

ABSTRACT

Power flow within networks is becoming increasingly complex with high probability of unforeseen peak demands throughout the day. The use of thermally upgraded kraft (TUK) paper and FR3™ natural ester allowed TAMINI to successfully design, manufacture and test an autotransformer with increased load capacity (375 MVA vs 250 MVA nominal rating) for Italian system operator TERNA. With this solution the power demand fluctuations are better handled, energy losses are reduced, while environmental protection and fire safety are increased.

KEYWORDS

FR3™ natural ester, fire safety, increased loadability

FR3™ natural ester helps achieve greater continuous load capacity to better handle demand fluctuations

Tamini power transformer success story



250 MVA transformer with load capacity up to 375 MVA has improved environmental profile and fire safety

With transformers a major cost element for any utility or grid company, managing utilization is critical to cost-effectively and reliably managing the grid. Using TUK paper and Cargill's Envirotemp™ FR3™ natural ester fluid, TAMINI was able to successfully design, manufacture and test an autotransformer with significantly more load capacity (375 MVA vs 250 MVA nominal rating),

while maintaining the temperature rise allowed for high-temperature insulation materials and the expected insulation life. The enhanced load flexibility and appropriately sized transformer capacity allow TAMINI's customer, TERNA, to better handle demand fluctuations and ultimately effectively reduce energy loss. Terna is the largest transmission system operator in Europe and a majority owner

of the high voltage transmission grid in Italy.

The autotransformer's nominal rating of 420 kV/135 kV 250 MVA with continuous load capacity up to 375 MVA was validated by routine, type and special tests, including short circuit withstand capability performed at CESI in Rondissone, Italy. The transformer was installed in the Terna's substation of Tavazzano in December 2017.

The increased loadability of power transformers using natural ester deeply affects the criteria for transformer selection among electric utilities and grid companies

"Power flow within networks is becoming increasingly complex. There is a higher probability of unforeseen peak demands throughout the day, and we are seeing those demands for longer periods of

time. Current loading profiles based on mineral oil transformer limits may not be able to withstand those inconsistent demands,” said Fabio Scattiglio, head of the Terna chemical laboratory who was involved in the testing protocol with TAMINI. “The continuous permanent load capacity concept using natural ester represents a real paradigm shift for our industry, as it deeply affects the criteria for transformer selection among electric utilities and grid companies.”

Using natural esters to improve performance, meet industry demands

TAMINI was motivated to find a solution using natural ester-filled large power transformers because of regulations requiring increased environmental protection, higher fire safety and the desire to reduce the use of non-renewable resources. They also were looking for technical and financial benefits, including

the potential for increased loadability of the natural ester-filled transformer compared to traditional mineral oil-filled transformers.

FR3™ fluid is a well-known renewable, biodegradable transformer oil with increased fire safety properties. FR3™ fluid has been validated in over 250 tests, is used in more than 1 million distribution and power transformers across six continents and is proven in transformers through 420 kV. It meets IEC and IEEE specifications and is UL Certified and FM Global Approved. For more information visit envirotempfluids.com.

Increasingly complex power flow within networks with unforeseeable peak demands may be pushing mineral oil transformers over their limits

“TAMINI selected Cargill’s FR3™ natural ester based on the company’s extensive, proven experience in the transformer industry as well as the technical support provided during the design and manufacturing process,” said Luca Lombini, head of engineering at TAMINI.

About Cargill

Cargill provides food, agriculture, financial and industrial products and services to the world. Together with farmers, customers, governments and communities, we help people thrive by applying our insights and 150 years of experience. We have 150,000 employees in 70 countries who are committed to feeding the world in a responsible way, reducing environmental impact and improving the communities where we live and work. For more information, visit Cargill.com and our News Center.

About TAMINI

Tamini is the leading Italian company in the world for the design and production of power, industrial and special transformers. Founded in 1916 in Milan, it supplies its products to the most important industrial sectors (i.e. steel, aluminum, mining, oil & gas, chemical and transportation) and the most highly qualified operators in the electrical energy area (production, distribution and transmission). With a century of experience in the market and world records in the field, Tamini combines the quality of its products, designed and hand manufactured with the unmatched expertise of the Made in Italy. For more information, visit www.tamini.it

To learn more about Envirotemp™ FR3™ Fluid contact: Cargill Industrial Specialties

+31 20 500 6695

EMEAenvirotemp@cargill.com

