Flying Tundish Change

Question

We have a 6 strand billet caster making 100 mm square billets using open stream casting. Currently we are using basic/acid boards in our tundish having a life of five heats. To increase the productivity, we are planning for flying tundish practice at the caster but are not sure of its success. Are there any plants using tundish practice under similar casting conditions? Kindly suggest the anticipated problems and precautionary measures for the same.

PCD, India

Answer

For the reader, a flying tundish change occurs when the tundish is changed and the strand restarted using the slab or billet in the mold as the starter bar. Liquid metal from the new tundish flows into the mold and welds to the top of the old slab or billet. The caster is then restarted and the welded bar is withdrawn. The practice saves from 35 minutes to 2-hour turnaround time and yield losses incurred in starting and stopping a caster.

Many billet shops are using the flying tundish practice to extend caster sequences. Some shops run two weeks or longer without stop, but perhaps before going to a flying tundish practice consider extending the life of the current tundishes in use. Per ton production costs at your caster would be greatly decreased by extending the life of a tundish from the current five heats up to 20 or more heats prior to changing.

At some plants in the USA, a tundish with non-changeable metering nozzles may be used for 24 hours or more. This is done by using a dry vibe or sprayed basic lining combined with metering nozzles up to the task. A “Turbo Splash Pad” will help to reduce turbulence in the tundish and minimize splash pad wear. Additionally, precautions are taken in the steelmaking and casting process to avoid tundish nozzle clogging due to alumina, spinels or freeze-offs. Slag from the ladle is not allowed to get into the tundish.

The risk in extending the tundish life is that if the number of heats on a tundish are less than the current standard,

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the tundish cost per ton will increase. With that in mind, carefully consider all factors that cause casting aborts during the first five heats. For review examine the November, 2001 *Skull Session*, "High Carbon Billet Startup Breakouts."

Another important fact to consider in extending tundish life would be grade scheduling. Tundish changes may be needed due to mixed grades. Mixed grades in the tundish lead to reduced yield due to the need to take separation billets of mixed chemistry. Basically, if dissimilar grades need to be mixed in the tundish to extend a sequence, the tundish level should be lowered to the minimum acceptable operating level prior to opening the next ladle.

So if good sequential grade scheduling is the current practice and the life of the tundish has been improved then your company may want to implement a flying tundish change procedure. The flying tundish change practice starts with having a second tundish ready for casting on the tundish car. If your company does not have two tundish cars then the task is very difficult. A flying tundish change is not recommended if the caster has a single set of withdrawal rolls since slippage will be a major problem.

The metering nozzles in the new tundish should be plugged with wood dowels that are used as an alignment aid. Very fine chromate sand should be used to fill the nozzles. Steel from the old tundish should be run out in the normal fashion but one cannot allow any slag to get into any of the molds. Having a slight yield loss due to steel left in the old tundish would be much preferable to having a startup breakout on the new tundish.

Prior to moving the old tundish, a restart bar, ¾" diameter by 18" long with a 3 ¾" square plate positioned halfway along the bar length should be inserted into the billet so that the square plate rests on top of the meniscus. After inserting the restart bar, jog the billet down to the normal starting point. The operators will need to reduce the spray water flow by 50 % percent or more in the spray ring and Zone 1. The spray water should be completely shut off below Zone 1.

Prior to removing the old tundish, square pieces of cardboard or metal, 6" by 6" should be placed over the molds to prevent foreign material from falling into the molds during the switch. Launders, if available, can be used in a similar fashion. The old tundish is then removed and the new tundish is rolled over the molds and aligned. The full ladle should be

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brought to the caster no more than 5 minutes prior to opening. Liquid steel temperature in the ladle should be at levels normally used for start up heats. Operators have empirically found that the following time limits apply for starting opening the strands after a flying tundish change:

0.01 to 0.20 % C 30 minutes
0.21 to 0.50 % C 25 minutes
> 0.50% C 15 minutes.

The time limits are due to billet shrinkage. On grades with C > 0.70 %, 0.75 to 1.50 % Mn and Si > 0.85 % do not try a flying tundish change because the billets will break upon restart.

After all is ready start filling the new tundish. When the level in the new tundish reaches a minimum of 12" open the nozzles. If steel does not freely flow from the nozzles it may be necessary to lance it open. Instead of using a steel lance, consider using a lance made of copper tube to blow the oxygen for less destruction to the metering nozzle. When the mold starts to fill, start in automatic if the old billet is below the mold level set point, otherwise start in manual.

Ramp up the spray water when the new billet exits the withdrawal rolls. When the billet gets to the torch, make sure the cutoff point is ahead or behind the restart point so as to not jam up the roller table. A flying tundish change is considered successful when all of the restart billets have made it through the torches.

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