

Remarks for

Schaffner Recommendation List

Content

1.	EMI Filter	2
2.	Passive Harmonic Filter.....	3
2.1	Differences between FN3410/12 and FN3411/13 filter types	3
2.2	Important notes when applying high power line filter types FN3410/11/12/13	3
2.3	Important notes when applying FN3410HV filter types.....	3
3.	Output Filters	4
3.1	Comparison of dv/dt filter and sine-wave filter	4
3.2	dv/dt filters.....	4
3.3	Sine-wave filter.....	8
4.	Contact.....	9

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02	Additional content added	MW, XT, AK	AK	27.09.2016

Note: This document is intended to be used as supplements for Schaffner recommendation list. Please read both, the recommendation list and this document carefully. In case of any remaining question or uncertainty please do not hesitate to contact your local Schaffner sales partner or the contact persons named in this document.

1. EMI Filter

	Filter Type	Current Range	Voltage	Protection Category	EMC Emission Category *	EMI Attenuation Level	Temperatur	Overload Capability	Leakage Current **	Special Features
FN3258	3Ph EMC Filter	7 ... 180A	480VAC 520VAC (FN3258H)	IP20	EN61800-3, Class C2, 50m cable	High / Very High	50°C - up to 100°C with derating	1.5 x rated current for 1 Min., once per hour	33mA	Compact bookstyle form
FN258	3Ph EMC Filter	7 ... 250A	480VAC 690VAC (FN258HV)	IP20	EN61800-3, Class C1 or C2, 30m cable	High / Very High			< 1 ... 30mA	FN258HV/IT for IT network operation FN259L and FN258P with low leakage
FN3268	3Ph EMC Filter	7 ... 180A	520VAC	IP20	EN61800-3, Class C1, 30m cable Class C2, 100m cable	High / Very High			7 ... 75A: 4.5 ... 7.8mA 100 ... 180A: 20 ... 37mA	Compact bookstyle form In combination with RCD's
FN3120H	3Ph EMC Filter	25 ... 230A	520VAC	IP20	EN61800-3, Class C1, 100m cable	Very High			100mA	For regen applications
FN3359	3Ph EMC Filter	150 ... 2'500A	500VAC	IP00	EN61800-3, Class C2, 50m cable	High / Very High			<6mA	3-stage filter for a very wide range of application
FN3359HV	3Ph EMC Filter	150 ... 2'500A	690VAC (FN3359HV)	IP00	EN61800-3, Class C2, 50m cable	High / Very High			<6mA	For IT network operation
FN3280	3Ph+N EMC Filter	8 ... 600A	520VAC	IP20 up to 200A IP00 >200A	EN61800-3, Class C1, 30m cable Class C2, 100m cable	Very High			<1mA	High performance with low leakage

*Depends on field installation – for standard fulfillment please consult your local Schaffner partner or the contact persons named in this document

** For more details, please refer to the product's datasheet

2. Passive Harmonic Filter

2.1 Differences between FN3410/12 and FN3411/13 filter types

- | FN3410 (for 50Hz grid) and FN3412 (for 60Hz grid) filters are designed for **diode** rectifiers
- | FN3411 (for 50Hz grid) and FN3413 (for 60Hz grid) filters are designed for **thyristor** rectifiers (SCR).

2.2 Important notes when applying high power line filter types FN3410/11/12/13

- | High power line filters have current ratings from 380A up to 710A
- | In order to achieve ~5% THID, it is required to have L_{dc} included in the drive or to have load side choke L_{ac} installed upstream the drive.
- | Without L_{dc} or load side L_{ac} , <15% THID can be achieved by high power line filter at de-rated current rating, which can be calculated with Equation 1.

$$I_{\text{derated}} = I_{\text{nominal}} \cdot \sqrt{\frac{55^{\circ}\text{C} - T_{\text{amb}}}{15^{\circ}\text{C}}}$$

Equation 1 De-rating current calculation

2.3 Important notes when applying FN3410HV filter types

- | FN3410HV filters are designed to achieve 5% THID @ rated power for 690V applications.
- | For the filter types smaller than 60A, there is no requirement to have DC link choke L_{dc} or load choke L_{ac} . 5%THID is achieved @ rated power.
- | For the filter types with and above 60A (FN3410HV-60-35), to achieve ~5% THID, it is required to have L_{dc} included in the drive or to have load side choke L_{ac} installed direct upstream the drive.

3. Output Filters

3.1 Comparison of dv/dt filter and sine-wave filter

Performance	dv/dt filters	Sine-wave filters
<i>Stress of motor insulation</i>	Up to 300m cable (screened/unscreened) complies with the requirements of IEC60034-17 (general purpose motors). Above this cable length the risk of 'double pulsing' (twice the mains voltage) increases.	Provides a sinusoidal phase-to-phase motor terminal voltage. Complies with IEC-60034-17 and NEMA-MG1 requirements for general purpose motors with cables up to 500m
<i>Stress of motor bearing</i>	Slightly reduced, only in high power motors	Reduces bearing currents caused by circulating currents. Does not reduce CM currents (shaft currents).
<i>EMC performance</i>	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in FRI filters.	Eliminates motor cable ringing. Does not change the emission class. Does not allow longer motor cables as specified for the frequency converter's built-in RFI filter.
<i>Max. motor cable length</i>	300m	Up to 2km
<i>Acoustic motor switching noise</i>	Reduces slightly acoustic switching noise.	Reduces acoustic noise of the motor
<i>Relative size</i>	small	big
<i>Voltage drop</i>	0.5%	4-10%

3.2 dv/dt filters

- | For up to 500V dv/dt filters (FN5060) DM voltage distortions are reliably mitigated up to 1000V (phase-to-phase peak voltage)
 - o Drive output voltage dv/dt is reduced by minimum of factor 8 (up to 12 for some types), see Figure 1
 - o Multi-purpose motors and inverter duty motors are protected

- | For up to 690V dv/dt filters (FN5060HV) DM voltage distortions are reliably mitigated up to 1850V (phase-to-phase peak voltage)
 - o Drive output voltage dv/dt is reduced by minimum of factor 8 (up to 12 for some types)
 - o No distinction between different motor types defined in standards, see Figure 2

- | No effect on CM voltage distortions
 - o No motor protection for common mode voltages
 - o In case of CM distortions the use of all-pole sine wave filters is required/recommended

- | Derating might be needed with respect to voltage, switching frequency and cable length. Please refer to Figure 3 to find out if derating is required and needed derating factors
- | Schaffner patented dv/dt design approach does not contain power resistors and does increase reliability and decrease size compared to traditional dv/dt filter approaches
- | Motor frequency does have an impact on dv/dt filter choice
 - o In case of higher motor frequency with and above 60Hz dv/dt filters need to be derated by terms of filter current, the derating factor k can be found in Figure 4
- | UL approved Electrical insulation system class N (200°C)
- | FN5060 UL approval up to 700A
- | FN5060HV UL approval (pending) up to 320A

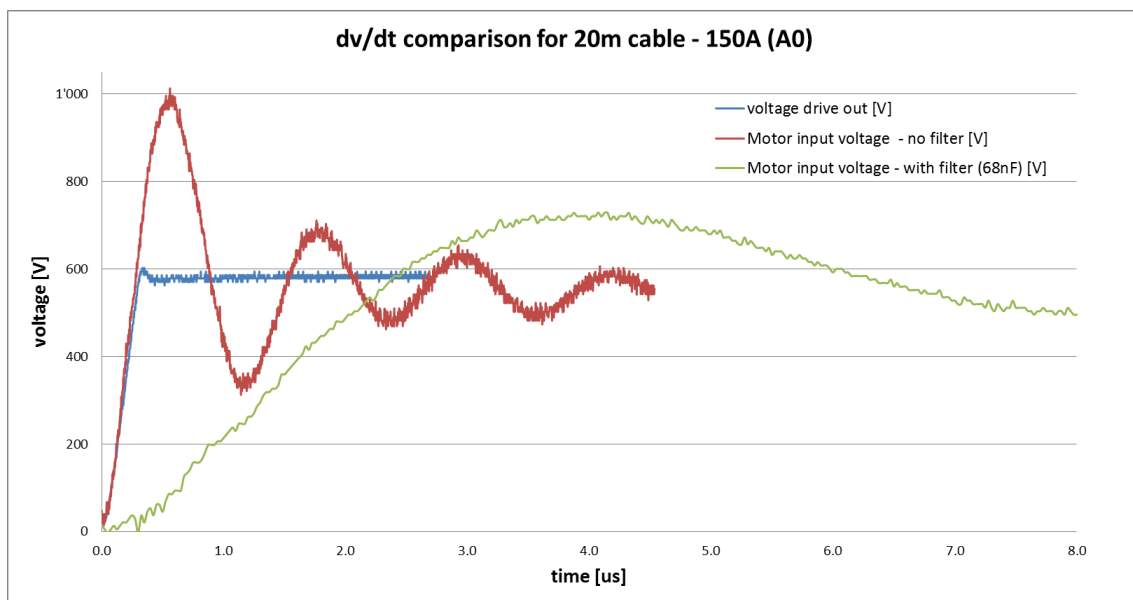


Figure 1 Motor input voltage with and without dv/dt filter (cable length 20m)

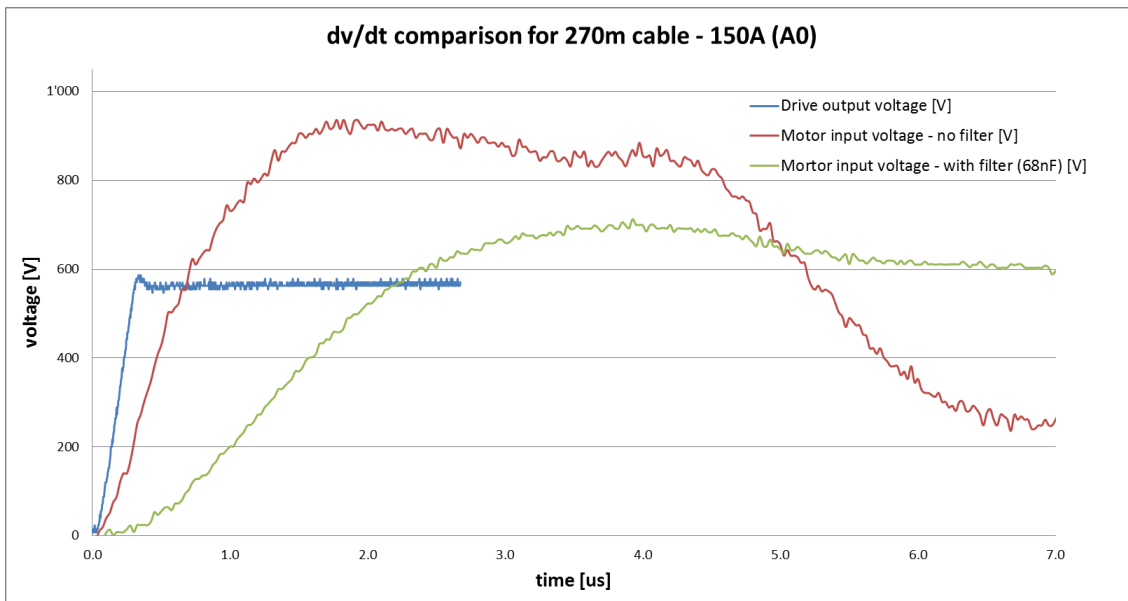


Figure 2 Motor input voltage with and without dv/dt filter (cable length 270m)

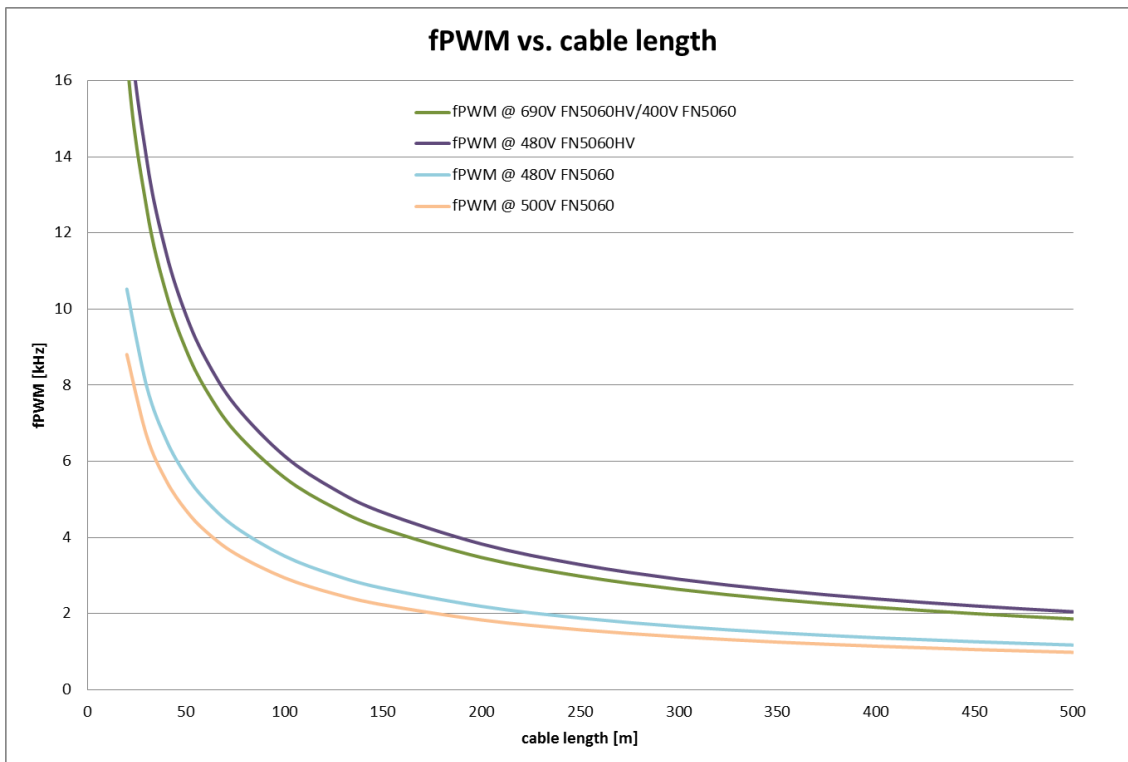


Figure 3 Switching frequency vs. motor cable length

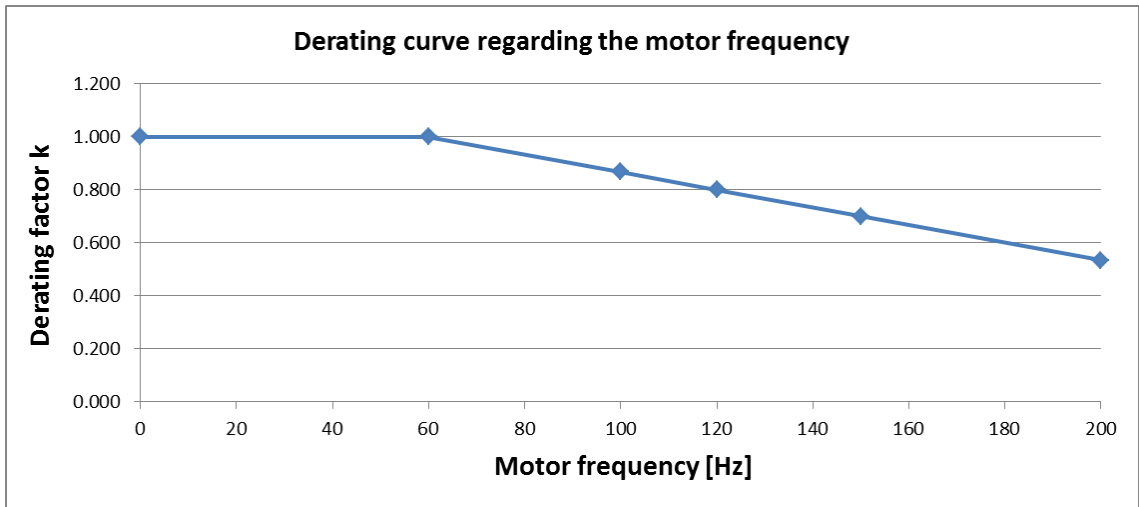


Figure 4 Derating curve of dv/dt filter regarding the motor frequency

3.3 Sine-wave filter

- | FN5040 filters convert the rectangular phase-to-phase PWM output signal of motor drives into a smooth sine wave voltage with low residual ripple (<5% ph-ph)
 - o Standard sine-wave filters do almost not have an effect on CM voltage distortions
 - o In case of needed CM voltage distortion mitigation all-pole sine-wave filters or additional add-on sinewave CM voltage module need to be used (please contact Schaffner representative in case of any needed support)
- | FN5040 sine wave filters are available in IP00 and IP20
- | FN5040HV are available in IP00
- | Derating of filter current rating regarding motor frequency can be found in Figure 5, which is applicable for FN5040 and FN5040HV
- | The maximum cable lengths for FN5040 filters and FN5040HV filters are shown in Figure 6 and Figure 7, respectively
- | UL approved Electrical insulation system class N (200°C)
- | FN5040 UL approval up to 750A
- | FN5040HV UL approval pending up to 300A

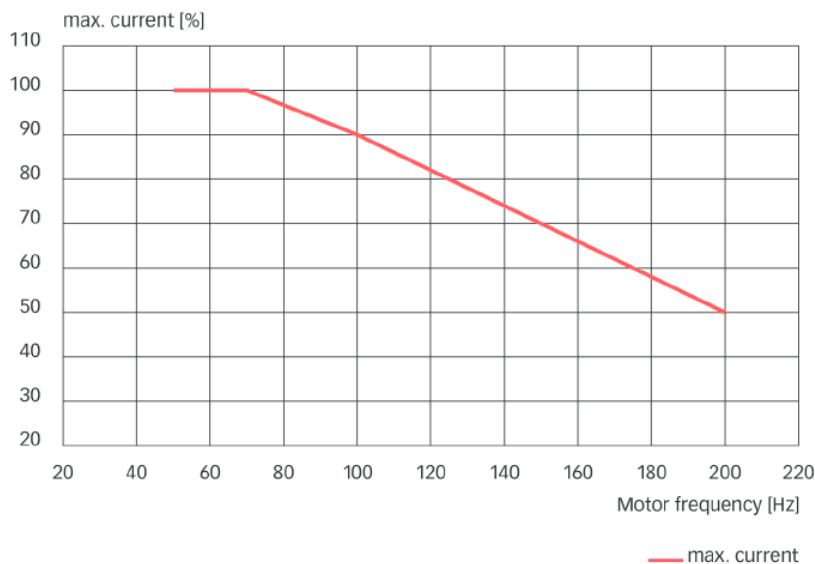


Figure 5 Motor frequency derating (for FN5040 and FN5040HV)

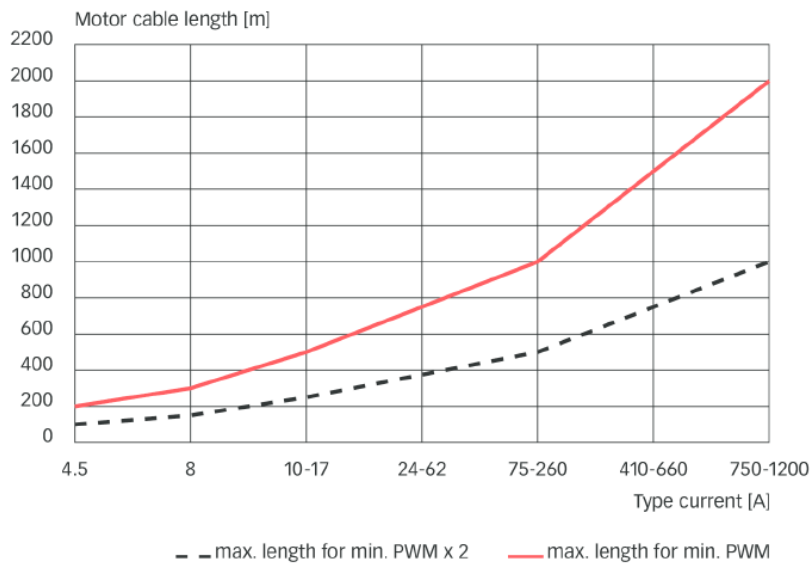


Figure 6 Max. motor cable length (For FN5040)

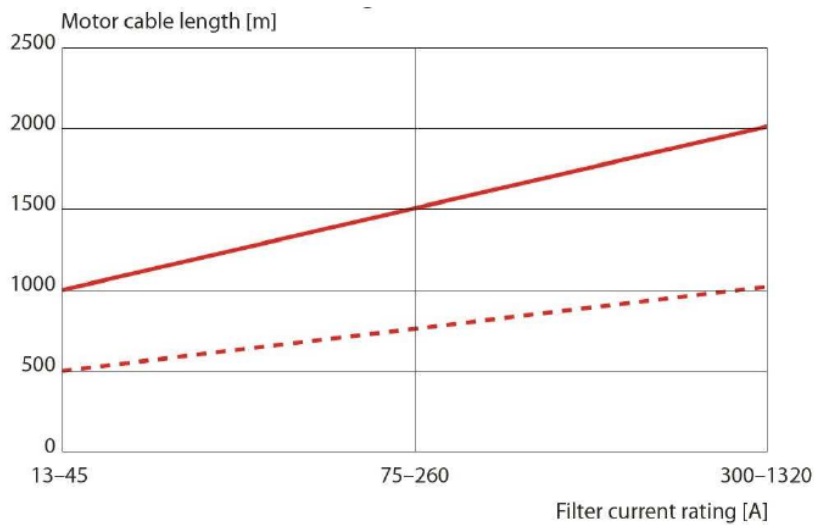


Figure 7 Max. motor cable length (In case a step-up transformer is used, then the length is meant to be between the filter and transformer)

4. Contact

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