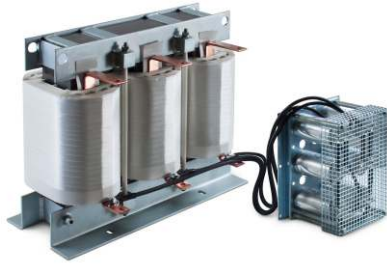


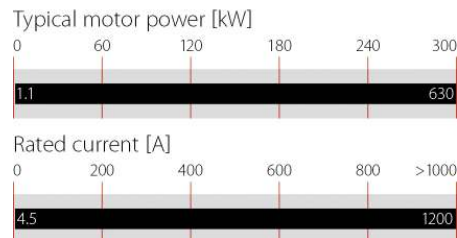
## LC Sine Wave Filter for Motor Drives



- Smooth sine wave without voltage peaks
- Perfect motor protection
- Reduce bearing currents
- Motor frequency up to 200 Hz
- Extended motor cable length capability



### Performance indicators



### Technical specifications

|                                                  |                                                      |
|--------------------------------------------------|------------------------------------------------------|
| <b>Approvals</b>                                 | UL 508 pending                                       |
| <b>Declaration of conformity</b>                 | CE / LVD                                             |
| <b>Design corresponding to</b>                   | IEC 61558-2-20                                       |
| <b>Environmental reliability</b>                 | IEC 60068-2-1                                        |
| <b>Flammability corresponding to</b>             | UL 94 V-2 or better                                  |
| <b>High potential test voltage</b>               | P → E 3000 VAC, 1 minute<br>P → P 2500 VAC, 1 minute |
| <b>Impedance (uk)</b>                            | 8 to 10% @ 400 V, 50 Hz and rated current            |
| <b>Insulation class</b>                          | EIS 200                                              |
| <b>Max. operating voltage</b>                    | 3x 500 VAC + 10%                                     |
| <b>Motor cable length</b>                        | Up to 2,000 m (see graph)                            |
| <b>Motor frequency</b>                           | 70 Hz (up to 200Hz with derating (see graph))        |
| <b>MTBF 1</b>                                    | >100,000 hours                                       |
| <b>Overload capability</b>                       | 1.5x rated current for 1 minute, once per hour       |
| <b>Protection category</b>                       | IP00 (FN 5040)<br>IP20 (FN 5045)                     |
| <b>Rated currents</b>                            | 4.5 to 1200 A @ 45 °C max.                           |
| <b>Residual ripple voltage</b>                   | <5%                                                  |
| <b>Switching frequency</b>                       | See filter selection table                           |
| <b>Temperature range (operation and storage)</b> | - 25 °C to +70 °C (25/070/21)                        |

### Approvals



UL508C up to 260 A. For use with AC or DC drives (power conversion equipment) only

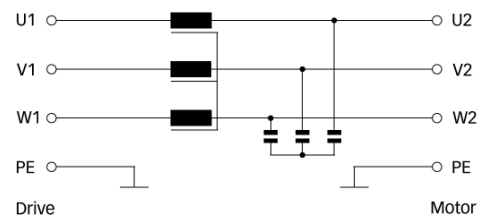
### Features and benefits

- Converts the rectangular PWM output voltage of motor drives into a smooth sine wave with low residual ripple
- Elimination of premature motor damage caused by high dv/dt, overvoltages, cable ringing, motor overheating, and eddy current losses
- Improves bearing life time because of bearing currents caused by circulating currents
- Complies with IEC 60034-17\* and NEMA-MG1 requirements for general purpose motors
- Optional with NEMA 1 protective cover

### Typical applications

- HVAC applications
- Pumps
- Ventilators
- Conveyors
- Compressors
- Elevators
- Cranes
- Medium voltage applications, deployed in front of the step-up transformer
- Retrofit installations with motor drives
- Motor drive with long motor cable
- Motor drive with multiple motors in parallel

### Typical electrical schematic



## Filter selection table

| Filter          | Rated<br>current<br>@ 45 °C/50<br>Hz | Rated<br>current<br>@ 45 °C/100<br>Hz | * Typical<br>motor<br>drive<br>rating | Nominal<br>inductance | Nominal<br>capacitance | Capacitance<br>connection | Min.<br>switching<br>frequency | **<br>Typical<br>power<br>loss | Input/Output<br>connections                                                                                                                                             | Weight |
|-----------------|--------------------------------------|---------------------------------------|---------------------------------------|-----------------------|------------------------|---------------------------|--------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                 | [A]                                  | [A]                                   | [kW]                                  | [mH]                  | [µF]                   |                           | [kHz]                          | [W]                            |   | [kg]   |
| FN 5040-4.5-82  | 4.5                                  | 4.05                                  | 1.1/1.5                               | 13                    | 2.2                    | Y                         | 4                              | 65                             | -82                                                                                                                                                                     | 3.3    |
| FN 5040-8-82    | 8                                    | 7.2                                   | 2.2/3                                 | 6.9                   | 4.7                    | Y                         | 4                              | 80                             | -82                                                                                                                                                                     | 4.6    |
| FN 5040-10-83   | 10                                   | 9                                     | 4                                     | 5.2                   | 6.8                    | Y                         | 4                              | 90                             | -83                                                                                                                                                                     | 6.1    |
| FN 5040-17-83   | 17                                   | 15.3                                  | 5.5/7.5                               | 3.1                   | 10                     | Y                         | 4                              | 115                            | -83                                                                                                                                                                     | 7.8    |
| FN 5040-24-84   | 24                                   | 21.6                                  | 11                                    | 2.4                   | 10                     | Y                         | 4                              | 150                            | -84                                                                                                                                                                     | 14.4   |
| FN 5040-38-84   | 38                                   | 34.2                                  | 15/18.5                               | 1.6                   | 10                     | Y                         | 4                              | 170                            | -84                                                                                                                                                                     | 25.0   |
| FN 5040-48-85   | 48                                   | 43.2                                  | 22                                    | 1.1                   | 14.7                   | Y                         | 4                              | 260                            | -85                                                                                                                                                                     | 33.0   |
| FN 5040-62-86   | 62                                   | 55.8                                  | 30                                    | 0.85                  | 30                     | Y                         | 3                              | 280                            | -86                                                                                                                                                                     | 36.0   |
| FN 5040-75-87   | 75                                   | 67.5                                  | 37                                    | 0.75                  | 30                     | Y                         | 3                              | 330                            | -87                                                                                                                                                                     | 42.0   |
| FN 5040-115-87  | 115                                  | 103.5                                 | 45/55                                 | 0.5                   | 20                     | Δ                         | 3                              | 500                            | -87                                                                                                                                                                     | 68.0   |
| FN 5040-180-99  | 180                                  | 162                                   | 75/90                                 | 0.3                   | 33                     | Δ                         | 3                              | 680                            | -99                                                                                                                                                                     | 86.0   |
| FN 5040-260-99  | 260                                  | 234                                   | 110/132                               | 0.2                   | 47                     | Δ                         | 3                              | 880                            | -99                                                                                                                                                                     | 125.0  |
| FN 5040-410-99  | 410                                  | 369                                   | 160/200                               | 0.13                  | 66                     | Δ                         | 3                              | 1100                           | -99                                                                                                                                                                     | 184.0  |
| FN 5040-480-99  | 480                                  | 432                                   | 250                                   | 0.11                  | 94                     | Δ                         | 3                              | 1350                           | -99                                                                                                                                                                     | 235.0  |
| FN 5040-660-99  | 660                                  | 594                                   | 315/355                               | 0.14                  | 141                    | Δ                         | 2                              | 2000                           | -99                                                                                                                                                                     | 310.0  |
| FN 5040-750-99  | 750                                  | 675                                   | 400                                   | 0.12                  | 165                    | Δ                         | 2                              | 2800                           | -99                                                                                                                                                                     | 470.0  |
| FN 5040-880-99  | 880                                  | 792                                   | 400/500                               | 0.11                  | 188                    | Δ                         | 2                              | 3400                           | -99                                                                                                                                                                     | 640.0  |
| FN 5040-1200-99 | 1200                                 | 1080                                  | 560/630                               | 0.075                 | 282                    | Δ                         | 2                              | 3800                           | -99                                                                                                                                                                     | 680.0  |
| FN 5045-4.5-44  | 4.5                                  | 4.05                                  | 1.1/1.5                               | 13                    | 2.2                    | Y                         | 4                              | 65                             | -44                                                                                                                                                                     | 4.1    |
| FN 5045-8-44    | 8                                    | 7.2                                   | 2.2/3                                 | 6.9                   | 4.7                    | Y                         | 4                              | 80                             | -44                                                                                                                                                                     | 5.4    |
| FN 5045-10-44   | 10                                   | 9                                     | 4                                     | 5.2                   | 6.8                    | Y                         | 4                              | 90                             | -44                                                                                                                                                                     | 6.9    |
| FN 5045-17-33   | 17                                   | 15.3                                  | 5.5/7.5                               | 3.1                   | 10                     | Y                         | 4                              | 115                            | -33                                                                                                                                                                     | 9.0    |
| FN 5045-24-33   | 24                                   | 21.6                                  | 11                                    | 2.4                   | 10                     | Y                         | 4                              | 150                            | -33                                                                                                                                                                     | 15.6   |
| FN 5045-38-33   | 38                                   | 34.2                                  | 15/18.5                               | 1.6                   | 10                     | Y                         | 4                              | 170                            | -33                                                                                                                                                                     | 18.9   |
| FN 5045-48-34   | 48                                   | 43.2                                  | 22                                    | 1.1                   | 14.7                   | Y                         | 4                              | 260                            | -34                                                                                                                                                                     | 35.8   |
| FN 5045-62-34   | 62                                   | 55.8                                  | 30                                    | 0.85                  | 30                     | Y                         | 3                              | 280                            | -34                                                                                                                                                                     | 37.8   |
| FN 5045-75-35   | 75                                   | 67.5                                  | 37                                    | 0.75                  | 30                     | Y                         | 3                              | 330                            | -35                                                                                                                                                                     | 60.0   |
| FN 5045-115-35  | 115                                  | 103.5                                 | 45/55                                 | 0.5                   | 20                     | Δ                         | 3                              | 500                            | -35                                                                                                                                                                     | 70.0   |
| FN 5045-180-99  | 180                                  | 162                                   | 75/90                                 | 0.3                   | 33                     | Δ                         | 3                              | 680                            | -99                                                                                                                                                                     | 92.0   |
| FN 5045-260-99  | 260                                  | 234                                   | 110/132                               | 0.2                   | 47                     | Δ                         | 3                              | 880                            | -99                                                                                                                                                                     | 131.0  |
| FN 5045-410-99  | 410                                  | 369                                   | 160/200                               | 0.13                  | 66                     | Δ                         | 3                              | 1100                           | -99                                                                                                                                                                     | 198.0  |
| FN 5045-480-99  | 480                                  | 432                                   | 250                                   | 0.11                  | 94                     | Δ                         | 3                              | 1350                           | -99                                                                                                                                                                     | 243.0  |
| FN 5045-660-99  | 660                                  | 594                                   | 315/355                               | 0.14                  | 141                    | Δ                         | 2                              | 2000                           | -99                                                                                                                                                                     | 425.0  |
| FN 5045-750-99  | 750                                  | 675                                   | 400                                   | 0.12                  | 165                    | Δ                         | 2                              | 2800                           | -99                                                                                                                                                                     | 482.0  |
| FN 5045-880-99  | 880                                  | 792                                   | 400/500                               | 0.11                  | 188                    | Δ                         | 2                              | 3400                           | -99                                                                                                                                                                     | 652.0  |
| FN 5045-1200-99 | 1200                                 | 1080                                  | 560/630                               | 0.075                 | 282                    | Δ                         | 2                              | 3800                           | -99                                                                                                                                                                     | 692.0  |

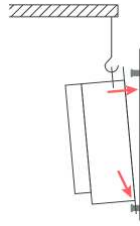
\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

## Installation

### Filter placement

Lift the filter with appropriate crane using lifting eye bolts – smaller types may be lifted manually by two persons (no lifting eye bolt applicable).



### Wiring and connection

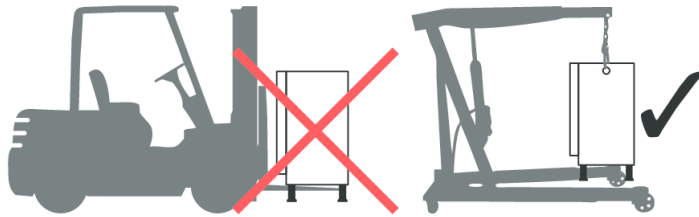
The filter rating has to be compatible with the inverter to which it is to be connected. All inverter manufacturer installation and safety instructions must be fulfilled. The typical block schematic is shown for a motor load but the load can be also multiple motors or a transformer. Inverter and load cable selection/placement should be in accordance with all local electrical standards and regulations. Filters with separate capacitor bank must be connected as follows:

### Required settings

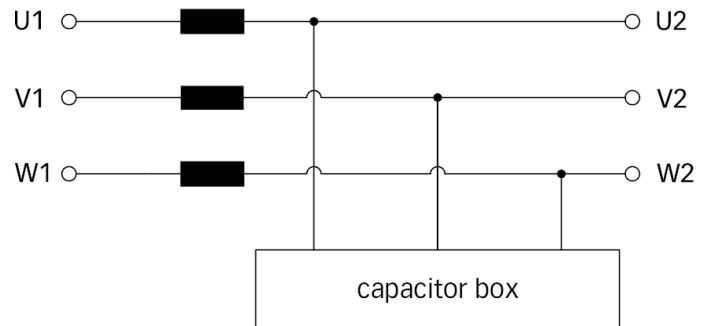
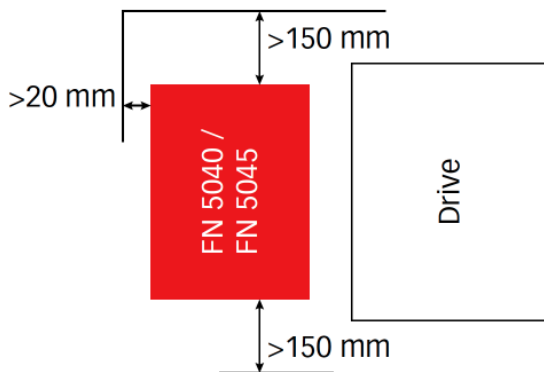
Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). Higher frequencies are allowed. The mode of operation must be "scalar" (V/Hz). Check the inverter manual whether special settings are necessary. In any doubt contact the inverter manufacturer.

**CAUTION:** If the inverter settings are not in accordance the filter may be damaged.

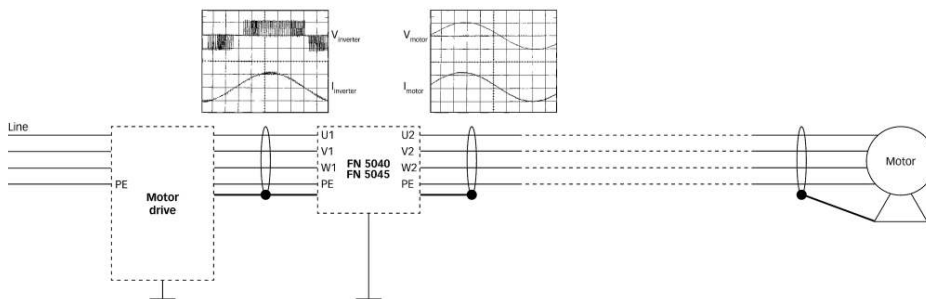
Never attempt to handle the filter with a forklift!



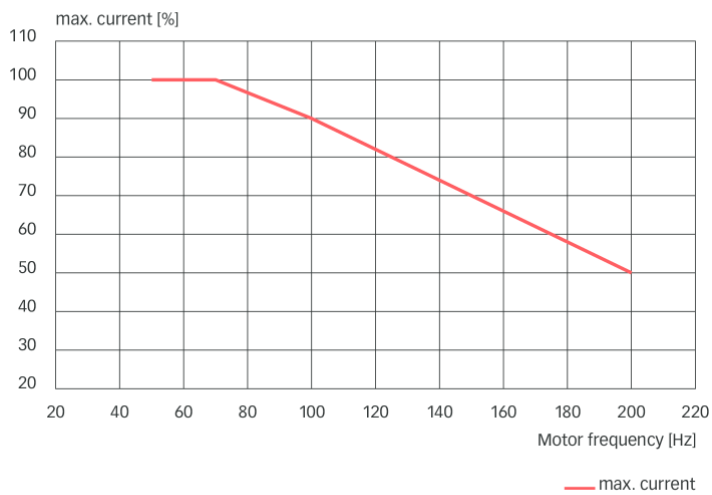
In order to ensure sufficient air flow, keep a distance of 150 mm above and below the filter to walls or other components. A 20 mm distance on either side is recommended.



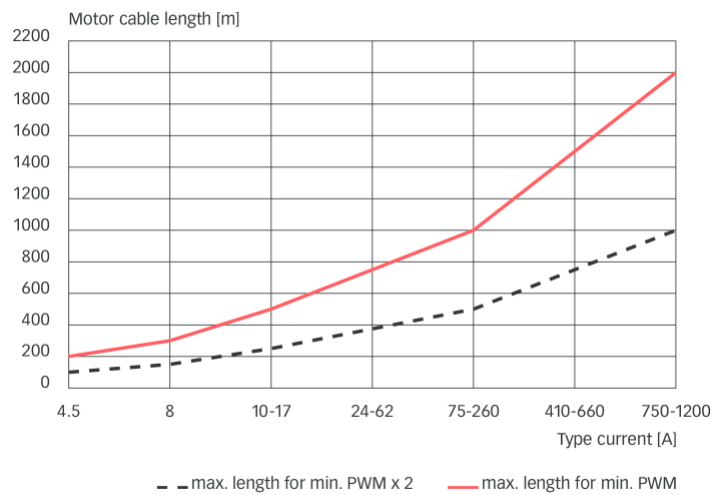
## Typical block schematic



## Motor frequency derating

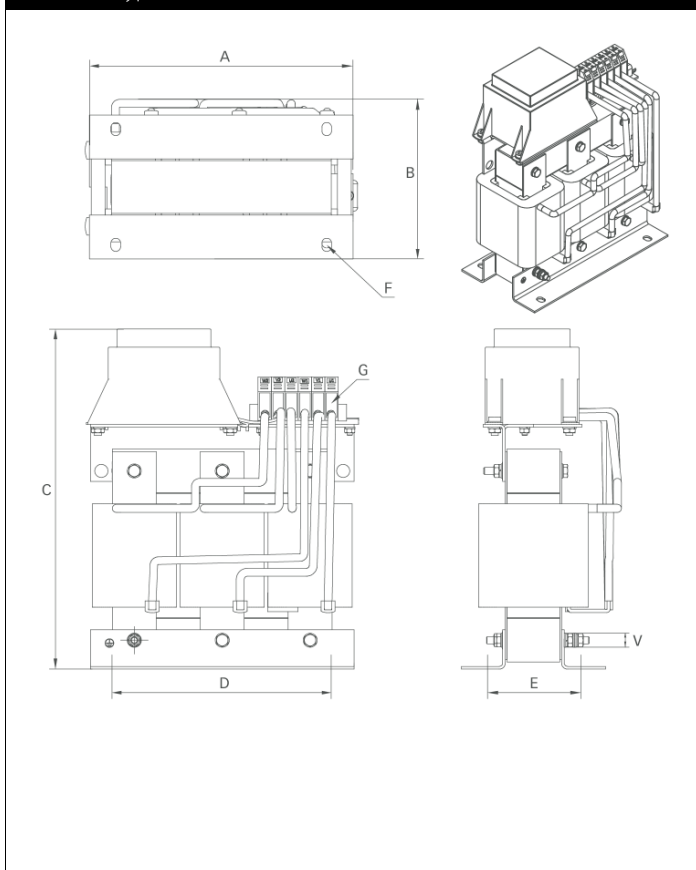


## Max. motor cable length

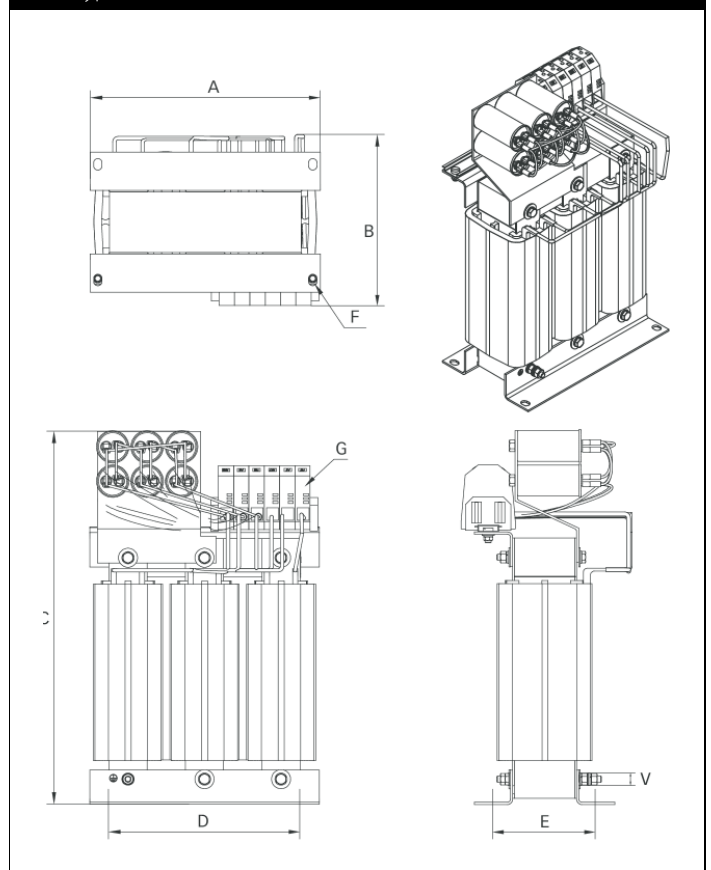


## Mechanical data FN 5040

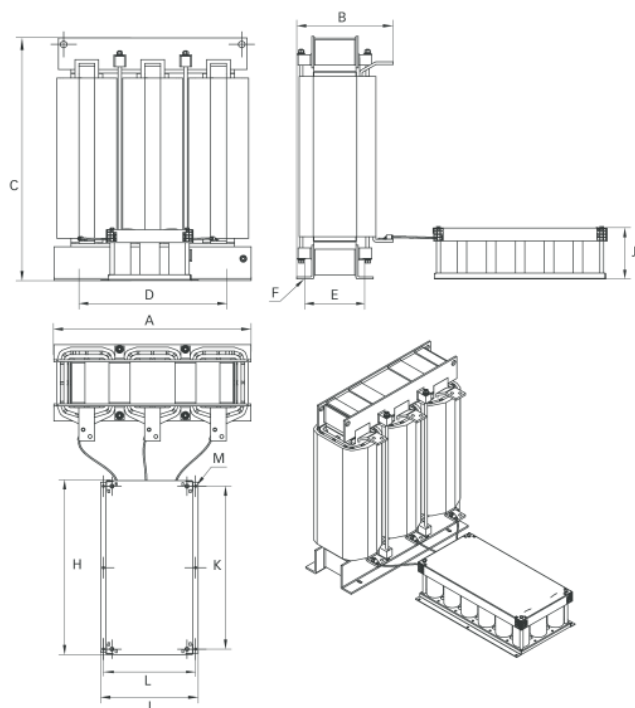
4.5 to 75 A types



115 A types



## 180 to 1200 A types\*



Cable length of capacitor box:

180 to 410 A = 1000 mm

480A to 1200 A = 1500 mm

## Dimensions FN 5040

|          | 4.5 A               | 8 A                 | 10 A              | 17 A              | 24 A               | 38 A               | 48 A               | 62 A               | 75 A               | 115 A              |
|----------|---------------------|---------------------|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| <b>A</b> | 125                 | 155                 | 155               | 190               | 190                | 230                | 300                | 320                | 305                | 305                |
| <b>B</b> | 77                  | 84                  | 94                | 115               | 116                | 151                | 171                | 190                | 240                | 236                |
| <b>C</b> | 171                 | 212                 | 208               | 224               | 224                | 275                | 355                | 395                | 395                | 495                |
| <b>D</b> | 100                 | 130                 | 123               | 170               | 170                | 180                | 240                | 240                | 240                | 280                |
| <b>E</b> | 55                  | 56                  | 71.5              | 57.5              | 77.5               | 122                | 137                | 132                | 162                | 151                |
| <b>F</b> | 5x8                 | 8x12                | 8x12              | 8x12              | 8x12               | 8x12               | 11x15              | 11x15              | 11x15              | 11x15              |
| <b>G</b> | 2.5 mm <sup>2</sup> | 2.5 mm <sup>2</sup> | 4 mm <sup>2</sup> | 4 mm <sup>2</sup> | 10 mm <sup>2</sup> | 10 mm <sup>2</sup> | 16 mm <sup>2</sup> | 35 mm <sup>2</sup> | 50 mm <sup>2</sup> | 50 mm <sup>2</sup> |
| <b>V</b> | M3                  | M4                  | M4                | M6                | M6                 | M8                 | M8                 | M8                 | M8                 | M8                 |

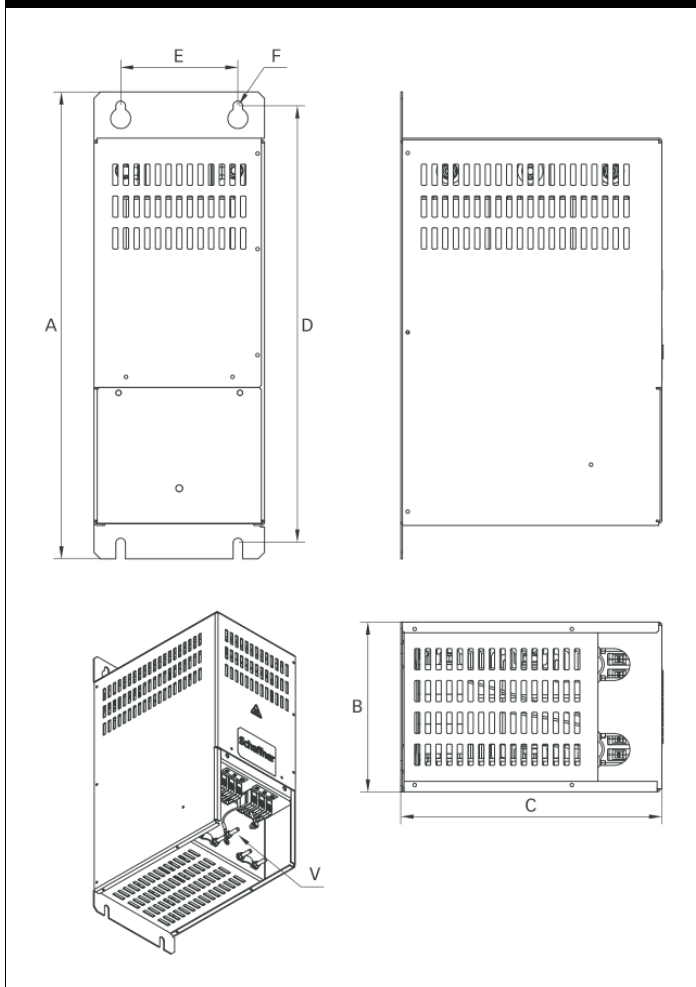
|          | 180 A     | 260 A     | 410 A     | 480 A     | 660 A     | 750 A     | 880 A | 1200 A    |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|-----------|
| <b>A</b> | 450       | 453       | 490       | 510       | 645       | 665       | 660   | 750       |
| <b>B</b> | 260       | 255       | 355       | 355       | 410       | 468       | 450   | 375       |
| <b>C</b> | 385       | 485       | 600       | 618       | 732       | 670       | 885   | 925       |
| <b>D</b> | 400       | 370       | 430       | 430       | 570       | 570       | 570   | 570       |
| <b>E</b> | 130       | 150       | 194       | 195       | 210       | 220       | 220   | 220       |
| <b>F</b> | 9x13      | 11x15     | 10.5x18.5 | 13x27     | 13x27     | 13x26     | 13x26 | 13x26     |
| <b>H</b> | 328       | 328       | 328       | 328       | 463       | 555       | 463   | 665       |
| <b>I</b> | 170       | 170       | 170       | 270       | 370       | 375       | 370   | 375       |
| <b>J</b> | 200       | 220       | 240       | 220       | 220       | 200       | 220   | 220       |
| <b>K</b> | 300 (150) | 300 (150) | 300 (150) | 300 (150) | 400 (200) | 510 (255) |       | 620 (310) |
| <b>L</b> | 150       | 150       | 150       | 250       | 350       | 350       | 350   | 350       |
| <b>M</b> | 9         | 9         | 9         | 9         | 9         | 9         | 9     | 9         |
| <b>V</b> | M10       | M10       | M10       | M10       | M10       | M10       | M10   | M10       |
| <b>W</b> | 25        | 25        | 40        | 40        | 40        | 40        | 50    | 60        |
| <b>X</b> | 13/15     | 13/15     | 13/16     | 13/20     | 20        | 20        | 14    | 17        |
| <b>Y</b> | 21        | 20        | 25        | 23        | 40        | 40        | 22    | 26        |
| <b>Z</b> | 10.3      | 10.3      | 10.3      | 10.3      | 14        | 14        | 14    | 14        |

All dimensions in mm; 1 inch = 25.4 mm

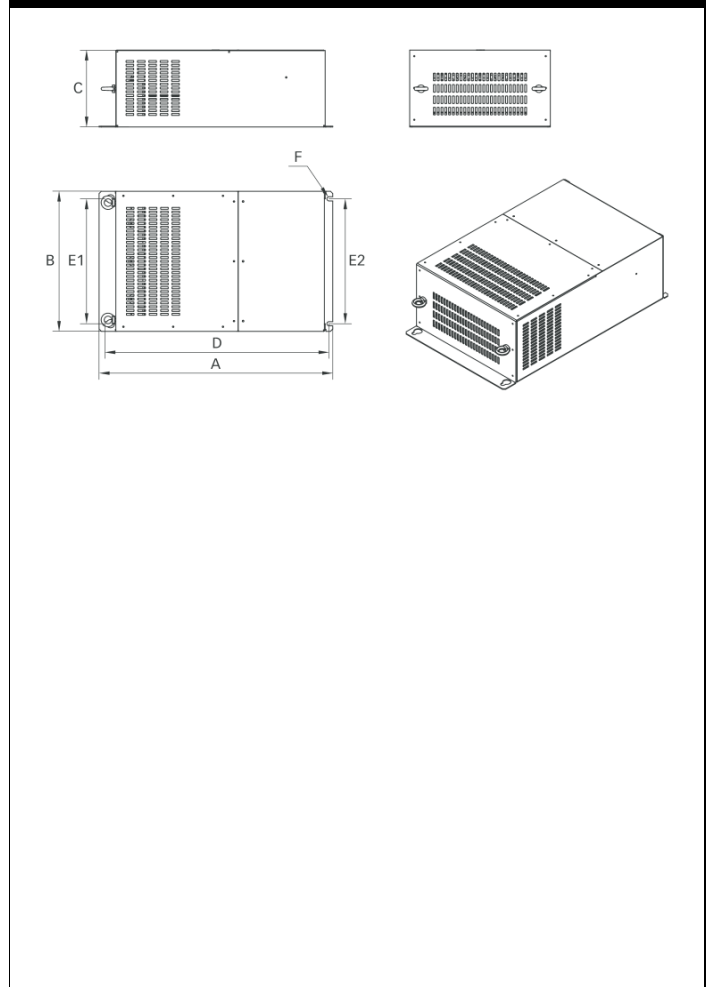
Tolerances according: ISO 2768-m / EN 22768-m

## Mechanical data FN 5045

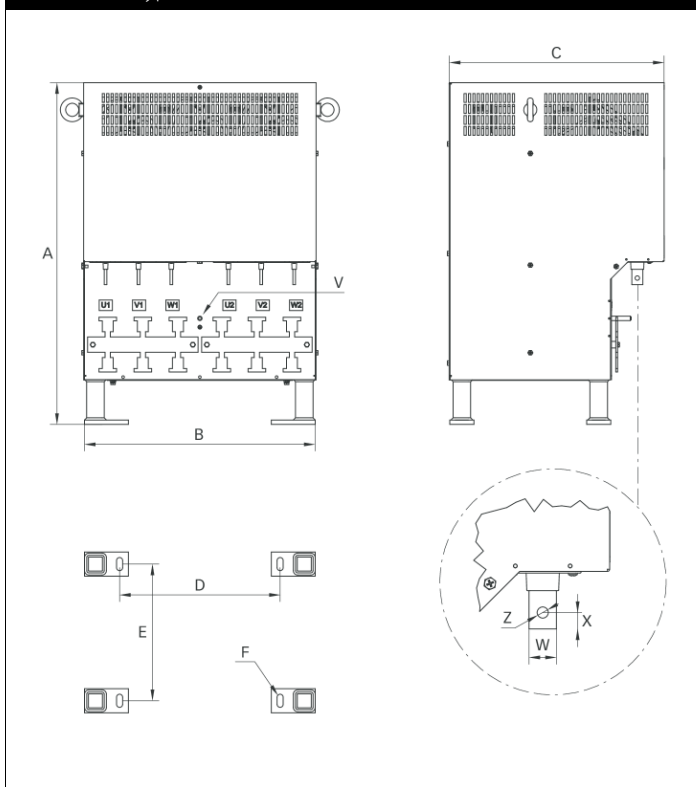
### 4.5 to 38 A types



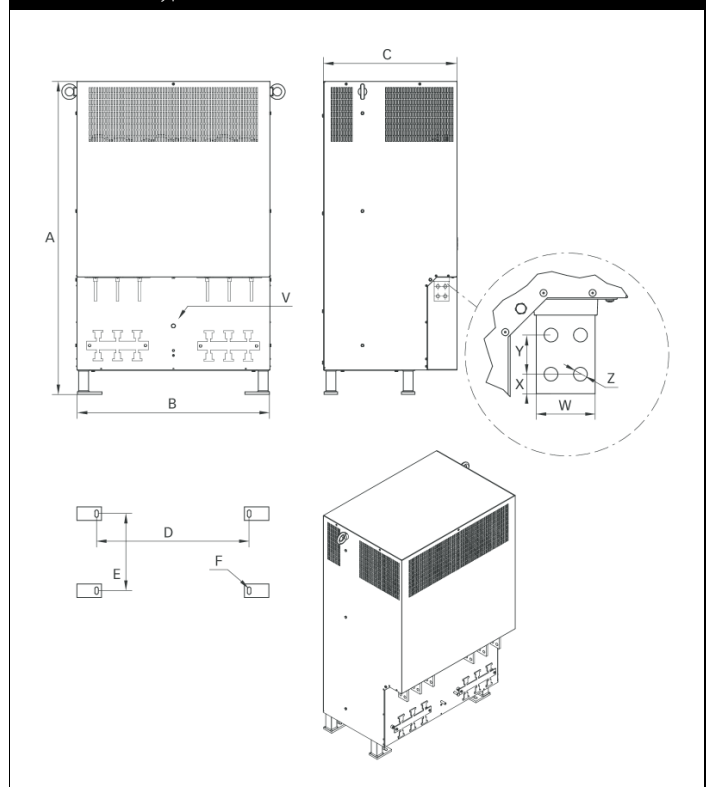
### 48 to 115 A types



### 180 to 480 A types



### 660 to 1200 A types



## Dimensions FN 5045

|          | 4.5 A | 8 A | 10 A | 17 A | 24 A | 38 A | 48 A | 62 A | 75 A | 115 A | 180 A | 260 A | 410 A | 480 A | 660 A | 750 A | 880 A | 1200 A |
|----------|-------|-----|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>A</b> | 330   | 330 | 330  | 440  | 440  | 440  | 515  | 515  | 615  | 615   | 650   | 650   | 780   | 780   | 1280  | 1280  | 1280  | 1280   |
| <b>B</b> | 100   | 100 | 100  | 160  | 160  | 160  | 320  | 320  | 370  | 370   | 508   | 508   | 538   | 538   | 794   | 794   | 794   | 794    |
| <b>C</b> | 165   | 165 | 165  | 245  | 245  | 245  | 153  | 153  | 203  | 203   | 400   | 400   | 494   | 494   | 498   | 498   | 550   | 550    |
| <b>D</b> | 310   | 310 | 310  | 412  | 412  | 412  | 488  | 488  | 590  | 590   | 336   | 336   | 336   | 336   | 622   | 622   | 622   | 622    |
| <b>E</b> | 60    | 60  | 60   | 110  | 110  | 110  | 280  | 280  | 330  | 330   | 243   | 243   | 312   | 312   | 315   | 315   | 315   | 315    |
| <b>F</b> | 7     | 7   | 7    | 9    | 9    | 9    | 9    | 9    | 11   | 11    | 14x30 | 14x30 | 14x30 | 14x30 | 14x30 | 14x30 | 14x30 | 14x30  |
| <b>J</b> | M5    | M5  | M5   | M5   | M5   | M5   | M5   | M5   | M8   | M8    | M10   | M10   | M10   | M10   | M10   | M10   | M10   | M10    |
| <b>W</b> |       |     |      |      |      |      |      |      |      |       | 20    | 20    | 25    | 40    | 40    | 40    | 40    | 60     |
| <b>X</b> |       |     |      |      |      |      |      |      |      |       | 15    | 15    | 15    | 15    | 20    | 20    | 20    | 20     |
| <b>Y</b> |       |     |      |      |      |      |      |      |      |       |       |       |       |       | 40    | 40    | 40    | 30/40  |
| <b>Z</b> |       |     |      |      |      |      |      |      |      |       | 9     | 9     | 10.2  | 10.2  | 14    | 14    | 14    | 14     |

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-m / EN 22768-m

## Filter output connector cross sections

|                           | <b>-33</b>                                                                          | <b>-34</b>                                                                          | <b>-35</b>                                                                            | <b>-44</b>                                                                            | <b>-82</b>                                                                            |
|---------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|                           |    |    |    |    |    |
| <b>Solid wire</b>         | 16 mm <sup>2</sup>                                                                  | 35 mm <sup>2</sup>                                                                  | 50 mm <sup>2</sup>                                                                    | 10 mm <sup>2</sup>                                                                    | 0.75 - 2.5 mm <sup>2</sup>                                                            |
| <b>Flex wire</b>          | 10 mm <sup>2</sup>                                                                  | 25 mm <sup>2</sup>                                                                  | 50 mm <sup>2</sup>                                                                    | 6 mm <sup>2</sup>                                                                     | 1.0 - 2.5 mm <sup>2</sup>                                                             |
| <b>AWG type wire</b>      | AWG 6                                                                               | AWG 2                                                                               | AWG 1/0                                                                               | AWG 8                                                                                 | AWG 18 - 12                                                                           |
| <b>Recommended torque</b> | 1.5-1.8 Nm                                                                          | 4.0-4.5 Nm                                                                          | 7-8 Nm                                                                                | 1.5-1.8 Nm                                                                            | 1.0-1.2 Nm                                                                            |
|                           | <b>-83</b>                                                                          | <b>-84</b>                                                                          | <b>-85</b>                                                                            | <b>-86</b>                                                                            | <b>-87</b>                                                                            |
|                           |  |  |  |  |  |
| <b>Solid wire</b>         | 0.75-4.0 mm <sup>2</sup>                                                            | 2.5-10.0 mm <sup>2</sup>                                                            | 2.5-25.0 mm <sup>2</sup>                                                              | 0.75-50 mm <sup>2</sup>                                                               | 16.0-50.0 mm <sup>2</sup>                                                             |
| <b>Flex wire</b>          | 1.0-4.0 mm <sup>2</sup>                                                             | 4.0-10.0 mm <sup>2</sup>                                                            | 4.0-16.0 mm <sup>2</sup>                                                              | 0.75-35 mm <sup>2</sup>                                                               | 25.0-50.0 mm <sup>2</sup>                                                             |
| <b>AWG type wire</b>      | AWG 18-10                                                                           | AWG 18-6                                                                            | AWG 22-4                                                                              | AWG 18-0/1                                                                            | AWG 6-0                                                                               |
| <b>Recommended torque</b> | 1.5-1.8 Nm                                                                          | 4.0-4.5 Nm                                                                          | 1.5-1.8 Nm                                                                            | 3.2-3.7 Nm                                                                            | 6.0-8.0 Nm                                                                            |

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.



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