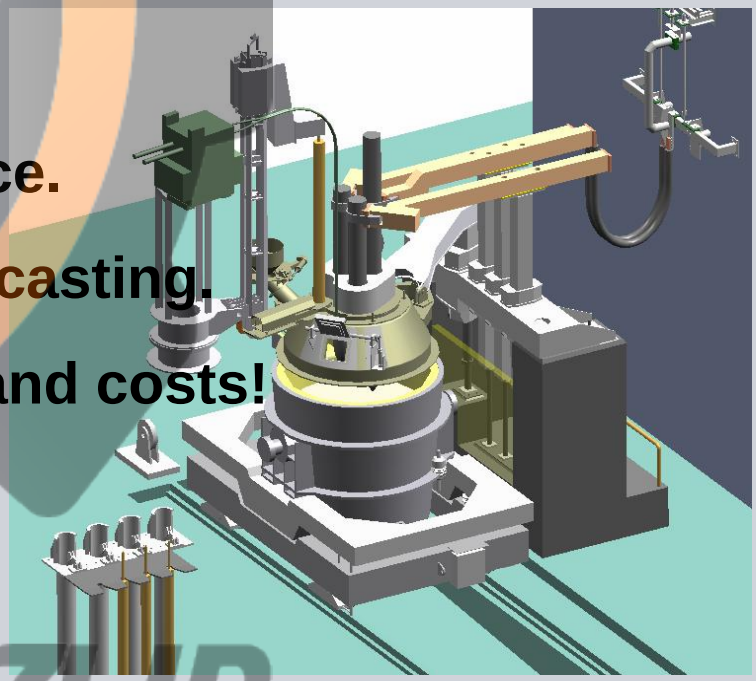
4. LF heating function

LF heating function

The LF heating function are summarised as follows:

1. **Heating with submerged arcs.**
2. **Stirring and rinsing of the steel with inert gas.**
3. **Refining under a basic white slag.**
4. **Inert gas atmosphere in the ladle furnace.**
5. **Serving as buffer between melting and casting.**
6. **Reducing overall consumption values and costs!**



LF heating function

ELECTRIC ARC

The electric arc burns between electrode and metal bath at a temperature of 4000 - 8000°C

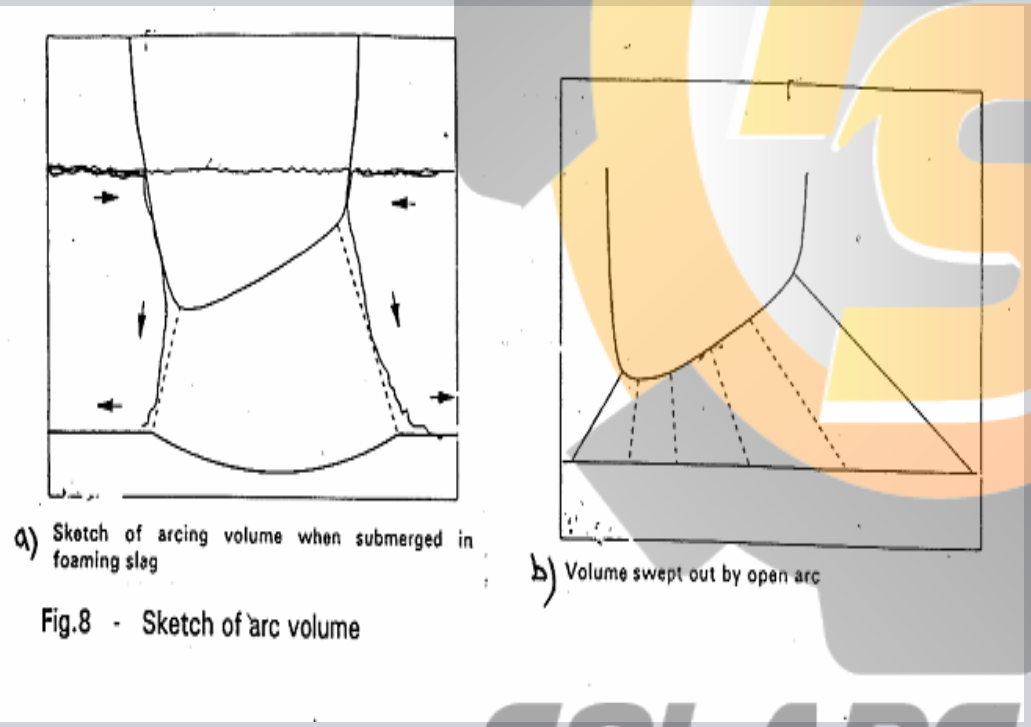
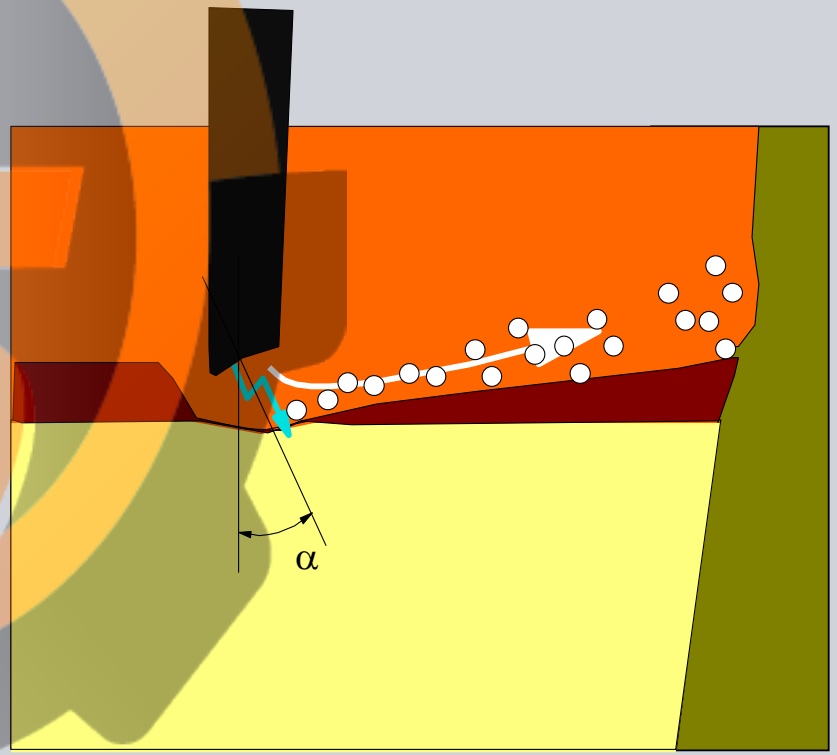


Fig.8 - Sketch of arc volume

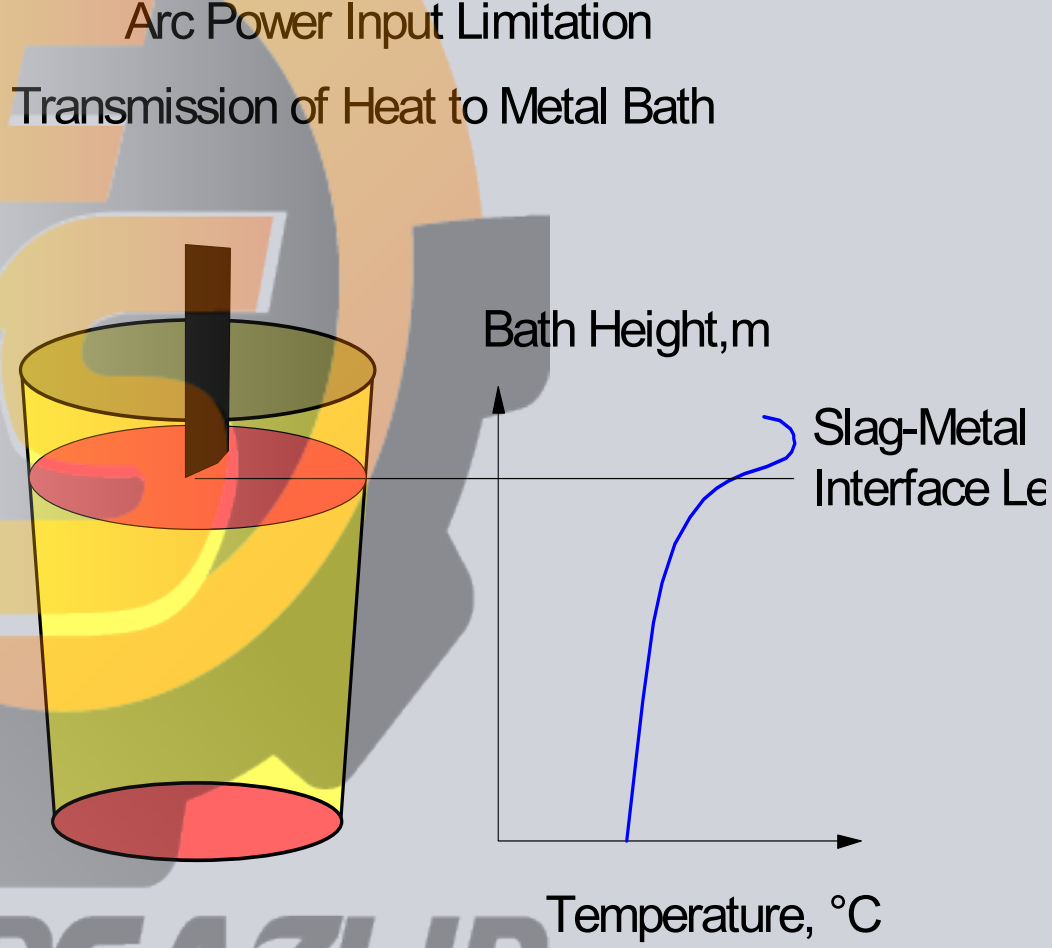
Generation of Hot-Spot Wear
Arc Deflection - Hot Particle Jet



LF heating function

Power input into a ladle furnace is influenced by:

- Arc power input
- Refractory type and quality
- Metal and slag temperature.
- Thermal profile in the refractory lining.
- Metal and slag composition.
- Slag thickness.
- Type and power of stirring
- Ladle furnace geometry.



LF heating function

Selection of operating point for the ladle furnace. The ladle furnace operator can set independent variables only, which define the so called operating point of a ladle furnace..

1. Secondary voltage.

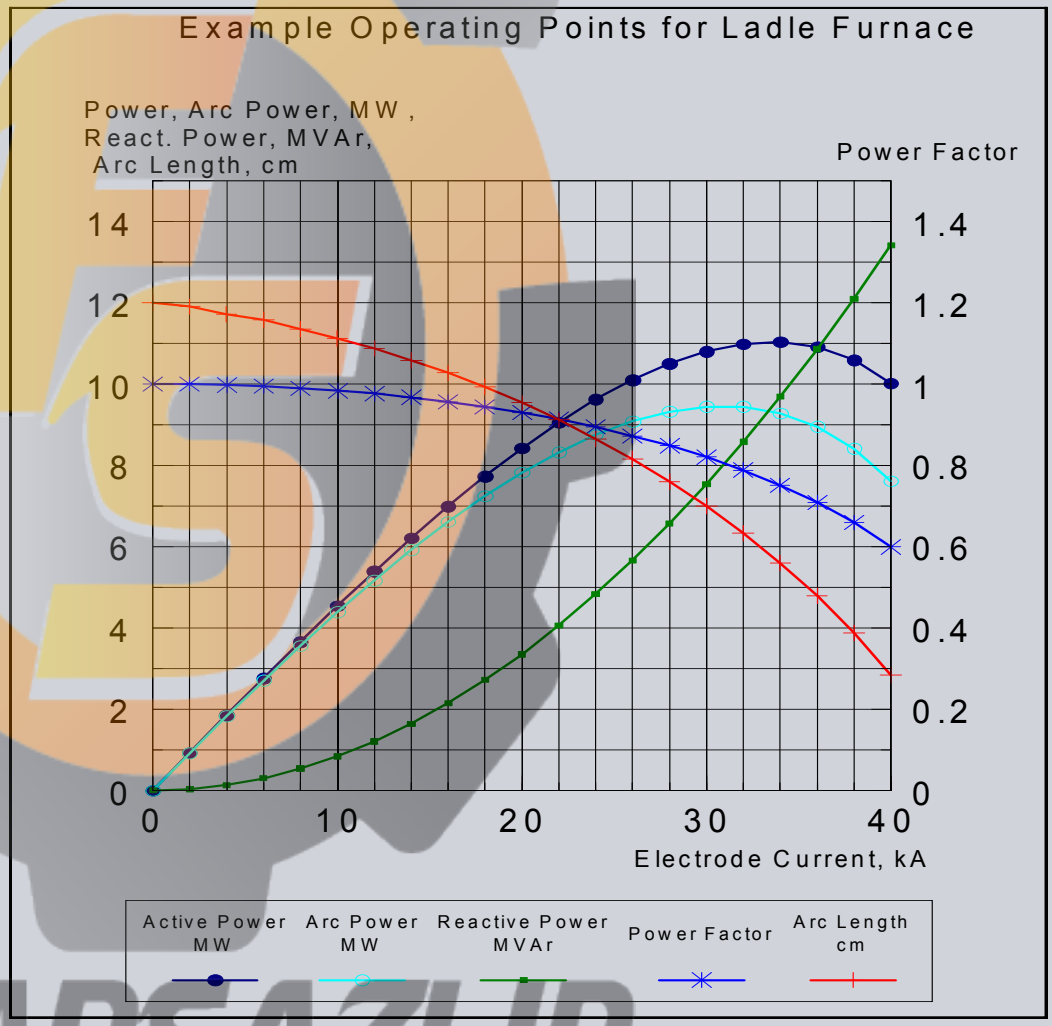
2. Electrode current.

The choice of operating point will then decide what values will be obtained of the independent variables active, and reactive power, power factor heating rate

LF heating function

Electrical parameters:

- Active and apparent power
- Arc power
- Refractory wearing index
- Power factor



LF heating function

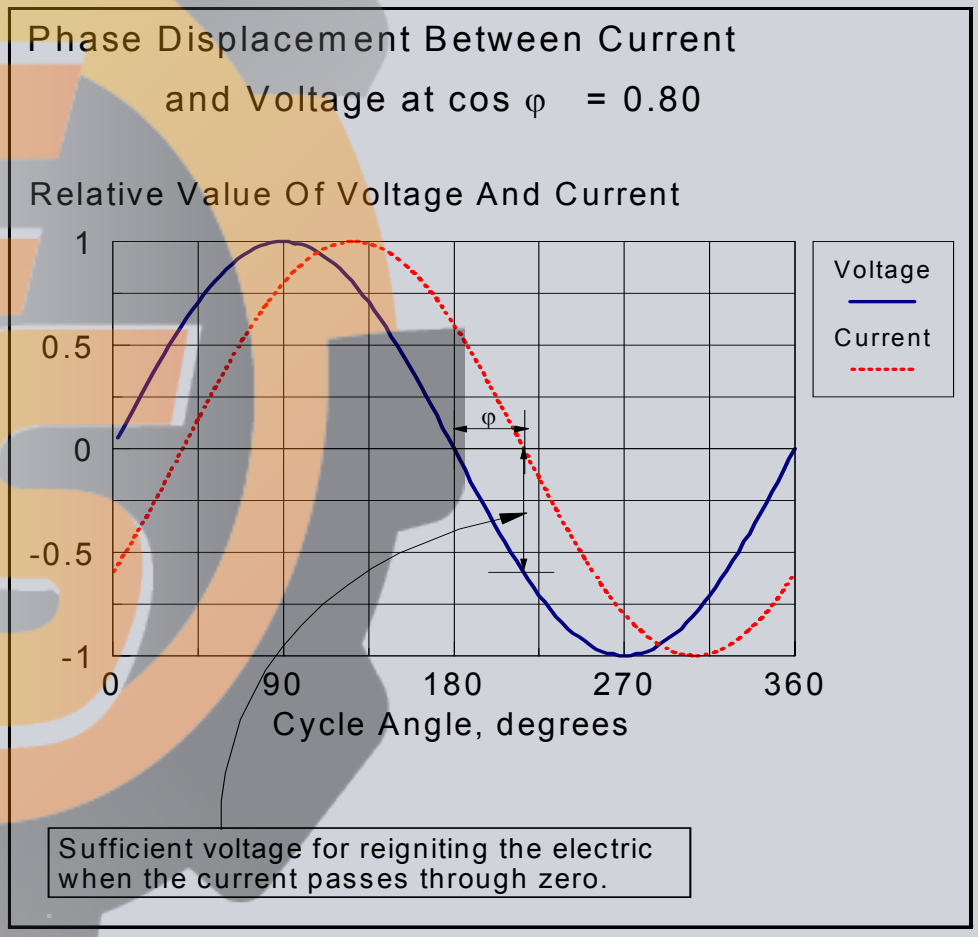
Experience shows that a power factor of cosφ = 0.78 to 0.80 is ideal for ladle furnace operation .

With a liquid slag of the proper composition it is possible to operate up to 0.90 without problems.

There is no purely technically motivated lower limit for the power factor.

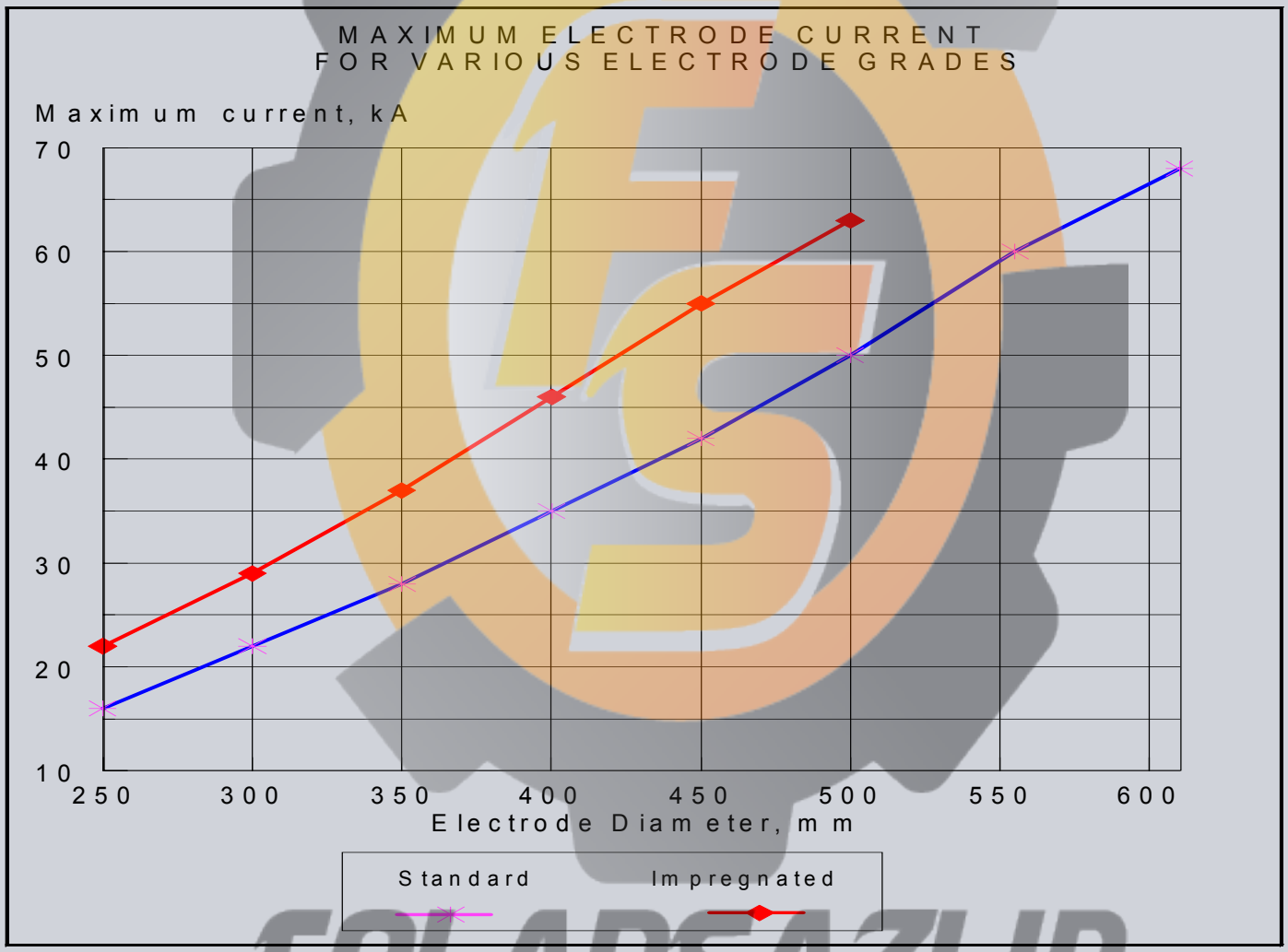
Since P = S*cosφ it follows that S = P / cosφ.

The transformer must be dimensioned on the basis of the required active power.

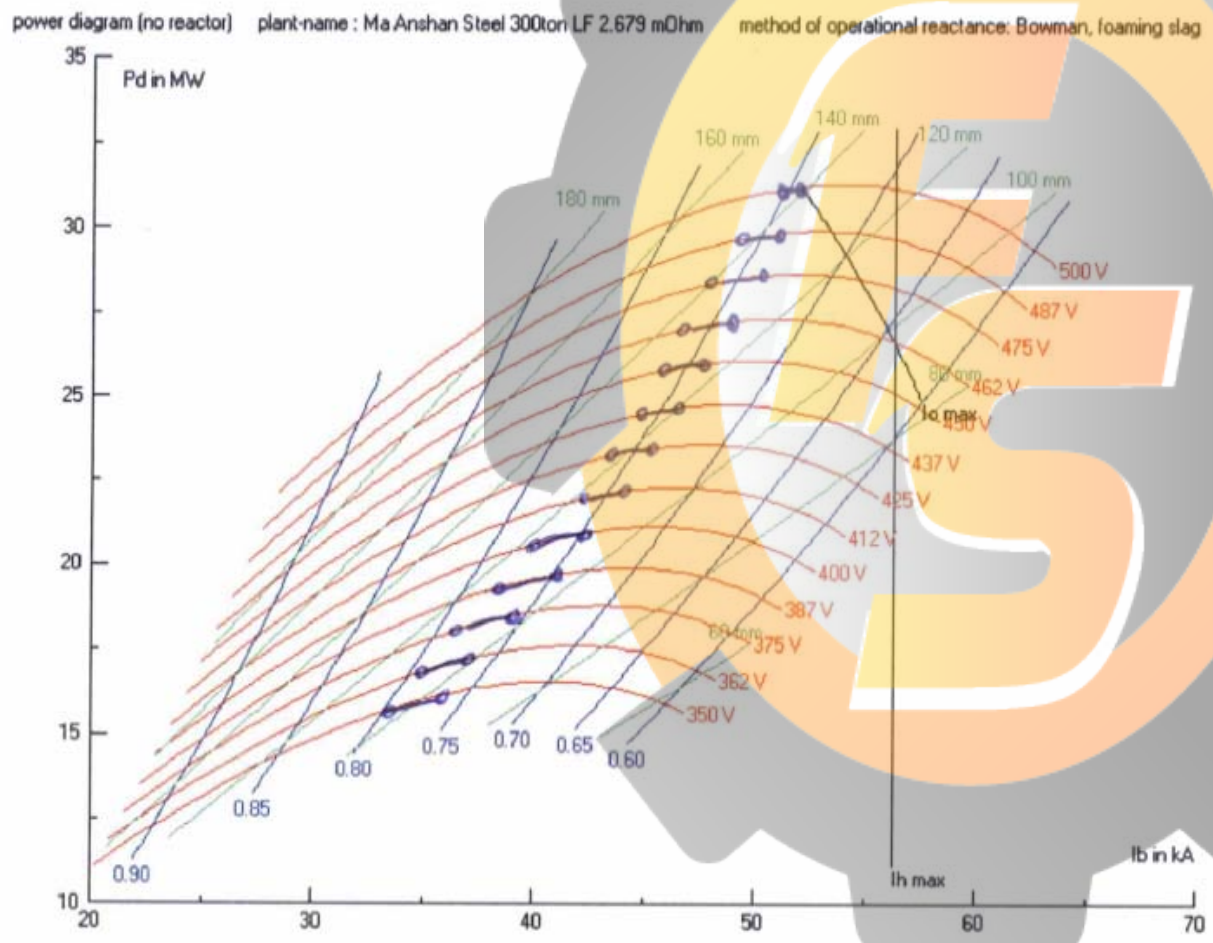


LF heating function

Electrode current.



LF heating function



TECHNICAL DATA

MELTING POWER	45 MVA
RATED POWER	45 MVA
FREQUENCY	50 HZ
REACTANCE OF FURNACE	2.679 OHM
NOMINAL VOLTAGE	35 KV
ADJUSTED	35 KV
SHORT CIRCUIT CAPACITY	1420 MVA
Maximal Current Sec.	56,2 KA
Maximal Current Prim.	0.74 KA

VOLTAGE TAPS

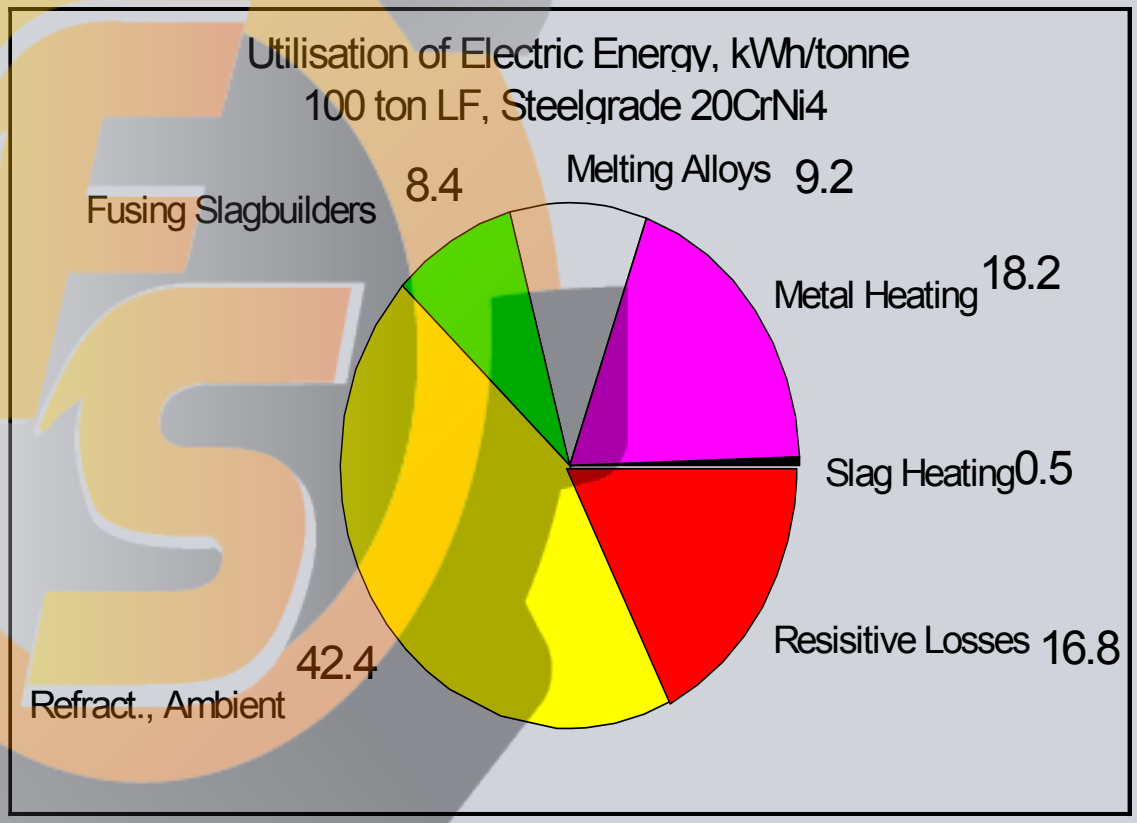
Tap 1	350 V	Tap 14
Tap 2	362 V	Tap 15
Tap 3	375 V	Tap 16
Tap 4	387 V	Tap 17
Tap 5	400 V	Tap 18
Tap6	412 V	Tap 19
Tap 7	425 V	Tap 20
Tap 8	437 V	Tap 21
Tap 9	450 V	Tap 22
Tap 10	462 V	Tap 23
Tap 11	475 V	
Tap 12	487 V	
Tap 13	500 V	

Cycle Diagram (typical)

LF heating function

Where does the electric energy go ?

- Heating of the steel
- Fusing of the slag builders.
- Heating of the slag.
- Melting of the alloys.
- Resistive losses in power supply systems and electrodes
- Losses to refractory, roof, off gas and ambient.

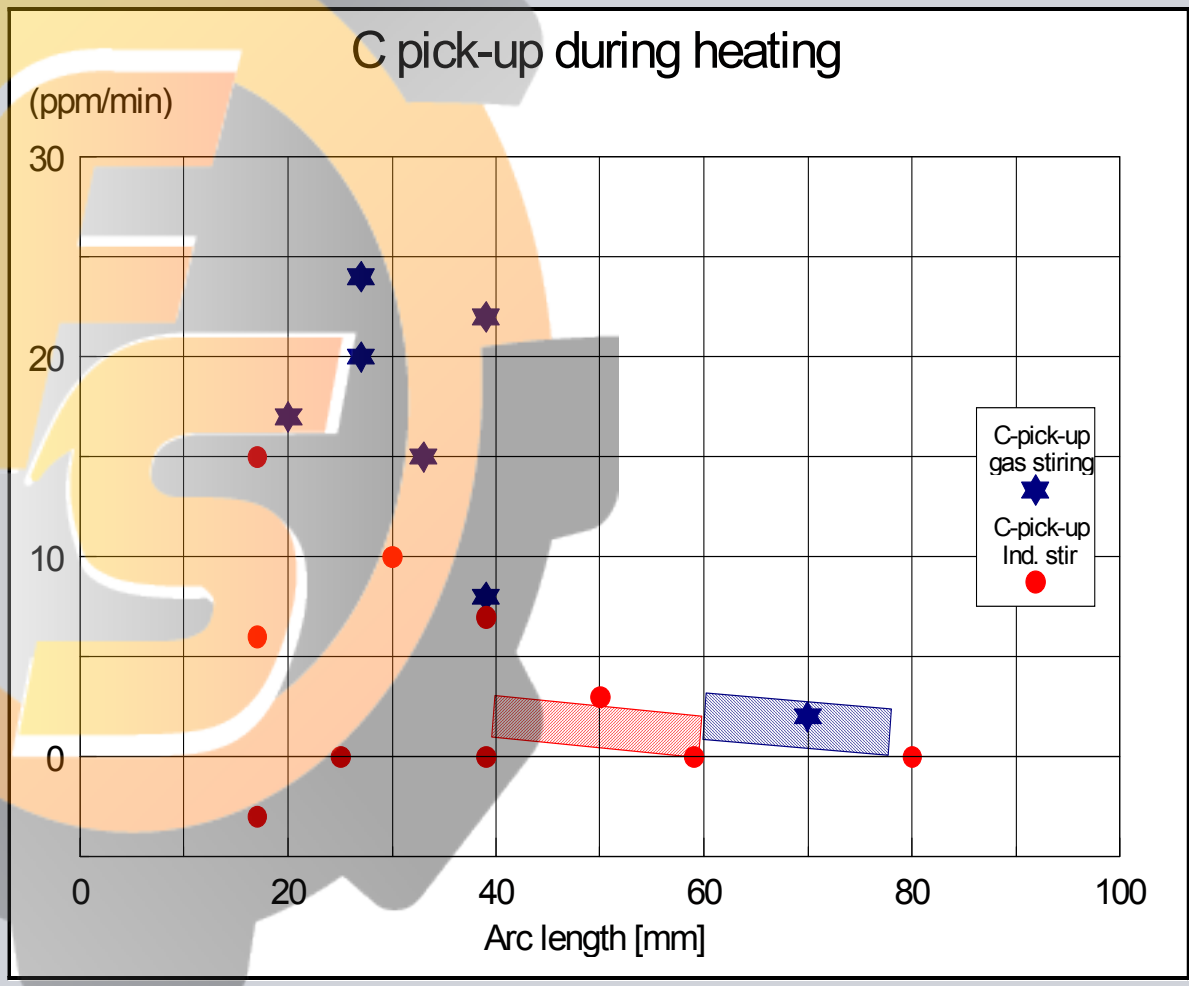


LF heating function

C pick up during Power on

The extent of this carbon pick-up depends on the following factors

- Oxygen activity in the metal bath.
- Metal bath stirring method.
- Arc length.

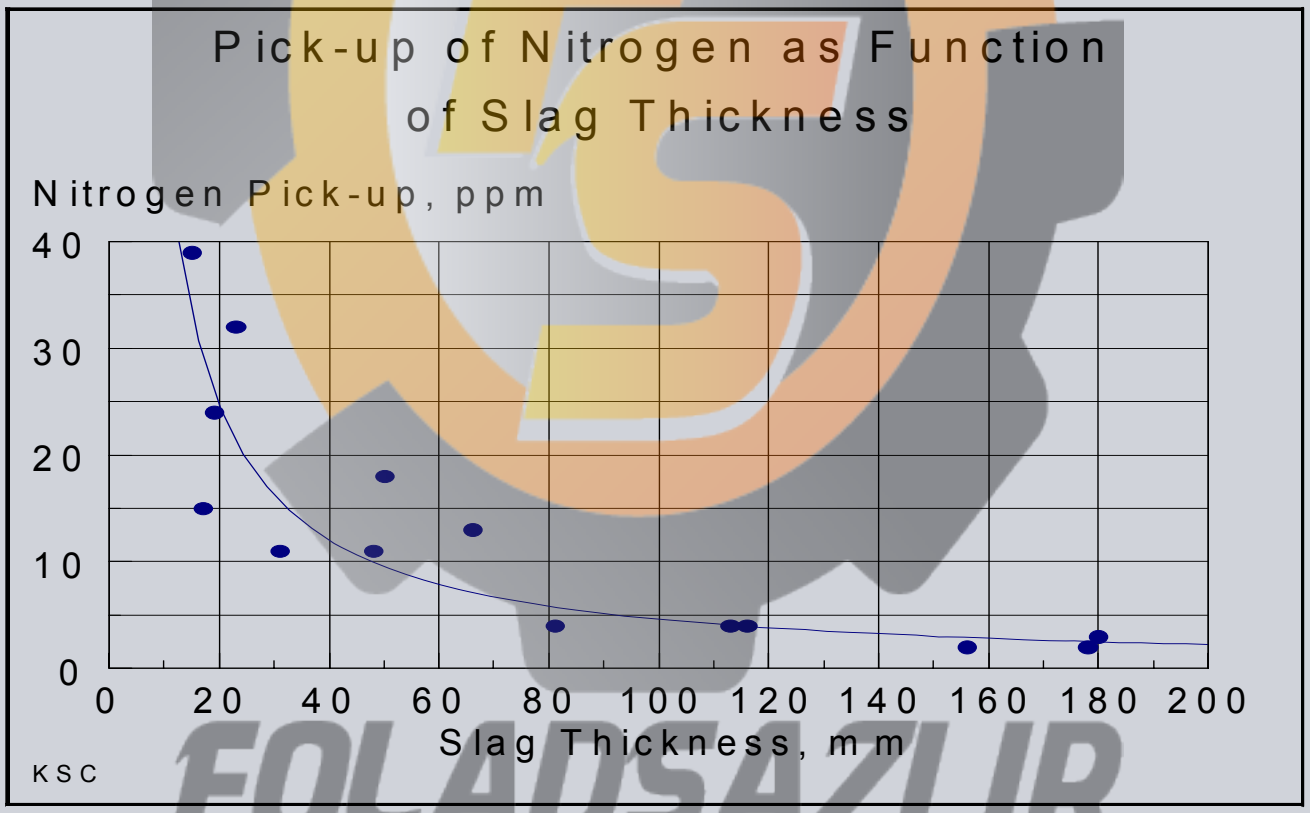


LF heating function

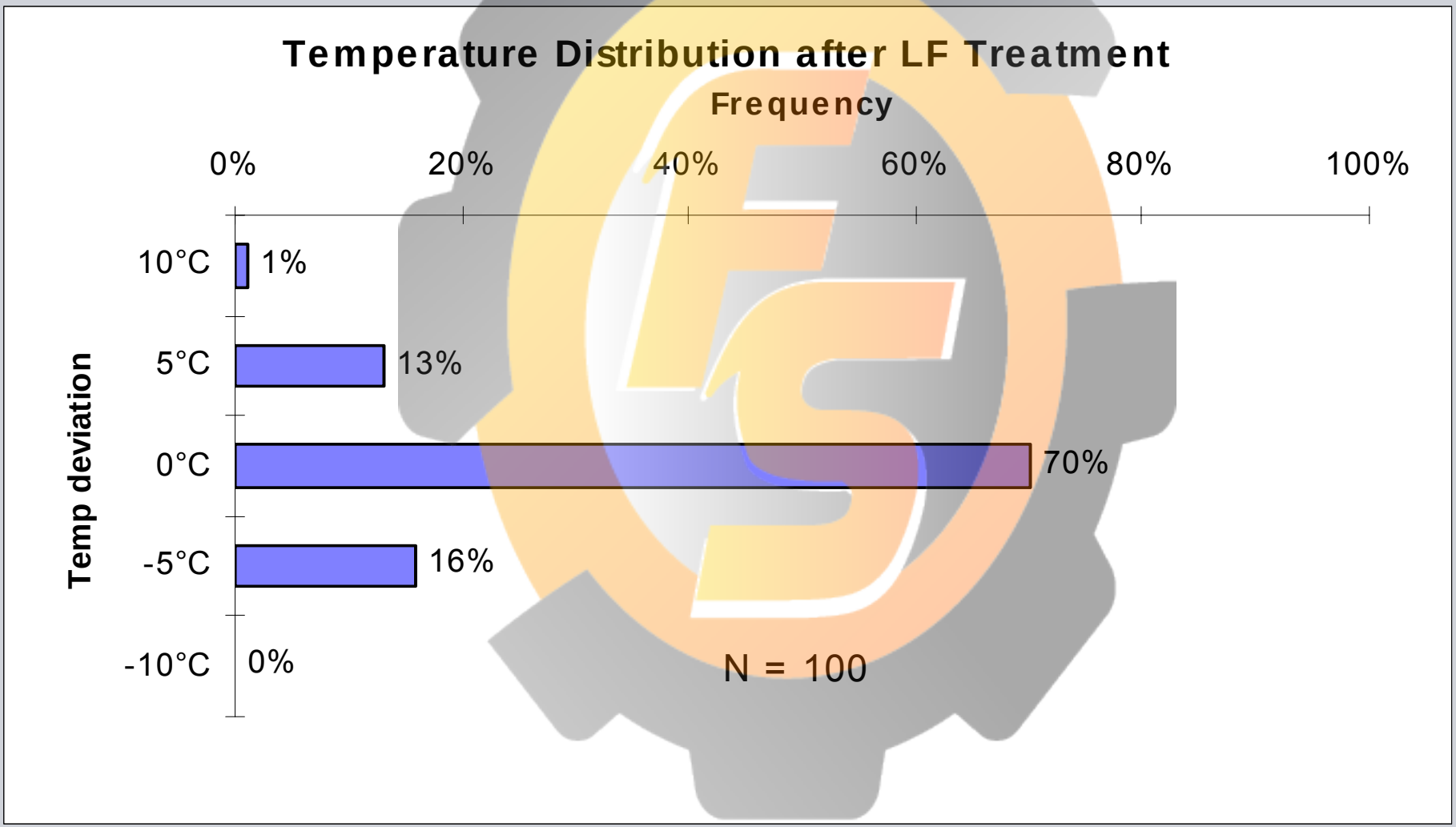
Nitrogen pick up

Electric arc heating is potentially cause a substantial pick-up of atmospheric gases, notably nitrogen

$N2 \rightarrow 2N \rightarrow 2\,[N]$



LF heating function



Temperature Distribution Final Temperature in LF

End

LF heating function