Client : Siemens Transmission & Distribution Ltd. / Princess Road / Manchester - UK
Order : 4511167776 dated 03.05.2019
NGC EGI CODE : P4VT10

EQUIPMENT TESTED

N° 10	Capacitor Voltage transformers type	:	TCVT 420
	Highest system voltage	:	420 kV
	Rated capacitance	:	4000 pF
	Rated frequency	:	50 Hz
	Serial numbers		30149712 ÷ 30149721

Ratio (kV/V)	Terminal marking	Burden (VA)	Class
396:√3 / 110:√3	a - n	50	0,5 / 3P

ROUTINE TEST

Test performed

1) Capacitor divider

1.1)	Tightness of capacitor voltage divider				(See page 06)	√
1.2)	Power-frequency withstand test at 50 Hz and partial discharge measurements.				(See page 02)	√
1.3)	Capacitance and tanδ measurement at power-frequency.				(See pages 03 - 04)	√

2) Electromagnetic unit

2.1)	Power-frequency tests on	:				√
	- primary windings at 150 Hz	:	18,6 kV for	40	s	√
	- secondary windings at 50 Hz	:	3 kV for	60	s	√
2.2)	Tightness of electromagnetic unit.				(See page 07)	√

3) Capacitor Voltage Transformer

3.1)	Verification of terminal markings and polarity tests.					√
3.2)	Power-frequency test on low voltage terminal at 50 Hz	:			4 kV for 60 s	√
3.3)	Ferro-resonance check.				(See annex A)	√
3.4)	Accuracy check (determination of errors).				(See page 05)	√

NOTE : Test results were satisfactory according to standard :

IEC 61869-1 edition 2007
IEC 61869-5 edition 2011

Trench Italia
Test Laboratory

Power - frequency test and partial discharge measurement

Test frequency : 50 Hz

TEST RESULTS :

Serial number	Unit	Power frequency test voltage test applied		Partial discharge measurement				
		Top unit 248,9 kV for 60 s	Lower unit 412,6 kV for 60 s	Top unit (kV) for 60 s at 165,9 (pC)	Top unit (kV) for 60 s at 115,0 (pC)	Lower unit (kV) for 60 s at 275,1 (pC)	Lower unit (kV) for 60 s at 190,6 (pC)	Background noise level (pC)
30149712	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149713	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149714	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149715	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149716	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149717	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149718	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149719	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			2,5	2,5	2,5
30149720	Top Unit	Satisfactory		3	3			3
	Lower Unit		Satisfactory			1,5	1,5	1,5
30149721	Top Unit	Satisfactory		2,5	2,5			2,5
	Lower Unit		Satisfactory			1,5	1,5	1,5

NOTE : Each single unit was testing at a value of test voltage equal to
1.05 x test voltage of the stack x rated voltage of the unit / rated voltage of the stack
(Standard IEC 61869-5 edition 2011 clause 7.3.2)

During the power frequency voltage test, no internal or external discharge occurred. The partial discharge test voltage are reached while decreasing the voltage after the power frequency test.

Trench Italia	STABILIMENTO DI CAIRO M.tte / CAIRO M.tte FACTORY **VERBALE DI COLLAUDO** **TEST REPORT**	Data / Date Ord. N° Pag.n° / Page n°	**10.10.2019** **17035/010** **3/7**

Capacitance and loss angle measurement

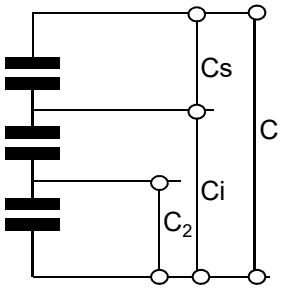
Rated capacitance : 4000 pF

Rated voltage ratio : 40,7

Capacitance of standard capacitor : 71,1 pF

Equipment used for measurement : Type 2809 Tettex

Ambient temperature : 25,8 °C



Serial number	Test procedure	Capacitance under test	TOTAL CAPACITANCE C Measuring voltage (kV) Cs : 86,0 Ci : 142,6 C (pF)	tgδ (%)	C_2 Measuring voltage voltage (kV) 5,6 C_2 (pF)	K C_2/C
30149712	A	Cs Ci C	10523,0 6356,3 3962,68	0,0679 0,0739	162476	41,001
	B	Cs Ci C	10540,0 6359,0 3966,14	0,0678 0,0733		
30149713	A	Cs Ci C	10550,3 6373,9 3973,40	0,0728 0,0725	163058	41,037
	B	Cs Ci C	10560,3 6376,5 3975,83	0,0705 0,0725		
30149714	A	Cs Ci C	10521,2 6385,3 3973,68	0,0788 0,0754	162845	40,981
	B	Cs Ci C	10535,6 6387,4 3976,55	0,0761 0,0730		
30149715	A	Cs Ci C	10538,6 6398,9 3981,43	0,0819 0,0794	162702	40,865
	B	Cs Ci C	10542,8 6401,3 3982,96	0,0790 0,0758		
30149716	A	Cs Ci C	10532,7 6381,6 3973,88	0,0812 0,0605	163248	41,080
	B	Cs Ci C	10538,3 6384,8 3975,92	0,0776 0,0730		
30149717	A	Cs Ci C	10471,0 6346,2 3951,37	0,0806 0,0807	163235	41,311
	B	Cs Ci C	10491,0 6348,2 3955,00	0,0786 0,0752		

Restricted

A : Before power frequency test and partial discharge test at 10% Upr.

B : After power frequency test and partial discharge test at 100% Upr.

Capacitance and loss angle measurement

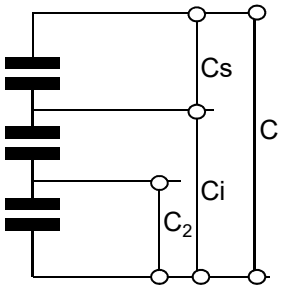
Rated capacitance : 4000 pF

Rated voltage ratio : 40,7

Capacitance of standard capacitor : 71,1 pF

Equipment used for measurement : Type 2809 Tettex

Ambient temperature : 25,8 °C



Serial number	Test procedure	Capacitance under test	TOTAL CAPACITANCE C Measuring voltage (kV) Cs : 86,0 Ci : 142,6 C (pF)	tgδ (%)	C_2 Measuring voltage voltage (kV) 5,6 C_2 (pF)	K C_2/C
30149718	A	Cs Ci C	10478,8 6364,8 3959,69	0,0879 0,0774	161822	40,867
	B	Cs Ci C	10478,8 6367,1 3960,58	0,0688 0,0756		
30149719	A	Cs Ci C	10559,7 6382,7 3978,15	0,0727 0,0981	163173	41,017
	B	Cs Ci C	10570,8 6384,6 3980,46	0,0676 0,0712		
30149720	A	Cs Ci C	10654,0 6481,5 4029,87	0,0671 0,0985	165660	41,108
	B	Cs Ci C	10645,0 6479,2 4027,70	0,0668 0,0981		
30149721	A	Cs Ci C	10526,6 6488,1 4014,04	0,0722 0,0980	165440	41,215
	B	Cs Ci C	10539,8 6496,2 4019,06	0,0670 0,0973		

Restricted

A : Before power frequency test and partial discharge test at 10% Upr.

B : After power frequency test and partial discharge test at 100% Upr.

Trench Italia	STABILIMENTO DI CAIRO M.tte / CAIRO M.tte FACTORY **ACCURACY TEST**	Data / Date **10.10.2019** Ord. N° **17035/010** Pag.n° / Page n° **5/7**

Voltage transformer type : TCVT 420

Rated voltage factor : 1,5 / 30s. **Rated frequency** : 50 Hz

Ratio (kV/V)	Terminal marking	Burden (VA)	Class
396:√3 / 110:√3	a - n	50	0,5 / 3P

Serial number	Terminal markings	Burden VA cosφ 0,8 a - n	Test voltage											
			2%Upr		5%Upr		80%Upr		100%Upr		120%Upr		150 % Upr	
			y %	ε min	y %	ε min	y %	ε min	y %	ε min	y %	ε min	y %	ε min
30149712	a - n	12,5	0,03	12,6	0,04	7,1	0,07	1,3	0,08	0,6	0,09	0,0	0,08	1,4
		50	-0,06	13,9	-0,04	9,2	-0,04	2,4	-0,03	1,7	-0,02	1,1	-0,03	2,5
30149713	a - n	12,5	0,01	23,0	0,00	13,4	0,03	4,2	0,05	3,6	0,05	3,0	0,04	4,4
		50	-0,04	27,2	-0,07	16,7	-0,06	6,2	-0,04	5,6	-0,04	5,0	-0,05	6,4
30149714	a - n	12,5	0,00	14,6	0,01	9,4	0,02	3,7	0,02	3,2	0,04	2,6	0,03	4,0
		50	-0,07	17,8	-0,06	12,2	-0,06	5,8	-0,06	5,3	-0,04	4,7	-0,05	6,1
30149715	a - n	12,5	0,01	11,0	0,04	6,2	0,06	1,7	0,07	1,2	0,08	0,6	0,07	2,0
		50	-0,06	12,6	-0,04	8,3	-0,04	3,1	-0,03	2,6	-0,02	2,0	-0,03	3,4
30149716	a - n	12,5	0,02	11,7	0,03	7,3	0,07	2,4	0,08	1,8	0,07	1,2	0,06	2,6
		50	-0,05	14,6	-0,04	9,7	-0,03	4,2	-0,02	3,6	-0,03	3,0	-0,04	4,4
30149717	a - n	12,5	0,01	14,7	0,01	9,2	0,03	3,2	0,04	2,6	0,05	2,1	0,04	3,5
		50	-0,06	18,1	-0,06	12,0	-0,06	5,2	-0,05	4,6	-0,04	4,1	-0,05	5,5
30149718	a - n	12,5	0,00	12,4	0,00	7,1	0,03	1,2	0,04	0,6	0,04	0,1	0,03	1,5
		50	-0,10	14,3	-0,09	9,1	-0,08	2,5	-0,07	1,9	-0,07	1,4	-0,08	2,8
30149719	a - n	12,5	0,01	11,7	0,02	7,6	0,05	3,0	0,06	2,5	0,07	1,9	0,06	3,3
		50	-0,06	14,8	-0,06	10,2	-0,04	4,7	-0,03	4,2	-0,02	3,6	-0,03	4,7
30149720	a - n	12,5	0,01	8,5	0,01	4,0	0,06	-1,7	0,07	-2,2	0,07	-2,9	0,06	-1,5
		50	-0,08	10,6	-0,08	5,6	-0,05	-0,8	-0,04	-1,3	-0,04	-2,0	-0,05	-0,6
30149721	a - n	12,5	0,02	14,2	0,03	7,6	0,05	1,8	0,07	0,9	0,07	0,5	0,06	1,9
		50	-0,07	17,1	-0,04	10,8	-0,04	3,8	-0,02	2,9	-0,02	2,5	-0,03	3,9

OIL LEAKAGE TEST ON CAPACITOR DIVIDER

The test was made on the capacitor divider entirely assembled.
Before the test, they were carefully cleaned, especially on the joint parts, and maintained at 1,0 bar over operating pressure for at least eight hours.

At the end of this period, it was observed :

Serial number	Observation
30149712	NO oil leakage
30149713	NO oil leakage
30149714	NO oil leakage
30149715	NO oil leakage
30149716	NO oil leakage
30149717	NO oil leakage
30149718	NO oil leakage
30149719	NO oil leakage
30149720	NO oil leakage
30149721	NO oil leakage

Test result :
Satisfactory, according to standard IEC 61869-5 ed. 2011

OIL LEAKAGE TEST ON ELECTROMAGNETIC UNIT

The test was made on the electromagnetic unit assembled as normal service carefully cleaned, especially on the joint parts, and maintained at 1,0 bar over operating pressure for at least eight hours, the e.m.u. shall be considered to have successfully passed the test if there is no evidence of leakage.

At the end of this period, it was observed :

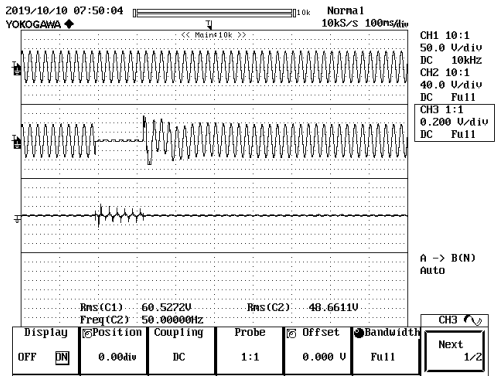
Serial number	Observation
30149712	NO oil leakage
30149713	NO oil leakage
30149714	NO oil leakage
30149715	NO oil leakage
30149716	NO oil leakage
30149717	NO oil leakage
30149718	NO oil leakage
30149719	NO oil leakage
30149720	NO oil leakage
30149721	NO oil leakage

Test result :
Satisfactory, according to standard IEC 61869-1 ed. 2007

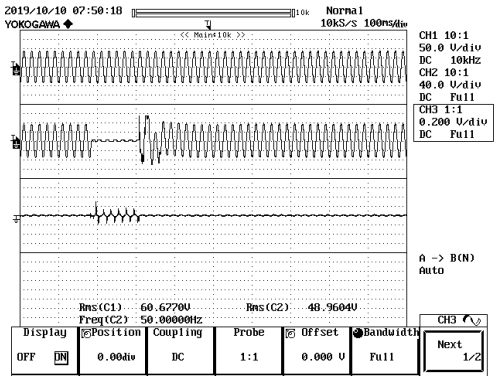
FERRO-RESONANCE TEST

Before the accuracy test, 3 short-circuit applications at 0.8 Upr and 3 short-circuit applications at 1.5 Upr have been performed on each TCVT with positive results. The following oscillograms related to serial number 30149712 are included for reference.

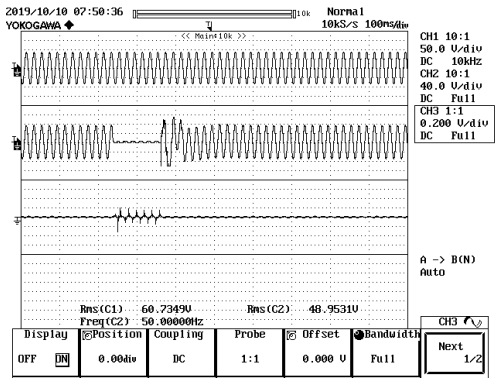
1° application at 0.8 Upr



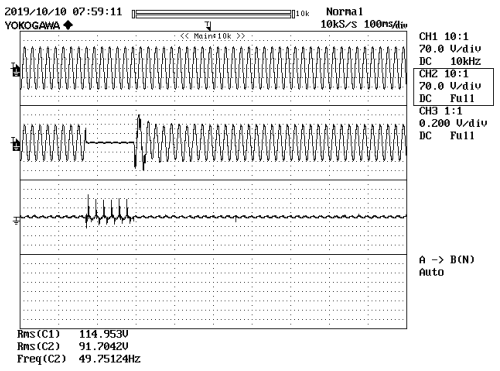
2° application at 0.8 Upr



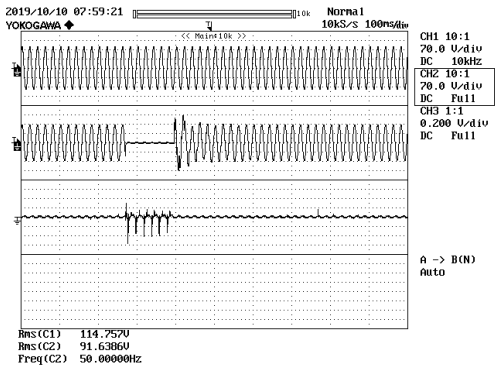
3° application at 0.8 Upr



1° application at 1.5 Upr



2° application at 1.5 Upr



3° application at 1.5 Upr