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TESTINGLY

Testing, Inspection & Certification Magazine

New standards, for new testing requirements

magazine by KEMA Labs

KEMA Labs

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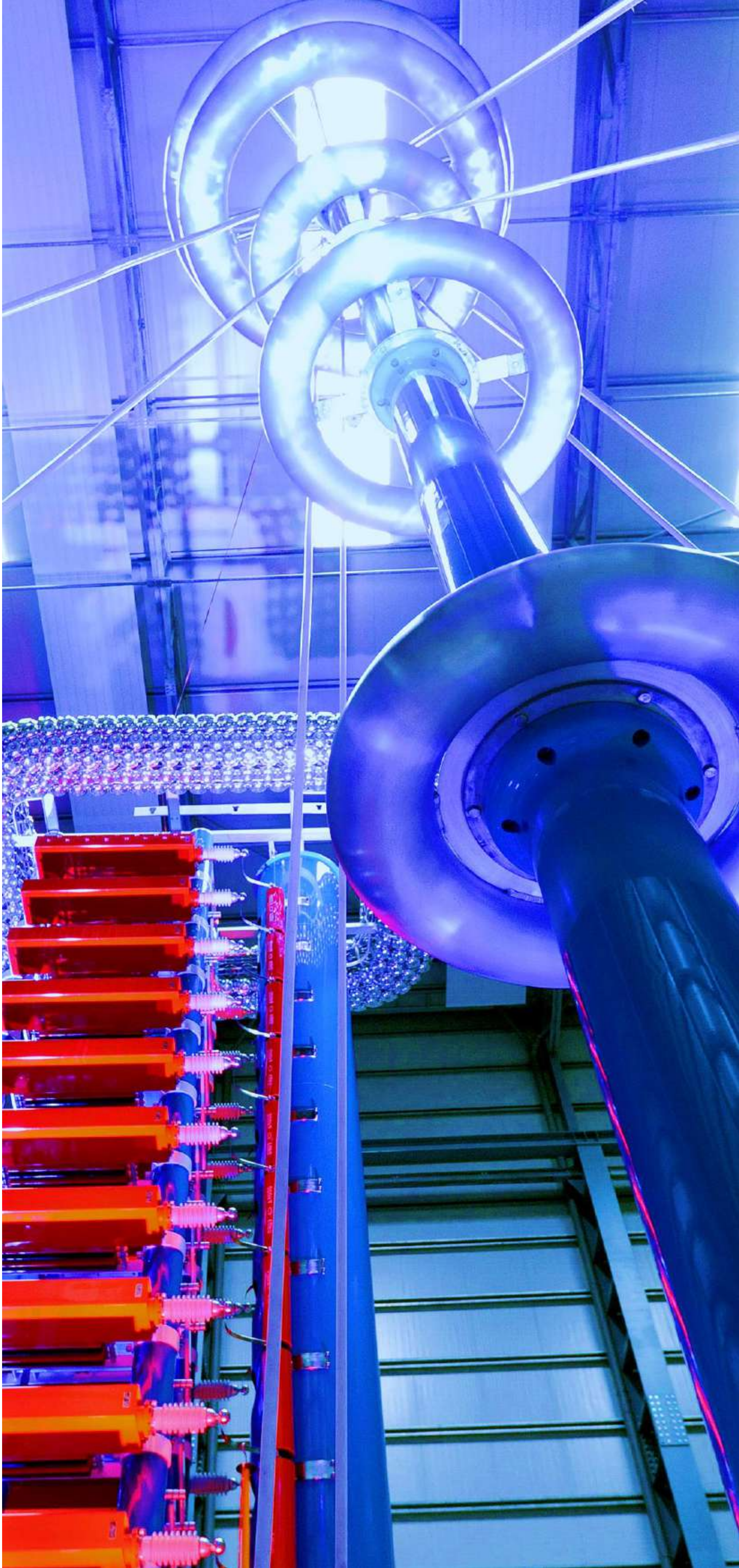


Index
CONTENT

Editorial
Ready to test according to new standards 01

Latest from TIC
Latest news from the TIC industry 02

T&D standards
Developments in Standards for HV T&D equipment 03

Metering standards
Standardization developments for electricity metering 04

USA standards
The latest on USA testing standards 05

Case History
First TOV Test performed on 525kV DC extruded Cable 06

Interviews with...
Cable testing experts from Prysmian R&D and KEMA Labs 07

Testing, Inspection and Certification events
Upcoming events, conferences, seminars and more 08

> International standards come to our aid by providing instructions, guidelines, rules, or definitions that are then used to design, manufacture, install, test, certify, maintain, and repair devices and systems.

Matteo Codazzi
CESI Group CEO

Ready to test according to new standards

The growing demand for electricity requires utilities to have **solid transmission and distribution networks** to ensure reliability and to reduce operation costs. Utilities are working to ensure electricity systems are **robust, reliable, resilient, and modernized**.

This underscores the importance and reliance on **international standards** that provide instructions, guidelines, rules, and definitions used to design, manufacture, install, test, certify, maintain, and repair devices and systems.

Standards are essential for **quality and risk management**; they allow manufacturers to produce products of consistent quality and performance. In addition, international standards are the basis for **testing and certification** to achieve a harmonized and acceptable level of quality for products that are procured and installed.

As the requirements for power networks change due to the need for **long-distance connections**, the integration of large amounts of **renewables**, and the increasing necessity of resilience due to extreme weather phenomena, the **development and updates to international standards** is a priority for the **Testing, Inspection, and Certification (TIC) industry**.

For this reason, the new issue of ***Testingly*, the KEMA Labs Magazine**, is dedicated to the latest updates of the key standards that apply to the **TIC sector**: from **IEC** and **IEEE**, to **CIGRE** and **ASTM**, to several others.

The section dedicated to *T&D Standards* takes into consideration several of the crucial standards that have been updated in 2020 and 2021: these include **IEC 62271-200,** alternating current disconnectors and earthing switches; **IEC 62271-103,** alternating current switches for rated voltages up to and including 52 kV; **IEEE C57.164:2021**, the guide for establishing Short-Circuit Withstand Capabilities of Power Transformers, Regulators and Reactors.

> This new issue of *Testingly*, the KEMA Labs Magazine, is dedicated to the latest updates of the main standards that apply to the testing, inspection, and certification sector

Domenico Villani – KEMA Labs, Executive Vice President

Metering equipment is another area where international standards play a crucial role. The *Metering Standards* section focuses on the standardization developments for electricity metering equipment. For such standards, new sections were introduced to cover the growing **smart metering** developments. In 2020, an important step was the update and publishing of the following: **new versions of the EN-IEC product standards** for electricity metering equipment, **the EN-IEC 62052-11, EN-IEC 62053-21, -22, -23, and -24**.

For the technical content of standards (e.g. IEEE, ASTM, UL) used in specific countries like the **United States, requirements for testing** are **noticeably different**. In the *USA Standards* section we focus on how, despite the differences between North America and Europe, the U.S. developed methods and strategies to address individualized customer requests.

In addition, this issue of *Testingly* features a ground-breaking *Case History*: the **first ever TOV (Transient Over Voltage) test performed on a 525kV DC Cable System**, which represents a milestone in **HVDC** development. The article includes insights from the two projects managers who were key players in this first of its kind TOV test: **Stefano Franchi Bononi** (**Prysmian Group R&D** VP for BU Projects) and **Heiko Jahn** (**KEMA Labs** Principal Engineer and Special Projects Coordinator).

Lastly, this issue provides a **collection of the latest tests and initiatives conducted in the TIC sector**, as well as a summary of recent conferences in energy sector, including the **CIGRE Session 2022**.

Enjoy the read!

Matteo Codazzi – CESI Group CEO
Domenico Villani – Executive Vice President CESI TIC Division – KEMA Labs

Latest news from the TIC industry

Alternative Gases to replace SF6 in HV Technology

For decades, SF6 gas has been the workhorse of HV technology, combining a "close to ideal" combination of excellent insulation and superior current interruption. Its dark side, is it is the most potent greenhouse gas on earth, having a CO2 equivalent (GWP – Global Warming Potential) of 23,500. In terms of mass, the worldwide SF6 emission of around 9,000 tons per year is totally dwarfed by the 34 billion tons of CO2 emission, but its ugly equivalent still makes SF6 emission contribute to around 0.6% of the global greenhouse gas emission.

KEMA Labs is actively supporting the transition of new alternatives to SF6 by providing impartial testing services for the Electromechanical Industry and for all those manufacturers working hard to upgrade their technologies to make them sustainable without compromising safety and performances.

Certification of EVSE and Interoperability Test

Electric Vehicle Charging Stations are vital to the the future of Electrical Mobility. The widespread adoption of Electric Vehicles is not only related to affordability of the Vehicles, but also to a sufficiently meshed charging network.

Safety, performances, and Interoperability across multiple vendors, are some of the challenges on the spotlight in this sector. Testing the single components, is not anymore sufficient.
In 2021, KEMA Labs performed several communication conformance testing of EVSE according to the CHADEMO and CCS standards in our Flex Power Grid Lab, as well as Interoperability Tests in our Digital Lab.

Customers from U.S., The Netherlands, and Europe performed tests on their equipment.

DC short-circuit tests on the wiring system

KEMA Labs Prague, Czech Republic, has recently performed a series of successful DC short-circuit tests on the wiring system for electric vertical take-off and landing (*eVTOL*) aircraft developed by a large European aircraft manufacture.

The aim of this test was to define clearance links to short-circuit between wiring system (1000 VDC) and metallic structure and other harnesses. In the frame of these tests campaign, several parameters were considered to determine their influence on damages caused by thermal / arcing effects during a short-circuit event.

Seismic Tests on PAO 345kV IEEE BUSHING

KEMA Labs is the global leader in testing insulators and bushing to most existing standards. We have a long track record and deep range of skills, as well as a portfolio of pollution and salt fog test facilities. This includes one of the biggest salt fog chambers ever built (which can test up to 600 kV DC and AC). Also, seismic events can affect the integrity of these apparatuses, that's why many standards require seismic qualification.

In this context, the GE IEEE PAO 345 kV has been submitted to seismic tests. During tests, bushing was mounted on a frame that reproduces the in-service condition (45° inclination). Triaxial seismic test with ZPA equal to 2 g (in horizontal directions) and 0,16 g (in vertical direction) was applied. As required by the standard, recorded acceleration signals placed at the top of the bushing have been processed (with double integration method) to obtain maximum displacements during seismic test.

The latest developments of the IEC and IEEE standards

HIGH-VOLTAGE STANDARDS

Developments in Standards for High-Voltage T&D equipment

International Standards provide instructions, guidelines, rules, or definitions that are then used to design, manufacture, install, test & certify, maintain, and repair devices and systems. They are essential for quality and risk management; they help researchers to understand the value of innovation and allow manufacturers to produce products of consistent quality and performance.

International standards also form the basis for testing and certification to achieve a harmonized and acceptable level of the quality of products that are procured and installed in the systems.

In this regard, **KEMA Labs** is actively involved in the process of development of the **IEC and IEEE standards.**

KEMA Labs is making a significant contribution to the world of Standards by deputing technical experts as members and convenors to the various working Groups and Maintenance Teams through respective National Committees. In these contexts, KEMA Labs shares their experience and contributes to standards development.

Being at the forefront of such development also enables KEMA Labs access to the state-of-the-art technologies and helps to develop its test facilities to match the needs of the latest requirements of the Standards. Additionally, KEMA Labs develops **new test systems required for innovative technologies such as alternative gases in circuit breakers and HVDC cables**.

In the next pages, you will find some of the primary Standards that have been updated in the past couple of years.

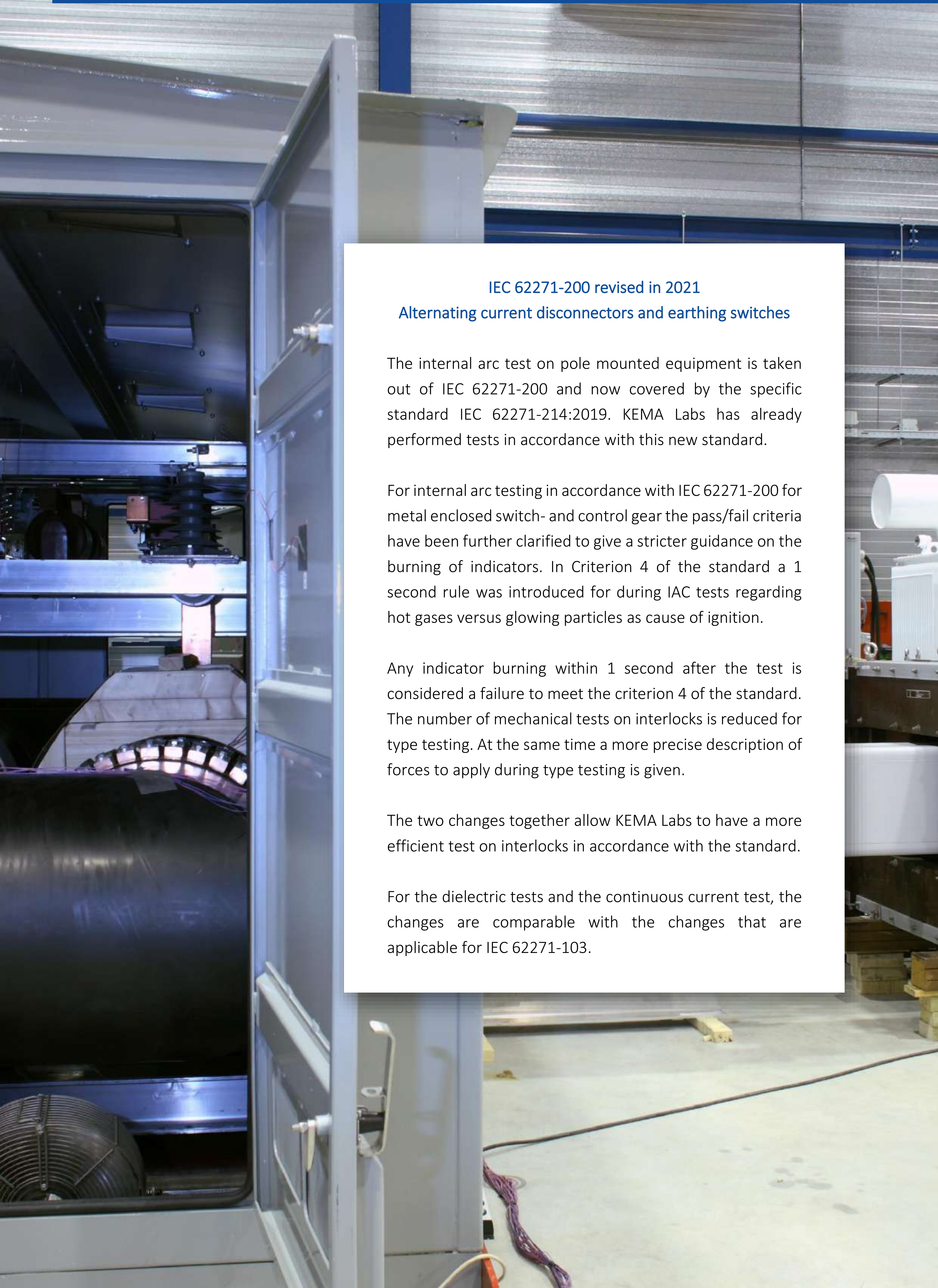
IEC 62271-103 revised in 2021
Alternating current switches for rated voltages up to and including 52 kV

The standard for alternating current switches IEC 62271-103 has been updated to align with other related product standards (for example IEC 62271-102 for earthing switches / disconnectors) for the kinematic chain and test on the position indicating device, making tests more uniform and have more clear acceptance criteria for the test.

The behavior of the switch during breaking tests has been elaborated further and more stricter boundaries for restrikes during breaking tests have been specified. A switch now has a defined time of clearing the current after contact separation, to avoid invalid and dangerous operations in energy networks.

For a switch, the tests are specified to be performed at rated frequency (50Hz or 60Hz) in IEC 62271-103. The latest edition, however, gives a procedure for combining tests at both rated frequencies. With a limited number of additional tests, a switch can be tested and certified for both rated frequencies.

For the dielectric tests and continuous current tests there are no major differences other than for these tests it is now referring to the current edition of IEC 62271-1 (2017). As a result, a clear procedure is now described for preconditioning tests in case vacuum interrupters are incorporated. Also, temperature-rise limits have been changed for the continuous current test.



IEC 62271-200 revised in 2021
Alternating current disconnectors and earthing switches

The internal arc test on pole mounted equipment is taken out of IEC 62271-200 and now covered by the specific standard IEC 62271-214:2019. KEMA Labs has already performed tests in accordance with this new standard.

For internal arc testing in accordance with IEC 62271-200 for metal enclosed switch- and control gear the pass/fail criteria have been further clarified to give a stricter guidance on the burning of indicators. In Criterion 4 of the standard a 1 second rule was introduced for during IAC tests regarding hot gases versus glowing particles as cause of ignition.

Any indicator burning within 1 second after the test is considered a failure to meet the criterion 4 of the standard. The number of mechanical tests on interlocks is reduced for type testing. At the same time a more precise description of forces to apply during type testing is given.

The two changes together allow KEMA Labs to have a more efficient test on interlocks in accordance with the standard.

For the dielectric tests and the continuous current test, the changes are comparable with the changes that are applicable for IEC 62271-103.

IEEE C57.164:2021
Guide for Establishing Short-Circuit Withstand Capabilities of Power Transformers, Regulators and Reactors

This IEEE Guide describes the ways to establish the capabilities for withstanding short-circuit currents resulting from external short-circuit faults.

The procedures described in this document are always based on the results of actual short-circuit tested transformers, being used directly as reference or the evaluated short-circuit stresses during such tests.

New transformer T401, built by Siemens Energy

KEMA Labs is making a significant contribution to the world of Standards.

Being in the forefront of such development also enables KEMA Labs access to the state-of-the-art technologies and helps to develop its test facilities match the needs of the latest requirements of the Standards.

Additionally, KEMA Labs develops new test systems required for innovative technologies such as alternative gases in circuit breakers and HVDC cables.

Other standards and updates

New editions of the standards for Generator Circuit Breakers, IEC 62271-37-013 and A.C. Circuit-breakers IEC 62271-100 been released in 2021.

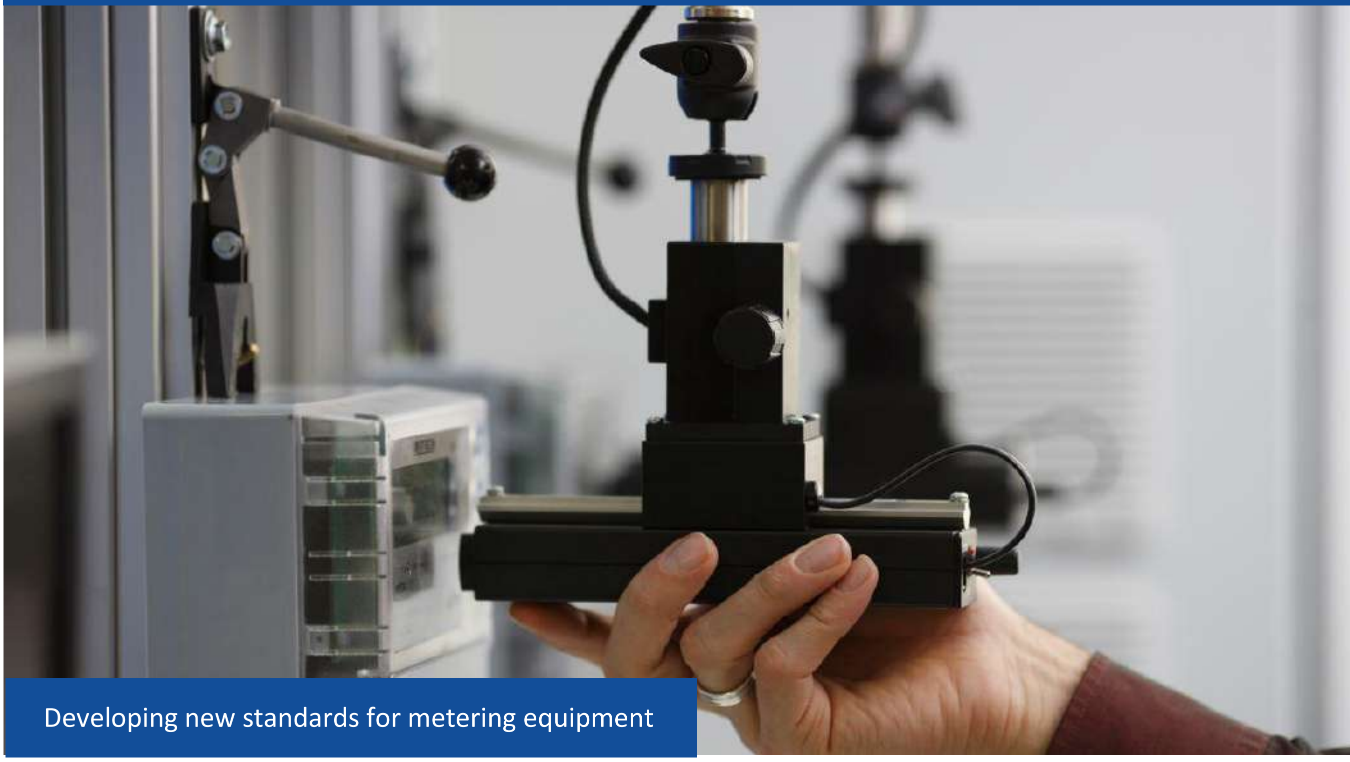
In IEC 62271-101 testing methods for synthetic testing of high voltage circuit-breakers are described.

KEMA Labs complies with the requirements of testing according to this latest edition (2021) of the standard. In April 2022, a new edition has been issued of the standard IEC 62067 (Edition 3) for testing of A.C. Power Cables and their Accessories for rated voltages above 150 kV.

In this new edition, some additional tests are introduced as well as some changes in the procedure for existing tests.

KEMA Labs considers that it is an important part of our business activities to continue support technical committees of international standards and keep customers and end-users informed of the developments to Standards.

The aim is to keep the readers updated with such developments.



Developing new standards for metering equipment

METERING STANDARDS

Standardization developments for electricity metering equipment

Standards create common rules for all the players in the power industry: manufacturers, utilities, and consumers. For that reason, they are of great benefit for the entire sector, as long as there are common ways to prove the compliance of the equipment to the standards themselves. Standards can apply nationally or internationally, depending on the specific needs, but in both cases, they ensure quicker introduction of innovative technologies, while increasing safety for society.

IEC Technical Committee TC13 deals with **standardization in the field of electrical energy measurement and control, for smart metering equipment and systems forming part of smart grids**. Those components, initially installed in few selected points, are nowadays pervading the whole electrical grid, being used in power stations, along the feeders and at energy users and producers. Since one of the aims of TC13 is also to prepare international standards for meter test equipment and testing methods, **KEMA Labs is heavily contributing to that technical committee**, participating in several working groups.

Due to the quick evolution, during the last decade those existing standards were often revised, and new sections were introduced to cover the increasing smart metering developments. In 2005, the IEC 62055-31 was introduced for prepayment meters. In 2015, the IEC 62052-31 was introduced for product safety.

In 2020, a major step was taken: **new versions of the EN-IEC product standards** for electricity metering equipment, **the EN-IEC 62052-11, EN-IEC 62053-21, -22, -23, and -24**, were published.

These second editions cancel and replace the first editions published in 2003, including their 2016 amendments. The main novelties concern some items aiming at starting to deal with DC meters and instruments transformers connected to the measurement units. Next to these test methods, requirements and guidance are given for multibranch meters, integrated and detached displays, ways of energy registration, and operation of supply control and load control switches.

The product safety (IEC 62052-31) and stability of metrological characteristics by applying elevated temperature (IEC 62059-32) are now integral parts of the 2020 versions. New tests are included for clock and timing accuracy (IEC 62054-21), load current variations, 2 kHz to 150 kHz disturbances on mains ports, ring wave on main ports and requirements are given for repeatability and meter marking and documentation. Finally, some details of existing tests are changed.

Once the new standards are published, time is grant to the different stakeholders to prepare themselves with new products. Given that, national legalization bodies, utilities and manufacturers agreed to **adapt to these new product standards starting in 2022**.

However, the standardization process never stops. At this moment working groups within IEC TC13 are developing new standards for new technologies.

In 2021, the first edition of the IEC 62053-41 for DC meters was introduced and new teams of experts have been called to work on both AC and DC meters for connection through **Low Power Instrument Transformers (LPIT)**, very interesting new equipment defined in another series of standards, the IEC 61869. Other ongoing activities are focusing on hot topics like dependability, cybersecurity, and embedded software requirements.

As usual, the European Measuring Instrument Directive 2014/32/EU, one of the main pillars to set the rules in that field, will become aligned with the new IEC standards.

KEMA Labs adapted to the new 2020 standards by **implementing new test procedures or revising existing test procedures and methods**.

Next to this, also the product safety standard EN-IEC 62052-31 was implemented with state-of-the-art facilities for switch endurance testing at different power factors and switch short circuit testing up to 10.000 A, single fault testing, and safety assessment. For the clock and timing accuracy tests the laboratory has access to a GPS time synchronization network with PPS, IRIG-B, PTP.

KEMA Labs offers type testing to all different versions of the EN-IEC products standards and is notified body for the Measuring Instrument Directive (MID 2014/32/EU). On request special national tests or tests per client instructions can be added. We are constantly developing our laboratories and skills to cope with the future.

We are ready to help you!

Aerial view of KEMA Powertest, LLC, Chalfont (Pennsylvania, USA)

USA STANDARDS

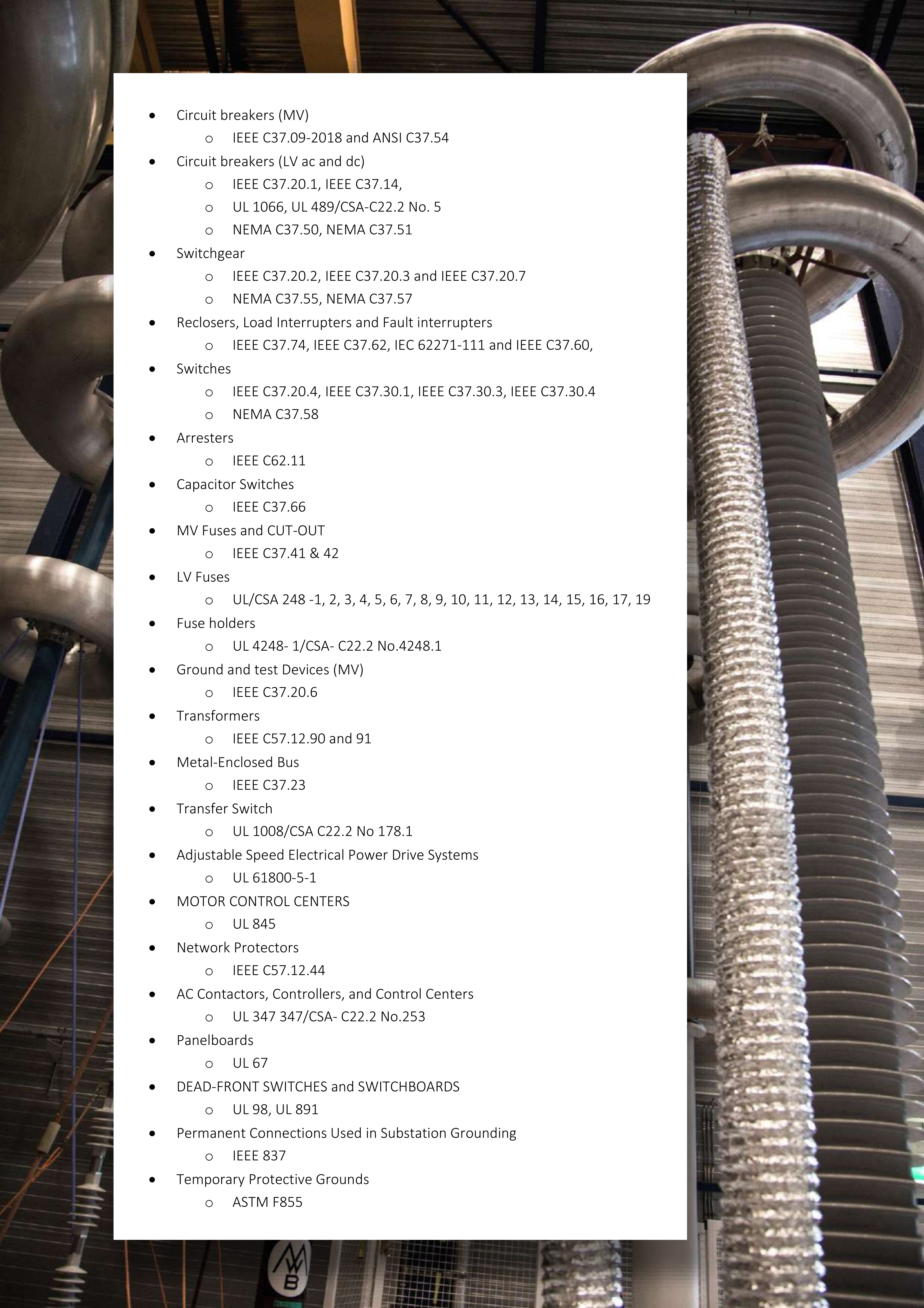
The latest on USA testing standards

Unlike our KEMA Labs in the European Union (Arnhem, Milano, Prague, Mannheim, Berlin), the Chalfont Lab primarily conducts testing to support Original Equipment Manufacturers (OEM) product research & development. Very little certification testing, or type testing is conducted in Chalfont, because the US market does not require Certification of equipment.

These differences have their genesis in how Standards were developed in the United States. The Institute of Electrical and Electronic Engineers (IEEE) started publishing Standards in the 1960's. The IEEE can trace its roots to the late 1800's and the pioneers of the electrical and wireless industries in the United States who formed the predecessor groups to the IEEE as a way to foster innovation, professionalism and growth in the nascent electric power industry in the United States.

Although the technical content of Standards (e.g. IEEE, ASTM, UL) used in the US may be similar to Standards (e.g. IEC, CIGRE) used in the rest of the world, the requirements for testing are markedly different. In the US, most end users rely on the contractual terms of their procurements which will typically include a Product Warranty to protect their investment. Consequently, the requirement to conduct independent testing is not as prevalent as the rest of the world.

The KEMA Labs Chalfont facility currently tests to the following US Standards for virtually every OEM in North America:



- Circuit breakers (MV)
    - IEEE C37.09-2018 and ANSI C37.54
- Circuit breakers (LV ac and dc)
    - IEEE C37.20.1, IEEE C37.14,
    - UL 1066, UL 489/CSA-C22.2 No. 5
    - NEMA C37.50, NEMA C37.51
- Switchgear
    - IEEE C37.20.2, IEEE C37.20.3 and IEEE C37.20.7
    - NEMA C37.55, NEMA C37.57
- Reclosers, Load Interrupters and Fault interrupters
    - IEEE C37.74, IEEE C37.62, IEC 62271-111 and IEEE C37.60,
- Switches
    - IEEE C37.20.4, IEEE C37.30.1, IEEE C37.30.3, IEEE C37.30.4
    - NEMA C37.58
- Arresters
    - IEEE C62.11
- Capacitor Switches
    - IEEE C37.66
- MV Fuses and CUT-OUT
    - IEEE C37.41 & 42
- LV Fuses
    - UL/CSA 248 -1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19
- Fuse holders
    - UL 4248- 1/CSA- C22.2 No.4248.1
- Ground and test Devices (MV)
    - IEEE C37.20.6
- Transformers
    - IEEE C57.12.90 and 91
- Metal-Enclosed Bus
    - IEEE C37.23
- Transfer Switch
    - UL 1008/CSA C22.2 No 178.1
- Adjustable Speed Electrical Power Drive Systems
    - UL 61800-5-1
- MOTOR CONTROL CENTERS
    - UL 845
- Network Protectors
    - IEEE C57.12.44
- AC Contactors, Controllers, and Control Centers
    - UL 347 347/CSA- C22.2 No.253
- Panelboards
    - UL 67
- DEAD-FRONT SWITCHES and SWITCHBOARDS
    - UL 98, UL 891
- Permanent Connections Used in Substation Grounding
    - IEEE 837
- Temporary Protective Grounds
    - ASTM F855

Even though the KEMA Labs Chalfont team has developed methods and strategies to address these individualized requests to fulfill customer's expectations, we are constantly looking for opportunities to improve our technical capabilities and our facilities to meet ever increasing expectations

This market difference results in testing evolutions that vary greatly from customer to customer, despite the Standards, as each individual customer is testing their equipment for a particular aspect of the Standard as necessary to achieve their product development objectives.

Even though the KEMA Labs Chalfont team has developed methods and strategies to address these individualized requests to fulfill customer's expectations, we are constantly looking for opportunities to improve our technical capabilities and our facilities to meet ever increasing expectations.

From the Sales stage, through the development of the Quotation, to the scheduling and test planning, preparation and resourcing, Sales and Operations work together to assure customer expectations are achieved.

Invariably, once the testing starts, the customer will introduce changes because of what they are learning during the conduct of the test. These changes sometimes create interesting challenges for the KEMA Labs Test Teams.

Meeting these challenges requires good understanding of what the customer, and their own end customers, are trying to achieve with their testing, the requirements of the particular Standard being used as the basis of the testing evolution and, of course, the physical limitations of the facility.

Inside the KEMA Labs Chalfont facilities

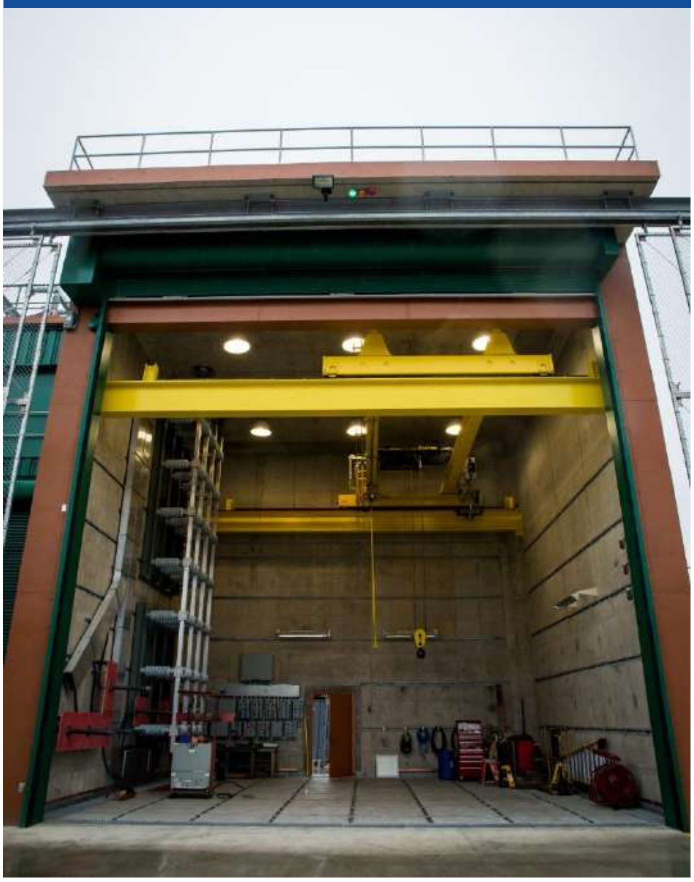


Image courtesy of Prysmian Group R&D

CASE HISTORY

First TOV Test performed on 525kV DC extruded Cable

KEMA Labs (CESI's Testing, Inspection and Certification Division) has carried out the **first TOV (Transient Over Voltage) test on a 525kV DC Cable System**, manufactured by **Prysmian Group**. This new and important goal for the HVDC Cable Sector has been reached in our **KEMA Labs Mannheim HVDC Laboratories**.

The long distance between renewable energy sources generation centers and the main power networks, as well as the need to transport the energy with the highest efficiency, with low losses, is driving increasing adoption and investments on HVDC power transmission infrastructures. The growing integration of **extruded HVDC cables into the energy transmission system** raises new questions regarding transient failure voltage waveforms and their simulation in the laboratory.

In this respect, immediately from the first simulations performed by the TSOs in 2018, it was found that the **IEC and CIGRE standard requirements** were not sufficient to cover cases of dangerous transient waveforms in growing DC networks.

Some TSOs, engaged in the transport of electricity from offshore wind farms in the North Sea and the Baltic Sea decided to verify the greater ability to withstand electrical transients of 525kV DC cable systems, which occur in HVDC Schemes such as during pole to ground fault, pole to pole fault, AC side faults, etc.

Early simulations revealed that transient overvoltage stress can occur on the cable. In the event of an earth fault in one polarity, the voltage in the other polarity can rise to a value between 1.7 and 2 p.u.

Following these simulations, KEMA Labs was contacted to evaluate, if such waveform could be generated in a typical HV test laboratory. All the requested waveforms contained two general waveshapes: oscillating discharge of a pre-charged cable and superimposed transient overvoltage in same or opposite polarity.

The oscillating discharge of a pre-charged cable requires the discharge through an inductor and, if necessary, a damping resistor to reduce the discharge time. The superimposed transient overvoltage was expected to be generated by a circuit similar to the superimposed impulse voltage test according to **IEC 62895/IEC 6023** but with different time parameters.

A first evaluation based on a simulation software revealed that we would be able to supply the test with oscillating discharge using laboratory equipment, which is available in the **Mannheim test laboratories**.

For the superimposed transient overvoltage this was not so easy since it was found that extreme values for damping and discharge resistor would be necessary when the available 300 kJ impulse generator shall be used. This result was confirmed by some available publications from other laboratories that also could not reach these parameters with a simple double-exponential waveshape.

Finally, **the breakthrough was the insertion of a rectifier** that allowed us to charge the test object with impulse voltage (forward direction) but to avoid the quick discharge (reverse direction). The simulation of such circuit confirmed this assumption.

Reduced view of the test bay containing the set-up for TOV tests during the assembly phase

Therefore, it was decided to start a laboratory evaluation with reduced values to prove that the simulation could be confirmed in the reality of the testing hall. Together with **Tennet**, the Mannheim test facility started a test program generating both described waveforms. Since a cable was not available at this time, this test program was carried out using lumped laboratory capacitors as a load.

At this time, a high voltage rectifier of sufficient capability was not available yet and therefore, an available Selenium rectifier was used. In summary, the results of this test program were very promising. The required waveshapes could be produced and the KEMA Labs could publish this success in a first paper on the **Jicable 2021 conference**.

After the computational simulations and the successful pre-test it was decided to push this project forward and the management supported the purchase of some new laboratory components by approving a project-related budget to purchase a new inductor for the oscillating discharge test, a new rectifier and a coupling capacitor for the superimposed transient voltage test. In parallel, a real cable system loop, consisting of 2 outdoor cable terminations, 2 joints and the DC cable, produced by Prysmian Group, was installed in the Mannheim test facility.

The full-size TOV test on the 525 kV cable system was carried out in the Mannheim test facilities between February 2022 and April 2022 in close cooperation between the laboratory and **Prysmian Group R&D**. It was observed by Tennet, the creator of the specification for this first test. All specified test parameters were fulfilled during the tests, and KEMA Labs could prove that it is technically possible to generate such extraordinary waveforms in a regular high-voltage test laboratory.

If you want to know more about this specific test and KEMA Labs services, feel free to reach us through the contact form here.

Overview picture of the test bay containing the set-up for TOV tests

Stefano Franchi Bononi

PRYSMIAN GROUP R&D

Prysmian Group R&D VP for BU Projects

- A new challenge for the high-voltage electricity laboratories
- More robust future connections
- Collaboration with KEMA Labs and CESI

Stefano Franchi Bononi was born in Ferrara in 1961, received a Degree in Electrical Engineering at Alma Mater Studiorum of Bologna in 1986. He has more than 30 years of experience in cables industry spent in Research and Development department of Prysmian Group, former Pirelli Cables. His experience includes accessories design (both telecom and energy), development of new generation of instruments for research activity, Chemical, Physical, Mechanical and Electrical Laboratories Management. He is currently Director of Prysmian R&D Projects Department. He is member of different international committee and working Group.

The first TOV (Transient Over Voltage) test carried out by KEMA Labs involved a 525kV DC Cable System, manufactured by Prysmian Group. What made you choose KEMA Labs as the right partner for this project?

TOV represented the new challenge for the high-voltage electricity laboratories committed to supporting the development of power transmission systems. A number of laboratories of different institutions had carried out simulations with simplified voltage waves, however, encountering major technological difficulties. Prysmian engaged with customers to carry out these tests with well-defined parameters very similar to those required by current international standards. In order to fully satisfy what was agreed with the customers, not only parameters and test methods, but also deadlines, we started a technical discussion with the world leader in electrical high-voltage test laboratories. We were looking for professionalism, expertise, availability, flexibility in facing new challenges and, of course, the best hardware available. In CESI, we found all this and started a fruitful collaboration that led to CESI being the first laboratory to carry out this test and Prysmian the first cable manufacturer to pass it.

What does this test mean for the future of cable systems?

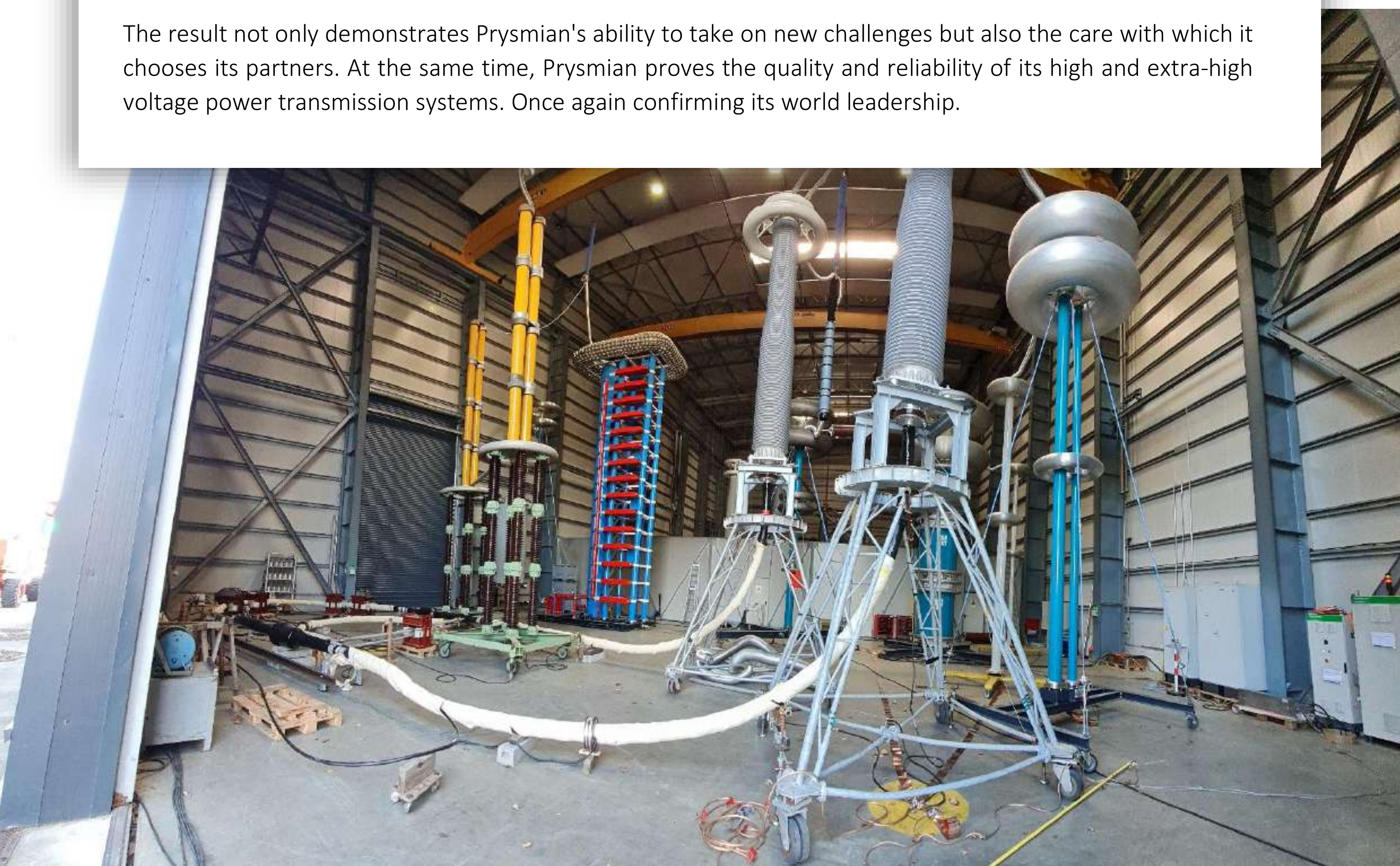
This test was endorsed by the international scientific committee CIGRE and it was introduced in the recent TB 852 recommendations after a long discussion involving the world's leading experts in the field. The world's scientific consensus questioned what problems might arise with the increasingly widespread use of systems involving a bi-pole instead of the more traditional single pole with return cable. The most critical phase was identified as the failures that can occur in one of the two poles and the possible consequences on the second pole. At the same time, abnormal stresses can also occur with faults in the converter stations and/or during the on/off switching operation. The cable system and accessories that pass the new tests defined by the standards guarantee the robustness of future connections. Ultimately, realizing and passing this new set of tests guarantees the performance of the power transmission system by raising its quality and reliability to the benefit of the end user.

Do you envision the collaboration between KEMA Labs and Prysmian Group to continue on such projects in the future?

I think that the result we have achieved with this collaboration is the fruit of two groups representing two world-excellencies. The result achieved is there to prove it. With this in mind, we will clearly continue to work together with KEMA Labs in the future. We are already working together these days to optimize the test setup and introducing some new methods in well-known tests (i.e.: superimposed impulses).

What does this achievement mean for Prysmian?

The result not only demonstrates Prysmian's ability to take on new challenges but also the care with which it chooses its partners. At the same time, Prysmian proves the quality and reliability of its high and extra-high voltage power transmission systems. Once again confirming its world leadership.



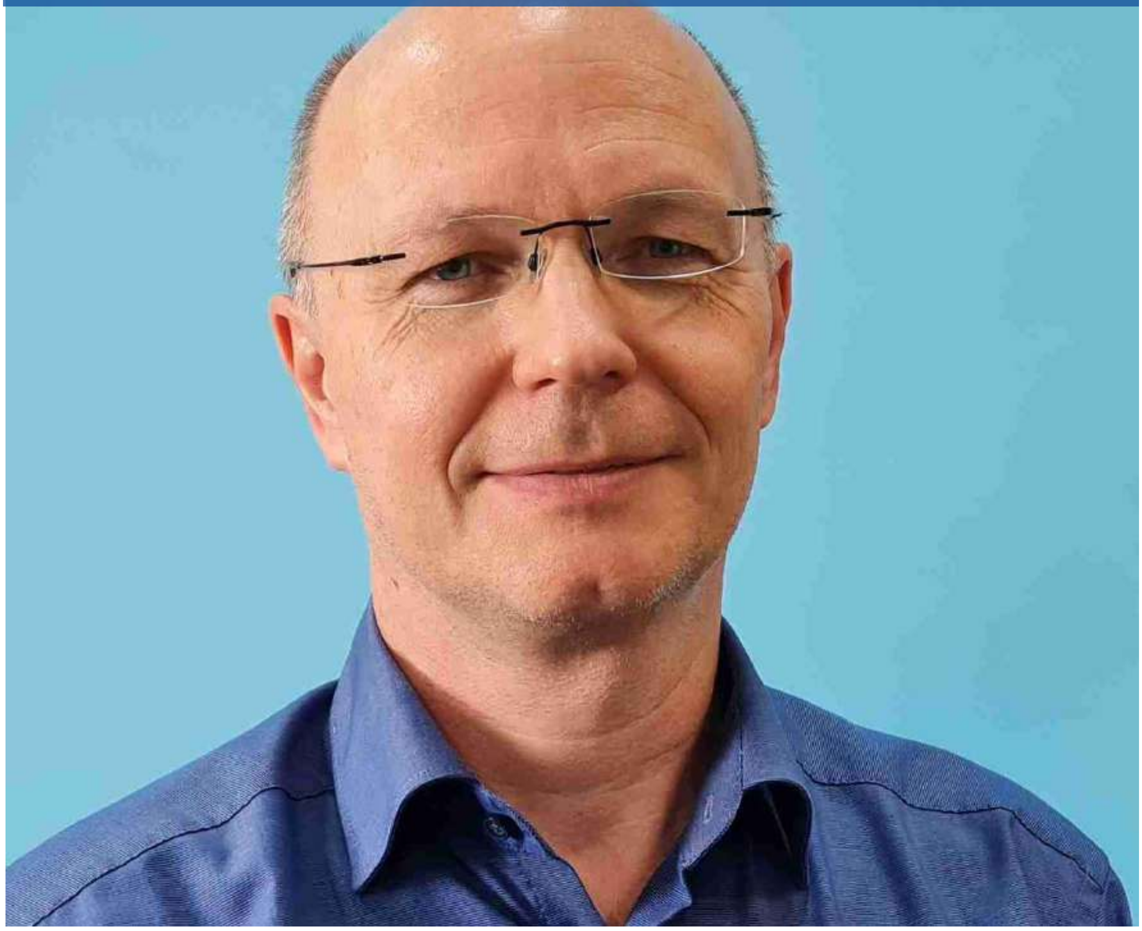
Heiko Jahn

KEMA LABS

Heiko Jahn

KEMA Labs Principal Engineer and Special Projects Coordinator

- Power transformers and compensating reactors
- Re-cycled materials
- CO2 reduction in transformers



Heiko Jahn is principal engineer and special projects at KEMA Labs FGH Engineering & Test GmbH, Mannheim (Germany). Since mid-2020, Jahn works as project coordinator for Central Europe. He has worked since 2006 at FGH Engineering & Test GmbH, initially as head of High-Voltage Test Laboratory and then as head of High-Voltage and High-Power Test Laboratory, platform manager of Mannheim Platform and principal engineer and special projects. Jahn has been a member of CIGRÉ WG A3.18 from 2003 to 2006. He previously worked at Siemens AG and has a doctor degree in engineering, Dresden Technical University, Germany.

KEMA Labs has carried out the first TOV (Transient Over Voltage) test on a 525kV DC Cable System. Can you tell us about your role in this great achievement?

I have been contacted already in 2019 to start an evaluation if testing with special waveforms could be provided by KEMA Labs. Starting with numerical simulations to find a test circuit in 2020 and down-scaled laboratory tests to prove the general feasibility in 2021, I have prepared the set-ups for the full-scale tests in 2022, and I have operated these tests on a 525 kV DC cable arrangement.

What does this test mean for the cable systems sector?

Testing with such special waveforms is not yet part of the test standard IEC 62895. But CIGRÉ Technical Brochures 852 and 853 already contain such tests. With the successful tests in the KEMA Labs in Mannheim we can give the manufacturers and the TSOs the certainty that such tests can be carried out in a regular HV laboratory with only small additional investments. Therefore, we can expect that requests for such tests will increase in the future.

This test was born from a solid collaboration between KEMA Labs and Prysmian. Do you think it will open the doors for similar projects in the future?

This collaboration has proven a solid confidence between Prysmian and KEMA Labs. We could show to Prysmian that KEMA labs is a reliable partner who supplies technical expertise and customized solutions. Vice versa Prysmian supported us with technical advice and short response time in our communication. Such a good collaboration exists also in Milano since many years and therefore, we can expect that it will be continued with new projects, also in the future.

What test parameters were fulfilled during the tests?

In fact, we have performed 2 different tests. While the first one was an oscillating discharge test, i.e. the discharge of the cable from operation voltage 525 kV to zero, the second one was a transient overvoltage test, where a transient overvoltage was superimposed to the operation voltage which reached a peak of 1.6 x 525 kV for the unipolar test and -0.6 x 525 kV for the test with opposite polarity. The frequencies for the oscillating tests were expected to be below 400 Hz (low-frequency test) and between 5700 Hz and 8000 Hz (high-frequency test). For the transient overvoltage test the main difficulty was the expected long time for the discharge, which shall exceed 100 ms. Introducing a high-voltage rectifier to the test circuit we were able to fulfill also this request and to offer a reliable solution.

Finally, what does this achievement represent for the KEMA Labs facility in Mannheim?

The KEMA labs facility in Mannheim is one of the smallest if we compare the headcount. However, this achievement proves that also in this small facility we have the power to develop technical innovation, basing on our expertise and on the experience with dielectric testing. Additionally, it confirms, that the decision of the management to install the HVDC laboratory in Mannheim, 10 years ago, was the right step.

Upcoming events

CIGRE Session 2022

29 August – 02 September 2022

Paris, France

CIGRE's renowned publications, developed through the collaborative sharing of 'real world experiences', are in many cases the authoritative source of reference information. This is the leading global event for power system expertise where to present the latest paper on electric networks.

1st Hydrogen Power System Integration Symposium

October 11, 2022

Delft, The Netherlands

International experts from energy suppliers, gas turbine manufacturers, electrolyzer and fuel cells manufacturers, automotive and industrial companies, research institutions and H2 solution providers will discuss how the transition to large scale green hydrogen application can succeed.

ISO Annual Meeting

September 19-23, 2022

Abu Dhabi, UAE

The ISO Annual Meeting is the keystone event in the ISO calendar featuring thematic sessions, networking opportunities, the ISO General Assembly and related governance meetings.

INMR WORLD CONGRESS

October 16-19, 2022

Berlin, Germany

The INMR WORLD CONGRESS is a skills-building and technical enrichment event for engineers and other professionals in the field of power transmission & distribution. It is comprised of a 3-day Conference and PRODUCT & TECHNOLOGY EXHIBITION.

KEMA Labs is the CESI Testing, Inspection and Certification Division

Through its Division KEMA Labs, CESI is the world leader for the independent Testing, Inspection and Certification activities in the electricity industry. With a legacy of more than 60 years of experience, CESI operates in 70 countries around the world and supports its global clients in meeting the energy transition challenges. CESI also provides civil and environmental engineering services.

The company's key global clients include major utilities, Transmission System Operators (TSOs), Distribution System Operators (DSOs), power generation companies (GenCos), system integrators, financial investors, and global electromechanical and electronic manufacturers, as well as governments and regulatory authorities.

CESI is a fully independent joint-stock company headquartered in Milan and with facilities in Arnhem (NL), Berlin (DE), Prague (CZ), Mannheim (DE), Dubai (AE), Rio de Janeiro (BR), Santiago de Chile (CL), Knoxville (US) and Chalfont (US).

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