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# Condensing Boiler Specification - Part 1 - Design Efficiency

**Monday Morning Minutes | by Norm Hall**

Condensing boilers can provide optimum efficiency for your clients' heating systems. What do you need to understand and decide on when creating the specification and selecting the boilers you will recommend. This series will feature the key points an engineer may consider when designing the boiler system. This first part one suggests what efficiency you should use when converting from input capacity to boiler output capacity.


## Understanding Condensing Boiler Published Efficiencies

We had a contact with a recent engineering graduate about an institutional system heating load of five million BTUH with a standby boiler required to meet N+1 requirements. This engineer was looking at possibly using three 2,500,000 BTUH boilers. When efficiency of the boilers came up in the discussion, he was going to check the heat load calculations to see if the 98% efficient boilers could work. He was surprised when we told him he should not use 98% in his calculations. Here is why.

He was concerned that the 98% published and marketed efficiency was untrue. We explained that the boilers were tested to AHRI standards and were very accurate. The issue was that his 180°F supply and 140°F return did not meet the testing parameters. We suggested he read our Condensing Boiler Efficiency and Your Boiler Schedule (deppmann.com) for more information.

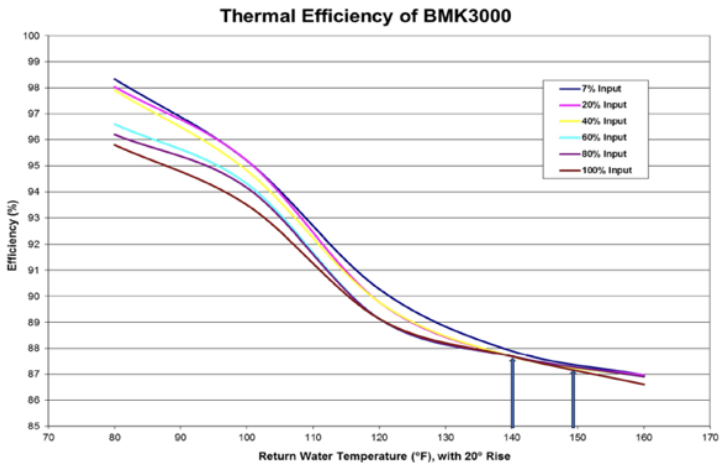
Greater efficiencies occur when the return temperatures are low. Condensing does not start in our Midwest weather conditions until you return around 135°F to the boiler.

## Condensing Boiler Efficiency with Warmer Return Water

So, what efficiency should I use when determining the output BTUH of a condensing boiler with a warmer return temperature? As mentioned above, the boilers will start to condense at return temperatures below around 135°F.

Many engineers may use a hydronic heating system temperature range of 180°F supply and either 150°F or 140°F return at design conditions. The designer could look up the actual efficiency of the boiler scheduled and use that. Some boiler manufacturers publish this data while others will require a contact be made. One example is shown below.

Aerco Benchmark 3,000,0000 BTUH Boiler




You can see that the published efficiency range of about 95.5% to 98% is at a cool 80°F. At a 140°F return temperature the efficiency at 100% load would be 87.8%. You could schedule the Benchmark and use the 87.8%. Unless the project documents were a base bid with mandatory alternates, you may end up with another brand. Will that brand have a true 87.8% at the design return temperature? Probably not.

I recommend you use 85% for your calculations between 2.5 and 10 million BTUH and 84% for under 2.5 million. These are numbers you should be safe with in the condensing world. Visit Minimum Boiler Efficiency & New D.O.E. Standards (deppmann.com) to see why. For information on

So, the design example of 5,000,000 BTUH required output would require:

**5,000,000 / 0.85 = 5,882,353 BTUH TOTAL LOAD**

We would use three Aerco BMK3000 boilers, two operating with N+1 standby. The three million BTUH input boilers provide just a little more than the design output condition required. If R. L. Deppmann receives the order and Benchmark boilers are installed, the owner will enjoy an extra 2.8% efficiency over the D.O.E. minimum.

What if you wanted a water tube boiler instead of a fire tube? Visit Condensing Boiler Efficiency and Your Boiler Schedule (deppmann.com) for an example.

How do we take advantage of condensing technology and higher efficiency? Look forward to part two of the series next week.