THREE-PHASE FILTERS
for chassis-mounting

SCHAEFFNER
Your number one name for EMC
Three-phase chassis-mounting powerline filters

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Powerline filters – a vital element of today’s equipment designs

In today’s world, more electrical energy is being generated at increasing levels of power, and more and more low power energy is being used for the transmission and processing of data. The result is vastly increased ‘electronic smog’ or noise. This noise can disrupt, and even destroy, electronic devices: an unacceptable situation, and one which is illegal in certain markets. The electronics industry must strive to protect equipment against such ‘noise’.

Noise, or interference, travels two ways. Switches - such as semiconductors - can emit interference, and be susceptible to it. The same is true for data processing equipment. The most common method of protection is the use of powerline filters, in conjunction with screening or gasket materials.

Schaffner is one of the world’s leading suppliers of electromagnetic compatibility (EMC) products. The breadth of our product range, the high attenuation characteristics of our filters under various load conditions, our dedication to quality - and above all our organization’s unique experience in filter design and manufacturing which spans more than 25 years - is your guarantee of excellence.

Power electronic devices such as industrial frequency converters, as well as machine tools, are typical application areas for three-phase powerline filters.

In addition to this industrial market sector, these types of filter are also suitable for mainframe computer systems, large uninterrupted power supplies, and medical equipment such as X-ray machines.

Total commitment to quality
Schaffner’s aim is to provide all its customers with fault-free products. To achieve this, 100% of our products undergo rigorous final testing. To ensure high quality we have instituted a system which meets all the stringent requirements of ISO 9001/EN 29001. The phrase ‘Quality Assurance’ is not just a slogan for us; it is applied in practice, and the Schaffner brand truly stands for reliability and quality.

Wide product range
This catalog describes three-phase powerline filters for currents from 3A to 1200A, which are suitable for the majority of high power office and mainframe computer equipment, as well as medium to high power industrial applications.

Safety standard IEC 950
The IEC 950 standard is a key safety specification for computers, business and industrial applications. A primary requirement is protection for personnel who come into contact with terminal equipment. Compliance with this standard by equipment manufacturers is essential - especially for deliveries within Europe - by virtue of the newly-introduced legislation. The standard applies in Europe under the designation EN 60950 and the USA as UL 1950.

Most of Schaffner’s three-phase filters are so constructed that the test requirements called for in IEC 950 (basic and supplementary isolation) can be met.

Further information on this topic can be found in the application note ‘IEC 950’, which your local Schaffner representative will be pleased to send you.
**Time to market**

The key reasons for choosing ready-made three-phase filters are convenience and cost. Although you can design your own filter using discrete components, or have a custom solution designed and assembled for you, the timescales involved - especially if safety approvals are required, tend to be long. This may not be an acceptable approach for you. The availability of off-the-shelf products is particularly important to industrial users and system commissioning personnel, who require next-day delivery of fit-and-forget EMC solutions simply to meet contractual obligations or to avoid incurring penalty clauses.

Ready-made filters provide a convenient single-source solution. The following guide to Schaffner's range of single-phase products will help you to choose a filter. Schaffner's application engineers, based in numerous sales outlets around the world, are available to provide in-depth advice if you require it.

**General technical information**

**Insertion loss**

The insertion loss characteristics of the filters are measured in accordance with the CISPR 17 standard. Two test conditions are specified in Section 4.2 of the CISPR 17 standard, namely input and output impedances of 50/50Ω and 0.1/100Ω. In general, three-phase filters perform the same in the face of differential interference as in the 50Ω insertion loss test. In order to show the performance under realistic conditions, Schaffner also shows the attenuation curves obtained from the 0.1/100Ω test, which are more meaningful for common mode interference. The inductance of the chokes used in the filters can change under load because of a saturation effect, which can also affect insertion loss.

**Flammability classification**

All the filters in this catalog comply with the requirements of UL 94V2 or UL 94V0.

**Climatic classification**

Schaffner three-phase filters comply with the climatic classification 25/085/21 according to DIN IEC 68 Part 1 (ambient temperature -25 to +85°C).

**Component tolerances**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>- Tol.</th>
<th>+ Tol.</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductance</td>
<td>30%</td>
<td>50%</td>
<td>1kHz</td>
</tr>
<tr>
<td>Capacitance</td>
<td>20%</td>
<td>20%</td>
<td>1kHz</td>
</tr>
<tr>
<td>Resistance</td>
<td>10%</td>
<td>10%</td>
<td>DC</td>
</tr>
</tbody>
</table>

**Current ratings**

The nominal currents stated refer to an ambient temperature of θN = 40°C or θN = 50°C. The maximum operating current at any other ambient temperature θ can be calculated by means of the following formula:

\[ I = I_N \left(1 - \frac{(85 - \theta)}{(85 - \theta_N)}\right) \]

**Leakage current**

**Operational conditions**

The values given in the technical filter specifications are based on IEC 1000-2-4, section 5.5, and the following conditions: nominal voltage 440VAC for standard types, 520VAC for H types, 690VAC for HV types; nominal frequency 50Hz; tolerance of capacitance ± 20%; unsymmetrical input voltage ± 3%.

**Worst case conditions**

Worst case conditions are based on the assumption that two of the three lines were disconnected. For the calculation of the leakage current, the voltage of one phase towards the ground UP – E 50Hz is used; capacitance tolerance ± 20%.

The values calculated under worst case conditions are equal to the values corresponding to the operational conditions on standard Japanese networks. In the case of a network with a neutral line, the values corresponding to the European operational conditions are equal to the Japanese operational conditions with a neutral line.

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### Schaffner's 3-phase chassis-mounting filter range

**Rapid selection**

Using the current rating and attenuation performance indicators, together with the major features shown on the right, this table allows you to quickly identify a 'short list' of filter families which are potentially suitable for your application, for subsequent detailed investigation using the technical specifications on the following pages.

**For currents up to 280A**

<table>
<thead>
<tr>
<th>Family</th>
<th>Current rating (A)</th>
<th>Insertion loss</th>
<th>2-stage</th>
<th>3-phase</th>
<th>3-phase + N</th>
<th>Safety terminal</th>
<th>For frequency inverters</th>
<th>Catalog page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 251</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>FN 256</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>FN 258</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>FN 351</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>FN 354</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>FN 355</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>FN 356</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22</td>
</tr>
</tbody>
</table>

**For high currents**

<table>
<thead>
<tr>
<th>Family</th>
<th>Current rating (A)</th>
<th>Insertion loss</th>
<th>2-stage</th>
<th>3-phase</th>
<th>3-phase + N</th>
<th>Safety terminal</th>
<th>For frequency inverters</th>
<th>Catalog page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 359</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>
This section introduces the standards and regulations associated with EMC protection, and provides detailed information to help you understand filter design and specifications. It will help you identify for your application the right specifications and type of filter.

Interference protection standards
Until recently most countries have had their own regulations and standards governing electro-magnetic interference (EMI) or radio frequency interference (RFI). However, on the 1 January 1996 the European Directive 89/336/EMC on electro-magnetic compatibility (EMC) came into force. This directive brings a common approach to EMC to every member state of the European Union. Common standards will be used throughout Europe to ensure that technical trade barriers are removed. As well as controlling EMI emissions from equipment, the directive also calls for equipment to be immune to external electro-magnetic disturbances.

Types of standards:
Basic standards describe the general and fundamental rules for meeting the requirements. Terminology, phenomena, compatibility levels, measurement, test techniques and classification of EM environments are so described within.

Generic standards refer to specific environments. They set minimal EMI levels which equipment in these environments must meet. Where no product specific standards exist then the generic standards are to be used. Generic standards describe household and industrial EMI environments.

Products standards are for specific products or product groups. These standards are coordinated with the generic standards.

In countries outside Europe other standards will be used, such as the FCC in the USA. Table 1 shows the main European standards.

Permissible noise limits
The various standards set down limits for conducted EMI emissions. These limits are measured in voltage and given in dBµV where 0dB is 1µV. The interference is measured using measurement equipment which has defined bandwidths and receivers. The two receivers used are a quasi-peak detector, and an average detector.

To ensure repeatability of the measurements, the impedance of the mains supply must be constant. The standards calls for a defined artificial mains network - sometimes called a line impedance stabilisation network (LISN) - which gives a defined impedance to the noise and also helps filter any noise on the mains which may affect the measurements.

Figure 1 shows the limits of EN 50081-1 the European generic standard for residential, commercial and light industrial environments, and Figure 2 of EN 50081-2, the European generic standard for the industrial environment.

Above 30MHz, radiated noise interference is measured instead of conducted noise. This takes place on an open field test site using defined antennas.

<table>
<thead>
<tr>
<th>Product type</th>
<th>Emissions</th>
<th>Immunity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Harmonics</td>
<td>Voltage fluctuations</td>
</tr>
<tr>
<td>Household appliances &amp; portable tools: vacuum cleaners, washing machines, heating, cooking equipment, dimmers</td>
<td>EN 60555-2</td>
<td>EN 60555-3</td>
</tr>
<tr>
<td>Luminaires with discharge lamps</td>
<td>EN 60555-2</td>
<td>EN 55015</td>
</tr>
<tr>
<td>TV receivers</td>
<td>EN 60555-2</td>
<td>EN 55013</td>
</tr>
<tr>
<td>Information Technology Equipment (ITE)</td>
<td>EN 60555-2</td>
<td>EN 55022</td>
</tr>
<tr>
<td>Mains signalling equipment</td>
<td>EN 50065-1</td>
<td>EN 50082-2</td>
</tr>
<tr>
<td>Industrial, scientific and medical eqpt. designed to generate RF energy</td>
<td>EN 55011</td>
<td>EN 50082-2</td>
</tr>
<tr>
<td>Industrial electronic power and control equipment</td>
<td>EN 50081-2</td>
<td>EN 50082-2</td>
</tr>
<tr>
<td>Industrial non-electronic equipment</td>
<td>EN 50081-2 (if producing RF interference)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. European EMC standards
Interference sources and spectrums

The most common source of conducted EMI is power electronic products such as switched mode power supplies (SMPS), pulse width modulated (PWM) frequency converters or motor drives, and phase angle controllers.

The emissions spectrum typically starts off very large at low frequency and rolls off as frequency increases. The point at which the noise falls below the permitted limits depends on several factors, the most important being the frequency of operation and the rise time of the semiconductor devices.

Interference spectrums generated can be either continuous, as in the case of phase angle controllers, (Figure 3) or discrete which is typical of the SMPS (Figure 4).

Interference propagation

EMI can propagate by two means:

- by radiation - where the energy can be coupled either through magnetic or electric field, or as an electro-magnetic wave between the source and the victim
- by conduction - where the EMI energy will propagate along power supply lines and data cables

Radiated and conducted EMI cannot be thought of as totally separate problems, because noise conducted along a cable may be radiated as the cable acts as an antenna. The radiation will increase as the cable length becomes comparable to the wavelength of the noise. Also, the cable will act as a receiving antenna and pick up radiated interference.

Below around 150MHz, the most efficient radiating devices in a system are usually the power supply and data cables. Proper filtering of these cables will reduce radiation due to the cables as well as conducted interference.

Above around 150MHz, PCB tracks and short internal cables will start to become efficient antennas. To reduce this radiation a PCB should be laid out to reduce track length and loop areas; ground planes should be used if possible. Decoupling of digital ICs is very important and shielding may be necessary.

Interference types

To understand the problems associated with conducted EMI it is first necessary to understand the two modes of conducted noise: differential mode (or symmetrical mode) and common mode (or asymmetrical mode). Differential mode interference creates a voltage between the phases of the system and is independent of earth; the differential mode currents flow along one phase and returns along another phase (Figure 5).

Common mode noise creates a voltage between each phase and the earth. The common mode currents flow from the noise source to the earth (usually via a parasitic capacitance) along the earth path and returns along the phases (Figure 6). A power line filter must be designed to attenuate both common mode and differential mode interference.
In addition to offering one of the world’s most comprehensive ranges of standard filter products, Schaffner offers the full complement of measurement and engineering services to support equipment manufacturers and users.

**EMC testing**
Schaffner operates the most sophisticated EMC test facilities available anywhere today - with extensive investment in screened rooms, specialist test equipment, and application engineering teams - distributed at seven locations throughout the world. Services available at these locations include:

- Faraday cage and open field testing
- harmonics instrumentation for current and voltage to the 49th harmonic
- radio emission measurements to CISPR, EN, VDE, FCC, Mil or SEV
- simulation of electro-magnetic fields
- simulation of short-term DC or AC mains failures
- simulation of transient parasitic voltages
- electro-static discharges to IEC 801-2, VDE 0843 part 2 specifications
- AC and DC insulation testing

**Engineering services**
Schaffner has extensive engineering experience in solving EMC problems. In addition to testing and measuring services Schaffner can provide the expert engineering support to help you bring your equipment to market quickly and efficiently; services available include:

- custom filter design
  - to optimize filter performance, and solve space, layout, mounting or connection problems
- circuit and equipment design
  - advising on circuit and equipment or enclosure design to overcome EMC problems
- turnkey component design and build
Ordering information

For all three-phase filters

**FN 251 & - x / y**

- **output connections**
  - 01 = solder-lug
  - 03 = clamp terminal with M4 screw
  - 05 = AMP fast-on
  - 06 = solder-lug/fast-on combination
  - 07 = wire
  - 24 = screw lead - through M6
  - 28 = screw lead - through M10
  - 29 = terminal block
  - 33 = terminal block
  - 34 = terminal block
  - 35 = terminal block
  - 36 = terminal block
  - 37 = terminal block
  - 40 = terminal block
  - 46 = strip terminal block
  - 47 = strip terminal block
  - 52 = strip terminal block
  - 99 = busbar connections

- **current rating (A)**

- **filter type**
  - H = high voltage
  - HV = very high voltage
  - P = medium leakage current
  - L = low leakage current

Examples:

- **FN 251-8/07** Type FN 251; current rating 8A; with wire output connections
- **FN 351H-50/33** Type FN 351H (high voltage); current rating 50A; with safety terminal block connections
- **FN 258L-55/07** Type FN 258L (low leakage current); current rating 55A; with wire output connections

For details see mechanical data
This filter family provides a very economic solution for overcoming EMI problems with motor drives and inverters. All FN 251 filters employ advanced two-stage LCR filter circuitry with non-saturating toroidal inductors, and have a very low leakage current which helps maximize performance and ensure operational reliability.

- 4 to 24A current ratings
- compact size
- insulated safety input terminals
- wire outputs

Technical specifications
Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40ºC
Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1700VDC
MTBF at 40ºC, 400V per Mil-HB-217F: 160,000 hours
Protection category: IP20
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings</th>
<th>Leakage current†</th>
<th>Power loss</th>
<th>Component values/phase</th>
<th>Connections input</th>
<th>Connections output</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 251 - 4 / 07</td>
<td>4 (4.6)</td>
<td>0.5</td>
<td>5.5</td>
<td>7</td>
<td>1.5</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>FN 251 - 8 / 07</td>
<td>8 (9.2)</td>
<td>0.5</td>
<td>7</td>
<td>4.2</td>
<td>1.5</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>FN 251 - 16 / 07</td>
<td>16 (18.4)</td>
<td>0.5</td>
<td>14</td>
<td>2.6</td>
<td>0.7</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>FN 251 - 24 / 07</td>
<td>24 (27.6)</td>
<td>0.5</td>
<td>18</td>
<td>1</td>
<td>0.5</td>
<td>1</td>
<td>15</td>
</tr>
</tbody>
</table>

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 7.7 times higher levels.

Mechanical data

<table>
<thead>
<tr>
<th>Current</th>
<th>-4, -8</th>
<th>-16, -24</th>
<th>Total ± mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>185</td>
<td>180</td>
<td>± 0.5</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
<td>75</td>
<td>± 0.5</td>
</tr>
<tr>
<td>C</td>
<td>60</td>
<td>60</td>
<td>± 0.5</td>
</tr>
<tr>
<td>D</td>
<td>85</td>
<td>85</td>
<td>± 0.5</td>
</tr>
<tr>
<td>E</td>
<td>115</td>
<td>115</td>
<td>± 0.2</td>
</tr>
<tr>
<td>F</td>
<td>35 ± 0.1</td>
<td>100</td>
<td>± 0.2</td>
</tr>
<tr>
<td>G</td>
<td>0.7</td>
<td>0.7</td>
<td>± 0.05</td>
</tr>
<tr>
<td>H</td>
<td>20</td>
<td>20</td>
<td>± 1</td>
</tr>
<tr>
<td>M</td>
<td>7 x 5.3</td>
<td>6.4</td>
<td>± 0.1</td>
</tr>
<tr>
<td>P</td>
<td>6</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>W</td>
<td>1.31mm²</td>
<td>2.08mm²</td>
<td>-</td>
</tr>
<tr>
<td>Y</td>
<td>300</td>
<td>300</td>
<td>± 10</td>
</tr>
<tr>
<td>Z</td>
<td>1</td>
<td>1</td>
<td>± 10</td>
</tr>
</tbody>
</table>

All dimensions in mm; 1 inch = 25.4mm
* Measurements share this common tolerance unless otherwise stated

Electrical schematic
See table for component values
FN 251 insertion loss
Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

4 amp types

8 amp types

16 amp types

24 amp types

Mechanical drawings
See mechanical data table for dimensions

FRONT

TOP

SIDE

TOP

FN 251-16 - 24
Input connection: /29

FN 251-4 - 8
Input connection: /29
FN 258 provides state-of-the-art filtering for industrial frequency inverters or power drive systems (PDS). This product sets major new performance standards, through its universal 480V rating; via its slim-line shape which sits neatly alongside the latest inverters; and innovative 2-stage circuitry which provides superlative performance that meets the latest EMC standards (EN 55011/55014, IEC 22G/21/CDV, UL1283 and the new EN 133200).

- 7 to 180A current ratings
- 480V/50°C ratings for world compatibility and simple specification
- slim book-style housing
- designed for long cable lengths (50m/54yds+)
- meets UL and new EN 133200 standards

### Technical specifications

Maximum operating voltage: 480VAC at 50ºC. Operating frequency: DC to 60Hz at 50ºC

Hipot test voltage: $P \Rightarrow E 2800VDC; P \Rightarrow P 1700VDC$

MTBF at 50°C, 400V per Mil-HB-217F: 220,000 hours

Protection category: IP20

Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings</th>
<th>Leakage current</th>
<th>Power loss</th>
<th>Component values/phase</th>
<th>Connections input</th>
<th>Connections output</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 258 - 7 / ?</td>
<td>7 (8)</td>
<td>18.0</td>
<td>4.5</td>
<td>4.5 4 1.5 1.5 0.68</td>
<td>/29</td>
<td>/07 /29</td>
<td>1.1</td>
</tr>
<tr>
<td>FN 258 - 16 / ?</td>
<td>16 (18)</td>
<td>20.0</td>
<td>9.0</td>
<td>3.0 5.9 1.5 1.5 0.68</td>
<td>/29</td>
<td>/07 /29</td>
<td>1.7</td>
</tr>
<tr>
<td>FN 258 - 30 / ?</td>
<td>30 (34)</td>
<td>26.5</td>
<td>14</td>
<td>2.0 6.6 2.2 1.5 0.68</td>
<td>/33</td>
<td>/07 /33</td>
<td>1.8</td>
</tr>
<tr>
<td>FN 258 - 42 / ?</td>
<td>42 (47)</td>
<td>28.2</td>
<td>19</td>
<td>1.5 6.6 2.3 1.5 0.68</td>
<td>/33</td>
<td>/07 /33</td>
<td>2.8</td>
</tr>
<tr>
<td>FN 258 - 55 / ?</td>
<td>55 (62)</td>
<td>28.2</td>
<td>20</td>
<td>1.1 6.6 2.3 1.5 0.68</td>
<td>/34</td>
<td>/07 /34</td>
<td>3.1</td>
</tr>
<tr>
<td>FN 258 - 75 / ?</td>
<td>75 (85)</td>
<td>28.2</td>
<td>20</td>
<td>0.9 6.6 2.3 1.5 0.68</td>
<td>/34</td>
<td>- /34</td>
<td>4.0</td>
</tr>
<tr>
<td>FN 258 - 100 /?</td>
<td>100 (113)</td>
<td>28.2</td>
<td>36</td>
<td>0.9 6.6 2.3 1.5 0.68</td>
<td>/35</td>
<td>- /35</td>
<td>5.5</td>
</tr>
<tr>
<td>FN 258 - 130 /?</td>
<td>130 (145)</td>
<td>32.8</td>
<td>40</td>
<td>0.6 11 2.3 1.5 0.68</td>
<td>/35</td>
<td>- /35</td>
<td>7.5</td>
</tr>
<tr>
<td>FN 258 - 180 /?</td>
<td>180 (204)</td>
<td>32.8</td>
<td>61</td>
<td>0.13 11 2.3 1.5 0.68</td>
<td>/40</td>
<td>/07 /40</td>
<td>11.0</td>
</tr>
</tbody>
</table>

* Max. leakage under normal circumstances. Note: if two phases are interrupted, worst case leakage current could reach 5.6 times higher levels. Filters with lower leakage current (P [3.5mA] and L [0.8mA] types) are available on request. The insertion loss values of the P and L types are not identical with those of the standard versions.

### Mechanical data

<table>
<thead>
<tr>
<th>Current</th>
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</table>

* Measurements share this common tolerance unless otherwise stated.

All dimensions in mm; 1 inch = 25.4mm

---

**Electrical schematic**

See table for component values

![Electrical schematic](image-url)

**Technical specifications**

- Maximum operating voltage: 480VAC at 50ºC
- Operating frequency: DC to 60Hz at 50ºC
- Hipot test voltage: $P \Rightarrow E 2800VDC; P \Rightarrow P 1700VDC$
- MTBF at 50°C, 400V per Mil-HB-217F: 220,000 hours
- Protection category: IP20
- Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

---

**Mechanical data**

- Current ratings: 7 to 180A
- Leakage current: (480V/50Hz) mA
- Power loss: W
- Component values/phase: Σ L, Σ Cx, Σ Cy, R1, R2, M1, M2
- Connections input/output
- Weight: kg
FN 258 insertion loss
Per CISPR 17; A = 50/50 Ω sym, B = 50/50 Ω asym, C = 0.1/100 Ω sym, D = 100/0.1 Ω sym

7 amp types

16 amp types

30 amp types

42 amp types

55 amp types

75 amp types

100 amp types

130 amp types

180 amp types

Note: the insertion loss values of the P and L types are not identical with those of the standard versions

Mechanical drawings
See mechanical data table for dimensions

BOTTOM VIEW

END/SIDE VIEW

7 to 55A current ratings /07 connection

7 to 180A current ratings /07 connection

180A current rating /07 connection
# High-power filter

FN 351 provides highly effective filtering solutions for industrial frequency inverters and drives, delivering standard-setting performance which has been widely imitated. Available in an extremely wide range of power ratings and two voltage levels the filter employs special core winding and inductor techniques which remain effective under extreme EMI.

- 5 to 280A current ratings, 440V and 520V versions
- high differential/common mode attenuation
- IEC 950 compliant

## Technical specifications

### Maximum operating voltage: 440VAC at 40°C for standard types; 520VAC at 40°C for H types

- IEC 950 compliant high differential/common mode attenuation
- 5 to 280A current ratings, 440V and 520V versions
- inductor techniques which remain effective under extreme EMI.

### FN 351

#### Current ratings

<table>
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<tr>
<th>Filter</th>
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<th>Leakage current</th>
<th>Power loss</th>
<th>Component values/phase</th>
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## Mechanical data

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<th>-80, -110</th>
<th>-180</th>
<th>-280</th>
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* Measurements share this common tolerance unless otherwise stated.

### Electrical schematic

See table for component values.

---

* FN 351 provides highly effective filtering solutions for industrial frequency inverters and drives, delivering standard-setting performance which has been widely imitated. Available in an extremely wide range of power ratings and two voltage levels the filter employs special core winding and inductor techniques which remain effective under extreme EMI.

- 5 to 280A current ratings, 440V and 520V versions
- high differential/common mode attenuation
- IEC 950 compliant
FN 351 insertion loss
Per CISPR 17; $A = 50 \Omega / 50 \Omega$ sym, $B = 50 \Omega / 50 \Omega$ asym, $C = 0.1 \Omega / 100 \Omega$ sym, $D = 100 \Omega / 0.1 \Omega$ sym

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<th>5 amp types</th>
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</table>

**Mechanical drawings**
See mechanical data table for dimensions

**FRONT**

**TOP**

FN 351-5, -8, -16, -25, -36, -50, -64
/29 connections shown
FN 359 sets a new standard in EMC filtering solutions for industrial frequency inverters or power drive systems, UPSs and other high power equipment. This family is additionally offered in a very high voltage version to match every type of power supply in use worldwide. Despite availability in a wide range of current ratings, all FN 359s come in the same compact, lightweight package, simplifying OEM system building.

- 250 to 1200A current ratings
- 440, 520 or 690VAC versions for worldwide compatibility
- small leakage current
- compact, light ‘one-size’ packaging
- built to meet UL, CSA and EN 133200 standards

### Technical specifications

**Maximum operating voltage:**
- standard types: 440 VAC
- H types: 520 VAC
- HV types: 690 VAC

**Operating frequency:**
DC to 60Hz at 50°C

**Hipot test voltage:**
- standard: P⇒E 2600 VDC, P⇒P 1900 VDC
- H: P⇒E 2750 VDC, P⇒P 2250 VDC
- HV: P⇒E 3050 VDC, P⇒P 3000 VDC; all for 2s (factory test)

**MTBF at 40°C, per Mil-HB-217F:**
- standard types: 155,000 hours
- H types: 109,000 hours
- HV types: 128,000 hours

**MTBF at 25°C, per Mil-HB-217F:**
- standard types: 307,000 hours
- H types: 222,000 hours
- HV types: 257,000 hours

**Overload:**
- 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

**Design corresponding to:**
- UL 1283, CSA 22.2 No 8 1986, EN 133200

### Filter and Current Ratings

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<th>Filter</th>
<th>Current ratings</th>
<th>Leakage current</th>
<th>Power loss</th>
<th>Component values/phase</th>
<th>Phase connections</th>
<th>Weight</th>
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<td>FN 359H</td>
<td>900</td>
<td>51</td>
<td>104</td>
<td>63 11 2.3 1 0.68</td>
<td>busbar</td>
<td>33.5</td>
</tr>
<tr>
<td>FN 359HV</td>
<td>900</td>
<td>60</td>
<td>104</td>
<td>63 5.5 2.1 1.5 0.68</td>
<td>busbar</td>
<td>34.5</td>
</tr>
<tr>
<td>FN 359</td>
<td>1200</td>
<td>39</td>
<td>146</td>
<td>63 11 2.3 1 0.68</td>
<td>busbar</td>
<td>35</td>
</tr>
<tr>
<td>FN 359H</td>
<td>1200</td>
<td>51</td>
<td>146</td>
<td>63 11 2.3 1 0.68</td>
<td>busbar</td>
<td>35.5</td>
</tr>
<tr>
<td>FN 359HV</td>
<td>1200</td>
<td>60</td>
<td>146</td>
<td>63 5.5 2.1 1.5 0.68</td>
<td>busbar</td>
<td>36.5</td>
</tr>
</tbody>
</table>

1 Max. leakage under normal circumstances. Note: If two phases are interrupted, worst case leakage current could reach 5.7 times higher levels. Measured at: standard types 400VAC; H types 520VAC; HV types 690VAC.
FN 359 insertion loss
Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

250A types

300A types

400A types

500A types

600A types

900A/1200A types

Mechanical drawings
See mechanical data table for dimensions

SIDE VIEW

TOP/END VIEW

I/O connections
FN 359 filters are fitted with an M12 screw for earth connection, and busbar-type connectors for phase terminals (dimensions vary according to current rating - see table).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>250/300A</th>
<th>400A</th>
<th>500A</th>
<th>600A</th>
<th>900A</th>
<th>1200A</th>
<th>Tol. mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>30</td>
<td>50</td>
<td>60</td>
<td>10.1</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>10.1</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>18</td>
<td>18</td>
<td>23</td>
<td>17</td>
<td>17</td>
<td>10.5</td>
</tr>
<tr>
<td>D</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>57</td>
<td>100</td>
<td>100</td>
<td>23.5</td>
</tr>
<tr>
<td>E</td>
<td>8.5</td>
<td>10.5</td>
<td>10.5</td>
<td>10.5</td>
<td>13</td>
<td>13</td>
<td>10.2</td>
</tr>
<tr>
<td>F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>26</td>
<td>10.2</td>
</tr>
<tr>
<td>G</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>26</td>
<td>10.2</td>
</tr>
</tbody>
</table>

All dimensions in mm; 1 inch = 25.4mm
The FN 256 family of filters is designed specifically for applications involving asymmetric loads, ranging from industrial control to medical electronics systems. These typically involve separate - and often unfiltered - frequency inverters and switch-mode power supplies on different phases, causing current imbalance and significant interference problems. Employing single-stage LCR circuits for each phase and the neutral line, FN 256 series filters provide particularly high attenuation of both symmetrical and asymmetrical interference. A special lightweight housing with a very small footprint ensures that the filters can be easily accommodated on control panels and in crowded equipment cabinets.

- 8 to 64A current ratings
- high attenuation
- small leakage current
- very compact dimensions

### Technical specifications

**Maximum operating voltage:** 480VAC (520VAC on request) at 50°C  
**Operating frequency:** DC to 60Hz at 50°C  
**Hipot test voltage:** P/N E 3000VDC for 2s; P/N P 2100VDC for 2s  
**MTBF** at 50°C, 400V per Mil-HB-217F: 8/16A 1,300,000 hours; 25/36/64A 600,000 hours  
**Protection category:** IP20

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings A at 50°C</th>
<th>Power loss W</th>
<th>Component values/phase</th>
<th>Phase connections</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 256 - 8 / ??</td>
<td>8 (9.1)</td>
<td>2.9</td>
<td>1.78 2.20 0.19 0.68 1.50</td>
<td>/46</td>
<td>1.0</td>
</tr>
<tr>
<td>FN 256 - 16 / ??</td>
<td>16 (18.1)</td>
<td>5.6</td>
<td>1.14 2.20 0.19 0.68 1.50</td>
<td>/46</td>
<td>1.1</td>
</tr>
<tr>
<td>FN 256 - 25 / ??</td>
<td>25 (28.3)</td>
<td>9.8</td>
<td>1.57 4.40 0.19 0.68 0.82</td>
<td>/47</td>
<td>1.4</td>
</tr>
<tr>
<td>FN 256 - 36 / ??</td>
<td>36 (40.8)</td>
<td>10.9</td>
<td>1.10 4.40 0.19 0.68 0.82</td>
<td>/47</td>
<td>1.5</td>
</tr>
<tr>
<td>FN 256 - 64 / ??</td>
<td>64 (72.6)</td>
<td>17.2</td>
<td>1.00 4.40 0.19 0.68 0.82</td>
<td>/52</td>
<td>2.2</td>
</tr>
</tbody>
</table>

*Max leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6 times higher levels.*

### Mechanical data

<table>
<thead>
<tr>
<th>Current</th>
<th>-8, -16</th>
<th>-25, -36</th>
<th>-64</th>
<th>Tol. ±mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>143</td>
<td>153</td>
<td>153</td>
<td>±1</td>
</tr>
<tr>
<td>B</td>
<td>115</td>
<td>125</td>
<td>125</td>
<td>±1</td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td>115</td>
<td>115</td>
<td>±0.5</td>
</tr>
<tr>
<td>D</td>
<td>120</td>
<td>135</td>
<td>140</td>
<td>±0.5</td>
</tr>
<tr>
<td>E</td>
<td>135</td>
<td>142</td>
<td>150</td>
<td>±0.5</td>
</tr>
<tr>
<td>F</td>
<td>156</td>
<td>166</td>
<td>176</td>
<td>±1</td>
</tr>
<tr>
<td>G</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>±1</td>
</tr>
<tr>
<td>H</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>±0.1</td>
</tr>
<tr>
<td>I</td>
<td>127.5</td>
<td>137.5</td>
<td>137.5</td>
<td>±0.3</td>
</tr>
<tr>
<td>J</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
<td>±0.1</td>
</tr>
<tr>
<td>K</td>
<td>M8</td>
<td>M8</td>
<td>M8</td>
<td>±1</td>
</tr>
<tr>
<td>L</td>
<td>59</td>
<td>94</td>
<td>99</td>
<td>±1</td>
</tr>
<tr>
<td>M</td>
<td>13.5</td>
<td>14.5</td>
<td>20</td>
<td>±1</td>
</tr>
</tbody>
</table>

All dimensions in mm; 1 inch = 25.4mm

### Electrical schematic

See table for component values

---

**EN 133200** (pending) (pending)
FN 256 insertion loss

Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

8 amp types

16 amp types

25 amp types

36 amp types

64 amp types

Mechanical drawings
See mechanical data table for dimensions

SIDE VIEW

TOP VIEW
The FN 354 family of filters is intended primarily for applications that demand extremely effective interference protection across a broad frequency spectrum. Advanced two-stage LCR filter circuits with non-saturating toroidal inductors, in conjunction with feed-through capacitors on each of the three phases and the neutral line, ensure that these filters provide very high attenuation in the upper frequency band.

- 4 to 25A current ratings
- high attenuation up to 300MHz
- three phases + neutral + earth connections
- choice of solder, fast-on or shrouded terminals
- suitable for Y and △ networks

**Technical specifications**

Maximum operating voltage: 440VAC at 40ºC; Operating frequency: DC to 60Hz at 40°C

Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1100VDC (1700VAC for 4 and 6A types)

MTBF at 40°C, 400V per Mil-HB-217F: 400,000 hours for 4 and 6A types

Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings</th>
<th>Leakage current</th>
<th>Power loss</th>
<th>Component values/phase</th>
<th>Phase connections</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 354 - 4</td>
<td>4 (4.6)</td>
<td>0.71</td>
<td>2.5</td>
<td>L: 0.3, L1: 4, Cx: 0.33, Cy: 15</td>
<td>/01 /05</td>
<td>0.225</td>
</tr>
<tr>
<td>FN 354 - 6</td>
<td>6 (6.9)</td>
<td>0.71</td>
<td>4.0</td>
<td>L: 0.5, L1: 4, Cx: 0.47, Cy: 15</td>
<td>/01 /03 /05</td>
<td>0.38</td>
</tr>
<tr>
<td>FN 354 - 12</td>
<td>12 (13.8)</td>
<td>0.72</td>
<td>10.0</td>
<td>L: 0.08, L1: 1700, Cx: 2.2, Cy: 15</td>
<td>/03</td>
<td>0.68</td>
</tr>
<tr>
<td>FN 354 - 15</td>
<td>15 (17.3)</td>
<td>0.40</td>
<td>18.0</td>
<td>L: 3, L1: 100, Cy: 0.47, Cy1: 0.01, R: 2.5</td>
<td>/03</td>
<td>5.45</td>
</tr>
<tr>
<td>FN 354 - 25</td>
<td>25 (28.8)</td>
<td>1.94</td>
<td>30.0</td>
<td>L: 1.4, L1: 60, Cy: 0.47, Cy1: 0.01, Cy2: 0.35, R: 0.5</td>
<td>/03</td>
<td>5.6</td>
</tr>
</tbody>
</table>

*Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6.7 times higher levels.

**Mechanical data**

<table>
<thead>
<tr>
<th>Current</th>
<th>-4</th>
<th>-6</th>
<th>-12</th>
<th>-15,-25</th>
<th>Total* ± mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>103 ± 5</td>
<td>120 ± 5</td>
<td>150</td>
<td>270</td>
<td>±1</td>
</tr>
<tr>
<td>B</td>
<td>44 ± 0.8</td>
<td>55</td>
<td>66</td>
<td>110</td>
<td>±1</td>
</tr>
<tr>
<td>G</td>
<td>40.5 ± 0.5</td>
<td>50.5 ± 0.5</td>
<td>60</td>
<td>110</td>
<td>±1</td>
</tr>
<tr>
<td>D</td>
<td>80</td>
<td>95</td>
<td>125</td>
<td>±3</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>95</td>
<td>110</td>
<td>140</td>
<td>230</td>
<td>±2</td>
</tr>
<tr>
<td>F</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>115 ±0.3</td>
<td>±1</td>
</tr>
<tr>
<td>O</td>
<td>0.5</td>
<td>0.75</td>
<td>1.05</td>
<td>±0.1</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>15</td>
<td>22</td>
<td>30</td>
<td>±1</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>7</td>
<td>11</td>
<td>9.5 ±0.5</td>
<td>±1</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>29</td>
<td>36</td>
<td>35.5</td>
<td>±0.2</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>3.8 ±0.1</td>
<td>4.4 ±0.5</td>
<td>7</td>
<td>±2</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>PG13.5</td>
<td>5AX4</td>
<td>2</td>
<td>±0.3</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>26.5</td>
<td>28</td>
<td>32.5</td>
<td>±0.1</td>
<td></td>
</tr>
</tbody>
</table>

All dimensions in mm; 1 inch = 25.4mm

* Measurements share this common tolerance unless otherwise stated
FN 354 insertion loss
Per CISPR 17; $A = \frac{50\Omega}{50\Omega}$ sym, $B = \frac{50\Omega}{50\Omega}$ asym, $C = \frac{0.1\Omega}{100\Omega}$ sym, $D = \frac{100\Omega}{0.1\Omega}$ sym

4 amp types

6 amp types

12 amp types

15 amp types

25 amp types

Mechanical drawings
See mechanical data table for dimensions

FRONT

TOP

SIDE

FN 354-4, -6, -12 /01 connections shown

FN 354-15, -25
The FN 355 family of general-purpose filters provides a cost-effective interference suppression solution for a wide variety of applications. Available in seven versions, with current ratings from 3 to 20A, the filters employ a single-stage 4-line LC circuit with non-saturating toroidal inductors, and have a very low leakage current. FN 355 filters are contained within an extremely compact housing, making them ideal for use in situations where space is at a premium.

- 3 to 20A current ratings
- low leakage current
- three phases + neutral + earth connections
- compact size
- suitable for Y and Δ networks

General-purpose filter

 FN 355

Technical specifications
Maximum operating voltage: 440VAC at 40°C; Operating frequency: DC to 60Hz at 40°C
Hipot test voltage: P ⇒ E 2000VAC; P ⇒ P 1700VDC
MTBF at 40°C, 400V per Mil-HB-217F: 850,000 hours
Overload: 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings A at 40°C (25°C)</th>
<th>Leakage current (400V/50Hz) mA</th>
<th>Power loss W</th>
<th>Component values/phase L mH Cx µF Cy nF</th>
<th>Phase connections</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 355 - 3 /??</td>
<td>3 (3.4)</td>
<td>0.07</td>
<td>1.5</td>
<td>1 0.1 4.7</td>
<td>/01 /05</td>
<td>0.25</td>
</tr>
<tr>
<td>FN 355 - 6 /??</td>
<td>6 (6.9)</td>
<td>0.07</td>
<td>1.5</td>
<td>0.45 0.1 4.7</td>
<td>/01 /05</td>
<td>0.25</td>
</tr>
<tr>
<td>FN 355 - 10 /??</td>
<td>10 (11.5)</td>
<td>0.07</td>
<td>1.7</td>
<td>0.2 0.1 4.7</td>
<td>/01 /05</td>
<td>0.25</td>
</tr>
<tr>
<td>FN 355 - 20 /??</td>
<td>20 (23)</td>
<td>0.29</td>
<td>3.6</td>
<td>0.12 0.1 22</td>
<td>/03</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 5.8 times higher levels.

Mechanical data

<table>
<thead>
<tr>
<th>Current</th>
<th>-3, -6, -10, -20</th>
<th>Tol. ± mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>85</td>
<td>± 0.5</td>
</tr>
<tr>
<td>B</td>
<td>34</td>
<td>± 0.5</td>
</tr>
<tr>
<td>C</td>
<td>50.3</td>
<td>± 1</td>
</tr>
<tr>
<td>D</td>
<td>65</td>
<td>± 0.2</td>
</tr>
<tr>
<td>E</td>
<td>75</td>
<td>± 0.05</td>
</tr>
<tr>
<td>F</td>
<td>0.7</td>
<td>± 0.5</td>
</tr>
<tr>
<td>G</td>
<td>11.3</td>
<td>± 0.5</td>
</tr>
<tr>
<td>H</td>
<td>28.8</td>
<td>± 0.5</td>
</tr>
<tr>
<td>I</td>
<td>36.3</td>
<td>± 0.5</td>
</tr>
<tr>
<td>L</td>
<td>27</td>
<td>± 0.5</td>
</tr>
<tr>
<td>M</td>
<td>6.3</td>
<td>± 0.1</td>
</tr>
<tr>
<td>P</td>
<td>5.3</td>
<td>± 1</td>
</tr>
</tbody>
</table>

All dimensions in mm; 1 inch = 25.4mm

Electrical schematic

See table for component values

![Electrical schematic diagram]
FN 355 insertion loss
Per CISPR 17; A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

3 amp types
6 amp types
10 amp types
20 amp types

Mechanical drawings
See mechanical data table for dimensions

FRONT

TOP
This filter family is designed specifically for high-current applications, such as large frequency inverters for motor drives, and high-power uninterruptible and switch-mode supplies. FN 356 filters are fully compliant with the IEC 950 safety standard, making them particularly suitable for use in large mainframe computer systems. Employing a single-stage LCR circuit for each phase and the neutral line, the filters provide high attenuation of both symmetrical and asymmetrical interference.

- 16 to 100A current ratings
- three phases + neutral + earth connections
- IEC 950 compliant
- meets EN 55011/55014 & VDE 0871/0875

### High-current filter

#### Technical specifications

- **Maximum operating voltage:** 440VAC at 40ºC; **Operating frequency:** DC to 60Hz at 40ºC
- **Hipot test voltage:** P ⇒ E 2000VAC; P ⇒ P 1700VDC
- **MTBF at 40°C, 400V per Mil-HB-217F:** 220,000 hours
- **Protection category:** IP20 for connections /29, /33 and /34
- **Overload:** 4 times rated current at switch on, then 1.5 times rated current for 1 minute, once per hour

<table>
<thead>
<tr>
<th>Filter</th>
<th>Current ratings A at 40ºC (25º)</th>
<th>Leakage current (400V/50Hz) mA</th>
<th>Power loss W</th>
<th>Component values/phase L mH Cx μF Cx1 μF Cy μF R kΩ</th>
<th>Phase connections</th>
<th>Weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN 356 - 16 / ??</td>
<td>16 (18.4)</td>
<td>0.43</td>
<td>8</td>
<td>1.2 0.68 1 15 220</td>
<td>/29</td>
<td>1.5</td>
</tr>
<tr>
<td>FN 356 - 25 / ??</td>
<td>25 (28.8)</td>
<td>0.43</td>
<td>28</td>
<td>1.3 2 2 15 100</td>
<td>/33</td>
<td>2.6</td>
</tr>
<tr>
<td>FN 356 - 36 / ??</td>
<td>36 (41.5)</td>
<td>0.43</td>
<td>30</td>
<td>0.95 2 2 15 100</td>
<td>/33</td>
<td>2.7</td>
</tr>
<tr>
<td>FN 356 - 50 / ??</td>
<td>50 (57.7)</td>
<td>0.43</td>
<td>13</td>
<td>0.55 2 2 15 100</td>
<td>/34</td>
<td>3.9</td>
</tr>
<tr>
<td>FN 356 - 100 / ??</td>
<td>100 (115.4)</td>
<td>1.33</td>
<td>14</td>
<td>0.32 2 2 47 100</td>
<td>/28</td>
<td>10</td>
</tr>
</tbody>
</table>

*Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6.0 times higher levels.*

### Mechanical data

<table>
<thead>
<tr>
<th>Current A</th>
<th>-16 (/29)</th>
<th>-16 (/06)</th>
<th>-25, -36 (/24)</th>
<th>-50 (24)</th>
<th>-50 (/33)</th>
<th>-75 (24)</th>
<th>-75 (33)</th>
<th>-100 (28)</th>
<th>-100 (34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>189.5</td>
<td>199</td>
<td>200 ± 1</td>
<td>199.5</td>
<td>199</td>
<td>199</td>
<td>199</td>
<td>199</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>189.5</td>
<td>199</td>
<td>200 ± 1</td>
<td>199.5</td>
<td>199</td>
<td>199</td>
<td>199</td>
<td>199</td>
<td></td>
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All dimensions in mm; 1 inch = 25.4mm

* Measurements share this common tolerance unless otherwise stated

### Electrical schematic

See table for component values

![Electrical schematic](image-url)

† Max. leakage under normal circumstances. Note: if two phases are interrupted, worst-case leakage current could reach 6.0 times higher levels.
FN 356 insertion loss
Per CISPR 17: A = 50Ω/50Ω sym, B = 50Ω/50Ω asym, C = 0.1Ω/100Ω sym, D = 100Ω/0.1Ω sym

16 amp types

25 amp types

36 amp types

50 amp types

100 amp types

Mechanical drawings
See mechanical data table for dimensions

FRONT

TOP

FN 356-16 with /29 connections

FN 356-16 /06 and FN 356-36, -50 with /24 connections (/24 shown)

FN 356-25, -36, -50 with /33 connections

FN 356-100 with /28 connections (note centred earth terminal)

FN 356-100 with /34 connections
Filter input/output connections

These are the standard types of input and output connections available for Schaffner's range of filter families.

Schaffner can also produce filters with other popular output connectors, or user-specific interfaces, to custom order. Please call your local sales office to discuss requirements.

All dimensions in mm.

Type /01
Solder lug with a hole capable of accommodating several small wires.

Type /03
Clamp terminal with M4 screw.

Type /05
Industry-standard size fast-on terminal, 6.3 x 0.8mm.

Type /06
Industry-standard size fast-on which may also be used as a solder lug, 6.3 x 0.8mm.

Type /07
Insulated wire, stripped ready for soldering. Wire gauge varies according to filter.

Type /09
Solder lug with a hole capable of accommodating several small wires.

Type /24
M6 screw lead-through.

Type /28
M10 screw lead-through.

Type /29
Safety terminal block for 6mm² or AWG 10 cables.

Type /33
Safety terminal block for 10mm² or AWG 6 cables.

Type /34
Safety terminal block for 25mm² or AWG 1/0 cables.

Type /35
Safety terminal block for 50mm² or AWG 1/0 cables.

Type /36 and /40
Safety terminal block for 95mm² or AWG 4/0 cables.

Type /37
Safety terminal block for 150mm² or AWG 6/0 cables.

Type /38
M16 screw lead-through.

Type /39
M20 screw lead-through.

Type /41
M25 screw lead-through.

Type /42
M30 screw lead-through.

Type /43
M36 screw lead-through.

Type /44
M40 screw lead-through.

Type /45
M46 screw lead-through.

Type /46
Strip terminal block for solid wire 10mm², flex wire 6mm², AWG 8.
*without neutral line

Type /47
Strip terminal block for solid wire 16mm², flex wire 10mm², AWG 6.
*without neutral line

Type /52
Strip terminal block for solid wire 25mm², flex wire 16mm², AWG 4.
*without neutral line
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