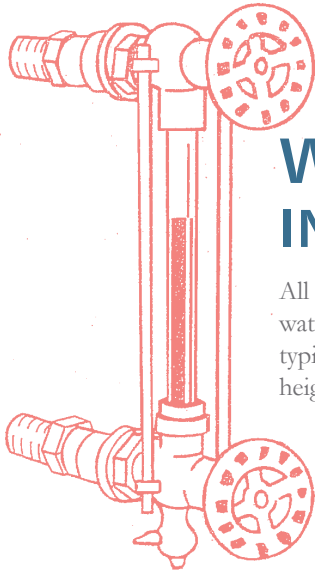




Helpful HVAC design information from ITT Residential & Commercial Water



WHAT IS THE NORMAL WATER LINE IN A STEAM BOILER?

All boiler manufacturers identify the “normal water line” in their instruction manuals. It is typically denoted as “NWL” and describes the height in inches from the bottom of the boiler up to this line. By not paying attention to the NWL, you can set yourself up for a whole lot of headaches. The manufacturers today know that for their boilers to provide good “dry” steam, they have to rely on the boiler’s near-boiler piping to help “shake out” any water that has come out of the boiler with the steam.

MOST MANUFACTURERS LIST THE HEIGHT OF THE BOILER’S HEADER PIPING ABOVE THE NWL AS AT LEAST 24” BECAUSE:

- 1) They want to minimize the amount of water that can climb up the supply riser(s) with the high velocity steam that is leaving the boiler, and
- 2) as the equalizer drip line fills with water on start-up (because the steam is condensing in the near-boiler-piping), they don’t want this

water to back up into the header piping. If this happens, the header piping’s internal diameter is drastically reduced which immediately increases the steam’s velocity which can cause more problems. The higher velocity steam will literally “suck” additional water right up out of the boiler and out to the system. This water-laden steam will condense prematurely because the water will rob the latent heat from the steam causing uneven distribution of heat throughout the building. It will cause the steam vents to spit condensate. It will create water hammer because condensate will slam into elbows, tees and anything else in its way. This high velocity steam will also create a low water condition back in the boiler because of all the water that left the boiler prematurely. The only time the NWL is the normal water line is when the boiler is off and cold. (Figure 1)

“NWL is only normal when the boiler is off and cold.”

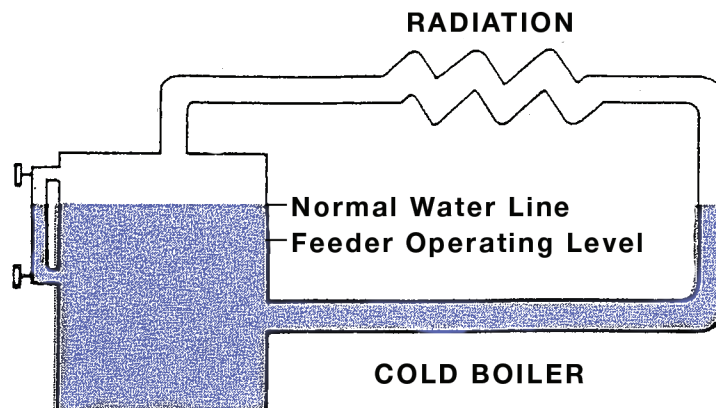


Figure 1





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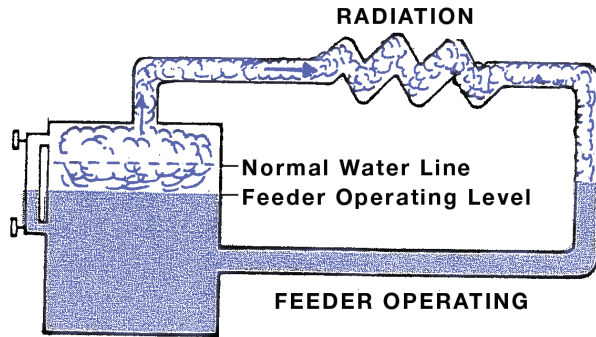


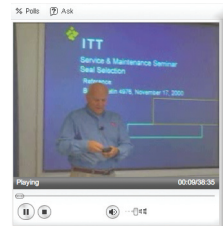
Figure 2

As soon as the boiler starts to make steam, the water line has to change because some of the water is changing its state from a liquid to a gas (Figure 2). How fast the water changes into steam is a function of the boiler's BTU/H capacity. An easy rule of thumb to refer to when attempting to calculate the boiler's steaming rate is 0.5 gpm for every 1000 square feet of Equivalent Direct Radiation (EDR). This means water is being taken out of the boiler in the form of steam at a rate of 0.5 gpm for every 1000 square foot rating of the boiler. If you have a residential steam boiler capable of providing 500 square feet of steam, water is leaving the boiler at a rate of 1/4 gpm for every minute the boiler is firing. If a boiler firing cycle lasts 15 minutes and the condensate hasn't started to return, 3.75 gallons of water will have left the boiler. That is a substantial amount of water that is no longer in the boiler.

We know how the NWL is established, but how it is set in a boiler? The only way to set the proper NWL is by manually filling the boiler to the proper level. Some believe that an automatic water feeder is responsible for maintaining this water line, but a feeder's only function is to maintain a safe minimum water level working in conjunction with the low water cut-off. You don't want a customer thinking that an automatic water feeder is convenience item lest they forget about the importance of regularly checking their boiler!

If you have any questions regarding low water cut-offs, automatic water feeders and steam boilers, contact your local ITT McDonnell & Miller Representative. They are well trained on steam subjects. ♦

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