



## Study Committee A3 “HV Equipment“

**Theory, design, construction and application of HV equipment components, equipment and equipment systems for both AC and DC systems**

**(devices for switching, interrupting and limiting currents, surge arresters, capacitors, busbars and equipment insulators, instrument transformers, bushings, ...)**

# SCA3 recent meetings

- **9<sup>th</sup> SC A3 meeting on 9<sup>th</sup> September 2011 in Vienna together with HV Equipment tutorial and colloquium (7<sup>th</sup> ad 8<sup>th</sup> September)**
- **10<sup>th</sup> SC A3 meeting on 31<sup>st</sup> August 2012 in Paris**

# WGs for disbanding

- ❖ **WG A3.15 „Non Conventional Instrument Transformers“ (P.Tantin, F) - TB to be published in 12/2012 - followed by new WG A3.31**
- ❖ **WG A3.17 „Surge Arresters“ (B. Richter, CH) - Part 1 - TB to be published in 2012 - followed by new WG A3.25 (Part 2)**
- ❖ **WG A3.06 “Reliability of HV Equipment” – 6 brochures ready for publishing (C. Solver, SE, M. Runde, N) - TB published in October 2012**
- ❖ **WG A3.23 “Guidelines and selection of FCL” (Schmitt, De) - TB 497**

# Running WGs

➤ **AG A3.01 “Strategic Planning”** (M. Waldron, UK)

➤ **AG A3.04 „Tutorials“** (D.Peelo, Ca)

❖ **A3.24 “Tools for Simulating Internal Arc and Current Withstand Testing”** (N. Uzelac, US)

Detailed analysis of topics identified by WGA3.20 as good candidates for using simulations and calculations in addition to or as a replacement of laboratory testing : internal arc testing of SF6 filled equipment and temperature rise type testing.

❖ **A3.25 “MO varistors and surge arresters for emerging system conditions”** (B. Richter, CH)

UHV (1000 kV and above) SA ratings and testing, field strength consequences, axial temperature distribution & testing (single vs multiple impulses, combined stresses, durability). – Part 2 (Part 1 published within WG A3.17)

# Running WGs

- ❖ **A3.26 “Influence of shunt capacitor banks on circuit breaker fault interruption duties”** (A. Bosma, SE)  
Influence of shunt capacitor banks on line CB TRVs, on fault interrupting time and outrush currents, CB designs considerations, precautions to avoid unnecessary stresses, standardization.
- ❖ **A3.27 “The impact of the application of vacuum switchgear at transmission voltages”** (R.Smeets, NL)  
Inventory of installations (4000 VCB 72,5 to 170 kV, 245 kV under development), technical issues (e.g. fast interruption, low energy drives, switching transients, capacitive switching, late restrikes), standardization, testing.

# Running WGs

- ❖ **A3.28 “Switching phenomena and testing requirements for UHV & EHV equipment”** (H. Ito, JP)  
Field experience and switching behaviour during and after commission, benchmark study of interrupting requirements of circuit breakers based on UHV/EHV networks model, benchmark study of switching requirements on disconnectors and earthing switches based on UHV/EHV substations model.
- ❖ **A3.29 “Deterioration and Ageing of HV Substation Equipment”** (A. Maheshwari, Australia) Material and equipment deterioration/degradation (mechanism, forensic analysis, risk to major failure, condition assessment, maintenance & service impact), Lifetime management (residual incl.), Life extension (re-testing, impact on further maintenance), Life management for new equipment (testing and maintenance incl.)

# Running WGs

- **A3.30 “Managing overstressing of substation equipment”** (A. Carvalho, BR) Evaluation of stresses in service vs equipment capabilities (parameters and performance limits), failure modes, risk assessment, standardization (endurance testing incl.), interaction with age and condition information impact on residual life
- **A3.31 “Accuracy, Calibration & Interfacing of Instrument Transformers with Digital Outputs”**  
(F. Rahmatian, CN) – Practical application of NCIT and EIT in the respect of their (and their measuring chain) accuracy, on-site calibration and interfacing

# New working items under discussion

## New TORs for discussion:

- ➡ **Experience with and Reliability of Surge Arresters**
- ➡ **Protection of Capacitor Banks against Overvoltages**
- ➡ **High Voltage Equipment Containing Field Grading Measures**

## Other topics:

- ✓ **Follow up of WG A3.06** (standardized reporting system, influence of AM practices on reliability, mitigation of predominant failure modes, ageing and diagnostics of secondary equipment, stresses during interruption of capacitive and inductive currents)
- ✓ Modeling of TRV for transformer limited faults
- ✓ Non-intrusive methods for condition assessment of HV and MV CB and fault interrupters
- ✓ Origin of requirements for disconnectors and earthing switches
- ✓ Two phase systems
- ✓ Questions to DC applications
- ✓ Application and benchmark of multi-physics simulations



# Publications since 2011

- ✓ **WG A3.21 : Brochure 455 „Aspects for the Application of Composite Insulators to HV apparatus”, Summary paper ELECTRA 255, April 2011**
- ✓ **WG A3.22 : Brochure 456 “Background of technical specifications for Substation Equipment Exceeding 800 kV AC”, Summary paper ELECTRA 255, April 2011**
- ✓ **WG A3.23 : Brochure 497 “Application and Feasibility of Fault Current Limiters in Power Systems”, Summary paper ELECTRA 262, June 2012**

# Publications submitted for publishing (circulated for SCA3 commenting)

## WG A3.06 “Final Report of the 2004 - 2007 international enquiry on reliability of high voltage equipment -

- ✓ TB 509 - Part 1 - Summary and General Matters”
- ✓ TB 510 - Part 2 - SF6 Circuit Breakers”
- ✓ TB 511 - Part 3 - Disconnectors and Earthing Switches”
- ✓ TB 512 - Part 4 - Instrument Transformers”
- ✓ TB 513 - Part 5 - Gas Insulated Switchgear”
- ✓ TB 514 - Part 6 - GIS practices“

Main results already published during tutorial held together with SC A3 meeting and colloquium in Vienna in September 2011



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# Publications submitted for publishing (circulated for SCA3 commenting)

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- ✓ Brochure WG A3.17 “MO Surge Arresters – Part 1 – Stresses and Test Procedures”
- ✓ Brochure WGA3.15 “Non-conventional Instrument Transformers” (summary to be completed)

# Other relevant HV Equipment AM publications

- **SC C1 : “Overview of Cigre Publications on Asset Management Topics” ELECTRA 262, June 2012**
- **WG D1.33 : “High- Voltage On-site Testing with Partial Discharge measurement” **TB 502****  
ELECTRA 262, June 2012

# SCA3 Paris Session 2012 – Preferential Subjects

- ✓ **PS1 : Equipment design to facilitate network developments** (HVDC equipment design and testing, UHV, intelligence within equipment, impact of changes in AC network operation)
- ✓ **PS2 : Reliability and Lifetime of HV equipment** (reliability experience, prediction of end of life due to age and potential overstressing, condition monitoring and assessment)
- ✓ **PS3 : Environmental suitability of HV equipment** (design to minimize environmental impact, design for extreme ambient conditions, design for offshore/marine environments)



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# SCA3 Paris Session 2014

## — Preferential Subjects for Considerations

- ✓ **PS1 : Developments of HVAC and HVDC equipment to cater for changing network conditions such as rapid penetration of renewable energy, supergrid (UHV) and microgrid**
- ✓ **PS2 : Lifetime management of overstressing and increased ageing HV and MV equipment**
- ✓ **PS3 : Impact of extreme operating conditions on HV and MV equipment** (temperature, humidity, earthquake, wind, heavy rain, geo-magnetic storms, load current, short circuit current, TOV, TRV, frequent operation, etc)
- ✓ **PS 4 : Emerging design, modeling, testing and simulations techniques applicable for HV and MV equipment**

# SCA3 future meetings

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- **SC A3 meeting in 2013 in Auckland, New Zealand, 14.-20.9.2013 together with parallel A3, B1, B2, B2+C6, A2+A3, B3 symposiums**

**Thank you for your attention**