TECHNICAL BULLETIN

Burnham Corporation

Commercial Steel Boilers

Wetback Design vs. Hard Refractory Dryback Design

It is extremely important to select a boiler that is free from known design deficiencies. For example, it is well known that a hard refractory dryback boiler is inherently susceptible to rear door refractory and gasket failure. The Burnham wetback and M Series designs are not. This fact can be readily verified by consulting with other dryback owners or contacting an independent boiler repair shop.

Why is a wetback design better?

As you can see from a drawing or catalog, a three-pass wetback design has a rear water wall that separates the primary heating surface of the combustion chamber from the rear tube sheet. This continuation of the water jacket eliminates the need for a refractory wall, for rear door swing space behind the boiler and also the need for costly refractory maintenance.

Further, the rear water wall eliminates the need for gasketing, which is vulnerable to the temperatures generated in the rear turnaround area. The fact of the matter is - a wetback design boiler not only overcomes these expensive deficiencies, but also has its own advantages such as greater overall efficiency and virtually maintenance-free construction.

A Burnham boiler will cost you less over the lifetime of the boiler because it is better by design.

Some Points to Remember

Wetback Advantage

Wetback boilers have separate tube sheets between all major temperature changes.

Rear access opening refractory replacement will be required approximately every 15 years. Washout and manhole gasketing will constitute the total wetback maintenance on a yearly basis.

The rear doors require no cool-down period and can be opened immediately plus there is no space consuming area required for swinging the door.

The split rear doors are easily removed. Efficiency is maintainable because hot gases cannot short circuit in a wetback design.

Dryback Disadvantage

Flue gas temperature differential of 1300-1600F between the second and third passes creates damaging stresses on the single tube sheet. The cost of rear door refractory replacement approximately every three years will drastically increase operating costs. Plus yearly rear door gasketing is expensive.

Opening and resealing the rear door is time consuming in man-hours and requires a 24-hour cool down period prior to opening. The heavy refractory door may sag on the davit and must be jacked back into place. Exposure of the refractory to hot flue gases causes erosion and destroys the baffle resulting in "short circuiting" of the flue gas and lower efficiency.

Rear refractory walls radiate heat with greater exterior radiation losses. These losses create an overall loss in efficiency compared to a wetback design.

Boiler Costs -- Are They Equal?

The true cost of a boiler is not just the purchase price. It is not the costs associated with the maintenance or the efficiency of operation, but a combination of all three over the life of the unit. The following information will give you practical and factual data to help you understand:

- Fuel cost savings
- Boiler efficiency comparisons
- Dryback refractory replacement
- Overall operating efficiency

What is fuel-to-steam efficiency and is it important?

Fuel-to-steam efficiency is very important because it is the only true measure of overall packaged boiler operational efficiency. True fuel-to-steam efficiency takes into account radiation and convection heat losses, which less reputable manufacturers will ignore. Buy your boiler from a manufacturer who guarantees fuel-to-steam efficiency and backs the guarantee. Remember, fuel-to-steam efficiency is the performance of your entire packaged boiler.

Maintainable efficiency vs. attainable efficiency.

When looking at efficiency as a criterion for purchasing a boiler, especially fuel-to-steam efficiency, the manufacturer's design efficiency sets your theoretical fuel cost while operating efficiency determines your actual fuel costs. There is a difference between attainable efficiency and maintainable efficiency. Correct burner adjustment is the key to maintainable efficiency. It is a compromise between the optimum and the practical. Good burner tuning is achievable only with a good burner design and a good boiler/burner packaging.

Will a dryback boiler cost more to own?

The answer is simple. Yes! The most important consideration in overall efficiency is the high cost of maintenance inherent in a dryback design. Consider this example: an average 300 HP boiler operating under normal conditions with a conservative life of 25 years. During this boiler's lifetime the rear door refractory would be replaced about eight times or roughly every three years. Also, assuming the boiler is opened only once a year for inspection, regasketing of the rear door would occur 25 times.

How much cheaper is that hard refractory backed boiler?

So, somebody is offering a hard refractory backed boiler design for less money than a wet back design. While it may make your initial capital investment costs look great, what does it do to your pocketbook in the long run?

Let's take a look! Let's use a 300 HP boiler with a conservative life span of 25 years as an example. During this life span, the hard refractory in the rear door will have to be replaced roughly every three years, or eight times. A yearly maintenance inspection will require the replacement of the rear door gaskets 25 times.

Average cost for replacing rear door hard refractory: $5,100
Average cost of regasketing the rear door: $425

Apply these costs to the average life span of the boiler:

$5,100 x 8 = $40,800
$425 x 25 = $10,625
$51,425

Compare the cost of replacing the rear door gasket of your wet back design:

$29 x 25 = $725

The difference between the hard refractory dryback maintenance and the wetback maintenance is $51,425 - $725 = $50,700

Now comes the shocking part of the study. For the same amount of money spent in hard refractory dry back maintenance, you could have bought a brand new boiler!!!

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