Applications for 690 V

Solutions for highly demanding 600/690 V applications

energy efficiency and reliability
The Schaffner Group is the international leader in development and production of solutions which ensure efficient and reliable operation of electronic systems. The Group’s broad range of product and services includes EMC/EMI components, harmonic filters and magnetic components as well as development and implementation of customized solutions. Schaffner components are deployed in energy-efficient drive systems and electronic motor controls, in wind and photovoltaic systems, rail technology, machine tools and robotics as well as power supplies for numerous electronic devices in sectors such as medical technology or telecommunications. Schaffner provides on-site service to customers around the world through an efficient, global organization and makes ongoing investments in research, development, production and sales to systematically expand its position as leader on the international market.
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The use of 600/690 V grids

Of course the most common voltage range used to supply low voltage electrical distribution systems is 380 to 480 V. As this is the same level widely used for the public electrical distribution network, an uncountable number of equipment and components is easily available on the market. However, the range and number of applications that is working on voltage levels between 600 and 690 V has drastically increased. Nowadays suitable solutions with frequency converters for 690 Vs are available from Megawatts down to 0.37 Kilowatts.

Energy at a lower price
The higher voltage level is capable to provide advantages, mainly in terms of energy efficiency improvements as well as cost optimization. Considerable savings can be achieved in the investment and operation costs for equipment by using motors with 690 V. The initial costs of such devices are considerable. As power losses decrease with higher voltages cabling and run time costs decrease significantly. This might make the choice of 690 V instead of lower voltages quite interesting and convenient.

Standards and limits for 600/690 V applications
The general requirements for EMC and power quality are increasing and a number of different international and national standards, norms and regulations have been introduced to give guidance for what is to be considered good EMC and power quality. Even if 690 V applications are providing a lot of advantages compared to the ones in the 400 V range, they suffer from the same issues like harmonics, unbalance and low power factor. And like any other 400 V device they have to meet the same international standards for immunity and safety of electrical and electronic equipment.
Get the most efficient and reliable performance out of your 600/690 V application

Of course there are numerous 600/690 V applications. And of course no project is similar to the other. But quite often the challenges and opportunities are similar to those that other applications are facing. With more than 50 years of experience in engineering and developing, the Schaffner Group is definitely able to meet your needs, no matter how demanding or challenging they are.

Ready-to-use solutions or customer-specific development
The Group's broad range of products and services including EMC/EMI components, harmonic filters and magnetic components as well as the development and implementation of customized solutions offers you a complete range of solutions to help you meet your applications challenges.

Energy efficiency and reliability
Electromagnetic interference or power quality issues are not always easy to classify and they even may not seem to be important, but understanding and improving EMC and power quality can easily help avoiding energy losses and improve the reliability and productivity of your applications. This helps processes to use energy more efficiently, avoid downtimes and even reduce maintenance and restart costs. And as almost all EMC/EMI and PQ standards are applicable the same way as on 400 V applications it is additionally the precondition to be allowed to run your process at all.

Global presence and unparalleled customer proximity
The Schaffner Group is the international leader in the development and production of solutions which ensure the efficient and reliable operation of electronic systems. But beside the technical know-how customers have additional key elements to consider for cooperation. The global presence of the Schaffner Group ensures the availability of products and flexible service wherever you need it. This helps to save time and efforts, reduce operating risks and to maintain your own high standards.
Solutions for highly demanding 600/690 V applications

Clean and efficient power – Harmonic mitigation

**Active Harmonic Filter**
- Compensation current: 0 to 200 A
- Frequency: 47 to 63 Hz
- Harmonic mitigation: THID < 5%, THID adjustable
- Voltage: 500 to 690 V

**Passive Harmonic Filter**
- Frequency: 50 Hz
- Harmonic mitigation: THID < 5%
- Rated Power: 7.5 to 250 kW
- Voltage: 690 V

1. Global or selective compensation of harmonic currents up to the 50th order
2. Compensation of displacement power factor
3. Load balancing capability
4. Response time of less than 300 microseconds
5. 3-level topology with 20–30% lower losses

1. The industry standard for 6-pulse rectifiers and motor drives
2. The most compact 5% THID filter available
3. Excellent behavior under partial load conditions
4. Filters for diode rectifiers

Standard fulfillment – EMC-suitable filtering

**FN 258HV Book-style three-phase EMC/RFI Filter**
- Attenuation performance: high, very high
- Leakage current: 0.7 to 30 mA
- Motor power: 4 to 132 kW
- Operating frequency: dc to 60 Hz
- Rated current: 7 to 250 A
- Voltage: ≤ 690 V

1. Industry standard EMC solution for three-phase PDS filtering
2. Slim space-saving book-style housing
3. Solid safety connector blocks or optional wire output connections
4. Excellent attenuation performance
5. HV versions for up to 690 VAC
6. HVIT versions for IT distribution networks
7. P/L versions with low leakage current

**FN 3359HV High-current three-phase EMC/RFI Filter**
- Attenuation performance: very high
- Leakage current: < 6 mA
- Motor power: 75 to 2000 kW
- Operating frequency: dc to 60 Hz
- Rated Current: 150 to 2500 A
- Voltage: ≤ 690 V

1. Off-the-shelf high power filter for rated currents up to 2500 A
2. HV versions designed for 690VAC IT power networks
3. Busbars for convenient and universal electrical connection
4. Protective plastic covers optionally available for unsurpassed safety

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**Diagram**
- Frequency Inverter (Energy regeneration)
- Rectifier
- DC Link
- Harmonics
- EMC/EMI
- PV converter
- Wind converter
- UPS converter
Solutions for highly demanding 600/690 V applications

- Custom reactors and filters
  - Special reactors for e.g. PV inverters
  - Special dv/dt filters for e.g. wind turbines
  - Special sine wave filters for e.g. motor drives
  - Special LCL filters for e.g. energy re-generation
  - Compact combinations of transformer and reactor

- Liquid-cooled custom magnetic components
  - Advanced cooling elements
  - without copper/copper alloys
  - Water, oil, glycol or mixture of these coolants
  - Simple liquid connection with one input and one output
  - Voltage: up to 1100 VAC
  - Frequency: up to 400 Hz
  - Current: 500 to 6000 A

- Low-voltage custom transformers
  - Isolation transformers
  - Auto-transformers
  - 1-phase transformers up to 500 kVA
  - 3-phase transformers up to 1500 kVA
  - Transformer-reactor combinations up to 1000 kVA
  - For e.g. industrial applications, renewable energy, rail

Maximize production – protect motors and reduce disturbances

Sine Wave Output Filter
- Motor power: 7.5 to 1200 kW
- Motor frequency: 0 to 70 Hz
- Motor cable length: ≤ 2000 m
- Rated current: 13 to 1320 A
- Switching frequency: 2 to 16 kHz
- Voltage: 0 to 690 V

- Smooth sine wave without voltage peaks
- Motor protection against pulse pattern stress
- Improvement of system reliability
- Reduces bearing currents
- Ideal for retrofit installations

Engineered to application – Customized solutions
Solutions for highly demanding 600/690 V applications

The power quality solutions for heavy industrial loads and demanding applications
Schaffner ECOsine® Active filters for 600/690 V with state-of-the-art 3-level inverter modules do compensate harmonics up to the 50th harmonic order, eliminate reactive power and phase unbalance and correct cos phi. Schaffner ECOsine® Passive harmonic filters represent an economical solution to the challenge of load-applied harmonics mitigation in three-phase 600/690 V power systems. The outstanding Schaffner harmonic filter portfolio – applicable for almost all applications – guarantees for:

- **Reliability**: Eliminates all relevant disturbance patterns in the power lines
- **Efficiency**: Prevents losses due to process downtimes
- **Flexibility**: Always the best cost-benefit ratio with numerous technical solutions available from Schaffner
- **Compliancy**: Ensures grid operator’s requirements and compliance to all PQ standards
- **Cost-savings**: Avoids/reduces wear on electrical loads and over-heating of cables and transformers
- **Plug-and-play**: Simple installation and intuitive operation

Sine wave output filter for 600/690 V motor drives applications

Electronic motor controls (motor drives) enable significant savings in electricity consumption and smart motor control. Their mode of operation – involving rectifiers and inverters – does however not only produce EMI and harmonics as a by-product, the output signal can also harm the motor side of the drive. Schaffner output filters and reactors protect electric drive systems, prevent from expensive equipment downtime and premature motor failure. Dedicated Schaffner products even allow the deployment of unshielded motor cables, the use of multiple motors in parallel on the same drive or the retrofit of modern drives in existing installations with old motors and unshielded cabling.

FN 5040HV Sine wave filter for 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 (≤ 2000 m)
- Motor drive power range up to 1,200 kW
- Motor cable length: ≤ 2000 m
EMC/RFI Filter – Industry standard
EMC solutions for 600/690 V

Three-phase power drive systems, inverters and converters
Schaffner offers the world’s broadest selection of EMC/EMI filters and chokes. Standardized and customer-specific solutions – with full engineering support – help to meet international compliance standards and improve the immunity and safety of electrical and electronic equipment. Most standard catalog items carry international approvals (UL, CSA, ENEC, CQC) and are available from major electronics distributors worldwide.

FN 258HV Book-style EMC/EMI filter for three-phase inverters and power drive systems
- Industry standard EMC solution for three-phase PDS filtering
- Slim space-saving book-style housing
- Solid safety connector blocks or optional wire output connections
- Excellent attenuation performance
- HVIT versions for IT distribution networks
- P/L versions with low leakage current

FN 3359HV High current three-phase EMC/EMI filter
- Off-the-shelf high power filter for rated currents up to 2500 A
- Busbars for convenient and universal electrical connection
- Protective plastic covers optionally available for unsurpassed safety
- Attenuation performance: very high
Schaffner has the expertise for the early identification of potential sources of interference, both in the development of new products and in subsequent system optimization. Beside the broad range of standard components Schaffner is able to provide an efficient measurement service, expert technical advisors and the skills to develop and produce customer-specific solutions quickly and deliver them to all key markets throughout the world. Schaffner operates five modern, high-capacity production sites worldwide: in Bueren (Germany), Kecskemét (Hungary), Lamphun (Thailand), Shanghai (China) and in Wytheville (USA). Specialists in 18 customer service and application centers around the globe maintain close contact with the development and application engineers of our regional and international customers.

Custom reactors and filters
- Special reactors for e.g. PV inverters
- Special dv/dt filters for e.g. wind turbines
- Special sine wave filters for e.g. motor drives
- Special LCL filters for e.g. energy re-generation
- Compact combinations of transformer and reactor

Liquid-cooled custom magnetic components
- Advanced cooling elements without copper/copper alloys
- Water, oil, glycol or mixture of these coolants
- Simple liquid connection with one input and one output

Low-voltage custom transformers
- Isolation transformers
- Auto-transformers
- 1-phase transformers up to 500 kVA
- 3-phase transformers up to 1500 kVA
- Transformer-reactor combinations up to 1000 kVA

Customized solutions for 690 V and above

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For mining and minerals

Safety, reliability and efficiency are the key facts for the optimized operation of mines

Beside the goal to meet governmental policies on energy efficiency the reduction of costs in the daily business is the path to a profitable operation of mining and mineral processing companies. Companies in the mining sector have identified several opportunities like:

- The use of new technologies
  - The overall use of high performance variable speed drives with optimized energy efficient motors
  - Energy regeneration

- Retro-fitting (same but more efficient technologies)
  - Replacement of DOL motors with drives even down to smallest power sizes

- Increased availability and reduced maintenance of devices
  - Fully enclosed devices with high IP categories for use in harsh environments
  - Ambient temperatures up to 50 °C

With its proven solutions The Schaffner Group can help to improve reliability, efficiency, maintenance practices, equipment use and life time in the typical highly demanding mining and mineral applications like:

- Conveyors and feeders
- Crushers
- Mills and separators
- Stackers and reclaimers
- Hoist applications
- Slurry pumping
Mining and minerals
For the metals industry

Improved productivity through modernization and strong automation

The metals industry is very capital-intensive and a globalized market. The key to success is productivity improvement with highest operation performance combined with highest possible energy efficiency and lowest impact on environment. The key technology that is used in the metals industry is definitely drives. They allow for:

- Optimized production output with high quality
- Minimized quality issues and scrap

With its proven and globally available solutions The Schaffner Group is the perfect partner to help increasing process reliability and reducing energy losses and CO₂ emissions. With over 50 years of experience we guarantee for minimized wear and tear of the equipment used in the demanding metal applications like:

- Motors, generators, drives
- Blast furnace blowers
- Profile rolling mills
- Hot flat rolling mills
- Cold rolling mills
- Fans and pumps
For the oil and gas industry

Safe operation, protection and high performance under most challenging conditions
The oil & gas industry requires solutions for a broad variety of tasks. The range of very complex applications beside the production and the transport and processing of primary fossil fuels includes complete systems like refineries with all required pipelines and storage and offloading (FPSO), compressor and pump solutions as well as automation and control technologies. Even technologies from other applications like power generation, water and wastewater management and industrial IT solutions are required. But at the end, the whole system depends on:

- Reliable solutions under most challenging conditions
- Resource-saving energy use

With its proven and globally available solutions The Schaffner Group is the perfect partner to help increasing system reliability and ensure high performance. With over 50 years of experience we can surely help to successfully solve the demanding challenges in the oil & gas applications like:

- Motors, generators, drives
- Drilling rigs
- Oil-line pumps
- Jack pumps
- Slurry pumps
- Submersible pumps
- Oil-swapping pumps
Clean water is one of the most precious goods of mankind, especially if it has to be safe enough to be consumed by humans or used with low risk of immediate or long term harm. As only 3% of the earth’s water is fresh non-saline, almost each drop of water requires some type of treatment before use. There are several technologies and levels of water treatment, e.g. primary, secondary and tertiary levels of treatment. Energy and operational efficiency can be reached by:

- High degree of automation
- Use of variable speed drives

Water and wastewater applications are the perfect field for the use of variable speed drives. They help to save huge amounts of energy. Nowadays special water and wastewater drives are used from the smallest pump station to the most complex treatment plant. With its proven and globally available solutions the Schaffner Group is the perfect partner to help compensating the harmonic distortion caused by the drives ensuring a reliable use of the equipment as well as compliance with the utility regulations. With over 50 years of experience we guarantee for working solutions for applications like:

- Compressors
- Turbo blowers
- Pumps and mixers
- Mixers
- Osmosis and desalination
For hoisting applications

Safe operation, maximized system performance and enhanced stability
Hoisting applications do usually move heavy loads; the drives included are big ones. Nevertheless high accuracy and safety while providing a good speed is required. Modern hoisting systems have integrated control systems and use variable speed drives to ensure speed and functionality of the application. The use of variable speed drives allows for:

- Enhanced stability of the trolleys due to synchronization functionality
- Smoother hoisting due to specialist functions
- Regenerating power that would otherwise be lost as heat in hoisting and other motion-control scenarios
- Savings in space and money

With its proven and globally available solutions The Schaffner Group is the perfect partner to help ensuring functionality and reliability and reducing energy losses of hoisting applications. With over 50 years of experience we guarantee grid compliance of the system and minimized wear and tear of the equipment used in hoisting applications like:

- Industrial cranes
- Harbor cranes
- Overhead crane-hoisting mechanisms
- Tower hoists
Enhanced availability, protection of people and equipment
and high and efficient performance with individual requirements

Marine and offshore applications are usually individual and independent with a flexible approach, providing client focused solutions. Almost all marine and offshore applications require electricity which has to be generated on-board or offshore by the use of fuel. Beside the increasing demands on safety and reliability, this leads also to a strong requirement for operational economy and environmental performance which can be ensured by:

- The use of modern and efficient motors, generators and drives
- The use of compact filters for reduced harmonics

As marine and offshore applications are very often unique and individual, Schaffner cannot provide each and every marine certificate for each product. Individual products are applicable for some major marine certificates on request. For all those projects not requiring marine certificates, The Schaffner Group with its proven and globally available solutions is the perfect partner to ensure smooth operation of the usually islanded systems and help increasing process reliability and reducing energy losses and CO emissions also for marine applications like:

- HVAC
- Winches and cranes
- Fans and pumps
- Generators and motors
- Auxiliary Drives
Marine and offshore
For the versatile energy and power industry

Optimized technologies and high availability
Increasing global demand, scarcity of fossil fuels and new ecological solutions are requiring optimized technologies with high degree of efficiency. This is true for all the different segments of the energy industry like thermal power, wind energy, biomass energy, waste incineration and photovoltaics, etc. Optimized energy plant performance can be reached through:

- Highly integrated and interconnected facilities
- The use of efficient variable speed drives
- Efficient, reliable and grid-compliant energy feed-in

With its proven and globally available solutions The Schaffner Group is the perfect partner to help maintain high power with a good reliability and profitability. With over 50 years of experience we guarantee for innovative solutions always up-to-date with the challenging technologies in demanding energy and power applications like:

- Fans and pumps
- Conveyors
- Compressors
- Crushers, mills
- Wind energy systems
- PV-Systems
Global presence, 50 years of experience and unparalleled customer proximity

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Schaffner – energy efficiency and reliability. You can put your trust in our solutions and products for efficient and reliable building technology and thus benefit from competent and comprehensive assistance and the excellent Schaffner services. Contact us right now. We are happy to assist you taking your challenges in modern building technology. For more information on all Schaffner sites, sales partners and their contacts or on all our products, please visit us under www.schaffner.com. We are looking forward to meeting you.