



11-13 September / Eylül 2014
TÜYAP Fair, Convention & Congress Center, İstanbul

7th International Ankiros Foundry Congress 7. Uluslararası Ankiros Döküm Kongresi



«Next Generation Of Electrical Ladle Heaters»

«Yeni Jenerasyon Elektrikli Pota Isıtıcılar»

Marcus Andersson
(SAN Malz. Tek.)

5.Oturum: Döküm Teknolojileri Demir Dışı **5th Session: Casting Technologies Non Ferrous**

Oturum Başkanı/Session Chairman: Can Demir (Componenta Döküm. Tic. San. A.Ş.- Alüminyum)



Kanthal® Global Services

Next generation Electrical ladle heaters

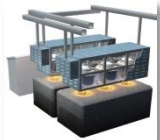
Marcus Andersson, Sandvik Heating Technology

Kanthal Global Services

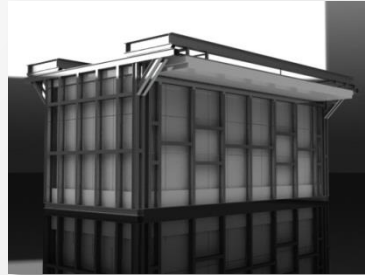
Electrical Heating Systems, Engineering services & Technical services



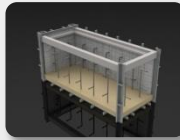
Electrical Heating Systems



- Concept solutions
- Ladle heaters
- Ladle dryers
- Mold heaters
- Stub dryers
- Anode heaters
- Cathode heaters



Engineering Service



- Furnace re-engineering
- Commissioning
- Complete furnace refurbishment projects
- “Taylor made” heating systems
- Product trainings



Technical Service



- System Installations
- Service contracts
- Spare parts
- Refurbishments
- Repairs

Ladle heater

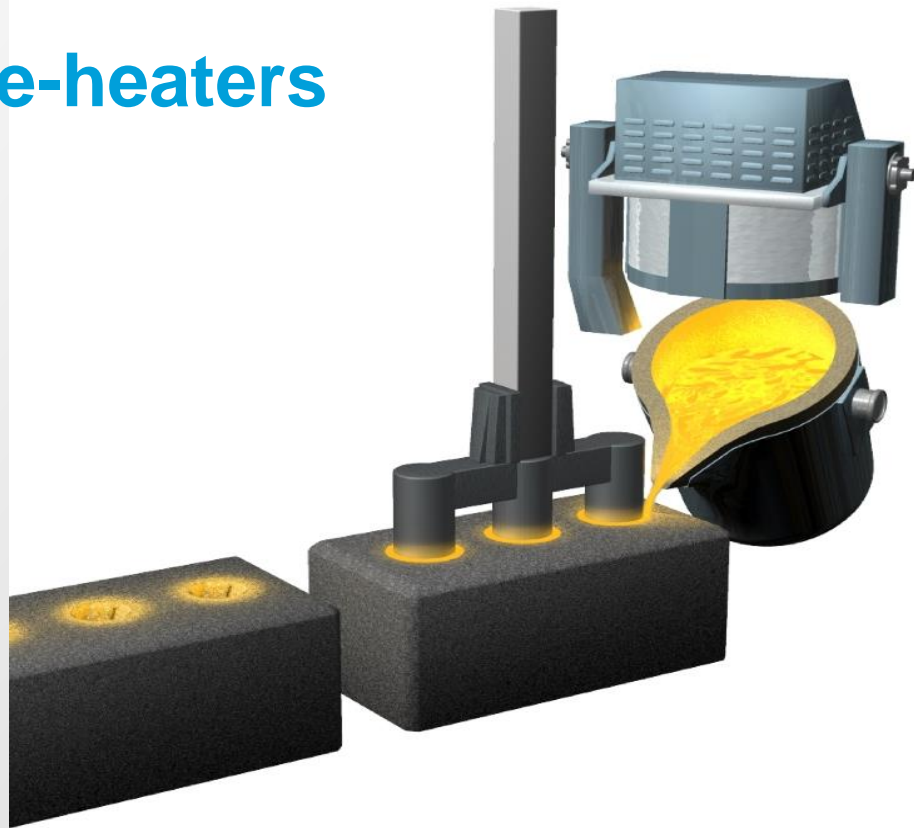
- Heater
- Controls
- Accessories
- Commissioning & Installation
- Service



Ladle dryers & Ladle pre-heaters

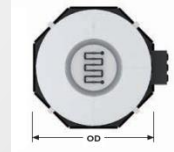
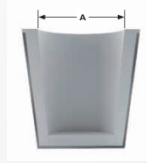
Kanthal electrical heating systems

- Suitable for both pre-heating and holding of liquid metal in primary and secondary aluminium processing and steel foundries
- Long life refractory lining by optimized processes



Ladle heaters

Product portfolio



Model	Ladle size A [mm] (inch)	Phases	Power [kW] (BTU/h)	Supply voltage [V]	Heater Dimensions	
					OD [mm] (inch)	H [mm] (inch)
5-7	500-700 (20"-28")	1-phase	30 (102 400)	230	1150 (45,3")	700 (27,5")
	500-700 (20"-28")	1-phase	45 (153 500)	230		
	500-700 (20"-28")	1-phase	66 (225 200)	400		
7-9	700-900 (28"-35")	1-phase	66 (225 200)	400	1350 (53,1")	700 (27,5")
	700-900 (28"-35")	3-phase	90 (307 000)	400		
9-11	900-1100 (35"-43")	3-phase	90 (307 000)	400	1550 (61")	700 (27,5")
	900-1100 (35"-43")	3-phase	135 (460 600)	400		
11-13	1100-1300 (43"-51")	3-phase	90 (307 000)	400	1750 (68,9")	700 (27,5")
	1100-1300 (43"-51")	3-phase	135 (460 600)	400		
13-15	1300-1500 (51"-59")	3-phase	90 (307 000)	400	1950 (76,8")	700 (27,5")
	1300-1500 (51"-59")	3-phase	135 (460 600)	400		
	1300-1500 (51"-59")	3-phase	200 (682 400)	400		
15-17	1500-1700 (59"-67")	3-phase	135 (460 600)	400	2150 (84,6")	700 (27,5")
	1500-1700 (59"-67")	3-phase	200 (682 400)	400		
17-19	1700-1900 (67"-75")	3-phase	135 (460 600)	400	2350 (92,5")	700 (27,5")
	1700-1900 (67"-75")	3-phase	200 (682 400)	400		
19-21	1900-2100 (75"-83")	3-phase	135 (460 600)	400	2500 (98,4")	700 (27,5")
	1900-2100 (75"-83")	3-phase	200 (682 400)	400		
	1900-2100 (75"-83")	3-phase	270 (921 300)	400		

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Electrical ladle pre-heating

Case story



Existing gas burner system

In aluminum foundry

- From room temperature to 850°C in one hour
(Retained three hours – 4 hours in total for preheating)
- Gas type: 13A (City gas)
Power: 41.7 MJ/m³
- Average gas consumption 6 m³/h
(24 Nm / 4 hours)



Electrical ladle heating system

- Heating elements made of Kanthal® Super RA (12/24) with 3D configuration
- Heater unit is automatically raised and lowered hydraulically
- Heater specification 54kW/600A
- Attachments on both sides to minimize heat loss from the spouts

Heater unit



System



When preheating



Visual comparison

Gas burner system vs electrical heating system

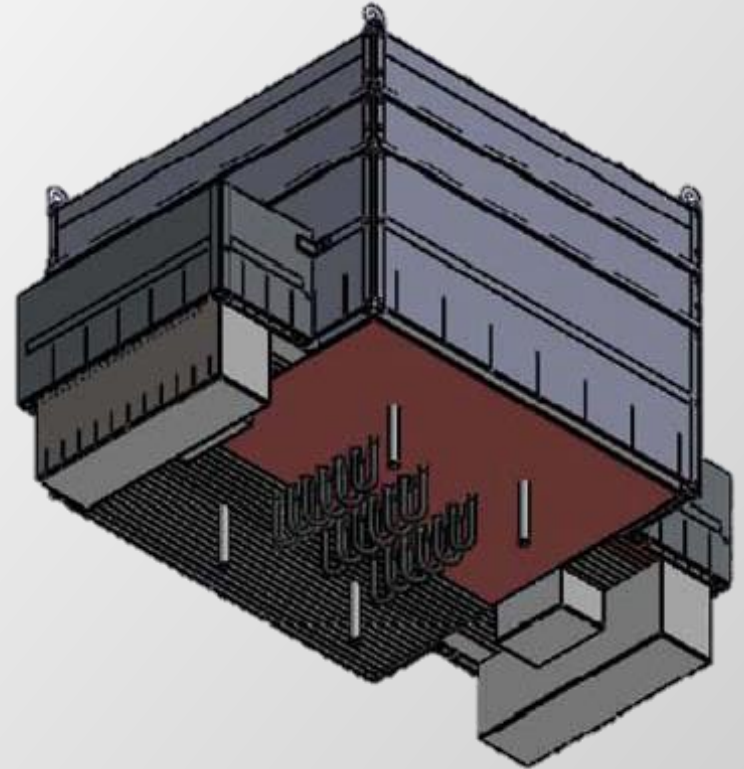
- There is a small gap between the gas burner and the ladle for exhaust gas, whereas there is no clear gap on the electric heater
- The electrical heating system is equipped with a shielding cover for safety. When the heater unit is lifted, residual radiation could harm an operator



Comparison

With gas burner system

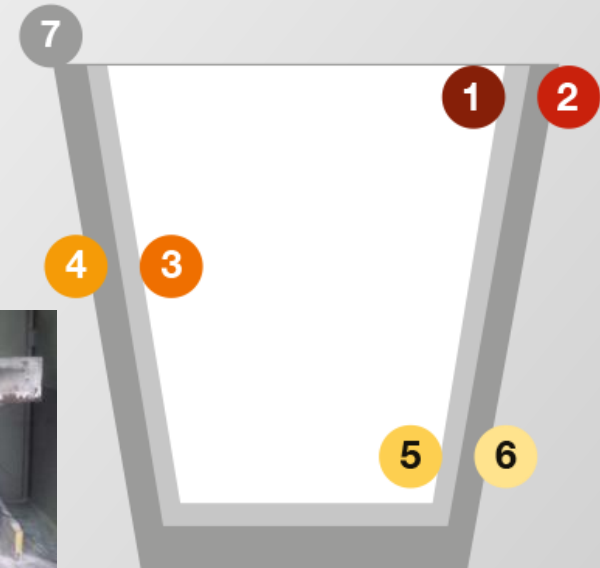
- Target temperature is fixed to achieve the same temperature in the outer wall, then a comparison is made in power consumption between the electrical heating system and the gas burner system
- Both primary and secondary electricity consumption are measured (to include power loss in controller, cable, etc)
- Target temperature: 920°C (thermocouple)
- Temperature monitoring is always active (by Programmable Logic Controller, PLC) and controlling upper limit



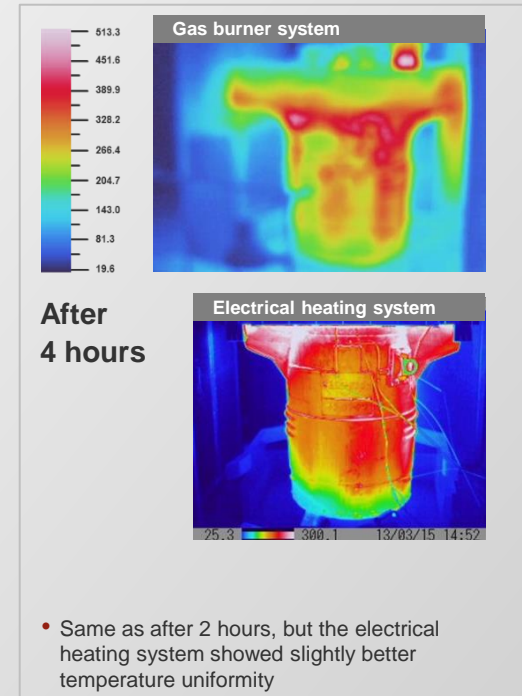
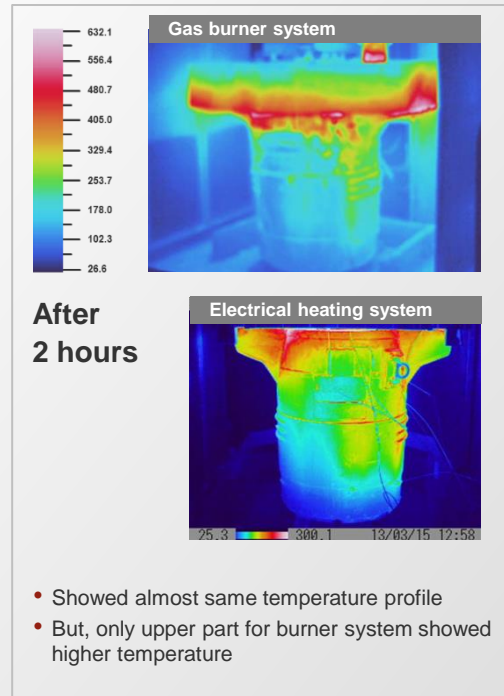
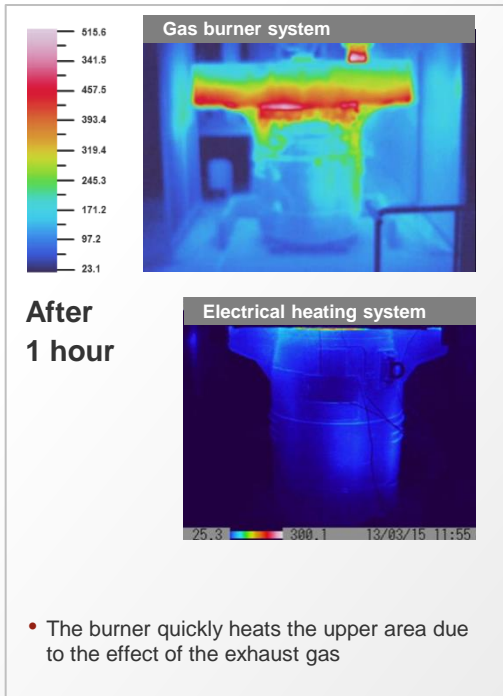
Temperature measurements

In aluminum foundry

- There are thermocouples at 7 points on the heater to measure temperature when preheating
- A data logger records each temperature every 30 seconds
- Thermocouple number 7 measures the temperature of the exhaust gas

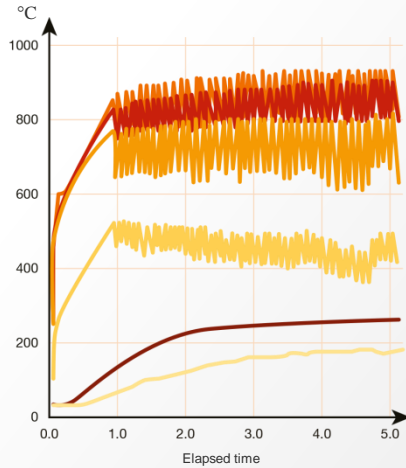


Temperature profile in outer shell

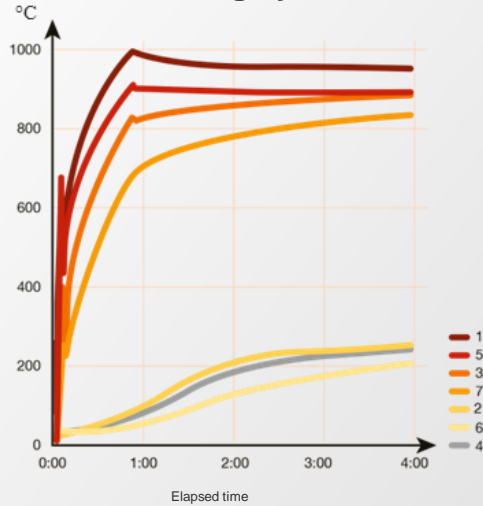


Temperature profile over time

Gas burner system

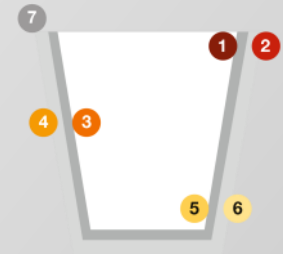


Electrical heating system



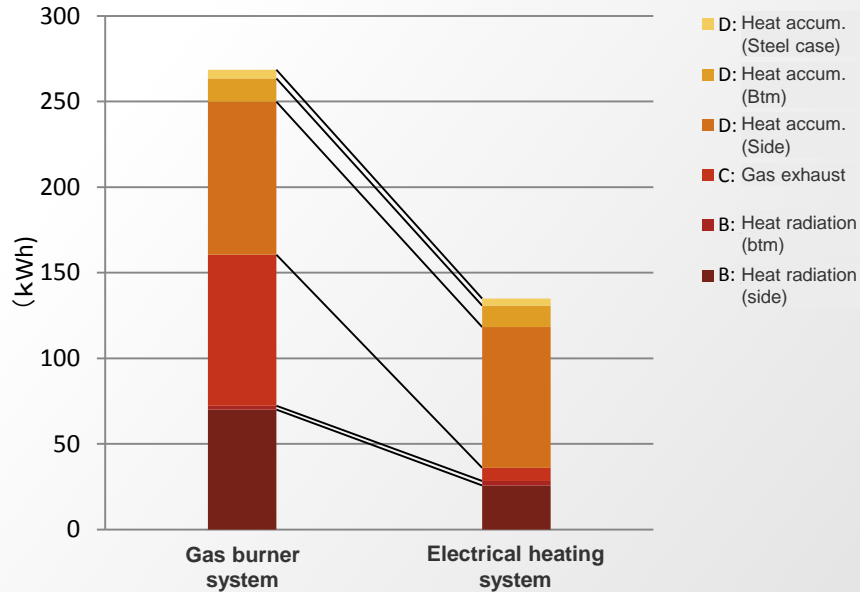
Data summary:

- CH ① (electrical) shows higher temperature than TC (setting temperature) due to the proximity effect from the heater
- Both tests reached same temperature at CH ④ after 4 hours preheating, 250C
- The electrical heating system showed better temperature uniformity in the outer shell and inner wall



Heat balance summary

Comparison



- In the same preheating conditions, the heat balance is as shown in the graph
- Pure efficiency improvement 50% (268 kWh / 134 kWh)

Advantages

Kanthal electrical ladle heating system

Economy

- Energy consumption reduced by 50 % compared to a gas burner system
- Increased refractory lifetime by 10 – 15 % due to better temperature control compared to a gas burner system
- Unmanned operation gives low labor cost



Advantages

Kanthal electrical ladle heating system

Quality and functionality

- Lack of combustible gases in the Kanthal ladle system gives a reduced risk of hydrogen in the molten metal which results in higher quality
- Same system can be used for drying / firing simply by changing patterns

Environment

- Reduced greenhouse gas emissions:
CO₂ emissions for electrical heating systems = 0
- Zero NO_x



Advantages

Kanthal electrical ladle heating system

Employee health

- Quiet in operation
- No harmful gas, such as CO

Employee safety

- When drying, fine tuning is possible, reducing risk of bubbles in the refractory
- No risk of water vapor build-up, low risk of vapor explosion
- No gas pipeline required



Information material

www.kanthal.com A200 Hall 2

KANTHAL Kanthal is a world-leading brand for products and services in the area of industrial heating technology and resistance materials.

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Home > Products > Furnace products and heating systems > Electric heating systems > Ladle dryers and ladle heaters

Electric heating systems

- Anode pre-heating station
- Anode stub drying station
- Cathode pre-heating station
- Ladle dryers and ladle heaters**

Ladle dryers, ladle heaters and ladle pre-heaters

Kanthal electrical ladle dryers and ladle heaters (pre-heaters) deliver significant reductions in energy consumption compared to gas-heated systems. The net efficiency of Kanthal electrically heated ladle dryers and ladle heaters (pre-heaters) is 70%, compared with only 20% for gas. The design of the system allows the radiation to be more accurately directed towards the target area – a highly efficient heating method.

Kanthal ladle heaters offer energy efficient solutions for heating and pre-heating up to ladle temperatures of 1700°C (2732°F) and ladle sizes from 10 000 litres to 10 000 000 litres (2 642 000 US gal).

Kanthal electrical ladle heaters are supplied as complete installations, comprising heating elements in a refractory casing, control and regulation equipment, sensor wiring and mechanical services. The innovative heater monitoring and control system optimizes performance and prolongs the lifetime of the heater by eliminating overheating. The system ensures maximum and consistent power, which reduces process times.

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Kanthal® electrical heating systems
The power of choice!

Electrical ladle pre-heating
Case study

- Heating elements
- Control systems

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Kanthal® electrical ladle heaters

Controlled heating for increased productivity

By heating ladles with electricity instead of gas, aluminum producers as well as aluminum and steel foundries can benefit from lower energy costs and increased process control.

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In Kanthal electrical heaters, the heating elements are arranged in a refractory casing. This allows the radiation to be more accurately directed towards the target area.

Optimized, custom made units can have the fully used and burned electrical heating attachments on both sides to maximize the space. The gas together with the steam preheating automatically at a pressure maintained and controlled by PLC.

KANTHAL ELECTRICAL LADLE HEATER ADVANTAGES

- 70% energy efficient heat efficiency (70% compared to only 20% for gas).
- Multipurpose: Innovative design enables the same heater to be used for both heating and drying.
- Reduced process times
- Increased productivity
- Reduced CO₂ emissions
- Cleaner working environment
- Complete installation

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An electric heater will cut energy costs – but do the benefits end there?

CASE STUDY – ISOWAR ENERGY CONSUMPTION AND REDUCED EMISSIONS WITH A KANTHAL® ELECTRICAL LADLE HEATING SYSTEM

A large automotive company in Japan using a gas burner ladle preheating system in its aluminum foundry made the decision to install a Kanthal electrical heating system. Comparison tests performed by Kanthal on the two systems showed that the electrical system is much more efficient, offering significant advantages for the automaker. Benefits include a 50% reduction in energy consumption, less environmental impact, and higher molten metal quality. The system also has a positive effect on operator health and safety.

KANTHAL

Kanthal® electrical heating systems

The power of choice!

al ladle heating system, is a detailed analysis of the gas burner heaters are made of graphite. The elements that allows the radiation to be directed towards the target area. The refractory casing, and sensor heat loss from the system, as well as controlled by PLC.

compared to the gas burner with thermocouples, heat passes on the ladle at the temperature at the nature of the exhaust gas

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Thank you for your attention!

