

APPLICATION AND ADVANTAGES OF COLD BOARD LADLE LINING SYSTEM

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ABSTRACT:

The scenario in foundry has totally changed after use of Cold Ladle Boards in ladle lining. Ladle preparation, refractory lining, ladle heating, non metallic inclusion, cold ladle or metal solidification, nozzle choking due to drop of temperature and tension of availability of ready ladle, metal skull generation and cleaning are all old worries.

This system is cost effective directly & indirectly very beneficial. This also reduces the tapping temperature from furnace and energy efficient with neat and clean shop.

Keywords: Fairflux, Cold ladle boards, Foundry division cold ladle boards.

STUDY:

Cold lining system in the metal foundry is established and one of the developments in the field of ladle technology which has been found economically beneficial compared to normal refractory lined ladle due to following advantages:

a) Saving of furnace oil / LDO as no preheating is required. There by saving in recurring cost as well as capital cost of pre-heater and its space.

b) Availability of ladle is increased as such melter of the melting furnace is totally relieved from the tension of ladle being made ready and concentrate better on heat making.

c) There is no skull or jamming in the ladle and thereby Oxygen lancing of the ladle is eliminating.

d) Yield of metal is increased because loss of metal due to ladle failure is totally eliminated and no skull is formed in the ladle.

e) There is no need of using refractory bricks or mortar. Therefore, steel will be free from refractory inclusions and dirt. Casting defects due to inclusions will be considerably reduced which will subsequently decrease fettling cost. Hot tears and cold shut problems can be eliminated due to controlled temperature teeming being possible.

f) Very neat and clean working with 100% safety. Solid casting is expected as some gases are released in porous boards. Ladle is ready within 3 hours for next casting, this results in double the production in shop.

g) There is consistency in fall of temperature from furnace to ladle in every heat as such standardization of tapping temperature becomes very easy and thereby failures of heats can be particularly stopped. Stopper fixing if delayed; there is no fear of falling the temperature of the ladle compare to earlier practice. Thus there is no need of giving slightly higher temperature to liquid steel to compensate heat loss. You may hold ladle for longer time with very less heat loss.

h) Due to Consistency in tapping temperature and refractory consumption of melting furnace will be considerably reduced.

It has been observed that the cost of furnace oil, refractory bricks, gas for cutting, skull, loss of metal due to failure of stoppers, etc, will be more than the cost contributed by cold boards. Therefore, many of the steel foundries are gradually changing over to cold ladle lining system.

DESCRIPTION OF COLD LADLE LINING AND METHOD OF ITS USE

The cold ladle lining is basically made of Insulating boards, either silica base or magnesite base. For construction of the cold ladle lining set it requires 12 Nos. of vertical boards and 2 Nos. of bottom boards. (Fig. shows the technique of using cold ladle lining). The two bottom boards installed first in the bottom of the ladle after leveling the bottom with dry sand. One of the two bottom boards has hole for the nozzle which is aligned with nozzle hole in the ladle. The nozzle is then fixed to the ladle and secured by means of adhesive paste. The base boards if firmly

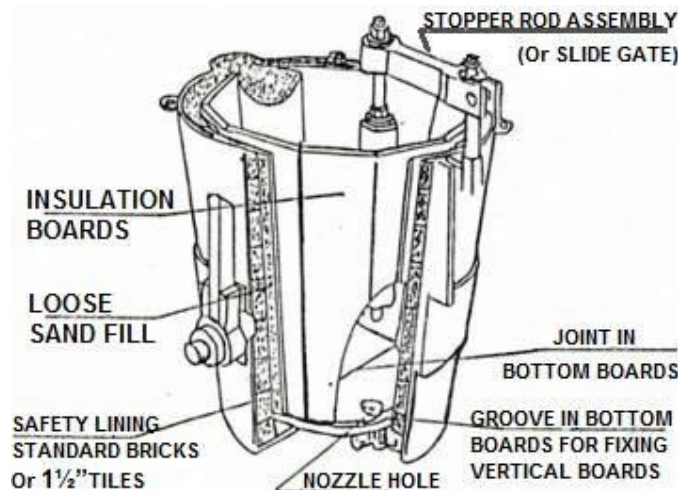
bedded down on to dry sand layer so that it is leveled with the top of the ladle nozzle.

After fixing of the bottom boards, twelve boards' panels are set side by side to achieve a complete circle as shown in Fig. for fixing of vertical panel boards, suitable grooves are provided in the bottom boards. All the liner gaps of boards are joint using adhesive cement in the form of paste supplied with Boards.

The gap between the boards and the safety lining of the ladle is filled with dry sand sufficiently coarse to allow good permeability to allow gas evolved to escape freely. The stopper rod is installed in a conventional way.

While it is true that the ladle lining requires no heating, the nozzle and the stopper rods need pre-heating by suitable means. The nozzle is heated from bottom for 15 to 20 minutes prior to using the ladle. When ladle is required, heat is removed from the nozzle, ladle is inspected for cleanliness and the melt is tapped in normal manner. Inspection for cleanliness and cleaning debris is easily carried out with this practice because almost no heat is present prior to use.

After pouring the melt the nozzle is pushed out, the ladle is inverted over the debris dump and the board lining is allowed to fall out. A new lining may be installed immediately since the safely lining is quite cool. Because of this the ladle turnover very fast and thereby ladle preparation delays are totally stopped and this also helps in achieving more production target without tension.



COLD BOARD LADLE LINING
(This is with two bottom Boards and 8 nos vehicle Boards)

PRECAUTION:

1. Boards should be moisture free.
2. Joint should be good & sealing should be dry set before use.
3. To back support of Boards, silica sand should be dry and properly reclaimed.
4. Special care in nozzle jointing required.
5. Tapping should be below 1600°C & gradual, and any ladle addition should be discussed with supplier.

ESTIMATED COST BENEFITS OF COLD BOARDS:

Cost benefits were worked out based on 100 heats of 2.5 Tons liquid steel from induction furnace i.e. total 250 Ton liquid steel.

A) Cost attributed by conventional ladle (refractory lined for 100 heats)				B] Cost attributed by cold ladle lining (For 100 Heats = 2.5 MT)			
<u>ITEM</u>		<u>COST (Rs.)</u>		<u>ITEM</u>		<u>COST (Rs.)</u>	
Side Arch Bricks	15.8 (200Nos) 40*2	8000.00		Cost of cold boards	1500/-	150000.00	
Standard Bricks	15.8 (50 Nos) 40*50	2000.00					
Fire Clay	4 T	3000.00		Loss due to Boards		3000.00	
Grog	2 T	8000.00		damages etc.			
Loss of	1.25 T* 30	30750.00		Other misc. expenses		10000.00	
Special Metal due to skull				filter loss of metal due to skull etc. (0.3 MT)			
Oil Consumption	2500 Ltrs @40/-	100000.00					
Extra Electricity Charges	@120/- per tonne for 250 T.	30000.00					
Extra Manpower		5000.00					
Oxygen	100 M ³	2000.00					
Metal Loss (due to failure of ladles)	2.50 T, @25/-	62500.00					
TOTAL		251250.00		TOTAL		163000.00	

Rs. 90000/- net savings by using cold lining works out for 250 T liquid steel, i.e. Rs. 360/- per tonne of liquid steel. Besides the above benefits, there will be substantial improvement in the quality of the casting due to cleanliness of steel and easy working in shop and time saving. This will substantially bring down the fettling cost.

CONCLUSIONS:

Energy required for ladle preheating can be totally eliminated by use of cold ladle lining and thereby saves costly light diesel oil or furnace oil and foreign exchange. This saves about 100000 kilocalories of energy per tonne of finished castings.

Besides direct money saving in steel making there is a tremendous savings in energy and cost of fettling related to casting repairs due to this reductions in non metallic inclusions in the castings from the ladle refractory, especially refractory's patching due to less no of ladle and easy de-skull, more production can be achieved.

From the above study, it is evident that use of cold board has got tremendous benefits in terms of cost economy as well as improvement in quality of castings. This paper outlines the main benefits of cold lining in ladle of steel foundry for its operational and economic advantages. But, the benefits obtained due to enhanced quality of castings, thereby reducing the repair cost has not been quantified and evaluated in details in this aspect may prove that cold boards lining can brings economic benefit considering the increased demand of quality requirements of the casting in coming future.