

CLiP®

Current Limiting Protector

*For systems rated 2.8-38kV,
and continuous currents through 5000A*



- ***Arc Flash and Arc Blast Reduction***
- ***Network Protection***
- ***SCADA Adaptable***
- ***Indoor or Outdoor Application***
- ***Professional Support***
- ***Easy to Install and Maintain***
- ***Laboratory and Field Tested***
- ***Cost Effective***

If a major fault occurred on your system today, could your circuit breakers clear it?

How long would it take, and what would be the cost of damage repair?

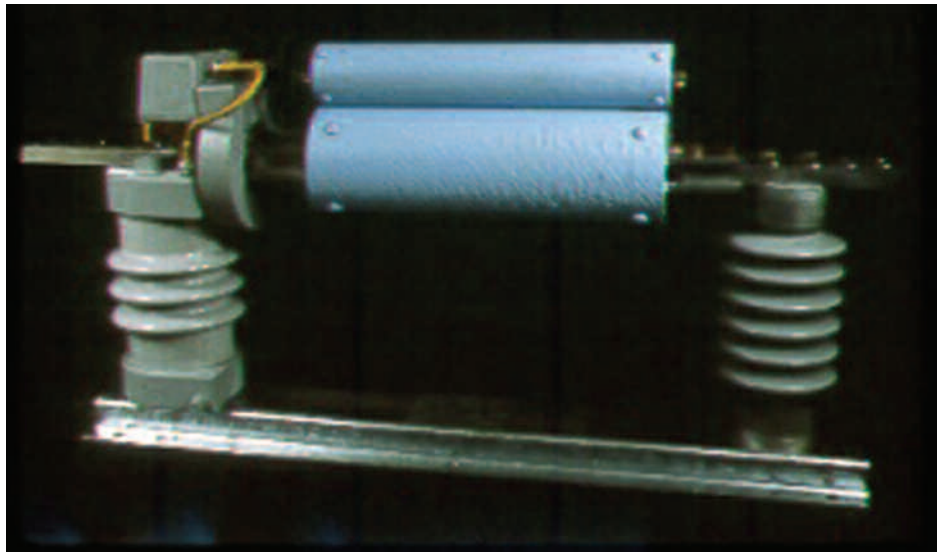
G&W offers a unique overcurrent protection device that can address these needs. G&W's **CLiP[®] (Current Limiting Protector)** has provided unparalleled system protection, around the world, for over 20 years. It offers the advantages of current limitation for systems rated to 38kV with high continuous current ratings up to 5000A. Fault interruption beyond 300kA rms symmetrical at 15.5kV has been achieved.

The CLiP is an electronically sensed and triggered, commutating form of current limiter, sometimes referred to generically as an **Is-Limiter**, where a continuous copper bus bar path carries the continuous current. This path is opened under overcurrent conditions to introduce a parallel mounted current limiting fuse which interrupts the fault.

NEED FOR IMPROVED PROTECTION

With the ever-increasing demand for electrical energy, distribution systems have been forced to expand and grow. Stiffened transmission systems, increased substation capacity, onsite and distributed generation all contribute to subsequent increases in available fault currents imposed on equipment. This short circuit current may exceed its thermal, mechanical and interrupt capability, potentially causing a catastrophic failure. The CLiP is a tool to prevent this.

Current limitation is a key benefit because it yields a significant reduction in the magnitude of the peak let-thru current. Also, since electromechanical forces and fault energy are related to the



▲ *Typical 15.5kV, 3000A Current Limiting Protector.*

mathematical square of the current value, limitation of the peak current has a dramatic affect. This can lead to substantial savings by reducing damage, and may also prevent the catastrophic failure of oil filled equipment, or greatly limit arc flash exposure.

CONVENTIONAL FAULT INTERRUPTING DEVICES

Traditionally, the current limiting fuse has provided good overcurrent protection on systems with normal continuous currents up to a few hundred amperes. Their current limitation capability, speed of operation, compact size and low cost make them ideal solutions for certain applications.

Expulsion fuses also fill a need. Yet, while these devices are relatively fast acting, they are unable to limit the destructive forces related to the peak currents. Electromagnetic forces and fault energy are related to the square of these unlimited peak current values.

For higher continuous currents, circuit breakers are most commonly used. However, circuit breakers are not current limiting and are relatively

slow interrupting devices (3-5 cycles). The application of a CLiP for protection of under-rated circuit breakers can provide significantly improved protection at a substantial cost savings over replacement of those circuit breakers. For applications where available fault currents have increased due to expanding power requirements, simply replacing the circuit breakers may not be adequate protection for other under-rated equipment on the system.

Another device is the current limiting reactor. Reactors have high continuous current capabilities and are current limiting. However, they require an auxiliary device to do the actual fault interruption. Reactors are inherently costly to operate because they introduce substantial losses to the system and impose an undesirable regulating voltage.

G&W's CLiP is the successful result of a project sponsored by the Electric Power Research Institute (EPRI), to develop a cost effective, single-shot, high continuous current, medium voltage current limiter for use indoors or out. These are five highly desirable elements never before available in one overcurrent protection device.

CLIP OPERATION (FIGURE 2)

A large section copper conductor carries the continuous current. Upon occurrence of a short circuit current, a sensing unit actuates a linear cutting device. This segments the copper conductor into a number of fractional lengths, and bends them upward, thereby forming multiple gaps. Arcs form at these gaps.

The resultant arc voltage across these gaps causes transfer of the short circuit current to a small, parallel current limiting fuse. This fuse then melts and clears the circuit, as would a conventional current-limiting fuse. Current extinction occurs in the first half loop, and limitation prior to the first peak. Reliable interruption is assured without venting of ionized gases.

Note the multiple breaks in the main current path to provide faster commutation of fault current to the current limiting fuse element, while providing improved dielectric withstand.

SERVICE LIFE

Interrupters are designed for a 20 year in-service life. There is no need to replace or rebuild repeatedly without ever operating.

ELECTRICAL RATINGS

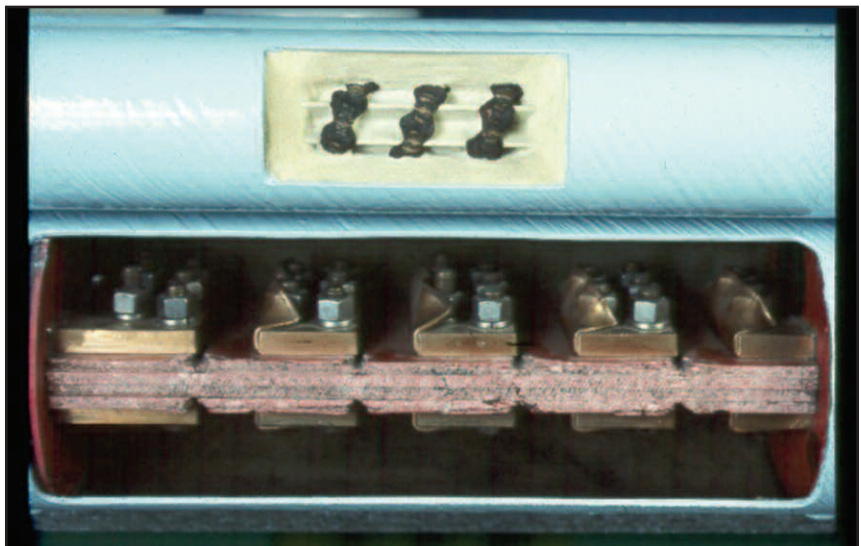
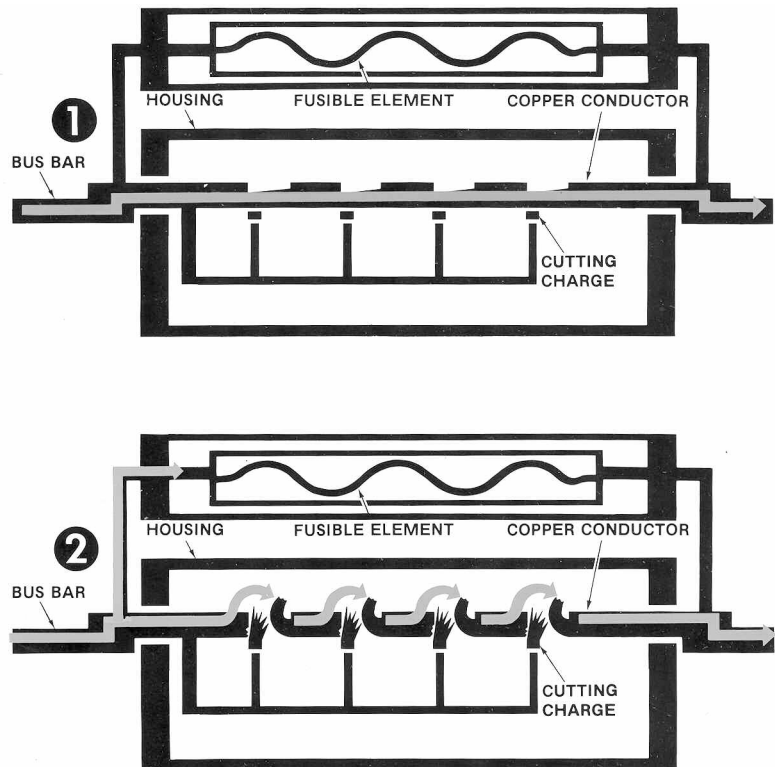
Voltage, kV2.8 - 38kV*
 Continuous current,
 A, rms, symUp to 5000**
 Interrupting rating,
 A, rms, symUp to 120kA**
 Peak let-thru current,
 @ 40kA rms, sym.
 @14kA trip level21 kA
 Available trip levels
 kA instantaneousUp to 42

* Consult factory for 600V and 72.5kV.

** Consult factory for higher ratings.

OPERATION SEQUENCE

Refer to copy Figure 2



▲ Close up of the severed main conductor and melted current limiting element of a 3000A (double bus) CLIP after interruption.

STANDARD FEATURES

1) A standard 3-phase unit comes complete with interrupters, mounting system using stainless steel channel base, isolation transformers, bus supports, sensing and firing logics, and tinned copper bus with pad for customer connection.

2) Sensing and firing logic units have field-selectable trigger level settings with ranges up to 42kA instantaneous. They do not use transient-susceptible rate of current rise (di/dt) sensing.

3) CLiP units are suitable for indoor use or for outdoor use with or without an enclosure.

4) Units are suitable for either 50 or 60hz applications.

5) Three-Phase Remote Indication of Operation provides one relay per phase with 2 N.O. and 2 N.C. (form C) contacts for customer fault sensing circuits (located in the control box). No need to trip all 3 phases for a 1 or 2-phase fault. Use these hi-speed remote indication relay contacts to trip an existing breaker and clear the unfaulted phases. No need to replace interrupters in unfaulted phases.

6) IP66, NEMA Type 4, welded steel, powder-coated Remote Control Box. This contains terminal blocks for user's power supply and alarm connections, control voltage monitor relay with 2 N.O. and 2 N.C. (form C) contacts.

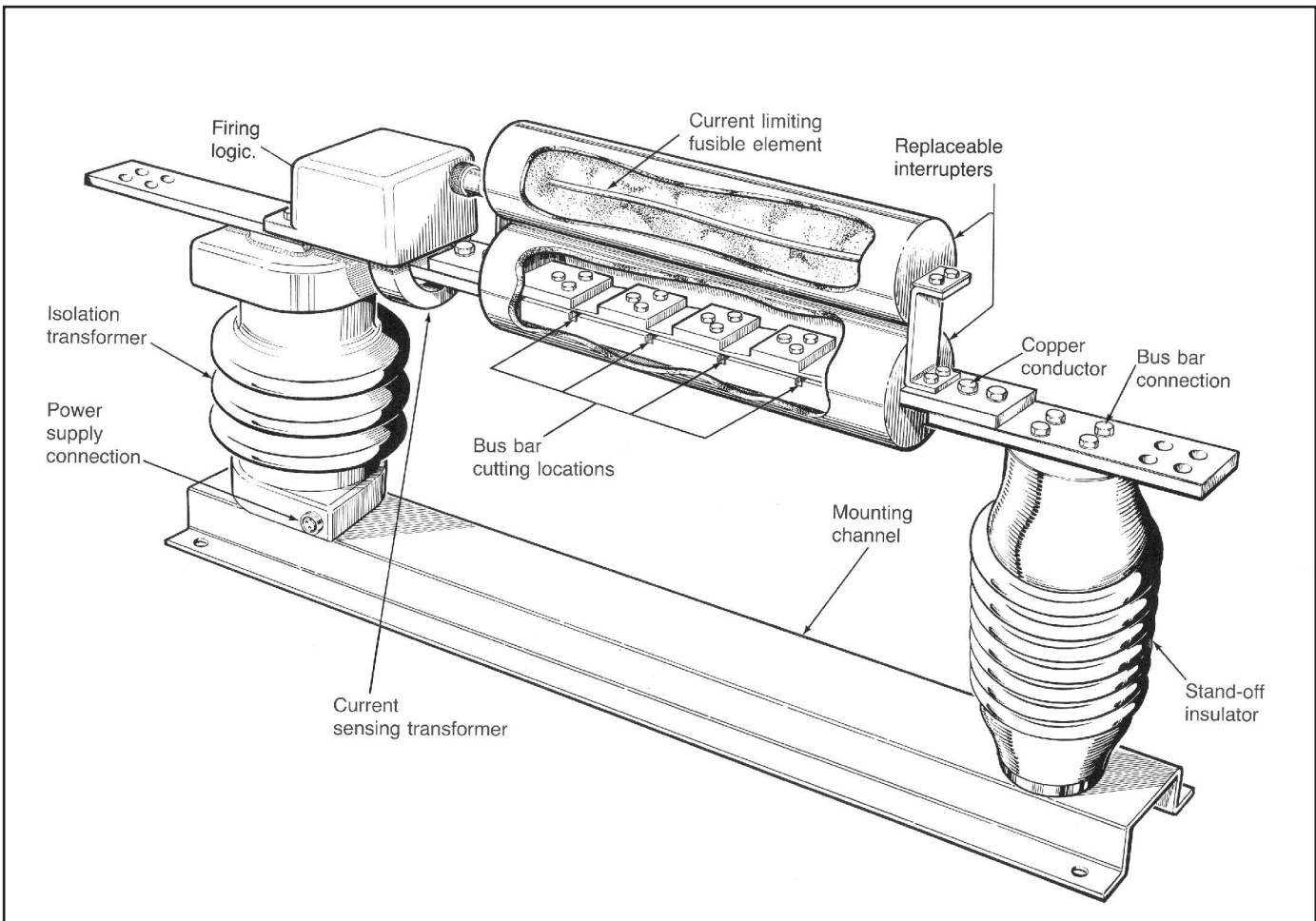
7) All hardware is stainless steel, brass or silicon bronze.

8) The CLiP can be installed in any orientation (with correct positioning of insulators). All control cables are of submersible construction.

9) If the CLiP protective capabilities are not required for a particular mode of system operation, it can be disabled locally or remotely. It then acts simply as a busbar. The operation modes of the CLiP are SCADA adaptable.

10) Local Indication of Operation. A striker pin projecting from one end of an interrupter indicates an operation has occurred.

11) The control box can be adapted to virtually any AC or DC control voltage supply.



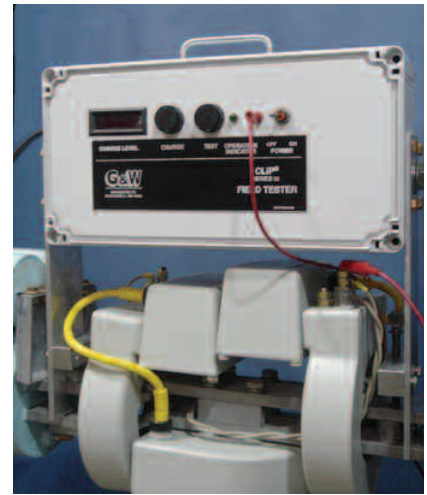
ORDERING INFORMATION

The following information is required at the time of order placement.

- 1) System operating voltage.
- 2) Continuous current.
- 3) One-line diagram with sources noted and associated prospective rms, symmetrical fault currents.
- 4) Rating of the protected equipment, or the desired limits.
- 5) Magnitudes of current inrushes to motors, capacitor banks, etc.
- 6) Proposed trigger level (G&W will assist customers in selection).
- 7) Environmental concerns, i.e. airborne contamination, excessive heat, etc.
- 8) Mounting orientation, i.e. vertical, horizontal, inverted, etc.
- 9) If an enclosure is required, the type and location of incoming and outgoing connection points.
- 10) Optional equipment.

OPTIONS

- 1) The Field Test unit provides a means to verify proper operation of the CLiP installation. It pulses a fault-level current through the main bus resulting in a triggering response that is measured for the proper characteristics.
- 2) Redundant Sensing & Firing Logic units provide a 2nd unit per phase, with independent sensing and triggering capability.
- 3) The CLiP Simulator verifies the customer's application conditions prior to activating the interrupters.
- 4) An Enable-Disable Relay provides the customer with a means of remotely disabling the CLiP when its protective capabilities are not required.
- 5) Powder coated IP32, or NEMA 3R enclosures are available.
- 6) D.C. to A.C. inverter virtually any D.C. voltage is converted to A.C. as used by the CLiP Controls.



▲ Field test unit and redundant sensing and firing logic.



Control box with inverter ►

| Maximum Voltage & Current | Overall Length Over Bus in (mm) | Maximum Height in (mm) | Height to Top of Bus in (mm) | Width of Energized Parts in (mm) | Weight per Phase lb (kg) | Impulse Rating of Insulators BIL |
|---------------------------|---------------------------------|------------------------|------------------------------|----------------------------------|--------------------------|----------------------------------|
| 2.8 & 5.5kV | | | | | | |
| 1500A | 46 (1168) | 23 (584) | 17 (432) | 9.4 (239) | 150 (68) | 110kV |
| 3000A* | 48 (1219) | 25 (635) | 19 (482) | 9.4 (239) | 200 (91) | 110kV |
| 5000A | 48 (1219) | 26 (660) | 19 (482) | 24 (609) | 330 (150) | 110kV |
| 8.3 & 15.5kV | | | | | | |
| 1200A* | 52 (1321) | 23 (584) | 17 (432) | 9.4 (239) | 160 (73) | 110kV |
| 3000A* | 54 (1372) | 25 (635) | 19 (482) | 9.4 (239) | 220 (100) | 110kV |
| 5000A | 54 (1372) | 26 (660) | 19 (482) | 14 (356) | 380 (173) | 110kV |
| 27 & 38kV | | | | | | |
| 1200A | 59 (1499) | 28 (711) | 22 (559) | 9.4 (239) | 195 (89) | 200kV |
| 2500A | 61 (1549) | 30 (762) | 24 (609) | 9.4 (239) | 280 (127) | 200kV |

*1250 and 3150A ratings are available

Note: Dimensions are approximate. Do not use for construction. Consult factory for 600A and 72.5kV configurations. Custom configurations requiring less space are available.

APPLICATIONS

- **Save money** - Upgrade the system source by adding transformers or cogenerators (resulting in higher available fault currents) without the changeout of downstream breakers.

- **Bypass current limiting reactors** to eliminate regulating voltage drop and real operating cost (up to \$10s of thousands per year) and eliminate voltage regulation difficulties.

- **Close tie position breakers** to improve voltage regulation or avoid further system upgrades while still being fully protected.

- **Protect under-rated equipment** (the ones that have been neglected over the years) and satisfy your insurance companies.

- **Reduce Arc Flash exposure.** Protective suits will only help with the thermal effects and not with the concussion. The CLiP can greatly reduce fault energy for much improved personnel protection.

- **Protect the system** from additional fault backfeed of large rotating loads.

- **Reduce fault energy** to limit damage or prevent transformer tank rupture (let-thru I^2t is commonly 0.5% of that from a 5-cycle breaker).

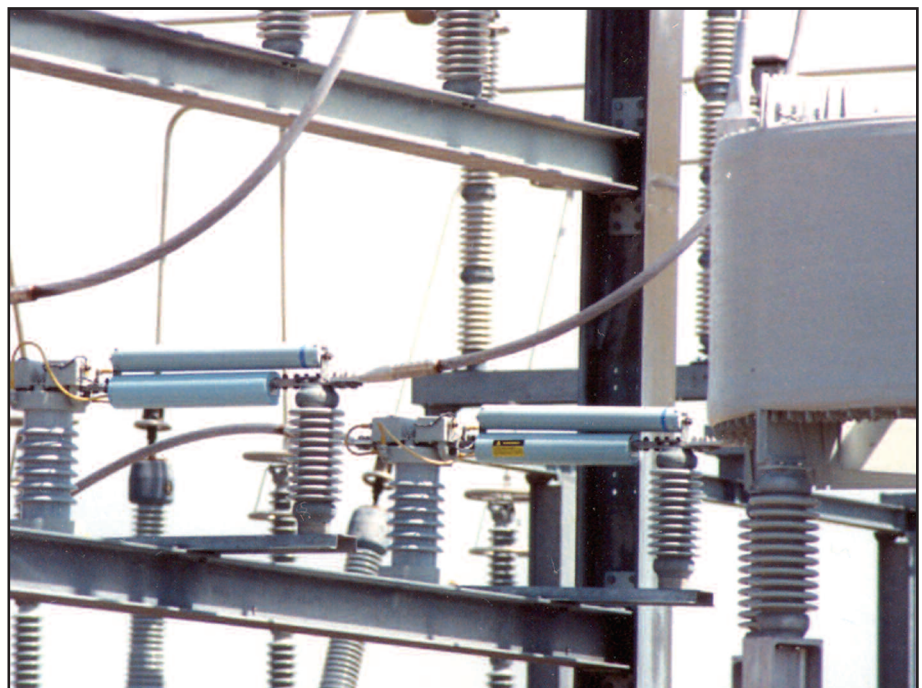
- **Clear the generator** with high asymmetries in 1/4 cycle where the breaker may not reach an effective current-zero for many cycles.

- **Limit cogenerator fault** contribution to the utility within utility mandated limits.

- **Protect cogenerators** - its a multimillion dollar investment that a breaker alone cannot fully protect.



▲ 5.5kV, 3000A CLiPs protecting the utility from a small cogeneration plant.



▲ Structure mounted 38kV, 1200A CLiPs in a reactor bypass application.

- **Escape the cost of full rated breakers** (especially generator breakers) and have a more effective protection package. Let the CLiP handle the excessive faults.

- **Protect capacitor bank switches** by limiting fault currents without operating on energization inrushes.

- **Protect harmonic filter systems** without responding to the higher frequencies and associated di/dt.

- **Bypass neutral reactors** to maintain system balance until a major fault occurs.

- **Limit damage from single-phasing and ferroresonance** by causing three phase clearing.

- **Limit fault damage** to variable speed drives.

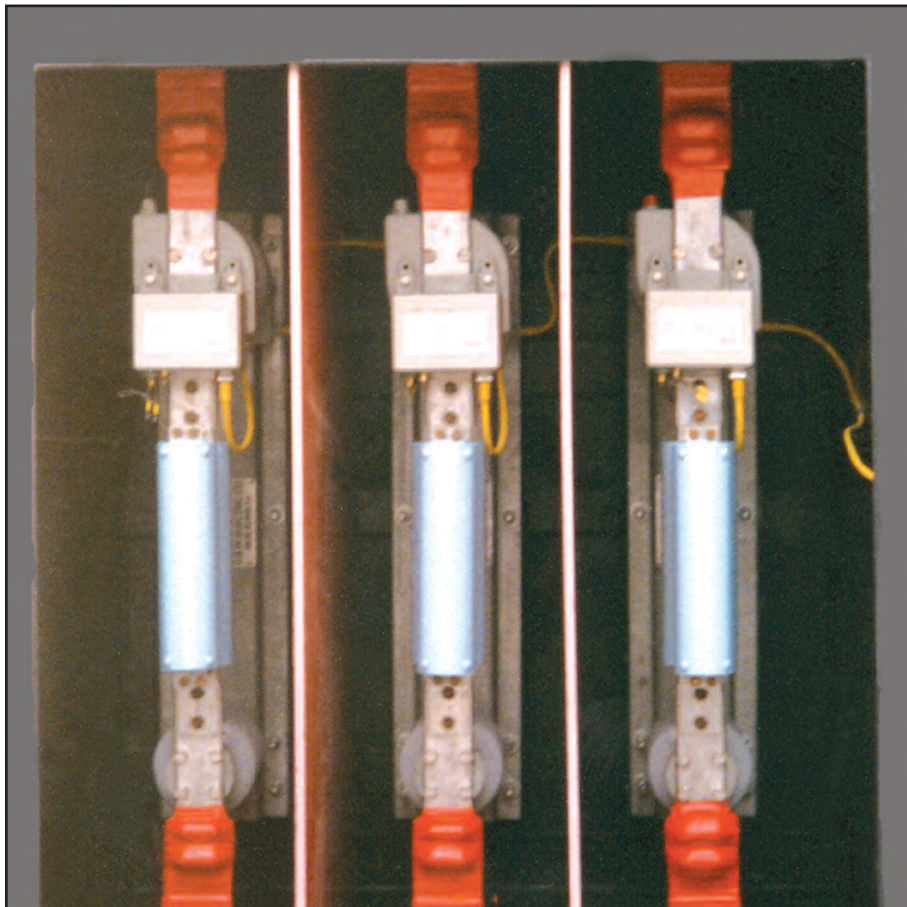
- **Improve power quality** by limiting the fault contribution to adjacent faulted buses that would cause unacceptable voltage sag on the system.

- **Protect wind turbine systems** from excessive grid fault energy and the grid from additional fault contributions.

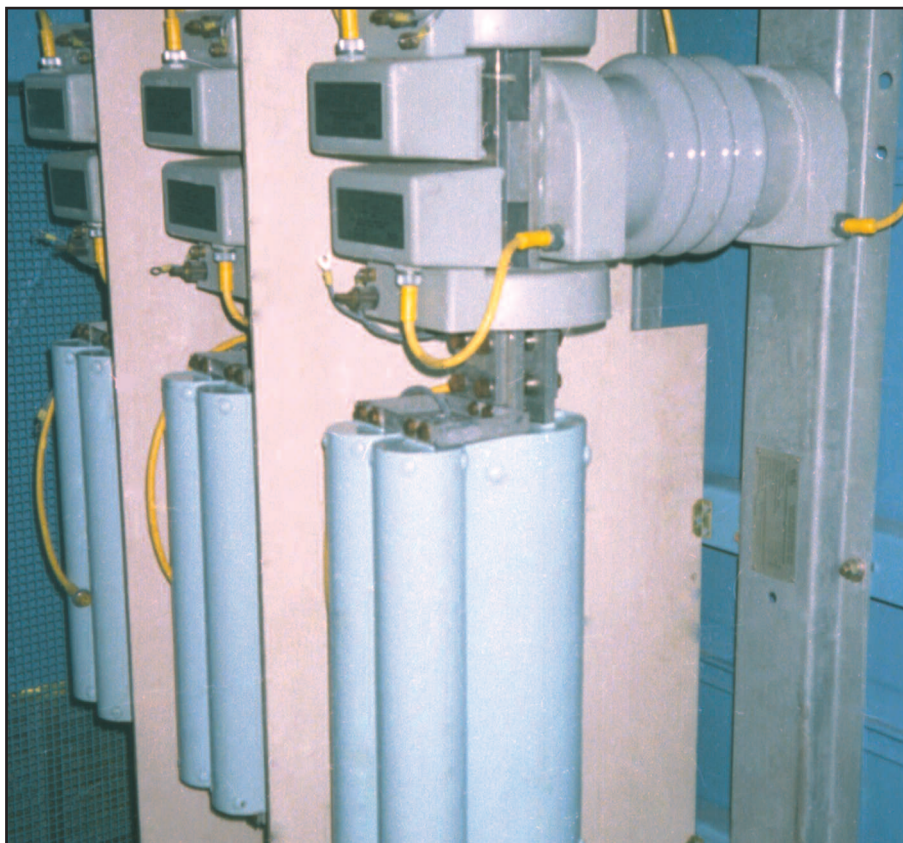
- **Reduce potential flying debris** in busy metro areas (e.g. manhole covers) resulting from network or other underground system faults. The CLiP can effectively limit fault energy.

Have a special application outside of our published ratings? Call us. We will work with you to provide a solution.

*15.5kV, 3000A, 120kA rms ►
symmetrical interrupting rated CLiPs
mounted in an enclosure at a large
paper pulp mill.*



▲ 5.5kV, 1200A CLiPs mounted in an enclosure.



LET-THROUGH CURRENT VS PROSPECTIVE FAULT CURRENT

The let-thru current plot (right) is applicable only for 40kA rated CLiP units. Consult your local G&W representative for alternate let-thru plots.

Let us assist you by showing exactly how the CLiP will perform in your specific application. See example graph below.



G&W ELECTRIC CO.

ISO 9001:2000 Certified

G&W ELECTRIC CO.

3500 W. 127th Street
 Blue Island, IL USA 60406
 (708) 388-5010
 FAX: (708) 388-0755
 Web site: gwelec.com
 ISO 14001 Certified

SHANGHAI G&W ELECTRIC LTD.

351 Guoshoujing Road
 Zhangjiang Hi-Tech Park (Z11)
 Pudong, Shanghai, China 201203
 +86-21-5080-0606
 FAX: +86-21-5080-0219
 Web site: gwelec.com.cn

