval holes over round holes with one of the keeper bolts removed.

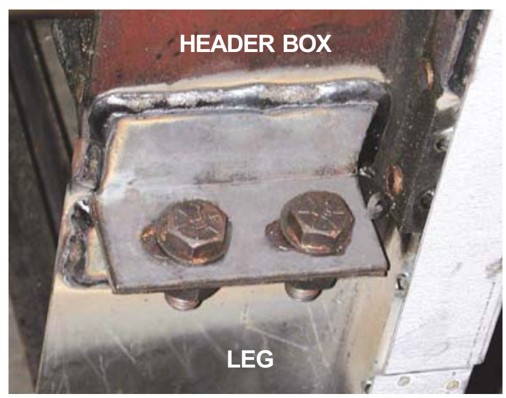


Fig. 3 Lineal slide assembly connecting leg to header using keeper bolts and backwelded nuts. Bearing surfaces are lubricated.

Fig. 4 View of tubes and rear header box showing right side lineal slide assembly.

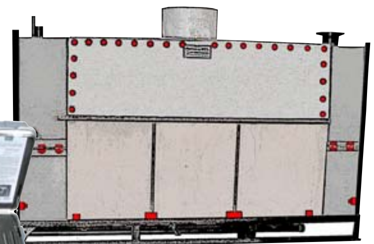
TAKE-A-PART

LIGHTER . . . EASIER . . . FASTER

CONTRACTORS: Do tough access replacement boiler jobs bring on your disappearing act? If so, then maybe it's time to consider a less frightening alternative. For every contractor that's had to string a boiler through a window, down a stairwell, around a corner, or into an elevator -- we would like to offer a little magic of our own: The ***RITE*** **Take-A-Part**. What makes our design better? ***Lighter*** weight parts for one, because there are ***no heavy cast iron sections***. ***Easier*** because there's ***no welding required***. ***Faster*** because you take it apart only as far as necessary. And ***simpler*** because the parts arrive assembled - with instructions - so you'll see exactly how they go together.

RITE T.A.P.s ship assembled

Tool Rental Kit

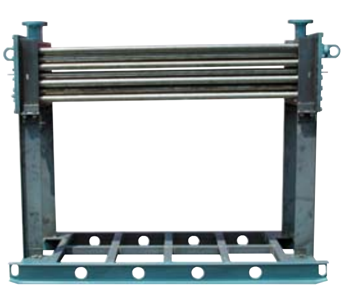


Removable Hardware
(shown in red)

PARTIAL TAKE-A-PART

Largest Piece: 50 Horsepower Boiler Pressure Vessel going through 34'' wide door (From ***RITE*** **Take-A-Part** Video)

Side View of Pressure Vessel Section above

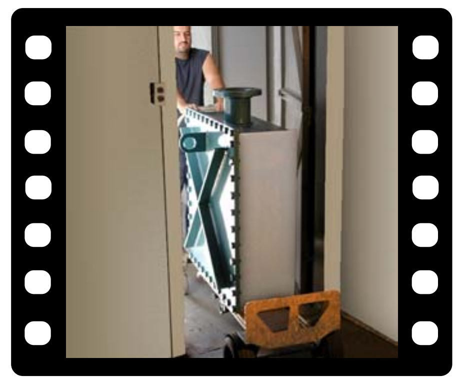


Tubes installed at factory,
No ASME hydrotest required

We can help you choose between our **Partial** and **Full Take-A-Part** boilers by providing dimensions and weights of the largest parts. **Need tube rolling tools for our Full Take-A-Parts**? Our **tool rental kit** (shown above) ships UPS.

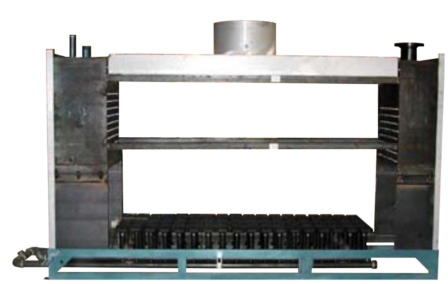
Can we handle special requests? You bet. We recently shipped (3) two-hundred horsepower steam boilers to a school in Chicago. At over 9' tall the boilers would not fit through the access doors unless they could be "sawed in half". With a few minor modifications to our **Partial Take-A-Part** design, we were able to deliver boilers that the contractor could knock down and rebuild in hours -- not days. Would you like to know more? Ask your representative for a free copy of our **Take-A-Part** video.

FULL TAKE-A-PART



Largest Piece: 90 Horsepower Steam Header going through 34'' wide door (From ***RITE*** **Take-A-Part** Video)

Tubes ship loose with boiler



Tubes installed by contractor,
ASME hydrotest is required

BEYOND T

In most endeavors it is a well known fact that the BASICS must be mastered before something special can emerge. The same can be said about boilers. The flexibility of our design promotes one of the broadest ranges in the industry. ***To go from low and high temperature water to low and high pressure steam, you've got to have a proven design***. And one with plenty of muscle behind it. (Which could come in handy the next time your boiler undergoes a little mistreatment).

All of which brings us to the "specials", "options", "extras", or whatever else you want to call them. Truth is, they are all pretty basic to us.

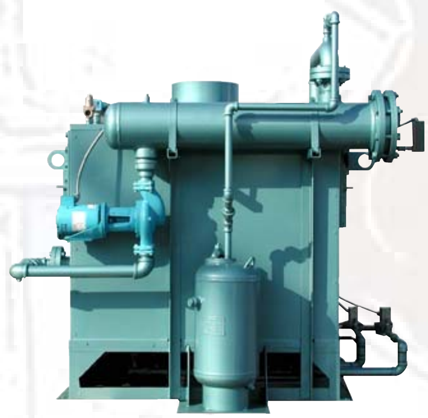
1

- SKID MOUNTED PACKAGED STEAM SYSTEM FOR OUTDOORS

2

- 12 PPM LOW NOx DUAL FUEL FIRED
- INSULATED HEADPLATES

6



- SIDEARM HEAT EXCHANGER
- EXPANSION TANK

7

- BLOWDOWN TANK 42" DIAMETER

11

- SOOT SCRAPER (SIMPLE PUSH/ PULL OPERATION)

12

- CONDENSATE RETURN-FEEDWATER TANK

HE BASICS

3

• 30 PPM LOW NOx
• WEATHERPROOF

4

• CERAMIC FIBER FIREBOX

5

• EXPANSION TANK (FRONT)
• INDUCED DRAFT FAN (REAR)
• HINGED HEADPLATES

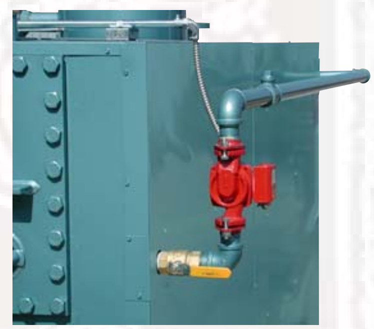
8

• SEWAGE TREATMENT PLANT BOILER (DIGESTER / NATURAL GAS FIRED)

9

• HINGED HEADPLATE
• HANDHOLE

10



• BOILER RUN-AROUND BLEND PUMP FOR LIMITED LOW TEMPERATURE RETURN

13

• WEATHERPROOF BOILER

14

• STAINLESS STEEL MIRROR FINISH JACKET

15

• +350° F HIGH TEMPERATURE HOT WATER BOILER (ASME SECTION 1)
• B 31.1 ASME PRESSURE PIPING

ENGINEERING HELPFUL HINTS & FORMULAS

HEATING LOAD EQUATIONS

- Hot Water heating: BTU output ≈ 500 x ΔT x GPM
- Divide BTU output by boiler efficiency (ie: .8 for 80%) to get input
- Pounds per Hour Steam Required to heat water ≈ $\frac{GPM}{2}$ x ΔT x 1.1
- PPH Steam Required to heat air with steam coil ≈ $\frac{\text{CFM AIR}}{800}$ x ΔT
- PPH Steam Required for humidification: www.riteboiler.com, click engineering.

METRIC CONVERSIONS

- $\frac{\text{KiloPascals}}{6.9}$ = pounds
- Kilowatts x 1.341 = Boiler Horsepower
- Kilowatts x 3413 = BTU
- Liters x .2641 = Gallons
- Degrees Centigrade ≈ (F° - 32) x .5555
- Degrees Fahrenheit ≈ (C° x 1.8) + 32

MISCELLANEOUS

- 1 Boiler Horsepower ≈ 34.5 PPH Steam ≈ 34,000 BTUH Output ≈ 140 sq. ft. E.D.R
- 1 PSI ≈ 28" W.C. (Water Column) ≈ 2" Hg (Mercury) = 16 ounces
- 1 gallon of water ≈ 8.3 pounds
- PSI x 2.31 ≈ feet of head

FUEL VALUES

- 1 Therm = 100,000 BTU
- 1 Cubic foot natural gas ≈ 1,000 BTU
- 1 Cubic foot L.P. gas (propane) ≈ 2500 BTU
- 1 gallon propane ≈ 36.5 cu. ft. ≈ 4.25 lbs.
- 1 gallon #2 oil (diesel) ≈ 140,000 BTU

AVOIDING CONDENSATION

Condensation can quickly ruin a hot water boiler. The #1 cause is persistent low return water temperature. A good system design can prevent it, but first you must know the boiler's minimum recommended return water temperature, for ***RITE***, it's 135° F. Next, make sure the boiler(s) selected can easily handle the load. For systems designed with a fixed operating temperature, the ΔT should never return water less than 135°. If reset is required (1) program it so the return can't fall below 135°, or (2) use a 3-way valve in the piping system to bypass cooler water around the boiler, or (3) use a primary-secondary loop.

- When boiler is used for humidification control, do not turn the boiler or pump off at night if the chilled water to the VAV boxes or air handler will indirectly cool the boiler loop water.
- Never run chilled water through a boiler, even in summer.
- Keep cold start-ups to a minimum during heating season. Cooling a system down only to reheat it again a short time later nets very little energy savings. To conserve energy consider (1) a night set-back control for 135° F return (2) An automatic stack (closing) damper (3) Turning off the secondary system pump(s) only, not the primary pump(s) or boiler(s) (4) Turning the system pump(s) and boiler(s) off over long weekends only.

•For 60°- 90° F water source heat pump systems, we can supply the piping arrangement shown below on any of our hot water boilers.

For natural & LP gas fired boilers. When using high sulfur fuels, the minimum return must also increase. For #2 oil: 155° F minimum return. For digester (sewage) gas, 190° F minimum return.

For complete engineering details about our Water Source Heat Pump packages as well as all our other piping diagrams, visit www.riteboiler.com, click engineering.

Glycol Derations For Rite Boiler

■ Ethylene Dowtherm SR-1™
♦ Propylene Dow "Dowfrost"™

% By Volume	Freeze Protection Down to F° ■	Freeze Protection Down to F° ♦	At 20° ΔT OR Through Boiler Derate Output By:	At 1 Foot Per Second Flow Through Tubes Derate Output By: ■	At 1 Foot Per Second Flow Through Tubes Derate Output By: ♦
10%	+25	+26	5%	NA	NA
20%	+15	+19	11%	NA	NA
30%	+3	+9	17%	1.2%	1.4%
40%	-12.5	- 4	21%	1.8%	2.2%
50%	-36	-23	25%	2.6%	3.6%

- Ethylene Glycol is highly toxic if ingested. Propylene Glycol is generally accepted as safer but still not intended for human consumption.
- Select a temperature rating at least 5° F lower than expected lowest ambient temperature.

Altitude Derations:

ATMOSPHERIC BOILERS: Up to 2000' above sea level, no output deration. Starting at 2500', derate 10%, @ 3000' derate 12%, @ 4000' derate 16%, and so on.

POWER BURNER FIRED BOILERS: Up to 2000', no deration. Starting at 2500', derate 2%, @ 3000' derate 4%, @ 4000' derate 8% and so on.

Note: Glycol & Altitude derations are not cumulative. Use only the larger of the two figures.

Hot Stuff 250°- 400° F

Looking for something really hot but don't want to go with thermal oil fluids or high pressure steam? Then try our **high temperature hot water boilers** instead. Environmentally safer than thermal oil and more energy efficient than steam, they're perfect for large campus type heating systems and high heat process loads.

See photo #15 on the preceding page (one of four sold to Honeywell) and contact us to learn more about why HTHW systems are fast becoming the preferred choice of many consulting engineers.

System Do's & Don'ts

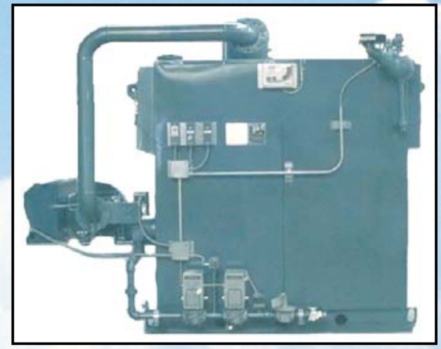
- ***Do*** specify 15-25 PSI cushion over the equivalent saturated steam pressure for hot water systems operating over 212° F.
- ***Do*** specify the boiler relief valve setting be at least 15% or more above the system's normal operating pressure. Generally speaking, the larger the gap the better.
- ***Do*** specify the pH in hot water systems at between 9 and 10 and for steam between 10 and 11.
- ***Don't*** specify pumping directly into hot water boilers (unless you've factored in the pump head pressure to the overall operating pressure and are 15% or more under the R.V. setting.

  Don't specify make-up air or exhaust fans in the boiler room without making provisions for potential positive or negative pressures.

  Don't specify non-return (stop-check) valves on low pressure steam boilers in battery (multiple units feeding a common header). When sizing non-return valves for high pressure steam boilers in battery - size to maintain 4000-5000 feet per minute velocity to prevent water carryover.

LEADERS IN LOW NOx TECHNOLOGY

In 1989, we were one of the first to provide Low NOx emission boilers in California. As **Low NOx** regulations have spread, the fever surrounding this new technology has spawned more than its share of freshly minted products to meet the demand. Unfortunately for many end users, some **Low NOx** burner systems have proved costly to maintain under long-term boiler operating conditions. Our approach to Low NOx is to provide trouble-free Low NOx burners that will benefit both the environment and our customers for many years to come.



RITE 30PPM Low NOx Boiler shown above. 20PPM & 12PPM Low NOx models also available.

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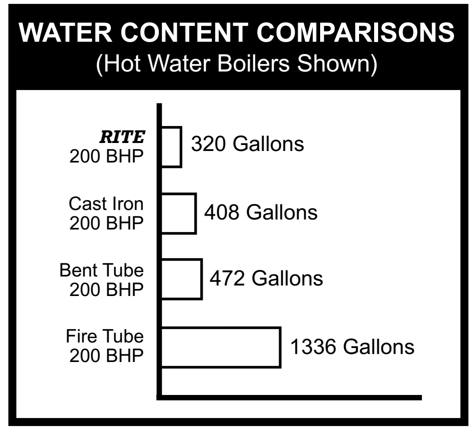
HYDRAULIC SAFETY

What is hydraulic safety? It's basically a boiler's ability to safely contain water or steam in the pressure vessel. Rite's low water volume design not only makes our boilers quick to respond to start-ups and changing load demands, it also means there is less stored energy in our boilers as well. Why is this so important? **Because the energy released as a result of a runaway firing condition is directly proportional to the boiler's water volume.** While no design can ever be considered explosion proof, the fact remains, we know of no ***RITE*** Boiler that has ever been associated with a hydraulic event. For more on this, please visit National Board's "Nine boiler accidents that changed the way we live" at **www.nationalboard.org**, click on publications, summer 2003, the article begins on page 20.

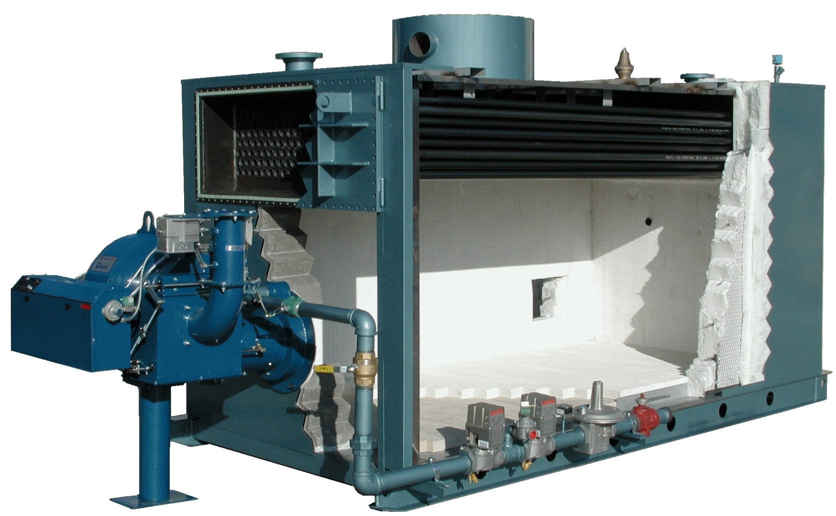


COMBUSTION SAFETY

•All boilers are fire tested before they leave the factory

ASME CSD-1

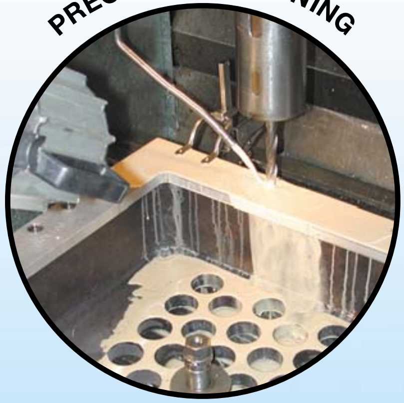
•All Fuel Trains and Safety Controls meet or exceed UL 795, UL 726 and ASME CSD-1.



• **All our boilers are negative draft.** This simply means our combustion chambers fire under a slight negative pressure (-.01" water column). **Why? Because positive draft boilers must rely on seal welds and gaskets to contain products of combustion.** If any of these fail, then carbon monoxide could leak into the boiler room, causing health problems that are often difficult to trace back to the source.

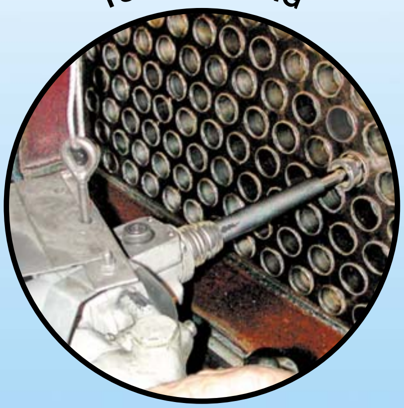
• For more on this, visit National Board's "Venting of Combustion Equipment" @ www.NationalBoard.org, click on Publications, Winter 2002, pg. 8.

PRECISION MACHINING



WELDING

TUBE ROLLING



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