

# VFI Transformer

Superior Protection,  
Compact Installation and Lower Cost





# More Flexibility and Greater Reliability...

The VFI Transformer from Cooper Power Systems combines a conventional distribution transformer with the proven Kyle® Vacuum Fault Interrupter (VFI). This combination provides both voltage transformation and overcurrent protection in one space saving, money saving package.

The VFI Transformer is practical for new or existing distribution systems where conventional transformer/switchgear packages are being considered. It is the superior choice for applications where conventional protective equipment doesn't provide adequate protection or coordination, where aesthetics are particularly important, or where real estate is limited.

It requires as little as half the space of conventional transformer/switchgear packages. And because there is only one piece of equipment to install, the installation is simpler, cheaper, and more aesthetically pleasing. One piece of equipment also means that costs associated with maintenance and operation are reduced.

The benefits of the VFI Transformer are not limited to just saving money and real estate. System reliability is also improved with superior protection against faults or abnormal currents. Flexibility to accommodate changes in load and fault conditions is made easier with trip settings that are simple to modify in the field. Outage area and duration are minimized by better coordination with other protective devices. And operator safety is enhanced with the trip-free VFI breaker that can be used for sectionalizing or as an On/Off switch.

The VFI Transformer can be used for outdoor or indoor installations (R-Temp® or Envirotemp® FR3™ less-flammable fluid-filled) and is available as a:

- Single-phase, dead-front, pad-mounted transformer
- Three-phase, live- or dead-front, pad-mounted transformer
- Primary open and secondary unit substation transformer

## Vacuum Fault Interrupter - Proven Performance & Safety

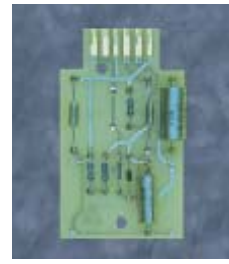
The VFI Transformer incorporates the latest technology in transformer and loop protection. The VFI (Vacuum Fault Interrupter) uses the same proven technology as in Kyle® VFI Pad-Mounted Switchgear.

Overcurrent protection is accomplished with Kyle vacuum interrupters instead of fuses. The VFI breaker has a continuous current carrying capability and an interrupting rating that far exceeds standard fuses. This expands the scope of transformers that can be protected internally instead of with a separate piece of switchgear. The resettable breaker mechanism allows immediate service restoration, eliminating the added downtime and expense associated with changing out conventional fuses. However, if a fault condition is present when the VFI breaker is closed, the trip-free feature will prevent the mechanism from being held in the closed position.

The VFI breaker is controlled by the Tri-Phase electronic breaker control. This control sets a new standard for ease of time-current-curve coordination. The Tri-Phase control offers over 100 minimum trip settings and an assortment of field replaceable time-current-characteristic curve modules. TCC curves for the Tri-Phase control can approximate either an S & C "E" fuse, a McGraw Edison® "K" or "T" link fuse, or resemble a recloser or relay curve. With standard instantaneous trip and optional ground trip curves, the Tri-Phase control will satisfy all coordination requirements.



# in Less Space



The instantaneous trip feature extends the range of coordination with upstream devices at higher fault levels. When current above the predetermined fault level is sensed, the instantaneous trip feature causes the control to bypass the normal TCC delay and trip immediately, thus eliminating any intentional delay.

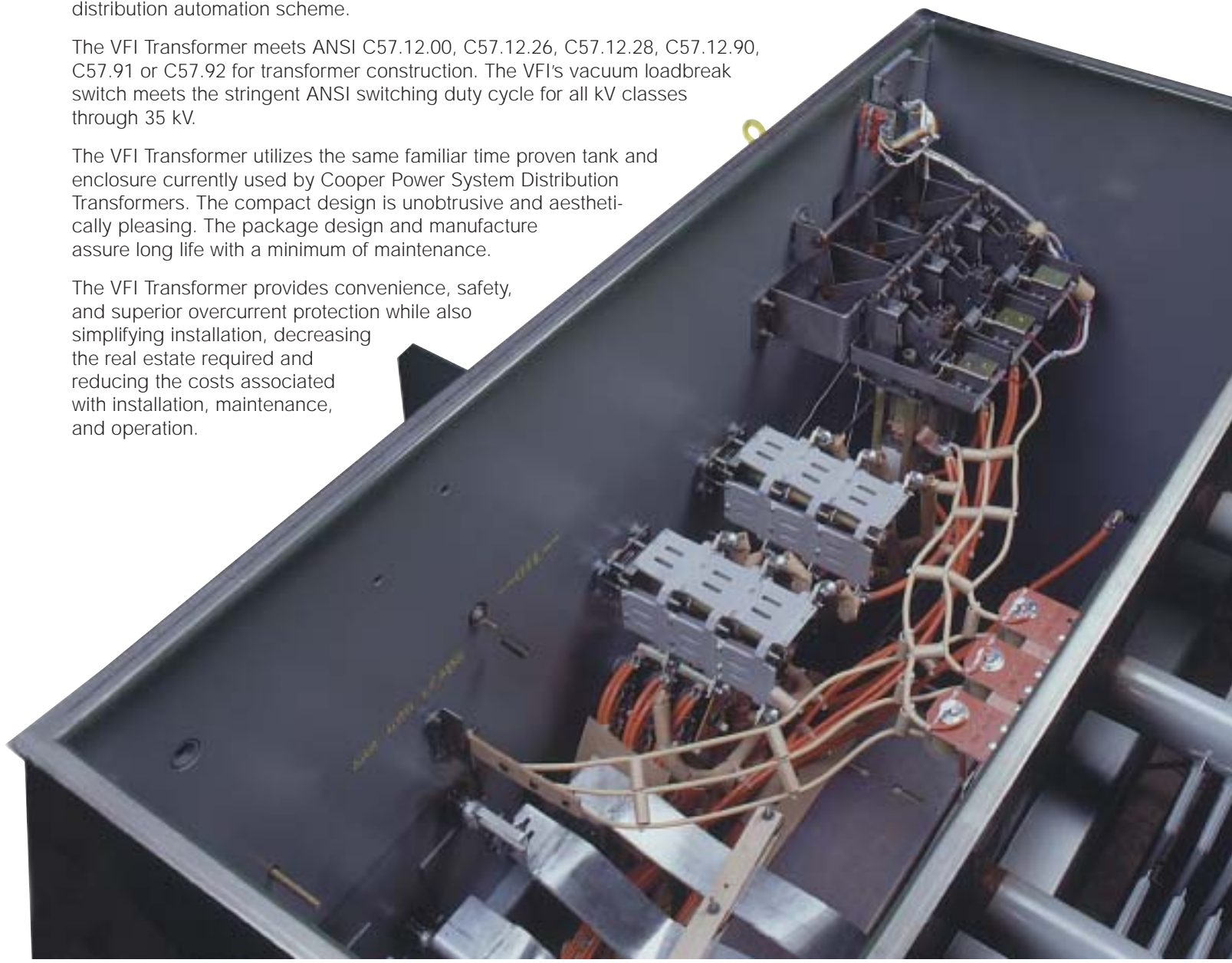
The optional Tri-Phase Ground (TPG) Trip Control provides improved coordination for systems fed by both underground and overhead feeders. The TPG control provides sensitive ground-fault protection that ensures quick fault interruption when low-level ground fault current is detected.

The VFI breaker also serves as a vacuum loadbreak switch. Tap switching or de-energizing equipment has traditionally been accomplished by pulling loadbreak elbows, or by load-busting fuses or switches. With the VFI, the tap or the transformer can be switched with a simple push-pull of the operation handle. These industry proven switches provide superior duty cycle, as compared to other switches, especially in higher voltage applications. The VFI can also be configured with an optional motor operator, enabling the transformer to be incorporated into a distribution automation scheme.

The VFI Transformer meets ANSI C57.12.00, C57.12.26, C57.12.28, C57.12.90, C57.91 or C57.92 for transformer construction. The VFI's vacuum loadbreak switch meets the stringent ANSI switching duty cycle for all kV classes through 35 kV.

The VFI Transformer utilizes the same familiar time proven tank and enclosure currently used by Cooper Power System Distribution Transformers. The compact design is unobtrusive and aesthetically pleasing. The package design and manufacture assure long life with a minimum of maintenance.

The VFI Transformer provides convenience, safety, and superior overcurrent protection while also simplifying installation, decreasing the real estate required and reducing the costs associated with installation, maintenance, and operation.



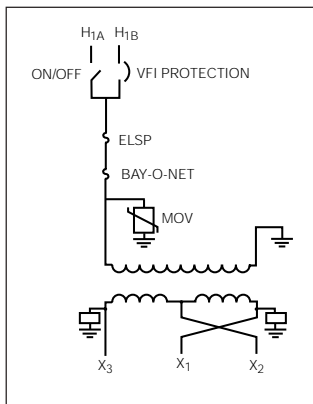


# Single-Phase Loop Protection

The Single-Phase VFI Transformer is designed for residential applications where real estate is limited; where in-line fault, tap or loop protection is difficult or impossible to coordinate; or where minimization of outage area and duration are important.

The VFI Transformer with loop protection is designed to protect the loop or downstream section of a feeder, and provide proper coordination with upstream and downstream protective devices. In this configuration, when a fault occurs downstream, the VFI breaker trips and isolates the fault, leaving the transformer load uninterrupted (see schematic).

The Single-Phase Shrubline® VFI Transformer provides voltage transformation and overcurrent loop or tap protection for underground distribution systems. The VFI makes coordination with upstream and downstream protective devices easy, and readily adaptable as changes in the system occur. The VFI breaker has an interrupting rating that far exceeds standard riser pole fuses, enabling better fault clearing coordination, and thereby minimizing outage area. In addition, the VFI breaker provides enhanced sectionalizing capabilities. And because it is resettable, it simplifies fault locating and reduces outage time. The optional 2-position loadbreak switch provides additional sectionalizing capabilities for maximum flexibility.



Single-phase VFI Transformer with loop protection

## RESETTABLE FAULT PROTECTION WITH SAFE, DEAD-FRONT CONSTRUCTION

- Reduces real estate requirements; one pad, one enclosure
- Interrupting rating far exceeds fuses
- Eliminates the added down time and expenses associated with changing out conventional fuses
- Simplifies fault locating and provides enhanced sectionalizing capability
- Superior overcurrent and fault protection
- Easily coordinated with upstream and downstream protection devices
- Increases operator safety
- Low profile – aesthetically pleasing

## VFI Transformer Features

- Overcurrent protection in the high voltage loop, tap or open points
- Resettable in-line fault protection to 25 kV
- Trip-free operation prevents the breaker mechanism from being held in the closed position if a fault condition is present
- Resettable breaker mechanism allows immediate service restoration
- Loadbreak switch with operating handle; no need to pull loadbreak elbow

## Product Scope

- 25-100 kVA, dead-front
- Maximum 25 kV, 125 kV BIL & below
- VFI rating: 200 A continuous; 12,000 A RMS interrupting
- Shrubline construction meeting ANSI/NEMA and CSA/CEA Standards
- 200 A VFI breaker (single-phase) with Tri-Phase control
- TCC curves for the Tri-Phase control can approximate either an S & C “E” fuse, a McGraw Edison® “K” or “T” link fuse, or resemble a recloser or relay curve
- Bay-O-Net fuse with drip guard
- 2-position loadbreak switch (on/off) (optional)
- ELSP under-oil current-limiting fuse (optional)
- Under-oil primary and/or secondary arresters (optional)
- R-Temp® or Envirotemp® FR3™ less-flammable fluid (optional)



# Three-Phase Transformer or Loop Protection

The Three-Phase VFI Transformer is designed for commercial or industrial applications where conventional transformer or loop protection packages are inadequate, or where space limitations prove to be restrictive. Designed for indoor or outdoor installations the VFI Transformer provides superior protection, coordination, and added flexibility. The compact design simplifies installation and requires less real estate than conventional distribution transformer/switchgear packages.

The VFI Transformer with transformer protection protects the transformer and provides proper coordination with upstream protective devices. When a transformer fault or overload condition occurs, the VFI breaker trips and isolates the transformer, leaving the feeder uninterrupted (see schematic).

The VFI Transformer with loop protection protects the loop or downstream section of a feeder. When a fault occurs downstream the VFI breaker trips and isolates the fault, leaving the transformer load uninterrupted (see schematic).

The Three-Phase Pad-Mounted VFI Transformer provides overcurrent protection with the VFI Tri-Phase electronic breaker control. Each phase of the control can be independently set to accommodate the variability of each phase while providing the necessary coordination with upstream and downstream devices. All three interrupters can be mechanically ganged together so that a trip signal on any one phase will open all three phases. This feature eliminates single-phasing of three-phase loads. The three interrupters may instead sense and trip independently for single-phase loads. The VFI is resettable, which makes restoring service faster and easier, and its trip-free operation makes it safer for operating personnel.

## RESETTABLE FAULT PROTECTION WITH LIVE- OR DEAD-FRONT CONSTRUCTION

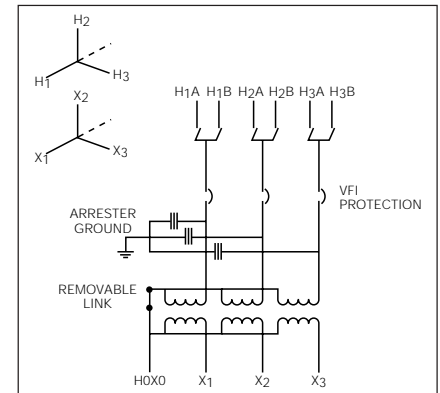
- Eliminates real estate requirements for separate piece of switchgear
- Simplifies and reduces cost of installation and maintenance
- Internal overcurrent protection for transformers up to 7500 kVA
- Eliminates single-phasing of three-phase loads and associated ferroresonance problems
- Added safety for field personnel and customers

### VFI Transformer Features

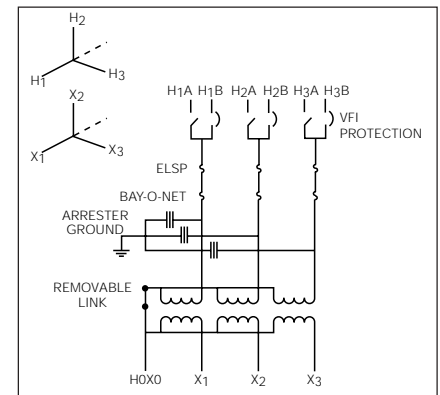
- Transformer or Loop overcurrent protection up to 35 kV
- Resettable fault protection eliminates the need to replace fuses and reduces outage time
- Independent phase initiation with three-phase mechanically ganged trip or independent single-phase trip
- Breaker can be used as loadbreak or sectionalizing switch

### Product Scope

- kVA range: through 7,500
- Primary voltage: through 35 kV (150 kV BIL)
- VFI rating: 600 A continuous; 12,000 A RMS interrupting
- TCC curves for the Tri-Phase control can approximate either an S & C "E" fuse, a McGraw Edison® "K" or "T" link fuse, or resemble a recloser or relay curve
- Sectionalizing switches on upstream and downstream high voltage feeds
- Motor operator for SCADA control (optional)
- Tri-Phase Ground (TPG) Trip Control (optional)
- SCADA accessory (optional)
- R-Temp® or Envirottemp® FR3™ less-flammable fluid (optional)
- FM Approved "Listed and Labeled" (optional)



Three-phase VFI Transformer with transformer protection



Three-phase VFI Transformer with loop protection

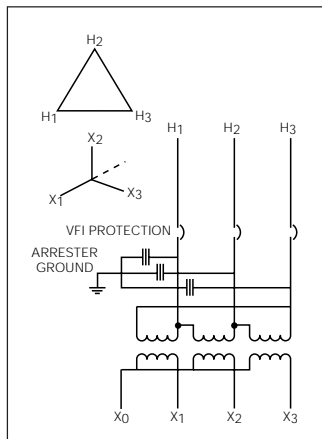




# Three-Phase Substation Transformer Protection

The Substation VFI Transformer is designed for industrial and commercial applications where superior transformer overcurrent protection and resettable three-phase gang tripping are required. The sealed tank design protects the VFI breaker so that operation is unimpaired by contaminated environments or flood conditions. It also permits operation in hazardous environments. Designed for indoor or outdoor applications, the transformer can be either a live- or dead-front, primary open or secondary unit. When filled with less-flammable fluid this compact unit is ideal for indoor applications or for positioning next to buildings or in congested areas.

The Three-Phase Substation VFI Transformer provides voltage transformation and transformer overcurrent protection. Overcurrent protection is provided by the VFI Tri-Phase electronic breaker control. In most industrial and commercial applications transformer loads are comprised of many small and large three-phase loads. Typically transformers feeding these loads have been protected with single-phase fuses. During a fault condition only one fuse usually opens. This “single-phases” three-phase loads and causes system overvoltage and ferroresonance problems. With the VFI breaker these problems are eliminated because all three phases are mechanically ganged together; a trip signal on one phase will simultaneously open all three phases. The VFI breaker can also serve as a three-phase gang operated loadbreak switch, enabling loads to be switched on and off quickly and safely. The VFI breaker provides a superior duty cycle, as compared to either oil or air-break switches, especially in higher voltage applications. The VFI breaker meets the duty cycle specified by ANSI C37.60.



Substation VFI Transformer with transformer protection

## Resettable Fault Protection with Safe, Sealed Construction

- Resettable switch makes restoring service faster and easier
- Trip-free operation prevents operator from closing in on a fault
- Eliminates maintenance costs associated with insulators or barriers
- Internal overcurrent protection for transformers up to 10,000 kVA
- Three-phase gang tripping eliminates single-phasing of three-phase loads
- Excellent solution for contaminated or hazardous environments
- Eliminates space requirements for a separate piece of switchgear and matching of transition sections between the transformer and switchgear
- Reduced inventory costs and maintenance costs
- Simplifies and reduces cost of installation

## VFI Breaker Features

- Transformer overcurrent protection
- Resettable fault protection up to 35 kV with no fuses to replace
- VFI immersed in insulating fluid with sealed tank design protects VFI breaker from hazardous or contaminated environments
- Maintenance-free VFI breaker
- Breaker can be used as on/off loadbreak switch

## Product Scope

- kVA Range: Through 10,000 kVA
- Live- or Dead-front construction
- Primary voltage: Through 35 kV (150 kV BIL)
- Secondary voltage: 208Y/120 - 24940Y/14400
- VFI Rating: 600 A continuous: 12,000 A RMS interrupting
- TCC curves for the Tri-Phase control can approximate either an S & C “E” fuse, a McGraw Edison® “K” or “T” link fuse, or resemble a recloser or relay curve
- 50 kA with current limiting fuse (optional)
- R-Temp® or Envirotemp® FR3™ less-flammable fluid (optional)
- FM Approved “Listed and Labeled” (optional)
- Visible disconnect (optional)



## Cooper Power Systems Transformer Products Group

Single- and Three-Phase Overhead Transformers

Shrubline®, MaxiShrub®, Ranch Runner®,  
Single-Phase Pad-Mounted Transformers

Three-Phase Pad-Mounted Compartmental Transformers

SST Transformers

Open and Unit Substation Transformers

FM Approved "Code-Listed and Labeled" Transformers

Envirotran™ Transformers

Overhead, Pad-Mounted and Substation Step-Voltage Regulators

R-Temp® Fire-Resistant Dielectric Fluid

Envirotemp® FR3™ Seed Oil-Based Fire-Resistant Dielectric Fluid

# How to Specify

"Transformer shall be a Cooper Power Systems liquid-filled transformer designed in accordance with the requirements of ANSI C57.12.00. The overcurrent protection shall be provided with a Vacuum Fault Interrupter (VFI) integral to the transformer tank. The VFI electronic breaker shall have a maximum interrupting rating of 12000 amps RMS symmetrical with resettable fault protection up through 35kV."

## VFI Transformer Product Scope

Single- and Three-Phase, Pad-Mounted and Substation Class  
kVA: 25 to 10,000  
Primary Voltage: Through 35 kV Classes, 150 kV BIL  
Secondary Voltage: Through 15 kV, 150 kV BIL  
VFI Rating: 200 or 600 A continuous; 12,000 A RMS Interrupting  
Temperature Rise: 65°C, 55/65°C  
Coolant: Mineral Oil  
(R-Tran™) R-Temp Fire Resistant Fluid  
(Envirotran™) Envirotemp FR3 Fire Resistant Fluid



**The VFI Transformer provides superior protection and a lower installed cost in half the space of a conventional transformer and switchgear package.**

**COOPER** Power Systems

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