Preventing Thermal Shocks to Overheated Heat Exchangers

Technical Information

The Issue

Accidentally overheated graphite heat exchangers (especially condensers) must be cooled down to 50-60°C (according to cooling media and temperature) to prevent thermal shocks (c.f. work standard 1501). This cool down period has been determined following a series of tests.

Test

A NB7-10 type annular groove condenser (11,5 m² area) was heated in an oven, and then cooled down to ambient temperature. The temperature in the center of the heat exchangers was measured using a resistance thermometer (Sensor Pt 100 type). Its surface temperature was measured using a digital thermometer (thermo element K type). All data was recorded.

Two measurement series were carried out:

Test A - Condenser filled with water on cooling side
Test B - Condenser empty on both sides

Test A:

Surrounding temperature: 23°C (constant)
Heating-up temperature: 86°C
Surface temperature: 82°C

time in h	0	1	2	3
Inside heat exchanger temperature	86	72	60	52
Surface temperature in °C	82	69	58	50

Test B:

Surrounding temperature: 20°C (constant)
Heating temperature: 111°C
Surface temperature: 106°C

time in h	0	1	2	3
Inside heat exchanger temperature	111	85	64	51
Surface temperature in °C	106	81	61	49

GAB Neumann GmbH | Alemannenstrasse 29 | D-79689 Maulburg
T +49 (7622) 6751 0 | F +49 (7622) 6751 20 | info@gab-neumann.de

Graphite and SiC Heat Exchangers and Process Equipment

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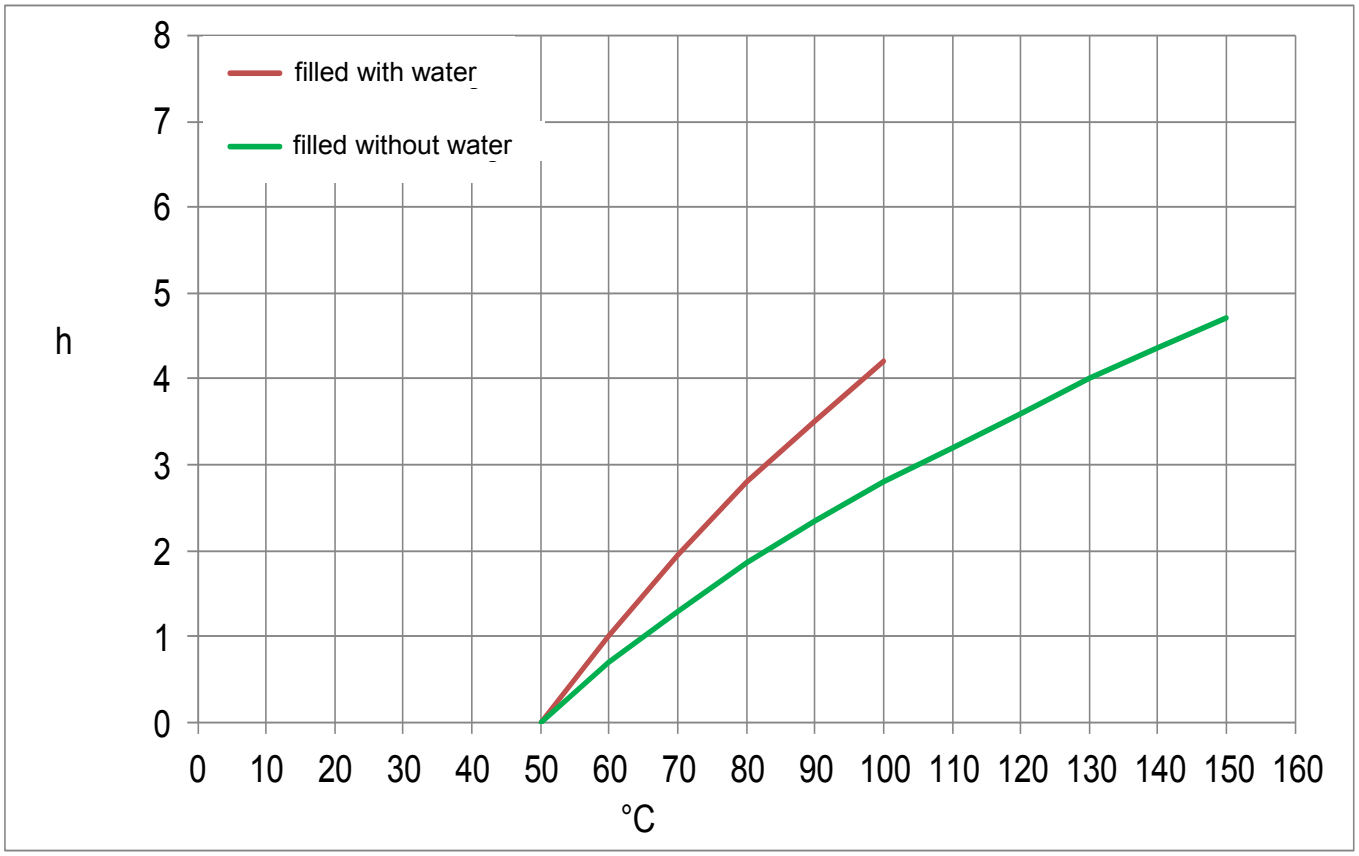
Necessary waiting period (hours) based on the wall temperature (°C)



4. Test results and assessment

1. The necessary cooling period to bring a hot heat exchanger down to 60°C lasts several hours.
2. Since graphite is an excellent heat conductor, the temperature difference between different heat exchanger centers is very low. This also means that the surface temperature is equal to the inner temperature of the heat exchanger.