CMQ **Compact Alpha Power Resistor** 14.5kW - 504kW

(73kJ - 2.5MJ) / body case style 5/1800s pulse load



The CMQ-H and CMQ-V resistors with optional integrated thermal supervision from the Danotherm high power range of ALU-MINIUM-HOUSED COMPACT BRAKE ALPHA RESISTORS are plications. electrically insulated compact resistors. They can easily be fitted into compact constructions and are especially designed to withstand high pulse-loads. The aluminium construction ensures that surface temperatures are kept low (see Table 3) such that any accumulated dust will not burn and trigger smoke alarms.

Steady-state power ratings range from **800W** to **4150W** per optimum solution for their designs. body case style and up to 20 bodies can be combined in one unit. The pulse-load capability is up to 380 times the nominal power for a duty cycle of one second per hour, depending on the ohmic value and resistor wire, which allows several MWs of pulse-load to be absorbed. CMQ resistors have thermal time- These special data-sheets are available on request. constants of about one hour.

Specially reinforced versions are available for Low Voltage Ride Through - LVRT as Energy Dump Resistors for Wind Turbine ap-

Danotherm has developed thermal models for all resistor types and resistor values which allow the prediction of temperature rise of both the internal resistor wire and the housing surface for all possible load profiles. This simulation capability is part of Danotherm's applications support to help customers find the

CMQ resistors are optionally available with different terminal boxes for various cable sizes and from IP20 to IP54 and in special cases, to IP65.



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Construction

The resistors are designed as follows:

The resistor elements are made with helixwound wire elements mounted in special ceramic fixtures. The outer housing is an extruded aluminium profile electrically insulated with micanite sheets on all inner surfaces. The resistor elements are fixed symmetrically in the housing by ceramic insulators which ensures symmetric expansion of the resistors and a maximal surge-withstand capability. Aluminium housings with fixed resistor elements are filled with Al₂O₃ or SiO₂. This ensures a minimal change of resistor surfacetemperature even at maximal pulse rating (minimized temperature cycles). Standard cables are 300 mm AWG 10 - AWG 4, 1000V but non-standard cables (different types, lengths, connectors ...) can also be supplied, on request.

Accessories

The resistor can be customized with respect to the following features: connection style (open terminals or connection box), IP class, horizontal or vertical mounting, thermal supervision (a PT-100 temperature sensor or NC thermal switch) can be fitted, in which case the maximal surface-temperature near the cables will be 200°C.

Thermal simulations

A power-time graph of the application is the start for each resistor selection which Danotherm inputs to thermal simulation models. The CMQ Compact Alpha Power Resistor has a very high pulse-load capability for 1 second, exceeding 380 times the steadystate load power (depending on resistor type and ohmic value). This makes the CMQ ideal for high pulse-load application like LVRT (Low Voltage Ride Through) and other high loaddumps from drives applications. Danotherm uses sophisticated simulation models that predict the behaviour of the power resistors under any given load conditions. This shortens the user's design-time and ensures the highest reliability because the resistor can be customized to the exact application requirements.



| | | Fil [W] @ 40 C | Accounting OL208 | | | | |
|-------------------------------|---|----------------|--|----------------------------|----------------------------|----------------------------|--|
| | 1 body | | 1 body | 2 bodies | 3 bodies | 4 bodies | |
| CMQ-BH(T)-XXX | Pn [W] @ 40°C According UL508 Max surface 250°C | RΩ | Max surface temp 190 °C | Max surface temp 250 °C | Max surface temp 250 °C | Max surface temp 250 °C | |
| S: Thermal switch no TS | | ± 10% | TS | no TS | no TS | no TS | |
| CMQ 210 | 800 | 0.02 - 30 | 555 | | | | |
| CMQ 260 | 1100 | 0.04 - 50 | 855 | | | | |
| CMQ 330 | 1500 | 0.065 - 80 | 1090 | | | | |
| CMQ 400 | 1900 | 0.07 - 100 | 1320 | 2925 | 4350 | 5800 | |
| CMQ 460 | 2200 | 0.09 - 140 | 1520 | 3375 | 5000 | 6650 | |
| CMQ 560 | 2700 | 0.12 - 170 | 1850 | 4090 | 6050 | 8050 | |
| CMQ 660 | 3100 | 0.15 - 210 | 2180 | 4825 | 7100 | 9450 | |
| CMQ 760 | 3500 | 0.18 - 250 | 2660 | 5875 | 8500 | 11300 | |
| CMQ 860 | 3850 | 0.2 - 300 | 3060 | 6750 | 10000 | 13300 | |
| CMQ 960 | 4150 | 0.25 - 340 | 3420 | 7575 | 11200 | 14900 | |
| | | General s | pecifications | | | | |
| Temperature Coefficient: | | | < ± 100 ppm | | | | |
| Dielectric strength | | Standard | 3500 VAC @ 1 minute | | | | |
| Dielectric stieligti | | On demand | | 6000 VAC @ | © 1 minute | | |
| Working voltage | | Standard | 1000 VAC / 1400 VDC | | | | |
| Isolation Resistance: | | | > 20 MΩ / body | | | | |
| Overload:@1secpul: | se / hour | | 80 - 225 x (depending on resistor) | | | | |
| Overload:@ 5 sec pulse / hour | | | 30 - 60 x (depending on resistor) | | | | |
| Environmental: | | | - 40 °C - 90 °C | | | | |
| De-rating cable version | | | Linear: 40°C = Pn@250°C to 70°C = 0,85 * Pn@250°C | | | | |
| De-rating TW 200°C version | | | Linear: 40°C = Pn@190°C to 70°C = 0,80 * Pn@190°C | | | | |
| De-rating TW 180°C version | | | Linear: 40°C = 0,85 * Pn@190°C to 70°C = 0,75 * Pn@190°C | | | | |
| De-rating vertical mounting | | | no de-rating | | | | |
| De-rating horizontal mounting | | | 0,8 * Pn | | | | |
| Thermal switch (optional) | | | 130 / 160 / 180 / 200 °C, 2A, 250 VAC NC | | | | |
| | · · · · · · · · · · · · · · · · · · · | | | | | | |





| Туре | L ± 2 [mm] | L1 ± 2 [mm] |
|------------------------------|------------|-------------|
| CMQ-H 210 CH(T) 0(X)1 XXR KT | 210 | 110 |
| CMQ-H 260 CH(T) 0(X)1 XXR KT | 260 | 160 |
| CMQ-H 330 CH(T) 0(X)1 XXR KT | 330 | 230 |
| CMQ-H 400 CH(T) 0(X)1 XXR KT | 400 | 300 |
| CMQ-H 460 CH(T) 0(X)1 XXR KT | 460 | 360 |
| CMQ-H 560 CH(T) 0(X)1 XXR KT | 560 | 460 |
| CMQ-H 660 CH(T) 0(X)1 XXR KT | 660 | 560 |
| CMQ-H 760 CH(T) 0(X)1 XXR KT | 760 | 660 |
| CMQ-H 860 CH(T) 0(X)1 XXR KT | 860 | 760 |
| CMQ-H 960 CH(T) 0(X)1 XXR KT | 960 | 860 |





| CMQ-CH(T) | | | | square pulse | each 120 seco | nds, ambient | temp. = 40°C | | | |
|---|--|--|---|---|---|--|---|---|--|---|
| | duty 1 second [kW] | Max surface temp. | duty 5 second [kW] | Max surface temp. | duty 10 second [kW] | Max surface temp. | duty 20 second [kW] | Max surface temp. | duty 40 second [kW] | Max surface temp. |
| CMO 210 | 53.7 | 205 | 173 | 265 | 9.2 | 270 | 4.6 | 270 | 23 | 270 |
| CMO 260 | 95 | 205 | 26.9 | 205 | 13.4 | 275 | 6.7 | 275 | 3.4 | 275 |
| CMO 330 | 125 | 230 | 20.5 | 275 | 19.4 | 275 | 0.7 | 275 | 1.5 | 275 |
| | 192 | 245 | 30.5 | 200 | 10.1 | 205 | | 280 | 4.5 | 200 |
| | 162 | 205 | 45 | 290 | 22.5 | 290 | 12.1 | 290 | 5.0 | 290 |
| | 203 | 295 | 53 | 295 | 20.3 | 295 | 16.2 | 295 | 0.0 | 295 |
| | 310 | 300 | 65 | 305 | 32.5 | 305 | 16.3 | 305 | 8.1 | 305 |
| CMQ 660 | 390 | 315 | //.5 | 315 | 38.8 | 315 | 19.4 | 315 | 9.7 | 315 |
| CMQ 760 | 470 | 325 | 95 | 325 | 47.5 | 325 | 23.8 | 325 | 11.9 | 325 |
| CMQ 860 | 550 | 335 | 110 | 335 | 55 | 335 | 27.5 | 335 | 13.8 | 335 |
| CMQ 960 | 620 | 345 | 125 | 345 | 62.5 | 345 | 31.3 | 345 | 15.6 | 345 |
| | square pulse each 1800 seconds, ambient temp. = 40°C | | | | | | | | | N 4 |
| | duty 1 second | Max surface | duty 5 second | Max surface | duty 10 second | Max surface | duty 20 second | Max surface | duty 40 second | Max surface |
| | [kW] | [°C] | [kW] | [°C] | [kW] | [°C] | [kW] | [°C] | [kW] | [°C] |
| CMQ 210 | 75 | 70 | 32 | 95 | 22 | 110 | 14.8 | 130 | 9.9 | 160 |
| CMQ 260 | 144 | 75 | 56 | 105 | 38.5 | 125 | 25.5 | 150 | 16.8 | 180 |
| CMQ 330 | 202 | 80 | 76 | 110 | 55 | 135 | 39 | 165 | 26.3 | 200 |
| CMO 400 | 284 | 85 | 101 | 110 | 74 | 140 | 52.5 | 175 | 35.5 | 210 |
| CMO 460 | 476 | 100 | 160 | 135 | 109 | 160 | 72 | 190 | 46.5 | 220 |
| CMO 560 | 532 | 100 | 174 | 125 | 124 | 155 | 87 | 190 | 58.5 | 230 |
| CMO 660 | 704 | 105 | 222 | 135 | 156 | 160 | 109 | 200 | 73 | 240 |
| CM0 760 | 920 | 110 | 282 | 140 | 19/ | 170 | 13/ | 200 | 89 | 250 |
| CMO 860 | 1264 | 125 | 380 | 160 | 252 | 190 | 168 | 210 | 107 | 250 |
| CMO 960 | 1712 | 140 | 504 | 175 | 232 | 200 | 204 | 225 | 107 | 200 |
| CIVIQ 500 | 1/12 | 140 | 504 | | each 1800 sec | ands ambier | 204 | 233 | 120 | 270 |
| | | | | Lindligic pulse | | | $\mathbf{H} = \mathbf{H} \mathbf{V} + \mathbf{H} \mathbf{H} \mathbf{H} \mathbf{H} \mathbf{H} \mathbf{H} \mathbf{H} \mathbf{H}$ | | | |
| Ν | | Maxsurface | | Maxsurface | | Maxsurface | | Maxsurface | | Maxsurface |
| | duty 1 second [kW] | Max s urface temp. [°C] | duty 5 second [kW] | Max s urface temp. [°C] | duty 10 second [kW] | Max surface temp. | duty 20 second [kW] | Max s urface temp. [°C] | duty 40 s e cond [kW] | Max s urface temp. [°C] |
| CMQ 210 | duty 1 second [kW] 158 | Max surface temp. [°C] 70 | duty 5 second [kW] | Max surface temp. [°C] 95 | duty 10 second [kW] 47.5 | Max surface temp. [°C] 115 | duty 20 second [kW] 32.5 | Max surface temp. [°C] 140 | duty 40 second [kW] 21.5 | Max surface temp. [°C] 165 |
| CMQ 210 CMQ 260 | duty 1 second [kW] 158 300 | Max s urface temp. [°C] 70 80 | duty 5 second [kW] 65 116 | Max surface temp. [°C] 95 110 | duty 10 second [kW] 47.5 82 | Max surface temp. [°C] 115 130 | duty 20 second [kW] 32.5 56 | Max surface temp. [°C] 140 160 | duty 40 second [kW] 21.5 36.8 | Max surface temp. [°C] 165 190 |
| CMQ 210 CMQ 260 CMQ 330 | duty 1 second [kW] 158 300 420 | Max surface temp. [°C] 70 80 80 | duty 5 second [kW] 65 116 152 | Max surface temp. [°C] 95 110 110 | duty 10 second [kW] 47.5 82 112 | Max surface temp. [°C] 115 130 135 | duty 20 second [kW] 32.5 56 83 | Max surface temp. [°C] 140 160 170 | duty 40 second [kW] 21.5 36.8 58 | Max surface temp. [°C] 165 190 210 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 | duty 1 second [kW] 158 300 420 592 | Max surface temp. [°C] 70 80 80 80 | duty 5 second [kW] 65 116 152 204 | Max surface temp. [°C] 95 110 110 115 | duty 10 second [kW] 47.5 82 112 148 | Max surface temp. [°C] 115 130 135 140 | duty 20 second [kW] 32.5 56 83 110 | Max s urface temp. [°C] 140 160 170 180 | duty 40 second [kW] 21.5 36.8 58 79 | Max surface temp. [°C] 165 190 210 220 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 | duty 1 second [kW] 158 300 420 592 992 | Maxsurface temp. [°C] 70 80 80 85 100 | duty 5 second [kW] 65 116 152 204 332 | Max surface temp. [°C] 95 110 110 115 135 | duty 10 second [kW] 47.5 82 112 148 230 | Max s urface temp. [°C] 115 130 135 140 165 | duty 20 second [kW] 32.5 56 83 110 157 | Maxsurface temp. [°C] 140 160 170 180 200 | duty 40 second [kW] 21.5 36.8 58 79 102 | Max surface temp. [°C] 165 190 210 220 235 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 CMQ 560 | duty 1 second [kW] 158 300 420 592 992 1100 | Maxsurface temp. [°C] 70 80 80 85 100 100 | duty 5 second [kW] 65 116 152 204 332 356 | Max surface temp. [°C] 95 110 110 115 135 130 | duty 10 second [kW] 47.5 82 112 148 230 248 | Max s urface temp. [°C] 115 130 135 140 165 155 | duty 20 second [kW] 32.5 56 83 110 157 182 | Maxsurface temp. [°C] 140 160 170 180 200 200 | duty 40 second [kW] 21.5 36.8 58 79 102 129 | Max s urface temp. [°C] 165 190 210 220 235 245 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 CMQ 560 CMQ 560 | duty 1 second [kW] 158 300 420 592 992 1100 1455 | Max s urfa ce temp. [°C] 70 80 80 85 100 100 105 | duty 5 second [kW] 65 116 152 204 332 356 456 | Max surface temp. [°C] 95 110 110 115 135 130 135 | duty 10 second [kW] 47.5 82 112 148 230 248 316 | Max surface temp. [°C] 115 130 135 140 165 155 165 | duty 20 second [kW] 32.5 56 83 110 157 182 228 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 | duty 40 second [kW] 21.5 36.8 58 79 102 129 161 | Max s urface temp. [°C] 165 190 210 220 235 245 245 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 CMQ 560 CMQ 660 CMQ 560 | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 | Max s urfa ce temp. [°C] 70 80 80 85 100 100 105 115 | duty 5 second [kW] 65 116 152 204 332 356 456 584 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 | Max surface temp. [°C] 115 130 135 140 165 155 165 165 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 215 | duty 40 second [kW] 21.5 36.8 58 79 102 129 161 196 | Max s urface temp. [°C] 165 190 210 220 235 245 245 250 260 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 CMQ 560 CMQ 660 CMQ 660 CMQ 760 | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 | Max s urfa ce temp. [°C] 70 80 80 85 100 100 100 105 115 130 | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 | Max surface temp. [°C] 95 110 110 115 135 130 135 135 145 160 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 578 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 205 215 235 | duty 40 second [kW] 21.5 36.8 58 79 102 129 161 196 238 | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 |
| CMQ 210 CMQ 260 CMQ 330 CMQ 400 CMQ 460 CMQ 560 CMQ 660 CMQ 760 CMQ 860 CMQ 860 | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 | Max s urfa ce temp. [°C] 70 80 80 85 100 100 100 105 115 130 140 | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 | Max surface temp. ['C] 95 110 110 115 135 130 135 145 160 180 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 | Max surface temp. [°C] 115 130 135 140 165 155 165 165 175 195 210 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 200 205 215 235 245 | duty 40 second [kW] 21.5 36.8 58 79 102 129 161 196 238 280 | Max s urface temp. [°C] 165 190 210 220 235 245 245 250 260 280 280 |
| $ \begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ | $\frac{Max surface}{temp.} [°C] 70 80 80 85 100 100 105 115 130 140 7 = \frac{R.C}{2}$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 ulse each 1800 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, | Max surface temp. [°C] 140 160 170 180 200 200 205 215 235 245 total energy | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 |
| $\begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ | Max surface temp. [°C] 70 80 80 80 85 100 100 105 115 130 140 $\tau = \frac{R.C}{2}$ Max surface | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu | Max surface temp. ['C] 95 110 110 115 135 130 135 145 160 180 ilse each 1800 Max surface | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, | Max surface temp. [°C] 140 160 170 180 200 200 205 215 235 245 total energy Max surface | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>Pmax</i> |
| $\begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second | $\frac{Max s urface}{temp.} \frac{[*C]}{70} \\ \hline 70 \\ \hline 80 \\ \hline 80 \\ \hline 85 \\ 100 \\ 100 \\ 100 \\ 105 \\ 115 \\ 130 \\ 140 \\ \hline \tau = \frac{R.C}{2} \\ \hline Max s urface \\ temp. \\ \hline$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 ilse each 1800 Max surface temp. | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu Tau 10 second | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rvve), ambien Max surface temp. | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 215 235 245 total energy Max s urfa ce temp. | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . P_max Max s urface temp. |
| $\begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kI] | $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 Iogoritmic pu Tau 5 second [kJ] | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 ulse each 1800 Max surface temp. [°C] | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu Tau 10 second [kI] | Max surface temp. [°C] 1115 130 135 140 165 155 165 175 195 210 rvve), ambien Max surface temp. [°C] | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] | Max s urfa ce temp. [°C] 140 160 170 180 200 200 200 205 215 235 245 total energy Max s urfa ce temp. [°C] | $\begin{array}{c} {}^{\rm duty40second}\\ {}^{\rm [kW]}\\ 21.5\\ 36.8\\ 58\\ 79\\ 102\\ 129\\ 161\\ 196\\ 238\\ 280\\ \hline {\mbox{E}=\mbox{τ}}\\ {\mbox{2}}\\ {\mbox{2}}\\ {\mbox{2}}\\ {\mbox{2}}\\ {\mbox{2}}\\ {\mbox{2}}\\ {\mbox{1}}\\ {\mbox{2}}\\ {\mbox{2}\\ {\mbox{2}}\\ {\mbox{2}\\ \mbox{2}$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>P</i> max Max s urface temp. [°C] |
| $ \begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kI] 126 | $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 Iogoritmic pu Tau 5 second [kJ] 292 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 Ilse each 1800 Max surface temp. [°C] 150 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu Tau 10 second [kI] 400 | Max surface temp. [°C] 1115 130 135 140 165 155 165 165 175 195 210 rve), ambien Max surface temp. [°C] 180 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 215 235 245 total energy Max s urfa ce temp. [°C] 220 | $\begin{array}{c} {}^{\rm duty40second}\\ {}^{\rm [kW]}\\ 21.5\\ 36.8\\ 58\\ 79\\ 102\\ 129\\ 161\\ 196\\ 238\\ 280\\ \hline {\mbox{E}}=\tau\\ {}^{\rm Tau40second}\\ {}^{\rm [kJ]}\\ 704 \end{array}$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 |
| $\begin{tabular}{ c c c c c } \hline CMQ 210 \\ \hline CMQ 260 \\ \hline CMQ 330 \\ \hline CMQ 400 \\ \hline CMQ 460 \\ \hline CMQ 560 \\ \hline CMQ 560 \\ \hline CMQ 660 \\ \hline CMQ 960 \\ \hline $p(t) = P_m$ \\ \hline \hline $cMQ 210$ \\ \hline $cMQ 210$ \\ \hline $cMQ 260$ \\ \hline \end{tabular}$ | $\begin{array}{c} {}^{\rm duty1second}\\ {}^{\rm [kW]}\\ 158\\ 300\\ 420\\ 592\\ 992\\ 1100\\ 1455\\ 1888\\ 2625\\ 3520\\ {}^{\rm ax.e} e^{-t/\tau}\\ {}^{\rm Tau1second}\\ {}^{\rm [kJ]}\\ 126\\ 236 \end{array}$ | $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 Iogoritmic pu Tau 5 second [kJ] 292 508 | Max surface temp. ['C] 95 110 110 115 135 130 135 145 160 180 Ilse each 1800 Max surface temp. ['C] 150 180 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kI] 400 696 | Max surface temp. [°C] 1115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface temp. [°C] 180 210 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 | Max s urfa ce temp. [°C] 140 160 170 180 200 200 205 215 235 245 total energy Max s urfa ce temp. [°C] 220 220 | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second [kI] 704 1152 | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 |
| $\begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 | $\begin{tabular}{lllllllllllllllllllllllllllllllllll$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 Max surface temp. [°C] 150 180 180 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 | Max surface temp. [°C] 1115 130 135 140 165 155 165 165 175 210 rve), ambien Max surface temp. [°C] 180 210 230 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 | Max s urface temp. [°C] 140 160 200 200 200 205 215 235 245 total energy Max s urface temp. [°C] 220 220 235 | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second [kJ] 704 1152 1600 | Max s urface temp. [°C] 165 190 210 220 235 245 250 280 280 280 280 280 280 280 280 280 28 |
| $\begin{tabular}{ c c c c c } \hline CMQ 210 \\ \hline CMQ 260 \\ \hline CMQ 330 \\ \hline CMQ 400 \\ \hline CMQ 460 \\ \hline CMQ 560 \\ \hline CMQ 560 \\ \hline CMQ 660 \\ \hline CMQ 960 \\ \hline $p(t) = P_m$ \\ \hline \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 | $\begin{tabular}{ c c c c } \hline Max surface temp. [°C] & 70 & 80 & 80 & 85 & 100 & 100 & 100 & 105 & 115 & 130 & 140 & $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 Max surface temp. [°C] 150 180 180 180 180 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 | Max surface temp. [°C] 1115 130 135 140 165 155 165 175 210 rve), ambien Max surface temp. [°C] 180 210 230 240 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 | Max s urface temp. [°C] 140 160 200 200 205 215 235 245 total energy Max s urface temp. [°C] 220 220 250 250 270 290 | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second [kJ] 704 1152 1600 1984 | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 280 280 280 280 280 280 280 |
| $ \begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 | $\begin{tabular}{ c c c c } \hline Max surface temp. [°C] & 70 & 80 & 80 & 80 & 85 & 100 & 100 & 105 & 115 & 130 & 140 & 115 & 130 & 140 & \hline t t t t t t t t t $$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 | Max surface temp. [°C] 95 110 110 115 135 135 135 145 160 180 180 Max surface temp. [°C] 150 180 180 180 180 190 230 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 210 rve), ambien Max surface temp. [°C] 180 210 230 240 280 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 | Max s urfa ce temp. [°C] 140 160 170 200 200 205 215 235 245 total energy Max s urfa ce temp. [°C] 220 250 250 270 290 300 | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second [kJ] 704 1152 1600 1984 2304 | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 280 280 280 280 280 280 280 280 28 |
| $\begin{tabular}{ c c c c c } \hline CMQ 210 \\ \hline CMQ 260 \\ \hline CMQ 330 \\ \hline CMQ 400 \\ \hline CMQ 460 \\ \hline CMQ 560 \\ \hline CMQ 560 \\ \hline CMQ 760 \\ \hline CMQ 960 \\ \hline $p(t) = P_m$ \\ \hline \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 776 | $\begin{tabular}{ c c c c c } \hline Max surface temp. [°C] & & & & & & & & & & & & & & & & & & &$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 1520 | Max surface temp. ['C] 95 110 110 115 135 135 135 145 160 180 180 Max surface temp. ['C] 150 180 180 180 180 190 230 220 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 2224 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 210 rve), ambien Max surface temp. [°C] 180 210 230 240 280 270 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 2880 | Max s urfa ce temp. [°C] 140 160 170 200 200 205 205 215 235 245 total energy Max s urfa ce temp. [°C] 220 250 250 270 290 300 | $\frac{duty 40 \text{ second}}{[kW]}$ 21.5 36.8 58 79 102 129 161 196 238 280 $E = \tau$ Tau 40 second [kJ] 704 1152 1600 1984 2304 2912 | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 280 280 280 280 280 28 |
| $\begin{tabular}{ c c c c c } \hline C_{MQ} 210 \\ \hline C_{MQ} 260 \\ \hline C_{MQ} 260 \\ \hline C_{MQ} 400 \\ \hline C_{MQ} 460 \\ \hline C_{MQ} 460 \\ \hline C_{MQ} 560 \\ \hline C_{MQ} 660 \\ \hline C_{MQ} 760 \\ \hline C_{MQ} | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 776 1008 | $\begin{tabular}{ c c c c c } \hline Max surface temp. [°C] & & & & & & & & & & & & & & & & & & &$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 1520 1936 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 Max surface temp. [°C] 150 180 180 180 180 190 230 220 230 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 0 seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 2224 2784 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface temp. [°C] 180 210 230 240 280 270 290 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 2880 3456 | Max s urfa ce temp. [°C] 140 160 170 200 200 205 215 235 245 total energy Max s urfa ce temp. [°C] 220 250 250 270 250 270 290 300 300 | $\begin{array}{c} {}^{\rm duty 40 second} \\ {}^{\rm [kW]} \\ 21.5 \\ 36.8 \\ 58 \\ 79 \\ 102 \\ 129 \\ 161 \\ 196 \\ 238 \\ 280 \\ \hline \\ {\color{black}E} = {\color{black} \tau} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ {\scriptstyle [kJ]} \\ \hline \\ {\color{black}Tau 40 second} \\ \hline \\ $ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 250 280 280 280 280 290 300 300 320 |
| $\begin{tabular}{ c c c c c } \hline CMQ 210 \\ \hline CMQ 260 \\ \hline CMQ 260 \\ \hline CMQ 400 \\ \hline CMQ 460 \\ \hline CMQ 560 \\ \hline CMQ 660 \\ \hline CMQ 760 \\ \hline CMQ 960 \\ \hline $p(t) = P_m \\ \hline \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 776 1008 1312 | $\begin{tabular}{ c c c c } \hline Max surface temp. [°C] & & & & & & & & & & & & & & & & & & &$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 1520 1936 2448 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 180 Max surface temp. [°C] 150 180 180 180 180 190 230 220 230 250 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 2224 22784 3488 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface temp. [°C] 180 210 230 240 230 240 280 270 290 300 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 2880 3456 4032 | Max surface temp. [°C] 140 160 170 200 200 205 215 235 245 total energy Max surface temp. [°C] 220 220 220 250 270 250 270 290 300 300 320 330 | $\begin{array}{c} {}^{\rm duty40second}\\ {}^{\rm [kW]}\\ 21.5\\ 36.8\\ 58\\ 79\\ 102\\ 129\\ 161\\ 196\\ 238\\ 280\\ \hline \\ {\color{black} E=\tau}\\ \hline \\ {\color{black} Tau40second}\\ {\color{black} [kJ]}\\ \hline \\ {\color{black} Tau40second}\\ \hline \\ {\color{black} [kJ]}\\ \hline \\ {\color{black} Tau40second}\\ \hline \\ {\color{black} [kJ]}\\ \hline \\ {\color{black} Tau40second}\\ \hline \\ {\color{black} [kJ]}\\ \hline \\ \\ {\color{black} Tau40second}\\ \hline \\ \hline \\ {\color{black} Tau40second}\\ \hline \\ \hline \\ {\color{black} Tau40second}\\ \hline \\ \hline \\ \\ {\color{black} Tau40second}\\ \hline \\ \hline$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 280 280 280 280 280 280 280 290 300 300 300 320 330 |
| $\begin{array}{c c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 776 1008 1312 1792 | $\begin{tabular}{ c c c c } \hline Max surface temp. [°C] & & & & & & & & & & & & & & & & & & &$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 1520 1936 2448 3264 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 180 Max surface temp. [°C] 150 180 180 180 180 190 230 220 230 220 230 250 280 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 2224 2784 3488 4480 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface temp. [°C] 180 210 230 240 230 240 280 270 290 300 330 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 2880 3456 4032 4608 | Max surface temp. [°C] 140 160 170 200 200 205 215 235 245 total energy Max surface temp. [°C] 220 220 220 250 220 250 270 290 300 300 320 330 | $\begin{array}{c} {}^{\rm duty40second} \\ {}^{\rm [kW]} \\ 21.5 \\ 36.8 \\ 58 \\ 79 \\ 102 \\ 129 \\ 161 \\ 196 \\ 238 \\ 280 \\ \hline \\ {\color{black} E = 7} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ \hline \\ \hline \\ {\color{black} Tau 40second} \\ \hline \\ \hline \\ \\ \hline $ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 280 280 280 280 280 280 280 280 28 |
| $ \begin{array}{c} \hline \\ \hline $ | duty 1 second [kW] 158 300 420 592 992 1100 1455 1888 2625 3520 $ax \cdot e^{-t/\tau}$ Tau 1 second [kJ] 126 236 316 432 720 776 1008 1312 1792 2416 | $\begin{tabular}{ c c c c } \hline Max surface temp. [°C] & & & & & & & & & & & & & & & & & & &$ | duty 5 second [kW] 65 116 152 204 332 356 456 584 792 1056 logoritmic pu Tau 5 second [kJ] 292 508 680 896 1424 1520 1936 2448 3264 4224 | Max surface temp. [°C] 95 110 110 115 135 130 135 145 160 180 180 180 Max surface temp. [°C] 150 180 180 180 180 190 230 220 230 220 230 220 230 250 280 320 | duty 10 second [kW] 47.5 82 112 148 230 248 316 400 528 688 D seconds (e-cu Tau 10 second [kJ] 400 696 1016 1344 1952 2224 2784 3488 4480 5120 | Max surface temp. [°C] 115 130 135 140 165 155 165 175 195 210 rve), ambien Max surface temp. [°C] 180 210 230 240 230 240 230 240 230 240 230 240 230 240 230 240 230 240 230 240 230 240 230 250 | duty 20 second [kW] 32.5 56 83 110 157 182 228 284 364 448 t temp. = 40°C, Tau 20 second [kJ] 532 912 1440 1952 2304 2880 3456 4032 4608 5120 | Max surface temp. [°C] 140 160 170 200 205 205 215 235 245 total energy Max surface temp. [°C] 220 220 220 220 250 270 220 250 270 290 300 300 300 320 330 | $\begin{array}{c} {}^{\rm duty40second} \\ {}^{\rm [kW]} \\ 21.5 \\ 36.8 \\ 58 \\ 79 \\ 102 \\ 129 \\ 161 \\ 196 \\ 238 \\ 280 \\ \hline \\ {\color{black} E = 7} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ {}^{\rm [kJ]} \\ \hline \\ {\color{black} Tau 40second} \\ \hline \\ \\ {\color{black} Tau 40second} \\ \hline \\ \\ {\color{black} Tau 40second} \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \hline \end{array} \end{array}$ | Max s urface temp. [°C] 165 190 210 220 235 245 250 260 280 280 280 280 . <i>Pmax</i> Max s urface temp. [°C] 250 280 280 280 280 280 280 280 280 280 28 |

Table 3

Pulse-load

The ability to withstand pulse-loads varies with resistor size and length and diameter of the internal resistor wire. As such, it is impossible to create standard graphs that would apply for most customers' applications. In some cases, the load-profile will be the combination of a square and a triangular pulse, such as is the case with Low Voltage Ride Through (LVRT) and Emergency Brake situations, as encountered in the Wind Power industry.

On request, Danotherm performs simulations based on the actual application and for guidance, has produced tables for various load-profiles for resistors with standard wire (but these are only examples). The table shown above is based on a 5 ohm resistor with standard wire thickness. Depending on the application, resistor construction can be adapted to optimally match the application.

In the table above, the peak power for a train of pulses of 1 to 40 seconds duty time (on-time) and cycle times of 120 seconds or 1800 seconds be found, corresponding to the duty cycle which brings the resistor wire temperature to its rated thermal maximum of 1000°C.



Danotherm offers standard solutions for one to six resistor bodies combined in one compact *resistor unit* with pulse-withstand capability of 3MW (15MJ) and also OEM versions with a maximum of 20 bodies. Depending on the electrical connection, the IP class ranges from IP 20 to IP 65. Connection can be via a terminal box, DIN-rail terminals or cable lugs. These resistor types are also offered in high-voltage versions.

The salient features of Alpha resistors are that they have:

- small dimensions
- low-temperature surfaces in operation
- high pulse-load capabilities
- high vibration capabilities
- no external electrically-live parts
- high IP classes
- fail-safe capabilities (on request)
- low noise levels.



Triple-body unit CMQ-V XXX BHT 283 Pnom. = 4350—11200 W, IP 54 Connection box with 3 cable glands



Danotherm Electric A/S is a NIBE company



CMQ-H XXX BHT 282

unit CMQ-BHT Pnom. = 2925—7575 W double-body unit (282) Pnom. = 5800—14900 W four-body unit (284) B-type Connection Box with 3 cable glands IP 54 protection class



CMQ-H XXX BHT 284





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