According to the Electric Power Research Institute (EPRI), “Under increased power flow conditions on existing assets, managing fault currents is crucial in order to avoid malfunctioning and damage of equipment as well as to increase system reliability.”

As demand for electricity increases, utilities around the world are adding capacity by increasing generation. This additional generation is becoming more decentralized with the incorporation of co-generators, independent power producers and alternative energy sources such as wind and solar.

The interconnectedness of the electrical grid is necessary to provide redundancy and improved reliability. As the energy requirement of the customer base increases, more generation is added and the fault current levels in the existing grid rise dramatically. This puts undue strain on the infrastructure and increases the threat of potential outages.

AND THE PROBLEM IS JUST GETTING BIGGER.
AN INNOVATIVE SOLUTION FOR MANAGING FAULT CURRENTS

Utilities require a solution for managing fault currents that offers minimal impedance (under normal operation), can significantly reduce the first peak in the fault current and is cost effective. Applied Materials’ fault current limiters (FCLs) deliver these features in a compact footprint to increase grid security and reliability, offering a viable, long-term, proven solution to the mounting fault current problem.

PRODUCT OFFERINGS

Applied’s FCLs use state-of-the-art technology and a modular design approach to allow easy configuration. Applied Materials has two solutions addressing different segments of the grid market:

- Superconducting FCL (SCFCL) using superconductors for high voltages from 11kV to 400kV
- Solid State FCL (SSFCL) using solid state electronics for voltages from 6kV to 45kV

Both FCLs work with normal currents ~3500Amps and are capable of handling faults exceeding 100kA.

COMPACT FOOTPRINT

The physical dimensions of Applied’s distribution class FCLs offer a very small footprint. At 1.2m wide x 2.4m long x 2.5m high, they can be easily retrofitted into existing substations.

The transmission class FCL has a footprint as small as 1.8m per phase. The footprint can be customized to meet the particular needs of the customer.

RELIABILITY AND SECURITY

Applied Materials’ FCLs have been designed to increase utility power system reliability. A common platform approach ensures easy scalability of the FCLs and simplifies testing. The FCLs require no outside control system to operate and are therefore not readily susceptible to control system failure or cyber-attack.

COST EFFECTIVE

- Avoid or defer capital investment in equipment upgrades
- Increase utilization of existing assets
- Protect both equipment and people by ensuring faults do not exceed equipment ratings
- Eliminate disruptions to circuits and critical infrastructure
<table>
<thead>
<tr>
<th>Parameter</th>
<th><strong>TRANSMISSION CLASS</strong> Super conducting FCL for 11kV to 400kV</th>
<th><strong>DISTRIBUTION CLASS</strong> Solid State FCL for 6kV to 45kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Voltage</td>
<td>11kV to 400kV Line to Line</td>
<td>6kV to 45kV Line to Line</td>
</tr>
<tr>
<td>Line current</td>
<td>Up to around 3.5kA</td>
<td>Up to around 3.5kA</td>
</tr>
<tr>
<td>Line Frequency</td>
<td>50/60Hz</td>
<td>50/60Hz</td>
</tr>
<tr>
<td>Fault current reduction</td>
<td>Up to 60% first peak and RMS</td>
<td>Up to 60% first peak and RMS</td>
</tr>
<tr>
<td>Normal (unfaulted) voltage drop</td>
<td>Negligible insertion impedance</td>
<td>Negligible insertion impedance</td>
</tr>
<tr>
<td>Insertion impedance if loss of control system</td>
<td>Negligible insertion impedance</td>
<td>Negligible insertion impedance</td>
</tr>
<tr>
<td>Fault duration</td>
<td>Designed to utility specifications</td>
<td>Designed to utility specifications</td>
</tr>
<tr>
<td>Fault sequence</td>
<td>Multiple faults per event compatible with the automated utility re-closure schemes</td>
<td>Multiple faults per event compatible with the automated utility re-closure schemes</td>
</tr>
<tr>
<td>Recovery time</td>
<td>Designed to the requirement as specified by the utilities</td>
<td>Designed to the requirement as specified by the utilities</td>
</tr>
<tr>
<td>FCL operation time w/loss of power</td>
<td>Up to a few days</td>
<td>UPS required</td>
</tr>
<tr>
<td>Typical Dimensions</td>
<td>1.8m L x 1.2m W per phase. Systems configured to substation needs</td>
<td>2.4m L x 1.2m W x 2.5m H. Exact size determined by MVA and current limiting specs</td>
</tr>
<tr>
<td>Fault Current</td>
<td>10kA to 100kA prospective unlimited fault current</td>
<td></td>
</tr>
</tbody>
</table>

* Specifications are subject to change.

**GLOBAL TECHNOLOGY LEADERSHIP**

**Applied Materials Inc.**

- **Stock Ticker**: NASDAQ: AMAT
- **Fiscal 2015 Revenue**: $9.7 Billion
- **Fiscal 2015 RD&E**: $1.5 Billion
- **Founded**: November 10, 1967
- **Headquarters**: Santa Clara, California
- **Global Presence**: 81 locations in 18 countries
- **Employees**: ~14,600 worldwide
- **Patents**: ~10,200 issued

*Data as of fiscal year end, October 25, 2015.
* Headcount excludes temporary and interns.