



MiURA

DESIGN
ADVANTAGE

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Investing in the right boiler is one of the most critical decisions for any process steam or hot water plant. A low-efficiency boiler can waste its purchase price of \$75,000 in energy costs within just one year, while a high-efficiency design delivers long-term savings.

Boiler savings can be categorized into three key areas: initial cost, maintenance, and operational efficiency. While capital and maintenance expenses are important to consider, it's the **ongoing running costs** that have the greatest impact on long-term profitability. Understanding the total cost of boiler operation is crucial to maximizing your investment year after year.

Miura specializes in developing advanced boiler technology that enhances operational efficiency and supports businesses in staying competitive, both domestically and internationally. The company's **LX (Low NOx gas-fired)** and **EX (gas/oil-fired)** models are designed to minimize energy consumption, reduce physical footprint, lower maintenance costs, and improve overall operational efficiency.



KEY INSIGHT

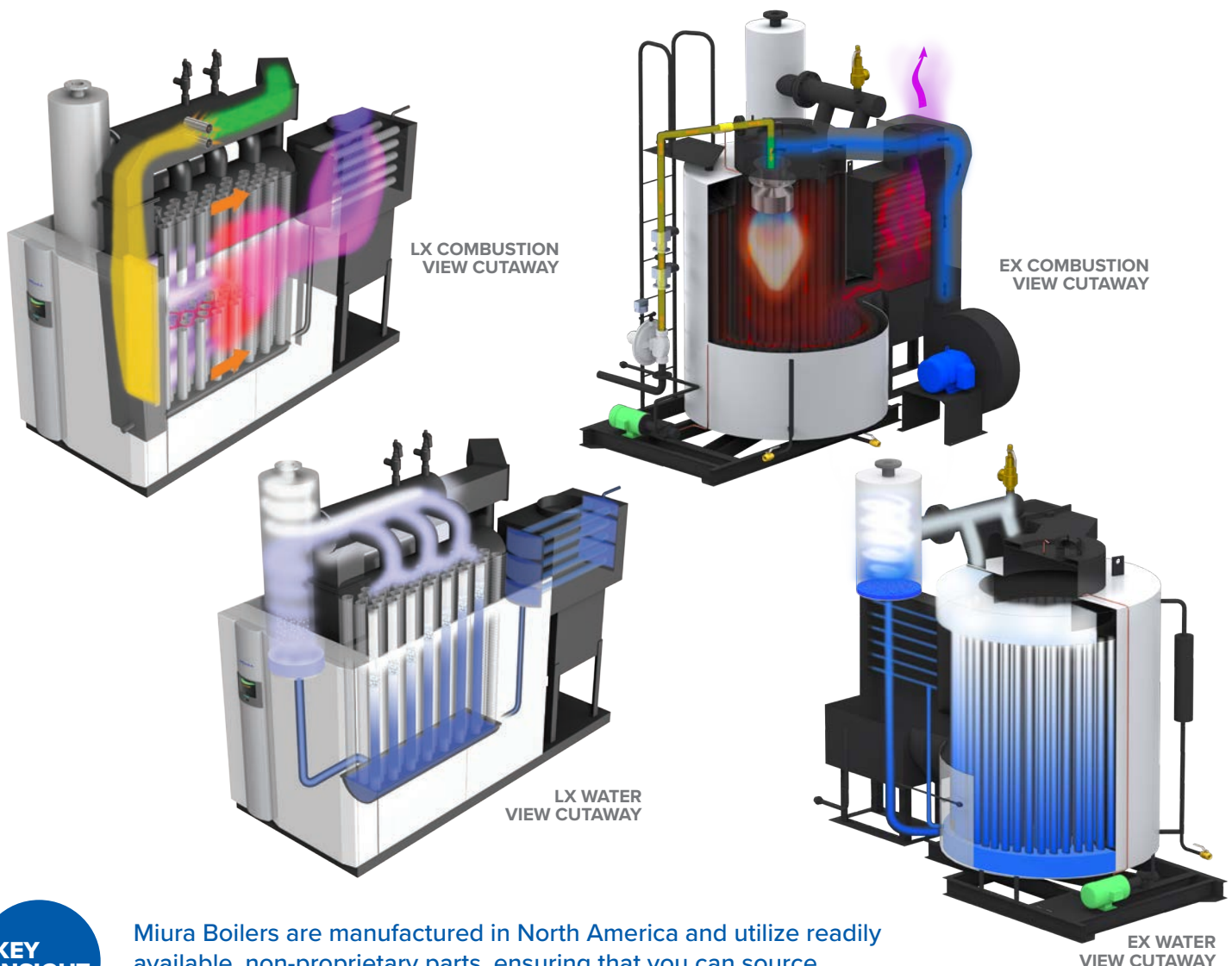
While the initial cost of a system may fade from memory, the issues it creates will always stand out. Choosing the right boiler system allows you to focus on solving more critical challenges, rather than dealing with avoidable operational problems.

MIURA'S SUPERIOR DESIGN



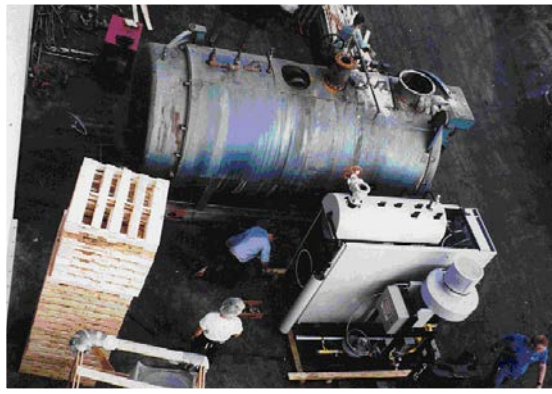
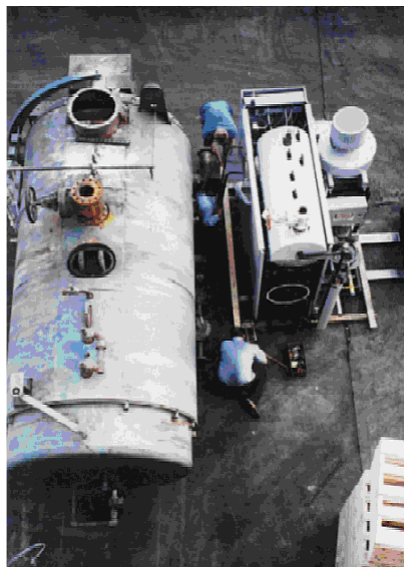
The Miura boiler design features rows of vertical tubes positioned between two annular or rectangular headers. Both headers are encased in a castable refractory, with only the tubes exposed to flame and combustion gases. The upper header is connected to the lower header solely by the tubes, allowing the headers to “float” as the tubes expand and contract. This **floating header** design, combined with forced-flow technology, significantly reduces stress and enables the use of cold water without the risk of **thermal shock**—a common issue in conventional boilers caused by rapid temperature changes that can damage the boiler.

Feed water enters the bottom header and is forced into the tubes, where it begins to boil, creating a two-phase steam/water mixture that rises in each tube. This process creates a **steam gradient**, with more steam at the top of the tubes than at the bottom. The steam is collected in the upper header, where baffles help further separate water from steam, and a final separation occurs in an external separator before the steam exits the pressure vessel to perform its work. Miura's patented two-way water control system ensures both safety and steam quality, with purity levels above **99%**.



KEY INSIGHT

Miura Boilers are manufactured in North America and utilize readily available, non-proprietary parts, ensuring that you can source components from your local suppliers with ease.



ACTUAL PICTURE OF A MIURA 200 HP BOILER ALONG SIDE A 200 HP FIRE TUBE.

WHY MIURA SAVES FUEL OVER OTHER BOILER DESIGNS

1. **Compact Design:** Miura designs are low-mass, water-tube boilers. For example, the LX model has approximately one-third the radiation surface area of a similarly sized fire tube boiler. This means **two-thirds less radiation loss** per boiler, and the fuel savings are magnified in a multiple installation system. Miura boilers can **double the capacity** of an existing boiler room or cut in half the space requirements for new installations.
2. **Reduced Downtime:** Miura boilers can be drained, inspected, and brought back online within **two hours**, eliminating costly annual shutdowns.
3. **Multiple Installation System (MI):** Miura's MI system is a setup where multiple Miura boilers work together to meet varying steam demands. This system saves fuel by bringing boilers online or offline based on real-time steam needs, ensuring only the necessary units operate. With Miura's fast **five-minute startup**, the system reduces fuel waste from idling and minimizes radiation losses by shutting down boilers when not in use, making it highly efficient.
4. **Thermal Shock Prevention:** Miura's design allows boilers to quickly go from a cold start to full steam production in just five minutes without the risk of thermal shock, unlike conventional designs. Conventional boilers must either idle to avoid thermal shock, wasting fuel, or warm up slowly, delaying steam production. Miura's ability to avoid these issues allows boilers to be turned off when not needed, reducing fuel consumption during idle periods and further maximizing fuel savings.

KEY INSIGHT

Regular maintenance like re-rolling tubes and castable repairs in conventional boilers can be costly and time-consuming. Miura's advanced design eliminates these common issues, reducing the need for expensive repairs and extending the life of your boiler, resulting in significant long-term cost savings.

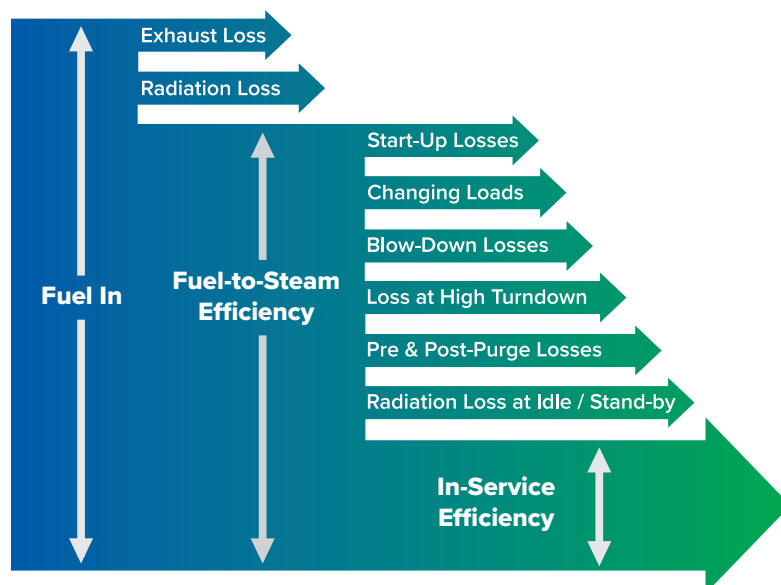
EFFICIENCY AND FUEL SAVINGS

When evaluating boiler performance, understanding the various types of efficiency is crucial. Miura boilers excel in in-service efficiency, which takes into account the full range of operational conditions and fuel usage, offering superior fuel savings.

Types of Efficiency

- **Combustion Efficiency:** Measures the burner's effectiveness in converting fuel into heat. This does not consider the boiler's heat exchanger or the losses from radiation and convection.
- **Thermal Efficiency:** Reflects how well the boiler's heat exchanger transfers heat to the water or steam, but it doesn't account for losses from radiation and convection.
- **Fuel-to-Steam Efficiency:** The ratio of BTU output to BTU input, accounting for radiation and convection losses. While useful, it doesn't account for the real-world variability in demand.
- **In-Service Efficiency:** This is the most comprehensive efficiency measure, taking into account the entire operational cycle of the boiler, including low loads, high loads, and idle periods. It reflects how well the boiler performs under actual conditions, making it the most reliable efficiency metric for comparing boilers.

For example, the fuel-to-steam efficiency of a fire tube boiler operating at 100% load is about 81%. However, when load drops to 25%, efficiency decreases to 78.5%. In contrast, in-service efficiency for the same fire tube boiler under real-world conditions (e.g., fluctuating loads, idle times) would be much lower.



KEY INSIGHT

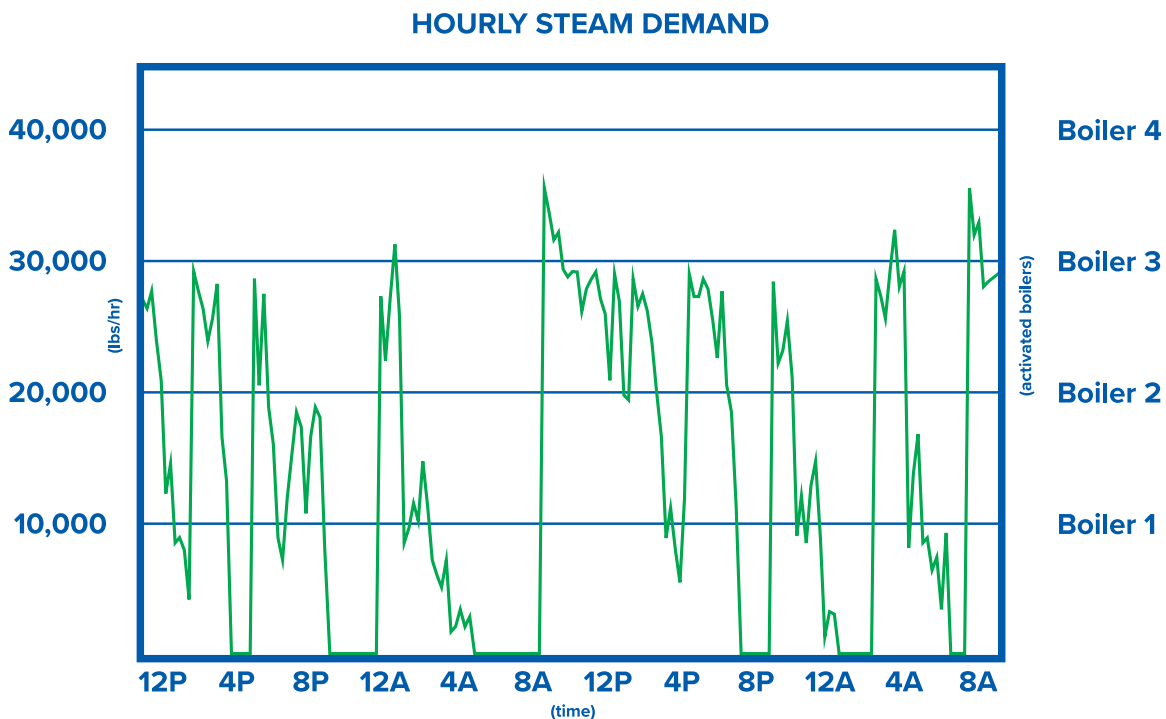
The most efficient boiler is a cold boiler, meaning the best way to save fuel is to turn boilers off when they're not needed, which Miura's design allows.

HOURLY STEAM DEMAND AND IN-SERVICE EFFICIENCY

The **Hourly Steam Demand** chart illustrates how Miura's **Multiple Installation (MI)** system optimizes in-service efficiency by adjusting to fluctuating steam demands. It also highlights **n+1 redundancy**, where an extra boiler remains off to conserve fuel but is ready to activate if one of the other three fails or if there's an unexpected spike in demand. This setup ensures reliable steam production while maintaining high efficiency. On average, Miura's MI system delivers fuel savings of around 20% compared to conventional boiler systems, thanks to its ability to reduce idling and minimize radiation losses.

In a typical large food processing plant, steam demand varies throughout the day. A conventional fire tube boiler modulates its fire rate to meet these fluctuations, but radiation losses remain constant, even during idle times. When the boiler is not producing steam, its in-service efficiency drops to zero.

In contrast, Miura's MI system allows boilers to be turned on or off as needed, which minimizes fuel waste by only running the necessary boilers, avoiding the inefficiencies of idling boilers.



Fuel Savings Example

- At **35% peak load**, a 300 BHP Miura boiler achieves an **in-service efficiency of 83%**, compared to a fire tube boiler's **72%**. This results in annual fuel savings of **\$58,040** for the Miura system, and **\$290,200** over five years.
- Even at **100% load**, Miura's in-service efficiency remains superior, at **85%**, compared to the **82%** efficiency of a fire tube boiler, leading to annual savings of **\$38,684**, and **\$193,423** over five years.

SINGLE BOILER EXAMPLE (11% SAVINGS) – 300 BHP PEAK DEMAND

1. Capital Costs

- A 300 BHP firebox fire tube boiler, with full trim, costs around **\$240,000**.
- A comparable 300 BHP Miura EX unit costs approximately **\$208,000**.
- Boiler room size requirements with allowance considered for the same ancillary equipment:
 - Fire tube: **810 sq. ft.**
 - Miura EX: **380 sq. ft.**
 - With construction costs at **\$225 per sq. ft.**, the **Miura system saves approximately \$96,750 in space costs.**

**Total capital cost savings
with Miura: \$128,750**

2. Fuel Savings (at 35% Peak Load Conditions)

- **Fire Tube Boiler** (in-service efficiency: 72%)
 - Steam Demand: 3.175×10^7 lbs/year (at 1 PSIG)
 - Natural Gas Cost: **\$0.01063/ft³**
 - Natural Gas HHV: **1004 BTU/ft³**
 - Steam Enthalpy: **1150 BTU/lb (at 1 PSIG)**
 - Feed Water Enthalpy: **212 BTU/lb**
 - Annual fuel cost calculation:
 $3.175 \times 10^7 \times 0.01063 \times (1150 - 212) / (0.72 \times 1004) = \$437,939/\text{year}$
- **Miura EX Boiler** (same conditions; in-service efficiency: 83%)
 - Annual fuel cost calculation:
 $3.175 \times 10^7 \times 0.01063 \times (1150 - 212) / (0.83 \times 1004) = \$379,898/\text{year}$

**Fuel savings in
favor of Miura:
\$58,040/year**

**Total fuel savings
over five years:
\$290,200**

3. Fuel Savings (at 100% Load Conditions)

- **Fire Tube Boiler** (in-service efficiency: 82%)
 - Steam Demand: 9.05×10^7 lbs/year (at 1 PSIG)
 - Natural Gas Cost: **\$0.01063/ft³**
 - Natural Gas HHV: **1004 BTU/ft³**
 - Steam Enthalpy: **1150 BTU/lb (at 1 PSIG)**
 - Feed Water Enthalpy: **212 BTU/lb**
 - Annual fuel cost calculation:
 $9.05 \times 10^7 \times 0.01385 \times (1150 - 212) / (0.82 \times 1004) = \$1,096,067/\text{year}$
- **Miura EX Boiler** (same conditions; in-service efficiency: 85%)
 - Annual fuel cost calculation:
 $9.05 \times 10^7 \times 0.01385 \times (1150 - 212) / (0.85 \times 1004) = \$1,057,382/\text{year}$

**Fuel savings in
favor of Miura:
\$38,684/year**

**Total fuel savings
over five years:
\$193,423**

MI SYSTEM EXAMPLE (11% SAVINGS) – 600 BHP PEAK DEMAND

1. Capital Costs

- Two 600 BHP fire tube boilers with full trim lists around **\$760,000**.
- A Miura MI system with four 200 BHP EX units and an MI controller costs approximately **\$651,270**.
- Boiler room size requirements with allowance considered for the same ancillary equipment:
 - Fire tube: **1,599 sq. ft.**
 - Miura EX: **1,065 sq. ft.**
 - With construction costs at **\$225 per sq. ft.**, the **Miura system saves approximately \$126,900 in space costs.**

**Total capital cost savings
with Miura: \$235,630**

2. Fuel Savings (at 35% Peak Load Conditions)

- **Fire Tube Boiler** (in-service efficiency: 72%)
 - Steam Demand: **6.35×10^7 lbs/year (at 1 PSIG)**
 - Natural Gas Cost: **\$0.01063/ft³**
 - Natural Gas HHV: **1004 BTU/ft³**
 - Steam Enthalpy: **1150 BTU/lb (at 1 PSIG)**
 - Feed Water Enthalpy: **212 BTU/lb**
 - Annual fuel cost calculation:
 $6.35 \times 10^7 \times 0.01063 \times (1150 - 212) / (0.72 \times 1004) = 875,878/\text{year}$
- **Miura EX Boiler** (same conditions; in-service efficiency: 83%)
 - Annual fuel cost calculation:
 $6.35 \times 10^7 \times 0.01063 \times (1150 - 212) / (0.83 \times 1004) = \$759,798/\text{year}$

**Fuel savings in
favor of Miura:
\$116,080/year**

**Total fuel savings
over five years:
\$580,400**

3. Fuel Savings (at 100% Load Conditions)

- **Fire Tube Boiler** (in-service efficiency: 82%)
 - Steam Demand: **1.81×10^8 lbs/year (at 1 PSIG)**
 - Natural Gas Cost: **\$0.01063/ft³**
 - Natural Gas HHV: **1004 BTU/ft³**
 - Steam Enthalpy: **1150 BTU/lb (at 1 PSIG)**
 - Feed Water Enthalpy: **212 BTU/lb**
 - Annual fuel cost calculation:
 $1.81 \times 10^8 \times 0.01063 \times (1150 - 212) / (0.82 \times 1004) = \$2,192,134/\text{year}$
- **Miura EX Boiler** (same conditions; in-service efficiency: 85%)
 - Annual fuel cost calculation:
 $1.81 \times 10^8 \times 0.01063 \times (1150 - 212) / (0.85 \times 1004) = \$2,114,765/\text{year}$

**Fuel savings in
favor of Miura:
\$77,369/year**

**Total fuel savings
over five years:
\$386,845**

MIURA'S APPROACH TO WATER TREATMENT & SCALE PREVENTION

Water treatment is vital for any boiler system, much like oil changes are for maintaining a car's engine. The presence of scale in a boiler can drastically reduce its efficiency, and Miura's system is designed to address this issue proactively.

Detecting Scale

Miura boilers are equipped with thermocouples that monitor the temperature of the tubes. When scale begins to form, the boiler shuts down and rings an alarm. This allows operators to trace the source of hardness in the water (e.g., malfunctioning water softener, issues in condensate return lines, or operator error), and conduct an acid rinse to restore the boiler to optimal performance.

Why Miura Detects Scale

Miura's design was developed with a focus on efficiency, especially in markets like Japan, where fuel costs are significantly higher than in the U.S., and land is at a premium. The Miura boiler is designed to alert operators as soon as scale begins to affect performance, ensuring minimal waste and quick resolution.

The Cost of Scale Buildup

Even a small amount of scale can lead to considerable energy loss:

**An eggshell thickness of scale results in about 9% energy loss.*

SCALE (in.)	1/64	1/32	1/16	1/8	1/4	3/8
ENERGY LOSS (%)	4.0	8.5	13	22	38	50

Example: Cost of Scale Buildup

For a 600 BHP fire tube boiler operating at **35% peak load**, with an in-service efficiency of **72%** and an eggshell-thick layer of scale with a 9% efficiency loss, the following fuel costs apply:

Without scale: $6.35 \times 10^7 \times 0.01063 \times (1150-212)/(0.72 \times 1004) = \text{\$875,878/year}$

With scale: $6.35 \times 10^7 \times 0.01063 \times (1150-212)/(0.63 \times 1004) = \text{\$1,001,003/year}$

**Total fuel waste:
\\$125,125/year**

Miura boilers are designed to detect and respond to scale, ensuring peak efficiency when proper water treatment is maintained. Unlike fire tube boilers, which can allow scale buildup without immediate issues, Miura boilers will alert operators when scale forms, allowing for quick resolution.

KEY INSIGHT

A 300 BHP Miura boiler holds only 100 gallons of water, compared to 2,000 gallons in a similar fire tube boiler, making acid rinses faster and more cost-effective. Proper water treatment is essential, as boilers don't create scale—they "find" it when it enters the system. The choice is simple: a boiler that ignores scale buildup, or one that helps you address it before it becomes a problem.