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تاریخ: ۱۳۹۹/۱/۲۰

به شرکت: بازرسی مهندسی روشاک پایا کنترل

قابل توجه: سرکار خانم مهندس جعفر پور

موضوع: اعلام نتیجه آزمون

با سلام:

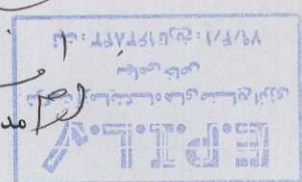
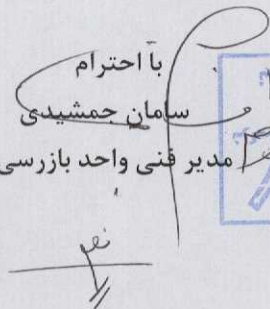
احتراماً باستحضار می‌رساند عطف به نامه شماره ۴۹۳۲۰/۶۲۱۵۵ مورخ ۹۸/۱۲/۰۷ شرکت بازرسی روشاک پایا کنترل مبنی بر انجام آزمون بر روی نمونه ارسالی نتایج آزمون به شرح ذیل تقدیم می‌گردد:

ردیف	نام کالا	سازنده	مدل	تعداد	شماره گزارش	استاندارد	نتیجه تست
۱	خازن	HYDRA	PRB DPM 25/440D/1608	۱	TIN-50141	IEC 60831	قبول

نتایج آزمون فقط برای نمونه ارسال شده معتبر می‌باشد.

• (نتیجه آزمایش در حضور نماینده رسمی شرکت روشاک پایا کنترل انجام گردیده است)

با احترام  
سامان جمشیدی  
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دفتر: تهران، خیابان ولیعصر، خیابان بزرگمهر، نبش فریمان، بن بست  
بوجاری صفت، پلاک ۲، طبقه ۳، واحد ۱۲  
کد پستی: ۱۴۱۶۸۵۴۵۲۳  
تلفن: ۰۲۱-۶۱۹۷۱ فکس: ۰۲۱-۶۶۱۷۴۲۸۳  
آزمایشگاه: کیلومتر ۸ اتوبان کرج-قزوین، بلوار سوپا، شهرک تحقیقاتی کاوش  
تلفن: ۰۲۱-۶۱۹۷۱ فکس: ۰۲۱-۶۶۹۵۴۶۰۱



## TEST REPORT

Equipment: Capacitor	Manufacturer/Brand: HYDRA	Model: PRB DPM 25/440D/1608
3*137 $\mu$ F	Voltage: 440 VAC (max)	25 kvar
Standard	Title	
IEC 60831	Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V.	
Applicant: RPC		
Project number: TIN-50141		
Issue date: 08-April-2020		
Result: PASS		

Prepared by: Test Engineer

M. Javadzadeh

Verified by: Technical Manager

S. Jamshidi

Approved by: CEO

S. M. Mirsadri



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No	Test	Description	Result
1	7- Capacitance measurement and output calculation	The capacitance shall not differ from the rated capacitance by more than -5 % to +10 % for units and banks up to 100 kvar; -5 % to +10 % for units and banks above 100 kvar. Result: 136.8 $\mu$ F	Pass
2	8- Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor	The value of $\tan \delta$ , 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. Result < 44 [ $10^{-5}$ ]	Pass
3	9- Voltage tests between terminals	Each capacitor shall be subjected to an a.c. test at $U_t = 2,15 U_N$ for a minimum time of 10 s. The a.c. test shall be carried out with a substantially sinusoidal voltage at a frequency between 15 Hz and 100 Hz, and preferably as near as possible to the rated frequency. During the test, no permanent puncture or flashover shall occur. Self-healing breakdowns are permitted. Voltage : 946 V	Pass
4	10- Voltage tests between terminals and container	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. The voltage to be applied is $2 U_N + 2 \text{ kV}$ or $3 \text{ kV}$ , whichever is the higher, for 10 s or 20 % higher for a minimum time of 60 s. If the units are intended to be connected directly to the aerial power line and by agreement between the manufacturer and the user, the test shall be performed with a voltage of 6 kV. Voltage: 3 kV	Pass
5	11- Test of internal discharge device	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). The choice of the method is left to the manufacturer.	Pass
6	12- Sealing test	The unit (in non-painted state) shall be exposed to a test that will effectively detect any leak of the container and bushing(s). The test procedure is left to the manufacturer, who shall describe the test method concerned. If no procedure is stated by the manufacturer, the following test procedure shall apply: Unenergized capacitor units shall be heated throughout so that all parts reach a temperature not lower than $20 \text{ }^\circ\text{C}$ above the maximum value in Table 1 corresponding to the capacitor symbol, and shall be maintained at this temperature for 2 h. No leakage shall occur.	Pass



No	Test	Description	Result
7	13- Thermal stability test	The test will stop in one of the following two conditions: – For a period of 6 h, the temperature of the container measured at 2/3 of the height from the bottom (excluding terminals) shall not increase by more than 1 °C. In this case, the test is considered as positive. – If the temperature increases of three successive periods of 6 h do not decrease in magnitude. In this case, the test is considered as having failed. At the end of the stability test, the difference between the measured temperature of the container and the ambient air temperature shall be recorded.	Pass
8	14-Measurement of the tangent of the loss angle (tan δ) of the capacitor at elevated temperature	The capacitor losses (tan δ) shall be measured at the end of the thermal stability test (see Clause 13). The measuring voltage shall be that of the thermal stability test. The value of tan δ, measured in accordance with 14.1, 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. Result < 44 [10 <sup>-5</sup> ]	Pass
9	15- Lightning impulse voltage test between terminals and container	Only units having all terminals insulated from the container shall be subjected to this test. The impulse test shall be performed with a wave of 1,2/50 μs to 5/50 μs having a peak value of 8 kV if the rated voltage of the capacitor is UN ≤ 690 V or having a peak value of 12 kV if UN > 690 V.	Pass
10	16- Discharge test	The unit shall be charged by means of d.c. and then discharged through a gap situated as close as possible to the capacitor. It shall be subjected to five such discharges within 10 min. The test voltage shall be equal to 2 UN. In the case of units with three-phase delta connection, two terminals shall be shortcircuited and the test carried out between the third terminal and the short-circuited terminals at 2 UN.	Pass
11	17- Ageing test	The capacitor is operated in a temperature chamber for two times 750h at the voltage of 1,25 times nominal voltage UN. After the first 750h, the capacitor must undergo 1000 discharge cycles. One cycle means to charge it to a d.c. voltage with level of 2 times nominal voltage UN and discharge it by inductance with value L (μH) = 1000 / C (μF). The duration of each cycle is minimum 30s. The housing temperature is 60°C.	Pass
12	18- Self-healing test	The capacitor or winding element is subjected to an a.c. voltage of 2,15 UN or to a d.c. voltage of 3,04 UN (2,15 a.c. peak value) for 10 s. If less than five breakdowns occur during this time, the voltage is increased slowly until five breakdowns have occurred since the beginning of the test or until the voltage has reached 3,5 UN in a.c. or 4,95 UN in d.c. voltage.	Pass



No	Test	Description	Result
13	19- Destruction test	<p>For three-phase units the test was carried out between two terminals only. In the case of three-phase delta connection two terminals were short-circuited.</p> <p>The test procedure is as follows:</p> <p>a) The capacitor is subjected to an a.c. voltage, the a.c. voltage source is set to 1,3 UN and the capacitor a.c. current was recorded. The minimum short-circuit current of the a.c. generator shall be 2 000A at the capacitor terminals.</p> <p>b) Then the capacitor is subjected to gradually increasing d.c. voltage (to maximum 10 UN) until a 300mA short circuit-current is created in the capacitor, and maintained for at least 3 s. The capacitor that becomes open circuit after the d.c. conditioning shall be replaced by another sample and not counted.</p> <p>Then again the a.c. test voltage of 1,3UN was applied to the capacitor for a period of 3 min when the a.c. current is again noted. In the case when:</p> <ul style="list-style-type: none"> <li>- If the a.c. current is higher than 66 % of the initial value (a), then the procedure (d.c. – a.c.) continues.</li> <li>- If the a.c. current is lower than 66 % of the initial value (a) and the voltage on capacitor is 1,3 UN, in this case the procedure is interrupted.</li> </ul> <p>When the procedure is interrupted the capacitor is cooled to the ambient temperature and the voltage test between terminals and container is carried out according to 10.1 of IEC 60831-1 applying an a.c. voltage of 1 500V.</p> <p>The container of the capacitor may be deformed and damaged but not broken. Escaping liquid material may wet the outer surface of the capacitor but shall not fall in drops. The result of a dielectric test between terminals and container with 1 500V for 10 s shall be satisfactory.</p>	Pass
14	20- Maximum permissible voltage	<p>Long-duration voltages Capacitor units shall be suitable for operation at voltage levels according to Table 3 (see also Clauses 29 and 32).</p> <p>Switching voltages The switching of a capacitor bank by a restrike-free circuit breaker usually causes a transient overvoltage, the first peak of which does not exceed <math>2\sqrt{2}</math> times the applied voltage (r.m.s. value) for a maximum duration of 1/2 cycle.</p>	Pass
15	21- Maximum permissible current	<p>Capacitor units shall be suitable for continuous operation at an r.m.s. line current of 1,3 times the current that occurs at rated sinusoidal voltage and rated frequency, excluding transients.</p> <p>Taking into account the capacitance tolerances of 1,1 CN, the maximum current can reach 1,43 IN.</p> <p>These overcurrent factors are intended to take into account the combined effects of harmonics, overvoltages and capacitance tolerance according to 20.1.</p>	Pass



No	Test	Description	Result
16	22- Discharge device	Each capacitor unit and/or bank shall be provided with a means for discharging each unit in 3 min to 75 V or less, from an initial peak voltage of $\sqrt{2}$ times the rated voltage UN. There shall be no switch, fuse cut-out, or any other isolating device between the capacitor unit and this discharge device. A discharge device is not a substitute for short-circuiting the capacitor terminals together and to earth before handling.	Pass
17	23- Container connections	To enable the potential of the metal container of the capacitor to be fixed, and to be able to carry the fault current in the event of a breakdown to the container, the metallic container shall be provided with a connection capable of carrying the fault current.	Pass
18	24- Protection of the environment	When capacitors are impregnated with products that shall not be dispersed into the environment, the necessary precautions shall be taken. In some countries, there exist legal if so required. Products of combustion of the terminals shall be environmentally acceptable. Self extinguishing materials with a minimum Glow-Wire Flammability Index (GWFI) of 750 °C shall be used for the terminals (see IEC 60695-2-12).	Pass
19	25- Other safety requirements	The purchaser shall specify at the time of enquiry any special requirements with regard to the safety regulations that apply to the country in which the capacitor is to be installed.	Pass
20	26- Marking of the unit		Pass
21	37- EMC	Emission: Under normal service conditions, power capacitors according to this standard do not produce any electromagnetic disturbances. Therefore, the requirements for electromagnetic emissions are deemed to be satisfied, and no verification by test is necessary. NOTE 1 Self-healing breakdowns are considered to create no electromagnetic emission because their effect is short-circuited by the parallel capacitance. NOTE 2 Due to the decreasing impedance of capacitors with frequency, measures should be taken to avoid inadmissible influence on ripple control systems. NOTE 3 When using capacitors and inductances in a network which is loaded with harmonic voltages or currents, care should be taken because the harmonics may be amplified. Immunity Capacitors shall be suitable for continuous operation in the presence of harmonics and interharmonics within the limits required in Clauses 2 and 3 of IEC 61000-2-2. A verification by test is not necessary. The high capacitance of power capacitors absorbs conducted transients and high-frequency disturbances without harmful effect. A severity level not exceeding level 3, as per IEC 61000-4-1, is deemed to be fulfilled and a verification by test is not necessary. Power capacitors are not sensitive to magnetic disturbances. A severity level not exceeding level 3, as per IEC 61000-4-1, is deemed to be fulfilled and a verification by test is not necessary. Power capacitors are not sensitive to electromagnetic disturbances. A severity level not exceeding level 3, as per IEC 61000-4-1, is deemed to be fulfilled and a verification by test is not necessary.	Pass



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Table 1 – Letter symbols for upper limit of temperature range

Symbol	Ambient temperature °C		
	Maximum	Highest mean over any period of	
		24 h	1 year
A	40	30	20
B	45	35	25
C	50	40	30
D	55	45	35

NOTE 1 The temperature values according to Table 1 can be found in the meteorological temperature table covering the installation site.

NOTE 2 Higher temperature values than those indicated in Table 1 can be considered in special applications by mutual agreement between manufacturer and purchaser. In that case, the temperature category should be indicated by the combination of minimum and maximum temperature values, for example, -40/60.

Table 2 – Ambient air temperature for the thermal stability test

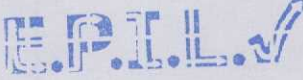
Symbol	Ambient air temperature °C
A	40
B	45
C	50
D	55

Table 3 – Admissible voltage levels in service

Type	Voltage factor $\times U_N$ r.m.s.	Maximum duration	Observations
Power frequency	1,00	Continuous	Highest average value during any period of capacitor energization. For energization periods less than 24 h, exceptions apply as indicated below (see Clause 29).
Power frequency	1,10	8 h in every 24 h	System voltage regulation and fluctuations.
Power frequency	1,15	30 min in every 24 h	System voltage regulation and fluctuations.
Power frequency	1,20	5 min	Voltage rise at light load (see Clause 29).
Power frequency plus harmonics	1,30	1 min	
So that the current does not exceed the value given in clause 21 (see also Clauses 33 and 34).			





  
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