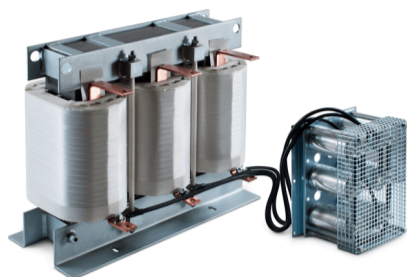


# LC Sine Wave Filter for 600 VAC and 690 VAC Motor Drives Applications

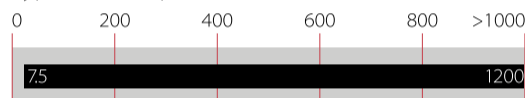


- Smooth sine wave without voltage peaks
- Motor protection against pulse pattern stress
- Improvement of system reliability
- Reduces bearing currents
- Ideal for retrofit installations
- Fits for long motor cable lengths (longer than 2000 m)
- Motor drive power range up to 1,200 kW

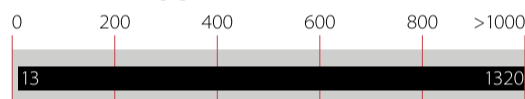


### Performance indicators

Typical motor power [kW]



Rated current [A]



## Technical Specifications

|  |  |
|--|--|
| <b>Nominal operating voltage</b>                 | 3x690 VAC (UL: 3x600 VAC)  |
| <b>Rated currents</b>                            | 13 to 1320 A @ 45°C  |
| <b>Overload capability</b>                       | 1.5 x rated current for 1 minute, once per hour  |
| <b>Residual ripple voltage</b>                   | <5%  |
| <b>Impedance (Uk)</b>                            | 8 to 10% @ 690 V, 50 Hz and rated current  |
| <b>Motor frequency</b>                           | 0..60 Hz (up to 200 Hz with derating, see graph)   |
| <b>Motor cable length</b>                        | Up to 2'000 m (see graph)  |
| <b>Switching frequency</b>                       | See filter selection table   |
| <b>Creepage and clearance distances</b>          | According UL 61800-5-1   |
| <b>High potential test voltage</b>               | P -> E 3600 VAC, 1 minute<br>P -> P 3600 VAC (without Caps), 1 minute<br>P -> P 2600 VDC, 1 minute   |
| <b>Oversvoltage category</b>                     | OV III (IEC 60664-1)   |
| <b>Temperature range (operation and storage)</b> | Operation for sizes 13 to 45 A: -25 to +30°C<br>Operation for sizes 75 to 1320 A: -25 to +45°C<br>Storage for all sizes: -25°C to 70°C (25/070/21) |
| <b>Protection category</b>                       | IP 00  |
| <b>Flammability corresponding to</b>             | UL 94 V-2  |
| <b>Design corresponding to</b>                   | IEC 61558-2-20   |
| <b>Insulation class</b>                          | EIS 200  |
| <b>Capacitor class</b>                           | UL 810 approved  |
| <b>Environmental reliability</b>                 | IEC 60068-2-1  |

### Approvals & Compliances



(UL up to 300 A)

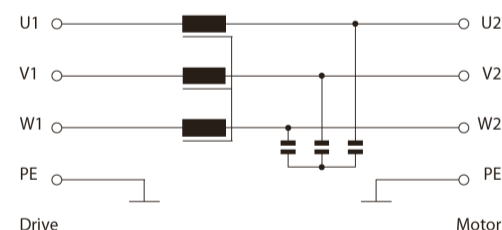
### Features and Benefits

- 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
- Reduces electromagnetic emissions and acoustic noise levels
- Eliminates pulse reflections in the motor cable

### 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 temp.<br>[°C] | Rated current<br>@ rated temp.<br>/ 50 Hz<br>[A] | Typical motor drive power rating |              | Nominal inductance<br>[mH] | Nominal capacitance<br>***<br>[µF] | Min. switching frequency<br>**<br>[kHz] | Typical power loss<br>[W] | Input/Output connections | Weight<br>[kg] |
|-------------------------|---------------------|--|----------------------------------|--------------|----------------------------|------------------------------------|---|---------------------------|--------------------------|----------------|
|                         |                     |  | 690 V/50 Hz*                     | 600 V/60 Hz* |                            |                                    |   |                           |                          |                |
| <b>FN5040HV-13-83</b>   | 30                  | 13   | 7.5                              | 10           | 11.7                       | 4.7                                | 2                                       | 170                       | -83                      | 18.2           |
| <b>FN5040HV-28-84</b>   | 30                  | 28   | 22                               | 25           | 5.5                        | 10                                 | 2                                       | 280                       | -84                      | 25.4           |
| <b>FN5040HV-45-86</b>   | 30                  | 45   | 37                               | 40           | 3.4                        | 20                                 | 2                                       | 360                       | -86                      | 38.2           |
| <b>FN5040HV-75-99</b>   | 45                  | 75   | 55                               | 60           | 2                          | 33                                 | 2                                       | 500                       | -99                      | 75             |
| <b>FN5040HV-115-99</b>  | 45                  | 115  | 90                               | 100          | 1.3                        | 47                                 | 2                                       | 850                       | -99                      | 110            |
| <b>FN5040HV-165-99</b>  | 45                  | 165  | 132                              | 150          | 0.9                        | 66                                 | 2                                       | 1100                      | -99                      | 160            |
| <b>FN5040HV-260-99</b>  | 45                  | 260  | 200                              | 250          | 0.6                        | 94                                 | 2                                       | 1200                      | -99                      | 200            |
| <b>FN5040HV-300-99</b>  | 45                  | 300  | 250                              | 300          | 0.5                        | 136                                | 2                                       | 1600                      | -99                      | 240            |
| <b>FN5040HV-430-99</b>  | 45                  | 430  | 355                              | 400          | 0.35                       | 272                                | 1.5                                     | 2000                      | -99                      | 330            |
| <b>FN5040HV-530-99</b>  | 45                  | 530  | 450                              | 500          | 0.28                       | 340                                | 1.5                                     | 2400                      | -99                      | 420            |
| <b>FN5040HV-660-99</b>  | 45                  | 660  | 630                              | 650          | 0.23                       | 408                                | 1.5                                     | 2900                      | -99                      | 530            |
| <b>FN5040HV-765-99</b>  | 45                  | 765  | 710                              | 750          | 0.2                        | 476                                | 1.5                                     | 3800                      | -99                      | 560            |
| <b>FN5040HV-940-99</b>  | 45                  | 940  | 900                              | 1000         | 0.16                       | 612                                | 1.5                                     | 3400                      | -99                      | 685            |
| <b>FN5040HV-1320-99</b> | 45                  | 1320   | 1200                             | 1300         | 0.12                       | 816                                | 1.5                                     | 4700                      | -99                      | 1010           |

\*\*\* At rated current, voltage and frequency. The proper power selection depends on the drive specification, the motor and the application requirements.

\*\*\* With reduced motor cable length, the max. switching frequency is 16 kHz.

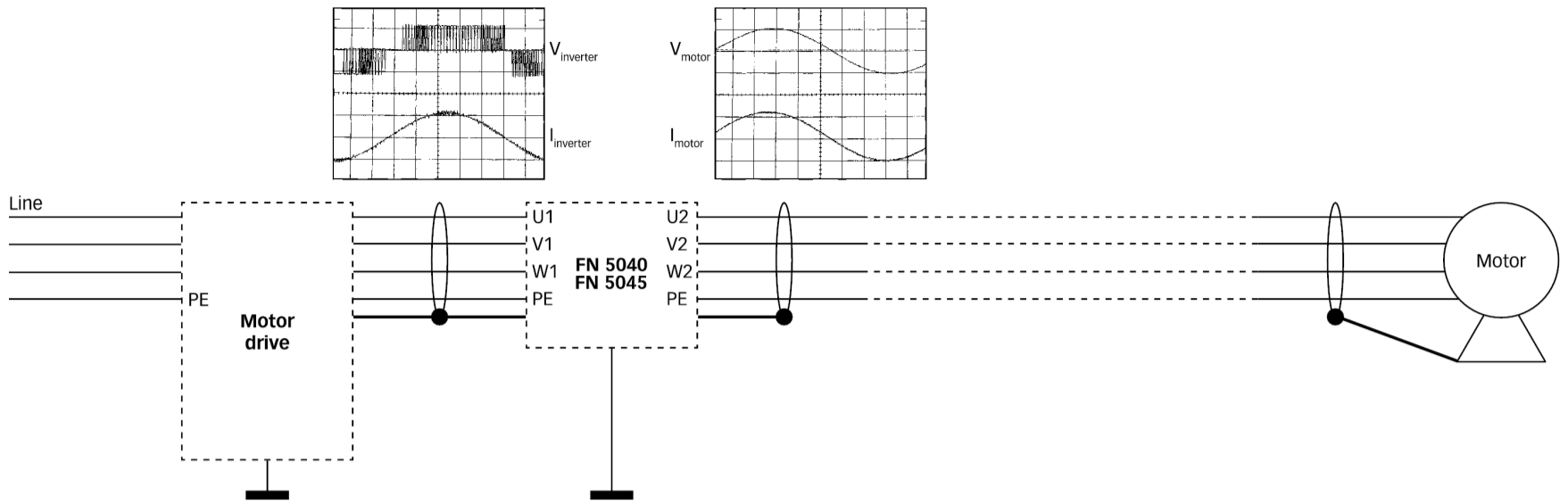
\*\*\* The capacitance connection is Y

\*\*\*\* Filters up to 300 A are with UL approval. 430 A ... 1320 A are without UL approval.

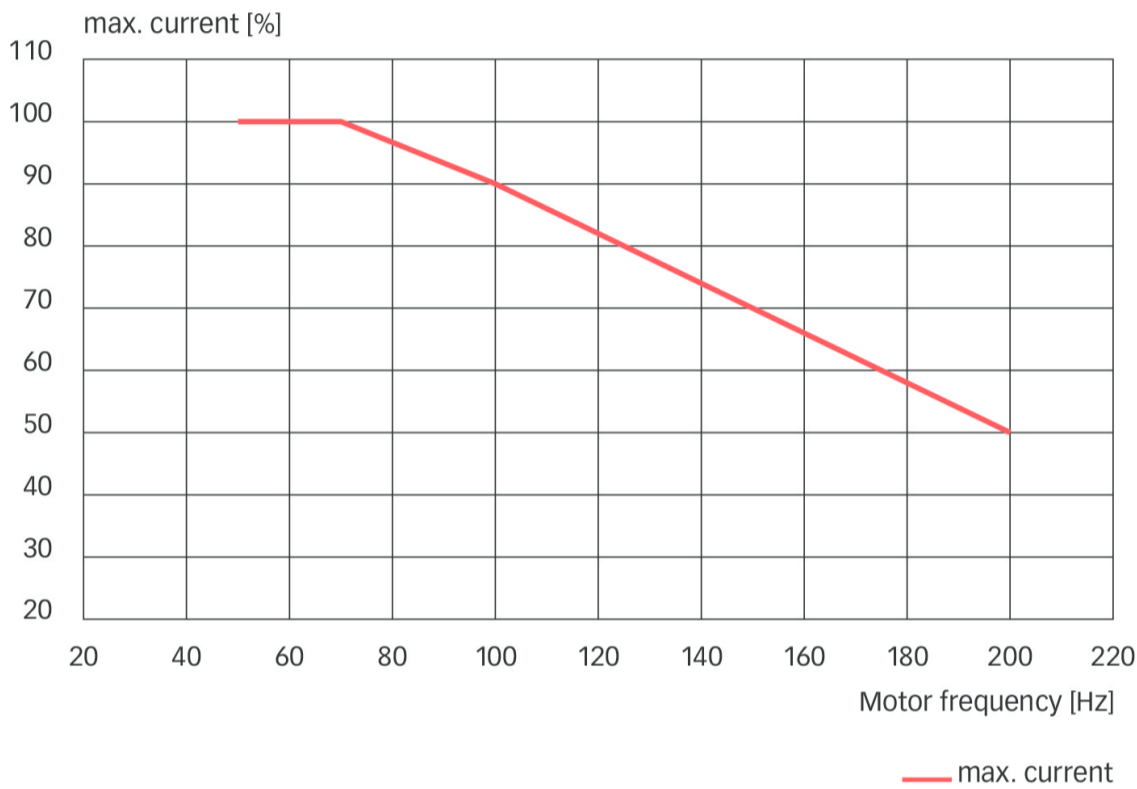
## Required Drives Settings

Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). The mode of operation must be "scalar" (V/Hz) with a fixed switching frequency. Check the drives manufacturer manual whether special settings are necessary. In any doubt contact the drives manufacturer. **CAUTION: If the motor drives settings are not correct the filter may be damaged.**

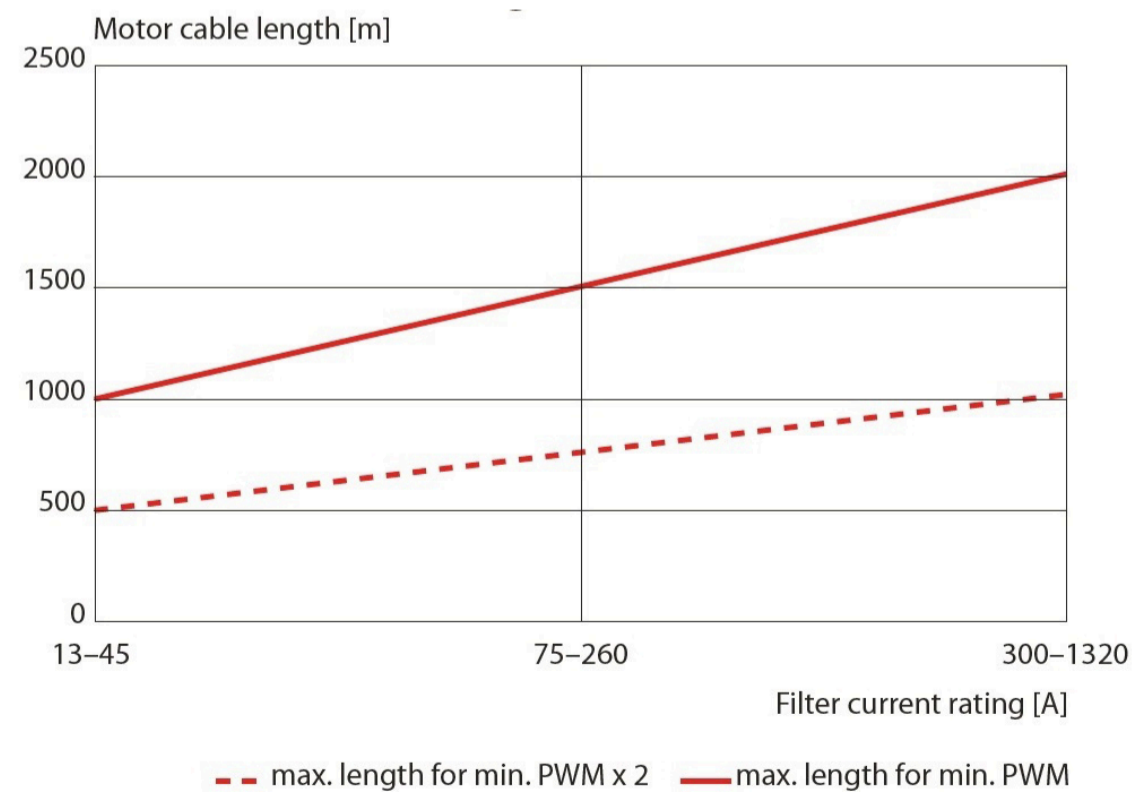
### Typical Block Schematic



### Motor Frequency Derating



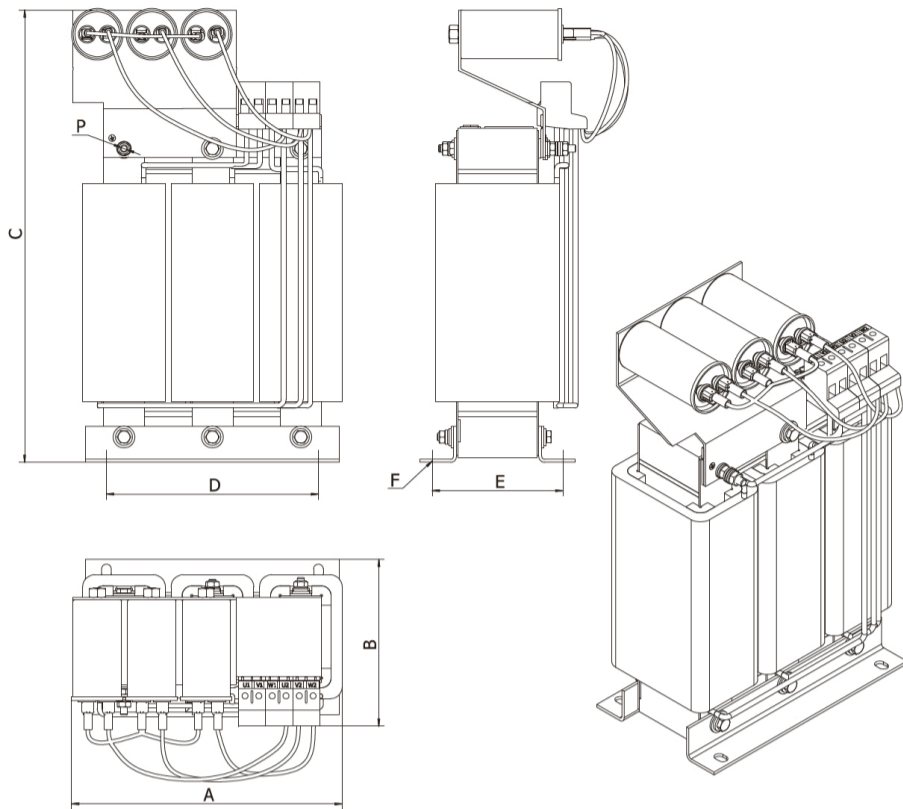
### Max. Motor Cable Length\*



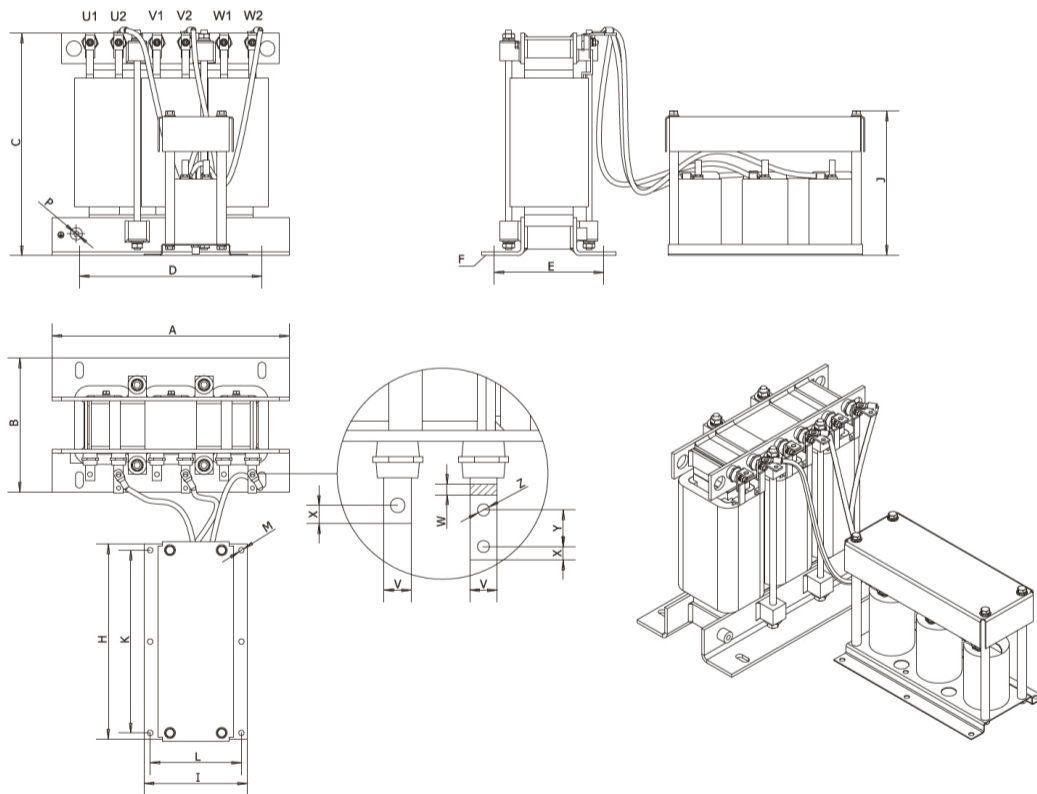
\*In case a step-up transformer is used, then the length is meant to be between the filter and transformer.

## Mechanical Data FN5040HV

13 to 45 A types



75 to 165 A types



260 to 430 A types

530 A type

## Mechanical Data FN5040HV

660 A types

765 A types

## Mechanical Data FN5040HV




940 A types

1320 A types

## Dimensions FN5040HV

|  | 13 A | 28 A | 45 A  | 75 A  | 115 A | 165 A | 260 A | 300 A | 430 A | 530 A | 660 A | 765 A | 940 A | 1320 A |
|--|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| <b>A</b>                               | 235  | 225  | 267   | 392   | 465   | 512   | 583   | 540   | 645   | 680   | 740   | 725   | 765   | 895    |
| <b>B</b>                               | 160  | 165  | 190   | 235   | 275   | 275   | 318   | 315   | 347   | 348   | 430   | 402   | 435   | 445    |
| <b>C</b>                               | 290  | 375  | 425   | 375   | 425   | 482   | 484   | 625   | 633   | 761   | 775   | 875   | 925   | 965    |
| <b>D</b>                               | 180  | 175  | 215   | 300   | 300   | 300   | 300   | 300   | 380   | 380   | 560   | 560   | 580   | 680    |
| <b>E</b>                               | 101  | 108  | 127   | 180   | 180   | 180   | 180   | 20    | 215   | 215   | 245   | 245   | 245   | 320    |
| <b>F</b>                               | 8x12 | 8x12 | 11x15 | 13x27 | 13x27 | 13x27 | 13x27 | 13x27 | 13x27 | 13x27 | 13x28 | 13x28 | 17x30 | 17x30  |
| <b>H</b>                               |      |      |       | 330   | 330   | 330   | 330   | 330   | 425   | 705   | 705   | 760   | 1055  | 1055   |
| <b>I</b>                               |      |      |       | 170   | 170   | 270   | 270   | 270   | 370   | 328   | 328   | 463   | 463   | 463    |
| <b>J</b>                               |      |      |       | 240   | 240   | 240   | 240   | 275   | 275   | 275   | 275   | 275   | 275   | 275    |
| <b>K</b>                               |      |      |       | 300   | 300   | 300   | 300   | 300   | 400   | 685   | 685   | 740   | 1035  | 1035   |
| <b>L</b>                               |      |      |       | 150   | 150   | 250   | 250   | 250   | 350   | 300   | 300   | 430   | 430   | 430    |
| <b>M</b>                               |      |      |       | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9    | Ø9     |
| <b>P</b>                               | M6   | M6   | M6    | M6    | M8    | M10   | M10   | M10   | M12   | M12   | M12   | M12   | M12   | M12    |
| <b>V</b>                               |      |      |       | 15    | 20    | 25    | 30    | 30    | 40    | 40    | 60    | 60    | 80    | 80     |
| <b>W</b>                               |      |      |       | 3     | 3     | 4     | 5     | 5     | 5     | 6     | 6     | 6     | 8     | 8      |
| <b>X(1)</b>                            |      |      |       | 7.5   | 10    | 12.5  | 15    | 15    | 20    | 20    | 17    | 17    | 20    | 20     |
| <b>X2</b>                              |      |      |       |       |       |       | 30    | 30    | 40    | 40    | 26    | 26    | 40    | 40     |
| <b>X3</b>                              |      |      |       |       |       |       |       |       |       | 40    | 40    | 40    | 40    | 40     |
| <b>X4</b>                              |      |      |       |       |       |       |       |       |       |       | 26    | 26    | 40    | 40     |
| <b>Y</b>                               |      |      |       | 30    | 30    | 30    |       |       |       |       |       |       |       |        |
| <b>Z</b>                               |      |      |       | 6.6   | 9     | 11    | 11    | 11    | 13.5  | 13.5  | 13.5  | 13.5  | 13.5  | 13.5   |
| <b>Capacitor bank cable length [m]</b> |      |      |       | 1 m   | 1 m   | 1 m   | 1.5 m | 1.5 m | 1.5 m | 1.5 m | 2 m   | 2 m   | 2 m   | 2 m    |

## Filter Input/Output Connector Cross Sections

|                           | -83   | -84  | -86   |
|---------------------------|---|--|---|
|                           |  |  |  |
| <b>Solid wire</b>         | 0.75 - 4 mm <sup>2</sup>  | 2.5 - 10 mm <sup>2</sup>   | 0.75 - 50 mm <sup>2</sup>   |
| <b>Flex wire</b>          | 1 - 4 mm <sup>2</sup>   | 4 - 10 mm <sup>2</sup>   | 0.75 - 35 mm <sup>2</sup>   |
| <b>AWG type wire</b>      | AWG 16 - 10   | AWG 18 - 6   | AWG 18 - 0/1  |
| <b>Recommended torque</b> | 1.24 Nm (11 lb-in)  | 1.24-2.26 Nm (11-20 lb-in)   | 3.4-5.6 Nm (30-50 lb-in)  |

### Note:

For additional information please consult the documents „Basis in EMC and Power Quality“ and the sine wave filter „Mounting and Installation Guidelines“, published in the download section „Installation Instructions“ of [www.schaffner.com](http://www.schaffner.com)



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