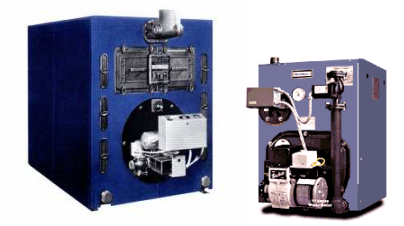
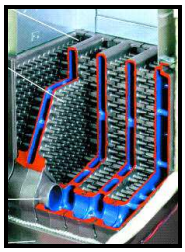


BOILERS WITH CAST IRON SECTIONS

For demonstration a Weil McLain & Burnham are shown at left

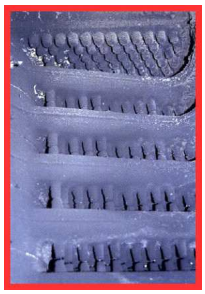
"Cleaning boilers reduces service costs and saves oil"

NEW CAST IRON BOILER W/O JACKET



CUT AWAY FLUE

FLUE GAS FLOW



FLUE SOOT BUILDUP

AFTER CLEANING

2003 COMMERCIAL BUILDING BETHEL, AK

BOILER SOOT & HARD SLAG DEPOSITS

PILOT STATION, ALASKA 2003

EFFICIENCY OPERATIONS AND MAINTENANCE PRACTICES

Proper yearly mandatory maintenance procedures for any standard cast iron oil fired boilers extends the life expectancy to 30 to 50 years. The boilers (Example at left) also retain most of its AFUE efficiency rating of approximately 85% if these fundamentals are followed exactly.

AFUE is "*Annual Fuel Utilization Efficiency". Indicated as a percentage, the Boiler AFUE tells how much energy is being converted to heat. For example, an AFUE of 85 means that 85% of the fuel oil is being used to warm the facility, while the other 15% escapes as exhaust with the combustion gases*

SOOT and SCALE DEPOSITS

In an AFUE 85% cast iron boiler, water surrounds the flues and hot fuel oil gases rise from the combustion area and travel through the flues between each boiler section. This results in soot and hard slag deposits accumulating within the flue. No matter what fuel is used (gas, oil, coal or wood) the flues need to be cleaned. If the flues are not cleaned regularly, boiler efficiency is sacrificed and heating fuel oil consumption increases.

Because soot and hard slag deposits have five times the insulating capacity of asbestos, the heat transfer loss in a sooty boiler rises dramatically as the layer of soot builds up. ***For example, government studies have shown that 1/2 inch of soot and hard slag deposits results in an increase in heating fuel oil consumption of approximately 42%*** and reduces substantially the AFUE and BTU rating of the boiler, which is why an old sooty boiler wants to run 24/7 during cold weather. For a cast iron boiler that had an AFUE rating of 85%, that is a good argument for ***mandatory boiler cleaning.***

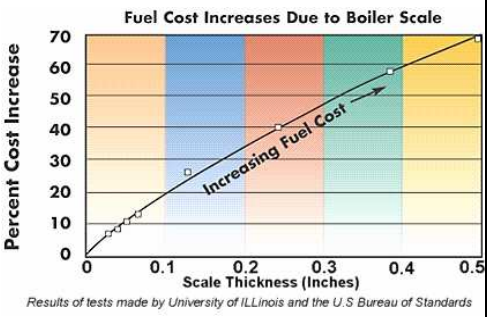
FACILTY ANNUAL SAVINGS DEMONSTRATION (Appendix A)

See Appendix "A": Modeling the above scenario a 35% factor was used to demonstrate as an approximation sample of fuel oil consumption when boilers have a little less than ½" of soot and scale.

MINERIAL (SCALE) DEPOSITS IN THE WATERWAYS

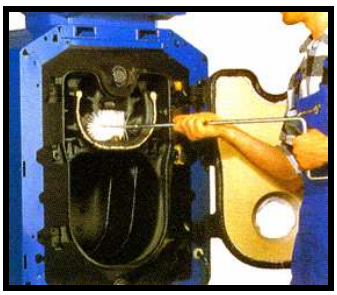
Mineral (Lime) and sludge in the waterways of cast iron sections can cause loss of efficiency and premature boiler failure such as a cracked section. As lime deposits or sludge accumulates in the bottom of sections, it will insulate the water from the cast iron, causing "hot" spots. Expanding and contracting from overheating and cooling eventually will weaken the cast iron, causing it to crack. Early symptoms are percolating sounds or a knock or ping when the boiler reaches its set point temperature.

Scale build-up up on the casting over a long period reduces heat transfer to the facility. BTU heat loss of 8% and increased fuel oil consumption of 2% will result from only 1/32" of scale in the boiler waterway sections.

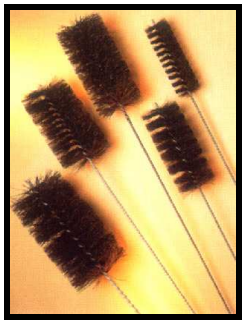


SCALE INEFFICIENCY'S

DAMAGED BOILER SECTION FROM SCALE



EXAMPLE CLEANING METHOD



FLUE CLEANING WIRE BRUSHES

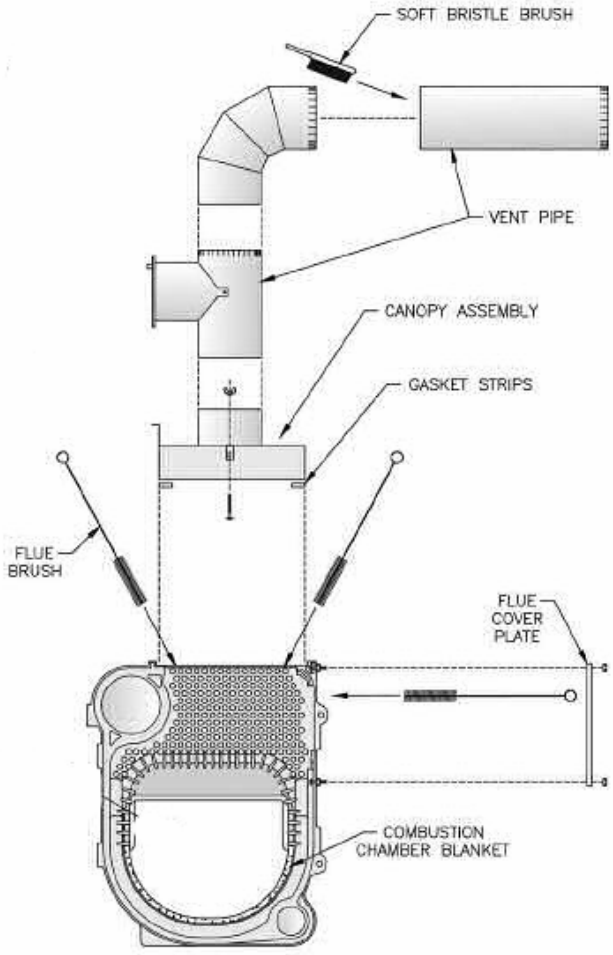
Boilers that exhibit symptoms of scale need replacement or an inhibited muriatic acid pumped through the boiler to remove the scale. Extreme caution should be taken muriatic acid is a highly toxic chemical, and qualified personnel experienced in chemical handling should perform this endeavor. Sometimes this procedure does not remove all of the scale from the boiler.

As an example, this procedure was used for the Chevak School District (Kashunamuit) in 1991. The boilers were two 1 million BTU Weil Mclain boilers (Pictured above and in burner section) and one boiler was knocking consistently when it reached its high setpoint temperature. Muriatic Acid was pumped through the boiler for three days. After completion, the boiler still had a noticeable ping or knock during its temperature-cycling period.

Common causes for scale build-up are:

1. Weeping relief valve (undersized expansion tank or water logged expansion tank will cause the pressure to rise and lift the relief valve.)
2. Leaking system piping mains, branches and fittings
3. Air vents that fail to close
4. Piping in utilidors or soffit space with hard to detect leaks

PROPER PROCEDURES FOR CLEANING A BOILER TO REMOVE SOOT



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