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LABORATORIO CENTRAL OFICIAL DE ELECTROTECNIA

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FUNDACIÓN PARA EL FOMENTO DE LA INNOVACIÓN INDUSTRIAL

TEST REPORT
IEC/EN 60831-1& IEC/EN 60831-2
Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1kV
Part 1: General – Performance, testing and rating – Safety requirements – Guide for installation and operation
Part 2: Ageing test, self-heating and destruction test

Report Number. .....:	2015030110B1-M3-A2	
Date of issue .....:	24/05/2017 **(A1:13/06/2018)**	**(A2:15/09/2021)** **(A2:18/07/2023)**
Total number of pages.....	23	

Applicant's name.....:	RTR ENERGIA, S. L.
Address .....:	Gavilanes, 11 bis - Pol. Ind. Pinto-Estación 28320 Pinto (Madrid) SPAIN

Test specification:	
Standard .....:	IEC 60831-1:2014 & EN 60831-1:2014 IEC 60831-2:2014 & EN 60831-2:2014
Test procedure .....:	--
Non-standard test method.....:	N/A

General disclaimer:

The test results presented in this report relate only to the object tested.
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Test item description .....:	SHUNT POWER CAPACITORS
Trade Mark .....:	RTR ENERGÍA
Manufacturer.....:	RTR Energia, S. L.
Model/Type reference .....:	Series DWCAP, DWCAP RCT AND DWCAP RTF
Ratings .....:	See additional table

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Testing procedure and testing location:	
☒ **Testing Laboratory:**	LABORATORIO CENTRAL OFICIAL DE ELECTROTECNIA (LCOE)
Testing location/ address.....:	C/ Eric Kandel, 1 – 28906 Getafe (Madrid) - SPAIN
Tested by (name).....:	ESTEBAN IZQUIERDO
Approved by (name + signature).....:	JESUS SANCHEZ PANDO Firmado digitalmente por JESUS SANCHEZ PANDO Nombre de reconocimiento (DN): c=ES, st=MADRID, o=Fundación para el Fomento de la Innovación Industrial / FP / 0000, 2.5.4.97=VATES-G80455231, ou=LCOE - BAJA TENSION, title=Responsable Técnico, sn=SANCHEZ PANDO, givenName=JESUS, serialNumber=08029499S, cn=JESUS SANCHEZ PANDO, email=jsanchezpando@ffii.es, 1.3.6.1.4.1.4710.1.3.2=G80455231 Fecha: 2023.07.18 11:56:55 +02'00' JESÚS SÁNCHEZ TECHNICAL RESPONSIBLE

List of Attachments (including a total number of pages in each attachment):

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All tests have been carried out on the follow samples:	LCOE C/Eric Kandel, 1 – 28906 Getafe (Madrid) C/ Diesel, 13 – 28906 Getafe (Madrid)

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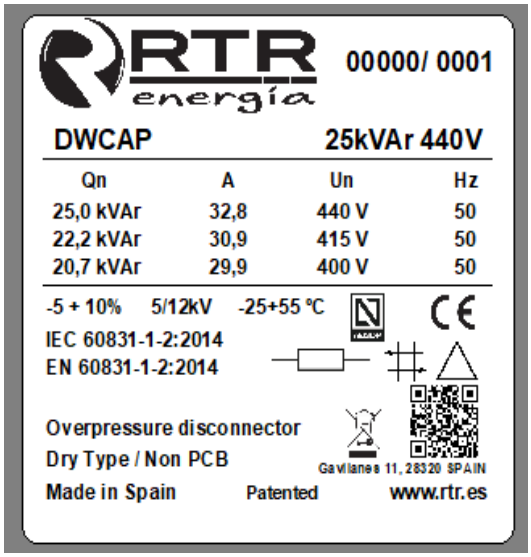
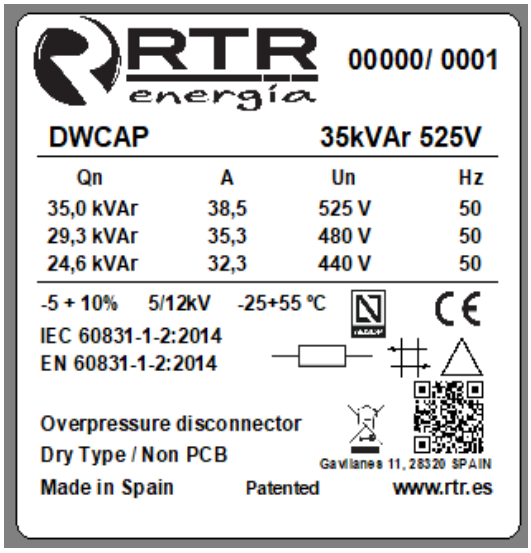
Copy of marking plate:





Test items particulars:	
type of capacitor ..... :	Three phase
self-healing capacitor ..... :	Yes
discharge device of capacitor ..... :	Yes
connection symbol ..... :	Δ
internal fuses of capacitor ..... :	NO
rated voltage of capacitor (U_N) ..... :	400/440 V; 440/480/525 V
rated frequency of capacitor (f_N) ..... :	50 Hz/60 Hz
rated capacitance of capacitor (C_N) ..... :	See general table
rated current of capacitor (I_N) ..... :	See general table
rated output of capacitor (Q_N) ..... :	See general table
Temperature category ..... :	-25/D
service conditions ..... :	Indoor
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P(Pass)
- test object does not meet the requirement ..... :	F(Fail)
Testing ..... :	
Date of receipt of test item ..... :	19/11/2014 (M1: 06/11/2015) (M2: 19/04/2016) (M3:21/03/2017)
Date (s) of performance of tests ..... :	28/11/2014 to 21/05/2015 (M1: 06/11/2015 to 27/01/2016) (M2: 25/04/2016 to 09/05/2016) (M3: 27/03/2017 to 28/03/2017) **M3-A1:13/06/2018) M3-A2:15/09/2021) (A2:18/07/2023)**

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

Amendment 1 Report:

The original Test Report Ref. No. 2015030110B1 dated 2015 May 05 was modified on January 29, 2016 to include the following changes and/or additions, which were considered technical modifications:

New models of the family of the products with the followings changes:

Power: 35 kVAr max.

Voltaje: 525 V max.

The construction is similar than the other products of the family, except the new models included than the **power** and voltage are higher. For this reason is necessary carried out the tests according to the following clauses: 7, 8, 9, 10, 16, 17

Amendment 2 Report:

The original Test Report Ref. No. 2015030110B1 dated 2015 May 05 was modified on May 10, 2016 to include the following changes and/or additions, which were considered technical modifications:

New Version of the Standard of application.

For this reason is necessary carried out the tests according to the following clauses: 15 on the base models of the family of products.

Amendment 3 Report:

The original Test Report Ref. No. 2015030110B1 dated 2015 May 05 was modified on March 2017 to include the following changes and/or additions, which were considered technical modifications:

- The series of capacitors change the electric strength.

For this reason is necessary carried out tests according to the following clauses: 10 and 15 on the base models of the family of products.

A2:

This report has been issued to correct a typographical error in the headline.

A2:

This report has been issued in order to include the correct marking plate of the samples umnder test.

A1:

This report has been issued in order to correct the typo of page 7 of the test report 2015030110B1-M3

This test report cancel and replace to report number2015030110B1-M3 issued 24/05/2017

General product information:

THREE PHASE POWER CAPACITORS SERIE DWCAP. DWCAP RCT AND DWCAP RTF

POWER		CAPACITY		CAPACITY TOLERANCE		CURRENT		VOLTAGE	FREQUENCY	TEMPERATURE CATEGORY	TANGENTE δ
MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX				
1 KVAR	25 KVAR 35 kVAR	16,5 µf 11.6 µf	411.1 µf 404.3 µf	-5%	15%	1,31 A 1,11 A	32.8 A 38.5 A	440 V 525 V	50 Hz	-25/D	<10* 10-4
1 KVAR	25 KVAR 35 kVAR	13.8 µf 9.7 µf	342.6 µf 336.9 µf	-5%	15%	1,31 A 1,11 A	32,8 A 38.5 A	440 V 525 V	60 Hz	-25/D	<10* 10-4

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SECTION 2	QUALITY REQUIREMENTS AND TESTS		-
5	Test requirements		-
5.1	General		-
	This clause gives the test requirements for capacitor units and, when specified, for capacitor elements.		P
	Supporting insulators, switches, instrument transformers, fuse, etc, shall be in accordance with relevant IEC standards.		N/A
5.2	Test conditions		-
	Unless otherwise specified for a particular test or measurement, the temperature of the capacitor dielectric at the start of the test shall be in the range of +5℃ to +35℃		P
	The dielectric temperature is the same as the ambient temperature		P
	Provide that the capacitor has been left in an unenergized state at constant ambient temperature for an adequate period		P
	When a correction has to be applied, the reference temperature to be used is +20℃		P
	Unless otherwise agreed between the manufacturer and the purchaser		N/A
	The a.c. tests and measurements shall be carried out at a frequency of 50Hz or 60Hz independent of the rated frequency of the capacitor, if not otherwise specified	50 Hz	P
	Capacitors having a rated frequency below 50Hz shall be tested and measured at 50Hz or 60Hz, if not otherwise specified		N/A
6	Classification of tests		-
6.2	Type tests		-
	a) thermal stability test(see clause 13)		**P**
	b) measurement of the tangent of the loss angle (tan δ) of the capacitor at elevated temperature(see clause 14)		P
	c) voltage test between terminals(see 9.2)		P
	d) voltage test between terminals and container(see 10.2)		P
	e) lightning impulse voltage test between terminals and container(see clause 15)		P
	f) discharge test(see clause 16)		P
	g) ageing test(see clause 17)		P
	h) self-healing test(see clause 18)		P
	i) destruction test(see clause 19)		P

	Unless otherwise specified, every capacitor sample to which it is intended to apply the type test shall first have withstood satisfactorily the application of all the routine tests.		P
	The successful completion of each type test is also valid for units having the same rated voltage and lower output, provided that they do not differ in any way that may influence the properties to be checked by the test.		P
7	Capacitance measurement and output calculation		P
7.1	Measuring procedure	Capacitor Bridge	P
	The capacitance shall be measured at:		P
	Test voltage .....:	Low voltage	P
	Test frequency .....:	50 Hz/60Hz	P
	The method used shall not include errors due to harmonics, or to accessories external to the capacitor to be measured, such as reactors and blocking circuits in the measuring circuit.		P
7.2	The capacitance tolerances		P
	The capacitance shall not differ from the rated capacitance by more than:		P
	-5% to +15% for units and banks up to 100Kvar;		P
	0% to +10% for units and banks above 100Kvar		N/A
	In three-phase units, the ratio of maximum to minimum value of the capacitance measured between any two-line terminals shall not exceed 1,08	Max. :L1-L3; Min.:L2-L3 Ratio: see appendix table	P
8	Measurement of the tangent of the loss angle(tanδ) of the capacitor		P
8.1	Measuring procedure		P
	The capacitor losses (or tanδ) shall be measured at the voltage and at the frequency chosen by the manufacturer.	Capacitor Bridge	P
	The method used shall not include errors due to harmonics, or to accessories external to the capacitor to be measured, such as reactors and blocking circuits in the measuring circuit.		P
	The measurement of the capacitor losses shall be carried out after the voltage test between terminals(see clause 9)		P
	Measurement at a voltage between 0,9 and 1,1 times the rated voltage, and at a frequency between 0,8 and 1,2 times the rated frequency shall be performed on the capacitor before the thermal stability test(see clause 13)		N/A
	and may be performed on other capacitors on request of the purchaser in agreement with the manufacturer		P
8.2	Loss requirements		P

	The value of tanδ, measured in accordance with 8.1, shall not exceed the value declared by the manufacturer for the temperature and voltage of the test, or the value agreed upon between manufacturer and purchaser.		P
9	Voltage tests between terminals		P
9.2	Type test		P
	Each capacitor shall be subjected to an a.c. test at Ut=2.15Un for a minimum time of 10s.	946 V; 1130 V	P
	The a.c. test shall be carried out with a substantially sinusoidal voltage at a frequency between 15Hz and 100Hz, and preferably as near as possible to the rated frequency.	50 Hz	P
	During the test, no permanent puncture or flashover shall occur. Self-healing breakdowns are permitted.		P
	When the circuit is composed of a number of elements, or a group of elements connected in parallel, and which are tested separately, it is not necessary to repeat the test on the unit.		P
	For polyphase capacitors, the test voltages should be adjusted as appropriate		P
	Operation of internal element fuses is permitted, provided the capacitance tolerances are still met and that not more than two fuses have operated per unit.		P
10	Voltage tests between terminals and container		P
10.2	Type test		P
	Units having all terminals insulated from the container shall be subjected to an a.c. voltage applied between the terminals (joined together) and the container.		P
	If the rated voltage of the capacitor is Un<=660V, the voltage to be applied is 3kV for 1 min	Test voltage: 5000 V	P
	If the rated voltage of the capacitor is Un>660V, the voltage to be applied is 6kV for 1 min.		N/A
	The test on units having one terminal permanently connected to the container shall be limited to the bushing(s) and container (without elements).		P
	If the capacitor container is of insulating material, the test voltage shall be applied between the terminals and a mental foil wrapped closely round the surface of the container.		N/A
	The test shall be made under dry conditions for indoor units, and with artificial rain (see IEC 60-1) for units to be used outdoors.		P
	During the test, neither puncture nor flashover shall occur.		P
	Units intended for outdoor installation may be subjected to a dry test only.		P
11	Test of internal discharge device		P

	The resistance of the internal discharge device, if any, shall be checked either by a resistance measurement or by measuring the self-discharging rate (see clause 22).		P
	The choice of the method is left to the manufacturer.		P
	The test shall be made after the voltage tests of clause 9		P
12	Sealing test		N/A
	The unit (in non-painted state) shall be exposed to a test that will effectively detect any leak of the container and bushing(s).		N/A
	If no procedure is stated by the manufacturer, the following test procedure shall apply:		N/A
	Unenergized capacitor units shall be heated throughout so that all parts reach a temperature not lower than 20℃ above the maximum value in table 1 corresponding to the capacitors symbol, and shall be maintained at this temperature for 2h.		N/A
	No leakage shall occur.		N/A
13	Thermal stability test		P
	The capacitor unit subjected to the test shall be placed between two other units of the same rating which shall be energized at the same voltage as the test capacitor or		P
	Alternatively, two dummy capacitors each containing resistors may be used		N/A
	The dissipation in the resistors shall be adjusted to a value so that the container temperatures of the dummy capacitors near the top opposing faces are equal to, or greater than, those of the test capacitor.		P
	The separation between the units shall be equal to, or less than, the normal spacing.		P
	The assembly shall be placed in still air in a heated enclosure in the most unfavourable thermal position according to the manufacturer's instructions for mounting on site.		P
	The ambient air temperature shall be maintained at or above the appropriate temperature shown in table 2.	D	P
	It shall be checked by means of a thermometer having a thermal time constant of approximately 1h.		P

Symbol	Ambient air temp. ℃
A	40
B	45
C	50
D	55

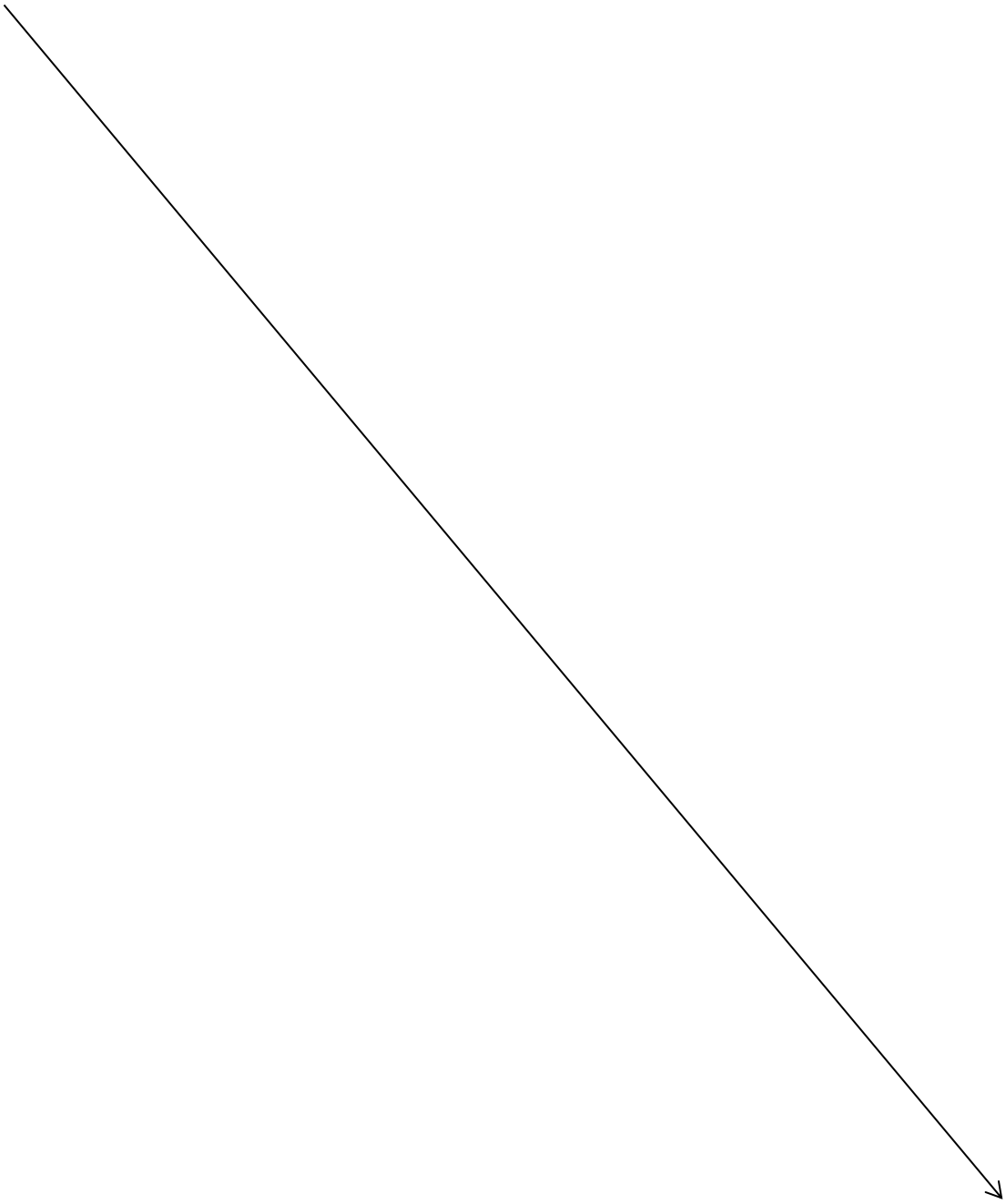
	The ambient air the thermometer should be shielded so that it is subjected to the minimum possible thermal radiation from the three energized samples		P
	After all parts of the capacitor have attained the temperature of the ambient air, the capacitor shall be subjected for period of at least 48h to an a.c. voltage of substantially sinusoidal form.	440 V; 55 ºC	P
	The magnitude of the voltage throughout the last 24 hours of the test shall be adjusted to give a calculated output, using the measured capacitance (see 7.1), of at least 1.44 times its rated output.	528 V; 55ºC	P
	During the last six hours, the temperature of the container near the top shall be measured at least four times. Throughout this period of 6h, the temperature rise shall not increase by more than 1℃, should a greater change be observed, the test may be continued until the above requirement is satisfied for four consecutive measurements during a 6h period.	Top capacitor temperature:	P
	At the end of the stability test, the difference between the measured temperature of the container and the ambient air temperature shall be recorded	Difference: 5,7 ºC	P
	Before and after the test the capacitance shall be measured (see 7.1) within the standard temperature range for testing (see 5.2), and these two measurements shall be corrected to the same dielectric temperature.	Capacitance before (sample 1):	-
	No change of capacitance greater than 2% shall be apparent from these measurements.	Difference < 1 %	P
	A measurement of the tangent of the loss angle (tanδ) shall be made before and after the thermal stability test, at a temperature of approximately 20℃.		P
	The value of the second measurement of the tangent of the loss angle shall be not greater than that of the first by more than 2×10-4		P
	For polyphase units, two possibilities are allowed:		N/A
	- use of a three-phase source;		P
	- modification of the internal connections in order to have only one phase with the same output.		N/A
14	Measurement of the tangent of the loss angle(tanδ) of the capacitor at elevated temperature		P
14.1	Measuring procedure		P
	The capacitor losses (tanδ) shall be measured at the end of the thermal stability test (see clause 13).		P
	The measuring voltage shall be that of the thermal stability test.		P
14.2	Requirements		P

	The value of tanδ, measured in accordance with 14.1, shall not exceed the value declared by the manufacturer for the temperature and voltage of the test		P
	or the value agreed upon by the manufacture for the temperature and voltage of the test		P
	or the value agreed upon between manufacturer and purchaser.		P
15	Lightning impulse voltage test between terminals and container		P
	Only units having all terminals insulated from the container and intended for exposed installations shall be subjected to this test.		P
	Unless otherwise agreed between manufacturer and purchaser, the impulse test shall be performed with a wave of 1,2/50μs to 5/50μs,having a peak value of 8kV if the rated voltage of the capacitor is Un<=690V	Test voltage: 12 kV	P
	Or having a peak value of 12kV if Un>660V		N/A
	Three impulse of positive polarity followed by their impulse of negative polarity shall be applied between terminals joined together and the container.		P
	After the change of polarity, it is permissible to apply some impulses of lower amplitude before the application of the test impulse.		P
	The absence of failure during the test shall be verified by a cathode ray oscillograph, which is used to record the voltage and to check the wave shape		P
	If the capacitor container is of insulating material, the test voltage shall be applied between the terminals and a metal foil wrapped closely round the surface of the container.		N/A
16	Discharge test		P
	The unit shall be charged by means of d.c. and then discharged through a gap situated as close as possible to the capacitor.		P
	It shall be subjected to five such discharges within 10 min.		P
	The test voltage shall be equal to 2Un.		P
	Within 5 min after this test, the unit shall be subjected to a voltage test between terminals (see 9.1).		P
	The capacitor shall be measured before the discharge test and after the voltage test		P
	The measurements shall not differ by more than 2%,	See appendix table	P
	no breakdown of an element,		P
	no blowing of an internal fuse		P
	For polyphase units, the test shall be carried out in the following manner:		P

	-In the case of units with three-phase delta connection, two terminals shall be short-circuited and the test carried out between the third terminal and the short-circuited terminals at 2Un.		P
	-In the case of units with three-phase star connection, the test shall be carried out between two terminals with the third terminal left unconnected. The test voltage shall be 4Un/$\sqrt{3}$ to achieve the same test voltage across the elements.		P
	If the first peak of the test current exceeds the value of 200In(r.m.s), it may be kept at this limit by means of an external coil.		P

17	Ageing test		-
17.1	Conditioning		-
	Capacitors are mounted in the test chamber		P
	Test temperature (°C)……..:	45 º C	—
	Test voltage (V)……:	550 V; 656.25 V	—
17.2	Test procedure		
a)	Test voltage (V)……:	550 V; 656.25 V	P
	Energized time (h); beginning; end…… ……..:	(For 25 kVAr/440 V) 750 h; beginning: 25/02/2015 end: 27/03/2015 (For 35 kVAr/525 V) Beginning: 16/11/2015 End:18/12/2015	P
b)	Test voltage (V)……:	880 V; 1050 V	P
	Inductance calculated (µH)	4,87 µH; 4.98 µH	P
	Nº of the cycles:	1000	P
c)	Test voltage (V)……:	550 V; 656.25 V	P
	Energized time (h); beginning; end…… ……..:	(For 25 kVAr/440 V) 750 h; beginning: 20/12/2015 end: 22/01/2016 (For 35 kVAr/525 V) Beginning: 20/12/2015 End:25/01/2016	P
17.3	Evaluation		P
	During the test, no permanent breakdown, interruption or flashover occur		P
	No apparent leak which forms droplets within 10 min when kept at upper temperature limit in the		P

	most unfavourable position		
	After the test, capacitance change not more than 5%	(See appended table)	P



18	Self-healing test		-
	Self-healing capacitors have adequate self-healing properties		-
	Test voltage (V)……..……..:	946 V	—
	Test time (s)……..……..:	10	—
	If fewer than five self-healing breakdowns (clearings) occur during this time, The voltage increase until five clearings have occurred since the beginning of the test or until the voltage has reached 3,5UN	(see appended table)	P
	The capacitors shall be deemed to have passed the test if they meet both of the following requirements:		P
	Change of capacitance is	(see appended table)	P

19	Destruction test		P
	Preparation and pre-conditioning		P
	The capacitors wrapped closely with cheese-cloth and mounted within an test chamber		P
	Test temperature (°C)……..……:	45ºC	—
	Test voltage (V)……:	440 V	—
	No open-circuit or short-circuit		P
	DC conditioning		-
	Pre-heated temperature (°C)……:	45 ºC	—
	The voltage of d.c. is raised from zero to a maximum of 10UN until a short-circuit occurs or 10UN has been reached	4400 V dc	P
	Capacitors shall be removed from d.c. conditioning when the voltage is zero or 10UN has been reached and maintained for a period of 5 min		P
	AC destruction test		-
	The capacitors maintained at the d.c. conditioning temperature, applied an a.c. voltage of 1,3UN	572 V	P
	Evaluation of the failure		P
	Each capacitor meet the following:		-
	a) Escaping liquid material may wet the outer surface of the capacitor, but not fall away in drops		P
	b) Capacitor case maybe deformed and damaged but not broken		P
	c) It should not be issued flames and / or glowing particles		P
	d) The capacitor withstand the test of clause 2.8 with the voltage being reduce to 0,8 times the value indicated		P

SECTION 5	MARKINGS		-
26	Marking of the unit		-
	The following information shall be marked indelibly, either directly or by means of a plate, on each capacitor unit:		P
	a)manufacturer's name .....:	RTR Energia	P
	b)Identification number and manufacturing year ...:		P
	c)rated output(QN) in Kvar .....: (for three-phase units, the total output shall be given)	25 Kvar; 35 Kvar	P
	d)rated voltage (UN) in V.....:	440 V; 525 V	P
	e)rated frequency (fN) in Hz .....:	50 Hz/60Hz	P
	f)Temperature category.....:		P
	g)Discharge device, if any.....:	Resistor	P
	h)Reference of self-healing design .....:	Symbol	P
	i)Connection symbol(see 26.2) .....:	Δ	P
	j)Internal fuses, if any.....:		N/A
	k)Indication for the overpressure or thermal disconnection, if such disconnector is fitted.....:		P
	l)Insulation level Ui in kilovolts(KV) .....:	Only for units having all terminals insulated from the container	N/A
	m)Reference to IEC 831(plus year of issue of the edition) .....:		P
26.2	Standardized connection symbols		-
	The type of connection shall be indicated either by letters or by the following symbols .....:	Δ	P
	D or △ = delta		P
	Y or Y =star		N/A
	YN or Y- =star, neutral brought out		N/A
	III or III =three sections without interconnections		N/A
26.3	Warning plate		N/A
	When capacitors are impregnated with products that shall not be dispersed into the environment(see clause 24), the capacitor shall carry markings in accordance with the laws or regulation in force in the user's country, the onus being on the user to inform the manufacturer of such laws or regulations.		N/A

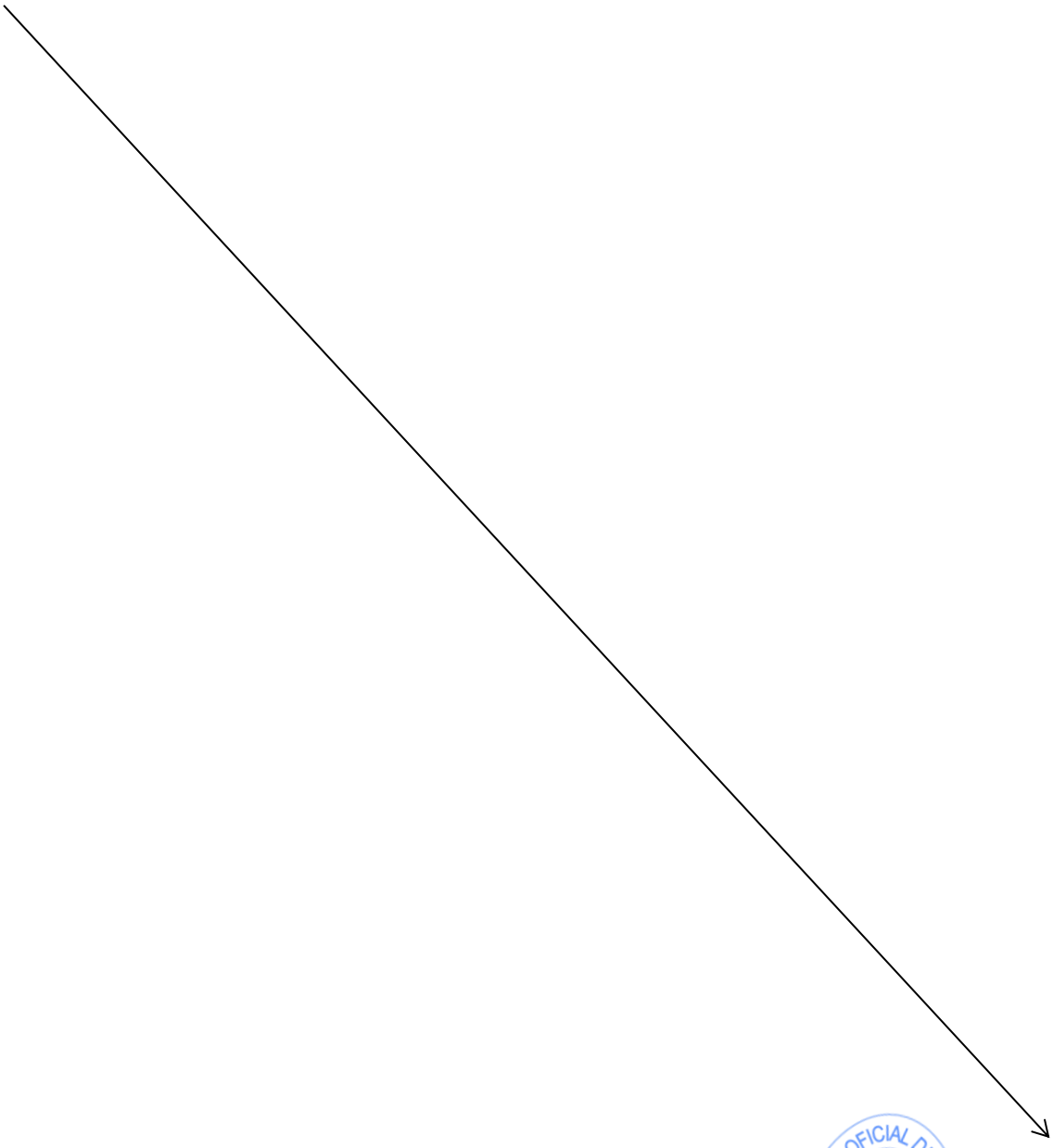
Appendix table

7.2	TABLE: capacitance tolerances			P
Sample No.:	Measured value(μF)	Variatons	Rated capacitance(μF)	ΔC/C (%)
25 Kvar(1)	L1- L2: 205,85 μF L1- L3: 206,98 μF L2- L3: 206,54 μF	1,00 - 1,08	205	0,6 %
25 Kvar(2)	L1- L2: 207,54 μF L1- L3: 206,21 μF L2- L3: 207,38 μF	1,00 - 1,08		0,5%
25 Kvar(3)	L1- L2: 207,14 μF L1- L3: 206,92 μF L2- L3: 206,93 μF	1,00 - 1,08		0,6 %

7.2	TABLE: capacitance tolerances			P
Sample No.:	Measured value(μF)	Variatons	Rated capacitance(μF)	ΔC/C (%)
35 Kvar(1)	L1- L2: 200,07 μF L1- L3: 200,99 μF L2- L3: 201,12 μF	1,00 - 1,08	200	0,36 %
35 Kvar(2)	L1- L2: 199,46 μF L1- L3: 199,89 μF L2- L3: 198,88 μF	1,00 - 1,08		0,29 %
35 Kvar(3)	L1- L2: 200,52 μF L1- L3: 200,64 μF L2- L3: 199,77 μF	1,00 - 1,08		0,15 %

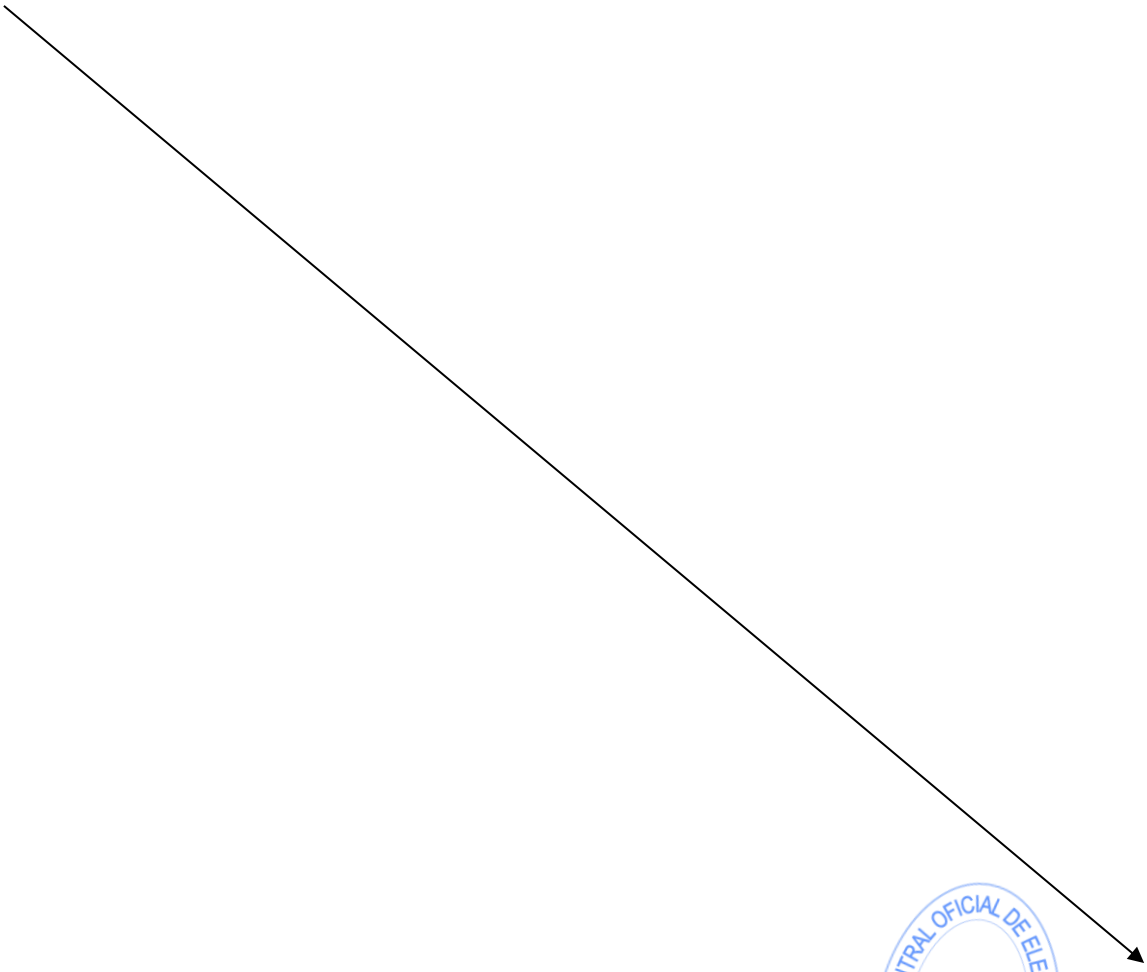
8.2	TABLE: Loss requirements(tanδ)		P
Sample No.:	Measured value	Rated value	Δtanδ(%)
25 Kvar(1)	$9,1x10^{-4}$	$< 10x10^{-4}$	P
25 Kvar(2)	$8,3x10^{-4}$	$<10x10^{-4}$	P
25 Kvar(3)	$8,6x10^{-4}$	$<10x10^{-4}$	P

8.2	TABLE: Loss requirements(tanδ)		P
Sample No.:	Measured value	Rated value	Δtanδ(%)
35 Kvar(1)	$40x10^{-4}$	≤ $40x10^{-4}$	P
35 Kvar(2)	$40x10^{-4}$	≤ $40x10^{-4}$	P
35 Kvar(3)	$40x10^{-4}$	≤ $40x10^{-4}$	P

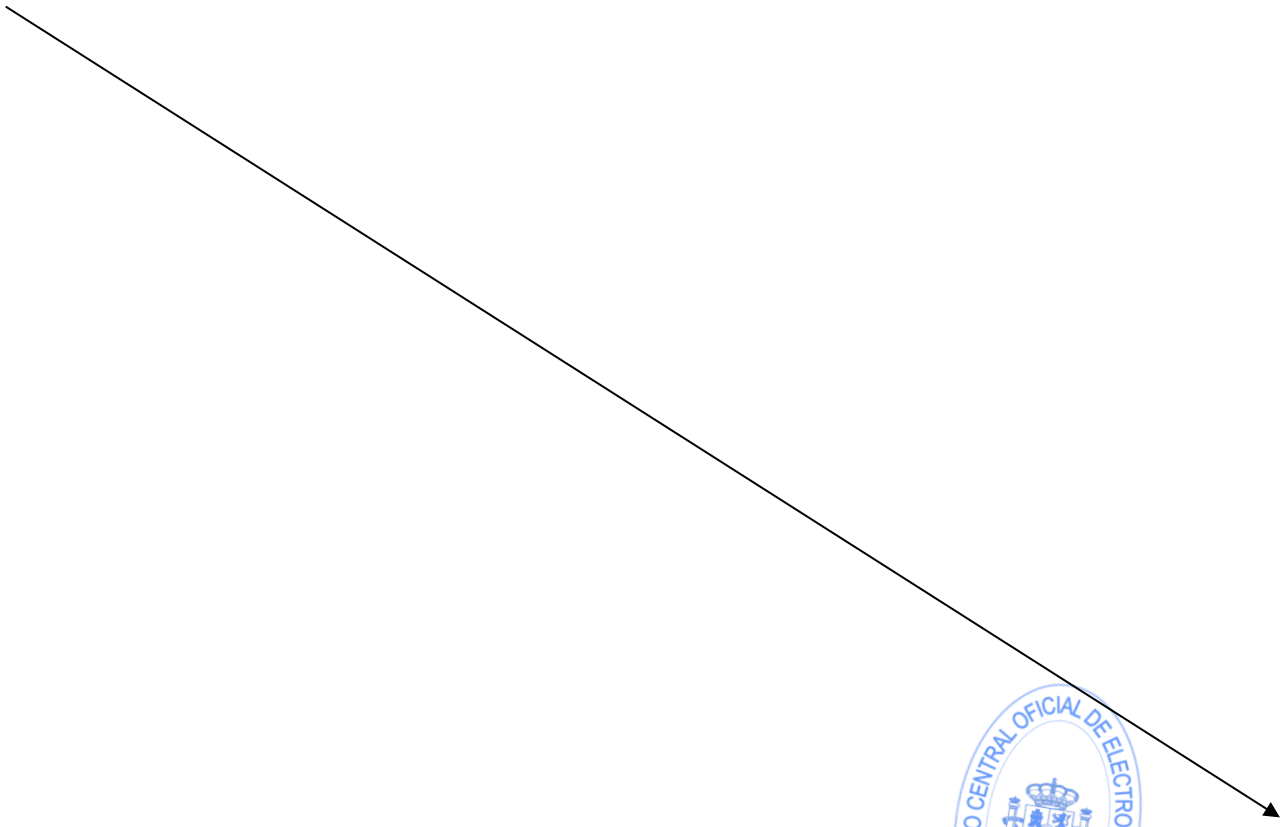


13,14	TABLE: Thermal stability test				P
Sample No.:	Before		After		Δ (%)
	Capacitance	tanδ	Capacitance	tanδ	
25 Kvar(1)	206,17	$9x10^{-4}$	206,51	$8,3x10^{-4}$	0.16
-	-	-	-	-	-

16	TABLE: Discharge test				P
Sample No.:	Before		After		Δ (%)
	Capacitance	tanδ	Capacitance	tanδ	
25 Kvar(1)	206,51	$8,3x10^{-4}$	206,43	$8,6x10^{-4}$	0.04
35 Kvar(2)	199.52	$40x10^{-4}$	199.53	$31x10^{-4}$	0.005



17	TABLE: Ageing test							
	Test period (h)……..:		750 h + 750 h					—
	Test voltage (V)……..:		550 V (25 kVAr (1)); 656 V (35 kVAr (1))					—
	Temperature of test chamber(°C)……..:		45 ºC					—
Tests	25 kVAr (1)	35 kVAr (1)						
Before test Capacitance Measurement C in µF at UN	206.43	200.72						
Ageing Test (part a to c)	204.15	-						
After test capacitance measurement C in µF at UN	200.76	200.35						
C/C in % (≤3%)	2.92 < 3 %	0.18 < 3 %						



18	TABLE: Self-healing test (individual capacitor on the sample)									
Tests	25 kVAr	15 kVAr	10 kVAr							
	1	1	1							
Before test capacitance measurement C in µF at UN	136.23	81.98	55.07							
U1 = 2UN	880 V									
Clearings	0	0	0							
Clearings within 10s	0	0	0							
Voltage increase U2 = 3,5UN	950 – 1150	1100 – 1320	910 - 1280							
Clearings	5	5	5							
Clearings with 10s	1	6	2							
After test capacitance measurement C in µF at UN	136.23	81,94	55,08							
C/C in %	0 %	0,04%	0,02 %							

19	PHOTOGRAPHS AFTER DESTRUCTION TEST	

PHOTOGRAPHS OF THE SAMPLE