

Specifying The Right Transformer Just Got Easier



Introducing the First FM Approved, Code Listed
Liquid-Filled Transformers for Indoor or Outdoor Locations

FM Approved Transformers—The Easy Choice, Indoor or Out



FM Approved, Code Listed

Cooper Power Systems has made it easier to select the right transformers for indoor and outdoor applications. Our FM Approved, Code Listed transformers are the Industry's first "Listed and Labeled" liquid-filled transformers. They provide state-of-the-art fire protection while making it easy to comply and verify compliance with the National Electric Code® (NEC®) for both indoor and outdoor locations.

Until now specifying a transformer to meet the requirements of the NEC had been time consuming, confusing, and difficult at times. Even if a liquid transformer was in compliance with code it was often difficult to verify this in the field, as the units themselves were not labeled. The new FM Approved transformer option makes the process simpler, because the transformers comply with the Factory Mutual Research Corporation (FMRC) Approval Standard Class 3990 for less-and non-flammable liquid-filled transformers. The FMRC standard incorporates the Code listing requirements integral to the transformer, for both indoor and outdoor applications. With the "FM Approved" logo clearly visible on the exterior and interior nameplates of the transformer, third party certification of NEC compliance is readily verifiable by the local authority having jurisdiction. All this makes it easy to specify a listed and labeled transformer for your distribution system design—saving you time and money.

The Best Solution

FM Approved transformers are ideal for institutional and industrial complexes, commercial office buildings, anywhere you need to locate a transformer. For all your loads, you can depend on the complete line of Cooper Power Systems' FM Approved transformers: single-and three-phase, substation class, pad-mounted and overhead, available in ratings from 5 to 10,000 kVA, up to 46 kV.

Easy Code Compliance and Verification

When you specify FM Approved transformers, you're choosing a simpler, more reliable solution for compliance with the National Electrical Code Section 110-3: *Requirements for Electrical Installations*, and Section 450-23: *Less-Flammable Liquid-Filled Transformer Requirements*. The need for dry types, fire vaults, auto sprinklers or special clearances in most applications can be eliminated. FM and NEC installation requirements are simplified.

Compliance with the FM Transformer Loss Prevention Data Sheet, used by the Insurance Industry, is much easier and less expensive when the FM Approved transformers are used. More importantly, the labeled transformers provide superior protection against tank rupture and fires in a more systematic manner. The FM nameplate clearly identifies the transformer's protective equipment and other compliance requirements, so the inspector can easily and quickly verify that the transformer and its installation comply with code.



Installation Flexibility and Peace of Mind

Superior Safety

FM Approved transformers provide added reliability and safety, first with specific protective systems, and second with a choice of Code listed, FM Approved fire resistant dielectric fluids, R-Temp® or Envirotemp® FR3™.

FM Approved transformers are systematically protected against both primary and secondary faults¹. Primary circuit fault protection options include current limiting fusing, vacuum fault interrupters (Kyle® VFI) or other devices with similar effectiveness in reducing the energy release of high current primary faults. The devices must have published fault let-through ratings expressed in I²t units that do not exceed specified values as listed in the FMRC Standard.

Secondary fault protection includes pressure relief devices that are coordinated with the transformer nominal rating, and minimum tank rupture withstand ratings. These safeguards are in addition to the minimum IEEE/PES Standard C57 and NEC over-current protection requirements. For certain transformer ratings and applications, sudden pressure relays and ground fault relays are also required by the FMRC Standard for enhanced secondary fault protection.

FM Approved transformers are filled with an FM Approved, Code Listed Less-Flammable or Non-Flammable liquid dielectric coolant. R-Temp dielectric fluid is one option. A proven paraffinic oil-based dielectric coolant, R-Temp fluid has excellent dielectric properties and a typical fire point of 312°C. R-Temp fluid-filled transformers have provided a flawless safety and exceptional performance record for the past 25 years in over 90,000 installations worldwide.



Another dielectric coolant option for the FM Approved transformer is Envirotemp FR3. The fluid has a typical fire point (360°C) that is even higher than R-Temp fluid, and most silicone oils. Envirotemp FR3 is an edible seed oil-based, readily biodegradable, non-toxic dielectric coolant which incorporates only food grade performance enhancing additives. Cooper Power Systems transformers filled with Envirotemp FR3 fluid are sold under the trade name Envirotran™, and also have the option of being FM Approved Listed and Labeled.

While there have been reported explosions and fires with dry-type and cast resin units as well as mineral-oil filled transformers, transformers filled with R-Temp or Envirotemp FR3 fluid have a flawless fire safety record.

More Design Flexibility

Now you can locate your transformers where you want, indoors or outdoors, on rooftops, near buildings and walkways, in clean or harsh environments.



FM Approved transformers can be located right next to the load for greater efficiencies and lower installation costs. They can be located as little as three feet from buildings and equipment. Now you don't have to settle for less-efficient dry-type and cast resin transformers, with their higher losses and greater burden on HVAC systems.

In dirty, wet, and corrosive environments, the sealed tank construction of the FM Approved transformers ensures reliable, long-term performance. In contrast, dry-type transformers typically need additional protective housings and frequent internal cleaning maintenance in such environments.

Unlike dry and cast resin types, liquid-filled transformers can be manufactured with fluid immersed accessory options, including under-oil load-break and sectionalizing switches, fuses and arresters. These integral accessories give you greater operation flexibility, and safety, while saving you installation space and money.

¹Because both R-Temp and Envirotemp FR3 fluids are also UL® Classified, all UL Classification requirements for the transformers are met automatically by complying with the FMRC Approval Standard Class 3990. See CPS Bulletin 92046, NEC Requirements Guidelines, or the fluid UL Marking for details.

Better Performance While Helping Preserve the Environment

Environmentally Desirable

The dielectric fluids used in FM Approved transformers are non-bioaccumulating and biodegradable. Envirotemp FR3, the fluid used in the Envirotran transformer, is formulated from edible seed oils and food-grade performance enhancing additives. Because of its special formulation, it is covered by the Edible Oil Regulatory Reform Act—making it a more favorable option when considering environmental risk and regulations.



Liquid-Filled Performance and Value

FM Approved transformers now provide the advantages that dry-type transformers provide and much more. Both provide advantages such as installation flexibility, reduced insurance/liability, and ease of specification and use. But liquid-filled transformers also provide additional benefits and advantages that dry-types do not provide. These advantages include lower first cost (at equal ratings), lower operating cost, higher overload capacity, cooler and quieter running, longer life, and sealed construction.

In addition, preventive sampling diagnostic methods such as dissolved gas analysis (DGA) are available only with liquid-filled transformers. Periodic fluid sampling and analysis of key fluid and dissolved gas properties can provide insight into the operating history and current condition of the transformer and its fluid. This early warning of possible growing operating stresses can help prevent costly and burdensome unplanned outages.

All of these advantages translate into substantial savings over the life of the transformer—making the FM Approved transformer the right economic choice over dry and cast resin type transformers.

Features and Benefits of FM Approved Transformers

Features	Benefits
Third party certification by Factory Mutual Research Corp.	Ease of specification, state-of-the-art fire safety design and construction
Meets requirements of National Electrical Code Sections 450-23 & 110-3	Ease of compliance
Transformer will be shipped with FM Approved label	Ease of verification of code compliance
Preference by insurance companies	Lower insurance cost potential. Fire vault and auto sprinklers typically not required
Ease of installation	Fire vault and auto sprinklers typically not required. Can place transformer closer to the loads for improved efficiency
Filled with less-flammable R-Temp Fluid or Envirotemp FR3 Fluid	Flawless safety record, biodegradable, essentially non-toxic fluid

K-Plus™ Transformers

Built to Withstand Severe Harmonics

If you are anticipating or experiencing problems caused by severe non-linear loads on your system, specify the FM Approved transformer with the K-Plus™ option. Depending on the severity of non-linear loading, the right K-Plus transformer design (K4 through K20) capable of withstanding constant and severe harmonic levels can be built. For systems with continual problems caused by non-linear loads, K-Plus transformers are designed to meet specific harmonic load level ranges. Because of their inherently superior overload capability, K-rated liquid transformers are less likely than K-rated dry-type transformers to suffer irreparable damage or failure if harmonic levels exceed specified load level ranges.

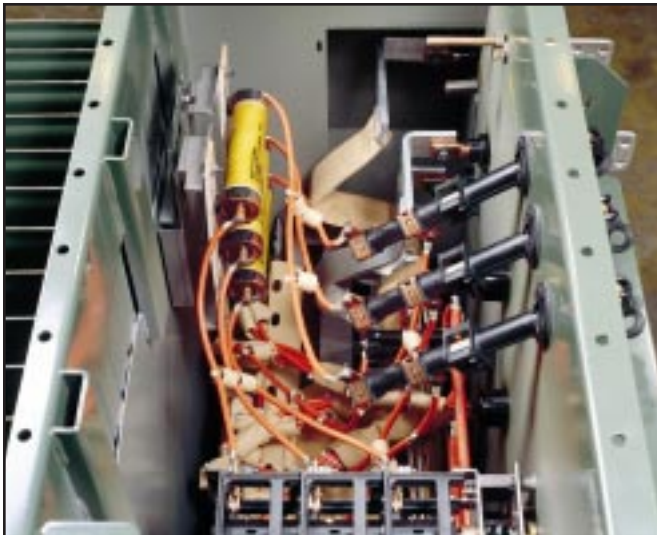
Call Us for the Full Story

Contact your Cooper Power Systems representative to get the full story about these exceptional transformers. For the Cooper Power Systems representative nearest you, use the locator on our web site at www.cooperpower.com, or call us at 1-877-CPS-INFO.

The FM Approved Transformer Standard

Factory Mutual Research Corporation issued Approval Standard Class Number 3990, the Industry's first liquid-filled transformer approval standard. It was granted to Cooper Power Systems in 1997, after years of research, design and testing. To use the FM Approved Label, the manufacturer must provide documentation that all aspects of the FMRC Standard are met. In addition, the manufacturer's designs, facilities, and procedures are subject to periodic auditing by FM field engineers for compliance with ANSI/IEEE standard C57.12.00. The following is a brief summary of the key requirements of this standard:²

- The transformer tank rupture strength shall be a minimum of 15 psi for rectangular tanks and a minimum of 20 psi for cylindrical tanks.



- The transformer primary circuit shall have over-current protection which limits the I²t let-through to a specified maximum value, based on the table in Section 2.3.5 of the FMRC standard. Current-limiting fusing and its functional equivalents are designed to interrupt a high current internal fault before the tank withstand pressure level is reached.
- The transformer tank shall be provided with a pressure relief device to vent internal over-pressures. The device must be capable of venting a minimum specified flow rate, based on the kVA of the transformer per the table in Section 2.3.3 of the FMRC standard. Proper pressure venting coordinated with proper tank pressure withstand rating has proven highly effective in preventing tank rupture from over-pressure due to internal fault currents below the trip rating of primary circuit current-limiting fuses.
- The transformer shall have an additional nameplate with the FM Approval mark specifying the following data: tank pressure rating, fuse part number, pressure relief device part number, and requirements particular to the installation.



- Transformers with grounded wye secondary windings and 1,000 or more nominal amperes, shall have a notification tag provided by the manufacturer, that is secured to the low voltage neutral bushing, advising that the transformer installation requires ground fault relay protection prior to energization (if not installed at time of manufacture).
- Transformers installed indoors rated greater than 500 kVA and transformers installed outdoors rated greater than 2,500 kVA shall be equipped with a rapid-rise relay and with alarm contacts on the pressure relief device.
- Three-phase pad-mounted and Substation transformers shall be equipped with an oil level indicator. Transformers rated greater than 750 kVA shall also be equipped with a liquid temperature indicator and a pressure-vacuum gauge.



- The transformer shall be filled with a FM Approved Less-Flammable Fluid. Cooper Power Systems R-Temp and Envirotemp FR3 transformer dielectric coolants are both FM Approved. Less-Flammable fluids, also known as high fire point or fire resistant liquids, are dielectric coolants that have a minimum fire point of 300°C (572°F).

All Cooper Power Systems Code Listed and Labeled transformers are designed and manufactured under strict compliance with FMRC Approval Standard Class 3990.

²For complete details of the FMRC Approval Standard Class 3990, contact your local Factory Mutual or Cooper Power Systems representative.

How to Specify

“Transformers shall be Cooper Power Systems FM Approved Code Listed and Labeled, designed in accordance with the requirements of ANSI/IEEE C57.12.00 and labeled by Factory Mutual Research Corporation as meeting the requirements of FMRC Approval Standard Class 3990, insulated with FM Approved less-flammable fluid (R-Temp® or Envirotemp® FR3™), all in compliance with the NEC® Sections 110-3 and 450-23.”

FM Approved Transformer Product Scope

Single-and Three-Phase, Overhead, Pad-Mounted and Substation Class
kVA: 5 to 10,000
Primary Voltage: Through 46 kV Classes, 250 kV BIL
Secondary Voltage: Through 15 kV, 150 kV BIL
Temperature Rise: 65°C, 55/65°C
Coolant: (R-Tran™) R-Temp Fire Resistant Fluid
(Envirotran™) Envirotemp FR3 Fire Resistant Fluid

K-Plus

K-Factor (F_{HL}) Ratings: K4, K9, K13, K20



APPROVED

You Can Count On Cooper Power Systems Down The Line.

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