

## Ladle Skull Melting Energy

### Question

In our meltshop, a 7' inside diameter ladle was returned from the caster with solid steel 8" thick covering the inner ladle bottom. Our nominal tap weight is 88 tons while the ladle inside surface pre-tap temperature is 1600°F. Does it make any sense to increase the next tap temperature at the EAF from 2930°F to our maximum limit of 2990°F in order to melt out the scrap? J.P., USA

### Answer

The ladle contains approximately 12,547 lb. of steel scrap which also means that the next time you tap into the ladle you will only be able to tap 82 tons of molten metal in order to maintain the nominal tap weight. Based on a scrap steel temperature of 1600°F, the extra energy required to heat and melt the steel scrap at 2790°F would be 329 BTU/lb for a total energy input of  $4.128 \times 10^6$  BTU.

Increasing the tap temperature from 2930 to 2990°F raises overall energy of the liquid steel by 11 BTU/lb. Based on a liquid steel tap weight of 82 tons the excess energy available as compared to normal conditions would be  $1.804 \times 10^6$  BTU. If all conditions were ideal, the excess heat input would melt about 44 % of the steel scrap left in the ladle. According to this calculation, the mean thickness of steel scrap that could be melted in your ladle would be around 3.5".

At this point, a decision must be made since the use of excess heat from a higher than normal tap temperature will not completely melt the scrap. The ideal solution would be to take the ladle out of service, allow it to sit and then remove the scrap upon cooling. This is not always practical since extra ladles may not be available. A second alternative would be to tap hot but allow extra time in the ladle furnace. Since the minimum amount of energy needed to completely melt out the scrap steel is known, the energy inputs and efficiencies from the ladle furnace can be used to calculate the excess time needed to complete the task. One caveat, make sure that the scrap composition is compatible with the current grade being produced. You probably would not want to mix scrap from a vanadium-bearing grade with a low carbon wire grade.