



SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

# TROUGH & RUNNERS

IRON MAKING REFRACTORIES



# SAINT-GOBAIN

## OUR MISSION

Saint-Gobain designs, manufactures and distributes materials and solutions which are key ingredients in the wellbeing of each of us and the future of all.

## OUR PURPOSE

Making the world a better home.



1 in 4 products did not exist 5 years ago



171,000 employees



sales of 42.6 billion



represented in 70 countries



3,800 researchers



8 main R&D centres

WE ARE COMMITTED TO BEING CARBON FREE BY 2050.

## PERFORMANCE CERAMICS & REFRACTORIES

Saint-Gobain Performance Ceramics & Refractories leads the industry in design, development and production of engineered ceramics and refractory products for extreme operating conditions and high temperature applications. Every product and material is designed to maximize performance and durability while minimizing environmental impact.

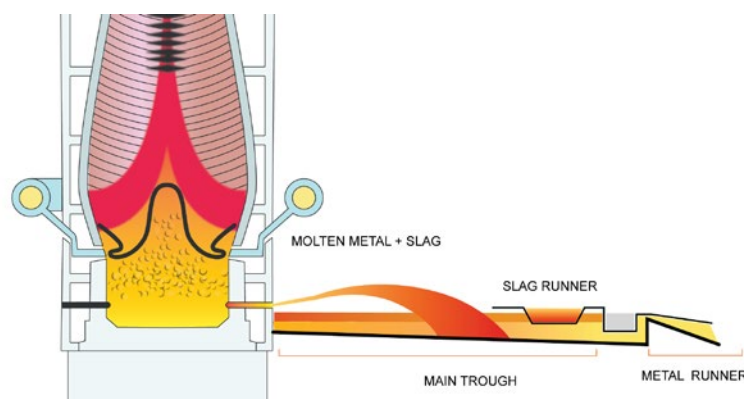


TOGETHER, WE MAKE THE MATERIAL DIFFERENCE.



## IRON MAKING & BLAST FURNACE

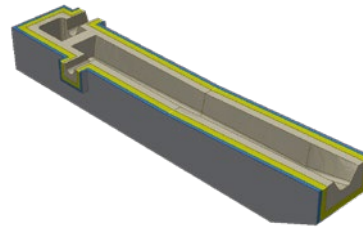
Saint-Gobain's wide experience with refractory materials for iron making assure its customers the best performance available in the market, with tailor-made solutions. We supply high-quality materials for TROUGH & RUNNERS which are used to transport the molten metal drained from the blast-furnace to the torpedo cars. The molten slag is separated by using a skimmer, where it follows a secondary path through the slag runner. The separation takes place because of the density difference between the hot metal and slag.



## PROVIDING END-TO-END SOLUTIONS

### Working Lining

- Ultra-low cement Al<sub>2</sub>O<sub>3</sub>-SiC-Carbon castables
- Colloidal-silica bonded Al<sub>2</sub>O<sub>3</sub>-SiC-Carbon castables
- Magnesium aluminate spinel containing castables
- Extremely high oxidation resistant castables







### Repair Materials

- Al<sub>2</sub>O<sub>3</sub>-SiC-C ready-to-use ramming mix
- High-performance gunning materials
- Shotcrete pumping materials

### Back-up Lining

- Ultra-low cement Al<sub>2</sub>O<sub>3</sub>-SiC-Carbon castables
- 70% Al<sub>2</sub>O<sub>3</sub>-SiC-C pre-shaped blocks
- Complete set of insulating castables, bricks and fibers

#### BENEFITS

-  Reduced maintenance costs
-  Lower repair time
-  Longer trough campaign
-  Customized solutions

PRODUCTS	CHARACTERISTICS	APPLICATIONS & BENEFITS
Ultra low cement castable	Oxidation, erosion and corrosion resistance	High performance materials customized for all regions of the casting floor and providing reduced maintenance cycles
Dry Mix Lining	Water free application	Extremely fast repairing materials designed for secondary runners
Shotcrete	High performance, low rebound, fast repair	Easy-to-pump and high corrosion resistance castables for cold and hot repairs for all regions of the main trough and secondary runners
Spinel containing castable	High resistance to FeO corrosion	Extended campaign of metal line and iron runners
Colloidal silica castables	High performance, quick drying	Zero-cement material designed for a reduced repair time of main trough and secondary runners
Pre-cast shapes	Controlled environment	Lower repair time and longer campaign for skimmers and secondary runners
High Performance Gunning mix	High adhesion	Versatility for all types of repairs in any region of the casting floor
Ramming mix	High workability	High performance and easy to apply mix for quick repairs at any regions of the casting floor

## CASTABLES - BLAST FURNACE MAIN TROUGHS

Due to the constant thermal cycling and the direct exposure of the refractory lining to oxidizing environments during the main trough operation, the standard  $\text{Al}_2\text{O}_3\text{-SiC-SiO}_2\text{-C}$  castable can be easily damaged and the trough campaign consequently reduced. When events like this happen, emergency repairs must be executed, resulting in increased refractory unit consumption and an unplanned shutdown of unit operation.

### AGGRESSIVE OXIDATION IN MAIN TROUGHS



#### Problem:

Aggressive oxidation leads to high porosity & low resistance. Root cause analysis of higher frequent repairs & lower yield.



#### New Material:

New material CASTFRAX® S25-NG shows improved performance - lower decomposition of refractory material.

### OUR SOLUTION - CASTFRAX® S25-NG

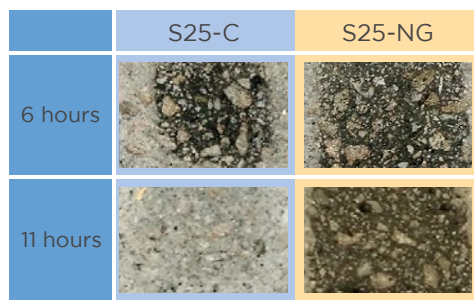
Different from the standard material and owing to the innovative concepts used in its formulation design, our outstanding CASTFRAX® S25-NG presents extremely high performance when exposed to air even after 11 hours at 1,000°C, which is the most critical temperature for  $\text{Al}_2\text{O}_3\text{-SiC-Carbon}$  castables.

As a low oxidation rate leads to small variances on the castable porosity, those results indicate that the material's corrosion resistance would clearly be increased during use.

		S25-NG = New Generation	
S25-S = Standard		S25-S	S25-NG
Oxidizer Layer (Relative Index)	6 hours	100%	46%
	11 hours	100%	39%

We developed an optimal material mix with very low oxidation rate.

Cross-sections of S25-S and S25-NG samples after oxidizing test at 1,000°C for 6 hours and 11 hours.

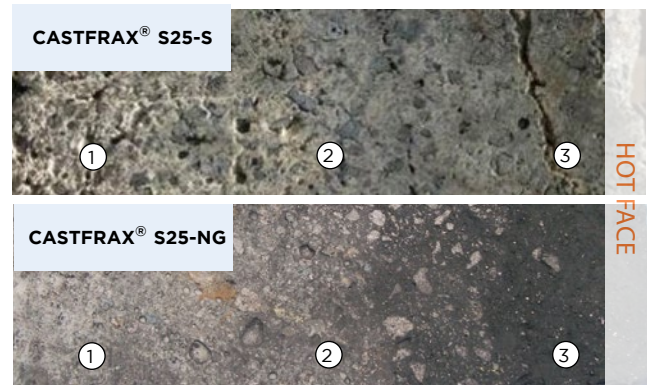


## NEW MATERIAL CASTFRAX® S25-NG

Post-mortem samples of both materials (highlighting the regions where chemical analyses were performed) show that it is clear that the reason for trough campaign instability at blast furnaces with two holes was directly related to the poor oxidation resistance of S25-S.

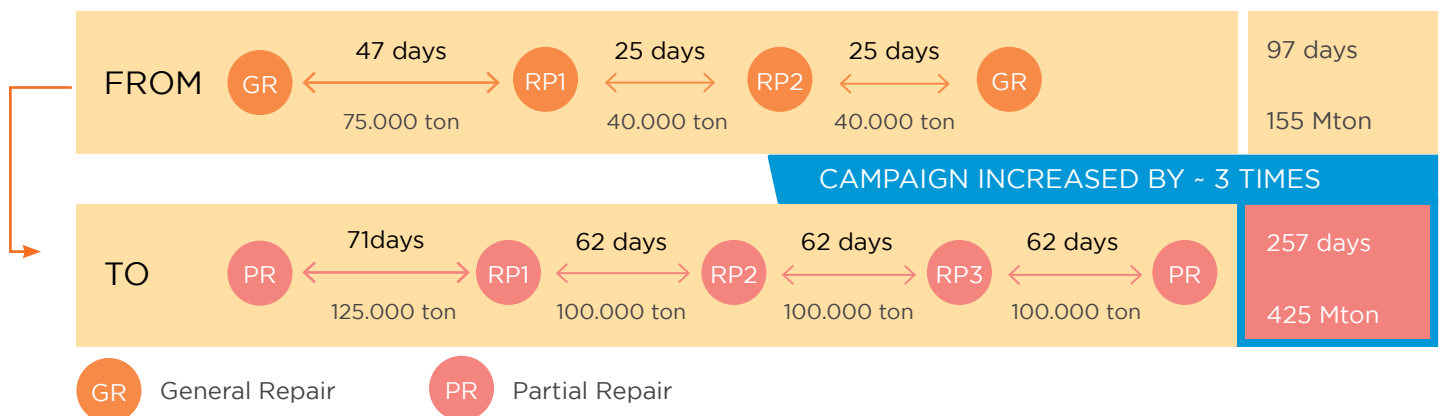
	Region	Al <sub>2</sub> O <sub>3</sub>	SiC + C	SiO <sub>2</sub>
CASTFRAX® S25-S	1	62.2	11.7	22.4
	2	65.4	11.9	17.6
	3	59.6	13.7	16.2
CASTFRAX® S25-NG	1	68.3	19.4	9.6
	2	68.3	22.0	7.0
	3	64.7	27.0	4.9

Chemical analyses of different regions in the post-mortem Samples of standard material and CASTFRAX® S25-NG (Results expressed in wt.%).

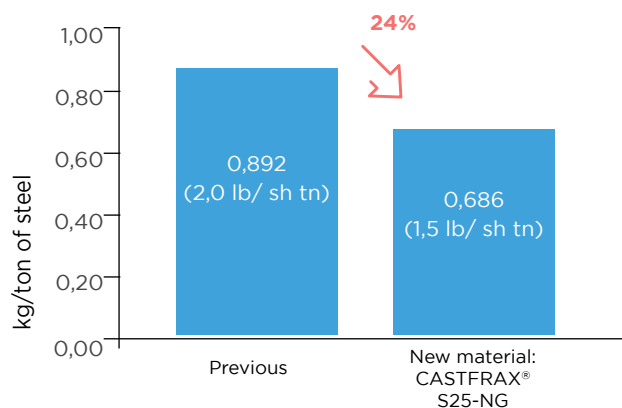


Post-mortem samples of standard material CASTFRAX® S25-NG after 250 days of operation.

### OUR SOLUTION HAS PROVIDED BETTER YIELD OF IRON PRODUCED FOR EVERY KG OF REFRACTORY USED



### SPECIFIC CONSUMPTION



### VALUE PROPOSITION

- ↑% Higher yield between repairs
- ↓ Lower consumption of refractory material
- ⌚ Longer trough campaigns
- ↑% Higher no. of campaigns

## SHOTCRETE MATERIAL SHOTFRAX® CSB

Easy-to-pump and high corrosion resistance castables for cold and hot repairs for all regions of the main trough and secondary runners.




### Characteristics

- State-of-the-art technology for T&R repair
- Quick installation rate
- Low rebound rate (< 5.0 %)
- Consolidated and long experience in the use of shotcrete for hot and cold repairs
- Association of fast pumping + robot application techniques, if necessary

### Materials

- **SHOTFRAX® CSB 18:** High-performance Al<sub>2</sub>O<sub>3</sub>-SiC-C for main trough and metal runner
- **SHOTFRAX® CSB 30:** High-performance Al<sub>2</sub>O<sub>3</sub>-SiC-C for main trough and slag runner

#### BENEFITS

-  Extended lifetime
-  Reduced refractory consumption
-  Increased trough availability

### Saint-Gobain Reference

NO. OF TAP HOLES	DAILY PRODUCTION*	SAINT-GOBAIN SPECIFIC CONSUMPTION**	TOTAL NO. OF T&R
1	1000 - 3000	0,60 - 0,70	3
2	3000 - 7500	0,60 - 0,70	13
3	7000 - 8500	0,60 - 0,70	3
4	8500 - 11000	0,45 - 0,65	18

\* Production in MT

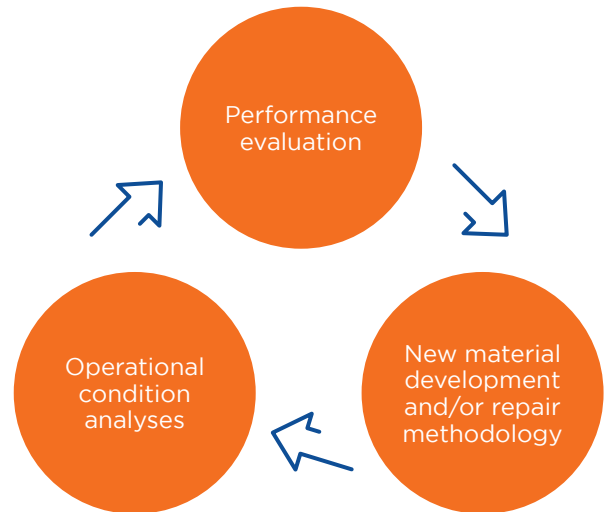
\*\* Specific consumption in kg/MT of Pig Iron



## SERVICE & APPLICATION

Continuous technical improvement in order to meet all the customer needs

- Technical assistance / continuous monitoring
- Equipment / procedures
- Reduction of repair time
- Campaign increase



VERY STRONG TECHNICAL ASSISTANCE DURING THE WHOLE LIFE CYCLE OF OUR PRODUCTS.  
FROM TECHNICAL INSTALLATION TO DEMOLITION.

## SERVICE & EQUIPMENTS

A vast experience with contractors and partners for refractory installation and repairs

### 1 DEMOLITION

We can support you with using the right equipment and technologies to ensure precise removal.

### 2 INSTALLATION SERVICE

Various machines & processes for the service.

### 3 PLANNED SCHEDULING OF REPAIRS

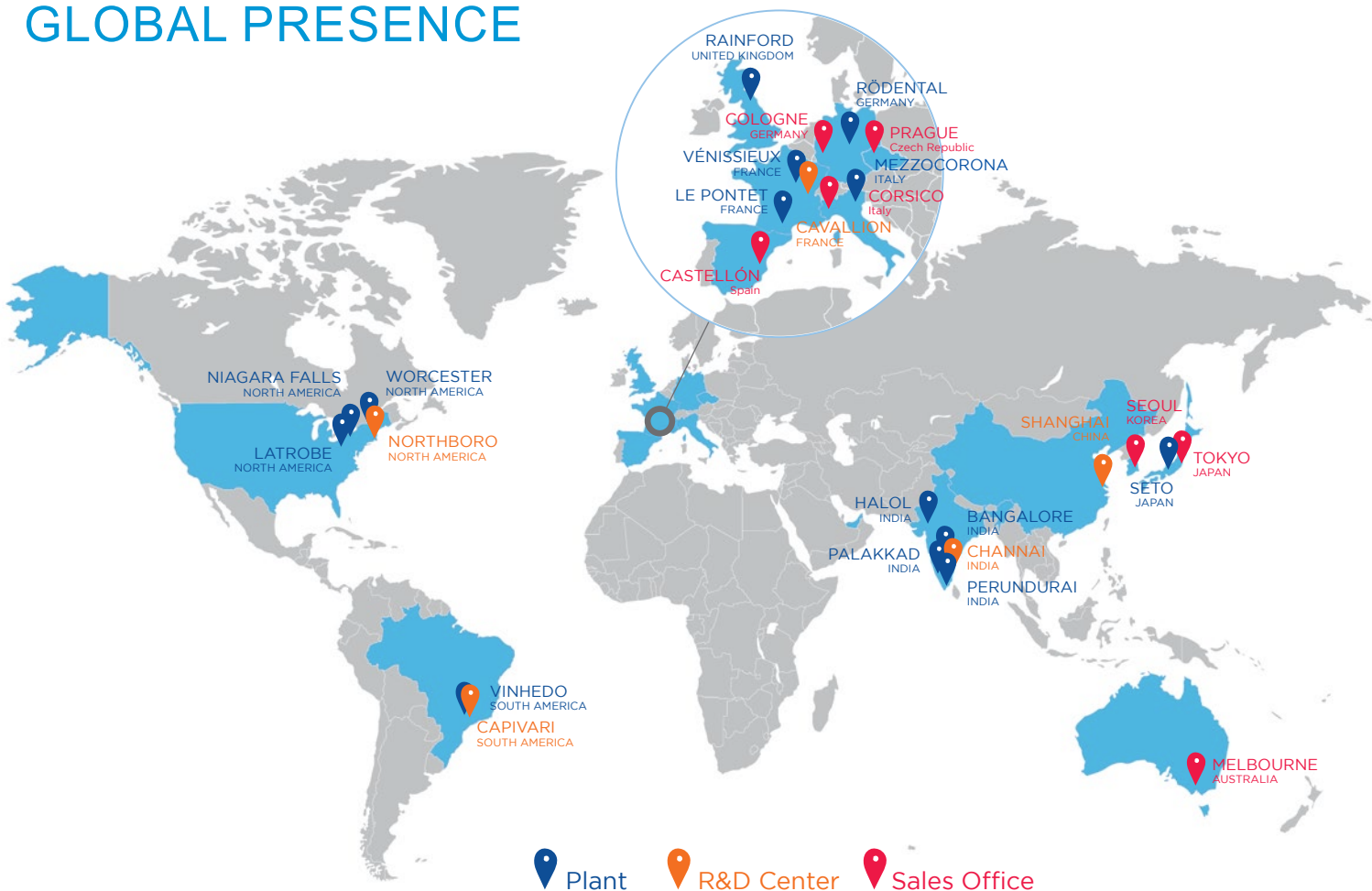
On the one hand, we monitor the original installation and subsequent repairs through frequent audits, and on the other hand, we help forecast repair needs well in advance.

### 4 RESIDUAL THICKNESS MAPPING

During audits we provide such detailed analysis for better understanding the performance of refractory material enabling continuous improvement & lowering of operational costs.



# GLOBAL PRESENCE



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