

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS® TECHNOLOGY

Breno Totti Maia



Always the best solution.



3RD ESTAD[®] 2017



Always the best solution.

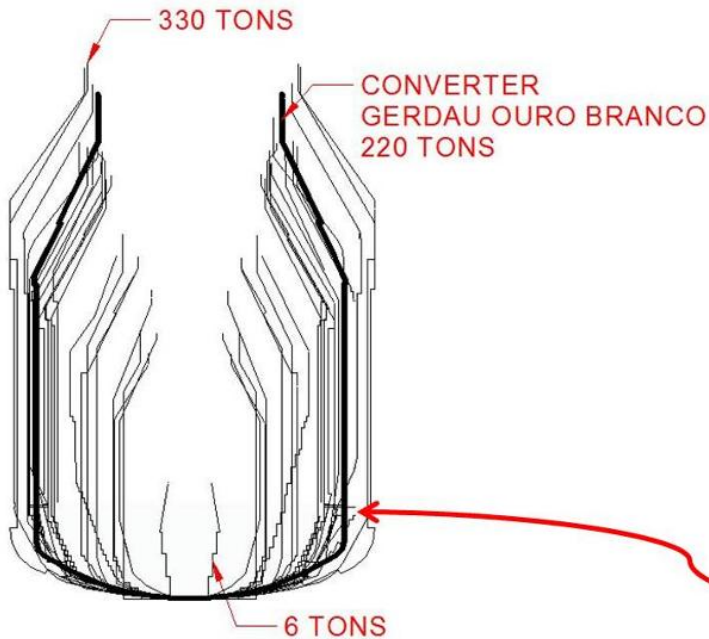
Fabício Silveira Garajau
Marcelo de Souza Lima Guerra
Wellington Morais de Andrade
Wenderson Marcial da Silva



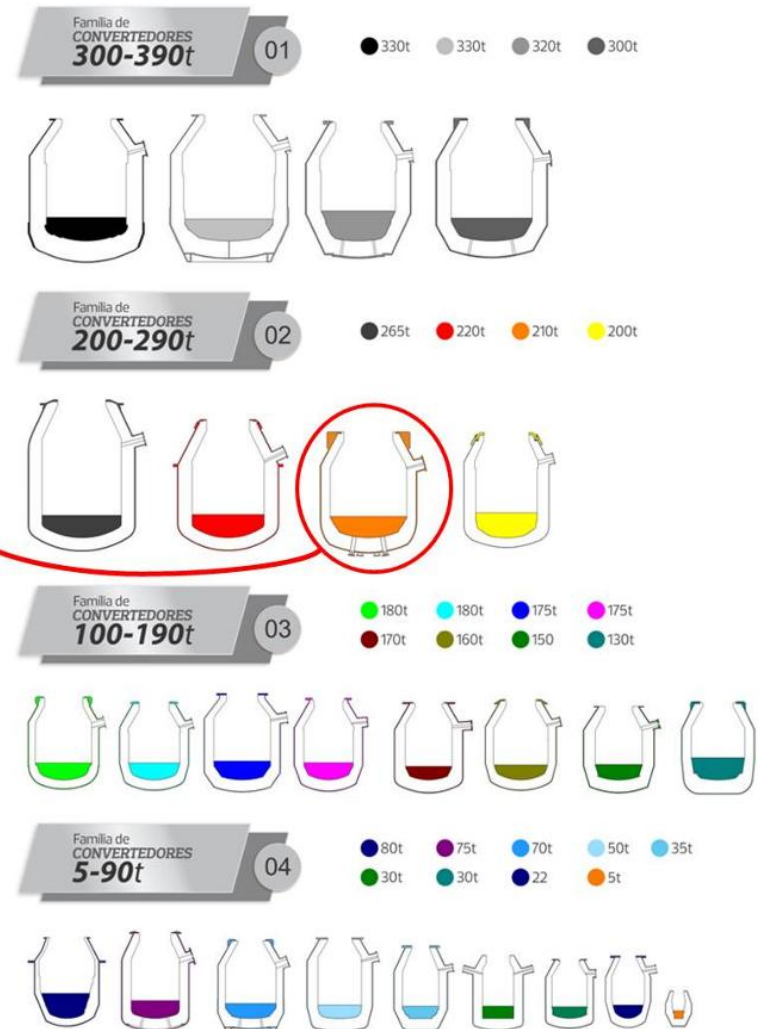
3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS[®] TECHNOLOGY

INTRODUCTION

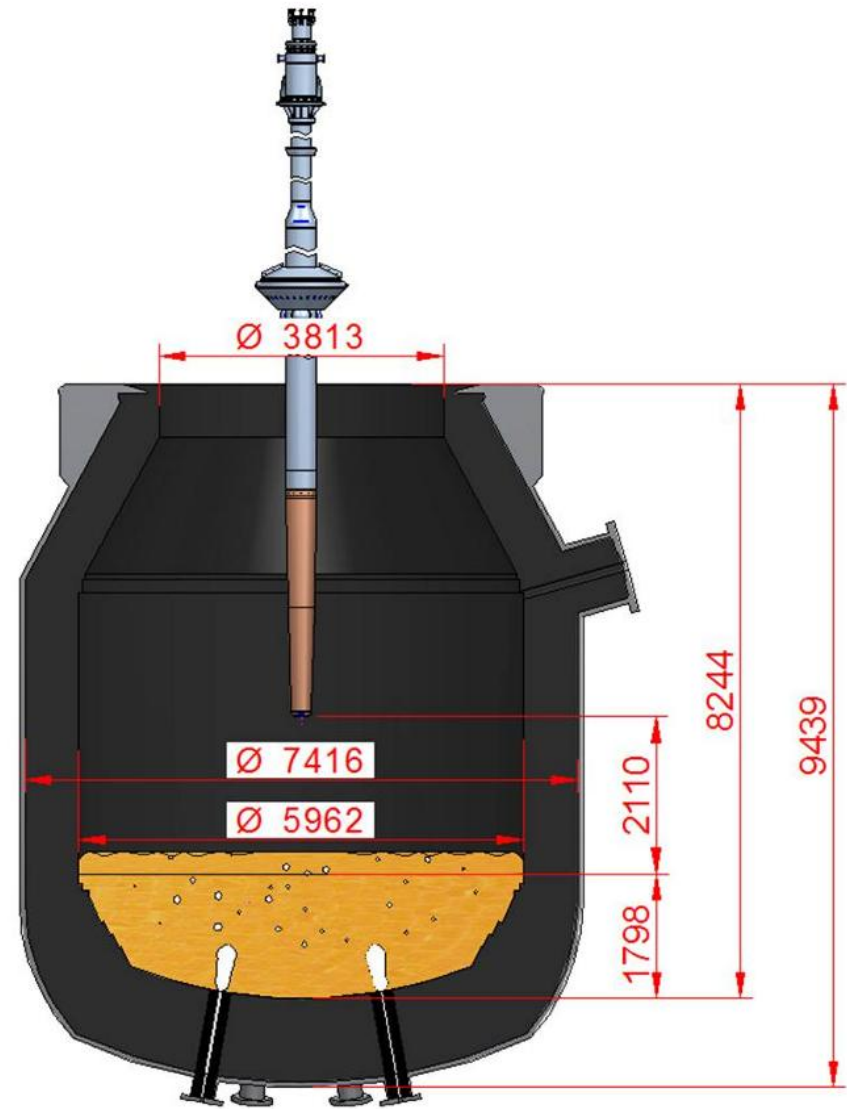
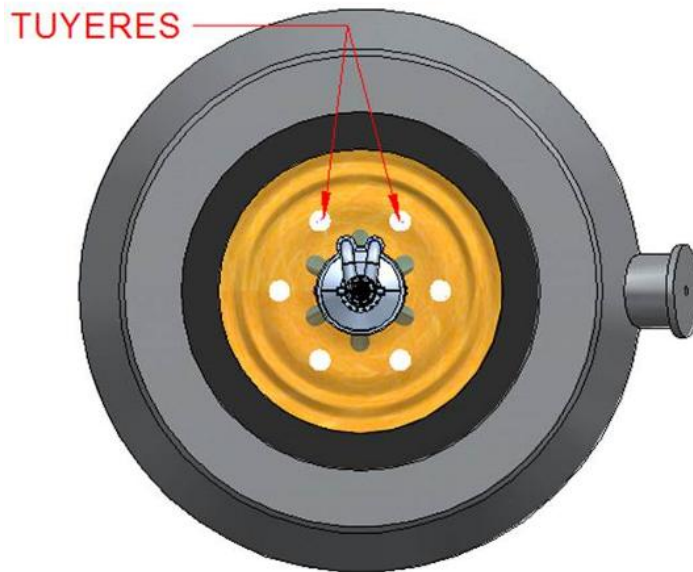


- Started operations in 1986 with 02 BOF converters with 180 tons each;
- Currently converters with 224tons;
- Bottom blowing system with 06 tuyeres;
- Sub-lances;
- Static and dynamic model aided by measurements from gas recovery system;
- Lowest slenderness ratio (height / diameter in trunnion region).



INTRODUCTION

Description	Unit	Value
Distance Bath Lance	mm (max)	3095
Distance Bath Lance	mm (min)	2110
Static Bath Level	mm	1798
H/D	#	0,94
Specific Volume	m ³ /t	0,84
Tuyere	#	6
Tuyere flow	Nm ³ /h	600

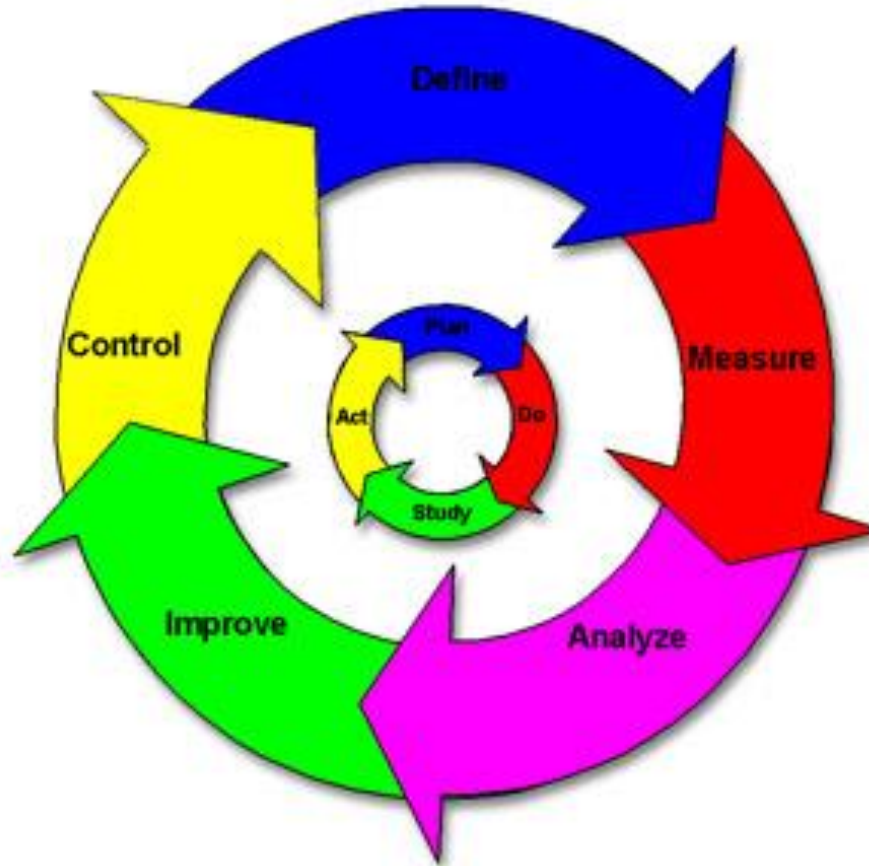




3RD ESTAD[®] 2017

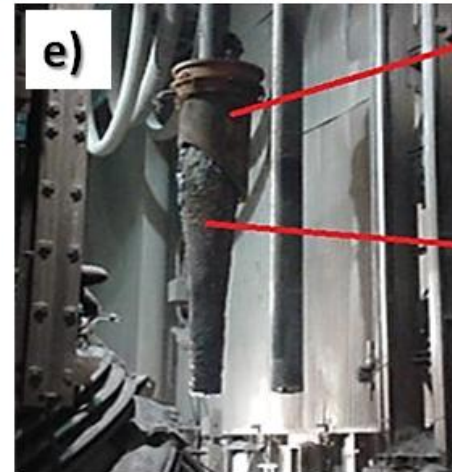
NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS[®] TECHNOLOGY

METHODS AND MATERIALS



METHODS AND MATERIALS

DEFINE – OBSERVATION OF CONVENTIONAL LANCE SKULLS BEHAVIOR



Sealing Lance Dome

Skulls

METHODS AND MATERIALS

DEFINE – OBSERVATION OF CONVENTIONAL LANCE SKULLS BEHAVIOR



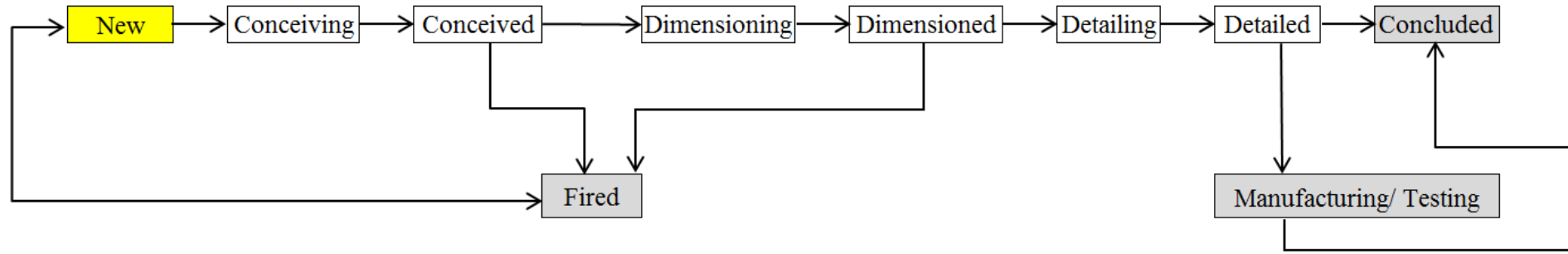
METHODS AND MATERIALS

MEASURE – CONVENTIONAL LANCE SKULLS NUMBERS AT 2010

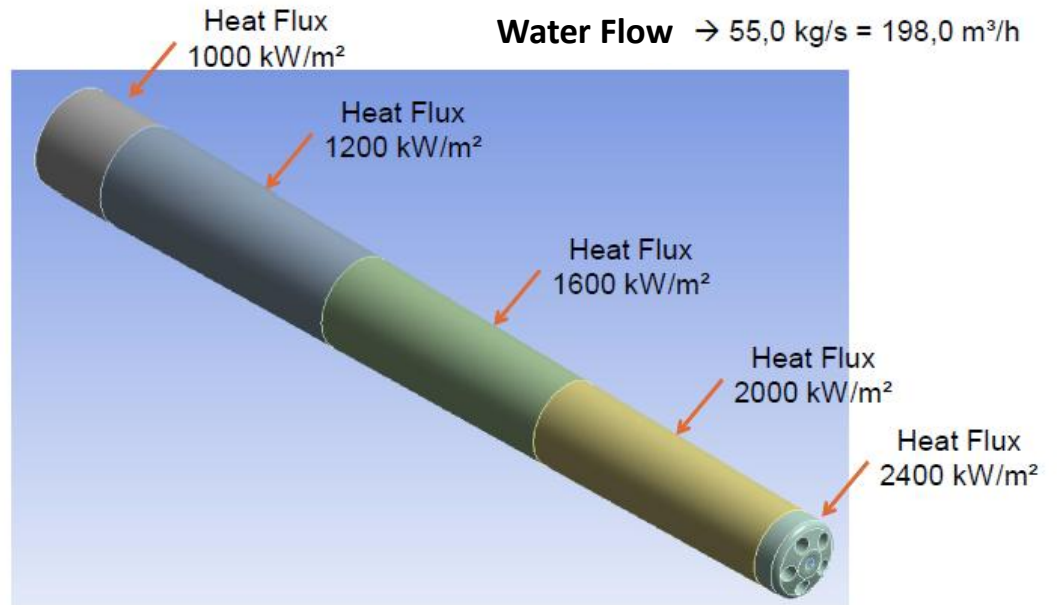
Item	Number	Unit
Man Power for lance maintenance	13 – 24 (proposed for 2011)	Peoples
Skull lance rate	6,7	Heats/skulls
Skulls per month	236	Skulls/month
Metallic yield losted	532	t/month

METHODS AND MATERIALS

ANALYSE – PMBOOK SYSTEM

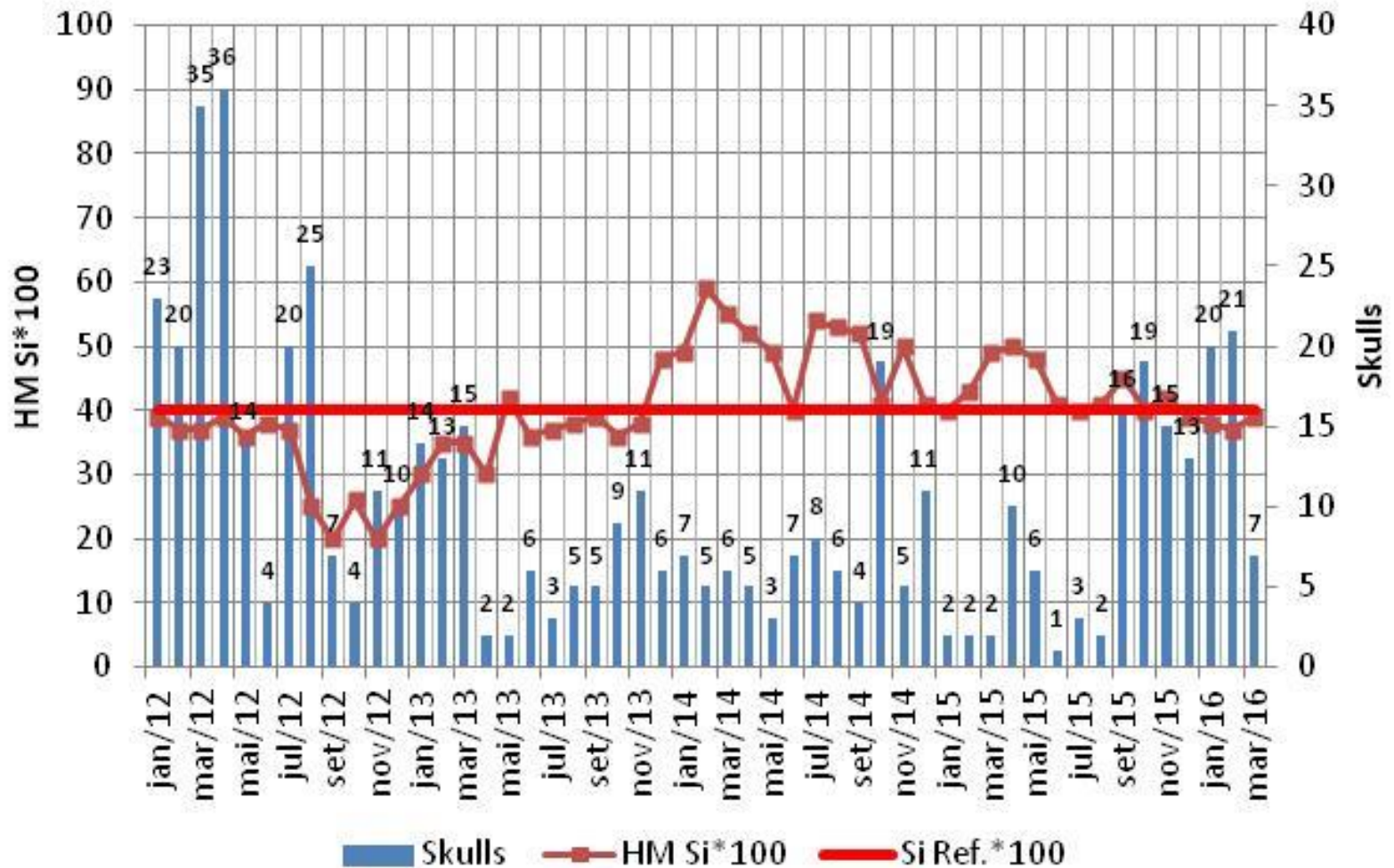


*Slagless*TM



RESULTS AND DISCUSSION

ANALYSE – HOT METAL SILICON X SKULLS FORMATION



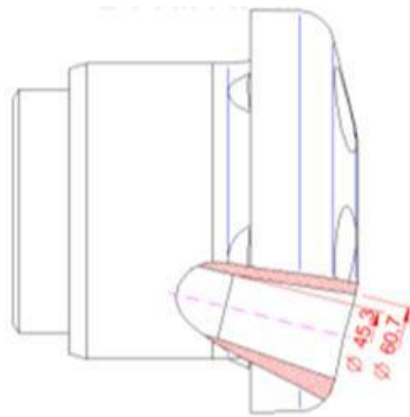
RESULTS AND DISCUSSION

ANALYSE – NOZZLE AND CARTRIDGE FACE WEAR



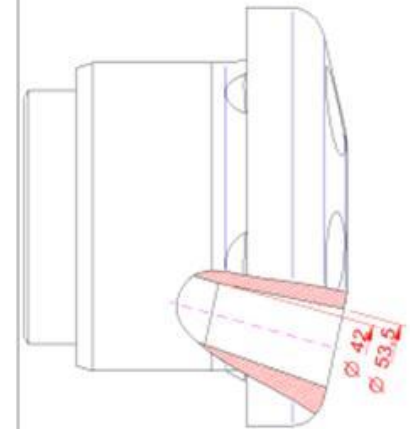
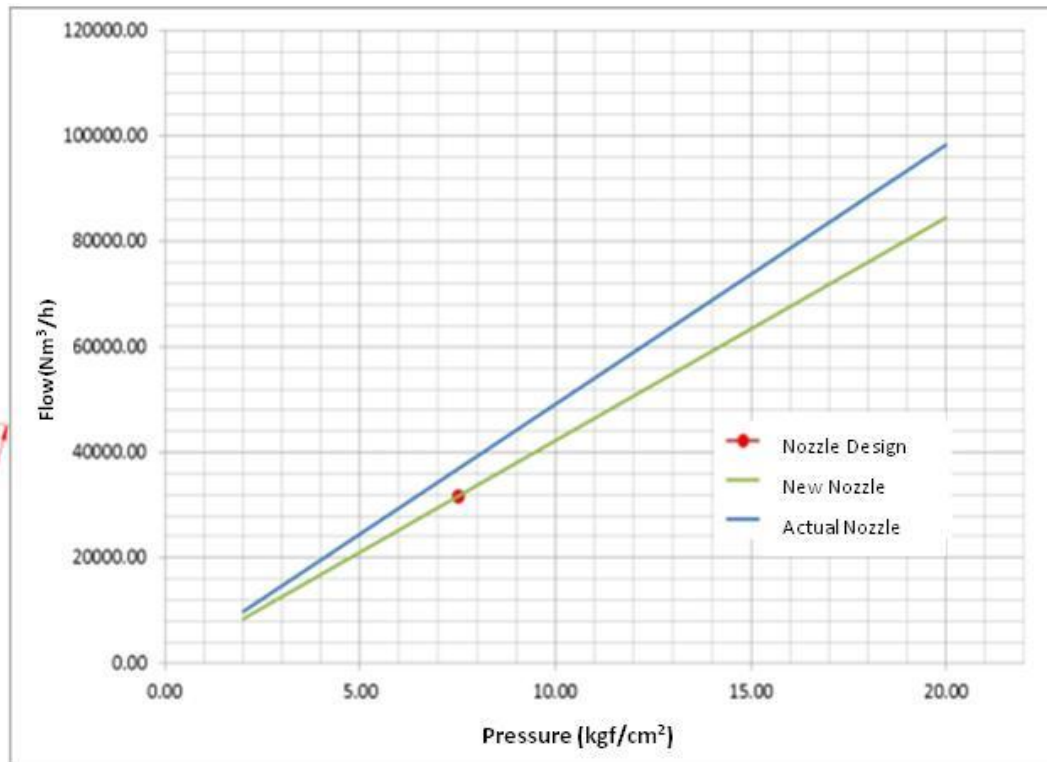
RESULTS AND DISCUSSION

IMPROVE – RESIZING OF SUPERSONIC NOZZLES SLAGLESS CARTRIDGE



Before

**F = 45.000 Nm³/h
P = 9 kgf/cm²**



After

**F = 40.000 Nm³/h
P = 9,5 kgf/cm²**

RESULTS AND DISCUSSION

ANALYSE – WATER QUALITY



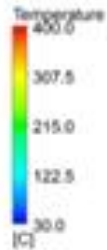
a) Solid material into water pipe lance



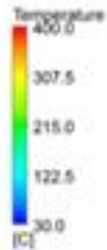
b) Cartridge tip face and damage due
bad heat transfer

RESULTS AND DISCUSSION

IMPROVE – SLAGLESS MODELS



14" – (2011 – 2012)



16" – (2013 – 2016)

*Slagless*TM

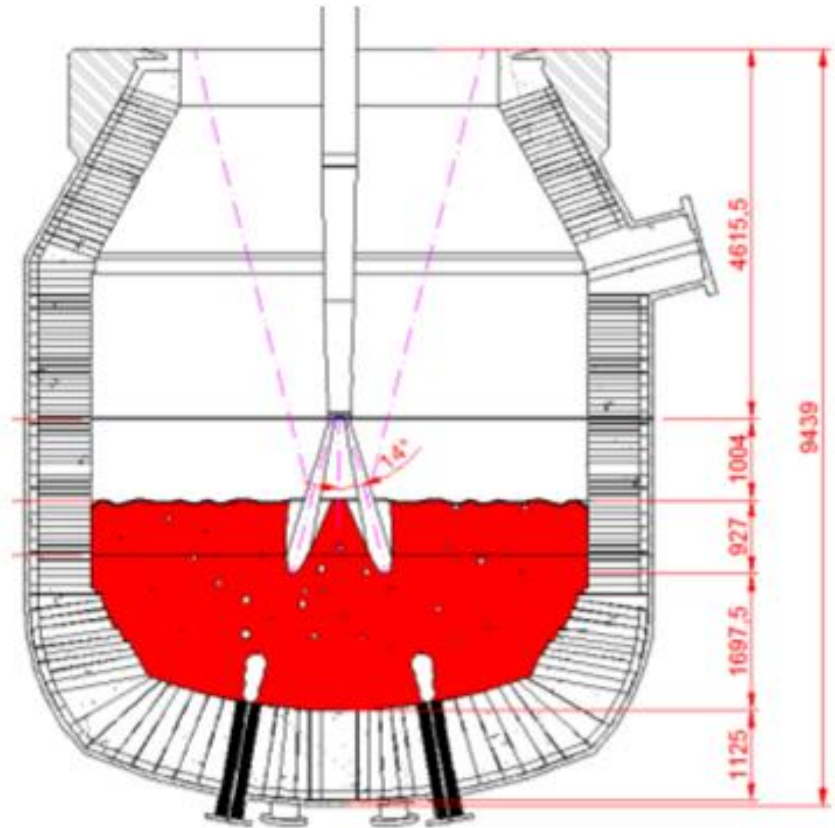
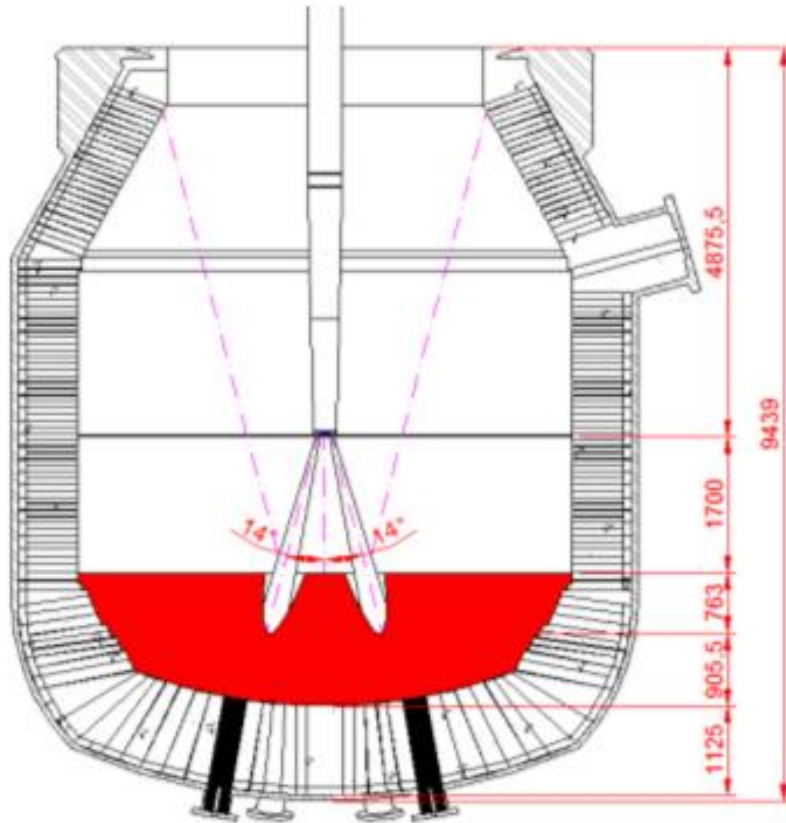


3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS[®] TECHNOLOGY

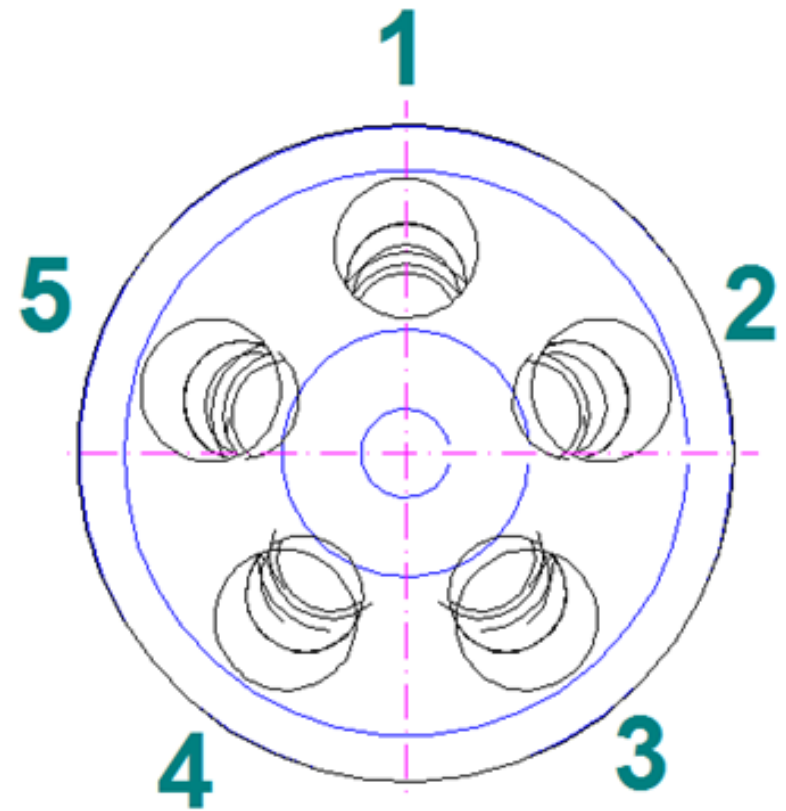
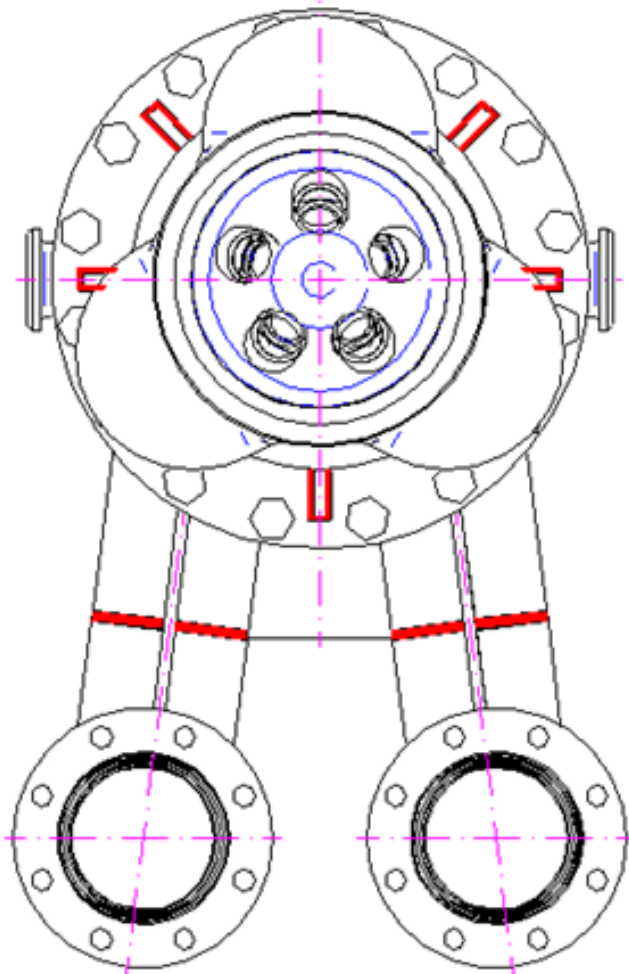
RESULTS AND DISCUSSION

ANALYSE – BOTTOM BLOW INFLUENCE



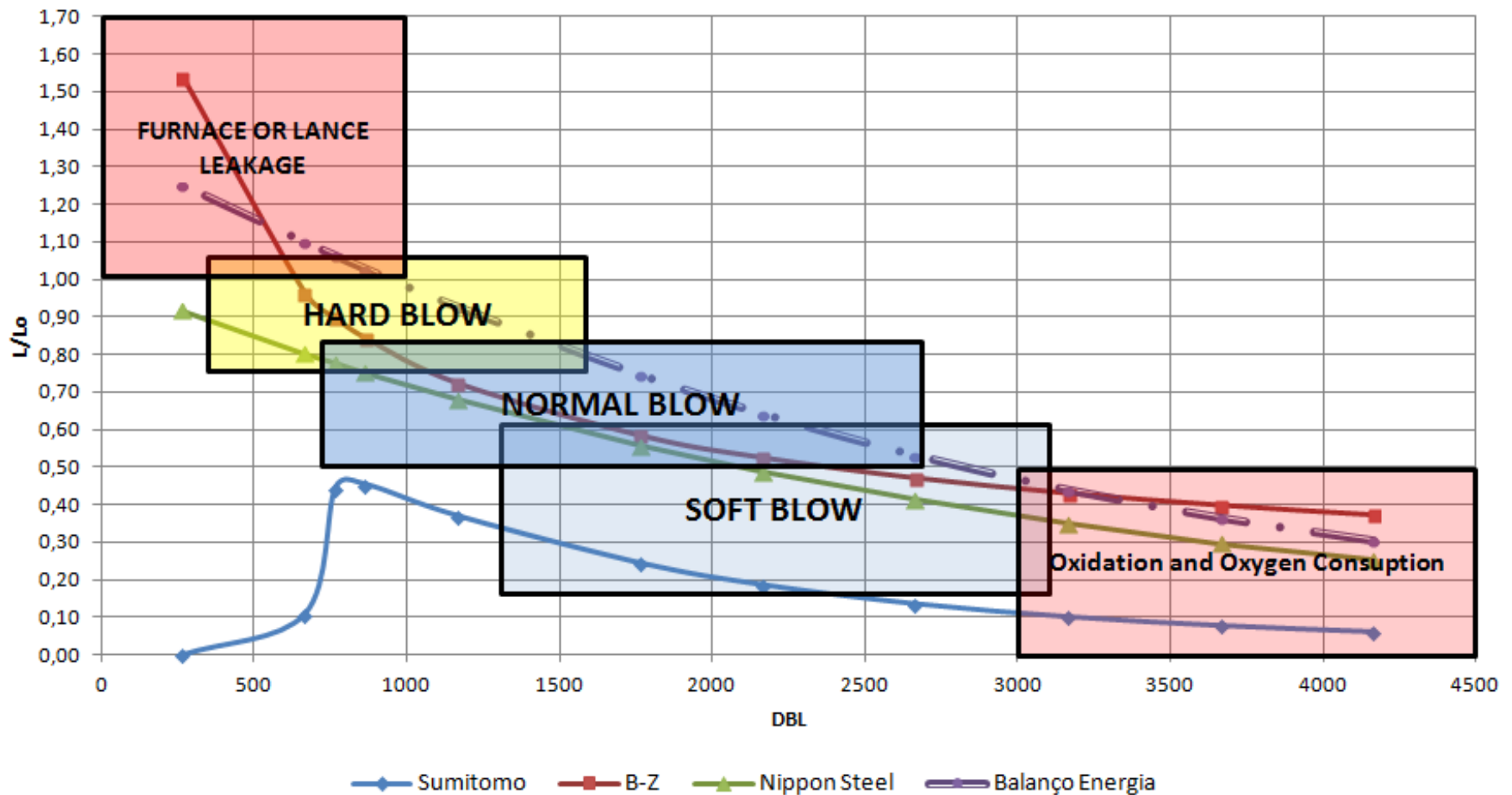
RESULTS AND DISCUSSION

IMPROVE – SLAGLESS ASSEMBLY PATTERN IN RELATION OF TUYERES POSITION



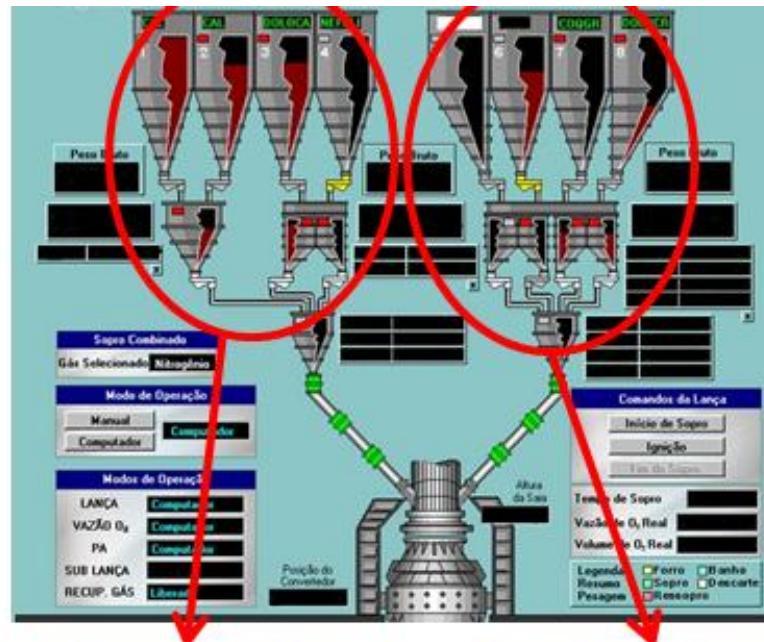
RESULTS AND DISCUSSION

ANALYSE – BEHAVIOR OF DIFFERENT MATHEMATICAL MODELS OF LANCE HEIGHT



RESULTS AND DISCUSSION

IMPROVE – WEIGHT SYSTEM: AMOUNT, TIME AND KIND OF MATERIALS SEQUENCE

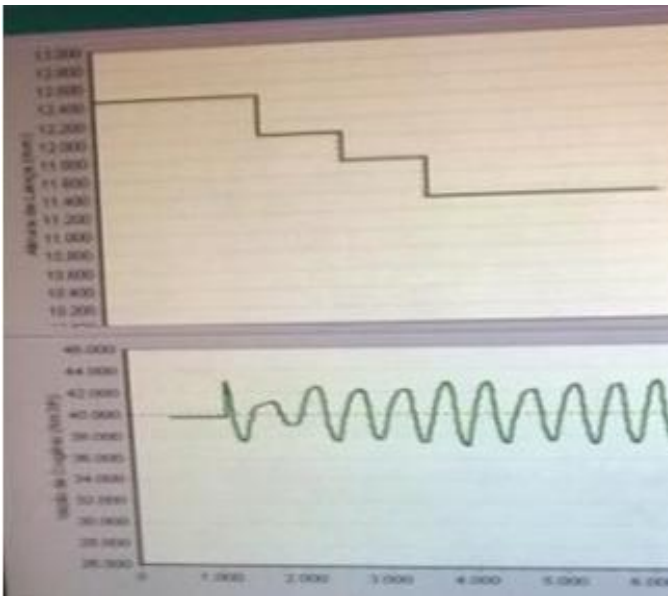


<i>Material</i>	Cal calcítica	Cal calcítica	Dolomita calcinada	Nefelina		Carapa	Escória LD	Coque	Dolomita Crua
<i>Seqência na Estação de Cálculo</i>	100	100	102	101		104	103	105	113
<i>Ordem de adição</i>	1ª	1ª	3ª	2ª		5ª	4ª	6ª	7ª

RESULTS AND DISCUSSION

ANALYSE – DBL AND OXYGEN CONTROL

BEFORE



AFTER



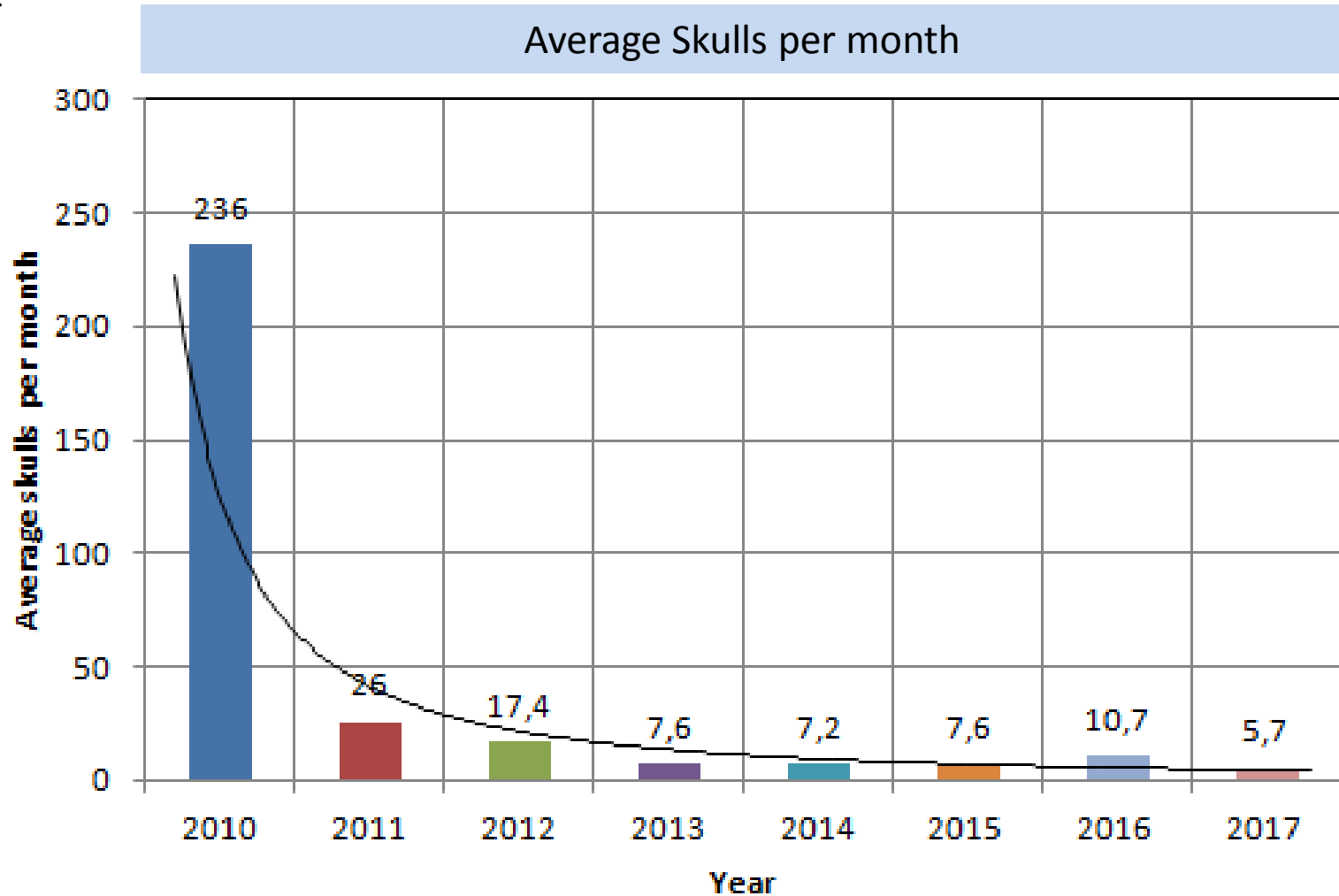


3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS[®] TECHNOLOGY

RESULTS AND DISCUSSION

CONTROL –



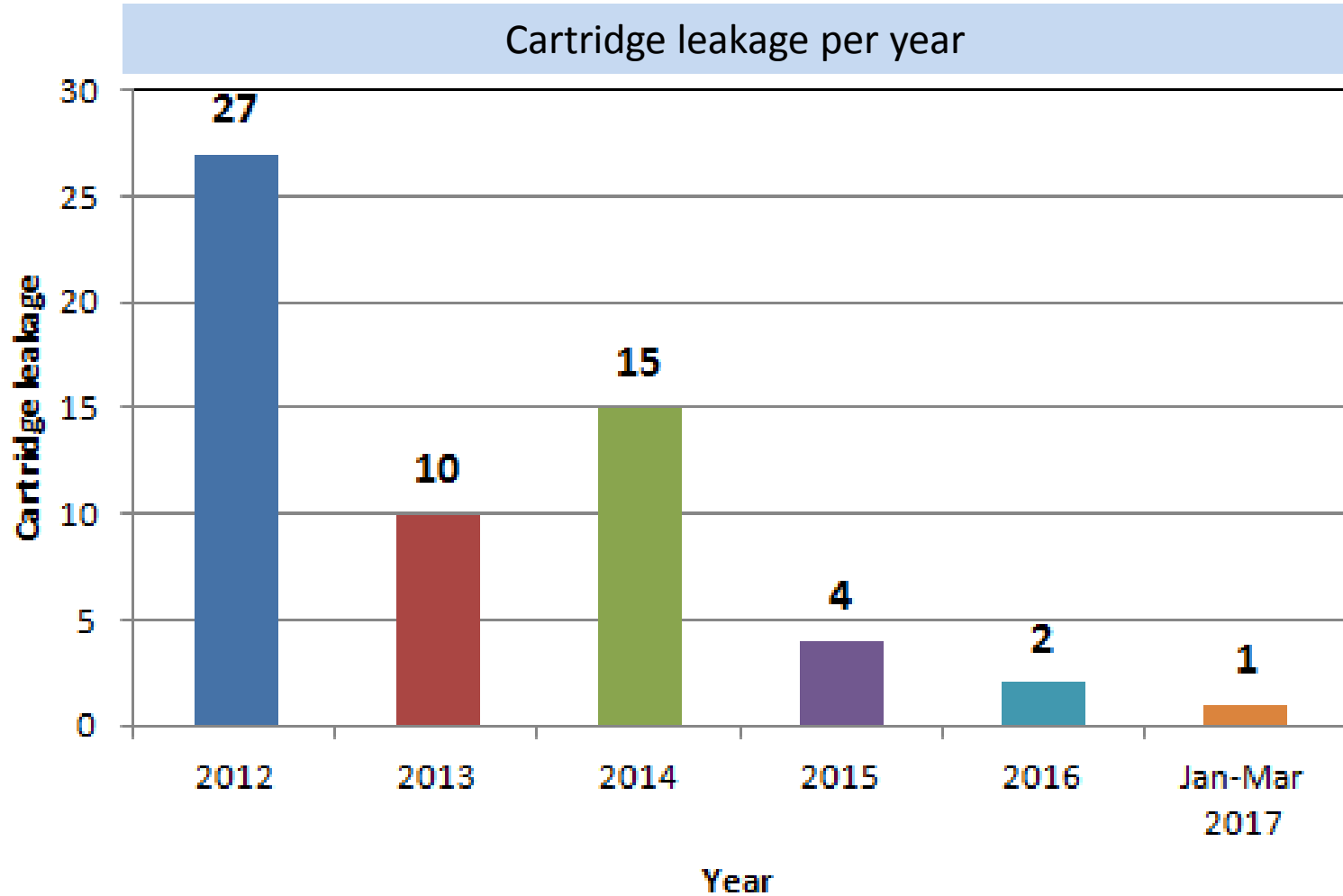


3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO BY SLAGLESS[®] TECHNOLOGY

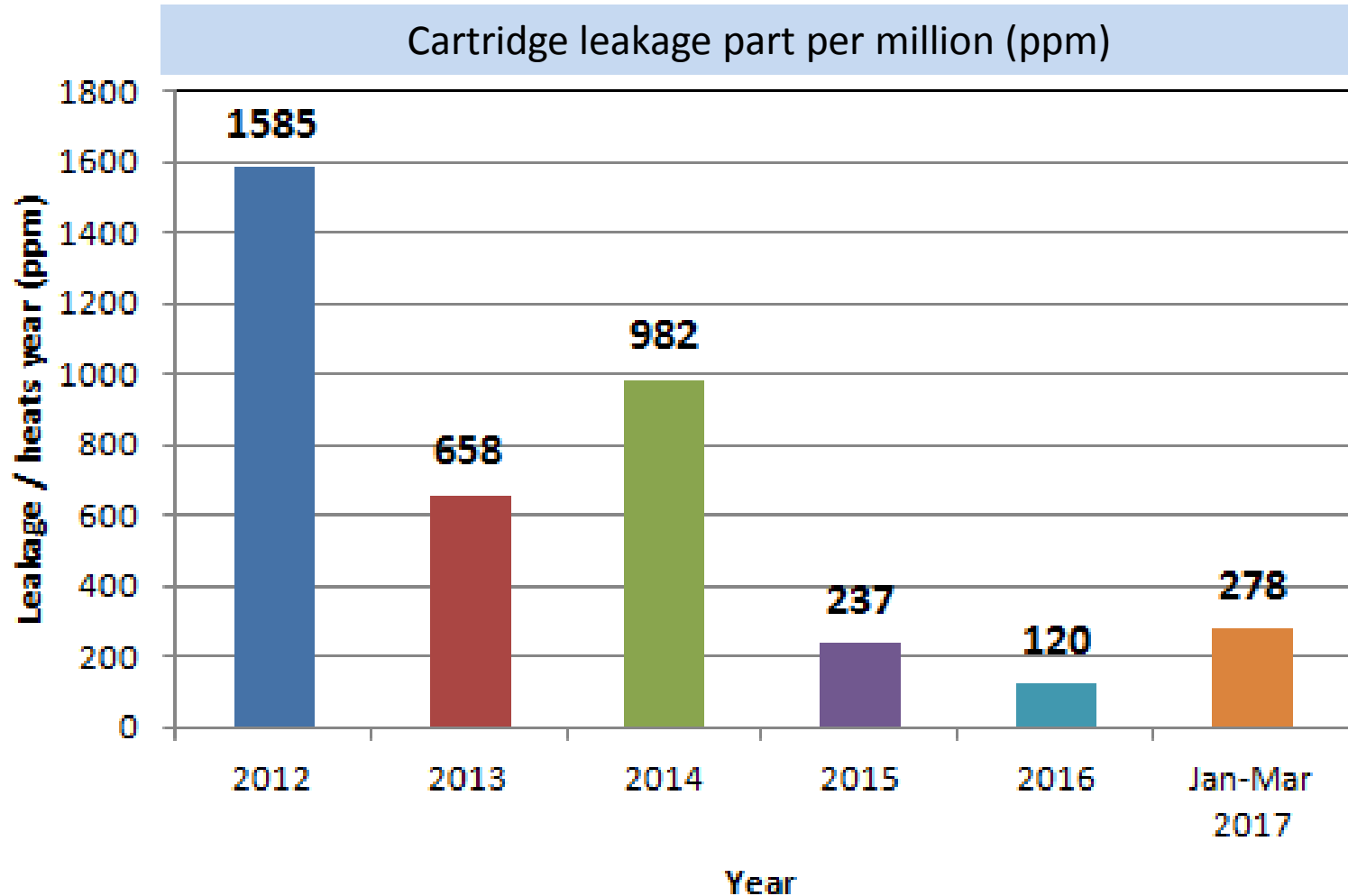
RESULTS AND DISCUSSION

CONTROL –



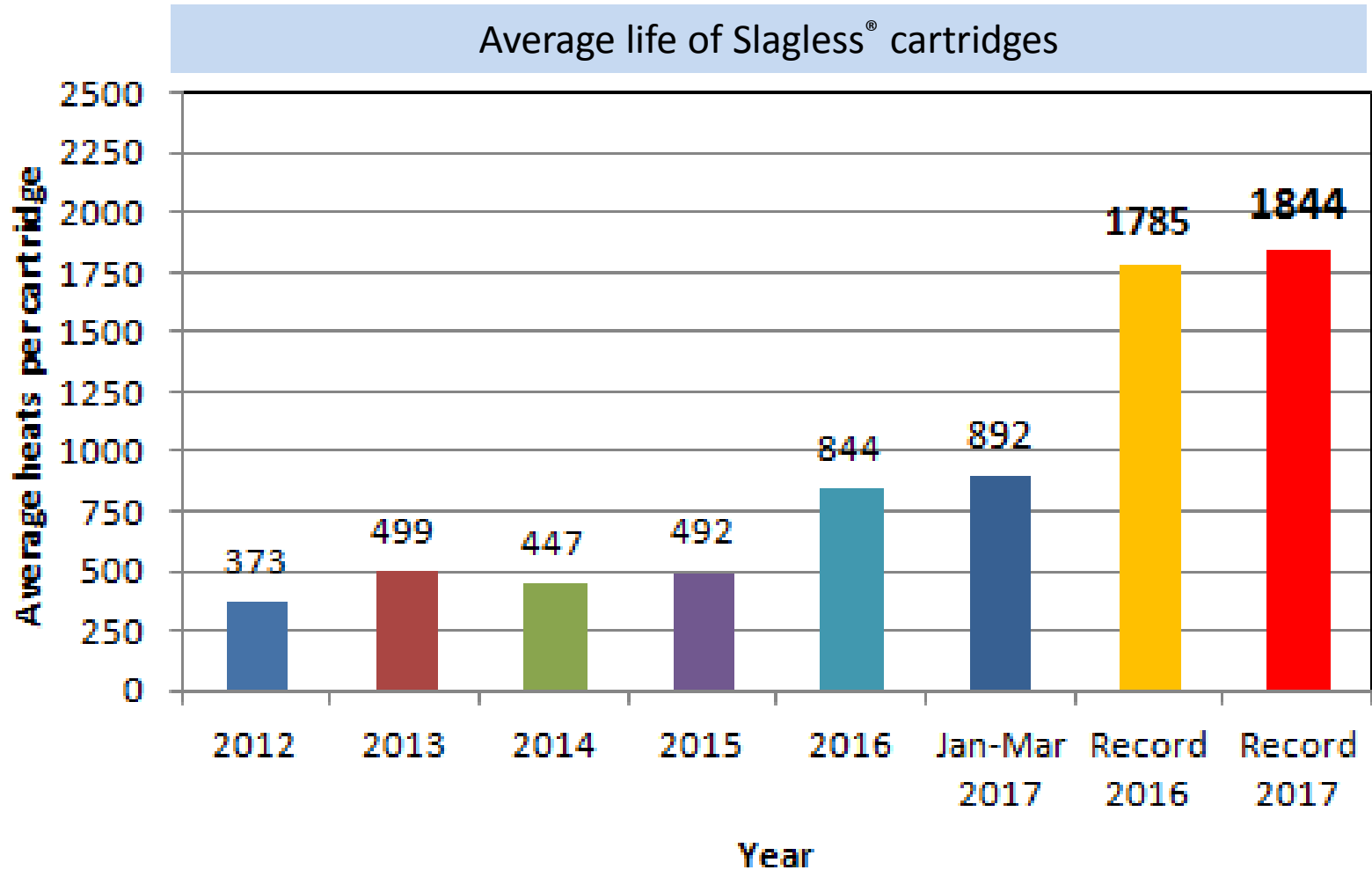
RESULTS AND DISCUSSION

CONTROL –



RESULTS AND DISCUSSION

CONTROL –



RESULTS AND DISCUSSION

CONTROL – LIFE OF SLAGLESS[®] CARTRIDGES



1604 HEATS



3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO
BY SLAGLESS[®] TECHNOLOGY

RESULTS AND DISCUSSION

CONTROL – LIFE OF SLAGLESS[®] CARTRIDGES

*Slagless*TM

1785 HEATS





3RD ESTAD[®] 2017

NEW BOF PERFORMANCE AT GERDAU OURO BRANCO
BY SLAGLESS[®] TECHNOLOGY

RESULTS AND DISCUSSION

CONTROL – LIFE OF SLAGLESS[®] CARTRIDGES

Slagless[™]

NEW

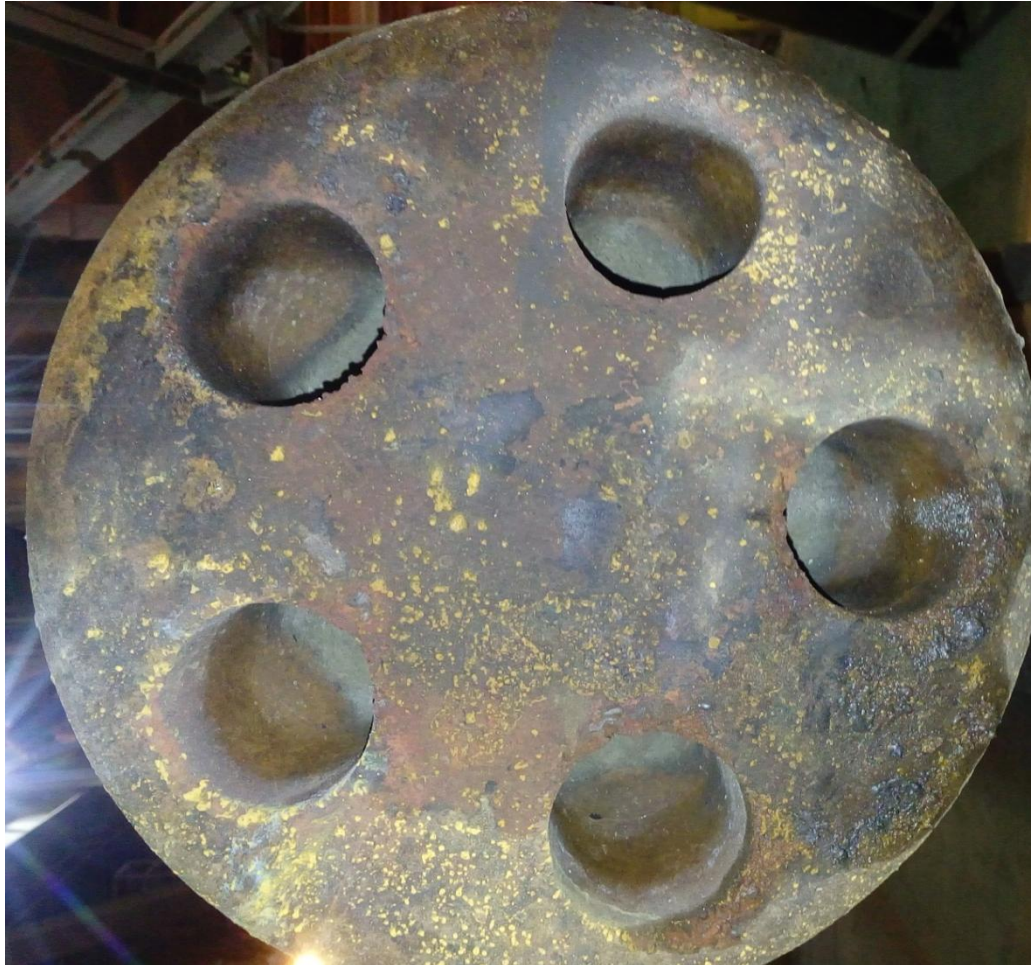
RECORD:

1844 HEATS

and still

BLOWING

(May 2017)



RESULTS AND DISCUSSION

CONTROL – LANCE SKULLS NUMBERS COMPARISON 2010 AND 2016

Item	2010	2016	Unit
Lance	Conventional	<i>Slagless</i> TM	
Man Power for lance maintenance	13 – 24 (proposed for 2011)	3	Peoples
Skull lance rate	6,7	130,1	Heats/skulls
Skulls per month	236	10,7	Skulls/month
Metallic yield losted	532	24,1	t/month
Lance tip / Cartridge average life	180	844	Heats

CONCLUSIONS

- The PMBook methodology was effective in implementing improvements to the Slagless® cartridge;
- The safety premise of not allowing BOF to operate with water leaks was decisive in the development of Slagless® technology;
- Adjustment in the nozzles and cooling circuit of the cartridges allowed to operate without water leaks in the BOF for 1 year;
- Predictive inspections of face wear and nozzles are critical to ensure increased cartridge life in a safe operating condition leading to a **1785 heat record mark at 2016;**
- **New heats record at 2017: 1844 heats and cartridge still blowing;**
- Adjustments in the process parameters at which lance height, lance displacement practice and addition of fluxes have contributed to reduction of the formation of skulls, even in periods of low Si.

Thank You



Always the best solution.

<http://www.lumarmetalsgroup.com>

breno.totti@lumarmetals.com.br