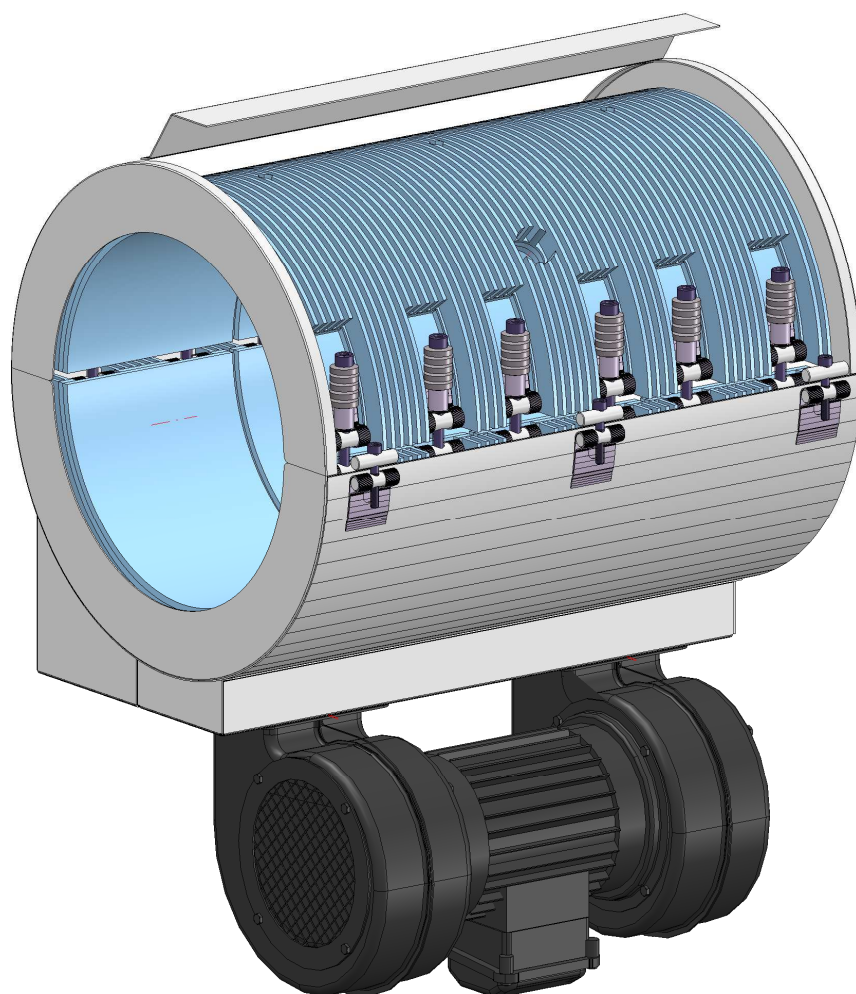


TECHNICAL COMPARISON

HEAT-COOL-COMBINATIONS



GROUP OF COMPANIES



IHNE & TESCH
ELEKTRO-WÄRMETECHNIK

KELLER IHNE + TESCH
ELEKTRO-WÄRMETECHNIK

CELTIC

KIT ELECTROHEAT

HEAT-COOL-COMBINATIONS

TECHNICAL COMPARISON

The application of Heat-Cool-Combinations will result in rapid and effective heating and cooling coupled with energy-efficiency.

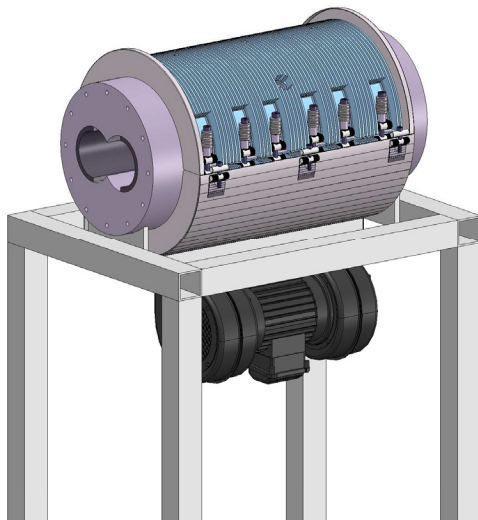
Conventional systems such as HKK (ceramic) or HKC (ceramic with copper cooling fins) give fast heat-up times but without uniform temperature distribution along the heated area as achieved by the HAK system.

With its compact design and heating elements inclosed in high heat conductive aluminium small temperature differences along the screw barrell can be achieved.

Stresses and material deposits are reduced or even avoided. High machine productivity and product quality are supported and encouraged.

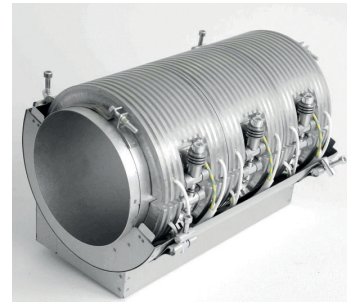
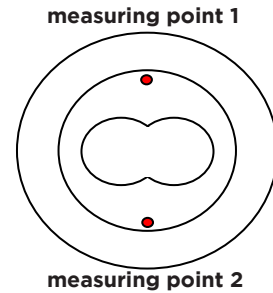
Test set up

HKK 225D 360L 230V 4800W
HAK 225D 360L 230V 4800W

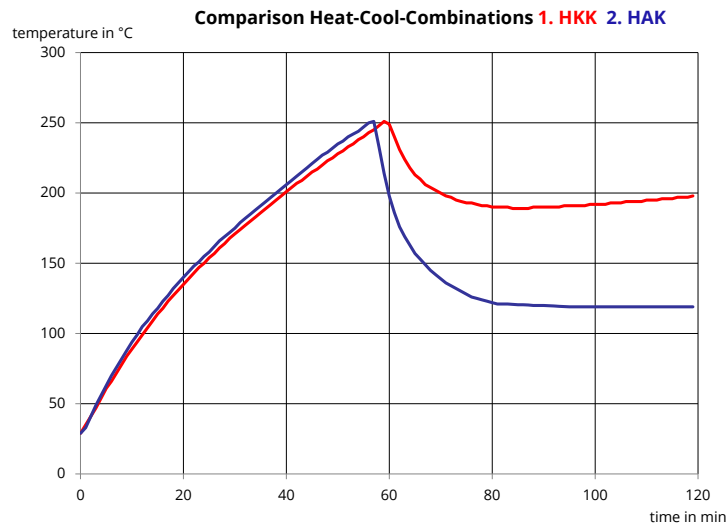


Test procedure

1. heat up cylinder to 250°C (measuring point 1) via the heating elements HKK or HAK
2. turn off Heat-Cool-Combinations, turn on the internal heating elements (8 kW) and the blower



Variation-diagram: heat-up and cool-down behaviour



Due to the enlarged radiating surface and the use of aluminum as heat and energy element a significant

increase in performance is achieved.

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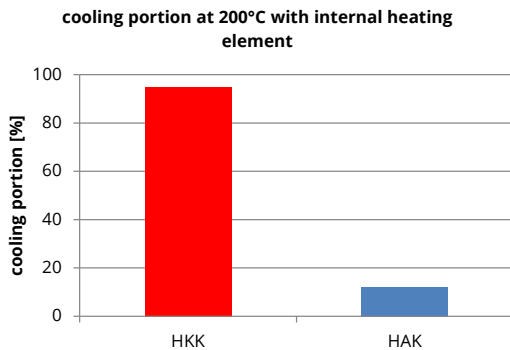
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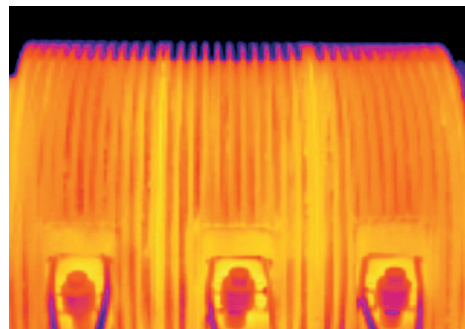
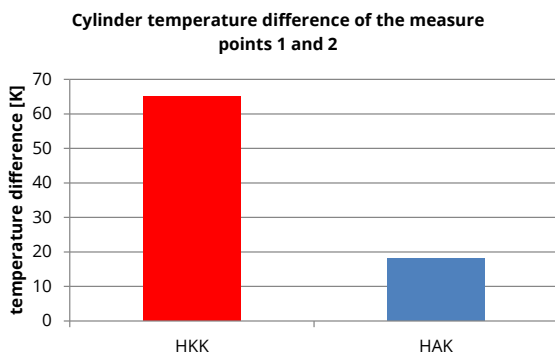
www.electricalheat.com

Cooling energy demand



In the cooling cycle (see fig. on left) high energy for cooling is required with the conventional HKK compared to the new HAK. In order to maintain the set temperature constant, the HAK requires less energy consumption compared with conventional ceramic-insulated Heat-Cool-Combinations. The minimum temperature can be maintained even in difficult areas and will also help to increase the material throughput.

Temperature uniformity in the screw barrel



The uniform temperature spread along Cylinders with extrusion lines (see right hand figure above) is particularly significant. By using the HAK not only the throughput and product quality can be improved, but also taken influence on the material (negative voltage build-up). The isothermal temperature distribution of the HAK on the

cylinder simultaneously causes a uniform material cooling, which helps to avoid cylinder stresses.

Temperature distribution and airflow HAK

Simulation of the temperature distribution and air flow in a 3D model

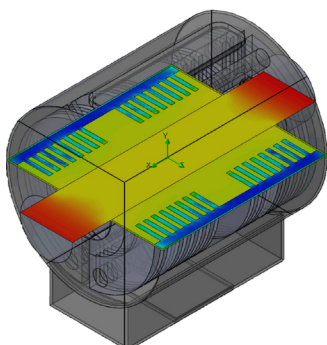


Fig.: Flow Simulation from Mentor Graphics

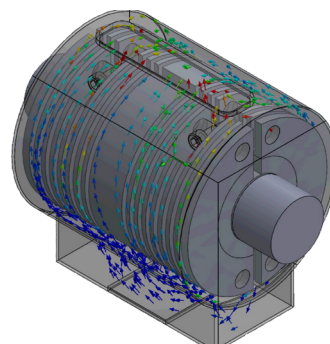


Fig.: Flow Simulation from Mentor Graphics

With the "HAK" the heating works on the contact side across the entire zone length and thus ensures an even heat distribution. The arrangement of the cooling fins

occurs an enlargement of the radiating surface and provides a good air circulation in the cooling jacket.

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Locations



GERMANY

Ihne & Tesch GmbH
Am Drostenstueck 18
D-58507 Luedenscheid
P.O.Box 1863
D-58468 Luedenscheid

Phone: +49 2351 666 0
Fax: +49 2351 666 24
info@itlmail.de

Ihne & Tesch GmbH
Aalener Straße 42
D-90441 Nuremberg

Phone: +49 911 96678 0
info@itnmail.de

www.elektroaermetechnik.de

Ihne & Tesch GmbH & Co. KG
Kunigundenstraße 13
D-68623 Lampertheim
P.O.Box 5164
D-68612 Lampertheim

Phone: +49 6241 98808 0
Fax: +49 6241 80056
info@kitmail.de

www.elektroaermetechnik.de



AUSTRIA

Keller, Ihne & Tesch GmbH
Bahnhofstraße 90
A-3350 Haag

Phone: +43 7434 43880
Fax: +43 7434 43883
info@kitmail.at

www.elektroaermetechnik.at

FRANCE

Celtic S.A.R.L.
2/4 Rue René Cassin
ZAC La Villette-aux-Aulnes
F-77290 Mitry-Mory

Téléphone: +33 160 21 21 80
Téléfax: +33 160 21 21 81
info@celtic.fr

www.celtic.fr

GREAT BRITAIN

KIT Electroheat Ltd.
Mexborough Business Centre
College Rd
GB-S64 9JP Mexborough

Phone: +44 1443 442 176
Fax: +44 1443 441 861
mail@kitelectroheat.co.uk

www.kitelectroheat.co.uk