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E-mail : erda@erda.org
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TEST REPORT

NAME & ADDRESS OF CUSTOMER	**REPORT NO. :** RP-1718-019142 **DATE :** 18.07.2017	
TIBREWALA ELCTRONICS LIMITED, 6-56/2/40 , Bombay Highway , Balanagar, Hyderabad-500037	**CUSTOMER REF.NO.**	**DATE**
	TEL/ERDA/2017- 2018	26.04.2017
	DATE OF SAMPLE RECEIPT	**DATE OF TESTING**
	28.04.2017	12.06.2017 to 17.07.2017

SAMPLE DESCRIPTION	**SAMPLE IDENTIFICATION**
AC MOTOR CAPACITORS **Rated Capacitance** : 2.25 Mfd ± 5% **Rated voltage** : 440V AC **Rated frequency** : 50/60 Hz **Type of Dielectric** : MPP **Ref. to Self-Healing**: SH **T. Max** : 85°C	**ERDA Sample code Nos.:** ERDA-00196315 to ERDA-00196340(26 Nos.) **MARK Nos.:** 1 to 26 on capacitors **Test Schedule:** Routine tests carried out on all 26 nos. Type tests carried out as per below mentioned groups, **Group 1:** Mark No. 01 to 04 = 04 nos. **Group 2:** Mark No. 05 to 14 = 10 nos. **Group 3:** Mark No. 15 to 20 = 06 nos. **Group 4**: Mark No. 21 to 26 = 06 nos.

TEST DETAILS . As per sheet 2 of 16.	**TEST SPECIFICATION** As per sheet 2 of 16.

TEST RESULTS : As per sheets 3 of 16 to 15 of 16.

ENCLOSURE : Photographs of test sample and rating plate as per sheet no.16 of 16.

NOTE : All the mentioned test on sheet 2 of 16 were tested at a frequency of 50 Hz.

REMARKS : The capacitor **conforms** to the requirements of test specification for test no.1 to 15 as per sheet no. 2 of 16.

PREPARED BY **CHECKED BY** **(S.B. Patel)** **APPROVED BY**

Note :
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ROUTINE TEST DETAILS :

SR. NO.	TEST DETAILS	TEST SPECIFICATION
1.	Visual examination	As per cl.no.7.1.1.a of IS 1709:1984
2.	Insulation resistance test	As per cl.no.7.1.1.b of IS 1709:1984
3.	Voltage test between terminals	As per cl.no.7.1.1.c of IS 1709:1984
4.	Voltage test between terminals and container	As per cl.no.7.1.1.d of IS 1709:1984

TYPE TEST DETAILS :

GROUP	SR. NO.	TEST DETAILS	TEST SPECIFICATION
1.	5.	Visual examination	As per cl.no.7.2 of IS 1709:1984
	6.	Check of dimensions	As per Appendix A of IS 1709:1984
2	7.	Sealing test	As per cl.no.7.12 of IS 1709:1984
	8.	Capacitance as a function of temperature	As per cl.no.7.13 of IS 1709:1984
	9.	Measurement of tangent of loss angle	As per cl.no.7.16 of IS 1709:1984
	10.	Endurance test	As per cl.no.7.6 of IS 1709:1984
3	11.	Damp heat test	As per cl.no.7.15 of IS 1709:1984
	12.	Insulation resistance between terminals and container	As per cl.no.7.3.1 of IS 1709:1984
	13.	Voltage test between terminals	As per cl.no.7.4.1 of IS 1709:1984
	14.	Voltage test between terminals and container	As per cl.no.7.4.2 of IS 1709:1984
4	15.	Self-healing test	As per cl.no.7.14 of IS 1709:1984

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ROUTINE TEST - On all 26 Nos. Capacitors (On mark nos. 1 to 26).

Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained Value	Remarks
1.	Visual examination (Cl. No.: 7.2)	All the capacitors shall be visually examined for finish and marking.	The finishing and marking of the capacitors found satisfactory. Marking as per Table – 1 (sheet 11 of 16)	Conforms
2.	Insulation resistance test (Cl. no.: 7.3) Insulation resistance between terminals and container (Cl. no.: 7.3.1)	The insulation resistance shall be measured at 500Vdc after 30±5 sec duration after the application of test voltage between the terminals connected together and a metal foil tightly wrapped to the capacitor case. The value of the insulation resistance shall not be less than 100MΩ.	Measured values of all the capacitors found within limits and as per Table –2 (sheet 11 of 16)	Conforms

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Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained Value	Remarks
3.	Voltage test between terminals (Cl. No.: 7.4.1)	The test voltage is applied to the terminals of a capacitor. Test voltage: $1.5U_N$ ac Test duration: 10 seconds No permanent breakdown shall occur during the test.	All the capacitors withstood the test voltage between terminals. No permanent breakdown occurred during the test.	Conforms
4.	Voltage Test between Terminals and Container (Cl. No.: 7.4.2)	Capacitor shall be subjected to twice the rated voltage + 1000V, but not less than 2000V rms value for 10 seconds, between terminals & case. No dielectric breakdown or flashover shall occur during the test.	Capacitors withstood 2000 Vrms for 10 seconds , between terminals and case. No dielectric breakdown or flashover observed.	Conforms

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TYPE TESTS FOR GROUP 1 – On 04 Nos. Capacitors (On mark nos. 1 to 4).

Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained Value	Remarks
5.	Visual Examination (Cl. No.: 7.2)	All the capacitors shall be visually examined for finish and marking.	The finishing and marking of the capacitors found satisfactory. Marking as per Table – 1. (sheet 11 of 16)	Conforms
6.	Check of Dimensions (Cl. No.: 1.2, Appendix A)	The dimensions of the capacitor shall be within the recommended maximum dimensions. Diameter: 40mm max. Length: 75mm max.	The dimensions of the capacitors are as per Table–3 (sheet 12 of 16).	Conforms

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TYPE TESTS FOR GROUP 2 – On 10 Nos. Capacitors (On mark nos. 5 to 14).

Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained Value	Remarks
7.	Sealing Test (Cl. No.: 7.12)	After degreasing, the capacitors shall be stored in a position most likely to reveal leakage at a temperature 5 °C higher than the maximum permissible capacitor operating temperature of 80°C for a time sufficient for all parts of capacitor to reach this temperature. The total heating & cooling cycle time shall be 8 hours. Maintain the capacitor at the highest temperature for one hour. No leakage shall occur.	After degreasing ,the capacitors were stored at 85°C for 1 hour. No leakage observed at the end of the test.	Conforms
8.	Capacitance as a Function of Temperature (Cl. No.: 7.13)	The change in capacitance at limit temperatures as compared to the value measured at 27°C ± 5°C shall not exceed 5 % corresponding to its value at 70 °C and 3% corresponding to 0°C.	Measured capacitance is as per Table – 4 (sheet 12 of 16)	Conforms
9.	Measurement of Tangent of Loss Angle (Cl. No.: 7.6)	The measurement shall be done at rated frequency and voltage. The determined value of Tan δ shall not exceed by more than 10% of the value agreed between manufacturer and purchaser. However, the maximum value of the tan δ shall not exceed 0.002 (for SH-MPP type)	The measured values of Tan δ are within limits and as per Table – 5 (Sheet 13 of 16)	Conforms

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Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained value	Remarks
10.	Endurance Test (Cl. No.: 2.13)	Capacitors shall be kept in chamber with hot air circulation. Temperature of circulating air shall be adjusted to 75°C (85°C-10°C)±2°C. Thermocouple was placed on the capacitor having lowest tan delta value. Capacitors shall be energized to the test voltage of 550 Vac (1.25 x 440V). After 24 hours, the difference between tc (85°C) and the max. value of temperature recorded on the capacitor case shall be measured. Then the adjustment shall be made such that the temperature of capacitor case is at 85°C. The test shall be continued for 500 hours from the moment of energization. During the test no permanent breakdown, interruption or flash over shall occur. Before & after the test, Capacitance & Tan δ shall be measured and recorded. Max. Permitted variation in capacitance is 5% and Max. value of Tan δ shall be 0.002	All the capacitors were kept at 75°C in energized condition at 550V. After 24 hours measured case temperature was 77°C. Then after adjustment test temperature of case for each capacitor was maintained at 85°C±2 °C throughout the test. During the test, no permanent breakdown, interruption or flashover shall occur. No leakage was observed. The capacitance and tanδ is then measured. Measured values of capacitance and tanδ for all capacitors after and before this test are as per table -6 on Sheet 13 of 16. Change in capacitance observed is less than 5%. Measured values of tanδ are within limits.	Conforms

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TYPE TESTS FOR GROUP 3 – On 6 Nos. Capacitors (On mark nos. 15 to 20).

Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained value	Remarks
11.	Damp Heat Test (Cl. No.: 2.14)	All the capacitors shall be kept in the Environment Chamber without energizing for 21 days at a temperature of 40°C ± 2°C & relative humidity between 90% to 95%. No measurement shall be taken during the test. After the damp-heat period capacitance is measured, after 1 hour and before 2 hours duration after capacitors stored in standard atmospheric condition for recovery. Capacitance change shall be less than 5 % before and after the test.	Measured values of capacitance for all capacitors after and before this test are as per table -7 on Sheet 14 of 16. Change in capacitance observed <5 %.	Conforms
12.	Insulation resistance between Terminals and Container (Cl. No.: 7.3.1)	The IR shall be measured at 500V dc after 30 ± 5 sec of the application of voltage. The value of IR shall not be less than 100 MΩ	IR values > 100 MΩ observed in all the capacitors and are as per table 8 on sheet 14 of 16.	Conforms

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Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained value	Remarks
13.	Voltage Test between Terminals (Cl. No.: 7.4.1)	Capacitor shall withstand $1.5U_N$ ac for 10 seconds, between terminals. No permanent breakdown shall occur during the test.	Capacitors withstood the test voltage. No permanent breakdown observed.	Conforms
14.	Voltage Test between Terminals and Container (Cl. No.: 7.4.2)	Capacitor shall be subjected to twice the rated voltage + 1000V, but not less than 2000V rms value for 10 seconds, between terminals & case. No dielectric breakdown or flashover shall occur during the test.	Capacitors withstood the test voltage. No dielectric breakdown or flashover observed.	Conforms

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TYPE TESTS FOR GROUP 4 – On 06 Nos. Capacitors (On mark nos. 21 to 26).

Sr. No.	Particulars of Tests & Cl. No.	Requirement as per Specification	Obtained value	Remarks
15.	Self-healing Test (Cl. No.: 7.14)	The capacitor shall be subjected to 1.5U_N AC for 10 seconds between terminals. If fewer than five breakdowns occur during this time, the voltage shall be increased slowly until five breakdowns have occurred since the beginning of the test, or until the voltage has reached 3.5 times the rated voltage. After this, the voltage shall be reduced to 0.8 times the initial value and maintained for 10 seconds. Before and after the test capacitance shall be measured. Change in capacitance shall not be more than 0.3%	The capacitor was subjected to 1.5 U_N for 10 sec . No. of self-healing observed at 1.5 U_N as per Table-09 sheet 15 of 16. Capacitance measured after self-healing test is as per table-10 sheet 15 of 16. Change in capacitance observed <0.3 %.	Conforms

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Table 1

Sr.No.		Marking observed on capacitor case
1.	Manufacturer's name	TIBCON Capacitors
2.	Rated Capacitance with tolerance	2.25 MFD +/-5%
4.	Rated Voltage	440 VAC
6.	Rated frequency	50/60 Hz
7.	Maximum Temperature	85°C
8.	Date of manufacture	26/04/17
9.	## or SH for self-healing capacitors	SH-MPP
10.	Reference Standard	IS 1709:1984

Table – 2

INSULATION RESISTANCE TEST BETWEEN TERMINALS & CONTAINER

MARK	MEASURED RESISTANCE (GΩ)	MARK NO.	MEASURED RESISTANCE
1	41.8	14	38.8
2	77.7	15	147.7
3	48.9	16	51.2
4	38.3	17	36.0
5	42.0	18	46.1
6	44.8	19	38.2
7	344	20	281
8	32.0	21	44.9
9	43.4	22	99.3
10	303	23	150.5
11	46.1	24	31.8
12	201	25	109.7
13	150.8	26	46.6

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Table – 3

CHECK OF DIMENSIONS OF CASE:

MARK NO.	Specified Maximum Diameter (in mm)	Measured Diameter (in mm)	Specified Maximum height (in mm)	Measured height (in mm)
1	40	27.70	75	51.86
2		27.77		51.80
3		27.67		51.78
4		27.61		51.72

Table-4

Capacitance as a function of temperature

Mark No.	Capacitance (at 27±5°C)	Capacitance (at 0-5°C)	Change (max =3%)	Capacitance (at 70±5°C)	Change (max=5%)
5	2.280	2.290	0.44	2.271	-0.39
6	2.278	2.287	0.40	2.261	-0.75
7	2.271	2.280	0.40	2.258	-0.57
8	2.289	2.298	0.39	2.276	-0.57
9	2.290	2.299	0.39	2.282	-0.35
10	2.278	2.287	0.40	2.268	-0.44
11	2.279	2.287	0.35	2.266	-0.57
12	2.280	2.288	0.35	2.271	-0.39
13	2.283	2.291	0.35	2.269	-0.61
14	2.284	2.292	0.35	2.272	-0.53

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Table-5
Measurement of tangent of Loss Angle

Mark no.	Tan δ measured
5	0.000541
6	0.000490
7	0.000535
8	0.000513
9	0.000534
10	0.000539
11	0.000522
12	0.000531
13	0.000502
14	0.000493

Table-6
Measurement of capacitance before and after endurance test

Mark no.	Capacitance (Before endurance)	Capacitance (After endurance)	Tan δ (After endurance)	Change in capacitance (max=5%)
5	2.296	2.275	0.000510	-0.91
6	2.289	2.288	0.000324	-0.04
7	2.285	2.280	0.000572	-0.22
8	2.301	2.297	0.000305	-0.17
9	2.307	2.310	0.000345	0.13
10	2.294	2.297	0.000391	0.13
11	2.292	2.294	0.000402	0.09
12	2.296	2.298	0.000361	0.09
13	2.294	2.294	0.000300	0.00
14	2.296	2.295	0.000344	-0.04

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Table – 7 (for Type test group 4 test Sr. No.1)
Measurement of capacitance before and after Damp Heat test

Mark no.	**Capacitance** Before Damp Heat	**Capacitance** After Damp Heat	**Tan δ** After Damp Heat	**Change in capacitance** (max=5%)
15	2.288	2.288	0.000495	0.00
16	2.280	2.279	0.000471	-0.04
17	2.284	2.283	0.000505	-0.04
18	2.289	2.288	0.000467	-0.04
19	2.286	2.284	0.000499	-0.09
20	2.291	2.289	0.000479	-0.09

Table – 8

INSULATION RESISTANCE TEST BETWEEN TERMINALS & CONTAINER

MARK NO.	**MEASURED RESISTANCE (GΩ)**
15	216
16	317
17	275
18	188.5
19	133.9
20	181.5

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Table – 9 (for Type test group 4 test Sr. No.1)
Measurement of self-healings :

MARK NO.	NO. OF SELF-HEALINGS OBSERVED AT 1.5 U_N (U_t)	NO. OF SELF-HEALINGS OBSERVED AT 0.8 U_t
21	05	0
22	05	0
23	05	0
24	05	0
25	05	0
26	05	0

Table – 10 (for Type test group 4 test Sr. No.1)
Measurement of capacitance before and after self-healing test

Mark no.	Capacitance Before self-healing	Capacitance After self-healing	Tan δ After self-healing	Change in capacitance (max=0.3%)
21	2.274	2.274	0.000490	0
22	2.275	2.275	0.000498	0
23	2.293	2.294	0.000497	0.04
24	2.297	2.298	0.000493	0.04
25	2.267	2.267	0.000476	0
26	2.287	2.287	0.000490	0

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PHOTOGRAPHS

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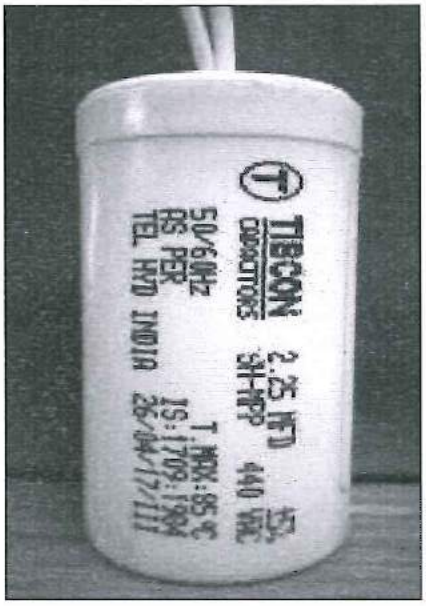
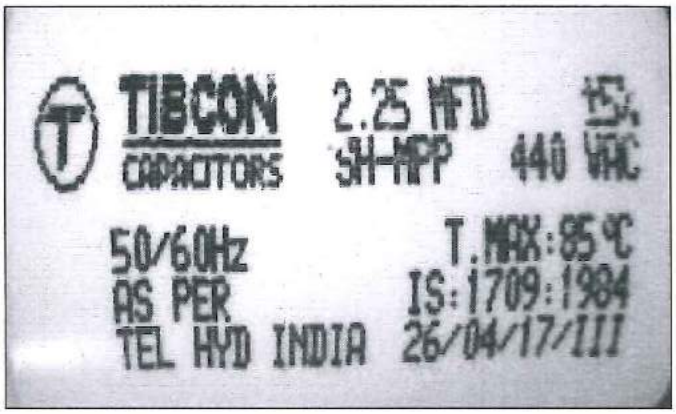
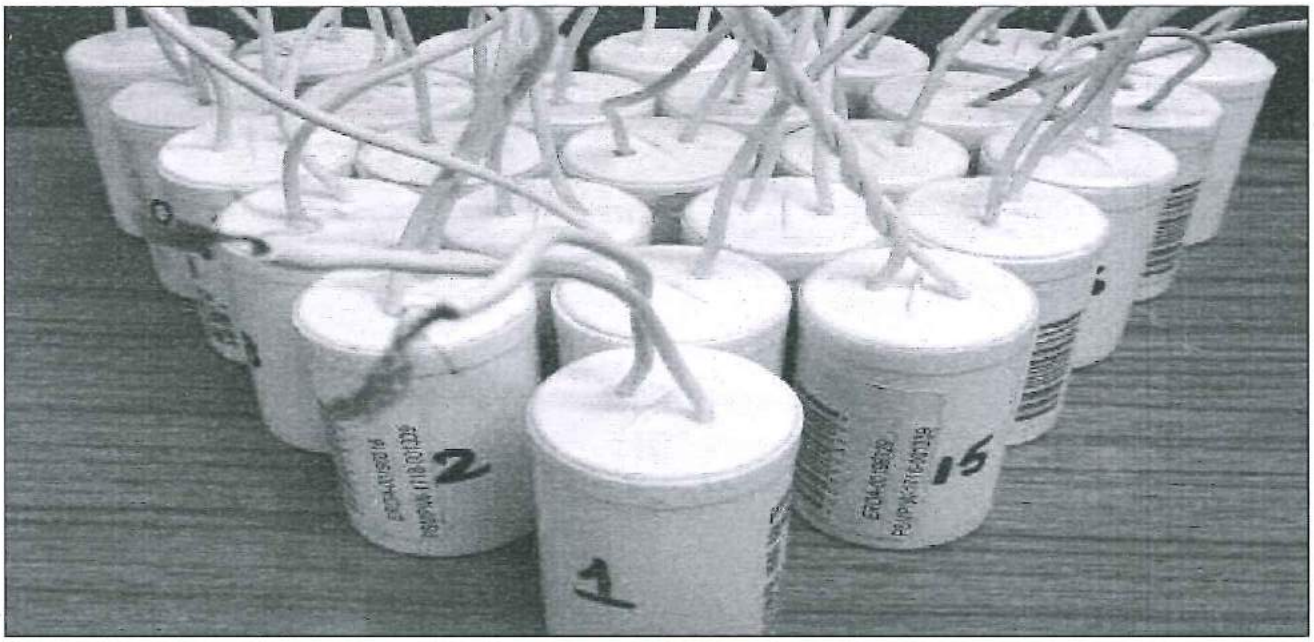
DATE :18.07.2017

TEST SAMPLE	NAME PLATE
	



PREPARED BY **CHECKED BY**

TC 2287286