

protec®

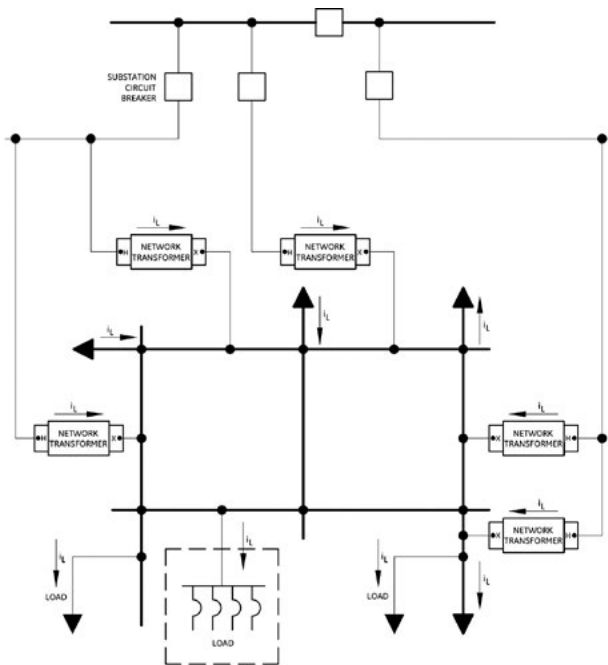


Safe-NET® Network Transformer



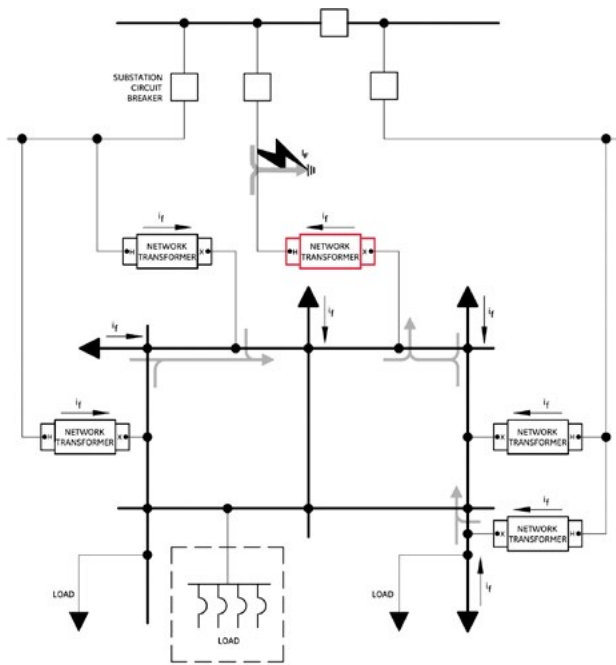
Low Voltage Secondary Networks

Low voltage secondary networks have been an effective method of serving dense loads like office buildings and downtown areas. The network system's reliability comes from having multiple sources. The grid network in the diagram below shows the network system fed by multiple transformers with multiple sources back at the substation, meaning the loss of any single transformer or line will not have an effect on the load served by the network.



Normal Load Conditions: Load is shared among all the transformers. The system includes connections to other parts of the grid that may act as a load or a source.

However, the very same strengths of the low voltage secondary network lead directly to its challenges. The multiple sources of load current can potentially become multiple sources of fault current during a high energy transformer event. Since the networks are uniquely effective for serving dense loads, they are placed in populated areas and steps must be taken to eliminate threat to the surrounding populace in the rare case of a system failure.



Primary Fault Condition: Fault current adds up and flows through the single transformer. The highlighted transformer is at risk if the fault is not cleared fast enough.

The background features a night cityscape with a network overlay of glowing blue lines and nodes. A teal gradient is at the top. A large dark blue circle contains the text, and a smaller light blue circle is positioned below it.

The safest
transformers available
in the industry for
secondary network
applications.

Safe-Net[®]

Network Transformer

Key Benefits

Prolec GE Safe-NET[®] Network Transformers offer utilities a solution that can help them provide safe, reliable and dependable electrical service to their end customers. These non-network applications also include intertie [step] transformers for interconnecting two different voltage systems. The installed base includes units with 85+ years of service, giving utilities peace of mind and operational assurance for their networks.

Network Transformer Portfolio

- 300 – 2,500 kVA, 3 Phase
- Suitable for secondary networks and spot networks

Patented Tank Technology

- Rupture resistant tank design allows for a safe and controlled sequence of events during high energy event
- Exceeds the tank pressure requirements laid out in ANSI/IEEE C57.12.40 standard

Long Operational Life

- Tested and certified to the maximum (ground level) seismic levels in North America
- Best in class corrosion resistant exterior

Superior Coil Design

- High short circuit strength
- Insulation system designed for increased loading capacity



Mechanical Strength


- Rugged clamping
- Safe lifting provisions

Eco-friendly with Low Carbon Footprint:

- Available high flash point vegetable-based insulating oil

Applications

- Underground metropolitan vault applications
- Government, commercial, institutional and industrial facilities
- Office towers, skyscrapers
- Vault applications with occasional/continuous submersion

The background of the image is a night-time cityscape with numerous skyscrapers and buildings, their lights glowing. Overlaid on this are many vertical and horizontal light trails in shades of blue, purple, and pink, creating a sense of motion and digital connectivity. A large, dark blue circle is positioned in the upper center, containing white text. A smaller, solid green circle is located at the bottom left edge of the large blue circle.

Exclusive
transformer tank
design and patented
tank technology.

Safe-NET[®] Network Transformer Tank Design

Prolec GE's exclusive tank design, validated by independent third party test agencies, addresses the challenge of high fault energy driven tank events and the limitations with traditional network transformer designs.

- **Tested & Validated by KEMA**

Prolec GE Safe-NET[®] Network Transformers are capable of withstanding in excess of 11 MJ of energy, with KEMA testing confirming all scenarios yield controlled energy evacuation downward and through the tank radiators.

- **Seismic Certification**

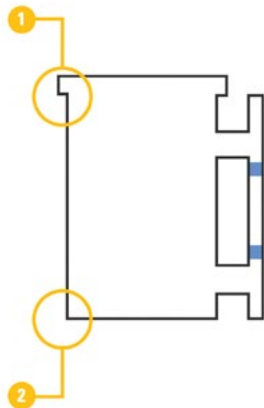
Tested and certified to the highest North American standard for ground-level seismic levels, validating that the transformers are expected to withstand the mechanical vibrations of an earthquake.

- **Exceeds ANSI/IEEE Standards**

The tank design far exceeds the tank pressure requirements laid out in the ANSI/IEEE C57.12.40 standard.

Initial State

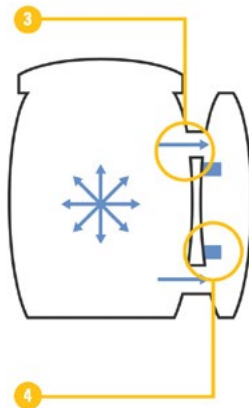
Increase tank rupture pressure by cover improvement



Increase bottom rupture capability

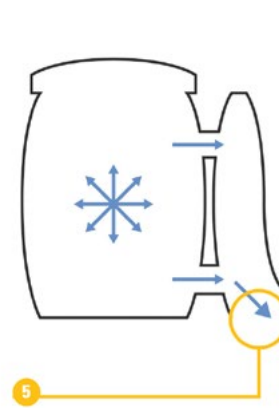
Pressure Relief

Up to 11 MJ of pressure relief through header pipe into radiator



Radiator Spacer Failure allows "pillowing", creating large expansion volume

Over 11 MJ of Pressure Relief

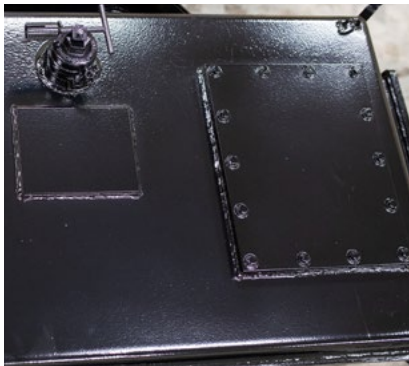


Radiator designed to fail at bottom or side serving as a directional blowout port

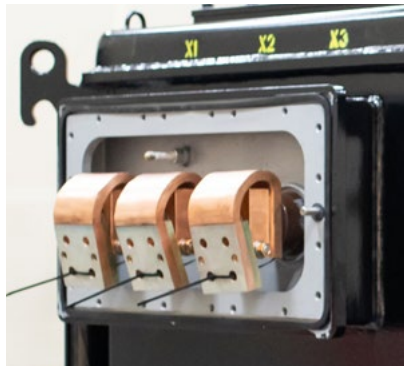
Network Transformer Features



Cover-mounted tap changer with welded & bolted handhole



Low voltage throat with flex connectors & transformer lifting lug



Insulated neutral bushing



Switch-box with cover removed (primary switch is exposed)



Switch-box with viewing window



Parking stands



Network Transformer Technical Specification

	Standard Offering	Optional Offering
Power Rating	300 kVA through 2,500 kVA (three-phase only)	• Special kVA ratings to maximize kVA/in ³ in the vault
Voltage Ratings	<ul style="list-style-type: none"> • Primary voltages from 2.4 kV through 34.5 kV • Primary taps per C57.12.40 • Secondary voltages from 208 GrdY/120 to 480 GrdY/277 	<ul style="list-style-type: none"> • Dual voltage (series multiple) primary • Special primary taps • Secondary voltages up to 4.33 kV (60 kV BIL rating)
BIL Ratings	<ul style="list-style-type: none"> • Primary BIL ratings 60 kV to 200 kV BIL • Secondary BIL rating of 30 kV BIL 	Non-standard BIL ratings
Thermal Ratings	Thermal rating of 55°C/65°C rise	Thermal rating of 65°C rise
Impedance	Impedances per C57.12.40	Special Impedances
Efficiency	Meets required DOE efficiency levels	Small vault and high-efficiency designs
Frequency	<ul style="list-style-type: none"> • 50 Hz frequency • 60 Hz frequency 	
Ratings	IEEE C57.12.40	<ul style="list-style-type: none"> • IEC 60076-1 • Designs for elevations higher than 3,300 feet
Insulating Fluid	Mineral oil or Natural ester	• Stainless steel tank or radiators
Tank & Features	<ul style="list-style-type: none"> • High-Fault Energy Tank Design rated for 11 MJ of fault energy • Steel thicknesses per C57.12.40 • 4" tall I-beam sub-base • Welded hand-hole(s) • Secondary throat dimensions per C57.12.40 • Welded secondary bushings with flex connectors • Robust lifting provisions • Exceptional paint system: zinc-rich epoxy primer & black epoxy top coat, 6.0 mils dry film thickness 	<ul style="list-style-type: none"> • 1.5" tall bar sub-base or up to 8" tall I-beam sub-base (also in Stainless Steel) • Bolted hand-hole(s) • Special primary or secondary bushing locations • Bolted bushings • Insulated neutral bushing(s) • ANSI #61, ANSI #70 Grey top coat
Primary Switch	<ul style="list-style-type: none"> • Laser-etched Stainless Steel nameplate, 1/16" thick • Prolec GE designed Primary Grounding & Disconnect Switch meets C57.12.40-2017 short-circuit requirements • Single-compartment HV chamber • Bushings or Bushing-wells welded on top of box • Drain on the bottom of the switch box • Deadbreak interlock 	<ul style="list-style-type: none"> • Switch capable of interrupting magnetizing current (Mag-I interlock) • Sequential Grounding Switch, additional interlocks & other special switches • Phase Sequence Identification (Phasing tubes) • Switch-box viewing window • Two-compartment box with wipe-sleeves • Other special HV entrances
Gauges & Valves	<ul style="list-style-type: none"> • Mechanical gauges on tank (without alarm contacts) • Welded dial-type magnetic liquid level gauge, on tank and switch-box • Dial-type thermometer 	<ul style="list-style-type: none"> • Special temperature, liquid-level, and pressure sensors with alarm contacts or analog output • DGA sensors and special Monitoring & Diagnostics devices • Special drain valves and oil sampling valves

Typical Ratings

The range of ratings below are representative of ratings which Prolec GE can provide, but are not the limit of our capabilities.

Power (kVA)	Primary Voltage (V)	Secondary Voltage (V)
300	2,400 - 34,500	216 Y/125 - 480Y Y/277
500	4,160 Y/2,400 - 34,500 Y/19,920	
600*		
750		
1000	4,160 - 34,500	480 Y/277 - 4,330 Y/2,500
1500	4,160 Y/2,400 - 34,500 Y/19,920	
2000	12,000 - 34,500	
2500	12,470 Y/7,200 - 34,500 Y/19,920	

* Prolec GE can custom design kVA ratings to maximize the kVA cubic inches in your vault, such as 600 kVA.

Safe-NET[®] Network Transformer Product Testing

100% of Prolec GE units are tested per the Routine Tests defined in IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers (C57.12.00) and tested per IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers (C57.12.90).

Prolec GE can perform design and other tests as defined by IEEE and IEC standards on-site at our manufacturing facility and with 3rd party test labs.

See Product Testing table for special testing conducted.

Network Transformer Product Testing Table

Testing Type	On-site	3rd party
Temperature Rise (Heat Run)	•	
Dissolved Gas Analysis (sample taken on-site)		•
Audible Sound Level	•	
Short-Circuit Capability		•
RIV (μ V)	•	
Partial Discharge (pC)	•	
Winding Insulation Resistance (Megger)	•	
Insulation Power Factor	•	
Capacitance	•	
ANSI Impulse	•	
Lightning Impulse	•	
Seismic Testing		•
Pressure Testing	•	

Advanced Technology and Manufacturing

Prolec GE designs, manufactures and tests to the highest standards in the industry in its state-of-the-art 600,000 square-foot facility comprised of operations such as metal fabrication, welding, core assembly, and coatings.

The manufacturing site is ISO 9001 certified and conducts quality inspections for purchased and outsourced materials. The manufacturing facility is located in Shreveport, LA and serves customers around the world.



Exceptional Quality and Reliability

- ISO 9001 certified processes
 - ANSI compliant products available
 - 3rd party product certifications, including KEMA and other internationally recognized testing facilities
 - Multiple checkpoints in the production, assembly and inspection process yield high quality products
 - Rigorous electrical, oil quality, and leak testing
 - Special testing such as heat run and sound tests with reporting capability available
 - On-site Prolec GE quality engineers and technicians
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ANSI is a registered trademark of American National Standards Institute, Incorporated. IEEE is a registered trademark of the Institute of Electrical Electronics Engineers, Inc. KEMA is a registered trademark of DNV. ISO is a registered trademark of the International Organization for Standardization. Prolec GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.



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