



Industry	Iron and Steel
Application	110MT Steel Ladle
Product Solutions	Superwool 1650SI Board, WDS [®] LambdaFlex [®] Super
Location	Asia
Date	June 2020

The Challenge

Our Customer was experiencing ladle casing temperature increase that was triggering the ladle relining alarm as the ladle temperature quickly reached 450°C. The increase in ladle casing temperature is not safe for employees or the process to be efficient and prevent molten metal loss.

In August 2020 our Customer requested we in two of their plants—each in a separate plant. The current ladle design needed to remain the same but the backup insulation, currently vermiculite structural insulation board required to be changed. The ladle casing temperatures of each of these ladles were noted at 280°C (536°F) with the vermiculite structural insulation board backup lining system and ladle lining alarm is set to 450°C (842°F).

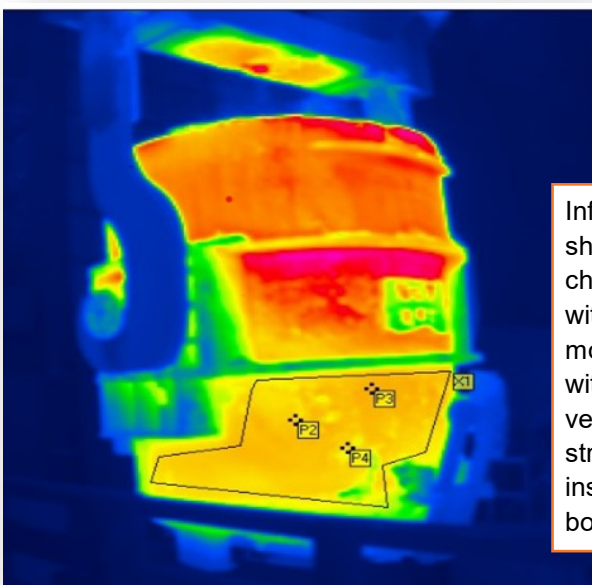


Application Overview

Our Customer is seeking to reduce heat loss of two 110MT steel ladles. Current shell temperature range was 280-293°C. Reducing heat loss would provide improved working conditions for the employee and provide longer sequence of continuous casting and better temperature management at pouring and tapping.

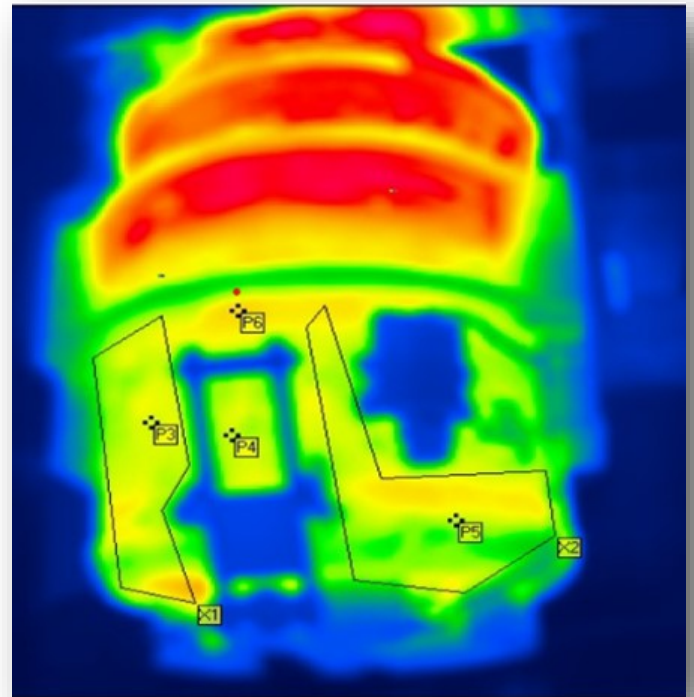
The ladle design will not change and the customer has chosen to replace the backup lining to our Superwool 1650SI Boards and WDS LambdaFlex Super.

Superwool 1650SI Board is designed especially for backup insulation in high-temperature molten metal transfer applications such as ladles, tundishes and torpedos.



Infrared shows challenge with in the molten metal with existing vermiculite structural insulation board.

Superwool® 1650SI Board Backup Insulation for 110MT Ladle



The Solution

The Customer chose to replace the backup lining with our ladle system solution, Superwool 1650SI Board and WDS LambdaFlex Super. The Customer requested to not redesign the ladle, only to replace the lining system.

Superwool 1650SI Board is designed especially for backup insulation in high-temperature molten metal transfer applications such as ladles, tundishes and torpedos. The outstanding performance of Superwool 1650SI Boards offers our customers a unique value proposition:

- High-temperature capability providing increased safety to the worker and process
- Best-in-class insulating and thermal performance - 60% improvement – resulting in excellent energy savings and reduction in CO2 emissions
- Optimum mechanical strength providing reliability of ladle performance

Customer Impact

1. The first ladle is still running at Plant 2 and is achieving **900+ cycles** up to now and the second ladle was running for **800+ cycles** at Plant 1 and relined entirely in August 2021.
2. The shell temperature at the liquid steel section is consistent with the heat calculations submitted by Morgan. Superwool 1650SI Boards show superior insulation performance with the **lower shell temperature at 30 to 35°C**.
4. The outstanding performance of Superwool 1650SI Board results in two advantages to the steel makers in terms of operation:
 - The starting temperature of pouring and the subsequent tapping temperatures of the Continuous Casting sequence can be easily managed upon the in-situ operational requirements.
 - The longer sequence of Continuous Casting is achievable and manageable.
4. The **Customer was quite satisfied at the performance** of Superwool 1650SI Boards and awarded the annual orders to reline the backup linings of the balance (22) ladles.

Steady state heat transfer calculation cylindrical wall - vertical

Offer/Order No. Name Albert Huang
Customer Fengshin Steel Date 03-Aug-2020
Project SW 1650SI Transferring Ladle Trial Revis Name Albert Huang
Location Fengshin Steel Taiwan Revis Date 03-Sep-2020

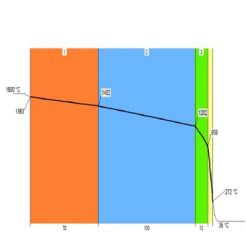
Calculation New shape Ladle liquid steel (40% thickness remain)

	inside	outside	unit	lining characteristics
Ambient temperature	1600	35	°C	49688 W/m (4969 W/m ²) Heat loss
Surface temperature	1563.2	271.8	°C	7238 KJ/m heat storage
Heat transition coefficient	150	20.57	W/m ² K	4550 kg/m weight
Diameter	2607	3183	mm	188 mm total thickness

(1) Calculation method ASTM C985, issue 2004. Emissivity 0.70 - steel 0.80

wall layers from inside to outside

Material	Thickness (mm)	Density (kg/m ³)	Temperature (°C)		K (mean) W/mK
			inside	outside	
1 Alumina-Magnesia-Carbon Firebrick	70	2955	1671	1653.2	1607
2 SILLIMANITE BRICK "S 70"	100	2650	1740	1451.7	1327
3 Superwool 1650 SI Board	13	849.9	1650	1202.1	0.988
4 WDS LambdaFlex	5.0	365	1000	559.9	0.54



Outcome of new lining and after 60% erosion of the working lining:

- Interface temp on board reaches 1202°C with working lining erosion
- Temperature capability of the backup board is very crucial