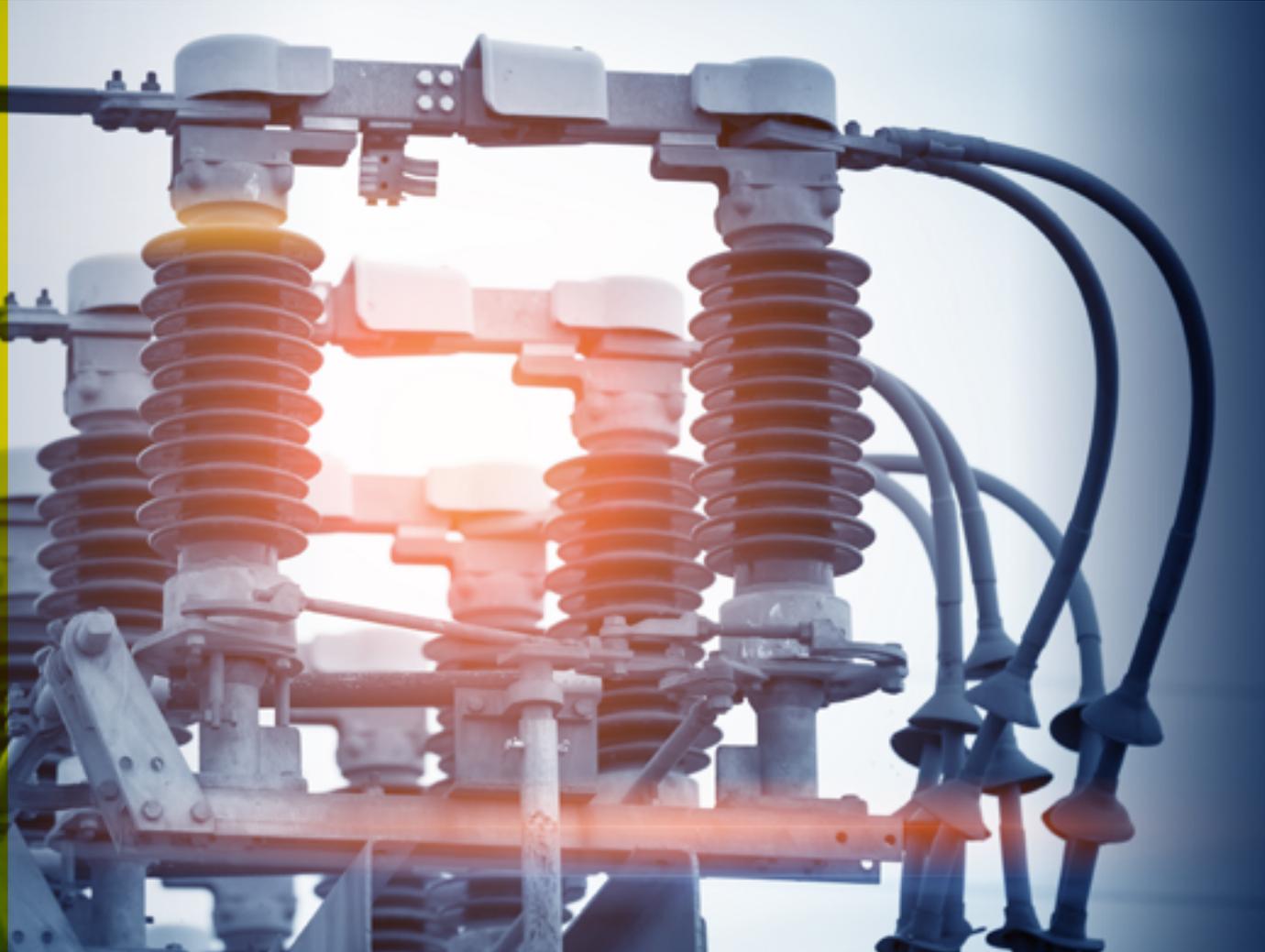


Case Study

How S.E.A.
guarantees
efficiency and
performance of
high-value power
transformers



S.E.A.

Based near Vicenza in northern Italy, S.E.A. (Società Elettromeccanica Arzignanese) is a manufacturer of single-phase, three-phase and custom transformers, and reactors and coils. Its oil-cooled, air-cooled and cast resin transformers are used in power transmission and power distribution networks, in electrical substations, in railway infrastructure and in factories and industrial equipment.

Customers range from multinational utility companies and electrical grid infrastructure operators to industrial companies both large and small.

When customers buy a S.E.A. product, they are investing in a high-value asset which is expected to provide a return over a long lifetime of one, two or more decades. Quality, durability, safety and reliable performance are therefore the key characteristics that customers are looking for when they specify a new transformer or reactor.

Founded in 1959, S.E.A. has gained a worldwide reputation for engineering excellence and high production quality. It also invests heavily in new technology and processes in an effort to develop products which offer continually improving efficiency and performance.



The Challenge

Background

Inefficiency – power losses – in any part of the power transmission and distribution network cause two main undesirable effects:

- Financial loss, as more electricity has to be generated at the power station in order to deliver the power required by the consumer.
- Increased pollution – the extra energy that has to be generated to make up for the power lost in transmission results in extra emissions of greenhouse gases and other pollutants.

Transformers play a crucial role in the transmission and distribution of electrical energy: they precisely regulate the voltage of the electricity supply as it is transmitted from power stations to the homes, offices and factories that consume it. Transformers are also used to regulate the voltage of the electricity supplied to high power consumers such as railway rolling stock and large industrial equipment.

The process of converting an electricity supply from one voltage level to another is inherently inefficient: there will always be some power loss. In a transformer operating at transmission-network voltages of tens of thousands of volts, the loss of even a fraction of 1% of total power converted can result in losses of many thousands of Watt-hours of energy every year.

So, faced with government regulations mandating tough energy-saving benchmarks, and demand from customers to minimize the financial cost of wasted power, transformer manufacturers such as S.E.A. have developed highly efficient products.

The efficiency of a transformer, however, needs to be carefully verified before shipment to the customer: the terms and conditions of the sale of a transformer typically specify financial penalties running to tens of thousands of dollars if an installed transformer fails to operate as efficiently as specified by the manufacturer.

The Challenge

S.E.A. must precisely characterize the efficiency of its transformers with a very high degree of confidence. The efficiency measurement made by S.E.A. at its factory in Italy before shipment to the customer must be so accurate that there is no possibility that its actual performance once installed will be found to be different from its measured performance.

If the efficiency measurement in S.E.A.'s factory is inaccurate even by a fraction of a percentage point, the transformer might fail to meet the efficiency benchmarks specified in the contract of sale. Such a measurement error could cost S.E.A. thousands of dollars.



“For us, it is really important to give our customer a product that matches the design specifications.”

The Solution

Application requirements

The goal of S.E.A. is to achieve a close match between the efficiency performance guarantee that it makes to a customer, and the actual performance of the transformer that it supplies to that customer. In other words, S.E.A. deliberately keeps the safety margin between specified performance and actual performance small, so that it is able to offer the customer a promise of the highest possible operating efficiency. This gives it a competitive edge in the market, since claimed efficiency is one of the most important factors affecting the transformer buyer's choice of product.

This S.E.A. strategy means that its measurements of power efficiency must be extremely accurate. Even a small variance in the efficiency measurement could lead S.E.A. to ship a transformer to a customer which S.E.A. wrongly believes meets the specifications, but which on installation is found to under-perform.

The measurement of a transformer's efficiency according to the IEC60076-1 industry standard calls for an instrument capable of measuring voltage, current, phase and power (VA) at a range of power factor values from 1 to 0.01.

Measurement solution

S.E.A. has chosen to entrust these crucial transformer power measurements to the WT5000 Precision Power Analyzer from Yokogawa. The WT5000 is the world's most accurate precision power analyzer, offering minimum AC power measurement accuracy of $\pm 0.03\%$ at 50/60 Hz.

Its accuracy specifications are guaranteed across a range from 1% to 130% of the selected voltage and current values. The ultra-high accuracy specification of $\pm 0.03\%$ is maintained at low power factor values down to 0.02, which makes it ideal for the measurement of transformer losses in no-load conditions.

It is a modular instrument which provides seven slots for measurement modules. In the S.E.A. measurement set-up, the WT5000 operates with three modules for measurement of three-phase power.

S.E.A.'s confidence in the accuracy of the WT5000's measurements is reinforced by the quality of the instrument's calibration in the Yokogawa calibration laboratory (Amersfoort, The Netherlands). This laboratory is the only commercial, non-government calibration facility in the world to be ISO/IEC17025 accredited (RvA K164) for the validation of the performance of power measurement instruments at frequencies up to 100 kHz. S.E.A. can therefore use its calibrated WT5000 to detect losses in switching harmonics at frequencies other than the primary 50/60 Hz grid frequency.

Renato Franco, Testing Manager at S.E.A., says that when buying an instrument intended for use over a period of many years, measurement stability is as important as accuracy. He says: 'Evidence from calibration shows that the instrument's performance is constant over time. Its accuracy is maintained even after many years of use – this is a very important reason for us to choose the WT5000.'



Results

Accurate measurements for guaranteed performance

The WT5000 has enabled S.E.A. to build a long track record of delivering transformers that meet its customers' minimum efficiency specifications. The products' high efficiency and low losses are helping utility companies and electricity grid operators to achieve excellent operating efficiency and to reduce the impact of electrical power supplies on the world's climate.

For S.E.A., the confidence with which it can verify the performance of its transformers helps it to negotiate successfully with potential customers, and to make responses to requests for proposal (RFPs) from transformer buyers that it is sure it can fulfil.

Renato Franco of S.E.A. says: 'For us, it is really important to give our customer a product that matches the design specifications. That's why we need a measurement that is both accurate and precise, to verify the performance of the transformer for our customer. We are confident in the power measurements that the WT5000 gives us.'

WT5000 Precision Power Analyser

Offering the best in isolation, noise immunity, current sensing and filtering in a modular architecture, the WT5000 is an extensible measurement platform that provides precision power analysis backed by the world's leading in-house calibration facility for power analysers.

Users can make simultaneous measurements on up to seven inputs and compare them in split-screen mode on the high-resolution 10.1" touchscreen. The modular architecture of the WT5000 provides seven slots supporting various types of input modules, providing a flexible and extensible measurement system.

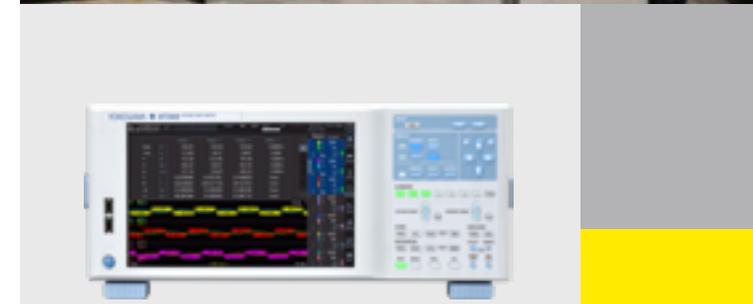
The WT5000 also offers advanced filtering options, including:

- Synchronization source filter
- Enhanced frequency filter
- Digital parallel path filters

Operable by a touchscreen and hardware controls, the WT5000 offers an intuitive measurement experience. As S.E.A.'s Renato Franco says: 'Formulas pre-loaded into the instrument mean we can easily set the desired values for each of the three channels, and get the measurement results that we need without programming.'

For more information on the WT5000, visit tmi.yokogawa.com.

For more information on S.E.A., visit www.seatrasformatori.it.



About Yokogawa Test & Measurement

Yokogawa has been developing measurement solutions for 100 years, consistently finding new ways to give R&D teams the tools they need to gain the best insights from their measurement strategies. The company has pioneered accurate power measurement throughout its history, and is the market leader in digital power analyzers.

Yokogawa instruments are renowned for maintaining high levels of precision and for continuing to deliver value for far longer than the typical shelf-life of such equipment. Yokogawa believes that precise and effective measurement lies at the heart of successful innovation – and has focused its own R&D on providing the tools that researchers and engineers need to address challenges great and small.

Yokogawa takes pride in its reputation for quality, both in the products it delivers – often adding new features in response to specific client requests – and the level of service and advice provided to clients, helping to devise measurement strategies for even the most challenging environments.

The guaranteed accuracy and precision of Yokogawa's instruments results from the fact that Yokogawa has its own European standards laboratory at its European headquarters in The Netherlands.

This facility is the only industrial (i.e. non-government or national) organization in the world to offer accredited power calibration, at frequencies up to 100 kHz. ISO/IEC17025 accreditation (RvA K164) demonstrates the international competence of the laboratory.



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