

PEH 200 85°C

RoHS
Compliant

- High CV-value
- Long Life
- Low ESR and ESL
- Compact size
- Optimized designs available on request

APPLICATION

Typical applications for the new PEH 200 would be found in Uninterruptable Power Supplies (UPS), Ground Power Units (GPU), Welding Equipments and Drives where high current ratings and compact size are important.

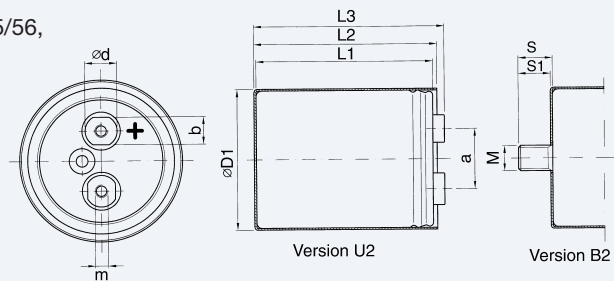
BASIC DESIGN

PEH 200 series has a polarized, all-welded design, heavy duty screw terminals, extended cathode construction, safety vent and plastic insulation. The sealing systems designed for electrolyte leakage free operation and a very low gas-diffusion rate of electrolyte.

Mechanical contact between the winding and the aluminium case allows excellent heat transfer from the winding hot spot to the ambient, which means cooler operation and very high current ratings.

SPECIFICATION

| | |
|------------------------------|----------------------------------------------------|
| Standards | IEC 60384-4 Long Life Grade 40/85/56, DIN 41240 |
| Capacitance range | 100–330000 µF |
| Capacitance tolerance | –20 to +20% |
| Rated voltage | 25–550 VDC |
| Temperature range | –40 to +85°C |
| Shelf life | 2000 h at 0V +85°C, or 4 years at 0V +40°C |
| Operational life time | 60000 h at +85°C (Case Ø = 90 mm) |
| Diameter range | 35–90 mm |



Dimensions table PEH 200 (mm)

| D x L | Case code | D1 ±1.0 | L1 ±1.0 | L2 ±1.0 | L3 ±1.0 | S | S1 | M | a ±0.5 | b | d | m* | Weight approx (g) |
|----------|-----------|---------|---------|---------|---------|----|------|-----|--------|----|----|----|-------------------|
| 35 x 47 | E | 36.6 | 47.5 | 50.5 | 55.0 | 12 | 11.0 | M8 | 13.0 | — | 8 | M5 | 60 |
| 35 x 51 | A | 36.6 | 51.5 | 54.5 | 58.9 | 12 | 11.0 | M8 | 13.0 | — | 8 | M5 | 70 |
| 35 x 60 | B | 36.6 | 59.5 | 62.5 | 66.9 | 12 | 11.0 | M8 | 13.0 | — | 8 | M5 | 85 |
| 35 x 75 | C | 36.6 | 73.5 | 76.5 | 80.9 | 12 | 11.0 | M8 | 13.0 | — | 8 | M5 | 105 |
| 35 x 95 | D | 36.6 | 94.5 | 97.5 | 101.9 | 12 | 11.0 | M8 | 13.0 | — | 8 | M5 | 130 |
| 50 x 49 | G | 51.6 | 48.5 | 51.5 | 56.4 | 16 | 15.0 | M12 | 22.0 | 13 | 15 | M5 | 150 |
| 50 x 75 | H | 51.6 | 74.5 | 77.5 | 82.4 | 16 | 15.0 | M12 | 22.0 | 13 | 15 | M5 | 180 |
| 50 x 95 | J | 51.6 | 95.5 | 98.5 | 103.4 | 16 | 15.0 | M12 | 22.0 | 13 | 15 | M5 | 240 |
| 50 x 105 | K | 51.6 | 103.5 | 106.5 | 111.4 | 16 | 15.0 | M12 | 22.0 | 13 | 15 | M5 | 265 |
| 50 x 115 | I** | 51.6 | 115.5 | 118.5 | 123.4 | 16 | 15.0 | M12 | 22.0 | 13 | 15 | M5 | 300 |
| 65 x 105 | O | 66.6 | 106.0 | 109.2 | 113.0 | 16 | 14.8 | M12 | 28.5 | 13 | 15 | M5 | 415 |
| 65 x 115 | Q** | 66.6 | 118.0 | 121.2 | 125.0 | 16 | 14.8 | M12 | 28.5 | 13 | 15 | M5 | 460 |
| 65 x 130 | S** | 66.6 | 129.0 | 132.2 | 136.0 | 16 | 14.8 | M12 | 28.5 | 13 | 15 | M5 | 520 |
| 65 x 140 | R** | 66.6 | 141.0 | 144.2 | 148.0 | 16 | 14.8 | M12 | 28.5 | 13 | 15 | M5 | 650 |
| 75 x 78 | L | 76.6 | 77.0 | 80.2 | 84.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 430 |
| 75 x 98 | P** | 76.6 | 98.0 | 101.2 | 105.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 530 |
| 75 x 105 | T | 76.6 | 106.0 | 109.2 | 113.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 585 |
| 75 x 115 | U | 76.6 | 118.0 | 121.2 | 125.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 640 |
| 75 x 145 | V | 76.6 | 146.0 | 149.2 | 153.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 800 |
| 75 x 220 | X | 76.6 | 221.0 | 224.2 | 228.0 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 1400 |
| 90 x 78 | M | 91.6 | 76.5 | 79.7 | 83.4 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 750 |
| 90 x 98 | N | 91.6 | 97.5 | 100.7 | 104.4 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 950 |
| 90 x 145 | Y | 91.6 | 145.5 | 148.7 | 152.4 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 1400 |
| 90 x 220 | Z | 91.6 | 220.0 | 223.2 | 226.9 | 16 | 14.8 | M12 | 32.0 | 13 | 15 | M5 | 1500 |

* M6 and other threads on request. **on request

ARTICLE TABLE PEH 200 (85°C)

| C_R | D x L | Case code | I_{RAC}^* 85°C | I_{RAC}^* 50°C ** | I_{RAC}^* 40°C | ESR* 20°C | ESR* 20°C | L_{ESL} Approx. | Article code |
|--------------------------------|----------|-----------|---------------------|---------------------------|---------------------|----------------------|-----------------------|----------------------|---------------------------------------------|
| μF | mm | | 100 Hz A | 10 kHz A | 10 kHz A | 100 Hz m Ω | 100 kHz m Ω | nH | U ₂ = Plain can B2 = Stud can |
| 25 VDC (U_R) | | | | | | | | | |
| 15000 | 35 x 51 | A | 11.9 | 28.7 | 19.0 | 25 | 21 | 12 | PEH200HA5150M-- |
| 22000 | 35 x 75 | C | 15.2 | 34.3 | 24.4 | 17 | 14 | 12 | PEH200HC5220M-- |
| 33000 | 35 x 95 | D | 17.8 | 38.0 | 28.1 | 12 | 10 | 12 | PEH200HD5330M-- |
| 47000 | 50 x 75 | H | 20.2 | 43.3 | 30.1 | 11 | 10 | 16 | PEH200HH5470M-- |
| 68000 | 50 x 95 | J | 23.4 | 47.4 | 34.6 | 8 | 7 | 16 | PEH200HJ5680M-- |
| 100000 | 50 x 105 | K | 23.9 | 46.1 | 34.7 | 7 | 7 | 16 | PEH200HK6100M-- |
| 150000 | 65 x 105 | O | 26.3 | 50.0 | 37.2 | 7 | 7 | 16 | PEH200HO6150M-- |
| 220000 | 75 x 105 | T | 35.0 | 63.6 | 49.5 | 5 | 5 | 17 | PEH200HT6220M-- |
| 330000 | 75 x 145 | V | 40.0 | 73.1 | 56.9 | 4 | 4 | 17 | PEH200HV6330M-- |
| 40 VDC (U_R) | | | | | | | | | |
| 6800 | 35 x 51 | A | 9.9 | 27.2 | 18.1 | 33 | 25 | 12 | PEH200KA4680M-- |
| 10000 | 35 x 60 | B | 12.0 | 31.5 | 21.4 | 23 | 18 | 12 | PEH200KB5100M-- |
| 15000 | 35 x 75 | C | 14.6 | 36.1 | 25.5 | 16 | 12 | 12 | PEH200KC5150M-- |
| 22000 | 35 x 95 | D | 17.1 | 39.8 | 29.2 | 12 | 9 | 12 | PEH200KD5220M-- |
| 33000 | 50 x 75 | H | 18.9 | 41.1 | 28.8 | 11 | 9 | 16 | PEH200KH5330M-- |
| 47000 | 50 x 95 | J | 22.1 | 46.3 | 33.6 | 8 | 7 | 16 | PEH200KJ5470M-- |
| 68000 | 65 x 105 | O | 25.2 | 49.9 | 35.6 | 7 | 7 | 16 | PEH200KO5680M-- |
| 100000 | 65 x 105 | O | 24.9 | 46.3 | 36.9 | 8 | 8 | 16 | PEH200KO6100M-- |
| 150000 | 75 x 115 | U | 35.7 | 67.7 | 51.2 | 5 | 4 | 17 | PEH200KU6150M-- |
| 220000 | 75 x 145 | V | 34.4 | 62.3 | 48.9 | 5 | 5 | 17 | PEH200KV6220M-- |
| 63 VDC (U_R) | | | | | | | | | |
| 4700 | 35 x 51 | A | 9.0 | 26.8 | 18.0 | 32 | 21 | 12 | PEH200MA4470M-- |
| 6800 | 35 x 75 | C | 11.5 | 32.7 | 23.5 | 21 | 14 | 12 | PEH200MC4680M-- |
| 10000 | 35 x 95 | D | 13.6 | 36.0 | 27.0 | 15 | 10 | 12 | PEH200MD5100M-- |
| 15000 | 50 x 75 | H | 16.1 | 37.3 | 26.5 | 14 | 11 | 16 | PEH200MH5150M-- |
| 22000 | 50 x 95 | J | 19.0 | 42.0 | 30.9 | 10 | 8 | 16 | PEH200MJ5220M-- |
| 33000 | 65 x 105 | O | 22.8 | 45.9 | 34.8 | 10 | 8 | 16 | PEH200MO5330M-- |
| 47000 | 65 x 105 | O | 21.8 | 42.7 | 32.0 | 10 | 9 | 16 | PEH200MO5470M-- |
| 68000 | 75 x 115 | U | 31.5 | 61.3 | 46.8 | 6 | 5 | 17 | PEH200MU5680M-- |
| 100000 | 75 x 145 | V | 34.3 | 62.2 | 50.3 | 5 | 5 | 17 | PEH200MV6100M-- |
| 100 VDC (U_R) | | | | | | | | | |
| 1500 | 35 x 51 | A | 5.7 | 18.0 | 12.1 | 92 | 63 | 12 | PEH200PA4150M-- |
| 2200 | 35 x 60 | B | 7.0 | 21.3 | 14.7 | 63 | 44 | 12 | PEH200PB4220M-- |
| 3300 | 35 x 75 | C | 8.7 | 25.0 | 17.8 | 43 | 30 | 12 | PEH200PC4330M-- |
| 4700 | 35 x 95 | D | 10.3 | 28.9 | 21.1 | 31 | 21 | 12 | PEH200PD4470M-- |
| 6800 | 50 x 75 | H | 12.7 | 30.4 | 21.5 | 33 | 27 | 16 | PEH200PH4680M-- |
| 10000 | 50 x 95 | J | 15.3 | 34.7 | 25.6 | 23 | 19 | 16 | PEH200PJ5100M-- |
| 15000 | 50 x 105 | K | 17.3 | 37.6 | 27.9 | 17 | 14 | 16 | PEH200PK5150M-- |
| 22000 | 65 x 105 | O | 19.3 | 38.7 | 30.1 | 15 | 13 | 16 | PEH200PO5220M-- |
| 33000 | 75 x 105 | T | 26.3 | 53.0 | 39.8 | 10 | 8 | 17 | PEH200PT5330M-- |
| 47000 | 75 x 145 | V | 30.8 | 60.5 | 47.3 | 7 | 6 | 17 | PEH200PV5470M-- |
| 250 VDC (U_R) | | | | | | | | | |
| 330 | 35 x 51 | A | 2.2 | 13.5 | 8.7 | 330 | 170 | 12 | PEH200SA3330M-- |
| 470 | 35 x 60 | B | 2.7 | 15.9 | 10.6 | 240 | 120 | 12 | PEH200SB3470M-- |
| 680 | 35 x 75 | C | 3.4 | 18.7 | 13.0 | 160 | 84 | 12 | PEH200SC3680M-- |
| 1000 | 35 x 95 | D | 4.1 | 21.2 | 15.6 | 110 | 58 | 12 | PEH200SD4100M-- |
| 1000 | 50 x 49 | G | 4.3 | 20.7 | 12.6 | 120 | 69 | 16 | PEH200SG4100M-- |
| 1500 | 50 x 75 | H | 5.9 | 28.7 | 19.5 | 78 | 42 | 16 | PEH200SH4150M-- |
| 2200 | 50 x 95 | J | 7.3 | 32.5 | 23.2 | 54 | 29 | 16 | PEH200SJ4220M-- |
| 3300 | 65 x 105 | O | 10.0 | 39.8 | 29.4 | 38 | 22 | 16 | PEH200SO4330M-- |
| 3300 | 75 x 78 | L | 10.5 | 43.8 | 29.6 | 38 | 22 | 17 | PEH200SL4330M-- |
| 4700 | 65 x 105 | O | 11.3 | 38.2 | 27.2 | 29 | 18 | 16 | PEH200SO4470M-- |

* Maximum values. ** 2 m/s forced air, studmounted on 3°C/W aluminium chassis.

ARTICLE TABLE PEH 200 (85°C)

| C _R | D x L | Case code | I _{RAC} * | I _{RAC} * | I _{RAC} * | ESR* | ESR* | L _{ESL} Approx. | Article code |
|--------------------------------|----------|-----------|--------------------|--------------------|--------------------|--------------|---------------|--------------------------|---------------------------------|
| | | | 85°C | 50°C | 40°C | 20°C | 20°C | | |
| μF | mm | | 100 Hz A | 10 kHz A | 10 kHz A | 100 Hz mΩ | 100 kHz mΩ | nH | U2 = Plain can B2 = Stud can |
| 250 VDC (U_R) | | | | | | | | | |
| 4700 | 90 x 78 | M | 12.7 | 44.2 | 30.4 | 30 | 18 | 16 | PEH200SM4470M-- |
| 6800 | 75 x 105 | T | 14.7 | 51.5 | 36.5 | 20 | 12 | 17 | PEH200ST4680M-- |
| 6800 | 90 x 98 | N | 15.8 | 52.1 | 37.3 | 21 | 13 | 16 | PEH200SN4680M-- |
| 10000 | 75 x 145 | V | 18.0 | 59.0 | 44.0 | 14 | 9 | 17 | PEH200SV5100M-- |
| 12000 | 75 x 145 | V | 18.8 | 58.6 | 43.6 | 14 | 9 | 17 | PEH200SV512AM-- |
| 15000 | 75 x 220 | X | 20.6 | 61.6 | 49.2 | 10 | 6 | 17 | PEH200SX5150M-- |
| 15000 | 90 x 145 | Y | 21.8 | 60.1 | 45.5 | 12 | 8 | 16 | PEH200SY5150M-- |
| 350 VDC (U_R) | | | | | | | | | |
| 220 | 35 x 51 | A | 2.0 | 13.7 | 8.8 | 360 | 170 | 12 | PEH200UA3220M-- |
| 330 | 35 x 60 | B | 2.6 | 16.6 | 11.0 | 240 | 110 | 12 | PEH200UB3330M-- |
| 470 | 35 x 75 | C | 3.2 | 19.3 | 13.4 | 170 | 79 | 12 | PEH200UC3470M-- |
| 680 | 35 x 95 | D | 3.8 | 21.9 | 16.0 | 120 | 55 | 12 | PEH200UD3680M-- |
| 680 | 50 x 49 | G | 4.0 | 20.7 | 12.6 | 130 | 66 | 16 | PEH200UG3680M-- |
| 1000 | 50 x 75 | H | 5.5 | 28.8 | 19.5 | 85 | 41 | 16 | PEH200UH4100M-- |
| 1500 | 50 x 95 | J | 6.8 | 32.9 | 23.4 | 57 | 28 | 16 | PEH200UJ4150M-- |
| 2200 | 65 x 105 | O | 9.4 | 39.8 | 29.2 | 41 | 21 | 16 | PEH200UO4220M-- |
| 2200 | 75 x 78 | L | 9.8 | 43.5 | 29.4 | 41 | 21 | 17 | PEH200UL4220M-- |
| 3300 | 65 x 105 | O | 10.9 | 38.6 | 27.5 | 31 | 17 | 16 | PEH200UO4330M-- |
| 3300 | 90 x 78 | M | 13.1 | 54.0 | 37.0 | 28 | 15 | 16 | PEH200UM4330M-- |
| 4700 | 75 x 115 | U | 14.5 | 54.7 | 39.5 | 20 | 11 | 17 | PEH200UU4470M-- |
| 4700 | 90 x 98 | N | 15.0 | 51.3 | 36.7 | 22 | 13 | 16 | PEH200UN4470M-- |
| 6800 | 75 x 145 | V | 16.8 | 57.0 | 42.3 | 15 | 8 | 17 | PEH200UV4680M-- |
| 10000 | 75 x 220 | X | 19.4 | 60.8 | 48.5 | 11 | 7 | 17 | PEH200UX5100M-- |
| 10000 | 90 x 145 | Y | 23.3 | 75.2 | 56.9 | 11 | 6 | 16 | PEH200UY5100M-- |
| 15000 | 90 x 220 | Z | 27.3 | 79.8 | 64.4 | 8 | 5 | 16 | PEH200UZ515AM-- |
| 385 VDC (U_R) | | | | | | | | | |
| 220 | 35 x 51 | A | 2.1 | 14.6 | 9.3 | 330 | 150 | 12 | PEH200XA3220M-- |
| 330 | 35 x 75 | C | 2.7 | 17.0 | 12.0 | 220 | 97 | 12 | PEH200XC3330M-- |
| 470 | 35 x 95 | D | 3.3 | 19.1 | 14.2 | 150 | 69 | 12 | PEH200XD3470M-- |
| 470 | 50 x 49 | G | 3.6 | 20.9 | 12.8 | 160 | 78 | 16 | PEH200XG3470M-- |
| 680 | 50 x 75 | H | 4.7 | 26.8 | 18.4 | 110 | 51 | 16 | PEH200XH3680M-- |
| 1000 | 50 x 95 | J | 5.9 | 31.7 | 22.8 | 76 | 35 | 16 | PEH200XJ4100M-- |
| 1500 | 50 x 105 | K | 7.1 | 34.1 | 24.7 | 52 | 25 | 16 | PEH200XK4150M-- |
| 2200 | 65 x 105 | O | 9.6 | 36.7 | 26.1 | 38 | 20 | 16 | PEH200XO4220M-- |
| 2200 | 75 x 78 | L | 10.0 | 42.7 | 28.8 | 38 | 20 | 17 | PEH200XL4220M-- |
| 3300 | 75 x 105 | T | 12.8 | 52.5 | 37.4 | 25 | 13 | 17 | PEH200XT4330M-- |
| 3300 | 90 x 78 | M | 13.3 | 52.6 | 36.0 | 26 | 14 | 16 | PEH200XM4330M-- |
| 4700 | 75 x 145 | V | 15.2 | 57.6 | 43.9 | 19 | 11 | 17 | PEH200XV4470M-- |
| 4700 | 90 x 98 | N | 16.6 | 62.4 | 44.4 | 19 | 10 | 16 | PEH200XN4470M-- |
| 6800 | 90 x 145 | Y | 20.9 | 74.8 | 57.2 | 14 | 8 | 16 | PEH200XY4680M-- |
| 6800 | 75 x 220 | X | 17.4 | 58.9 | 47.0 | 14 | 8 | 17 | PEH200XX4680M-- |
| 400 VDC (U_R) | | | | | | | | | |
| 220 | 35 x 51 | A | 2.2 | 11.4 | 9.6 | 310 | 130 | 12 | PEH200VA3220M-- |
| 330 | 35 x 75 | C | 2.8 | 14.3 | 12.6 | 210 | 90 | 12 | PEH200VC3330M-- |
| 470 | 35 x 95 | D | 3.4 | 16.5 | 14.8 | 140 | 63 | 12 | PEH200VD3470M-- |
| 470 | 50 x 49 | G | 3.7 | 15.0 | 12.7 | 150 | 73 | 16 | PEH200VG3470M-- |
| 680 | 50 x 75 | H | 4.9 | 21.2 | 18.3 | 110 | 55 | 16 | PEH200VH3680M-- |
| 1000 | 50 x 95 | J | 5.9 | 24.2 | 21.3 | 76 | 38 | 16 | PEH200VJ4100M-- |
| 1500 | 65 x 105 | O | 9.1 | 49.1 | 35.1 | 53 | 27 | 16 | PEH200VO415AQ-- |
| 1500 | 75 x 78 | L | 8.8 | 34.0 | 29.0 | 52 | 27 | 17 | PEH200VL4150M-- |
| 2200 | 65 x 105 | O | 9.6 | 29.1 | 25.6 | 39 | 21 | 16 | PEH200VO4220M-- |
| 2200 | 90 x 78 | M | 11.8 | 44.1 | 37.1 | 36 | 19 | 16 | PEH200VM4220M-- |
| 3300 | 65 x 105 | O | 11.0 | 30.5 | 26.7 | 29 | 16 | 16 | PEH200VO433AM-- |
| 3300 | 75 x 115 | U | 13.8 | 52.0 | 45.7 | 22 | 10 | 17 | PEH200VU433AQ-- |
| 3300 | 90 x 98 | N | 14.9 | 52.8 | 45.2 | 25 | 13 | 16 | PEH200VN4330M-- |

* Maximum values. ** 2 m/s forced air, studmounted on 3°C/W aluminium chassis.

ARTICLE TABLE PEH 200 (85°C)

| C _R | D x L | Case code | I _{RAC} * | I _{RAC} * | I _{RAC} * | ESR* | ESR* | L _{ESL} Approx. | Article code |
|--------------------------------|----------|-----------|--------------------|--------------------|--------------------|--------------|---------------|--------------------------|---------------------------------|
| | | | 85°C | 50°C | 40°C | 20°C | 20°C | | |
| μF | mm | | 100 Hz A | 10 kHz A | 10 kHz A | 100 Hz mΩ | 100 kHz mΩ | nH | U2 = Plain can B2 = Stud can |
| 400 VDC (U_R) | | | | | | | | | |
| 3300 | 75 x 105 | T | 13.0 | 41.5 | 36.3 | 26 | 14 | 17 | PEH200VT4330M-- |
| 4700 | 75 x 145 | V | 15.6 | 57.0 | 42.5 | 18 | 10 | 17 | PEH200VV447AM-- |
| 6800 | 75 x 220 | X | 17.6 | 51.2 | 47.7 | 13 | 8 | 17 | PEH200VX4680M-- |
| 6800 | 90 x 145 | Y | 21.4 | 64.1 | 56.8 | 13 | 7 | 16 | PEH200VY4680M-- |
| 10000 | 90 x 220 | Z | 24.7 | 69.2 | 64.0 | 9 | 5 | 16 | PEH200VZ5100M-- |
| 420 VDC (U_R) | | | | | | | | | |
| 150 | 35 x 51 | A | 1.8 | 12.1 | 7.8 | 400 | 170 | 12 | PEH200OA3150M-- |
| 220 | 35 x 75 | C | 2.3 | 14.3 | 10.3 | 270 | 110 | 12 | PEH200OC3220M-- |
| 330 | 35 x 95 | D | 2.9 | 16.3 | 12.3 | 180 | 76 | 12 | PEH200OD3330M-- |
| 330 | 50 x 49 | G | 3.2 | 20.4 | 12.6 | 190 | 80 | 16 | PEH200OG3330M-- |
| 470 | 50 x 75 | H | 4.2 | 24.8 | 17.0 | 140 | 62 | 16 | PEH200OH3470M-- |
| 680 | 50 x 95 | J | 5.1 | 28.1 | 20.4 | 96 | 44 | 16 | PEH200OJ3680M-- |
| 1000 | 50 x 105 | K | 6.3 | 32.0 | 23.2 | 67 | 31 | 16 | PEH200OK4100M-- |
| 1500 | 65 x 105 | O | 8.8 | 38.9 | 28.4 | 47 | 23 | 16 | PEH200OO4150M-- |
| 1500 | 75 x 78 | L | 9.1 | 42.3 | 28.5 | 47 | 23 | 17 | PEH200OL4150M-- |
| 2200 | 75 x 105 | T | 11.5 | 51.6 | 37.0 | 32 | 16 | 17 | PEH200OT4220M-- |
| 2200 | 90 x 78 | M | 12.2 | 52.7 | 36.0 | 33 | 17 | 16 | PEH200OM4220M-- |
| 2700 | 65 x 105 | O | 12.4 | 57.3 | 40.1 | 24 | 10 | 16 | PEH200OO427AM-- |
| 3300 | 75 x 145 | V | 14.0 | 57.5 | 43.7 | 22 | 11 | 17 | PEH200OV4330M-- |
| 3300 | 90 x 98 | N | 15.4 | 61.9 | 44.0 | 22 | 12 | 16 | PEH200ON4330M-- |
| 4700 | 75 x 220 | X | 15.7 | 57.6 | 46.8 | 16 | 8 | 17 | PEH200OX4470M-- |
| 4700 | 90 x 145 | Y | 18.2 | 62.2 | 47.5 | 17 | 9 | 16 | PEH200OY4470M-- |
| 8200 | 90 x 220 | Z | 23.8 | 77.3 | 63.1 | 10 | 5 | 16 | PEH200OZ4820M-- |
| 450 VDC (U_R) | | | | | | | | | |
| 150 | 35 x 51 | A | 2.0 | 14.6 | 9.3 | 350 | 150 | 12 | PEH200YA3150M-- |
| 220 | 35 x 75 | C | 2.5 | 16.8 | 11.9 | 240 | 99 | 12 | PEH200YC3220M-- |
| 330 | 35 x 95 | D | 3.1 | 19.4 | 14.5 | 160 | 66 | 12 | PEH200YD3330M-- |
| 330 | 50 x 49 | G | 3.5 | 20.8 | 12.7 | 170 | 75 | 16 | PEH200YG3330M-- |
| 470 | 50 x 75 | H | 4.5 | 25.5 | 17.5 | 120 | 58 | 16 | PEH200YH3470M-- |
| 680 | 50 x 95 | J | 5.5 | 28.8 | 20.8 | 86 | 41 | 16 | PEH200YJ3680M-- |
| 1000 | 50 x 105 | K | 6.7 | 32.7 | 23.6 | 60 | 29 | 16 | PEH200YK4100M-- |
| 1500 | 65 x 105 | O | 9.3 | 39.2 | 28.2 | 43 | 22 | 16 | PEH200YO4150M-- |
| 1500 | 75 x 78 | L | 9.6 | 42.3 | 28.5 | 43 | 22 | 17 | PEH200YL4150M-- |
| 1800 | 65 x 105 | O | 10.6 | 47.8 | 34.0 | 43 | 22 | 17 | PEH200YO418AM-- |
| 2200 | 75 x 105 | T | 12.1 | 50.1 | 35.6 | 29 | 15 | 17 | PEH200YT4220M-- |
| 2200 | 90 x 78 | M | 12.7 | 52.4 | 35.8 | 30 | 16 | 16 | PEH200YM4220M-- |
| 3300 | 75 x 115 | U | 14.2 | 52.5 | 37.7 | 30 | 16 | 17 | PEH200YU433CM-- |
| 3300 | 75 x 145 | V | 14.7 | 57.3 | 43.7 | 20 | 10 | 17 | PEH200YV4330M-- |
| 3300 | 90 x 98 | N | 16.1 | 61.9 | 43.9 | 21 | 11 | 16 | PEH200YN4330M-- |
| 4700 | 75 x 145 | V | 17.9 | 68.3 | 50.4 | 14 | 7 | 17 | PEH200YV447BM-- |
| 4700 | 75 x 220 | X | 16.8 | 59.3 | 47.6 | 14 | 8 | 17 | PEH200YX4470M-- |
| 4700 | 90 x 145 | Y | 18.9 | 61.4 | 46.9 | 16 | 9 | 16 | PEH200YY4470M-- |
| 6000 | 75 x 220 | X | 18.5 | 60.5 | 47.8 | 12 | 7 | 17 | PEH200YX460BQ-- |
| 8200 | 90 x 220 | Z | 24.9 | 77.7 | 63.4 | 10 | 5 | 16 | PEH200YZ4820M-- |
| 500 VDC (U_R) | | | | | | | | | |
| 100 | 35 x 51 | A | 1.5 | 6.1 | 3.9 | 1000 | 590 | 12 | PEH200ZA3100M-- |
| 150 | 35 x 60 | B | 1.9 | 7.5 | 4.9 | 670 | 390 | 12 | PEH200ZB3150M-- |
| 220 | 35 x 75 | C | 2.3 | 8.4 | 5.8 | 505 | 310 | 12 | PEH200ZC3220M-- |
| 220 | 50 x 49 | G | 2.5 | 10.1 | 6.1 | 520 | 320 | 12 | PEH200ZG3220M-- |
| 330 | 35 x 95 | D | 2.9 | 10.7 | 7.7 | 300 | 180 | 12 | PEH200ZD3330M-- |
| 470 | 50 x 75 | H | 4.2 | 15.8 | 10.5 | 220 | 130 | 16 | PEH200ZH3470M-- |
| 680 | 50 x 95 | J | 5.1 | 18.4 | 12.8 | 150 | 90 | 16 | PEH200ZJ3680M-- |
| 1000 | 65 x 105 | O | 6.8 | 21.4 | 15.5 | 130 | 79 | 16 | PEH200ZO4100M-- |
| 1500 | 75 x 105 | T | 9.2 | 29.8 | 21.0 | 82 | 52 | 17 | PEH200ZT4150M-- |
| 1800 | 65 x 105 | O | 10.6 | 40.9 | 28.2 | 44 | 29 | 16 | PEH200ZO418HM-- |
| 2200 | 75 x 145 | V | 11.1 | 33.7 | 25.1 | 58 | 38 | 17 | PEH200ZV4220M-- |
| 3300 | 75 x 220 | X | 12.8 | 36.5 | 29.0 | 38 | 25 | 17 | PEH200ZX4330M-- |

* Maximum values. ** 2 m/s forced air, studmounted on 3°C/W aluminium chassis.

ARTICLE TABLE PEH 200 (85°C)

| C_R | D x L | Case code | I_{RAC}^* 85°C | I_{RAC}^* 50°C ** | I_{RAC}^* 40°C | ESR* 20°C | ESR* 20°C | L_{ESL} Approx. | Article code |
|-----------------------------------|----------|-----------|---------------------|---------------------------|---------------------|---------------------|----------------------|----------------------|---------------------------------|
| μF | mm | | 100 Hz A | 10 kHz A | 10 kHz A | 100 Hz $m\Omega$ | 100 kHz $m\Omega$ | nH | U2 = Plain can B2 = Stud can |
| 500 VDC (U_R) | | | | | | | | | |
| 3300 | 90 x 145 | Y | 15.7 | 46.9 | 35.4 | 38 | 24 | 16 | PEH200ZY4330M-- |
| 5600 | 90 x 220 | Z | 19.6 | 53.4 | 42.6 | 25 | 17 | 16 | PEH200ZZ4560M-- |
| 550 VDC (U_R) | | | | | | | | | |
| 680 | 65 x 105 | O | 6.6 | 21.1 | 15.4 | 160 | 110 | 16 | PEH200TO3680M-- |
| 1000 | 65 x 105 | O | 8.0 | 25.2 | 17.9 | 120 | 76 | 16 | PEH200TO4100M-- |
| 1200 | 90 x 78 | M | 10.2 | 33.7 | 22.6 | 97 | 63 | 16 | PEH200TM412AM-- |
| 1200 | 75 x 105 | T | 9.5 | 30.5 | 21.6 | 96 | 62 | 17 | PEH200TT4120M-- |
| 1500 | 75 x 145 | V | 10.6 | 32.3 | 24.4 | 77 | 49 | 17 | PEH200TV4150M-- |
| 1800 | 75 x 145 | V | 11.6 | 35.3 | 26.3 | 66 | 42 | 17 | PEH200TV4180M-- |
| 2200 | 75 x 220 | X | 11.1 | 29.4 | 24.1 | 65 | 45 | 17 | PEH200TX4220M-- |
| 2700 | 75 x 220 | X | 13.4 | 37.8 | 30.1 | 45 | 29 | 17 | PEH200TX4270M-- |
| 2700 | 90 x 145 | Y | 15.7 | 44.4 | 33.7 | 47 | 30 | 16 | PEH200TY4270M-- |

* Maximum values. ** 2 m/s forced air, studmounted on 3°C/W aluminium chassis.

PEH200 - INCREASED SURGE VOLTAGE (1,15X_{U_R}) AND TRANSIENT CAPABILITY

*** Transient measurements

Procedure

The transient voltage has been determined in the following way. Before measurement, the capacitor is charged to the rated voltage at the maximum allowed ambient temperature for 12 hours. The capacitor is then placed in the test equipment and subjected to a transient corresponding to the surge voltage. Note that no operating

voltage is applied over the capacitor. The voltage of the capacitor bank in the test equipment is increased 100 V between each pulse. Pulses are applied until the capacitor breaks. Data from the last pulse the capacitor withstand are evaluated. This procedure is repeated for 25 capacitors.

Data evaluation

The average value, μ , and the standard deviation, σ , of the maximum voltage for the 25 measurements are calculated. The transient voltage U_T is then taken as: $U_T = \mu - 2\sigma$

ARTICLE TABLE PEH 200 (85°C)

| C _R | D x L | Case code | I _{RAC} * 85°C 100 Hz A | I _{RAC} * 50°C** 10 kHz A | I _{RAC} * 40°C 10 kHz A | ESR* 20°C 100 Hz mΩ | ESR* 20°C 100kHz mΩ | L _{ESL} Approx. nH | U _T *** V | Article code |
|------------------------------------------------------------|----------|-----------|-------------------------------------------|---------------------------------------------|-------------------------------------------|------------------------------|------------------------------|-----------------------------------|-------------------------|---------------------------------|
| μF | mm | | | | | | | | | U2 = Plain can B2 = Stud can |
| 400 VDC (U_R), (U_{SURGE} = 460V) | | | | | | | | | | |
| 220 | 35 x 51 | A | 2.1 | 12.3 | 7.7 | 400 | 230 | 12 | 720 | PEH200VA322TM-- |
| 330 | 35 x 75 | C | 2.7 | 14.3 | 9.9 | 270 | 150 | 12 | 710 | PEH200VC333TM-- |
| 470 | 50 x 49 | G | 3.6 | 18.7 | 11.2 | 200 | 120 | 16 | 700 | PEH200VG347TM-- |
| 560 | 35 x 95 | D | 3.6 | 18.0 | 12.9 | 160 | 91 | 12 | 700 | PEH200VD356TM-- |
| 820 | 50 x 75 | H | 5.2 | 25.2 | 16.7 | 110 | 65 | 16 | 680 | PEH200VH382TM-- |
| 1500 | 50 x105 | K | 7.2 | 31.0 | 22.0 | 63 | 37 | 16 | 660 | PEH200VK415TM-- |
| 2200 | 65 x105 | O | 9.7 | 36.8 | 25.8 | 46 | 29 | 16 | 640 | PEH200VO422TM-- |
| 2200 | 75 x 78 | L | 10.0 | 41.1 | 27.2 | 45 | 28 | 17 | 640 | PEH200VL422TM-- |
| 2700 | 90 x 78 | M | 12.6 | 52.0 | 35.0 | 36 | 22 | 16 | 640 | PEH200VM427TM-- |
| 3300 | 75 x105 | T | 12.7 | 48.4 | 33.6 | 31 | 19 | 17 | 630 | PEH200VT433TM-- |
| 4700 | 75 x145 | V | 15.3 | 55.7 | 41.6 | 21 | 13 | 17 | 630 | PEH200VV447TM-- |
| 4700 | 90 x 98 | N | 16.7 | 60.9 | 42.5 | 22 | 14 | 16 | 630 | PEH200VN447TM-- |
| 8200 | 75 x 220 | X | 18.7 | 59.1 | 46.5 | 13 | 9 | 17 | 630 | PEH200VX482TM-- |
| 8200 | 90 x 145 | Y | 22.5 | 73.6 | 54.9 | 13 | 9 | 16 | 630 | PEH200VY482TM-- |
| 12000 | 90 x 220 | Z | 26.3 | 78.3 | 62.4 | 10 | 6 | 16 | 630 | PEH200VZ512TM-- |
| 420 VDC (U_R), (U_{SURGE} = 480V) | | | | | | | | | | |
| 150 | 35 x 51 | A | 1.8 | 10.6 | 6.7 | 490 | 260 | 12 | 740 | PEH200OA315TM-- |
| 270 | 35 x 75 | C | 2.6 | 13.6 | 9.4 | 280 | 140 | 12 | 730 | PEH200OC327TM-- |
| 330 | 50 x 49 | G | 3.2 | 18.5 | 11.1 | 230 | 120 | 16 | 720 | PEH200OG333TM-- |
| 390 | 35 x 95 | D | 3.1 | 15.4 | 11.2 | 190 | 100 | 12 | 720 | PEH200OD339TM-- |
| 680 | 50 x 75 | H | 5.0 | 26.0 | 17.2 | 110 | 60 | 16 | 700 | PEH200OH368TM-- |
| 1000 | 50 x105 | K | 6.3 | 30.2 | 21.1 | 77 | 41 | 16 | 680 | PEH200OK410TM-- |
| 1500 | 75 x 78 | L | 9.0 | 41.1 | 27.2 | 53 | 29 | 17 | 660 | PEH200OL415TM-- |
| 1800 | 65 x105 | O | 9.4 | 38.2 | 26.9 | 46 | 26 | 16 | 660 | PEH200OO418TM-- |
| 2200 | 90 x 78 | M | 12.0 | 51.5 | 34.6 | 37 | 21 | 16 | 650 | PEH200OM422TM-- |
| 2700 | 75 x105 | T | 12.3 | 50.3 | 35.1 | 31 | 17 | 17 | 650 | PEH200OT427TM-- |
| 3300 | 90 x 98 | N | 15.3 | 61.1 | 42.7 | 25 | 14 | 16 | 650 | PEH200ON433TM-- |
| 3900 | 75 x 145 | V | 14.9 | 56.7 | 42.1 | 21 | 12 | 17 | 650 | PEH200OV439TM-- |
| 5600 | 75 x 220 | X | 17.0 | 59.1 | 46.2 | 15 | 9 | 17 | 650 | PEH200OX456TM-- |
| 5600 | 90 x 145 | Y | 18.8 | 60.9 | 45.6 | 19 | 12 | 16 | 650 | PEH200OY456TM-- |
| 8200 | 90 x 220 | Z | 23.9 | 77.9 | 62.2 | 11 | 7 | 16 | 650 | PEH200OZ482TM-- |
| 450 VDC (U_R), (U_{SURGE} = 515V) | | | | | | | | | | |
| 150 | 35 x 51 | A | 1.8 | 10.2 | 6.5 | 500 | 280 | 12 | 770 | PEH200YA315TM-- |
| 270 | 35 x 75 | C | 2.6 | 13.1 | 9.1 | 280 | 160 | 12 | 760 | PEH200YC327TM-- |
| 330 | 50 x 49 | G | 3.3 | 18.1 | 10.8 | 230 | 130 | 16 | 750 | PEH200YG333TM-- |
| 390 | 35 x 95 | D | 3.2 | 15.1 | 11.1 | 190 | 100 | 12 | 750 | PEH200YD339TM-- |
| 680 | 50 x 75 | H | 5.1 | 25.3 | 16.8 | 110 | 64 | 16 | 730 | PEH200YH368TM-- |
| 1000 | 50 x 105 | K | 6.4 | 29.3 | 20.7 | 78 | 45 | 16 | 710 | PEH200YK410TM-- |
| 1500 | 75 x 78 | L | 9.2 | 40.8 | 27.3 | 54 | 31 | 17 | 700 | PEH200YL415TM-- |

* Maximum specified values. ** 2 m/s forced air, studmounted on 3 °C/W aluminium chassis.

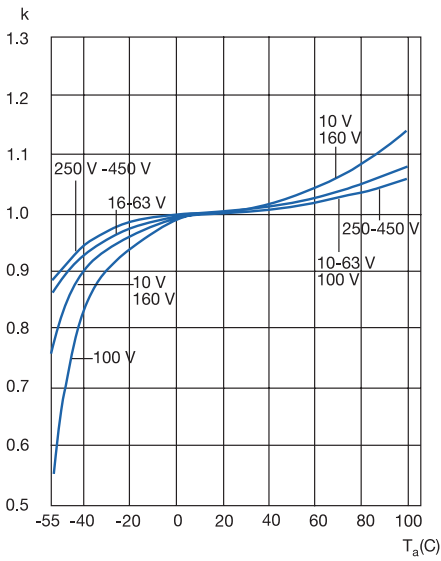
ARTICLE TABLE PEH 200 (85°C)

| C_R | D x L | Case code | I_{RAC}^* 85°C 100 Hz | I_{RAC}^* 50°C ** 10 kHz | I_{RAC}^* 40°C 10 kHz | ESR* 20°C 100 Hz | ESR* 20°C 100kHz | L_{ESL} Approx. | U_T^{***} | Article code |
|------------------------------------------------------|----------|-----------|-------------------------------|----------------------------------|-------------------------------|------------------------|------------------------|----------------------|-------------|-----------------|
| μF | mm | | A | A | A | m Ω | m Ω | nH | V | |
| 450 VDC (UR), ($U_{SURGE} = 515V$) | | | | | | | | | | |
| 1800 | 65 x 105 | O | 9.6 | 36.8 | 25.8 | 47 | 29 | 16 | 690 | PEH200YO418TM-- |
| 2200 | 90 x 78 | M | 12.4 | 52.0 | 34.9 | 37 | 22 | 16 | 690 | PEH200YM422TM-- |
| 2700 | 75 x 105 | T | 12.6 | 50.0 | 35.2 | 31 | 19 | 17 | 680 | PEH200YT427TM-- |
| 3300 | 90 x 98 | N | 15.6 | 61.2 | 42.9 | 25 | 15 | 16 | 680 | PEH200YN433TM-- |
| 3900 | 75 x 145 | V | 15.1 | 55.8 | 41.7 | 22 | 13 | 17 | 680 | PEH200YV439TM-- |
| 5600 | 90 x 145 | Y | 20.7 | 72.7 | 55.0 | 15 | 10 | 16 | 680 | PEH200YY456TM-- |
| 6800 | 75 x 220 | X | 18.6 | 59.9 | 46.7 | 14 | 9 | 17 | 680 | PEH200YX468TM-- |
| 10000 | 90 x 220 | Z | 25.9 | 78.0 | 62.5 | 9 | 6 | 16 | 680 | PEH200YZ510TM-- |

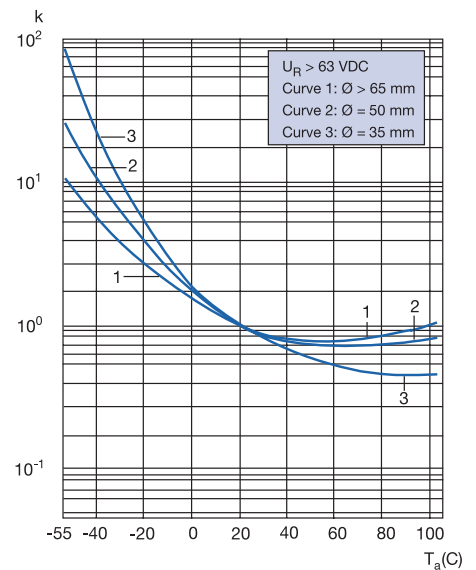
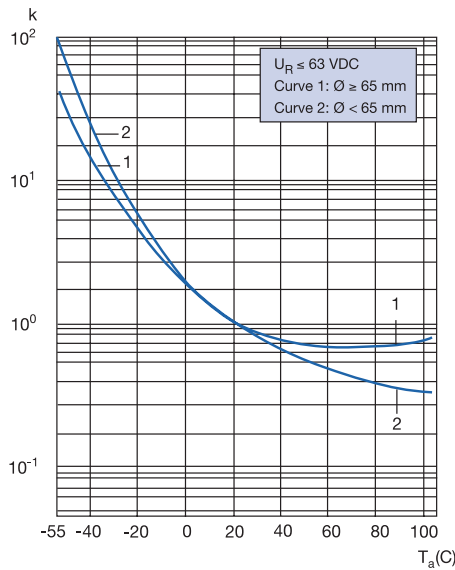
* Maximum specified values. ** 2 m/s forced air, studmounted on 3 °C/W aluminium chassis.

TECHNICAL DATA PEH 200 (85°C)

The capacitance vs ambient temperature (T_a) at $f = 100$ Hz



ESR as a function of ambient temperature (T_a) at $f = 100$ kHz. $k = R_{ESR}(T_a)/R_{ESR}(20^\circ C)$



LEAKAGE CURRENT

Rated leakage current, I_{RL} (μA)

Rated voltage, U_R (V)

Rated capacitance, C_R (μF) $I_{RL} = 0.003 \times C_R \times U_R + 4$ ($U_R \leq 500V$)
 $I_{RL} = 0.006 \times C_R \times U_R + 4$

THERMAL RESISTANCE

R_{th} – short form table versus chassis area and air speed

| D x L | Case code | STUDMOUNTED | | | | CLIPMOUNTED | |
|----------|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-------------|-----------|
| | | $R_{thhs} = 3^{\circ}C/W$ (0.5 m/s) | $R_{thhs} = 2^{\circ}C/W$ (0.5 m/s) | $R_{thhs} = 3^{\circ}C/W$ (2.0 m/s) | $R_{thhs} = 2^{\circ}C/W$ (2.0 m/s) | (0.5 m/s) | (2.0 m/s) |
| 35 x 47 | E | 5.6 | 5.3 | 4.5 | 4.4 | 11.9 | 8.3 |
| 35 x 51 | A | 5.6 | 5.3 | 4.5 | 4.4 | 10.6 | 7.4 |
| 35 x 60 | B | 5.4 | 5.1 | 4.4 | 4.3 | 9.8 | 7.0 |
| 35 x 75 | C | 5.3 | 5.1 | 4.4 | 4.3 | 9.2 | 6.7 |
| 35 x 95 | D | 5.3 | 5.1 | 4.4 | 4.3 | 8.9 | 6.7 |
| 50 x 49 | G | 3.3 | 2.9 | 2.8 | 2.5 | 6.7 | 4.5 |
| 50 x 75 | H | 3.6 | 3.3 | 2.8 | 2.7 | 6.3 | 4.4 |
| 50 x 95 | J | 3.4 | 3.2 | 2.7 | 2.6 | 5.8 | 4.2 |
| 50 x 105 | K | 3.4 | 3.2 | 2.7 | 2.6 | 5.8 | 4.2 |
| 50 x 115 | I | 3.4 | 3.2 | 2.7 | 2.6 | 5.8 | 4.2 |
| 65 x 105 | O | 2.6 | 2.4 | 2.1 | 2.0 | 4.2 | 3.1 |
| 65 x 115 | Q | 2.6 | 2.4 | 2.1 | 2.0 | 4.2 | 3.1 |
| 65 x 130 | S | 2.6 | 2.4 | 2.1 | 2.0 | 4.2 | 3.1 |
| 65 x 140 | R | 2.6 | 2.4 | 2.1 | 2.0 | 4.2 | 3.1 |
| 75 x 78 | L | 2.3 | 2.0 | 1.8 | 1.7 | 4.1 | 2.7 |
| 75 x 98 | P | 2.3 | 2.0 | 1.8 | 1.7 | 4.0 | 2.7 |
| 75 x 105 | T | 2.3 | 2.1 | 1.7 | 1.6 | 3.7 | 2.6 |
| 75 x 115 | U | 2.2 | 2.0 | 1.6 | 1.5 | 3.5 | 2.5 |
| 75 x 145 | V | 2.2 | 2.0 | 1.6 | 1.5 | 3.4 | 2.5 |
| 75 x 220 | X | 2.3 | 2.1 | 2.0 | 1.9 | 3.4 | 2.6 |
| 90 x 78 | M | 1.9 | 1.7 | 1.6 | 1.4 | 3.4 | 2.2 |
| 90 x 98 | N | 1.9 | 1.7 | 1.5 | 1.4 | 3.1 | 2.1 |
| 90 x 145 | Y | 1.8 | 1.6 | 1.5 | 1.4 | 2.7 | 1.9 |
| 90 x 220 | Z | 1.9 | 1.7 | 1.6 | 1.5 | 2.7 | 2.0 |

OPERATIONAL DATA

Please see operational lifetime section.

RELIABILITY

The failure rate is derived from our periodic test results. The failure rate (λ_p) is therefore only given at test temperature for life tests. An estimation is also given at 60°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity.

| T_a | Failure rate per hour |
|-------|-----------------------|
| 85°C | 1×10^{-6} |
| 60°C | 1×10^{-7} |

Failure rate per hour for catastrophic plus parametric failures.

MECHANICAL DATA

Mounting position

The capacitor can be mounted upright or inclined to a horizontal position.

See "Accessories". Max tightening torque: M8: 3 Nm M12: 8 Nm. Max chassis thickness 5 mm. Mounting hole: See "Accessories".

Insulation can

PEH200 is supplied with a polypropylene insulation can, thickness 0.8 mm. Voltage proof of the insulation sleeve: ≥ 4000 VDC.

Clamp fixing

Clips must be ordered separately. See "Accessories".

Screw terminals

M5 x 10 according to DIN 41.248. Max tightening torque: 2.5 Nm. Must be ordered separately: See "Accessories". Recommended max connector thickness with delivered screw: 4 mm. M6 thread on request.

PVC shrink sleeve only on request.

Stud fixing

Nylon cap nut must be ordered separately. For the stud fixing insulated version the outer insulation serves as lock washer.

ORDERING INFORMATION

For further ordering information please see page 8.

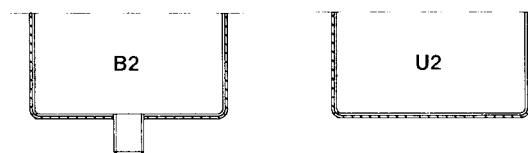
Pos 1-20

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|--|
| P | E | H | 2 | 0 | 0 | K | U | 6 | 1 | 5 | 0 | M | B | 2 | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |

Capacitance tolerances:

Pos. 13:M: -20 to +20%

Pos. 14-15: B2 = with bottom stud
U2 = without bottom stud



Quantities and weights

| CASE CODE | A | B | C | D | E | G | H | I | J | K | L | M | N | O | P | R | Q | S | T | U | V | X | Y | Z |
|-----------------------|----|----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Weight approx (g) | 70 | 85 | 105 | 130 | 60 | 150 | 180 | 300 | 240 | 265 | 430 | 750 | 950 | 415 | 530 | 650 | 460 | 520 | 585 | 640 | 800 | 1400 | 1400 | 1500 |
| Standard box quantity | 42 | 42 | 42 | 42 | 42 | 20 | 20 | 20 | 20 | 20 | 9 | 6 | 6 | 12 | 9 | 12 | 12 | 12 | 9 | 9 | 9 | 9 | 6 | 6 |