



# KilnCooler Hot Spot—Technical

Infrared controlled **water cooling** of kiln shells

- expansion of kiln's operation time
- reduced mechanical tension
- almost no noise emission
- fast, but carefully cooling down
- very low energy consumption (2-50W)
- energy savings



controller



control panel



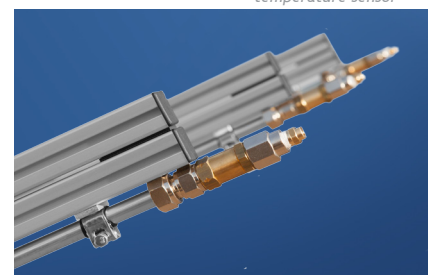
sliding element



connector block



temperature sensor



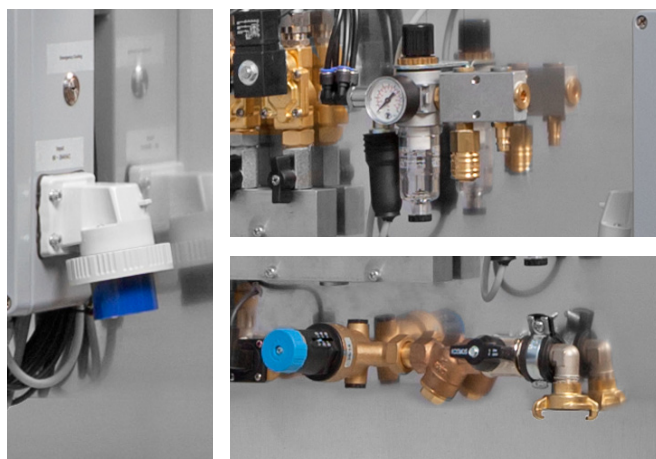
water nozzle



KilnCooler Hot Spot — in action

## External Connections

Besides the electrical power and the water supply the KilnCooler Hot Spot needs a compressed air supply for keeping the temperature sensors free from dust. After plugging in the connections the KilnCooler is directly ready for use.

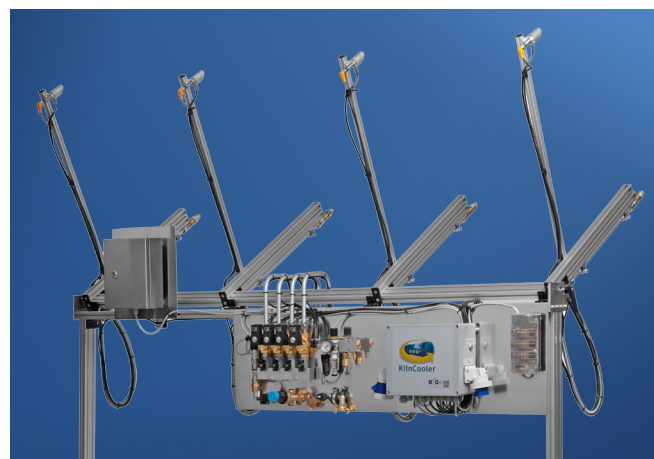


## Properties

electrical	88..264 VAC
	50..60 Hz
	2..50 W
water	3..8 bar max. 12 l/min *
air	1..16 bar (dry, non-lubricated)
	94 l/min (at 0.5 bar)

## Dimensions

The KilnCooler Hot Spot is specially designed as mobile unit. All dimensions and components are designed for fast and easy transport to any position along the kiln.



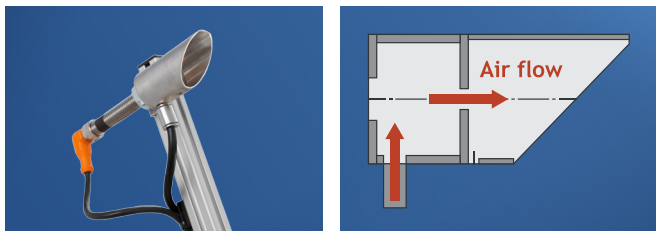
## Properties

weight	50 kg
height	2 m
width	2.05 m
depths	0.7 m
cooling area	2.6 m (4 x 0.65 m)
storage temperature	-20..80 °C -4..176 °F
operating temperature	-10..80 °C 14..176 °F

\* By permanent spraying with the default nozzle (type 306) at 3 bar. For more information refer to page 5: „Nozzles & Performance“.

## Temperature Sensor

Continuous temperature monitoring by IR pyrometer. The Sensor Dust Protection ensures by the mean of air flow that the sensor gets a precise temperature value at any time.

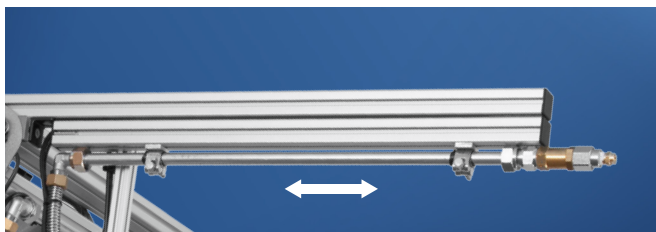


### Properties

measuring range	120..480 °C
air consumption	23 l/min (at 0.5 bar)

## Sliding Elements

The nozzels and sensors are mounted on a tiltable sliding arm that enables you to adjust the distance between the kiln and the spraying unit in order to get an optimal spraying pattern.

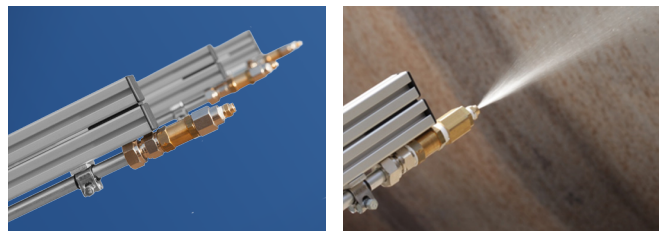


### Properties

slide range	700..1200 mm
tipping angle	0..90°

## Water Nozzle

Adjustable fan nozzles for optimised surface coverage at minimised water consumption. The nozzle is interchangeable within minutes by screw.



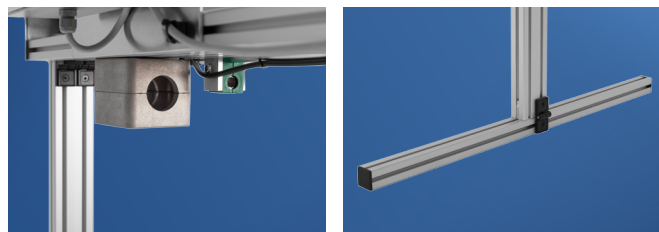
### Properties

cooling area	650 mm
water consumption	max. 3 l/min *

## Assembly

There are two different mounting kits within the scope of supply.

1. pipe clip
2. foot



### Properties

pipe clip diameter	40 mm
foot width	0.7 m
foot height	1 m



## Control Panel

Enables you to change temperature settings and to view trends. There are different operation modes available:

1. **Easy to use:** change the temperature set point by the rotary knob with just one hand—for all four nozzles.
2. **Everything under control:** e.g. adjust every single nozzle set point independently via display.

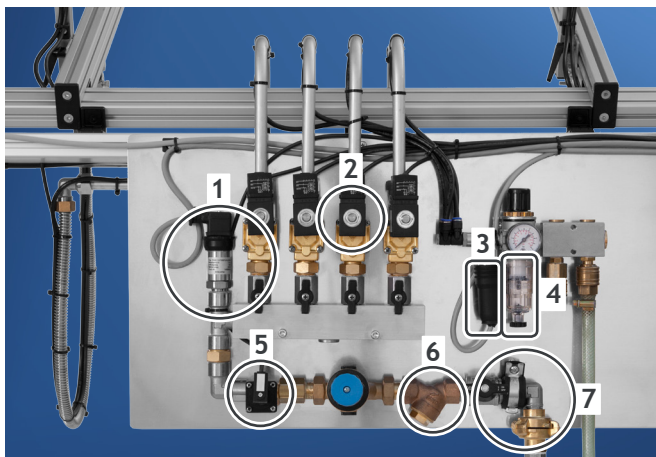


## Controller

Due to sophisticated control scheme, the kiln's shell temperature is kept at or below the desired set point. Every single nozzle will be controlled individually by the FUZZY controller.



## Connector Block



## Operation Safety



## Properties

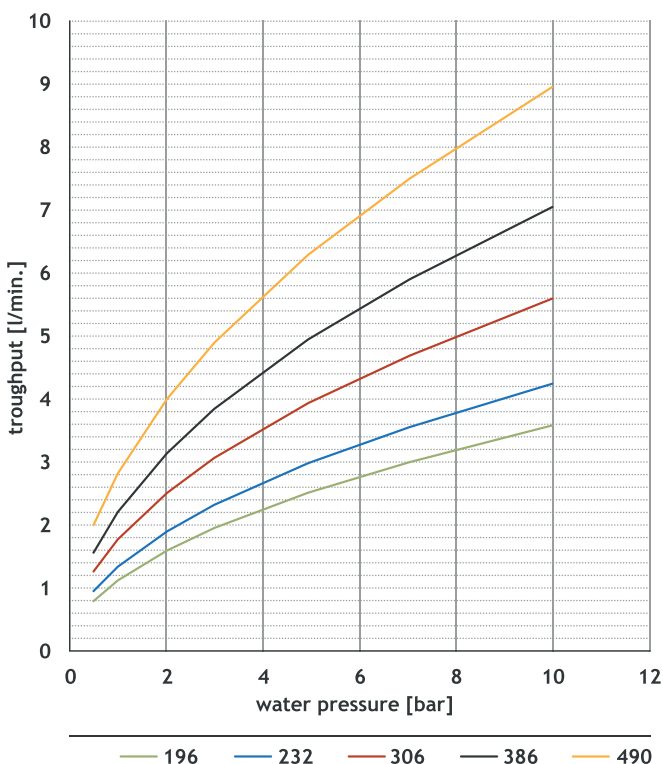
1. internal water pressure monitoring
2. high performance water valve
3. internal air pressure monitoring
4. air pressure reducer
5. water volumeter
6. water dirt trap
7. water stopcock

The system conducts an hourly test (default setting) to check for damage to the device or feed pipes, showing the results by means of a traffic light display. In addition, it continuously monitors water pressure, flow rate and air pressure to alert you immediately in the event of a leak or malfunction.

A PLC interface permits notifications to be sent directly to the control console in the event of e.g. a loss in pressure or power outage (Live-Bit).

## Performance Adjustment

By selecting the appropriate nozzle, the cooling capacity of KilnCooler can be adapted to kiln on site. It is necessary to use a nozzle that is calibrated for the relevant water pressure since cooling performance depends, amongst other things, on the water pressure. The table and graph will help you to select the appropriate nozzle.



## Nozzles & Performance

The table lists the desired maximum water volume in l/min at different water pressures for each type of nozzle.

bar type	0.5	1	2	3	5	7	10
196	0.8	1.13	1.6	1.96	2.53	2.99	3.58
232	0.95	1.34	1.9	2.32	3	3.55	4.24
306	1.25	1.77	2.5	3.06	3.95	4.67	5.59
386	1.57	2.23	3.15	3.86	4.98	5.89	7.04
490	2	2.83	4	4.9	6.33	7.49	8.95

## Cooling Capacity

Typically water pressure is 3 bar. The table below compares the cooling capacity of various nozzles to a fan driven air stream where the air is heated by 40 Kelvin.

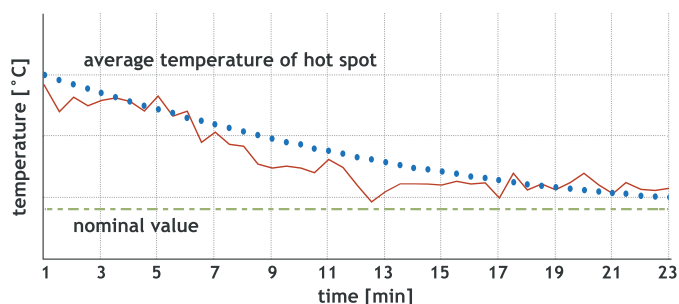
Ventilation ( $\Delta T = 40\text{ K}$ )	KilnCooler (max waterflow at 3 bar)
5000 m <sup>3</sup> /h	Type 196: 1.96 l/min
6300 m <sup>3</sup> /h	Type 232: 2.32 l/min
8400 m <sup>3</sup> /h	Type 306: 3.06 l/min
10500 m <sup>3</sup> /h	Type 386: 3.86 l/min
13500 m <sup>3</sup> /h	Type 490: 4.9 l/min

comparison per nozzle (650 mm of kiln in axial direction)

## Cooling down a hot spot

A hot spot can be cooled down rapidly but careful, to avoid any shrinkage of the kiln shell. Typically cooling rate is chosen to be 0.5 Kelvin/min, but can be up to 2 Kelvin/min.

After cooling down, the shell temperature is kept on its nominal value, thus eliminating mechanical tension.



## Frequently Asked Questions (FAQ)

### Question

### Answer

**What are the real benefits of KilnCooler HotSpot?**

‘If a Hot Spot appears on the kiln’s surface, KilnCooler is able to cool it down, thereby reducing mechanical tension in the shell and initiating formation of a new insulating layer on the refractory bricks. Therefore it enhances the runtime of the kiln.’

**How much water is really sprayed on the kiln per nozzle?**

‘Typically 4..10 ml/s while cooling down a hot spot, and 0..4 ml/s while holding the shell on its nominal temperature. Finally this depends on the condition of the kiln’s surface. A closed loop control system which is guided by an infrared pyrometer controls the water spray by means of a magnetic valve and keeps the surface at an adjustable temperature level.’

**I feel uncomfortable with water on the kiln, will it remain wet?**

‘No, it is the very principle of operation, that the water being sprayed on the kiln evaporates immediately on contact. That means, that the surface remains dry for more than 99 % of the revolution time. (Compare this to the wetting due to rain)’

**Anyway, does water on a hot iron surface affect its integrity?**

‘As long as the temperature of the surface is below 600 °C (1112 °F) there will be no effect. If the surface temperature is higher, KilnCooler will give an alarm and stops spraying water. (Configurable)’

**The water we can provide is calciferous, will there be a lime layer and how thick will it be?**

‘Yes, very thin. Spraying pretty hard water (11 dGH ~ 11 gpg) 365 days, 24 hours a day will lead to a layer of 2.5 mm, but only if the complete lime content in the water is really deposited. Realistic values are in the range of 0.1mm..0.3 mm.’

**Will the lime layer affect the cooling efficiency?**

‘Interestingly not or nearly insignificant. Limestone has a lower thermal conductivity, but a better emissivity for infrared radiation than rusty iron.’

**Why do we also need pressurised air?**

‘A small amount (23 l/min per nozzle) is needed to keep the pyrometers clean due to the dusty environment of cement plants.’

**Are there other benefits on using KilnCooler?**

‘Low energy consumption.’

