Ask Dr. Galv

Dear Dr. Galv: Can I run more steel in my kettle? How do I know when I am running at full capacity?

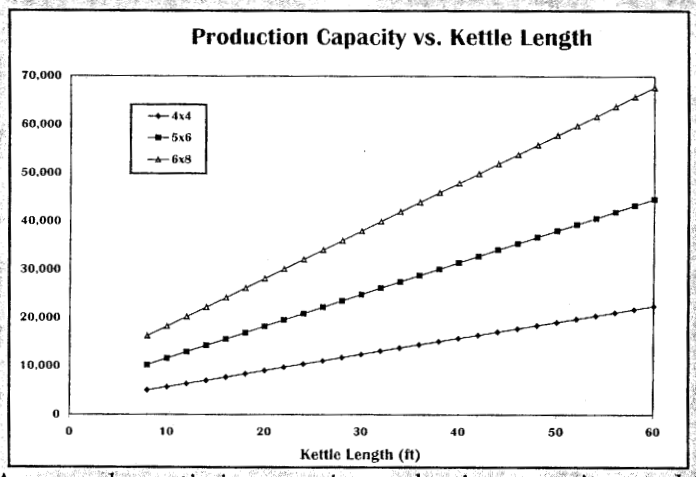
A. In order to maximize plant efficiency, you need to know the production capacity of your kettle. Production capacity is dependent on the dimensions of the kettle, the "safe heat input rate," and the bath temperature of the zinc. Plant efficiency is based on the rate of steel production per hour as compared to the kettle's theoretical production capacity. For example: If the production capacity of your kettle is 20,000 pounds per hour and the average load per lift is 5,000 pounds, you can run four lifts per hour through your kettle. This assumes that you add zinc to the kettle during non-production periods.

Production capacity of galvanizing kettles is based on balanced thermodynamic equations. The amount of heat needed to maintain bath temperature must equal the amount of heat supplied through the kettle walls. The heat needed to maintain the bath is dependent on two factors; the heat loss from the bath to the environment and the heat required to bring the incoming steel to the galvanizing temperature. Increased production capacity increases plant efficiency.

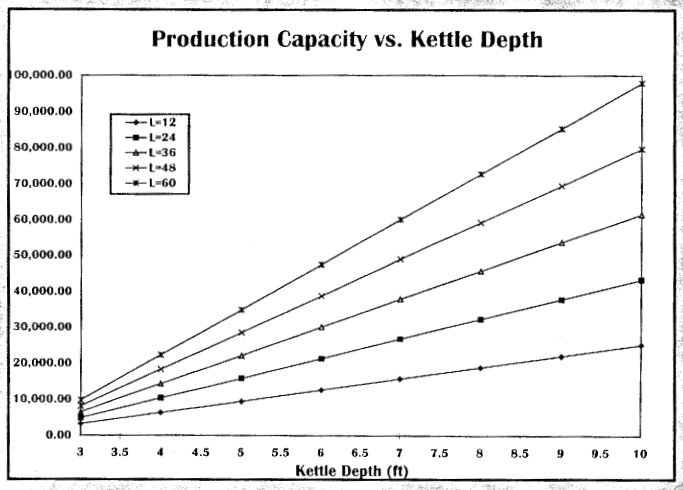
Increasing production capacity can be accomplished in a few different ways. Decreasing the galvanizing temperature can provide between a 5 and 10 percent increase in production capacity. A lower bath temperature, such as 820 degrees Fahrenheit, increases the production capacity by 5 percent from a bath 850 F. For a typical galvanizing kettle, 30' x 4' x 6', the production capacity at 820 F is 26,919 pounds of steel per hour and at 850 F the production capacity is 25,736 pounds of steel per hour, a decrease of 5 percent.

Another route to increase your capacity is to preheat the steel before it enters the galvanizing bath. Preheating the steel to 300 F gives an increase in production capacity of 40 percent for at bath operating at 850 F. Most triple salt fluxes may remain stable up to 300 F and other fluxes may remain stable at even higher temperatures. Check with your flux supplier to find out the best preheat temperature for your flux system.

The previous two suggestions are used to increase efficiency of your current kettle. The next suggestions only apply if you are changing out your kettle. The following two plots show the relationship between kettle geometry and production capacity. The plot *Production Capacity vs Kettle Length* shows the geometry of three different kettles. As you can see, an increase in length gives a slight increase in production capacity for these kettles. There is about a 7 percent increase per foot of kettle length.



A more dramatic increase in production capacity can be seen in the second plot of *Production Capacity vs. Kettle Depth*. Increasing the depth by as little as one foot can have a significant effect on the production capacity. This plot shows production capacity versus depth for a number of different kettle lengths. The kettle width is held constant at four feet.



A change from a four foot depth to a six foot depth can double your production capacity. If you hold the kettle length and kettle depth constant and increase the kettle width, production capacity goes down slightly due to increased heat losses at the kettle surface.

Once you determine your kettle capacity, you can determine the efficiency by calculating the weight of steel through the kettle per hour compared with the production capacity of the kettle. A shortened kettle life can occur if you are significantly running the kettle over the capacity. If you are significantly under the production capacity, you can increase efficiency by running more weight per lifts or fewer plant hours. A galvanizing plant's efficiency is determined by the production capacity of the kettle.

Full scale plots and production capacity calculations are available through the AGA. For more questions on production capacity contact the AGA Technical Department.