



# **SC D1: MATERIALS AND EMERGING TEST TECHNIQUES**

## **Last meetings:**

SC D1 Paris, August 30, 2018

SC A3/B4/D1 Colloquium 2017 in Winnipeg (CA), Oct. 1-6, 2017

## **SC D1 Officer:**

R. Pietsch (DE), Chair SC D1

J. Seiler (DE), Secretary SC D1

## **CIGRE D1 Italian Representative:**

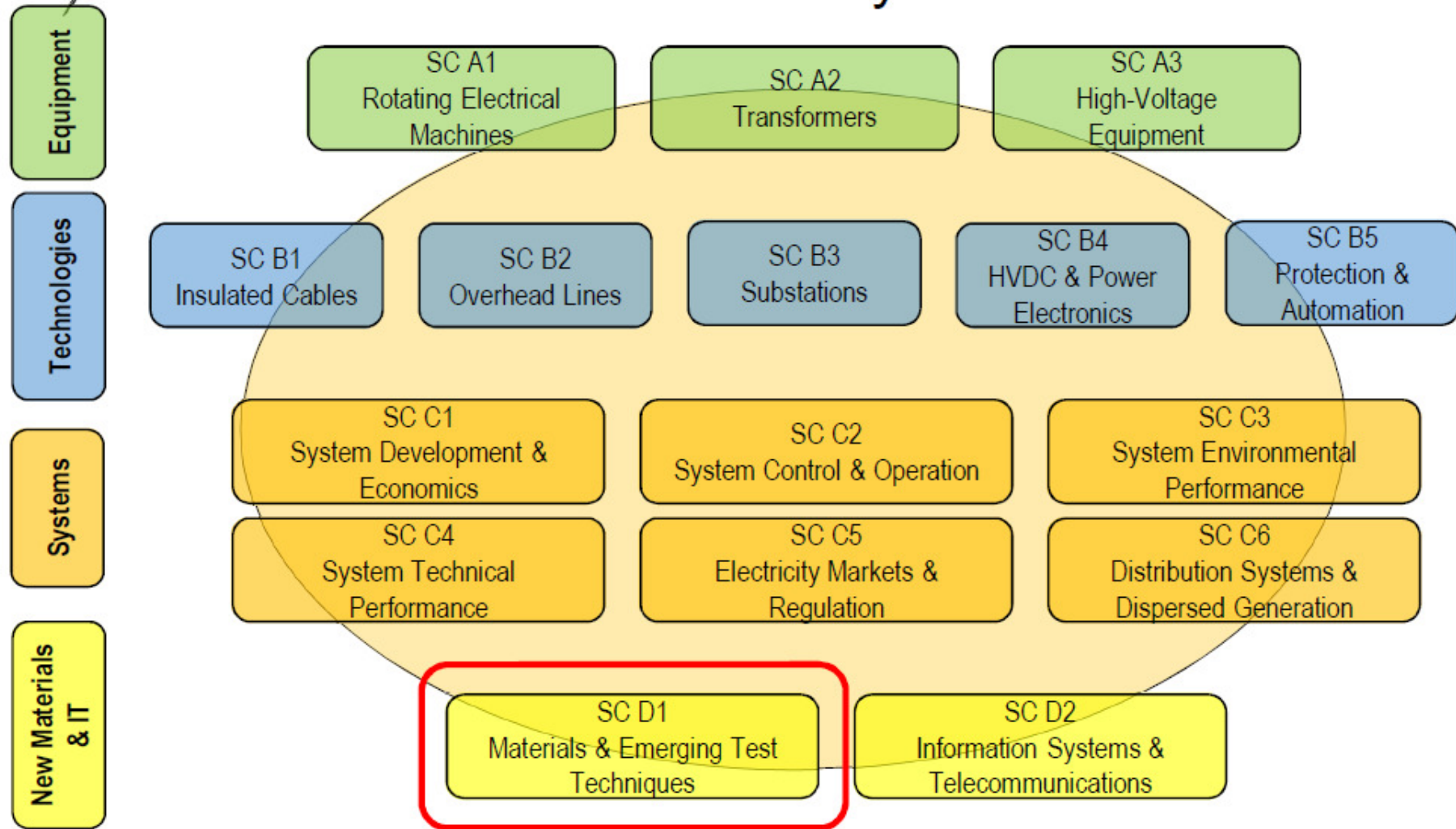
Massimo Pompili, University of Roma "La Sapienza", Chair

Luigi Calcara, University of Roma "La Sapienza", Secretary



# Study Committee D1 – Organisation

## CIGRE Study Committees



CIGRE SC D1 Meeting, Paris (FR), August 30, 2018



## Study Committee D1 – Organisation Members and Working Bodies

**Status Paris 2018**

- 23 Regular Members
- 4 additional Regular Members
- 10 Observer Members
- 5 Advisory Groups (SCAG, TAG and 3 Area AGs)
- 25 Working Groups  
(incl. 1 JWG D1/A2, 1 JWG D1/B1, 1 JWG D1/B3  
+ 2 JWG A2/D1)
- 39 Countries represented
- 443 Experts



# Study Committee D1 – Organisation Membership 2018-2020

## Regular Members (27)

Status Paris 2018

W. Koltunowicz	AT	M.A. Sanchez	ES	B.-W. Lee	KR
J. Tusek	AU	S. Sutton	GB	R. Ross	NL
A. de Castro	BR	P. Agren	FI	B. Larzelere	US
D. Oliver	CA	T. Berteloot	FR	F. Mauseth	NO
C. Franck	CH	J. Sundar	IN	A. M. Peixoto	PT
X. Liang	CN	R. Swinny	ZA	F. Sahlén	SE
K. Juhre	DE	M. Pompili	IT	L. van der Zel	US
J. Castellon	FR	T. Takahashi	JP	N. Mahatho	ZA
A. Aliabadi	IR	Y. Zhang	CN	A. Slavinsky	RU

## Observer Members (10)

L. Catalano	AR	A. Anagnostou	GR	L. P. Gutierrez	AN
R. Simal	BE	M. Florkowski	PL	R. Gatechompol	TH
J. Lachman	CZ	M.-G. Plopeanu	RO	F. Erenler	TR
A. Shkolnik	IL				

# Technical Direction

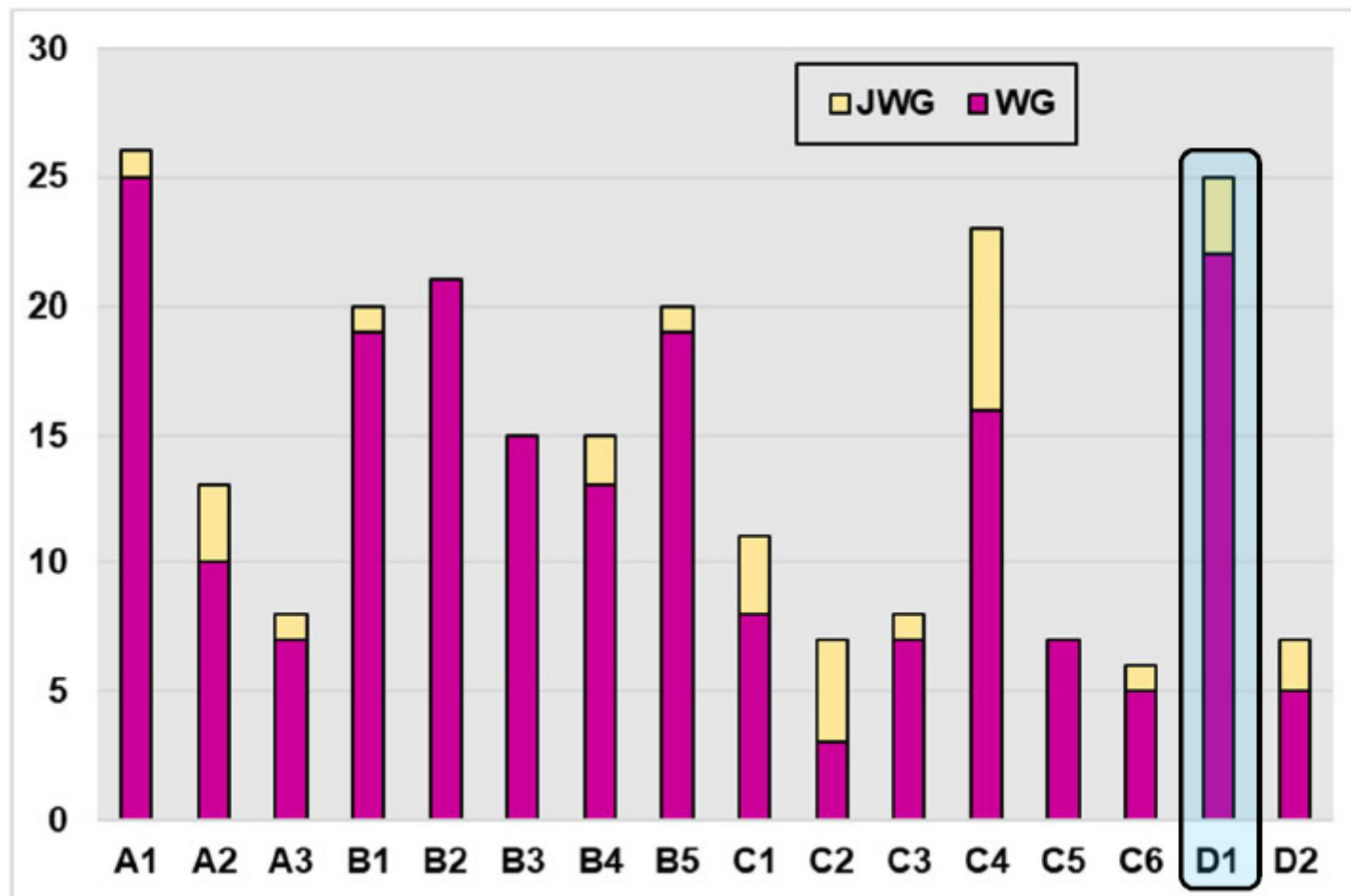
- Technical Direction 1: Materials for electrotechnology and Electrical Insulation Systems (12 WGs)
- Technical Direction 2: New and emerging test techniques (6 WGs)
- Technical Direction 3: Diagnostic tools and related knowledge rules (7 WGs)



## *Distribution of WGs on Study Committees*

SCs	WG	JWG	Total
All	202	30	232

JWG : 13% last year 14%





# **cigré** *Synthesis of the 2017 review*

SC	Nb WG	Nb countries	Nb Positions	Nb Experts		Pos/expert	Ladies/ experts
				Nb experts	of which Nb Ladies		
A1	28	40	408	301	4	1.36	1%
A2	15	44	435	367	37	1.19	10%
A3	9	29	189	181	12	1.04	7%
B1	30	34	432	347	34	1.24	10%
B2	18	44	576	385	23	1.50	6%
B3	17	45	444	353	26	1.26	7%
B4	17	32	460	386	38	1.19	10%
B5	23	36	423	366	18	1.16	5%
C1	11	36	218	196	28	1.11	14%
C2	7	33	151	143	16	1.06	11%
C3	8	30	149	106	33	1.41	31%
C4	32	54	697	587	42	1.19	7%
C5	8	32	125	106	17	1.18	16%
C6	9	34	201	175	16	1.15	9%
D1	25	39	626	443	38	1.41	9%
D2	11	39	260	227	18	1.15	8%
All SC	240	72	5470	3986	336	1.37	8%



# Synthesis of the 2017 review

	All SC	WG		
	Country	Exper	Positic	Pos/E
1	US	337	481	1.43
2	DE	298	396	1.33
3	CA	230	349	1.52
4	UK	224	308	1.38
5	CN	217	264	1.22
6	JP	213	291	1.37
7	FR	203	252	1.24
8	BR	176	242	1.38
9	AU	140	187	1.34
10	ZA	137	198	1.45
11	ES	135	158	1.17
12	IT	128	169	1.32
13	SE	126	160	1.27
14	CH	112	159	1.42
15	NL	98	119	1.21

**2016**



	All SC	WG		
	Country	Exper	Positic	Pos/E
1	US	348	513	1.47
2	DE	323	450	1.39
3	CA	260	401	1.54
4	CN	246	302	1.23
5	GB	233	324	1.39
6	FR	220	296	1.35
7	JP	210	304	1.45
8	BR	189	274	1.45
9	ZA	151	217	1.44
10	AU	139	199	1.43
11	SE	130	168	1.29
12	ES	130	158	1.22
13	IT	124	173	1.40
14	CH	118	166	1.41
15	NL	108	137	1.27

**2017**





## Study Committee D1 – Publications Technical Brochures in **2016**

- TB 646 HVDC Transformer insulation: oil conductivity (JWG A2/D1.41), January 2016
- TB 654 UHF partial discharge detection system for GIS: Application guide for sensitivity verification (WG D1.25), April 2016
- TB 661 Functional nanomaterials for electric power (WG D1.40), August 2016
- TB 662 Guidelines for partial discharge detection using conventional (IEC 60270) and unconventional methods, (WG D1.37), August 2016



## Study Committee D1 – Publications Technical Brochures in **2017**

- TB 676 Partial discharges in transformers  
(WG D1.29), February 2017
- TB 691 Pollution test of naturally and artificially  
contaminated insulators  
(WG D1.44), July 2017
- TB 703 Insulation degradation under fast, repetitive voltage  
pulses, (WG D1.43), September 2017
- TB 705 Guidelines for altitude correction of pollution  
performance of insulators  
(WG D1.44), November 2017



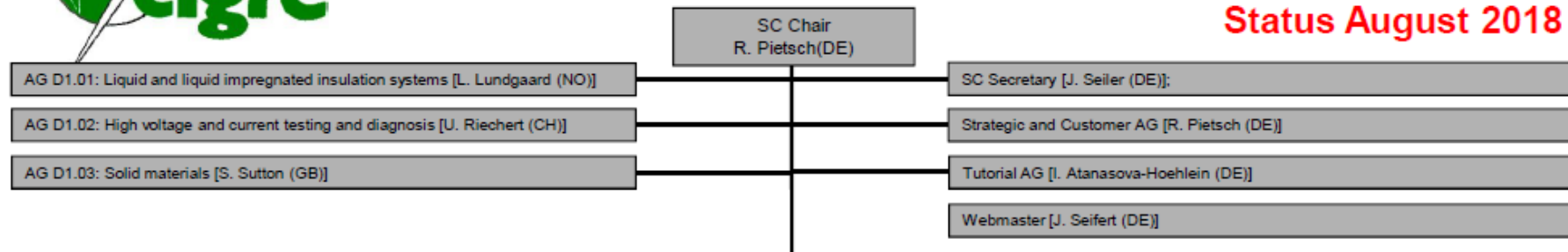
## Study Committee D1 – Publications Technical Brochures in **2017/2018**

- TB 706 Guidelines for the use of statistics and statistical tools on life data  
(WG D1.39), November 2017
- TB 730 Dry air, N<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub>/SF<sub>6</sub> mixtures for gas-insulated systems  
(WG D1.51), **June 2018**
- TB 738 Ageing of liquid impregnated cellulose for power transformers (D1.53), **August 2018**
- TB 741 Moisture measurement and assessment in transformer insulation – evaluation of chemical methods and moisture capacitive sensors (D1.52 ),  
**August 2018**



# Study Committee D1 – Organisation

Status August 2018



Liquid & impregnated systems	Testing & Diagnosis	Gases	Solids	Solids
JWGD1/A2.47 [Duval (CA)/2011-08] New frontiers of DGA interpretation for power transformers and their accessories	WG D1.50 [J. Rickmann (US)/2012-04] Atmospheric and altitude correction factors for air gaps and clean insulators	JWGD1/B3.57 [C. Neumann (DE)/2013-12] Dielectric Testing of Gas-insulated HVDC Systems	JWGD1/B1.49 [M. Jarvid (SE)/2012-04] Harmonized test for the measurement of residual inflammable gases in insulating materials by gas chromat.	WG D1.62 [B. Komanschek (DE)/2014-10] Surface degradation of polymeric insulating materials for outdoor applications
WG D1.65 [Schmidt (DE)/2015-12] Mechanical properties of insulating materials and insulated conductors for oil insulated power transformers	WG D1.54 [B. Dardel (CH)/2013-01] Principles and methods to measure the AC and DC resistance of conductors of cables and overhead lines	WG D1.66 [W. Koltunowicz (AT)/2016-08] Requirements for PDM systems for gas insulated system	WG D1.56 [Hinrichsen (DE)/2013-03] Field grading in electrical insulation systems	WG D1.64 [Hayakawa (JP)/2015-12] Electrical insulation systems at cryogenic temperatures
JWGA2/D1.46 [Mertens (BE)/11-08] Field experience with transformer solid insulating ageing markers	WG D1.60 [Y. Li (AU)/2014-09] Traceable measurement techniques for very fast transients	WG D1.67 [C. Franck (CH)/2016-08] Dielectric performance of non-SF6 gases and gas mixtures for gas-insulated systems	WG D1.58 [Kornhuber (DE)/2014-01] Evaluation of dynamic hydrophobicity of polymeric insulating materials under AC and DC voltage stress	WG D1.71 [J. Tusek (AU)/2017-08] Understanding and mitigation of corrosion
JWGA2/D1.51 [Coenen (DE)/14-02] Improvement to PD Measurements for Factory and Site Acceptance Tests of Power Transformers	WG D1.61 [N. Mahatho (ZA)/2014-09] Optical corona detection and measurement		WG D1.59 [J. Seifert (DE)/2014-01] Methods for dielectric characterisation of polymeric insulating materials for outdoor applications	WG D1.73 [Frechette (CA)/2017-12] Nanostructured dielectrics: Multifunctionality at the service of the electric power industry
WG D1.68 [M. Pompili (IT)/2017-01] Natural and synthetic esters - Evaluation of the performance under fire and the impact on environment	WG D1.63 [R. Plath (DE)/2015-04] Partial discharge detection under DC stress			
WG D1.70 [I. Hoehlein (DE)/2016-11] Functional properties of modern insulating liquids for transformers and similar electrical equipment	WG D1.69 [R. Taylor (AU)/2017-02] Guidelines for test techniques of High Temperature Superconducting (HTS) systems			
	WG D1.72 [Lambrecht (DE)/2018-04] Test of material resistance against surface arcing under DC			

WG under D1 resp.
JWG under D1 resp
JWG not under D1

# SCOPE OF THE CIGRE WG D1.68



CIGRE Study Committee D1

## PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP (1)

WG* N° D1.68	Name of Convenor Massimo POMPILI (ITALY) E-mail address: massimo.pompili@uniroma1.it	
Technical Issues # (2) : 2	Strategic Directions # (3) : 2 / 3	
The WG applies to distribution networks (4): Yes		
Title of the Group: Natural and synthetic esters - Evaluation of the performance under fire and the impact on environment		
<p><b>Scope, deliverables and proposed time schedule of the Group :</b></p> <p><b>Background :</b></p> <p>IEC 61099 "Specifications for unused synthetic organic esters for electrical purposes" was revised in August 2010 (Ed. 2.0) and IEC 62770 Ed 1.0 "Unused natural esters for transformers and similar electrical equipment" was published in November 2013. Just after, IEC TC10 launched the project for preparation of a user's maintenance guideline for natural esters. This proposal (Convenor: Clair Claiborn, US) was unanimously approved in January 2015 under the code IEC 62975.</p> <p>Natural and synthetic ester insulating liquids are being applied in electrical equipment worldwide, primarily in distribution transformers. These liquids are also being increasingly used in power transformers. It is estimated that there are over ½ million distribution transformers and several thousands of small, medium and large liquid immersed power transformers using natural esters. The increased usage of the natural ester insulating liquids is based on their high biodegradability, sustainability, superior fire safety, and the protection factor they provide to cellulose-based solid insulation systems in transformers.</p> <p>A point of considerable interest is now to assess specifically the real advantages in the use of synthetic and natural esters, in comparison with mineral oils, in terms of fire behavior and impact on the environment in case of possible spills in soil.</p> <p><b>Scope :</b></p> <ol style="list-style-type: none"> <li>1. Fire behavior comparison between natural and synthetic esters and mineral insulating oils;</li> <li>2. Environmental impact comparison in case of spills of natural and synthetic esters and mineral insulating oils;</li> </ol> <p><b>Deliverables :</b> Technical brochure, summary report in Electra and Tutorial Presentation.</p> <p><b>Time Schedule :</b> start : January 2017 <span style="float: right;"><b>Final report :</b> 2020</span></p>		
<p><b>Approval by Technical Committee Chairman :</b> <i>M. Wald</i> Date : 17/01/2017</p>		

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2  
(4) Delete as appropriate

# DGA AND DIAGNOSTIC

Discussion on future works

prepared by Fabio SCATIGGIO (Italy)



# Study Committee D1

## Draft - Preferential Subjects – Paris 2020

- **PS1 Testing, Monitoring and Diagnostics**
  - Experience and insight from monitoring systems.
  - Reliability of equipment and systems for testing, monitoring and diagnostics.
  - Data handling, analytics and advanced condition assessment.
- **PS2 Materials – functional properties and degradation**
  - New stresses (e.g. power electronics and semiconductors, load cycling, higher temperatures, compact applications, etc.).
  - Materials with lower environmental footprint (e.g. production, operation, disposal, etc.).
  - Characterization methods for validating functional properties.
- **PS3 Insulation systems of advanced components**
  - Materials under high stresses (e.g. field stress, flux, electric current, frequency, etc.)
  - Experience and requirements for new test procedures and standards.
  - Development of new materials (e.g. 3D printing, lamination, casting, additive and subtractive manufacturing, etc.)