Presented by Wayne Pepper - Convener

Brisbane – 21/11/2019

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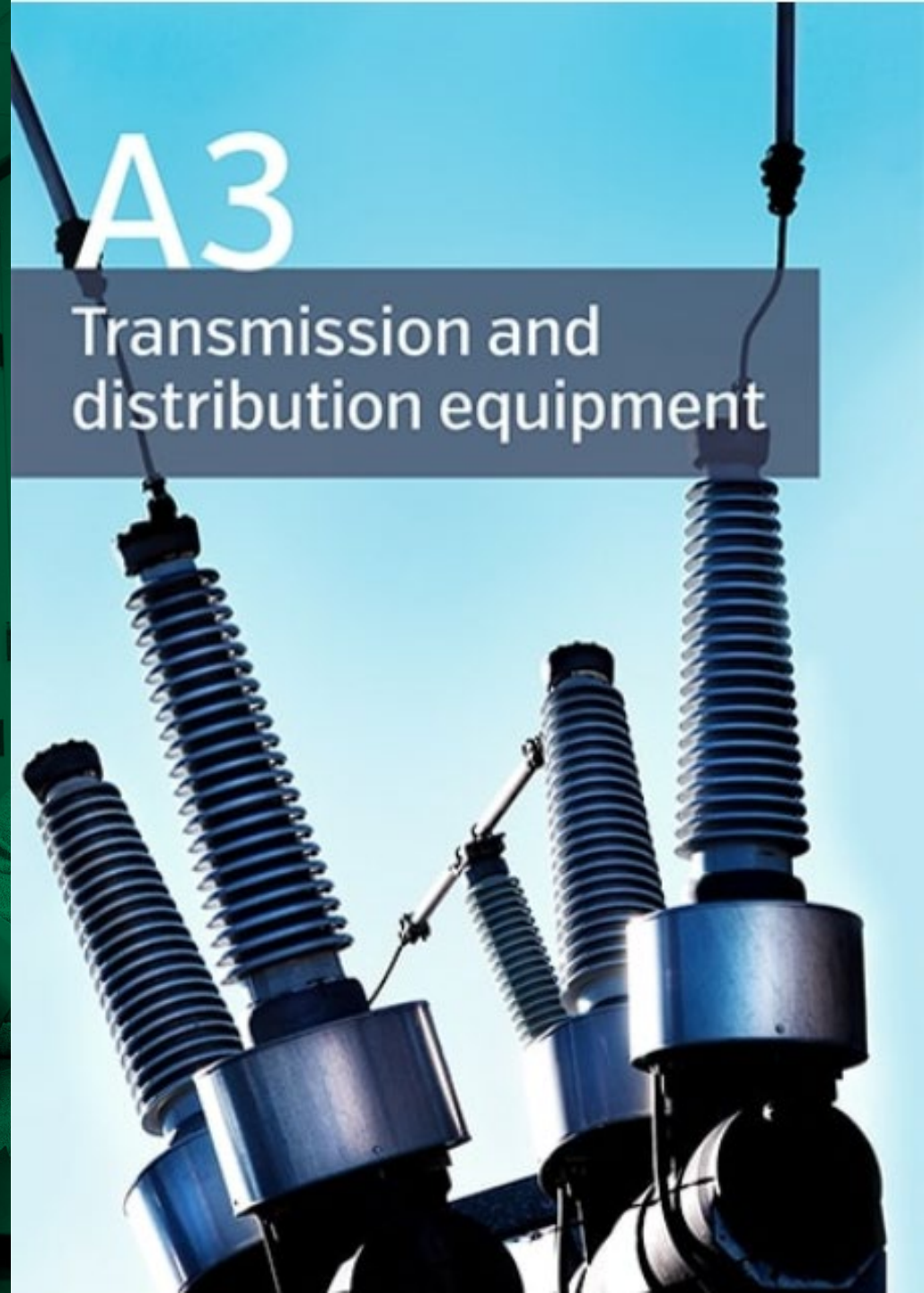
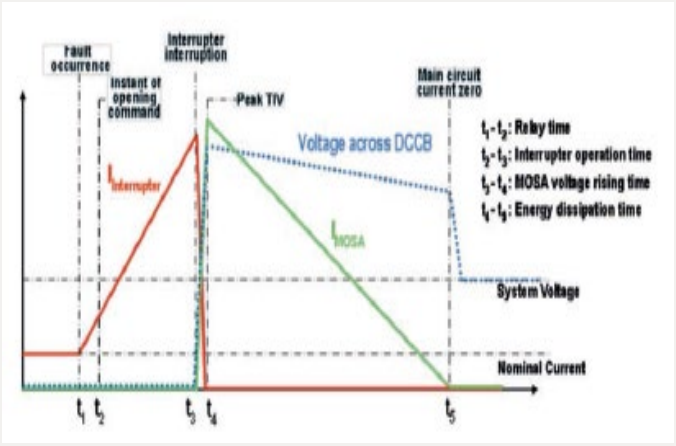


SC A3 Overview

Scope

- Responsible for theory, design, construction and application of equipment components, equipment, and equipment systems applied to both AC and DC systems from distribution up to highest transmission voltage levels.
- Equipment covered includes:-
  - Switching equipment (CB's, disconnectors, earthing switches, distribution equipment)
  - Fault current limiters
  - Surge arresters,
  - Capacitors (series & shunt)
  - Busbars
  - Bushings
  - Insulators
  - Instrument transformers (CT's, VT's, CVT's, NC-IT's etc)



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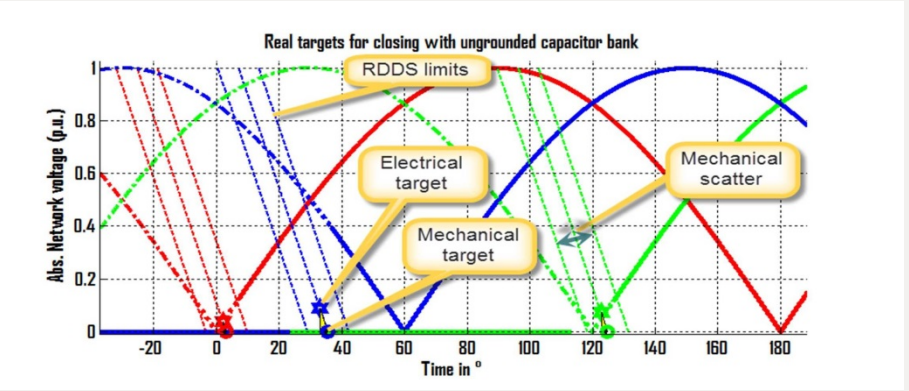
SC A3 Overview

Areas of Interest

- Innovative technologies (e.g UHV equipment and DC Circuit Breakers)
- Requirements for equipment in changing network conditions
- Incorporation of intelligence in HV equipment (e.g Controlled Switching)
- Monitoring and diagnostics of transmission and distribution equipment
- New and improved testing techniques
- Reliability assessment, end-of-life assessment of ageing equipment
- Mitigation methods for overstressing and overloads



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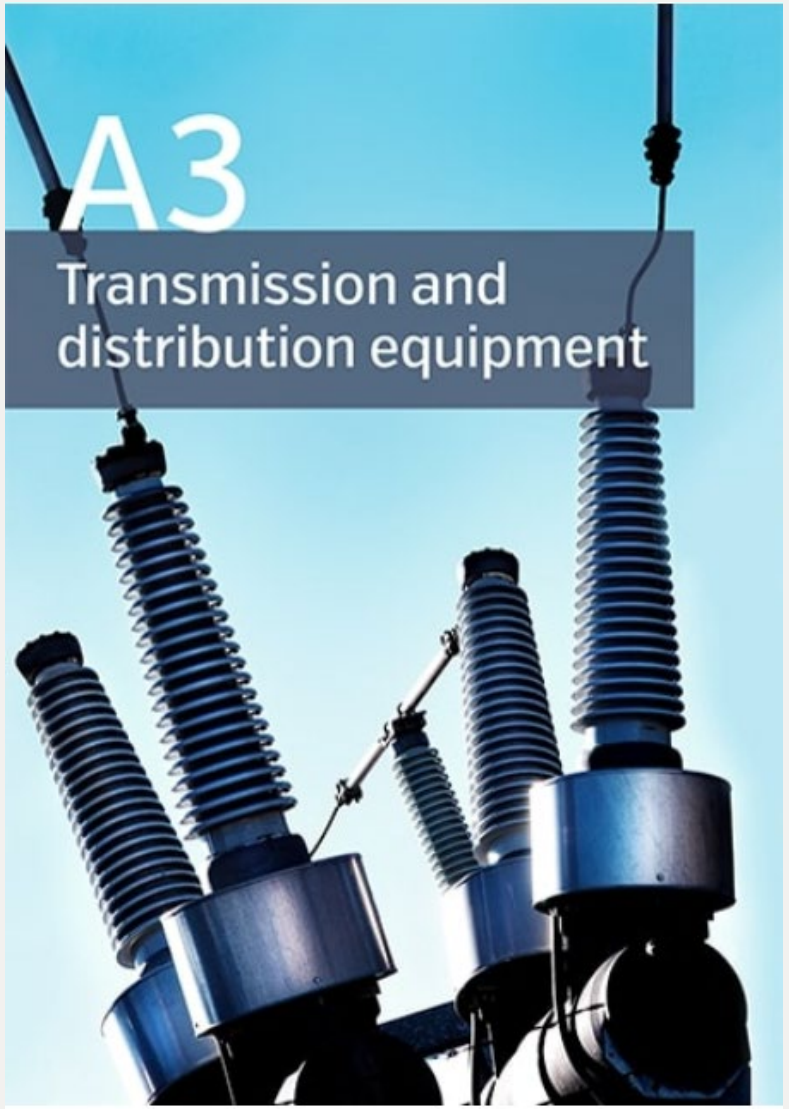
2019 International Activities

SC A3

- In September 2019, A3 SC meeting was in Bucharest, Romania, with Condition Monitoring, Diagnosis and Maintenance (CMDM) conference. The CMDM conference is a biennial conference organised by CIGRE Romania.
- 3 days of technical papers and 6 Tutorials from 3 SC's.
- 2 WG's completed their activities, with 3 new WG's commencing in 2019. Currently 8 WG's active.
- Proposal for a Utility Advisory board to commence with members from utilities to meet twice yearly. Aim is to meet needs of Utilities with proposals for new WG's and Preferential subjects.



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2019 Deliverables

Technical Brochures

- TB 757 – Guideline and best practices for the commissioning and operation of controlled switching projects.

Green Book

- A3 Green Book – “Switching Equipment” published in August 2018 – 489 copies sold @ Sept – 2019.
  - A3 AU contribution to chapter on “Lifetime Management of Equipment”
- 2nd edition being planned with additional content
- Contributing to a chapter in future C1 Green Book on “Asset Management”

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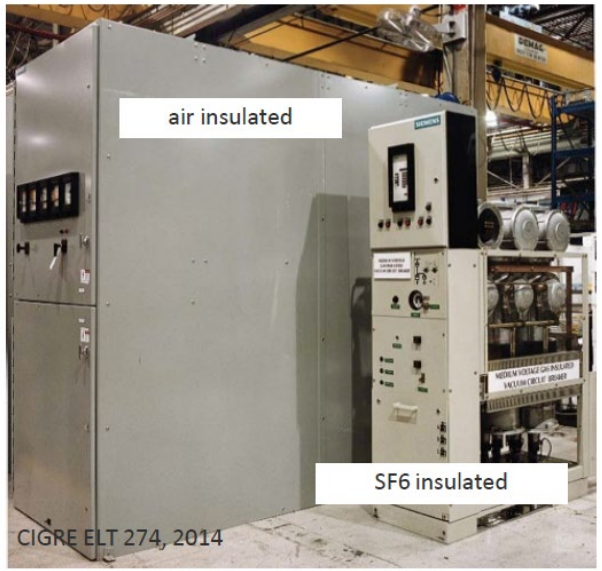
Big Issue - SF6

- Greenhouse gas GWP SF6 1kg = 22,500kg CO2
- Legislation to phase out SF6 use in Europe and many other countries.
- Several companies developing SF6 alternatives. No direct replacement for SF6. Change to CB designs required to use alternative gases and operate at higher pressures.
- Trials of equipment with SF6 alternatives occurring around world in a variety of equipment have been occurring since 2012.
- No penalties in Australia for SF6 equipment leaks.
- Leak repair cost ~$25,000.

Paris 2018

- 5 papers in A3
  - WG A3.41 Impact on switching with alternative gases
- 3 papers in B3
  - WG B3.45 Application in GIS
- 3 papers in D1
  - WG D1.67 Dielectric Performance



36 kV switchgear panel

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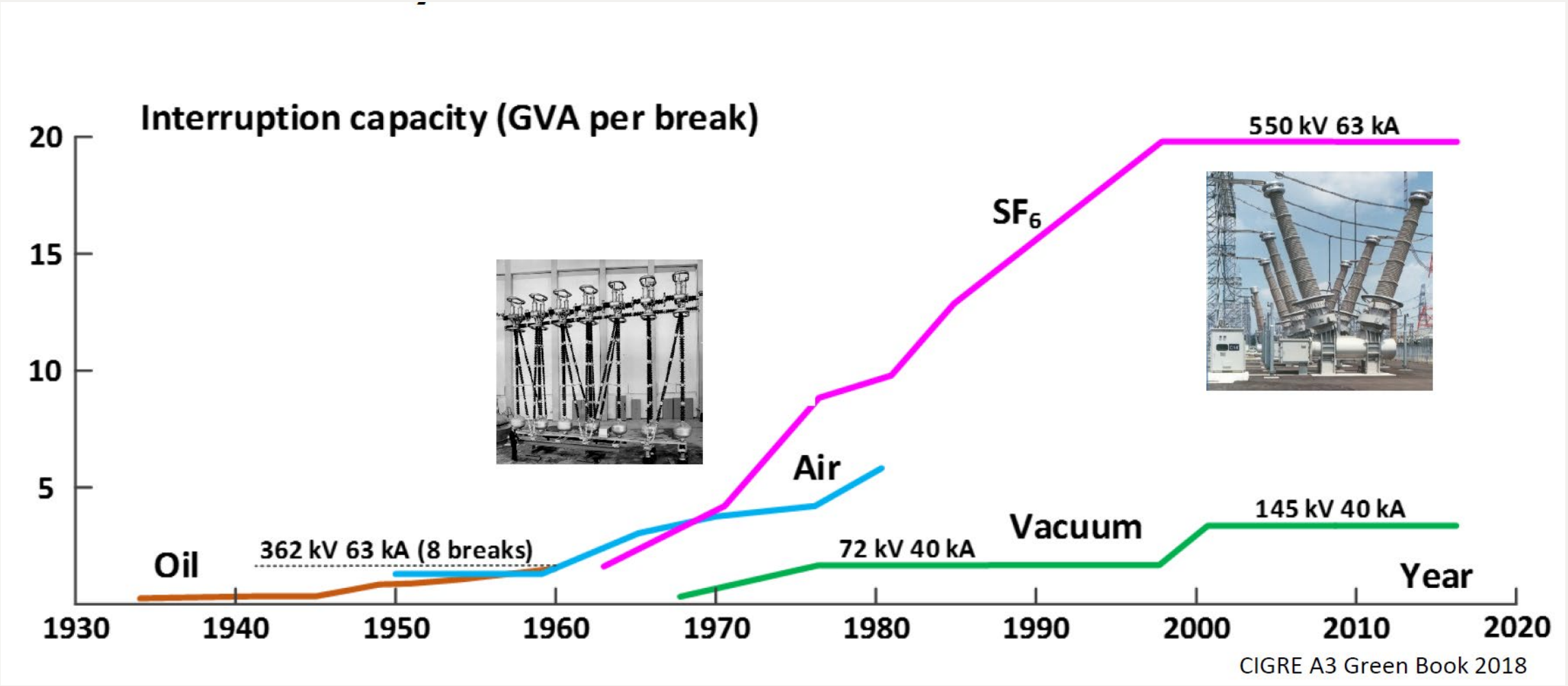
Circuit Breaker SF6 Success story

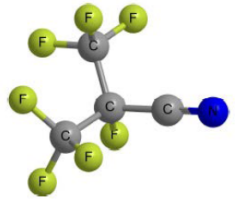


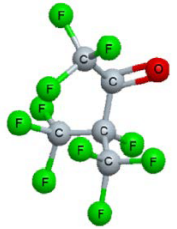
SF6 alternatives @ CIGRE 2018

Pure gas	GWP	P_{min} (MPa)	T_{min} (deg)
SF_6	23500	0.43 .. 0.6	-41 .. -31
CO_2	1	0.6 .. 1	-48
Vacuum (Clean Air™)	0	<<	-60

g³™ (fluoronitrile)	GWP	P_{min} (MPa)	T_{min} (deg)
HV: CO_2+O_2? + 4-6% C4-PFN	327 .. 690	0.67 .. 0.8	-25 .. -10
MV: N_2 + 20-40% C4-PFN	1300 .. 1800	0.13	-25 .. - 20

AirPlus™ (fluoroketone)	GWP	P_{min} (MPa)	T_{min} (deg)
HV: CO_2+ O_2 + 6-12% C5-PFK	1	0.7	-5 .. +5
MV: Air + 7-13% C5-PFK	0.6	0.13	-25 .. -15





Recent developments and interruption performance with SF6 alternative gases, Electra 291, 2017

2019 AU/NZ Activities

2019 AP-A3 Meeting in Perth in October

- 6 attendees
- Discussion points:-
  - Local and International CIGRE matters since last meeting – 2019 SC A3 matters, WG activities and surveys
  - Utility reports – New equipment, ageing equipment risk assessments, equipment failure presentations, procurement issues, SF_6 management and equipment leak issues
  - Asset management topics including Lifecycle cost evaluations; Application of RCM and FMEA for substation equipment; Risk based asset management of substation equipment
- AU A3 providing information to A3 WG surveys on 2014-17 equipment reliability survey & Lifecycle management of T&D switchgear.
- AU A3 member on new WG on Instrument Transformer Failure analysis
- 2 x AU A3 members on WG for Lifecycle management of T&D switchgear

Thank You
Any Questions?

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Ausgrid (NSW)

21 November 2019

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