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Paper name: Refractory Design Modification by Application of Monolithic Refractory Material and Improvement of Steel Ladle life in SMS-III BSP, SAIL

PRESENT AFFILIATION	**Bhilai Steel Plant, SAIL**
AREAS OF INTEREST	**Refractory, Customer Service, music**
Education	**B-Tech (Ceramic Technology)**
Experience	• **Stabilization of BSP SAIL, SMS-III Steel Ladle, RH Degasser.** • **Refractory Repair & Maintenance work execution in BSP SMS-II, RHF, RMP.** • **Customer Care Service Head, North Zone, India, Parryware Roca Pvt Ltd**
Projects:	• **"Reduction of Water Mark on Wall Tile" at Karaikal plant of H & R JOHNSON (INDIA) LIMITED.** • **"Reduction of Color Variation" at Kiln & Glaze Department, Parryware Roca Pvt Ltd, Ranipet Plant, Tamilnadu.**
Publication	**"Effect of Mixed Additives on Densification of Reaction Sintered Mullite-Zirconia Composites". The paper was published in Indian Ceramic Society Yearly Bulletin 2005.**

Refractory Design Modification by Application of Monolithic Refractory Material and Improvement of Steel Ladle life in SMS-III BSP, SAIL

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BHILAI STEEL PLANT

स्टील अथॉरिटी ऑफ इण्डिया लिमिटेड
STEEL AUTHORITY OF INDIA LIMITED

Brief Description of BSP, SAIL

- Started in late Fifties with production capacity of 1 MT per year, with Open Hearth furnace at SMS-I .
- In 1967 capacity increased to 2.5 MT per year.
- In 1998 converted all open Hearth furnaces to four numbers of Twin Hearth furnaces with 250 T + 250 T capacity each.
- During mid-eighties plant capacity increased to 4.0 Mt by introducing SMS-II shop.
- With the view of modernization cum expansion SMS-III shop installed in the year 2018.

Brief Description of SMS-III, BSP, SAIL

- Capacity 180/165 Ton
- Three LD BOF Converter
- Three ARS
- Three LF
- One RH Degasser unit
- Two Billet casters
- One Bloom cum Billet caster
- One Beam blank bloom caster

Initial Phase of Steel Ladle in SMS-III, BSP
Previous Bottom Relining Pattern

- **Previous bottom lining patterns was with Back-up safety of 64 mm insulation with the ladle shell followed by 64 mm High alumina Bricks.**

- **Bottom working lining was 250 mm magnesia carbon bricks and at bottom impact area 300 mm magnesia carbon bricks.**

Previous Metal zone Relining Pattern

- **Back up lining was 10 mm ceramic fiber board, then 32 mm insulation bricks, followed by 76 mm high alumina bricks.**
- **Working lining was 152.4 mm Magnesia Carbon (Mgo-C) bricks.**
- **In between working lining and back-up safety lining Back filling material of thickness 32 mm.**

Previous Slag zone Relining Pattern

- Back up lining was 10 mm ceramic fiber board, then 32 mm insulation bricks, followed by 76 mm high alumina bricks.
- Working lining was 203.2 mm Magnesia Carbon (Mgo-C) bricks.
- In between working lining and back-up safety lining Back filling material of thickness 32 mm.
- Among total 42 layers of side wall, metal zone consists of 32 layers and slag zone 10 layers including free beard area.

Previous Design of SMS-III Steel Ladle

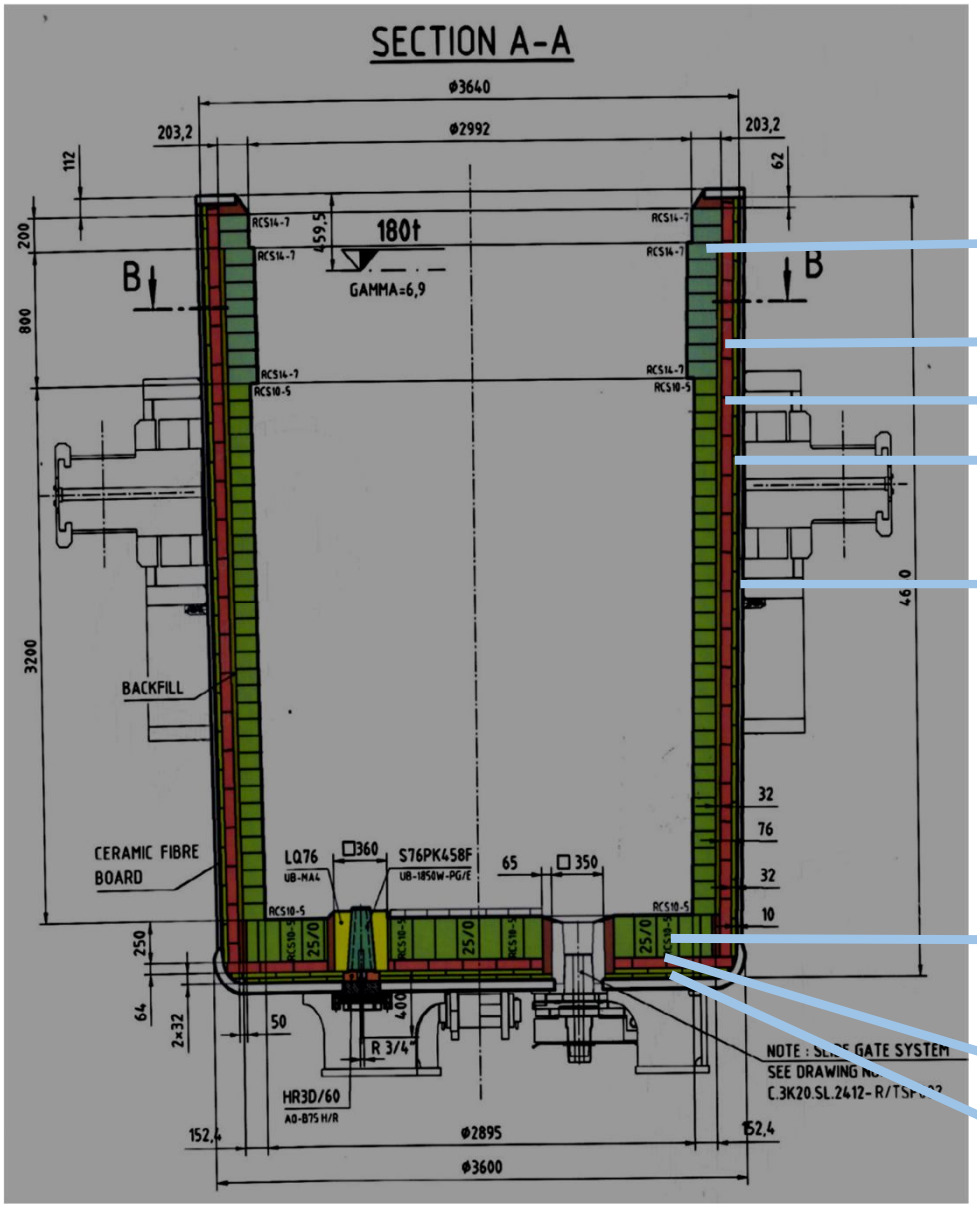


Fig. Previous Design of Steel Ladle

Working Layer of Magnesia Carbon Bricks- 203.2 mm

Back Filling Material- 32 mm

High Alumina bricks- 64 mm

Insulation bricks- 32 mm

Ceramic Fiber Board- 10 mm

Working Layer of Magnesia Carbon Bricks 250 mm

Working Layer of High Alumina Bricks-64 mm

Working Layer of Insulation bricks- 32 mm +32 mm = 64 mm

Previous Design Steel Ladle During Relining Work

Problems faced at Initial Stage

- Frequent metal through in Slag Zone area
- Metal Loss
- Sequence break up in Continuous Casting
- Ladle Furnace area equipment damage
- Continuous weakening of the Ladle shell
- Long lead time for De-Skulling of ladle.

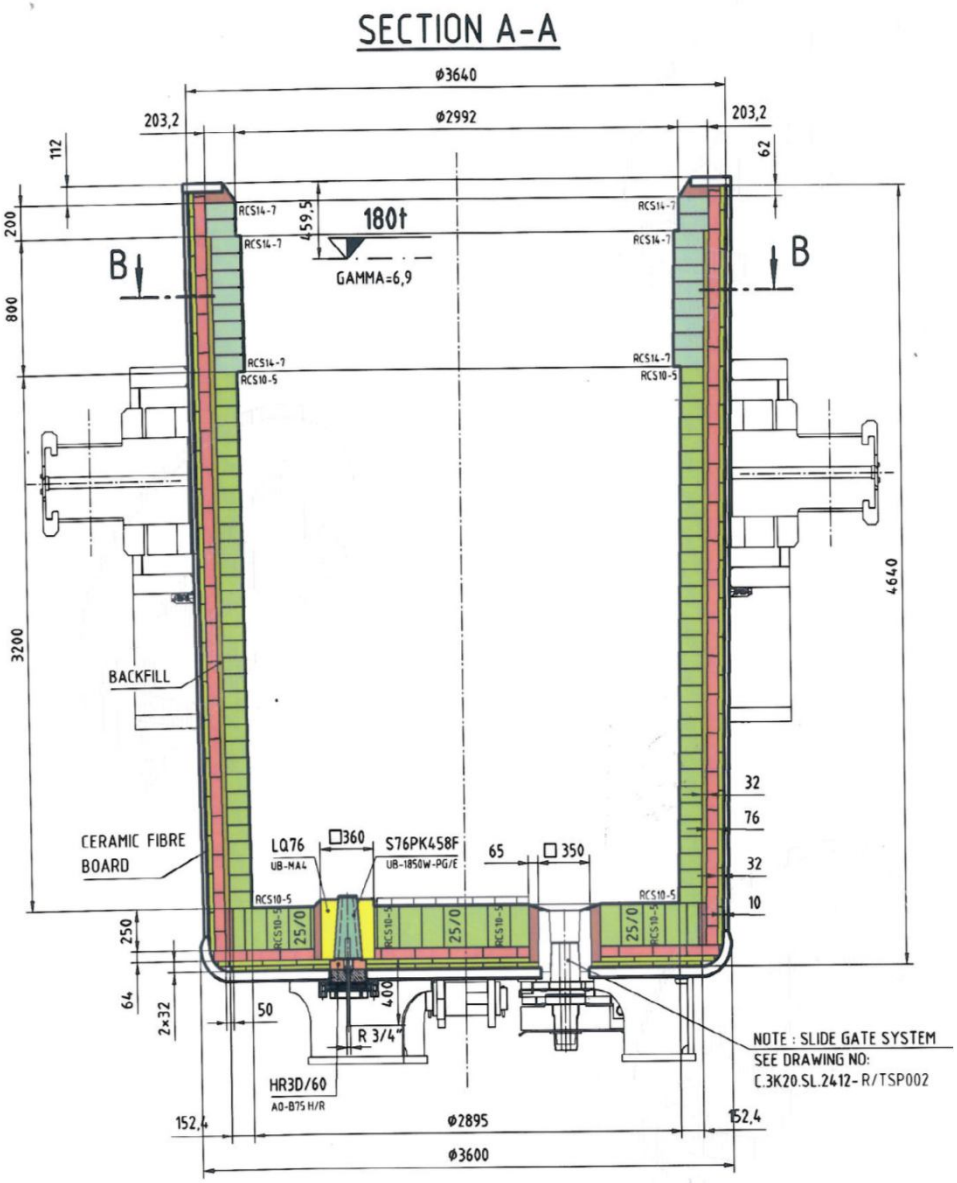
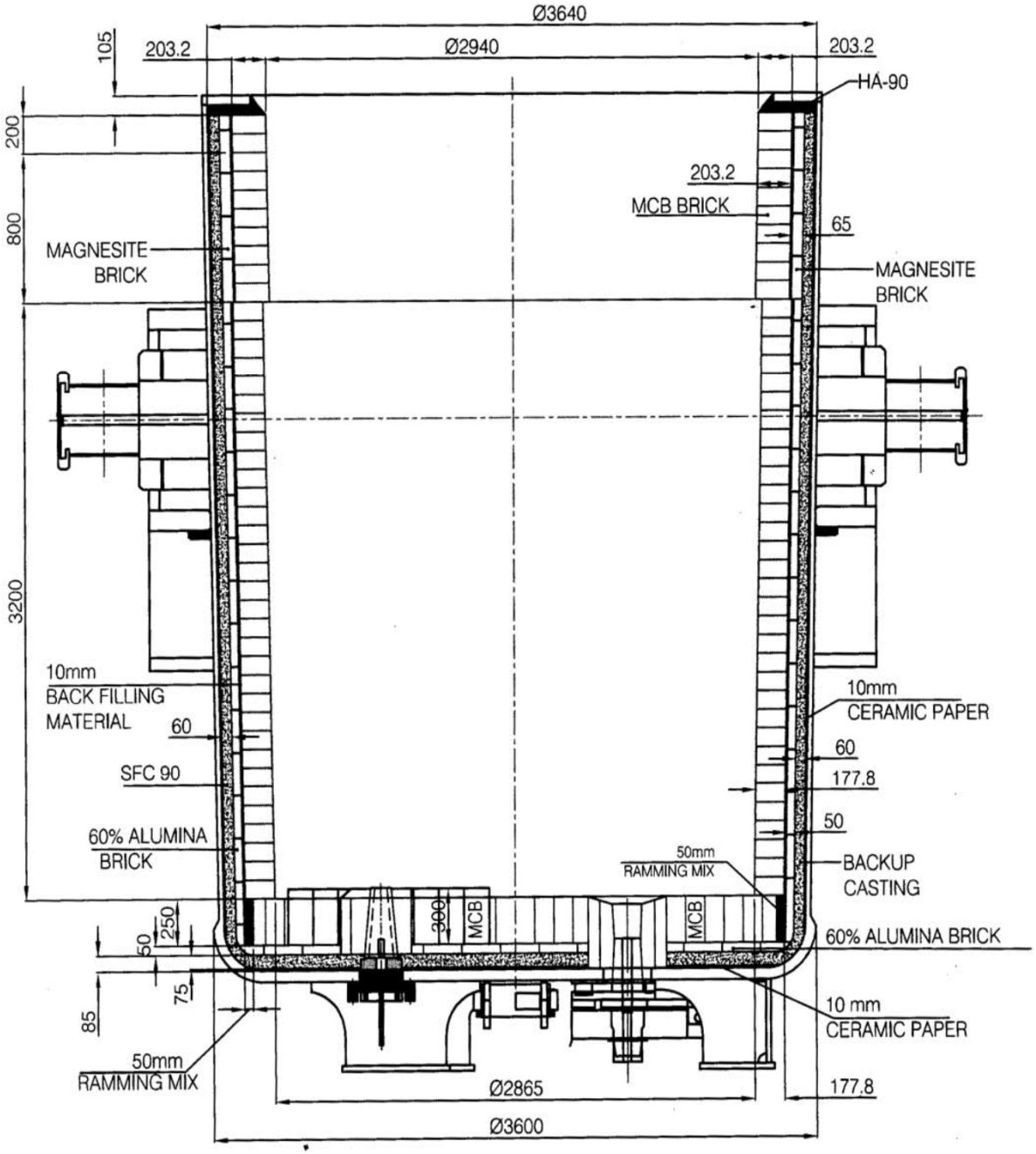


Fig. Original Design of Teeming Ladle

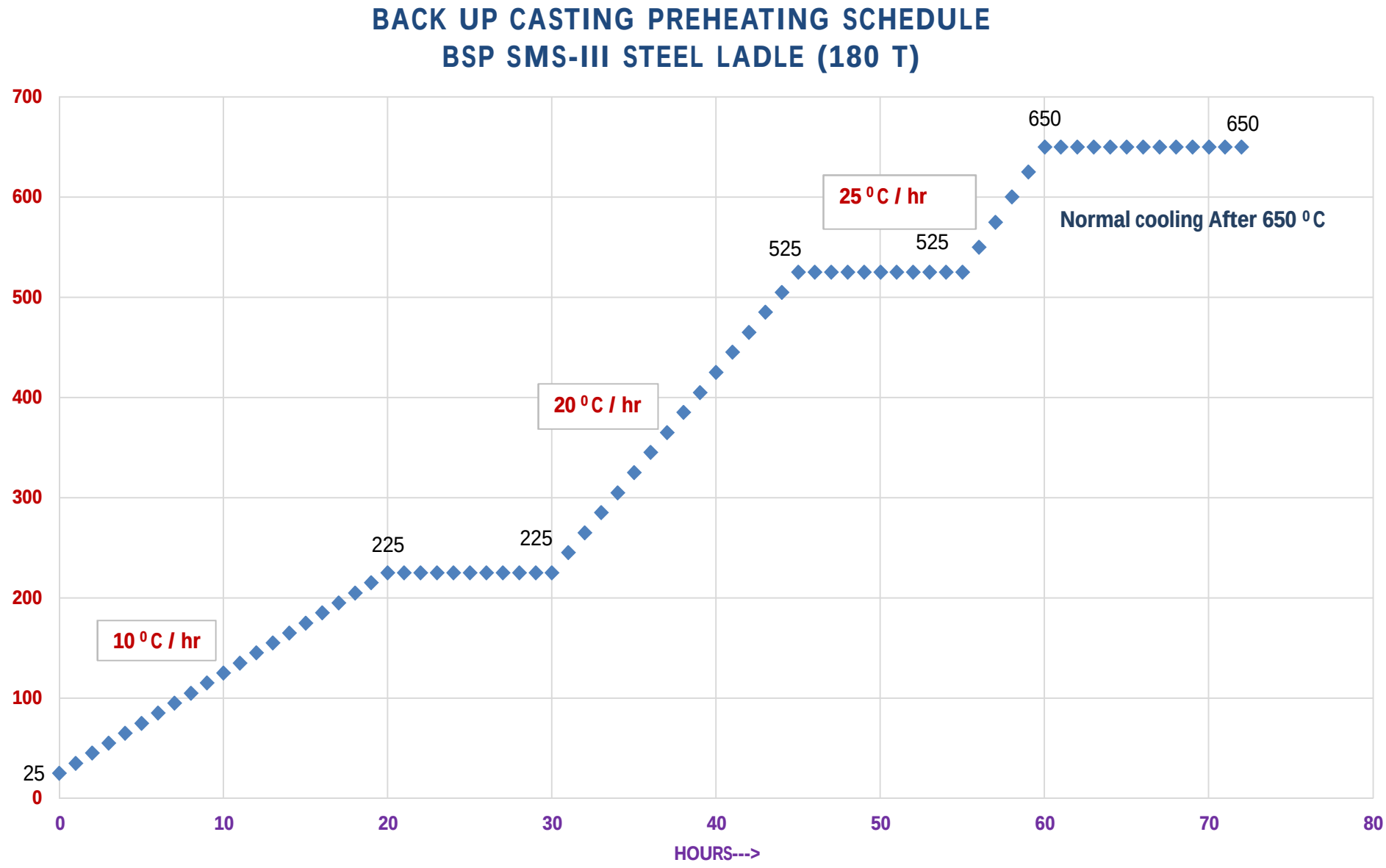
Issues faced at Initial Stage

Modified Design of SMS-III Steel Ladle



Modified Design SMS-III Steel Ladle with Back-up Casting

Back-up Casting Preheating Schedule



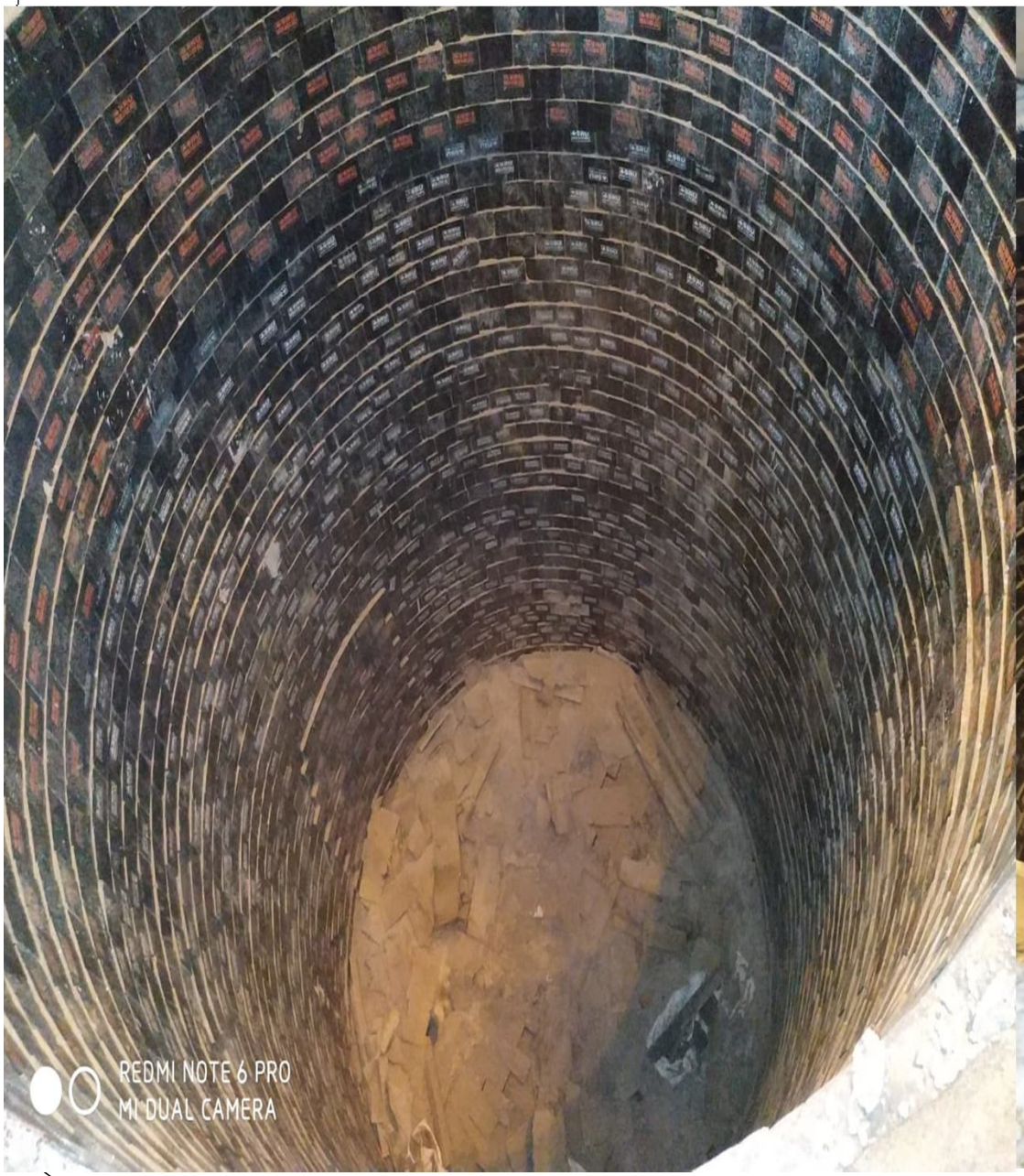
Modified Bottom Relining Pattern

- Long horn anchor of 50 mm with spacing of horizontal and vertical length 200 mm and 150 mm respectively in staggered manner.
- 10 mm ceramic paper at the bottom shell, followed by 65 mm monolithic casting and then 50 mm High alumina Bricks.
- Bottom working lining was 250 mm magnesia carbon bricks and at bottom impact area 300 mm magnesia carbon bricks.

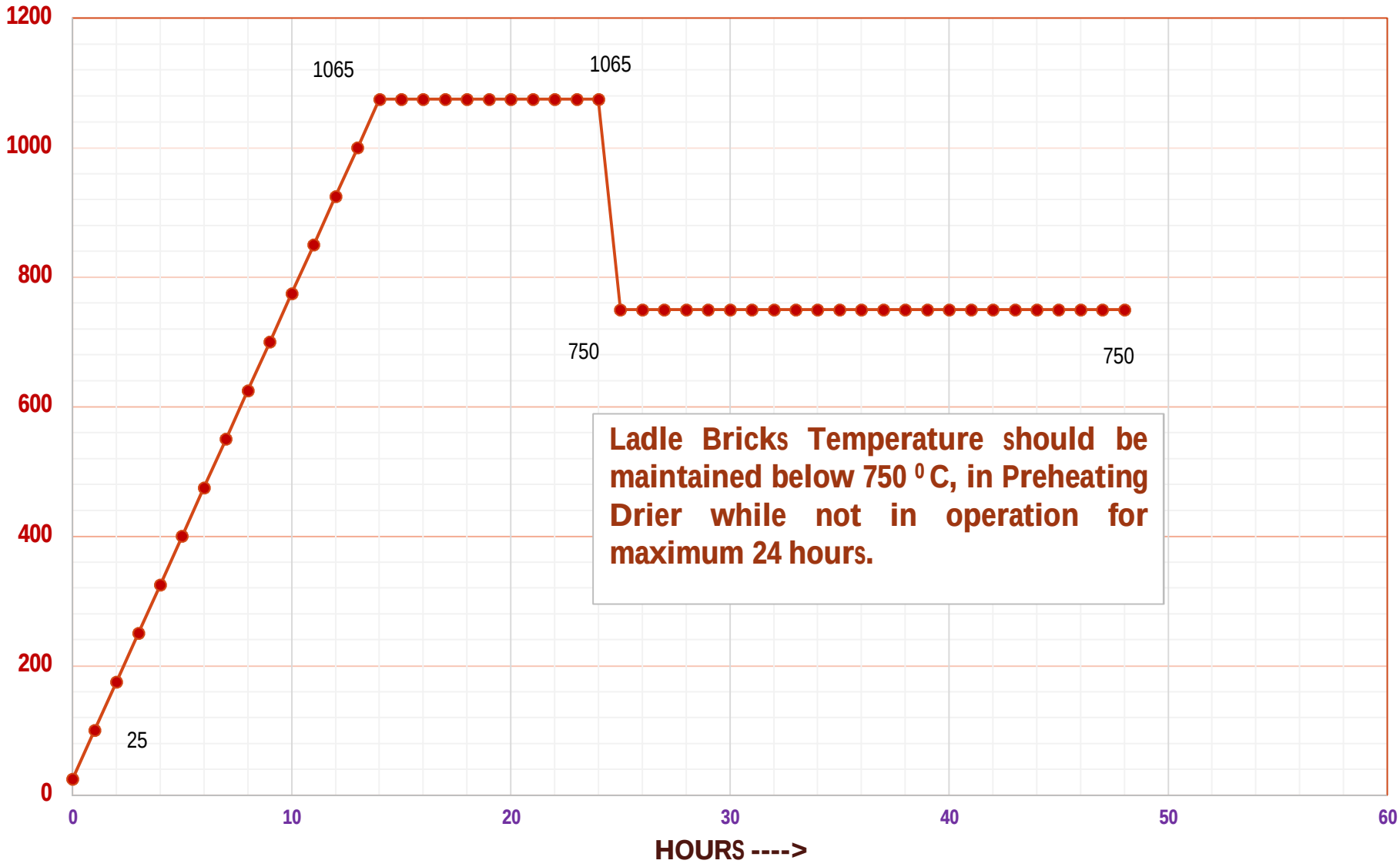
Modified Metal Zone & Slag Zone Relining Pattern

- Side wall casting with thickness of 65 mm throughout the ladle as Back up lining using self-flow 90% alumina castable.
- Metal zone and Slag zone safety lining 50 mm High Alumina bricks after Back-up casting.
- Metal zone and Slag zone working lining Working lining was 177.8 mm and 203.2 mm Magnesia Carbon (Mgo-C) bricks respectively.
- In between working lining and back-up safety lining Back filling material of thickness 10 mm.

Steel Ladle After Complete Relining Work

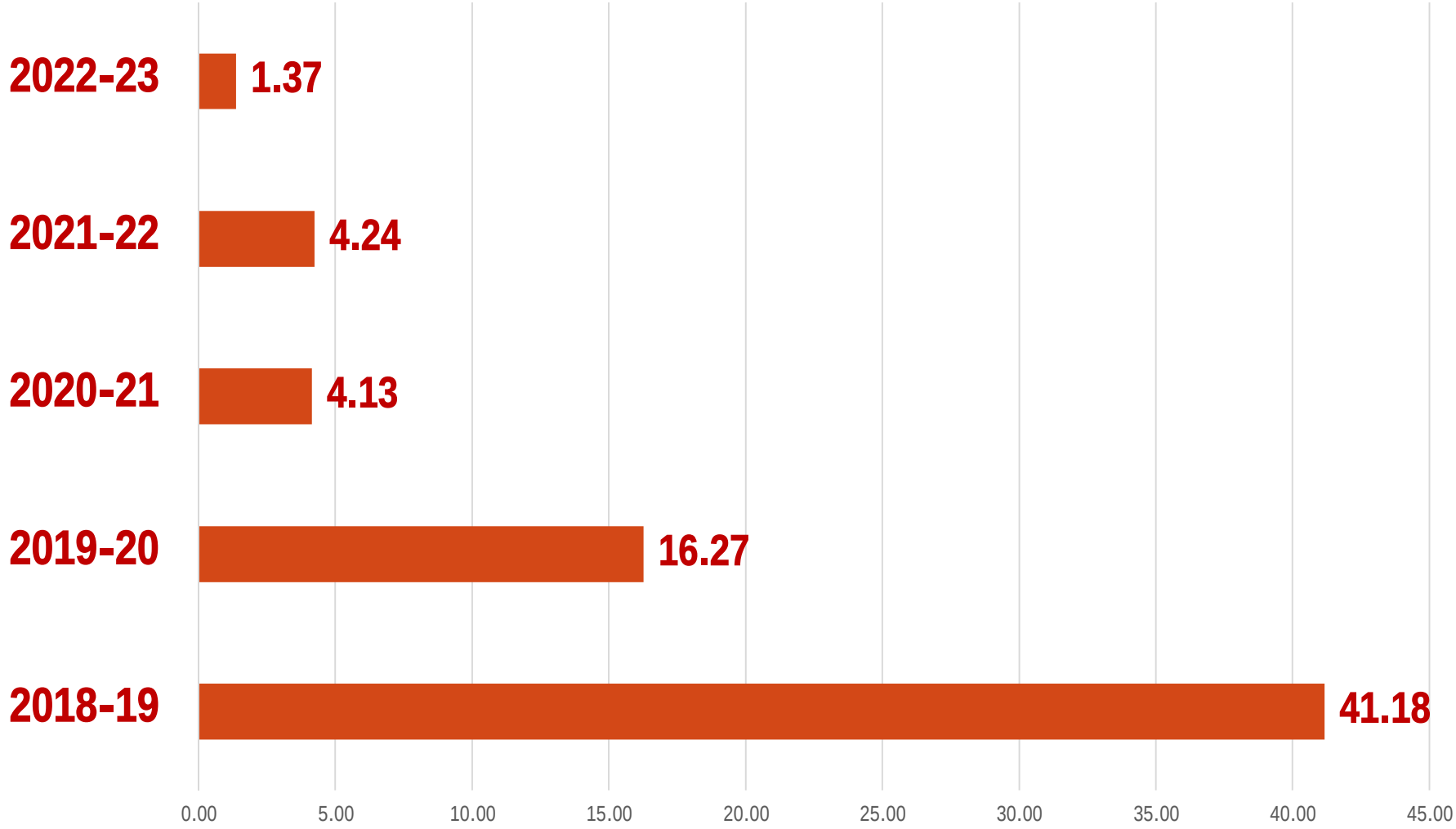


Ladle Preheating Schedule After Completion of Relining Work by Shaped Refractory



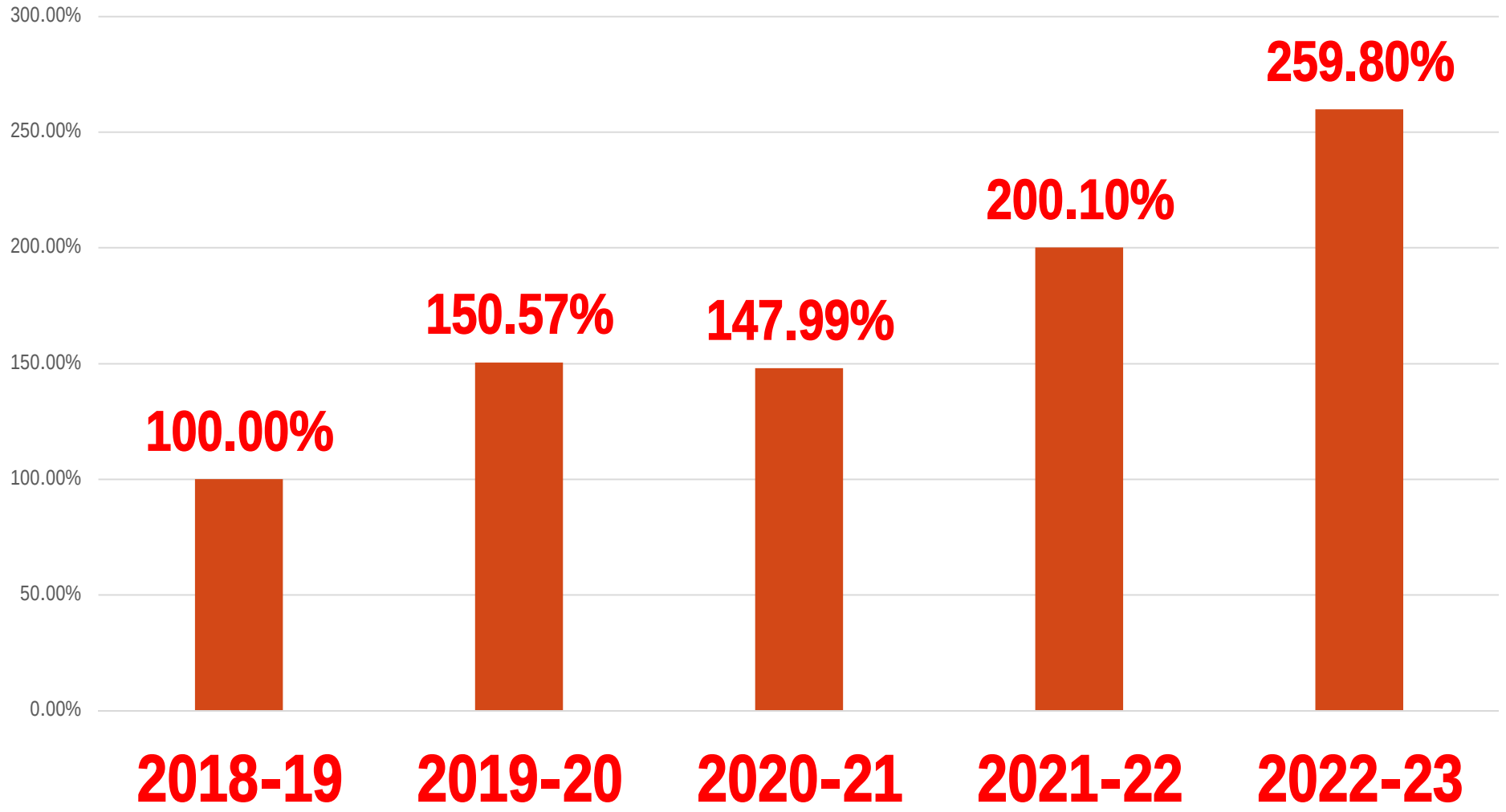
Reduction of Ladle Skulling after Design modification

Steel Ladle Skull %



Improvement after Design modification

Improvement %



THANK YOU

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