

# FAULT CURRENT LIMITERS

Wilson Transformer Company and GridON have proven the first fully tested commercial Fault Current Limiters (FCLs), scalable to extra high voltage ratings. Unlike previous FCL technologies which have not reached commercial viability, our solution, utilising standard transformer technology and manufacturing expertise, offers a robust product range, scalable in size for distribution and transmission networks.



THE TRANSFORMER  
PEOPLE

## KEY FEATURES

- > Protects the Grid by Suppressing Fault Currents
- > Instantaneous Response to Network Faults
- > Immediate Recovery when Fault Clears
- > Scalable to Extra High Voltage Ratings
- > Cuts Capital and Operating Costs of the Grid
- > Facilitates Interconnectivity & Smart Networks



Wilson Transformer Company partnered with GridON to bring its novel, world-class portfolio of FCL products to the market. FCLs facilitate network interconnectivity and improve the quality and availability of the grid enabling the ever-increasing demand for capacity increase and connection of power generation from both conventional and renewable energy sources.

Designed using rudimentary electromagnetic principles, our self-triggered FCL suppresses prospective fault currents on distribution and transmission grids. Using a unique and proprietary concept of magnetic-flux alteration (requiring no superconducting or cryogenic components), the FCL's impedance rises instantaneously upon fault condition. It limits the fault current for its entire duration and recovers to its normal condition immediately thereafter, guaranteeing protection from consecutive faults.

The Energy Technologies Institute (ETI) commissioned and invested in a US\$7m project to develop and demonstrate our first FCL system. The FCL has been fully tested by Testing & Certification Australia, an independent high power test laboratory, and was put into service in a UK Power Networks substation in May 2013.

Extensive experience has been gained in design, manufacture and testing of saturated core FCLs, in a range of current/load conditions, at Wilson Transformer Company's manufacturing facility in Melbourne, Australia. The units operating in the UK sites have seen trouble-free service both during normal load and during fault events. Fully tested, HTS-free FCLs are commercially available for both Distribution and Transmission networks.

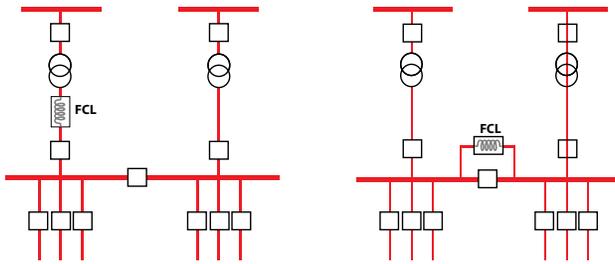
## APPLICATION

### FCL in a transformer feeder location

Placing a FCL in a transformer feeder location offers great flexibility in reducing substation fault levels to accommodate switchgear ratings. One or more FCLs may be installed, depending on the fault reduction required, with minimal changes to existing protection settings. The FCL may be included in the transformer protection zone, with no additional relays or CTs required. The FCL may also be used to improve load balancing between feeder transformers with different impedances and/or rated power. FCLs enable capacity increase on existing grids.

### FCL in a bus-tie location

Placing a FCL in a bus-tie location offers significant advantages in paralleling bus sections upon loss of one or more transformers in the substation. It also enables paralleling of bus sections in previously split substations, allowing interconnectivity, more flexible running arrangements and increased power quality. One or more FCLs may be installed, depending on the bus-bar topology and fault reduction required, with minimal changes to existing protection settings. The FCL may be paralleled with existing bus-tie circuit breakers, with no additional relays or CTs required.



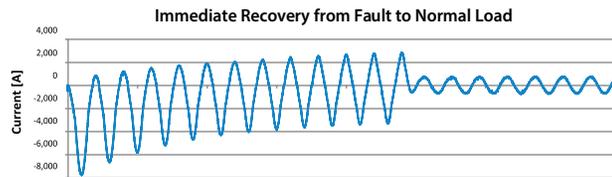
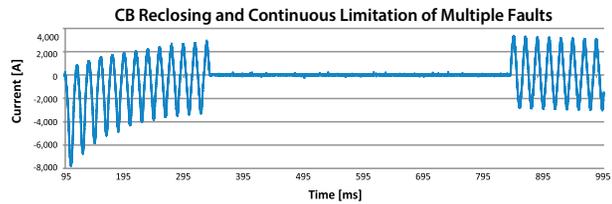
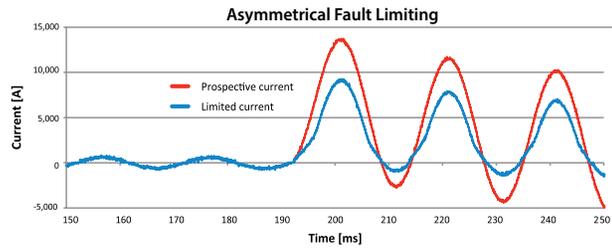
The FCL utilises copper windings wound onto a DC biased, pre-saturated iron core, enabling it to present very low impedance during normal operation. When fault conditions occur, the iron core is self-driven instantaneously out of saturation, presenting much higher impedance to the grid, thereby limiting the fault current.

Upon fault clearing, the FCL immediately (< 1ms) resumes its low impedance normal condition, ready to protect against any subsequent network faults.

## 10MVA FCL FOR UK POWER NETWORKS

Prior to installation, the FCL was fully tested under extreme network conditions by Testing & Certification Australia, a certified high power laboratory. Performance and withstand to fault current events have been demonstrated over 50 fault tests. Immunity to loss of DC bias has been verified both in nominal load and fault conditions.

The device has been tested under circuit breaker reclosing and fault recovery conditions, demonstrating full fault limiting capability for repeated faults. Instantaneous recovery from fault back to nominal impedance has been demonstrated.



## 10MVA KEY PARAMETERS

Parameter	Value
Line Voltage	11kV, 50Hz, 3-ph
Nominal load current (power through)	525Arms (10MVA)
Prospective fault current	5.34kArms, 13.6kA peak
Limited fault current	2.22kArms, 9.13kA peak
Fault current reduction (clipping)	58% of steady state rms (33% of first peak)
Tested fault withstand duration	3 seconds
Recovery from fault to normal load	Instantaneous (< 1msec)
CB reclosing	Fully tested with 500msec dead zone between faults
Voltage drop during normal operation	0.8-2%
Power frequency voltage withstand	28kV
Lightning impulse withstand	75kV

## 30MVA FCL FOR WESTERN POWER DISTRIBUTION

A 30MVA, 11kV FCL was commissioned into service at the Western Power Distribution Castle Bromwich sub-station, UK in April 2015. Its specifications are far more demanding than the 10MVA unit with over 50% fault level reduction.

The FCL has been installed on one of the dual LVs of a 132/11-11kV, 60MVA transformer.

For information about other projects, please visit: <http://www.wtc.com.au/your-requirements/products/fault-current-limiters/>

## WILSON TRANSFORMER COMPANY PTY LTD

**Power Transformer Business Unit**  
 310 Springvale Road, Glen Waverley (PO Box 5)  
 Vic 3150 Australia  
 T: +613 9560 0411  
 F: +613 9560 0599  
 E: powersales@wtc.com.au



**Built Smart for Life**