

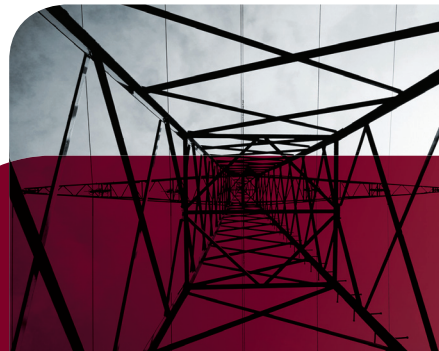
## Superconductor Fault Current Limiters for MV AC Networks

### About Nexans

With energy as the basis of its development, Nexans is a global player in the infrastructure, industry, building and Local Area Network (LAN) markets. As a worldwide leader in the cable industry, it offers an extensive range of cables and cabling systems to raise industrial productivity, improve business performance, enhance security, enrich the quality of life, and assure long-term network reliability. With an industrial presence in 40 countries and commercial activities worldwide, Nexans employs 24,500 people and had sales in 2011 of 7 billion euros. Nexans is listed on NYSE Euronext Paris, compartment A.

### About AMSC®

AMSC (NASDAQ: AMSC) generates the ideas, technologies and solutions that meet the world's demand for smarter, cleaner ... better energy. Through its Windtec Solutions, AMSC provides wind turbine electronic controls and systems, designs and engineering services that reduce the cost of wind energy. Through its Gridtec Solutions, AMSC provides the engineering planning services and advanced grid systems that optimize network reliability, efficiency and performance. The company's solutions are now powering gigawatts of renewable energy globally and enhancing the performance and reliability of power networks in more than a dozen countries. Founded in 1987, AMSC is headquartered near Boston, Massachusetts with operations in Asia, Australia, Europe and North America.



Talk to us about

- Solving your most complex power challenges
- Enhancing competitive advantage
- Improving your system's performance, reliability and profitability

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Whether you wish to make new advances in renewable technology, optimize power generation or delivery, or simply gain a better understanding of the issues you face, please get in touch. We're here to help.



Nexans



## Superconductor Fault Current Limiters for MV AC Networks

Nexans



ultra-fast,  
automatic,  
proven

Gridtec  
Solutions™



# Superconductor Fault Current Limiters for MV AC Networks

## Short circuit current levels keep increasing

As demand for electricity has grown along with the need for increased system reliability, utilities have added generation and built interconnections to more tightly mesh their networks. Upgrades such as these result in higher fault current levels. As fault levels increase, the ability to interrupt the fault currents - and the ability of stationary equipment to withstand the forces associated with them - become a concern. Utilities have long employed a variety of fault current mitigation systems and techniques such as fault current limiting reactors, complicated operating schemes and the use of over-rated equipment. However, each of these approaches has distinct drawbacks.

**Superconductor Fault Current Limiters (SFCLs) are ideal for locations in the grid where high fault currents are approaching or exceeding existing equipment ratings.**

## SFCLs manage high short circuit currents

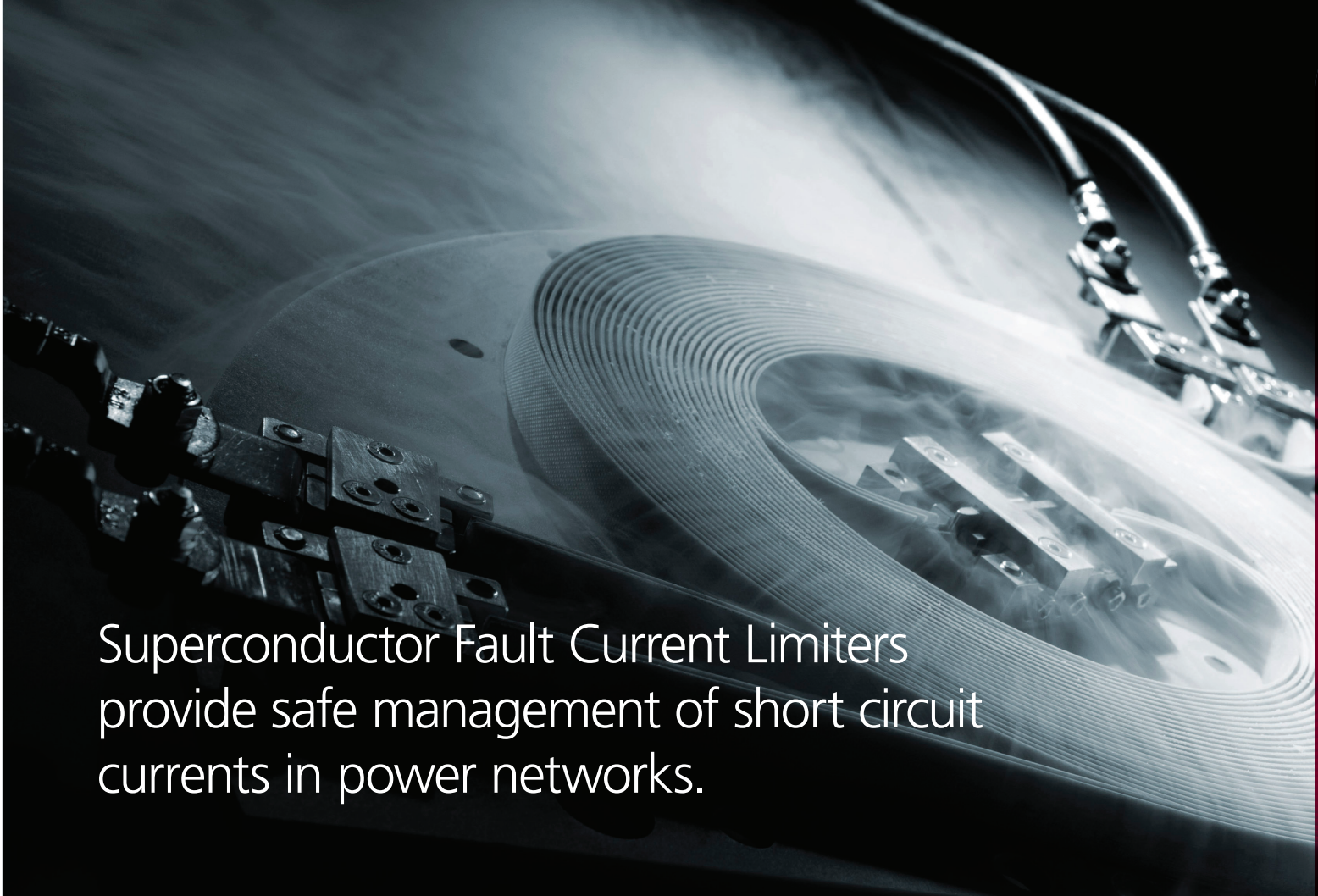
The resistive SFCL from Nexans and AMSC is an ultrafast, automatic, reusable solution that does not restrict or impair the operation of the power system during normal operation, and limits fault currents starting with the first half-cycle peak.

Resistive SFCLs have essentially zero insertion impedance under normal conditions, eliminating steady-state losses, voltage drop, and other negative system impacts associated with the introduction of steady-state impedance. During a fault, the system becomes highly resistive. The effect is an immediate reduction in fault current magnitude, including the first half-cycle peak. After the fault is cleared, the SFCL returns to service, ready for the next event.

**SFCLs allow for more secure and reliable grid operations**



- **Defer or Eliminate Equipment Replacement**
- **Increase Equipment Life**
- **Reduce System Equipment Costs**
- **Improve System Operation**
- **Simplify Renewables Integration**
- **Improve Operator Safety**



Superconductor Fault Current Limiters  
provide safe management of short circuit  
currents in power networks.

### Defer or Eliminate Equipment Replacement

The addition of generation and new transmission ties increase short circuit levels. This often requires the construction of new substations or existing substations to be upgraded. These upgrades usually include the installation of new circuit breakers with higher interrupting capacity, stronger bus work and improved ground mat properties. SFCLs are a cost effective option to restrict fault currents to levels that eliminate or defer the need for such investments.

### Increase Equipment Life

Reducing fault current levels prevents damage to a variety of substation equipment, including circuit breakers and grounding equipment, extends the life of power transformers and ensures proper operation of circuit interrupting devices. Used on underground circuits, SFCLs can also limit thermal and mechanical damage to cables.

### Improve System Operation

SFCLs eliminate the need to split substation buses as a means to reduce short circuit currents while avoiding the decrease in system reliability and the introduction of operating constraints that accompanies such grid decouplings. The need for sequential tripping schemes can be avoided through the use of SFCLs. These schemes slow fault clearing times and often demand tripping of unfaulted circuits, unnecessarily disconnecting customers and lowering reliability indices, while having no impact on the mechanical forces associated with the first few cycle peaks of a fault. Finally, the operation of protective relay devices can be improved by reducing or eliminating the effect of fault-current-induced current transformer (CT) saturation. The resistive characteristic of the AMSC/Nexans SFCL also reduces the DC offset associated with asymmetrical faults, further reducing the risk of CT saturation.

### Reduce System Equipment Costs

By lowering peak currents, the need and cost to install over-rated equipment throughout the surrounding grid can be avoided altogether.

### Simplify Renewables Integration

Small to mid-size renewable plants that increase fault current levels may not be able to directly connect to distribution networks. In such cases, the renewable plant is usually tied to the transmission network through a transformer, mitigating the increase in fault current level. An SFCL placed between the renewable plant and the distribution grid connection can eliminate the need for this HV transformer and its associated substation. SFCLs can also moderate short circuit levels in such situations, potentially allowing protective relay settings to be left unchanged.

### Improve Operator Safety

Reduce the risk of increased step and touch potentials within substations caused by high short circuit currents.

### SFCLs address many issues facing utilities with high fault current levels:

- Insufficient circuit breaker interrupting ratings
- High short circuit forces
- Under-rated bus work, ground mats and other equipment
- Lower reliability from split bus operation
- Excessive DC-offsets during faults
- Need for expensive substation upgrades
- Use of reactors and their associated steady state power loss
- Sequential tripping

### AMSC and Nexans combine to offer complete, turnkey fault current limiter solutions:

- Fully engineered SFCL systems
- T&D planning
- Project management
- Construction management
- Professional substation design engineering
- Substation control and protection
- Ongoing maintenance services
- Cooperative consulting with your engineering department or preferred design firm

