

 - einen Ton besser.	Research and Development	Date: 26.09.2022 Page: 1 of 3
Profile	Heat storage capacity of heat storage bricks produced for the firm: Fischer GmbH Heiz- und Umwelttechnik Edisonstraße 5-7 86399 Bobibingen	B.Eng. A. Esser

Principles:

A chamotte brick is essentially composed of the oxide components silicon dioxide and aluminium oxide. Chamotte bricks are classified according to their aluminium oxide content. With an outstanding thermal conductivity of 1.4 W/m*K, heat is conducted highly effectively through the brick; it is this characteristic, in combination with their specific heat capacity of 1.00 kJ/kg*K that makes chamotte bricks an excellent raw material for heat storage units. Depending on the initial materials used and the manufacturing processes employed, a range of different bulk densities can be achieved with chamotte bricks. 'Kärlicher Blauton', is a material with unique properties. Its composition and characteristics enable the production of chamotte bricks with exceptionally high heat storage capacities. In addition, to mould the heat storage bricks, the material is compressed by a worm extruder, which subjects it to forming pressures of up to 18 bar. It is these factors that make the KTS KG a unique heat storage brick with outstanding characteristics. The bricks are produced for Fischer GmbH Heiz- und Umwelttechnik, who install them for heat storage use in electric storage heaters.

Problem formulation:

To determine the heat storage capacity of the manufactured heat storage bricks. The calculation refers to the heat storage capacity of a heat storage brick of the dimensions 900 x 360 x 40mm and with 12 holes.

Calculation:

Formula:

$$C_{wirk} = c * \rho * d_{wirk} * A$$

C_{wirk} = effective heat storage capacity in kJ/K

c = specific heat capacity: 1.00 kJ/kg*K

ρ = bulk density: 2100 kg/m³

d_{wirk} = effective component thickness 0.04 m

A = component area: 0.273 m²

(base area 900x360 = 0.324 m² | area of 12 holes = 0.051 m²)

$$C_{wirk} = 1.00 \frac{kJ}{kg * K} * 2100 \frac{kg}{m^3} * 0.04m * 0.273m^2 = 22.932 \frac{kJ}{K}$$

$$22.932 \frac{kJ}{K} \approx 6,067 \frac{Wh}{K}$$

(Ratio: 1kJ = 0.27777777777778 Wh)

Result:

The heat storage bricks of the dimensions 900 x 360 x 40mm manufactured by KTS have a heat storage capacity of 22.932 $\frac{kJ}{K}$ or 6.067 $\frac{Wh}{K}$.

The stated heat storage capacity refers solely to the heat storage brick. To enable an assessment of the heat storage capacity of a heating system, the heat storage capacity of the casing must be taken into account.

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Annex:

Typische Werkstoffsorten	Rohdichte g/cm ³	offene Poren Vol %	KDF N/mm ²
A 40 t	2,20–2,30	15–18	40–70
A 35 t	2,10–2,22	16–19	30–50
A 30 t	2,05–2,20	15–19	30–50
A 25 t	2,05–2,17	1–18	35–90
A 40 h	2,10–2,23	17–21	25–45
A 35 h	2,05–2,18	17–20	25–40
A 30 h	2,05–2,15	16–20	25–45
A 25 h	2,05–2,17	14–19	30–70
E-Sorten (DIN 1089 T2)	> 2,0	≤ 25	≥ 20
spezielle saure Schamottesteine	> 2,0	< 23	> 30

TABELLE 4.5 B:
Eigenschaften der
Schamottesteine

TABLE 4.5 B:
Characteristics of chamotte bricks

Typical material types	Bulk density g/cm ³	Open pores Vol. %	CCS N/mm ²
A 40 t	2.20-2.30	15-18	40-70
A 35 t	2.10-2.22	16-19	30-50
A 30 t	2.05-2.20	15-19	30-50
A 25 t	2.05-2.17	1-18	35-90
A 40 h	2.10-2.23	17-21	25-45
A 35 h	2.05-2.18	17-20	25-40
A 30 h	2.05-2.15	16-20	25-45
A 25 h	2.05-2.17	14-19	30-70
E grades (DIN 1089 T2)	>2.0	≤25	≥20
Special acid chamotte bricks	>2.0	<23	>30

Characteristics of heat storage bricks¹

¹ Routschka, Gerald/ Wuthnow, Hartmut (5th Edition): Praxishandbuch Feuerfeste Werkstoffe, p.44

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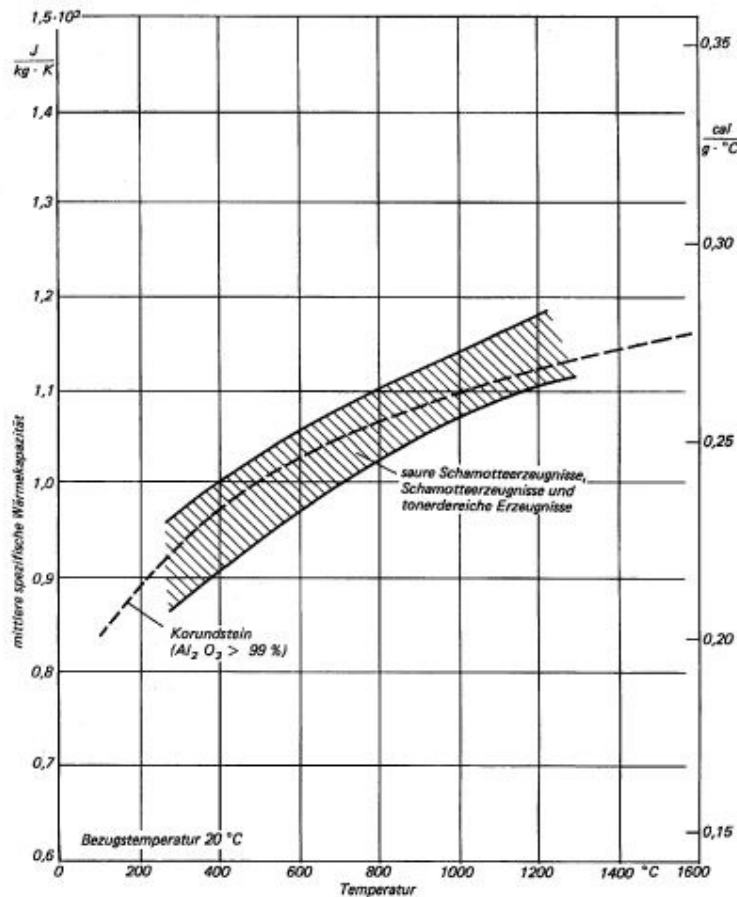


BILD A19: Mittlere spezifische Wärmekapazität (VDI 3128 Blatt 4)

Achsen:

Average specific heat capacity
Temperature

Grafik v.o.n.u.:

Acid chamotte products, chamotte products and high-alumina products
Corundum brick
Reference temperature

FIG. A19: Average specific heat capacity (VDI 3128 Sheet 4)

Average specific heat capacity of chamotte products²

² Routschka, Gerald/ Wuthnow, Hartmut (5th Edition): p. 309