

# “HVDC cable testing – new requirements and challenges for test laboratories”

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# Differences between tests on HVDC cables and cable systems

Routine Tests	Standard	Production Quality Assessment	Manufacturer
Type Tests	Standard	System Quality Assessment	Test Laboratory
Pre-Qualification Tests	Standard	System Lifetime Assessment	Test Laboratory
Client's Requirements	Non-Standard	Grid Compatibility Assessment	Test Laboratory
Commissioning Tests	Non-Standard	Assembling Quality Assessment	Supplier On-Site

# Possibilities in KEMA Laboratories

## Facilities

- Test Laboratory in Mannheim/Germany provides 3 bays for either PQ or type tests up to 525 kV and another bay for type tests only
- Test Laboratory in Milano/Italy provides 2 test bays for type tests

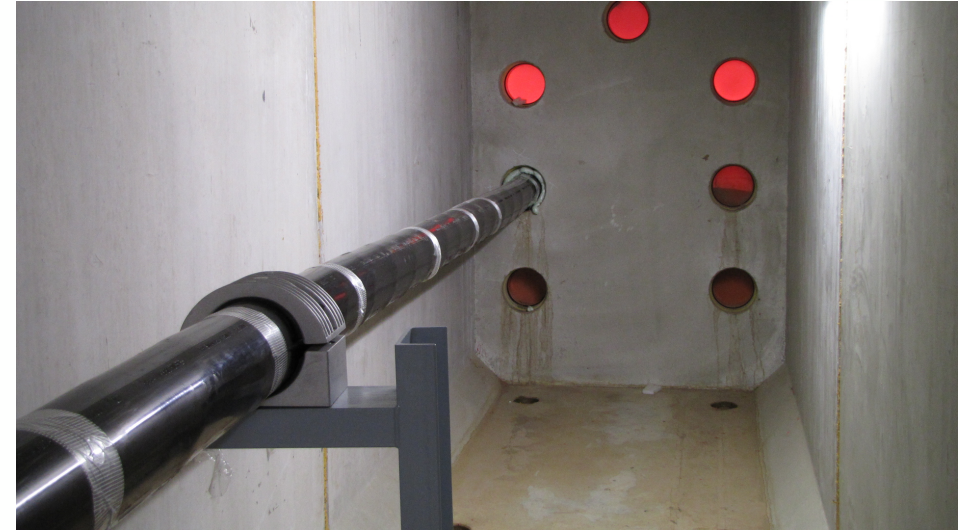




# Possibilities in KEMA Laboratories

## Pre-Qualification Tests

- Simulation of typical laying conditions
- Cable loops up to 240 meters at system voltage of 525 kV were already tested
- Distributed Temperature Sensing (DTS) can be supplied using cables optical fibers or by applying external fibers to the cable surface.





# Possibilities in KEMA Laboratories

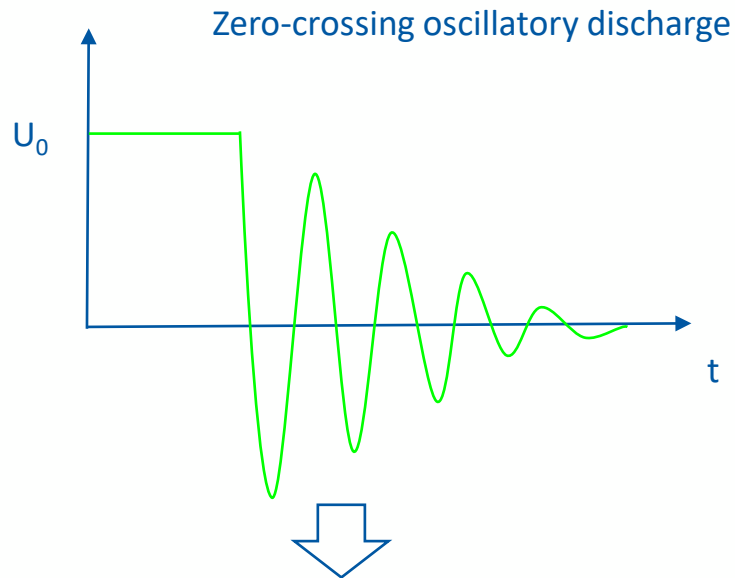
## Type Tests

- Proving of system components quality on loops containing all components with a typical loop length of 50 meters
- System voltages up to 525 kV were already tested
- DTS measurement can be supplied

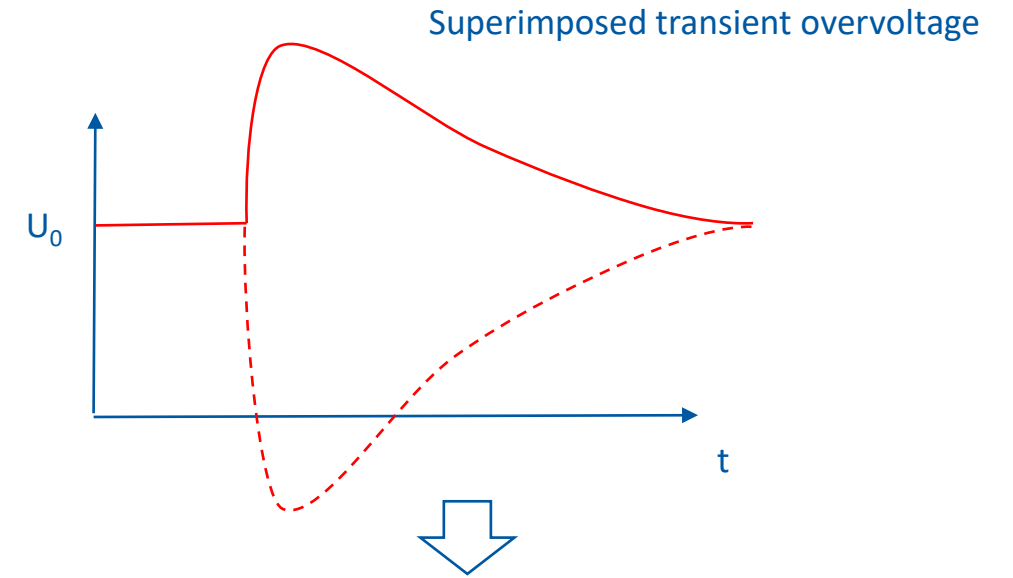


## Client's Requirements

- Test to prove functionality of components when stressed with system-specific waveshapes resulting from grid simulation
- Typically carried out on a type test length
- Test requirements will be submitted either by the manufacturer or by the end user (TSO)



Discharge of a capacitor through an inductor with damping



Similar to a superimposed impulse voltage test according to IEC 62895/IEC 60230 but with different time parameters



## Client's Requirements

- Solutions for both requirements were developed, tested and available now
- Expertise of the laboratory provides flexibility to adopt to client's requirements and expectations
- Full-scale test on a 525 kV HVDC cable system is planned to be performed at the end of this year
- The space consumption exceeds the efforts for superimposed impulse testing only slightly

Zero-crossing oscillatory discharge



Superimposed transient overvoltage



# Summary

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- KEMA Labs provides facilities for type tests, pre-qualification tests and test according to client's requirements for HVDC cables up to system voltages of 525 kV
- Test set-ups for testing transient overvoltage stresses in HVDC cable systems were developed and already pre-tested. The circuits are intended to be applied to type test loop lengths.
- It has been found that some components have to be used that maybe are not available in all dielectric laboratories. However, the used components are available on the market.
- The required space in the laboratory is mainly the same as for the superimposed impulse voltage test according to IEC 60230. But of course, this depends on the availability of components in every single laboratory.
- At the end of the year 2021 a full-scale test on a type test cable length with  $U_0 = 525$  kV is intended to be carried out to confirm the feasibility of this kind of tests in a dielectric test laboratory.





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